Division / Business Unit:	Engineering and Systems
Function:	Signalling
Document Type:	Standard

Train Protection Warning System

ESD-07-04

Applicability

ARTC Network Wide

SMS

Publication Requirement

Internal / External

Primary Source

Document Status

Version #	Date Reviewed	Prepared by	Reviewed by	Endorsed	Approved
1.0	17 Oct 22	Standards	Stakeholders	Manager Signalling Standards	A/General Manager Technical Standards 19/11/2022

Amendment Record

Amendment Version #	Date Reviewed	Clause	Description of Amendment
1.0	17 Oct 22		First issue of document

Table of Contents

1 Introduction

1.1 Purpose

The purpose of this standard is to provide the minimum requirements for use of the Train Protection Warning System (TPWS) on the ARTC rail network. The Designer may need to exceed these minimum requirements to achieve the SFAIRP design.

1.2 Scope

This standard covers the Train Protection Warning System that is type approved for use on the ARTC rail network. It covers the minimum requirements for design, installation, testing, commissioning, maintenance, temporary removal and decommissioning.

Scope is limited to the section between Melbourne and Albury on ARTC network for V/Line trains.

1.3 Document Owner

The General Manager Technical Standards is the Document Owner. For any query, initial contact to be made at standards@artc.com.au.

1.4 Responsibilities

Project Manager, Project Signal Engineer, Signal Design Engineer, Signal Maintenance Engineer and Business Unit Managers are responsible for implementation of this standard. This is necessary to ensure consistency, maintainability, and reliability of the Signalling System.

The supplier is responsible for compliance and confirmation to this document and applicable Australian and International standards.

1.5 Reference Documents

The following documents support this standard:

- Thales document HB1376-5 – User Technical Specification for the TPWS Trackside Equipment
- ESC-07-03 - Small Buildings, Location Cases, Terminal Cases and General Purpose Cases
- ESC-09-02 - Lightning and Surge Protection Requirements
- ESC-11-01 - Construction of Cable Route and Associated Civil Work
- ESC-21-01 - Inspection and Testing of Signalling – Roles, Responsibilities and Authorities
- ESC-21-02 - Inspection and Testing of Signalling – Plans, Programs, Documentation and Packages
- ESC-21-03 - Inspection and Testing of Signalling – Inspection and Testing Principles
- ESC-21-04 – Inspection and Testing of Signalling – Standard Forms
- ESM-26-02 – Signalling Technical Maintenance Plan
- ESW-26-01 Signals Service Schedules/Standard Jobs

- ESD0704F-01 – TPWS Maintenance Record Form
- AS 7717 – Signal Testing and Commissioning
- AS 7718 – Signal Design Process Management
- AS/NZ- 1768-2007 - Lightning Protection

1.6 Definitions

The following terms and acronyms are used within this document:

Term or acronym	Description
ARTC	Australian Rail Track Corporation Ltd.
Arming Frequency	Frequency at which a specific arming loop operates. Multiple frequencies are available to allow multiple loops to be placed in parallel in adjacent tracks and/or for bidirectional movement without interfering with each other's operation.
Arming Loop	A term that refers specifically to the grid/aerial portion of a TPWS unit that is installed in the middle of the tracks. In particular, this loop "primes" the train borne TPWS unit for subsequent enforcement application, if the train passes over a trigger loop within a given time limit.
CBI	Computer Based Interlocking
DIS	TPWS Disconnection Box
GRP	Glass-Reinforced Plastic
LED	Light Emitting Diode
Loop	In the TPWS context, it refers to either an arming loop or a trigger loop without preference
OSM	Over Speed Sensor Module
Over Speed Sensor (OSS)	A TPWS trackside device. The device is activated by the signalling system and in conjunction with the train-borne component is able to apply the emergency brake for over- speeding trains.
SAP	Signal Arrangement Plan
SFAIRP	So Far As Is Reasonably Practicable
SIM	Signalling Interface Module
SPAD	Signal Passed at Danger
Train Protection Warning System (TPWS)	A signal enforcement system, functionally the same as a train-stop system, except that it uses a non-contact form of interface (radio frequency) between the track and the train.
Train Stop Sensor (TSS)	A TPWS trackside device. The device is activated by the signalling system and in conjunction with the train-borne component is able to apply the emergency brake for trains passing a signal at stop.
Trigger Frequency	Frequency at which a specific trigger loop operates. Multiple

Term or acronym	Description
	frequencies are available to allow multiple loops to be placed in parallel in adjacent tracks and/or for bidirectional movement without interfering with each other's operation.
Trigger Loop	A term that refers specifically to the grid/aerial portion of a TPWS unit that is installed in the middle of the tracks. In particular, this loop in-conjunction with an arming loop interacts with the train borne TPWS unit to cause an emergency brake application if the arming and trigger signals are received within a given time limit.
VCR	TPWS Control Relay
V/Line	The statutory authority that operates regional passenger train services in Victoria.

