

Ref	SSI8003-74
Issue	4
Date	April 2008

SSI Applications Manual

SSI Data Preparation Lockout Devices

Endorsement, Authorisation and Issue Record

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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Published & Issued by: Network Rail 40 Melton Street, London NW1 2EE



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1 Introduction

The two types of lockout devices are covered, viz. "Patrolman's Lockout Devices" (PLOD) and "Lockout Devices to Protect Staff Working on Trains".

2 Patrolman's Lockout Devices (PLOD)

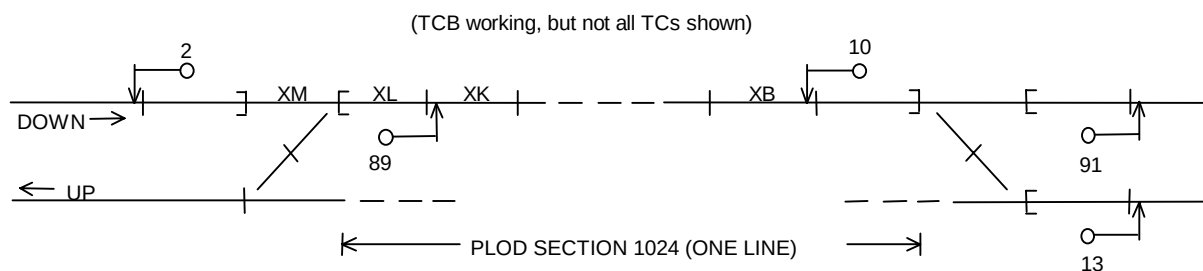
Section 2.1 covers a simple PLOD case with a single instrument applying to one line entirely in one Interlocking.

Section 2.2 covers a more complicated PLOD case with two instruments in different Interlockings applying to two lines.

Section 3 covers Lockout Devices to Protect Staff Working on Trains.

2.1 Simple PLOD - Principles

Principles are as defined in Signalling Principle Standard GK/RT0030 Issue One; the typical application shown in Appendix A of GK/RT0030 is also followed. The principle specified in Standard Signalling Principle 80 (04/93) Section 7.4 is also complied with.



The above figure shows a typical PLOD section. The precise boundaries of the PLOD section will be as agreed with the Operators, and thus as shown on the Scheme Plan and Control Tables, but here the boundaries are shown with the PLOD section extending up to, but not including, the crossover track circuits. In this example wrong direction working only applies to one line.

The Signaller is provided with a release for the PLOD section, similar to that used for a ground frame. This release has to be given by the Signaller before the Patrolman can use the PLOD instrument to change the PLOD section from "Traffic" to "Patrol" mode. The release can be cancelled by the Signaller with the PLOD section in either mode, but the Interlocking will not consider the release "normal" until the PLOD section has been returned to "Traffic" mode by the Patrolman.

The PLOD instrument is provided with a key-operated two-way switch labelled "Normal" and "Operate", together with a pair of buttons labelled "Patrol" and "Traffic". When a release is given, the Signaller advises the Patrolman of this (a "Release Free" indication is not required). With the release given and the switch in the "Operate" position, the Patrolman is able to put the PLOD section into "Patrol" mode by operating the "Patrol" button. Conversely, with the switch

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in the "Operate" position, the Patrolman is able to put the PLOD section into "Traffic" mode by operating the "Traffic" button, irrespective of the release state. "Patrol" and "Traffic" indication are provided at the PLOD instrument to indicate the current mode of the section, with the former also proving that the release is not normal.

Any wrong direction routes can only be set if the release is normal and the PLOD section in "Traffic" mode. Thus once the release has been given, any wrong direction routes are prevented from being set until the release is normal. In the above figure, routes from signals 13 & 91 leading to the down line and all routes from signal 89 are prevented from being set.

The signals associated with these routes and any intermediate wrong direction signals in the section also prove, in their aspects, both the release normal and the PLOD section in "Traffic" mode. (The latter is required to cover any unusual situation where the PLOD section fails to remain in "Traffic" mode with the release normal.) In the above figure, this applies to signals 13 and 91, when these routes are set, to any intermediate auto signals between these signals and section exit signal 89, and to signal 89 for any route.

