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Level 2

Signalling Design: Module B9 -

Interlockings – Free Wired Route Setting Interlocking Guidelines

Endorsement and Authorisation

For endorsement and authorisation, please refer to
NR/L2/SIG/11201

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Issue record

Issue	Date	Comments
4	June 2011	Modularisation of handbook and guidance notes, contains content of former NR/GN/SIG/11600 Appendix F2.

Compliance

This Module is mandatory and shall be complied with by Network Rail and its contractors if applicable from 03/09/2011.

When this standard is implemented, it is permissible for all projects that have formally completed GRIP Stage 3 (Option Selection) to continue to comply with the issue of any relevant Network Rail standards current when GRIP Stage 3 was completed and not to comply with requirements contained herein, unless stipulated otherwise in the scope of this standard.

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Ref:	NR/L2/SIG/11201 – Mod B9
Issue:	4
Date:	04/06/2011
Compliance date:	03/09/2011

Contents

1 INTRODUCTION	4
2 ROUTE SETTING	4
3 ROUTE STICK RELAY CHAIN	8
4 SIGNAL RELAY (ROUTE PROVING)	10
5 ROUTE RELEASING	13
6 POINT CIRCUITS	15
7 SWINGING OVERLAPS	18
8 PRE-SET SHUNT SIGNALS	19
9 REMOTE CONTROL OVERRIDE	20
10 GROUND FRAMES	20

Ref:	NR/L2/SIG/11201 – Mod B9
Issue:	4
Date:	04/06/2011
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1 INTRODUCTION

Unless otherwise stated, these notes are generally applicable to the Network Rail route relay interlocking typical circuits and their predecessor, [BRS-SW67](#). The control table notation used is in accordance with [NR/L2/SIG/11201, Module A18](#), and relay notation with [NR/L2/SIG/11201, Module A19](#).

[NR/L2/SIG/11201, Module B7](#), Section 3 laid down the requirements for interlocking controls and specified their tabulation in control tables. The application of the principles and requirements to route setting systems are summarised in [NR/L2/SIG/11201, Module B7](#), Section 7. This module demonstrates how those controls may be provided by the use of free-wired circuitry. Figures:1 and 2 identify how the standard controls are applied to free-wired interlocking and enables a comparison with the other interlocking systems.

Other relay configurations are possible, particularly where it is not necessary to store the state of interlocking functions in the event of a power failure, in which case lock relays can be dispensed with altogether. Examples are given in [NR/L2/SIG/11201, Module B7](#), Figure 21 and [NR/L2/SIG/11201, Module B10](#), Figure10.

2 ROUTE SETTING

2.1 ROUTE INITIATION

The signaller interface is performed by one of the means described in [NR/L2/SIG/11201, Module B7](#), Section 3.1.

Route setting in the actual interlocking commences, for entrance-exit control systems, with contacts of the start and destination relays, (S)R and (D)R, on the return side of the route lock circuit. Equivalent contacts are used for other control systems. Any control panel or non-safety contacts should be arranged at the negative supply end of the circuit, as explained in [NR/L2/SIG/11201, Module B3](#).

2.2 ROUTE AVAILABILITY

The requirements for route controls are given in [NR/L2/SIG/11201, Module B7](#), Section 3.2.

Route lock relays are similar to the signal lock relays described in [NR/L2/SIG/11201, Module B7](#), Section 6.2, except that one is required for every route from a signal. Anti-preselection may be provided in the operation of the reverse route relay by means of a stick circuit as follows:

Ref:	NR/L2/SIG/11201 – Mod B9
Issue:	4
Date:	04/06/2011
Compliance date:	03/09/2011

R O U T E R E Q U I R E S	Points Set or Free		Track Circuit	Routes and Sectional Route Locking Normal	Sectional Route Locking Released by Track Circuits Clear OR Occupied		Time \$46	Special Controls/Remarks		R O U T E R E Q U I R E S			
	Normal	Reverse	TPR of per- missive track to pick up appro- priate route RLR.	NLR of opposing routes in the route RLR, plus first opposing USR up.	Route NR and ALSR up to latch its NLR, plus USRs repicked to release the route locking.	TJPR of permissive track to repick permissive track USR.		In the route RLR, as appropriate.					
	Route Disable Control Provided												
S I G N A L C O N T R O L S	Points Set and Locked and Detected		Points Set & Detected N or R	Track Circuits Clear				Track Circuits Occupied		S I G N A L C O N T R O L S			
	Normal	Reverse	(NWKR or RWKR) to pick up the GR, or OSR to hold it up while points swing.	TPRs in the GR.				TPR or timer in the GR in series with the appropriate route RLR.					
	NKLPR (proves detection, including NLR up, and WZR down) in the GR.	RKLPR (proves detection, including RLR up, and WZR down) in the GR.											
R E Q U I R E S	Signals Alight	Track Circuits Occupied for \$40 to Inhibit Replacement	Slick Control Applied When Signal Off & Track Circuit Occupied		Special Controls/Remarks		A S P S U H R a n d U E C R i n t h e H R.	Route Indication Alight	Aspect to be Shown	Next Main Signal:		Track Circuits Occupied	
	ECPR in the GR.		GSR in the GR.	In the GR.		Aspect				Route Set	Banner Aspect		
						Aspect							
						Meshed circuit.							
						Aspect Disable Control/Link Provided				Automatic Working Facility Provided	A W S		Permanent Magnet Electro-Inductor
A P P R O A C H L I N K G.	Approach Locking Applied When Signal Clears (or Attempts to Clear or to Show a Route Indication) Unless Track Circuits are Clear		Signals ON and Free of Approach Locking		Approach Locking Released by Signal ON and Track Circuits		Time \$46	Special Controls/Remarks		T O R R	TORR Requires Approach Locking Free and Tracks NR in the NLR pick up.		T O R R
	The TAR proves tracks clear back to the signal in rear. The ATSR combines TARs for the sections in rear.				TASR and the first track TPR clear in series in the ALSR.		AJR to repick the ALSR.						

