



**INSTALLATION AND MAINTENANCE MANUAL**  
**FOR**  
**DIESEL ENGINE FIRE PUMP CONTROLLER**  
**MODEL GPD**

## INTRODUCTION

Diesel engine fire pump controllers are designed to automatically start a diesel engine driven fire pump upon detection of a pressure drop in the fire protection system. A Diesel Engine fire Pump controller DEFPC provides automatic & manual starting and stopping, automatic start, is controlled by a pressure transducer. The combination

automatic/non-automatic option provides a 30-minutes automatic stop after automatic start once all starting causes have returned to normal.

The diesel engine fire pump controller includes two battery chargers to maintain engine batteries continuously charged.

## TYPES OF DIESEL ENGINE FIRE PUMP CONTROLLERS

FIRE PUMP CATALOGUE NUMBER					
MODEL NO. EXAMPLE : GPD – N – 12 – F – E – BCE10-12					
GPD	N	12	F	E	BCE10-12
Model prefix	Type of ground	Battery voltage	Type of cabinet	Language	Type of battery charger
<b>GPD</b>	<b>N :</b> Negative ground	<b>12 :</b> 12V	<b>F :</b> Floor mounted (with 18" feet)	<b>E :</b> English	<b>BCE10-12 :</b> 10 Amp – 12V
	<b>P :</b> Positive ground	<b>24 :</b> 24V	<b>W :</b> Wall mounted	<b>F :</b> French	<b>BCE10-24 :</b> 10 amp – 24V
			<b>B :</b> Base mounted (transducer on the side)	<b>S :</b> Spanish	

## INSTALLATION

The GPD DEFPC is UL listed, FM certified and CSA approved. The controller is built in accordance with the latest edition of the National Fire Protection Association (NFPA) standard for the Installation of Centrifugal

Fire Pumps, NFPA No.20 (Centrifugal Fire Pumps 1999 Edition). The controller is intended to be installed in accordance to NFPA 20-1999 and

in USA	National Electrical Code NFPA 70
in Canada	Canadian Electrical Code, Part 1
others *	Local Electrical Codes *

\* Only American and Canadian applicable codes have been considered during the design of the controllers and the selection of components.

## LOCATION

The controller shall be located as close as practical to the motor they control and shall be within sight of the motor.

The controller shall be so located or so protected that it will not be injured by water escaping from pump or pump connections. Current carrying parts of controller shall be not less than 12 in. (305 mm) above the floor level.

Working clearances around controller shall comply with NFPA 70, National Electrical Code, Article 110 or C22.1, Canadian

Electrical Code, Article 26.302 or other local codes.

The controller is suitable for use in locations subject to a moderate degree of moisture, such as a damp basement. The pump room ambient temperature shall be between 41°F (5°C) and 104°F (40°C).

The standard controller enclosure is rated NEMA 3. It is the installer's responsibility to assure that either the standard enclosure meets the ambient conditions or that an enclosure with an appropriate rating has been provided.

## MOUNTING

The diesel engine fire pump controller shall be mounted in a substantial manner on a single noncombustible supporting structure. Wall mounted controller shall be attached to the structure or wall using all four (4) mounting ears provided on the controller with hardware designed to support the weight of the controller at a height not less than 12 in. (305 mm) above floor level.

Floor mounted controller shall be attached to the floor using all holes provided on the mounting feet with hardware designed to support the weight of the controller. The mounting feet provide the necessary 12 in. (305 mm) clearance for current carrying parts.

A concrete slab is recommended to avoid water accumulation at the controller's feet.

# CONNECTIONS

## WATER CONNECTIONS

The threaded connection of the pressure transducer (1/4" NPT. F) is flush with the bottom of the enclosure. See the dimensions drawing for the exact location. If the enclosure is base mounted, the pressure transducer connection is located on the side of the controller.

The pump start - stop pressure transducer (PT1) shall be connected to the system as per NFPA 20, Chapter 9-5.2.1 (b) and (c).

The optional low suction pressure switch (PS2) shall be connected to the suction side of the system, following standard practice.

## ELECTRICAL WIRING AND CONNECTIONS

### ELECTRICAL WIRING

The electrical wiring between the power source and the diesel engine fire pump controller shall meet the NFPA 20, Chapter 9-6.4, NFPA 70 National Electrical Code Article 695 or C22.1 Canadian Electrical Code, Section 32-200 or other local codes.

used when distance between controller and batteries is less than 25'/7.6m. For distance between 26'/7.9m to 50'/15.2m stranded #6AWG minimum wire must be used. For control wiring, stranded #14AWG minimum wire must be used. For power supply wiring, stranded #14AWG minimum wire must be used.

### ELECTRICAL CONNECTIONS

A licensed electrician shall supervise the electrical connections.

Only watertight hub fittings shall be used when entering the cabinet to preserve the NEMA rating of the cabinet.

The installer is responsible for adequate protection of diesel engine fire pump controller components against metallic debris or drilling chips. Failure to do so may cause injuries to personnel, damage the controller and subsequently void warranty.

### INCOMING POWER CONNECTIONS

Diesel engine fire pump controller shall be powered by a dedicated source protected by a 15A max circuit breaker.

Incoming power is to be connected to terminals identified L1-N (120V) or L1-L2 (220-240V) located on the terminal strip.

### SIZING

For battery wiring (terminals 6, 7, 8 and 11), stranded #10AWG minimum wire must be

### **IMPORTANT**

Diesel engine fire pump controller shall not be used as a junction box to supply other equipment.

## TERMINAL STRIP DESCRIPTION

Refer to terminal diagram affixed inside the controller before connecting any terminals.

### INCOMING POWER TERMINALS

Incoming power terminals are sized for #16 to #6AWG wire. They are located on the bottom right and labeled L1-N for a 120VAC incoming voltage or L1-L2 for a 220-240VAC incoming voltage.

The ground terminal is located beside to connect the ground.

### DIESEL ENGINE CONNECTION

Diesel engine terminals are sized for #16 to #6AWG wire. They are located vertically on the bottom left and they are labeled 1 to 12.

The terminals are numbered according to the engine standards:

- 1: fuel solenoid valve
- 2: engine run contact
- 3: engine over speed contact
- 4: engine oil pressure contact
- 5: engine coolant thermostat contact
- 6: battery #1 positive
- 8: battery #2 positive
- 9: start contactor #1
- 10: start contactor #2

- 11: engine ground
- 12: energized to stop fuel solenoid valve

### **FIELD CONNECTIONS**

A terminal strip is located on the left side and is used to connect external contacts.

