

ENGINE-DRIVEN FIRE PUMP CONTROLLER

INSTRUCTION MANUAL



DIGI-FLO Controller

Microprocessor-Based Digital Diesel Engine-Driven Fire Pump Controllers

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1. INTRODUCTION

1.1 Safety

This technical document is intended to cover most aspects associated with the installation, application, operation, and maintenance of DIGIFLO Diesel Engine Fire Pump Controller. It is provided as a guide for authorized and qualified personnel only in the selection and application of DIGIFLO controller. If further information is required by the purchaser regarding particular installation, application, or maintenance activity, please contact Smoothflo Pumps or authorised sales agent or an installing contractor.

1.2 Warranty

No warranties, expressed or implied, including warranties of fitness for a particular purpose of merchantability, or warranties arising from course of dealing or usage of trade, are made regarding the information, recommendation and descriptions contained herein. In no event will Smoothflo Pumps be responsible to the purchaser or user in contract, in tort (including negligence), strict liability or otherwise for any special, indirect, incidental or consequential damage or loss whatsoever, including but not limited to damage or loss of use of equipment, plant or power system, cost of capital, loss of power, additional expenses in the use of existing power facilities, or claims against the purchaser or user by its customers resulting from the use of the information and descriptions contained herein.

1.3 Safety Precautions

All safety codes, safety standards, and /or regulations must be strictly observed in the installation, operation, and maintenance of this device.



COMPLETELY READ AND UNDERSTAND THE MATERIAL PRESENTED IN THIS DOCUMENT BEFORE ATTEMPTING INSTALLATION, OPERATION, OR APPLICATION OF THE EQUIPMENT. IN ADDITION, ONLY QUALIFIED PERSONS SHOULD BE PERMITTED TO PERFORM ANY WORK ASSOCIATED WITH THIS EQUIPMENT. ANY WIRING INSTRUCTIONS PRESENTED IN THIS DOCUMENT MUST BE FOLLOWED PRECISELY. FAILURE TO DO SO COULD CAUSE PERMANENT EQUIPMENT DAMAGE.

1.4 Product Overview

The DIGIFLO controller is a comprehensive, multi-functions microprocessor based diesel engine-driven fire pump controller – Digital Controller.

Designed to meet the needs of markets worldwide. It fully complies to AS2941-2008 and NFPA-20.

1.5 AS2491-2008 Requirements

A fire pump controller must start the diesel engine-driven fire pump in response to an external starting signal which is normally pressure-setting of a pressure switch plumbed into piping works.

Once started, the engine must continue to run until it is manually stopped or runs out of fuel.

Each automatic or manual starting system shall have the capacity to provide a minimum 3min (15s intermittent cranking with 15s rest) cycle at full rate cranking speed.

2. INSTALLATION AND ELECTRICAL CONNECTIONS

2.1 Mounting

Carefully unpack the controller and inspect thoroughly.

The DIGIFLO controller is designed for floor, wall or stand mounting. Note the controller is not free standing and must be bolted securely to a wall. The weight is about 40KG.

2.2 Pressure Sensor

The DIGIFLO is equipped with system pressure sensor. It dynamically displays the system's pressure. Please refer to the wiring diagrams.

2.3 Electrical Connections

NOTICE

QUICK COUPLING IS PROVIDED WITH CONTROLLER. THE MATING COUPLING IS LOACED ON THE BOTTOM OF CONTRLLER. DRILLING OR INSTALLING CONDUIT ABOVE THE MICROPROSSOR BOARDS WILL VOID WARRANTY.

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 the controllers should be a minimum of 300mm above floor.

Prior to starting, verify all data on the nameplate such as battery voltage, AC line voltage.

Inspect all electrical connections, components, and wiring for any visible damage. Correct as necessary. Ensure that all electrical connections are tightened before energisation.

Refer to the appropriate field connection drawings provided with this manual, for all wiring information pertaining to the incoming AC power supply, batteries and engine wiring.

All terminals are numbered.

Terminals 45 through 47 are for remote communication with RS485.

The DigiFlo Controller is compatible with VDO senders.

2.3.1 Head Sender (Terminals 48) (Refer to Wiring Illustration 1)

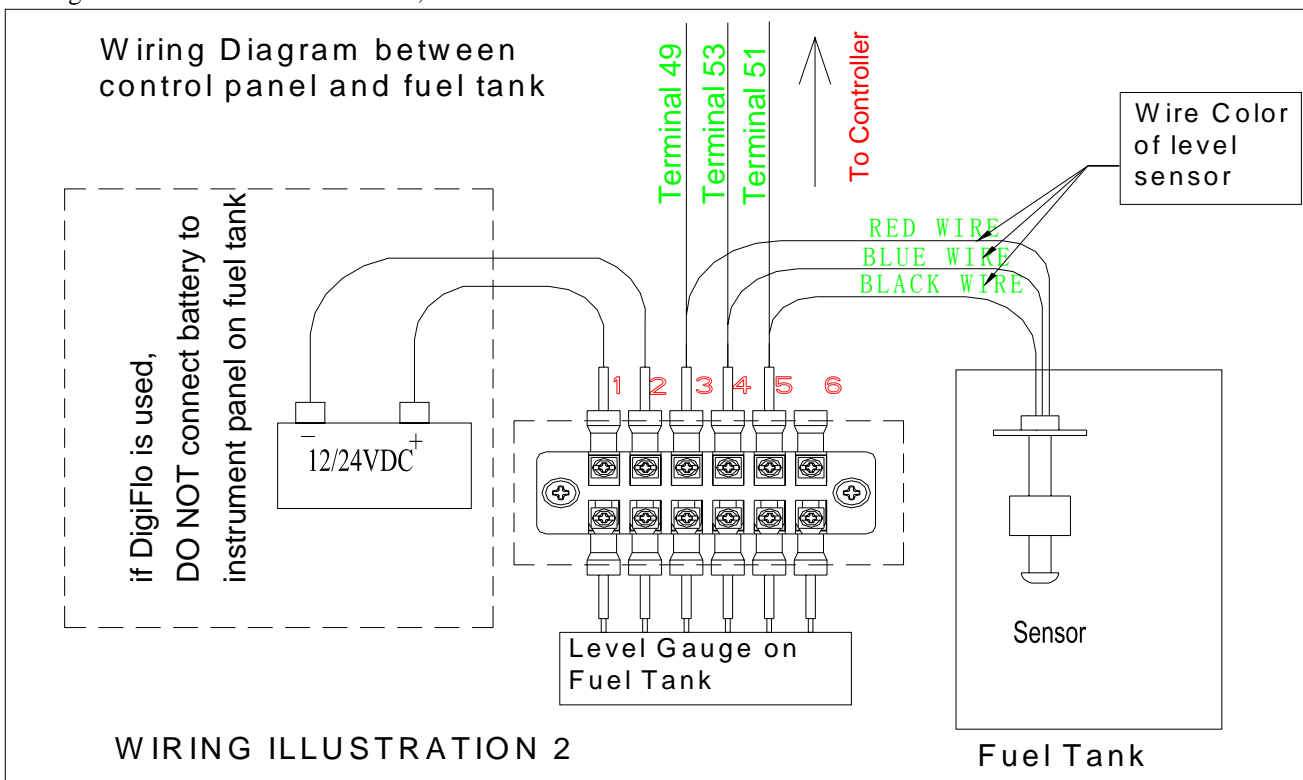
Terminals 48 & 49 are for system head sender. Terminal 49 is power line and connected to positive (red) line of head sender. Terminal 48 is negative or earth. Output signal is 4 – 20mA. This sender is fitted on the pump discharge.

2.3.2 Terminal 49 (Refer to Wiring Illustration 1)

Terminal 49 is power line (12V or 24V). When the controller has AC power input, this power exists. It is used with Terminals 48 and 51.

2.3.3 Temperature Sender (Terminal 50) (Refer to Wiring Illustration 1)

Terminal 50 is connected to coolant temperature sender. The sender has two terminals: one connects to Terminal 50 on the controller. The other one connect to earth (Terminal 53). Use wire not less than 1.5mm². Keep the wire as short as possible. If the length of the wire is more than 15m, the thick wire should be used.



2.3.4 Fuel Level Sender (Terminal 51) (Refer to Wiring Illustration 2)

Terminal 51 is connected to fuel level sender. The output is 0 ~ 1 V dc. 0V represents no fuel (fuel tank is empty). 1V represents 100% (fuel tank is full). Wiring: refer to External Wiring Diagrams.

2.3.5 Fuel Tank

The fuel tank supplied by Smoothflo Pumps is equipped level sender and level gauge. And also equipped with a **alarm and light**. They are compatible with DIGI-FLO. When fuel drips to 70%, the alarm will work.

2.3.6 Wiring between DIGI-FLO Controller and fuel sender (Refer to Wiring Illustration 2)

Terminal 49 (power line, 12V/24V) to positive line of fuel sender (Terminal 3 on the drawing of Smoothflo fuel tank wiring diagram). Terminal 51 to fuel level sender signal line (Terminal 5 on the drawing of Smoothflo fuel tank wiring diagram). Terminal 53 to fuel level sender negative line (Terminal 4 on the drawing of Smoothflo fuel tank wiring diagram).

2.3.7 Oil Pressure Sender (Terminals 52) (Refer to Wiring Illustration 1)

Terminal 52 is for oil pressure sender. The Oil Pressure Sender has two terminals: one connects to Terminal 52. And the other connects to earth (Terminal 53).

2.3.8 Terminal 53 (Refer to Wiring Illustration 1)

Terminal 53 is earth, negative pole of the battery. This terminal should connect on temperature sender, fuel level sender, and oil pressure sender.

2.3.9 Terminals 54 & 55 (Refer to Wiring Illustration 1)

Speed Sender has two terminals that respectively connect to Terminals 54 & 55.

Speed Sender (Magnetic Pickup) must be fitted correctly. The clearance to flywheel is not more than 0.45mm.

The cables for speed sender must be shielded cables that can reduce the interference. If the system fitted with electronic speed adjustor, they can use the same speed sender.

2.3.10 Terminal 59

The Terminal 59 is used for cases in which the water source is a pond, instead of town water.