2 Introduction

TPWS is designed to reduce the likelihood and consequences of a Signal Passed at Danger (SPAD), by initiating an automatic brake application on the train. It is also able to reduce the consequences of a train exceeding the speed on approach to a signal or to a junction or to buffer stops.

The objective of TPWS is to intervene in the control of a train when there is an evidence that signal being passed at danger without authority or excess speed by a train.

The TPWS onboard train systems receive a signal from the TPWS track mounted loops regarding the maximum permitted speed or the status of a stop signal. The onboard system may implement enforcement and an emergency application of train brakes to bring the train to a stop where required.

The trackside systems cover Train Stop Sensor (TSS) and Over Speed Sensors (OSS).

- The TSS is for the emergency brake enforcement when a signal is at stop and the train SPADs the signal.
- The OSS is an overspeed sensor on the approach to a signal and/or switch turnout configured to a specific design speed for the location. If the train exceeds the speed, the onboard system will enforce train brake application and bring the train to a stop.

3 TPWS Principles

The following principles apply to the design of TPWS for the ARTC network.

3.1 Protection from Overspeed and Derailment

The TPWS includes an Over Speed Sensor which can enforce the fitted train is operating at higher than the design speed at the location. This is used to ensure that the train will not exceed the speed nominated for the turnout that the train is approaching.

The OSS is placed on the approach to the turnout with a design speed that is consistent with the train braking profile of the TPWS fitted train.

The design shall be based on the existing speed limit for the turnout. The specific design speed of each OSS shall include + 5 km/h above the Service Braking profile of the train to allow for small variations in performance of the trains.

Two OSS shall be placed on the approach to the turnout. These are placed between the commencement of the train braking profile and the location for the required turnout speed. Design engineer is to risk assess the specific situation and apply additional mitigation measure(s) on a case by case basis.

3.2 Protection from Collision

The application of TPWS allows for a train (fitted with TPWS) that SPADs a signal fitted with TPWS to be brought to a stop within the nominal overlap distance. Where the available overlap is less than that required for trip braking of the TPWS equipped train, there shall also be an overspeed enforcement.

This overspeed enforcement shall ensure that the train has a braking profile to reduce its speed from the maximum line speed to the speed for emergency braking at the stop signal, to come to a stop within the nominal overlap.

Where there is an Over Speed Sensor installed to enforce a speed limit (for example for a turnout speed) then this OSS if suitable may be used with the TSS to ensure that the train stops within the available overlap.

3.3 Protection from TPWS Failure and Inadvertent Trip braking

The TPWS trackside equipment may fail to operate to provide the required enforcement. The equipment may also fail to revert to the normal state of no enforcement. When TPWS fails to revert to the normal state of no enforcement, this can lead to trip braking of the approaching TPWS equipped train.

In both cases the interlocking interface shall detect the failure and output an alarm to the signal control system.

4 Design requirements

The design of the TPWS for the Train Stop Sensor (TSS) and the Overspeed Speed Sensor (OSS) for the ARTC network shall follow this document.

The TSS is set to stop when the associated signal is at stop. A train passing the TSS when set at stop will have a penalty brake application applied. The objective is that a train that SPADs a signal will be brought to a stop within the designed overlap.

The ARTC network has a nominal overlap and not a trip braking overlap. In these cases, an OSS is required on the approach to the TSS to ensure that the train speed at the TSS is not greater than that for a braking distance equal to the available overlap.

The OSS is configured to represent a specific design speed. If the train moving over the OSS exceeds the specific design speed, then a penalty brake application is applied. The OSS can be used in advance of the TSS and is configured with a speed that matches the train braking profile for the train to be within acceptable speed range on the approach to the stop signal.

The OSS can be used to manage the speed of a train approaching a speed restriction as required for a turnout. The OSS is configured to represent a specific design speed based on the train braking profile of the train and the distance from where the speed limit is applicable.

Where there are multiple types of TPWS fitted trains operating, then designer is required to consider the braking performance of all the trains in the design to provide effective control for all TPWS fitted trains.

4.1 Train Braking Calculations

As part of the design process, designer is required to do braking calculations for all different types of train operating in the section. Designer may take help from the ARTC Stop-Dist train braking calculator for general guidance. For V/Line trains, VRIOG -009.3 braking distance calculator may be used.

