Architectural Solutions

INSTALLATION & MAINTENANCE

SA19/1P INVERTER CHARGER

Power failure back-up system for synchronous clock movements

Input voltage:	☐ 100-120V, 50/60Hz	☐ 200-240V, 50/60Hz
Output voltage:	☐ 100-120V	☐ 200-240V
Frequency:	☐ 50Hz	☐ 60Hz
Timekeeping:	☐ GPS signal	☐ Quartz

Issued by: ☐ John Smith & Sons ☐ William Potts & Sons ☐ J B Joyce & Co ☐ John Smith & Sons (Ireland)

See back page for contact details

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GENERAL DESCRIPTION OF OPERATION

The Automatic Permanent Inverter/Charger System is specifically designed to control up to four small synchronous clock motors and no other electrical device or equipment should ever be connected to the clock outputs.

The system internally generates a permanent pre-selected supply to accurately run the clocks. This voltage is derived from a 12 volt battery which when fully charged is capable of running four synchronous clock movements for up to 24 hours before requiring recharging.

The battery is constantly charged whenever the local mains supply voltage is available and has an expected life of 5 years (dependent on working temperature and humidity). During power outages, a battery control circuit ensures that the battery

voltage does not drop to a level which would cause inaccurate operation of the clock(s). To prevent this condition occurring and to protect the battery, the system also incorporates an auto-restart function which will switch off the Inverter and stop the clock(s) for 12 hours.

When the power is reinstated the battery will begin recharging and then, providing power is still on or the battery is sufficiently charged, will start the clock(s) exactly 12 hours from the point where they were originally stopped. This 12 hour auto-restart function can be switched to 24 hour mode if required. Therefore, if a lengthy power outage results in a discharged battery, the clock(s) will automatically stop and then restart again at the exact time showing on the dial(s) providing the power has been reinstated or if the battery has been charged sufficiently in the meantime.

All the above functions are controlled by the on-board computer, the memory of which also contains the currently available Daylight Savings dates. These enable the system to automatically make the necessary changes at the correct times each year. At these times the clock(s) will stop for the required time to effect the hour change.

The clock time and date are pre-programmed at the factory and under normal circumstances should not need resetting. However, if the need arises, please follow the instructions on page 6.

When the inverter is configured for GPS, in normal running mode and the output is on then the LED labeled GPS SYNC PULSE will flash once per second once the aerial has locked onto a GPS signal. The function of the GPS SYNC PULSE (accurately produced every second by the GPS aerial) is to ensure that only 50 cycles of the output voltage feeding the clock movements are generated every second. In the event of the GPS SYNC PULSE failing the inverter output is locked by a very accurate quartz based circuit.

Diagram 1a & 1b: satellite GPS aerial.

DO NOT TOUCH ANY CONTROLS WHEN THE CLOCK(S) HAVE BEEN SWITCHED OFF BY THE COMPUTER AS THE TIMING FUNCTIONS WILL RESTART THE CLOCK(S) AT THE CORRECT TIME

WARNING: High voltage on clock terminals. The Inverter Battery Switch (or fuse) and the external Isolator/Consumer unit switch MUST be switched off before any work is carried out on wiring or clocks connected to the Inverter/Charger outputs.

There is a green indicator by the clock output connectors to indicate when 110/230 volts is present on the clock connectors.

INSTALLATION

The Automatic Inverter/Charger System is intended for internal use only and must not be installed in any position where it will be subjected to extremes of temperature variation, such as exposed walls, window openings, direct sunlight etc.

The electrical outputs on this system are specifically designed for the functions stated below and no other electrical systems or non-specified apparatus should be connected to them.

Failure to comply with the specifications can result in permanent damage to the Inverter/Charger System.

NOTE: Letters in brackets ( ) in this text refer to details on the Layout Diagrams.

POWER REQUIREMENTS

The Inverter/Charger System requires a power supply of 100/120v or 200/240v, 50/60Hz single phase, dependent upon factory settings. This supply should be terminated in a Fused Spur Unit close to the Inverter and fused at 5 amps.

The wiring and connections must be exactly as shown in the wiring diagrams. All connections must be made through the bottom gland plate and any unused gland holes must be plugged. The supplied glands may be changed to accommodate different versions if the wiring used requires this.

