

## THE T & N MASTER CLOCK

### 1. GENERAL

Three types of T & N master clocks are in service as follows:-

- (i) Master clock without Programme Instrument (Chronogram)
- (ii) Master clock with Programme Instrument suitable for sounding bells - hooters, etc
- (iii) Master clock with Programme Instrument suitable for sounding signals via a Broadcasting amplifier.

Item (iii) is similar to item (ii) but has an additional pair of contacts fitted at the rear of the Programme Instrument for switching an amplifier "on" and "off" as required.

These three clocks use the same basic movement which is weight driven. Timekeeping is controlled by a  $\frac{1}{2}$  second pendulum which releases a "Graham" dead beat escapement. An electrical rewind mechanism raises the weight each time it nears the limit of its descent.

The master clock requires a 24 V DC supply (usually obtained from a float charged battery) and provides reversed polarity impulses each minute suitable for impulsing clocks of the TR ornamental type.

### 2. DRAWINGS

A.6589 - T & N Master Clock Connections.

A.6594 " " " " " Programme Instrument Connections.

### 3. DESCRIPTION

The master clock movement is contained in a locked metal case (early types had wood cases) which is hinged at the right-hand side.

A feature of this clock is the ease with which it may be dismantled into the following main units:-

- (i) Flywheel and Rewind Mechanism
- (ii) Pendulum
- (iii) Dial and Escapement Mechanism
- (iv) Minute Impulse Contact Unit
- (v) Terminal Block.

The terminal block is mounted on threaded studs which protrude from the metal case and is locked in place by two knurled nuts. Electrical contact springs are suspended from this unit and these bear on contacts mounted on the insulated baseplate which carries the Flywheel and Rewind Mechanism with pendulum suspension unit. This baseplate is also secured to the case via two knurled nuts and threaded pillars. The insulated baseplate carries four pillars which retain the dial and escapement mechanism. The two top pillars are hooked, and the bottom two are slotted to provide a spring lock feature.

The minute impulse contact unit is mounted behind the escapement mechanism and when in situ its contact springs bear on four pillars which protrude from the baseplate. This unit is secured in position by two cheese headed screws.

### 4. FLYWHEEL AND REWIND MECHANISM

The movement is driven by a weight which hangs from a cord looped round the flywheel. As the weight descends the flywheel turns in an anti-clockwise direction, carrying with it an electrical contact which completes a circuit to operate the armature of the winding magnet just before the flywheel comes into contact with its stop. The armature in operating imparts energy to the flywheel which runs round on a ratchet at the same time raising the weight to a new position. The drive from the flywheel is via a ratchet and gear wheel to a spiral spring which engages on the main motionwork.

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## 5. THE PENDULUM

The pendulum is a  $\frac{3}{4}$  second nickel steel compensated type. It consists of five main parts:-

- (i) The rod
- (ii) The bob
- (iii) The locknut
- (iv) The fine regulator and indicator
- (v) The pad and adjusting screw.

The pendulum is located on the suspension spring from front to rear so that the slot at the top of the rod faces the rear of the clock.

The pad is positioned on the rod between two fine grooves so that the adjusting screw is at the right-hand side.

The rod is threaded at the bottom and the locknut, bob, and fine regulator are each screwed on to the rod in that order. The indicator is held inside the fine regulator by light spring tension and should be turned to the front to facilitate adjustment.

## 6. FINE ADJUSTMENT

Fine adjustment may be made by holding the pendulum rod firmly and turning the fine regulating tube which does not butt on the bob, and therefore moves freely.

Each division on the indicator represents 0.25 seconds per day.

Turn clockwise to advance.

Turn anti-clockwise to retard.

## 7. COARSE ADJUSTMENT

To carry out coarse adjustment it is necessary to remove the pendulum from the clock. Once removed the pendulum bob may be moved by first slackening off the locknut which is above the bob and then moving the bob as required.

Raising the bob one division will cause the clock to gain 10 seconds per day.

Lowering the bob one division will cause the clock to lose 10 seconds per day.

Following adjustment, the locknut should be screwed down to lock the bob and the indicator, if disturbed, should be removed to the front of the pendulum.

