Lydney Junction Line Concentrator

November 2011 : The concentrator for Lydney Junction Signal Box is now in service.

A rack has been built in the signal box locking room and is equipped with the following items :

1) A set of four 12 volt batteries giving between 50 and 55 volts when floated from a nominally 60 volt charger. The excess voltage is dissipated in a set of paralled 50 volt bulbs, the number of bulbs controlling the amount of charge.

2) A UAX13 ringer.

3) A relay set that monitors the battery voltage and receives alarms from the equipment on the rack and forwards the alarm condition to a display in Norchard exchange. The relay set also receives 30 sec pulses from the Norchard clock system to operate clocks within the box, and perhaps the station at a later date.

4) The concentrator which is built in three relay set cans, ie 6 line circuits (expansion to 8 circuits is possible), the operator's circuit and a timer.

5) Space has been left for a small 22 line exchange to be provided in the future.

6) A public address system to allow the signalman to make announcements to the station area.

There is also an ex BT ten way key and lamp unit mounted on the signal man's desk to act as the concentrator head. The KLU had to be much modified from its previous condition to be made suitable but is a very tidy and discreet way to present the connections to the signalman.

At the design stage we were referred to the IRSE recommendations for line concentrators and these can be summarised as :

"The design must include a display of the identity of the telephone (and thus the signal number and by inference, its location) at the signaller's control panel.....The system must ensure that only one conversation can take place to each signaller at any one time, thus preventing the overhearing of operational messages by other drivers. Systems should allow the signaller call back to the driver.

The modern Signal Post System is regarded as a secure system. There has to be a high degree of assurance that the lineside telephone connected during a call is at the location indicated at the signaller's console and that no other call can be inadvertently connected or interrupted whilst the call is in progress. All incoming calls from within a signalling area are directed to the signaller controlling that particular area and in turn outgoing calls to lineside telephones in the area are restricted to that signaller. All telephones at signals operate as CB extensions to the particular signaller's keyboard."

This meant that we were not providing a switchboard but a key and lamp system where it would not be possible to operate more than one speak key at a time.

Operation of the Lydney Junction Line Concentrator

1) SPT calls, box answers.

The SPT receives ring tone, the call lamp flashes on the concentrator and the bell rings.

The Box answers within time out period (2mins 30secs) by throwing the SPT and Operator's keys down. The ring tone stops, the call lamp goes out and the bell stops. The Signalman can speak to the SPT.

On release from the call, should the signalman clear first, the SPT will recall the concentrator until the SPT clears.

2) SPT calls, no response from Signal Box

The SPT receives ring tone, (if the signalman has thrown his out of use key, then the SPT receives NU tone), the call lamp flashes on the concentrator and the bell rings.

After time out period (2mins 30 secs) the call lamp glows permanently on the concentrator, but the bell stops. SPT receives NU tone.

Any other calling SPT receives NU tone and cannot call the box.

If the SPT continues to call, then, when the box is again staffed the call lamps indicate a problem. The faulty SPT can be isolated by operating the line circuit disconnect key upwards for that SPT. This action restores the system to normal. The calling SPT is isolated. The first action should be to check that the handset has been correctly replaced. If it has, then the fault needs to be reported to the Electrical and Telecoms Group for investigation.

3) Signalman calls an SPT, SPT answers.

The signalman throws the key down for the SPT required and his operator's key. The signal man presses the ring key briefly. Ringing is sent to the SPT and the call lamp flashes at ringing cadence to assure the signalman that the SPT is being rung.

When the SPT answers, the ringing stops and the call lamp goes out.

The Signalman can speak to the SPT.

On release from the call, should the signalman clear first, the SPT will recall the concentrator until the SPT clears.

4) Signalman calls an SPT, No response from SPT.

The signalman throws the key for the SPT required and his operator key. The signal man presses the green ring key briefly. Ringing is sent to the SPT and the call lamp flashes at ringing cadence to assure the signalman that the SPT is being rung.

After time out period (2min 30sec) the call lamp dims and ringing stops.

To restart ringing, the signalman will again need to press the ring key briefly.

5) Miscellaneous Operations.

a) The lamp above the operator's key will light whenever an SPT is on the line but will go out if the SPT hangs up.

b) Normally the bell will ring for as long as an SPT is calling, although the bell will stop after the time out period of 2mins 30sec. Throwing the short buzz key down will result in the bell ringing for just a second or so if this is preferred. This does not affect the lamps from indicating a caller.

c) If an attempt is made to connect two SPTs together by thowing two or more line keys simultaneously, none of the keys will connect its line and the bell sounds to indicate that something is wrong.

d) When the box is unattended the red operator's key can be thrown upwards. This connects NU tone to any calling SPT so that the caller is aware that the box is unattended.

e) The PA amplifier is not normally switched on. To switch the amplifier on, throw the PA key upwards. The lamp will light to inform the signal man that the amplifier is ready for use.

Equipment Operation

Line Circuit

Each line key has three positions. Centralised it connects the line circuit to line to await a call. Downwards it operates a K relay which switches the line through to the common equipment. Upwards the line is disconnected.

The lamp is normally out. If the SPT calls then it is flashed at a rapid rate. When the call is answered the lamp goes out. Should the call not be answered after a timeout period (2min 30sec) the lamp remains permanently lit. If the signaller calls the SPT, he operates the line key and then momentarily operates the ringing key. This causes ringing to be sent to line and the line lamp flashes slowly in synchronism with the ringing cadence.

Common Equipment and Operator's Circuit

The common equipment has a standard transmission bridge which is connected between any SPT and the signalman's telephone circuit by the operation of the SPT speak key and the operator's key.

The PHA relay circuit is of interest. It was derived from the IRSE text book on Railway Signalling and consists of a relay connected across a bridge circuit. If no speak key is thrown, then no current flows and the PHA relay remains released. If one speak key is thrown, then 430 ohm earths are connected to each side of the PHA relay which is balanced and remains released. If more than one key is thrown then 430 ohms is connected to the right hand side of the PHA relay and 215 ohms or less on the left hand side. This unbalances the circuit and current flows through PHA to operate it. PHA2 disconnects the earth from the SC wire thus preventing any K relay operating in the line circuits. PHA1 also operates the main warning light and the buzzer to tell the operator that he is misoperating the equipment.

A calling L relay in a line circuit, or the PHA relay operating lights the main warning lamp and starts the buzzer. At the same time relay SB starts its slow to operate feature. It takes a second or two to operate. The long/short buzzer key can select whether to use the period after the SB operation to ring the buzzer continuously or the short time before the SB operation to give just a quick call on the buzzer. In either case the main lamp lights continuously.

Any calling L relay or the operation of the ringing relays R and RR extends a start earth to the tone, ringing and time pulse relay set via the STA wire.

The ring trip circuit is of the standard type using the slow to operate F relay.

Tone, Ringing and Time Pulse Equipment

The timing relays are started by an earth on the STA lead. This operates relay ST which in turn causes relays FE and FR to interact and allow relay FE to provide a "flicker earth" pulse. This flicker earth at FE4 flashes any calling lamp rapidly. From here the relay set times out in around 2 mins 30secs.

Relays RA and RB divide the FE1 pulses by two, RC and RD reduce the pulse frequency by a further factor of two, as do relays RE and RF. Over all the pulse frequency is divided by eight. Various timings can be picked off the relay dividers. In particular RGB is operated in a similar cadence to British Ringing and then RUS covers the short gaps in the cadence to give a US type ring. In practice the British ring is not too satisfactory as the rings are too short, so the US ring has been adopted for this installation.

Each time the dividers end a sequence a type 4 uniselector T is operated. Each time T completes a sweep around its bank it operates uniselector TA. When TA moves to outlet 3 relay TP operates. This is after 2 mins 30 sec but the timing can be altered by strapping the earth to a different TA outlet. This releases relay ST and at the same time holds to the start condition. The relay set stops timing. TP7 stops the buzzer from sounding (but the main lamp stays alight). TP5 stops the calling lamp flashing and causes it to glow permanently although at a somewhat reduced brilliance. TP2 connects NU tone to any caller. The situation can be released by the signalman operating a line disconnect key or a speak key.