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1. INTRODUCTION

The ACCESS 4000 microprocessor based generator control panel is an auto-start system providing a comprehensive array of operational features. Utilising the latest advances in embedded microprocessor technology, surface mount printed circuit board assembly and software development techniques, the design provides for a powerful, easy to use system together with high accuracy for all metering and protection functions.

Once activated the ACCESS 4000 module carries out all the start and stop procedures for the engine, indicates the operational status and fault conditions; and automatically shuts down the generator set in the event of a critical condition arising.

A range of optional features allow other functions such as an open protocol communication interface, for communicating with Supervisory Control And Data Acquisition (SCADA) systems, or remote monitoring via a volt free relay interface module.

The module is housed in a robust plastic case for front panel mounting within a control panel. Connection to the unit is via locking plugs and sockets.

The ACCESS 4000 provides the following advanced features:

- Microprocessor based circuitry
- NFPA 110 Level 1 compliance
- NEMA 1 enclosure
- Large format alpha-numeric Liquid Crystal Display
- Open protocol communication interface
- Digital 3 or 1 phase voltage and current metering
- Digital engine parameter metering
- Up to 16 fault circuits utilising analogue and digital inputs
- 20 event fault log memory
- Password protected operator levels
- Site programmable using the integral keypad or Laptop PC
- Configuration stored in non-volatile memory

2. CONTROL SYSTEM OVERVIEW

The following installation guidelines are provided for general information only. For specific site installation information, consult your local dealer as required.

CAUTION:



All installation and/or service work performed must be done by qualified personnel only. Failure to do so may cause personal injury or death.

2.1 Panel Equipment

The ACCESS 4000 control panel consists of three main parts; an ACCESS 4000 control module, external control equipment and a panel enclosure. Figure 2.1 shows a fully optionised diagram of an ACCESS 4000 control panel.

Note:

- The addition of non-standard optional equipment may add items not shown here. The following descriptions explain the function of each item on the panel, a more detailed description of the control module follows in section 3.

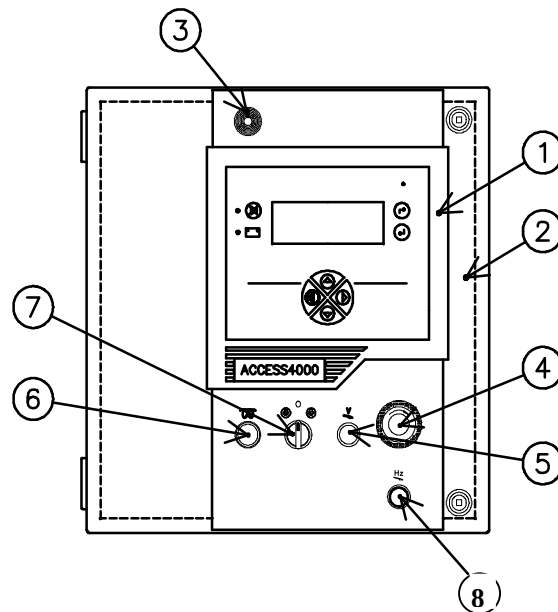


Figure 2.1 - Diagram of a Typical ACCESS 4000 Control Panel

1. ACCESS 4000 Control Module
2. Panel Enclosure - housing the module and associated external controls.
3. Audible Alarm - a buzzer that sounds on sensing a fault condition. [option]
4. Emergency Stop push-button - a red lock-down button is used to initiate an emergency stop signal to the generator set. This will cause the engine to immediately stop and be prohibited from operation until the button is released.
5. Voltage Adjust Control - a potentiometer providing manual control of the generator output voltage (AVR excitation). [option]
6. Thermostart Control - a momentary action button is used to pre-heat the engine prior to cranking. [option]
7. Control Switch - a three position switch controlling the mode of operation. Refer to the operating instructions for detailed information.



RUN

In this position, the engine will start and operate continuously providing no shutdown fault conditions are active. All protective functions will be operative in this mode. There will be no start delay or stop (cooldown) delay in this mode.



OFF

Manually initiates a stop signal to the generator and prohibits automatic starting/running. The control switch must be returned to this position following a shutdown fault condition before any further generator set operation will occur.



AUTO

In this position, starting and stopping of the engine will be controlled by the REMOTE START contact. With the contact closed, the generator set will start and run. With the contact removed, the generator set will stop and return to standby.

8. Speed Adjust Control - a potentiometer providing manual control of the generator output frequency (engine speed). [Option]

2.2 Environmental Constraints

The module when mounted correctly within a panel will conform to IEC 529 IP-56 and NEMA 1. The panel should be vibration isolated from the engine and alternator and protected against excessive temperature swings.

2.3 Power Supply

The ACCESS 4000 control system is designed to operate on any direct current (DC) battery supply in the range 9 to 32 volts. The battery negative must be grounded to the engine block, usually via the starter motor negative terminal. An internal battery is not provided and is not necessary.

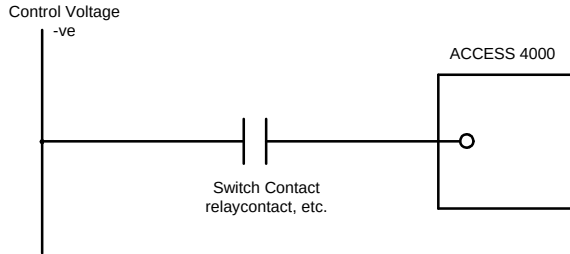


Figure 2.2 - Typical DC Control Input Wiring

2.4 DC Control Inputs

All DC control inputs to the ACCESS 4000 are optically isolated for protection from noise and transient spikes. All inputs are designed to switch low i.e. to the battery negative including the remote start contact. The use of POWERED CONTACTS may damage the control module.

2.5 DC Control Outputs

All dc control outputs from the ACCESS 4000 are volt-free relay contacts. The contacts are rated for 2 Amps at 30Vdc and are isolated Form C type. The use of interposing relays between the ACCESS 4000 and the external device is necessary to prevent potential internal damage due to excessive current. For loads generating switching spikes, the application of transient suppression is also recommended.

Note:

- On power loss ALL outputs will switch to the de-energised state.

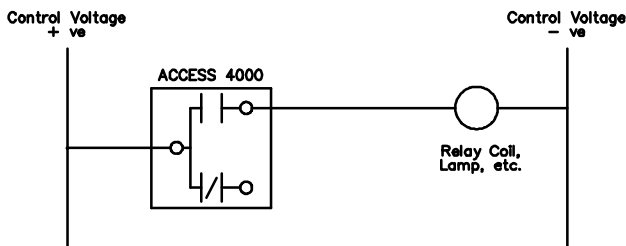


Figure 2.3 - Typical DC Control Output Wiring

2.6 DC Sender Inputs

Both engine sender inputs (oil pressure and engine coolant temperature) are designed to operate with variable resistive type senders.

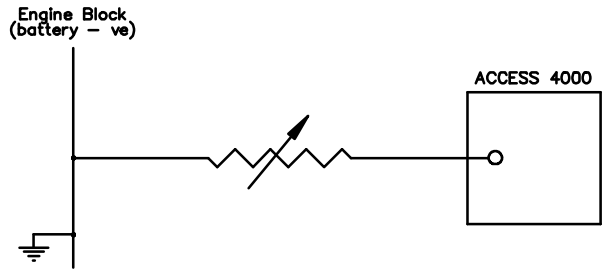


Figure 2.4 - Typical DC Sender Input Wiring

2.7 AC Voltage Inputs

The ACCESS 4000 is designed using a multi-tapped potential transformer for all AC voltage input in the range 60 - 300Vac, using one of four tapings on the high accuracy potential transformers fitted external to the ACCESS 4000 (figure 2.5). Standard single or three phase systems can be accommodated using one of five alternator winding configurations as shown in figure 2.6. High voltage systems may be interfaced using additional specialised transformers.

