LAT GENERATING SET
OPERATORS' HANDBOOK

ORIGINIAL INSTRUCTIONS

P027-10628
Abbreviations
The following are the abbreviations used in Lister Petter Power Systems operators’ handbooks.

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>alternating current</td>
</tr>
<tr>
<td>ASU</td>
<td>automatic control module</td>
</tr>
<tr>
<td>BC</td>
<td>battery charger</td>
</tr>
<tr>
<td>CCS</td>
<td>manual contactor switch</td>
</tr>
<tr>
<td>CT1</td>
<td>current transformers</td>
</tr>
<tr>
<td>DC</td>
<td>direct current</td>
</tr>
<tr>
<td>DCCB</td>
<td>DC circuit breaker</td>
</tr>
<tr>
<td>DCS</td>
<td>DC control switch</td>
</tr>
<tr>
<td>EPB</td>
<td>emergency stop pushbutton</td>
</tr>
<tr>
<td>ETS</td>
<td>engine temperature switch</td>
</tr>
<tr>
<td>ETX</td>
<td>engine temperature sender</td>
</tr>
<tr>
<td>F1</td>
<td>fuses</td>
</tr>
<tr>
<td>FCS</td>
<td>fuel control solenoid</td>
</tr>
<tr>
<td>LED</td>
<td>light-emitting diode</td>
</tr>
<tr>
<td>MC</td>
<td>mains contactor</td>
</tr>
<tr>
<td>MCB</td>
<td>AC circuit breaker</td>
</tr>
<tr>
<td>MOL</td>
<td>mains-on-load lamp</td>
</tr>
<tr>
<td>OPS</td>
<td>oil pressure switch</td>
</tr>
<tr>
<td>OPX</td>
<td>oil pressure sender</td>
</tr>
<tr>
<td>PC</td>
<td>plant contactor</td>
</tr>
<tr>
<td>POL</td>
<td>plant-on-load lamp</td>
</tr>
<tr>
<td>SB</td>
<td>starter battery</td>
</tr>
<tr>
<td>SM</td>
<td>starter motor</td>
</tr>
<tr>
<td>SS</td>
<td>starter solenoid</td>
</tr>
</tbody>
</table>

Statement of Indemnity
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# MODEL DESIGNATION

<table>
<thead>
<tr>
<th>Genset Model</th>
<th>Engine Type</th>
<th>Engine r/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAT8</td>
<td>TR1</td>
<td>1500/1800</td>
</tr>
<tr>
<td>LAT15</td>
<td>TR2</td>
<td>1500/1800</td>
</tr>
<tr>
<td>LAT24</td>
<td>TR3</td>
<td>1500/1800</td>
</tr>
</tbody>
</table>
1. INTRODUCTION AND PRECAUTIONS

This handbook covers the operation and routine maintenance of LAT generating sets powered by Lister Petter Power Systems TR series engines in the following versions:

• Electric Start;
• Automatic Mains Failure (AMF).

There is a separate handbook for the engine.

Some features and facilities of the generating set are specific to certain models, as indicated in the text. To determine the version of generating set that you are using refer to the serial number stamped on the nameplate and read section 1.1 Nameplates.

1.1 NAMEPLATES

There are nameplates on the generating set, engine and alternator. They tell you what each item or equipment can do. The generating set nameplate defines the performance of the complete generating set and its limits.

An example of a generating set serial number is:

11 12345 G TR2 22 6

which is interpreted as follows:

11 ...............Year of manufacture code
12345 .............Consecutive number of genset
G ...............Lister Petter Power Systems diesel genset
TR2 ..................Engine model
2 ..........Starting mode 2 (electric start)
2 .......... Electrical output mode 2 (3-phase, 4-wire, 50Hz)
6 ....................Lister Petter Power Systems alternator

For future reference write your genset serial number in the box below.

The engine nameplate defines the capabilities of the engine.

The alternator nameplate defines the maximum capabilities of the alternator at specific power ratings for the voltage, frequency, connection arrangement, ambient temperature and conditions shown.

Where there are differences between the nameplates, the generating set name plate data should be used.

1. T series LAT generating sets: acoustic set (left) and open set (right).
1.2. The ISO 8999 symbols used by Lister Petter Power Systems

the nameplates, the generating set nameplate data should be used.

1.2 SAFETY SYMBOLS
Take note of, and be familiar with, the ISO 8999 symbols used by Lister Petter Power Systems, shown in figure 1.2.

1.3 CAUTIONS AND WARNINGS
When a diesel engine is being serviced there are risks that must be avoided. If you do not take proper safety precautions you may be injured or killed, or the product may be damaged. Warning messages are used throughout this publication to alert you, as follows:

⚠️ CAUTION
This caution draws attention to special instructions or procedures which, if not correctly followed, can result in damage to, or destruction of, equipment.

⚠️ WARNING
A warning with this type of text draws attention to special instructions or procedures which, if not correctly followed, can result in personal injury.

⚠️ WARNING
A WARNING SYMBOL WITH THIS TYPE OF TEXT draws attention to special instructions or procedures which, if not correctly followed, can result in severe personal injury, or loss of life.

1.4 GENERAL PRECAUTIONS

⚠️ WARNING
Before your generating set can be used it must be correctly installed by qualified engineers. See Appendix: Installation and Commissioning.
**WARNING**

Untrained people must not start or operate any diesel generating set. It is dangerous. Operators must read and follow the instructions contained in this manual as well as the engine and alternator handbooks supplied.

Before the first start, and at regular intervals, check the fuel and lubricating oil levels. For full details refer to the Engine Operators’ Handbook.

When the Set is Running
- Wear ear defenders.
- Do **not** touch any electrical connections.
- Do **not** run the set with any covers or guards removed or damaged.
- Do **not** smoke near the generating set.
- Do **not** touch any part of the exhaust system.
- Do **not** breathe exhaust fumes.