4.2 Design Elements

The Signal Arrangement Plan (SAP) shows the type and location of the TSS and OSS loop on the track. The circuit sheets detail the wiring connections between the signal interlocking the TPWS modules and the TPWS loop.

The design calculations should be detailed in the Design Report. The design calculations shall include the braking distance and braking profile calculations for the TPWS equipped trains.

4.3 TPWS Unit Configuration

This details the placement and frequency requirements for the TPWS units. The arming and trigger frequency allocations shall be as per table below.

TPWS Function	Arming Frequency	Trigger Frequency
OSS (Up direction)	64.25 kHz (f1)	65.25 kHz (f2)
TSS (Up direction)	66.25 kHz (f3)	65.25 kHz (f2)
OSS (Down direction)	64.75 kHz (f4)	65.75 kHz (f5)
TSS (Down direction)	66.75 kHz (f6)	65.75 kHz (f5)

The TSS shall have the Arming unit directly preceding the Trigger unit. For the OSS the distance between the leading edge of the Arming unit and the Trigger unit determines the speed that the OSS will enforce the braking of the train. Where a TSS and an OSS are placed at a signal then the Trigger unit is common for both functions. The Trigger is controlled by the OSS. The OSS will always be activated when the TSS is activated.

As detailed in the example below, the information should be detailed on the Signal Arrangement Plan.

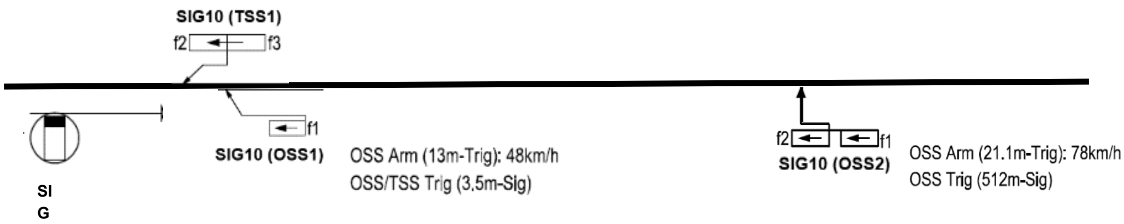


Figure 1 Signal Arrangement Plan

4.4 Design Guideline

Below details provide the design guidance to the designers.

4.4.1 Where TSS is required with a main line signal

Where TSS is required with main line signal, following requirements are to be followed.

1. TSS shall be continuously proven to be disarmed in the signal's control for main-arm (normal and medium speed) aspects.
2. TSS shall be proved to be disarmed for running low speed moves. However, the TSS is not required to be proved to be disarmed for low-speed aspects where the train is already proved at rest.
3. All opposing signals into the same single line section shall prove the TSS in the armed position.
4. TSS is generally not required to be proved in armed position in the rear signal unless required by design for a specific location or specifically requested by ARTC.
5. Direction control for a single line section shall not prove the state of TSS associated with automatic signals.
6. After passage of each train signalled with a main aspect, the TSS shall be proved to be armed.
7. When the TSS is released to the arm position but is not detected an alarm shall be generated and indicated on the signalling panel.
8. TSS shall be disarmed when the signal is at proceed and shall be released to the armed position when the signal is at stop.

4.4.2 Where OSS Units used on approach to a reduced overlap

1. The placement of the OSS will be at the full overlap distance from the authorised speed to the end of the overlap.

2. The OSS shall be armed whenever the stop aspect is displayed.
3. The OSS speed value shall be set to the maximum authorised speed profile (i.e. train is expected to stop at signal) plus a maximum 8 km/h margin,
4. The track gradient shall be taken in account in all relevant calculations.
5. Where the design procedure results in more than two OSS units on the approach the arrangements shall be re-considered.
6. The outputs relevant to this design are the OSS speed value and the relative position of the OSS to the reduced overlap in advance.

