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SSI Applications Manual

SSI Data Preparation Permissive Controls

Endorsement and Authorisation

For endorsement, authorisation and issue record of this document, please refer to the SSI Applications Manual Contents, NR/L2/SIG/17002

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1 Introduction

Permissive controls are applied to minimise the risk of collision between two trains, the second having been signalled onto a running line which is already occupied by the first. The requirements for controlling such a risk are stated in Signalling Principle Standard [GK/RT0044](#) (ref.1) and [SSI8003-83](#) is based on these requirements.

2 Full Permissive Controls - Principles

The permissive controls in this document apply to all circumstances in which trains are admitted to an occupied line by the use of a position light signal. Such movements onto an occupied line include those out of sidings but not those within or into sidings. The extent of the line being occupied is that from the entry signal to the exit signal or buffer stop.

[GK/RT0044](#) permits two types of permissive working, that involving just passenger trains and that involving just freight trains, the controls for the former being more restrictive.

In this document, one or more trains already occupying the line are known as the "First Train(s)", and the train being signalled onto the occupied line is known as the "Second Train".

2.1 Non-permissive/Permissive Selection

The entry signal will either be a position light associated with a main aspect or a position light shunting signal.

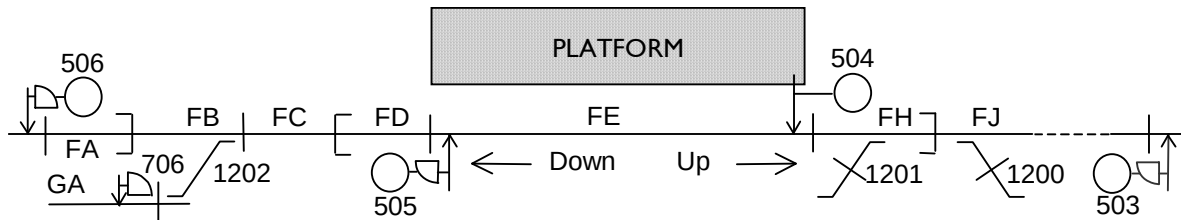
Where main/call-on selection is required, separate control devices normally have to be provided. The call-on may be selected by using either a separate yellow exit button (as specified in the now-withdrawn [GK/GN0525](#)), or a separate yellow entrance button. The use of a separate button means that, at time of route setting, the [NR/L2/SIG/11201](#) Module B7 (ref. 2) requirement to test the exit signal's berth track section has been interpreted as applying to call-on routes (these requiring this track section occupied), but not to main routes (these no longer requiring this track section clear). This also holds if ARS has set a main or call-on route, having itself checked that the class of trains involved are compatible.

A non-preferred alternative to provision of a separate button, permitted where already in use at existing signal boxes, is for the Signaller to use the same entry and exit buttons with the Interlocking determining from the state of the exit signal's berth track section(s) whether a main or call-on route is to be set. The above mentioned [NR/L2/SIG/11201](#) Module B7 (ref. 2) requirement does apply, thus for example the re-stroking of a main route will fail if the exit signal's berth track section has subsequently become occupied. Data examples of this main/call-on selection are shown in [SSI8003-63](#) Section 3.

For a position light shunting signal leading into a permissive section, whether the move is to be permissive or non-permissive will need to be decided at time of route setting. This is usually done by the Interlocking determining this from the state of the exit signal's berth track section(s).

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2.2 Route and Signal Aspect Controls



The pre-[GK/RT0044](#) controls required for permissive moves were:

- A The route up to the signal ahead of the First Train is set and locked (an overlap is not required).
- B No opposing routes called or set.
- C The line is clear from the entry signal to the nearest point where the end of the First Train may legitimately be positioned.
- D The First Train, if an opposing movement, has completed its last signalled movement.
- E The Second Train, if being signalled for a call-on route, has stopped or nearly stopped at the entry signal.
- F An AWS associated with the exit signal shall not be permitted to give any indication which conflicts with the requirement for the driver of the Second Train to stop short of the First Train.

[GK/RT0044](#) added additional controls, and extended Controls D & E above, in order to achieve or strengthen the following objectives:

- To maintain the First Train at a stand while the Second Train is making its movement, and
- To prevent reading through by the driver of the Second Train, and
- To confirm the speed of the Second Train is under control.

