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SSI Applications Manual

SSI Data Preparation AWS & SPAD Inductors

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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1 Introduction

This document covers the control of inductors used for AWS ("Automatic Warning System"). It also covers the use of these inductors as part of measures associated with SPAD ("Signal Passed At Danger"). Information on simple applications of controlling the electro-magnet part of inductors, using the AWS data section of the Output Telegram Special for Signal, is given in SSI8003-10G Section 1.2.8, together with the syntax rules for this data section. SSI8003-76 expands this information on inductors to include:

- control of an AWS electro-magnet where points occur between the AWS inductor and its signal
- control of an AWS electro-magnet where permissive working applies
- suppression of an AWS permanent magnet for opposing moves
- control & suppression of an AWS electro- and permanent magnet located ahead of its signal at the transition from unfitted lines
- suppression of SPAD magnets

This document has been prepared in accordance with Signalling Principles Standard GE/RT8035 and Guidance Note GI/GN7606 (note: the provision of SPAD magnets is now non-compliant with GE/RT8035).

2 General

2.1 Principles

The prime use of the AWS system is to give a warning in the cab to a train driver of the aspect of the signal ahead. It is also used to give warnings of other items such as speed restrictions and SPADs. Each AWS inductor installation always has a permanent magnet and this, when detected by the train-borne apparatus, triggers the warning in the cab.

If the signal to which it applies has a green aspect then an electro-magnet is situated beyond the permanent magnet in the direction of travel. This is energised, when the signal is alight and displaying a green aspect, to an opposite magnetic polarity to that provided by the permanent magnet. The detection by the train-borne apparatus of the permanent magnet followed by the energised electro-magnet results in a clear indication, rather than a warning, being given in the cab to the train driver.

Special controls are provided for electro-magnets where points occur between the AWS inductors and their signals (see Section 3) or, where permissive working applies, to avoid a second train wrongly receiving a clear indication intended for the first train (see Section 4). Special controls are also provided

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for electro-magnets in certain circumstances at the transition from lines not fitted with AWS (see Section 6).

Where it is required that a train driver should not receive an indication from an AWS installation (because it does not apply to him/her) then the permanent magnet is fitted with a suppression coil to counteract its effect. This coil is energised when suppression is required, most commonly for opposing moves (see Section 5). Suppression is also required for SPAD magnets (see Section 7) and in certain circumstances at the transition from lines not fitted with AWS (see Section 6).

2.2 Data

As described in SSI8003-10G Section 1.2.8, the AWS data section of the Output Telegram Special for Signal is used for the control of electro-magnets via a telegram command (current or non-current). A preceding optional test list of the form "if...\", is available for adding conditions over and above the inherent test for the signal alight and at green. Examples of data utilising this test list, together with data located elsewhere for electro-magnet control and permanent magnet suppression, are shown in the following Sections.

3 Points between AWS inductor and signal

3.1 Principles

If points, facing or trailing, occur between the AWS inductor and its signal, then energisation of the electro-magnet should be inhibited unless the points are controlled and detected in the position applying to the signal. The inclusion of detection is essential for facing points in case they have been manually operated into a position out of correspondence with their controlled position, and, for consistency, detection is also included for trailing points.

3.2 Data

The optional test list in the AWS data section of the Output Telegram for Signal Special is used to hold the test for the points controlled and detected in the required position. The data typically will be:

```
if P1056 cdn \      G s 1                      . / AWS
```

If an electro-magnet applies to more than one signal then this form of data still applies, with non-current telegram commands where required.

However if more than one electro-magnet applies to a signal then the AWS data section of the Output Telegram for Signal Special can no longer be used to control the energisation of the electro-magnets.

For electro-magnets controlled by the same Signal Module, the data instead takes the form of a conditional statement located at the end of the aspect sequence data section. If there are approach controls or other conditions controlling the clearance of the signal in this data section then the conditional

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statement should be situated such that it is only processed if the signal is off, thus reducing data processing time.

The conditional statement has to include tests for the requisite signal lit at green, as well as the intervening trailing points controlled and detected in the correct position. For this application Current Telegram commands are used - typical data follows:

```
G s 7 \
S101 seq 4 , G s 7654
if S101 set lp+g
then if P1056 cdn then G s 1 \      / 101 AWS via 1056N
      if P1056 cdr then G s 0 \      / 101 AWS via 1056R
\                                     . / ASD
                                     . / No AWS
                                     / AWS controlled by ASD data
```

The above data method must not be used where the electro-magnets are controlled by a different Signal Module; the data instead takes the form of a conditional statement located immediately after this Output Telegram for Signal Special. This ensures that if the Signal Module controlling the signal has entered the red-retaining state, then the aspect code will have been set to the most restrictive aspect at the end of the aspect sequence data before it is tested by this added conditional statement (see SSI8003-10G Section 1.2.7 for more details).

As before, the conditional statement has to include tests for the requisite signal lit at green, as well as the intervening trailing points controlled and detected in the correct position. Non-current Telegram command(s) are used; typical data follows:

```
if S101 set lp+g
then if P1056 cdn then G12 s 1 \      / 101 AWS via 1056N
      if P1056 cdr then G12 s 0 \      / 101 AWS via 1056R
\
```

A comment is to be added where the AWS data is usually located to indicate where the AWS-controlling data has been moved to.

4 Control of AWS electro-magnet where permissive working applies

4.1 Principles

GK/RT0044 (ref. 1) requires that AWS electro-magnets on lines, where the "Permissive" system of train working applies, shall be controlled to prevent the driver from receiving a "clear" indication which does not apply to his train. Such permissive working can be allowed by the use of call-on and/or shunt routes to an occupied line.

It is considered that even if GK/RT0044 has been applied to permissive passenger working such that there is locking between the entry signal and the exit signal (that with the AWS in question) then these methods will still be required. SSI8003-83 "Permissive Controls" gives further details.

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Two methods are available, depending on the arrangement of Track Sections.

4.1.1 Separate Track Section between AWS inductor and signal

In the first method, a separate Track Section is provided between the AWS inductor and its signal. The electro-magnet is maintained de-energised if this Track Section is not clear. Thus if the signal is lit at green and the Track Section occupied by the train for which the signal has been cleared then the electro-magnet will not give a clear indication to a following train. This method assumes that the Track Section joint is placed such that the AWS electro-magnet will not be prematurely de-energised before the train borne apparatus has passed over the inductor.

If the signal is not replaced automatically to danger by the first Track Section past it the electro-magnet must be controlled by additional Track Sections as necessary. Usually just the first Track Section past the signal is added. This ensures, with last wheel replacement, that irrespective of data implementation a race condition between signal replacement and electro-magnet energisation cannot occur as the berth Track Section is cleared.

4.1.2 No separate Track Section between AWS inductor and signal

In the second method a control maintains the electro-magnet de-energised after a signal for a shunt or call-on route into an occupied section has been cleared.

The control is first applied when the entry signal is off with a permissive shunt or call-on route set. This control has to be maintained until the train(s) ahead have vacated the permissive part of the route and the exit signal has been replaced.

One accepted disadvantage of this method may arise if the second train, i.e. that for which the entry signal was cleared, reaches this part of the route before it is vacated by the previous train. If the second train does not pass over the electro-magnet until after the exit signal is cleared to green for it, a warning, instead of clear, indication will be received. Similarly, this can also apply to the previous train if the control is applied before this train has passed over the electro-magnet.

4.2 Data

4.2.1 Separate Track Section between AWS inductor and signal

An additional test for the exit signal's berth Track Section being clear is added to the optional test list in the AWS data section of the Output Telegram for Signal Special: