



Operation Manual for LPC/EN12845
Diesel Engine Driven Fire Pump Controller
Type H100-840
Version 1.0, July 2022

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General

This controller is designed for the starting and stopping of one diesel engine driven fire pump in accordance to EN12845, LPS1236 and LPC TB210. The controller is based around two electronic modules. One is the door mounted which is complete with an integral keyboard and graphic LCD (liquid crystal display). The other electronic module is a purpose designed interface module which is mounted on the gear tray and collects all the appropriate inputs signals and derives all the outputs at the correct voltage and power levels, this board also contains the power supply for the door mounted unit.

Note: the module on the gear tray contains mains voltage. Before examining this board the mains supply should be fully isolated first.

Before the controller is operated for the first time, it is strongly suggested that the controller rating label is checked against the actual site conditions. For example, confirm that the site batteries match the controller rating voltage (correct voltage and type, eg Lead acid or NICAD.)

If the controller is to be stored prior to installation, then it should be stored vertically and in a dry place. Preferably it should be stored under cover in a dust free environment. If the controller is to be stored for greater than four weeks then action should be taken to avoid the build-up of moisture inside, such as a temporary anti-condensation heater.

When lifting the controller, the appropriate lifting equipment must be used. Before lifting ensure that the weight of the controller is well within the capabilities of the lifting equipment. The controller should be lifted by using appropriate slings, lifting eyes and straps or lifting eyes if the controller has these fitted.

Every care has been taken during the design and testing stage to ensure that this controller will operate reliably within the intended environment. However, certain measures should be taken on site to help reduce installation issues. For example, all input signal cables should be installed in dedicated conduit, well away from noisy electrical and power cabling.

The entirety of this manual should be read before the controller is first switched on. Please call Harrijess Ltd for advice if you have any doubts regarding the suitability of this product for the intended installation or if you have any questions regarding the operation and function of this controller.

Note: The engine batteries should only be used for powering this control panel and for starting the engine. Other auxiliary parts and modules should not be powered from the engine batteries.

Mounting and Connections

This control panel should be mounted as close as possible to the pump and engine it is controlling and it should be visible for any user working around it. The control panel can be mounted on the wall or over metallic supports. If it is to be mounted on the engine skid, then suitable anti-vibration mounts should be used. If possible, it should be mounted away from overhead water pipes and potential water leaks.

All the electrical connections must comply with the local and national codes and regulations.

We recommend that the control wires are 1.5 mm² cross sectional wires.

The mains power lines should be 6mm² cross sectional wires.

While the connections are being made to the controller, ensure that the AC isolator is turned off, and that the isolator switch on the relay board is also turned off.

Switch on

To energise the controller, all internal circuit breakers should be turned on, the relay board isolator switch should be turned on, and then with the door closed, the AC isolator should be switched on.

The display and indicators should now light up as appropriate.

Display

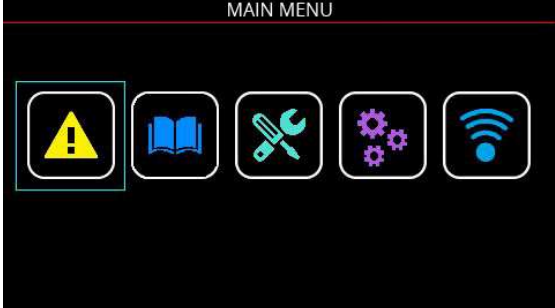
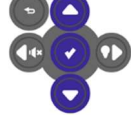
The LCD display has various modes of operation.