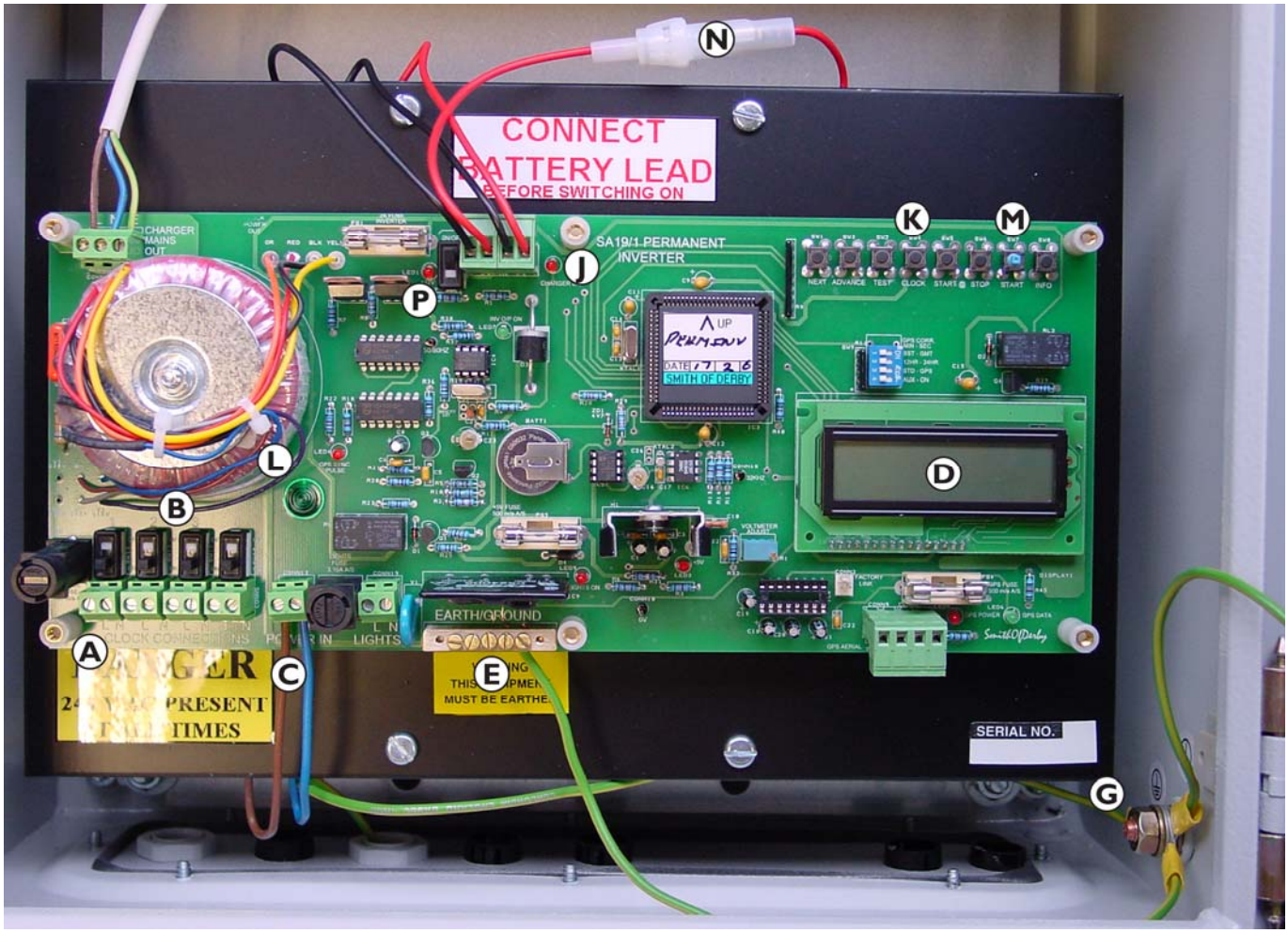

Diagram 2: main circuit board.

WIRING

The incoming power Live and Neutral is connected to the power terminal (C) and the case Earth stud.

The four clock terminal connectors (A) must only be connected to clock movements and MUST NOT be commoned in any way to any other wiring. Four Line and Neutral connectors are provided so that the independent control of each clock dial is available from the Inverter corrector switches (B). If the wiring diagram is not followed exactly then it is possible that independent control of each dial will be lost.

