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Signalling

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Signalling Operator Interface

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About This Standard

This document details the interface through which a Signaller monitors and controls the signalling safety system.

Document History

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List of Amendments –

ISSUE	DATE	CLAUSE	DESCRIPTION
1.1	01/09/2004		▪ Reformatting to ARTC Standard
1.2	14/03/2005	Disclaimer	▪ Minor editorial change ▪ Footer reformatted

Contents

1. Introduction

The Signalling Operator Interface is to be used by a signaller. A signaller is a person who has the relevant certificates of competency in railway operations safeworking issued on behalf of the NSW Department of Transport.

The Signalling Operator Interface provides all of the functionality needed by the signaller to control and monitor the signalling system.

The duties of the signaller are detailed in the Safeworking Units (SWU). The signaller's main duties are covered in the ARTC SWU 110 to 119.

The signaller works as part of the Train Control System. An overview of Train Control is provided in the ARTC SWU 130 to 133.

The signaller learns the particular area of control, including the train movements that are provided by the signalling safety system.

The signaller receives information about what is happening or is going to happen in a number of different ways. These are:

- Working Timetable
- Special Train Notices
- The AMBA book
- Safeworking circulars
- Weekly Notice
- Telegrams or faxes
- Telephoned instructions from Operations Control or Train Control
- Telephone/ radio conversations
- Signalling displays

The major responsibility of Signallers is to operate the signalling equipment in order to ensure the safety of the public and the safe and efficient passage of trains in the area under their control.

Signallers monitor a signalling display so that they are aware of all train movements and any events happening in their area of control. This includes any areas where they have no control of the signalling equipment, but the trains are under their supervision.

The Signaller is also responsible for compiling a train register book, which includes entries for the following information:

- train arrivals and departures at nominated locations.

significant events that affect or may affect train working.

The Signalling Operator Interface is intended to facilitate and automate as many of the routine functions of the Signaller as is reasonable with the current technology.

Aids to the signaller will only be considered in conjunction with the prime need of a dependable system that is available for train operations whenever trains are scheduled to travel through the area of control.

Where the normal Signalling Operator Interface is remote from the interlocking then an emergency Signalling Operator Interface system local to the interlocking is required.

Section 10 *Mimic Panel Implementation Requirements* details current accepted practice for that type of implementation and is only a requirement when that type of signalling display/control panel is provided.

The Signalling Operator Interface is also used to test the signalling system when the signalling system is altered.

2. Definitions

Entrance – Exit control system	A system where an entrance and an exit are identified to a particular signal route.
Commence	Generally used to mean the first signal of a pair of signals used to identify a particular signal route.
Finish	Generally used to mean the second signal applying to the direction of traffic but in the case of a route which leads into a section, siding or terminal road the exit button is located in the section, siding or terminal road.
Identify	A particular action on the Signaller's part, to indicate to the system that a particular object is the one the system is to use for the Signaller's command.
Area of Control	The area of control includes all of the controlled signalling equipment and any automatic signalling which is supervised by the Signaller. An area of control is normally defined by the signalling safety system and is the smallest unit of control that can be allocated to a person.
Interlocking	An area of rail track in which the controlled signals and points are interlocked with each other and the track circuits. The interlocking arrangement is defined in the Signalling Control Tables.
Vital Block	A facility to protect personnel and property from trains by use of the signalling system. This facility is implemented within the signalling safety system.

Non-Vital Block	A facility to protect personnel and property from trains by use of the signalling system. This facility is implemented outside the signalling safety system.
ARTC	Australian Rail Track Corporation, the Infrastructure owner.
ELCP	Emergency Local Control Panel.
RCP	Remote Control Panel.
Metropolitan area	The metropolitan area for New South Wales is the area of Sydney within Cowan, Waterfall, Macathur, and Emu Plains. These locations are included in the metropolitan area.
Extended Metropolitan area	The extended metropolitan area for New South Wales is the areas surrounding Sydney between Cowan and Newcastle stations, Waterfall and Bomaderry stations, Macathur and MossVale stations, and Emu Plains and Lithgow stations. The stations at the extremities are included in the extended metropolitan area.

3. Performance

The Signalling Operator Interface shall allow a Signaller who has completed the training required of a Signaller and provided for the system to achieve the following level of performance:

1) Perform command actions for setting any route within the area of control within 3 seconds. Setting a route should have no more than 3 arm movements and 3 actions.

2) Perform command actions for cancelling any signal within the area of control within 2 seconds. Cancelling a signal should have no more than 2 arm movement and 2 actions.

3) Perform command actions to manually move any free set of points within 4 seconds. Moving a set of points should have no more than 2 arm movement and 2 actions.

4) Perform command actions to manually lock or unlock any set of points within 5 seconds.

5) Perform command actions for miscellaneous functions within 6 seconds.

6) Perform command actions to apply any block within 120 seconds, including the completion of any safeworking forms.

7) Perform command actions to remove any block within 20 seconds.

8) Detect any failure condition with the control and indication of the signalling safety system within 45 seconds.

9) Able to perform all user equipment replacement tasks and re-start the Operator Interface within 10 minutes.

10) Perform and complete any security procedures, and be able to use the Signalling Operator Interface within 60 seconds.

11) Responsiveness of the system to the Signaller, (for example for Mouse movement), is such that the natural actions of the Signaller are not impeded by the system.

12) Perform command actions to acknowledge any alarm or warning within 3 seconds. Acknowledging alarms or warnings should have no more than 2 arm movements and 2 actions.

13) Perform command actions within 10 seconds to acknowledge the maximum alarms or warnings that can occur due to 2 or more separate events.

14) There shall be no more than one incorrect display indication in 50,000 hours of operation for each Operator Interface that is not detectable by the Signaller as a failure of a part of the system. Detectable failures should generate alarms or warnings.

15) If the information to maintain the display is lost then the Operator Interface shall clearly indicate that the display is no longer valid.

16) There shall be no more than one incorrect control in 50,000 hours of operation for each Operator Interface, due to causes other than faults in the Signalling safety system, incorrect use of the system, or failures that generate alarms or warnings.

17) The signalling display shall be viewable from at least 1 metre.

18) More than 2 independent failures must occur before it is possible to remove the effectiveness of a block. Each of these failures must generate an alarm.

19) The Signaller shall be able to detect or be informed of at least 99% of unusual events and anomalies in the Signalling Operator Interface or unusual information provided to the Signalling Operator Interface. The Signalling Operator Interface shall not mask any such indication or event from the signaller.

20) The Signaller shall be able to control the running of trains so that in the Metropolitan area, no more than 1 train in 50,000 are delayed by more than 3 minutes due to the Signalling Operator Interface or its use per 500 signal routes.

21) The Signaller shall be able to control the running of trains so that in the extended Metropolitan area, no more than 1 train in 25,000 are delayed by more than 3 minutes due to the Signalling Operator Interface or its use per 250 signal routes.

22) The Signaller shall be able to control the running of trains so that outside the Metropolitan, and extended Metropolitan areas, no more than 1 train in 1000 are delayed by more than 3 minutes due to the Signalling Operator Interface or its use per 100 signal routes.

23) The current date and time shall be continuously displayed to the Signaller with a resolution of 1 second and updated every second. The clock shall have an accuracy of +/- 20 seconds in 30 days. The date and time should be coloured white or grey to demonstrate the correct colour balance of the display.

24) Select, search, display, print, and archive the historical information kept by the system with commonly used reports being available within 10 seconds.

25) Historical information must be kept for at least 28 days and with the maintenance of historical information not normally requiring actions by the Signaller, Maintainer, or any other party.

26) The Signaller and others shall not be able to gain authorised access to the system so that they could delete, or alter historical information, disrupt the system, or bypass the system. It is assumed that the Signaller and others may observe maintainers, etc gain access to the system and therefore the security arrangements must consider this as a possible method of gaining un-authorised access.

4. Control and Display Layout

The Signalling Operator Interface shall be based on a geographical display of the railway tracks in their area of control. The controls for the signalling shall be either embedded in the geographical display or in a separate scaled version of the geographical display.

The control and indication status of the signalling system shall be continuously displayed for the complete area of control for the Signaller in real time. The presentation of the information shall be such that it highlights problems and unusual events to the Signaller.

Indication status shall display the actual state of the signalling equipment as indicated by the signalling safety system.

The Operator Interface is expected to be of VDU control system type, unless specified otherwise.

The Signalling Operator Interface shall comply with all relevant Australian Standards for Occupational Health and Safety, including:

- AS 1680 Interior lighting and visual environment
- AS 2107 Acoustics
- AS 2700 Colour Standards
- AS 3590 Screen Based workstations

4.1. Geographical display

The geographical display shall show the complete geographical area for the Signaller's area of control and approaches to the area of control.

The background colour for the display shall be selected to provide the optimum colour contrast for the range of colours used by the dynamic and static display elements.

The Signaller shall be able to view the entire area under their area of control at any time without the need to manipulate the system in any manner.

The display shall have dynamic elements, which shall change the way they are displayed based on their signalling status and Signaller commands.

The display shall also have static elements, which shall not change their display.

The dynamic elements include:

- Signals
- Tracks
- Points
- Releasing Switches
- Vital and Non-vital blocks
- Time Releases
- Alarms
- Warnings
- Miscellaneous equipment

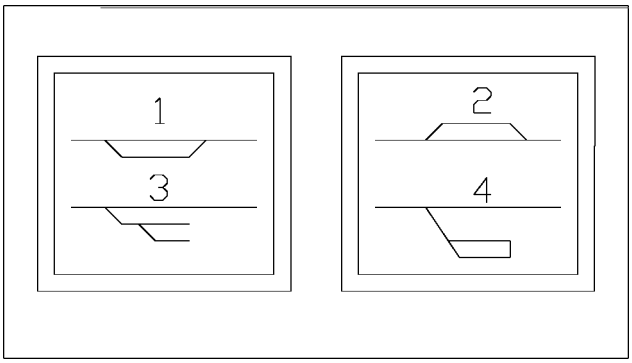
The static elements include:

- Platforms
- Block Joints
- Automatic signals
- Distant signals
- Notice boards, and Landmark signals
- Tunnels
- Major over-pass, underpass, bridges, and viaducts.
- Level crossings
- Non-track circuited sidings
- Freight loading and unloading facilities
- Weighbridges

The tracks shall normally to be laid out horizontally. In general the direction to Sydney, Central station will be on the left-hand side, and the direction away from Sydney, Central Station will be on the right hand side.

