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Level 2

Signalling Design: Module B7 - Interlockings - General

Endorsement and Authorisation

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

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5	03/09/2011	Amended references due to withdrawal of NR/L3/SIG/30018
6	07/06/2014	Clause 3.2.6 updated to incorporate GK/RT0044 (1)

Compliance

This Module is mandatory and shall be complied with by Network Rail and its contractors if applicable from 06/09/2014.

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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Contents

1 INTRODUCTION 7

2 DESIGN PRINCIPLES 9

2.1 REGULATORY REQUIREMENT 9

2.2 SELECTION OF INTERLOCKING SYSTEM 9

2.3 INTERLOCKING INTEGRITY AND PROVING 9

2.4 MOVEMENT AUTHORITIES AND PROVING OF ROUTE 10

2.5 PERMISSIVE MOVEMENTS 11

2.6 WITHDRAWAL OF AUTHORITY 11

2.7 MOVABLE INFRASTRUCTURE 11

2.8 OVERRUN PROTECTION AND MITIGATION 12

2.9 CONTROL POINT 12

2.10 DEGRADED OPERATION 12

2.11 SYSTEM MONITORING 13

2.12 MAINTAINER'S FACILITIES 13

2.13 IDENTITY OF INTERLOCKING FUNCTIONS 13

2.14 DOCUMENTATION 13

2.15 RELAXATION 14

3 INTERLOCKING REQUIREMENTS 14

3.1 SIGNALLER'S INTERFACE 16

3.1.1 CONTENT 16

3.1.2 ARRANGEMENT 16

3.1.3 AUTOMATIC ROUTE SETTING (ARS) SYSTEMS 18

3.2 SIGNAL AND ROUTE CONTROLS 18

3.2.1 CONTROLLED STOP SIGNALS ASSOCIATED WITH NON-ROUTE SETTING INTERLOCKINGS 18

3.2.2 CONTROLLED STOP SIGNALS AND ROUTES, ASSOCIATED WITH ROUTE SETTING INTERLOCKINGS 21

3.2.3 STOP SIGNALS NOT ASSOCIATED WITH AN INTERLOCKING 25

3.2.4 REPEATING SIGNALS AND INDICATORS 28

3.2.5 RESTRICTED APPROACH ARRANGEMENT (ALSO KNOWN AS WARNING ARRANGEMENT) 29

3.2.6 PERMISSIVE MOVEMENTS 30

3.2.7 SHUNTING MOVEMENTS 32

3.2.8 PRE-SET SIGNALS 33

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3.2.9 SLOTS AND RELEASES 34

3.2.10 APPROACH CONTROL 35

3.2.11 AUTOMATIC WORKING FACILITIES 36

3.2.12 DELAYED CLEARANCE 36

3.2.13 NO SIGNALLER ROUTE SETTING 36

3.3 TRACK SECTIONS 37

3.3.1 TRACK CIRCUIT BLOCK 38

3.3.2 STATION LIMITS IN NON-TRACK CIRCUIT BLOCK 40

3.3.3 ESTIMATION OF TRAIN POSITION OR SPEED BY EXPIRY OF AN ELAPSED TIME 41

3.3.4 FOUL TRACK SECTIONS 44

3.4 OVERRUN PROTECTION AND MITIGATION 46

3.4.1 MAIN OVERLAPS 46

3.4.2 LOCKING OF THE OVERLAP 50

3.4.3 SHUNT OVERLAPS (FORMER METHOD) 54

3.4.4 FLANK POINT SETTING (FLANK PROTECTION) 54

3.4.5 TRAP POINTS (TRAPPING PROTECTION) 55

3.4.6 OVERRUN DETECTION USING FLANK TRACK SECTIONS 57

3.4.7 ENHANCED OVERRUN PROTECTION 58

3.4.8 TRAIN WARNING OR PROTECTION SYSTEMS 58

3.5 CONTROLS FOR POINTS AND OTHER MOVABLE INFRASTRUCTURE 59

3.5.1 CONTROL AND NUMBERING 59

3.5.2 SPLIT DETECTION 61

3.5.3 LIE OF POINTS 63

3.5.4 SETTING OF POINTS 63

3.5.5 ANTI-PRESELECTION 65

3.5.6 LOCKING OF POINTS AND OTHER MOVABLE INFRASTRUCTURE 65

3.5.7 RELAXATION OF POINT LOCKING, ETC. 66

3.5.8 ROUTE AND OVERLAP LOCKING 67

3.5.9 OPPOSING LOCKING AND BI-DIRECTIONAL LINES 69

3.6 GROUND FRAMES AND GATE BOXES 70

3.6.1 GROUND FRAMES IN INTERLOCKING AREAS AND STATION LIMITS 71

3.6.2 REMOTE GROUND FRAMES: TRACK CIRCUIT BLOCK AND INTERMEDIATE BLOCK SECTIONS 74

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3.6.3 IN-SECTION GROUND FRAMES: ABSOLUTE BLOCK AND SINGLE LINE BLOCK WITHOUT TOKENS 75

3.6.4 IN-SECTION GROUND FRAMES: KEY OR TOKEN RELEASES 77

3.6.5 RELAXATION IN INTERLOCKING PRINCIPLES FOR GROUND FRAMES 78

3.7 SIGNAL REPLACEMENT AND ROUTE NORMALISATION 78

3.7.1 SIGNAL REPLACEMENT 79

3.7.2 APPROACH LOCKING 80

3.7.3 RELAXATION OF APPROACH LOCKING 83

3.7.4 TRAIN OPERATED ROUTE RELEASE (TORR) 83

3.7.5 RELEASE OF ROUTE AND OVERLAP LOCKING 84

3.8 LEVEL CROSSINGS 85

3.8.1 INTERLOCKED GATED CROSSINGS 86

3.8.2 CONTROLLED BARRIER CROSSINGS 86

3.8.3 AUTOMATIC CROSSINGS 86

3.9 MISCELLANEOUS FACILITIES 87

3.9.1 MOVABLE BRIDGES 87

3.9.2 LOCKOUT DEVICES 87

3.9.3 TRAIN ACTIVATED WARNING SYSTEMS (TAWS) 87

3.10 INTERFACES AND TRANSMISSION SYSTEMS 88

3.10.1 SAFETY INTEGRITY REQUIREMENTS 88

3.10.2 TRANSMISSION SYSTEMS 89

3.10.3 REMOTE CONTROL FAILURE 91

3.11 MAINTAINER'S FACILITIES 92

3.11.1 INDICATION MONITORING 93

3.11.2 LOCAL CONTROL PANEL 94

3.11.3 FAILURE MONITORING 94

3.11.4 OPERATION MONITORING 95

3.11.5 MAINTENANCE FACILITIES 95

3.11.6 RESETTING AND RESTORATION 96

3.11.7 RESTRICTIVE CONTROLS 96

4 APPLICATION TO MECHANICAL SIGNALLING SYSTEMS 97

4.1 GENERAL 97

4.2 MECHANICAL CONTROL AND INTERLOCKING 97

4.3 POINT LOCKING 98

4.4 INDICATIONS 98

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4.5 SEQUENTIAL LOCKING AND OTHER PROVING 98
4.6 NUMBERING ASSOCIATED WITH LEVER FRAMES 99
4.7 LEVER NOMENCLATURE PLATES 99
4.8 LEVER PAINTING 100
5 APPLICATION TO ELECTRO-MECHANICAL SIGNALLING SYSTEMS 100
5.1 GENERAL 100
5.2 INTERLOCKING 100
5.3 ELECTRIC SELECTION LOCKING 101
5.4 APPROACH LOCKING AND SIGNAL DISENGAGING 104
5.5 ELECTRICAL CONTROL AND OPERATION 104
5.6 PROVING 105
5.7 INDICATIONS 106
5.8 SEALED EMERGENCY RELEASES AT SIGNAL BOXES 106
6 APPLICATION TO ALL-ELECTRIC NON-ROUTE SETTING INTERLOCKING SYSTEMS 106
6.1 GENERAL 106
6.2 INTERLOCKING 107
6.2.1 LEVER FRAMES 107
6.2.2 SWITCH PANELS WITH LATCHED RELAYS 107
6.2.3 ALTERNATIVE ARRANGEMENTS 108
6.2.4 ROUTE LOCKING 108
6.2.5 ANTI-PRESELECTION 110
6.3 SELECTION LOCKING 110
6.4 APPROACH LOCKING 110
6.5 CONTROL AND OPERATION 110
6.6 PROVING 111
6.7 INDICATIONS 111
6.8 SEPARATE ELECTRIC LOCKS 111
7 APPLICATION TO ROUTE SETTING INTERLOCKING SYSTEMS 111
7.1 GENERAL 111
7.2 SIGNALLER'S CONTROLS 112
7.3 ROUTE SETTING 112
7.3.1 ROUTE INITIATION (OR REGISTRY) LEVEL 112
7.3.2 COMPLETION LEVEL 113
7.3.3 ROUTE LOCKING LEVEL 115

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7.3.4 ASPECT (OR ROUTE PROVING) LEVEL 115

7.4 ROUTE RELEASING 116

7.5 OPERATION 116

7.6 PROVING 116

7.7 IDENTIFICATION IN ROUTE SETTING SYSTEMS 117

8 HYBRID SYSTEMS 117

1 INTRODUCTION

1.1

This module applies, in support of GK/RT0060, to the design of interlockings (including ground frames) associated with:

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a) mechanical signalling systems;

b) electro-mechanical signalling systems;

c) electro-pneumatic signalling systems;

d) all-electric non-route setting signalling systems;

e) free-wired route setting signalling systems;

f) geographical route setting signalling systems;

g) electronic signalling systems; and

h) hybrid systems.