There are two methods of wiring the clocks:

Wiring method 1: where the clock dials are some distance apart from each other each clock can have a separate Line, Neutral and Ground taken from the individual connectors

Wiring method 2: where the clock dials are close together, separate Live connections can be taken from the Live terminals of the four connectors together with a common Neutral from any of the four connectors and an Earth connection from the earth bar (E). With this method a mains rated multicore cable can be used.

Finally, double check all wiring and ensure that a proper Earth connection is made to the cabinet Earth stud.

In the space below, write down which clock dial is connected to each of the separate clock output connectors (A) and corrector switch controls (B). This allows each dial to be separately identified so that it can be run, stopped or corrected independently. This information is essential, particularly where access to the dial/s is difficult.

Corrector Switch No.	Dial Identification
1	
2	
3	
4	

The GPS aerial (if fitted) should be wired as shown in the wiring diagrams and be in full view of the sky. This can be outside or very close to a glass window.

CLOCK LIGHTS OUTPUT

Mains lights may be controlled from the inverter. Connection details are given in the wiring diagrams at the end of this book. When connected these will switch on and off mains voltage lights at pre-programmed times dependent on the month; these on/off times are shown in tabular form below. If it is required that the lights are on permanently switch number 4 of the small group of switches (H) on the circuit board should be moved to the on position. The maximum load should not exceed 800 Watts for incandescent lights and 240 Watts for fluorescent lamps.

AUTOMATIC LIGHTING TIMES FOR THE CLOCK LIGHTS

Month	Off	On
January	08.00	16.00
February	08.00	17.00
March	07.00	18.00
April	07.00	20.00
May	06.00	20.00
June	05.00	21.00
July	05.00	21.00
August	06.00	20.00
September	07.00	19.00
October	08.00	18.00
November	08.00	16.00
December	08.00	16.00

FUSES

All circuits are separately fused on the Inverter/Charger PCB, these are identified on the board and on diagram 12. Any replacements used must be of identical rating to the original fuses.

ADJUSTMENTS AND CONTROLS

All preset controls are accurately set during manufacture and must not be touched as this could cause incorrect operation of the system and may invalidate guarantees.

The function setting switches (H) are also pre-set as shown below and will not normally need to be altered. Switches 1 to 4 change various functions as listed below:

Switch no. 1 Daylight Savings
BST – Changeover operational.
GMT – No changeover.

Switch no. 2 12/24 Hour restart function.

Switch no. 3 Standard quartz control – GPS time synchronized.

Switch no. 4 Lights output. Controlled or permanently on.

Diagram 3: control function pushbuttons

CONTROL FUNCTION PUSHBUTTONS.

These buttons (K) are used for setting up the clock times and various other functions in conjunction with the LIQUID CRYSTAL DISPLAY (D), located on the main circuit board.

The liquid crystal display (LCD) displays current and historical information about the system operation and enables the operator to see at a glance the current status of the system.

INITIAL TESTING AND SETTING UP PROCEDURE

It is advisable to have the clock hands set to a time in advance of the actual time so that reasonable time is available for the Inverter to be tested and ready for final commissioning before real time matches the time on the clock hands. If this is not possible and the clock hands are at a completely different time of day then follow the INITIAL START instructions below then go to STARTING THE CLOCK HANDS AT A PRE-DETERMINED TIME (Page 6).

If the inverter is configured as a GPS controlled inverter, ensure the aerial is connected correctly before applying power. Once the aerial is connected check the GPS signal by pressing the TEST button. If the aerial is functioning correctly the display will show the correct time (always GMT) and 'sig OK' or 'no sig' as shown later. Also a green LED, labeled GPS DATA will flash. If the display shows 'no data present' check the aerial connections are correct. With a brand new aerial the display may show 'no sig' for up to half an hour before finding a signal and showing 'sig OK'

NB Only minutes and seconds are corrected to GPS time in normal inverter running mode, therefore the local time must be entered manually to ensure the hours are correct.

To return from displaying GPS time press the TEST button once again. To ensure the inverter operates correctly do not leave displaying GPS time as automatic time correction will not function in this mode.

Diagrams 4a & 4b: screens associated with GPS.