#### **LOW FUEL FLOAT SWITCH**

The “low fuel” float switch must be connected to terminal 23–24. The contact must be closed upon low fuel level.

#### **DELUGE VALVE**

The deluge valve NC contact must be connected to terminal 23–25 and the J2 jumper must be removed to enable the function.

#### **WATER RESERVOIR LOW**

The “water reservoir low” float switch must be connected to terminal 23–26. The contact must be closed upon water reservoir low level.

#### **WATER RESERVOIR EMPTY**

The “water reservoir empty” float switch must be connected to terminal 23–27. The contact must be closed upon water reservoir empty level.

#### **LOW PUMP ROOM TEMPERATURE**

The “low pump room temperature” thermostat must be connected to terminal 23–28. The contact must be closed upon low temperature condition.

#### **HIGH FUEL LEVEL**

The “high fuel level” float switch must be connected to terminal 23–29. The contact must be open upon high fuel level condition. The J4 jumper must be removed to enable the function.

#### **LOW SUCTION PRESSURE**

The “low suction” pressure switch must be connected to terminal 23–30. The contact must be closed upon low suction condition.

### **ALARM CONTACTS**

Four standard alarm relays and two alarm contacts are located on the left side.

#### **MAIN SWITCH IN MANUAL OR IN OFF POSITION**

A contact of the main switch is provided. Rated for 10 A., 240 VAC.

The contact is connected to terminals Y1–Y2 and will close to signal that the main switch is in Manual or in Off position.

#### **MAIN SWITCH IN AUTO POSITION**

A contact of the main switch is provided. Rated for 10 A., 240 VAC.

The contact is connected to terminals Y3–Y4 and will close to signal that the main switch is in Auto position.

#### **ENGINE TROUBLE**

DPDT contacts of the Engine Trouble relay (AR1) are provided. Rated for 10A., 240V. The normally open contacts are located on the relay socket itself (terminals 11-14 & 21-24) and will close to signal the engine trouble condition.

The normally closed contacts are located on the relay socket itself (terminals 11-12 & 21-22) and will open to signal the engine trouble condition.

#### **ENGINE RUN**

DPDT contacts of the Engine Run relay (AR2) are provided. Rated for 10A., 240V. The normally open contacts are located on the relay socket itself (terminals 11-14 & 21-24) and will close to signal that the engine is running.

The normally closed contacts are located on the relay socket itself (terminals 11-12 & 21-22) and will open to signal that the engine is running.

#### **PUMP ROOM ALARM**

DPDT contacts of the Pump Room Alarm relay (AR3) are provided. Rated for 10A., 240V.

The normally open contacts are located on the relay socket itself (terminals 11-14 & 21-24) and will close to signal a pump room alarm condition.

The normally closed contacts are located on the relay socket itself (terminals 11-12 & 21-22) and will open to signal a pump room alarm condition.

#### **CONTROLLER TROUBLE**

DPDT contacts of the Controller Trouble Alarm relay (AR4) are provided. Rated for 10A., 240V.

The normally open contacts are located on the relay socket itself (terminals 11-14 & 21-24) and will close to signal a controller trouble condition.

The normally closed contacts are located on the relay socket itself (terminals 11-12 & 21-22) and will open to signal a controller trouble condition.

## **OPTIONAL TERMINAL STRIP DESCRIPTION**

Refer to the option diagram affixed inside the controller before connection. The terminal strip is vertically mounted and is located on the top left side in the enclosure.

### **ENGINE ALARM RELAYS**

#### **WEEKLY TEST ALARM**

DPDT contacts of the weekly test alarm relay (AR5) are provided. Rated for 10A., 240V.

The normally open contacts are located on the relay socket itself (terminals 11-14 & 21-24) and will close to signal that the weekly test is running.

The normally closed contacts are located on the relay socket itself (terminals 11-12 & 21-22) and will open to signal that the weekly test is running.

#### **OVERSPEED ALARM**

DPDT contacts of the over speed alarm relay (AR6) are provided. Rated for 10A., 240V.

The normally open contacts are located on the relay socket itself (terminals 11-14 & 21-24) and will close to signal that the engine has failed on an over speed condition.

The normally closed contacts are located on the relay socket itself (terminals 11-12 & 21-22) and will open to signal that the engine has failed on an over speed condition.

#### **LOW OIL PRESSURE ALARM**

DPDT contacts of the low oil pressure alarm relay (AR7) are provided. Rated for 10A., 240V.

The normally open contacts are located on the relay socket itself (terminals 11-14 & 21-24) and will close to signal that the engine has failed on a low oil pressure condition.

The normally closed contacts are located on the relay socket itself (terminals 11-12 & 21-22) and will open to signal that the engine has failed on a low oil pressure condition.

#### **HIGH TEMPERATURE ALARM**

DPDT contacts of the high temperature pump room alarm relay (AR8) are provided. Rated for 10A., 240V.

The normally open contacts are located on the relay socket itself (terminals 11-14 & 21-

24) and will close to signal that the engine has failed on a high temperature condition. The normally closed contacts are located on the relay socket itself (terminals 11-12 & 21-22) and will open to signal that the engine has failed on a high temperature condition.

#### **FAIL TO START ALARM**

DPDT contacts of the fail to start alarm relay (AR9) are provided. Rated for 10A., 240V.

The normally open contacts are located on the relay socket itself (terminals 11-14 & 21-24) and will close to signal that the engine did not start after the cranking sequence.

The normally closed contacts are located on the relay socket itself (terminals 11-12 & 21-22) and will open to signal that the engine did not start after the cranking sequence.

#### **BATTERY #1 FAILURE ALARM**

DPDT contacts of the battery #1 failure alarm relay (AR10) are provided. Rated for 10A., 250V.

The normally open contacts are located on the relay socket itself (terminals 11-14 & 21-24) and will close to signal a battery #1 failure condition.

The normally closed contacts are located on the relay socket itself (terminals 11-12 & 21-22) and will open to signal a battery #1 failure condition.

#### **BATTERY #2 FAILURE ALARM**

DPDT contacts of the battery #2 failure alarm relay (AR11) are provided. Rated for 10A., 250V.

The normally open contacts are located on the relay socket itself (terminals 11-14 & 21-24) and will close to signal a battery #2 failure condition.

The normally closed contacts are located on the relay socket itself (terminals 11-12 & 21-22) and will open to signal a battery #2 failure condition.

#### **CHARGER #1 FAILURE ALARM**

DPDT contacts of the charger #1 failure alarm relay (AR12) are provided. Rated for 10A., 240V.

