

Instructions for Cutler-Hammer Diesel Engine Fire Pump Controllers

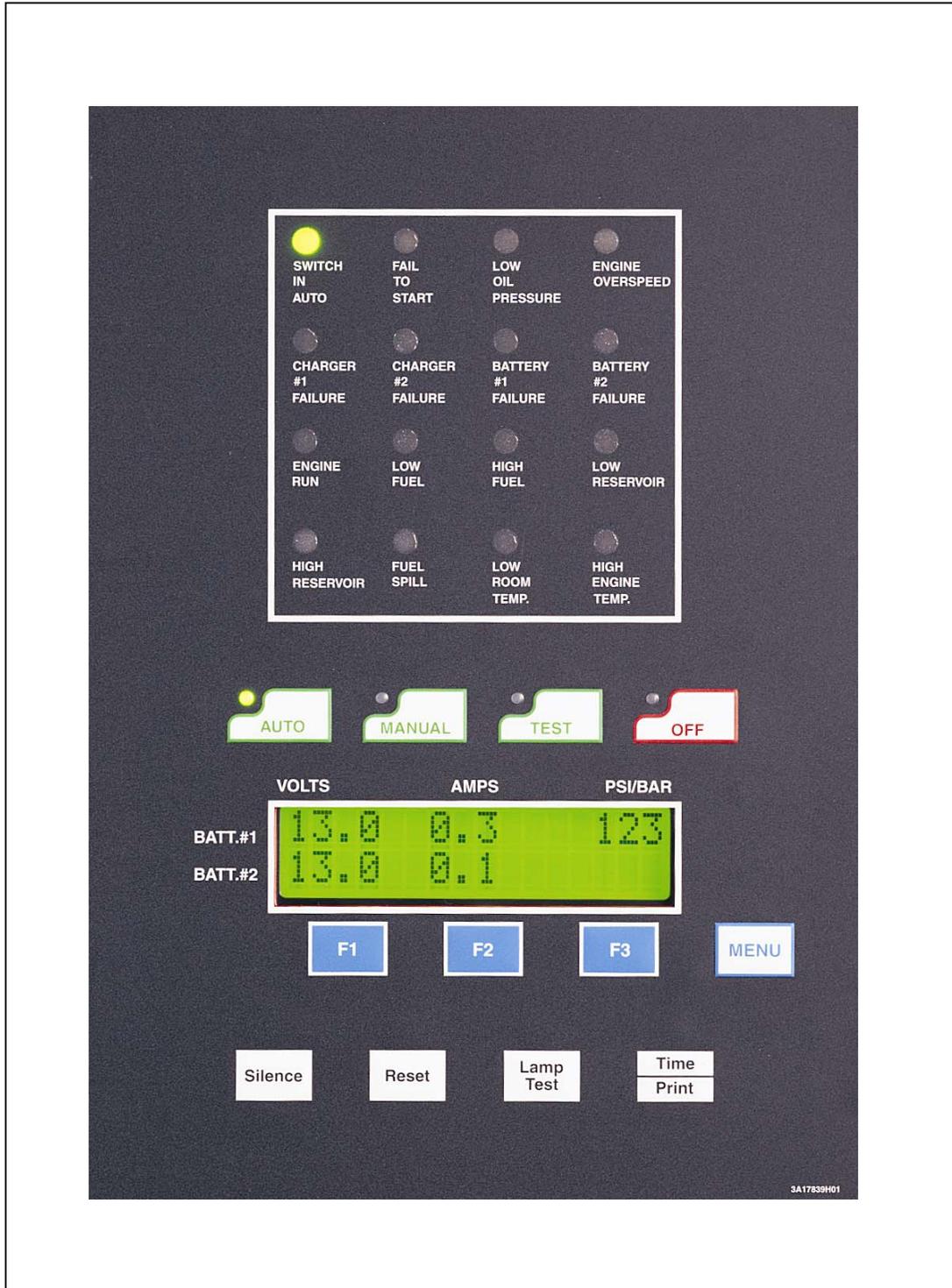


Table of Contents

1. INSTALLATION AND MOUNTING OF CONTROLLER.....	1
2. ELECTRICAL CONNECTIONS	1
2.1 WIRE SIZES.....	1
3. SYSTEM PRESSURE CONNECTION.....	2
4. MAIN DISPLAY PANEL	2
4.1 LCD DISPLAY.....	2
4.2 ANNUNCIATORS	2
4.3 MAIN SWITCH.....	2
4.4 FUNCTION (F1, F2, F3) AND MENU KEYS	2
4.5 SILENCE AND RESET BUTTON	2
4.6 LAMP TEST BUTTON	2
4.7 TIME/PRINT BUTTON	2
5. OPERATION OF CONTROLLER	3
5.1 OFF MODE	3
5.2 MANUAL MODE	3
5.3 AUTO MODE	3
5.4 STOP MODES	3
5.5 WEEKLY TEST TIMER.....	3
5.6 TEST MODE	4
5.7 RUN PERIOD TIMER (RPT)	4
5.8 SEQUENTIAL START TIMER.....	4
6. PROGRAMMING THE MAIN CONTROLLER	5
6.1 TO PROGRAM THE CONTROLLER.....	5
6.2 PROGRAM DESCRIPTIONS	5
6.2.1 <i>Change Date</i>	5
6.2.2 <i>Change time</i>	5
6.2.3 <i>Weekly Timer</i>	5
6.2.4 <i>Run Period Timer</i>	5
6.2.5 <i>Language</i>	5
6.2.6 <i>Pressure Transducer</i>	6
6.2.7 <i>Pressure Start Pt</i>	6
6.2.8 <i>Pressure Stop Pt</i>	6
6.2.9 <i>Low Suction Shutdown</i>	6
6.2.10 <i>Printer Deviation</i>	6
6.2.11 <i>Current Pressure</i>	6
6.2.12 <i>Sequential Start</i>	6
6.2.13 <i>Stop Mode</i>	6
6.2.14 <i>AC Failure Start</i>	6
6.2.15 <i>Print Routine</i>	7
6.2.16 <i>Print Status</i>	7
6.2.17 <i>Select Mode or Press Menu</i>	7
7. ALARM SIGNALS.....	8
7.1 BATTERY FAILURE	8
7.2 CHARGER FAILURE.....	8
7.3 ENGINE RUN.....	8
7.4 ENGINE OVERSPEED	8
7.5 FAIL TO START	8
7.6 RELIEF VALVE DISCHARGE.....	8
7.7 HIGH ENGINE TEMPERATURE.....	8

7.8	LOW / HIGH FUEL	8
7.9	LOW OIL PRESSURE	8
7.10	LOW / HIGH RESERVOIR.....	8
7.11	LOW ROOM TEMPERATURE.....	8
8.	BATTERY CHARGERS	9
9.	OPERATING TEMPERATURE	9
10.	INITIAL START UP.....	10
10.1	AUTOMATIC START TEST.....	10
10.2	MANUAL START TEST.....	11
10.3	TEST START TEST	11
10.4	WEEKLY EXERCISER TEST	11
11.	FIELD FAILURE ALARM SIMULATION	12
11.1	CHARGER FAILURE.....	12
11.2	BATTERY FAILURE	12
11.3	LOW OIL PRESSURE	12
11.4	HIGH ENGINE TEMPERATURE.....	12
11.5	ENGINE FAIL TO START.....	12
11.6	ENGINE OVERSPEED	12
11.7	OTHER ALARMS (PUMP ROOM ALARMS).....	12
12.	PRINTER - RECORDER INSTRUCTIONS.....	13
12.1	OPERATING PROCEDURE	13
12.2	SELF TEST FUNCTION	13
12.3	PAPER LOADING	13
12.4	PRINT MODES	14
12.4.1	<i>Auto Print</i>	14
12.4.2	<i>Manual Print</i>	14
12.5	PRINT STATUS	14
12.6	PRINTER DEVIATION.....	14
12.7	REPLACEMENT PAPER TYPE.....	15
13.	FACEPLATE DETAILS.....	16
14.	MENU FLOWCHART	17
15.	APPENDIX A: ANNUNCIATOR ALARMS.....	18
16.	APPENDIX B: PRINTER 'EVENT' MESSAGES	19
17.	DIMENSIONS AND SHIPPING WEIGHT.....	20
18.	FIELD CONNECTIONS, TERMINAL BLOCK	21
19.	TYPICAL SCHEMATIC.....	22

Installation & Maintenance Manual for Diesel Engine Fire Pump Controller

In order to familiarize yourself with the FD100 Diesel Controller, please read this instruction manual thoroughly and carefully. Retain the manual for future reference.