For the purpose of a fire pump, this terminal is not presented on the controller.

2.3.11 Terminal 60 (Refer to Wiring Illustration 1)

Terminal 60 delivers the “starting” signal of fire pump. This terminal connects to one pole of the pressure switch plumbed into the discharge of the pump. And the mating pole of pressure switch connects to earth. When the system pressure drops off, Terminal 60 is earthed. And then the fire pump starts.

2.3.12 Terminals 65 & 66

When the fire pump **needs variable speed** and fitted with an **electronic speed adjustor**, it is connected to Terminals 65 & 66. But if the fire pump only runs on a constant speed, no connections are needed to above terminals.

2.3.13 Terminal 69

Terminal 69 is a power line (12V/24V) for fuel supply for starting. This line only has the power when the controller starts to work.

For the fire pump with constant speed

This line is connected to stop solenoid (specially supplied) and also connected to electronic regulator **B+** (or alternator **B+**).

For the fire pump with variable speed

Terminal 69 is connected to the electronic speed adjustor and also connected to electronic regulator **B+** (or alternator **B+**).

2.3.14 Terminals 73 & 74

They are volt-free contacts for pump running indicator for remote connection.

2.3.15 Terminals 91 & 92

They are volt-free contacts for common fault alarm indicator for remote connection.

2.3.16 Terminal 100

This terminal should connect to a **START RELAY** first and then connect ignition pole of motor starter.

2.3.17 Terminals LO1, LO2, N1 & E (Jockey Pump) (Refer to Wiring Illustration 3)

All those terminals are for single phase 240V Jockey (jacking) pump. L1 is connected to by-pass Live cord for manual-use of Jockey pump. L2 is connected to Live cord with pressure switch connection. N1: Neutral. E: Earth.

2.3.18 Terminals 95 & 96 (Refer to Wiring Illustration 3)

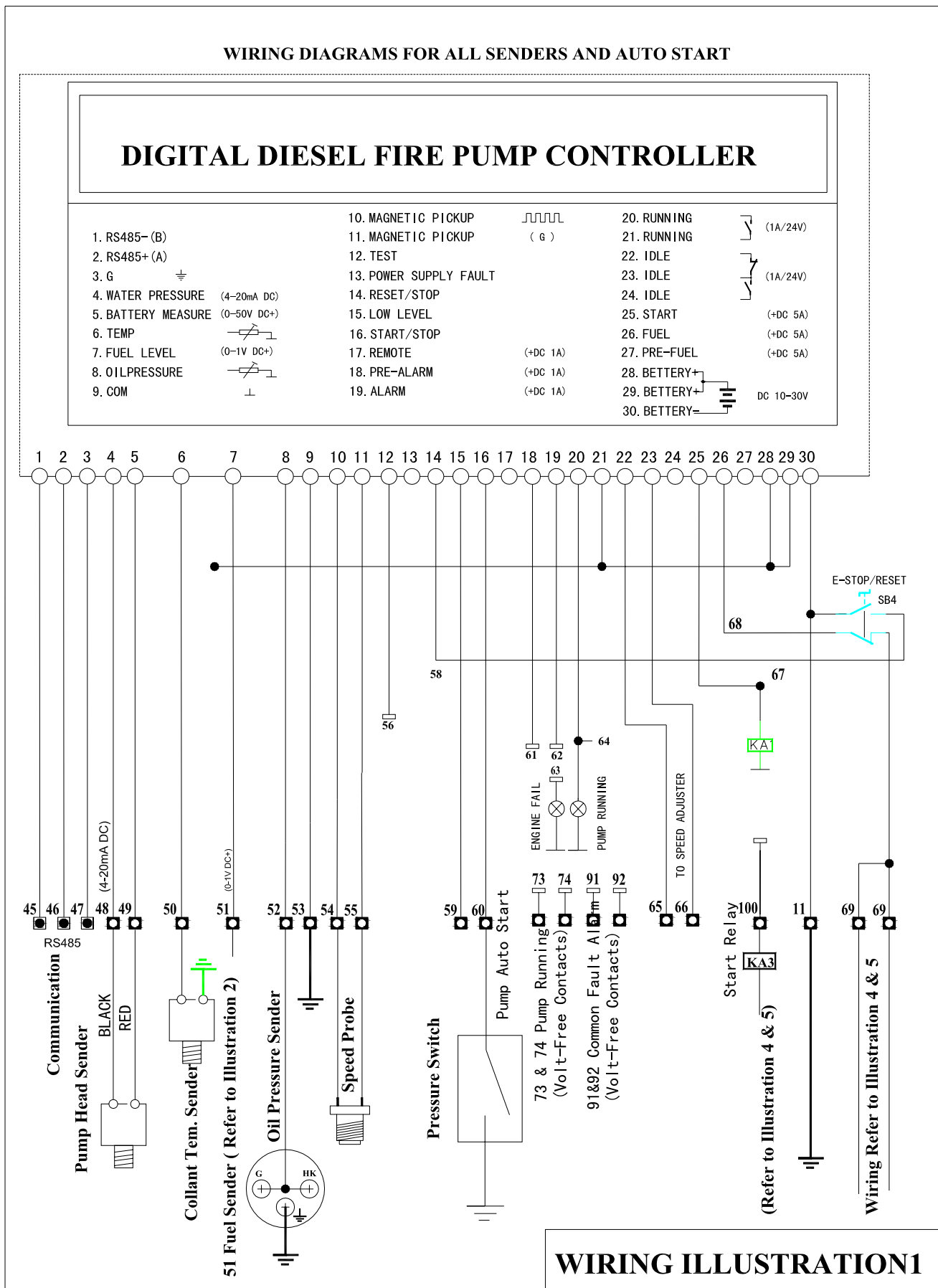
They are volt-free contacts for AC power supply indicator for remote connection.

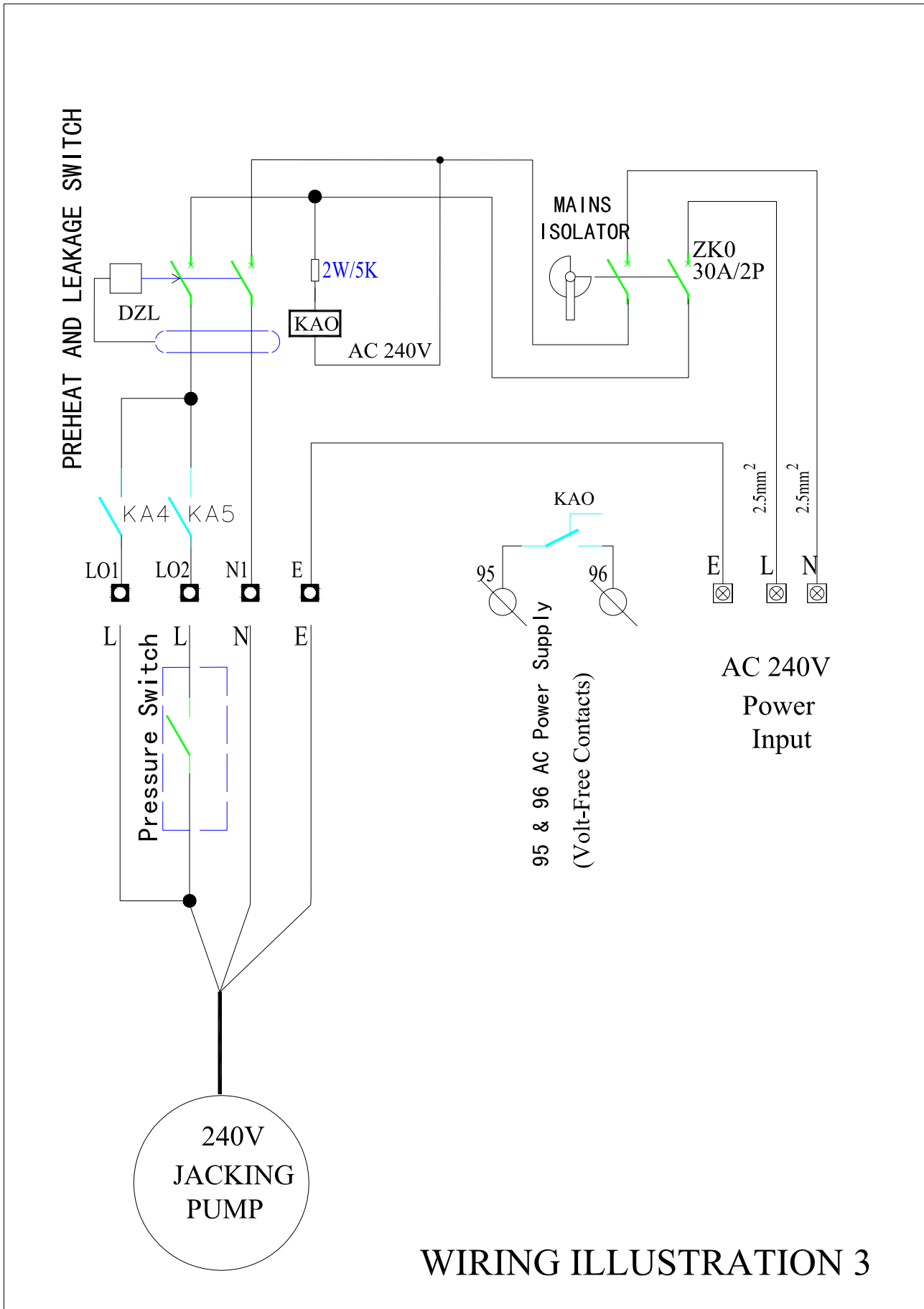
2.3.19 Terminals L, N & E (Refer to Wiring Illustration 3)