The normally open contacts are located on the relay socket itself (terminals 11-14 & 21-24) and will close to signal a charger #1 failure condition.

The normally closed contacts are located on the relay socket itself (terminals 11-12 & 21-22) and will open to signal a charger #1 failure condition.

#### CHARGER #2 FAILURE ALARM

DPDT contacts of the Charger #2 failure alarm relay (AR13) are provided. Rated for 10A., 240V.

The normally open contacts are located on the relay socket itself (terminals 11-14 & 21-24) and will close to signal a charger #2 failure condition.

The normally closed contacts are located on the relay socket itself (terminals 11-12 & 21-22) and will open to signal a charger #2 failure condition.

#### AC FAILURE ALARM

DPDT contacts of the AC Failure alarm relay (AR14) are provided. Rated for 10A., 240V.

The normally open contacts are located on the relay socket itself (terminals 11-14 & 21-24) and will close to signal that the AC power supply is not present.

The normally closed contacts are located on the relay socket itself (terminals 11-12 & 21-22) and will open to signal that the AC power supply is not present.

### **PUMP ROOM ALARM RELAYS**

#### LOW FUEL LEVEL ALARM

##### OPTION B1

DPDT contacts of the low fuel level alarm relay (AR15) are provided. Rated for 10A., 250V.

The normally open contacts are located on the relay socket itself (terminals 11-14 & 21-24) and will close to signal a low fuel level condition.

The normally closed contacts are located on the relay socket itself (terminals 11-12 & 21-22) and will open to signal a low fuel level condition.

#### WATER RESERVOIR LOW ALARM

##### OPTION B2

DPDT contacts of the water reservoir low alarm relay (AR16) are provided. Rated for 10A., 240V.

The normally open contacts are located on the relay socket itself (terminals 11-14 & 21-24) and will close to signal a water reservoir low condition.

The normally closed contacts are located on the relay socket itself (terminals 11-12 & 21-

22) and will open to signal a water reservoir low condition.

#### WATER RESERVOIR EMPTY ALARM

##### OPTION B3

DPDT contacts of the water reservoir empty alarm relay (AR17) are provided. Rated for 10A., 240V.

The normally open contacts are located on the relay socket itself (terminals 11-14 & 21-24) and will close to signal a water reservoir empty condition.

The normally closed contacts are located on the relay socket itself (terminals 11-12 & 21-22) and will open to signal a water reservoir empty condition.

#### LOW PUMP ROOM TEMPERATURE

##### ALARM

##### OPTION B4

DPDT contacts of the low pump room temperature alarm relay (AR18) are provided. Rated for 10A., 240V.

The normally open contacts are located on the relay socket itself (terminals 11-14 & 21-24) and will close to signal a low pump room temperature condition.

The normally closed contacts are located on the relay socket itself (terminals 11-12 & 21-22) and will open to signal a low pump room temperature condition.

#### HIGH FUEL LEVEL ALARM

##### OPTION B5

DPDT contacts of the high fuel level alarm relay (AR19) are provided. Rated for 10A., 240V.

The normally open contacts are located on the relay socket itself (terminals 11-14 & 21-24) and will close to signal a high fuel level condition.

The normally closed contacts are located on the relay socket itself (terminals 11-12 & 21-22) and will open to signal a high fuel level alarm condition.

#### LOW SYSTEM PRESSURE ALARM

##### OPTION B6

DPDT contacts of the low system pressure alarm relay (AR20) are provided. Rated for 10A., 250V.

The normally open contacts are located on the relay socket itself (terminals 11-14 & 21-24) and will close to signal a low system pressure condition.

The normally closed contacts are located on the relay socket itself (terminals 11-12 & 21-22) and will open to signal a low system pressure condition.

### LOW SUCTION PRESSURE ALARM OPTION B7

DPDT contacts of the low suction pressure alarm relay (AR21) are provided. Rated for 10A., 240V.

The normally open contacts are located on the relay socket itself (terminals 11-14 & 21-24) and will close to signal a low suction pressure condition.

The normally closed contacts are located on the relay socket itself (terminals 11-12 & 21-22) and will open to signal a low suction pressure condition.

### EXTERNAL CONTROL SIGNALS

#### LOCKOUT CIRCUIT FROM OTHER EQUIPMENT OPTION C1

The lockout condition prevents the controller to start in response to a pressure drop in the system while in automatic position only. Manual, remote and deluge valve starting remains operational.

Lockout circuit is so designed that the controller remains operational in case of failure in the lockout circuit (wires shorted or cut) in accordance with article 9-5.2.5 of NFPA 20.

DPDT contacts of the lockout circuit alarm relay (AR22) are provided. Rated for 10A., 240V.

The normally open contacts are located on the relay socket itself (terminals 11-14 & 21-24) and will close when the controller is in lockout condition.

The normally closed contacts are located on the relay socket itself (terminals 11-12 & 21-22) and will open when the controller is in lockout condition.

Two (2) terminals labeled 60–62 are added on the terminal strip to receive the external signal. The external signal must be a power source (voltage to be specified when ordering) activated by a lock out signal and connected to terminals 60–62. During a lock out, the power source activates the relay CR8 and the DEFPC is locked out. If the lock out wires are shorted, the fuse FU1 blows and the lock out function is inoperative. If the lock out wires are cut, the

relay CR8 cannot be energized and the lock out function is again inoperative.

#### INTERLOCK CIRCUIT TO OTHER FPC OPTION C2

Interlock circuit provides a 12VDC or 24VDC voltage on terminals 11–64 in order to prevent other equipment from starting. The condition of locking other equipment may vary from one application to another. The interlocking conditional contact must be connected to terminals 23–32 (depending of the application, those contacts may be connected by the manufacturer). The external circuit must be connected to terminals 11–64.

SPDT contacts of the interlock circuit relay (AR23) are provided. Rated for 10A., 240V. The normally open contacts are located on the relay socket itself (terminals 11-14) and will close when the controller is in interlock condition.

The normally closed contacts are located on the relay socket itself (terminals 11-12) and will open to signal when the controller is in interlock condition.

#### ENGINE BLOCK HEATER CIRCUIT OPTION C7

Provide power to feed an engine block heater. Connect the block heater to terminals 50–51 in a 220–240VAC application ( 10A max. ), or 50–N in a 120VAC application (15A. max.).

#### FOAM PUMP CONTROLLER OPTION C8

Four terminals are added to connect an external starting circuit. Normally open contact must be connected to terminals 23–72 and normally closed contact must be connected to terminals 23–73. The starting sequence occurs either upon contact closure or opening of these contacts.

