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INSTRUCTIONS FOR THE INSTALLATION AND MAINTENANCE OF THE MODEL XC407 "CHRONOPHER" ELECTRONIC MASTER CLOCK SYSTEM.

1. Description of the system

The Gent electronic Master Clock incorporates a fully temperature compensated electronically driven pendulum, which passes pulses at intervals of exactly one second to a stepping motor. This motor drives a cam, which closes contacts at one-minute intervals. The contacts feed power via further alternate action contacts to the energising coils of two plug-in relays. These relays are energised alternately at one-minute intervals. The contacts of the relays are arranged to transmit impulses of alternate polarity of 24 volts D.C. at one-minute intervals to the slave clocks.

The whole system obtains its power from the A.C. mains through a transformer rectifier unit, fitted within the Master Clock, but should the mains supply fail, a stand-by sealed nickel cadmium battery will automatically switch in and continue to drive the whole system for six hours. The battery is constantly charged from the mains supply to keep it in full readiness for a mains failure.

With the standard system, if the interruption of the mains supply does not exceed six hours duration, the whole system will remain in operation, obtaining power from the stand-by batteries, and at the end of the interruption, the transformer rectifier unit will automatically take over the supply of power to the system. The batteries will then revert to their stand-by condition and re-charging will commence immediately.

In larger systems, dealt with in section 9, the length of time for which the system will remain operative depends on the capacity of the external batteries used.

The slave clocks used in conjunction with the electronic Master Clock must be driven by polarised movements, which have the advantage of having purely rotational action, thereby ensuring silent operation. No settings or adjustments are required.

2. Electrical Circuit and Wiring

The wiring diagram for the standard system is shown on page 4. The A.C. supply must be obtained from a penmanent source which is not interrupted or switched off during the nights or weekends. The wiring for this circuit should be carried out in 240 volt grade 1 m.m^2 cable to the current I.E.E. wiring regulations.

The slave clocks are connected in parallel on a simple 2-wire circuit. The cable used for this circuit should be of sufficient mechanical strength to avoid any accidental damage,

and the size of cable must be large enough to ensure that the voltage at the farthest end of the circuit does not drop below 12 volts.

The maximum number of slave clocks, with dials not exceeding 24" diam., that can be controlled by the standard Master Clock is 100. Each slave clock has a resistance of 3,000 ohms and draws 8 milliamps at 24 volts D.C.

When wiring the slave clock circuit it should be noted that the terminals on the slave clocks cannot be used for connecting clock loops. The wiring should be terminated at the clock positions utilising connectors or terminals, from which a flexible connection can be taken to the socket fitting into the side of the movement cover. The knurled screws of the socket should be screwed home tightly to grip the conductors of the flexible cable securely.

3. Fixing the Master Clock.

Care taken in selecting a suitable position for the Master Clock will be amply repaid. It should be fixed so that the dial is at eye level, to facilitate easy operation of the time control switch. The wall on which it is to be fixed should be firm and free from vibration from such external sources as lorries on an adjacent road or heavy machinery on an adjacent floor. The area should be dry and free from rapid change in temperature. A position allowing direct sunshine to reach the Master Clock is not recommended neither is the use of a wooden partition.

It is essential that the Master Clock be fixed in position securely, as the slightest movement of the backboard will result in indifferent timekeeping. All three fixing holes must be used.

It may be necessary to raise the backboard of the Master Clock from the surface of the wall a distance greater than that already provided by the standard pillars, in order to accommodate the external wiring and to enable it to be threaded through holes in the backboard adjacent to the terminals. In this case, use three pieces of hardwood $1\frac{1}{4}$" square and of appropriate thickness for the wiring, drilled in the centre 3/16" diameter to take the fixing screws.

The top fixing should be made first using one of the screws and washers provided, taking great care to avoid brick dust etc., falling into the clock mechanism. It is advisable that the Master Clock is not fixed into position until such time as all building work and wiring has been completed, in order to be certain that foreign matter does not enter the clock mechanism.