WARNING

! The incorrect connection of the AC Voltage Inputs will damage the controller. Ensure that correct primary voltage tapping connections are made.

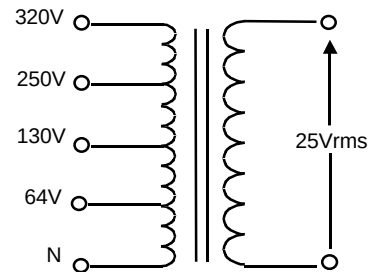


Figure 2.5 - Multi-tap Transformer

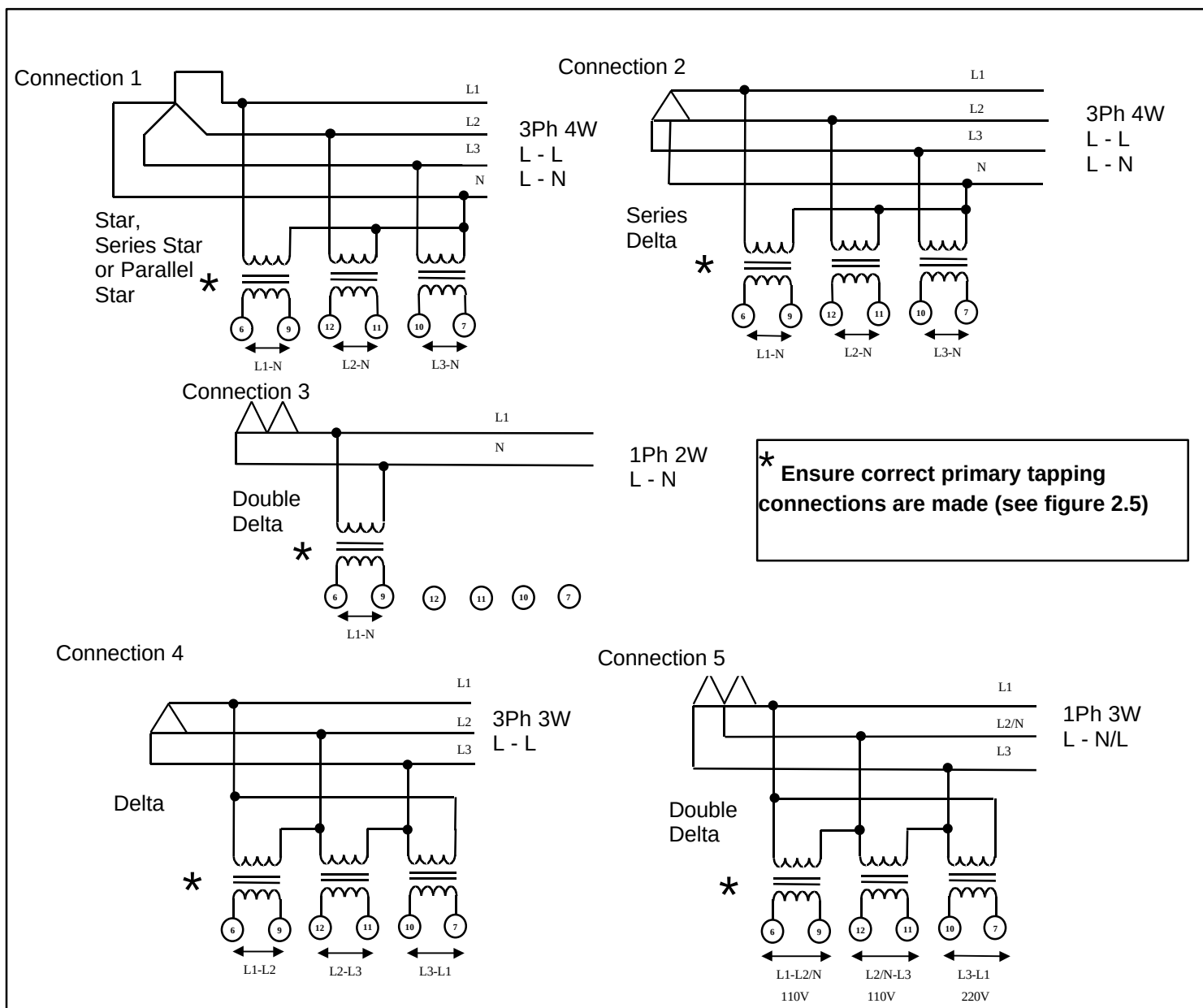


Figure 2.6 - Typical AC voltage input wiring

2.8 AC Current Inputs

The ACCESS 4000 is designed to measure current indirectly using current transformers. The maximum secondary current is 5 Amps. It is recommended for improved accuracy that an independent six wire unearthed connection arrangement is adopted as shown in figure 2.7.

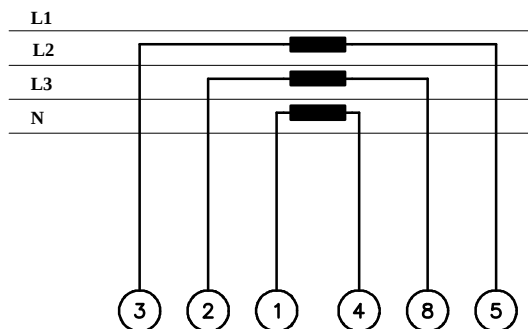


Figure 2.7 - Typical AC Current Input Wiring

An industry standard RS422/485 communications port is provided for both factory programming and customer interface. Connections to the module should be made using individually screened twisted pair cable. Please also refer to section 3.12.

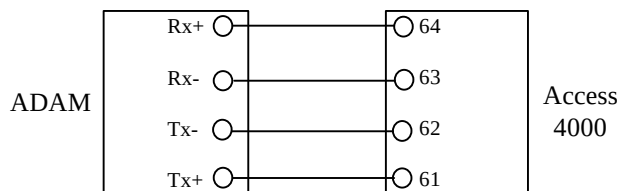


Figure 2.8 - Communication Wiring

2.9 Communication Interface

3. CONTROL

The ACCESS 4000 control module utilises both analogue and digital inputs and outputs to perform its control and monitoring functions. The module provides the means of starting and stopping the generating set, monitoring its operation and output, and automatically shutting down the set in the event of a critical condition arising such as low lubricating oil pressure or high engine coolant temperature.

The main component of the module front is the membrane keypad, the features of which are described as follows with reference to figure 3.1.