## 8. DIAL AND ESCAPEMENT

The dial, motionwork, and escapement are assembled together as one unit which mounts on four pillars in front of the pendulum and flywheel. Where a programme instrument is provided then this forms part of the movement from which it obtains its mechanical drive.

The movement incorporates a precision release unit which controls the minute impulse contact unit in the following manner.

Progression of the movement via pendulum and escapement causes rotation of a snail cam which raises the release lever. Mounted on this lever are two pallets which bear in sequence on a stop pin fixed to a gear wheel. At the 60th second the release lever drops clear of the snail cam permitting the second of the two pallets to clear the stop pin, thus releasing the gear train which drives the minute contact drum.

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8. DIAL AND ESCAPEMENT (Contd/...)

This gear train obtains its energy from the main drive spring via a differential mechanism. Its movement, and therefore the duration of the minute impulse is controlled by a governor of the windvane type.

When the gear train completes its cycle the release lever prevents repeat operation by engaging the first pallet against the stop pin.

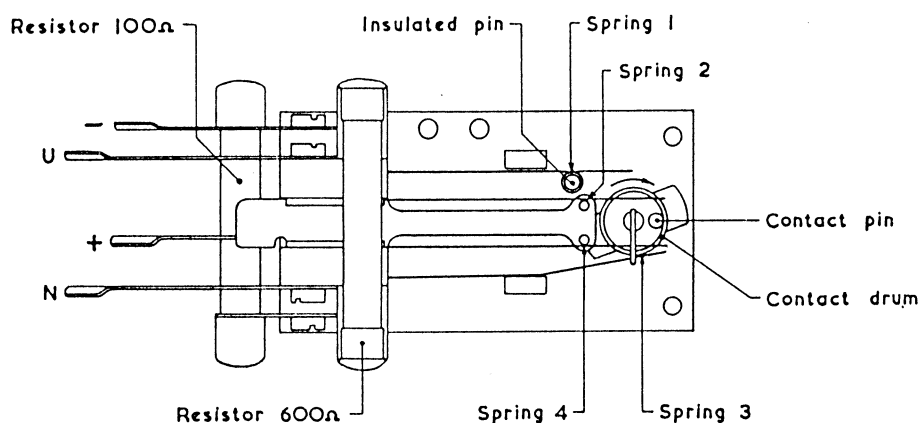
9. MINUTE IMPULSE CONTACT UNIT (See Drg. A.6589)

This unit provides impulses of reversed polarity each minute to advance polarised impulse clocks of the TR ornamental type. It may also be used to operate non-polarised units, i.e. Time Recorders, etc. The contacts are operated by a drum which moves through one half revolution each time the precision release unit operates.

The impulsing contacts are very lightly tensioned on the drum and it is therefore important to limit the impulse current to ensure spark free operation. It is recommended that the impulse current should be limited to 240 mA which is the current taken by 40 impulse clocks. Should the number of clocks of an installation exceed this figure, then a relay unit should be installed to take the additional load. Relay CR 20 K23424.G should be used for non-polarised equipment and a special relay, ordered as required, should be used for polarised equipment.

There are two points which should be observed in connection with the impulse unit. The first is that the springsets are arranged so that the lines to the impulse clocks are short circuited between impulses, and the second is that during impulsing a negative battery is connected to the frame of the unit.

The adjustments of the springsets are shown below.



Spring tensions should be measured at the points indicated on the above sketch. They are as follows:-

Spring 1 should have just sufficient pressure to hold it against the insulated pin.

Spring 2 should bear on pin with pressure of 8-10 grms.

Spring 3 should bear on drum with pressure of 10 grms.

Spring 4 should bear on pin with pressure of 8-10 grms.

NOTE: R1 - 600 ohm Resistor is permanently across the clock circuit (N.U. terminals).

R2 - 100 ohm Resistor in series at start of impulse - shorted out when contact drum touches No. 1 spring. Short is removed when contact drum clears No. 1 spring.

It is important that springs 2 and 4 are perfectly straight and are not turned in at the ends as this can result in short circuiting the battery supply.