Where appropriate, reference to “signals” should be understood in relation to movement authorities within both lineside signalling and cab signalling systems.

1.2

This module does not cover the presentation and production processes for design details.

For the presentation and use of mechanical locking charts, interlocking circuit diagrams and central interlocking data listings within the design process, see NR/L2/SIG/11201, Module A2. and NR/L2/SIG/11201, Module A19. Documentary requirements for control tables are given in NR/L2/SIG/11201, Module A18.

1.3

Where it entirely addresses the situation under consideration, the use of this Standard is an alternative to the risk-based approach. However, where the particular application or intended environment for the system introduces additional risks, these should be subject to separate assessment.

The design principles in Section 2 give the minimum requirements, even when the risk-based approach is used. These principles are mandated in NR/L2/SIG/11201. More detailed requirements for the design of interlockings are given in Section 3. Sections 4 to 8 describe the application of the design principles and requirements, as evolved through different interlocking systems, starting with the most basic.

1.4

The following guidelines should satisfy the principles encompassed within the Standard:

a) guidelines on mechanical locking in NR/L2/SIG/11201, Module B8;

b) guidelines on relay route setting applications in NR/L2/SIG/11201, Module B9;

c) the route relay interlocking typical circuits listed in NR/L3/SIG/19272;

d) guidelines on geographical relay interlocking systems in NR/L2/SIG/11201, Module B10;

e) guidelines on electronic interlocking systems in NR/L2/SIG/11201, Module B11; and

f) interlocking systems application manuals, such as NR/L2/SIG/17002 for SSI.

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The use of interlocking circuits or system application manuals that pre-date this standard should be assessed against the design principles given in Section 2 and the signalling principles in NR/L2/SIG/30009.

The examples shown in this Standard are based on the signalling layout and control table illustrations given in NR/L2/SIG/11201, Module A18.

2 DESIGN PRINCIPLES

These principles are mandated in NR/L2/SIG/11201.

2.1 REGULATORY REQUIREMENT

Suitable and sufficient interlocking, in conjunction with appropriate operating and maintenance procedures, shall be provided to prevent, so far as is reasonably practicable, the following occurrences:

a) collision between vehicles;

b) collision between a vehicle and a buffer stop;

c) derailment caused by confliction with movable infrastructure; and

d) derailment caused by excessive speed.

This is a requirement of the Railway Safety (Miscellaneous Provisions) Regulations 1997. Note that items (b) and (d) are considered further in NR/L2/SIG/11201, Module B17.

2.2 SELECTION OF INTERLOCKING SYSTEM

The choice of interlocking system should be made to achieve an appropriate balance between manual and automatic protection, in order to control risks so far as is reasonably practicable. A risk assessment should consider such factors as:

a) service frequency;

b) traffic type and mix (including light railway/metro, passenger and/or freight);

c) permissible speeds;

d) layout complexity;

e) interfacing with trains;

f) interfacing with adjacent interlockings and existing systems;

g) available space or housing;

h) power supply availability;

i) target life span; and

j) skills availability (in design, installation, operating and maintenance fields).

2.3 INTERLOCKING INTEGRITY AND PROVING

Interlockings and interfaces between interlockings should follow the principles for safety-critical systems. The interface with the trackside signalling equipment (or cab signalling system) should also be safety-critical.

Interlocking equipment should provide for the operation of interlocked trackside signalling equipment, corresponding to the state of the appropriate function within the

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interlocking. Where necessary to reduce risks to an acceptable level, proving should be used to confirm interlocking and/or trackside equipment is in a safe state before another operation can be carried out, as described in the design principles in NR/L2/SIG/11201, Module B3.

Where necessary to achieve Network Rails specified availability level (see NR/L2/SIG/11201, Module A20), the state of safety-critical interlocking functions should be stored by a means that will remain secure in the event of a total failure of all power supplies, e.g. by locked lever, latched relay or non-volatile memory. Interlockings should be designed to prevent an unsafe state occurring during power supply failure or restoration, including momentary loss.

Where the state of safety-critical information is not stored (e.g. in the case of relay interlocking systems without latch relays, or certain electronic interlocking systems), the system should be designed to revert to a safe state, or refresh to correspond to the state of the railway, before being restored to use. Wherever practicable, circuits should function in their usual manner following power supply loss and restoration without having to be manually reset by a maintainer, unless a safe state cannot otherwise be confirmed. Where necessary to re-establish the integrity of the interlocking, a delay should be incorporated into the restoration to confirm that all movements have come to a stand.

Transient conditions or faults in the train detection system should not allow conflicting routes to be set, or routes to be prematurely released.

2.4 MOVEMENT AUTHORITIES AND PROVING OF ROUTE

It should only be possible to give a movement authority when it is safe to do so, i.e. when movable infrastructure over which it is given is set and locked in the correct position. The interlocking should confirm that no conflicting authority can be given to trains or level crossing users.

Wherever practicable, the interlocking should be proved effective before a movement authority can be given.

The operation of the trackside signalling equipment should be proved to be in correspondence with the state of the appropriate function within the interlocking before a movement authority can be given. For example, points should be detected before a signal reading over them can be cleared and a signal should have been proved on before a conflicting signal can be cleared.

A movement authority should not be given if any foul track sections on the flanks of the route are occupied.

Facilities should be provided to allow for the maintenance of a safe distance between trains travelling on the same line through, or within, the interlocking area. Except where permissive working is authorised, an authority should not be given for a running movement to proceed over a line of route that is occupied. The requirements for block systems are given in GK/RT0041, GK/RT0042, GK/RT0051 and GK/RT0054.

Signals should not show a proceed aspect unless the next signal ahead is displaying a valid aspect, in accordance with GK/RT0045. Wherever practicable, this should be engineered in such a way that will facilitate degraded operation with a reduced level of protection, as detailed in Section 2.10. Any shunting signals in the line of route

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that are not associated with a main aspect should be cleared before authority for a running movement past them can be given.

It should not be possible to give a movement authority for a diverging route unless the train speed has been appropriately controlled, or the driver has had sufficient warning of the divergence to be able to appropriately control the train speed.

Wherever practicable, the movement authority should be automatically cancelled if any of the conditions that allowed the authority to be given are lost, except for those conditions that are required only at time of signal clearance.

2.5 PERMISSIVE MOVEMENTS

Where facilities for attaching and detaching operations are required, at terminal platforms, or otherwise where specially authorised in the Sectional Appendix, a subsidiary signal (PLS or semaphore) should be used to give authority for a shunting movement, or permissive movement in accordance with GK/RT0044, as appropriate.

It should not be possible to select more than one class of route from a signal at any one time.

2.6 WITHDRAWAL OF AUTHORITY

Once authority to proceed over a line of route has been given, the route should remain protected until that authority is withdrawn. The interlocking should prevent the release of points and conflicting signals that have been locked to give an approaching train authority to proceed until the train has passed through the route or has been proved to have come to a stand before entering the route, in accordance with GK/RT0063. The route may be released progressively for operational flexibility. The route may also be released in order to authorise a permissive movement up to a stationary train.

Wherever practicable, movement authorities should be withdrawn as soon as possible after the passage of a train. Where this is not practicable, other precautions should be taken to prevent more than one train being inadvertently admitted to the same signal section. The route may be released automatically once it has been confirmed that the train has passed through the route.

Facilities should be provided for the signaller to withdraw movement authorities from any train under his/her control. These facilities should be maintained under degraded operating conditions. Under ordinary operating conditions, an independent facility should be available for each signal or train.

2.7 MOVABLE INFRASTRUCTURE

Once authority to proceed over a set of points, controlled level crossing, movable bridge, or traverser, etc. has been given, the infrastructure should be locked until that authority is withdrawn. The locking of the infrastructure should be maintained, preventing operation:

a) when the section of track over the infrastructure is occupied (track locking); and generally

b) when the section of track between a protecting signal and the infrastructure concerned is occupied (route holding).

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2.8 OVERRUN PROTECTION AND MITIGATION

Where the risk of a Signal Passed at Danger (SPAD) is high, and it is impracticable to reduce the risk, special precautions should be taken to warn the driver in the event of a SPAD (see NR/L2/SIG/11201, Module B17) and, where reasonably practicable, withdraw movement authorities on conflicting routes. Risk criteria are given in GI/RT7006.

A minimum distance between trains (i.e. overlap) should be maintained, in accordance with GK/RT0064, except where the risk of a SPAD is low. This requirement should be enforced in the case of running movements in track circuit block by proving the overlap clear in the signal in rear, as if it were in the line of route. Examples of movements with a low risk of SPAD include:

a) those made under the restricted approach arrangement;

b) permissive movements; and

c) non-running movements.

Where facing points are situated in the overlap, they may be moved to give an alternative overlap without replacing the signal, providing the alternative is available and detection is re-established within a certain time. Where trailing points are situated in the selected overlap, they should be locked as if they were in the line of route. Such overlap locking may be released once the movement authority has been withdrawn and the train is proved to have come to a stand at the destination signal.

Trap points and other points that afford flank protection should generally be set to avoid the risk of collisions, in accordance with GK/RT0064.

2.9 CONTROL POINT

The interlocking equipment should be controlled from a signal box (or other control point). The state of the signalling equipment should be indicated at the signal box (or other control point). Control and display systems should be designed in accordance with TI 157, which mandates the former GK/RT0025..

Where proving or detection is required in Section 2.4 for use in the interlocking (e.g. for the state of controlled functions, train detection, routes and time releases) it should also be indicated to the signaller. See TI 157.

The interface between the interlocking and the signalling control and display system should be safety-related.