4.4.3 Where OSS unit(s) used on approach to a junction

1. Purpose of this set of requirements is to control the speed of a train approaching a junction in order to mitigate the risk of derailment at the turnout.
2. Designer is to design OSS or OSS+ considering the different types of trains operating in the sections and their maximum line speeds permitted in such a way that the speed targeted at the junction by the OSS/OSS+ arrangement shall be the nominal turnout speed permitted.
3. The design process may determine that OSS units are not required on the approach as the OSS provided at the junction signal already controls the derailment risk.
4. For diverging junctions, the target speed reference location is the toe of the turnout; for converging junctions, the reference location is the toe of the turnout less a nominal 50m.
5. The track gradient shall be taken in account in all relevant calculations.
6. The OSS unit(s) shall be placed, and the speed value set to the maximum authorized speed profile plus a minimum 5 km/h margin.
7. Where the design procedure results in more than three OSS units on the approach the arrangements should be re-considered. Possible outcomes include:
   - Upgrading the turnout rating
   - Relocating the junction signal further from the junction
   - Containing the number of OSS units on approach to three. This approach requires the agreement of the Infrastructure Manager and the residual derailment risk is to be assessed and recorded.
8. The outputs relevant to this design are the OSS speed limits and the relative positions of the OSS trigger loop(s) to the junction in advance.

4.4.4 TSS at permanent stop signal

The TSS shall be:

a. Permanently raised / energised.

b. Detected as raised / energised and failures alarmed and indicated to the network controller.

4.4.5 Protecting a Buffer Stop at a Terminal Station

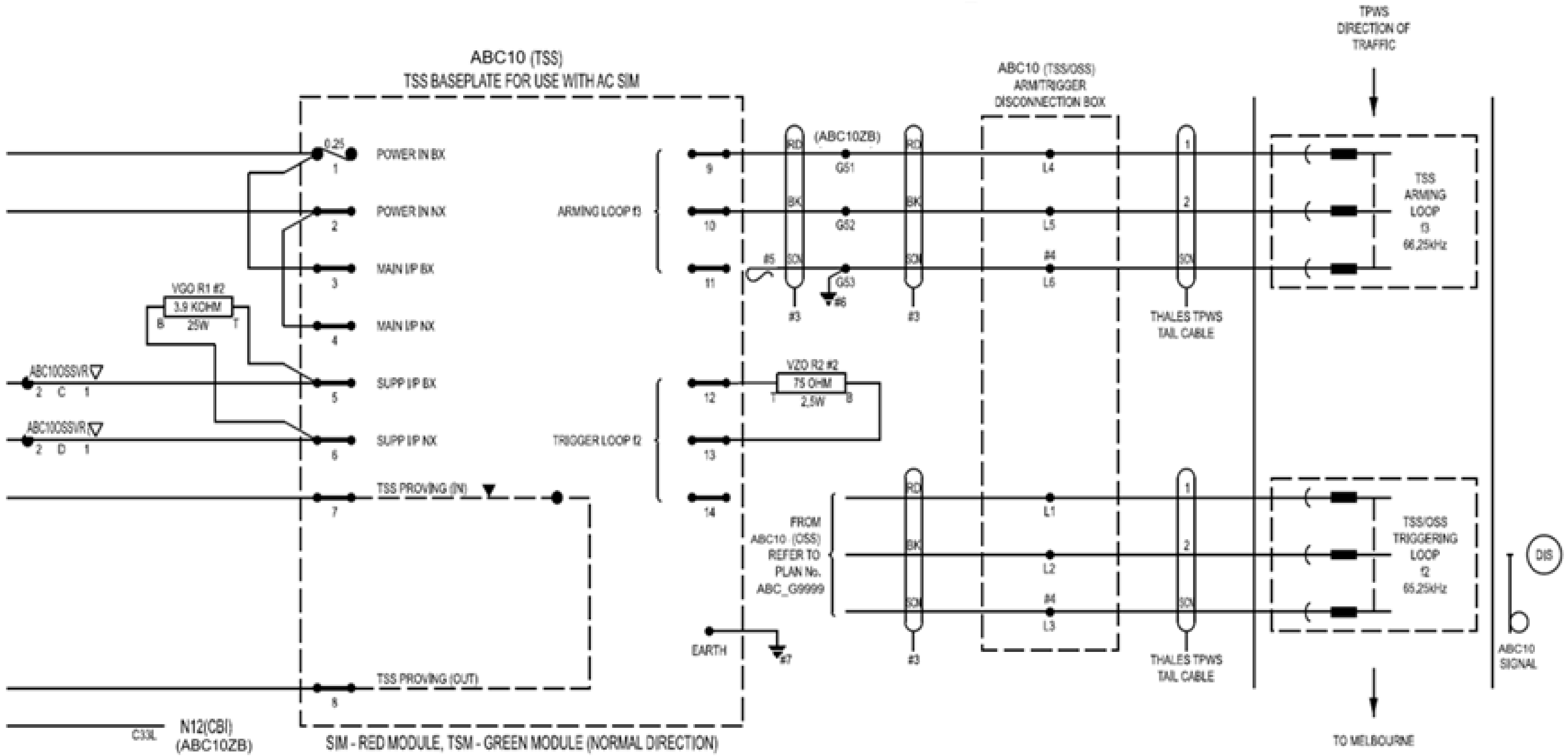
Determine the buffer stop design speed (most likely to be under 30km/h but should be more than 15km/h as TPWS does not work reliably below this speed).