When the Set is at Rest
- Do **not** touch the exhaust system immediately after the engine has stopped. It will still be very hot.
- Do **not** attempt any maintenance or adjustments unless you have the necessary knowledge and qualifications. See 8. Routine Maintenance and read the precautions in this chapter.
- Do **not** work on the set before disconnecting the starter battery. Always disconnect the negative terminal first, reconnect the negative terminal last and use insulated tools.
- If work is to be carried out inside control or contactor cubicles they **must** be isolated from both AC and DC supplies.

### 1.5 PREPARING THE BATTERY

If batteries are supplied they can be supplied ‘wet’ or dry-charged. Wet batteries need to be charged. Dry-charged batteries can normally be used for operation after filling with battery acid without initial charging.

**WARNING**

*Battery electrolyte is corrosive. Batteries must be handled with care, and protective clothing should be worn.*

Preparing a Dry-Charged Battery

The following procedure should be used to prepare a battery with factory-sealed charge.
1. Remove the vent plugs.
2. Fill the individual cells of the battery with sulphuric acid in accordance with VDE 0510 of density 1.280 kg/l (for tropical countries 1.230 kg/l) up to the maximum acid level mark, or 15 mm above upper edge of plates. The temperature of the battery and acid should be at least 10°C before filling.
3. Allow the batteries to stand for 20 minutes, tilt slightly several times and top up with acid to correct level if required.
4. Clean and dry the outside of the battery. Thinly coat the terminals with petroleum jelly and fit the vent plugs.
5. Clean the plant connections, thinly coat with petroleum jelly and connect the battery, making sure that the positive cable is connected to the positive terminal and the negative terminal cable to the negative terminal. If the battery does not provide an adequate starting performance then it must be charged.
Charging a Battery
1. Use a charge rate of approximately 6A. Discontinue the charging if the acid temperature exceeds 55°C. The battery is fully charged when the acid density and charging voltage have stopped rising for two hours.
2. After charging check the acid level and if required top up with distilled water to the maximum acid level mark, or 15 mm above the upper edge of the separators.
3. The battery should be checked within a week to ensure that the specific gravity is uniform throughout the battery and that no cell has a specific gravity below 1.280 kg/l. If this is not the case then the battery must be recharged as in steps 1. and 2. above.

Care of Batteries
- Never allow the battery to stand for long periods in the discharged state. Always recharge the battery promptly.
- Check the level of the battery acid at regular intervals and adjust by adding distilled or de-ionized water.

⚠️ CAUTION
Do not use impure water or so-called 'improving agents'.

- Keep the top of the battery clean and dry. Inspect the terminals, and if necessary clean them and coat them with petroleum jelly.
- Do not allow metal objects to short-circuit the cells. Take special care when using spanners near a battery.

⚠️ WARNING
Never allow battery cells to become short-circuited by metal objects. Severe burns and electric shock can result.

1.6 USING THIS HANDBOOK
Refer to the table of contents (page 3) to find the section you need.
It is recommended that the individual steps contained in the various maintenance or repair operations are followed in the sequence in which they appear.
When a diesel engine is operating or being overhauled there are a number of associated practices which may lead to personal injury or product damage. Your attention is drawn to the caution and warning messages used throughout this publication (section 1.3).
Work should be carried out only if the necessary hand and service tools are available. When the user has insufficient tools, experience or ability to carry out adjustments, maintenance or repairs, this work should not be attempted.
Where accurate measurements or torque values are required they can only be made using calibrated instruments.

⚠️ WARNING
Under no circumstances should makeshift tools or equipment be used as their use may adversely affect safe working procedures and operation.

1. Tropical rates apply to those countries or areas where the average temperature of any month of the year exceeds 27°C (80°F).
2. THE CONTROL MODULE

2.1 THE CONTROL MODULE

The control module is used to start and stop the engine, either manually or automatically and to indicate operational status and fault conditions. Front panel mounted push buttons provide Automatic, Manual, Start, Stop/Reset, Lamp Test and Display Scroll facilities. It monitors various engine and generator parameters. Under out of limit conditions it will either show a warning alarm or shut the engine down, indicated by a LCD symbol or LED display.
2.2 CONTROLS AND INDICATORS

Figure 2.1 Electric Start Control Module

Figure 2.2 Typical AMF Control Module
The LED display shows the selected parameter code and function as indicated by the icon.

<table>
<thead>
<tr>
<th>Code</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Automatic mode selection</td>
</tr>
<tr>
<td>2</td>
<td>Manual mode selection</td>
</tr>
<tr>
<td>3</td>
<td>Start under manual control</td>
</tr>
<tr>
<td>4</td>
<td>Stop/Reset - this will clear any alarm condition or stop the engine if it is running</td>
</tr>
<tr>
<td>5</td>
<td>Alarm mute/Lamp test button</td>
</tr>
<tr>
<td>6</td>
<td>Display scroll buttons - used to step through measured parameters</td>
</tr>
<tr>
<td>7</td>
<td>Generator available LED</td>
</tr>
<tr>
<td>8</td>
<td>Connect to load LED</td>
</tr>
<tr>
<td>9</td>
<td>Main Status LCD display</td>
</tr>
<tr>
<td>10</td>
<td>Configurable alarms indicators</td>
</tr>
<tr>
<td>11</td>
<td>Transfer to generator button</td>
</tr>
<tr>
<td>12</td>
<td>Open generator button (ES), transfer to mains (AMF)</td>
</tr>
<tr>
<td>13</td>
<td>Connect to mains (LED)</td>
</tr>
<tr>
<td>14</td>
<td>Test mode button</td>
</tr>
<tr>
<td>15</td>
<td>Mains available LED</td>
</tr>
</tbody>
</table>

2.3 VIEWING THE INSTRUMENTS

At power up, the display will show the software version and then show the default screen, which will display Generator Voltage. It is possible to scroll to display the different pages of information by repeatedly operating the next / previous page buttons.

The contents of each information page is shown below. Once selected the page will remain on the LCD display until the user selects a different page, or after an extended period of inactivity, the module will revert to the status display.