1. Installation and Mounting

Carefully unpack the diesel controller and inspect thoroughly.

The controller should be located as close as is practical to the engine it controls and shall be within sight of the diesel engine and batteries, preferably ten feet or less.

The FD100 controller is designed for either wall or floor mounting. Note that the controller is not free-standing and must be mounted with feet or bolted securely to a wall. Refer to the dimension drawing (Figure #3) in this manual for dimensional data.

The enclosure should be mounted with fastening devices capable of supporting 250lbs/114kg.

2. Electrical Connections

All electrical connections should meet national and local electrical codes and standards.

The controller should be located or so protected that it will not be damaged by water escaping from pumps or pump connections. Current carrying parts of controllers shall be a minimum of 12 inches (305 mm) above the floor level.

- Verify all data on the nameplate such as catalog number, polarity of grounding, AC line, battery voltage and system pressure.
- Inspect all electrical connections, components and wiring for any visible damage and correct as necessary. Ensure that all electrical connections are tightened before being energized.
- Refer to the appropriate field connection drawing affixed to the enclosure door, for all wiring information pertaining to the incoming AC power supply, batteries and engine wiring.
- Install necessary conduit using proper methods and tools.
- Terminals 1 through 12, located on the lower terminal block, are for interconnection to the respective terminals on the diesel engine terminal block.

- Incoming AC line voltage is clearly marked L, N and GD (ground) located on the lower terminal block.
- Terminals 16 through 31, located on the lower terminal block, are for interconnection of all remote alarm functions.
**Do not apply an AC voltage to these terminals. Dry contact rating only.*
- Terminals 39 through 134, located on the Relay Board, are for connection of all output relay functions. These terminals are of the pull-apart variety for ease of wiring.
- Input terminals on controller card are rated for 30 VDC.

NOTE: All field connections and AC wiring must be brought into the enclosure through the lower right or bottom right side ONLY (refer to label affixed inside enclosure),

****OTHERWISE WARRANTY IS VOID.****

2.1 Wire Sizes

- For control wiring, use #14 AWG wire for all electrical connections except battery connections.
- For battery connection, terminals **6, 7, 8** and **11**, use the following:

#10 AWG: 0' to 25' (7.62 m)
8 AWG: 25' to 50' (15.2 m)

3. System Pressure Connection

The FD100 is supplied with a Pressure Transducer or, as an option, a Mercoird Pressure Switch. The controller is provided with a 1/4" NPT female system pressure connection located on the bottom, external side of the enclosure. The connection should be installed as per NFPA, pamphlet No. 20.

The "TEST" drain connection, located to the left of the system pressure connection, should be piped to a drain or to waste.

NOTE: Water lines to the drain valve and pressure switch must be free from dirt and contamination.

The main controller panel interfaces with either the pressure transducer or the optional Mercoird pressure switch. The controller must be programmed for the appropriate device.

Using the standard pressure transducer, the actual pressure is displayed on the top right hand corner of the LCD display. Precise start and stop pressure set points can be programmed into the controller via the membrane switches. Pressure readings are also displayed on the printer during alarm situations or pressure deviations.

With the Mercoird pressure switch option, the LCD will display "OK" if the pressure is satisfied, and "LOW", if the contacts on the pressure switch change state. The printer will indicate "Low Pressure" on the paper display when the pressure is not satisfied.

4. Main Display Panel

The main display panel located inside the enclosure, behind the breakable glass panel, serves many operator interface functions (refer to Figure #1 for the main display panel layout):

- LCD Display
- Annunciators
- Main Switches
- Ammeter and Voltmeter for Each Battery
- Pressure Indicator
- Programming Functions

4.1 LCD Display

The LCD display located on the bottom of the main display panel indicates both the voltage and current reading of each battery as well as the system pressure, in PSI.

The LCD display is also used while programming the diesel controller.

4.2 Annunciators

The alarm and status indicators are located in the top portion of the main display panel and will illuminate only if the situation occurs.

The indicators are color coded to signify the urgency of the alarm:

GREEN: Normal Running Condition
 RED: Critical Alarm
 YELLOW: Supervisory Alarm

4.3 Main Switch

Four membrane switches labeled AUTO, MANUAL, TEST and OFF, each equipped with an LED indicator, are clearly marked for easy operation of the controller.

4.4 Function (F1,F2,F3) and MENU Keys

There are four membrane switches, F1, F2, F3 and MENU which are dedicated to programming the controller. Refer to section 6 for programming of the controller.

4.5 Silence and Reset Button

Used to silence and/or reset prescribed alarms as per NFPA Pamphlet No. 20.

4.6 Lamp Test Button

When depressed, the LED's will illuminate sequentially, row by row. This function can be utilized at any time during the operation of the diesel controller.

4.7 Time/Print Button

This button toggles between two functions. When initially depressed the LCD display will indicate:

TOP: Actual date and time
BOTTOM: Weekly Test Timer, date and time.
BOTTOM: Quantity of messages stored
RIGHT in memory.

When depressed again the controller will prompt the user to hold the button for 3 seconds (at which time an audible tone is heard) after which the stored event and alarm messages will be transmitted to the printer. This is only applicable when the 'Print Routine' is set for *Manual Print*, otherwise the data is sent directly to the printer without user intervention. Refer to Section 12. The "Time/Print" key is not functional when the controller is in the OFF mode.

5. Operation of Controller

Before accessing any mode, you must return to the OFF mode.

5.1 OFF Mode

In the OFF position the controller prevents the engine from starting and resets the following alarms:

- Overspeed
- Charger Failure
- Battery Failure
- Fail to Start
- Low Oil Pressure
- High Engine Temperature

The OFF position will silence all alarms.

Three (3) sets of alarm contacts are provided to indicate that the controller is in the "OFF" mode. The contacts are rated for 10 A @ 220 VAC / 32 VDC. Terminals 120 to 128.

5.2 Manual Mode

This position allows the starting of the engines using the manual crank buttons, Crank #1 and Crank #2, located below the main display panel. For added cranking capacity, both Crank buttons can be depressed simultaneously.

The engine can be stopped by the 'Local Stop' pushbutton or by placing the controller in the OFF mode. The engine will automatically stop in the case of an OVERSPEED condition.

All alarms, except for "FAIL TO START", are active in the MANUAL mode.

CAUTION: *Only depress Crank #1 or Crank #2 pushbuttons with controller in the 'MANUAL' mode.*

Do not depress the crank pushbuttons in any other mode or while engine is running. Doing so can result in serious damage to the engine.

Three (3) sets of alarm contacts are provided to indicate that the controller is in the "MANUAL" mode. The contacts are rated for 10 A @ 220 VAC / 32 VDC. Terminals 63 to 71.

5.3 AUTO Mode

Placing the controller in the AUTO mode illuminates the "SWITCH IN AUTO" annunciator. The controller is now ready to start the engine in an emergency situation.

A drop in pressure, 'Remote Start' signal, a signal from the 'Deluge Valve' or Weekly Test Timer will initiate the "attempt to start" cycle. This cycle consists of 6 crank periods of 15 seconds duration separated by 5 rest periods of 15 seconds duration. Battery 1 and Battery 2 are alternated for each crank cycle. In the event that one battery is inoperative or missing, the controller will lock-in on the remaining battery during the cranking sequence. Once the engine is running, the controller will stop all further cranking.

5.4 Stop Modes

The Stop Mode is programmable for either 'Manual Stop' or 'Auto Stop' (see Figure #2). Note that the engine can be stopped at any time by placing the controller in the OFF position or automatically in case of an OVERSPEED condition.

Manual Stop Mode: the engine will continue to run until the 'Local Stop' or 'Remote Stop' pushbutton is depressed, providing all starting causes have been eliminated.

NOTE: When the controller starts in this mode there is a 15 second time delay in which the 'Local Stop' pushbutton will have no effect.

Auto Stop Mode: the engine will continue to run until the running period timer (RPT) has timed out (factory set at 30 minutes) and all starting causes have been eliminated.