#### NON PRESSURE ACTUATED CONTROLLER OPTION C9

Two terminals are added to connect an external starting circuit. Normally open contact must be connected to terminals 23–72. The starting sequence occurs upon contact closure.

Pressure line is removed.

# CONTROL CIRCUIT PROTECTION

The two batteries that are continuously connected to individual battery chargers power the control circuit. The control circuit is protected by two circuit breakers (CB3 &

CB4) located in the top right of the enclosure. Those circuit breakers are not monitored and must both be left in the ON position.

## CONTROLLER SEQUENCE OF OPERATION

### MAIN SWITCH

The main switch is located on the controller door. It is behind a breakable and pad lockable cover.

#### MAIN SWITCH IN OFF POSITION

This position shuts off the engine and prevents engine start. It also resets all alarm conditions.

#### MAIN SWITCH IN MANUAL POSITION

This position provides for manual engine start by energizing the start fuel solenoid valve.

Depressing the Crank #1 push button provides manual start with battery #1, depressing the Crank #2 push button provides manual start with battery #2. By depressing both push buttons simultaneously, the batteries #1 and #2 are used in parallel to start the engine. 'Fail to start' and 'Fail when running' alarm signals are not operational in this position. An 'Over speed' condition will stop the engine and sound an alarm. All other alarm signals are operational but have no influence on the engine operation.

#### MAIN SWITCH IN AUTO POSITION

This position enables the engine to start when one of the following occurs:

- A system pressure drop as sensed by the pressure transducer located in the controller.
- An artificial water pressure drop as a result of the activation of the water solenoid valve (activated by the programmable weekly test or by the 'run test' push button).
- A remote start signal,
- A deluge valve.
- An AC power failure (optional).

Any of those conditions will initiate the automatic engine cranking cycle. The cranking cycle consists of energizing the fuel

solenoid valve and cranking the engine for 15 seconds and then rest for 15 seconds, this sequence is repeated six (6) times. If the engine fails to start, then the controller will indicate an "Engine fail to start" alarm. The battery changeover is made automatically but if one battery is inoperative or missing, the cranking sequence locks out on the remaining battery.

#### WATER PRESSURE CONTROL

When the main switch is in Auto position, the engine will start automatically when the pressure transducer detects a low pressure, provided that the controller was not already started and the controller is not locked out by any other equipment (see lockout section). The controller is supplied with the automatic shutdown provision factory defeated (to offer manual shutdown only), the engine can only be stopped by depressing the STOP push-button located on the controller after the pressure is re-established (above the cut out pressure adjustment).

If the controller is field converted to automatic shutdown, a running period timer set at 30 minutes will automatically shutdown the motor after all starting causes have returned to normal. The engine can also be stopped by depressing the STOP push-button located on the controller provided all starting causes have returned to normal and system pressure is above the cut out pressure adjustment. All engine alarm signals are operational but do not prevent the engine to run, except for the Overspeed signal that immediately stops the engine.

#### MANUAL ELECTRIC CONTROL AT REMOTE STATION

The engine can be electrically manually started by the momentary opening of a remote contact independent of the pressure transducer and then can be manually stopped by depressing the STOP push-

button located on the controller, provided that the system pressure is above the cut out pressure adjustment.

All engine alarm signals are operational but do not prevent the engine to run, except for the Overspeed signal that immediately stops the engine.

#### FIRE PROTECTION EQUIPMENT CONTROL

When a deluge valve is provided, the controller can be started by the opening of a normally closed contact (fail safe circuit) on the fire protection equipment (deluge valve) independent of the pressure transducer. The engine can be manually stopped by the STOP push-button located on the controller but only after the fire protecting equipment contact has returned to normal provided that the system pressure is above the cut out pressure adjustment.

All engine alarm signals are operational but do not prevent the engine to run, except for the Overspeed signal that immediately stops the engine.

#### WEEKLY TEST

The controller can be set for a weekly test. When the weekly test is enabled, the engine will start at the programmed start time and it will stop at the programmed stop time or after a 30 minute delay whichever is the shortest. The Stop push button is enable and will stop the engine before expiration of the weekly test.

All alarm signals are operative. Low oil pressure, high temperature or overspeed condition will immediately stop the engine to prevent damage.

#### RUN TEST

Depressing the 'run test' push button located on the front panel simulates a pressure drop. The engine will stop automatically after

30 minutes or when the stop push button is pressed.

All alarm signals are operative. Low oil pressure, high temperature or overspeed condition will immediately stop the engine to prevent damage.

#### AC FAILURE START

This feature is optional and can only be programmed at the factory. The engine will start automatically if the power supplied is absent for more than a preset time. The engine will immediately stop when the AC power is reestablished.

#### SEQUENCE STARTING

In case of multiple pump application, it may be necessary to delay the starting of the engine in case of a water pressure drop to prevent simultaneous starting of all motors. Sequential start time is selectable (0, 5, 10, 15 sec).

#### LOCK OUT SIGNAL

When lockout signal is present, the controller is inhibited to start on water pressure drop detection, weekly test and run test. All other starting causes produce a starting cycle.

### **OPERATOR EQUIPMENT**

#### **STOP PUSH BUTTON**

The red stop push button can be used to stop the engine only when the main switch is in automatic position and when the system pressure is above the cut in value provided that all starting causes have returned to normal (remote start and deluge valve)

#### **CRANK #1- CRANK#2 PUSH BUTTONS**

Those push buttons can be used only when the main switch is in the manual mode. They are used to manually crank the engine using battery #1 or #2, or both if both push buttons are activated simultaneously.

# STATUS DISPLAY AND ANNUNCIATOR ON CONTROLLER

## STATUS DISPLAY

The top line shows the #1 battery and #1 battery charger status.

- The first group of digits indicates the battery voltage.
- The second group of digits indicates the current delivered by the charger to the battery.
- The third group of digits indicates the charger status.
  - “Bulk” indicates that the charger is delivering the maximum current for fast recovering of the battery charge
  - “Over” indicates that the charger is in overcharge mode to maximize the battery charge
  - “Float” indicates that the charger is maintaining the voltage of the battery
  - “AC Fail” indicated that the charger is not connected to power source
  - “no ans” indicates that the charger has lost the communication with the main electronic board

The second line shows the #2 battery and #2 battery charger status. See above for detail.

The third line shows the controller date and time or various alarm messages. The date (D/M/Y) and the time are always shown except when one or more alarm are present. When more than one alarm are detected, the line will scroll the different messages.

