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FIGURES A-1

BASIC OPERATION

Introduction

Congratulations on your purchase of a Microprocessor Control-equipped truck mount unit. Used in industrial applications for many years, microprocessor controls have been tested and proven under the most adverse conditions. The control is simple to operate, and its advantages include increased reliability, control, and protection of your cleaning unit, as well as digitally displayed diagnostics, service, and management information.

This manual presents detailed descriptions of the Microprocessor Control basic operating procedures, and is designed to help the inexperienced operator get started using the system productively as quickly as possible. Some prior knowledge of Prochem truck mount carpet cleaning systems is assumed. If you are unfamiliar with any cleaning system terms or concepts presented here, consult the Operation and Service Manual for your cleaning unit, or contact your Prochem dealer.

It will be helpful when reading this manual to have a Microprocessor Control available on which you can follow along. Although every effort has been made to make this manual as clear and concise as possible, many of the procedures presented here are best illustrated by actually performing them.

2. Warranty and Repairs

All Microprocessor Controls are warranted against defects due to workmanship and/or component failure for 18 months from the date of manufacture. We will correct these problems free of charge on a return-to-factory basis. This warranty does not cover failure due to mishandling, improper installation, or abuse. Our liability is limited to the product itself and excludes consequential damages to other equipment.

Repairs beyond the warranty terms and/or date will be performed on a return-to-factory basis. Cost of repairs may be handled on a fixed price per unit or time and material basis.

3. Features

Dot-matrix liquid crystal display provides continuously updated cleaning system and engine operating parameters.

Safety interlocks cause unit to shut down in presence of dangerous or damaging conditions. Shutdown display allows user to quickly diagnose and correct problems.

Both the operating mode and solution temperature are user selectable, allowing unit operation to be tailored to suit various cleaning applications such as flood extraction, delicate upholstery, etc.

Controller retains operating history information such as elapsed hours, shutdown causes, maintenance actions, and management information.

Computer interface allows for easy factory setup and remote monitoring of machine operation.

Ruggedized design provides reliable operation in harsh environmental conditions.

4. Description

The Microprocessor Control is a small, application-specific computer system comprising a microcomputer chip, a non-volatile memory, a display and keypad interface, a series of sensor interfaces, and a set of control relays. Each of these items will be briefly described in the following paragraphs. Note that the information that follows is general in nature and is given to provide some context for the specific operating instructions to be given in later sections.

Keypad

Figure 1 shows the system keypad. The surface of the keypad is composed of a rugged polycarbonate material that is weather resistant. The keys themselves are membrane type switches, and are designed to be easily actuated even while wearing gloves. The specific functions of each key are best left to the more detailed sections to follow. However, it is worth noting here that the keys are non-tactile - that is, they do not snap or click when pressed. The Microprocessor Control will acknowledge that a key has been pressed by giving some sort of visual feedback from the display (again, specifics will come later). Please also note that the keys should not be pressed with any object other than a human finger. Hard and/or pointed objects such as pencils and screwdrivers will damage the keypad and void the warranty. If necessary, the keypad may be cleaned with water or a gentle cleaning agent such as glass cleaner. Alcohol or cleaning solvents will destroy the protective hardcoat finish and void the warranty.

Display

The liquid crystal display (LCD) unit is located behind a window immediately above the keypad (Figure 1). The display unit uses a backlight and an automatic contrast adjustment circuit to provide optimal readability under varying environmental conditions. Note that the display will be most readable when viewed from straight ahead (line of sight perpendicular to the control panel) rather than from an angle. Specific information on status displays will be provided in the following sections.

Sensors

As stated previously, the Microprocessor Control monitors and displays for the user both engine and cleaning system operating parameters. Cleaning system parameters include:

Exhaust Diverter/Pump Override Status
Solution Temperature
Solution Pressure
Vacuum Pressure
Waste Tank Status

Engine parameters include:

Engine RPM
Oil Pressure
Battery Voltage
Battery Amps
Coolant Temperature (water cooled models only)
Operating Hours

The Microprocessor Control monitors the above parameters via a set of pressure sensors, temperature sensors, and micro-switches mounted in various locations throughout the cleaning unit. Sensors are discussed separately and in detail in the advanced maintenance section.

Control Relays

The Microprocessor Control manages the cleaning unit by manipulating a set of electronic switches, or control relays. The control relays apply power to the cleaning accessories such as the water pump clutch and the temperature control solenoid, engage the engine starter solenoid, and on some models control the engine fuel solenoid.

Microcomputer

The heart of the Microprocessor Control is a small microcomputer chip that is specially programmed to operate the cleaning unit. The microcomputer dynamically controls the cleaning system by continuously monitoring incoming data and processing it according to a set of stored instructions. The processed data is then used to make decisions as to which control relays need to be energized. Incoming data include signals from the system sensors as well as user instructions through the keypad. The stored instructions contain rules governing the operations of the cleaning system based on engine and cleaning system conditions, user programming, and safety considerations. Besides the control functions, the microcomputer processes sensor data so that it may be displayed and keeps track of elapsed operating time for management and maintenance purposes.

Non-Volatile Memory

Non-volatile memory is simply computer memory that retains its contents after the power is turned off. The Microprocessor Control uses its non-volatile memory to remember operator preferences such as cleaning mode and solution temperature, unit model information, sensor calibration data, and management and maintenance information such as elapsed operating hours and start/stop times. Time and management data are stored automatically; no intervention by the cleaning operator is required. User preferences, however, must be communicated to the Microprocessor Control by the operator. The process of programming the user preferences will be discussed in section 6.

5. Powering Up the Microprocessor Control

Insert the key into the ignition key switch and turn it clockwise to the on position. The display backlight should come on, and the display should read:

Prochem, Inc.
(version number & date)

After approximately two seconds, the display should read:

SHUTDOWN
MANUAL STOP

Should an oil change advisory appear instead of the shutdown display shown above, see section 11. If the powerup sequence does not proceed in exactly this manner or the display is blank or unreadable, turn the ignition key switch counter-clockwise to the off position and consult the Installation and Configuration section of this manual or contact the Prochem service department.