5.5 Weekly Test Timer

Each diesel controller is equipped with a **Weekly Test Timer**, 24 hour clock, to automatically exercise the engine once a week. The controller initiates the starting sequence by opening the drain valve resulting in a simulated system pressure loss. The drain valve is automatically closed once the controller receives an "ENGINE RUN" signal. The engine will continue to run for a minimum of 30 minutes or for the duration of the RPT setting, whichever is greater. "Weekly Test Started" will be indicated on the hard copy printout.

In the event that the engine is inoperative at the time the Weekly Test is to be initiated, the Weekly Test will commence immediately after the engine is put in service. This ensures that the engine is exercised at least once a week for the time specified as per NFPA Pamphlet No. 20.

In order to protect the engine, during the Weekly Test sequence, an OVERSPEED condition, LOW OIL PRESSURE or HIGH ENGINE TEMP alarm will automatically shutdown the engine.

5.6 TEST Mode

Placing the controller in the TEST position initiates a starting sequence by opening the drain valve resulting in a pressure loss. The controller will start the engine in the automatic mode.

The TEST sequence can be terminated by putting the controller in the OFF mode, otherwise the STOP mode prevails as programmed.

All alarms are active in the test mode. In order to protect the engine, in the test mode, an OVERSPEED condition, LOW OIL PRESSURE or HIGH ENGINE TEMP alarm will automatically shutdown the engine.

5.7 Run Period Timer

The Run Period Timer (RPT) performs the automatic stopping function in a Fire Pump Controller after a start initiated by the pressure switch during automatic operation.

The purpose of the RPT is to ensure that the engine is not subjected to frequent starts in response to the pressure. Refer to Section 6 for programming of the RPT.

5.8 Sequential Start Timer

The Sequential Start Timer is standard in all diesel fire pump controllers.

“The controller for each unit of multiple pump units operating in parallel shall incorporate a sequential timing device to prevent any one motor from starting simultaneously with any other motor. If water requirements call for more than one pumping unit to operate, the units shall start at intervals of 5 to 10 seconds. Failure of a leading motor to start shall not prevent subsequent pumping units from starting” – NFPA, Pamphlet 20, Chapter 7.

The sequential start timer (SST) delays the starting of a fire pump in response to the pressure switch. It does not delay a pushbutton or emergency handle start..

With a SST in each controller, any pump may be selected as the lead pump by appropriate setting of the timers. If the lead pump restores the pressure in less than the time

delays applied to the lag pumps, then the lag pumps will not start.

In addition, the provision of a sequential start timer, set to a few seconds delay, will prevent the lead pump controller from responding to momentary hydraulic transient pressure loss which would otherwise start the fire pump unnecessarily.

The SST can be programmed from 0 – 300 seconds. Typically, each pump should be delayed by 10 seconds from the pump ahead of it. If hydraulic transients are a problem, all timers can be adjusted for a few seconds extra time delay.

6. Programming of the Main Controller

>> *The controller is programmable << in the 'OFF' mode only*

The LCD display will prompt the programmer with data and allow the operator to modify the program using a combination of the **MENU** key and three function keys; **F1**, **F2** and **F3**. The displayed parameter value indicates the present setting of the controller. Located above the F1, F2 & F3 keys are designated symbols and/or words describing their function. The function keys are used to increase, decrease or accept preset values.

While programming, a Function key or the MENU key must be depressed within a 60 second time period, otherwise the controller will return to the initial prompt.

6.1 To Program The Controller

Place the controller in the 'OFF' mode and depress the **MENU** key, followed by the **F3** key. Figure #2 (Page 17) illustrates the sequence in which the operator is prompted for each parameter. To move to the next parameter, press the **MENU** key. Note that moving from one parameter to the next does not affect the value of the parameter currently displayed.

F1 and F2 are used to change the value while F3 is used to enter the value into memory or accept the present value and proceed to the next parameter.

For example, if the parameter displayed is "CHANGE DATE", press the **MENU** key three (3) times to access the "RUN PERIOD TIMER" parameter and press **F3** to change the time. **F1** increases the count, **F2** decreases the count and **F3** enters the selected value into memory and proceeds to the next parameter.

PROGRAMMABLE RANGES

Run Period Timer:	1-60 mins
Pressure (Start/Stop):	1-500 PSI
Pressure Deviation:	1-100 PSI
AC Failure Delay:	0-300 sec
Sequential Start Timer:	0-300 sec
Low Suction Shutdown	YES or NO

6.2 Program Descriptions

Refer to Appendix A attached .

6.2.1 Change Date

Factory set, however, this parameter allows the user to set the current date.

6.2.2 Change Time

Factory set, however, this parameter allows the user to set the current time.

6.2.3 Weekly Timer

This function allows the user to set the controller to automatically start and stop the engine once per week. Select the day and time (24-hour clock) for the engine to run. Once selected, choose the run time desired, in minutes. The engine will now start once per week as programmed. **The engine will run for a minimum of 30 minutes or for the duration of the RPT setting, whichever is greater.**

You can view the status of the Weekly Test date by depressing the TIME/PRINT button twice.

6.2.4 Run Period Timer

To activate the RPT, the STOP MODE function must be 'Set for Automatic' (see below in this section). When the engine is started in response to the pressure switch, it will continue to run for the duration of the RPT, in minutes. Once timed out, if no further starting causes prevail, the engine will automatically stop.

If the engine is started manually the RPT has no affect and the engine must be stopped manually.

If the STOP MODE function is 'Set for Manual', the RPT does not affect the operation of the controller and becomes inoperative.

The timing range for the RPT is: 1-60 mins

Note: that the RPT timer must be reset to thirty (30) minutes when the controller is placed in service.

6.2.5 Language

The language can be selected for either English, Spanish or French.

6.2.6 Pressure Transducer

When selected as YES, the controller will start based on the signal from the pressure transducer.

When selected as NO, the engine will start when the controller detects a contact closure between terminals 31+11, i.e. Mercoid pressure switch start.

For both starting conditions above, the Sequential Start Timer is activated when selected.

6.2.7 Pressure Start Pt

The value programmed determines at what pressure the controller will initiate a start command to the engine.

The pressure range is: 1-500 PSI

6.2.8 Pressure Stop Pt

The value programmed determines at what pressure the system must reach before the controller will STOP the engine, either manually via the STOP pushbutton or automatically via the RPT timer. If the actual pressure does not exceed the STOP pressure value, the engine will continue to run.

The pressure range is: 1-500 PSI

6.2.9 Low Suction Shutdown

This function monitors a contact closure between terminals 29+11. If shutdown is disabled, the LCD display will show low suction and the engine will continue to run.

If shutdown is enabled, to prevent the controller from responding to momentary hydraulic transient pressure loss (which would otherwise shut down the engine unnecessarily), a time delay must be programmed to ensure a steady state.

The shutdown time delay is selectable between 0-30 seconds. Upon detecting a steady state contact closure, the engine will turn off.

The reset mode of the engine is user selectable. For AUTOMATIC reset, a time delay between 0- 30 seconds is selected, after which the controller observes the input for a true signal, and if true, will not allow the engine to restart. If false, the controller will function as normal and respond to a start signal.

If MANUAL reset is selected, the RESET pushbutton must be depressed to reset the controller. If the situation continues to exist, the controller will not restart the engine and the alarm will reappear.

The LCD display will indicate 'Low Suction Shutdown' in both situations.

NFPA 20, Section 2-9.9, specifically prohibits the installation of any device in the suction piping that will restrict starting or stopping of the fire pump. Cutler-Hammer assumes no liability when this function is used.

6.2.10 Printer Deviation

This value determines how often to print system pressure fluctuations as programmed by the user. In effect, it performs as a chart recorder.

For example, if 10 PSI is programmed, each time the system pressure fluctuates by 10 PSI, up or down, the actual pressure is recorded in memory and printed, tagged with a date and time. This method avoids continual, time-based printing of unnecessary pressure values.

6.2.11 Current Pressure

Allows the user to view the actual pressure during programming of the *Diesel Controller*.

6.2.12 Sequential Start

This parameter allows you to program a start delay after a start request. To bypass the start delay, set the parameter to zero.

The programmable range is: 0-300 sec

6.2.13 Stop Mode

If 'Set for Manual', once started, the engine MUST be stopped manually by depressing the STOP pushbutton located on the flange, regardless of the starting cause. If 'Set for Auto', the RPT becomes operative.

6.2.14 AC Failure Start

If 'Enabled', the controller will automatically start upon the loss of AC power. There will be a non-adjustable delay of 180 seconds before the AC failure is detected. An additional delay can be set if desired. Time range is between 0 & 300 seconds. If 'disabled' AC power failure will have no affect on the starting of the engine.