Determine positions of OSS's in a manner similar to speed control through a junction enforcing the speed to the buffer stop design speed.

4.4.6 Trackside arrangement

The following design provides the guideline to the designer for arrangements of the TSS and OSS. The arrangements apply for connections to a relay interlocking or a CBI.

TSS and OSS typical circuits for TPWS for signal ABC10



EQUIPMENT LIST - TRAINSTOP SENSOR (THALES) - GOLD CONTACT UNIT USED				
MODULE	PART NUMBER	DIRECTION	PIN CODE	COLOUR
TSS BASEPLATE	606630-31	NORMAL	N/A	N/A
110V AC & SIM	604366-20	N/A	1035	RED
TSS MODULE (FREQ: f3/f2)	604367-21	NORMAL	1038	GREEN

Figure 2 Typical Circuit for a TSS with OSS control of the Trigger Loop

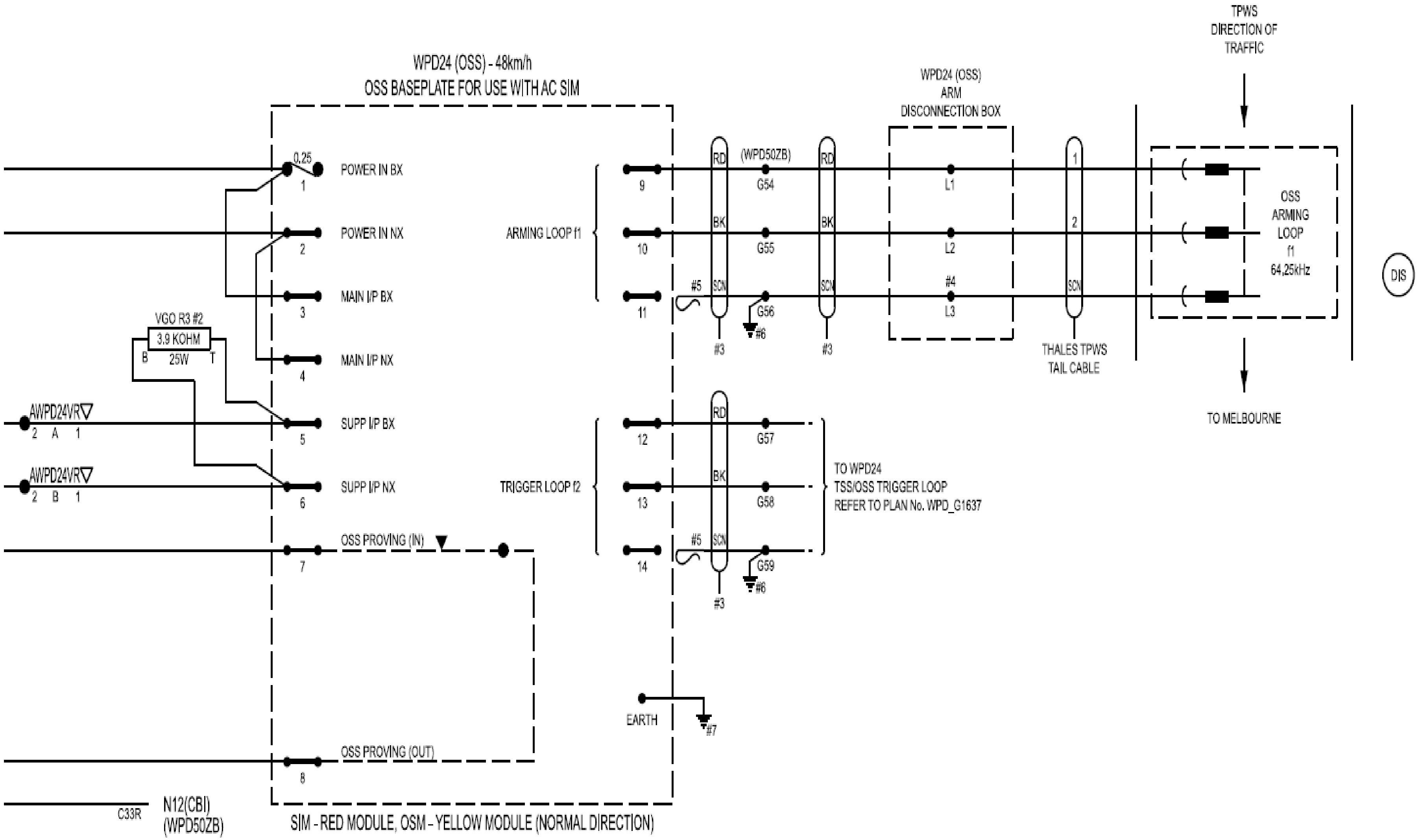


Figure 3 Typical Circuit for an OSS Arming Loop (see Figure 2 for Trigger Loop)

