MODEL EC282

ENGINE CONTROL

INSTRUCTION MANUAL

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Index

SECTION 1: EC282 ENGINE CONTROL

1.1 General Description

The Staticraft Ltd. Model EC282 is a solid state, microprocessor based engine control, designed to comply with CSA standard C282-1977, as we understand it. The unit provides all of the signal processing, hardware, software, and annunciation for the complete control and protection of a diesel engine. A programming switch located on the back of the control is provided to modify the operating sequence to suit various applications. The unit is flush mount, with dimensions of 7" H x 7" W x 1.5" D.

The inputs and outputs for the EC282 are accomplished with an interface card, selected from one of three available configurations. A battery voltage range of 8 - 30 VDC allows the card to be used on 12 VDC or 24 VDC systems. Refer to section 2 for details.

An expansion card (Model EC283) may be added to the EC282 system to provide four additional fault inputs. It is connected to the EC282 via a nine conductor ribbon cable approximately 12" long, terminated with a DB9 socket at each end. Refer to section 1.10 and to figure 3.

1.2 EC282 Operation

1.2.1 Unit Start

The start signal may be applied to the EC282 in two ways:

- by connecting manual (terminal 5) to battery negative.

- by connecting auto (terminal 6) to battery negative, and shorting the engine start contact (terminal 7) to negative.

Upon receiving the start signal, the EC282 will energize the fuel and crank outputs. As the engine fires and comes up to speed, the starter circuit is disengaged, and a bypass time delay (adjustable 0 - 60 seconds) is initiated. The low oil pressure and high coolant temperature circuits are inhibited until this delay has timed out.

Closure of either contact following the delay will result in an engine shutdown, and the appropriate lamp will be lit on the front panel of the controller. A bypass delay output is

provided to extend the delay signal. The output will energize as the delay times out.

If the engine fails to start during the crank cycle (adjustable 1 - 4 cycles), the fuel circuit will de-energize, shutting down the engine, and the overcrank lamp will be lit on the front panel. An overcrank output is also generated.

If a fault input signal is received, the diesel is shut down, and an output signal is generated. If the model 282-MAX or 282-SSO interface card is selected, a separate output is provided for each fault. The 282-MIN provides a common alarm output. Note that a low engine temperature, low fuel, or low battery voltage input will result in an alarm only (no shutdown). Set the EC282 to the OFF position to reset the annunciators following a fault.

Note: the operating sequence described in the previous paragraphs may be altered substantially with the use of a programming switch. Refer to section 1.3 for details.

1.2.2 Electronic Speedswitch

The EC282 incorporates an internal speedswitch which monitors a speed signal derived from the generator frequency, or from a magnetic pickup (selectable with programming switch). If derived from the generator, the speed signal is a nominal 24 VAC, but will operate from a signal as small as 0.02 VAC or from a signal considerably in excess of 24 VAC. It is very important that the speedsignal wiring is completely isolated from any other engine wiring (refer to section 1.11). The speedsignal is used in conjunction with two switchpoints:

Low Switchpoint - used to terminate starter cranking. It is adjustable from 30% - 60% of nominal engine speed. As engine speed increases, the low switchpoint opens, and is latched in this position to ensure that the starter does not attempt to re-engage in the event of a loss of signal.

High Switchpoint - used to provide overspeed for the engine. It is adjustable from 90% - 120 % of nominal engine speed. Refer to user adjustments (section 1.8) for the location of the adjustment potentiometers.

Note: the continuity of the speedsignal is monitored by the EC282. If the signal is lost for a period of 3 seconds while the unit is cranking or running the diesel will be shut down, a loss of signal output will be generated, and the No Speed Signal annunciator will energize. The time delay loss of speed signal (TDLS) may be extended to 30 seconds with the programming switch (refer to section 1.3).

1.2.3 Battery Voltage Sensor

The EC282 is equipped with a low battery voltage sensor suitable for use with 12 VDC or 24 VDC systems.

The battery voltage applied to terminals 1 (positive) and 2 (negative) of the interface card is sampled by an analog to digital converter internal to the EC282. The digital value is then compared to the reference voltage value set by the operator, which is stored in memory. A potentiometer located on the left side of the circuit card (as viewed from the back), allows the reference voltage to be adjusted from 9.0 - 25.5 VDC. Refer to section 1.9 for adjustment details.

If a low voltage situation is sensed, a three minute time delay is initiated, indicated by a flashing Low Battery Voltage annunciator. If the voltage remains below the setpoint as the delay times out, a low voltage output alarm is generated, and the pilot lamp will remain on continuously. If battery voltage exceeds the setpoint the circuit will reset. The voltage sensor will only operate if the EC282 is in the Auto or Manual position (it will not work in Off).

1.2.4 Fault Circuitry

The model EC282 provides five shutdown and three alarm inputs. In each case, a fault will result in a pilot lamp energizing, and an output signal being sent to the interface card.

No Speed Signal (shutdown) - this circuit will activate if the speedsignal is lost for a period greater than three seconds. The time period may be set to thirty seconds if desired using the programming switch. The No Speed Signal annunciator will flash during the time delay to indicate the impending failure.

Overcrank (shutdown) - this circuit will activate if the diesel fails to start following the crank cycle.

Low Oil Pressure (shutdown) - this circuit will activate if a low oil pressure fault is received following bypass time delay. If a low oil pressure inhibit on startup is included in the operating sequence (refer to section 1.3), a LOP input must be received in order for the diesel to attempt to start. If the LOP switch remains closed during bypass, the LOP annunciator will flash to indicate the condition.

High Coolant Temperature (shutdown) - this circuit will activate if a high coolant temperature fault is received following bypass time delay. If the HCT switch closes during bypass, the HCT annunciator will flash to indicate the

condition.

Overspeed (shutdown) - this circuit will activate instantly if engine speed exceeds the high switchpoint.

Low Engine Temperature (alarm) - this circuit will activate instantly if a low engine temperature fault is received. This input is armed regardless of engine status, providing the controller is not set to the Off position.

Low Fuel (alarm) - this circuit will activate instantly if a low fuel fault is received. This input is armed regardless of engine status, providing the controller is not set to the Off position.

Low Battery Voltage (alarm) - this circuit will activate following a three minute time delay if a low battery voltage situation exists. The pilot lamp will flash during the time delay. This circuit is armed regardless of engine status, providing the controller is not set to the Off position.

Note: if any of the three alarms are active when a shutdown condition occurs, the alarm status will be latched to inform the operator of the situation. Switching the EC282 to Off will reset the alarms.

1.2.5 Additional Annunciation

The EC282 provides a pilot lamp for each fault circuit mentioned in the previous section. In addition, a Switch Not in Auto lamp is supplied. This lamp is energized if the EC282 is set to Off or Manual, and an output is generated to provide a remote indication of switch position.

1.2.6 Lamp Test

A lamp test circuit is provided to verify annunciator operation. To activate, connect terminal 8 to battery negative. If the EC283 expansion card is included in the system, the four annunciators on that unit will also flash.

1.2.7 Time Delays

The EC282 is equipped with seven time delays. Two are fixed, one has a switchable time constant, and four are adjustable. Refer to section 1.8 for adjustment details.

Time Delay Fuel (TDF) - fixed at 30 seconds. This delay is only relevant if the fuel control has been configured for "energized to stop" operation. Refer to section 1.3 for details. The delay is initiated by placing the selector

switch in the Off position, or opening the engine start contact (assuming the controller is in the Auto mode of operation). The fuel output is energized during the delay period. Note: if TDCD (refer to "f" this section) is selected, TDF will not start until TDCD has timed out.

Time Delay Battery Voltage (TDBV) - fixed at 3 minutes. The delay is initiated when battery voltage drops below the reference voltage set by the operator. At the end of the delay, a low battery voltage output is generated. If battery voltage exceeds the setpoint the circuit will reset.

Time Delay Loss of Signal (TDLS) - the time constant for this delay may be set to 3 seconds or 30 seconds using the programming switch. At the end of the delay the diesel is shut down and a No Speed Signal output is generated.

Time Delay Engine Start (TDES) - adjustable 0 - 15 seconds. The delay is initiated by the closure of the engine start contact. It is intended to prevent unnecessary diesel operation if the hydro fault is of short duration. If the start contact remains closed at the end of the delay period, the fuel and crank outputs will energize. The delay is only active in the Auto mode of operation.

Time Delay Crank (TDCR) - adjustable 0 - 60 seconds. The delay is initiated by setting the controller to Manual, or by setting the controller to Auto and closing the engine start contact. The crank and fuel outputs are energized during the delay period (providing "energized to stop" operation is not selected). If more than one crank cycle is selected with the programming switch, a rest delay of equal duration is inserted between crank attempts. If TDES is selected, the crank delay will not begin until TDES has timed out.

Time Delay Bypass (TDBP) - adjustable 0 - 60 seconds. The delay is initiated by the opening of the low switchpoint (engine run). The low oil pressure and high coolant temperature faults are inhibited until this delay times out. Following the delay, an output is generated to provide a remote extension of the timer. The LOP and HCT shutdowns are armed at this point. If a fault occurs, the TDBP output is terminated.

Time Delay Cool Down (TDCD) - adjustable 0 - 30 minutes. The delay is initiated by opening the engine start contact. The delay provides a period of time for the diesel to run at no load following prolonged operation. The delay is only active in the Auto mode of operation.

1.3 EC282 Programming Switch

The operating sequence of the EC282 controller may be altered with a 10 pole DIP switch, located on the back of the circuit board. To access the switch, remove the back cover. In addition to modifying the sequence of operation, the DIP switches are used when setting time delay and low battery voltage values. Refer to section 1.9 for more information. Programming functions are as follows:

DS-1: ETR/ETS Selection

Dip switch 1 is used to select the type of fuel control desired. Closing DS-1 will result in "energized to run" operation. The fuel output will energize whenever the engine is to crank or run. Opening the switch will select "energized to stop" operation. The fuel output will energize when the engine is required to stop, and for approximately 30 seconds thereafter.