6.2.15 Print Routine

If selected for Auto, the messages will print immediately without any user intervention.

If selected for Manual, the messages will be stored in the controller's memory and will print once the TIME/PRINT key is pushed and held for 3 seconds.

To avoid paper build up inside the enclosure, it is recommended that the print mode be selected as 'MANUAL' during normal operation of the controller.

6.2.16 Print Status

If selected as 'NO', a Status report will not print when exiting the programming menu. If selected as 'YES', after exiting the program mode, and pressing the Time/Print button for 3 seconds, the programmed parameters and selected controller readings will be printed. This is most helpful during and after commissioning of the Fire Pump Controller. A sample status printout is shown in section 12:

6.2.17 Select Mode or Press Menu

If programming of the unit is complete pressing the mode keys will put the controller back into operation.

7. Alarm Signals (Annunciator Panel)

Each FD100 Diesel Controller is equipped with all the alarms as shown on page 18. Unused alarms can be activated at any time. Refer to the schematic supplied with the FD100 for alarm connections.

Refer to Appendix A: "Annunciator Alarms" affixed inside the enclosure, which describes each alarm, method of resetting, associated terminal reference number, common trouble alarm and print out. Section 12 describes the "Print Mode".

7.1 Battery Failure

There are two annunciators on the alarm panel for, "Battery #1 Failure" and "Battery #2 Failure". The alarm is activated during the cranking cycle when the controller detects a weak or discharged battery, i.e. 67% of rated voltage, or less, or whenever a battery cable is disconnected.

7.2 Charger Failure

There are two annunciators on the alarm panel for, "Charger #1 Failure" and "Charger #2 Failure". The alarm is activated when the supply power to the charger is lost or when the charger malfunctions (alarm contacts are fed into the controller from the charging unit). The engine continues to run. To avoid nuisance power failures, a 20 second delay is built in to the *Charger Failure* alarm actuation circuit.

7.3 Engine Run

This annunciator illuminates when the controller receives a running signal from the diesel engine.

7.4 Engine Overspeed

An "Engine Overspeed" alarm will shutdown the engine regardless of the start condition - *in all modes*. The signal is sent from the engine to the controller.

7.5 Fail To Start

After 6 cranking attempts, three attempts per battery, the "Fail To Start" annunciator will illuminate. Attention to the diesel and its associated equipment is required immediately.

7.6 Fuel Spill*

Indicates that the relief valve has been manually opened. This will cause a start of the engine once the pressure drops below the set value.

7.7 High Engine Temperature

Indicates that the coolant temperature in the water jackets is extremely hot. The over temperature switch on the engine signals the controller. The engine continues to run in the AUTO and MANUAL modes. In the "TEST" mode and during the weekly test cycle the engine will shutdown.

7.8 Low / High Fuel **

(When Fuel Level Switch Wired)

Indicates that the engine fuel supply is low / high. The engine continues to run.

7.9 Low Oil Pressure

The controller has an inherent delay to bypass the low oil pressure alarm during engine start up. After the delay, should the engine receive a 'Low Oil Pressure' signal, the controller will initiate an alarm. The engine will continue to run in the 'AUTO' and 'MANUAL' mode. In the 'TEST' mode and during the weekly test cycle this alarm will automatically shutdown the engine. This situation will result in serious engine damage if kept running.

7.10 Low / High Reservoir

Indicates that the water reservoir level is low / high. (Signal supplied by others)

7.11 Low Room Temperature

(When Thermostat Installed)

Should a "Low Room Temperature" alarm occur the engine will continue to run.

* Software versions before V2.91 have a *Relief Valve Discharge* alarm in lieu of the *Fuel spill* alarm.

** Software versions prior to V2.91 have an audible alarm for Low / High Fuel which followed the input signal from the fuel tank.

8. Battery Chargers

Battery chargers are independent chargers producing a maximum of 10 amps each at full rate. The battery chargers are fully electronic and will limit the output current to 10 amps even during a continued short circuit.

The green LED on the charger indicates the presence of AC power.

Once the battery comes up to full charge the charger will automatically go into a float rate mode and will provide the exact trickle current required to maintain the batteries fully charged.

The chargers are equipped with two sets of dry, Form C contacts. One to detect low battery voltage, **J2**, (not wired) indicated with a red LED marked as LOW VOLTS, and the other to detect the loss of AC power, **J3**, wired to the controller.

The required charge mode can be selected using the 3-position toggle switch located near the center of the instrument panel of the charger.

The three available modes are:

- Continuous "FLOAT"
- Continuous "EQUALIZE"
(not recommended for more than 12 hours)
- "AUTOMATIC" (factory setting)

NOTE: It is essential that the toggle switch be left in the automatic mode when the controller is not supervised.

In this mode "EQUALIZE" is automatically initiated by a low battery voltage and automatically terminated by a high battery voltage. This assures that the battery will receive an "EQUALIZE" charge only when needed and only for the required period of time.

The chargers have reverse polarity protection which prevents the charger from starting on a battery which has been connected in reverse polarity or having a voltage below a certain minimum, as indicated by the red LED.

Two other LED's are provided to indicate which mode the charger is operating in, FLOAT or EQUALIZE.

Note that the two chargers are rotated 180° from each other. A label affixed to each charger clearly indicates the position of the 3-position switch and the indication of the five LED's.

Extra care must be taken while working near the chargers. The chargers contain live parts and caution must be exercised with AC power applied to the units.

NOTE: All of the charger potentiometers are factory set and are based on the required current charging rates, and battery voltages. DO NOT adjust these potentiometers. Doing so will void warranty.

9. Operating Temperature

The operating temperature range of the FD100 is: -20°C to 70°C.

Temperatures lower or higher than those specified may cause damage to the diesel engine controller.

10. Initial Start Up

1. Ensure that circuit breakers CB1 and CB2 are in the OFF (0) position.
2. Ensure that AC power is supplied to terminals L and N, and GD is grounded.
3. Connect engine batteries to the controller, terminals 6,8 and 11. If batteries are connected in wrong polarity the battery voltage will read zero.
Note that terminals 6A and 8A are for factory use only and NOT for external connections.
4. The Chargers MUST be in placed in the **AUTO** mode (refer to toggle switch on chargers - factory set in the **AUTO** mode).
5. Turn circuit breakers CB1 and CB2 ON ("1" position).
6. Turn printer ON *after* CB1 and/or CB2 have been turned ON.
7. Pressure (start) is factory preset at 1 PSI.
8. Place the controller in the 'OFF' mode by depressing the "OFF" button.
9. Ensure that the Diesel is programmed to user's specifications. Refer to section 6 in this manual. Refer to STATUS printout for factory set parameters.

10.1 Automatic Start Test

Test printer while in Auto mode as per Section 12 of manual. _____

Depress the "AUTO" button. _____

LED on "AUTO" button will light and Annunciator "Switch in Auto" will illuminate. _____

Ensure that water pressure is available and the LCD display on the Display Panel is reading the system pressure, in PSI. _____

Decrease water pressure. Controller will begin its cranking cycle. _____

Should the engine fail to start after 6 crank and rest cycles, the audible alarm will sound and the "Fail To Start" annunciator will illuminate. Depress "OFF" button to silence alarm. _____

When engine starts, "Engine Run" annunciator illuminates. _____

Increase water pressure above programmed STOP point. Press the stop pushbutton on the enclosure. If the pressure is satisfied, the engine will stop. _____

OR

If STOP mode is programmed for "Auto-Stop", engine will stop after Run Period Timer times out and pressure is satisfied. RPT is programmed by the user, factory set at 30 minutes. _____

If Sequential Timer is > 0 seconds, automatic start will be delayed by the number of seconds programmed. _____

If AC Power Failure is ENABLED, automatic start will be delayed by the number of seconds programmed upon a power failure. _____

10.2 Manual Start Test

Depress the "Manual" button. The LED on the button will illuminate. _____

Fuel Solenoid relay will change state. _____

Press Crank No.1 pushbutton. Engine cranks and starts, "Engine Run" annunciator illuminates. _____

Press "OFF" button. Wait for engine to stop. Push "Manual" button then press Crank No.2 pushbutton. Engine cranks and starts, "Engine Run" annunciator illuminates. _____

Press "OFF" button. Engine will stop. _____

10.3 Test Start Test

Depress the "Test" button. LED on button will illuminate. _____

Drain Valve Solenoid will energize and reduce pressure. Controller will start engine automatically. "Engine Run" annunciator illuminates. _____

Press "OFF" button. Engine will stop. _____

NOTE: Engine will stop if Low Oil Pressure, High Water Temp or Overspeed alarms are detected.