Metering:
- Engine Speed
- Oil Pressure
- Coolant Temperature
- Engine Battery Volts
- Run Time
- Number of Engine Starts
- Generator Voltage (ph-N)
- Generator Voltage (ph-ph)
- Generator Frequency
- Generator Current
- Generator Load
• Generator kVA
• Generator Power Factor
• Generator Load (kVAR)
• Generator Load (kWh, kVAh, kVArh)
• Generator Phase Sequence
• Mains Voltage (ph-N)
• Mains Voltage (ph-ph)
• Mains Frequency
• Events Log
Not all parameters are available on all of the control modules.

2.4 EVENT LOG
Press the left or right scroll button to gain access. Pressing the down button on this display will move to the previous event, the event log entry at position 1 being the most recent. On moving from the instrumentation to the event log the unit will display the most recent entry. A number in the bottom left indicates the event log entry currently displayed.

The number of event log entries varies on control modules. When the event log is displayed the icon in the alarm icon area indicates the alarm type at that position of the event log. The hours run at the time of the alarm shows in the instrumentation area. The bottom right icon indicates the current mode as normal.

Example of Auxiliary Input Shutdown Alarm (see Figure 2.4). Note display may vary depending on control module.

![Figure 2.4 Example of Auxiliary Input Shutdown Alarm](image)

**Controls**

**Stop / Reset**
This button places the module into its Stop/Reset mode. This will clear any alarm conditions for which the triggering criteria have been removed. If the engine is running and the module is in Stop mode, the module will automatically instruct the changeover device to unload the generator (‘Close Generator’ becomes inactive (if used)). The fuel supply de-energises and the engine comes to a standstill. Should a remote start signal be present while operating in this mode, a remote start will not occur.
### Manual
This mode allows manual control of the generator functions. Once in **Manual mode** the module will respond to the start button, start the engine, and run off load. If the engine is running off-load in the **Manual mode** and a **remote start signal** becomes present, the module will automatically instruct the changeover device to place the generator on load (**Close Generator** becomes active (if used)). Upon removal of the **remote start signal**, the generator remains on load until either selection of the **STOP/RESET** or **AUTO** modes.

### Auto
This button places the module into its **Automatic** mode. This mode allows the module to control the function of the generator automatically. The module will monitor the remote start input and mains supply status and once a start request is made, the set will be automatically started and placed on load.

Upon removal of the starting signal, the module will automatically transfer the load from the generator and shut the set down observing the stop delay timer and cooling timer as necessary. The module will then await the next start event.

### 2.4.1 TEST (DSE7x20 only)
This button places the module into its **Test** mode. This allows an on load test of the generator. Once in **Test mode** the module will respond to the start button, start the engine, and run on load.

### 2.4.2 START
This button is only active in **STOP/RESET** or **MANUAL** mode. Pressing this button in manual or test mode will start the engine and run off load (manual) or on load (test).

Pressing this button in **STOP/RESET** mode will turn on the CAN engine ECU (when correctly configured and fitted to a compatible engine ECU)

### Mute / Lamp Test
This button silences the audible alarm if it is sounding and illuminates all of the LEDs as a lamp test feature.

### Transfer to generator
Allows the operator to transfer the load to the generator (when in Manual mode only)

### Open generator (DSE7x20 only)
Allows the operator to open the generator (when in Manual mode only)

### Transfer to mains (DSE7x20 only)
Allows the operator to transfer the load to the mains (when in Manual mode only)

### Menu navigation
Used for navigating the instrumentation, event log and configuration screens. For further details, please see the more detailed description of these items elsewhere in this manual.
2.5 MODULE DISPLAY

The display is segmented into areas for instrumentation, units, alarm icons and various other icons.

<table>
<thead>
<tr>
<th>Inst. Icon</th>
<th>Instrumentation</th>
<th>Units</th>
<th>Alarm Icon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active config event index</td>
<td>Instrumentation</td>
<td>Units</td>
<td>Mode Icon</td>
</tr>
</tbody>
</table>

2.5.1 Display Example

This example shows Generator Volts as shown by the Generator symbol.

![Figure 2.5.1 Display Example](image)

2.5.2 Mode Icon

An icon is displayed in the mode icon area of the display to indicate what mode the unit is currently in.

<table>
<thead>
<tr>
<th>Icon</th>
<th>Graphic</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stopped</td>
<td>![Stopped Icon]</td>
<td>Appears when the engine is at rest and the unit is in stop mode.</td>
</tr>
<tr>
<td>Auto</td>
<td>![Auto Icon]</td>
<td>Appears when the engine is at rest and the unit is in auto mode.</td>
</tr>
<tr>
<td>Manual</td>
<td>![Manual Icon]</td>
<td>Appears when the engine is at rest and the unit is in manual mode.</td>
</tr>
<tr>
<td>Timer Animation</td>
<td>![Timer Icon]</td>
<td>Appears when a timer is active, for example cranking time, crank rest etc.</td>
</tr>
<tr>
<td>Running Animation</td>
<td>![Running Icon]</td>
<td>Appears when the engine is running, and all timers have expired, either on or off load. The animation rate is reduced when running in idle mode.</td>
</tr>
<tr>
<td>Front Panel Editor</td>
<td>![Front Panel Editor Icon]</td>
<td>Appears when the unit is in the front panel editor.</td>
</tr>
</tbody>
</table>
2.5.3 Auto Run Icon
When the engine is running in AUTO mode, an icon is displayed to indicate the reason for the set being run.

<table>
<thead>
<tr>
<th>Auto Run Reason</th>
<th>Icon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remote Start Input</td>
<td></td>
</tr>
<tr>
<td>Low battery run</td>
<td></td>
</tr>
<tr>
<td>Scheduled run</td>
<td></td>
</tr>
<tr>
<td>Mains failure (7x20 only)</td>
<td></td>
</tr>
</tbody>
</table>

2.5.4 Instrumentation Icons
When displaying instrumentation a small icon is displayed in the instrumentation icon area to indicate what value is currently being displayed.