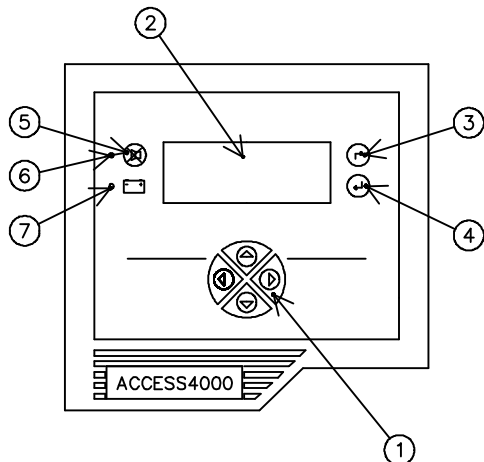


Figure 3.1 - ACCESS 4000 Control Module (front view)

1. **CURSOR CLUSTER.** The arrow keys are used to navigate around the status menus or for programming values within the configuration menu. The "UP Key" will increase numerical values of parameters or setpoints. The "DOWN Key" will decrease numerical values of parameters or setpoints. The "LEFT Key" will move the cursor to the previous item in the menu screens or to the left when programming parameters or setpoints. The "RIGHT Key" will move the cursor to the next item in the menu screens or to the right when programming parameters or setpoints.
2. **LCD VIEWING WINDOW.** The backlit LCD display is mounted behind and visible through the clear lexan viewing window.
3. **ESCAPE Key.** Pressing this key will exit from any menu or programming screen without saving the new value.
4. **ENTER Key.** Use of this pad selects the menu item or amends the new programmed parameter or setpoint. This key is also used to acknowledge and reset alarms or shutdowns from within the alarm log menu.
5. **ALARM MUTE.** De-energises the common alarm output relay thus muting any audible alarm (siren) if fitted.
6. **FAULT LED.** The fault LED illuminates when any pre-programmed fault has been activated. The LED will flash quickly alerting the user to a shutdown (critical) condition. The LED will flash slowly alerting the user to an alarm (non-critical) condition. Once all shutdowns have been acknowledged the LED will 'go solid' and de-energise once they are all reset.
7. **Power LED.** Illuminates when the unit is powered in the healthy state.

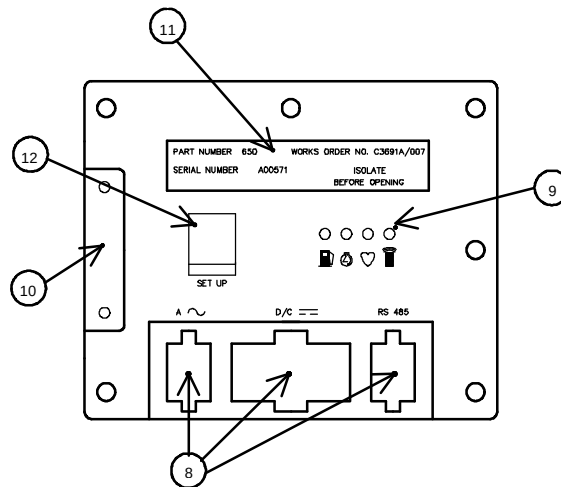


Figure 3.2 - ACCESS 4000 Control Module (rear view)

8. **Electrical Connections.** Connections to the ACCESS 4000 are via locking plug and sockets.
9. **Diagnostic LED's.** The ACCESS 4000 provides four diagnostic Light Emitting Diodes to facilitate simple module diagnosis. Their functions and symbols are described as follows:
 -  **FUEL CONTROL SOLENOID.**
This LED is illuminated whenever the module has called for the engine to run. The LED mirrors the status of the output relay which controls the fuel control solenoid.
 -  **STARTER CONTROL SOLENOID**
This LED is illuminated whenever the module is initiating an engine crank cycle. The LED mirrors the status of the output relay which controls the auxiliary starter solenoid.
 -  **WATCHDOG**
This LED flashes on and off at regular intervals indicating that the microprocessor is functioning normally.
 -  **REMOTE CONTROL**
This LED is illuminated whenever the module is being controlled from a remote signal i.e. via the communication facility or via the remote start input.
10. **Expansion Port.** Provision for expansion of the ACCESS 4000's functional capability is provided for using the expansion port. For further details on the options available, refer to your local dealer.
11. **Serial Number Label.** A two part serial number label details the unit part number, individual unit serial number and generator set works order number. Please quote all three items of information when requesting dealer or factory support.
12. **Communications Set Up.** Set all dip switches to "ON" in a single ACCESS 4000 system. In a multiple ACCESS 4000 system, set dip switches to "ON" on the unit furthest away from the MCM2(PC) / MCM3(Tel) leaving the switches on the intermediate units to "OFF" position.

Connector "DC"

Pin Number	Description	Signal Type
1	Fuel control solenoid control - COM	Volt Free
2	Battery positive	Input 9 - 32Vdc
3	Battery negative	Input 0Vdc
4	Sender earth reference	Input 0Vdc
5	Not Used	
6	Not Used	
7	Water temperature sender	Output - 13mA
8	Oil pressure sender	Output - 37.5mA
9	Programmable relay no. 2 - COM	Volt Free
10	Fuel control solenoid control - N/C	Volt Free
11	Not Used	
12	Future development	Volt Free
13	High engine temperature switch input	Input - active low
14	Run switch input	Input - active low
15	Remote start switch input	Input - active low
16	Spare input 2	Input - active low
17	Spare input 4	Input - active low
18	Programmable relay no. 2 - N/C	Volt Free
19	Fuel control solenoid control - N/O	Volt Free
20	Magnetic Pickup (+)	5 - 30Vac (w.r.t. pin 21)
21	Magnetic Pickup (-)	5 - 30Vac (w.r.t. pin 20)
22	Low oil pressure switch input	Input - active low
23	Emergency stop switch input	Input - active low
24	Auto switch input	Input - active low
25	Spare input 1	Input - active low
26	Spare input 3	Input - active low
27	Programmable relay no. 2 - N/O	Volt Free
28	Starter solenoid control - COM	Volt Free
29	Starter solenoid control - N/O	Volt Free
30	Starter solenoid control - N/C	Volt Free
31	Common alarm - COM	Volt Free
32	Common alarm - N/O	Volt Free
33	Common alarm - N/C	Volt Free
34	Programmable relay no. 1 - COM	Volt Free
35	Programmable relay no. 1 - N/O	Volt Free
36	Programmable relay no. 1 - N/C	Volt Free

Connector "AC"

Pin Number	Description	Signal Type
1	AC Current - Phase C (send)	0 - 5 A ac
2	AC Current - Phase B (send)	0 - 5 A ac
3	AC Current - Phase A (send)	0 - 5 A ac
4	AC Current - Phase C (return)	0 - 5 A ac
5	AC Current - Phase A (return)	0 - 5 A ac
6	AC Voltage - Phase A (live)	25Vac nominal (w.r.t. pin 9)

Connector "AC" (Continued)

Pin Number	Description	Signal Type
7	AC Voltage - Phase C (neutral)	See pin 10
8	AC Current - Phase B (return)	0 - 5 A ac
9	AC Voltage - Phase A (neutral)	See pin 6
10	AC Voltage - Phase C (live)	25Vac nominal (w.r.t. pin 7)
11	AC Voltage - Phase B (neutral)	See pin 12
12	AC Voltage - Phase B (live)	25Vac nominal (w.r.t. pin 11)

Communications Connector "RS485"

Pin Number	Description	Signal Type
1	Isolated power supply - positive	5Vdc
2	Communication receive - RX+	TTL
3	Communications receive - RX-	TTL
4	Communications transmit - TX-	TTL
5	Communications transmit - TX+	TTL
6	Isolated power supply - common	0Vdc

4. OPERATING INSTRUCTIONS

The ACCESS 4000 control system is required to operate with an external changeover system designed to handle all mains sensing and load transfer functions. The ACCESS 4000 controller will start and stop the engine in either a local "manual" or remote "automatic" mode. When a 'required to run' command is issued, the controller issues engine fuel control solenoid on and starter motor crank output signals. The engine speed is monitored and once engine firing speed has been reached the module terminates the crank signal. While the engine accelerates up to and runs at nominal speed, the ACCESS 4000 continually monitors the engine speed signal. Should the engine speed exceed the setpoint determined by the OVERSPEED fault condition, the engine is shutdown by termination of the fuel control solenoid on signal.