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10. INSTALLATION

The master clock should be fixed to a solid wall in clean dry surroundings maintained at a reasonably constant temperature.

First it is necessary to unpack the clock and check that no damage has occurred in transit. Following this, the master clock should be dismantled into its main units so that the case only is available for hanging on the wall.

Proceed as follows:-

- (a) Remove the dial and motionwork complete by gripping the lower framework and pulling the unit away from the two lower pillars. Pivot the unit on the two upper pillars and lift off.
- (b) Undo the knurled nuts retaining the winding mechanism baseplate and remove the baseplate.
- (c) Undo the knurled nuts retaining the terminal block and remove same.
- (d) Insert a round-head No. 12 woodscrew in the wall 6' above floor level so that the head protrudes about  $\frac{1}{4}$ ". Feed cables through entry and hang clock on screw.
- (e) Plumb case and enter two woodscrews through fixing holes advancing these until they are almost fully home. Advance spring mounted screws until the case is in contact with the wall at each corner - at the same time ensuring that the case remains plumb when checked from the front and from one side.
- (f) Re-fit terminal strip. Connect cable and dust inside of case.
- (g) Open the link connections on the winding mechanism baseplate and re-fit this unit in the case.
- (h) Hang weight on cord checking that the cord lies in the pulley wheel and hangs in front of flywheel. Momentarily close "wind" strap (with the supply connected) to check winding action.
- (i) Insert pendulum suspension spring. This may be entered either way - there is no "top" or "bottom" end.
- (j) Check pendulum pad is in correct position and hang pendulum, holding rod just above the bob. Re-check plumbing of case against amplitude scale.
- (k) Turn minute contact drum in clockwise direction until toggle arm is in 6 o'clock position.
- (l) Engage movement on the two top pillars; lift balance lever projecting at top right of movement and swing movement down and inwards so that the lower two pillars locate in the backplate. Check that the pin on the anchor arm lies against the pad on the right-hand side of the pendulum rod.
- (m) Advance wind wheel (small gear wheel inside flywheel) to lightly tension the main drive spring. Close "wind" link and lock in position.

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10. INSTALLATION (Contd/...)

- (n) Swing pendulum just above minimum amplitude (about  $\frac{1}{2}$  of scale marking) and listen for even beat. Adjust as necessary by varying knurled screw on pad at right-hand side of pendulum as follows:-
- (i) If, on right-hand swing, click is heard appreciably before pendulum reaches maximum swing then withdraw screw.
- (ii) If, on left-hand swing, click is heard appreciably before pendulum reaches maximum swing then advance screw.

11. SETTING TO TIME

Stop the pendulum when the precision release mechanism is unlatched at the 60th second.

Advance minute hand carefully in a clockwise direction until clock is on minute mark one minute in advance of correct time.

Hold pendulum to right and release precisely on minute.

DO NOT MOVE HANDS BACKWARDS.

12. TO ADVANCE IMPULSE CLOCKS

Close impulse clock link and lock in position. Behind the dial on the right-hand side is situated an "Advance" lever which when pressed down releases the minute impulsing mechanism which transmits one pulse. This lever may be held down to run up the impulse clocks to correct time.

13. PROGRAMME SIGNALLING INSTRUMENT (CHRONOGRAM)

Where provided this instrument forms an integral part of the master clock from which it obtains its mechanical drive.

It provides the following facilities:-

- (a) Two separate programmes of sound signals to two circuits without day variations.
- or (b) Two separate programmes of sound signals to one circuit with day discrimination.
- or (c) One programme of steady and interrupted signals to one circuit of loudspeakers.

Signals can only be provided at minute intervals of five minutes, i.e. 8.00 - 8.05, 8.10 etc. - but this arrangement can be altered to 8.01 - 8.06 etc. when all other signal times will be similarly offset by 1 minute.