If the controlled area needs to be displayed on more than one screen, then the preference is for the lines are to be drawn left to right across screens, before moving down to a second line on the screen.

That is, this



is preferred over

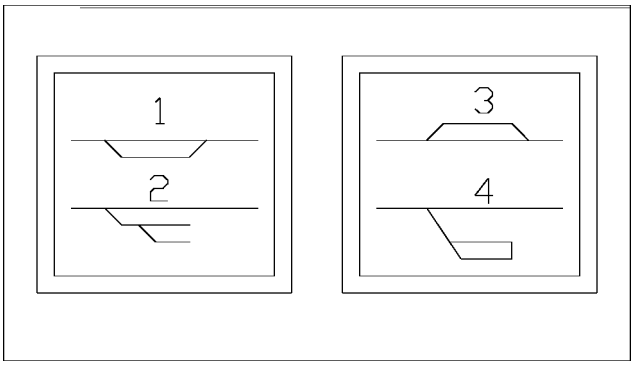


Figure 1 Sequence to draw tracks across screens for a single area of control.

Where the display is in a fixed position, the direction of the tracks as shown on the display shall reflect the geographical direction of the tracks, particularly when the control centre is next to the railway line.

An alternative, is for the tracks to the north and west of Sydney to have the up direction towards the left; and for tracks to the east and south of Sydney the up direction towards to the right.

When multiple screens are used, the screens used shall be of a type designed to be fitted adjacent to other screens to produce a single continuous display. The reasons for this are to reduce the gap between displays and to ensure that the displays are designed to not cause distorting electromagnetic interference to each other.

The display shall show all individual track circuitry arrangements, signal names, point names, station names, alarms, warnings, track names, track circuit names, time release lights and any

other miscellaneous indications. These names need not be continuously displayed or all displayed at the same time.

The display shall be positioned so that it is fully visible to the Signaller while they are performing other duties away from the display, when a dedicated Signaller is not employed.

4.2. Maintenance access

Maintenance shall have access to all parts of the Operator Interface such that :

- no potential exists for the disruption or delay of trains during preventative maintenance.

- no delays or disruption occurs during corrective maintenance additional to that directly attributable to the failed item

4.3. Sizes of objects on display

The size of objects on VDUs shall comply with AS 3590.1 – 1990 *Screen Based Workstations*. In paragraph 6.5 of AS 3590.1 the minimum heights of characters is specified as.

$H_{min} = K L_d$ for $_{Hmin}$ 3mm

H_{min} is the minimum height in mm of the text.

K is a factor based on the display object

For positive polarity (dark characters, light background) K=0.005.

For negative polarity (light characters, dark background) K=0.006.

L_d is the maximum recommended viewing distance

Distance from Screen	**500**	**1000**	**2000**	**3000**	**5000**
H_{min} for positive polarity	3	5	10	15	25
H_{min} for negative polarity	3	6	12	18	30

Status of Signal repeaters shall be viewable from 2 metres
Status of Track circuits, and points shall be viewable at from 2 metres from the display. All other signalling indications shall be viewable from 1 metre from the display.

Location text shall be viewable from 1 metre.
Labelling text shall be viewable from 0.5 metres.

4.4. Additional displays

Additional displays shall be identical to and be able to provide the same level of indications as the Signalling Operator Interface with the exception that they are prevented from controlling the signalling equipment.

An additional display may be required for the maintenance personnel and for Train Controllers or other personnel involved in train operations.

4.5. Limits of display area

The display shall also cover the approaches to the Signaller's area of control.

Approaching train track occupancy indications adjacent to the area of control for each line are, as a minimum to be provided to include all tracks involved in the conditions of the Approach Locking of the first controlled signal.

In a departing direction the track circuit indications shall be provided as a minimum for all tracks up to and including the overlap track of the last controlled signal.

5. Display

5.1. Display Principles

The signalling display for the Signaller shall be based on the following principles.

1) The complete area of control is always displayed in sufficient detail for the Signaller to be aware of what is happening in their area.

2) Any anomaly in system operation, or in the signalling indications is to be bought to the attention of the Signaller. Alternatively the anomaly must be readily detectable by the Signaller when viewing the display.

3) Any event or change of state of a duration greater than 0.2 seconds will be displayed.

4) Events that need a response or action by the Signaller are brought to the Signallers attention by two means. Normally visually, and audibly.

5) It will be obvious to the Signaller that the information displayed is valid or otherwise.

6) The display shall be of sufficient detail so that the Signaller can with the aid of their knowledge of the signalling determine:

- The exact location of trains.
- Clearance points for signals.

- Type and form of each signal available.
- If a particular route should be available, that is all information that affects a route's availability shall be indicated to the signaller.
- If a failure or fault (intermittent or permanent) has occurred, and record sufficient details for maintenance staff effectively to respond.
- The names of items of equipment.
- The names of physical locations.
- The geographical relationship of rail lines.
- The purpose of locations for train running.

7) Sufficient information is provided on trains approaching the Signallers area of control for the Signaller to efficiently manage trains.

8) Sufficient information is provided on trains departing the Signallers area of control so that the Signaller can be aware of when the next train will be able to depart, and that a train has completely departed their area of control. This should include some overlap into the adjacent area of control.

9) All indications for a particular area of control will be consistent within the area of control.

10) The display will be structured in a manner that minimises information usually displayed, so that the display does not have a cluttered appearance.

11) All colours shall match the Australian Standard colour as closely as is reasonable for the display type.

12) The display will accurately reflect the status of the signalling equipment with the time lag for updates to the display being less than 1.5 seconds.

13) Any processing necessary to convert the indications provided by the signalling safety system will be done external to the signalling safety system.

14) No indication or display item will obstruct or mask any other indication.

15) All display items will be of a similar scale. The display is not required to have one geographical scale, but should be based on the Signallers functional needs and aesthetics.

5.2. Display Integrity

The operation of the display shall comply with the reliability requirements of electronic systems, as specified in the ARTC specification 'Standard Requirements for Signalling Electronic Systems' SPS 01.

The display will only display the correct information, if the display is not correct, or the information to maintain the display is lost, then the Operator Interface shall indicate that the display is no longer valid.

There shall be no more than one incorrect display indication in 50,000 hours of operation for each Operator Interface that is not detectable by the Signaller as a failure of a part of the system. Detectable failures shall generate alarms or warnings.

5.3. Tracks/Routes

The railway lines shall be displayed with the lines sub-divided as per the signalling track plan into track circuits. The separation of track circuits should be shown by gaps in the line of width greater than 0.5 mm and less than 1 mm.

Tracks should normally be drawn horizontally but may have any rotation as appropriate for the geographical layout.

All track circuits are to be brought back to the control centre as individual indications.

Track circuit indications on the display should only be grouped when the individual track circuit indications are logged and the display principles are not compromised, particularly in regard to determining signal, and points clearance points.

Track Condition	**Track Colour**
Quiescent State – Unoccupied, no route set	White or line colour where specified
Occupied	Red
Route set up or in the process of being set up	Green
Route over points where points are not detected in required lie for the route	Flashing Green
Indication Failure	Grey
Blocked for route setting, and track unoccupied.	Blue
Blocked for route setting, and track occupied.	Purple

5.3.1. Route Indication

Tracks in the route between commence and finish signals shall be coloured green to indicate that the route over the tracks is set or in the process of being set. Overlaps shall not be indicated.

The green route lines shall remain ahead of a train travelling through a route while the route is set or while there is a train in the route. If the train does not complete the route and leaves the route then green route lines shall return to quiescent state. If the train does not complete the route and remains on a track circuit with time release then the green route line to the end of the

route shall be removed returning the track indication to the quiescent state when the time release occurs.

Track indications to the rear of the train travelling through a route shall return to green if the route is still set, otherwise the track indications shall return to their quiescent state.

Where there are intermediate automatic signals, the green route line shall propagate to the next controlled signal or the boundary of the area of control.

Where there are overset shunt signals the route line is to be based on the main route set.

5.3.2. Track Circuit Occupation Indications

Colouring the track indication red shall indicate the track occupancy.

5.3.3. Track Circuit un-occupied Indications

Colouring the entire track white shall indicate the quiescent state of a track circuit, that is unoccupied and no route set over it.

5.3.4. Tracks over Points

Track indications over points are made up of at least five pieces. These are:

- common leg
- reverse detection leg
- normal detection leg
- points pivot normal
- points pivot reverse

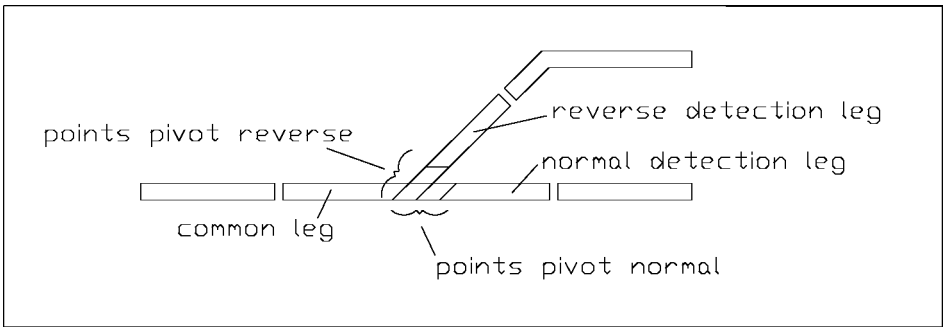


Figure 2 Track pieces that make up a set of points

Route line indications over points shall only be displayed on the common leg, the required detected leg and points pivot.

Where points for a route are not in the required position when the route is set, then the required detection leg of the track shall flash green until the points are detected in the required position, then it shall become steady green.

Track occupancy indications over points shall normally only be displayed on the common leg and the detected leg and points pivot.

If a track over points becomes occupied with a route set and no points detection then the common leg and the called leg and pivot shall flash.

If a track over points becomes occupied without a route set then the all three legs, including the indicated pivot shall show occupied, unless the system provides a warning to the Signaller if track become occupied out of sequence.