10.4 Weekly Exerciser Test

Depress "OFF" button. _____

To test the Weekly Exerciser, preprogram the controller to initiate the test at a time suitable to the user. _____

Depress "AUTO" button. _____

At programmed time and date the drain valve solenoid will open. When the pressure drops below the start PSI value, engine will start, "Engine Run" annunciator will illuminate, and drain valve solenoid will close. _____

Press "OFF" button. Engine will stop. _____

Reprogram Weekly Exerciser for normal operation. _____

NOTE: Engine will stop if Low Oil Pressure, High Water Temp or Overspeed alarms are detected.

11. Field Failure Alarm Simulation

Ensure that CB1 and/or CB2 are in the *ON* position prior to applying power to the printer (refer to nameplate above printer).

Ensure that both CB1 and CB2 are in the *ON* position and that there is AC power to the chargers. Place the controller in either the *AUTO* or *MANUAL* mode.

NOTE: - For all engine alarms, the Engine Trouble Alarm relay will energize.
- Do not put an AC voltage on these contacts.

11.1 Charger Failure

Remove AC power to the diesel controller panel. After a delay of 180 seconds, the alarm will sound and both Charger #1 Failure and Charger #2 Failure indicating LED's will display. Or, jumper 11 & 22, 11 & 23; [11 is Battery (negative)].

After test, reapply AC power to continue testing of other alarms. To reset alarm go to *OFF* mode and then back into *AUTO* or *MANUAL* mode.

11.2 Battery Failure

Turn *OFF* CB1. Alarm will sound and Battery Failure #1 will indicate in the display. To reset alarm go to *OFF* mode and then back into *AUTO* or *MANUAL* mode.

Turn *ON* CB1 and turn CB2 *OFF*. Alarm will sound and Battery Failure #2 will indicate in the display. Reset alarms as per above.

NOTE: Do not turn off both CB1 and CB2 simultaneously. Otherwise power will be lost to the controller card.

NOTE: For the following tests, while controller is in the *AUTO* or *MANUAL* mode, place a JUMPER between terminal 2 & 11. This will give an *ENGINE RUN* signal to the controller. Or, you can run the engine.

There is an inherent 15 second delay for detecting alarms after an *ENGINE RUN* signal.

11.3 Low Oil Pressure

Jumper 4 & 11. Alarm will sound and indicate on the display. To silence alarm, controller must be in the *OFF* mode. *If the engine is wired to the panel and the engine itself is NOT running, the LOW OIL PRESSURE alarm will automatically alarm after the 15 second delay, with terminals 2 and 11 jumpered.*

11.4 High Engine Temperature

Jumper 5 & 11. Alarm will sound and indicate on display. To silence alarm, controller must be in the *OFF* mode. *Note that the LOW OIL PRESSURE alarm will also indicate if terminal 4 is wired from the engine to the panel and the engine is not physically running.*

11.5 Engine Fail to Start

(ALL ENGINES EXCEPT CATERPILLAR)

1. Disconnect field wires #9 & #10 on Fire Pump Controller & initiate automatic start (Place controller in *TEST* mode). Note that actual engine will not crank thus reducing wear and tear on its starters and batteries.

Caterpillar Engines: Install a wire jumper between terminals 1 & 12 and initiate automatic start.

2. Allow pressure to drop and begin cranking sequence.
3. Wait 180 seconds to allow for 3 cranks per battery (15 seconds cranking, 15 seconds rest, 6 times).
4. Alarm will sound and *Fail To Start* indicator will display. To silence alarm, place controller in the *OFF* mode.

11.6 Engine Overspeed

Mechanically close speed switch relay on the diesel engine or jumper 3 & 11. Alarm will sound, *Engine Overspeed* indicator will display, and the *fuel stop* relay will energize.

To silence alarm, place controller in the *OFF* mode.

11.7 Other Alarms (Pump Room Alarms)

To test pump room alarms, such as Low Fuel, Low Room Temp etc., place a jumper between terminal 11 and the corresponding alarm terminal input (refer to Appendix A affixed to controller door).

NOTE: The Pump Room Trouble relay will also activate.

12. Printer - Recorder Instructions

The microprocessor-controlled printer is supplied as standard with all *Diesel* Fire Pump Controllers. Mounted inside the enclosure the printer-recorder provides a hard copy status report of all alarms, events, voltage, system pressure, weekly test timer and programmed parameters of the controller. Each alarm printout is stamped with the time and date that can be used as a trouble-shooting tool to determine start-up causes and exact times of all events.



Note: Printer shipped with controller may differ than shown above.

12.1 Operating Procedure

The printer-recorder is shipped from the factory with two rolls of paper.

Caution must be taken while inside the controller to avoid electrical shocks.

The functions of operating controls are as follows:

Control	Function
L.E.D.	Indicates 'power on' when green and 'paper out' when orange
Switch	Power off in down position Power on in up position
Latch	To secure main body of the printer to mounting enclosure.

12.2 Self Test Function

To activate self-test feature, press and hold the feed button then turn the power on. To stop the self-test before the end of the message, power down the printer.

12.3 Paper Loading

Remove printer chassis from enclosure by turning the latch counter clockwise. Pull out chassis until it stops.

Install the paper spindle into a new roll of thermal paper. Position the roll of paper so that it will feed from the top, then place the roll and spindle into the paper support brackets, making certain that the paper is level. It is recommended that square and clean cut edge is used for entry of paper into the printer mechanism – scissor cut preferred.

To load paper, turn on the power. Now feed the cut edge of the paper into the guide until the paper stops. Press feed button, paper will advance as long as button is held. Feed paper until lead edge lines up with paper cutter.

At this time it is recommended that a self-test be performed to ensure that the paper is installed correctly, (thermal side up) and that it is feeding properly.

In the event of a paper jam condition do not force the paper into the unit, or try to pry the paper out of the unit, this may damage the thermal print mechanism. Disconnect primary power and interface cable before servicing the unit. Carefully remove paper with a set of tweezers, or a small pair of needle nose pliers. If the paper cannot be cleared, remove the face plate by removing the five Philips head screws and nuts holding the face plate. This will allow access to the printer mechanism. Once paper is cleared from the mechanism, re-assemble the unit. At this time, re-load paper.

NOTE: Do not remove jumpers inside of printer

12.4 Print Modes

While in the MENU mode, the 'PRINT ROUTINE' can be set up for either 'Auto' or 'Manual'.

12.4.1 Auto Print

Messages will print directly to the printer as the event or alarm occurs.

DO NOT LEAVE IN THIS MODE

12.4.2 Manual Print

The event and alarm messages are stored in memory until the 'Time/Print' key is depressed, at which time all stored data is printed. The controller will store up to 1024 messages on a First In-First Out basis. To print the stored data hold the 'Time/ Print' key for 3 seconds or more. *DO NOT REMOVE POWER FROM PRINTER UNTIL ALL MESSAGES ARE PRINTED, OTHERWISE INFORMATION WILL BE LOST.*

12.5 Print Status

When programmed as YES, the printer will print the "STATUS" of the controller upon exiting the program mode and *only* after selecting AUTO, MANUAL or TEST mode on the main switch.

12.6 Printer Deviation

Is used to determine how often to print system pressure fluctuations, in PSI, as programmed by the user.

For example, if 10 PSI is programmed, each time the system pressure varies by 10 PSI or greater, the actual pressure, date and time will be printed on the printout display (if a Mercoid Pressure Switch is supplied this parameter has no effect).

The programming of the print mode is detailed in Section 6.