Before completing the two lower fixings, the clock should be accurately plumbed by using the pendulum as described below.

When the Master Clock has been fixed to the wall by means of its top fixing screw, the pendulum clamping block should be released, by unscrewing the two bolts protruding from the top of the block. Allow the pendulum to drop to its normal operating position by entirely removing the clamping blocks, avoiding any severe movements of the pendulum that would damage the suspension-spring. After the clamping block has been removed, the pendulum should be allowed to come to rest, and then, with the aid of the

pendulum alignment bracket situated directly below the pendulum the point of the pendulum should be aligned with the bright spot at the tip of the alignment bracket. Alignment must be made both sideways and front to back. This may require packing of the base spacing pillars, depending on the condition of the wall on which the Master Clock is mounted.

After alignment has been completed satisfactorily, the position of the two lower fixing screws should be marked accurately on to the wall and the pendulum clamping block replaced firmly around the pendulum before proceeding with drilling of the wall.

Great care should be taken in the alignment of the Master Clock to avoid the necessity for re-alignment should it be found that the pendulum catches on the coils mounted on either side of it.

After fixing, ensure that all three fixing screws are screwed securely home.

4. Wiring Connections of the Master Clock - Starting of the System

The wiring connections for the systems are shown overleaf. Connect the slave clock circuit, making sure that the slave clocks are connected with the correct polarity, i.e. the P lead to the red pin on the clock movement, and the N lead to the black pin, - this wiring should now be checked for short circuits and earth faults. Once the wiring has been proved satisfactory, the slave clocks should be set to the same time as that indicated by the Master Clock. Setting the hands of the slave clocks is undertaken by loosening the knob at the side of the movement cover, allowing the latter to be removed to expose the nylon setting spindle at the top of the movement. The hand setting spindle can be turned in either direction without damage to the clock movements.

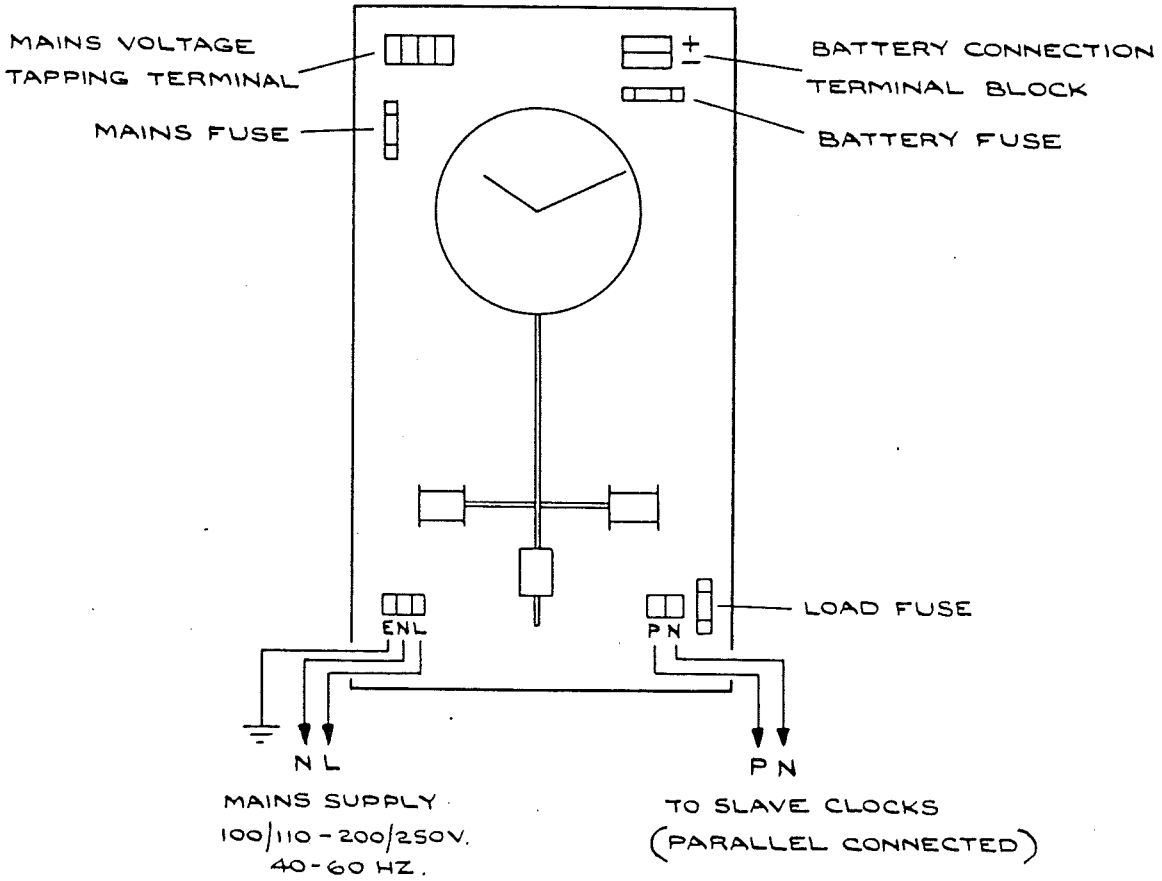
After connecting the slave clock circuit, select the correct mains voltage tapping within the Master Clock and connect the mains input lead into the Master Clock, WITHOUT SWITCHING ON THE SUPPLY.