INITIAL START

1 Turn on the Battery switch (P) and ensure the battery fuse (N) is fitted. The red indicator (F) will light and the LCD will show this information:

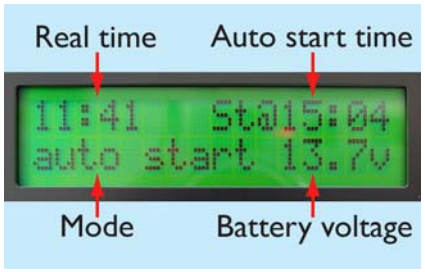

Diagram 5: starting.

The top line of information shows, on the left, the current time of day in 24-hour format, and on the right, the time when the inverter was last switched off.

The bottom line shows "auto start" and the main battery voltage (around 12-14v).

2 Turn on the external Isolator/House switch, the Power Input and DC indicators (J) will light if power is now reaching the inverter.

3 Press the blue 'START, push button (M). This will switch on the clock(s) power and start the clock motors, the green "Clock Power On" indicator (L) should also be lit. The LCD will change to show:

Diagram 6: charging.

4 Check that all corrector switches (B) are turned ON and that the clock hands on each dial are moving.

5 Turn off the external Isolator/House switch and observe that the "Power Input" indicator (J) goes off and the green "Clock Power On" indicator (L) stays on. This indicates the Inverter is operating correctly and is now driving the clock(s) from the internal battery. The LCD will change to show this display:

Diagram 7: battery mode.

6 Turn the external Isolator/house power switch to ON.

7 The LCD should return to the previous display and the inverter battery will be charging from external power.

That completes the initial tests. If these tests have been completed with the clock hands showing the correct time then the Inverter can be left running and no further tests are necessary.

If the clock hands are not showing the correct time, go to the next section: starting the clock at a pre-determined time.

STARTING THE CLOCK HANDS AT A PRE-DETERMINED TIME

NOTE: the clock hands cannot be moved quickly to a new time from the Inverter, i.e. the clock hands will only move at normal speed. They can only be stopped and then restarted when the real time matches the time on the hands.

If access to the clock movements is relatively simple, it is often best to move the clock hands from the knob on the clock motor following the separate clock motor instructions. If access is not possible, correction can be initiated as follows:

If the clocks are actually running, the green Clock Power Light (L) will be on and the LCD will either show 'Charging' or 'Batt Mode' together with the correct time and date at the top.

NOTE: If the time or date are not correct on the display then it is important to adjust this first, go to the section - SETTING THE INTERNAL DISPLAY TIME AND DATE.

1 Press the STOP button. The Green Clock Power light (L) will go off and the clock hands will stop. The LCD shows "Man stop" which indicates that a manual stop has been activated.

NOTE: It is necessary to know the exact time showing on the stopped clock hands so that this time can be entered.

2 Press the START AT button. The LCD changes to show a flashing block over the hour digit of the start time to be entered.

3 Press the ADVANCE button to increment the hours to match the hours noted on the clock hands. Each press advances the display by one hour. When correct go to next step.

4 Press the NEXT button. The flashing block moves to the minutes on the display.

5 Press the ADVANCE button to increment the minutes to match the minutes noted on the clock hands. Each press advances the display by one minute. When correct go to next step.

6 Press the NEXT button. The display will now show "auto start". This shows that the unit is now in the auto restart mode which automatically starts the clock hands when "real time" matches the time at which the clock/s are now set.

7 Ensure that the corrector switches are all set to ON.

8 The system can now be left to start the clocks at the selected time.

SETTING THE INTERNAL LCD TIME AND DATE DISPLAY

This routine should only be necessary if a serious disturbance has been experienced on the power supply.

When power is connected to the Inverter, the top line of the internal display should show the correct time and date. Any error showing can be corrected by following this routine.

NOTE: When the CLOCK button is pressed, the display clock will stop running. Choose a time a few minutes in advance of actual time before starting. This allows for all digits to be set before the final press of the NEXT button which actually restarts the internal clock.

1 NOTE: the digital clock cannot be changed whilst in AUTO START mode.

2 Press the CLOCK button, the hour digit will flash. If required, increment the hours by pressing the ADVANCE button until the correct hour of day is showing on the two-hour digits. If no adjustment is required to the hours go straight to 3.