6. Programming

Wash Modes

The Microprocessor Control features three separate cleaning modes: high temperature wash, low temperature wash, and flood extraction. The two wash modes provide for user-programmable solution temperatures, while in the flood extraction mode the solution temperature is held constant at approximately 180°F. The high temperature setpoint range is 50-250°F, while the low temperature setpoint can be programmed for 50-180°F. Please note that the temperature setpoint for each wash mode is retained separately in non-volatile memory; that is, it is not necessary to reprogram the solution temperature after switching wash modes or turning off the power.

Selecting a Wash Mode

The cleaning mode selection may be changed at any time (even while cleaning) by simply pressing the SETUP key. After the SETUP key is pressed, the top line of the display should read "SELECT MODE", while the bottom line should contain text referring to one of the three wash modes: "HI TEMP WASH", "LO TEMP WASH", or "FLOOD EXTRACTION". To select a wash mode, press one of the arrow keys (ENGINE STOP/RESET or ENGINE START) repeatedly until the bottom line of the display reflects the desired mode. When the choice is complete, press the ENTER key to store the wash mode selection in non-volatile memory. If the high or low temperature wash modes are selected, the temperature selection screen will appear (see the following paragraphs). If flood extraction mode is selected, the display will return to the previous display mode (either Shutdown or one of the running displays; see section 9).

Selecting a Temperature Setpoint

After high or low temperature wash mode is selected, the corresponding temperature setpoint may be programmed for that mode. Note that if you have previously programmed both setpoints and have simply changed wash modes, it is not necessary to perform this step; simply press the SETUP key again to exit the program mode.

After the wash mode is chosen and the ENTER key is pressed to store the selection, the top line of the display will read "HI TEMP SETPOINT" or "LO TEMP SETPOINT", depending on the wash mode in effect. The lower line of the display will contain the current temperature setpoint for that wash mode. To change the setpoint, press one of the two arrow keys. The up arrow key increases the displayed number while the down arrow decreases it. Pressing the key repeatedly will change the displayed value by 1 each time the key is pressed; holding the key down will cause the number to roll continuously. Notice that adherence to upper and lower limits for the temperature is automatically enforced; attempting to decrease the setpoint beyond the lower limit will cause the display to wrap around to the upper limit, and vice versa. When the desired setpoint is displayed, press the ENTER key to store the setpoint selection in non-volatile memory, at which time the Microprocessor Control will return to whatever mode it was in when the process started. Note that if the SETUP key is pressed instead of the ENTER key the display mode will still revert to the previous mode, but the setpoint will not be stored - the old setpoint will remain in effect.

Figure 2 illustrates an example programming session.

7. Starting the Unit

Before attempting to start the unit, be sure to read the Operation and Service Manual. Be sure to observe all precautions and starting procedures listed there. Once all starting procedures have been performed, turn the ignition key switch clockwise to the on position and make certain that the Microprocessor Control powerup sequence proceeds according to section 5. Before the unit may be started, the display must read:

SHUTDOWN
MANUAL STOP

Once the control powerup sequence has finished, press and hold the ENGINE START key. At once, three things should happen: the display backlight will go dark, the starter motor will begin to crank, and the display will read as follows:

STARTING ENGINE
xxx RPM

The bottom line rpm display will reflect the actual engine rpm during the starting interval. Hold the ENGINE START key in until the engine starts, just as you would a normal key ignition switch. Once the engine is running, release the ENGINE START key and follow the Operation and Service Manual instructions for warming up the unit.

8. Stopping the Unit

The unit may be stopped by pressing the ENGINE STOP/RESET key. On some models, the engine is manually stopped by starving the carburetor, so the engine may run on for some few seconds after pressing the ENGINE STOP/RESET key. In an emergency, the engine may be stopped quickly by simply turning the ignition key switch counter-clockwise to the off position. However, this method of stopping is not recommended for normal usage as it may cause errors in the stored engine operating hours.

9. Status Displays

While the cleaning system is running, the Microprocessor Control provides a series of displays that provide information on the status of the engine and the cleaning system. The status displays are:

Cleaning System Status
Engine Status
Heat Transfer Status
Wash Mode
Engine Coolant Status (water cooled models only)

Once the engine is started, the Microprocessor Control will always display the cleaning system status. To select a different status display press the ENTER key repeatedly until the desired screen is visible. The selected display will remain until the ENTER key is pressed again or until the cleaning system is shut down. Refer to Figure 3 and the following paragraphs for detailed explanations of the status displays.

Cleaning System Status Display

The number displayed on the upper left represents the solution pressure in pounds per square inch (the "S" preceding the "PSI" stands for "solution"). The upper right quantity represents the solution temperature in degrees Fahrenheit, the lower left numeral represents the vacuum pressure in inches of mercury, and the lower right corner shows the elapsed operating hours for the cleaning system. Note that the operating hours represent the total elapsed running time for the engine and do not reflect actual cleaning activities.

Engine Status Display

The engine status display comprises the engine RPM, the battery voltage, the engine oil pressure in pounds per square inch (OPSI stands for "oil PSI"), and the battery charge current in Amps.

Heat Transfer Status Display

The top line of the heat transfer status display shows the status of the diverter valve, and will read either "HE" for "heat exchanger", or "MUF" for "muffler". The lower line of the display reflects the status of the electric clutch on the water pump.

Wash Mode Display

The wash mode display reflects the wash mode currently in effect (see section 6 for an explanation of wash modes). The lower line on the display will read either "HI TEMP WASH", "LO TEMP WASH", or "FLOOD EXTRACTION".

Engine Coolant Status Display

This screen shows the engine coolant temperature in degrees Fahrenheit. Note that this display is only available on water cooled cleaning units. On cleaning units with air cooled engines, pressing the ENTER key at the wash mode display will return the control to the cleaning system status display.

10. Shutdowns

One of the most important features of the Microprocessor Control is its ability to monitor the engine and cleaning system for damaging and/or hazardous conditions, to shut down when such conditions are detected, and to provide diagnostic information to the user so that corrective action may be taken. This feature not only helps to protect your equipment investment, but also plays a part in providing a safe working environment for the equipment operator.