5.3.5. Track Circuits with abnormal indications

Cut tracks, Coded tracks, some Intermediate receiver track circuits, and Axle counters indicated as track circuits can give abnormal track indications. This may cause these track indications appearing to operate in the wrong sequence.

The system shall cope with these type of abnormal indications and provide a consistent, meaningful display.

5.3.6. Non Track Circuited track

Non track circuited track shall include those tracks for which there are no indications provided.

Non track circuited track shall be displayed in a darker shade of the colour used to display a quiescent state track indication.

Non track circuited track shall be provided on the display in sufficient detail for the Signaller to determine the purpose of train movements into and out of non track circuited track and possible alternative train movements.

Non track circuited track may show occupied if this is part of the systems operation in conjunction with train identification and the occupation indication can be removed by the Signaller.

5.4. Signal Repeaters

5.4.1. General

Signal repeaters shall be provided for all controlled signals. All signals on the same pole shall be combined into a single repeater, except where there is a shunt aspect, which shall have its own repeater.

The signal repeaters shall be drawn on the correct side of the track and in the correct geographical relationship with other display elements. The repeater shall be drawn with the base perpendicular and the stem parallel to the track it applies to. Each signal shall be labelled with the same name that appears on the signal nameplate and when identified in reports and lists the name shall be the Interlocking name followed by the signal name.

Automatic signals, except for those with emergency replacement, will not normally be indicated.

Automatic signals with emergency replacement shall have an indication based on the signal being clear or at stop. The letter ‘E’, coloured red is displayed at the base of the signal repeater when the signal has emergency replacement in force. The letter ‘E’, shall be coloured grey when the signal does not have emergency replacement in force.

Automatic Signals without emergency replacement that are indicated, or Signals that can be identified as auto re-clearing shall have the letter ‘A’, displayed at the base of the signal repeater. The letter ‘A’, shall be coloured green when the signal is in auto re-clearing mode. The letter ‘A’, shall be coloured grey when the signal is not in auto re-clearing mode.

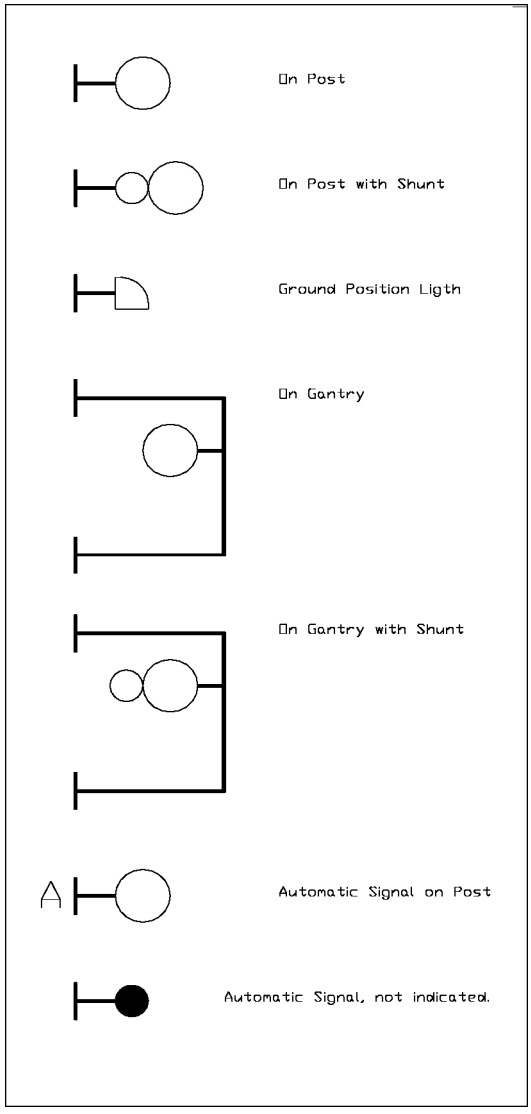


Figure 3 Signal Repeater Representation

Subsidiary shunt signals shall be provided with a separate yellow indicator on the main signal repeater to indicate that the shunt route has been selected.

Examples of signal repeater representation are given in figure 3.

5.4.2. Colours

The base and stem or gantry for signals shall normally be coloured grey.

The indication colour of the repeater shall truly reflect the status of the signal in the field as defined in the following table

Colour	Meaning
Red	Signal is at stop
Flashing Red	The signal is at 'stop' but still subject to approach locking conditions
Green	A proceed indication is displayed in the signal
Flashing Green	Signal will clear when control conditions have been satisfied.
Yellow	Shunt or subsidiary aspect clear.
Grey	Failed or not indicated
Blue	Blocked and the Signal is not clear
Orange	Blocked and the Signal is clear

Table 2 'Signal Repeater Colours'

A signal is defined as failed if it has no field indications, conflicting indications or unstable indications.

Automatic signals that are not indicated shall be coloured grey.

5.5. Point/Releases

5.5.1. General

Points/Releases shall be drawn as in figure 4.

Points shall be indicated as defined in section on *Tracks over Points*.

Points normal detection shall indicate the normal points pivot in the track colour. Points reverse detection shall indicate the reverse points pivot in the track colour.

Points that are not detected Normal or Reverse are said to be ‘In Transit’. The In Transit condition shall be indicated by the points detection leg, and points pivot of the requested lie flashing.

The requested lie is:

- the same as the points call when the points call is normal or reverse.
- the opposite lie to the previously detected or called lie when the points are not interlocked.
- the existing lie when the points are interlocked. If the points are detected

both normal and reverse, they shall be indicated as failed. The Points free

indication shall be given by the one of the following methods:

- colour of the points number Red for locked, Green for free with the points number always displayed.
- colour of the points pivot piece in the track, quiescent track colour for free, track occupied or route line colour for locked.
- colour of a separate points free indication, Red for locked, background colour for free.

The Points control indications are detailed in the section on points controls.

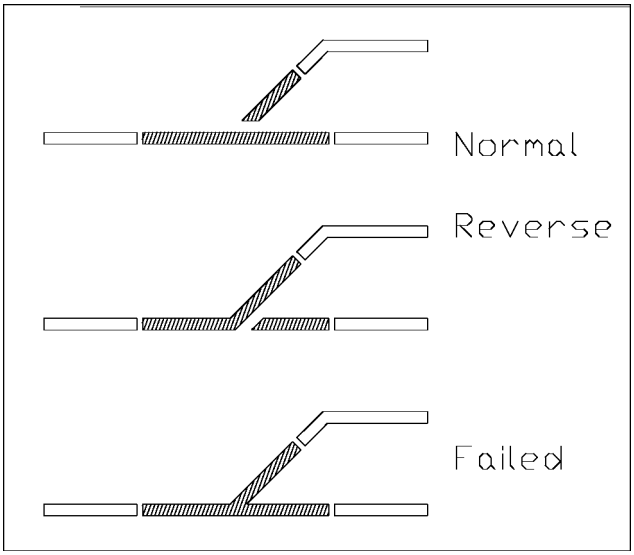


Figure 4 Points and release representation with the points detected in the requested lie and a centre control

5.5.2. Release/Ground Frame

The lie of switches controlled by ground frames shall be drawn and indicated in a similar manner as points.

Releases shall have a label giving the name of the associated ground frame drawn next the display indication to identify that it is a Release/Ground frame and not a set of motorised points.

Control and Block indications are detailed in the section on Release/Ground Frame controls.

If the release does not have reverse detection then reverse detection will be composed of no normal control, no normal lock indication and no normal detection.

5.6. Blocking

When a block has been applied the equipment that has had the block applied shall normally be coloured blue. The indications are detailed under each equipment's heading.

Vital blocks shall be distinguished from Non-Vital blocks.

Vital blocks shall be indicated by text naming the block, the colour of the text shall change from grey to blue when the indication from the interlocking is received that the block is applied.

5.7. Alarms

Alarm indications shall be provided for detectable equipment failures that require immediate attention from maintenance staff to prevent or minimise train delays.

The alarm display element shall be the colour red when in the alarm state. The alarm display element should not be visible when it is not in the alarm state.

Typically alarms will be provided for:

- Grouped Signal lamp failure
- Power supply failure for each AC, DC power supply point
- Telemetry failure for each field station
- Inability to deliver a control to a field station
- Level Crossing Equipment failure
- Location equipment failure
- Fire alarm

When an alarm indication changes to the alarm state then the Signaller shall be informed by two means.

These method of informing the Signaller should be one of the following methods:

1) Flashing the particular alarm display element in its alarmed state and a continuous audible warning until the Signaller acknowledges the alarm indication. The alarm display element then displays steady in its alarmed state and the audible warning is silenced.

2) The alarm display element displays steady in its alarmed state, a 1 second audible warning is sounded and an alarm acknowledgement "dialogue box" or "window" is presented to the Signaller for acknowledgement. The "dialogue box" or "window" is not to obscure the signalling display or prevent the Signaller from controlling the signalling.

The second method shall be able to handle extreme cases of repeated alarm occurrence without acknowledgement.

Alarms should have a hierarchy so the failure of one piece of equipment does not cause false alarms in equipment it controls or affects.

An 'acknowledge all alarms' command shall be provided if the second method is used.

When an alarm indication changes to the non alarmed state then the Signaller shall be informed by two means:

1) An audible warning of 1 second duration

2) The particular alarm display element becoming invisible.

5.8. Warnings

Warning indications shall be provided for detectable equipment failures that require attention from maintenance staff to prevent a failure that may cause train delays.

The warning display element shall be the colour yellow when in the warning state. The warning display element should not be visible when it is not in the warning state.

Typically warnings will be provided for:

- Grouped Signal lamp, primary filament failure
- Power supply equipment warning for each AC, DC Power supply point
- An ELD warning for each AC, and DC Power supply point
- Telemetry equipment warning for each field station
- Level Crossing equipment warning
- Location equipment warning
- Point transit warning when any point machine has been in transit for more than 15 seconds.
- Track occupancy out of sequence

- Track clearance out of sequence
- Train past Signal at Stop
- Train Ready to Depart

If an indication changes to the warning state then the Signaller shall be informed by either of two means.

