Norchard Clock Equipment

The clocks at Norchard are controlled by either of two ex GPO/BT pendulum master clocks. The operational clock produces pulses every two seconds, every six seconds and every thirty seconds. A locally designed relay set is used to interconnect the pendulum clock and the clock faces around the site.

We have several circuits feeding the series clocks. The first circuit uses ordinary ex BT clocks which require a pulse of current every thirty seconds. These clocks are connected in series using the normal telephone cabling. This circuit connects the clocks close to the master equipment.

The second circuit uses ex Underground clocks (ie +- clocks) which require a permanent current which reverses direction at every clock pulse. These clocks are connected in parallel using the normal telephone cabling. This circuit connects the clocks which are remote from the master equipment.

Clock pulses are also fed to Parkend, Norchard signal box and Lydney Junction signal box over one wire of a pair to earth. At present clocks are only fitted in our apparatus rooms, however, they seem to be very reliable and it may be that we will fit clocks in these remote public areas showing "Norchard Time". The other wire is used to relay alarm conditions from these outstations back to Norchard.

The equipment normally runs with thirty second pulses, but should the clocks need adjustment, there are advance and retard switches provided in the master clocks and in the shop to make the adjustments. Using advance, the clocks step every two seconds, using retard the clocks are stopped until time catches up with the clocks.

There are separate switches in both the series and +- clock circuits which can isolate each circuit from the master clock. This facility is required should the two circuits get out of step as it allows either circuit to be stepped on or stopped independently.

The above arrangements still hold but were recognised as being unable to provide much growth as we had no more +- clocks available and we were going to be asked to provide clocks distant from the main building. A second relay set was constructed which allows a series pulse clock to be operated over a fairly long line. Such clocks are now referred to as auxiliary clocks. Nine auxiliary clocks are able to be connected to the relay set.

Eight distant clock drivers for the circuits to remote sites are also incorporated into the relay set. The clock pulses are monitored by the CPA - CPH relays. Normally the clock pulses show as a pulse on the alarm lamp on the relay set, but should a pulse not be monitored and the appropriate CP relay fails to operate, relay CC also fails to operate to the pulse. With the main pulse relay CR operated and CC not operated, relay CA operates and holds to the alarm reset link on the relay set. CA3 also lights the alarm lamp continuously to show that at some time a clock pulse has gone missing.

The relay set also holds the NU tone for spare levels relays.

Circuit Notes for diagram ck001d

Two clock mechanisms have been provided. The drive magnets can be energised via the clock isolate keys in the mounting above the clocks. Either or both clocks can be run.

To select which clock pulses are used, there is a link on the relay set test jacks which in position tj 1&2 select clock 1 and in tj 7&8 operate relay CS which changes over the reception of clock pulses to clock 2.

To change clock mechanisms, it is necessary to both select the key above the clocks and move the link to the required test jacks.

6 Second Pulse : This pulse from the selected clock operates relay CR and then CRR. Seven contacts CRR1 - CRR7 then provide earth pulses to U points 18 - 23 for direct connection to any equipment requiring the facility.

30 Second Pulse : This pulse operates both relay A and Relay ARR. Relay A drives the clocks via relay AR.

AR1 drives the local series clocks with a battery condition from the 200 ohm resistor. This value has been chosen to allow the correct current to flow round the series connected clocks.

AR3 dims the relay set lamp to show that the clock pulsing is happening correctly. AR2 is part of a divide by two circuit. When the first pulse arrives, AR2 operates C and when the pulse is removed AR2 holds C via C1 and also operates B. Thirty seconds later a further pulse arrives and AR2 releases C but holds B via B4. When the pulse ceases, AR2 releases B. Relay B is therefore operated for thirty seconds and released for thirty seconds.

Contacts B2 and B3 reverse the battery and earth conditions to the +- clocks every thirty seconds.

Relay ARR contacts provide 30 second pulses to miscellaneous equipment as required.

2 Second Pulse : This can be made to step the clocks on quickly when a correction is needed. Advance and retard keys are provided within the clock mechanisms and replace the 30 second pulse with a 2 second pulse to advance the clocks or stop the pulses completely to retard the clocks. A key in the shop office will also accomplish this by operating ADV or RTD as required.

Circuit Notes for diagram ck002b

This separate relay set was added when clocks were required too far from the exchange to be included in the series clock circuit. We had no more +- clocks but could find series clocks. We therefore provided more "series" circuits on a one per clock basis. These circuits would work over pairs up to a hundred ohms or similar. We have called these clocks, "auxiliary" clocks.

At the same time we included facilities to extend clock pulses to distant sites over a single wire to earth at the distant end. These clocks are now referred to as "distant "clocks.

This relay set is driven from a +- feed from the original ck001d relay set. This feed operates relay RC which is therefore operated for 30 seconds and is released for 30 seconds.

IP1 and RC2 will energise relay STP during the operate and release lags of relay IP every time RC operates or releases. ie STP pulses briefly every thirty seconds.

Note that relay PB is normally operated and the release lag of the relay is used to time the pulses out to the auxiliary and distant clocks. STP2 operates PA which holds via PB1 and PA2. PA2 releases PB but during its release lag PA1 and PB2 operate relay OP.

Note that STP1 and PB3 hold STP and at STP2, relay PA holds until PB3 releases STP. This ensures that the output pulse is always the same length ie the release lag of PB.

OP1-9 provide 250 ohm battery conditions to operate a series clock somewhere distant on the Norchard site.

OP10 pulses relay CR every thirty seconds. CR1-8 connect battery to line via relays CPA - CPH. These relays pulse to the line current to distant exchanges. If the connection is a spare it is necessary to provide a strap to earth on the IDF to simulate a line. Should all eight CPA - CPH relays operate, indicating that the pulse has been sent and presumably received, the alarm lamp flashes and CC operates.

When CR operates every thirty seconds, It attempts to operate CA but will fail to do so as long as CC has operated. CA has a slow to operate feature to prevent it operating during the small delay between CR and CC operating. If a pulse is missing, then CA operates and holds to CA1 and test jack earth. CA3 holds CC and lights the alarm lamp permanently until the test jack is removed.

An alarm lamp that flashes every thirty seconds is the required condition, if the lamp glows continually then it indicates that a pulse has not been received. Removing the distant relay set from its jack eg would cause the continuous alarm lamp to light.

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