These additional controls are as follows:

- N1 The entry signal for the permissive move may clear only when the exit signal of the permissive move (i.e. that ahead of the First Train) is at danger.
- N2/N3 The entry signal for the permissive move may clear only when the First Train has completed its last signalled movement and is at a stand, i.e. as Control D but extended to same direction moves (Control N2) and made more onerous after opposite direction permissive moves (Control N3).
- N4 The entry signal for the permissive move may clear only when the Second Train has stopped or nearly stopped at this signal (i.e. as Control E but extended to include permissive shunt moves).
- X1 For permissive moves the exit signal may be cleared only when the Second Train has stopped or nearly stopped on completion of its movement.

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X2 The exit signal of the permissive move shall be replaced to danger as soon as practicable after the front of the First Train passes it.

The effect of these additional controls is now considered in more detail.

2.2.1 Permissive Entry Signal Controls

Control N1

This requires that the entry signal for the permissive move may clear only when the exit signal of the permissive move (i.e. that ahead of the First Train) is at danger. In this document this control is applied at route setting level, for the reasons that now follow.

For this control there is no explicit requirement to prevent a permissive route being set from an entry signal at the same time as a route from the exit signal ahead - the first to clear would presumably hold the aspect of the other. However, this is undesirable, as it may lead to race conditions, e.g. if the exit signal's aspect is approach controlled, especially in cross-boundary cases.

In addition, the entry signal shall not be allowed to clear after the exit signal is replaced to red by the First Train moving off, as the entry signal itself will then be replaced when the First Train clears the platform track section. This would also be in contravention of Control N2, which requires the First Train to be at a stand for the entry signal to clear. Therefore, setting a permissive route from an entry signal should prove that there is no route set from the exit signal, thus inherently proving the exit signal is at red.

An example of this, using the Figure above, is:

The setting of route 506(C), and of route 706 in permissive mode, requires no routes set from signal 504.

In order that the entry signal, having cleared, cannot then be replaced to red by then setting a route from the exit signal, setting a route from the exit signal will need to prove that there is no permissive route set up to the exit signal (see Section 2.2.2).

Control N2/N3

This requires that the entry signal for the permissive move may clear only when the First Train has completed its last signalled movement and is at a stand. This control will vary depending on whether the First Train movement was in the same direction (Control N2) or in the opposing direction (Control N3) - it has been applied at aspect level for the former and at route setting level for the latter.

Control N2 - Same Direction

Following a First Train movement in the same direction, the entry signal for a permissive move shall not be allowed to clear until the exit signal berth, i.e. platform track section, has been occupied for time and the track section prior to the platform, i.e. the approach track section, has been clear for time. The "for time" part of the latter test confirms that if a train prior to the First Train is already occupying the platform track section, the signal cannot clear as soon the First Train clears the approach track section.

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Examples of this are:

Signal 506 for route 506(C), and signal 706 for route 706 in permissive mode, require track sections up to FC inclusive clear, approach track section FD clear for "yy" seconds and platform track section FE occupied for "xx" seconds.

Note: "yy" is the time required to prove a train to a stand on the platform track section FE after the rear of the train has cleared approach track section FD; "xx" is the time required to prove a train to a stand on the platform track section FE from the point that the train enters this track section.

Control N3 - Opposite Direction

Following a First Train movement in the opposite direction, the setting of a permissive route from an entry signal requires, at a minimum, Controls B & D. If such First Train movements can also be permissive, then these controls alone are inadequate proof of the First Train at a stand as the condition track section FE occupied for "xx" seconds may have already been satisfied by a still present earlier train. An additional condition is required, i.e. the First Train permissive move is considered complete. The Control X1 part of Section 2.2.2 shows the conditions required for a permissive move up to signal 504 to be considered complete - the conditions required for this permissive move in the opposite direction up to signal 505 to be considered complete are derived in the same manner.

An example of this is:

The setting of route 506(C), and of route 706 in permissive mode, requires:

Opposing route locking up to signal 505 freed up to track section FH inclusive,
AND
(opposing route locking up to signal 505 freed on platform track section FE or FE occupied for "xx" seconds),
AND
opposing overlap locking beyond signal 505 freed,
AND
any permissive moves up to signal 505 proved complete.

The first condition will need to be modified where the rear of the First Train is permitted to hang out on track section FH.

Control N4

This requires that the entry signal for the permissive move may clear only when the Second Train has stopped or nearly stopped at this signal. This control is applied at aspect level.