<table>
<thead>
<tr>
<th>Icon</th>
<th>Graphic</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generator</td>
<td><img src="Generator.png" alt="Icon" /></td>
<td>Used for generator voltage and generator frequency</td>
</tr>
<tr>
<td>Mains</td>
<td><img src="Mains.png" alt="Icon" /></td>
<td>Used for mains voltages and mains frequency</td>
</tr>
<tr>
<td>Engine Speed</td>
<td><img src="EngineSpeed.png" alt="Icon" /></td>
<td>Engine speed instrumentation screen</td>
</tr>
<tr>
<td>Hours Run</td>
<td><img src="HoursRun.png" alt="Icon" /></td>
<td>Hours run instrumentation screen</td>
</tr>
<tr>
<td>Battery Voltage</td>
<td><img src="BatteryVoltage.png" alt="Icon" /></td>
<td>Battery voltage instrumentation screen</td>
</tr>
<tr>
<td>Engine Temperature</td>
<td><img src="EngineTemperature.png" alt="Icon" /></td>
<td>Coolant temperature instrumentation screen</td>
</tr>
<tr>
<td>Oil Pressure</td>
<td><img src="OilPressure.png" alt="Icon" /></td>
<td>Oil pressure instrumentation screen</td>
</tr>
<tr>
<td>Flexible sensor</td>
<td><img src="FlexibleSensor.png" alt="Icon" /></td>
<td>Flexible sensor instrumentation screen</td>
</tr>
<tr>
<td>Event Log</td>
<td><img src="EventLog.png" alt="Icon" /></td>
<td>Appears when the event log is being displayed</td>
</tr>
<tr>
<td>Unit time</td>
<td><img src="UnitTime.png" alt="Icon" /></td>
<td>Current time held in the unit</td>
</tr>
<tr>
<td>Scheduler setting</td>
<td><img src="SchedulerSetting.png" alt="Icon" /></td>
<td>The current value of the scheduler run time and duration</td>
</tr>
<tr>
<td>Generator Current</td>
<td><img src="GeneratorCurrent.png" alt="Icon" /></td>
<td>Generator current instrumentation screen</td>
</tr>
</tbody>
</table>
2.6 PROTECTIONS
When an alarm is present the LCD display will jump from the ‘Information page’ to display the Alarm Page. In the event of a warning alarm, the LCD will display the appropriate icon. If a shutdown then occurs, the module will again display the appropriate icon, flashing.

2.7 WARNING ALARMS
Warnings are non-critical alarm conditions and do not affect the operation of the generator system, they serve to draw the operators attention to an undesirable condition.

In the event of an alarm the LCD will jump to the alarms page, and scroll through all active warnings and shutdowns. Warning alarms are self-resetting when the fault condition is removed.

<table>
<thead>
<tr>
<th>Display</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>⚡️</td>
<td>Battery High Voltage</td>
</tr>
<tr>
<td>⚡️</td>
<td>Battery Low Voltage</td>
</tr>
<tr>
<td>⚡️</td>
<td>Charge Alternator Failure</td>
</tr>
<tr>
<td>⚡️</td>
<td>Digital Input A-D</td>
</tr>
<tr>
<td>⚡️</td>
<td>Analogue Input A-C</td>
</tr>
</tbody>
</table>
| ⚡️ | Fail to Stop | The module has detected a condition that indicates that the engine is running when it has been instructed to stop.  
**NOTE:** 'Fail to Stop' could indicate a faulty oil pressure sensor - If engine is at rest check oil sensor wiring and configuration. |
| ⚡️ | Generator High Voltage Warning | The generator output voltage has risen above the pre-set prealarm setting. |
| ⚡️ | Generator Low Voltage Warning | The generator output voltage has fallen below the pre-set prealarm setting after the Safety On timer has expired. |
| ⚡️ | High Coolant Temperature Warning | The module detects that the engine coolant temperature has exceeded the high engine temperature pre-alarm setting level after the Safety On timer has expired. |
The module detects that the engine oil pressure has fallen below the low oil pressure pre-alarm setting level after the Safety On timer has expired.

The module detects that the fuel level is below the configured setting.

The generator output frequency has risen above the pre-set prealarm setting.

The engine speed has risen above the overspeed pre alarm setting.

The generator output frequency has fallen below the pre-set prealarm setting after the Safety On timer has expired.

The engine speed has fallen below the underspeed pre alarm setting.

The flexible sensor warning alarm has been triggered.

Table: 2.8 SHUTDOWN ALARMS

<table>
<thead>
<tr>
<th>Display</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Digital Input A-D" /></td>
<td>Auxiliary Digital inputs can be user configured as Digital inputs and will display the relevant icon.</td>
</tr>
<tr>
<td><img src="image" alt="Analogue Input A-C" /></td>
<td>Auxiliary Analogue inputs can be user configured as Digital inputs and will display the relevant icon.</td>
</tr>
<tr>
<td><img src="image" alt="Emergency Stop" /></td>
<td>The emergency stop button has been depressed. This is a failsafe (normally closed to battery negative) input and will immediately stop the set should the signal be removed. <strong>NOTE:</strong> The Emergency Stop Negative signal must be present otherwise the unit will shutdown.</td>
</tr>
<tr>
<td><img src="image" alt="Fail to Start" /></td>
<td>The engine has not fired after the preset number of start attempts.</td>
</tr>
<tr>
<td><img src="image" alt="Generator High Voltage Shutdown" /></td>
<td>The generator output voltage has risen above the preset level.</td>
</tr>
<tr>
<td><img src="image" alt="Generator Low Voltage Shutdown" /></td>
<td>The generator output voltage has fallen below the preset level.</td>
</tr>
<tr>
<td><img src="image" alt="High Coolant Temperature Shutdown" /></td>
<td>The module detects that the engine coolant temperature has exceeded the high engine temperature shutdown setting after the Safety On timer has expired.</td>
</tr>
</tbody>
</table>
### Fault Conditions