"STATUS" Printout

```

*****
S T A T U S   rev4.4
SO 16E5612 CO 103558
 10/20/00, 08:29:23
Weekly Test Time is
  MONDAY 07:05
AC Failure   DISABLED
Print Mode in MANUAL
Stop Mode in  AUTO
SST Setting = 000SEC
RPT Setting = 30 MIN
Start Point =001PSI
Stop Point  =110PSI
Pressure    =119PSI
Low Suction Shudwn:
  Disabled
Charger #1  = 00.2 A
Charger #2  = 00.3 A
Battery #1  = 13.0 V
Battery #2  = 12.9 V
*****

```

Alarm & Message Printout

```

05/26/99, 07:26:01
Pressure = 172 PSI
  **AUTO**

05/26/99, 07:26:18
Pressure = 182 PSI
  **AUTO**

05/26/98, 07:37:51
Low Fuel
  **AUTO**

05/26/98, 07:38:12
Low Room Temp
  **AUTO**

05/26/98, 07:38:22
Battery #2 Failure
  **AUTO**

05/26/98, 07:40:11
Remote Start Request
  **AUTO**

05/26/98, 07:40:11
Fuel Solenoid Open
  **AUTO**

05/26/98, 07:40:11
Cranking Battery #1
  **AUTO**

05/26/98, 07:40:25
Engine Run
  **AUTO**

```

12.7 Replacement Paper Type

The printer-recorder uses a thermographic printing paper on a 2-3/4" diameter roll which is 2-1/4" wide and having a plastic core with a 7/16" hole. Suitable paper is available at most office-supply stores. See list below depicting the office supply stores and their respective catalog number for the paper.

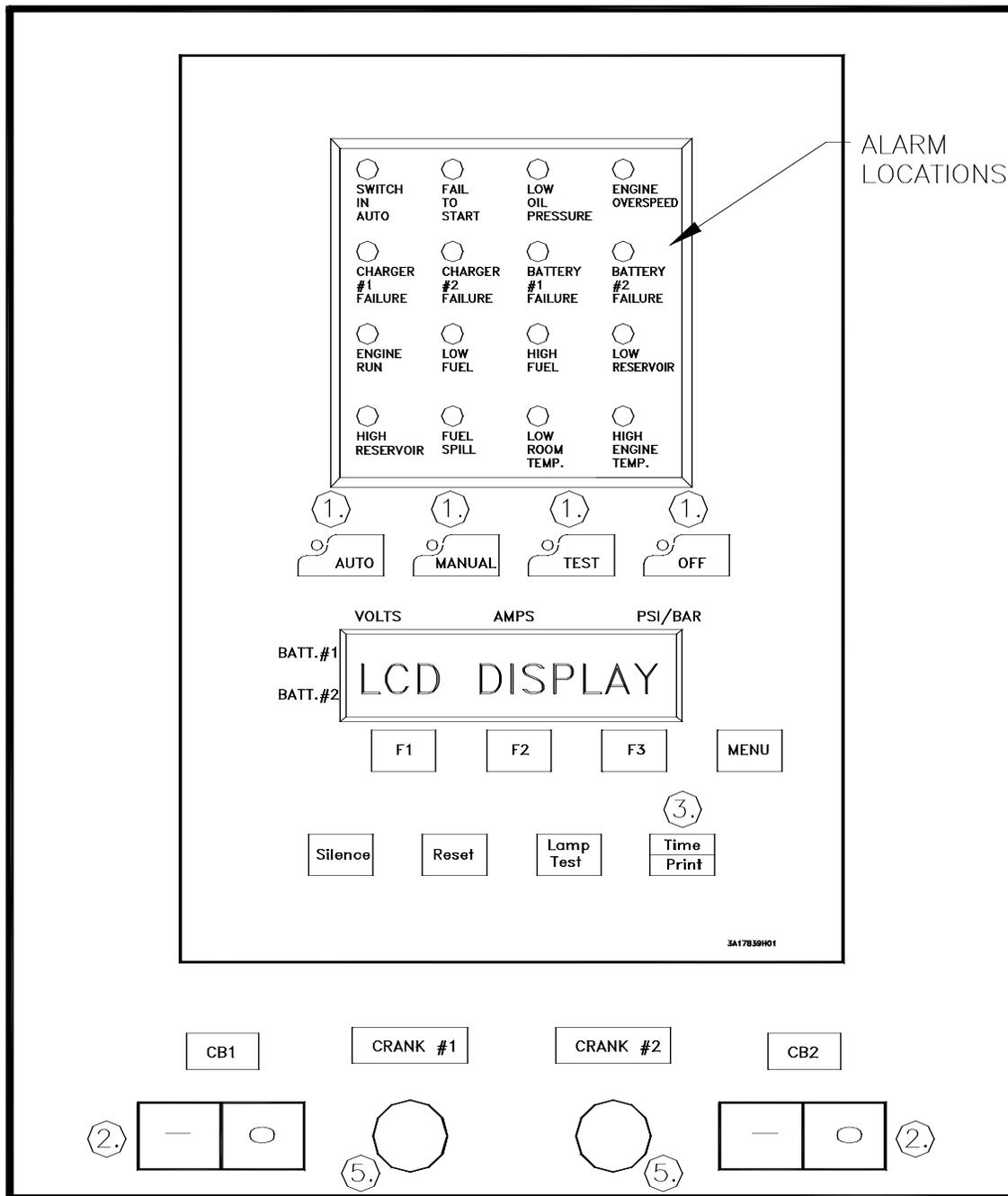
NOTE: If the end of the paper roll is taped, extra caution must be taken when the colored stripe appears – indicating the paper is running out. At this point turn the printer off and replace the roll. Note that one or two messages may be lost as a result.

NON-TAPED ENDED ROLLS

WILSONS: LAB CR722

TAPED ENDED ROLLS

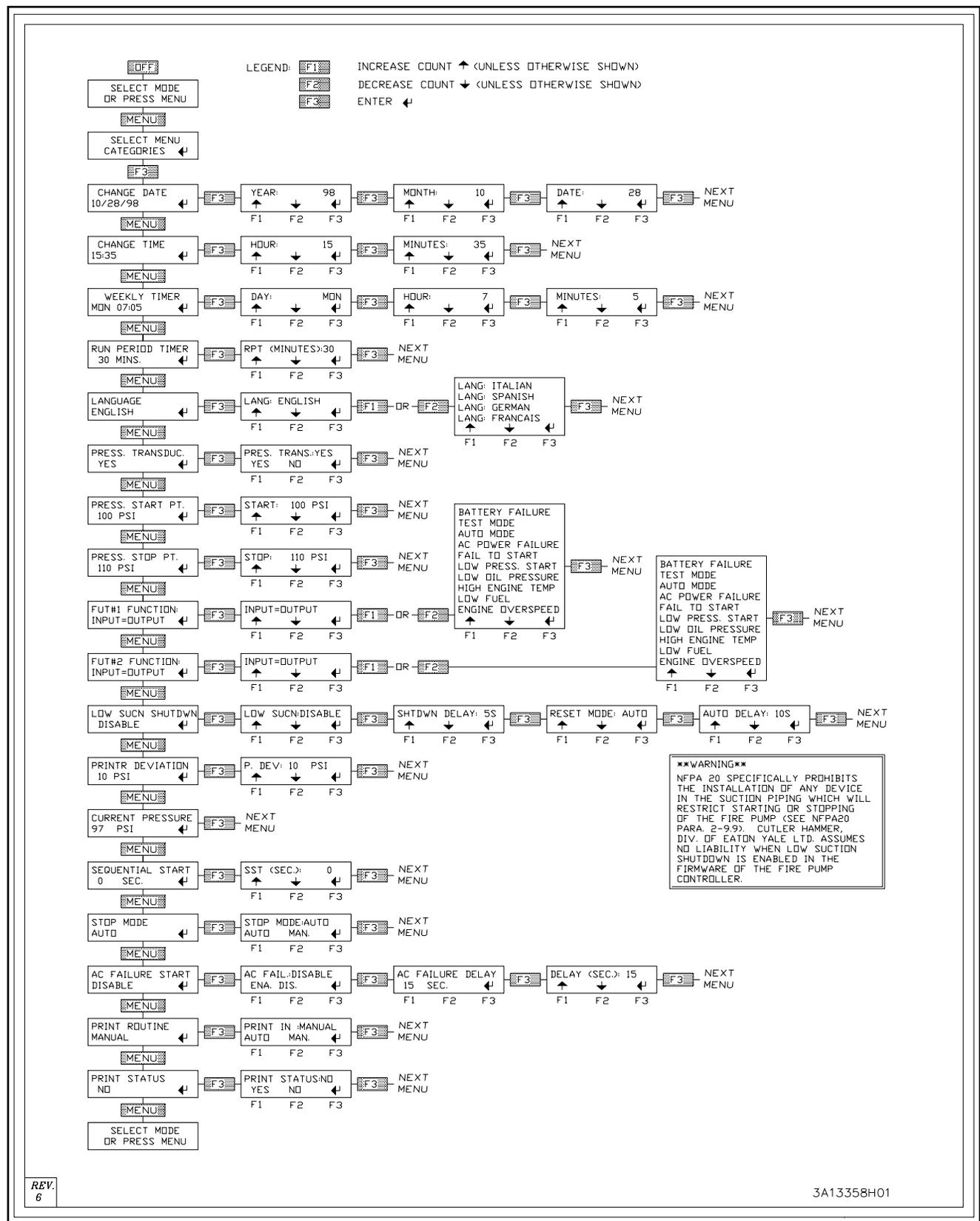
STAPLES: 14485
GRAND & TOY: 7767000
OFFICE DEPOT: 302-232