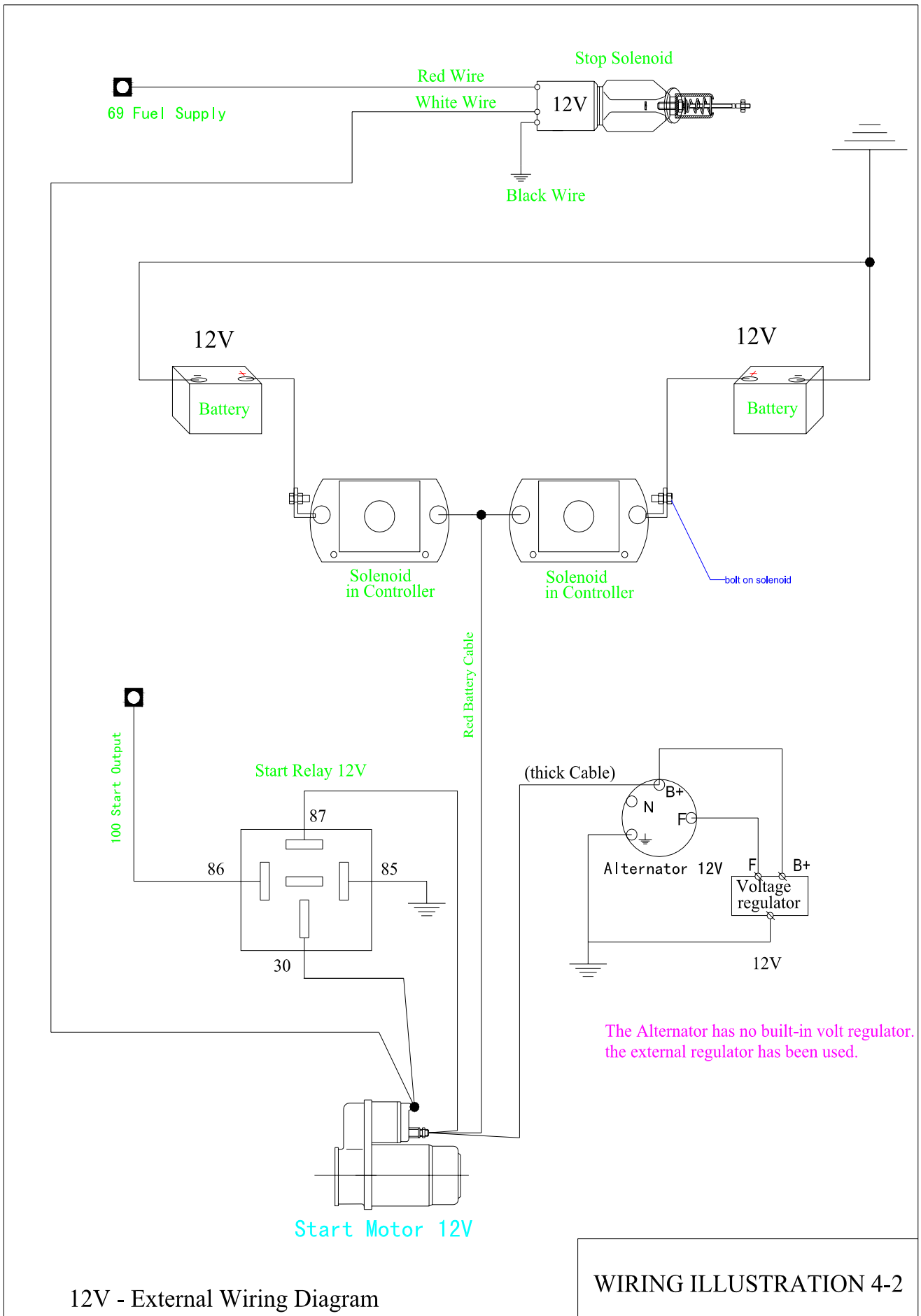
Those terminals are connected to AC 240V power supply.