	○ Menu and screen navigation ○ Modification of values
	○ Exit ○ Cancel
	○ Select ○ Accept
	○ Menu entry from main screen

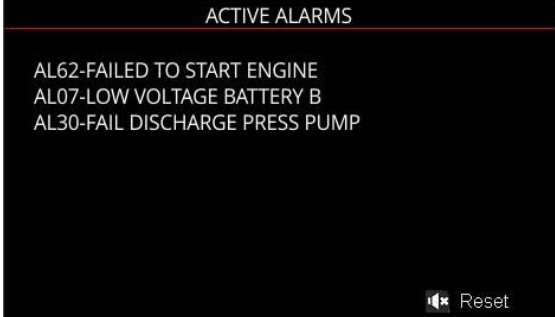
Main System Page

	Top bar; • Mode of operation of the control panel • Date and time: Day week YYYY/MM/DD hh:mm:ss • Ambient temperature recorded in the pump room Battery Zone; • Mains voltage and frequency. • Condition of battery chargers. • Charger failure (yellow icon) • States: TEST / EQUALIZATION • Battery voltage A /B instantaneous. • Instantaneous A/B load current. • Hours until next battery equalisation. • State of the batteries • Battery failure (yellow icon) Pump Zone; • Origin of the demand for start-up • Pump pressure switch • Remote start • Condition of the pump • stop • starting a, b, a+b • pause • stopping • engine running • pump running generating pressure • Accumulated engine running hours and minutes • Number of starts Instrument Zone; • Engine speed Bottom Bar; • Yellow pop-up bar indicating that an alarm is active • In the case of several active alarms, they shall be displayed alternately with 1s intervals between them.
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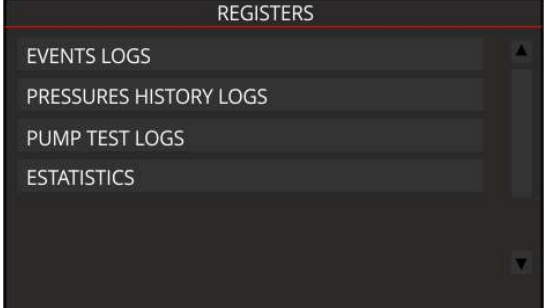
Main Menu

	From the MAIN SCREEN by pressing any of the following push-buttons:  • Latest alarms • Registers • Maintenance • Configuration • WIFI
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Last Alarms

	From the main menu select  This screen shows a list of the last alarms that have occurred. Alarms may be reset by pressing the "horn off" key on this screen as on the main screen.
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Active Alarms

	From the main menu select  This screen shows, in different sections, all the information registered and gives access to the corresponding document downloads.
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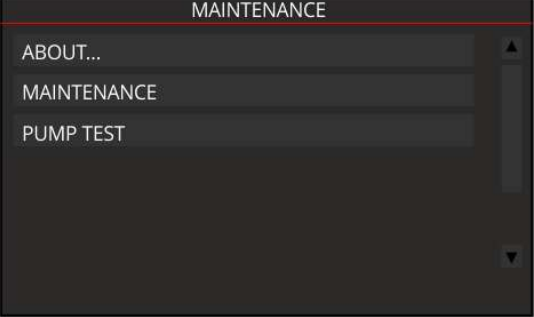
Statistics

	Total accumulated pump running time (hours and minutes) Number of engine starts Date and time of last start-up of the motor-pump assembly
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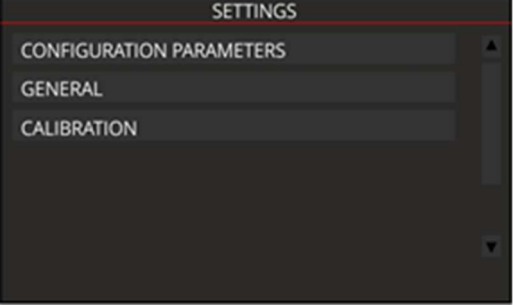
Events

	The H100-840 control panel stores the log of the last 1200 events indexed by date and time: hh:mm:ss of occurrence. The last 200 are displayed. All 1200 are viewable from the embedded web.
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Maintenance

	From the main menu select  This screen shows the utilities focused on the technical maintenance personnel of the engine pump assembly.
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Configuration

	From the main menu select  This screen provides access to the configuration of the different parameters to adapt the control panel to the different possible conditions of each installation. Configurable parameters , General configuration Calibration
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Off mode

In OFF mode, the engine will not start. All automatic start inputs are deactivated and the manual start push buttons are not available.