2.10 DEGRADED OPERATION

Wherever reasonably practicable, provision should be made for the graceful degradation of operating facilities in the event of a failure of a strategic signalling system. It should be possible to give restricted movement authorities with a certain minimum level of protection in order to maintain safe operation under degraded conditions.

Examples include:

a) facilities to allow a signal to clear to single yellow with the signal ahead displaying no aspect, provided the controls of the signal ahead are off, (but, wherever reasonably practicable, a failed green aspect at the signal ahead should step down to display a cautionary aspect);

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b) allowing a signal to clear with the signal ahead displaying a single yellow aspect in lieu of a double yellow, (but, wherever reasonably practicable in four aspect sequences, the signal in rear should step down to display a cautionary aspect);

c) inauguration of permissive working, or use of the restricted approach arrangement;

d) remote control override (an interface system with restricted facilities that can override the main signal box to interlocking transmission system);

e) reconfiguration to isolate failed equipment and permit other parts of the system to be reinstated; and

f) initiation of single route setting following the failure of flank protection.

Where necessary, procedures should permit maintainers or signallers to release certain equipment to permit restricted movement authorities to be given.

2.11 SYSTEM MONITORING

Where necessary to achieve Network Rail s specified availability level (see NR/L2/SIG/11201, Module A20), monitoring should be provided to warn the signaller or maintainer of a failure, by means of an audible and/or visual alarm. Monitoring alarms that directly affect train operations should be communicated to the signaller, but other alarms need only inform the maintainer.

2.12 MAINTAINER'S FACILITIES

The following maintainer's facilities should be provided at the interlocking, to the degree necessary to satisfy Network Rail specified maintainability requirements (see NR/L2/SIG/11201, Module A20):

a) monitoring of indications being transmitted to the signalling display;

b) means of taking local control;

c) failure monitoring, giving indication of faults;

d) operation monitoring, including event recording equipment and data loggers;

e) maintenance facilities to assist the tracing of faults;

f) isolation devices to allow off-line resetting of equipment, as required by GK/RT0028; and

g) means to set restrictive controls, in accordance with GK/RT0060.

2.13 IDENTITY OF INTERLOCKING FUNCTIONS

All signalling functions should bear an identity, in accordance with GK/RT0009, that is unique to the interlocking and corresponds with the identity shown on the signalling display.

2.14 DOCUMENTATION

The signalling functions controlled from each interlocking should be depicted on a signalling/scheme plan and their interlocking logic should be tabulated in the form of control tables, as described in NR/L2/SIG/11201, Module A2.

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2.15 RELAXATION

Certain principles that it is not reasonably practicable to satisfy may be relaxed where the section of track concerned is clearly visible from the controlling point. These may include the requirements for:

a) continuous train detection in non-track circuit block;

b) approach control of signals;

c) approach locking of signals, as permitted in GK/RT0063;

d) track locking and route holding of controlled level crossings, where the protecting signal is within 100m of the crossing, as permitted in NR/L3/SIG/30018;

e) track locking and route holding of ground frame points, as permitted in GK/RT0061;

f) track locking and route holding of trailing points and other movable infrastructure; and

g) detection **or** locking of facing points (non-passenger movements only). See NR/L2/SIG/11201, Module B13.

In such cases the automatic protection generally afforded by the interlocking should be provided manually by the signaller.

Any proposed use of this relaxation should be subject to the agreement of the Route Asset Manager (S&T) and should demonstrate that risks are controlled so far as is reasonably practicable.

3 INTERLOCKING REQUIREMENTS

This section gives the detailed requirements to be incorporated, where appropriate, in all types of interlocking.

For the application of the design principles and requirements to different types of interlockings, see the following sections:

a) purely mechanical lever frames - Section 4;

b) electro-mechanical lever frames - Section 5;

c) all-electric non-route setting interlockings - Section 6; and

d) route setting interlockings - Section 7.

The following abbreviated terms are used in this section:

At a stand	=	the track section has been occupied for such a time that it may be assumed that the movement has stopped.
Block overlap (BOL)	=	the acceptance overlap beyond the home signal up to the clearing point in non-track circuit block.
Hinge points	=	facing points within an overlap that are permitted to swing in order to give an alternative overlap.

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Independent PLS	=	a position light signal not associated with a main aspect.
LC/TA	=	block indicator at “line clear” (absolute block) or “train accepted” (tokenless block).
Limit of shunt (LOS)	=	shunting signal fixed on (PLS or semaphore), or LOS indicator.
Non-colour light signal	=	semaphore signal or reflectorised board.
Non-track circuit block (Non-TCB)	=	absolute block or one of the various types of single line block.
Overlap (OL)	=	for a stipulated distance ahead of the next signal in advance, or to the end of the overlap track section (where provided), whichever is the greater.
Permissive track	=	the track section(s) where permissive working is authorised, e.g. where attaching and detaching operations take place.
Phantom overlap (POL)	=	the limit of overlap locking in cases where the overlap track section extends further.
Power operated signal	=	motorised semaphore, or colour light signal.
Pre-set signal	=	a facing signal in the line of route that is required off by a pre-setting signal.
Pre-setting signal	=	the signal that requires pre-set signal(s) off in the line of route.
Related stop signal(s)	=	in relation to a distant signal, all of those signals that are required to be proved clear before the distant signal can be cleared.
Reduced overlap	=	a full overlap of reduced length.
Restricted overlap (ROL)	=	a short overlap used under the restricted approach arrangement (e.g. delayed yellow) where there is also a full overlap.
Subsidiary PLS	=	a position light signal associated with a main aspect.
TOL/TIS	=	block indicator at “train on line” (absolute block) or “train in section” (tokenless block).
Track (Tk)	=	track section, i.e. track circuit(s) or other means of continuous train detection.

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Train warning or protection systems	=	train interactive systems for SPAD mitigation, such as the automatic warning system (AWS), automatic train protection (ATP), train protection and warning system (TPWS) and trainstops.

The requirements of this section are summarised in tables (Figures 1 to 6 and 12 to 18) which are referred to in the text. Options which are explained in the appropriate columns of the tables are shown in [square brackets]. Controls that are required unconditionally are marked with a tick (✓).

3.1 SIGNALLER'S INTERFACE

The interlocking system should be capable of operating from a specified signalling control and display system, using an appropriate interface. It should also operate, where required, in conjunction with an automatic route setting system that simulates the signaller's controls.

Full details of signalling control and display systems are given in TI 157.

3.1.1 CONTENT

The interface for a lever frame is mechanical (see NR/L2/SIG/11201, Module B8).

The interface for a non-route setting interlocking operated from a control panel is generally directly wired (see Section 6). (It may also include a remote control system, where the interlocking is remote from the signal box, and/or generation of suitable track and route displays from the indication functions.)

The interface system for a route setting interlocking may include:

a) derivation of the interlocking control functions from the signaller's requests;

b) route setting, unless provided in the interlocking system;

c) automatic route setting (ARS), where required (see Section 3.1.3);

d) train operated route release (TORR), where required (see Section 3.7.4);

e) generation of track and route displays from the indication functions, to suit the display system; and

f) remote control system, where the interlocking is remote from the signal box (see Section 3.10.2).

The operation of an interface system is described in Sections 7.3.1 and 7.3.2.

3.1.2 ARRANGEMENT

Network Rails future requirements should be considered when designing the signaller's interface with the interlocking, e.g. whether control of the interlocking might subsequently be transferred to a remote signal box or a VDU based system.

The interface system is required to be safety-related, but not safety-critical (see Section 3.10.1), so there are advantages in separating it from the safety-critical interlocking system. However, it should satisfy the Network Rails availability requirements (see NR/L2/SIG/11201, Module A20).

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There are disadvantages in using non-standard components, such as sub-miniature or non-safety relays.

Note that the interface system may be located either at the interlocking or at the signal box. The location should generally be chosen to minimise the number of remote control system channels.

The length of cabling susceptible to interference, the number of interfaces and the size of equipment rooms should also be minimised after considering the other factors.

The following are examples of interface systems (requiring appropriate approval for each application in accordance with NR/L2/SIG/11201):

a) The most fundamental arrangement comprises an interlocking system without route setting that simply locks the signalling functions, together with a comprehensive interface system (as in Section 3.1.1) that inputs the signaller's requests, performs the route setting and outputs signalling functions normal or reverse.

b) Panel processors are interface systems with inputs and outputs that may be configured to suit the required control and interlocking systems. Programmable logic controllers may be used.

c) The BRS-SW67 route relay free-wired interlocking system (see NR/L2/SIG/11201, Module B9) incorporates a push button interlocking (PBI) interface using relays at the interlocking. (WBS systems are similar.) This is the conventional interface designed for use with entrance-exit (NX) panels, transmitting button pushed/pulled. Route setting and TORR is performed within the interlocking system, using safety relays.

d) With the solid state interlocking (SSI) system (see NR/L2/SIG/11201, Module B11) the interface is a panel processor module (PPM) in the interlocking cubicle, but the route setting is performed in the safety-critical interlocking multi-processor module (MPM).

e) Electronic route setting equipment (ERSE) is an interface system, located at the interlocking, between a simplified relay interlocking without route setting and an NX panel.

f) An electronic interface between a BRS-SW67 route relay interlocking (RRI) and a VDU based control system is available, but route setting is performed within the interlocking system, using safety relays. TORR and ARS can be provided in the electronic control system at the signal box.

g) The E10k free-wired interlocking uses an interface system of non-safety relays at the signal box. This may be used with turn-push panels, transmitting route set to the interlocking. Alternative circuits are provided for NX and one control switch (OCS) panels. (AEI-GRS systems are similar, but with the interface at the interlocking.)

h) The GEC geographical system uses a common control set as the interface.

i) Other arrangements that comply with the considerations of this section (3.1.2) may also be used.