2.4 Connections for start Motor, Batteries, Stop Solenoid, Start Relay, and Alternator Charge

Refer to four of illustration 4-2

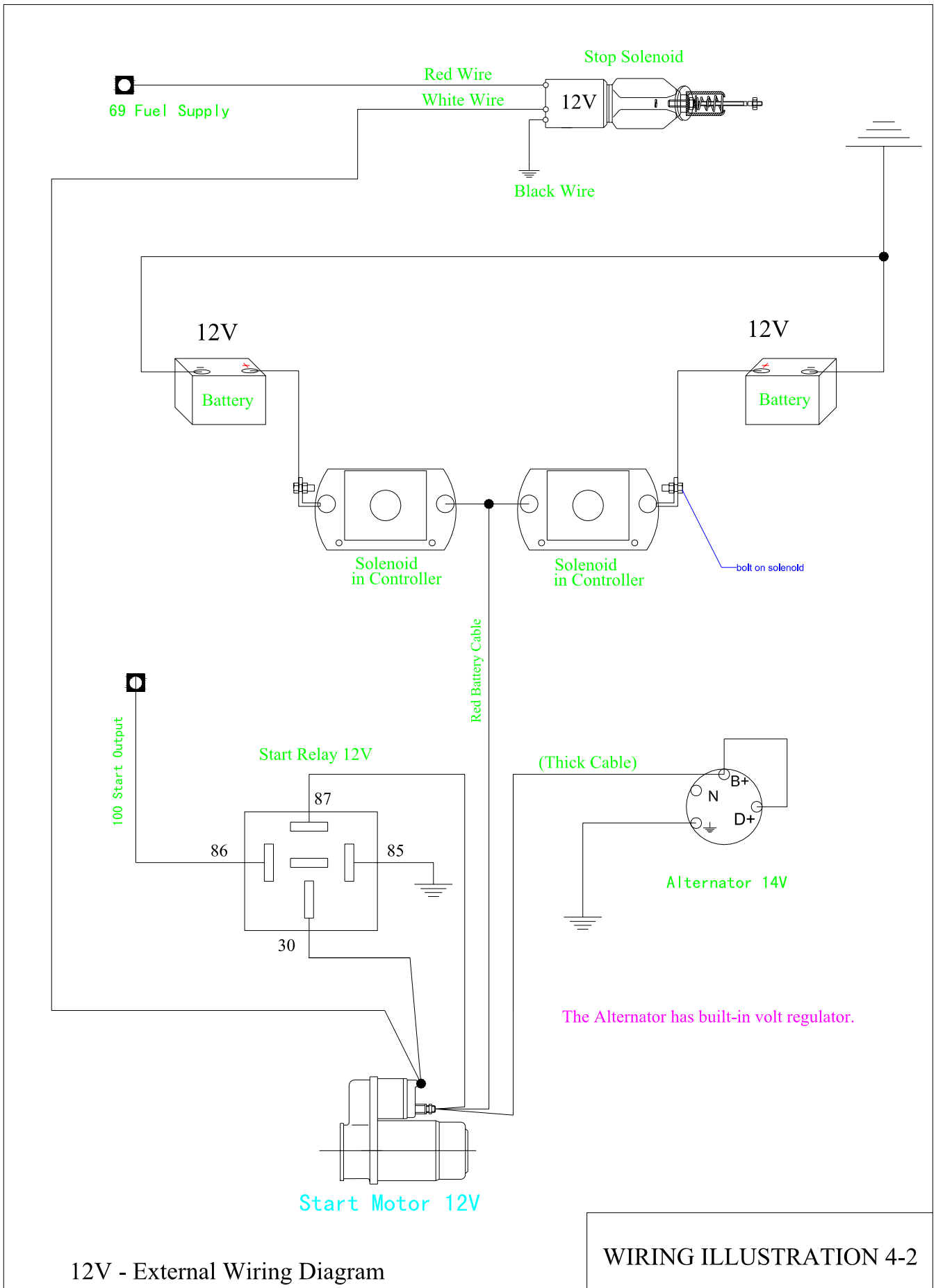


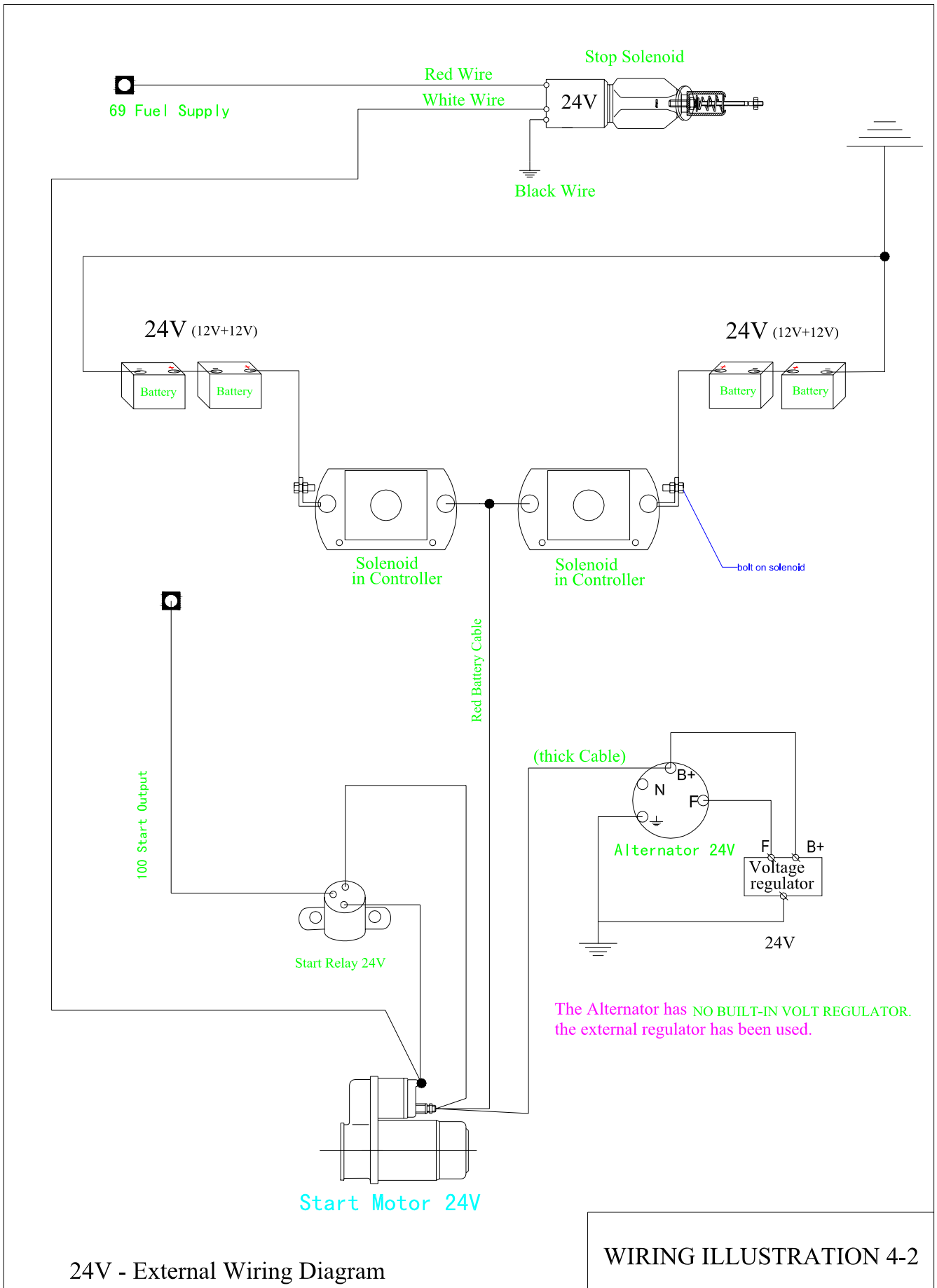


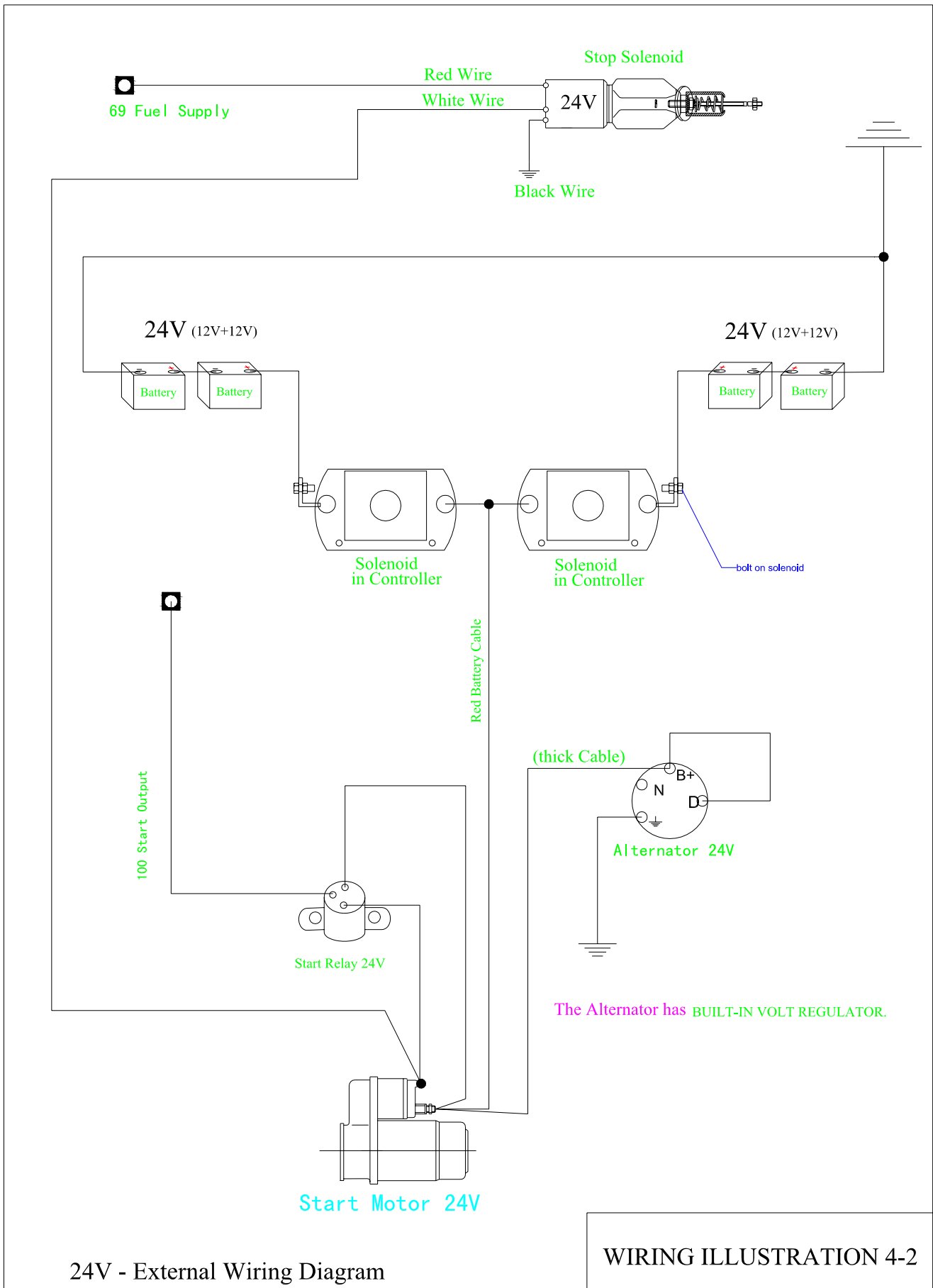


12V - External Wiring Diagram

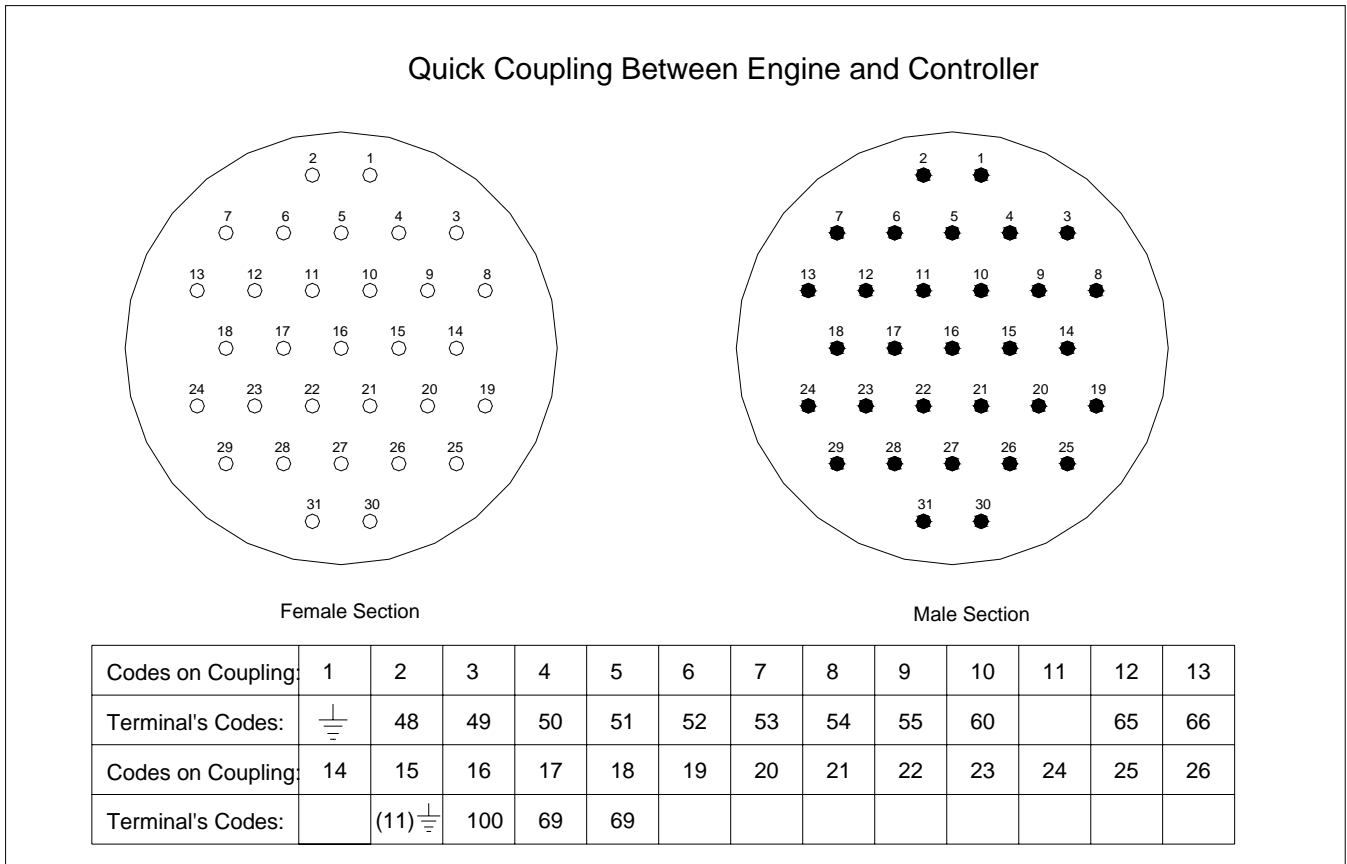
WIRING ILLUSTRATION 4-2







2.5 Code Check List Between Terminals and Quick Coupling



3. HARDWARE DESCRIPTIONS

General

The purpose of this section is to familiarize the reader with the hardware on Digi-Flo Controller, its nomenclature, and to list the unit’s specifications.

3.1 Battery Chargers

Battery chargers are independent chargers and constant potential type, producing a maximum of 10 amps each at full rate. The chargers will protect themselves by shutting down when there are short circuit, over-current.