5 Construction Requirements

The TPWS track sub-system equipment consists of two main elements:

- the trackside equipment - consists of the TPWS control equipment, power supply and signalling interfaces.
- the track mounted equipment - consists of transmitter loops secured to the track.

The TPWS track mounted equipment is connected to the TPWS trackside equipment by transmitter loop feeder cables and tail cables, and to the signalling system by a signalling interface cable or internal wiring in a relay room or apparatus case.

5.1 General

All installation works of TPWS need to be carried out in accordance to manufacturer's manuals and approved signal design.

5.2 Housing

Equipment housings, cable routes and trackside equipment must comply with

- ESC-07-03 Small Buildings, Location Cases, Terminal Cases and General-Purpose Cases.
- ESC-07-01 Installation of Trackside Equipment
- ESA-11-01 Cables for Railway Signalling Applications – General Requirements
- Manufacture's requirements

5.3 Trackside Arrangement

In general, TPWS transmitter loops shall be kept at least 1 metre from any significant on-track metal object.

Where it is required to position the loops within a set of points, a distance of 300mm from the switch rails to the nearest part of the loop shall be maintained.

The Cable tail is used from the trackside disconnection box to the loop. The cable from the location case to the trackside disconnection box is 2.5mm2 twisted pair cable with screen. The TPWS twisted screen cable is not terminated on the TPWS baseplate but is insulated and secured behind the baseplate. At the location case incoming terminals, the TPWS cable screen is earthed electrically and mechanically to the mounting rail and the mounting rail is directly connected to the main earth.

6 Testing and Commissioning

All testing and commissioning activities shall be carried out in accordance with ARTC standards as listed below and manufacturer's manuals.

- ESC-21-01 - Inspection and Testing of Signalling – Roles, Responsibilities and Authorities
- ESC-21-02 - Inspection and Testing of Signalling – Plans, Programs, Documentation and Packages
- ESC-21-03 - Inspection and Testing of Signalling – Inspection and Testing Principles
- ESC-21-04 – Inspection and Testing of Signalling – Standard Forms

In the test plan some of the items to be included by Tester In-charge/Testing and Commissioning engineer are as below:

- Loops installation are at correct location as per design
- Frequency and signal strength measurements
- Visual inspection of LEDs on TPWS equipment
- Function test and correspondence test of the TPWS system
- Visual inspection of TPWS equipment such as modules, baseplates, loops etc.

For detailed requirements for the test plan and testing requirements please refer to the ARTC testing and commissioning standards from section 1.5 and as per the requirements of the manufacturer. Test certificate is required to be submitted to ARTC.

7 Maintenance

All maintenance works shall be carried out in accordance with ARTC standards and manufacture's requirements.

Preventative maintenance actions shall be undertaken in accordance with published Technical Maintenance Plans and Maintenance Service Schedules.

Maintenance staff are required to observe trends in performance, allowing problems to be detected before they cause a failure. Gradual consistent variations indicate the deterioration of a component. The causes of these problems are to be identified and resolved as per manufacturer's manual.

7.1 Examination

Following items required to be inspected during maintenance visits for checking the condition of TPWS and their associate equipment.

- Check that all bolts, nuts, screws, electrical connections etc. are fitted and secure.
- Examine equipment for cracks, fractures, bending or other damage caused by trackside vehicles and plant equipment.
- Check that all wiring insulation is intact and that no bare wires are exposed.
- Examine equipment for signs of corrosion (rust), overheating (discolouration) or leaks from pipes and hoses (stains/noise).
- Check equipment covers, cable entry points and cable glands for damage, which may permit the ingress of moisture or dust.
- Check equipment environs for evidence of flooding.
- Examine staple and padlocks for effective operation and security.
- Check equipment for other damage, particularly that caused by vandalism.
- Check for evidence of occupation by animals, insects or vegetation, which may detract from the operational efficiency of the equipment.
- Check the loops, cables and disconnection box of TPWS.