Figure 1 – Free-Wired Interlocking - Signal Route & Aspect Controls

Ref:	NR/L2/SIG/11201 – Mod B9
Issue:	4
Date:	04/06/2011
Compliance date:	03/09/2011

	Requires Track Circuits Clear	Set by Routes or Ground Frame	Requires Routes & Sectional Route Locking Normal or Points/GF	Sectional Route Locking Released by Track Circuits Clear Track Circuit Time OR Occupied \$46	Swinging Overlap Requires					
						Track Circuits Clear	AND	Points Set or Free	OR	Routes & Sectional Route Locking Normal
P O I N T S C A L L E D N > R	N > R Disable Control Provided	Route RLRs in parallel in the point lock circuit (N50 side), or via a RCUR.	Route NLRs in series in the N > R leg of the point lock circuit (B50 side).	Point track USRs in the N > R leg of the point lock circuit (B50 side).	TJPR of destination signal berth track to repick (O/L)USR.		TPRs in series in ROAR.	NZLPR or RZLPR up in ROAR. The ROAR forms part of one leg of those points' NCUR or RCUR.		Overlap route OCZR up in ROAR.
	TPRs in the point lock circuit (B50 side).									
P O I N T S C A L L E D R > N	As above.	Route RLRs in parallel in the point lock circuit (N50 side), or via a NCUR.	Route NLRs in series in the R > N leg of the point lock circuit (B50 side).	Point track USRs in the R > N leg of the point lock circuit (B50 side).	As above.		TPRs in series in NOAR.	NZLPR or RZLPR up in NOAR. The NOAR forms part of one leg of those points' NCUR or RCUR.		Overlap route OCZR up in NOAR.
	R > N Disable Control Provided									
TIME OF OPERATION LOCKING	EFFECTIVE	When Routes Used			R E L B Y	Tracks Clear or Tracks Occupied		\$8	Secs	
		Applies a control: (O/L USR up, --- to the common leg of the point lock circuit.				--- OR berth track clear, -----		OR occupied -----	for a time)	

Figure 2 2 – Free-Wired Interlocking - Point Controls

Ref:	NR/L2/SIG/11201 – Mod B9
Issue:	4
Date:	04/06/2011
Compliance date:	03/09/2011

- a) control systems using switches: by providing the interlocking conditions present and switch normal, prior to the switch being reversed; or
- b) other systems: by applying the call for a limited period and sticking it out by a contact of the reverse route relay.

In a typical free-wired interlocking, each route has a normal and reverse pair of interlocking relays (NLR & RLR). The NLR is latched, but the RLR is ordinary acting. On the supply side of the relay coils are the locking conditions required for the route to set, and on the return side are the setting conditions, the equivalent of the entrance and exit buttons (Section 2.1). The locking conditions are defined on the "route requires" section of the Signal Route & Aspect control table sheet (Figure:1), in particular the "points set or free" and the "routes and sectional route locking normal" entries. In the circuit these are represented by the point normal or reverse ZLPRs (free or appropriately locked repeater relays) and the opposing route NLRs, respectively. Opposing routes includes both directly opposing routes and different class routes from the same signal. In addition, a front contact of certain opposing route stick relays (USRs) should be included here (see Section :2.4). (ZLPRs are energised by the points free relay in parallel with the appropriate point lock relay.)

Where sectional route locking comprehensively locks all track sections, the opposing route NLRs are not strictly necessary, so long as a USR is included that is cascaded from the NLR (or ALSR where there are no NLRs) and will perform the same function. However, these USRs should not be released in the event of track section failure.

Track sections are not proved when setting a route except those that distinguish between different classes of route, i.e. call-on (C) or main (M). (These appear in the "track circuit" entry.) When this is done it is necessary to stick out this control with an RLR front contact, to prevent the route unsetting itself when the track condition is removed. This may be achieved most conveniently by including the track section concerned in the return side of the circuit in addition to the button proving contacts.

Any special signal route controls, or other route controls summarised in [NR/L2/SIG/11201, Module B10](#), Figure 3 (Section 2.2), should also be included in this route lock circuit.

The NLR is released preventing conflicting routes or points from setting, and the RLR is energised thus proving that the registered route is available and initiating point setting (see Section 6.2).

The NLR latched relay should be down proved (as required in [NR/L2/SIG/11201, Module B3](#)) and this is achieved by proving the NLR released before the RLR can energise, although the converse is not required where the RLR is an ordinary acting relay.

2.3 ALTERNATIVE FREE-WIRED SYSTEMS

In systems where the route relay (RLR or UR) is a latched relay, the signaller's route cancel function (e.g. OCS route switch reverse) should be additionally included in the signal aspect controls, to allow manual replacement.

In systems where the integrity of latched relays is such that they can only be thrown down by operation to the opposite position, a single latched relay may be used, instead of a separate NLR and RLR. This does not require down proving before being called to the