The converse applies - a release cannot be given by the Signaller, and thus the PLOD section cannot be put into "Patrol" mode, unless the PLOD section is free of all the wrong direction route locking. In the above figure this includes the up direction route locking from signals 13 (via the crossover) and 91 to the exit signal 89, including the overlap, and the up direction route locking from signal 89 to the crossover track circuit exclusive.

Additionally Standard Signalling Principle 80 Section 7.4 requires that the route locking of any right direction routes in the PLOD section is not allowed to be released "if the PLOD section is in use", i.e. whilst the release is not normal. (This item in Standard Signalling Principle 80 is ideally suited to the RRI implementation method of applying PLOD locking against wrong direction route setting - however, it must still be provided in SSI - its main effect is the extra illumination of the right-direction route lights and direction arrow to the Signaller, indicating that the PLOD section is in "Patrol" mode.)

In the above figure the down direction route locking between track circuit XL (i.e. the extent of the PLOD section at this end) and the right direction exit signal 10 is thus prevented from releasing. The route locking of exit signal 10 is not affected by this PLOD section.

Note that in the typical application shown in the above figure, the PLOD section extends beyond exit signal 89. An alternative application could be for this to be reduced such that it only extended as far as this signal. Routes from signal 89 would then no longer be interlocked with the PLOD section.

Any potential race conditions have to be addressed. Such a condition is the Signaller attempting to cancel the release and set a wrong-direction route as the Patrolman is putting the section into "Patrol" mode. Re-initialisation of the

interlocking whilst the section is in "Patrol" mode has to be catered for - the "memory" of the section being in this mode must not be lost.

The Signaller has a two position switch for giving the release, with adjacent "Normal" and "Free" lights. Moving the switch to the "Released" position will give the release if the relevant wrong direction route locking is free. Moving the switch to the "Normal" position will unconditionally cancel the release.

Optionally the release may be controlled by a button instead of the two position switch. Also, area indications, placed at the extremities of the PLOD section to indicate when the Signaller cannot set wrong direction routes into the section, may be provided.

The behaviour of all the above indications is covered in Section 2.2.7.

2.2 Simple PLOD - Data

Any PLOD-associated identities are named after the allocated PLOD section number (e.g. 1024 as used below). A latched relay, typically named 1024 NLR (driven by two Signal Module output relays 1024 (TF)R & 1024 (PL)R) is provided to register the state of the section, i.e. whether it is in "Traffic" mode (latched up) or in "Patrol" mode (latched down). This relay is provided to ensure that the state of the section is remembered during any mode of start-up of the Interlocking. Data-only methods of registering the state of the section are not acceptable as under start-up conditions they can result in either the use of fallible operational procedures or unnecessary attendance at PLOD instruments in order to reset section states.

2.2.1 Identities

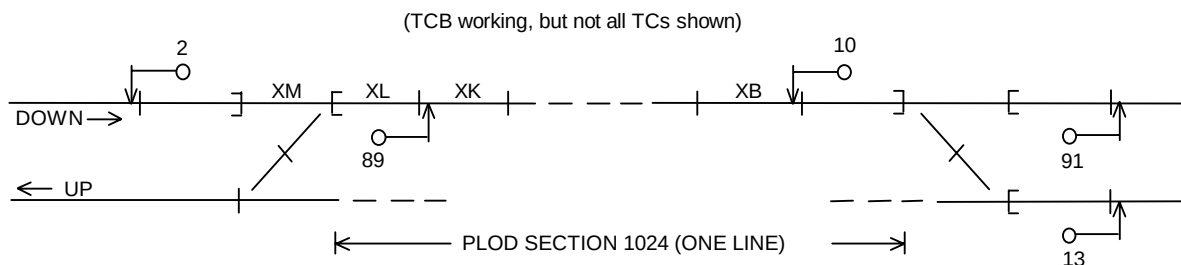
Identities required for each PLOD section xxx are as follows:

Rxxx	In the ROU file, the PLOD release route identity, which is set when the release is given and unset when the release is cancelled.
LxxxRELN	In the FLG file, the PLOD release-normal latch, which is unset when the release is given and set when the release has been cancelled together with the PLOD section in "Traffic" mode and timer Exxx > 5.
LxxxTFC	In the FLG file, the PLOD traffic latch identity, which repeats the state of the latched relay. It is set only whilst the latched relay is in the latched up state, i.e. in "Traffic" mode. (This is the equivalent of Ground Frame detection normal.)
Exxx	In the ELT file, the PLOD timer identity that, when "Patrol" mode is requested, inhibits the release being declared normal whilst the latch relay is responding. This is to address the potential race condition of the above occurring

whilst the Signaller is simultaneously cancelling the release and then setting a wrong-direction route.

- BxxxN In the BUT file, an identity for the Signaller's release switch "Normal" contact.
- BxxxR In the BUT file, an identity for the Signaller's release switch "Released" contact.
- IxxxF In the IND file, a flashable identity for the Signaller's "Release Free" indication.
- IxxxN In the IND file, a non-flashable identity for the Signaller's "Release Normal" indication.
- IxxxA Optionally, in the IND file, non-flashable
- IxxxB identities for the Signaller's PLOD area indications.
- QRxxx In the QST file, a request identity for giving the release.
- QXRxxx In the QST file, a request identity for cancelling the release.

The figure in Section 2.1.1 is repeated here for the reader's convenience. This example is of a one line, one instrument PLOD section entirely within one Interlocking. Wrong direction working is present only on the Down line.



2.2.2 PRR File

The request for giving the PLOD release has to prove the release has not been barred by the technician and that any wrong direction route locking is free. The PLOD release route identity is then set and the PLOD release-normal latch unset.

Proving this locking is free is done by testing that the appropriate opposing direction sub-routes and sub-overlaps are free, i.e. as would be done in the setting of a right direction route extending just the length of the PLOD section. Thus for this PLOD section the up direction sub-route (UXK-AB) for the exit signal berth track circuit, the exit signal sub-overlap (OXL-AB) and the final up direction sub-route (UXL-AB) of the PLOD section are all proved free. This assumes that the setting of a wrong

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direction route into the section will lock all sub-routes up to the exit signal and the sub-overlap beyond it even if there are intermediate signals. If this is not so then the appropriate extra tests will have to be added to achieve the same result.

```
*QR1024
  if R1024 a
    UXK-AB f , OXL-AB f , UXL-AB f
  then R1024 s , L1024RELN xs
  \ .
```

The request for cancelling the release unconditionally unsets the PLOD release route identity.

```
*QXR1024  R1024 xs .
```

All wrong direction route setting has to prove the release normal and the PLOD section in "Traffic" mode. (The latter protects against any unusual situation where the PLOD section fails to remain in "Traffic" mode whilst the release is normal, e.g. a replacement latched relay being installed with the contacts in the wrong state.) This proving is implemented by including the following tests in the requests for setting of these routes:

```
L1024RELN s , L1024TFC s
```

These tests will be included, for example, in request QR91.

The potential race condition between the Signaller cancelling the release and setting a wrong-direction route as the Patrolman operates the "Patrol" button is catered for by the above test on release normal and IPT file data below as follows. If the PLOD release is cancelled and request QR91 is processed immediately before the "Patrol" button-pushed input then the route will be set and, because of the IPT file PLOD release test below, the PLOD section will stay in "Traffic" mode. If the PLOD release is cancelled and request QR91 is processed immediately after the "Patrol" button pushed input, then initially the timer test and subsequently the PLOD traffic latch test in the IPT file below will prevent the PLOD release-normal latch from being set. This in turn will cause the route setting to fail and the PLOD section will enter "Patrol" mode.

2.2.3 IPT File

This data interfaces with the PLOD instrument and the latched relay used to "remember" the state of the PLOD section, and is shown in the combined circuit and data figure below. In this example two TFMs are used; the circuitry shown can alternatively be connected to the same TFM. Double cutting and any latch relay economising contacts have been omitted for clarity.