When a shutdown occurs, the upper display line will display the word "SHUTDOWN" and the lower line will display a text message indicating the cause of the shutdown. After the unit stops, the Microprocessor Control will not permit a restart until the problem condition is cleared. When the control decides that safe operation is again possible, the lower display line will flash, indicating that it is ready for reset. At this point the operator may press the ENGINE STOP/RESET key to clear the shutdown, at which point the control will indicate "MANUAL STOP". Once the shutdown is cleared the engine may be restarted. As previously mentioned, the control must display "MANUAL STOP" before it may be restarted.

It is important to note here that for certain shutdowns the control may indicate a ready for reset condition as soon as the engine stops because the condition is directly linked to the running engine. Examples would be high engine RPM or high solution pressure. In such cases an immediate restart is possible, but it is important to ascertain the root cause of the problem in order to ensure that it does not recur.

The following table may be used as a diagnostic aid to correcting unit shutdowns. Note that for some conditions corrective action may not be possible at the worksite. In such cases, contact the Prochem service department.

Shutdown Message	Cause	Corrective Action
HI PRESSURE	Water pressure exceeds 1000 psi.	Reduce water pressure. See operation manual for proper setting.

Shutdown Message	Cause	Corrective Action
LO PRESSURE	Water pressure drops below 50 psi.	Check water supply. Check water pump. See operation manual.
LO OIL PRESSURE	Engine oil pressure drops below 10 psi.	Check engine oil level. Check oil pump.
HIGH VACUUM	Unit vacuum exceeds 18in Hg.	Reduce unit vacuum. See operation manual for proper setting.
HI ENGINE RPM	Engine rpm exceeds 3000 rpm.	Reduce engine speed. See operation manual for proper setting.
WASTE TANK FULL	Waste tank full.	Drain waste tank. Check wiring to float switch.
HI STEAM TEMP	Solution temperature exceeds 285°F.	Allow solution to cool. Check bypass system.
HIGH ENGINE TEMP	Engine coolant temperature exceeds 240°F (Performer/Performer405) or 220°F (Bruin 2).	Allow engine to cool. Check engine coolant level.
FUEL?	Low engine rpm.	Engine stopped for unknown reason. Check fuel level.
BAD OIL SENSOR	Engine oil pressure sensor failed.	Check wiring. Replace oil pressure sensor.
BAD VAC SENSOR	Vacuum sensor failed.	Check wiring. Replace vacuum sensor.
SYS PRESS SENSOR	Water pressure sensor failed.	Check wiring. Replace water pressure sensor.
STEAM TEMP SENDR	Solution temperature sensor failed.	Check wiring. Replace heat exchanger temperature sensor.
ENGINE TMP SENDR	Engine coolant temperature sensor failed (water cooled models only).	Check wiring. Replace engine temperature sensor.

11. Advisory Messages

Advisory messages may appear to indicate required scheduled maintenance or to indicate that damage may occur if the cleaning unit is operated.

At this point, pressing the ENGINE STOP/RESET key will put the control back in the manual shutdown state so that corrective action may be taken. Pressing the ENGINE START key will proceed to start the engine.

If the unit is exposed to freezing temperatures, the water in the unit may freeze, causing serious damage to the unit. Starting the unit after a freezing advisory will void any and all warranties pertaining to the unit.

Oil Change Advisory

The Microprocessor Control uses its elapsed operating hours feature and non-volatile memory to keep track of scheduled engine oil replacement requirements. If an oil change is due, the operator will be alerted when the Microprocessor Control is powered up. After the "Prochem, Inc." display, the control will present the following message:

(unit model)
OIL CHANGE DUE

Since it may not always be possible to change the oil immediately, the operator may press the ENTER key to bypass the advisory message and continue cleaning operations. This message will continue to appear at powerup until it is manually cleared.

To clear the oil change advisory:

1. Turn the ignition key switch clockwise to the on position and wait for the "MANUAL STOP" display.

2. Press the SETUP key.

3. Continue through the wash mode and setpoint menus by pressing the ENTER key once or twice, as necessary. The Microprocessor Control will retain mode and temperature settings.

4. After the wash mode menus, the following display will appear:

OIL CHANGE DUE
CLEAR ADVISORY? Press enter 3 times

5. Press the ENTER key to clear the advisory. The Microprocessor Control will automatically return the "MANUAL STOP" display.

It is important to remember that while the Microprocessor Control has no way to enforce the oil changes (i.e., advisories do not inhibit operation), scheduled maintenance is very important. **Skipping or delaying oil changes will shorten engine life and will void the warranty.**

INSTALLATION AND CONFIGURATION

1. Installation

Truck mounted cleaning units are normally shipped from the factory with the Microprocessor Control installed and configured. Should it be necessary to replace a Microprocessor Control, please follow the instructions in the following paragraphs.

Please note that at all times during removal and installation of the Microprocessor Control, the gasoline engine should be stopped, the ignition key turned counter-clockwise to the off position, and the battery disconnected. Failure to observe this precaution could result not only in damage to the Microprocessor Control and the voiding of the warranty, but in severe personal injury or death.

Please also note that the Microprocessor Control contains no user serviceable parts. Do not open the metal control box as this may damage the unit and void the warranty.

Removal

To remove a Microprocessor Control, perform the following:

1. Make certain that the engine is stopped and that the ignition key switch is in the off position.

2. Disconnect the battery.

3. Remove the right and left hood assemblies that cover the cleaning unit (Figure 4).

4. Disconnect from the Microprocessor Control the two white locking connectors (Figure 5). The connectors may be disengaged by squeezing the two locking tabs on the outside of the connector housing while pulling the connector housing away from the control box. Do not pull on the wires as this may damage the wiring harness and cause faulty operation. Note that these connectors are designed to hold securely in high vibration environments and thus may require some effort to disengage.

5. Secure the control box from behind and remove the four Allen head screws holding the control box to the control panel (Figure 6).

6. Remove the Microprocessor Control.

Installation

To install a Microprocessor Control, perform the following:

1. Secure the Microprocessor Control to the rear of the control panel using the four

Allen head screws removed previously. Make sure that the keypad is oriented correctly and visible through the opening in the front of the control panel.