If the engine is running when the OFF mode is selected, then it will be shutdown.

All other alarms, such as low engine temperature and engine heater tripped work as normal.

Off mode should be selected when making changes to the controller's settings.

MAN mode

Note: Before running the engine for the first time, complete the diesel engine pre-checks as described by the manufacturer. Also ensure that the water pipe valves are in the correct position.

In manual mode, the operator can start and stop the engine manually. In this mode the automatic start inputs are disabled.



To crank the engine via battery A, press and hold: **START A**, release when the engine starts.

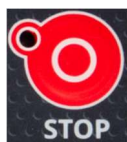


To crank the engine via battery B, press and hold: **START B**, release when the engine starts.

When the engine runs,

CAUSE / STATUS	EFFECT
LCD	Shows Running & RPM
Volt free	Engine running
LED	Red indicator lit (pumping)
Alarm	Silent

A few seconds after the engine has started, the "Engine monitor" green indicator will be lit. At this time the "Low oil pressure" and "High water temperature" inputs are active.



To stop the engine, briefly press **STOP**.

The controller will energise the stop solenoid, show “STOP PUMP” on the screen, and show a count down timer in the pump icon. Until this timer is finished the engine cannot be restarted.

Note:

The engine cannot be stopped in automatic mode if there is a start signal present, ie pump on demand. If the engine is needed to stop due to an emergency while there is a demand, then the controller should be put into OFF mode.

Automatic mode

In this mode, the start inputs are active. These are the remote start and pressure switch inputs.

If either of these inputs are activated then the crank sequence is initiated until the engine is started. If the engine does not start then the full crank sequence will continue until the failed to start alarm is raised.

CAUSE / STATUS	EFFECT
Pressure switch or remote start activated	Pump on demand
LCD	Shows which input is activated
LED	Pump on demand, red
Crank sequence begins	Crank A (Starting – A, shown on screen)
	Rest
	Crank B (Starting – B, shown on screen)
	Rest
	Crank A (Starting – A, shown on screen)
	Rest
	Crank B (Starting – B, shown on screen)
	Rest
	Crank A (Starting – A, shown on screen)
	Rest
	Crank B (Starting – B, shown on screen)
Crank sequence completed	
LCD	Failed to start
LED	Failed to start, red
Volt free	Failed to start
Push button	Start Test pb active, and lit
Further automatic starting is disabled	
Press 	To reset ** Must be in OFF mode to reset
Or press manual start test	Activates crank sequence again

Notes:

The crank sequence can only be stopped once initiated, by pressing the OFF mode push button.

If either battery fails at any time during the above crank sequence, then the remaining crank attempts will be all from the other battery.

If both batteries have failed, then all remaining crank attempts will be from both batteries.

The first crank attempt is always from battery A when the crank sequence is initiated from either the pressure switch or the remote start input.



Start test

This button will only work when the control panel is in AUTO mode and the red manual start test light is on. The led light will come up after an automatic start of the pump followed by a manual stop or after six automatic crank attempts (Failed to start).

When this push button is pressed, the automatic crank sequence will begin. The crank sequence will always begin with battery B from a test start.

Once the manual start test is completed the circuit will be deactivated automatically and the blue led light will go off.

Alarms

One of the basic functions of this controller is to monitor and protect the diesel engine fire pump and its water supply. These tasks are achieved by permanently monitoring the electrical, mechanical and hydraulic variables, and by taking the necessary actions against any given alarm.

Any alarm will:

Trigger the display to automatically change to the “Active Alarms” page.

ALARM 

The yellow Alarm indicator will also be lit.

Alarm buzzer will be activated

Common fault volt free contacts will change over.

To reset an alarm, press the  push button. If the fault is still present, then the buzzer will be silenced. If the fault has been cleared, then the alarm condition will be cleared. See cause and effect chart for a full list of alarms.