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See References for the interlocking systems quoted above.

3.1.3 AUTOMATIC ROUTE SETTING (ARS) SYSTEMS

These are systems, invariably electronic, for setting routes without any action of the signaller, based upon a stored timetable, train running information, defined priority selection criteria and operating algorithms.

It is a requirement of ARS that TORR be provided (see Section 3.7.4).

They are provided where necessary to reduce the workload of the signaller, and form part of the interface system with the interlocking.

For automatic platform or junction working see Section 3.2.11(c).

3.2 SIGNAL AND ROUTE CONTROLS

This section describes the signalling controls, interlocking and other signalling facilities which the interlocking system should be designed to provide.

Each controlled signal (except for co-acting signals) should generally be controlled by a separate signaller's request (but see Section 3.2.6 for calling-on arrangements). Signals reading to more than one destination should generally be controlled by separate signaller's requests for each destination.

For signal positioning, operation and proving, aspect sequence controls and special signal controls, see NR/L2/SIG/11201, Module B17.

3.2.1 CONTROLLED STOP SIGNALS ASSOCIATED WITH NON-ROUTE SETTING INTERLOCKINGS

Non-route setting interlockings should provide the controls and facilities summarised in Figure 1. The requirements for normalisation are summarised in Figure 2. The controls for each signal should be specified in control tables, in accordance with NR/L2/SIG/11202.

Figures 1 and 2 may be read for any type of non-route setting interlocking, as follows:

a) On purely mechanical lever frames, both the interlocking and aspect (arm) controls are mechanically operated. Mechanical controls require lever reverse, mechanical point detection and mechanical slots off. Electric locks are only required where there are track circuits, electrical detection, or block controls, etc.

b) On electro-mechanical lever frames, the interlocking is generally mechanical, but electrical locking is applied through an electric lock known as the selection lock (to distinguish it from the interlocking lock, where electrical interlocking is provided). Mechanically operated signals also have the controls applied through the selection lock as shown, as they have no aspect circuits.

c) Non-route setting interlockings with lock relays, e.g. individual function switch (IFS), combine the interlocking and selection lock functions in the lock relay operation and release circuits.

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NON-ROUTE SETTING SIGNALLING SYSTEMS								
INTERLOCKED STOP SIGNALS		**Main**			**Subsidiary or Shunt**			
	Mechanical or Electro-Mechanical Interlocking - Level →	**Mech'l Inter-locking**	**Electric Selection Lock, if provided**	**Mech'l Op or Aspect Controls**	**Mech'l Inter-locking**	**Electric Selection Lock, if provided**	**Mech'l Op or Aspect Controls**	**See Section or Part**
	All-Electric (Miniature) Lever Frame - Level →	**Inter-locking Lock**	**Selection Lock**	**Aspect Controls**	**Inter-locking Lock**	**Selection Lock**	**Aspect Controls**	
	All-Electric Relay (IFS) Interlocking Controls and Facilities ↓ - Level →	**Lock Relays**		**Aspect Controls**	**Lock Relays**		**Aspect Controls**	
REQUEST	Signal requested by operation of signal lever or switch, the class of route being selected by separate lever or switch.	✓			✓			3.2.1 TI 157
REQUEST	Signal lever reverse or reverse lock relay energised.			✓			✓	6.5
Directly opposing signals normal, including conflicting overlaps.		Confliction in route or OL			Confliction in route, [or opposing locking omitted]			2.4 3.2.1 4.2
Other classes of route from this signal normal.		✓			✓			2.5 3.2.1
Any slot from another control point given.				✓			✓	3.2.9
Where required for junction signals, approach control satisfied, including special controls for signals with flashing yellows, splitting distant, or splitting banner in rear.				✓				3.2.10
Approach controlled to clear when train nearly at a stand, OR main signal in rear locked normal. [May be by instruction in non-TCB.]			Mech op sigs only: appr contr if signal ahead on	Approach control if sema-phore sig ahead on	Signal in rear normal	Mech'ly operated sigs only: approach control	Approach control	3.2.10 5.3
When applied, temporary approach control satisfied.				✓				3.2.10
Signal clearance is delayed, where necessary, to give sufficient warning for an automatic level crossing or train activated warning system.			Mech'ly operated sigs only	✓		Mech'ly operated sigs only	✓	3.2.12
Signal clearance is delayed until train is at a stand in platform, for an automatic level crossing with stopping selected.			Mech'ly operated sigs only	✓		Mech'ly operated sigs only	✓	Mod X02
Permissive track occupied for calling-on at time of selection and at time of signal clearing.						For call-on only	For call-on only	3.2.6
Where provided, Lime Street controls satisfied.							For call-on only	
Signals required to be pre-set by this signal reverse and proved off.		All shunts in route reverse	Mech'ly operated signals with power op sig ahead	Power operated signals proved off	Any shunt close ahead reverse			3.2.8
The line of route, foul tracks [and overlap] are clear [delayed replacement tracks clear at time of signal clearing only]. [May be by instruction in non-TCB.]			Mech'ly operated signals only	Up to end of OL		Mech'ly operated signals only	In route up to permis'ive track (ex-clusive)	3.3.1 3.3.4 3.4.1 3.7.1
Points set, locked (except where released by other points that release signal), and detected in line of route, [overlap], and flank/trap points. [Flank points detected where required only.] [Power operated facing points in OL set to acceptable position and detected only.] [FPLs provided only for mechanical facing points. Non-passenger moves require FPL or detection.] [Trailing mechanically operated points not detected.] [BOL locking is by instruction in non-TCB.]		Set and locked in route, OL, flank and trapping & FPLs in (route and OL only)	Mech-anically operated sigs only: electrical detection	Locked and detected in route, OL, flank and trapping (and FPLs detected)	Set and locked in route, flank and trapping & FPLs in (line of route only)	Mech-anically operated sigs only: electrical detection	Locked and detected in route, flank and trapping (and FPLs detected)	3.4.2 3.4.4 3.4.5 3.5.4
Trailing points, switch diamonds, etc. in overlap set to prevent conflicting moves.					Shunts only			3.4.3
Facing train operated points detected and pressure normal.			Mech'ly operated sigs only	✓		Mech'ly operated sigs only	✓	3.5.1

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NON-ROUTE SETTING SIGNALLING SYSTEMS							
INTERLOCKED STOP SIGNALS	**Main**			**Subsidiary or Shunt**			
Mechanical or Electro-Mechanical Interlocking - Level →	**Mech'l Inter-locking**	**Electric Selection Lock, if provided**	**Mech'l Op or Aspect Controls**	**Mech'l Inter-locking**	**Electric Selection Lock, if provided**	**Mech'l Op or Aspect Controls**	**See Sect-ion or Part**
All-Electric (Miniature) Lever Frame - Level →	**Inter-locking Lock**	**Selection Lock**	**Aspect Controls**	**Inter-locking Lock**	**Selection Lock**	**Aspect Controls**	
All-Electric Relay (IFS) Interlocking Controls and Facilities ↓ - Level →	**Lock Relays**		**Aspect Controls**	**Lock Relays**		**Aspect Controls**	
Facing hand points or spring points detected normal.						For shunt moves	
GF releases and GF points set, locked, and detected normal in line of route, [overlap] and flank/trap points. [Trailing mechanically operated points not detected.] [BOL locking is by instruction in non-TCB.]	In route, OL and flank: release normal	Mech'ly operated sigs only: electrical detection	In route, OL and flank: detected normal	In route, and flank only: release normal	Mech'ly operated sigs only: electrical detection	In route, and flank only: detected normal	3.6.1
Gate box releases are normal (with gates locked across road or barriers proved down and crossing clear).	✓			✓			3.6.1
Signal stick set (not applied).			Or auto working selected			✓	3.2.11
Where necessary for permissive working, signal ahead locked normal.				✓			3.7.1
All authorised opposing and conflicting movements clear of route and overlap, or overlap swung away. (Route locking.)		✓					3.7.5
All authorised opposing and conflicting movements at a stand on permissive track or at destination signal, or clear of route [or opposing locking omitted]. (Route locking.)					✓		
Interlocked gated level crossings in the route: gates proved locked across the road. [Does not generally apply to gated level crossings in the overlap.]	Gate stops normal or gate locks in			Gate stops normal or gate locks in			Mod X02
Controlled barrier crossings, in the route [and 50m overlap]: proved barriers down and crossing clear, at time of signal clearing only. [CCTV crossings also require barriers intact and local controls locked.]	Where lock lever provided (route & OL)	Mech'ly operated sigs only (route & OL)	In route and overlap	Where lock lever provided (route only)	Mech'ly operated sigs only (route only)	In route only	
Any movable bridge set, locked and detected normal.	Bolts in		✓	Bolts in		✓	3.9.1
Any lockout devices normal.		✓	✓		✓	✓	3.9.2
Where provided, all-signals-on switch not operated.			✓			✓	3.7.1
Where required for route holding or sequential locking, trailing points in rear locked both ways.	✓			✓			4.3 4.5
Signal ahead proved on if it is not automatically replaced by the passage of a train. (Sequential locking.)	Non-reciprocal mech'l lock'g (not new work)	✓					4.5
Main colour light signal ahead proved alight, to prevent a less restrictive aspect than the signal ahead being displayed in the event of failure (both distant and stop signals where applicable, including each head of a splitting distant). Any banner repeater ahead proved on and alight or controls off.		Mech'ly operated sigs with colour light signal ahead	✓			Where required (not for call-on)	2.4 Module B17
Independent PLS ahead proved red lamp alight or controls off, for limiting wrong road moves. LOS proved alight.						Not for call-on	ModuleB17
Where required for colour light junction signals, route indicator proved alight.			✓			✓	
Special controls satisfied where signal ahead is for closing-up.			✓				
Where provided, special controls satisfied where signal ahead is a tunnel signal, at time of signal clearing only.			✓				

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NON-ROUTE SETTING SIGNALLING SYSTEMS							
INTERLOCKED STOP SIGNALS	**Main**			**Subsidiary or Shunt**			
Mechanical or Electro-Mechanical Interlocking - Level →	**Mech'l Inter-locking**	**Electric Selection Lock, if provided**	**Mech'l Op or Aspect Controls**	**Mech'l Inter-locking**	**Electric Selection Lock, if provided**	**Mech'l Op or Aspect Controls**	**See Sect-ion or Part**
All-Electric (Miniature) Lever Frame - Level →	**Inter-locking Lock**	**Selection Lock**	**Aspect Controls**	**Inter-locking Lock**	**Selection Lock**	**Aspect Controls**	
All-Electric Relay (IFS) Interlocking Controls and Facilities ↓ - Level →	**Lock Relays**		**Aspect Controls**	**Lock Relays**		**Aspect Controls**	
Where provided, special controls satisfied for signals in advance of junction signals to guard against reading through, at time of signal clearing only.		Mech'ly operated sigs only	✓				
Section signal for non-TCB requires: LC/TA or token release (one train only), at time of signal clearing only.	Bi-directional lines only	Mech'ly operated signals only	✓	Bi-directional lines only: by special instr'ns	Mech'ly operated sigs only: by special instr'ns	Authorised by special instr'ns	GK/RT0041, 42, 51 & 54
Entrance signal for direction lever working requires:	This SB lever normal		Next SB lever reverse	This SB lever normal		Next SB lever reverse	
Where provided, released when king lever reversed.	✓			✓			
Hazard detectors (trip wire etc) proved normal.			✓			✓	

Figure 1 – Non-Route Setting Signalling System Controls

Normalisation Facilities	**Inter-locking**	**Electrical Selection Backlock**	**Aspect Replaced**	**See Sect-ion**
Any related distant signal normal.	✓			3.7.1
Any other signal normal that requires to be preceded by this one.	✓			3.2.8
Signaller's control device not reversed.			✓	TI 157
Withdrawal of electrical aspect controls (except those marked at time of clearing only).			✓	3.7.1
Signaller's control device not reversed, signal on and free of approach locking.		✓		2.6
Signaller's control device not reversed with signal approach locked.		Timed or manual release		3.7.2 3.7.4
Line is clear between signal and points, where separate route locking is not provided.		✓		3.5.6 5.3

Figure 2 – Normalisation of Controlled Signals (Non-Route Setting Systems)

3.2.2 CONTROLLED STOP SIGNALS AND ROUTES, ASSOCIATED WITH ROUTE SETTING INTERLOCKINGS

Route setting interlockings should provide the controls and facilities summarised in Figure 3. The requirements for normalisation are summarised in Figure 4. The controls for each signal should be specified in control tables, in accordance with NR/L2/SIG/11202.

Figures 3 and 4 may be read for any type of route setting interlocking, as follows:

Conventional route setting interlockings register a route request if the locking is free (i.e. points available), and then automatically call the points to the required position. The route request with the points correctly called sets the route, which, in turn, locks the points.

With programmable electronic interlockings, the route request may control the points and set the route, if the points are free to move. There may be no separate locking.

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With route setting systems, signals should be controlled by the following types of route:

a) main colour light or semaphore signal: main or warning route;

b) subsidiary signal (PLS or semaphore): call-on or shunt route;

c) shunting signal (PLS or semaphore): shunt route;

d) semaphore calling-on signal: call-on route;

e) semaphore shunt-ahead signal: shunt route;

f) semaphore warning signal: warning route (not for new work).

ROUTE SETTING SIGNALLING SYSTEMS

Signal Type		**Main**		**Main**		**Subsidiary PLS**		**Any PLS**		**See Section or Part**
Route Class		**Main (M)**		**Warning (W)**		**Call-On (C)**		**Shunt (S)**		
Level → / **Controls and Facilities ↓**		**Route Set and Locked**	**Aspect Controls**	**Route Set and Locked**	**Aspect Controls**	**Route Set and Locked**	**Aspect Controls**	**Route Set and Locked**	**Aspect Controls**	
REQUEST	Route requested by switch, push buttons, tracker ball, or keyboard.	Normal exit [with perm'sive tk clear at setting, if (C) route exists]		Selected by special exit device or full OL un-available	Auto step-up to (M) route if a'propriate (before sig clears)	Normal exit, with permissive track occ'd at time of setting	Permis'ive track occupied at time of signal clearing	Selected by shunt exit device		3.2.5 3.2.7 7.3.1 TI 157
	Route set (both parts of route if dual controlled).		(M) route, or stepped-up (W) route		(W) route, or (M) route if no locking in OL		(C) route		(S) route, (or pre-set - indep PLS only)	3.2.2 7.3
Directly opposing routes normal, [unless opposition only in overlap and able to be swung away].		In route and full OL		In route and ROL		In route only		In route only [or opposing locking omitted]		2.4 7.3.3
Other class routes from this signal normal.		✓		✓		✓		✓		2.5 7.3.3
Any slot from another control point given.			✓		✓		✓		✓	3.2.9
Approach controlled to clear when train nearly at a stand.					Clears to yellow aspect only		✓		Only for subsidiary PLS	3.2.10
Where required for junction signalling, approach control satisfied.			✓							
When applied, temporary approach control satisfied.			✓							
Signal clearance is delayed, where necessary, to give sufficient warning for an automatic LC or train activated warning system.			✓		✓		✓		✓	3.2.12
Signal clearance is delayed, for an automatic level crossing with stopping selected, until train is at a stand in platform.			✓		✓		✓		✓	Mod X02
Where provided, Lime Street controls satisfied.							✓			3.2.6
Routes from any signal pre-set by this route normal.		✓		✓		✓		✓		3.2.8
Routes pre-setting this signal normal.								Indep PLS only		
Signals pre-set by this route proved off.			✓		✓		✓		✓	

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ROUTE SETTING SIGNALLING SYSTEMS									
Signal Type	**Main**		**Main**		**Subsidiary PLS**		**Any PLS**		**See Section or Part**
Route Class	**Main (M)**		**Warning (W)**		**Call-On (C)**		**Shunt (S)**		
Level → / **Controls and Facilities ↓**	**Route Set and Locked**	**Aspect Controls**	**Route Set and Locked**	**Aspect Controls**	**Route Set and Locked**	**Aspect Controls**	**Route Set and Locked**	**Aspect Controls**	
Aspects of routes pre-setting this signal ready to clear. (Aspect controls as pre-setting route.)								Independent PLS when pre-set	
The line of route and foul tracks are clear [delayed replacement tracks clear at time of signal clearing only].		✓		✓		Up to perm'sive track (exclusive)		Up to perm'sive track (exclusive)	3.3.1 3.3.4 3.7.1
The overlap and foul tracks are clear, or alternative overlap available.		Up to full OL		Up to ROL if separate track					3.3.4 3.4.1
Points set, locked & detected in the route, [overlap, or alternative overlap available], and flank/ trap points. [Flank points detected where required only.] [Facing points in overlap set to acceptable position and detected only.] [Trailing mechanically operated points not detected.]	Set and locked in route, full OL, flank and trapping	Locked and detected in route, full OL, flank and trapping	Set and locked in route, ROL, flank and trapping	Locked and detected in route, ROL, flank and trapping	Set and locked in route, flank and trapping only	Locked and detected in route, flank and trapping only	Set and locked in route, flank and trapping only	Locked and detected in route, flank and trapping only	3.4.2 3.4.4 3.4.5 3.5.4
Trailing points, switch diamonds, etc. in overlap set and locked to prevent conflicting moves.							Up to independent PLS/LOS		3.4.3
Facing train operated points detected and pressure normal.		✓		✓		✓		✓	3.5.1
Facing hand points or spring points detected normal.								✓	
GF releases and GF points set, locked, and detected normal in the route, [overlap, or alternative overlap available] and flank/trap points. [Trailing mechanically operated points not detected.]	Set and locked in route, full OL, flank and trapping	Locked and detected in route, full OL, flank and trapping	Set and locked in route, ROL, flank and trapping	Locked and detected in route, ROL, flank and trapping	Set and locked in route, flank and trapping only	Locked and detected in route, flank and trapping only	Set and locked in route, flank and trapping only	Locked and detected in route, flank and trapping only	3.6.1
Gate box releases are normal with gates locked across road or barriers proved down and crossing clear.	✓		✓		✓		✓		
Signal stick set (not applied).		Or auto working selected		Or auto working selected		✓		✓	3.2.11
All authorised opposing and conflicting movements clear of route and overlap, or alternative overlap available. (Route locking.)	Route and full OL		Route and ROL						3.7.5
All authorised opposing and conflicting movements at a stand on permissive track or at destination signal, or clear of route [or opposing locking omitted]. (Route locking.)					✓		✓		
Controlled level crossings in the route [and overlap]: proved barriers down and crossing clear at time of signal clearing only. [CCTV crossings also require barriers intact and local controls locked.]		In route and overlap of 50m		In route and ROL		In route only		In route only	Mod X02