2. Reconnect the wire harnesses to the control box by pushing connector housings in until the locking tabs snap into place. The connectors are keyed to prevent incorrect insertion. If you are unable to fully engage the connector housings, check for proper orientation and try again.

3. Reconnect the battery.

4. Turn the ignition key switch clockwise to the on position. The display backlight should come on and the following message should appear for approximately 2 seconds:

Prochem, Inc.
(version & date)

Followed by:

SHUTDOWN
MANUAL STOP

Do not attempt to start the engine until the unit is configured. See section 2 for configuration procedures.

5. If the above step is unsuccessful, turn the ignition key switch counter-clockwise to the off position and recheck the wire harness connections. If you are unable to resolve your difficulties, consult the Prochem service department.

2. Configuration

The Microprocessor Control is available as an option on Performer/Performer 405, Bruin 2, and Legend cleaning systems. Because the models use different engines, it is necessary for proper operation that the control be configured after installation. The configuration procedure also includes calibration for the solution pressure sensor and the battery current shunt.

The following instructions assume a basic knowledge of the Microprocessor Control keypad and display layout, as well as some familiarity with programming procedures. If unsure, read and become familiar with the Basic Operation section of this manual. To perform these procedures, it will be necessary to obtain a hardware key (Figure 7) from the Prochem service department.

Model Selection

1. Turn the ignition key switch counter-clockwise to the off position and remove the right and left hood assemblies (Figure 4).

2. Remove the plastic boot from the 9 pin connector on top of the Microprocessor Control (Figure 5).

3. Plug the small end of the hardware key into the 9 pin connector on top of the Microprocessor Control.

4. Turn the ignition key switch clockwise to the on position and wait until the display reads:

SHUTDOWN
MANUAL STOP

5. Press the SETUP key and proceed through the wash mode and temperature setpoint screens until the upper line of the display reads "SELECT MODEL". (Wash mode and temperature may be programmed now if desired).

6. Press one of the arrow keys repeatedly until the correct model name is displayed on the lower display line. Press the ENTER key when the selection is complete.

Calibration

The following instructions assume that the model selection has just been completed:

1. Proceed through the modem selection menu by pressing the ENTER key.

2. The display now should read "REMOVE PRESSURE" with a pressure display on the bottom line. Ensure that there is no pressure in the solution system by opening the heat bypass valve. After all system pressure has bled off, press the ENTER key.

3. The display should read "Calibrating" for approximately two seconds. If the display reads "Calibration not Performed", check that system pressure has been removed and repeat procedure. It may be necessary to repeat model selection to get back to this point. If still unsuccessful, consult with the Prochem service department.

4. The display will now read "REMOVE SHUNT" above a battery current display. Before proceeding, ensure that all accessories such as waste pumps, fuel pumps, demand pumps, etc., are turned off or disconnected. If the battery current does not fall below +/- 10A, disconnect the small brown wire from the current shunt (Figure 8) and reconnect it to the other end of the shunt

5. Press the ENTER key. The display should again read "Calibrating" for about two seconds, after which the control will return to the shutdown display. If "Calibration not Performed" is displayed, repeat the procedure.

6. Turn the ignition key switch counter-clockwise to the off position, remove the hardware key, and replace the plastic connector boot on the top of the Microprocessor Control. Replace the right and left hood assemblies. The cleaning unit is now configured for operation.

USING A MODEM FOR REMOTE DIAGNOSTICS

1. Introduction

Prochem may perform remote troubleshooting of your Microprocessor Control via modem.

2. Equipment Required

Modem

The following is a list of modems that can be used with your Microprocessor Control:

US Robotics Sportster 14,400 Fax Modem (external)
Hayes Accura 144 External
Practical Peripherals PM144MTII
Cardinal MVP144XF

If the US Robotics modem is used, it will be necessary to make sure the switches on the back of the unit are set correctly. Use a small screwdriver or other small instrument to change the switch settings, if necessary. The correct settings are (left to right):

1. Down
2. Up
3. Down
4. Up
5. Up
6. Up
7. Down
8. Down

The Hayes, Cardinal, and Practical Peripherals modems do not have any external switches.

Make sure the modem selection stored in the Microprocessor Control matches the modem you are using. The modem selection is made in the same manner as truck mount model selection: use the up and down arrow keys to find the desired selection and press the ENTER key to accept the selection.

Other Equipment Required

The following is a list of the other hardware required to perform remote diagnostics on your Microprocessor Control:

DB25 male - DB9 female serial cable. A six foot cable should be sufficient. This should be a one-to-one cable, not a null modem cable.

Four-wire TELCO cable terminated at both ends with RJ-11 connectors. Length depends on availability of telephone outlet.

Active telephone outlet, and 115 VAC standard wall outlet.

3. Cabling Procedure

Use the following procedure to ready your Microprocessor Control for remote diagnostics:

1. Ensure both the modem and Microprocessor Control are powered down. The ignition key switch on the truck mount unit should be turned counter-clockwise to the off position.

2. Connect the modem to the Microprocessor Control using the DB25 male - DB9 female cable.

3. Plug the modem power cord into a 115 VAC standard wall outlet.

4. Connect the modem to an active telephone outlet using the four-wire TELCO cable.

5. Power on the modem.

6. Power on the Microprocessor Control.

Your modem and Microprocessor Control should be ready to accept incoming calls from Prochem's remote PC running the Prochem Remote Monitoring Software. Now contact the Prochem service department with the modem phone number to begin remote diagnostics.