<table>
<thead>
<tr>
<th>Icon</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>🏛️</td>
<td>Low Oil Pressure Shutdown</td>
<td>The engine oil pressure has fallen below the low oil pressure trip setting level after the Safety On timer has expired.</td>
</tr>
<tr>
<td>🍃</td>
<td>Low Fuel Level</td>
<td>The module detects that the fuel level is below the configured setting.</td>
</tr>
<tr>
<td>🎯</td>
<td>Over Frequency Shutdown</td>
<td>The generator output frequency has risen above the preset level.</td>
</tr>
<tr>
<td>🏛️</td>
<td>Over Speed Shutdown</td>
<td>The engine speed has exceeded the pre-set trip.</td>
</tr>
<tr>
<td>🎯</td>
<td>Under Frequency Shutdown</td>
<td>The generator output frequency has fallen below the preset level.</td>
</tr>
<tr>
<td>🏛️</td>
<td>Under Speed Shutdown</td>
<td>The engine speed has fallen below the pre-set trip after the Safety On timer has expired.</td>
</tr>
<tr>
<td>🚂</td>
<td>Temperature Sensor Open Circuit</td>
<td>Temperature sensor has been detected as being open circuit.</td>
</tr>
<tr>
<td>🍃</td>
<td>Oil Pressure Sensor Open Circuit</td>
<td>Oil pressure sensor has been detected as being open circuit.</td>
</tr>
<tr>
<td>🚂</td>
<td>Flexible Sensor</td>
<td>The flexible sensor warning alarm has been triggered.</td>
</tr>
</tbody>
</table>

**Note:**

When the fault condition has been rectified press the stop/reset button to reset the module.
3. THE CONTROL SYSTEM

The generating set is governed by the control panel (Figure 3.1), the operation of which is described in 4. Electric Start Sets and 5. Automatic Mains Failure Sets. Automatic mains failure sets have an additional wall-mounted automatic transfer cubicle.

The principal element in the control system is the control module (Figure 2.1 or 2.2).

3.1 CONTROL SYSTEM FEATURES

The set-mounted control system features:
- Automatic engine control module
- Emergency stop button (open sets only)
- DC control switch
- DC circuit breaker
• 2-, 3- or 4-pole AC circuit breaker
• AC instrumentation protection fuses
• Current transformers
• Terminal connection points for the following remote input and output circuits:
  - Emergency stop
  - Common alarm
  - Control contact input
  - Load transfer signal
• Battery charger standard on AMF, optional on electric start.

3.2 THE CONTROL MODULE
The control module is used to start and stop the engine, either manually or automatically, and to indicate operational status and fault conditions. Instructions as to its specific use are given in the following two chapters.

3.2.1 Controls and Indicators
The controls and indicators are illustrated and labelled in Figure 3.1 and 3.2. In both electric start and automatic mains failure sets there is a choice between manual mode and automatic mode (refer to sections 4 & 5).
4. STANDARD ELECTRIC START SETS

4.1 FEATURES
Standard electric start sets have the following features:
• Set-mounted control system (see 3. The Control System).
• Lister Petter Power Systems air cooled engine, close coupled to a brushless alternator
• Fabricated steel base frame with anti-vibration mountings
• Starter battery and leads
• 12-volt starter motor and solenoid
• Fuel solenoid, energised to run
• Oil, air and fuel filters
• Fuel-lift pump
• Integral fuel tank (44 or 66 litre)
• Integral silencer

4.2 EMERGENCY STOP
An emergency stop button is fitted to the control cubicle on open sets. On housed sets, an emergency stop button is fitted externally on the housing. The operation of an emergency stop device will initiate a controlled shutdown.
Any attempt to restart the set will be prevented until the emergency stop device has been reset.

4.3 MANUAL CONTROL
This section describes the manual control and operation of the generating set.

4.3.1 Starting
1. Ensure the AC circuit breaker is in the off position before starting.
2. Turn the DC control switch to the on position.
3. Press the manual mode button on the control module. An LED indicator by the side of the button will illuminate.
4. Press the start button on the control module.
5. The generating set will start and run up to speed and voltage.
6. When the generator available LED illuminates the set can be connected to the load circuit by closing the AC circuit breaker (switching to on position).
Also press the Transfer to generator push button, this will illuminate the Transfer to load LED and the configurable alarm LED (Load Transfer). It is important that this is done as some functions of the Control module will not operate if it is not.

4.3.2 Monitoring
Electrical outputs and engine conditions can be monitored on the control module display by successive operation of the scroll button; see Figure 2.1 Control Module.

4.3.3 Stopping
1. Open the AC circuit breaker (switch to off) to disconnect the load circuits.
2. Press the stop button on the control module. The engine will shut down and come to rest.
3. If the generating set is not going to be used again for more than eight hours it is recommended that the DC control switch is turned to the off position.
4.3.4 Alarm and Fault Conditions
During the running period the engine control module monitors the set for the alarm and shutdown faults detailed in 2.6 Protections. A 12v DC signal for remote indication of an alarm can be taken across terminals B3(+) and B4(-).

4.3.5 AC Circuit Breaker Trip
If the AC circuit breaker trips, investigate and rectify the cause, then wait two minutes before re-closing it. The set will continue to run.

4.4 AUTOMATIC CONTROL
This section describes the automatic control and operation of the standard generating set.
A remote switch or contact has to be connected across terminals B5 and B6. The contact is arranged to close to start and run the set, and to open to stop it. A 12v DC signal for remote indication of plant available (load transfer) can be taken across terminals B7(+) and B8(-).

4.4.1 Starting
1. Turn the DC control switch to the on position.
2. Press the automatic mode button on the control module. An LED indicator by the side of the button will illuminate.
3. On closure of the remote contact and after a short delay the set will start and run up to speed and voltage.
4. When the set is ready, the generator available LED illuminates and the 12V DC signal becomes available at B7 and B8. At this point the load can be connected to the generating set.

4.4.2 Monitoring
Electrical outputs and engine conditions can be monitored on the control module display by successive operation of the scroll button; refer to Figure 2.1 Control Module.

4.4.3 Stopping
1. Disconnect the load from the generating set.
2. Open the remote contact.
3. After a one-minute cooling-down period the engine will shut down and come to rest.
4. If the generating set is not going to be used again for more than eight hours it is recommended that the DC control switch is turned to the off position.