3 Press the NEXT button. The minutes digit will flash. If required, increment the minutes by pressing the ADVANCE button until the correct minutes (one or two minutes in front of actual time) are showing on the minute digits. If no adjustment is required to the minutes go straight to 4.

4 Press the NEXT button. The year digit will flash. If required, increment the year by pressing the ADVANCE button until the correct year shows on the year digits. If no adjustment is required to the year go straight to 5.

5 Press the NEXT button. The month digit will flash. If required, increment the month by pressing the ADVANCE button until the correct month shows on the month digits. If no adjustment is required to the month go straight to 6.

6 Press the NEXT button. The day of the month digit will flash. If required, increment the days by pressing the 'ADVANCE' button until the correct day shows on the day digits. If no adjustment is required to the day number go straight to 7.

7 The complete display should now show the correct date and time a minute or so in front of actual time. When this time is reached, press the NEXT button. The internal clock is now correctly set.

THE POWER OUTAGE MEMORY LOG

If an installation has had problems i.e. clocks have stopped and restarted at odd times, it is possible to view the internal log of power outages which will show the time and date of any power failure together with the time and date the power was re-instated.

From this display the precise length of any power cut can be shown down to the second. This will prove just how good or bad the power is in a particular area and show when the Inverter was activated to keep the clocks running.

A typical display for a power outage would be:

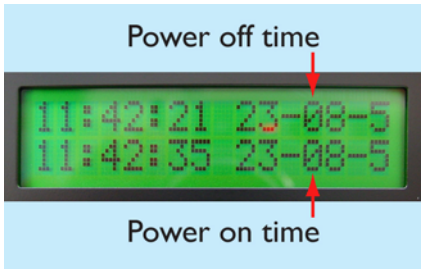

Diagram 8: power outage.

The top line shows when the power went off, displayed in hours, minutes, and seconds, then the date in days, months and the last digit of the year. The bottom line shows when the power came back on, displayed in hours, minutes, and seconds then, the date in days, months and the last digit of the year.

From this example it can be seen that the power failed at 42 minutes and 21 seconds past 11 o'clock on the morning of 23 August 2005. The power was re-instated the same day at 42 minutes and 35 seconds past 11 o'clock in the morning, a total power outage of 14 seconds.

The log has the facility to store over 200 power off/on times and when viewed will always start at the latest failure time. The memory can be stepped back through earlier entries until the time and date of the original installation of the Inverter shows. After this the display will show zeros.

CHECKING THE POWER OUTAGE LOG

1 Press the INFO button. The display top line will change to show the start time and date of the latest power outage and, on the bottom line, the latest 'power on' start time and date.

2 Press the NEXT button. The display will then show the previous power outage times

3 This operation can be repeated until the display shows zeroes, thereby indicating that the end of the log has been reached.

4 Press the INFO button to return to the previous condition before commencing these information tests.

BATTERY TESTING

It is important to check the condition of the battery each year. A battery voltage meter is incorporated on the Display on the main control board, and this should be observed during a simulated power outage to see how quickly the voltage drops. It should read between 12.5 and 13.0 V after 1 hour, if it was fully charged at the beginning of the test.

As a battery ages, it loses its ability to retain its charged voltage and, therefore, the length of time it can supply the Inverter diminishes. If many power outages occur, then it is possible that the battery voltage could fall quite quickly to the cut off point, whereupon the clocks would stop. The system then operates in auto start mode which will only allow the clocks to restart after the battery has been recharged sufficiently.

If the system does stop the clocks, the Display will show the state of the battery and system:

Diagram 9: battery low.

This display shows that the battery voltage has dropped to 11.1v (the cut off voltage) whilst running the Inverter during a power outage. The battery voltage must recharge to at least 12volts before the auto start system is enabled and the power must be reinstated for this to happen.

Diagram 10: battery flat.

This display shows that the battery has deteriorated even further by dropping below 8 volts and the system has locked out. Nothing can be done at this stage to restart the clocks and the battery may not recover. If power is on, the battery voltage should rise. If this does not happen then check to see if any fuses have blown causing the serious battery condition.

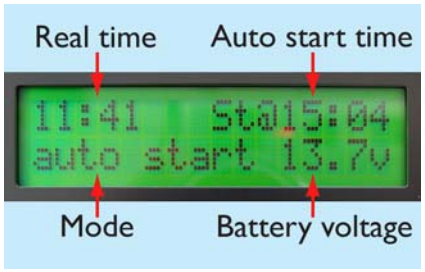

Diagram 11: battery voltage.