The available messages are the following :

- “Low System Pressure” indicates that the system pressure is under 85% (this value can be adjusted at factory) of the cut in pressure value for more than 1 second.
- “Remote Start” indicates that the engine has been started by activation (opening) of the remote contact (21–13)
- “Automatic Start” indicates that the engine has been started by detection of a pressure drop (under cut in value)
- “AC Power Failure” indicates that the controller is powered only by batteries

- “RPT mm:ss” indicates the remaining time before automatic shutdown (automatic shutdown must be enable)
- “Seq. Start Time :ss” indicated the remaining time before start sequence (sequential start timer must be enable)
- “Press Line Failure” indicates that the solenoid valve has been activated but the pressure drop has not been detected.
- “Low Fuel Level “ indicates that the low fuel float contact (23–24) is closed for more than 1 second
- “Water Reservoir Low” indicates that the water reservoir low contact (23–26) is closed for more than 10 seconds
- “Water Reservoir Empty” indicates that the water reservoir empty contact (23–27) is closed for more than 10 seconds
- “Low Pump Room Temp” indicates that the low pump room thermostat contact (23–28) is closed
- “High Fuel Level” indicates that the high fuel float contact (23–29) is closed
- “Low Suction Pressure” indicates that the low suction pressure switch contact (23–30) is closed for more than 3 seconds
- “Weekly Test mm:ss” indicates the remaining time before the end of the weekly test. This feature requests a correct setting of the weekly test.
- “Lockout Signal” indicates that the controller is locked by other equipment and will not start automatically. This feature is optional
- “Interlock On” indicates that the controller is supplying voltage to other equipment that must be locked. This feature is optional
- “AC Failure Start mm:ss” indicates the remaining time before automatic start in case of detection of loss of power supply. This feature is optional and must be programmed at factory.

The fourth line is dedicated for the pressure system status.

- The first group of digits shows the cut-out threshold.

- The second group shows the cut-in threshold.
- The third group shows the actual system pressure.

Note : 'O' means cut-Out which is the value where the pump has to stop,  
'I' means cut-In which is the value where the pump has to start.

## ANNUNCIATOR PANEL

Sixteen indicators give the status of the controller and the engine. The indicators with (\*) activate the alarm bell and must be reset by switching the main selector to the OFF position. The indicator with (\$) activates the alarm bell and is auto resettable.

The indicators are lit up in the following conditions :

- "AC Power On" : (green) indicates that the controller is connected to an external AC power source.
  - "Main switch in Auto" : (green) indicates that the controller main switch is in auto position.
  - "Battery #1 Failure" (\*) indicates that either one of the following conditions occurred
    - Battery #1 voltage drops below 50% of nominal battery voltage
    - Battery #1 does not reach appropriate voltage after 24 hours with 10Amp charging current
    - Battery #1 is connected in reverse polarity
  - "Battery #2 Failure" (\*) is same as Battery #1 Failure applied to battery #2
  - "Charger #1 Failure" (\*) indicates that either one of the following conditions occurred :
    - The Electronics board detects an internal fault.
    - The average current value reaches 15A.
    - Battery Charger is desynchronized with the AC source for more than 5min when the AC source is provided.
    - The current stay less than 0.5A in Bulk mode when battery is connected.
    - The charger #1 is not connected to the AC source although the charger #2 is connected to the AC source.
  - "Charger #2 Failure" (\*) is same as Charger #1 Failure applied to charger#2
  - "Engine Low Oil Pressure" (\*) indicates that the engine oil pressure contact has opened when the motor was running.
- This detects an abnormal pressure in the diesel engine oil pressure circuit. Note that the oil pressure must be reached no later than 8 seconds after the engine run signal input.
- "Engine High Temperature" (\*) indicates that the engine high temperature contact has opened when the motor was running. This detects an abnormal temperature of the diesel engine coolant liquid.
  - "Engine Overspeed" (\*) indicates that the engine overspeed switch contact has closed
  - "Engine run" indicates that the engine run contact is closed. This detects a running condition of the motor
  - "Engine Fail to Start" (\*) indicates that the starting sequence of six successive cranking period has been performed, but a closed engine run contact has not been detected
  - "Fail When Running" (\*) indicates that an open engine run contact has been detected even though the diesel engine controller demands a continuous running condition.
  - "Pump Room Alarm" (\$) indicates either low suction condition, low fuel level condition, water reservoir low condition, water reservoir empty condition, low pump room temperature condition, high fuel level condition, AC power failure condition, or alarm #1 condition occurred.
  - "Deluge Valve / Remote Start" indicates that the deluge valve contact is open or the remote start contact is open
  - "Weekly Test" indicates that the weekly test is in progress
  - "Controller Trouble" (\*) indicates either a battery #1 failure, a battery #2 failure a charger #1 failure a charger #2 failure or a pressure line failure has occurred.

## PRESSURE ADJUSTMENT

Two pressure adjustment push buttons can be used to modify the cut in pressure (pump start level) and the cut out pressure (pump stop level). The pressure adjustment push

button are activated when the “pressure adjustment lock” dip switch is correctly set.

## PUSH BUTTONS

The “Lamp Test/Silence” push button has two functions. First, it is used to test the display LED’s and the audible alarm. When activated, the left column light up for 1 second, then the right column for 1 second, then the alarm bell for 1 second. Secondly, it is used to silence the ‘pump room’ alarm, as well as the ‘fail when running’ alarm.

The “Run Test” push button is used to release the pressure on the pressure transducer to simulate a drop of pressure.

The “Print” push button is used to print a resume of the last seven-day events as well as the last seven-day pressure data.

The “Paper Feed” push button is used to feed paper through the printer slot in order to avoid tearing the printout.

## PRINTER

### GENERAL

The printer is located behind a plastic cover. This cover protects the printer from humidity and dust. The cover must be lifted when printing. The printer works on demand only.

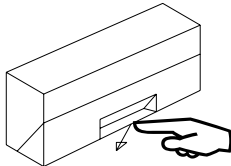
However, in order to prevent a paper drum deformation, the paper drum is activated automatically at regular intervals.

### PAPER REPLACEMENT

The printer is a thermal type. The paper must be thermal paper and be correctly oriented.