When all external connections have been made set the time setting switch in the Master Clock to Retard and then connect the battery within the Master Clock to the battery connection terminal block at the top right hand of the Master Clock base. As soon as possible after this has been connected, the mains should be connected up, and the supply switched on.

N.B. If there is undue delay in switching on the mains supply after the battery has been connected there will be unnecessary draining of power from the battery.

With mains and battery connected, the system is now operative and ready for testing and setting to time.

Once again remove the pendulum clamping block and move the time setting switch to the Normal position, move the pendulum about $\frac{1}{4}$" to the left and allow it to swing freely.



CONNECTIONS FOR STANDARD MODEL XC407 MASTER CLOCK WHERE SLAVE CLOCK CIRCUIT REQUIRES UP TO A MAXIMUM OF 800 MA (100 STANDARD CLOCKS).

Ensure that the permanent magnets projecting on either side of the pendulum rod are not touching the coils, if they are, the clock has not been correctly positioned on the wall.

Note the operation of the time dial, this should advance at one minute intervals after the pendulum has been started. Note also that the slave clocks are advancing in step with the time dial. Check all clocks are operating in synchronism, and set the system to time. There are two ways of doing this.

a) If the system is slightly fast, it may be Retarded by operating the time setting switch. Wait for an impulse of the time dial minute hand, and immediately switch the time setting switch to Retard. Wait until the time indicated on the time dial is exactly correct, then move the time setting switch back to Normal.

b) If the indicated time is slow, wait for an impulse of the time dial minute hand and immediately move the time setting switch through the Retard position to the Advance position, leave in the Advance position until the time dial indicates one minute in advance of the correct time. Move the switch to the Retard position and wait for the indicated time to be exactly that of the correct time, and switch to Normal. After undertaking either of the above procedures, the clock will now be set to time within one or two seconds.

When the system has been set to time, the Master Clock cover should be replaced and left for at least 48-hours before any pendulum or other adjustments are made.

Note - if any of the slave clocks are found to show a time one minute behind that of the time dial, it will be found that the connecting leads have been fitted with the incorrect polarity. The socket of the particular clock should be reversed and the movement advanced manually to show the same time as the remainder of the clocks.

5. Adjusting the Pendulum of the Master Clock for Accurate Timekeeping.

The pendulum of the Master Clock is compensated for temperature changes and its length is adjusted before leaving the Works. Final adjustment for accurate timekeeping, however, must be made after installation to obtain the accuracy of better than $\pm$ 15-seconds per month, of which it is capable.

Allow the Master Clock to operate for several days before checking the time against standard time. The average gain or loss should be calculated and an adjustment made to the pendulum.

When making adjustments to the pendulum, care must be taken to ensure that the suspension spring is not distorted resulting in unsatisfactory timekeeping. The following procedure is advisable:

Grasp the knurled portion of the rating nut firmly with the left hand, and with the right hand loosen the smaller diameter locking nut, (the locking nut is located on the

pendulum rod beneath the rating nut). Adjust the rating nut by the desired amount and tighten up the locking nut. Each small division on the rating nut makes a difference of one second per day and one complete revolution makes a difference of 20-seconds per day.

If the Master Clock is losing raise the rating nut an appropriate amount or lower it if it is gaining. After the pendulum has been adjusted the Clock System should be reset to time as described in sub-section 4.

Allow the Master Clock to operate for a further period of at least seven days and again adjust the pendulum as described above, if necessary, until satisfactory timekeeping is obtained. There is no advantage in making daily corrections of the pendulum length unless the error is very great.

6. Alteration for Summer/Winter Time

Advancing or Retarding the clocks by one hour is effected by the time control switch. The clocks can be advanced one hour in approximately two minutes as described in paragraph 4 (b). In order to retard by one hour the time control switch may be left in the Retard position for one hour, or if desired, the whole system may be advanced by eleven hours, this will take approximately 23-minutes. Either method will result in the same correction being made. If the system includes Time Recorders and/or Programme Instruments the system should be retarded rather than advanced when making an adjustment of minus one hour otherwise the correct a.m. or p.m. indication will not be given.

7. Removing and Adding Subsidiary Clocks.

The slave clocks have plug connections at the side of the movement cover. Before removing a clock from the system withdraw the socket from the plug.

An additional clock can be connected to the system by installing the additional wiring to connect the clock in parallel with the remainder. The polarity of the wiring and of the terminals of the slave clocks must be observed as otherwise there will always be a discrepancy of one minute between the clocks added to the circuit and the remainder of the system.

N.B. It should be remembered that the maximum current in the slave clock circuit is 800milliamps. This should not be exceeded on the standard system.

Should the slave clock circuit be inadvertently shorted while installing the additional wiring, the slave clock fuse in the Master Clock will blow and all the slave clocks will stop. The Master Clock, however, will continue to operate and indicate the correct time.

8. Maintenance and Fault Finding

The Gent Electronic Master Clock System has been designed to give trouble-free service.

After the pendulum has been correctly adjusted, it will only be necessary to check the time keeping with standard time once per

month. Any adjustment which may be necessary, can be made by means of the time setting switch on the Master Clock. The following notes will be helpful in the event of any difficulties being experienced:

(a) Pendulum of Master Clock discovered at rest.

This may be caused by the mains supply having been switched off for more than six hours, or that a number of mains failures have occurred within a few days, the total of which is in excess of six hours.

Ensure the mains supply is connected and start the pendulum swinging. If the minute hand moves after a period not exceeding one minute, then the system may be considered working once again. The system should be reset to time, using the time setting switch, as described in Section 4. If the mains supply is connected, but the system still does not operate, check the Transformer Fuse at the top left hand side of the Master Clock and replace if necessary.

If the pendulum appears sluggish in operation, it should be checked, to ensure that it is not catching on the pendulum driver or pick-up coils.

(b) Pendulum Swinging, but Time Dial or Slave Clocks not Working.

Ensure that the time setting switch has not been left in the Retard position after adjusting the Slave Clocks.

Check the stepping motor at the rear of the time dial to ensure that it is rotating, and that the two silver contacts on the finger springs make good contact with the silver pin rotating on the wheel on the stepping motor shaft. If these are operating satisfactorily, check that the Relays are pulling up at one minute intervals (these are mounted to the right hand side of the printed circuit board). If so, then it could be that the Relay contacts are worn, but this will only occur after many years of operation. If only one Relay operates, the Relay which is not operating may have an open circuit coil winding. This may be checked by changing over the Relays and checking that the serviceable Relay operates within two minutes. If necessary replace the faulty Relay.

(c) Master Clock operates but Not Slave Clocks.

Check the Fuse in the Slave Clock circuit. If this has blown, remove it and advance or retard the Master Clock so that it registers the same time as that shown by the Slave Clocks. Replace the Fuse, and bring the whole system up to the correct time as described in Section 4.

Should one clock or one section of Clocks be inoperative, investigate for a break in the wiring feeding the inoperative Clock or Clocks. When the fault has been rectified, synchronise each Slave Clock previously inoperative.

(d) Slave Clock Fails to Operate.

If after ascertaining that the Clock circuit is complete to the Clock position, the Clock is still inoperative, ensure that the

flexible cable is satisfactorily connected to the socket, the knurled screws are tight and that good connection is established with the connection pins attached to the Clock movement. Should the Clock still be inoperative, remove the cover of the Clock movement and spin the rotator by means of the spindle at the top. The rotor must rotate quite freely.

If the rotor is stiff, look for foreign matter causing an obstruction between the rotor and pole pieces. Also check for the hands touching on the glass, the dial or each other. If necessary re-oil the pivots and bearings with good quality clock oil, noting that neither oil nor grease is to be applied to the worm or worm gears.

Re-oiling is only likely to be required after the Clock has been in service for very many years, or has operated in very hot or dusty conditions. To re-oil the rotor bearing, remove the electro-magnet assembly by with-drawing the two screws securing the magnet assembly to the sides of the brass pillars. This enables the magnet assembly, complete with rotor, to be withdrawn from the movement, sufficiently for the rotor and worm to be removed from its bearing stud. Clean andoil the bearing stud with good quality clock oil. On reassembly, before finally tightening the two screws securing the magnet assembly to the pillars, check that there is a safe minimum "back-lash" between the worm and worm wheel and adjust the position of the magnet assembly if necessary. When the Clock is reconnected to the circuit, the hands must be set with the aid of the knob on the rotor to the time indicated by the remaining clocks in the System. It may be found that the Clock will only operate either one minute in advance or slow when compared with the remainder. This error will have been caused by the worm and wheel having been disengaged and not being assembled in the same relative position to each other. To correct this reverse the position of the two knurled screws coloured red and black in the connecting socket, without altering the flexible cable connections. The socket can now be reconnected to the connection pins on the movement with the red socket matching the red pin. After setting the Clock to the same time as the remainder, it will now operate in synchronism with them.

9. Special Systems Requiring an Output Current Greater than 800 Milliamps.

Under these conditions, a separate Battery and Charger will be required to operate the system. Connections are as shown on pages 9 and 10 as follows:-

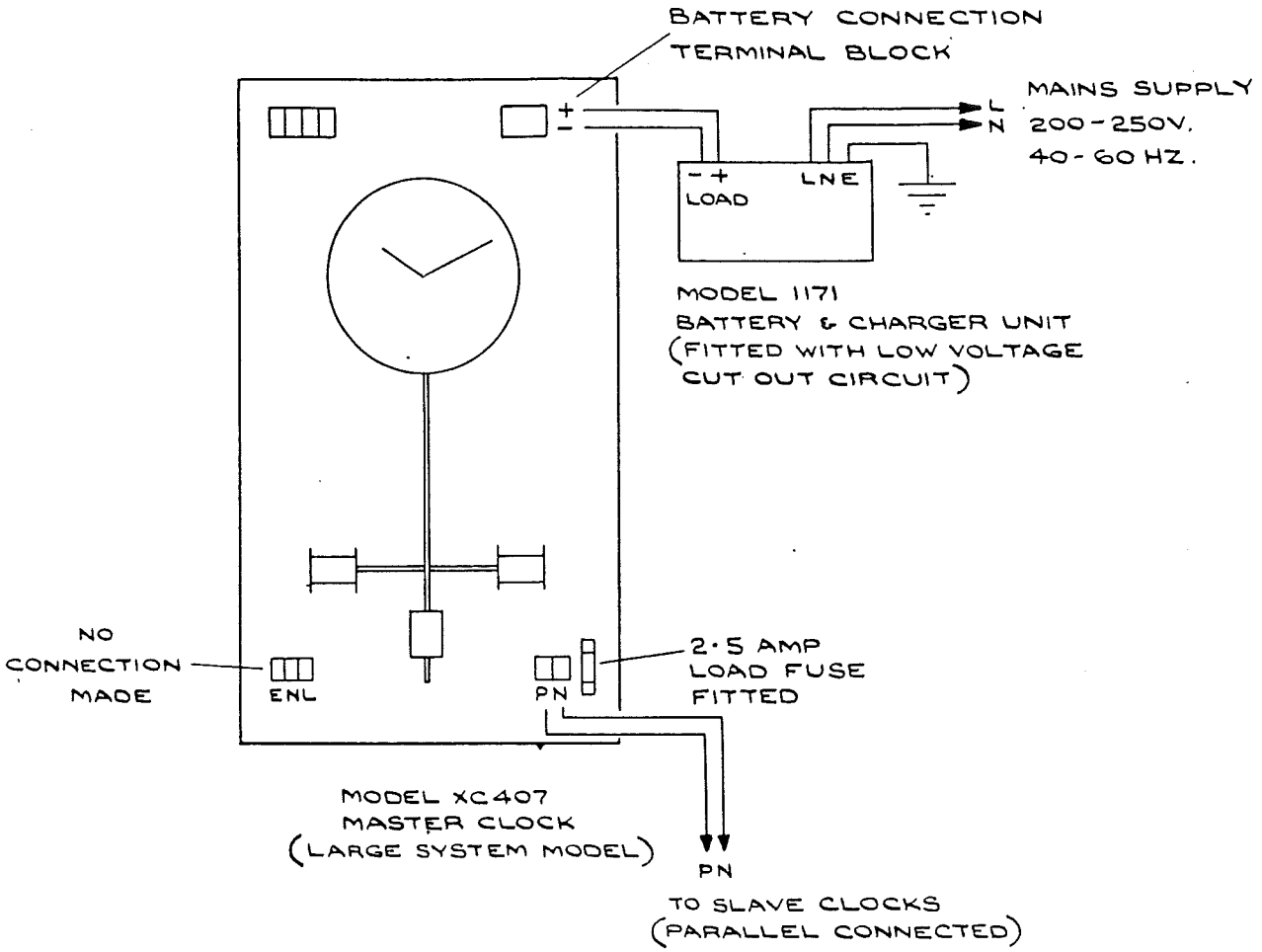
(a) Systems requiring a maximum output Current of 2 amps.

Note - No mains connection is made within the Master Clock.