In addition to the OVERSPEED fault condition, the ACCESS 4000 continuously monitors all other necessary engine conditions, together with additional optional fault conditions as required by the customer. For detailed information on all fault conditions, refer to section 5.

On removal of the 'required to run' command, the engine will automatically stop.

The ACCESS 4000 includes all necessary user programmable timer functions to enable start, cranking and stop (cooldown) time delays. For further information on configuration of the ACCESS 4000, refer to section 6

4.1 Automatic Mode Of Operation

When the ACCESS 4000 control panel is selected for Automatic (AUTO) standby operation using the Control Switch (ref. Figure 1.1 - Item 7), the generating set will automatically start and run upon activation of the remote start contact input. The engine will attempt to crank after the start delay timer expires. Note: the start sequence will NOT be initiated if any shutdown fault condition is present. Assuming the engine starts and accelerates successfully, the ACCESS 4000 will default to display on the LCD an OVERVIEW screen. Once the generating set reaches rated voltage and frequency the disconnection of the mains from the load and connection of the generator to the load is handled by the changeover system.

The generator continues supplying the load until the remote start signal is removed, the panel is switched to OFF or a shutdown fault condition arises. If a shutdown fault condition arises, and before any further

The generating set may continue to run on no load for cooling purposes before stopping automatically and returning to automatic standby.

When the ACCESS 4000 control panel is selected for Manual (RUN) operation using the Control Switch (ref. Figure 1.1- Item 7), the generating set will automatically start and run. Note: the start sequence will NOT be initiated if any shutdown fault condition is present. Assuming the engine starts and accelerates successfully, the ACCESS 4000 will default to display on the LCD an OVERVIEW screen.

The generator continues to supply any load applied to it until the Control Switch is switched to the OFF or AUTO positions or a shutdown fault condition arises. If a shutdown fault condition arises, and before any further operation of the generator set can occur, an operator is required to acknowledge the fault and, within the ALARM LOG menu, reset the fault(s). In addition, the controller must be switched to OFF and back to RUN before the system will respond.

The ACCESS 4000 displays all user interface information on a series of pre-programmed screens on the Liquid Crystal Display (LCD). On initial power-up, the controller enters a bootstrap mode during which it initialises all system parameters.

		B	O	O	T	S	T	R	A	P		M	O	D	E		
		V	e	r	s	i	o	n		1.		1	7				

After approximately five seconds the controller defaults to display the main menu. All further information relating to the generator system may be accessed through a series of main and subordinate menus, the selection of which is performed by the operator.

4.3.1 Main Menu: This top level user interface menu provides the operator with the opportunity to select detailed information displays as required. Navigation of the menu is achieved via the LEFT and RIGHT cursor keys, selection of the menu item is achieved using the ENTER key.

The screen displays the following information:

[illegible]

- Pressing the ESCAPE key will momentarily display information relating to the type and version of software used within the controller. This information will be required when requesting support from either your local dealer or the factory.

4.3.2 Overview: This default operating status menu provides the operator with general information as to the status of the generator set. On initiation of a start sequence and/or following five minutes of operator keypad inactivity, the controller automatically selects the overview menu.

H	2	O		8	5	°	C	1	8	5		°	F		
O	i	I	3	9			B	5	6	6			P	S	I
V			1	2	0			A			7	2			
H	z		6	0	0			G	e	n	O	K			

Gen	Fault condition status, if the display reads OK there are no faults requiring reset in the fault log. If the display reads FAULT, the operator is required to reset faults.
-----	---

4.3.3 Generator: Up to three generator AC metering screens provide the operator with detailed information relating to the electrical output from the generator set. Navigation between the screens is achieved via the LEFT and RIGHT cursor keys and exit from a screen is achieved using the ESCAPE key.

L	~	L		A	ϕ				B	ϕ				C	ϕ			
V			4	1	5				4	1	5			4	1	5		
A			1	3	4				1	3	4			1	3	4		
H	z		5	0	.	0			L	~	N	←	p	o	w	e	r	→

[displaying Line to Line (L~L) voltages, press left arrow key to display L~N voltage, press right arrow key to display power measurements]

Aφ, Bφ, Cφ Three phase readings for the generator

V Line to Line voltage per phase (for single phase applications only A ϕ displayed)

A Line current per phase (for single phase applications only A ϕ displayed)

Hz	Generator frequency
0	0
10	10
20	20
30	30
40	40
50	50
60	60
70	70
80	80
90	90
100	100

L	~	N		A	ϕ			B	ϕ			C	ϕ				
V			2	4	0			2	4	0		2	4	0			
A			1	3	4			1	3	4		1	3	4			
H	z		5	0	.	0		L	~	L	←	p	o	w	e	r	→

[displaying Line to Neutral (L~N) voltages, press left arrow key to display L~L voltage, press right arrow key to display power measurements]

A ϕ , B ϕ , C ϕ Three phase readings for the generator

V Line to Neutral voltage per phase (for single phase applications only A ϕ displayed)

A Line current per phase(for single phase applications only A ϕ displayed)

Hz Generator frequency

c	o	s	ø	-	0	.	8	k	V	A				1	0	0
k	W					8	0	k	V	A	r				6	0
k	W	h			3	9	5									

[displaying power measurements, press ESCAPE to return to previous screen]

$\cos \phi$ Average three phase generator power factor

kW Total three phase generator real power

S	H	U	T	D	O	W	N												
			L	O	w		O	i	l		P	r	e	s	s				
												r	e	s	e	t			

On initiation of the starting sequence, the following screen is displayed. On detection of the engine crank and engine speed rising to crank disconnect speed, information relating to the engine speed at which the starter motor is dis-engaged (Pull-out RPM) is displayed. The display will automatically return to the OVERVIEW screen following expiry of the timing sequence.

[illegible]

H ₂ O	Engine coolant water temperature (Degree Celsius/Fahrenheit)
Oil	Engine lubricating oil pressure {BAR/PSI}
RPM	Engine speed in revolutions per minute
Batt	Engine starter (or control) battery voltage
Hours	Accumulated unit operating hours
Starts	Accumulated start/crank cycle attempts

5. FAULT CONDITIONS

Shutdown: These critical faults cause the generating set to stop. They also prevent the generating set from starting and must be acknowledged and reset before any further generator set operation can occur. Note: A shutdown condition will prevent the generator set from starting in automatic mode.

To reset shutdowns/alarms refer to Section 4.3.5

In addition, faults can be constrained as follows:

Immediate: These fault conditions are armed at all time.

Time Delayed: These alarms are inhibited for a programmable transient time period following receipt of the first fault signal. If, following the time delay, the fault is still present the fault condition is latched.

Fault Protection Timer (FPT): These fault conditions are inhibited until the generating set has reached normal running conditions and the FPT time has expired.