DS-2: LOP Inhibit Selection

Dip switch 2 is used to select or delete an oil pressure inhibit on startup. If DS-2 is open, the EC282 will check the continuity of the low oil pressure circuit. If the LOP contact is not closed, the diesel start procedure will be inhibited, the LOP output will energize and the LOP annunciator will flash. Subsequent closure of the contact will initiate the resumption of the start procedure. Closing DS-2 will permit diesel startup regardless of the status of the low oil pressure contact.

DS-3: TDLS Selection

Dip switch 3 is used to select one of two time constants available for time delay loss of signal. Closing DS-3 will provide a TDLS of 3 seconds. Opening the switch will provide a 30 second time delay before shutdown occurs.

DS-4: TDES Selection

Dip switch 4 is used to select or inhibit time delay engine start. If DS-4 is closed, the delay will be initiated by the closure of the engine start contact. Opening DS-4 will remove the delay from the start sequence.

DS-5,6,7: Crank Cycle Selection

Dip switches 5, 6 and 7 are used to select the number of crank cycles desired, from one to four. Switch operation is

as follows:

Pole (Open)	# of Crank Cycles
none	1
5	2
5,6	3
5,6,7	4

If more than one crank cycle is selected, a rest delay equal to the value of the crank time period is inserted between crank attempts.

DS-8: TDCD Selection

Dip switch 8 is use to select or inhibit time delay cool down. If DS-8 is closed, the delay will be initiated by the opening of the engine start contact. Opening the switch will remove the delay from the engine stop procedure.

DS-9: MPU/50-60 Hz. Selection

Dip switch 9 is used to select the appropriate speed sensor time constant to permit operation with a magnetic pickup or 50 - 60 Hz. source. If DS-9 is closed, the speedswitch will operate properly from a 50 or 60 Hz. signal. Opening the switch will allow the speed sensor to operate properly from an input signal derived from a magnetic pick up. The range of adjustment for magnetic pickup is approximately 1200 to 2400 Hz. for the low switchpoint and 3600 to 4700 Hz. for the high switchpoint. If the range of adjustment does not cover the desired application, the speedswitch calibration potentiometer may require adjustment. Refer to section 3 (reference) for details on the adjustment procedure.

DS-10

Dip switch 10 is used to enable a test program, verifying the correct operation of EC282 dipswitches, annunciators, and outputs. Open DS-10 to enable the test routine, and close DS-10 to resume normal controller functions. Refer to section 1.9 for a detailed explanation of the test routine.

Factory Settings

All dipswitches are set to the closed position before the unit leaves the factory. A quick reference chart is provided

in section 3 summarizing switch functions and settings.

1.4 Tachometer Drive

The model EC282 controller is equipped with tachometer drive, suitable for use with a DC ammeter, 0 - 1 mADC, calibrated in RPM. The drive signal is proportional to the speed of the diesel engine. A potentiometer located on the back of the circuit card is provided to adjust the sink current from 0.6 to 1.2 mADC at 100% speed.

1.5 Electrical Characteristics

- current drain: 0.35 ADC (max) with 282-MAX interface card.

Note: refer to section 2 for the electrical characteristics of each interface card.

1.6 Mechanical Characteristics

- dimensions 7" W x 7" H x 1.5" D.
- stainless steel front panel.
- brushed aluminum back cover.
- finish - yellow iridite.

1.7 Factory Adjustments

The only factory adjustment for the EC282 is for the calibration of the internal electronic speedswitch. The potentiometer located on the back of the circuit card is used to adjust the 120% frequency to 72 Hz. A white sealing compound is then applied to the potentiometer. If magnetic pickup operation is selected, it may be necessary to re-calibrate the 120% point. Refer to section 3 (reference) for adjustment details.

1.8 User Adjustments

The EC282 has eight user adjustments. All adjustments are made with 15 turn (nominal) potentiometers located on the left side of the circuit card, as viewed from the back. The potentiometers may be adjusted with the back cover in

place. Refer to figure 2 located at the end of the manual.

The Model EC282 is controlled by an 80C31 microprocessor. As such, it is possible to incorporate functions into the controller that would not be easily accomplished using conventional logic, given the physical dimensions of the control.

One area where this is particularly apparent is the setting of time delays. Two methods are available. If an approximate delay time is all that is required, simply turn the relevant potentiometer clockwise. The potentiometers are linear, so the 50% value of a 15 turn pot would be achieved after 7.5 turns. Therefore, if a delay is adjustable 0 - 60 seconds, turning the potentiometer clockwise 7.5 turns from fully CCW position would result in a delay of approximately 30 seconds.

However, if a more exact time delay is required, the EC282 has a provision to set a delay value using binary encoding. Refer to section 1.9 for details.

User adjustments are as follows:

Low Battery Voltage

Adjustable: 9.0 - 25.5 VDC
Factory Setting: 12.0 VDC

Tachometer

Adjustable: 0.6 - 1.2 mADC at 100% speed.
Factory Setting: 1.0 mADC at 120% speed.

Speedswitch High

Adjustable: 90% - 120% of nominal engine speed.
Factory Setting: 110% (66 Hz.).

Speedswitch Low

Adjustable: 30% - 60% of nominal engine speed.
Factory Setting: 33% (20 Hz.).

Time Delays

Delay	Adjustment	Factory Setting
TDES	0 - 15 sec.	5 sec.
Crank	0 - 60 sec.	20 sec.
TDBP	0 - 60 sec.	10 sec.
TDCD	0 - 30 min.	60 sec.

1.9 EC282 Test Routine

Two programs reside in the EC282 system memory. The first program provides the necessary functions to control a diesel engine. The second program is a test routine, capable of verifying the operation of dipswitches, annunciators, and outputs. The routine is also used to set time delays and the low battery voltage setpoint using binary values.

The testing sequence is as follows:

- check lamp operation
- check dipswitch operation
- set time delays
- set low battery voltage sensor
- check output circuits

The test routine will only operate if the EC282 controller is set to Off. If the operator attempts to start the routine while the controller is in Manual or Auto the request will be ignored, the red lamps on the front panel will flash, and the EC282 will continue to provide normal engine control functions.

If the test routine is running, attempting to place the selector switch in either Manual or Auto will cause the red lamps on the EC282 front panel to flash. If the selector switch is returned to the Off position, the test program will resume.

> Important: Before proceeding, note the current dipswitch settings. Ensure that the dipswitches are returned to the same positions at the end of the test routine. This is extremely important in the case of dipswitch 10 (DS-10), which enables the test program. If DS-10 is left in the open position (test enabled), the EC282 will not be capable of executing normal engine control functions.

In order to use the test function, the following steps must be performed in the order specified.

1.9.1 Close all dipswitches.

1.9.2 Open DS-10. This will initiate the test routine. To terminate the test routine close this pole.

1.9.3 The LED's on the EC282 will now flash for a period of five seconds, verifying correct annunciator operation. If the Model EC283 is included in the system, the four annunciators on that unit will also flash.

1.9.4 Dipswitch operation is now checked. Opening switch DS-1 will cause the Switch Not In Auto lamp to de-energize. Similarly, opening DS-2 will de-energize the No Speed Signal lamp. All of the dipswitches may be checked in this manner with the exception of DS-9 and DS-10.

1.9.5 The next part of the program is used for setting or reading the time delay and low battery voltage sensor values. The adjustment potentiometers used are:

Potentiometer	Function
5	Engine Start
6	Crank
7	Bypass
8	Cool Down
9	Low Battery Voltage Sensor

All values are increased by turning the potentiometer in a clockwise direction. Use the decimal to binary conversion table in section 3 (reference) to convert the front panel lights to decimal numbers.

This portion of the routine is stepped through by opening and closing switch DS-1.

1.9.6 To continue, close DS-1, DS-2 and DS-4 to DS-9 (leave DS-3 open). The front lamps will display a flashing 5 to indicate that you are about to adjust time delay engine start.

- open DS-1.
- adjust TDES from 0 to 15.0 seconds (in 0.1 second increments).

- close DS-1.
- display shows flashing 6 (time delay crank).

- open DS-1.
- adjust crank delay from 0 to 60 seconds.

- close DS-1.
- display shows flashing 7 (time delay bypass).

- open DS-1.
- adjust TDBP from 0 to 60 seconds.

- close DS-1.
- display shows flashing 8 (time delay cooldown).

- open DS-1.
- adjust TDCD from 0 to 1800 sec. (10 second increments).

- close DS-1.
- display shows flashing 9 (low battery voltage sensor).

- open DS-1.
- adjust LBV sensor from 9.0 to 25.5 volts (0.1 volt increments).

Note: Examples of reading time delays are located in section 3 (reference).

1.9.7 Closing DS-1 after the voltage setpoint is displayed will cause the test routine to perform a sequential check of the outputs on the EC282 interface card. Each output will be energized for a period of three seconds, followed by an off period of one second. The test order is Crank, Fuel, TDBP, SNIA, No SS, O/C, LOP, HCT, O/S, LET, LF, LBV. If the controller is equipped with the 282-MIN interface card, the common alarm output will energize and de-energize for each of the output signals.

1.9.8 The next section of the test routine will verify the DB9 connection to the EC283 expansion card. During this part of the program the TDBP output on the EC282 interface card will energize for 20 seconds. If the expansion card is not present, the TDBP output will be the only indication of the execution of this section of the program.