7.2 Check and Adjust

7.2.1 TPWS modules

- Check the VCR relay is energised.
- Check with either the signaller or Network Controller that no fault indication has been received at the signal.
- Check the LED indications on all modules are as follows.

LED	Color	State
Power On	Green	Lit
Fault	Red	Unlit

1. If failed indication alight, follow steps in System Reset section.
2. If failed indication reappears undertake fault investigation.

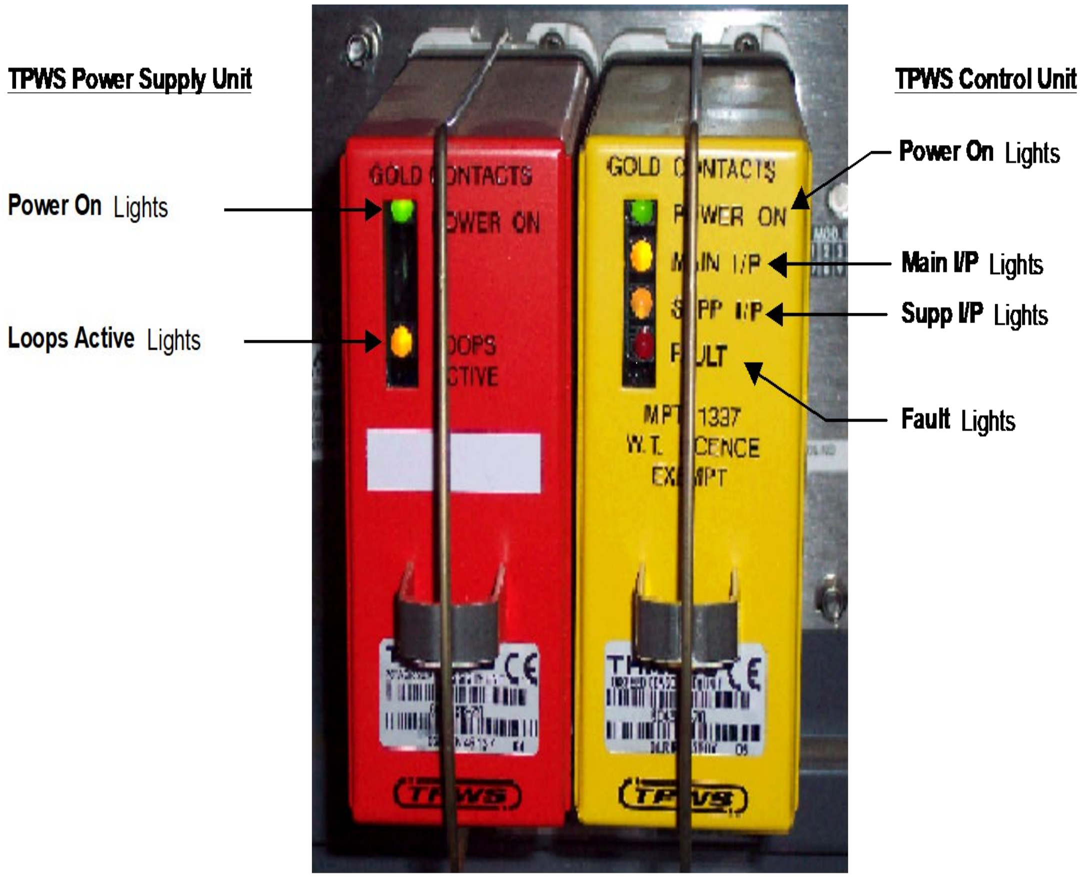
Notes:

3. Check that no other LED's change state whilst maintenance is occurring.
4. Check that the yellow signal status LED indications ('Main I/P' and 'Supp I/P') correspond with the signal aspects being displayed.
5. Check that the Power On (Green) LED is illuminated and measure the voltage between the BX110 and NX110 bus bar on terminals 3 and 4 on the back of the TPWS module.
6. Check that each unit is not excessively hot.

SPECIAL NOTE

Check the Power Module Installation Date. If the date is greater than 4 years the Power Module is to be replaced.

The removed Power Module is to be tagged for the Loop Proving Relay to be replaced.



7.2.2 Interference Test

1. Arrange for the Network Controller to display the correct aspect which ensures the loop is de-energised.
2. Check that the green "Power On" LED's are lit on all modules for the signal.
3. Check that the red "Fault" LED is not lit.
4. Check that the yellow "Main I/P" and "Supp I/P" are either both unlit or both lit.
5. Place the maintenance jig across the centre of the loop aerial and insert the test aerial (connected to the Fluke test-meter) 60-100mm below the top of the rail.
6. Measure the field strength which must be no more than 2 mV (measured on the 50mVac range or auto-scale).
7. Record the field strength (mVac) on the TPWS Maintenance Record Form.