The existing requirement for call-on aspects to be approach controlled has been extended to position light shunting signals used for permissive moves along or onto a passenger line. Whether approach control is applied to a particular position light shunting signal is determined by the control tables and will depend on such factors as to whether a train can make a signalled running move up to such a signal or the move from such a signal can only be a reversal.

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2.2.2 Exit Signal Controls

Control X1

This requires that the exit signal of the permissive move may be cleared only when the Second Train has stopped or nearly stopped on completion of its movement. Initially this control is applied at route setting level such that setting any route from the exit signal requires no permissive route set up to it. An example of this, using the Figure above, is:

The setting of any route from signal 504 requires route 506(C), and route 706 in permissive mode, not set.

Once the Second Train has entered the permissive route and the latter has been released, this control requiring the permissive move completed is applied at aspect level. (This can instead be applied at route setting level if the control tables require it. However, it is less efficient from the Signaller's point of view as the Signaller will have to wait to set a route from the exit signal until a permissive movement is considered complete, rather than being able to do this earlier with the exit signal then clearing automatically when the permissive movement is considered complete.)

With a move determined as permissive (see Section 2.1), such a move is considered complete when the train is either proved to a stand or it has reversed direction or the route has been cancelled without a train taking the route.

Illustrating this, using the Figure above, after a permissive movement up to signal 504, this move will be considered complete when:

Route locking is freed up to approach track section FD clear for "yy" seconds (i.e. the train has come to a stand on platform track section FE or the route has been cancelled without a train taking the route),

OR

approach track section FD is occupied for a period of "zz" seconds after the entry signals' routes have been released (i.e. the train has come to a stand on track sections FD & FE, thus hanging out beyond the platform),

OR

approach track section FD is occupied with opposite direction route locking applied on this track section (i.e. the train has arrived on platform track section FE, and has immediately reversed, taking a route set from signal 505).

Note: "yy" is the time required to prove a train to a stand on the platform track section FE after the rear of the train has cleared approach track section FD, "zz" is the greater of 120 seconds or the time required to prove a train to a stand on approach and platform track sections FD and FE.

The second condition is provided irrespective of whether trains normally "hang out" beyond the platform. The third condition is usually unnecessary, provided that the time in the first condition is short enough to always be less than the time taken to couple-up and reverse the train.

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Proving the second train to a stand by timing track section FD occupied is only valid if FD wasn't already occupied prior to the arrival of the second train. The entry signals' permissive aspects shall therefore prove FD clear, as per control N2.

If the route locking remains locked behind the train for any reason then the permissive move may not be considered complete. This is acceptable if this is due to a further permissive route being overset. However, main or warning or non-permissive shunt routes should be prevented from oversetting a permissive move (see Section 2.2.3) as such oversetting could wrongly prevent a permissive move being eventually declared complete. This in turn would wrongly prevent the exit signal from being cleared or an opposing permissive route from being set.

Control X2

This requires that the exit signal of the permissive move is replaced to danger as soon as practicable after the front of the First Train passes it. This minimises the risk of a Second Train wrongly passing an exit signal cleared for a First Train. Control X1 prevents the exit signal from clearing until the Second Train is stopped or nearly stopped at the signal, thus a cleared aspect, delayed in being replaced, can only be presented to the driver of a stationary or near stationary Second Train.

Where delayed replacement is necessary (for example due to the proximity of replacement joints to the signal) then second track replacement should be considered to confirm that the signal is replaced as soon as possible. If the first track section is sufficiently long that replacement will still be unacceptably delayed, then consideration can be given to replacing the signal by first track occupied for time, typically for five seconds.

Control F

This requires that an AWS associated with the exit signal shall not be permitted to give any indication which conflicts with the requirement for the driver of the Second Train to stop short of the First Train. Thus one has to confirm that an exit signal's AWS electro-magnet is not energised for the First Train whilst the Second Train is passing over it.

This will initially be met by not allowing the exit signal to clear until the Second Train's permissive movement has been declared complete, i.e. at or nearly at a stand (Control X1). It does not necessarily cover the final part of this movement from "nearly at a stand" (when the exit signal can clear) to being "at a stand". Also, it does not cover the next potential movement when the Second Train follows the departing First Train towards the exit signal, up to the point that the First Train replaces this signal, especially if the First Train was not standing immediately in rear of this signal.

Although the worst case, that of an exit signal with delayed replacement, can be covered by making the AWS first wheel replacement (by proving the first track section past the exit signal clear in the AWS data), it is considered that the special controls shown in [SSI8003-76](#) Section 4 should be provided regardless of whether Control X1 is present as the former will provide complete coverage.