In the event of a fault condition, regardless of category, the cause will be indicted on the LCD, the visual fault LED will flash and any optional siren will sound. When acknowledged the LED will become continuous and the audible alarm will become silent. Once activated all fault conditions are logged in the ALARM LOG and latched active until manually reset. When the entire contents of the ALARM LOG have been reset the fault LED will go out.

To view multiple fault conditions (if present), press the UP and DOWN arrow keys to scroll through the list of logged faults. Conditions requiring reset are highlighted by a '*' at the end of the fault text. To reset a fault place the cursor over the appropriate '*' and press the ENTER key. A running tally of the number of active (i.e. those requiring reset) faults is displayed at the top of the screen.

4.3.6 Configure: For information relating to the configuration of the ACCESS 4000 control module, please refer to section 6.

4.3.7 Additional Status Screens: In addition to the screens which the operator may select, a number of automatically initiated operating status screens may replace the currently selected screen.

On detection of an alarm type fault condition, the following screen is displayed for ten seconds. The screen provides information as to the nature of the fault condition. The display will automatically return to the OVERVIEW menu following expiry of the timing sequence. Note: the operator is not required to perform any fault condition acknowledgement. Reset of the fault condition is achieved via the ALARM LOG menu.

On detection of a shutdown type fault condition, the following screen is displayed prompting the operator to acknowledge the fault. The screen provides information as to the nature of the fault condition. To acknowledge the fault and clear the screen, the operator is required to press the ENTER key. The display will automatically return to the MAIN MENU.

The type and number of fault conditions are defined during factory configuration and so not all fault conditions described here may be enabled within your controller. If you have any queries regarding your configuration or require additional fault conditions, please contact your local dealer.

5.1 Internal Fault Conditions

Internal fault conditions are those which are activated internally by the system, many of them from the analogue instrumentation channels. The ACCESS 4000 is supplied from the factory with two standard internal fault conditions, and six optional internal fault conditions.

FAIL TO START (Overcrank) - [standard, shutdown, immediate]. The fail to start fault condition is initiated when the engine fails to start after the selected crank time and number of crank cycle repeats. The fail to start fault condition is internally programmed as a shutdown fault and is not user programmable.

OVERSPEED [standard, shutdown, immediate]. The overspeed fault condition is initiated when the engine's speed has increased above the overspeed setpoint as detected by the flywheel mounted magnetic pick-up. The overspeed fault condition is internally programmed as a shutdown fault and is user programmable as an engine speed approximately 10% above nominal for diesel engines and 15% above nominal for gas engines. Refer to the configuration instructions (section 6.2) for further programming information.

APPROACHING LOW OIL PRESSURE [option, alarm, FPT]. The approaching low lubricating oil pressure fault condition is activated when the lubricating oil pressure drops below a pre-determined setpoint. The approaching low oil pressure fault is internally programmed as an alarm condition and is user programmable for pressure setpoint level. Refer to the configuration instructions (section 6.2) for further programming information.

APPROACHING HIGH ENGINE TEMPERATURE - [option, alarm, FPT]. The approaching high engine coolant temperature fault condition is activated when the engine jacket coolant rises above a pre-determined setpoint. The approaching high coolant temperature fault is internally programmed as an alarm condition and is user programmable for temperature setpoint level. Refer to the configuration instructions (section 6.2) for further programming information.

LOW BATTERY VOLTAGE [option, alarm, time delay]. The low battery voltage fault condition is activated when the engine battery voltage drops below a pre-determined setpoint for a specified time delay. The low battery voltage fault is internally programmed as an alarm condition and is user programmable for voltage setpoint level and transient time delay. Refer to the configuration instruction (section 6.2) for further programming information.

HIGH BATTERY VOLTAGE [option, alarm, time delay]. The high battery voltage fault condition is activated when the engine battery voltage rises above a pre-determined setpoint for a specified time delay. The high battery voltage fault is internally programmed as an alarm condition and is user programmable for voltage setpoint level and transient time delay. Refer to the configuration instruction (section 6.2) for further programming information.

BATTERY CHARGER FAILURE [option, alarm, time delay]. The battery charger failure fault condition is activated when the engine battery voltage drops below a pre-determined setpoint for a specified time delay, indicating a failure in the battery trickle/float charging system. The battery charger failure fault is internally programmed as an alarm condition and is user programmable for voltage setpoint level and transient time delay. The battery charger failure fault is normally programmed for a higher battery voltage setpoint than the low battery voltage fault condition. Refer to the configuration instruction (section 6.2) for further programming information.

NOT IN AUTO MODE [option, alarm]. The not in auto mode fault condition is activated when the control switch (ref. Figure 1.1 - item 7) is changed from the AUTO position to any other position. The not in auto mode fault condition is internally programmed as an alarm condition and may be enabled or disabled by the user.

5.2 External Fault Conditions

The ACCESS 4000 controller provides up to seven digital fault inputs. Each digital fault input is activated via a remote sensing contact that is external to the controller. The ACCESS 4000 is factory fitted with three standard external fault inputs and the remaining four fault inputs are available as options.

Each optional external fault input may be programmed with a unique fault label and must be specified at the time of equipment purchase.

HIGH ENGINE TEMPERATURE [standard, shutdown, FPT]. The high engine temperature fault condition is activated when the engine jacket coolant rises above a setpoint as determined by the engine mounted temperature switch. The high engine coolant temperature fault is internally programmed as a shutdown condition.

LOW OIL PRESSURE [standard, shutdown, FPT]. The low lubricating oil pressure fault condition is activated when the engine oil pressure drops below a setpoint as determined by the engine mounted pressure switch. The low lubricating oil pressure fault is internally programmed as a shutdown condition and is inhibited until normal running conditions are established.

EMERGENCY STOP [standard, shutdown, immediate]. The emergency stop fault condition is activated when the control panel mounted emergency stop push-button is pressed or the canopy mounted emergency stop push-button (if applicable) is pressed. The emergency stop fault condition is internally programmed as a shutdown condition. This shutdown fault can be reset by turning the control switch to the OFF position.

USER PROGRAMMABLE EXTERNAL FAULT INPUTS [option, alarm/shutdown, time delay, FPT]. The four user programmable external fault conditions are activated when their corresponding inputs are switched low. The fault conditions are fully user programmable for action and time delays. Refer to the configuration instructions (section 6.3) for further programming information.

6. CONFIGURATION

The ACCESS 4000 is fully programmed before it leaves the factory however an operator may, if required, modify the factory defaults to best suit the site application. Configuration of the ACCESS 4000 control system is selected via the CONFIGURE option within the main menu. The operator will be presented with a sub-menu displaying the following:

				S	Y	S	T	E	M	*	*	S	E	T	P	O	I	N	T	S		
				I	N	P	U	T	S	*	*	O	U	T	P	U	T	S				
				S	E	C	U	R	I	T	Y	*	*	C	A	L	I	B	R	A	T	E

- Pressing the ESCAPE key will return the control to the main menu.

Level	Default Password	Authorisation
One (Operator)	1111	Resetting alarms and shutdowns
Two (Technician)	2222	The above plus configuration of system, setpoints, inputs and outputs.
Three (Factory/Dealer)	****	The above plus re-calibration of the analogue channels
Remote [option]	9999	Permits control and monitoring access via the communication facility

Within this menu selection the operator may change settings relating to the generator system. A level two password is required for entry. A series of twenty screens are presented requesting input or conformation of data entry. The first in the series is as shown in the following table:

				U	N	I	T		A	D	D	R	E	S	S						
									*	*											
																e	n	t	e	r	J

Unit Address (0 to 15) - Unique address for each unit in the system. Maximum of 16 units on the network.