The method of informing the Signaller should be one of the following methods:

1) Flashing the particular warning display element in its warning state and a continuous audible warning until the Signaller acknowledges the warning indication. The warning display element then displays steady in its warning state and the audible warning is silenced.

2) The alarm display element then displays steady in its warning state, a 1 second audible warning is sounded and an warning acknowledgement “dialogue box” or “window” is presented to the Signaller for acknowledgement. The “dialogue box” or “window” is not to obscure the signalling display or prevent the Signaller from controlling the signalling.

The second method shall be able to handle extreme cases of repeated warning occurrence without acknowledgement.

An acknowledgement of all un-acknowledged warnings command shall be provided if the second method is used.

When an warning indication changes to the non warning state then the Signaller shall be informed by two means:

An audible warning of 0.5 second duration

The particular warning display element becoming in-visible.

5.9. Healthy Indications

Healthy indications are not normally expected for VDU based Operator Interfaces.

If the display system may fail in a manner that particular alarm or warning indications will not be displayed when they are in the alarm or warning state without a complete failure of the Operator Interface system, then a corresponding healthy indication shall be provided.

The healthy display element shall be grey or green colour when the corresponding alarm and warning indications are not in the alarm or warning state.

The healthy display element shall not be visible when either of the corresponding alarm and warning indications are in the alarm or warning state.

5.10. Authority to Control Interlocking

Typically an interlocking may be controlled from an Emergency Local Control Panel (ELCP) or a Remote Control Panel (RCP). Either of these Control Panels may conform to this

Signalling Operator Interface. The Control Panel that is controlling the interlocking has all of the voice communications to the controlled area.

5.10.1. Emergency Local Control Panel

The ELCP is provided with a control key switch which has a local control position, a remote control position, and optionally a closing position if appropriate.

The switch status indications shall be displayed by one of the following methods:

1) The text local, remote, and closing adjacent to which is a yellow display element which is displayed when the interlocking is in that mode of control.

2) The text local, remote, or closing appearing in yellow colour adjacent to the interlocking name when that mode of control is in use.

If more than one Operator Interface exists or may exist then the Operator Interface that has authority to control the interlocking will normally display the interlocking name in the green colour. Operator interfaces that do not have authority to control the interlocking shall display the interlocking name in a colour that distinctively identifies that it is operational but not controllable from the Operator interface.

5.10.2. Remote Control Panel

The remote control panel, shall display the position of the control switch at the ELCP.

If the ELCP control switch is in the local control position then a local control indication shall be displayed near the name of the interlocking. Normally this indication will be designated by the text ‘Local Control’ in steady yellow text appearing near the interlocking name. When the interlocking is in ‘Local Control’, it shall prevent control of the interlocking from the remote control panel.

If the ELCP control switch is in the remote control position then neither local control indication or closing control indication shall be displayed near the name of the interlocking and the remote control panel is not prevented from controlling the interlocking.

If the ELCP control switch is in the closing control position then a closing control indication shall be displayed near the name of the interlocking. Normally this indication will be by the text ‘Closed’ in steady yellow text appearing near the interlocking name. When the interlocking is in ‘Closing Control’, it shall prevent control of the interlocking from the remote control panel.

5.10.3. Test mode

When the Operator Interface is in test mode, as detailed in section *6.11.2 Test Mode,* then there shall be a dominate indication to the operator that this mode of operation is in effect using the words ‘Test Mode’.

5.11. Axle Counter

Axle Counters shall be displayed as per Track Circuits.

Alarms and warnings shall be provided for any alarm or warning generated by the axle counter equipment.

5.12. Miscellaneous Indications

5.12.1. General

Indications not explicitly covered should operate as follows:

Normal state: Name of indication in grey text on display.

Not normal state: Name of indication in yellow text on display.

5.12.2. Bi-directional/Single Line Working

Bi-directional lines or single lines between interlockings shall be provided with an indication to indicate the direction of travel of trains in the section.

The direction indication may be provided:

- as part of the train description
- as part of the track occupancy indication
- as a separated direction indication.

Separate direction indications shall be illuminated red (train approaching) and green (train departing) if only one interlocking is in the Signaller's area of control. Otherwise the separate direction indications shall be illuminated blue for UP trains and yellow for DOWN trains.

5.12.3. Time Release Indications

For track circuits that are provided with time release facilities for the release of route holding, a red display element shall be provided below or adjacent to the track it applies to, to indicate that the timing release is in effect. The display element shall not be visible when the timing release is not in effect.

5.12.4. Dual Controlled Signals

Dual controlled signals may be used at the interface to an adjacent Signaller's area of control.

Control is given to clear a signal into the area of control by selecting the signal repeater as the commence and the home signal as the finish. This is indicated by flashing the dual control signal repeater green.

A dual control signal out of the section of control is available to be set when control has been granted from the adjacent section. This is indicated by a steady yellow control repeater above the signal. The signal can then be cleared by selecting the signal as the commence, and then selecting the appropriate finish point.

5.12.5. Maintenance Call Light

If maintenance call facilities are provided then the text ‘Maintenance call’ in yellow colour is to be displayed adjacent to the particular location name when the maintenance call is active. Normally the text ‘Maintenance call’ will be coloured grey.

5.12.6. Staff Instrument

Where the Operator Interface control system interfaces to a staff instrument, the Operator Interface shall provide indications for the state of controls that have been issued for the staff instrument as well as whether there is a staff in the section (when the indication has been requested).

5.12.7. Maintenance Releases

Where there are maintenance releases for maintenance in bi-directional areas they shall usually be indicated as follows:

Normal	Name of release in grey text.
Release given but not taken or returned	Name of release in yellow flashing text.
Reverse	Name of release in yellow text.

5.12.8. Master Shunt

For each interlocking that has the Master shunt facility it will usually be indicated as follows:

Normal state	The text “Master Shunt” is displayed near the interlocking name in white or grey colour.
Active state	The text “Master Shunt” is displayed near the interlocking name in yellow colour.

5.12.9. Derail

Derails shall be drawn as a solid equilateral triangle with one side on the track and the opposite point, pointing in the direction that a train is intended to derail in.

5.13. Audible Warnings

5.13.1. General

An audible warning occurs whenever an Alarm or Warning indication changes to the Alarm or Warning state.

5.13.2. Train Arrived Indication

An audible warning shall be provided to indicate the approach of a train to the controlled area. A different tone is to be used for each direction, the up direction being a higher tone than the

down direction. The train arrived indication shall be able to be enabled and disabled by the Signaller.

5.13.3. Performance

Audible indications shall be a least 10db above ambient noise level in the area the Signaller is located.

The audible warning shall be at least 0.5 second duration for a warning and at least 1 second duration for an alarm.

If the associated visual indication is not sufficient to ensure the Signaller is aware of the alarm or warning then the audible warning shall be continuous until the alarm or warning is acknowledged.

6. Controls

6.1. Control Principles

1) Control will always be available. That is route setting is independent of Alarm acknowledgement etc.

2) Signalling equipment is only controllable by one Signaller at a time.

3) Controls and the use of controls will not hide information on the display.

4) Controls used for signalling a train through the area of control for each train will be intuitive, and the easiest to use of all of the controls available.

5) Controls used to return the equipment to their safer state will not be prone to accidental operation but will be fast and easy to use in both emergency and failure situations. These controls will operate irrespective of the indicated state of the equipment.

6) Controls to use facilities that provide protection to personnel or property (i.e. where protection is in the signalling safety system) shall be a two step process in their application and removal.

7) Controls used to provide protection to people or property for circumstances that are not covered by the signalling safety system (i.e. where protection is in the control system and not in the signalling safety system) will have at least a three step process for their removal and provide a continuous indication of their state.

8) The state of controls used to provide protection to people or property for circumstances that are not covered by the signalling safety system will not be ‘forgotten’ by the system under any foreseeable circumstances. If the system is unsure of the state of these controls then they will be set to provide protection.

9) If a command is not valid it will be rejected and it will be obvious that the command has been rejected as invalid.

10) All controls for a particular area of control will be consistent within the area of control.

11) Start-up, shutdown, or failure of the control system should not change the state of controls at the interface to the Signalling safety system in any way that would cause points to move, routes to be set, and blocks removed. It is preferable that signals are not cancelled.

12) Controls for the operation of equipment will not be continuously asserted on the interface to the signalling safety system unless it is a requirement of the signalling safety system or the control's purpose is to keep the signalling safety system from putting the signals to stop.

13) Controls that have been stored from the Signalling's Operator Interface (such as for route storage) should not be sent to the interface to the Signalling Safety system until the function has been continuously available for at least 3 seconds.

14) Controls will provide feedback to the Signaller so that the Signaller is aware that their request is being processed.

15) Storage of controls may only be provided for routes.

16) Storage is not normally available for shunt routes. Shunt routes may have storage if the shunt route is the only route to enter a commonly used facility or the shunt route is overset by a main route.

17) Storage of controls for routes where provided will be implemented outside of the signalling safety system.

18) There shall be less than one incorrect control in 50,000 hours of operation for each Operator Interface, due to causes other than faults in the Signalling safety system, incorrect use of the system, or failures that generate alarms or warnings.

19) A mode of operation is required to test the signalling safety system that must not prevent the issuing of any requested controls to the signalling safety system.

6.2. Method of Control

The standard method of control for signalling systems is to be the Entrance Exit format. This requires the Signaller to identify the Commence (Entrance) signal and then identify the Finish (Exit) signal so that the particular route from the Commence signal is identified and a request sent to the interlocking for the particular route to be set.

The method used to request routes is referred to in this document as Entrance Exit.

The points that define the route are referred to in this document as commence signal and finish signal; these are analogous to the terms entrance signal and exit signal, which are not used in this document.

The action of identifying an object for a command may be implemented using different methods depending on the system. For example on a panel a signal is identified as a commencement point by pressing its associated button, or on a VDU system the signal may be identified by moving the cursor so that it is on top the signal and pressing the left mouse button.

6.3. Control Integrity

There shall be no more than one incorrect control in 50,000 hours of operation for each Operator Interface, due to causes other than faults in the Signalling safety system, incorrect use of the system, or failures that generate alarms or warnings.

6.4. Route Setting

6.4.1. Entrance - Exit Control System

All controlled signals shall be identifiable as commence signals.