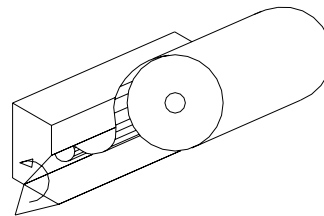
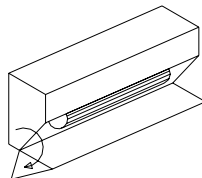
The following operations must be followed to replace the paper :

1. Remove the empty roll by removing the holder screw,



2. Release the drum by pushing down the drum holder

3. Drum holder must be fully swung open



4. Insert the thermal paper on the slot above the drum. The sensitive paper side must be oriented up

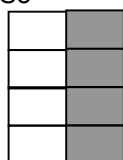
5. Fully close the drum holder

# SET UP

## DIP SWITCH CONFIGURATION

To have access to the dip switch, the door must be open. Two dip switches are located on the side of the electronic board mounted on the door. Dip switch S5 is on the top, Dip switch S10 is on the bottom. The factory setting are as follow :

S5



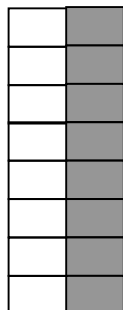
S5-4 for factory only

S5-3 for factory only

S5-2 langage

S5-1 langage

S10



S10-8 test for factory use

S10-7 pressure interval

S10-6 pressure interval

S10-5 pressure unit

S10-4 sequential start timer

S10-3 sequential start timer

S10-2 run period timer

S10-1 pressure adjustment lock

### PRESSURE ADJUSTMENT S10-1

When On, the pressure adjustment push buttons are unlocked. When Off the adjustment of the pressure cut in and cut out are not permitted

### RUN PERIOD TIMER S10-2

When On, the controller is set for automatic stop. The engine will stop 30 minutes after pressure is re-established (above cut out adjustment). When Off, the controller is set for manual stop, engine will stop only by depressing the stop push button.

### SEQUENTIAL START TIMER S10-3&4

The controller delays the engine start cycle by 5,10 or 15 seconds upon a water pressure drop detection, a remote start or a deluge valve detection. All other starting causes activate the engine immediately. To modify the delay, set the dip switch according to the following table

DIP	ON	OFF	Time
S10-4 OFF S10-3 OFF	<input type="checkbox"/>	<input checked="" type="checkbox"/>	0 second
S10-4 ON S10-3 OFF	<input checked="" type="checkbox"/>	<input type="checkbox"/>	5 seconds
S10-4 OFF S10-3 ON	<input type="checkbox"/>	<input checked="" type="checkbox"/>	10 seconds
S10-4 ON S10-3 ON	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	15 seconds

### PRESSURE UNIT S10-5

The pressure can be displayed in kPa (kilo Pascal) or in psi (pound per square inch). When On, the pressure unit is kPa. When Off, the pressure unit is psi.

### PRESSURE INTERVAL S10-6&7

The pressure data is recorded each time the pressure varies more than the pressure interval. The pressure interval can be adjusted to 1 psi, 2 psi, 5 psi or 10 psi. Note : 1 psi = 6.895kPa = 0.06895 bar. To modify the pressure interval, set the dip switch according to the following table

DIP	ON	OFF	PSI interval
S10-7 OFF S10-6 OFF	<input type="checkbox"/>	<input checked="" type="checkbox"/>	5 psi 34.475 kPa
S10-7 ON S10-6 OFF	<input checked="" type="checkbox"/>	<input type="checkbox"/>	10 psi 68.950 kPa
S10-7 OFF S10-6 ON	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1 psi 6.8950 kPa
S10-7 ON S10-6 ON	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2 psi 13.790 kPa

### TEST MODE S10-8

This dipswitch is reserved for factory use. It must remains always to OFF.

## **PRESSURE ADJUSTMENT**

In automatic position, when the system pressure drops below the cut-in pressure value, the controller initiates a pump starting sequence. When the system pressure reaches the cut-out value, the engine will stop when the stop push button is activated or will be stopped automatically if adjusted for an automatic stop (see run period time section).

It is important to adjust the cut out value first. This adjustment must be set below the maximum pressure of the pump otherwise the engine will never stop.

The cut in value must be adjusted at the system pressure.

Before adjusting the pressure set points, the adjustment dip switch must be unlocked by selecting the S10-1 dip switch to ON (previous page).

A quick push on the push button will increase the value by one. A long push will increase value by 10. The value only increases from minimum to maximum, and when the maximum is reached, the value return to the minimum value.

It is important to re-set the dip switch S10-1 to OFF to prevent unauthorized changes.

## **CLOCK – WEEKLY TEST**

The controller can be set for a weekly test. When the “Print” and the “Run test” push buttons are simultaneously activated for 3 seconds, the display switch over into “time” mode. In this mode, the display shows on the first line the controller date and time, on the second line the weekly test activation (yes or no), on the fourth line the day of the week when the weekly test will be performed with the start and stop time.

To select which value to change, press the “Print” push button. To modify the value, press the ‘Run Test” push button. To save the modification and return to the “normal” display mode, press simultaneously the ‘Run Test” and the “Print” push buttons. If no

buttons are pressed for within 30 seconds, the display returns automatically to the “normal” mode without saving any modifications.

If the weekly test is enable, at start time, the solenoid valve simulates a pressure drop on the sensor and the controller starts the engine. The engine will stop at programmed stop time or after 30 minute whichever is the shortest. The “Stop” push button is always enable and it can be used to stop the engine before expiration of weekly test.

Note : according to the NFPA20, the weekly test must last at least 30 minutes per week. To respect this condition, the stop time must be set 30 minutes after the start time.

# BATTERY CHARGER

Each battery charger is equipped with its own individual power transformer, and circuit breakers.

The battery charger has a RS485 communication port to send data' to the main electronic board.

The battery charger #1 is powered by the XTR1 transformer protected by the CB1 circuit breaker.

The battery charger #2 is powered by the XTR2 transformer protected by the CB2 circuit breaker. The breakers and the power transformers are located in the lower left of the enclosure.

**NOTE :** When operating in bulk mode, the power transformer reaches a very high temperature. **This temperature rise is normal.**

Battery chargers are equipped with indicators :

- “Logic power “ indicates that the electronic board is powered up. This indicator must always be on or flashing.
- “Bulk” indicates that the battery charger is in bulk mode. In this mode, the charger delivers its maximum rated current to the battery.
- “Overcharge” indicates that the battery charger is maintaining a constant voltage and regulating the delivered current in order to increase the gravity of the battery electrolyte.

- “Floating” indicates that the battery is fully charged and the battery charger is delivering the minimum current to maintain the battery charge.
- “Charger Failure” indicates a charger malfunction. This occurs when the microprocessor detects an internal fault, or when the average current value reaches 15A, or when the Battery Charger is desynchronized with the AC source for more than 5 minutes or when the current stays less than 0.5 amp in bulk or in overcharge mode.
- “Battery Failure” indicates a battery problem. This occurs when the battery voltage drops below 50% of the nominal battery voltage, or when battery does not reach the appropriate voltage after 24 hours in bulk mode, or when the battery is disconnected or connected in reverse polarity.
- “AC Present” indicates that the power transformer is feeding the battery charger. When the AC power is not present, The indicators are flashing at regular intervals in order to save power.