Comms Type (2 or 4) - Defines the communication bus connection type. Two wire connection for half duplex RS485 or four wire for full duplex RS422.

Phase B inside PT ratio (64V, 130V, 250V ,320V or 370V) -
Defines the internal transformer primary voltage for phase B.

Phase C inside PT ratio (64V, 130V, 250V, 320V or 370V) -
Defines the internal transformer primary voltage for phase C.

Rated kW (5 - 5000kW) - Rated electrical power of the generating set

Rated kVA (5 - 5000kVA) - Rated apparent power of the generating set

System Frequency (50 or 60Hz) - Defines the nominal operating frequency of the generating set

Number of Phases (1.2 or 3) - Defines the customer power connection type. Used in the determination of the correct parameter calculation algorithms

No. of Teeth (1 - 999) - Defines the scaling factor applied to the RPM readout and associated fault conditions

No. of Poles (2, 4, 6) - Defines the number of alternator pole pairs.

System Voltage (100 - 13800Vac) - Defines the nominal operating voltage of the generating set

VT Ratio (1 - 999) - Defines the scaling factor applied to the voltage readout and associated fault conditions. This VT ratio is for additional voltage transformers mounted externally to the Access 4000 box and should not be mistaken for the inside PT ratio mentioned above.

CT Ratio (1 - 9999, 5 Amp secondaries) - Defines the scaling factor applied to the current readout and associated fault condition

Crank Cut-Out (1 - 999 rpm) - Engine RPM level where the starter motor crank signal is cancelled.

Crank Time (1 - 99 sec) - Defines the period of engine cranking per crank cycle

Crank Delay (1- 99 sec) - Defines the period of time between engine crank attempts

Crank Repeats (1 - 10) - Defines the number of times the controller will attempt to crank the engine

Within this menu selection the operator may change settings relating to the fault conditions, both standard and optional. A level two password is required for entry. Depending on the number of optional fault conditions specified at time of order, a series of up to twenty-six screens may be presented requesting input or conformation of data entry. A typical screen is shown below:

			O	V	E	R	S	P	E	E	D		R	P	M	>			
S	E	T	P	O	I	N	T												
							1	9	8	0	r	p	m						
												e	n	t	e	r			

The cursor keys are used to modify the values, the UP and DOWN keys cause the value to increment and decrement and the LEFT and RIGHT keys move the cursor along the data field. Pressing ENTER will input a new value or confirm the existing value. The controller will automatically move onto the next programming screen. ESCAPE will return the controller to the configure sub-menu.

Overspeed

Setpoint (1000 - 4200 rpm) - Defines the maximum allowable engine speed

Battery Voltage High V>

Setpoint (12 - 34 Vdc) - Defines the maximum allowable engine battery voltage

Time Delay (0 - 99 sec) - Defines the fault transient ride through period

Battery Voltage Low V<

Setpoint (9 - 24Vdc) - Defines the minimum allowable engine battery voltage

Time Delay (0 - 99 sec) - Defines the fault transient ride through period

Battery Charger Fail

Setpoint (9 - 28Vdc) - Defines the minimum allowable battery charging voltage

Time Delay (0 - 99 sec) - Defines the fault transient ride through period

Appr Low Oil Pressure

Setpoint (1 - 9 bar) - Defines the normal minimum engine lubricating oil pressure (1 Bar = 14.5 PSI)

Appr High Engine Temperature

Setpoint (90 - 105°C/194-221°F) - Defines the normal maximum engine coolant temperature

Not in Auto (enabled, disabled) - Defines whether the fault is enabled or disabled

FPT Delay

Time Delay (0 - 99 sec) - Defines the engine fault condition inhibit time period

6.3 Inputs Menu

Within this menu selection the operator may change settings relating to the four external fault inputs. A level two password is required for entry. Depending on the number of optional fault inputs specified at time of order, a series of up to fourteen screens may be presented requesting input or conformation of data entry. A typical screen is shown below:

			F	A	U	L	T		I	N	P	U	T		1				
T	I	M	E		D	E	L	A	Y										
									*	*	*	s	e	c					
															e	n	t	e	r

The cursor keys are used to modify the values, the UP and DOWN keys cause the value to increment and decrement and the LEFT and RIGHT keys move the cursor along the data field. Pressing ENTER will input a new value or confirm the existing value. The controller will automatically move onto the next programming screen. ESCAPE will return the controller to the configure sub-menu.

Fault Input 1

Time Delay (0 - 99 sec) - Defines the fault transient ride through period

Action (alarm, shutdown) - Defines how the generator will respond to the fault

FPT Delay (enabled, disabled) - Defines if the fault is to be inhibited during startup

Fault Input 2

Time Delay (0 - 99 sec) - Defines the fault transient ride through period

Action (alarm, shutdown) - Defines how the generator will respond to the fault

FPT Delay (enabled, disabled) - Defines if the fault is to be inhibited during startup

Fault Input 3

Time Delay (0 - 99 sec) - Defines the fault transient ride through period

Action (alarm, shutdown) - Defines how the generator will respond to the fault

FPT Delay (enabled, disabled) - Defines if the fault is to be inhibited during startup

Fault Input 4

Time Delay (0 - 99 sec) - Defines the fault transient ride through period

Action (alarm, shutdown) - Defines how the generator will respond to the fault

FPT Delay (enabled, disabled) - Defines if the fault is to be inhibited during startup

Remote Start

Time Delay On (0 - 99 sec) - Defines the delay period between receiving the remote start signal and the controller initiating the engine start sequence.

Time delay Off (0 - 99 min) - Defines the delay period between receiving the remote stop signal and the controller terminating the engine run signal

6.4 Outputs Menu

Within this menu selection the operator may change settings relating to the optional two programmable relay outputs and the expansion port. A level two password is required for entry. Depending on the number of optional outputs specified at time of order, a series of up to three screens may be presented requesting input or conformation of data entry. A typical screen is shown below:

			O	U	T	P	U	T		R	E	L	A	Y		1			
A	C	T	I	O	N														
					O	V	E	R	L	O	A	D							

The cursor keys are used to modify the values, the UP and DOWN keys cause the value to scroll through the option list. Pressing ENTER will input a new value or confirm the existing value. The controller will automatically move onto the next programming screen. ESCAPE will return the controller to the configure sub-menu.

Output Relay 1

Action - Defines under what alarm/status condition the output relay will energise

1. Running - generator started and producing rated speed and voltage
2. Alarm - alarm fault condition active
3. Shutdown - shutdown fault condition active
4. Ready to Load - generator started in automatic and producing rated speed and voltage
5. Overspeed - the controller has detected an engine overspeed condition
6. Overload - the controller has detected an overload fault condition
7. Not Defined - future development
8. Not Defined - future development
9. Not Defined - future development

Output Relay 2

Action - Defines under what alarm/status condition the output relay will energise

1. Running - generator started and producing rated speed and voltage
2. Alarm - alarm fault condition active
3. Shutdown - shutdown fault condition active
4. Ready to Load - generator started in automatic and producing rated speed and voltage
5. Overspeed - the controller has detected an engine overspeed condition
6. Overload - the controller has detected an overload fault condition
7. Not Defined - future development
8. Not Defined - future development
9. Not Defined - future development

Expansion Port

Action - Defines the mode of operation of the expansion port

1. Annunciator - controls the remote annunciator interface module
2. Data Logger - not yet available [contact factory for details]
3. Modem - not yet available [contact factory for details]
4. Not Defined - future development
5. Not Defined - future development
6. Not Defined - future development
7. Not Defined - future development
8. Not Defined - future development
9. Not Defined - future development

6.5 Security Menu

Within this menu selection the operator may change the level one, level two or remote access passwords. In order to change the password the original password must first be entered:

E	N	T	E	R		Y	O	U	R		P	A	S	S	W	O	R	D					
						*	*	*	*														
																		e	n	t	e	r	↵

The controller will then prompt for entry of the new password:

		N	E	W		L	1		P	A	S	S	W	O	R	D							
						*	*	*	*														
																		e	n	t	e	r	↵

and then a further confirmation.