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ROUTE SETTING SIGNALLING SYSTEMS									
Signal Type	**Main**		**Main**		**Subsidiary PLS**		**Any PLS**		**See Sect-ion or Part**
Route Class	**Main (M)**		**Warning (W)**		**Call-On (C)**		**Shunt (S)**		
Level → / **Controls and Facilities ↓**	**Route Set and Locked**	**Aspect Controls**	**Route Set and Locked**	**Aspect Controls**	**Route Set and Locked**	**Aspect Controls**	**Route Set and Locked**	**Aspect Controls**	
Any movable bridge in route [and overlap]: set, locked by this route and detected normal.	In route, & OL if no trap points	In route, & OL if no trap points	In route, & ROL if no trap points	In route, & ROL if no trap points	In route only	In route only	In route only	In route only	3.9.1
Any lockout devices normal.	✓	✓	✓	✓	✓	✓	✓	✓	3.9.2
Where provided, all-signals-on switch not operated.		✓		✓		✓		✓	3.7.1
Route [or aspect] not disabled.	Route	Aspect	Route	Aspect	Route	Aspect	Route	Aspect	3.11.7
Signal ahead proved alight, to prevent a less restrictive aspect than the signal ahead being displayed in the event of failure (both distant and stop signals where applicable, including each head of a splitting distant). Any banner repeater ahead proved on and alight or controls off.		✓		✓				Where required (for shunt moves up to main signal only)	2.4 Mod B17
Independent PLS ahead proved red lamp alight or controls off, for limiting wrong road moves. LOS proved alight.								✓	Mod B17
Where required for junction signalling, RI proved alight.		✓		✓		✓		✓	
Special controls satisfied to confirm driver sees whole sequence where flashing yellows, splitting distant, or splitting banner in rear.		✓							
Special controls satisfied when signal ahead is only for closing-up, at time of signal clearing.		Full OL (platform) clear		Plat occ, next tk occ ROL clear					
Special controls satisfied when signal ahead is a tunnel signal, at time of signal clearing only.		✓		✓					
Special controls satisfied to guard against reading through, at time of signal clearing only.		✓		✓					
Section signal for non-track circuit block requires: LC/TA or token release (one train only), at time of signal clearing only.	Bi-directional lines only	✓	Bi-directional lines only: restricted accept'ce	Restricted accept-ance arr-angement		Perm'sive working only (uni-directional)	Bi-directional lines only: by special instr'ns	Authorised by special instr'ns	GK/RT0041,42,51&54
Hazard detectors (trip wire etc) proved normal.		✓		✓		✓		✓	
Note: For signals designated controlled solely to protect a controlled level crossing, see Figure 5.									

Figure 3 – Route Setting Signalling System Controls

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Normalisation Facilities	Route Released	Aspect Replaced	See Section
Route cancelling device operated.		✓	TI 157
Withdrawal of aspect controls (except those marked at time of clearing only).		✓	3.7.1
TORR, or route cancelling device operated, signal on and free of approach locking.	✓		2.6
Route cancelling device operated with signal approach locked.	Timed release		3.7.2 3.7.4
Pre-set signals: pre-setting route cancelling device operated, unless train between pre-setting and pre-set signals.		✓	3.2.8

Figure 4 – Normalisation of Controlled Signals and Routes (Route Setting Systems)

3.2.3 STOP SIGNALS NOT ASSOCIATED WITH AN INTERLOCKING

a) General

This section applies to signals without separate locking and aspect levels, where all the controls are provided in the signal aspect. (Signals operated from a lever frame should instead follow Section 3.2.1.) These signals are not centrally interlocked and should generally be provided with the controls and facilities summarised in Figure 5. The controls for each signal should be specified in control tables, in accordance with NR/L2/SIG/11202.

A non-interlocked signal should be controlled as follows:

I. by the passage of trains, for automatic and semi-automatic colour light signals in track circuit block only;

II. by a single device, for signals (including non-block signals) that are only designated controlled in order to protect a neutral section, or other hazard (together with an automatic working facility in track circuit block);

III. by an entrance/exit request in route setting interlockings, with an indication of route set, for controlled signals protecting a controlled level crossing; or

IV. exceptionally, for non-block signals, by the absence of a hazard.

(Where necessary to maintain consistency in existing signal boxes, signals in category iii may instead be controlled by a single device in route setting interlockings, with no indication of route set.)

Certain of these signals may be controlled or locally locked by a ground frame or level crossing, as shown in Figure 5 (see GK/RT0061). Signals that work automatically may be normally off.

Signals should be designated in accordance with GK/RT0045. Non-block signals should be plated as controlled, except where they protect ground frames in track circuit block and fulfil the criteria for semi-automatic.

Block signals should be automatically replaced following the passage of a train wherever reasonably practicable, and under all circumstances where permissive working is authorised. Block signals that protect movable infrastructure, such as a ground frame or controlled level crossing, should not be designated automatic or intermediate block home. Stop boards, such as those instructing the driver to obtain token, should be regarded as unworked block signals.

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Non-block signals are not required to be controlled by train detection, but only by a particular hazard or infrastructure detection system. Non-block signals should be located close to the hazard or infrastructure that they are to protect, but overlap distance clear (see Figures 12 and 13). Where non-block signals are arranged to be normally off with automatic replacement by the presence of a hazard (e.g. if a rock fall is detected, or if detection of ground frame points is lost), special instructions should be issued to inform train crew of the action to be taken if such signals are found to be at danger. Remote ground frame markers and stop boards, such as those protecting unmanned or automatic level crossings, should be regarded as unworked non-block signals.

In the case of ground frame markers (and gated level crossings without a protecting stop signal), the controls should be applied to a worked distant signal (see Sections 3.4.2(h), 3.6.2(a) and 3.7.2(j)).

Both block and non-block signals that protect movable infrastructure should generally be provided with approach locking and route holding, although relaxations are available. See Sections 3.7.3 and 3.5.7.

For signals on bi-directional lines, see Section 3.5.9.

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Aspect Controls		**See Section**
REQUEST	Automatic and semi-automatic signals: signal box replacement control not operated, OR	3.2.3
	Non-interlocked controlled signals (simple control, e.g. single push button): signal box control operated for signals protecting a track sectioning cabin/ neutral section, or where train must not pass red signal with failed SPT (signal designated controlled or non-block signal), OR	TI 157
	Non-interlocked or locally-locked controlled signals (standard control): signal box control operated for signals protecting a controlled level crossing or ground frame (signal designated controlled or non-block signal).	
Where provided, hazard detectors (trip wire, etc.) proved normal.		3.2.3
Signal clearance is delayed, where necessary, to give sufficient warning for an automatic level crossing (e.g. with stopping selected, clearance delayed until train is at a stand in platform).		3.2.12
Facing train operated points detected and pressure normal.		3.5.1
Ground frame points (facing points within 800m of signal) are set, locked, and detected normal (signal designated semi-automatic or non-block signal). [Trailing mechanically operated points are not detected.] [Signals over 800m from facing points, including points in overlap, to be designated controlled or non-block signal].		3.6
Level crossing gates in route locked across road (signal designated semi-automatic or non-block signal). [Does not generally apply to gated level crossings in the overlap.]		Mod X02
Controlled level crossings in route [and 50m overlap]: proved barriers down and crossing clear, at time of signal clearing only (signal designated controlled, semi-automatic or non-block signal). [CCTV crossings also require barriers intact and local controls locked.]		
Any lockout devices proved normal.		3.9.2
BLOCK	The line of route and overlap are clear.	3.3.1
	Restricted overlap, with approach control to clear only to yellow aspect when train nearly at a stand, automatically stepped up to full overlap if available before signal clears [requires special controls satisfied when the next signal is for closing-up].	3.4.1
	Facing points in overlap set to acceptable position and detected.	3.4.2
	Entrance route to bi-directional lines set [or, for signals reading in predominant direction, opposing entrance route not set].	3.5.9
	Gate box or ground frame releases are normal or slots off (signal designated semi-automatic or controlled).	3.6
SIGNALS	Signal stick set (not applied) or auto working selected, where signaller's control provided.	3.2.11
	Where signal box control transmitted by main remote control system, all-signals-on switch not operated.	3.7.1
	Aspect not disabled [SSI signals] or signal post switch [where provided] set to auto.	3.11.7
	Where provided, special controls satisfied where signal ahead is a tunnel signal, at time of signal clearing only.	Module B17
	Where provided, special controls for signals in advance of junction signals to guard against reading through, at time of signal clearing only.	
	Block signal ahead proved alight (both distant and stop signals where applicable, including each head of a splitting distant). Any banner repeater ahead proved on and alight or controls off.	
Note: For signals designated semi-automatic because signal box can switch out, see Figure 1 or 3, as appropriate.		

Figure 5 – Block and Non-Block Stop Signals Not Associated with an Interlocking (all systems)

b) Replacement Devices

Signaller's replacement devices should be provided for all block signals that are not controlled (i.e. automatic and semi-automatic signals). These should always be given safety-critical integrity, so that they can be used to provide the following facilities, as applicable:

I. protection for personnel working under possession;

II. protection for users at unmanned or automatic level crossings, when verbally authorised by the signaller;

III. suppression of level crossing strike-in or gate box warning when shunting movements are taking place; and

IV. provision of stopping/non-stopping controls where a station platform is located within the strike-in of an automatic level crossing.

(Where necessary to maintain consistency in existing signal boxes, signals providing facilities ii, iii or iv may instead be controlled by a single device in route setting interlockings with an automatic working facility, but no indication of route set. Such signals should be designated automatic.)