3.1.1 Specifications:

- Voltage: AC85 – 265V
- Frequency: 25 – 100Hz
- Ambient temperature: -40 ~ 50 °C
- Relative humidity: 98% (no condense water)

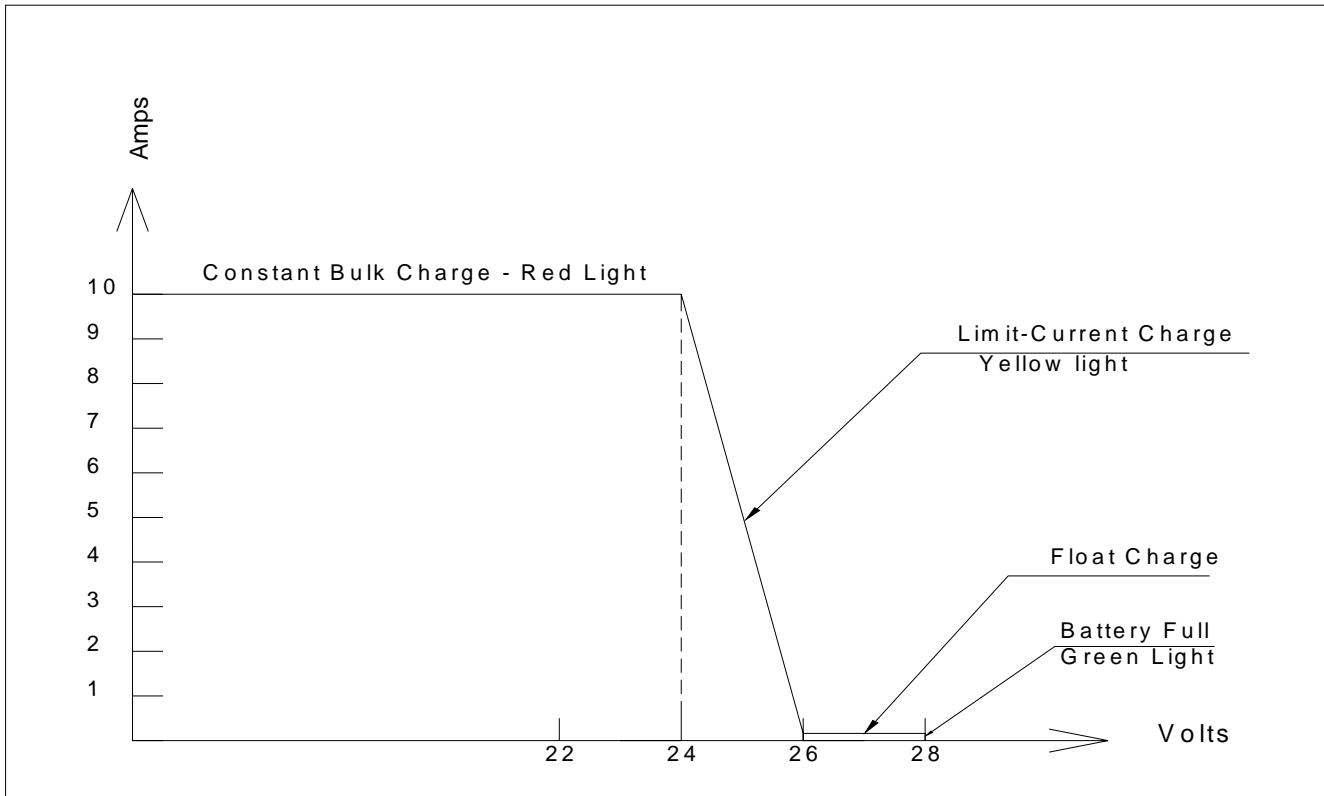
3.1.2 Three Step Charge

the battery chargers incorporate a three step charge to guarantee the faster charge times while optimising battery life.

The three steps are referred to as Bulk Mode, Limit-Current Mode and Float Mode.

In Bulk Mode, a current of 10 amps is delivered into the batteries until the voltage reaches 12 V/24V. When the charger senses this state, it switches to the Limit-Current mode. When the battery volt reaches 13.4V/27.6V, the charger enters into float mode. In float mode, the current remains 0.1 ~0.2Amps. Once Bulk and Limit-Current modes are completed, the charger will remain the battery charge in Float mode by regulating to 13.3V/27.6V. If the charger cannot maintain the battery capacity while in Float Mode, the charger will begin a new charging sequence by entering Bulk Mode.

Charging Characteristics Curves



3.1.3 Charger Shut Down

The charger will automatically shut down if there is no load connected to the output or if there is a short on the load side of the charger. In addition, the charger will not operate if a battery is connected incorrectly or if the wrong voltage of battery is connected.

3.2 Front Operator Panel

The front operator panel is normally accessible from the outside of the door. The front panel provides a means to:

- Alert the user to specific conditions
- Program the controller
- Set and monitor the operating parameters
- Perform a manual start of the controller

3.2.1 Switches

There are two lockable switches on Front Operator Panel: Mains Isolator and Cranking Isolator.

3.2.1.1 Mains Isolator

This switch is rotary and lockable, for AC power input isolation. Turning off this switch will cause an alarm condition, and the light of Battery Charger Fail will flash and the light of Mains Power Supply Present will extinguish.

3.2.1.2 Cranking Isolator

2-position rotary key lockable switch located to the middle-left of front operator panel.

In the off (isolate) position, the engine cranking circuits are disconnected from the controller. Automatic pressure switch starting and controller manual starting are disabled. If the engine is running, it is not stopped. This switch position will allow routine maintenance to be taken without concerning about the engine starting.

In the on position, the controller will crank the engine whenever an external start signal is present or when the controller start button is pressed.

When this switch is in off position, the engine can be started by using emergency manual start buttons located on the bottom of the front face of the controller.

3.2.2 Double Battery Manager

It is located in the centre of the front panel. DIGI-FLO controller is fully electronic. Two batteries work alternatively (they are still recognised as Control Battery and Start Battery). There are 11 LED lights.

- Two LED lights show which battery is on line.
- Two LED lights respectively show the battery's volt and current.
- Two LED lights respectively show the battery's volt and current.
- Four LED lights respectively show the batteries volts too high and too low.
- One LED light shows the volt for Mains AC Power.
- One LED light shows the failure for Mains AC Power.
- One LED light shows the power input into the controller.



Parameters in Double Battery Manager

There are four input parameters in Double Battery Manager: battery low voltage and high voltage, mains AC power low voltage and high voltage. When the voltages are out of the ranges the controller will go to alarm conditions. The parameters setting will be mentioned in PROGRAMMING section.

3.2.3 The Microprocessor Board of the Controller


The microprocessor is the heart of the controller. It can be programmed by the user.

There are 16 LED lights on the microprocessor.

- Battery On – This green LED indicates batteries in working conditions. It is normally lit.
- Ready – This Green LED shows the fire pump is in standby status and ready to start. It is normally lit.
- Pump Running – This red LED indicates whether or not the fire pump is in working condition. The fire pump works and the system is in alarm condition when it is lit.
- Emergency Stop – This red LED will be illuminated when the emergency stop button is pushed down.
- Start Fault – This red LED will be illuminated: 1/ if the controller has not received an engine run signal from the engine after attempting to crank the engine a total of 6 times. 2/ the duty is not achieved after starting. It goes off when the duty is acquired.
- Auto Start Isolated – This red LED will be illuminated when the microprocessor board is not in working conditions.
- Low Fuel Level – This red LED will be illuminated when the controller receives a signal from fuel level sender which indicated the fuel level is lower than the user's setting.
- Low Level – This red LED will be illuminated when the water level is lower than the user's settings. This function only works when the level probe/sender is installed in water source. **It will be not functioned for fire pumps.**
- Battery Fault – This red LED will be illuminated during the cranking cycle when the controller detects a weak or discharged battery, i.e. 67% of rated voltage, or less, or when ever a battery cable is disconnected.
- Auto Start - This blue LED indicates whether or not the fire pump is in Auto Start status. It is lit as long as the fire pump is in automatic start mode.
- Remote – This blue LED will be illuminated after receiving a start signal on the remote area.
- Communication – this blue LED indicates whether or not the controller is in remote communication mode. Terminals 45 through 47 are for remote communication with RS485.
- TACHO RPM – This red LED shows the engine is running and the window beside dynamically shows the engine speed.
- HEAD – This red LED and the window beside dynamically show the system's pressure in meter.
- TEMP – This red LED and the window beside dynamically show the engine's temperature.
- PRE KPA – This red LED and the window beside dynamically show the engine's oil pressure in KPA.



Buttons on the microprocessor board:

- START button – push this button to manually start the fire pump.
- STOP/RESET button - push this button to manually stop the fire pump. And the system returns to standby mode after release of the button.
- Four function Buttons . They are used for entering function parameters and reviewing the parameters. They are introduced in PROGRAMMING section.

3.2.4 The Indicator Lights on front panel

- Engine Fail – This red light will be illuminated when the engine has the common failures.
- Start Fail – This red light is the same as LED. It will be illuminated: 1/ if the controller has not received an engine run signal from the engine after attempting to crank the engine a total of 6 times. 2/ the engine starts but the head does not reach the duty head (if this happens, the engine speed should be adjusted. After adjusting, this indicator light will go out and the alarm will stop automatically.
- Battery Low Voltage – This red light will be illuminated when the controller detects the battery volts are lower than settings values.
- Battery Charger Fail – This red light will be illuminated when the supply power to the chargers is lost or when the chargers malfunction.
- Pump Running – This red light is the same as LED. It indicates whether or not the fire pump is working. The system is in alarm condition and the pump works when it is lit and flash.
- Alarm – This alarm is aural when there is an alarm condition.
- Mains Power Supply Present - This green light shows the AC Power supply to the controller. It is normally lit.

3.2.5 Alarm mute and Test Buttons

- Alarm Mute – Pressing this button will mute alarm bell if it is currently operating. The alarm cause will continue to be indicated by the alarm and indicator lights. Alarm mute will be automatically cancelled when all alarm causes are cleared or reset.
- Lights Test – Pressing this button will illuminate all indicating lights. It is provided as a test for indicator failure.
- Alarm Test – When pressed will test the external alarm bell and all circuits related with the alarm.

3.2.6 Emergency Button/Switches

- Emergency Stop/Reset – Pushing this button will stop the engine. And the controller will return to the standby status when the button is released.
- Emergency Manual Start switches – located below front operator panel. Turn either the switch to crank the engine from the start or control battery, external to the controller circuitry.

3.2.7 Jockey Pump Switch

DIGI-FLO controller only provides a three-position switch for a single-phase 240V of jockey pump.

AUTO: the Jockey Pump will automatically start/stop when the Jockey Pump pressure switch is closed/opened.

MANUAL: The Jockey Pump will be operated manually.

OFF: The Jockey Pump will not run.

3.3 Start Relay

Since starting current is bigger than contacts' current, the SATRT RELAY is provided. The wiring is shown on the external wiring diagram.