The reset push button, located on the top right of the board, is used to restart the charger and to clear internal fault.

**IMPORTANT :** the fuse, located on the board, is a **SLO-BLO 3AG-32VDC-20A model**. It is very important to replace the fuse by the exact fuse model.

# RELAY FUNCTION

## ENGINE TROUBLE RELAY

The engine trouble relay is energized if one of the following conditions occurs :

- Low oil pressure
- Engine high temperature
- Engine fail to start after 6 cranking cycles
- Overspeed
- Fail when running.

The engine trouble relay can only be reset by switching the main switch to the OFF position.

## ENGINE RUN RELAY

The engine run relay is energized when the motor is running.

## PUMP ROOM ALARM RELAY

The pump room alarm relay is energized if one of the following conditions is present :

- low suction (signal must be maintained more than 3 seconds)
- low fuel level (signal must be maintained more than 1 second)
- water reservoir low (signal must be maintained more than 10 seconds)
- water reservoir empty (signal must be maintained more than 10 seconds)
- low pump room temperature
- high fuel level
- AC failure ("AC power on" is not present)
- Alarm #1 (optional)

If none of those conditions are present, the pump room alarm is reset.

## CONTROLLER TROUBLE RELAY

The controller trouble relay is energized if one of the following conditions occurs :

- Battery #1 failure
- Battery #2 failure
- Charger #1 failure
- Charger #2 failure
- Pressure line failure
  - o Note : a pressure line failure is detected if weekly test or run test is performed but the drop of pressure is not detected by the pressure sensor or if the actual pressure is out of normal pressure range.

The controller trouble relay can only be reset by switching the main switch to the OFF position.

## WEEKLY TEST RELAY (OPTION A1)

The weekly test relay is energized when a weekly test is running. It is not energized when a run test is running.

## OVERSPEED RELAY (OPTION A2)

The overspeed relay is energized if an overspeed condition is detected.

The overspeed relay can only be reset by switching the main switch to the OFF position.

Note : overspeed alarm must also be reset on the engine itself.

## LOW OIL PRESSURE RELAY (OPTION A3)

The low oil pressure is energized if the oil pressure contact is not closed in the first 8 seconds after an engine start, or if the oil pressure contact opens when the engine is running.

The low oil pressure relay can only be reset by switching the main switch to the OFF position.

## HIGH TEMPERATURE RELAY (OPTION A4)

The high temperature relay is energized when the engine water coolant temperature contact is closed.

High temperature relay can only be reset by switching main switch to the OFF position.

## FAIL TO START RELAY (OPTION A5)

The fail to start relay is energized if the controller does not receive the engine run signal after 6 cranking cycles. A cranking cycle consists of a cranking period of 15 seconds followed by a rest period of 15 seconds.

The fail to start relay can only be reset by switching the main switch to the OFF position.

## BATTERY #1 AND #2 FAILURE RELAY (OPTION A6)

The battery failure relay is energized if one of the following conditions occurs : when the battery is disconnected or connected in reverse polarity, or when the battery voltage is below 50% of the nominal battery voltage, or when the battery voltage is higher than 150% of the nominal voltage or when the battery does not reach the appropriate voltage after 24 hours in bulk mode. In this last condition, the battery is probably dead and must be replaced.

Battery failure relay can only be reset by switching the main switch to the OFF position

#### CHARGER #1 AND #2 FAILURE RELAY (OPTION A7)

The Charger failure relay is energized in the following conditions :

- microprocessor detects an internal fault,
- average current value reaches 15A
- Battery Charger is desynchronized with the AC source for more than 5 minutes
- current stays less than 0.5 amp in bulk or overcharge mode,
- the AC source is present on one charger only (primary circuit breaker tripped)
- the fuse is blown

NOTE : Under several conditions, the battery charger must be reset by depressing the reset push button located above the LED indicators (top right of the board)

The charger failure relay can only be reset by switching the main switch to the OFF position.

#### AC FAILURE RELAY (OPTION A8)

The AC failure relay is energized when AC is not present.

#### LOW FUEL LEVEL RELAY (OPTION B1)

The low fuel level relay is energized when the low fuel level contact (normally closed float switch) is closed for more than 1 second; and it is reset when this contact opens.

#### WATER RESERVOIR LOW RELAY (OPTION B2)

The water reservoir low relay is energized when the water reservoir low contact (normally closed float switch) is closed for more than 10 seconds; and it is reset when this contact opens.

#### WATER RESERVOIR EMPTY RELAY (OPTION B3)

The water reservoir empty relay is energized when the water reservoir empty contact (normally closed float switch) is closed for more than 10 seconds; and it is reset when this contact opens.

#### LOW PUMP ROOM TEMPERATURE RELAY (OPTION B4)

The low pump room temperature relay is energized when the low pump room temperature contact (thermostat) is closed indicating that the temperature of the

mechanical room is under preset temperature.

#### HIGH FUEL LEVEL RELAY (OPTION B5)

The high fuel level relay is energized when the high fuel level contact (normally closed float switch) is open indicating that the high fuel level is reached.

#### LOW SYSTEM PRESSURE RELAY (OPTION B6)

The low system pressure relay is energized when the system pressure is under 85% of the cut in pressure for more than 1 second; and it is reset when system pressure reaches the cut in pressure. For example, the cut in pressure is adjusted at 130psi, the low system pressure will be energized when the pressure reaches 104psi; and be reset when the pressure reaches 130psi.

#### LOW SUCTION PRESSURE RELAY (OPTION B7)

The low suction pressure relay is energized when the suction pressure switch contact is closed for more than 3 seconds; and it is reset when the suction pressure switch contact opens.

#### LOCKOUT RELAY (OPTION C1)

The lockout relay is energized when the controller is locked out by other equipment to prevent the engine from starting.

#### INTERLOCK RELAY (OPTION C2)

The interlock relay is energized when the interlock signal contact is closed. This signal contact function depends on the application.

# ALARM BELL

The alarm bell is activated under default condition. There are two types of defaults.

## “TYPE 1” DEFAULTS

“Type 1” defaults are related to the engine and the controller. Those default are considered as major defaults. When a “type 1” default occurs, the alarm bell starts ringing. The only way to silence is to set the main switch onto OFF position.