The clocks cannot be started until battery voltage reaches 12volts.

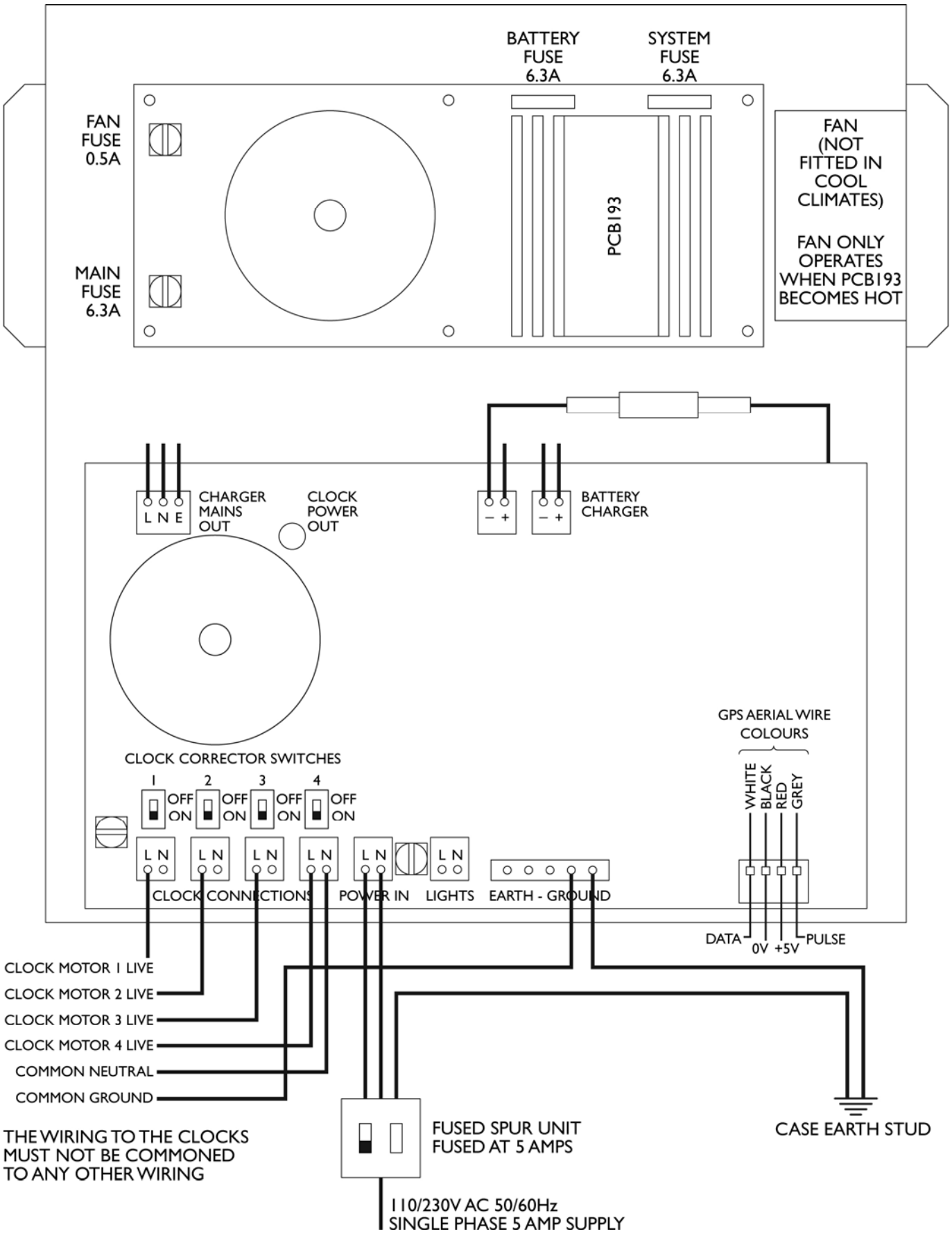

Diagram 12: SA19/1P Inverter Charger internal wiring.