		C	O	N	F	I	R	M		L	1		P	A	S	S	W	O	R	D			
						*	*	*	*														
																		e	n	t	e	r	↵

The new password MUST be entered correctly on both screens before it will be accepted. The cursor keys are used to modify the values, the UP and DOWN keys cause the value to increment and decrement and the LEFT and RIGHT keys move

the cursor along the data field. Pressing ENTER will input a new value. ESCAPE will return the controller to the configure sub-menu.

Entering a level 1 password enables the operator to change only the level 1 password. Entering the level 2 password enables the operator to change either the level 1 or level 2 passwords. Entering the remote access password enables the operator to change only the remote access password.

6.6 Calibrate Menu

While each ACCESS 4000 unit is fully calibrated before it leaves the factory, there may be a requirement to re-calibrate during commissioning. Within this menu selection the operator may only modify factory calibration settings, returning all gain values to one (1) and offset values to zero (0) will return the unit to the factory calibrated default. A level three password is required for entry and so may only be performed by suitably qualified and authorised personnel. A series of sixteen screens will be presented requesting input or conformation of data entry. The first in the series is as shown below:

						V	T			P	H	A	S	E		A										
G	A	I	N	:																						
										+	*	.	*	*	*											
																					e	n	t	e	r	↵

The cursor keys are used to modify the values, the UP and DOWN keys cause the value to increment and decrement and the LEFT and RIGHT keys move the cursor along the data field. Pressing ENTER will input a new value or confirm the existing value. The controller will automatically move onto the next programming screen. ESCAPE will return the controller to the configure sub-menu.

For detailed information on the procedure for re-calibrating the controller please contact your local dealer.

7. CONTROL SYSTEM OPTIONS AND UPGRADES

A large variety of options may be fitted to customise the control system for a specific installation. The following sections cover the use and operation of these options.

7.1 Battery Charger

A battery charger is required for maintaining a correct battery charge level, especially on the stand-by generating sets. Please consult your dealer for this item.

7.2 Heaters

In addition to conventional space heaters that are useful in keeping the generating set warm and dry in cold or humid environments, four types of heater may be fitted on the generating set.

Immersion type heaters (engine heaters) may be fitted in the engine coolant system to ensure that the engine is easy to start and able to take load more quickly.

Oil sump heaters may be fitted to the engine sump case to ensure that the lubricating oil viscosity is maintained so aiding in engine starting and load acceptance

Alternator anti-condensation heaters may be fitted to the alternator stator windings to keep them dry in humid conditions.

Battery trace heaters may be fitted to the engine starter battery system to maintain the battery electrolyte at a temperature which will ensure good battery performance under engine starting conditions.

7.3 Remote Annunciator Interface (See Appendix A)

A hardware package is available to remotely monitor the generating set. A series of sixteen fault condition monitoring relays activate to signal, via Form C volt-free contacts, a remote annunciator. Connection details are provided with the option package.

7.4 Remote Control and Monitoring

A hardware and software package is available to remotely control and monitor the generating set either directly with a PC or over a telephone line using a modem. Detailed operating instructions are provided with the option package.

An open protocol communication port is available to remotely control and monitor the generating set via a Building Management System (BMS) or Supervisory Control And Data Acquisition (SCADA) system. Detailed protocol information is available from your local dealer.

8. CONTROL SYSTEM FAULT FINDING/TROUBLE SHOOTING GUIDE

A number of faults may cause the ACCESS 4000 control module not to function correctly. Refer to the following list of typical problems. For further detailed information or any problems not listed, please consult your local dealer.

CAUTION

! There are NO user serviceable parts within the ACCESS 4000 control module. Any attempt to open the module will result in termination of the product warranty.

All fault finding and service procedures must be undertaken by qualified and authorised personnel only.

OVERSPEED	start-up	
	Inadequate MPU signal	Check the connections of the MPU.
Generating set voltage fluctuates or is unstable.	AVR dynamics are improperly setup	Refer to a qualified generating set technician

Fault	Cause	Remedy
Unit does not power up	No input dc power supply	Check the 9 - 32 Vdc power supply
LCD does not display screen text	Microprocessor not functioning	Check the watchdog LED on the rear of the unit, it should flash at regular intervals
Start command (i.e. RUN or AUTO) does not start the engine	Starter motor not engaging	Check the starter motor LED on the rear of the unit , it should energise on for a few seconds and then off.
	Fuel control solenoid not energising	Check the fuel control LED on the rear of the unit, it should energise on.
	Shutdown fault condition active	Check the fault log for active shutdown faults
		Refer to a qualified generating set technician
Starter motor stays engaged after the engine starts	Crank cut-out setpoint in the system menu is too large	Adjust the setpoint down
ACCESS 4000 indicates	Engine has overspeed during	Refer to a qualified generating set technician

Fault	Cause	Remedy
Engine speed is unstable	Speed control dynamics are improperly set-up	Refer to a qualified generating set technician
FAIL TO START	The engine has no fuel supply	Check fuel level/pressure
HIGH ENGINE TEMP fault displayed	Engine stops due to high engine temperature	Check engine was not overloaded
		Check radiator for obstructions
		Check coolant level within radiator
		Refer to a qualified generating set technician
LOW OIL PRESSURE fault displayed	Engine stops due to low lubricating oil pressure	Check oil level
		Refer to a qualified generating set technician
EMERGENCY STOP fault displayed	Emergency Stop pushbutton has been pressed	Check and release emergency stop buttons.
Incorrect voltage or current meter reading	Incorrect VT & CT ratio programming	Verify that the VT & CT ratios are correct
	Incorrect primary PT connection	Verify that PT input voltages tapping connections are correct (see figure 2.5 & 2.6)
	Incorrect primary PT ratio setting	Verify that PT ratios are correct
Incorrect engine temperature or oil pressure meter reading (or displaying #####)	Incorrect wiring connection	Verify that the voltage and current sensing wiring is as per the appropriate wiring diagram
	Incorrect analogue calibration	Refer to a qualified generating set technician