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A typical replacement arrangement would be a direct wired circuit operated by a stick relay at the signal box, de-energising a replacement relay at the signal, which in turn controls the signal aspect relay. A red replacement indication should prove that the remote replacement has been effective (replacement relay de-energised), as well as proving the signal on (aspect relay de-energised) and proving the lamp alight. Any related distant and/or banner repeating signals should also be proved on and alight. An off indication should not be provided. In the case of semi-automatic signals that are approach locked to protect ground frames, etc., (see Section 3.6.2) the red indication should flash whilst any manual approach lock release is timing. See Section 3.7.1 for general signal replacement requirements.

Wherever such a signal is equipped with a signaller's replacement facility, any signal post replacement switch should be removed, to prevent personnel placing reliance on a device which could be susceptible to hazardous failure.

3.2.4 REPEATING SIGNALS AND INDICATORS

Distant and banner repeating signals should be provided with the controls and facilities summarised in Figure 6. The controls for each signal should be specified in control tables, in accordance with NR/L2/SIG/11202.

A separately controlled distant signal should be released by the related stop signal(s). If no lever is provided for a power operated distant signal there can be no interlocking or selection lock, so any such controls should be provided in the aspect. The signal should then work automatically, its aspect dependent upon the aspects displayed by its related stop signal(s).

A distant signal should be controlled as follows:

a) by a different device from its related stop signal(s) for mechanically operated signals;

b) by the same signaller's request as the related stop signal in route setting interlockings; or

c) by either method (a) or (b) for other power operated signals. (If a common device is used, a replacement device should also be provided in circumstances where: non-track circuit block working is in force; a level crossing is situated in the route beyond any related stop signal; or otherwise as requested by Network Rail.)

In semaphore signalled areas, where the minimum signal spacing distance (from GK/RT0075) places a distant signal within the station limits of a signal box in rear, it should be mounted on the same post as the next stop signal in rear, repeated below any intervening stop signals between the outer distant and its first related stop signal, and slotted in accordance with Section 3.2.9.

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Controls and Facilities	**Inter-locking**	**Electrical Selection Lock**	**Aspect Controls**	**See Sect-ion**
Distant or inner distant requires all related stop signals ahead levers reverse, and aspect requires any signals proved off if power operated. (In the latter case the distant should be power operated.)	Levers reverse		Proved off	3.2.1
Outer distant requires inner distant lever reverse, and aspect requires it proved off if power operated. (In the latter case the outer distant should be power operated.)	Lever reverse		Proved off	
Distant signal lever/switch reverse, if provided.			✓	
Distant arm is slotted to require any stop arm off, either on the same post as the distant, or between the distant and its first related stop signal. (In the latter case, a repeat distant arm is required.)			✓	3.2.9
Distant arm requires slot off from any other signal box for which it acts also as distant.			✓	
Distant signal associated with remote ground frame marker requires ground frame points detected normal. (Mechanically operated signals require mechanical detection.)			✓	3.6
Distant signal requires colour light stop signal ahead proved alight. Any banner repeater ahead proved on and alight or controls off.		Mech'ly op signals only	✓	Module B17
Banner repeater requires its related stop signal proved off (and alight if colour light).			✓	
Any train detection device between a power operated distant signal or banner repeater (except in terminal platforms) and its first related stop signal is clear.			✓	

Figure 6 – Distant Signal and Banner Repeating Signal Controls (all systems)

A banner repeating signal should be controlled by the same signaller's request as its related stop signal.

Wherever reasonably practicable, and under all circumstances where permissive working is authorised, a distant or banner repeating signal should be replaced by a train detection device situated between itself and its first related stop signal. An exception is made in the case of a banner repeating signal in a terminal platform, where it is generally more informative for it to reflect the state of the platform starting signal.

Where provided (for the use of station personnel), an off indicator should be controlled simply by the platform starting signal and never be replaced by a train detection device between itself and the signal. Where permissive working is authorised, off indicators should not be positioned such that they can be read by a driver.

3.2.5 RESTRICTED APPROACH ARRANGEMENT (ALSO KNOWN AS WARNING ARRANGEMENT)

Under the restricted approach arrangement trains are brought nearly to a stand at a main signal before it is allowed to show the most restrictive proceed aspect to indicate that the next stop signal is at danger and the overlap may be unavailable. For new work, movements made under the restricted approach arrangement should be signalled with the main signal, approach controlled in accordance with Section 3.2.10, and should be provided with a restricted overlap. Otherwise, these controls may be imposed by instruction.

(However, a slightly higher approach speed is preferable to minimise the likelihood of drivers accelerating sharply between the signals. The overlap length related to the approach speed is given in Section 3.3.3(c).)

In colour light track circuit block, such movements should be authorised by a warning aspect (delayed yellow); also where colour light signals are used within station limits in non-track circuit block. In route setting interlockings they should be controlled by a separate warning route, if the overlap locking is less than that required by the main

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route. Otherwise the main route should suffice, controlled by a restricted approach arrangement when only the restricted overlap is available.

If the signal ahead is subsequently selected such that the full overlap becomes available (locked and clear), before the warning aspect has cleared, the interlocking (or aspect if the locking is the same) may step up to allow an unrestricted main aspect to be displayed, in accordance with GK/RT0060.

An automatic signal may also be provided with a warning aspect where necessary for operating purposes, e.g. as a closing-up signal. Likewise, a controlled signal may be provided with an automatic working facility. These signals may step up to a main aspect, as above, but should revert to restricted overlap conditions following the passage of each train.

For non-track circuit block sections, restricted acceptance arrangements are given in the appropriate regulations in the NR/L2/SIG/10064 series. Where stated in signaller's instructions, this should be enforced by manually delaying the clearance of the section signal. If the section signal is colour light, it is preferable for it to be combined with the distant signal ahead (subject to the signal spacing requirements of GK/RT0034), to enable a delayed yellow, rather than a delayed green, aspect to be displayed.

A signal authorising movements under the restricted approach arrangement should be controlled as follows:

a) in non-route setting interlockings where the overlap locking is the same, or where the control system is subject to particular constraints (e.g. on lever frames), by a single device, but with the restricted overlap selected by a supplementary operating device (such as a plunger);

b) in route setting interlockings and other non-route setting interlockings, by a different signaller's request from the main route;

c) by the passage of trains, for automatic signals; or

d) by a separate device from the main signal where a separate warning signal is provided (not for new work).

Examples are given in NR/L2/SIG/11201, Module B8, Figure 12 for non-route setting systems and NR/L2/SIG/11201, Module A18, Figure 5 for route setting systems. For further details of restricted overlaps see Section 3.4.1.

3.2.6 PERMISSIVE MOVEMENTS

a) General

The provision of permissive running movements, as distinct from shunting movements, for either passenger or freight trains, requires risks to be controlled so far as is reasonably practicable in accordance with GK/RT0044 and NR/L2/OPS/085.

A permissive movement should be signalled with a subsidiary signal (PLS or semaphore), and should be controlled by a call-on route in route setting interlockings.

A signal authorising permissive movements should be controlled as follows:

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I. by the signaller selecting a different control device from the main route in new / modified interlockings and control systems, and for mechanically operated signals;

II. by the signaller selecting the same control devise as the main route setting interlockings (non-preferred permitted only for modifications to existing systems that use this method of operation);

III. by either method i) or ii) for other existing power operated signals (a different device should generally be used where the main signal has interlocking in the overlap); or

IV. by the passage of freight trains, for intermediate automatic signals.

Examples are given in NR/L2/SIG/11201, Module B8, Figure 12 for non-route setting systems and NR/L2/SIG/11201, Module A18, Figure 5 for route setting systems.

In track circuit block, signals authorising permissive movements require a permissive track section occupied, both when setting the route (or selecting the signal) and at time of signal clearance, but subsequent clearance of the track section should not replace the signal.

Conversely, a main signal associated with a permissive signal requires the permissive track section clear, both when setting the route (or selecting the signal) and at time of signal clearance. Stepping down of aspects is not permitted. Stepping up of aspects is not permitted where permissive passenger movements are authorised.

In non-track circuit block, permissive working is permitted in accordance with GK/RT0042 (absolute block), GK/RT0051 (only within station limits on single lines), or GK/RT0054 (RETB). (See also the NR/L2/SIG/10064 series of regulations.) In absolute block sections a counting device (or special block instrument) may be used to determine when the line is clear.

For new work, approach control should be provided, in accordance with Section 3.2.10.

No controls ahead of the destination signal are required.

Automatic working facilities for controlled signals authorising a permissive movement are not permitted. However, on a permissive goods line, intermediate automatic signals may be provided, with selection of main or subsidiary aspect by track occupancy. Such signals should be track replaced with the subsidiary aspect approach controlled to prevent the stepping down of aspects. Stepping up may be permitted when the train ahead is clear of the route and overlap.

b) Platform Space

Where passenger trains of more than two vehicles are required to be signalled into an occupied terminal platform, the following controls (commonly known as “Lime

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Street" controls) may be provided, as one of the control measures following review of risks required by GK/RT0044 and NR/L2/OPS/085.

Where passenger trains of more than two vehicles are required to be signalled into an occupied terminal platform, the following controls (commonly known as "Lime Street" controls) may be provided, as one of the control measures following review of risks required by GK/RT0044 and NR/L2/OPS/085.

I. a berth track section, known as the measuring track, at the signal controlling the entrance to the platform, of the same length as the outer platform track section;

II. two platform track sections, the inner one nearer the buffer stops being as short as possible to accommodate the longest train that may be in the platform when it is necessary to signal in a further train;

III. the permissive aspect controls should require the inner platform track occupied (for a permissive movement), the outer platform track clear (short space available), the measuring track occupied (for approach control) and the track section in rear of the measuring track clear (proves short train).

These controls prevent a train that is longer than the available space from being signalled into a platform.