A route is set, and the signal leading over it cleared, by the Signaller identifying the commence signal and then identifying the finish signal in sequence. The finish signal is generally at the next signal applying to the direction of traffic being dealt with.

If the route leads out of the Signallers area of control then the finish signal may be an automatic signal or a controlled signal that is only valid as a finish signal for the Signaller.

If the route leads into a siding, or terminal road then the finish signal may be a notice board or a dummy non indicated signal that is only valid as a finish signal for the Signaller.

Once the commence and finish signal have been identified and registered by the system the route request is sent to the signalling safety system, which will respond with indications from the signalling safety system as a result of the request.

If a conflicting route is set or points within the route are locked in the incorrect position for the route being called, then the interlocking will reject the route and it will be necessary for the Signaller to again identify the route when the conflicts no longer exist.

To clear the next route on the line, the last signal identified which represented the finish of the previous route is again identified and this time it acts as an Commence for the next route. The next signal along the track in the same direction is then identified to set the route.

6.4.2. Identification of Signals **Accuracy/precision required**

The precision required to identify signals shall be not be less than 3 mm.

Identifiable objects shall not be placed at a density where a movement of the pointing device of less than 2 mm can change that object being identified.

Ability to identify signals without selecting signals

For VDU systems a signals may be identified by pointing to the signal or track before (approaching) the signal, with a pointing device such as a mouse and pressing the left mouse button.

For panels with push button controls, signals shall be identified by pressing the button associated with that signal.

Where a commence signal leads to a finish signal that is not able to be controlled by the Signaller then the finish signal shall be identifiable as a finish signal only.

Where a commence signal does not lead to a finish signal then a finish point that is not a signal shall be identifiable.

Control Feedback

The system shall provide feedback to the Signaller that a particular signal has been identified as a commencement signal.

If the controls are not positioned on the display with the object they control but are located separately and a commence signal has been identified but not the finish then the commence signal control shall flash and a display element labelled 'Machine in Use' shall flash green on the display.

Upon identification of the finish signal, the Commence signal shall cease to indicate that it has been identified as the Commence signal.

Identification of a main or shunt signal

Where a subsidiary calling-on or shunt signal is provided on the post of a running signal there shall be separate indication and where applicable control point, for both types of route.

Selecting a track before (approaching) the signal shall select the main route, rather than the shunt route.

Only the main signal shall be identifiable as a finish.

To identify a main route the main signal repeater or control point is identified.

To identify a shunt or subsidiary route the shunt/subsidiary signal repeater or control point is identified.

Preset shunts and overset shunts.

The actions of setting and cancelling main and overset shunt signals shall affect each other as defined in the control tables.

To clear the preset and overset shunt signals for movements originating at the shunt signal the shunt signal is identified as the commence signal and a finish point is selected in the normal manner.

6.4.3. Master Shunt override

If the Master shunt over-ride facility is provided for an interlocking then a "Master Shunt" control point is provided near the interlocking name. The master shunt control point is Identified after identifying the commence shunt and before identifying the finish signal.

The Master Shunt control point will indicate that it has become active when it is identified and will return to its normal state when the finish signal has been identified.

6.5. Cancelling Signals

Cancelling a signal issues the control to the interlocking to put the signal to stop.

If it is required to cancel the route, prior to the passage of a train or prior to the establishment of the route, the commence signal for the route is cancelled.

Signals shall be cancelled by one of the following processes:

- pointing to the signal and issuing a cancel command
- entering cancel mode and identifying the signal.
- pulling the signal button on a panel.

If a signal is in automatic re-clear mode or any other mode when it is cancelled then the signal shall be removed from the particular mode and put to stop.

6.6. Automatic Re-clear

An automatic re-clear function may be provided to enable a group of controlled signals (one or more) to act as automatic signals. Once selected to operate in the automatic mode the signals will continue to re-clear subject to the conditions of the interlocking/track occupancy following the passage of each and every train to pass the signal/signals. Removal of automatic re-clear mode returns all the applicable signals back to a fully controlled mode of operation.

Automatic re-clear is normally provided for the through lines of each interlocking where there are multiple lines through the interlocking.

Signals shall not be able to be placed into automatic re-clear mode unless all the applicable signal routes have been previously set in the normal manner.

Removing a group of signals from automatic re-clear mode shall not affect the routes set from the signals.

A group of signals are placed into automatic re-clear mode, after they have been set, by applying the Automatic Re-clear command to one of the signals of the group of signals or by identifying the particular automatic re-clear control point on the display or control panel.

Signals or groups of signals are removed from automatic re-clear mode by applying the Remove Automatic Re-clear command to one of the signals of the group of signals or by identifying the particular automatic re-clear control point on the display or control panel for cancel. Cancelling any of the signals in the automatic group shall only remove that signal in the auto group from automatic re-clearing mode.

6.7. Emergency Replacement

Certain automatic signals can be forced to remain at stop. This facility is called emergency replacement. Signals with the emergency replacement facility are normally at the end of a Station platform on a line that is proceeding into a tunnel or over a bridge/viaduct.

The method of placing a signal into emergency replacement shall be the same as that for cancelling a controlled signal.

Emergency replacement is removed by identifying a signal as the commence and the next signal as finish, as per setting a route from a controlled signal.

6.8. Points

Controls shall be provided to operate points without the necessity of setting a route. This type of operation is required for maintenance purposes, and under failure conditions or where it is required to hold a set of points in a particular position during route setting.

Each set of points has three controls, Normal, Reverse, and Centre. The Normal control requests the interlocking to move the points normal and lock the points in the normal position. The Reverse control requests the interlocking to move the points reverse and lock the points in the reverse position. The Centre control allows the interlocking to move the points based on the interlocking conditions. Points controls are sometimes referred to as points calls because they only request the signalling safety system to move the points.

When route setting is being used the points control is placed in the centre position. If individual operation of the points is required the control is placed in the normal state to set the points normal and the reverse state to set the points reverse.

The points operation is such that before the position of the points can be changed from normal to reverse the point call must be set to the centre call until the points become free, then the points call can be set to the desired call. This pause in the centre call is necessary to allow the point locking to be removed. The centre call, intermediate step is also used to prevent the storage of points controls in the interlocking moving the points.

There are 3 different methods of controlling points that are acceptable. These are:

1) Select the common leg and the required leg to move the points to the required lie. Select the points number to turn on or off the points centre control.

2) Select the points command and required leg to move the points. Select the points number to turn on or off the points centre control.

3) Select the normal, centre, or reverse control point for the set of

points. The state of the points controls shall be indicated on the display.

The method of indicating the state of the points controls shall not mask or change the field indications of the points as to the current position of the points.

The indications for the points control shall be either an N, R, or C adjacent to the points or by changing the display normal, reverse, and centre control points for the points.

There shall be additional controls for blocking of points, refer to section *6.10 Blocking* for details of these controls.

6.9. Releases

6.9.1. Ground Frame

Ground frame releases will be provided to allow an electrical release to be given to the line side releasing switches, enabling the Annett key to be removed once the release has been accepted by personnel in the field.

The release shall be given and taken back in a similar manner to controlling a set of points, the release shall be given by identifying the reverse leg of the switch that the ground frame operates. The release shall be taken back, once the ground frame has been returned to its normal state and the Annett key returned, by identifying the normal leg of the switch.

When the release has a normal call the releasing switch number shall have a ‘N’ suffix.

When the release has a reverse call the releasing switch number shall have a ‘R’

suffix.

6.9.2. Maintenance

Maintenance releases are provided for double line bi-directional sections. The maintenance release when given disables bi-directional operation.

Maintenance releases are displayed as control points with suitable labels which when identified either give a release or normalise the release as appropriate.

6.10. Blocking

The blocking facilities are used in conjunction with the ARTC relevant Safeworking Units (SWU) and provide protection to people and or equipment.

The application and removal of some blocks is associated with completing particular Safeworking forms.

Both the application of blocks and the removal of blocks shall be at least a two step processes.

Non vital blocking shall be available to prevent the clearing of routes, moving points or allowing trains into sections. Non vital blocks can be identified for placement and removal by the Signaller, and act as reminders to the Signaller of special conditions that exist such as maintenance activity or unsafe conditions that the interlocking is unable to detect.

Vital blocking is provided as part of some signalling safety systems.

If the Signaller attempts to perform a function that is blocked then the system shall notify the Signaller that the function is not available and give the reason.

All blocks shall be stored in non-volatile memory so that in the event of a system restart, the blocks shall remain in effect.

As a minimum the system shall record when each block is placed and by who, and when removed, and by who. This record shall be kept as historical information.

The Signaller shall be able to bring up a list of all of the blocks currently applied to their area of control.

6.10.1. Safeworking forms

The Safeworking procedures require that specific safeworking forms are filled out when blocks are used.

It is desirable for the Signalling Operator Interface to provide the forms and manage the record keeping of the forms in a database. However the process must not be more onerous that the existing paper forms. This process shall include:

- being able to set routes etc while filling out the form
- being able to view old forms
- changing to a new form format.

Any forms that the procedures require shall be duplicated by the control system. The entering of details on these forms shall be automated by the control system.

A unique sequential number shall be given to the form for each particular block applied.

The Control System shall record on the Safeworking forms the date and time and the login name of the Signaller that is applying an action that results in changes to the blocking arrangements, or when details are added to the forms.

When a Signaller applies a block the affect of the block shall apply immediately. The control system shall then require the Signaller to enter the details to appear on the Safeworking form.

A Signaller shall be able to, while the block has been placed, add to the form details such as extensions of time, or change of staff information.

When a Signaller removes a block, the block shall remain in affect until the Signaller has entered the required information for the Safeworking form.

Details entered on the Safeworking form shall not be able to be changed once the Signaller has completed the removal of the block.

Safeworking forms shall be kept as historical information.

6.10.2. Vital Blocking

Vital Blocking is implemented in the signalling safety system. The control system allows the Signaller to apply these types of blocks and indicates to the Signaller the state of these blocks.

Vital Blocks normally apply to a section of single line and are displayed by the name of the block appearing along side the track where the block is applied. Vital blocks are applied by the Signaller identifying the name of the block.

6.10.3. Non Vital

Non Vital blocking is implemented by the control system and requires an independent validation review on its integrity.