MICROPROCESSOR CONTROL-SPECIFIC PARTS

Part Number	Description
33-900220	Shunt, Current Microprocessor
35-900194	Sensor, Pressure Microprocessor
35-900195	Sensor, Vacuum Microprocessor
35-900196	Sensor, Temperature Microprocessor (2 Req'd on Bruin 2, Performer, and Performer 405 Microprocessor Control-equipped models)
35-900198	Sensor, Oil Pressure Microprocessor
35-901015	Controller, Microprocessor
56-502083	Box, Mounting Microprocessor
61-950894	Assembly, Cover for Mounting Box Microprocessor

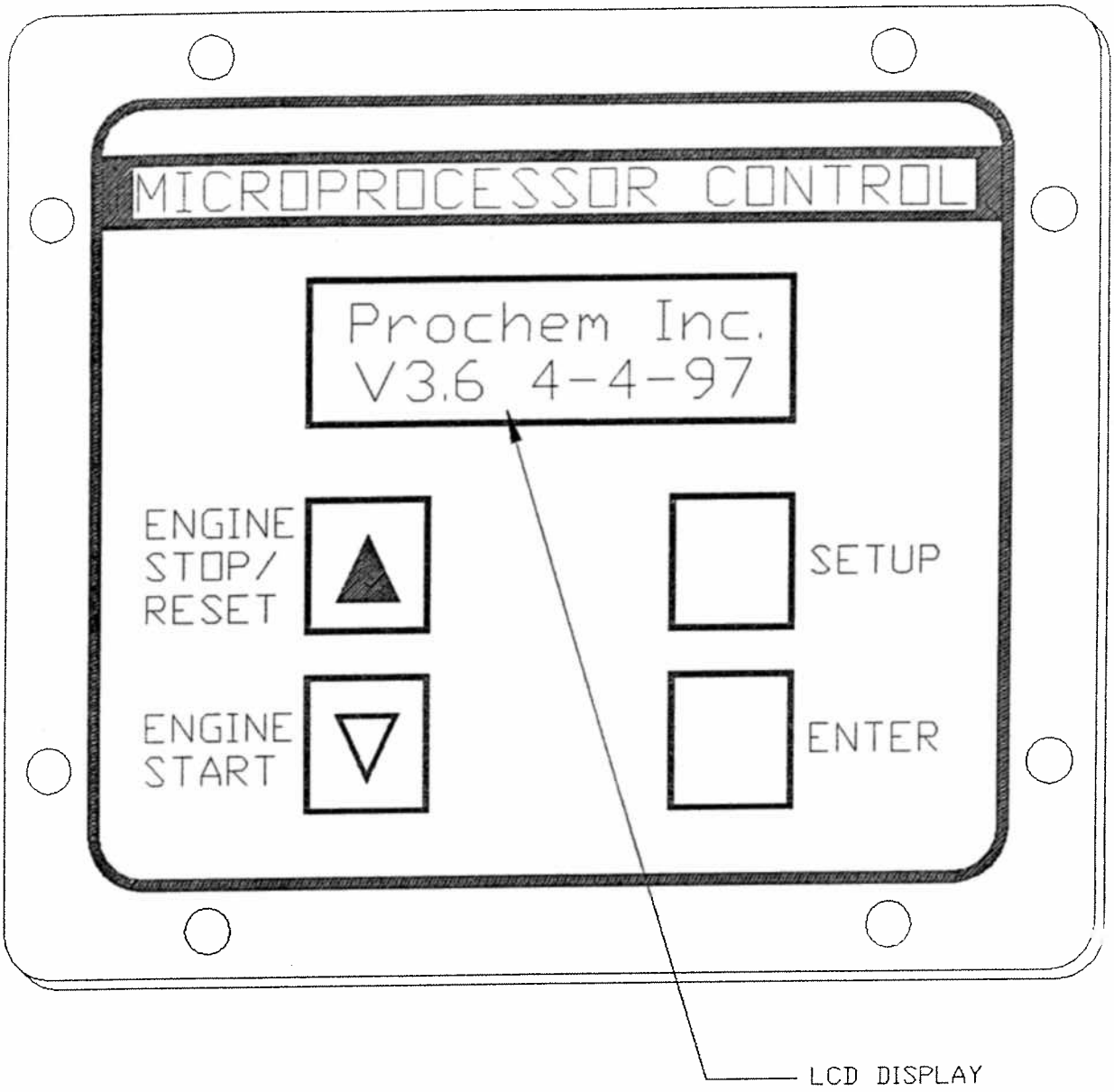


FIGURE 1 - BASIC OPERATION
MICROPROCESSOR KEYPAD & LCD DISPLAY

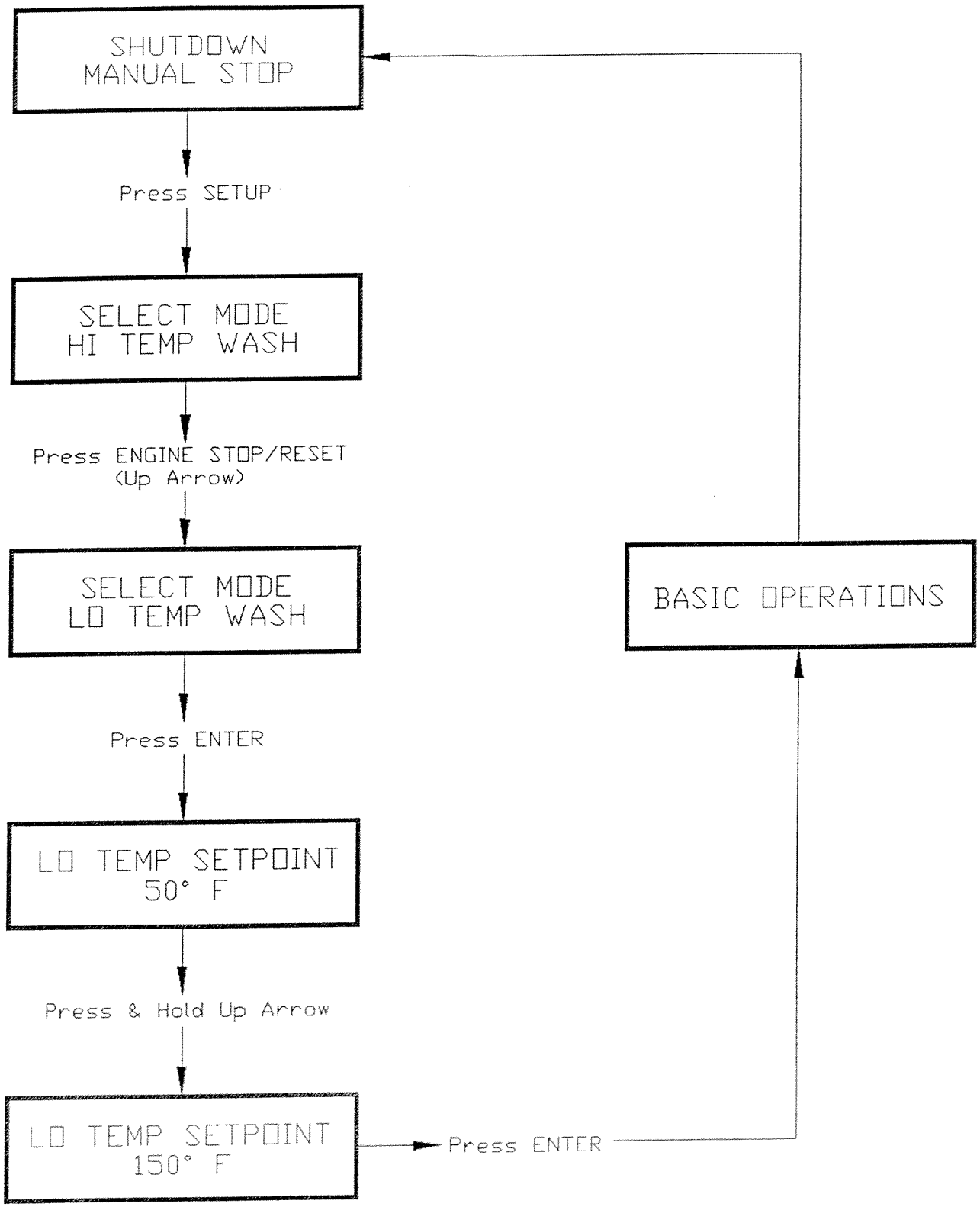
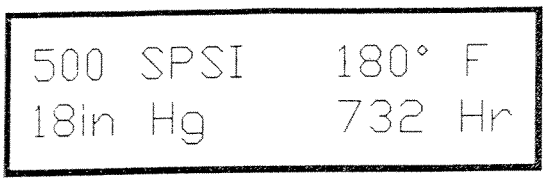
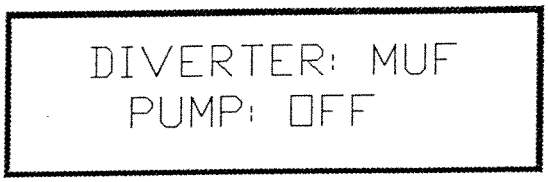