4.4.4 Alarm and Fault Conditions
During the running period the engine control module monitors the set for the alarm and shutdown faults detailed in 2.6 Protections. A 12v DC signal for remote indication of an alarm can be taken across terminals B3(+) and B4(-).

4.4.5 AC Circuit Breaker Trip
If the AC circuit breaker trips, investigate and rectify the cause, then wait two minutes before re-closing it. The set will continue to run.

4.5 EMERGENCY HAND START
If you have purchased the hand start option with your electric start set, the following procedure should be followed to start the set by hand.
**WARNING**
Always use the correct Lister Petter Power Systems starting handle which has been designed for the engine. Ensure that there are no burrs on it and lightly oil that part of the engine which fits into the engine. **Do not attempt to start the engine if the starting handle is damaged or dirty.**

A non-limited kick-back handle, or limited kickback handle system may be fitted to the engine. The two types of handle are not interchangeable and care must be taken to ensure the correct handle is retained with the engine.

1. Disconnect the battery.
2. Ensure the AC circuit breaker is in the 'OFF' position.
3. Operate the fuel solenoid linkage by hand and fix this in position with the locking latch (see Figure 4.1).
4. Turn the DC control switch to the 'OFF' position.
5. Refer to the engine Operators Handbook for the hand starting procedure.

**WARNING**
Always completely remove the handle when the engine has fired.

6. Close the AC circuit breaker when the engine is up to speed, stable and the output voltage is correct.

**4.5.1 Stopping**
1. Switch the circuit breaker to the 'OFF' position.
2. Allow the set to run on no load for 1 minute to cool down.
3. Release the fuel solenoid locking latch. The arm should spring return to the 'STOP' position. The engine will now come to rest.

**CAUTION**
Under this mode the failure circuits are in-operative.
5. AUTOMATIC MAINS FAILURE SETS

5.1 FEATURES
Automatic Mains Failure (AMF) sets have the following features:
• Set-mounted control system with integral ATS. The features of the control system and the operation of the control module are described in 3. The Control System.
• Lister Petter Power Systems air cooled engine close-coupled to a brushless alternator
• Fabricated steel base frame with anti-vibration mountings
• Starter battery and leads
• 12-volt starter motor and solenoid
• Fuel solenoid, energised to run
• Oil, air and fuel filters
• Fuel-lift pump
• Integral fuel tank (44 or 66 litre)
• Integral silencer
• Battery charger (mains-operated, for battery maintenance)

5.1.1 Automatic Start and Transfer System
The integral automatic transfer system contains:
• Mechanically and electrically interlocked plant and mains contactors
• Plant-on-load and mains-on-load indicator lamps
• AC protection fuses
• Terminal blocks for power and auxiliary circuits

5.1.2 Emergency Stop
An emergency stop button is fitted to the control cubicle (open sets only). On housed sets, an emergency stop button is fitted externally on the housing.

Operation of the emergency stop button will initiate a controlled shutdown.
Any attempt to restart the set will be prevented until the emergency stop device has been reset.

5.2 AUTOMATIC OPERATION

WARNING
Automatic sets can start without warning. Keep clear of the set at all times.

1. Turn the DC control switch to the on position.
2. Press the automatic mode button on the control module. An LED indicator by the side of the button will illuminate.

5.2.1 Mains (Utility) Failure
On receipt of a mains failure condition there is a ten-second start delay. The engine preheat circuit is then energised for ten seconds (LPWT4 only) after which the set will start and run up to speed and voltage. When the set is ready the changeover contactor operates to isolate the mains (utilities) circuit and then transfers the load circuit on to the generator.
During this operation the mains-on-load lamp is extinguished and the plant-on-load lamp is illuminated.

5.2.2 Monitoring
Electrical outputs and engine conditions can be monitored on the control module display by successive operation of the scroll button; refer to 2.1 Control Module.
5.2.3 Mains (Utility) Returns
The mains (utility) supply must remain healthy for five minutes before the load circuit is transferred back to it from the set. At the end of this time the **plant-on-load lamp** is extinguished and the **mains-on-load lamp** is illuminated. The set will continue to run for a further one minute on no load to allow for engine cooling.

5.2.4 Alarm and Fault Conditions
During the running period the engine control module monitors the set for the alarm and shutdown faults detailed in 2.6 Protections.

5.2.5 AC Circuit Breaker Trip
If the AC circuit breaker trips, investigate and rectify the cause, then wait two minutes before re-closing it. The set will continue to run.

5.3 MANUAL OPERATION
5.3.1 Starting
1. Turn the **DC control switch** to the **on** position.
2. Press the **manual mode** button on the control module. An LED indicator by the side of the button will illuminate.
3. Press the **start** button on the control module.
On LPWT4 sets there will be a ten-second preheat period. The generating set will then start and run up to speed and voltage. It will automatically connect to the load circuit if the mains (utility) supply has failed. Otherwise it will run off-load.

5.3.2 Stopping
1. Press the **stop** button on the control module. The engine will shut down and come to rest.

5.3.3 Mains (Utility) Failure
If the mains (utility) supply fails while the set is under manual control, the set will connect automatically to the load circuit. On mains (utility) return, the set will continue to run on load until the **automatic mode** button is pressed. After a five-minute delay the load will then be transferred back to the mains supply. The set will continue running on no load for the one-minute cooling period. If the **stop** button on the control module is pressed before the mains returns, the set is immediately disconnected from the load and will shut down.

5.4 EMERGENCY HAND START
If you have purchased the hand start option with your A.M.F. set, the following procedure should be followed to start the set by hand.

⚠️ WARNING
*Always use the correct Lister Petter Power Systems starting handle which has been designed for the engine. Ensure that there are no burrs on it and lightly oil that part of the handle which fits into the engine. Do not attempt to start the engine if the starting handle is damaged or dirty.*

A non-limited kick-back handle, or limited kickback handle system may be fitted to the engine. The two types of handle are not interchangeable and care must be taken to ensure the correct handle is retained with the engine.
1. Disconnect the starter battery.
2. Ensure the contactor control switch in the contactor cubicle is in the 'AUTO' position.
3. Operate the fuel solenoid linkage by hand and fix this in position with the locking latch (see Figure 4.1).