NOTES:

- ① LED LIT TO INDICATE WHICH MODE THE CONTROLLER IS IN.
- ② CONNECT BOTH BATTERIES FIRST THEN CLOSE BOTH BREAKERS.
- ③ TIME/PRINT TOGGLES BETWEEN TWO FUNCTIONS. WHEN IN PRINT FUNCTION TAKE INSTRUCTION FROM LCD DISPLAY.(HOLD BUTTON FOR AT LEAST 3 SEC. THEN PRINTER WILL PRINT ANY AVAILABLE INFORMATION)
- ④ FOR DETAILED PROGRAMMING AND SET UP INSTRUCTIONS REFER TO OPERATING MANUAL.
- ⑤ TO MANUALLY START THE DIESEL DEPRESS THE "OFF" MODE SWITCH THEN THE "MANUAL" MODE SWITCH. PRESS CRANK #1 OR CRANK #2 OR BOTH TILL DIESEL IS STARTED.

FIGURE #1



REV. 6

3A13358H01

FIGURE #2

APPENDIX A : ANNUNCIATOR ALARMS

Alarm	Terminal Ref. No.	Audible Alarm Silenced By :	Annunciator * Reset By:	Common Trouble Alarm			Alarm ** Print Out
				Type	Relay #	Reset By:	
Battery #1 / #2 Failure	N/A	Placing Controller in the "OFF" Mode	Pressing RESET On Controller Panel	Pump Room	PRT	Pressing RESET On Controller Panel	MMDDYYR, HHMM/SS Battery #X Failure ***mode**
Charger #1 / #2 Failure	22 / 23	Placing Controller in the "OFF" Mode	Pressing RESET On Controller Panel	Pump Room	PRT	Pressing RESET On Controller Panel	MMDDYYR, HHMM/SS Charger #X Failure ***mode**
Engine Overspeed	3	Placing Controller in the "OFF" Mode	Placing Controller in the "OFF" Mode, Resetting Speed Switch on Diesel	Engine	ETA	Placing Controller in the "OFF" Mode	MMDDYYR, HHMM/SS Engine Overspeed ***mode**
Fail To Start	N/A	Placing Controller in the "OFF" Mode	Placing Controller in the "OFF" Mode	Engine	ETA	Placing Controller in the "OFF" Mode	MMDDYYR, HHMM/SS Fail To Start ***mode**
Fuel Spill	20	Pressing SILENCE On Controller Panel	Pressing RESET On Controller Panel	Pump Room	PRT	Eliminate Problem and Press RESET	MMDDYYR, HHMM/SS Fuel Spill ***mode**
High Engine Temperature	5	Placing Controller in the "OFF" Mode	Placing Controller in the "OFF" Mode	Engine	ETA	Placing Controller in the "OFF" Mode	MMDDYYR, HHMM/SS High Engine Temp ***mode**
Low Fuel Or High Fuel	16 17	Pressing SILENCE On Controller Panel	Placing Controller in the "OFF" Mode	Pump Room	PRT	Eliminate Problem	MMDDYYR, HHMM/SS Low (or High) Fuel ***mode**
Low Oil Pressure	4	Placing Controller in the "OFF" Mode	Placing Controller in the "OFF" Mode	Engine	ETA	Placing Controller in the "OFF" Mode	MMDDYYR, HHMM/SS Low Oil Pressure ***mode**
Low Reservoir Or High Reservoir	18 19	Pressing SILENCE On Controller Panel	Pressing RESET On Controller Panel	Pump Room	PRT	Eliminate Problem and Press RESET	MMDDYYR, HHMM/SS Low (or High) Reservoir ***mode**
Low Room Temperature	21	Pressing SILENCE On Controller Panel	Pressing RESET On Controller Panel	Pump Room	PRT	Pressing RESET On Controller Panel	MMDDYYR, HHMM/SS Low Room Temp ***mode**

* Alarms are not resettable if condition continues to exist.

** Mode *** refers to Main Switch Mode - AUTO, MANUAL, TEST

PAGE 2 OF 3

3A14093H01-C

APPENDIX B: PRINTER 'EVENT' MESSAGES

Message	Description of Message	Message ** Print Out
Cranking Battery #1 or #2	Indicates which battery the controller is cranking during an "attempt to start" cycle. This message will not print in the manual mode.	MM/DD/YR, HH/MM/SS Cranking Battery #X **mode**
Drain Valve Opened	In the "TEST" mode or when initiating the weekly test timer this message prints to indicate the actual time that the drain valve has opened.	MM/DD/YR, HH/MM/SS Drain Valve Opened **mode**
Deluge Valve Open	Indicates that the engine was requested to start due to the Deluge Valve being activated.	MM/DD/YR, HH/MM/SS Deluge Valve Open **mode**
Engine Run	Prints after the controller receives an "Engine Run" signal from the diesel engine.	MM/DD/YR, HH/MM/SS Engine Run **mode**
Engine Stopped	Prints after the diesel engine has stopped as indicated by the "Engine Run" contacts.	MM/DD/YR, HH/MM/SS Engine Stopped **mode**
Fuel Solenoid Closed	Any time the fuel solenoid is de-activated, after a manual stop for example, this message will print.	MM/DD/YR, HH/MM/SS Fuel Solenoid Close **mode**
Fuel Solenoid Open	Any time the fuel solenoid is activated, prior to cranking for example, this message will print.	MM/DD/YR, HH/MM/SS Fuel Solenoid Open **mode**
Low Pressure	This message is printed when the controller is called upon to start the diesel engine as a result of low system pressure.	MM/DD/YR, HH/MM/SS Low Pressure **mode**
Manual Stop Request	Indicates that the Local STOP pushbutton has been depressed to initiate an engine shutdown.	MM/DD/YR, HH/MM/SS Manual Stop Request **mode**
Pressure = XXX PSI	Pressure reading will print if the deviation in pressure exceeds the amount, in PSI, as programmed in to the controller by the user.	MM/DD/YR, HH/MM/SS Pressure = XXXPSI **mode**
* Pressure Start	Future #2 relay will energize once the pressure is less than the programmed Pressure Start Point and the engine starts. Can be enabled or disabled.	MM/DD/YR, HH/MM/SS Pressure Start **mode**
Remote Start Request	Indicates that the engine was called upon to start due to someone pressing the "Remote Start" pushbutton.	MM/DD/YR, HH/MM/SS Remote Start Request **mode**
RPT Time Out	After the Weekly Test Timer or Running Period Timer expires (if STOP Mode is programmed for Auto) this message will print.	MM/DD/YR, HH/MM/SS RPT Timed Out **mode**
Weekly Test Started	This is the actual time that the Weekly Test Timer is called upon to start. The engine will continue to run for 30 minutes after the time indicated.	MM/DD/YR, HH/MM/SS Weekly Test Started **mode**