FIGURE 2 - BASIC OPERATION
EXAMPLE PROGRAMMING SESSION

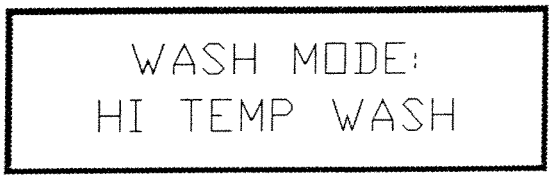


CLEANING SYSTEM STATUS

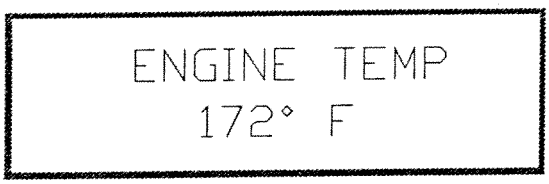
ENGINE STATUS



HEAT TRANSFER STATUS

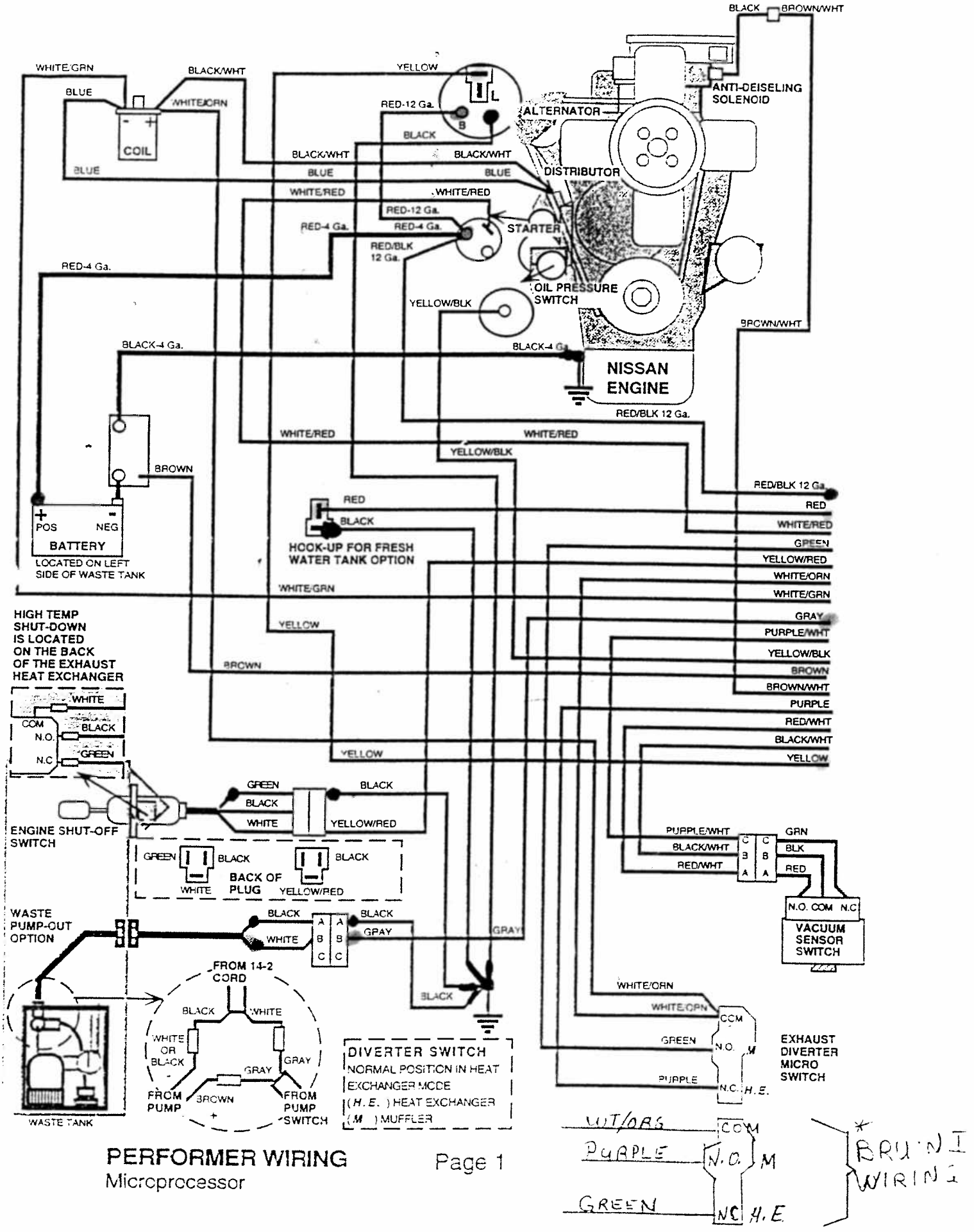


WASH M□DE



ENGINE C□□LANT STATUS