Non Vital blocking shall be able to be applied to each signalling control available on the Signalling Operator Interface.

Signal Blocks

Signal blocks shall be applied by selecting the blocking mode and then identifying the signal that the block is to apply to. This shall have the effect of not allowing routes to be commenced from the blocked signal. Routes shall not be able to be stored from or through a blocked signal. Routes shall be able to finish at the Signal while it is blocked.

A signal block shall not be able to be applied while the signal is clear or has been requested to clear or there is a route in storage that would be applied over the block.

If a signal is blocked then this shall be indicated by colouring the signal repeater blue. If the signal clears while blocked then an alarm shall be generated.

Track Blocks

Track blocks shall be applied by selecting the block mode and then identifying the track circuit that the block is to apply to. This shall have the effect of not allowing routes to be called where the clearing of the route would allow a train to proceed over the blocked track circuit. Routes over the affected track shall not be able to be stored.

A track block shall not be able to be applied while a route has been set over the track circuit being blocked or there is a route in storage that would be set over the blocked track circuit.

Track blocks shall apply to all of the track that is indicated by the same track circuit i.e. a track block applied to a points track shall block routes over both lies of the points.

Track blocks shall be indicated to the Signaller by colouring for the track circuit repeater blue.

Track blocks shall not mask track occupation, tracks shall be coloured purple when both blocked and occupied.

Points/Ground Frame Blocks

Points shall be able to be blocked in a particular lie. Blocking a set of points shall prevent the control system from calling the points to the other lie, or request any routes that would call the points to the other lie. Points Blocks shall be applied after calling the points to the lie that they are to be blocked in, selecting the blocking mode and then identifying the opposite lie of the points.

The points controls must be in either Normal or Reverse before a points block is accepted. Points shall not be able to be blocked with a Centre points call.

Points blocks shall be identified by colouring the tracks of the other lie of the points blue. For double-ended sets of points, blocking one end of the points blocks both ends of the points, and the block is displayed on both ends of the points.

Ground Frames are blocked in the same manner as points.

Removal of blocks

Blocks shall be removed by selecting the remove mode and then identifying the piece that is indicated blocked; or displaying the list of blocks and identifying a block in the list for removal. Either method shall require three separate steps to remove the block.

6.11. Authority to Control an Interlocking

Typically an interlocking may be controlled from an Emergency Local Control Panel (ELCP) or a Remote Control Panel (RCP). Either of these Control Panels may conform to this Signalling Operator Interface. The Control Panel that is controlling the interlocking has all of the voice communications to the controlled area.

If the Signallers interface is for an ELCP then the Signalling Operator Interface shall provide for local, remote, and closing controls.

If more than one Operator Interface at either site could control the interlocking then facilities to manage control of interlockings between Operator Interfaces is required. These facilities must include:

- Ensuring that normally only one Operator Interface is controlling a particular interlocking
- Requesting, Granting, and Releasing of Authority to Control an interlocking.
- Taking Authority to Control an interlocking in the event that the controlling Operator Interface has failed.
- Temporary shared Authority to Control an interlocking to provide for maintenance work.

6.11.1. Emergency Local Control Panel control switch.

The ELCP is provided with a control key switch which has a local control position, a remote control position, and optionally a closing position if appropriate.

If the control switch is in the local control position then the ELCP has full control of the interlocking and the remote control panel is prevented from controlling the interlocking. In the local control switch position the voice communications for the controlled area are directed to the ELCP.

If the control switch is in the remote control position then the remote control panel has full control of the interlocking and the ELCP is prevented from controlling the interlocking. In the remote control switch position the voice communications for the controlled area are directed to the remote control panel.

If the control switch is in the closing position then the remote control panel is prevented from controlling the interlocking and the ELCP is prevented from controlling the interlocking. In the closing control switch position the voice communications for the controlled area are directed to the nearest attended control panel.

6.11.2. Test mode

A test mode facility shall be provided to allow direct control of the signalling safety system. This is only required on the ELCP if necessary to allow the signalling safety system to be tested.

Test mode shall allow all controls to be passed to the signalling safety system without any integrity or availability checking so the signalling safety system can be tested.

If the Signalling Operator Interface is in Test mode then it shall display "TEST MODE" as a warning as described in section *5.10.3 test mode*

Entry to test mode shall be protected against unauthorised use. The protection mechanism shall be suitable to prevent a person who observed entry to test mode from gaining test mode authority.

6.12. Acknowledgements

Alarm and warning acknowledgements shall be provided as required.

6.13. Maintenance (Staff) Call

Where field locations are fitted with audible maintenance call devices then the Signaller shall have the facility to control these devices.

6.14. Staff Instrument

Where the control system interfaces to Staff Instruments that are remote from the Signaller then the Signaller shall have the facility to enable and disable the release of staffs from the near end, and distant end Instruments. The normal state of the staff Instrument controls shall be to prevent the release of staffs from either end. An additional control shall be provided where required to determine the state of whether there is a staff in the section.

6.15. Notations

The Signaller shall have a facility for placing text notes on the display, the text shall be able to be placed anywhere on the geographical display so as to be able to locate the text where applicable.

Notations have a title and detail text. The title is normally all that appears on the display.

By identifying the notation title the system displays a text window which displays the existing detail text, and in which the Signaller may enter more text.

The Signaller shall have facilities to create, move, edit, and delete notations. The notations shall be stored in non-volatile memory on the system so that in the event of a system restart the notations will be not be lost

6.16. Reset equipment

Some equipment used as part of the signalling system may need to be reset under certain circumstances. The Signalling Operator Interface shall provide the means for these resets.

The resetting of some devices must only be performed in conjunction with a Safeworking procedure. Any reset as part of a Safeworking procedure shall be at least a 2-step process.

Resets may be provided for axle counters, and track sequence warnings.

6.17. Multiple route setting

Where the majority of signals for the commonly used train paths can not be put into automatic re-clearing mode then multiple routes in sequence shall be able to be set in one request. This shall be achieved by identifying the commence signal as the start point for the multiple routes, then finish point for the last route. Where more than one path exists between the commence and finish signals, the control system shall select the optimum path (these optimum paths may be predefined but will follow the main lines as far as possible). The Signaller may specify the path to take by identifying intermediate points.

7. Signaller aids

Signaller aids are additional to the normal functionality of the Signalling Operator Interface and will be nominated for inclusion by the purchaser.

7.1. Security

The Signalling Operator Interface shall provide security to prevent unauthorised access or use of the system.

It is desirable to maintain a record of the Signaller in control of the system at any time. The record shall be integrated into any other logging facility provided with the system. Normally they shall be provided by log on, and log off facilities.

When the system is logged off it shall still provide view only for the display. Each security

procedure shall take less than 30 seconds each.

7.2. Replay of events on the display

The system shall be able to replay events from the event log onto a geographical display without disruption to train operations.

7.3. Alarms

All alarms are to be stored in an alarm log. When the fault condition clears, the clearing of the fault shall also be logged. Events are to be date and time stamped and appear in the order that they occurred. Alarms events shall be stored as historical information.

The Signaller shall have the facility to view this log.

A separate list of outstanding alarms shall be provided.

7.4. Train identities

The Signaller shall have the facility to allocate a description to a train. The description shall consist of up to at least 6 characters that can contain capital letters, the digits 0 – 9 and the special characters '*' '-'.

The Signaller shall have the facility of applying or changing the description to a train moving through their area of control.

Train descriptions shall track the movement of the train based on the track circuit occupancy, points detection, and routes set.

Train descriptions shall be displayed as close as reasonable to the front of the leading track circuit occupancy of the train and avoid overwriting other information on the display.

Trains leaving the system at a normal exit point of the system shall have the train description automatically deleted from the system in Country areas and leave the description at the exit point and overwrite previously exited train description in metropolitan areas.

A hold facility shall be provided for shunting manoeuvres, especially where the sidings or loops are not track circuited. When held the description will not move until it is released.

In country areas train descriptions shall be able to be manually queued at entry points to the system.

In metropolitan areas train descriptions shall be queued at the entry points from the timetable or manual entry.

7.5. Train Reporting

Train reporting is the recording of the arrival and departure of trains at nominated locations within the Signallers Area of Control. It will also include locations adjacent to the Signallers Area of Control if appropriate.

The train report will identify the train, the date and time to the minute, the location, the line, and arrival or departure.

Report screen layouts shall be set to maximise the number of trains that are concurrently displayed while meeting the viewing distance requirements.

Report screens shall use the colour yellow for DOWN direction and blue for UP direction.

The nominated reporting points will normally include: Platforms, major system entry points, major system exit points, significant junctions, and crossing loops.

Detection of arrival and departure of trains at locations shall be based on a sequence of track occupancies. If an arrival or departure sequence occurs then a report shall be made irrespective of the train having a description or not.

Train reporting information shall be automatically archived by the system and be able to be retrieved, searched, viewed, and selectively printed by the Signaller. This information shall be password protected and be protected against modification or erasure.

A set of reports of the recorded train reporting information shall be available to the Signaller for viewing, searching, and printing. These will include:

- All information for a train on a particular day.
- All trains with an initial time between two nominated times on a particular day.

If a Train Controller has a display from the control system then they shall have a train reporting display configured to their area of control with an overlap of one reporting point in the approaching direction.

7.6. Timetable facilities

The control system shall be able to use information from a train timetable. The timetable shall be able to be generated at a location remote from the control centre and downloaded on a day previous to its application. Changes shall be able to be made to the timetable in real time while trains are running to it. Where the control system has a dual redundant standby system then the standby system shall remain up to date with changes that are made.

Report screens shall use the colour yellow for DOWN direction and blue for UP direction.

7.6.1. Timetable based identification of trains

The control system shall be able to allocate train descriptions according to the daily timetable. Prior to a train entering the controlled area, the control system shall allocate the train the next description according to the timetable, and then request the Signaller to acknowledge this allocation, or provide an alternative description.

7.6.2. Timetable based changing identification of trains

Trains shall be able to be timetabled to change their description at nominated locations, as specified in the timetable. The control system shall automatically change these train descriptions when they arrive at the location defined as the change point.