Note: You must be on the Active alarms page to reset an alarm.

Emergency Start

The emergency start push button is designed to crank the engine in the event of a total electronics failure of the modules. To operate, first the cover should be broken and then the push button pressed and held until the engine runs. The push button will directly connect both batteries to the starter motor.

Cause and Effect Chart

Function	Indication	Activates Alarm	Activates auto start	Activates Common Alarm	Prevents autostart	Dedicated volt free	Reset to clear	AL	Comment
Battery A, OK	LED	Yes, if failed		Yes, if failed			Yes	06 35	If battery <12v >15 minutes If battery <8v >0.5s during cranking
Battery B, OK	LED	Yes, if failed		Yes, if failed			Yes	07 36	If battery <12v >15 minutes If battery <8v >0.5s during cranking
Charger A Healthy	LED	Yes, if failed		Yes, if failed					
Charger B Healthy	LED			Yes, if failed					
Mains Supply on	LED	Yes, if failed		Yes, if failed		Yes		01	
Alarms in Service	LED								
Not in Auto	LED				Yes	Yes			
Off Mode	LED				Yes				
Manual mode	LED				Yes				
Auto mode	LED								
Engine Running	LED					Yes, 2			
Pump on demand	LED					Yes			
Low oil pressure	LCD	Yes		Yes			Yes	03	Active only after "engine monitor" is lit
High Water temperature	LCD	Yes		Yes				04	Active only after "engine monitor" is lit
Low fuel level	LCD	Yes		Yes				05	
Low engine temperature	LCD	YES		Yes				31	
Failed to start	LED	Yes		Yes	Yes	Yes	Yes	12	Must be in off mode to clear
Operate Test start	LED		Yes, if pressed						
Pressure switch input	LCD		Yes						Open to start
Remote start input	LCD		Yes						Close to start
Engine Heater tripped	LCD	Yes		Yes				10	
Alarms Active	LED								
High battery A voltage	LCD	Yes		Yes				33	>25% nominal
High battery B voltage	LCD	Yes		Yes				34	>25% nominal
Speed Switch fault	LCD	Yes		Yes				16	10s time delay
Starter coil failure	LCD	YES		Yes				30	>160 ohms on terms 9 & 10.
Engine overspeed	LCD	YES						02	>125% nominal speed

Battery Charging

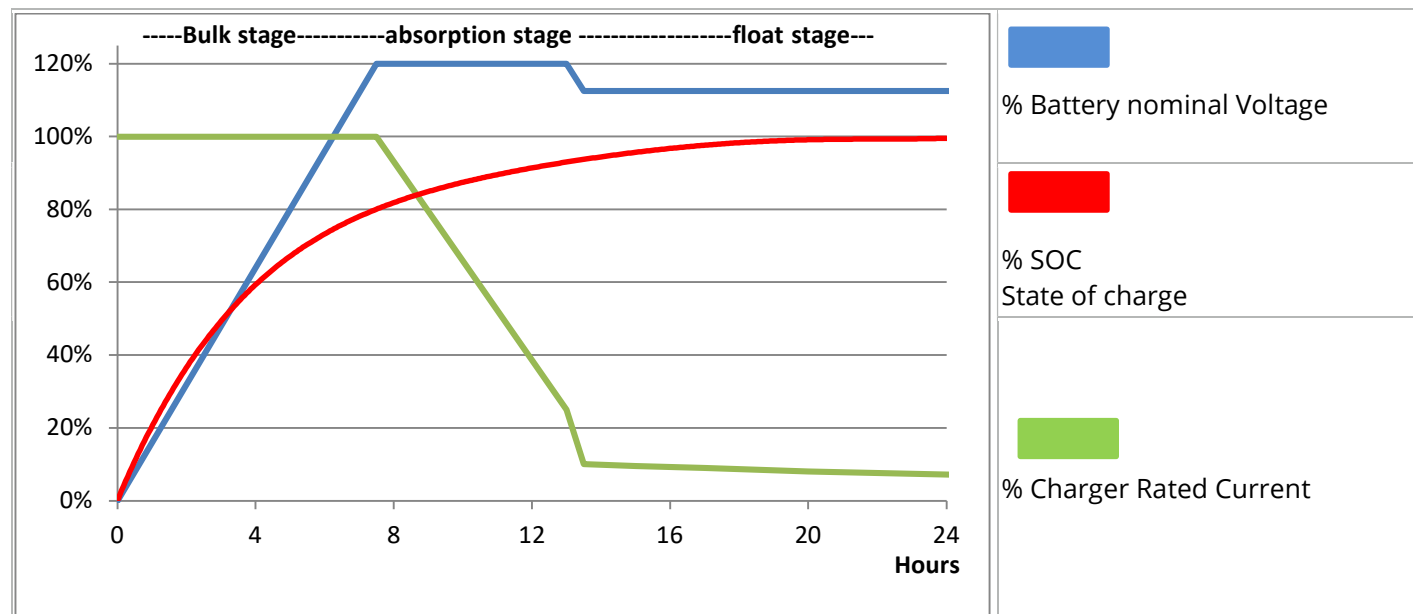
The SBB-(X) series of robust and highly efficient battery chargers and power supplies with high frequency switch mode technology.