If it is desired to signal one or more locomotives onto a train when both platform tracks are occupied, the measuring track may be divided to prove the length of the locomotive(s). Alternatively, a shunting facility may be provided, controlled by a different signaller's request as described in Section 3.2.7.

Similar controls, but with only one platform track and a shorter measuring track, may be provided where it is not required to signal more than locomotive(s) into an occupied platform.

Where required by the Network Rail, similar controls may be provided at through platforms.

Where required by the Network Rail, more complex controls may be provided for longer platforms, perhaps using three platform tracks and two measuring tracks.

3.2.7 SHUNTING MOVEMENTS

A shunting movement should be signalled with a shunting signal or subsidiary signal (PLS or semaphore) and should be controlled by a shunt route in route setting interlockings.

A signal associated with a main aspect that authorises shunting movements should be controlled by a different signaller's request from the main signal.

In track circuit block, shunting signals (PLS or semaphore), that read onto or along running lines, should generally require all track sections clear up to the signal (or LOS) ahead. However, where attaching or detaching operations are necessary, the track sections where these operations occur may be omitted from the controls. In such cases, the signal ahead should have a separate overlap track section and first wheel replacement.

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In non-track circuit block, train detection control may be omitted from shunting signals, except for those reading into an intermediate block section. Shunting ahead into the block section should be in accordance with GK/RT0042, GK/RT0051 or GK/RT0054, as appropriate. (See also the NR/L2/SIG/10064 series of regulations.)

For new work, approach control should be provided for subsidiary signals (PLS or semaphore), in accordance with Section 3.2.10.

For pre-set shunting signals see Section 3.2.8. For shunt overlaps see Section 3.4.3. For omission of opposing locking see Section 3.5.9.

3.2.8 PRE-SET SIGNALS

One or more independent shunting signals (PLS or semaphore) may be pre-set by any class of route from a signal. When such signals are pre-set, they should not clear until the aspect controls for the pre-setting route are off, awaiting only the clearance of the pre-set signal(s). Once the signals have cleared, the track sections between the pre-setting and the pre-set signals should be selected out of the pre-set aspect controls to prevent premature replacement. These aspect controls should then include any further pre-set signals in advance proved off.

Approach locking and route locking should be applied to the pre-setting route, as if the pre-set signal did not exist.

Replacement conditions should be as follows:

a) Before the train passes the pre-setting signal, restoring the pre-setting signal control device should replace the pre-setting and pre-set signals. The signals may be recleared by re-stroking the whole route. (If the train has, by then, entered the route, only the signals ahead of the train should clear.)

b) After the train enters the route, restoring the pre-setting signal device should have no effect on the pre-set signals. (Additionally on permissive lines it should be possible to extend the replacement of the pre-set signal to include “replacement only after the pre-setting route has been cancelled and the route locking release has reached the pre-set signal”).

c) Restoring the pre-set signal control device(s) at any time should replace the signal whose device is restored, as well as pre-set signals to the rear and the pre-setting signal. Such restoration should not initiate the approach lock release timer. The restoration may be nullified by re-stroking the whole route.

d) Once the pre-setting signal has been replaced, an emergency replacement facility should be provided, whereby the restoration of any pre-set control device should replace all the pre-set signals in the route. The restoration may be nullified by simply operating the device again to reclear the pre-set signal(s).

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e) Track section replacement conditions should be as described in Section 3.7.1. The pre-set signal should have the same type of replacement as the pre-setting signal when in pre-set mode, but may have another type in non-pre-set mode.

Exceptionally a main signal may be required to be pre-set by another main route, in which case controls similar to those described above should be provided.

3.2.9 SLOTS AND RELEASES

Where signals are required to be controlled from more than one signal box or ground frame (as described in Section 3.6.1), a slot should be provided such that signal clearance requires authority from two or more control points. The withdrawal of any authority should replace the signal.

It should not be possible to fully normalise a slot so as to release other locking, until the signal concerned is proved on and free of approach locking.

Semaphore distant signals mounted below any stop signal for another signal box should be slotted by that stop signal. An outer distant should also be slotted by any stop signal mounted on the same post as the inner distant. The outer distant should, conversely, be back slotted by the inner distant and any stop signal mounted on the same post. The slotting should be extended in like manner where there are more than two distant signals. See also Section 3.2.4 for distant signals.

Back slotting is a means of confirming that an outer distant arm cannot be off when either:

a) the inner distant arm is on; or

b) an intervening stop signal worked from another box is on.

Slotting should be achieved either mechanically or electrically, as appropriate. Where any of the slot controls are electrical, the slotted signal should be made power operated, so that it is replaced immediately any of the controls are withdrawn. A combination of mechanically operated signal and electrical slot (via the lever lock) should not be provided for new work. Mechanical slotting should be achieved by balance levers on the signal post, as described in NR/L2/SIG/11201, Module B17. Previous alternative methods of control (such as by underbolting the signal lever with a release from the other signal box) should not be provided for new work. (In the case of underbolting, the signal is not automatically replaced when the slot is withdrawn.)

Where such slotting is not practicable, a separate electrical release may be provided to release the locking on one or more signals, e.g. for a shunter or at a gate box. Where the withdrawal of such a release does not replace the signals, it may be necessary to provide an emergency replacement facility, or alarm, at the appropriate control point.

The response of the signal (aspect or arm) and slot control (disengaging relay or slot balance lever) in the on position, and of the slot control in the off position should be suitably repeated and indicated. The minimum indication requirement is to show slot off from the other control point(s) at the signal box that has primary control of the

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signal, i.e. the signal box whose identification plate and/or signal post telephone is provided at the signal.

For ground frame releases see Section 3.6. For ground frame and slotted signal control circuits see NR/L2/SIG/11201, Module B9.

3.2.10 APPROACH CONTROL

Approach control of power operated signals should generally be provided, with automatic signal clearance, in the following situations:

a) where there is insufficient spacing between a single yellow and a red aspect in a four aspect sequence, as described in GK/RT0045 (the signal to be released after passing the previous signal);

b) at the commencement of a four aspect sequence to avoid a signal displaying the first cautionary aspect for more than one signal, as described in GK/RT0045 (the signal to be released after passing the previous signal);

c) to confirm that train speed is adequately reduced to safely negotiate a turnout, as an alternative to advance warning of divergence, either by approach control from red or from yellow, in accordance with GK/RT0045 (the signal to be released when the train has attained the correct speed, as shown in Figure 10);

d) to prevent the driver sighting a proceed aspect before the route indicator, where no advance warning of divergence has been received and this could result in a train approaching the turnout at an excessive speed (the signal to be released at the sighting point of the route indicator, as shown in Figure 9);

e) to confirm that train speed is adequately reduced to stop short of buffer stops in a bay platform (the signal to be released when the train has attained the correct speed, as shown in Figure 10);

f) before displaying a delayed yellow (warning) aspect, to confirm that train speed is adequately reduced to safely approach the signal beyond with only a restricted overlap available (the signal to be released when the train has attained the correct speed, as shown in Figure 10); and

g) before displaying a subsidiary aspect (permissive or shunting), where necessary to confirm that train speed passing the signal is such that the train can stop short of any obstruction (the signal to be released when the train is nearly at a stand, nominally 15mph, at approximately 50m from the signal, as shown in Figure 8).

For mechanically operated signals, the above should be applied where reasonably practicable, with manual signal clearance by the signaller. Other options include providing advance warning of divergence by means of splitting distant arms and subsidiary signals that lock the signal in rear.

See Section 3.3.3 for the use of track section timers. See Section 4.5 for approach controlled signals with sequential locking.

Additionally, a temporary approach control facility (requiring berth track section occupied) should be provided to cover any such need for a reduction in speed that

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may arise, but a timer or additional track circuit is not required for the purpose. See also Section 3.11.7.

3.2.11 AUTOMATIC WORKING FACILITIES

Facilities should be provided in the interlocking to allow controlled signals in track circuit block to be automatically re-cleared, as well as replaced, dependent upon track section conditions, in the following situations:

a) for nominated signals, by the provision of an additional automatic working control device for each signal;

b) where automatic working is in operation under remote control failure conditions (see Section 3.10); or

c) for automatic terminal platform or junction working, initiated by special control device and/or a remote control override system. TORR is a requirement. A "first come, first served" arrangement may be used for trailing junctions. Routing information may be derived from a train describer system for facing junctions. See Section 3.2.13 for other arrangements. The points should not be called until a time has elapsed after the release of all point locking, to protect against wrong side failure of track sections.

The interlocking should be capable of allowing a signal to work automatically for each main route to which it applies as selected by the signaller on initiation of automatic working. This facility may also be extended to warning class routes, as described in Section 3.2.5.

Automatic working of controlled signals should otherwise be inhibited by means of a signal stick. This control should be applied by the occupation of the first track section beyond the signal when the signal is off. (The berth track is required occupied at the same time to guard against a failure of the first track.) Once applied the signal route must be cancelled and re-set to enable the signal to clear when the remainder of the controls come off again.

3.2.12 DELAYED CLEARANCE

Where signal clearance requires some other function to have been operating for a time, automatic operation may be achieved by arranging for the signal aspect controls to initiate the other function and operate a timing device for the required time. Signal clearance then requires the aspect controls and the time cycle completed. Examples include signals positioned within the strike-in point of an automatic level crossing, or of a train activated warning system. See Section 3.2.13(a) for a manual option.

3.2.13 NO SIGNALLER ROUTE SETTING

Signal route setting may be initiated by train or station personnel under certain circumstances. The following examples are illustrative:

a) Where a station platform is located close to an automatic level crossing and the time for station duties is not consistent, a train ready to start (TRTS) plunger may be provided for train crew to initiate the time cycle described in Section 3.2.12.

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