7.6.3. Timetable based route setting

The control system shall request routes for trains according to their paths as defined in the timetable. The requests shall be based on the positions of trains, their positions relative to the order specified in the timetable and route/aspect availability. The Signaller shall have the

facility to override the requests issued by the control system and disable the timetable route setting functionality for particular signals or routes.

Timetable based route setting shall only set routes for trains in accordance with their timetabled order.

Timetable based route setting shall generate an alarm if the route can not be set for a train it is to set a route for.

Timetable based route setting shall be designed to set routes so that trains are not unnecessarily delayed.

7.6.4. Comparison of actual train service against timetabled train service

A list of reporting points shall be defined and agreed for the timetable comparison. These will normally be as per Train Reporting. When trains arrive (or depart when specified) the reporting points the actual time shall be recorded with a comparison to the timetabled time for the reporting point.

The control system shall provide a display of these on timetable based reports. The display shall contain the time of arrival (or departure), the train description and the recording point for all trains; and the number of minutes late or early for timetabled trains. The format of the display shall require approval from ARTC's General Manager ISP or nominated Signalling representative.

The control system shall also provide the facilities generate reports of the on time running of all timetabled trains.

7.6.5. View and search timetable

Facilities shall be provided to view, search, and print (all or part) the current timetable.

7.7. Control availability checking

Controls shall not be sent to the interface to the Signalling Safety system when the function is not available except when required to test the operation of the Signalling Safety system.

7.8. Route storage

The facility shall be provided for storing (in the control system) routes that are not available due to the interlocking conditions.

A stored route shall be indicated by placing a small white dot within or adjacent to the signal repeater for every signal that would be called by the stored route.

The control system shall maintain a list of the stored routes for each Signaller from which the Signaller shall be able to view, re-order and delete stored routes.

An individual route will be released from storage when:

there is no previously stored route that conflicts (including the overlaps) with the route,

- the route is available to set in accordance with the Signalling Control tables,
- and the route does not require the next route as part of a multiple stored route to be set prior to, or in conjunction to stored route. In this case the next route must also be available for release before the route is released.

The Signaller shall be able to add-on to a previously stored route without preventing the release of previously stored routes.

Stored routes shall handle cases where particular routes need to be released in reverse sequence.

Stored routes shall handle partial release of stored routes commencing and proceeding from the initial commence signal.

The release of stored routes shall be predictable to the Signaller based on the order that they stored the routes.

Shunt routes shall not be able to be stored, unless it is an overset/preset shunt or the only route for a regularly used train movement

7.9. Wordprocessing

The Signaller shall have access to a word processing facility, and be able to create, edit, delete, save and print document files.

7.10. Train Register book

The control system shall provide a computerised train register book.

Facilities shall be provided to make entries in, display, search, print, and archive the computerised train register book.

The train register book shall be stored as historical information.

The train register book would integrate the train reporting, timetable comparison recording, blocking forms, alarm logs, etc with the facilities to make notes on significant events.

7.11. Email

Facilities shall be provided to send and receive Email concerning train running to other personnel directly associated with train running.

7.12. Extended Approaches

Extended approach indications are desirable, and their features include:

- the Expected Time of Arrival of trains during the next 10 minutes or
- where approaching trains are, for 5 kilometres in the rear of the first signal affected by the Signaller's controlled signals.

8. System requirements

All VDU based displays used as part of the system shall comply with the Graphical User Interface of the operating system used on the computer that drives the VDU.

The accepted operating systems are:

- Microsoft Windows NT range of operating system
- O/S 2
- The UNIX range of operating systems under the X Windows standard. Positioning of

pop up windows etc shall not obscure the display of signalling status. Positioning of pull down

menus etc shall not obscure the display of signalling status.

The following issues are dealt with in ARTC Specification SPS 01 Standard Requirements for Signalling Electronic Systems. Comments are added for additional requirements or clarification.

- Start-up and shutdown of the complete system, including the operating system shall be able to be performed by the Signaller.
- Reliability
- Maintainability

The Signaller shall be able to replace the mouse or keyboard.

- Configurability.

When a user logs in, the system shall be configured so that the display shows the area that that user normally has controls over, or the area normally viewed by the user.

The colours used for the display shall be configurable.

All the tools, manuals and source data shall be provided to enable the system to be altered to reflect changes that occur to the railway infrastructure.

- Security issues.

Where the system is not located in a secure area, the system shall be fitted with security devices to prevent unauthorised access, such as floppy drive locks. The Operator shall also be prevented from accessing the operating system or any of its functions that they do not require, by shutting down the application, or by any other means.

- Responsiveness.

9. Operation under failure conditions

The expected failure modes of the Signalling Operator Interface shall be defined and for each expected failure mode there shall be a defined work method to minimise disruption to train running.

The controlled area shall have a defined alternate method of working which complies with Safeworking procedures for train working in the event the normal method is not available for a prolonged period.

10. Mimic Panel Implementation Requirements

The following requirements provide specific implementation details when a physical mimic panel is used. The resultant Signalling Operator Interface must still conform to the previously stated requirements unless specifically altered in this section.

All console and diagram indications shall be of the LED technology.

10.1. Control and Indication Panel Construction

There are two main types of Signalling control panel configuration. The combined type has the push buttons, point key switches and other Signalling controls mounted on the same panel as the indications. All point and signal numbering, track names, track circuit names, 'to' and 'from' inscriptions, station names, push button arrows, notice boards and alarm inscriptions are shown on this panel as well as all illuminated indications.

The other type features a separate control desk and indication diagram. With this configuration the control desk is fitted with the signal push buttons and point and release levers. Control desk inscriptions are provided for signal and point names, track names, stations, push button arrows, notice boards, 'to' and 'from' inscriptions and inscriptions for any other operating key switch. The associated indication diagram shows all individual track circuitry arrangements (combined where appropriate), signal names, point names, station names, alarm lights and inscriptions, track names, track circuit names, machine lights, time release lights and any other miscellaneous indications.

Lights directly associated with the control function, i.e. point lever lights, push button lights, closing level lights etc., are always mounted within or adjacent to the function. Space is to be left where point numbers are not used.

The control console and diagram are to be so constructed that the Signaller can operate all controls comfortably within arms-reach. The indicator diagram is to be clearly visible from the Signaller and controllers seated position, which may be up to 2 metres from the diagram. Signal and point numbers, track names and station names are to be clearly visible but track circuit names need not be as prominent.

Artwork for the diagram and console or combined diagram is to be supplied by the Supplier. The ARTC’s GM ISP or nominated Signalling representative may, however, provide drawings showing a conceptual layout for the Suppliers guidance. Any significant deviation to the concept should be brought to the ARTC’s GM ISP or nominated Signalling representative’s attention as soon as they are evident for resolution.

The track layout is to be geographically consistent with the mounted orientation of the panel.

The Signaller's telephone and radio facilities shall be incorporated in the console.

The cabinet shall be constructed from steel, aluminium, or timber in such a manner as to ensure adequate strength and rigidity when fixed in position. All steelwork shall be effectively treated and painted as in accordance with the relevant ARTC Specification. Adequate provision shall be made for cable entry into the console.

The console shall be construction in sections or in such a manner as to allow entry through doorways or apertures in the building.

Adequate ventilation for heat generating components is to be provided and arranged in such a way as to minimise entry of dust.

The panel shall be positioned so that it is fully visible to the Signaller while he is performing other duties in the office away from the panel, when dedicated Signaller are not employed.

10.2. Panel Requirements

Maintenance diagrams shall be manufactured identical to and provide the same level of indications as an Emergency Local Control Panel with the exception of track route lights which shall be limited to a single route indication in front of the signal position in the track layout.

All visible surfaces of the panels shall be non-reflective and have a durable finish that will withstand normal wear. For small panels suitable materials would be Formica or its equivalent, "metal photo" anodised aluminium. Larger panels must be of a mosaic tile system.

The inscribed diagram and control panel area is to be divided into individual panels of sizes that will permit economical replacement if alterations to inscriptions or control equipment becomes necessary.

All engraving must be of a sufficient height and density to allow Signaller with a minimum of 6/24 vision in each eye to read all the engraving from a distance of 2 metres without any difficulty.

10.2.1. Diagram

Background	Manilla	AS 2700 Y45
Main Lines	Bright Blue	AS 2700 B23(eg. Illawarra, EH, Bankstown)
Goods Lines	Chocolate	AS 2700 X64
Suburban or Local Lines	Moss Green	AS 2700 G14
Sidings (including parcels dock)	Orange	AS 2700 X15
Sidings (not track circuited)	Orange open lines	AS 2700 X15
Ground Frames	Rich Blue	AS 2700 B11
Platforms	Deep Stone	AS 2700 Y55

Signal Box	Signal Red	AS 2700 R13
Printing & Symbols Ironbark		AS 2700 X63

10.2.2. Control Panel

Background	Manilla	AS 2700 Y45
Tracks	as for diagram	
Printing	as for diagram	

10.3. Push Buttons, LED's and Key Switches

All wiring to push buttons, LED's and key switches shall be plug and socket connected to allow rapid replacement of the units. Suitable arrangements shall be made to ensure that only the correct connections are made when changing push buttons and levers. All push buttons are to be individually wired.

10.4. Signal Buttons on Panel

Buttons shall be provided for all controlled signals operated from the panel. A button may act either as a commence button to a route or as a finish button from a route, or as both.

Arrowheads on the buttons shall indicate the direction of travel, the commence function being shown by a black arrowhead and the finish function by a clear arrowhead. Where a button acts both as commence and finish, separate arrowheads shall be displayed. Finish only buttons shall be provided where required.

10.5. Emergency Replacement

On panels, Emergency Replacement shall be implemented using buttons. The action of pulling the button replaces the automatic signal to stop, and extinguishes the ‘A’ light. The signal will continue to remain at stop until the button is pressed. The signal then returns to a fully automatic signal.

10.6. Button Collar/Switch Colour Codes

10.6.1. Buttons

Different colours shall indicate the various functions of the buttons as follows:

Yellow Buttons: commence or finish for running movements in the Down direction .

Blue Buttons: commence or finish for running movements in the Up direction.

Red Buttons: commence for shunting and/or calling on and/or close up movements whether or not the shunting signal and/or calling on signal is a subsidiary to a running signal or provided separately.