“Type 1” defaults are :

- Engine Overspeed
- Engine Low oil pressure
- Engine High temperature
- Fail to start
- Charger #1 failure
- Charger #2 failure
- Battery #1 failure
- Battery #2 failure

## “TYPE 2” DEFAULTS”

“Type 2” defaults are related to accessories and are considered as various defaults. When a “type 2” default occurs, the alarm bell starts ringing. The bell can be silenced by depressing the “Lamp test / silence” push button.

When silenced, the alarm bell restarts ringing if a new default occurs.

The alarm bell automatically stops ringing if all “type 2” defaults are vanished.

“Type 2” defaults are :

- Pressure line failure
- Low suction pressure
- Water reservoir low
- Water reservoir empty
- Low fuel level
- High fuel level

# EVENT AND PRESSURE DATA RECORDING

The controller records events and pressure data's of the last seven days. The information is accessible either by using the printer, a RS232 port (optional) or a modem (optional).

When provided with a printer, the events and the pressure data can be obtained by depressing the “print” push button.

When provided with a RS232 port, this port must be connected to a laptop and, using a communication software as ‘hyper terminal’ (provided with Windows) the data's can be easily retrieved (see 9MAN524 for detail).

When provided with a modem, the data can be easily retrieved using TornaTech communication software (see 9MAN— for detail).

When the “print” push button is activated once, the printer starts printing. The printout begins by the “last seven day résumé” which includes :

- Actual day–date–time;
- Actual pressure setting with the date and time when it is has been adjusted;
- Minimum pressure and when this minimum pressure has been reached;
- Maximum pressure and when this maximum pressure has been reached;
- Day and time of the weekly test start and stop time (only if weekly test is enable);

- Elapse time meter : indicates how long the engine has ran (based on the engine run signal)
- Automatic start : indicates the number of time, as well as the date and time, when the pressure has dropped under cut in setting.
- Manual start : indicates the number of time, as well as the date and time, when the engine start by manual operation.
- All pump start count : this information is based on the pressure chart and is informative to indicate how many time the jockey pump (or other pumps) has started. This information is helpful to indicated eventual leaks in the pressure system.
- Events : indicates description, date and time of any change of the controller status.

If the “Print” push button is depressed in the 60 second after the end of the last seven day résumé, the printer starts printing the pressure data's. Depending on the pressure variation in the pressure system, this printout can be very long.

The pressure data's starts by indicating the unit of the pressure data's.

Each line includes the pressure and date–time. Printout starts by earliest data.

“End of pressure data's” indicates the end of the printout.

## TABLE OF CONTENTS

Introduction .....	2
Types of diesel engine fire pump controllers .....	2
Installation .....	3
Location .....	3
Mounting .....	3
Connections .....	4
Water connections .....	4
Electrical wiring and connections .....	4
Electrical wiring .....	4
Electrical connections .....	4
Sizing .....	4
Incoming power connections .....	4
Terminal strip description .....	4
Incoming power terminals .....	4
Diesel engine connection .....	4
Field connections .....	5
Low fuel float switch .....	5
Deluge valve .....	5
Water reservoir low .....	5
Water reservoir empty .....	5
Low pump room temperature .....	5
High fuel level .....	5
Low suction pressure .....	5
Alarm contacts .....	5
Main switch in manual or in off position .....	5
Main switch in auto position .....	5
Engine trouble .....	5
Engine run .....	5
Pump room alarm .....	5
Controller trouble .....	5
Optional terminal strip description .....	6
Engine alarm relays .....	6
Weekly test alarm .....	6
Overspeed alarm .....	6
Low oil pressure alarm .....	6
High temperature alarm .....	6
Fail to start alarm .....	6
Battery #1 failure alarm .....	6
Battery #2 failure alarm .....	6
Charger #1 failure alarm .....	6
Charger #2 failure alarm .....	7
AC failure alarm .....	7
Pump room alarm relays .....	7
Low fuel level alarm option B1 .....	7
Water reservoir low alarm option B2 .....	7
Water reservoir empty alarm option B3 .....	7
Low pump room temperature alarm option B4 .....	7
High fuel level alarm option B5 .....	7
Low system pressure alarm option B6 .....	7
Low suction pressure alarm option B7 .....	8
External control signals .....	8
Lockout circuit from other equipment option C1 .....	8

Interlock circuit to other fpc option C2 .....	8
Engine block heater circuit option C7 .....	8
Foam pump controller option C8 .....	8
Non pressure actuated controller option C9 .....	8
Control circuit protection .....	9
Controller sequence of operation .....	9
Main switch .....	9
Main switch in off position .....	9
Main switch in manual position .....	9
Main switch in auto position .....	9
Water pressure control .....	9
Manual electric control at remote station .....	9
Fire protection equipment control .....	10
Weekly test .....	10
Run test .....	10
AC failure start .....	10
Sequence starting .....	10
Lock out signal .....	10
Operator equipment .....	10
Stop push button .....	10
Crank #1- crank#2 push buttons .....	10
Status display and annunciator on controller .....	11
Status display .....	11
Annunciator panel .....	12
Pressure adjustment .....	13
Push buttons .....	13
Printer .....	13
General .....	13
Paper replacement .....	13
Set up .....	14
Dip switch configuration .....	14
Pressure adjustment S10-1 .....	14
Run period timer S10-2 .....	14
Sequential start timer S10-3&4 .....	14
Pressure unit S10-5 .....	14
Pressure interval S10-6&7 .....	14
Test mode S10-8 .....	14
Pressure adjustment .....	15
Weekly test .....	15
Battery charger .....	16
Battery charger .....	16
Relay function .....	17
Engine trouble relay .....	17
Engine run relay .....	17
Pump room alarm relay .....	17
Controller trouble relay .....	17
Weekly test relay (option A1) .....	17
Overspeed relay (option A2) .....	17
Low oil pressure relay (option A3) .....	17
High temperature relay (option A4) .....	17
Fail to start relay (option A5) .....	17

Battery #1 and #2 failure relay (option A6) .....	17
Charger #1 and #2 failure relay (option A7).....	18
AC failure relay (option A8).....	18
Low fuel level relay (option B1).....	18
Water reservoir low relay (option B2) .....	18
Water reservoir empty relay (option B3).....	18
Low pump room temperature relay (option B4) .....	18
High fuel level relay (option B5).....	18
Low system pressure relay (option B6) .....	18
Low suction pressure relay (option B7) .....	18
Lockout relay (option C1).....	18
Interlock relay (option C2).....	18
Alarm bell.....	19
"Type 1" defaults .....	19
"Type 2" defaults" .....	19
Event and pressure data recording .....	19