However, if the EC283 is present, the inputs and outputs may be tested during the 20 second delay. Shorting each input to battery negative will cause the relevant annunciator and corresponding output to energize.

1.9.9 The last step in the routine is signaled by the amber annunciators on the front of the EC282 flashing. This indicates that the operator has a period of 20 seconds to close dipswitch DS-10 and return to the normal engine control program. If switch DS-10 is not closed the routine will repeat. Note that the test routine will not end until the 20 second delay has timed out.

1.9.10 Remember to reset all dipswitches to the positions recorded before the test routine was executed.

1.10 EC283 Expansion Card

The Model EC282 controller is designed to accept an expansion card, the model EC283, to provide four additional fault inputs. The EC283 is surface mounted, with dimensions 7" H x 3.5" W x 1.5" D. A pilot lamp is provided for each additional fault.

Like the EC282, the inputs and outputs for the EC283 are accomplished with an interface card, selected from one of three configurations. The 283-SSO provides four relay driver outputs, rated at 1 A at 30 VDC (max). The 283-MIN provides one form C dry contact relay common to the four alarms. The contacts are rated at 3 A at 120 VAC or 28 VDC. The 283-MAX provides four separate form C dry contact relays. Contact ratings are the same as the 282-MIN.

A ten-pole programming switch is incorporated into the EC283. Switch functions include selection of TDBP (generated by the EC282) for any of the fault inputs, assignment of inputs as shutdown or alarm only, and the configuration of alarms C and D to enable operation with or without the presence of the engine start signal.

1.11 Application Notes

The inputs for the internal electronic speedswitch (terminals 3 and 4 of the interface card) are sensitive enough to operate from a signal as small as 0.02 VAC. As a result, certain precautions should be taken to avoid problems. For example, assume the EC282 was being used on a standby diesel generator set. The engine has a block heater powered by a 60 Hz. commercial line. If some of the wiring for the heater and the speed sensing transformer are common, the 60 Hz. IR drop along the common wiring may be interpreted by the EC282 as engine speed. As such, the EC282 would not initiate the crank signal because it assumes that the engine is already running. To eliminate this problem, separate wires should be used for the speed sensing transformer.

Similarly, if the speed sensing wiring of the EC282 is common with wiring used for a poorly filtered battery charger, a problem may arise due to the 60 Hz. ripple at the output of the charger. The 120 Hz. ripple along the common wiring may be interpreted by the EC282 as an overspeed condition, resulting in the EC282 shutting down the unit. To eliminate this problem, separate wiring should be used for the speed signal wiring.

If the EC282 speed sensing is derived from a magnetic pickup, neither of the two potential problems mentioned would apply.

A poorly filtered charger may also produce a dangerous voltage surge at the DC input of the EC282 interface card greater than nominal 30 VDC (max). This occurs when a highly capacitive battery is removed from the DC bus (eg. maintenance). It is recommended that the charger always be turned

off in this circumstance.

Lastly, the logic inputs of the EC282 are all high impedance, and protection against electrical noise is incorporated into each input. However, if external lead lengths in excess of 50 feet are required, it is recommended that slave relays be used at the EC282 location.

1.12 Maintenance

The EC282 is a completely solid state device. The only recommended maintenance is periodic inspection for dust or excessive heat buildup. If this occurs, the best approach is to disassemble the unit and clean with a soft bristle brush.

SECTION 2: EC282 INTERFACE CARDS

2.1 General Description

The inputs and outputs for the EC282 are accomplished with an interface card. As mentioned, three configurations are available (282-SSO, 282-MIN and 282-MAX) with different output arrangements. The card is intended to be mounted on the back of the relay panel housing, using a section of track supplied with the circuit board.

Each of the interface cards is powered by a battery voltage of 8 - 30 VDC, for use on 12 VDC or 24 VDC systems. The battery voltage is also applied to the voltage sensor internal to the EC282.

Connections between the interface card and the EC282 are made with a ribbon cable, fitted with a DB25 socket at each end (refer to figure 3).

2.2 282-SSO

The 282-SSO provides twelve solid state relay driver outputs rated at 1 A (max) at 30 VDC. Relay coils may be connected from battery positive to the output terminal.

2.2.1 Electrical Characteristics

Battery Voltage

- terminals 1 (positive) and 2 (negative).
- 8 - 30 VDC input range.

Speed Signal Input

- terminals 3, 4.
- 24 VAC input for speed sensor.
- signal must come from the generator output and must not be switched or interrupted.

Logic Inputs

- terminals 5 - 12.
- source impedance 680 Kohms.

- open circuit voltage 5 VDC.
- logic signal is entered by applying battery negative to the input terminal.

Relay Driver Outputs

- terminals 13 - 24.
- high current silicon transistors provide current sink to battery negative.
- 1 ADC @ 30 VDC (max).
- relay connected from battery positive to output terminal.

Tachometer Drive

- terminal 25
- provides an electrical signal for a 0 - 1 mADC meter calibrated in RPM (supplied by others).
- calibration potentiometer provides adjustment from 0.6 mADC to 1.2 mADC at 100% speed.

Operating Temperature

- -20 to +55 degrees C.

2.2.2 Mechanical Characteristics

- card dimensions - 7.75" W x 3.25" H.
- 24 pole terminal block.
- one tach drive screw terminal.
- one DB25 pin connector
- mounting card dimensions 8" W x 3.375" H.

2.2.3 Terminal Description

Refer to figure 4 for suggested wiring connections.

1 - Positive - battery positive is connected to this terminal. This terminal provides the input for the low battery voltage sensor internal to the EC282.

2 - Negative - battery negative is connected to this terminal.

3 - Speed Signal - this 24 VAC input is the signal for the speed sensor. As such, it should not be switched.

4 - Speed Signal - this is the common terminal for the speed sensor. It is common to terminal 2 (battery negative).

5 - Manual - this is the connection point for the manual position of the control switch. When battery negative is applied to this terminal the diesel engine will start and run. Removing battery negative from this terminal will stop the engine.

6 - Automatic - this is the connection point for the automatic position of the control switch. When this terminal is connected to negative the engine will start and stop when the engine start contact is closed and opened.

7 - Engine Start Contact - this is the connection point for the remote start contact. If the controller is in the Auto position the engine will start when this contact is closed, and stop when it is opened.

8 - Lamp Test - connecting this terminal to negative causes all of the annunciators to flash on and off.

9 - Oil Pressure Switch - an engine mounted lube oil pressure switch is connected from this point to negative. Switch operation should be contact closure on falling oil pressure. If dip switch DS-2 is open, contact closure must be made on this terminal to enable the diesel to start.

10 - High Coolant Temperature Switch - an engine mounted coolant temperature switch is connected from this point to negative. Switch operation should be contact closure on rising coolant temperature.

11 - Low Engine Temperature Switch - an engine mounted coolant temperature switch is connected from this point to negative. Switch operation should be contact closure on low engine temperature. This input is armed regardless of engine status.

12 - Low Fuel Switch - an externally mounted fuel level switch is connected from this point to negative. Switch operation should be contact closure on falling fuel level. This input is armed regardless of engine status.

13 - Crank - this output (relay driver) is completed to negative whenever the engine is to crank.

14 - Fuel - this output (relay driver) is completed to negative whenever the fuel control is to be energized. Two operating modes are available:

- energized to run (ETR) whenever the engine is to crank or run.

- energized to stop (ETS) whenever the engine is to stop and for approximately 30 seconds thereafter.

15 - TDBP - this output (relay driver) is completed to negative when time delay bypass expires. It is used to provide remote extension of the delay.

16 - Switch Not In Auto - this output (relay driver) is completed to negative whenever the control switch is in the Off or Manual position to provide a remote indication of switch position.

17 - No Speed Signal - this output (relay driver) is completed to negative whenever the engine shuts down due to a loss of speed signal fault. It is used to provide a remote alarm when required.

18 - Overcrank - this output (relay driver) is completed to negative whenever the engine shuts down due to an overcrank fault. It is used to provide a remote alarm when required.

19 - Low Oil Pressure - this output (relay driver) is completed to negative whenever the engine shuts down due to a low pressure fault. It is used to provide a remote alarm when required. This output will also energize and de-energize continuously if the oil pressure inhibit on startup is selected and the LOPS has not been closed. Subsequent closure of the switch will terminate the output.

20 - High Coolant Temperature - this output (relay driver) is completed to negative whenever the engine shuts down due to a high coolant temperature fault. It is used to provide a remote alarm when required.

21 - Overspeed - this output (relay driver) is completed to negative whenever the engine shuts down due to an overspeed fault. It is used to provide a remote alarm when required.

22 - Low Engine Temperature - this output (relay driver) is completed to negative whenever a low engine temperature input signal is received. It is used to provide a remote alarm when required.

23 - Low Fuel - this output (relay driver) is completed to negative whenever a low fuel input signal is received. It is used to provide a remote alarm when required.

24 - Low Battery Voltage - this output (relay driver) is completed to negative following a three minute time delay if a low battery voltage condition exists.

25 - Tachometer Drive - this output provides a current sink of approximately 0 - 1 mADC. The current sink is proportional to engine speed.

2.3 282-MIN

The 282-MIN provides four separate form C dry contact relay outputs. The contacts are rated at 3 A at 120 VAC or 28 VDC.

2.3.1 Electrical Characteristics

Battery Voltage

- terminals 1 (positive) and 2 (negative).
- 8 - 30 VDC input range.

Speed Signal Input

- terminals 3, 4.
- 24 VAC input for speed sensor.
- signal must come from the generator output and must not be switched or interrupted.

Logic Inputs

- terminals 5 - 12.
- source impedance 680 Kohms.
- open circuit voltage 5 VDC.
- logic signal is entered by applying battery negative to the input terminal.