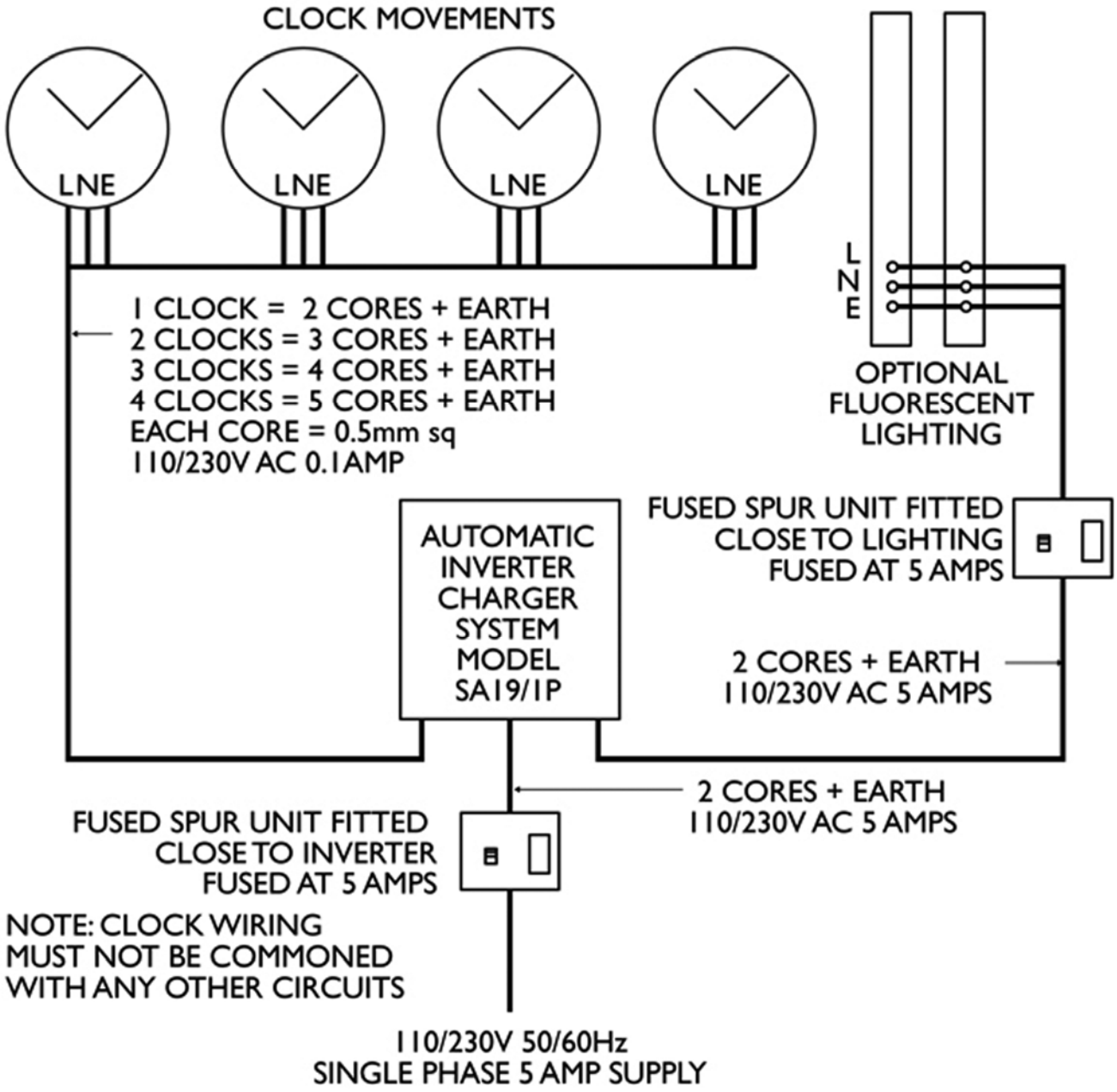

Diagram 13: SA19/1P Inverter Charger wiring installation with time controlled clock lighting.