9. SPECIFICATION

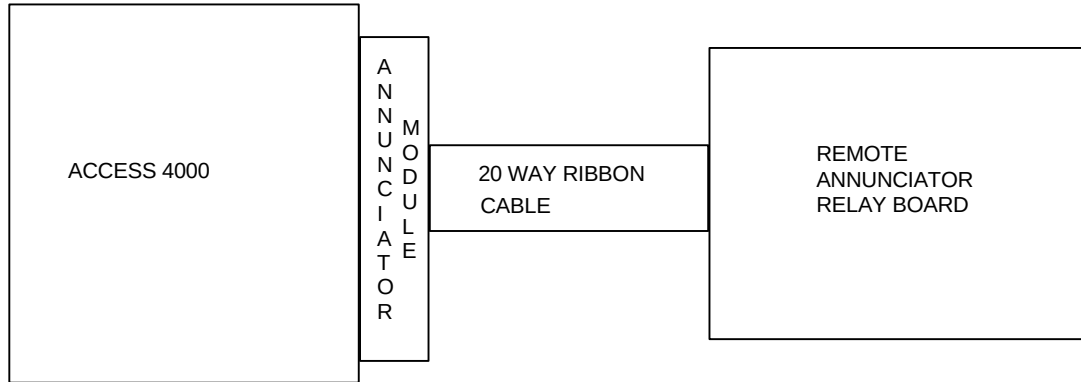
Power Supply 9 - 32 Vdc, negative ground (voltage dip transient, 4.5V dc for 50 ms)

- Operating Temperature -10 to +50° (14 to 122°F)
- Ingress Protection IEC 529 IP-56, NEMA 1
- Power Consumption 6 Watts (maximum)
- AC Metering Accuracy $\pm 1.5\%$ @ 25°C
- Engine Parameter Accuracy $\pm 1.0\%$ @ 25°C (plus sender accuracy)
- Inputs:
 - Engine Speed Sensing (Magnetic Pick up) 50Hz - 10,000Hz, 5 - 30Vac (rms)
 - AC Voltage (nominal) 110 - 480Vac (L-L)/63.5 277Vac (L-N) 50 - 60 Hz
 - AC Current (nominal) 0 - 5A
 - Engine Parameters Variable resistance type senders
 - Digital Inputs Switch to power supply negative
- Outputs 2A, 30 Vdc, Form C

APPENDIX A

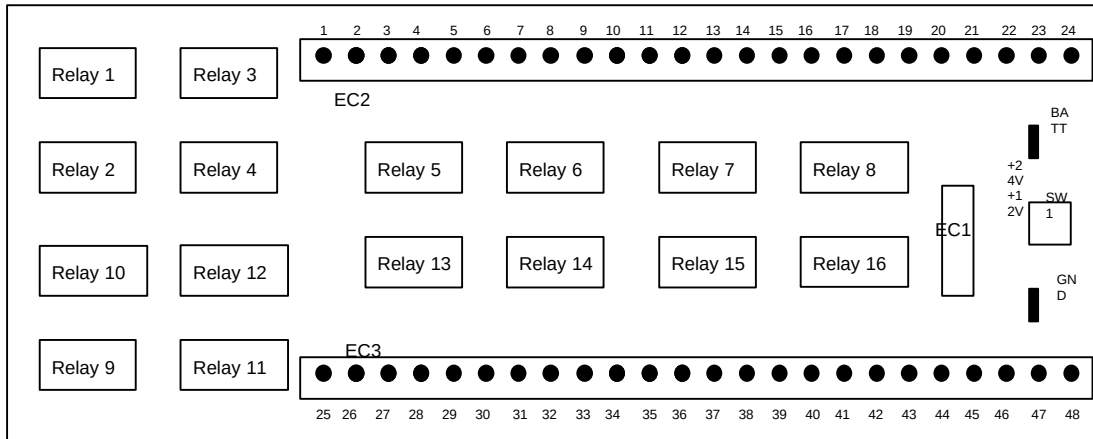
REMOTE ANNUNCIATOR BOARD for the ACCESS 4000

The remote annunciator board has sixteen relays, which are activated by the ACCESS 4000 to switch external devices (lights, alarms, sirens, etc.) when a shutdown/alarm activates. There are two units associated with the remote annunciator, the **ANNUNCIATOR MODULE** and the **REMOTE ANNUNCIATOR RELAY BOARD**. These are connected to each other via a 20-way ribbon cable as shown in the diagram below.



The Annunciator unit is connected to the ACCESS 4000 control panel as follows:

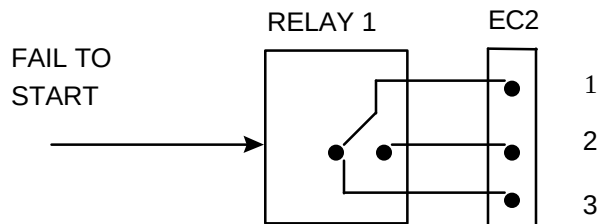
1. The cover plate on the side of the ACCESS 4000 is unscrewed and removed to reveal the 15 way D connector.
2. The **Annunciator Module** is connected to the 15 way D connector and is screwed into place.
3. SW1 on the **Remote Annunciator Relay Board** is set to either 12V or 24V according to the battery voltage.
4. The Supply voltage and Ground wires (7 and 5) are connected to the **Remote Annunciator Relay Board** 'BATT' and 'GND' terminals.
5. The 20 way Ribbon Cable is connected between the **Annunciator Module** and EC1 on the **Remote Annunciator Relay Board**.



REMOTE ANNUNCIATOR RELAY BOARD

When a shutdown or alarm occurs, the Access 4000 signals the remote annunciator relay board to energise the appropriate relay(s).

For example in the diagram below pins 1 and 3 are normally connected (in the no alarm state) through relay 1. Whenever the fault FAIL TO START occurs the relay will energise, and pins 1 and 2 will be connected.



There are 15 standard fault conditions enabled on all ONA NFPA 110 Access 4000 control systems. The table below shows the corresponding relay to each protection function

Fault Condition	Relay
FAIL TO START	1
OVERSPEED	2
EMERGENCY STOP	3
HIGH COOLANT TEMPERATURE	4
LOW OIL PRESSURE	5
CONTROL SWITCH NOT IN AUTO	6
APPROACHING LOW OIL PRESSURE	7
APPROACHING HIGH ENGINE TEMPERATURE	8
LOW BATTERY VOLTAGE	9
HIGH BATTERY VOLTAGE	10
BATTERY CHARGER FAILURE	11
SPARE FAULT INPUT 1	12
SPARE FAULT INPUT 2	13
SPARE FAULT INPUT 3	14
SPARE FAULT INPUT 4	15

The relays and their associated pins on the Remote Annunciator Relay Board connectors EC2 and EC3 are shown in the table below.

Each relay has a single set of changeover contacts. These switch from the 'no fault condition' to the 'fault condition' when the associated alarm or shutdown is activated and switch back again once the fault has been cleared.

RELAY	PIN NUMBERS			PINS CONNECTED			
	Connector - EC2			No fault condition		Fault condition	
1	1	2	3	1	3	1	2
2	4	5	6	4	6	4	5
3	7	8	9	7	9	7	8
4	10	11	12	10	12	10	11
5	13	14	15	13	15	13	14
6	16	17	18	16	18	16	17
7	19	20	21	19	21	19	20
8	22	23	24	22	24	22	23
	Connector - EC3						
9	25	26	27	25	27	25	26
10	28	29	30	28	30	28	29
11	31	32	33	31	33	31	32
12	34	35	36	34	36	34	35
13	37	38	39	37	39	37	38
14	40	41	42	40	42	40	41
15	43	44	45	43	45	43	44
16	46	47	48	46	48	46	47

Remote Annunciator Relay Contact Ratings:

10 Amps	at	125V	AC
7 Amps	at	250V	AC
7 Amps	at	30V	DC