(Performer, Bruin II only)

FIGURE 3 - BASIC □PERATION
STATUS DISPLAYS



PERFORMER WIRING

Microprocessor

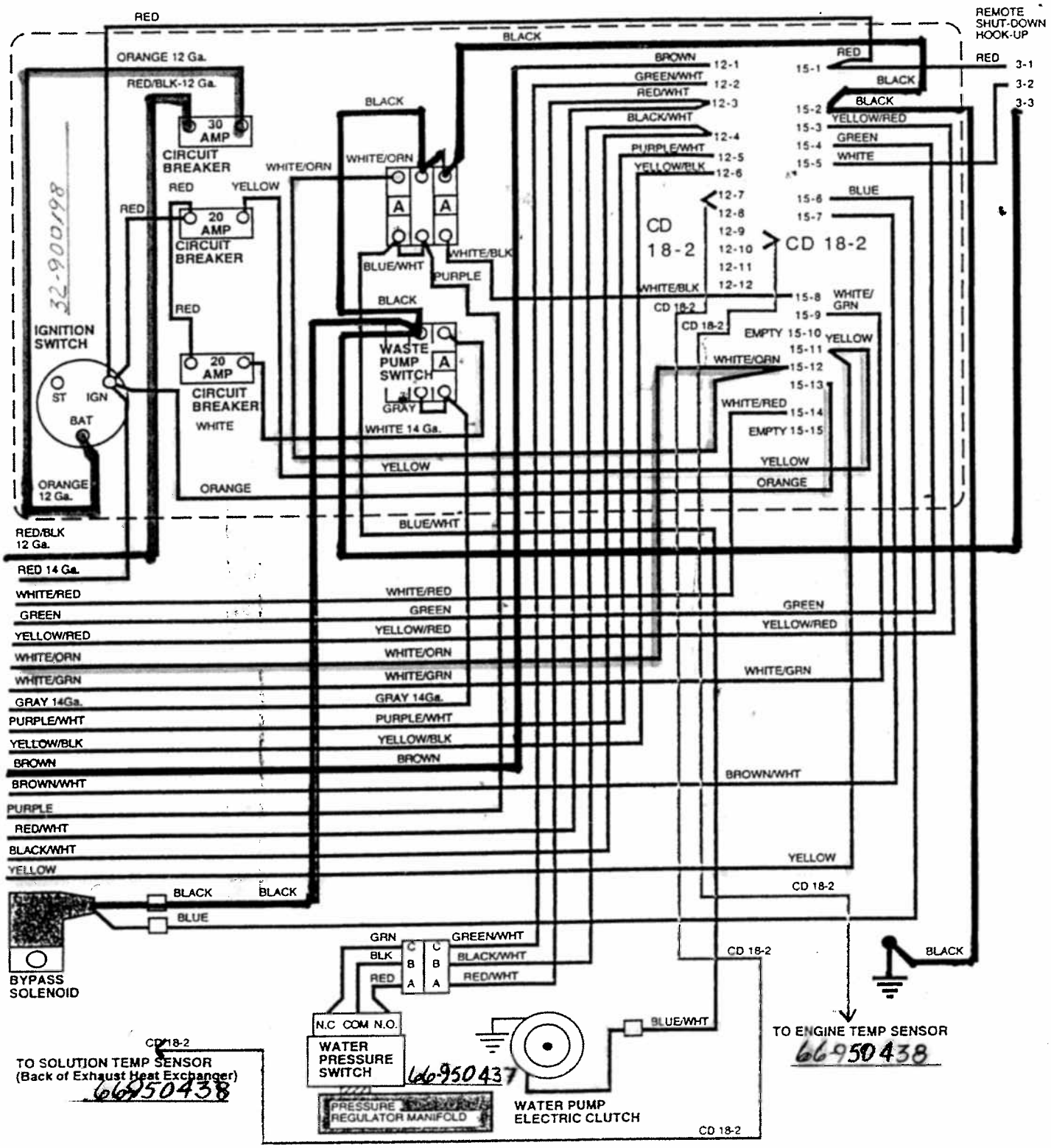
Page 1

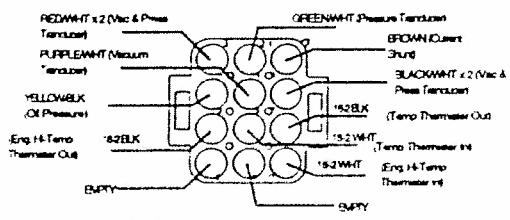
MOTORS

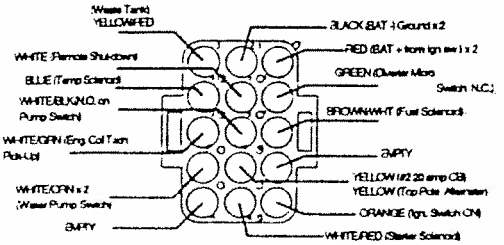
PURPLE — N.O. — M

GREEN — N.C. — H.E.