**WARNING**
*Always completely remove the handle when the engine has fired.*

4. Turn the DC control switch to the 'OFF' position.

5. Refer to the engine Operators Handbook for the hand starting procedure.

### 5.4.1 Connecting to the Load

Once the generating set is up to speed, stable and the output voltage is correct, turn the plant contactor switch to the 'MANUAL' position, which will connect the generator to the load circuits.

### 5.4.2 Stopping

1. Return the contactor control switch to the 'AUTO' position.
2. Allow the set to run on no load for 1 minute to cool down.
3. Release the fuel solenoid locking latch. The arm should spring return to the 'STOP' position. The engine will now come to rest.

**WARNING**
*Battery electrolyte is corrosive and batteries should be handled with care. Do not splash electrolyte on your skin and wear protective clothing.*
6. HAND START SETS

6.1 FEATURES
Hand start sets have the following features:
- Lister Petter Power Systems air cooled engine close coupled to a brushless alternator.
- Fabricated steel base frame with anti-vibration mountings.
- Oil, air and fuel filters.
- Fuel lift pump.
- Integral fuel tank (8 hour run).
- Integral silencer.
- Starting handle.

6.2 HAND START CUBICLE
Set mounted cubicle containing:
- Combined digital voltmeter, ammeter, frequency meter and running hours recorder
- 2, 3 or 4 pole AC circuit breaker
- AC instrumentation protection fuses
- Current transformers.

6.3 HAND START SET OPERATION
A non-limited kick-back handle, or limited kickback handle system may be fitted to the engine.
The two types of handle are not interchangeable and care must be taken to ensure the correct handle is retained with the engine.
Before starting refer to the starting precautions in the engine operators' handbook.
1. Ensure the AC circuit breaker is in the 'OFF' position.
2. Refer to the engine Operators Handbook for the hand starting procedure.
3. Close the AC circuit breaker when the engine is up to speed, stable and the output voltage is correct.

6.3.1 Monitoring the Output of the Set
The multifunction meter provides indication of the voltage, current, frequency, power and time run. These are selected by four buttons marked I, V/Hz, P and E on the meter. LED annunciators in two columns and one row around the main display indicate which parameter is being displayed. Consecutive presses of the buttons show the following:
- I - line current - neutral current (3 phase) - current demand - maximum current demand
- V/Hz - phase voltage (3 phase) - line voltage - frequency
- P - power factor/time run (hours + minutes) - kW/kVA demand - kW/kVA maximum demand - kW/kVAR/kVA
- E - not used

6.3.2 Stopping
1. Switch the circuit breaker to the 'OFF' position.
2. Allow the set to run on no load for 1 minute to cool down.
3. Turn the engine control lever clockwise to the 'STOP' position and hold it there until the engine comes to rest.

⚠️ CAUTION
Never stop the engine by operating the decompressor lever or valve damage may occur.

Figure 6.1 Engine Control
7. LONG RUN SETS

7.1 FEATURES
Long run sets have the following standard features:
- Available in either Electric start and AMF control systems.
- Fabricated steel base frame with anti vibration mountings
- Lister-Petter air cooled engine close coupled to a brushless alternator
- 55 litre steel fabricated lube oil tank (in place of standard fuel tank)
- Starter battery and leads
- 12 volt starter motor and solenoid
- Inspection cover for lube tank for ease of access and cleaning
- Heavy duty fuel agglomerator
- Heavy Duty oil filter
- 7" Air Cleaner
- High Performance Oil bypass filter
- Bulk Head fittings for “external” fuel

7.2 LONG RUN SETS COMMISIONING

7.2.1
Ensure the 55 litre lube tank contains 20 litres of running oil.

Generator sets manufactured at Lister Petter Power Systems will come as standard with 20 litres of running oil.

If the set arrives without this oil then the following oil is recommended;
- Naturally aspirated engines: API CC or CD 15W40.

7.2.2
Connect a suitable fuel supply and run the leak-off back to tank.

7.2.3
Fill the cooling system with coolant
concentrate. A mix of 50% protects the system from damage and corrosion under all operating conditions. Ensure that the radiator level is full right up to and into the filler neck. Unless the cooling system is totally full the expansion bottle system will not operate correctly. The radiator is fitted with a twin seal closed system filler cap. Fill the expansion bottle to the level marked.

7.2.4
Connect the unit to a suitable load bank to ensure that the unit can operate at 75% of its rated load.

7.2.5
To ensure that the engine oil system is primed prior to starting the engine, motor the engine with the fuel control solenoid de-energised for 15 seconds. The engine may then be started.

7.2.6
Once the engine has obtained operating speed apply 75% load and run for 100hrs. This exercise is essential to ensure that the engine is run in prior to commissioning. It also necessary as this will reduce the future risk of problems linked to light-load running.

7.2.7
On completion of the 100 hrs:
• Drain the oil tank and then refill with 55 litres of new lubricating oil as specified in 1. above.
• Renew the engine-mounted oil filter. (The bypass filter element does not need replacing at this time.)
• Check the coolant level and top up if necessary.
• Check all connections to ensure the integrity of the system.

NOTE:
*Running hours (2000) are based on the following parameters:*

• Engine is maintained in good operational condition.
• Engine installation is correct and well ventilated.
• Oil consumption does not exceed 0.5% of the fuel consumption.
• Fuel is clean and to the correct specification, BSS2869 Class A1.
• Engine has an adequate supply of clean combustion air (in dusty operating conditions additional air filtration may be necessary).
• Average running load of the unit does not drop below 40% of its rated load.
8. ROUTINE MAINTENANCE

**WARNING**
Only qualified engineers should attempt any maintenance or adjustments. Refer to 1.2 Safety Symbols, 1.4 Safety Precautions and the equivalent sections of your engine Operators' Handbook.

**WARNING**
Do not work on the set before disconnecting the starter battery. Always disconnect the negative terminal first, reconnect the negative terminal last and use insulated tools.