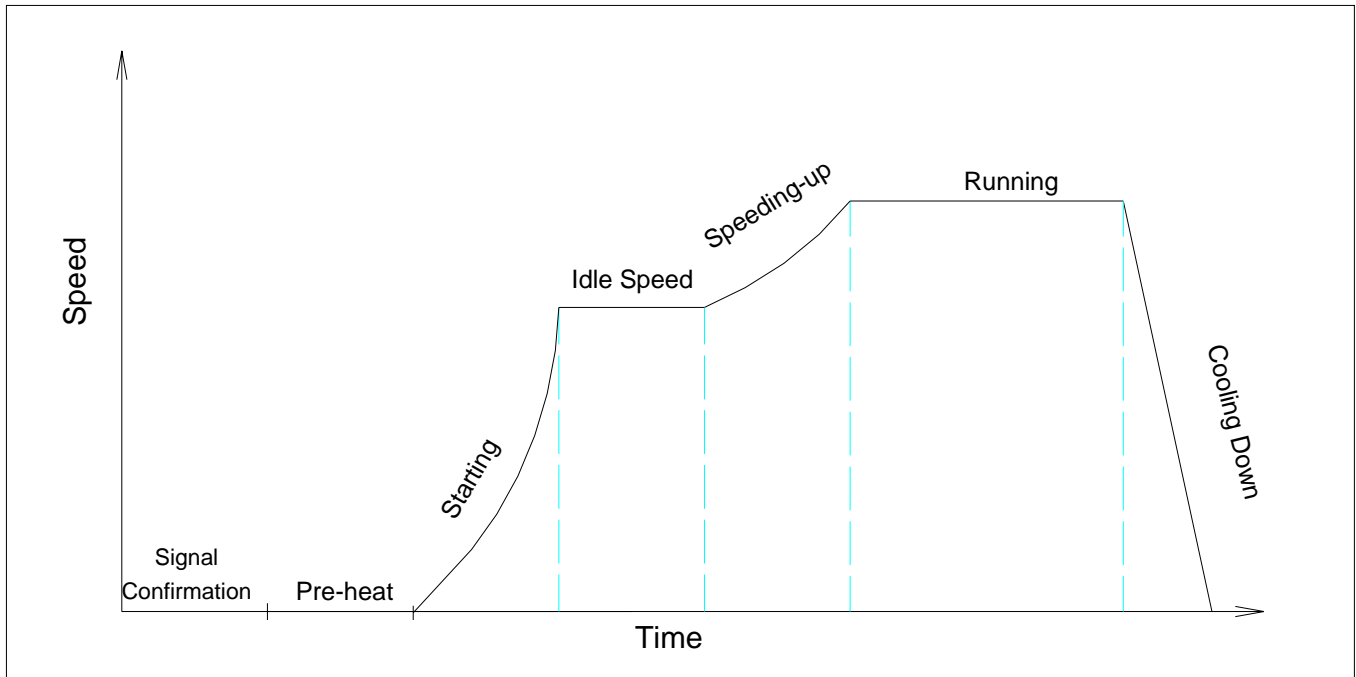
4 PROGRAMMING

4.1 Introduction

The DIGI-FLO controller is fully electronic and programmable from the device's faceplate. The users can program set points and the parameters. The engine and pump will be controlled by the parameters entered.

Before programming, the user needs to know duty speed, number of flywheel teeth, the speed of different phases, ect..

Speed Control Process



4.2 Speed Signal Frequency (SSF)

The Speed Signal Frequency (SSF) must be calculated correctly. The wrong SSF will lead to the controller to control the engine based on wrong information. This will be first parameter entered into controller. The calibration of SSF will be introduced in Section 6.2.

SSF=number of flywheel teeth x (rated speed ÷ 60)

For example, D4100 has 119 teeth, duty speed=2900rpm,

SSF=119x(2900 ÷ 60)=5752 Hz

380/480/485: 115 TEETH
 SSF=5558
 490/4102: 119 TEETH
 SSF=5752

4.3 Parameters List

The following table lists all parameters (data entry) in the microprocessor board in sequence displayed in the window.

Alarm: The engine will stop.

Pre-Alarm: The alarm will generate the sound but the engine will not stop.

| Codes | Parameter Settings |
|--------|---|
| 01tCAL | Speed signal frequency (SSF) - Hz |
| 02EGSP | Engine duty speed (rpm) |
| 03CdSP | Speed for start motor separate from flywheel (set 350rpm) |
| 04Crtn | The time for start motor separate from flywheel (set 3-5 seconds) |
| 05Sdly | The time from starting signal appeared to procedures-starting (set 5 seconds) |
| 06hEAt | The time for Pre-heat or pre-lubrication (set 2 seconds) |
| 07rdLY | The time for Idle speed run (set 2 seconds) |
| 08odLy | The time for Speed-up run (set 2 seconds) |
| 09CooL | The time for engine stop cooling-down (set 5 seconds) |
| 10SPLA | Set to 0 (zero) for under-speed alarm, (set ZERO) |
| 11SPLP | Speed for undervoltage pre-alarm (set 1000rpm) |
| 12SPhP | Speed for overspeed pre-alarm (10% Above duty speed) |
| 13SPhA | Speed for overspeed alarm (20% Above duty speed) |
| 14oPrA | Oil pressure for low oil pressure pre-alarm 250KPa |
| 15oPrP | Oil pressure for low oil pressure pre-alarm 250KPa |
| 16CLtP | Temperature for high temperature pre-alarm 85°C |
| 17CLtA | Temperature for high temperature pre-alarm 85°C |
| 18bAtL | Volts for battery volt too low pre-alarm |
| 19bAth | Volts for battery volt too high pre-alarm |
| 20FUEL | Fuel Level for fuel-level low pre-alarm 67% |
| 21PSEn | Upper-value for pump head sender (160m) |
| 22PbAS | Static suction head (set zero (0) for suction lift) |





| Codes | Parameter Settings |
|--------|----------------------------------|
| 23PrUn | Duty head |
| 24Fh1P | Flow rate for overflow pre-alarm |
| 25Fh1 | Flow rate for overflow pre-alarm |
| 26FhdL | Time to alarm when overflow |
| 27Pr 1 | Head 1 (m) |
| 28FL 1 | Flow rate 1 |
| 29Pr 2 | Head 2 (m) |
| 30FL 2 | Flow rate 2 |
| 31Pr 3 | Head 3 (m) |
| 32FL 3 | Flow rate 3 |
| 33Pr 4 | Head 4 (m) |
| 34FL 4 | Flow rate 4 |
| 35Pr 5 | Head 5 (m) |
| 36FL 5 | Flow rate 5 |
| 37Pr 6 | Head 6 (m) |
| 38FL 6 | Flow rate 6 |
| 39Pr 7 | Head 7 (m) |
| 40FL 7 | Flow rate 7 |
| 41Pr 8 | Head 8 (m) |
| 42FL 8 | Flow rate 8 |
| 43PSEn | Leave it blank for fire pumps |
| 44Addr | Communication address. |

Notes:

Parameters from 27 to 42 are for pump performances – flow and head. They should be obtained from real testing data or trustable curves. Flow rate 1 is maximum flow and flow rate 8 is minimum flow. Head is in meters. Flow rate can be any units. But cubic meter per hour may be better for accuracy.

4.4 Parameters set-up

4.4.1 Function Buttons

| | |
|---|--|
|  | Turn-Page Button – Press this button, the widow will turn to next parameter. |
|  | Value-Up Button – Press this button to increase current parameter value. |
|  | Value-Down Button – Press this button to decrease current parameter value. |
|  | Auxiliary Button |

4.4.2 Passwords

The passwords for entering parameters are pressing function buttons in the following sequence



4.4.3 Set-up or Viewing the Parameters

- First press Turn-Page Button, the window will display “PASS” .
- And then press the passwords. Thus the controller enters into parameters-set-up status.
- The parameters can be changed any time. But the changes may affect the engine operation. So the changes should be done when the engine is not in service.
- The first display is 01TCAL. Its value will be displayed in 2 seconds. Press VALUE-UP OR VALUE-DOWN BUTTONS to adjust the parameter value. And then PRESS TURN-PAGE BUTTON to go to next parameter.





4.4.4 Exiting From The Parameters Windows

DIGI-FLO: DIGITAL CONTROLLER FOR ENGINE-DRIVEN FIRE PUMPS

To exit the parameter windows, just wait up to 5 seconds and the window will return to “READY” or “RUNNING” status.

4.5 Set-Up Parameters In Double Battery Manager

4.5.1 Function Buttons

| | |
|---|---|
|  | VALUE-INCREASE BUTTON: press this button to increase the current value. |
|  | VALUE-DECREASE BUTTON: press this button to decrease the current value. |
|  | START BATTERY BUTTON: press this button to keep this battery on-line-use |
|  | CONTROL BATTERY BUTTON: press this button to keep this battery on-line-use |

4.5.2 Parameters

There are four parameters in double battery manager:

1. Low AC power volt;
2. High AC power volts;
3. Low battery volt;
4. High battery volt;


When the values exceed the ranges, the controller will go to alarm conditions.

4.5.3 Navigations and Changing Parameters

- Press two buttons of **VALUE-INCREASE AND VALUE-DECREASE** together, and then the wind will display 1. XXX (low battery volt).
- To change it, press **START-BATTERY** button, and then the value can be changed by pressing **VALUE-INCREASE** button or **VALUE-DECREASE** button.
- To save the value, press **START-BATTERY** button again.
- To exit and return to normal display windows, press the **CONTROL-BATTERY** button.

4.6 Viewing Parameters

When the system is in operation, press buttons ▲ or ▼ to display operating parameters of the system. The first display is “SPEED”, and then its value will be followed after 2 seconds. Press buttons ▲ or ▼ to check the other parameters. To return

RUNNING status, just press TURN-PAGE button 

| Item No. | DISPLAY | MEANING |
|----------|---------|------------------------------------|
| 1 | SPEEd | Current Speed (Rpm) |
| 2 | OiL-SP | Current Oil Pressure (KPa) |
| 3 | C-tEmP | Current Coolant Temperature (°C) |
| 4 | bAtt | Current Battery Volt (V) |
| 5 | FUEL | Current Fuel Level (%) |
| 6 | HoUrS | Operation Hours (Accumulated) |
| 7 | PrESS | Current Head On Pump Discharge (M) |
| 8 | FLoU | Current Flow |

5 ALARMS

The controller will go to alarm conditions and the alarm will generate the sound and flash when the system has troubles or the system/engine runs out of the parameters' limitation. Meanwhile the window on the controller will display the code of alarm conditions, such as P00-XX (P01 or P02-XX, or ALA-XX). XX is the code of the alarm cause. When ALA-XX is displayed, the engine will stop.