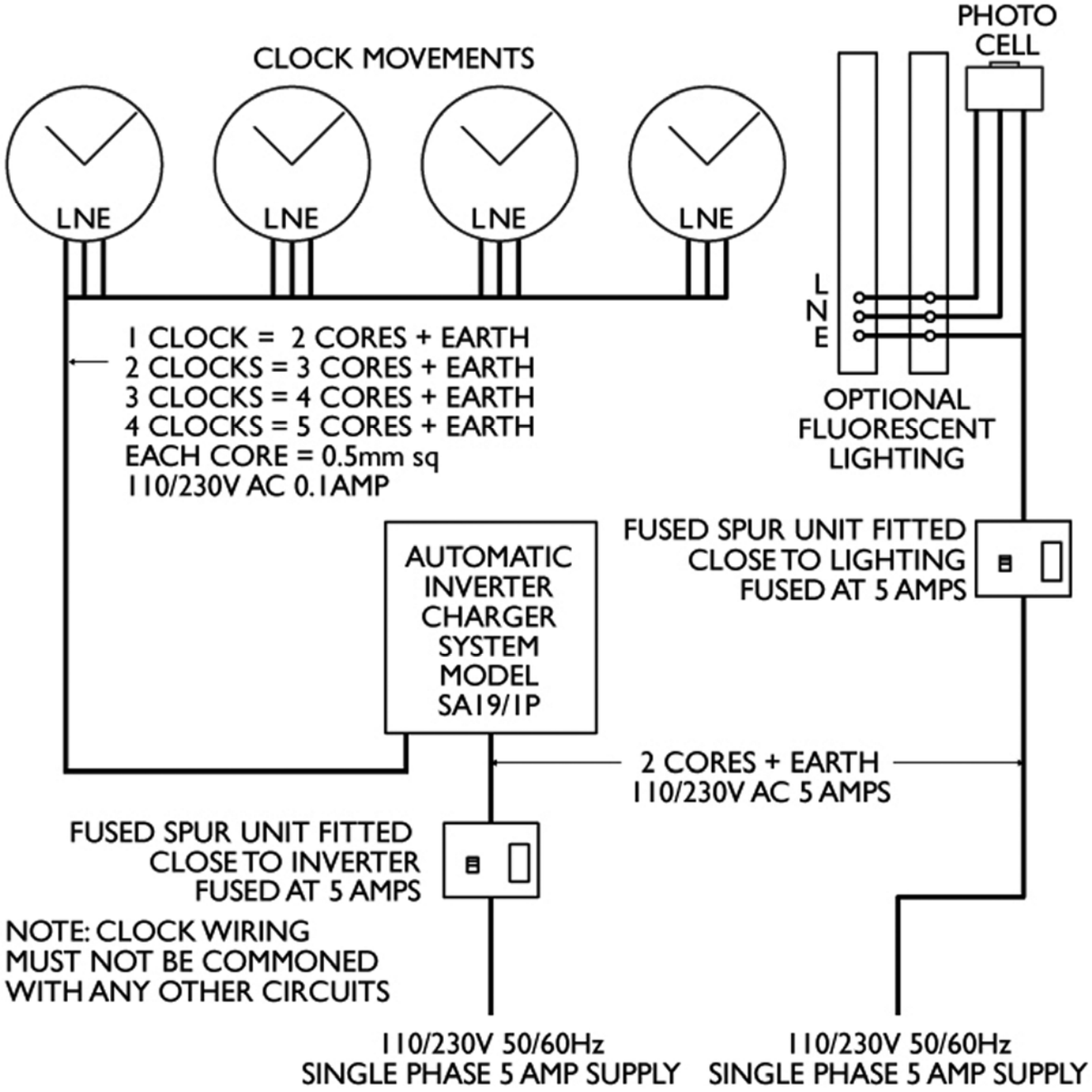

Diagram 14: SA19/1P Inverter Charger wiring installation with photocell controlled clock lighting.

Architectural Solutions

JOHN SMITH & SONS • WILLIAM POTTS & SONS
Smith of Derby Ltd Head Office 112 Alfreton Road, Derby DE21 4AU UK
Tel: +44 (0)1332 345569 Fax: +44 (0)1332 290642
Service dept. direct line: +44 (0)1332 257111
E-mail: service@smithofderby.com

JB JOYCE & CO
Station Road, Whitchurch, Shropshire SY13 1RD
Tel: 01948 662817 Fax: 01948 665068
E-mail: sales@jbjoyce.com

JOHN SMITH & SONS (IRELAND)
44 Ashleigh Gardens, Skehard Road, Blackrock, Cork
Tel: 021 429 3372 Fax: 021 429 1588
E-mail: oliverstack44@eircom.net