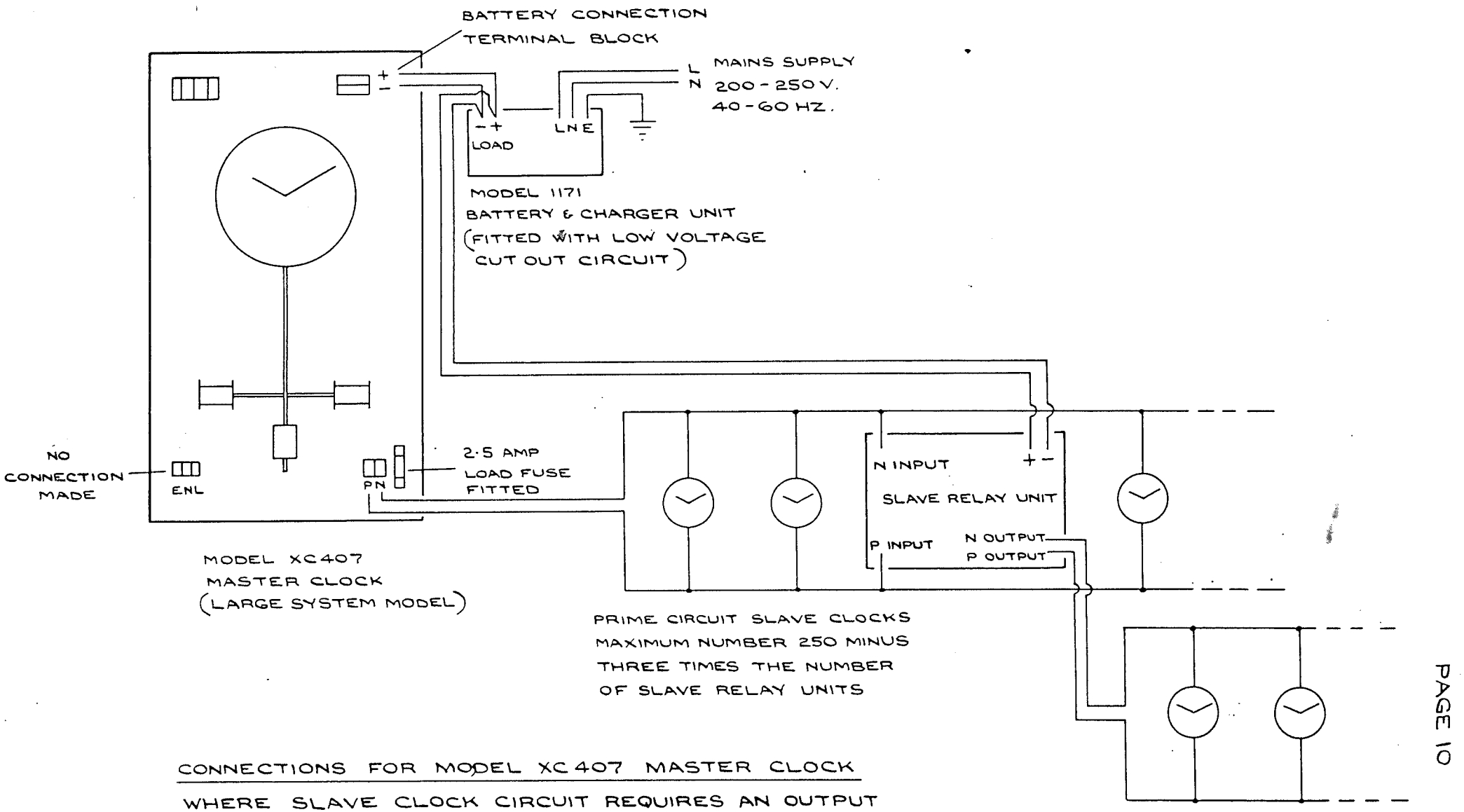
The 1 amp load fuse normally fitted within the Master Clock must be replaced by one having a rating of 2.5 amps.

(b) Systems requiring Currents in excess of 2 amps.

Note - Any number of Slave Relay units may be used, providing they are each considered as being equivalent to three Slave Clocks.



CONNECTIONS FOR MODEL XC407 MASTER CLOCK WHERE SLAVE CLOCK CIRCUIT REQUIRES AN OUTPUT CURRENT ABOVE 800 MA (100 STANDARD CLOCKS) AND UP TO 2 AMPS (250 STANDARD CLOCKS).



CONNECTIONS FOR MODEL XC407 MASTER CLOCK WHERE SLAVE CLOCK CIRCUIT REQUIRES AN OUTPUT CURRENT IN EXCESS OF 2 AMPS. (250 CLOCKS)