As battery chargers the SBB-(X) are specially designed for emergency generators and engine driven fire pump starting batteries. Designed to be permanently connected to the battery they continuously monitor the status of batteries and always keep them in peak capacity. SBB-(X) battery chargers remain operational during the engine start process.

The battery charger includes four indicators mounted on its front plate:

ON	Green	Illuminated if the AC is present and with a battery >6v
Charging	Green	Stays Lit during the 1st charge phase: "Bulk" Blinking during the 2nd charge phase: "Absorption" Blinks every two seconds during the 3rd charge phase: "Float" If current exceeds 5% of the maximum output current Off if current does not exceed 5% of the maximum output current
Battery fault	Red	VBat out of range <12 V DC >15 V DC 12 V DC Batteries <24 V DC >30 V DC 24 V DC Batteries Signalling delay: 5 minutes
Equalization	Blue	Lit when Equalization mode is active

SBB-(X) provides a three stage battery charging system represented in the following graphic:



- Bulk stage:** SBB-(X) maintains maximum output current until the voltage on its output terminals reaches V_{nom}
- Absorption:** SBB-(X) maintains voltage control at V_{Boost} until the output current intensity to the battery drops below 25% of current maximum or after 6 hours
- Float:** SBB-(X) maintains voltage control in V_{Float} , limiting the current to a maximum of 10% maximum current.

SBB-(X) will start in charge phase 1 whenever it is connected to AC power, and the battery voltage is below 12v (or 24v on a 24v controller) for more than 30s.

If the AC mains is not going to be available for several days, then switch off circuit breaker Q1 to prevent the batteries from being completely discharged and possibly damaged.

Battery Monitoring

The controller continuously monitors the state of the batteries to ensure that they are ready to crank the engine when required.

If the battery voltage falls below the nominal level, for example 12v, for >15 minutes, then the appropriate battery OK indicator will not be lit. The light will automatically come back on when the charger rises the battery voltage back above this level.

If the battery voltage falls below around 8v during cranking, then the appropriate battery OK indicator will go off, the alarm will sound and the common fault free contacts will change over. All remaining cranks will be from the other battery as explained above. This condition must be manually reset when

the battery has been charged again above 6v. To reset the controller press the  push button whilst on the Active alarms page.

Every 5 minutes, the controller will check if the batteries are connected. On the Batteries page, during this test, the battery icon will show 'test' and the output current of the charger will switch off. If the battery voltage is low for three successive measurements (15 minutes total), then the appropriate battery OK indicator will go off, the alarm will sound and the common fault free contacts will change over.