DIGI-FLO: DIGITAL CONTROLLER FOR ENGINE-DRIVEN FIRE PUMPS

For example: when the oil pressure is lower than the setting, the alarm will generate the sound and flash. Meanwhile the window will display P00-22. **22 is the code of the alarm cause for low oil pressure.**

| ALARM CODES | MEANINGS |
|--------------|---|
| 11 | Over-speed, will shut down the engine |
| 12 | Under-speed, DISABLED by 0 setting |
| 20 | Oil sender circuit break |
| 22 | Oil pressure lower than setting |
| 32 (9998) | Temperature sender short circuit |
| 32 (9999) | Temperature sender circuit break or poor connection |
| 32 | Temperature lower than setting |
| 33 | Ambient temperature lower than 4°C |
| 40 | Engine Start failure |
| 41 | Engine Stop failure |
| 50 | Battery volt lower than setting |
| 51 | Battery volt higher than setting |
| 52 | Fuel level lower than setting |
| 53 | Water level too low |
| 60 | Flow rate too high |
| 61 | Head sender circuit break or poor connection |
| 80 | Power system failure |
| Special Code | |
| P09-50 | Low oil pressure and low battery volts |
| P0A-51 | Low oil pressure and too high battery volts |

When the alarm cause ceases, the alarm will automatically turn off. But when ALA-11(over-speed) is displayed, the engine will stop.

6 INSTALLATION AND OPERATIONS

6.1 Installation

The controller should be mounted in a position away from vibration, heat and hot exhaust pipes and potential diesel fuel and water spills.

If it is located outdoors, the consideration must be given to a sunshade. Direct sunlight combined with high ambient temperature will cause controller failure.

The controller is certified to IP54 AS1939. It should be wired to stop solenoid, engine, external start signal, using wiring diagrams supplied with the controller.

Before connecting AC power or batteries, double-check all wiring and voltage rating.

6.2 Operations

The controller must be programmed before putting in use. Refer to programming section. The programming can be done as long as the controller has 240V AC power supply. Please note the total time of settings for 04Crtn 05Sdly 06hEat 07rdLY 08odLY (see parameter list) are not more than 15 seconds by fire code. The speed signal frequency must be correctly worked out.

DUTY SPEED (02EGSP) is engine-working speed. With this speed the system can achieve the required flow and head. If Start Fail illustrates after starting, it means that the duty is not achieved. Duty speed should be calculated again.

CALIBRATION OF SSF FREQUENCY (for DUTY SPEED): when the engine gets into normal operation, use non-contact-laser TACHO Meter to adjust engine speed to duty speed. If the display speed of the controller has big difference from the measuring speed, the SSF need to be calibrated. To calibrate SSF frequency, first get into 01tCAL of parameter-set-up and then press

button  to save current frequency as SSF frequency. Normally the calibration is not necessary.

DIGI-FLO: DIGITAL CONTROLLER FOR ENGINE-DRIVEN FIRE PUMPS

OVERSPEED SHUT-DOWN (13SPhA): when the speed exceeds duty speed up to the speed for over-speed pre-alarm (12SPhP in parameter list), the alarm will work but the engine will not stop. If the speed goes up further to the speed for over-speed alarm (13SPhA in parameter list), the engine will stop. The speed for over-speed shut-down is a speed approximately 20% above the engine duty speed.

UNDERSPEED (11SPLP): if for some reason the engine runs slower than duty speed to the speed of under-speed pre-alarm (11SPLP in parameter list), the alarm will work but the engine will not stop. For fire pumps, the engine is not allowed to stop for under-speed. So 10SPLA in parameter list must be set to ZERO (0).

8 DUTY POINTS: the controller monitors the fire pump by using parameters including 8 duty points. So 8 duty points should be real testing data, as accurate as possible, especially for the cases with variable speed drive.

- Check to make sure all wirings, AC power connections are correct. Check the battery's volt and make sure 24V battery is not lower than 18V, and 12V battery is not lower 9V.
- Connect the batteries. And ensure the correct polarity.
- Make sure fuel level, oil level, coolant level reach the correct levels.
- Make sure Mains Isolator and Cranking Isolator on front panel door to OFF positions.
- Connect quick couplings provided with the controller to the sockets on the system and on the controller.
- Check the system's pressure. Turn on the Jockey pump to increase the system pressure if necessary.
- Check wiring connection on pressure switch for automatic start signal.
- Turn on Mains Power switches and battery power switches **in the controller**. Close the front panel door.
- Turn on the Mains Isolator and Cranking Isolator. Thus the system. When the controller has input power, the window will display "AIS-EC" for 2 seconds and then go to "ready".
- Press the start button to start the engine manually.
- When the engine starts, the window will display in the following sequence:

| | Displays | Meanings |
|---|-----------------|---------------------------------------|
| 1 | AIS-EC | When power on |
| 2 | rEAdy | In standby status |
| 3 | StArt | The engine is starting |
| 4 | P-HEt | Pre-heat and pre-lubrication |
| 5 | FUEL | Supplying Fuel |
| 6 | CrAnY | Engine cranking |
| 7 | SdELAY | Slow delay (engine run on idle speed) |
| 8 | odELAY | Over delay (speed increasing) |
| 9 | rUnn | Pump running |

When pressing stop/reset button, the window will display:

| | |
|-------|-------------------------------------|
| CooL | Engine cooling down |
| StoP | Engine stop |
| rEAdy | Back to STANDBY status when release |

When pressing ESTOP/RESET button, the window will display:

| | |
|-------|-------------------------------------|
| EStoP | Emergency stop |
| rEAdy | Back to STANDBY status when release |

ELECTRIC FIRE PUMP CONTROLLER

INSTRUCTION MANUAL



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INSTRUCTION MANUAL FOR EFPC ELETRICAL FIRE PUMPS

1. INTRODUCTION

1.1 Safety

This technical document is intended to cover most aspects associated with the installation, application, operation, and maintenance of FPSC Electrical Fire Pump Controller. It is provided as a guide for authorized and qualified personnel only in the selection and application of FPSC controller. If further information is required by the purchaser regarding particular installation, application, or maintenance activity, please contact Smoothflo Pumps or authorised sales agent or an installing contractor.

1.2 Warranty

No warranties, expressed or implied, including warranties of fitness for a particular purpose of merchantability, or warranties arising from course of dealing or usage of trade, are made regarding the information, recommendation and descriptions contained herein. In no event will Smoothflo Pumps be responsible to the purchaser or user in contract, in tort (including negligence), strict liability or otherwise for any special, indirect, incidental or consequential damage or loss whatsoever, including but not limited to damage or loss of use of equipment, plant or power system, cost of capital, loss of power, additional expenses in the use of existing power facilities, or claims against the purchaser or user by its customers resulting from the use of the information and descriptions contained herein.

1.3 Safety Precautions

All safety codes, safety standards, and /or regulations must be strictly observed in the installation, operation, and maintenance of this devise.



CAUTION

COMPLETELY READ AND UNDERSTAND THE MATERIAL PRESENTED IN THIS DOCUMENT BEFORE ATTEMPTING INSTALLATION, OPERATION, OR APPLICATION OF THE EQUIPMENT. IN ADDITION, ONLY QUALIFIED PERSONS SHOULD BE PERMITTED TO PERFORM ANY WORK ASSOCIATED WITH THIS EQUIPMENT. ANY WIRING INSTRUCTIONS PRESENTED IN THIS DOCUMENT MUST BE FOLLOWED PRECISELY. FAILURE TO DO SO COULD CAUSE PERMANENT EQUIPMENT DAMAGE.

1.4 Product Overview

FPSC controller is a comprehensive, multi-functions digital display, electrical driven fire pump controller. It is designed to meet the needs of markets worldwide. It fully complies to AS2941-2008 and NFPA-20.

1.5 AS2491-2008 Requirements

A fire pump controller must start the fire pump in response to an external starting signal which is normally pressure-setting of a pressure switch plumbed into piping works.

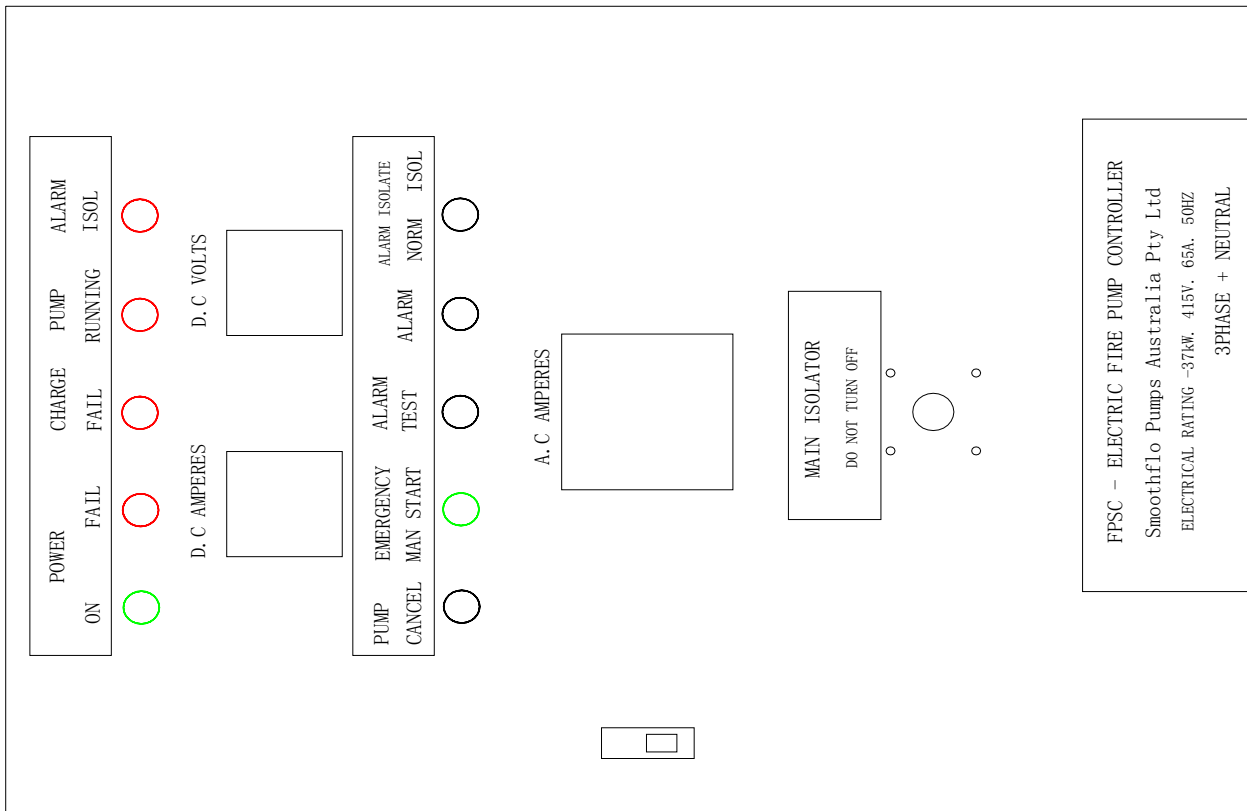
Once started, the pump must continue to run until it is manually stopped.