Dry Contact Output

- terminals 13 - 24
- four form C dry contact relays.
- contacts - 3 A @ 120 VAC or 28 VDC.

Tachometer Drive

- terminal 25
- provides an electrical signal for a 0 - 1 mADC meter calibrated in RPM (supplied by others).
- calibration potentiometer provides adjustment from 0.6 mADC

to 1.2 mADC at 100% speed.

Operating Temperature

- -20 to +55 degrees C.

2.3.2 Mechanical Characteristics

- card dimensions - 7.75" W x 3.25" H.
- 24 pole terminal block.
- one tach drive screw terminal.
- one DB25 pin connector
- mounting card dimensions 8" W x 3.375" H.

2.3.3 Terminal Description

Refer to figure 5 for suggested wiring connections.

Terminals 1 - 12 inclusive are functionally identical to the 282-SSO interface card. Refer to the 282-SSO terminal description.

Crank - terminals 13 (common), 14 (NO), 15 (NC) - this relay is energized whenever the engine is to crank. A slave relay coil may be connected from battery positive to the normally open contact. Battery negative is connected to the common terminal.

Fuel - terminals 16 (common), 17 (NO), 18 (NC) - this relay is energized whenever the fuel control is to be activated. Two operating modes are available:

- energized to run (ETR) whenever the engine is to crank or run.

- energized to stop (ETS) whenever the engine is to stop and for approximately 30 seconds thereafter.

A slave relay coil may be connected from battery positive to the normally open contact. Battery negative is connected to the common terminal.

TDBP - terminals 19 (common), 20 (NO), 21 (NC) - this relay is energized when time delay bypass expires. It is used to provide a remote extension of the delay.

Common Alarm - terminals 22 (common), 23 (NO), 24 (NC) - this relay is energized to provide a common alarm in any of

the following situations: no speed signal, overcrank, low oil pressure, high coolant temperature, overspeed, low engine temperature, low fuel, low battery voltage or switch not in auto.

25 - Tachometer Drive - this output provides a current sink of approximately 0 - 1 mADC. The current sink is proportional to engine speed.

2.4 282-MAX

The 282-MAX provides twelve separate form C dry contact relay outputs. The contacts are rated at 3 A at 120 VAC or 28 VDC.

2.4.1 Electrical Characteristics

Battery Voltage

- terminals 1 (positive) and 2 (negative).
- 8 - 30 VDC input range.

Speed Signal Input

- terminals 3, 4.
- 24 VAC input for speed sensor.
- signal must come from the generator output and must not be switched or interrupted.

Logic Inputs

- terminals 5 - 12
- source impedance 680 Kohms.
- open circuit voltage 5 VDC.
- logic signal is entered by applying battery negative to input terminal.

Dry Contact Outputs

- terminals 13 - 48.
- twelve form C dry contact relays.
- contacts - 3 A @ 120 VAC or 28 VDC.

Tachometer Drive

- terminal 49
- provides an electrical signal for a 0 - 1 mADC meter calibrated in RPM (supplied by others).

- calibration potentiometer provides adjustment from 0.6 mADC to 1.2 mADC at 100% speed.

Operating Temperature

- -20 to +55 degrees C.

2.4.2 Mechanical Characteristics

- card dimensions - 11.75" W x 3.25" H.
- 48 pole terminal block.
- one tach drive screw terminal.
- one DB25 pin connector
- mounting card dimensions 12" W x 3.375" H.

2.4.3 Terminal Description

Refer to figure 6 for suggested terminal connections.

Terminals 1 - 12 inclusive are functionally identical to the 282-SSO interface card. Refer to the 282-SSO terminal description.

Crank - terminals 13 (NO), 14 (NC), 15 (common) - this relay is energized whenever the engine is to crank. A slave relay coil may be connected from battery positive to the normally open contact. Battery negative is connected to the common terminal.

Fuel - terminals 16 (NO), 17 (NC), 18 (common) - this relay is energized whenever the fuel control is to be energized. Two operating modes are available:

- energized to run (ETR) whenever the engine is to crank or run.

- energized to stop (ETS) whenever the engine is to stop and for approximately 30 seconds thereafter.

A slave relay coil may be connected from battery positive to the normally open contact. Battery negative is connected to the common terminal.

TDBP - terminals 19 (NO), 20 (NC), 21 (common) - this relay is energized when time delay bypass expires. It is used to provide a remote extension of the delay.

SNIA - terminals 22 (NO), 23 (NC), 24 (common) - this relay is energized whenever the control switch is in the Off or Manual position to provide a remote indication of switch position.

NO SS - terminals 25 (common), 26 (NO), 27 (NC) - this relay is energized whenever the engine shuts down due to a loss of speed signal fault. It is used to provide a remote alarm when required.

O/C - terminals 28 (common), 29 (NO), 30 (NC) - this relay is energized whenever the engine shuts down due to an overcrank fault. It is used to provide a remote alarm when required.

LOP - terminals 31 (common), 32 (NO), 33 (NC) - this relay is energized whenever the engine shuts down due to a low oil pressure fault. It is used to provide a remote alarm when required. This output will also energize and de-energize continuously if the oil pressure inhibit on startup is selected and the LOPS has not been closed. Subsequent closure of the switch will terminate the output.

HCT - terminals 34 (common), 35 (NO), 36 (NC) - this relay is energized whenever the engine shuts down due to a high coolant temperature fault. It is used to provide a remote alarm when required.

O/S - terminals 37 (common), 38 (NO), 39 (NC) - this relay is energized whenever the engine shuts down due to an overspeed fault. It is used to provide a remote alarm when required.

LET - terminals 40 (common), 41 (NO), 42 (NC) - this relay is energized whenever a low engine temperature input signal is received. It is used to provide a remote alarm when required.

Low Fuel - terminals 43 (common), 44 (NO), 45 (NC) - this relay is energized whenever a low fuel input signal is received. It is used as a remote alarm when required.

Low Battery Voltage - terminals 46 (common), 47 (NO), 48 (NC) - this relay is energized following a three minute time delay if a low battery voltage condition exists.

49 - Tachometer Drive - this output provides a current sink of approximately 0 - 1 mADC. The current sink is proportional to engine speed.

2.5 Maintenance

The interface cards (282-SSO, 282-MIN and 282-MAX) are not enclosed in a chassis and therefore should be inspected for dust buildup on a regular basis. If this condition occurs, clean the circuit board with a soft bristle brush.

Section 3: REFERENCE

3.1 Factory Settings

DIP Switch	Function	Open	Close	Factory Setting
1	Fuel Control	ETS	ETR	ETR
2	LOP Inhibit	In	Out	Out
3	TDLS	30 sec	3 sec	3 sec
4	TDES	Out	In	In
5	Crank			
6	Crank	All closed one		1
7	Crank	crank cycle		
8	TDCD	Out	In	In
9	MPU/60 Hz.	MPU	60 Hz.	60 Hz.
10	Test Routine	On	Off	Off

Function	Factory Setting
Tachometer	1.0 mADC @ 120% speed
Speedswitch Cal.	72 Hz. @ 120% speed
Speedswitch High	66 Hz. (110%)
Speedswitch Low	20 Hz. (33%)
TDES	5 seconds
Crank	20 seconds
TDBP	10 seconds
TDCD	60 seconds
Low Battery Voltage	12.0 VDC

3.2 Magnetic Pickup Calibration

If the EC282 speedswitch is configured to operate with a magnetic pickup (DS-9 open), the range of adjustment for the two switchpoints are as follows:

- low switchpoint: 1200 - 2400 Hz.
- high switchpoint: 3600 - 4700 Hz.

If this range of adjustment does not cover a particular application, the speedswitch calibration potentiometer will

require adjustment. To perform an approximate adjustment:

3.2.1 Turn the SS calibration potentiometer fully clockwise, and the SS high potentiometer fully counter-clockwise. The potentiometers will produce a "clicking" sound when the maximum and minimum adjustment points are reached.

3.2.2 Turn the SS high potentiometer clockwise 5 turns (this is approximately the 100% point).

3.2.3 Run the genset at 100% speed (switch EC282 to Manual).

3.2.4 Turn the SS calibration potentiometer CCW until an overspeed fault occurs. The high switchpoint is now adjustable from 90% to 120% of nominal engine speed, and the low switchpoint from 30 to 60% of nominal.

3.3 Reading Time Delay Settings

Time delay engine start, crank, bypass and cool down are set using the EC282 test routine (refer to section 1.9). Bypass and crank delays are read directly in seconds. Therefore, if value displayed by the lamps produces a decimal 30 (from the binary to decimal conversion chart), the delay was set for 30 seconds.

Time delay engine start is read in 0.1 second increments. Therefore, if the value displayed by lamps produces the decimal number 140, the delay was set for 140 x 0.1 = 14.0 seconds.

Lastly, time delay cool down is read in 10 second increments, so if the display results in decimal 90, the delay was set for 90 x 10 = 900 seconds (15 minutes).