Electrical Characteristics

Nominal battery voltage	12V DC or 24V DC depending on model
Power supply operating voltage	85V AC- 265V AC
Power supply operating frequency	47Hz-63 Hz.
Mains protection	to 1.5kV surge, 16A upstream MCB C or D curve
Nominal charge current	3.5A or 7A, depending upon model
Maximum battery voltage	35v DC
Engine crank outputs	10A rated
Engine stop output	25A rated
Volt free contacts	30v dc 0.3A rated

Recommended minimum cross-sectional area for the control wires	0.75mm
Maximum cross-sectional area for the control wires	2.5mm

Engine Maintenance

When performing maintenance on the engine, the controller should be first fully isolated. Please follow this procedure for isolation:

1. Turn off the mains supply at the controller, using the mains isolator
2. Turn off all circuit breakers inside the controller, Q1, Q2, & Q3
3. Disconnect the battery +ve connections from both batteries

The engine is now electrically safe to be worked on.

The following procedure should be used to energise the control panel:

1. Connect both battery +ve connections.
2. Turn on circuit breakers Q1, Q2 & Q3.
3. Turn on the mains supply via the controller isolator.
4. Ensure battery chargers are operating on the 'Batteries' screen.

Commissioning Guidance

The controller is fully tested and configured at Harrijess prior to despatch.

The following is a list of basic checks that should be carried out on site during commissioning

1. Energise the controller, by pressing the off mode push button while closing the internal circuit breakers Q1, Q2 & Q3. (Holding the off mode p.b at switch on will ensure the controller does not start the engine)
Note: the alarm will briefly sound periodically because the controller is not in auto mode.
2. Close the controller door and turn on the mains isolator.
3. Use the up and down arrow p.b's to the "Batteries" screen, and ensure that the chargers are producing an output current.
4. Confirm that the pump on demand indicator is off. If it is on, then check the pressure initiation board and pressure switches.
5. Confirm that there are no alarms on the controller and that it is in standby. (If an alarm is present, then use the up and down p.b's to navigate to the 'last alarms' screen to identify the fault.)
6. Confirm that the engine is ready to be started in accordance with the manufacturer's engine commissioning instructions.
7. Verify that the engine heater is powered up, if fitted.
8. Press the manual mode p.b
9. Press and hold the start A p.b until the engine runs. When the engine is running the controller will automatically go the 'Pump' screen.
 - a. Verify that the rpm value is correct.
 - b. On the 'Batteries' screen confirm that the charger A output is at maximum
 - c. Press the engine stop p.b
10. Repeat item 8, but for battery B.
11. Press the auto p.b and drop the water pressure to initiate the auto start sequence
 - a. Confirm that the engine starts
 - b. Confirm that the starter motor dis-engages and that the autostart sequence is terminated.
12. While the engine is running for greater than 10s,
 - a. Confirm that the low oil pressure alarm operates
 - b. Confirm that the high water temperature alarm operates
13. Stop the engine by pressing the stop p.b on the controller. After a brief period the 'operate test start' indicator will be lit.
14. Press the 'operate test start' p.b to initiate the autostart sequence and allow the engine to run.
15. Stop the engine by pressing the stop p.b on the controller, the controller should now be in standby.

Controller Maintenance

The controller is designed to be very low maintenance. It also monitors all essential internal circuits such as the battery chargers, engine heater supply, mains supply and the internal control boards. Should any fault occur then these will be annunciated on the LCD panel.

The weekly test should be followed. This test is important because it tests the essential circuits of the control panel as well as the pump and diesel engine. For example, it checks the pressure switch and wiring, the pressure switch inputs, the crank sequence and both crank solenoid outputs along with the stop output.

Recommended Yearly Checks:

- Grease all locks and handles.
- Verify battery charger output voltage.
- Press lamp test p.b and ensure all indicators are lit.
- Examine controller door gasketing for any deterioration.

Revision Notes

Revision 1.0, Initial release.