Norchard - STARS Alarm Reception Relay Set

Before looking at the actual diagrams in use, it may help to consider the means by which multiple alarm conditions are fed from Parkend and Lydney Signal Box to Norchard exchange. This all relay method was suggested by Peter Wood from the Signalling Group and we are grateful to him for his ingenuity.

The circuit uses four main DC signals over the alarm wire, ie a light negative condition (a 2400 ohm 50 volts negative signal), a heavy negative (a 250 ohm 50 volts negative signal), a heavy positive signal, and a light positive signal. These signals are applied one after the other as required to indicate the alarms present at Parkend.

The main practical problem was in finding relays that would distinguish these four conditions coming from Parkend via the single alarm wire. Relays LN and LP at Norchard needed to have a low operate voltage (4 volts)to operate to the 2400 ohm battery condition. Lightly loaded 500 ohm relays with very full windings and diodes to distinguish the direction of current flow fulfilled this requirement. Relay H needed to operate only to the heavy condition. A relay using only one of the two windings on the core and with a fairly heavy spring load and an operate value of 17 volts was found to be suitable. Luckily the railway has a large stock of 3000 type relays to choose from.

One problem became apparent. The H relay being more heavily loaded than the LN relay, released faster when the alarm signal was not required. With LN still holding and H released, relay W produced a pulse and at W1 released any alarm relays already operated. We could only overcome this problem by first slugging the H relay by shorting its second winding and by also adding a slow to release relief relay HH. This in turn meant that the sending of sequential signals from Parkend had to be slowed down as well. This was achieved by the addition of the slow to operate and release AA and BB relays.

Circuit Operation

At Parkend, there are three relays, P, Q and R which are normally held operated by a loop when there are no alarms. P4, Q4 and R4 prevent relays A, AA, B and BB from operating. With AA2 and BB1 released, a light negative condition is sent to line on the single wire to Norchard. This holds relay LN operated, but does not provide sufficient line current to flow to operate relay H. LN2 operates relay W which at W1 lights the green alarm clear lamp. W1 also ensures that relays X and Y are not held from any previous alarm condition. This is the normal standing condition. Should the power fail at Parkend or the cable become faulty, LN will release and the alarm clear lamp will dim.

Should a fault occur then P, Q and/or R will release. Say relay P releases. P4 initiates a sequence of conditions on the wire to Norchard. P4 released, operates relay A and then AA. AA3 operates B and then BB. BB3 releases relay A and AA. Relays B and BB hold via P4 released, BB3 operated, P2 released, Q2 and R2 operated and C2 released.

During this sequence the following conditions are sent to line, AA operates and at AA2 connects heavy negative to line, then BB1 operates and line condition is disconnected as AA4 is operated but Q8 is also operated. When AA4 releases the line is earthed.

At Norchard, we started with LN and W operated. When the heavy negative condition occurs relays H and HH also operate. LN2 and HH2 release W and operate relay X which holds via X1 to the W1 earth. X3 lights the alarm lamp appropriate to the original P relay. When the line becomes disconnected or an earth is present, relays LN, H and HH release, but X remains held to the W1 earth.

If any further faults occur after the first has been sent and registered, the P, Q, R and C contact arrangement ensures that any movement of P, Q and R will cause the release of B and BB, the reoperation of A and AA, the reoperation of B and BB which will then hold to any P4, Q4 and R4 earth.

The sequence is

1) light negative condition to operate LN and W and at W1 reset any X or Y relays.

2) heavy negative condition should P be released, to operate LN, H and HH and set relay X.

3) heavy positive condition should Q be released, to release LN and operate LP and set relay Y.

4) light positive condition should R be released to release relay H and HH and operate relay Z. In this case the light positive condition remains on the wire to hold LP and Z. Should R not be released then the final condition on the wire is an earth which releases LN, LP and H and HH but leaves X or Y locked to the W1 earth until the faults are cleared. In the alarm sending element, P8, Q8 and R8 prevent the sending of any condition where a fault is not present.

The Norchard STARS Alarm Reception Relay Set

Multi Alarm Circuits : These circuits, of which there are two, will accept the alarm extension signals from Parkend and Lydney Signal Box.

Local DC Alarm Circuits : Alarm circuits in the Norchard exchange area will be sent to the alarm reception relay set as DC signals ie :

Any alarm within Norchard exchange will operate relays NCD and NCDD with an earth. The fuse alarm, release alarm and charge fail circuits are connected, although the charge fail circuit is not operational at this time.

Alarms from telecoms installations within the Norchard area, eg Norchard signal box, will forward a battery condition on one wire when all is clear. A disconnection of that battery condition will release relays BA to bring up an alarm.

Alarms from Signalling installations within the Norchard area will be forwarded as a loop on a pair indicating that all is well, but a 6.8Kohms resistance on the pair will indicate a fault. This increase of resistance will release relays LA to bring up an alarm.

The BA and LA relays are therefore normally operated when all is well.