DECIMAL - BINARY CONVERSION TABLE

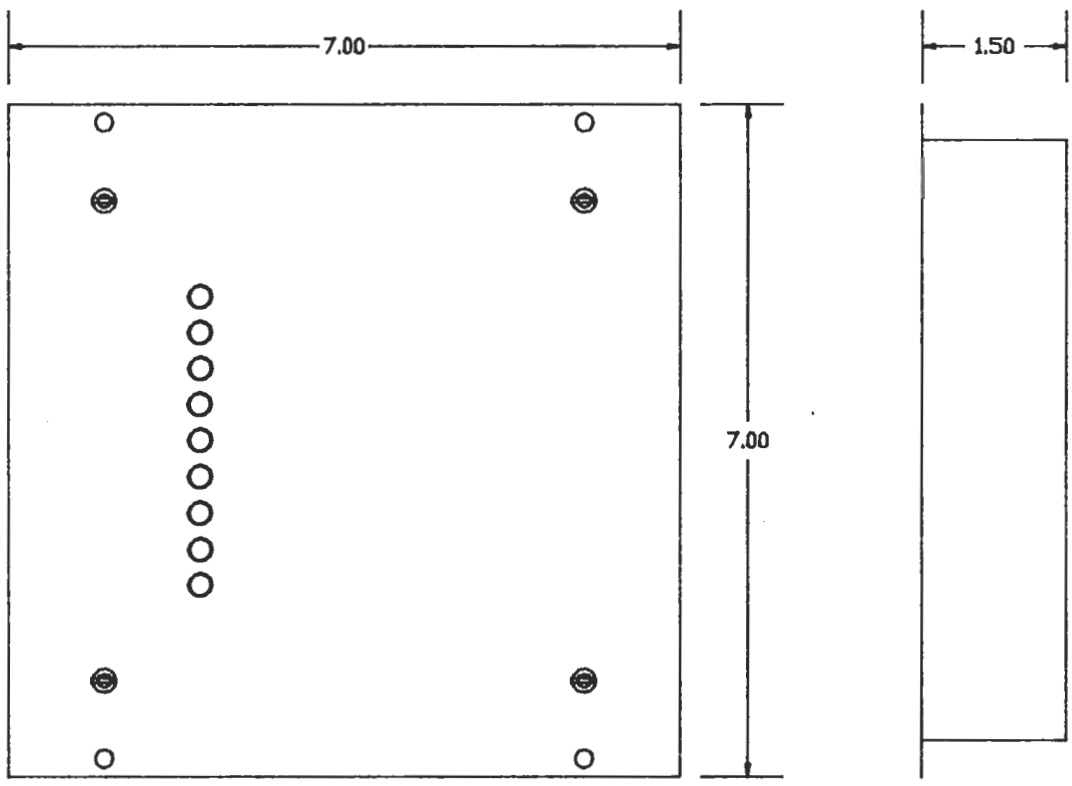
DECIMAL VALUE	BINARY EQUIVALENT								DECIMAL VALUE	BINARY EQUIVALENT								DECIMAL VALUE	BINARY EQUIVALENT							
	LF	LET	D/S	HCT	LOP	D/C	NSS	SNIA		LF	LET	D/S	HCT	LOP	D/C	NSS	SNIA		LF	LET	D/S	HCT	LOP	D/C	NSS	SNIA
0	0	0	0	0	0	0	0	0	43	0	0	1	0	1	0	1	1	86	0	1	0	1	0	1	1	0
1	0	0	0	0	0	0	0	1	44	0	0	1	0	1	1	0	0	87	0	1	0	1	0	1	1	1
2	0	0	0	0	0	0	1	0	45	0	0	1	0	1	1	0	1	88	0	1	0	1	1	0	0	0
3	0	0	0	0	0	0	1	1	46	0	0	1	0	1	1	1	0	89	0	1	0	1	1	0	0	1
4	0	0	0	0	0	1	0	0	47	0	0	1	0	1	1	1	1	90	0	1	0	1	1	0	1	0
5	0	0	0	0	0	1	0	1	48	0	0	1	1	0	0	0	0	91	0	1	0	1	1	0	1	1
6	0	0	0	0	0	1	1	0	49	0	0	1	1	0	0	0	1	92	0	1	0	1	1	1	0	0
7	0	0	0	0	0	1	1	1	50	0	0	1	1	0	0	1	0	93	0	1	0	1	1	1	0	1
8	0	0	0	0	1	0	0	0	51	0	0	1	1	0	0	1	1	94	0	1	0	1	1	1	1	0
9	0	0	0	0	1	0	0	1	52	0	0	1	1	0	1	0	0	95	0	1	0	1	1	1	1	1
10	0	0	0	0	1	0	1	0	53	0	0	1	1	0	1	0	1	96	0	1	1	0	0	0	0	0
11	0	0	0	0	1	0	1	1	54	0	0	1	1	0	1	1	0	97	0	1	1	0	0	0	0	1
12	0	0	0	0	1	1	0	0	55	0	0	1	1	0	1	1	1	98	0	1	1	0	0	0	1	0
13	0	0	0	0	1	1	0	1	56	0	0	1	1	1	0	0	0	99	0	1	1	0	0	0	1	1
14	0	0	0	0	1	1	1	0	57	0	0	1	1	1	0	0	1	100	0	1	1	0	0	1	0	0
15	0	0	0	0	1	1	1	1	58	0	0	1	1	1	0	1	0	101	0	1	1	0	0	1	0	1
16	0	0	0	1	0	0	0	0	59	0	0	1	1	1	0	1	1	102	0	1	1	0	0	1	1	0
17	0	0	0	1	0	0	0	1	60	0	0	1	1	1	1	0	0	103	0	1	1	0	0	1	1	1
18	0	0	0	1	0	0	1	0	61	0	0	1	1	1	1	0	1	104	0	1	1	0	1	0	0	0
19	0	0	0	1	0	0	1	1	62	0	0	1	1	1	1	1	0	105	0	1	1	0	1	0	0	1
20	0	0	0	1	0	1	0	0	63	0	0	1	1	1	1	1	1	106	0	1	1	0	1	0	1	0
21	0	0	0	1	0	1	0	1	64	0	1	0	0	0	0	0	0	107	0	1	1	0	1	0	1	1
22	0	0	0	1	0	1	1	0	65	0	1	0	0	0	0	0	1	108	0	1	1	0	1	1	0	0
23	0	0	0	1	0	1	1	1	66	0	1	0	0	0	0	1	0	109	0	1	1	0	1	1	0	1
24	0	0	0	1	1	0	0	0	67	0	1	0	0	0	0	1	1	110	0	1	1	0	1	1	1	0
25	0	0	0	1	1	0	0	1	68	0	1	0	0	0	1	0	0	111	0	1	1	0	1	1	1	1
26	0	0	0	1	1	0	1	0	69	0	1	0	0	0	1	0	1	112	0	1	1	1	0	0	0	0
27	0	0	0	1	1	0	1	1	70	0	1	0	0	0	1	1	0	113	0	1	1	1	0	0	0	1
28	0	0	0	1	1	1	0	0	71	0	1	0	0	0	1	1	1	114	0	1	1	1	0	0	1	0
29	0	0	0	1	1	1	0	1	72	0	1	0	0	1	0	0	0	115	0	1	1	1	0	0	1	1
30	0	0	0	1	1	1	1	0	73	0	1	0	0	1	0	0	1	116	0	1	1	1	0	1	0	0
31	0	0	0	1	1	1	1	1	74	0	1	0	0	1	0	1	0	117	0	1	1	1	0	1	0	1
32	0	0	1	0	0	0	0	0	75	0	1	0	0	1	0	1	1	118	0	1	1	1	0	1	1	0
33	0	0	1	0	0	0	0	1	76	0	1	0	0	1	1	0	0	119	0	1	1	1	0	1	1	1
34	0	0	1	0	0	0	1	0	77	0	1	0	0	1	1	0	1	120	0	1	1	1	1	0	0	0
35	0	0	1	0	0	0	1	1	78	0	1	0	0	1	1	1	0	121	0	1	1	1	1	0	0	1
36	0	0	1	0	0	1	0	0	79	0	1	0	0	1	1	1	1	122	0	1	1	1	1	0	1	0
37	0	0	1	0	0	1	0	1	80	0	1	0	1	0	0	0	0	123	0	1	1	1	1	0	1	1
38	0	0	1	0	0	1	1	0	81	0	1	0	1	0	0	0	1	124	0	1	1	1	1	1	0	0
39	0	0	1	0	0	1	1	1	82	0	1	0	1	0	0	1	0	125	0	1	1	1	1	1	0	1
40	0	0	1	0	1	0	0	0	83	0	1	0	1	0	0	1	1	126	0	1	1	1	1	1	1	0
41	0	0	1	0	1	0	0	1	84	0	1	0	1	0	1	0	0	127	0	1	1	1	1	1	1	1
42	0	0	1	0	1	0	1	0	85	0	1	0	1	0	1	0	1	128	1	0	0	0	0	0	0	0
	LF	LET	D/S	HCT	LOP	D/C	NSS	SNIA		LF	LET	D/S	HCT	LOP	D/C	NSS	SNIA		LF	LET	D/S	HCT	LOP	D/C	NSS	SNIA