* BRUNI WIRING







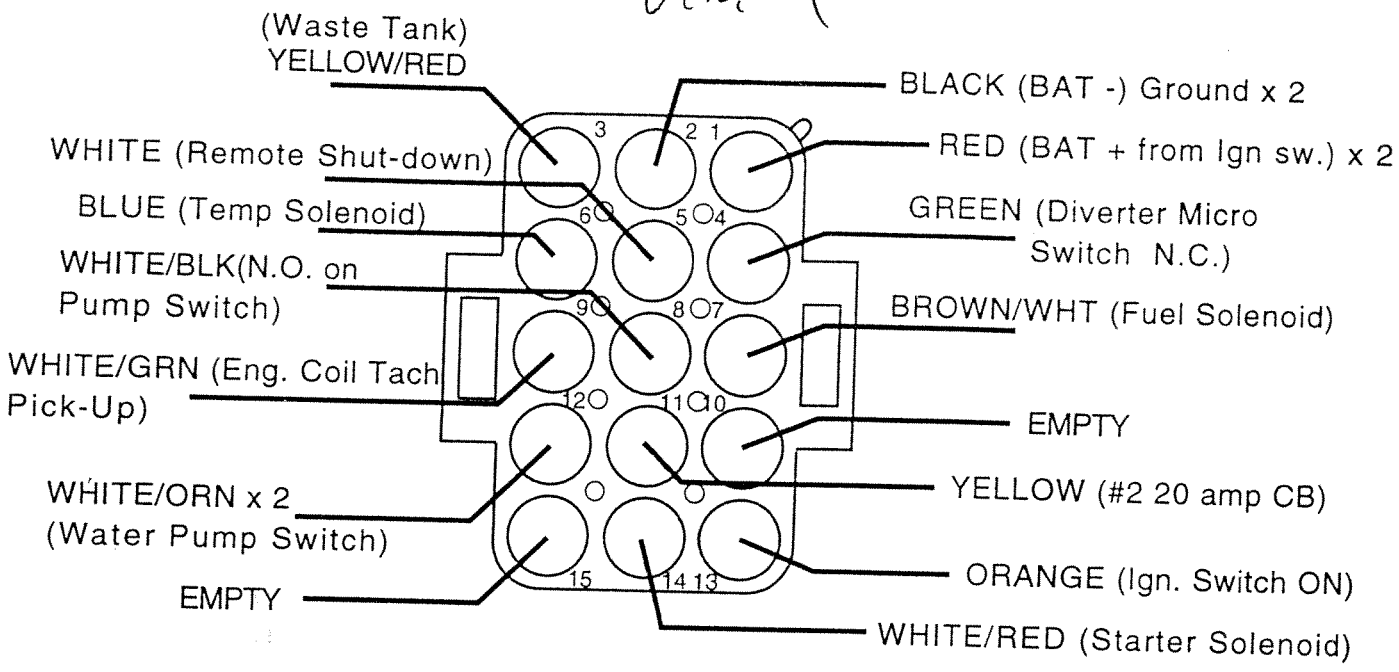
PERFORMER WIRING

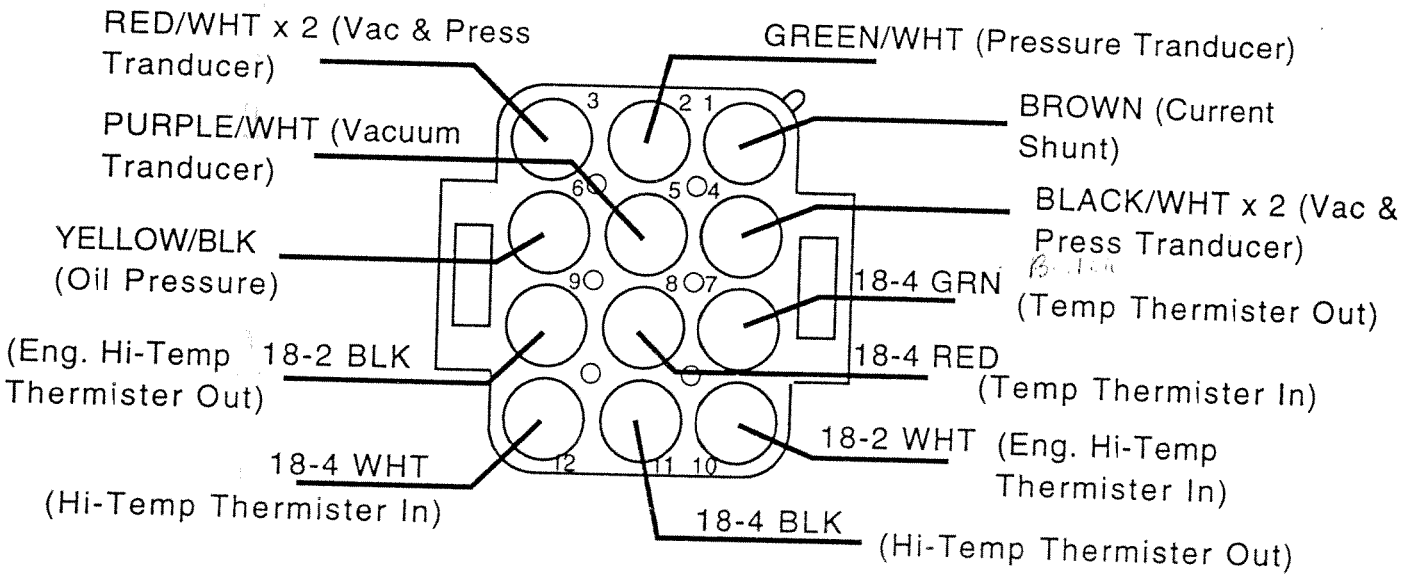
Microprocessor

NOTE

B ON THE CONTACT BLOCK INDICATES NORMALLY CLOSED (N.C.)
A ON THE CONTACT BLOCK INDICATES NORMALLY OPEN (N.O.)

Vers. 1



ALL WIRES 18 GAUGE UNLESS NOTED

PERFORMER & BRUIN II