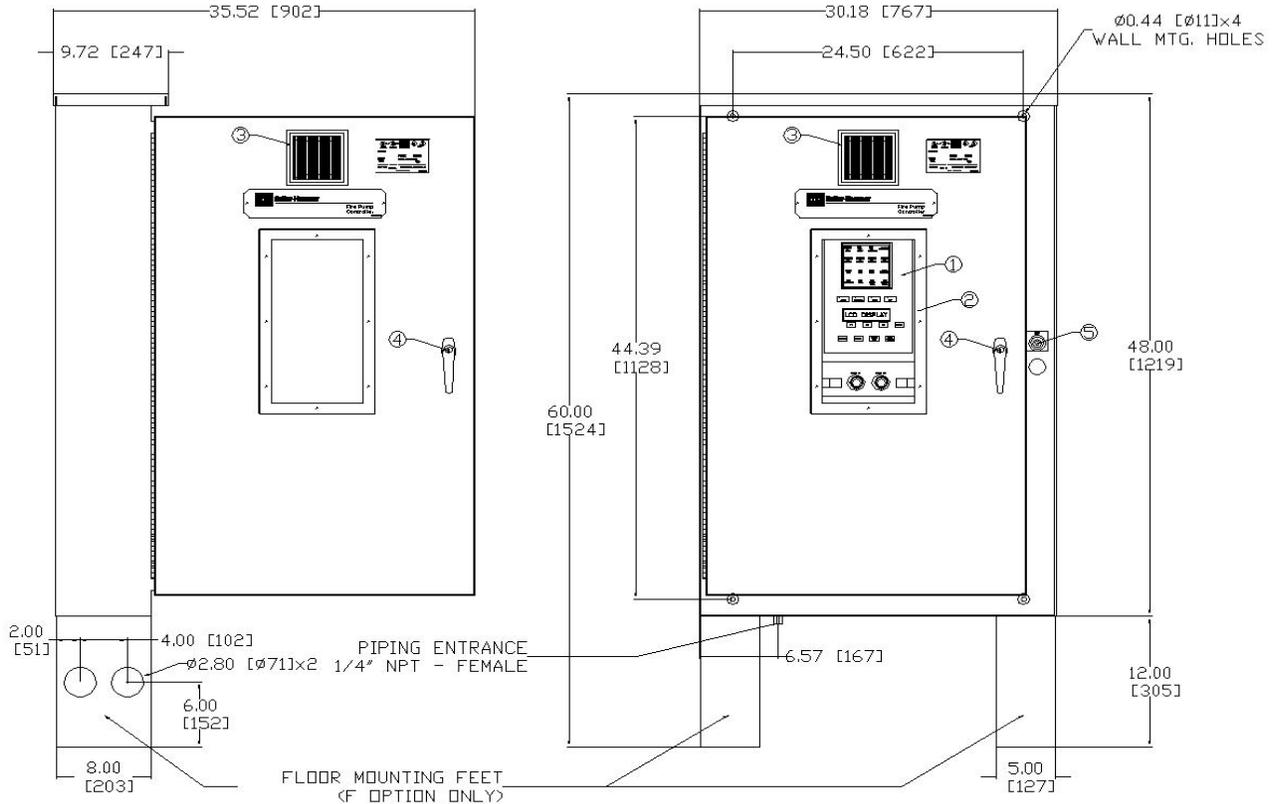
** Not Available on software versions V2.91 or earlier*

*** Mode ** refers to Main Switch Mode - AUTO, MANUAL, TEST*



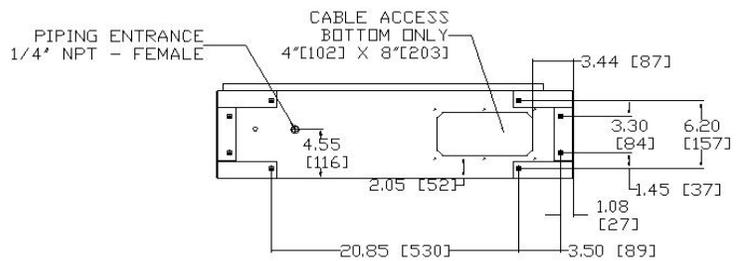
Fire Pump Controller Dimensions & Shipping Weights
Diesel

FD100



- ① -CONTROL PAD
- ② -BREAKABLE GLASS COVER
- ③ -COMMON ALARM HORN
- ④ -LOCKABLE 3 POINT HANDLE
- ⑤ -STOP PUSHBUTTON

Approx. Weight Lbs. [Kg.]
250 [113]



- NOTE:
1. ALL ENCLOSURES FINISHED IN FIRE PUMP RED
 2. CABLE ENTRANCE BOTTOM ONLY
 3. STANDARD ENCLOSURE TYPE NEMA 2
 4. ENCLOSURE MADE FROM #14 GAUGE(0.75) HR. STEEL

DIMENSIONS IN INCHES AND [MILLIMETERS]

ROUTING	DWG#	
1 - VAULT	DDFD100	
1 - FM	DATE	REV.
	01/24/02	G



FIGURE #3



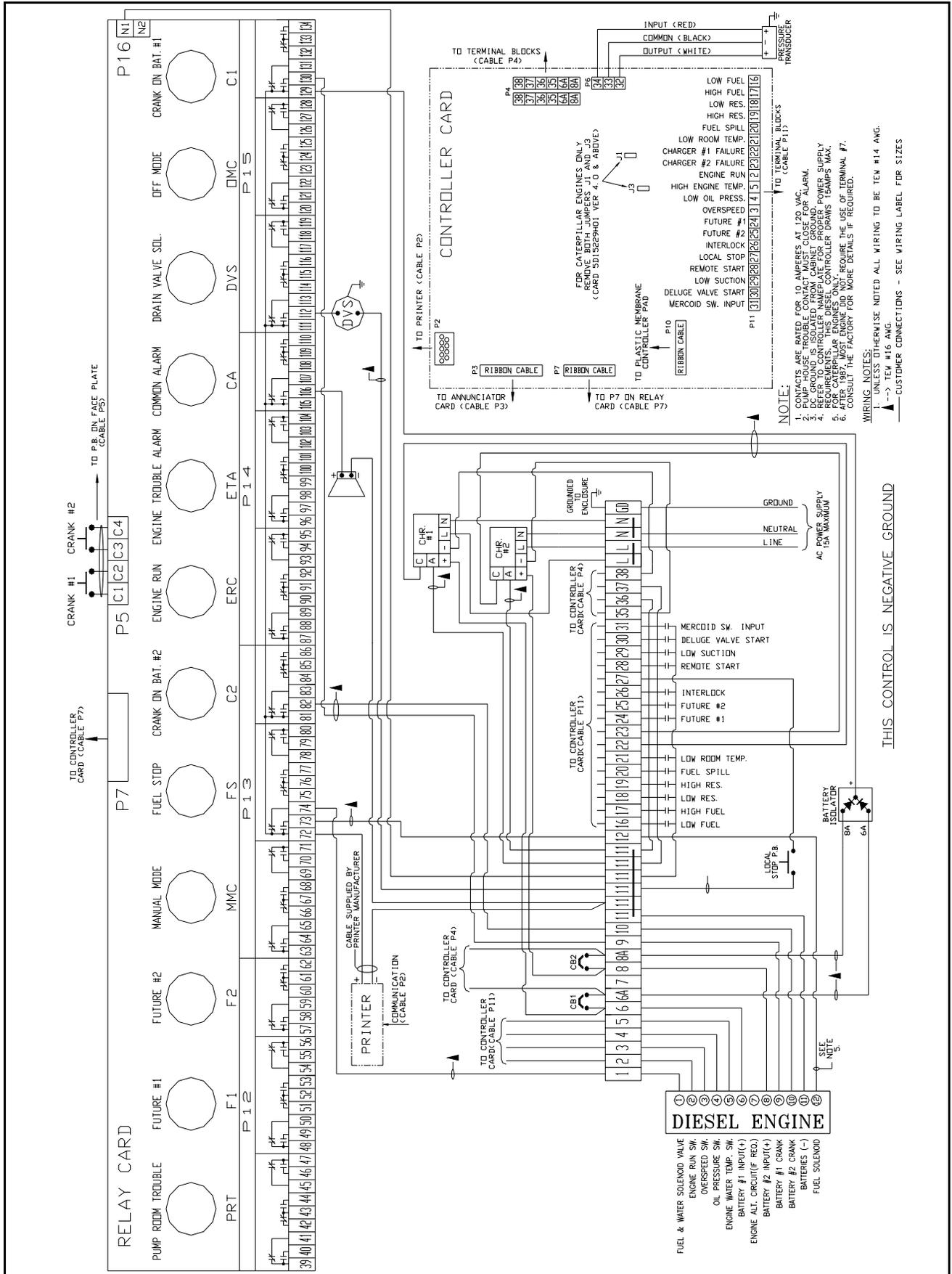


FIGURE #5

EATON

Cutler-Hammer

403 East Lake Blvd., Airdrie, Alberta, T4A 2G1

Canada

tel: 403-948-7955

fax: 403-948-6967

www.chfire.com



Cutler-Hammer

© 2003 Eaton Corporation
All Rights Reserved
Printed in Canada
Publication No.: IM05805003K
January 2003