0 = LAMP OFF 1 = LAMP ON

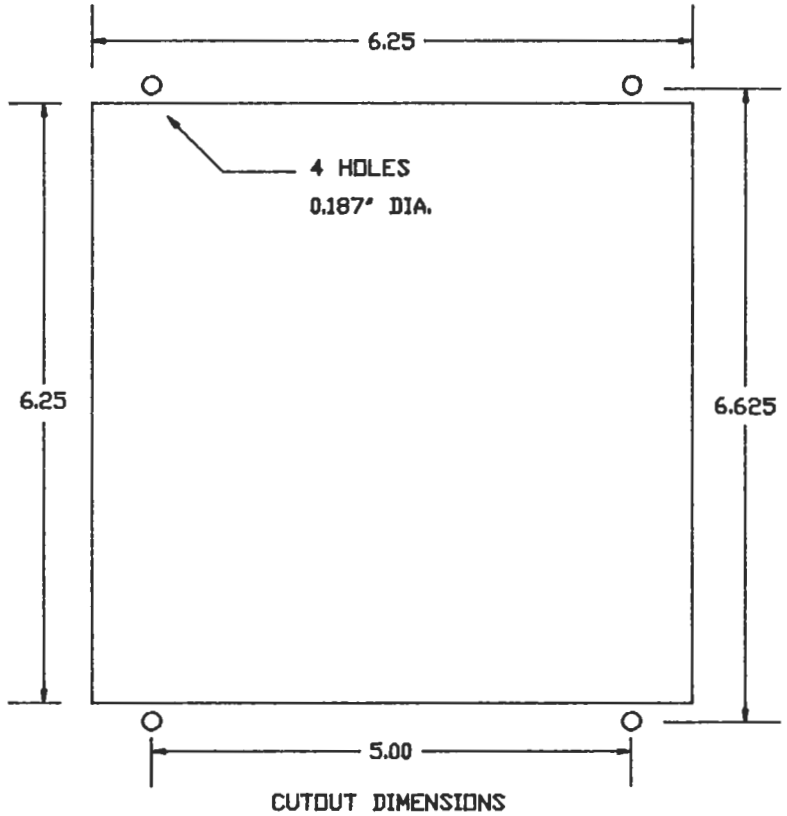
DECIMAL - BINARY CONVERSION TABLE

DECIMAL VALUE	BINARY EQUIVALENT								DECIMAL VALUE	BINARY EQUIVALENT								DECIMAL VALUE	BINARY EQUIVALENT							
	LF	LET	D/S	HCT	LDP	D/C	NSS	SNIA		LF	LET	D/S	HCT	LDP	D/C	NSS	SNIA		LF	LET	D/S	HCT	LDP	D/C	NSS	SNIA
129	1	0	0	0	0	0	0	1	172	1	0	1	0	1	1	0	0	215	1	1	0	1	0	1	1	1
130	1	0	0	0	0	0	1	0	173	1	0	1	0	1	1	0	1	216	1	1	0	1	1	0	0	0
131	1	0	0	0	0	0	1	1	174	1	0	1	0	1	1	1	0	217	1	1	0	1	1	0	0	1
132	1	0	0	0	0	1	0	0	175	1	0	1	0	1	1	1	1	218	1	1	0	1	1	0	1	0
133	1	0	0	0	0	1	0	1	176	1	0	1	1	0	0	0	0	219	1	1	0	1	1	0	1	1
134	1	0	0	0	0	1	1	0	177	1	0	1	1	0	0	0	1	220	1	1	0	1	1	1	0	0
135	1	0	0	0	0	1	1	1	178	1	0	1	1	0	0	1	0	221	1	1	0	1	1	1	0	1
136	1	0	0	0	1	0	0	0	179	1	0	1	1	0	0	1	1	222	1	1	0	1	1	1	1	0
137	1	0	0	0	1	0	0	1	180	1	0	1	1	0	1	0	0	223	1	1	0	1	1	1	1	1
138	1	0	0	0	1	0	1	0	181	1	0	1	1	0	1	0	1	224	1	1	1	0	0	0	0	0
139	1	0	0	0	1	0	1	1	182	1	0	1	1	0	1	1	0	225	1	1	1	0	0	0	0	1
140	1	0	0	0	1	1	0	0	183	1	0	1	1	0	1	1	1	226	1	1	1	0	0	0	1	0
141	1	0	0	0	1	1	0	1	184	1	0	1	1	1	0	0	0	227	1	1	1	0	0	0	1	1
142	1	0	0	0	1	1	1	0	185	1	0	1	1	1	0	0	1	228	1	1	1	0	0	1	0	0
143	1	0	0	0	1	1	1	1	186	1	0	1	1	1	0	1	0	229	1	1	1	0	0	1	0	1
144	1	0	0	1	0	0	0	0	187	1	0	1	1	1	0	1	1	230	1	1	1	0	0	1	1	0
145	1	0	0	1	0	0	0	1	188	1	0	1	1	1	1	0	0	231	1	1	1	0	0	1	1	1
146	1	0	0	1	0	0	1	0	189	1	0	1	1	1	1	0	1	232	1	1	1	0	1	0	0	0
147	1	0	0	1	0	0	1	1	190	1	0	1	1	1	1	1	0	233	1	1	1	0	1	0	0	1
148	1	0	0	1	0	1	0	0	191	1	0	1	1	1	1	1	1	234	1	1	1	0	1	0	1	0
149	1	0	0	1	0	1	0	1	192	1	1	0	0	0	0	0	0	235	1	1	1	0	1	0	1	1
150	1	0	0	1	0	1	1	0	193	1	1	0	0	0	0	0	1	236	1	1	1	0	1	1	0	0
151	1	0	0	1	0	1	1	1	194	1	1	0	0	0	0	1	0	237	1	1	1	0	1	1	0	1
152	1	0	0	1	1	0	0	0	195	1	1	0	0	0	0	1	1	238	1	1	1	0	1	1	1	0
153	1	0	0	1	1	0	0	1	196	1	1	0	0	0	1	0	0	239	1	1	1	0	1	1	1	1
154	1	0	0	1	1	0	1	0	197	1	1	0	0	0	1	0	1	240	1	1	1	1	0	0	0	0
155	1	0	0	1	1	0	1	1	198	1	1	0	0	0	1	1	0	241	1	1	1	1	0	0	0	1
156	1	0	0	1	1	1	0	0	199	1	1	0	0	0	1	1	1	242	1	1	1	1	0	0	1	0
157	1	0	0	1	1	1	0	1	200	1	1	0	0	1	0	0	0	243	1	1	1	1	0	0	1	1
158	1	0	0	1	1	1	1	0	201	1	1	0	0	1	0	0	1	244	1	1	1	1	0	1	0	0
159	1	0	0	1	1	1	1	1	202	1	1	0	0	1	0	1	0	245	1	1	1	1	0	1	0	1
160	1	0	1	0	0	0	0	0	203	1	1	0	0	1	0	1	1	246	1	1	1	1	0	1	1	0
161	1	0	1	0	0	0	0	1	204	1	1	0	0	1	1	0	0	247	1	1	1	1	0	1	1	1
162	1	0	1	0	0	0	1	0	205	1	1	0	0	1	1	0	1	248	1	1	1	1	1	0	0	0
163	1	0	1	0	0	0	1	1	206	1	1	0	0	1	1	1	0	249	1	1	1	1	1	0	0	1
164	1	0	1	0	0	1	0	0	207	1	1	0	0	1	1	1	1	250	1	1	1	1	1	0	1	0
165	1	0	1	0	0	1	0	1	208	1	1	0	1	0	0	0	0	251	1	1	1	1	1	0	1	1
166	1	0	1	0	0	1	1	0	209	1	1	0	1	0	0	0	1	252	1	1	1	1	1	1	0	0
167	1	0	1	0	0	1	1	1	210	1	1	0	1	0	0	1	0	253	1	1	1	1	1	1	0	1
168	1	0	1	0	1	0	0	0	211	1	1	0	1	0	0	1	1	254	1	1	1	1	1	1	1	0
169	1	0	1	0	1	0	0	1	212	1	1	0	1	0	1	0	0	255	1	1	1	1	1	1	1	1
170	1	0	1	0	1	0	1	0	213	1	1	0	1	0	1	0	1									
171	1	0	1	0	1	0	1	1	214	1	1	0	1	0	1	1	0									
	LF	LET	D/S	HCT	LDP	D/C	NSS	SNIA		LF	LET	D/S	HCT	LDP	D/C	NSS	SNIA		LF	LET	D/S	HCT	LDP	D/C	NSS	SNIA