White Buttons: All functions not covered by the yellow, blue, or red buttons.

10.6.2. Switches

Different colours and types shall indicate the various functions of the switches as follows:

Black Switches - Points. Blue Switches - Releases. Section blocks - Key switch Reset switches

- Key switch

10.6.3. Signal repeaters

Signal repeaters shall be provided for all controlled signals and shall show red when the signal is at stop (flashing red when the signal is at 'stop' but still subject to approach locking conditions). 'Green' when a 'proceed' indication is displayed in the signal. Flashing 'Green' repeater may be displayed for particular signals and the requirements of the flashing green will be as defined in the Specified Control Tables. Where applicable the 'stop' indication is to include the trainstop in the engaging position. The 'proceed' indication shall include the trainstop 'clear' if it is a main line 'proceed' indication and the trainstop is lowered by the first indication.

In the case where the trainstop is cleared by an 'approach time limit', the trainstop 'clear' shall be omitted. In the case of subsidiary signals, which lower the train stop, the conditions regarding the repeater will be shown in the remarks column of the control tables.

All signals on the same post shall be combined into a single repeater.

The 'stop' and 'proceed' indications for the same signal shall preferably be shown through a common aperture in the centre of the symbol representing the signal on the track diagram.

Automatic signals, except for those with emergency replacement, shall not be indicated, unless otherwise specified in the Particular Specification or the control tables.

Refer to the section on One Control Switch interlockings for specific one control switch shunt signal indications.

10.6.4. Points on Panels

For panels a yellow 'normal' detection indication to the left of the point key and yellow 'reverse' detection indication to the right of the point key shall be provided for all controlled points. A red light shall be positioned below the point key, which shall flash if the points and interlocking equipment are not in correspondence or during the transit time of the points.

A green light, known as the 'points free' light shall be provided over the centre of the rotary switch and will indicate that the points are free to be driven under route setting operation or are free to be operated by the individual points switch.

The rotary switches on panels for releasing ground frames etc. shall be fitted with two yellow indications, one to the left (normal) and one to the right (release) of the rotary switch. The steady indication of the left-hand sidelight shall indicate that the ground frame release and the controlling functions are locked and detected normal. When the releasing switch in the field has been normalised but the rotary switch on the control panel remains in the release position. A flashing indication is provided in the normal position. The right hand sidelight shall indicate that the release for the ground frame has been given by the Signaller.

10.7. Push Button Indications

When a button is operated as a commence button a flashing white light is exhibited in the button. When a finish button is pressed, and the button operation has registered, the commence button light becomes steady, provided the finish button pushed completes a legitimate signalling route from the commence button.

If the button operation is not successful or a non-legitimate finish button is selected, the flashing light in the commence button is extinguished.

When the route is cancelled, the entrance button for that route is pulled and if the cancelling action is complete the white button light is extinguished. If when the button is pulled the route cannot be cancelled due to approach locking, the button light will remain illuminated and when the approach locking is subsequently freed, the normalising action will become effective and the button light will be extinguished.

When a signal is working in automatic mode then the white light in the auto button will remain illuminated until such time as the auto mode is cancelled.

No illumination is required in emergency replacement buttons. A red signal repeater shall be provided when emergency replacement is enforced.

10.8. Track Circuits

Track circuits shall be indicated individually by a minimum of two red indications except on the single line block section, which shall have a minimum of three red indications between controlled signals of adjacent stations. Where intermediate signals are provided in the single line section, additional track indications shall be required to indicate signal clearance points.

Track occupancy indications over points shall be selected so as to indicate the actual route taken by the train. In the event that a track circuit fails or a train occupies a track circuit over which no route has been established, all the track occupancy lights pertaining to that track are to be illuminated.

10.9. Points Panel operation

On panels points keys shall be provided in separate groups on the control panel, the points keys shall operate as described in the following paragraphs.

The rotary switches for releasing ground frames etc. shall be fitted with two yellow indications, one to the left (normal) and one to the right (release) of the rotary switch. The steady indication of the left-hand sidelight shall indicate that the ground frame release and the controlling functions are locked and detected normal. When the releasing switch in the field has been normalized but the rotary switch on the control panel remains in the release position, a flashing indication is provided in the normal position. The right hand sidelight shall indicate that the release for the ground frame has been given by the operator.

10.10. Releasing switch on Panel

On panels the release shall be controlled by release keys which shall be located adjacent to the point keys. The panel release keys shall be of the rotary switch type and operate in two positions, left and right. For giving a release the panel release key is turned to the 'Right'. For locking the releasing switch, the panel release key, is turned to the 'Left' position, its normal state position.

In addition to the key indications a yellow light shall be positioned adjacent to the release symbol on the indicator diagram. When illuminated the light shall indicate that the release is normal and locked. The light will flash when the release is given and be extinguished when the release is taken.

10.11. Maintenance Call Light on Panel

When maintenance call facilities are provided a yellow light is to be positioned in the controlling button on the panel. The indication is to flash once selected until cancelled by the Signaller.

10.12. Panel Reminder Devices

On interlockings controlled by push buttons and switches, reminder devices shall be provided to inhibit routes or points being selected. Mechanical collars or covers, for fitting over push buttons and switches, that prevent buttons being pushed and switches being turned, facilitate this requirement. These devices are used in conjunction with the Safeworking procedures.

10.13. Section Blocks on Panels

On panels section blocks shall be implemented using key switches. The key switch shall have two positions, blocked and clear, the blocked position being achieved by turning the switch clockwise. The key shall be able to be removed in both the blocked and clear position. The key switch shall be labelled so as to identify the section block it applies to, as well as the blocked and clear positions.

On the diagram the block shall be indicated using two LED’s. These shall be positioned vertically above each other, with a label above identifying the section the indication is for. The topmost led shall be red and indicate that the block has taken effect. The lower LED shall be yellow and indicate that the block is not applied.

The words blocked and clear shall be written to the right of the appropriate LED’s.

The indication shall be located on the diagram above the section it applies to, or a location below or beside where more appropriate. The key switch shall be located below the section it applies to on the panel.

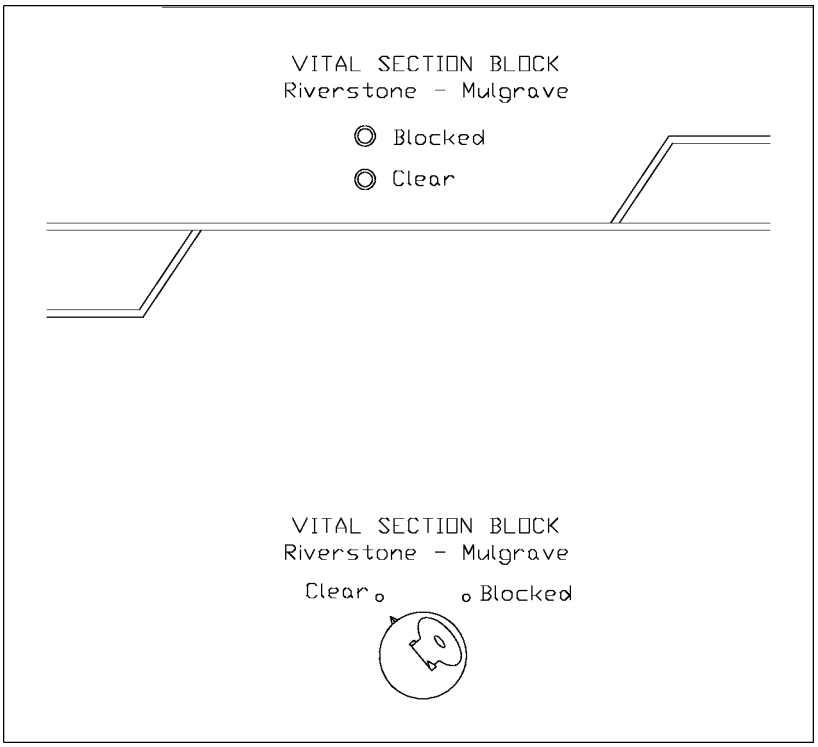


Figure 5 Panel section block key switch and indication

10.14. Entrance - Exit Route Indication

The illumination of the yellow route set lights on the track diagram shall give an indication of routes correctly set up or in the process of being set up with the points proved in or available to drive to their correct positions, between the commence and finish signals. Overlaps shall not be indicated.

Where points required for a route are not in the correct position when the route is set, two yellow route set lights in the track line over the points shall flash yellow until such time as the points have been driven and detected in the required position, they shall then become steady.

The yellow route lights shall remain illuminated ahead of a train travelling through a signal section. Route lights to the rear of the train travelling through a section shall return to yellow when the track circuits become clear unless a command, either manual or auto normalise, to normalise the signal controls has been issued. When such a command is issued, the yellow route lights will not continue to appear at the rear of the train as it travels through a section. The panel will return to its normal state, no route or track lights being displayed.

10.15. One Control Switch - Route Indication

Unless otherwise specified in the particular specification no separate route indications are provided on installations incorporating one control switch interlocking design philosophy. Point detection indications are provided in the form of yellow lights incorporated into the track diagram at sets of points. These lights indicate the lie of the points which effectively indicate the route selected. A minimum of one yellow light is to be provided to indicate the normal and reverse lie of each set of points. Other than during the transit of the points, from normal to reverse or visa versa when the lights flash, the lights remain illuminated even during occupation of the track.

10.16. One Control Switch Interlocking indications

10.16.1. Site Address

A yellow light is to be indicated on the mimic diagram adjacent to the Station name, it will flash to indicate the station address link is available when requested and indicate a steady yellow indication during the transmission of control information to the remote station.

10.16.2. Track Circuits

Track circuits shall be indicated individually by a minimum of two indications except on the single line block section which shall have a minimum of three indications between controlled signals of adjacent stations. Where intermediate signals are provided in the single line section, additional track indications shall be required to indicate signal clearance points.

10.16.3. Signals

Subsidiary shunt signals shall be provided with a separate yellow indicator on the main signal repeater to indicate that the shunt route has been selected. This arrangement applies to both the local and main controlling diagrams.

A flashing green indication is displayed in the signal repeater when the reverse route relay has energised but the signal is not displaying a green aspect due to other signalling constraints.