8.1 GENERAL
On a regular basis, check and replenish if necessary:
- The fuel level;
- The lubricating oil level;

Refer to the engine Operators' Handbook, P027-08265, supplied with the set, for capacities and specifications.

8. DIESEL ENGINE
Refer to the Engine Operators' Handbook, P027-08265, supplied with the set, for details of routine maintenance to be carried out after prescribed periods.

8.3 ALTERNATOR
No routine maintenance by the user is required, nor should it be attempted. The alternator manufacturer's manual is provided for use only by specialised personnel employed to undertake maintenance work on the alternator.

8.4 BATTERY
To keep terminals and connections free from corrosion, coat with petroleum jelly or other suitable protective. Also refer to 1.5 Preparing the Battery.

**WARNING**
Battery electrolyte is corrosive and must not be splashed on your skin. Batteries must be handled with care, and protective clothing should be worn.

9. TROUBLESHOOTING

**WARNING**
Fault finding and rectification should be undertaken only by competent professional engineers.

9.1 DIESEL ENGINE
The engine Operators' Handbook supplied with the set suggests possible causes for the most common faults, for the guidance of specialised diesel engine maintenance engineers.

9.2 ALTERNATOR
The alternator manual supplied with the set suggests possible causes for the most common faults, for the guidance of specialised electrical engineers.

9.3 ELECTRICAL SYSTEM
In the case of a suspected fault employ a qualified professional electrical engineer to resolve the fault. The wiring diagrams supplied with this manual are for use only by specialised electrical engineers.
10. REPLACEMENT PARTS

10.1 SOURCE OF SUPPLY
When purchasing parts or giving instructions for repairs users should, in their own interests, always specify genuine parts and quote the part number, description of the part and the serial number.
Replacement parts are available from the worldwide network of Lister Petter Power Systems diesel gensets distributors. For the name and address of the distributor nearest to you, contact the manufacturer (see 10.5).
Always use genuine parts supplied by Lister Petter Power Systems through our distribution network.
Use of non-genuine parts can damage your set and invalidates the warranty.

⚠️ IMPORTANT
Your distributor will need to know the generating set type and serial number stamped on the generating set nameplate to ensure that the correct parts are supplied.

10.2 ENGINE PARTS
A Master Parts Manual, P027-08030, is available from Lister Petter Power Systems or your local distributor.

10.3 ALTERNATOR PARTS
Consult Lister Petter Power Systems (see 10.5).

10.4 Cubicle Parts
Consult Lister Petter Power Systems (see 10.5).

10.5 CONTACTING LISTER PETTER POWER SYSTEMS
We are confident that you will obtain excellent safe service from your generating set. To achieve this however it is important that the installation, commissioning and maintenance of the set is undertaken by relevant competent engineers. If in doubt consult your local Lister Petter Power Systems gensets distributor.
To obtain advice on any aspect of the ownership of your Lister Petter Power Systems diesel generating set please contact your local distributor or the manufacturer:

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Lister Petter Power Systems Limited
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TQ14 9FA
T: +44 (0) 1285 702211

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Lister Petter Power Systems Limited
Units 13-15 Quadrant Distribution Centre, Hardwicke, Gloucester
GL2 2RN

sales@listerpetter.com
www.listerpetter.com
APPENDIX 1
INSTALLATION AND COMMISSIONING

SITE INSTALLATION

⚠️ WARNING
All installation work should be undertaken by a competent professional engineer.

1. The generating set must be installed in a suitable building or enclosure. This is essential to attenuate noise; protect the generating set from the environment; and prevent unauthorised access. The enclosure must have sufficient and suitable means to provide air for combustion and cooling and to remove hot air and exhaust gases.

2. Foundations must be of solid construction (usually concrete), with adequate load-bearing capabilities. If in doubt, consult a structural engineer.

3. The base frame must be securely fixed to a level and solid foundation to limit vibration to the base frame and cubicle assemblies. Distortion of the fabricated base frame must not occur when tightening down the foundation bolts. Packing shims should be used to ensure there are no irregularities occurring between the base frame and the foundations.

4. Separate floor trenches must be provided for fuel pipework and cabling.

5. When the installation is indoors, ensure that combustion and cooling-air inlets and hot-air outlets are provided with adequate ventilation. Heat from the engine must be expelled from the building, otherwise the engine can become damaged due to overheating.

6. Exhaust fumes are dangerous. Ensure that the fumes are safely piped to the outside of the building.

⚠️ WARNING
Do not breathe exhaust gases as they contain carbon monoxide, a colourless, odourless and poisonous gas that can cause unconsciousness and death.

7. The bulk storage of fuel oil should be sited in outbuildings if possible.

8. Check that the fire precautions are adequate and that the installer provides appropriate warning notices to ensure the safety of all personnel regarding all aspects of generating set operation.

9. Only lift the set by means of the identified lifting points, using certified lifting equipment. Open and housed sets have forklift pockets. Housed sets also have a centre-point lift option.

⚠️ WARNING
Never attempt to lift the set by the engine or alternator lifting eyes.

WIRING AND COMMISSIONING

⚠️ WARNING
All wiring installation, connecting up and commissioning of the generating set should be carried out by a competent electrical engineer.
1. It is the responsibility of the installer to ensure that the generating set is adequately earthed to a low-resistance earthing rod or earth plate.

2. Ensure that the battery is fully charged and serviceable, and that the engine has the correct quantity of the correct lubricating oil (see the Engine Operators' Handbook).

3. Ensure that the battery connections are secure. Make the final battery connection only when everything is ready for the first start, connecting the negative battery terminal last.


APPENDIX 2: LIST OF DRAWINGS

Electric Start Sets
TR1/2/3 (open) ............................................................................................... 084-27447
TR1/2/3 (acoustic) ........................................................................................... 084-27448

Automatic Mains Failure (AMF) Sets
TR1/2/3 (open) ............................................................................................... 084-27452
TR1/2/3 (acoustic) ........................................................................................... 084-27453
California Proposition 65 Warning
Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

T SERIES LAT GENERATING SET OPERATORS’ HANDBOOK,
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