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2.2.3 Non-permissive Entry Signal Controls

As part of achieving Control X1 (see Section 2.2.2), main or warning or non-permissive shunt routes are to be prevented from oversetting a permissive move as such oversetting could wrongly prevent a permissive move being eventually declared complete. This in turn would wrongly prevent the exit signal from being cleared or an opposing permissive route from being set.

This prevention is to apply irrespective of whether or not main/call-on or shunt permissive/non-permissive selection is based on the state of the exit signal berth track section, as this will confirm correct functionality in the event of an irregular clearance of this track section after the setting of the route.

2.2.4 Terminal Platforms

As the exit signal in the same direction as the entry signal has now been replaced by a buffer stop, only those principles that are still relevant apply.

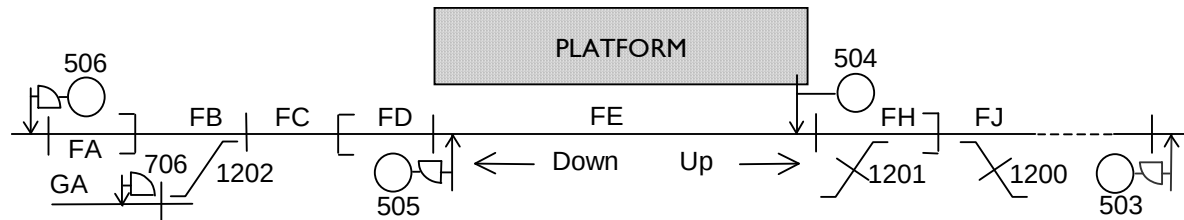
2.3 Signaller's Indication

An indication should already be provided in the form of a direction arrow which is extinguished when the route locking for the platform track section in that direction is freed or this track section has been occupied for time, i.e. as required by Control D.

This indication is to be enhanced such that after a permissive route has been set in this direction, the extinguishing of this indication also requires that the permissive movement has been completed, i.e. as required by Controls N3 & X1. This will provide the additional information the Signaller requires in determining when a subsequent opposite direction route can be set or the exit signal can be expected to clear after a same direction permissive move.

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3 Full Permissive Controls – Data



3.1 Identities

For permissive working, for each direction, three or four identities are required.

Firstly, a Permissive Locking Latch is required, "L<exit_signal>(P)" in the FLG file, thus in the Up direction in the Figure above, this latch will be named "L504(P)".

The Permissive Locking Latch is normally set. It is unset when a call-on or permissive shunt route is set up to the exit signal, i.e. the platform starting signal. It is used to prevent the exit signal (signal 504 in the Figure) from clearing and any opposing permissive routes towards the platform (up to signal 505 in the Figure) being set. It is returned to its set state when the permissive movement is deemed to have been completed, as defined in Section 2.2.2, or when the route is cancelled.

Secondly, a direction arrow latch is required in the FLG file, named after the direction arrow it is to control (see [SSI8003-20C](#) for the naming of direction arrows). In the Figure above, the Up direction arrow latch will typically be "LFE-BA-D".

Thirdly, a Special Track Section Timer, "EZ<appTC>(OCC)", is required in the ELT file where "<appTC>" represents the last track section before the platform, the approach track section, thus in the Up direction in the Figure above, this timer will be named "EZFD(OCC)".

This Timer is provided to return the Permissive Locking Latch to its normal state when the permissive movement has been completed, as defined in Section 2.2.2. Although it basically "times" the occupation of the approach track section it is, however, normally stopped and will only be started when the permissive routes have been released.

Note: in certain cases a corresponding "EZ<appTC>(CLR)" timer may also be required - see Section 3.4.

The fourth identity is only required on schemes where the same shunt routes can work in both permissive and non-permissive modes (i.e. where separate permissive and non-permissive shunt routes are not provided). This identity, located in the FLG file, is the Non-permissive Locking Latch, "L<exit_signal>(NP)", thus in the Up direction in the Figure above, this latch will be named "L504(NP)".

The Non-permissive Locking Latch is normally set. It is unset when a non-permissive shunt route is set up to the exit signal, i.e. the platform starting signal. It is returned to its set state when all the shunt routes up to the exit signal are in their released state.

It is used in the conditioning of any controls which are more onerous when a non-permissive rather than a permissive shunt route is set. Thus it is used in the aspect controls of the shunt route. It is also used in its own right, if required, in the freeing of the sub-overlap(s) beyond the exit signal.