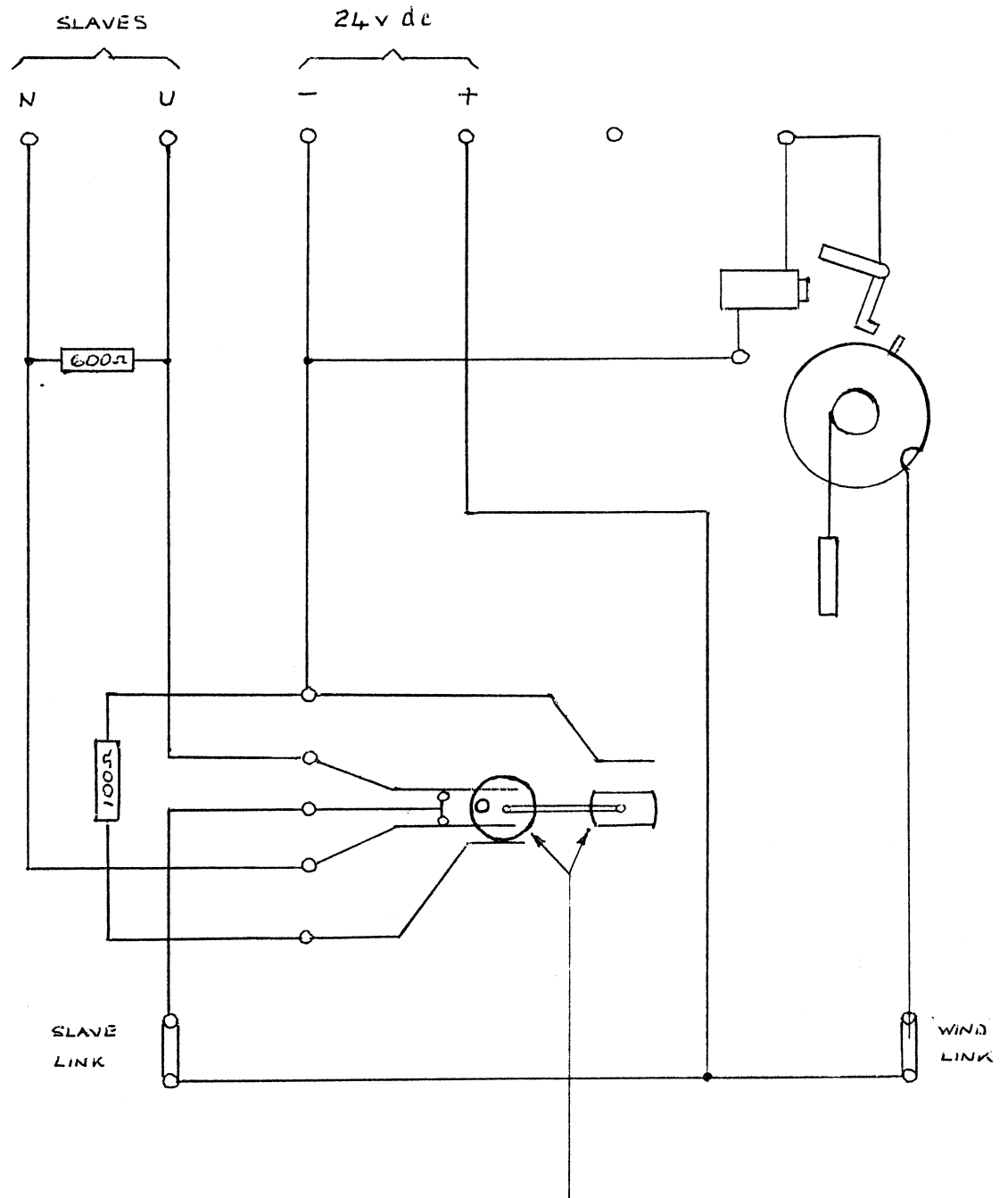
All signals may be automatically cut out on one or more complete days - usually Saturday and Sunday.

Circuit drawing A.6594 shows the connections of these units and includes the additional springset provided on certain units for the purpose of impulsing a latching relay to switch a broadcasting amplifier 'on' and 'off'.

Adjustment data is contained in the 'Instruction Manual for Programme Signal Instrument No.41329/2.

# TELEFONBAU UND NORMALZEIT (T & N)

Diagram of connections



Contact drum and half drum  
shown separately for clarity.  
They are connected together  
both mechanically and electrically.