2. FEATURES

- 2.1 The whole range offers STAR-DELTA start and large bright digital displays.
- 2.2 Automatically senses the sequence of phases and validates each phase.
- 2.3 The start cycle function consists of 3 AC contacts and a time relay. The ramp-up time can be adjusted up to 30 seconds though (KT or timed relay) in the control panel.

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- 2.4 All Contactors and battery charging Functions are 240V AC.
- 2.5 User interface e.g. indicators, buzzer, ammeter and voltmeter are all stepped down to 12V DC.
- 2.6 Onboard and instant DC ammeter and voltmeter allow for real time monitoring of current and voltage on the 12V DC battery charging circuit.
- 2.7 AC voltmeter provides instant and accurate voltage display as supplied to the electric motor.
- 2.8 Motor overload-alarm function. The ammeter provides the overload current setting. Once the motor is overloaded, the overload indicator light will be on and generates alarm conditions.
- 2.9 All Charging functions are closely monitored by the control panel, Audible alarms and fault warnings are displayed when charging is deemed faulty.



3. FUNCTIONS AND OPERATIONS

3.1 Start And Stop For Fire Pump

- 3.1.1 **Manual Start and Stop:** use the EMERGENCY MAN START button and PUMP CANCEL button to start and stop the pump manually.
- 3.1.2 **Automatic Start:** Terminals #1 and #2 receive a start signal from the pressure switch located in the piping system. When auto start occurs the pump will run until manual stopped.

3.2 Start and stop for Jacking pump

- 3.2.1 The jacking pump can be overridden on the control panel by using the 3 position switch MANUAL, OFF and AUTO.
- 3.2.2 Manual Start and Stop: Use MANUAL and OFF to operate jacking pump manually.

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3.2.3 Automatic start and stop: Terminals #11 and #12 are used to connect a signal line between controller and the pressure switch mounted on the jacking pump. The jacking pump will now be controlled by the system pressure.

3.3 Indicators, Alarms and buttons

3.3.1 Alarm Indicator Light – RED

3.3.1.1 Alarm indicator is an audible and visual indicator.

3.3.1.2 65 to 105dba sound output from alarm.

3.3.1.3 When the Alarm switch is in ALARM NORM position, fault alarms are audible. When the switch is in the ALARM ISOL position, fault alarms are muted and ALARM ISOL indicator light will be on.

3.3.1.4 Alarm conditions:

3.3.1.4.1 AC Power Supply Fail;

3.3.1.4.2 Fire Pump Running;

3.3.1.4.3 Battery charger fail;

3.3.1.4.4 Motor overload;

3.3.2 Power supply – GREEN: This light includes 3 phases of power. If there is a lack of phase, this indicator light will extinguish and simultaneously generate the alarm.

3.3.3 Power failure – RED: When the power has the fault of phases or incorrect sequence of phases, the light will be on (the green light for power supply is off) and simultaneously generate the alarm.

3.3.4 Pump running – RED: When the pump starts, this light will be on and simultaneously generate the alarm.

3.3.5 Battery charger fail – RED: If the battery charger failed, this light will be on and simultaneously generate the alarm. The reasons of battery charger failure: power supply to the charger failed or charger self failure. The controller will judge whether or not there is charger failure by check the output current and volt of the charger through DC ammeter and DC voltmeter. If the current is less than 0.1A, the controller will deem there is charger failure. If the volts measured by Voltmeter is lower than 10.5V, the controller will deem there is charger failure as well.

3.3.6 Emergency man start – GREEN: By pressing this button, the pump starts and the light of Pump RUNNING is on and simultaneously generates the alarm.

3.3.7 Pump cancel – by pressing this button, the pump stops. And the controller will automatically reset to original standby mode by releasing button.

3.3.8 Alarm test button: by pressing this button, all lights on facial board will be on and alarm will be activated.

3.3.9 Jacking Pump switch- Refer to above instructions.

3.3.10 Main isolator switch- This switch is used to turn on and turn off the 415V AC power.

4. TROUBLESHOOTING FOR POWER FAIL

Check the followings if the indicator light for Power Fail is on after connecting 415v ac power:

4.1 Check whether or not the indicator light on RELAY OF PHASE PROTECTOR is on.

4.2 Check out if there is power supply from switchboard;

4.3 Check out if there is a lack of phases from switchboard. The motor can be burnt if running motor under the lack of phases.

4.4 The sequence of phases is not matched. Refer to the following troubleshooting.

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5. TROUBLESHOOTING FOR WRONG MATCHING ON THE SEQUENCE OF THE PHASES

- 5.1 If the sequence of phases on the power supply does not match the sequence of phases in the controller, the indicator light on relay of phase protector will extinguish. And also the **GREEN** indicator light of AC POWE-ON will extinguish and **RED** indicator lights of AC POWER-FAIL will be on and simultaneously generate the alarm
- 5.2 **Normal Rotating Direction:** the rotating direction of DIN/ISO end-suction pumps is anti-clockwise viewing from pump end. The sequence of phases in controller has set up to suit above rotating direction. After connecting the controller to switchboard, if the sequences of phases can't be matched, **the electrician should immediately swap the positions of two wires in the cable from switchboard to match the controller.**
- 5.3 If the sequence of phases is not matched each, the motor still can start but will rotate in opposite direction.
- 5.4 The battery charger still has power supply and charge the battery.
- 5.5 **RECTIFY THE SEQUENCE OF PHASES IN CONTROLLER: IN CASE** of wrong sequence of phases in controller, it is simple to rectify the sequence. There are 3 wires connected on the relay of phase protector. Swapping any 2 wires will fix the problem. **STEPS:** 1/ release two locking latches on the sides of the RELAY OF PHASE PROTECTOR; 2/ pull out the relay of phase protector from the base; 3/ after swapping any two wires, the sequence of phases in the controller will be changed.

6. INSTALLATION AND ELECTRICAL CONNECTIONS

6.1 Mounting

Carefully unpack the controller and inspect thoroughly.

FPSC type of controllers is designed for wall-mounting or stand mounting. NOTE the controller is not free standing and must be bolted securely to a wall or a stand. The weight is about 30KG.

6.2 Electrical Connections

NOTICE

ALL CABLE ENTRIES MUST ENTER VIA THE BOTTOM OF THE CABINET. DRILLING OR INSTALLING CONDUIT ON THE TOP OF CONTROLLER BOX WILL VOID WARRANTY.

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 the controllers should be a minimum of 300mm above floor.

Prior to starting, verify all data on the nameplate such as battery voltage, AC line voltage.


Inspect all electrical connections, components, and wiring for any visible damage. Correct if necessary. Ensure that all electrical connections are tightened before operation.

Refer to the appropriate field connection drawings provided with this manual, for all wiring information pertaining to the incoming AC power supply, batteries and motor wirings.

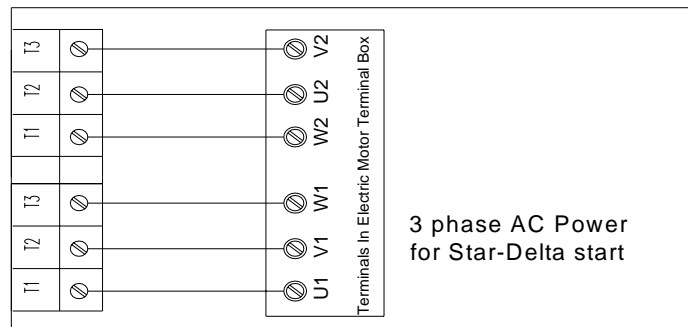
All terminals are numbered.

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TERMINALS FOR EXTERNAL WIRING CONNECTIONS

| | | | |
|----|---|---|--|
| E | ⊗ | | Earth |
| 10 | ⊗ | | Volt-Free Contacts for remote connection for POWE FAIL |
| 9 | ⊗ | | |
| 8 | ⊗ | | |
| 7 | ⊗ | | Volt-Free Contacts for remote connection for PUMP RUNNING |
| 6 | ⊗ | | |
| 5 | ⊗ | + | 12V connects to remote alarm. |
| 4 | ⊗ | - | |
| 3 | ⊗ | + | 12V connects to battery. |
| 2 | ⊗ | - | |
| E | ⊗ | | Earth |
| 1 | ⊗ | |  Pressure Switch 240V Connects to Pressure Switch on System Pipeworks |
| 14 | ⊗ | | |
| 13 | ⊗ | | N 240V connects to the motor of jacking pump L |
| 12 | ⊗ | | |
| 11 | ⊗ | | L 240V connects to pressure switch on jacking pump L |
| 10 | ⊗ | | |
| N | ⊗ | | Neutral |
| A | ⊗ | | Active |
| B | ⊗ | | Active |
| C | ⊗ | | Active |
| E | ⊗ | | Earth |

3 phase power input from switchboard



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WIRING DIAGRAM