0 = LAMP OFF 1 = LAMP ON



UNIT DIMENSIONS



CUTOUT DIMENSIONS

FIGURE 1
EC282 DIMENSIONS

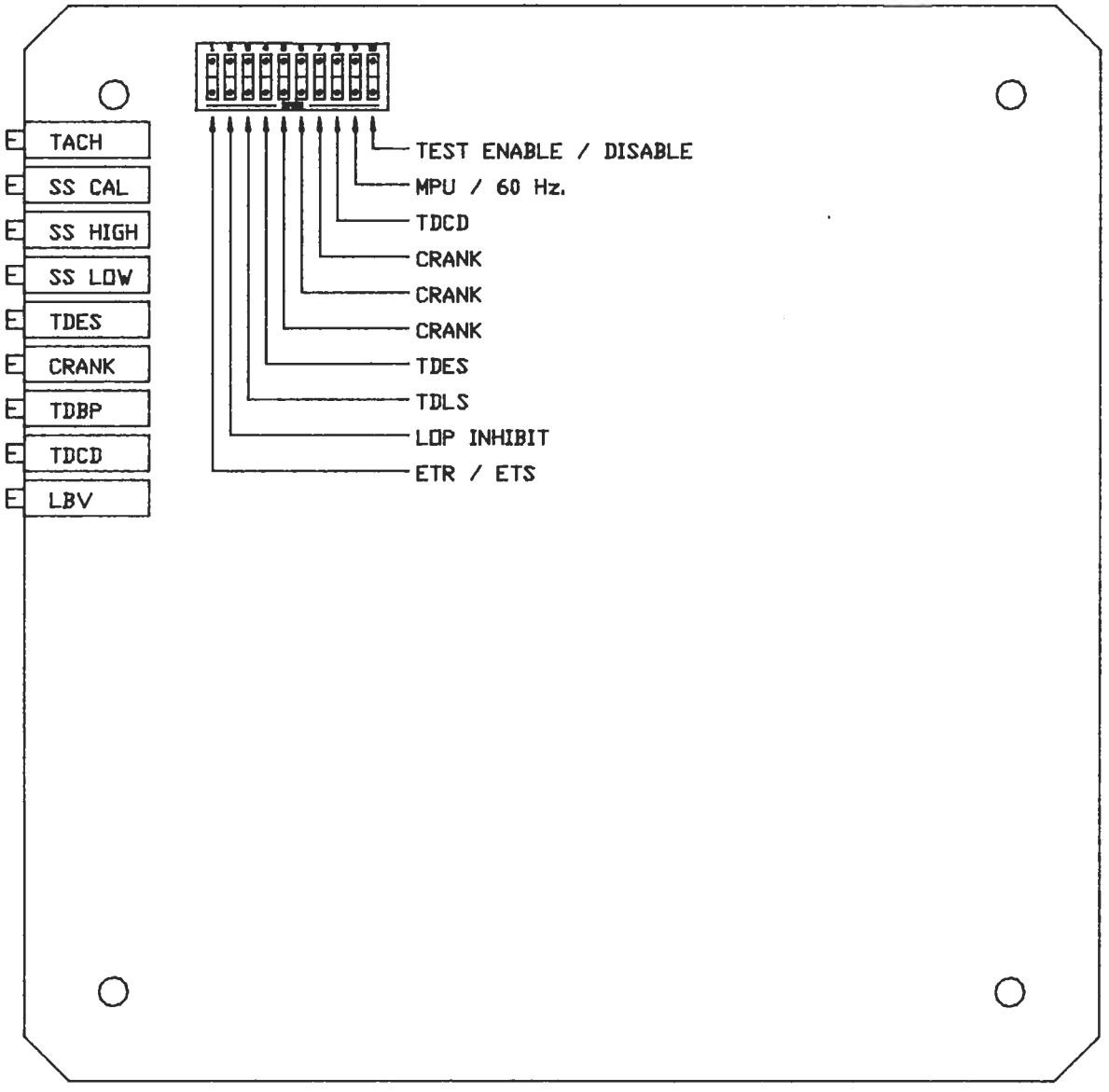


FIGURE 2

EC282 PROGRAM SWITCH AND
ADJUSTMENT POTENTIOMETERS

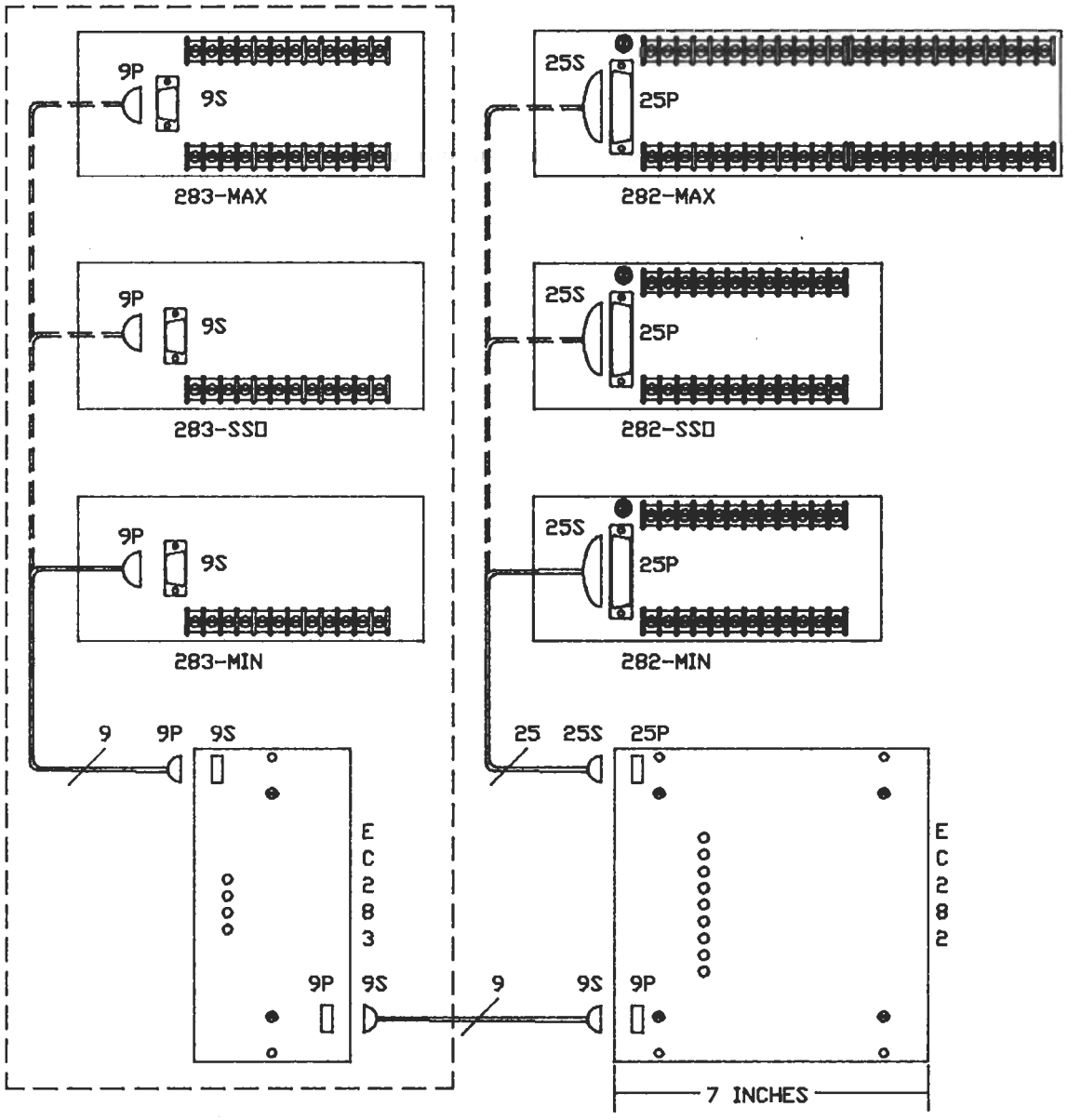


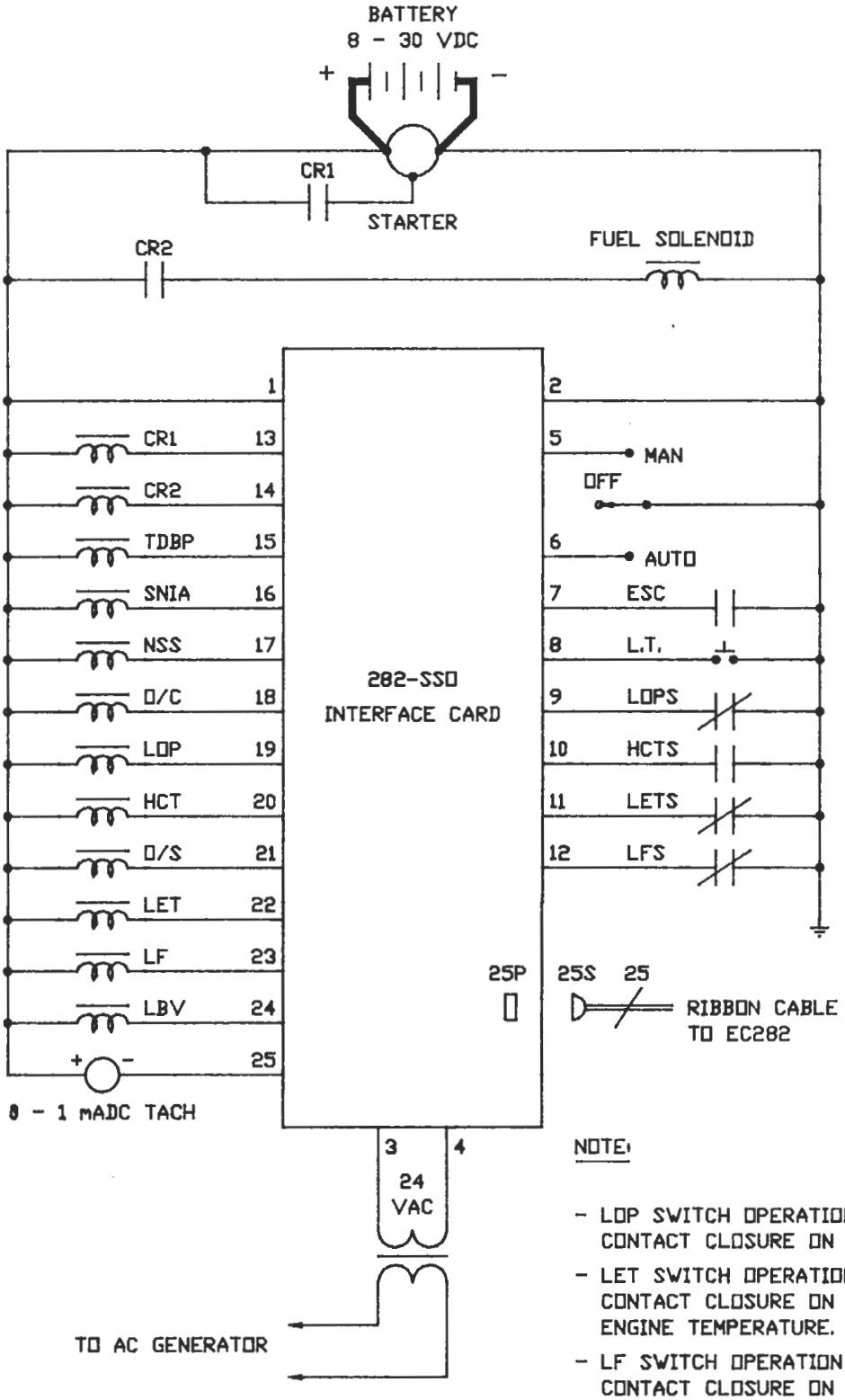
FIGURE 3
EC282 / EC283 SYSTEM CONFIGURATION

NOTE:

9S = DB9 SOCKET
9P = DB9 PIN

25S = DB25 SOCKET
25P = DB25 PIN

THE MODEL EC283 AND ASSOCIATED INTERFACE CARD ARE OPTIONAL.



NOTE:

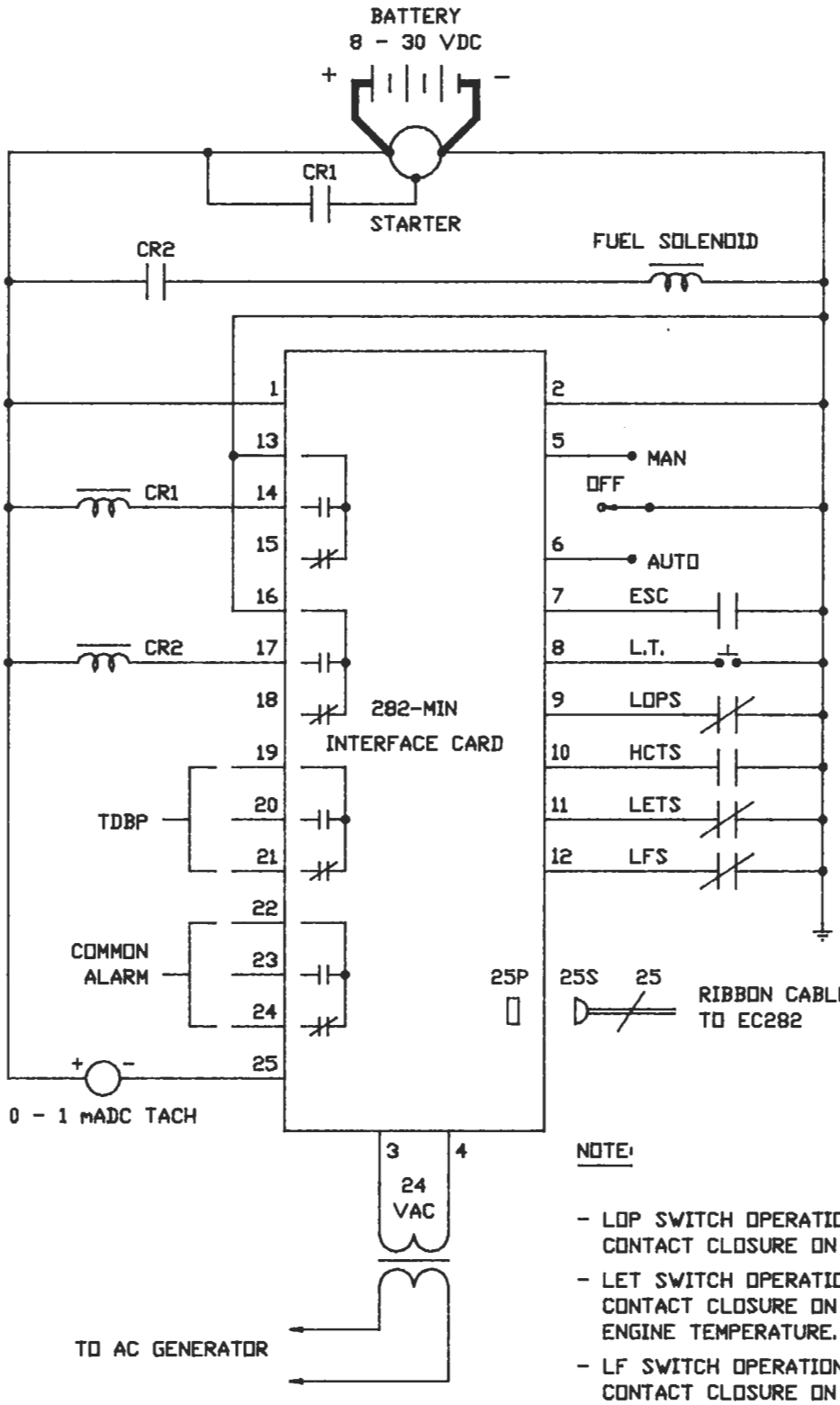
- LOP SWITCH OPERATION SHOULD BE CONTACT CLOSURE ON FALLING O/P.
- LET SWITCH OPERATION SHOULD BE CONTACT CLOSURE ON FALLING ENGINE TEMPERATURE.
- LF SWITCH OPERATION SHOULD BE CONTACT CLOSURE ON LOW FUEL.
- HCT SWITCH OPERATION SHOULD BE CONTACT CLOSURE ON RISING COOLANT TEMPERATURE.

NOTE:

25S = DB25 SOCKET
25P = DB25 PIN

FIGURE 4

MODEL 282-SSO CONNECTION DIAGRAM



NOTE:

- LOP SWITCH OPERATION SHOULD BE CONTACT CLOSURE ON FALLING O/P.
- LET SWITCH OPERATION SHOULD BE CONTACT CLOSURE ON FALLING ENGINE TEMPERATURE.
- LF SWITCH OPERATION SHOULD BE CONTACT CLOSURE ON LOW FUEL.
- HCT SWITCH OPERATION SHOULD BE CONTACT CLOSURE ON RISING COOLANT TEMPERATURE.

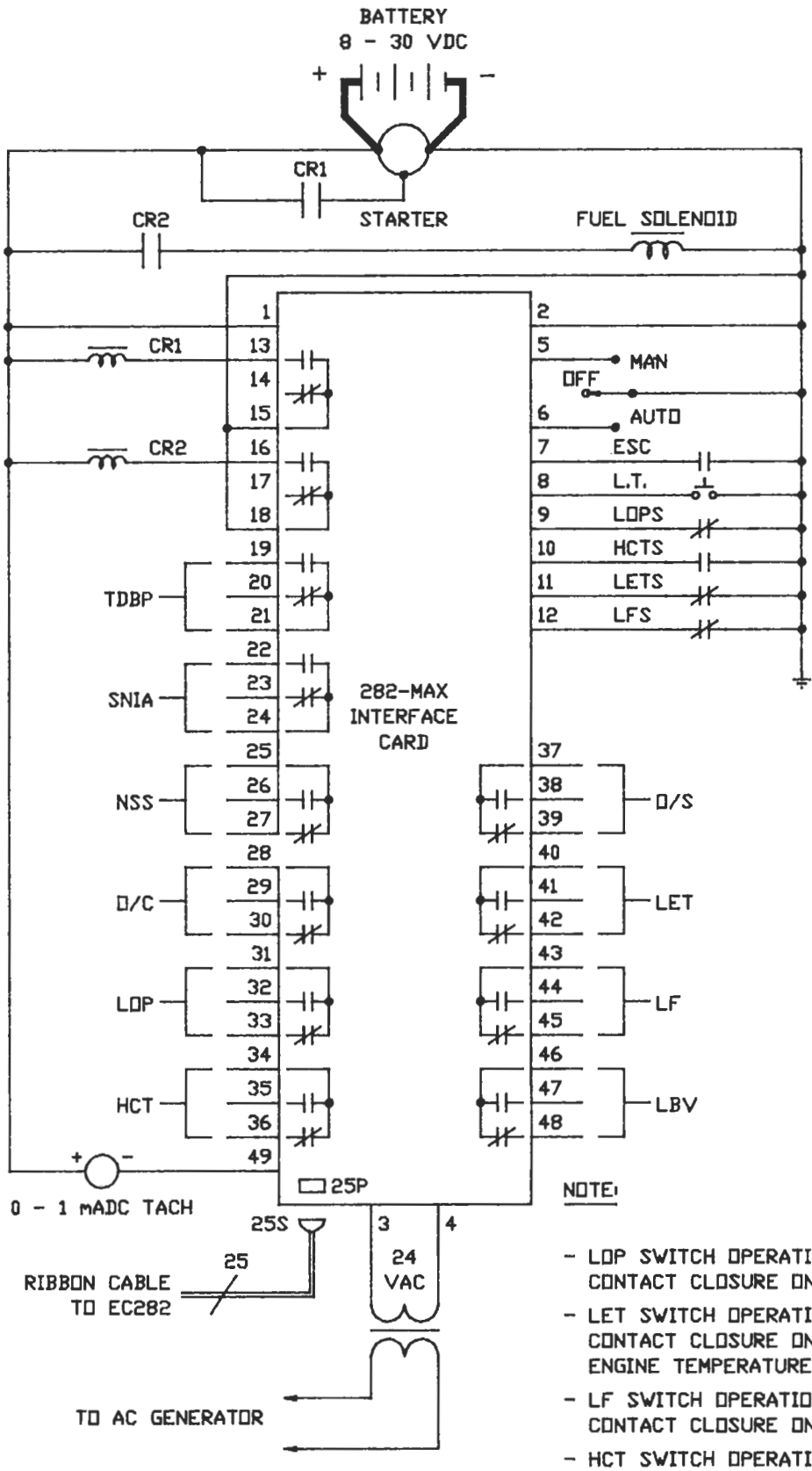
NOTE:

25S = DB25 SOCKET
25P = DB25 PIN

FIGURE 5

MODEL 282-MIN CONNECTION DIAGRAM

ALL CONTACTS SHOWN IN DE-ENERGIZED POSITION.



NOTE:

- LOP SWITCH OPERATION SHOULD BE CONTACT CLOSURE ON FALLING O/P.
- LET SWITCH OPERATION SHOULD BE CONTACT CLOSURE ON FALLING ENGINE TEMPERATURE.
- LF SWITCH OPERATION SHOULD BE CONTACT CLOSURE ON LOW FUEL.
- HCT SWITCH OPERATION SHOULD BE CONTACT CLOSURE ON RISING COOLANT TEMPERATURE.

NOTE:

25S = DB25 SOCKET
25P = DB25 PIN

FIGURE 6

282-MAX CONNECTION DIAGRAM

ALL CONTACTS SHOWN IN DE-ENERGIZED POSITION.