7.2.3 Signal Strength Measurement

1. Arrange for the signaller to display the correct aspect to energise the loops.
2. Check that the VCR relay is energised if applicable.
3. Check that the green "Power On" LED's are lit on all modules for the signal.
4. Check that the red "Fault" LED is not lit.
5. Check that the yellow "Main I/P" and "Supp I/P" are lit and unlit respectively.
6. Place the maintenance jig across the centre of the loop aerial and insert the test aerial (connected to the test-meter) 60-100mm below the top of the rail.
7. Measure the field strength, which must be at least 29 mV but no greater than 53 mV (measured on the 50mVac range or auto-scale), and the frequency which must be within 0.01kHz of the aerial's stated frequency.
8. Record the field strength (mVac) and frequency (kHz; five digits) on the TPWS Maintenance Record Form.

7.2.4 Location and Network Controller Indications

De-energise the OSS Arming loop by slipping links to the loop output circuit and check that the following LED indications are shown:

LED	Function	State
OSM/TSM	Fault	Lit (Red)
SIM	Loop Active	Unlit

1. Check the VCR relay has de-energised.
2. Re-energise the OSS Arming loop by remaking the links to the loop output circuit and check that the following LED indications are shown:

LED	Function	State
OSM/TSM	Fault	Lit (Red)
SIM	Loop Active	Lit (Yellow)

1. Check the VCR relay has re-energised.
2. Reset the system, check that the fault LED is unlit.
3. Repeat test for OSS Trigger loop, TSS Arming and Trigger loops.

7.2.5 TPWS Loop Inspection

1. Check loop aerial flying leads, tail cables and flexible conduit, connector couplings and disconnection boxes.
2. Check loop aerial GRP (glass-reinforced plastic) panels – replace if broken or cracked.
3. Check height of loop aerials (60-100 mm below top of rails) and record onto the TPWS Maintenance Record Form.
4. Check fixing and condition of loop aerial beams and mounting clamps.

Note: Use a torque wrench to tighten the mounting clamp set screws to a torque of 8 Nm as required.

5. Check location of TSS and OSS as per in-service signalling plans.
6. Check cable ties securing the connector coupling halves together and securing the flying lead and tail cable to the loop aerial round cross-members.

7.2.6 System Reset

1. To reset the 'Fault' LEDs (red), the BX110 supply is to be disconnected for 5 seconds by the removal of the fuse in terminal no.1. The fuse holder should not become detached from the terminal block.
2. When you re-connect the fuse, the 'Power on' LEDs (green), on all modules become lit and all 'Fault' LEDs should become un-lit.
3. Warning: Voltages will still be present on the signalling inputs and fault outputs following isolation of the system at the TPWS trackside enclosure or equipment box.
4. Check that isolation fuses/links are in the correct position.

8 Removal for track works

To facilitate the track works, TPWS loops and cabling may require to be removed and replaced on tracks.

Before any removals and upon subsequent reinstallation of TPWS trackside infrastructure, measurements need to be taken between the TPWS infrastructure, signal, insulated rail joints or other TPWS loops.

This ensures that on the TPWS loop reinstallation, after any removals for track and civil type works, that the TPWS infrastructure is returned to its original position and in accordance to current signal plans and signal arrangement plans.

8.1.1 Initial Measurements prior to TPWS loop and cabling removals

Before any removals and upon subsequent reinstallation of TPWS trackside infrastructure, measurements need to be taken between the TPWS infrastructure, signal, insulated rail joints or other TPWS loops shall be undertaken.

This ensures that on the TPWS loop reinstallation after any removals for track and civil type works, that the TPWS infrastructure is returned to its original position and in accordance to current signal plans and signal arrangement plans

The following measurements should be taken and recorded for use in the reinstallation process, refer to the **X** positions on Diagram 1.

1. Measure the distance from the closest part of the TPWS loop to the IRJ (if there are insulated rail joints present)
2. Where there are no IRJ present, measure the distance from the closest part of the TPWS loop to the centre of the signal mast.
3. Measure the distance from both sides of the TPWS loop to the closest edge of the rail on either side of the TPWS loop.
4. Where there is a second TPWS loop in use, such as for an over speed sensor (OSS), take the measurement from the part of the TPWS loop closest to the signal, back to the corresponding part of the second TPWS loop
5. Record all measurements

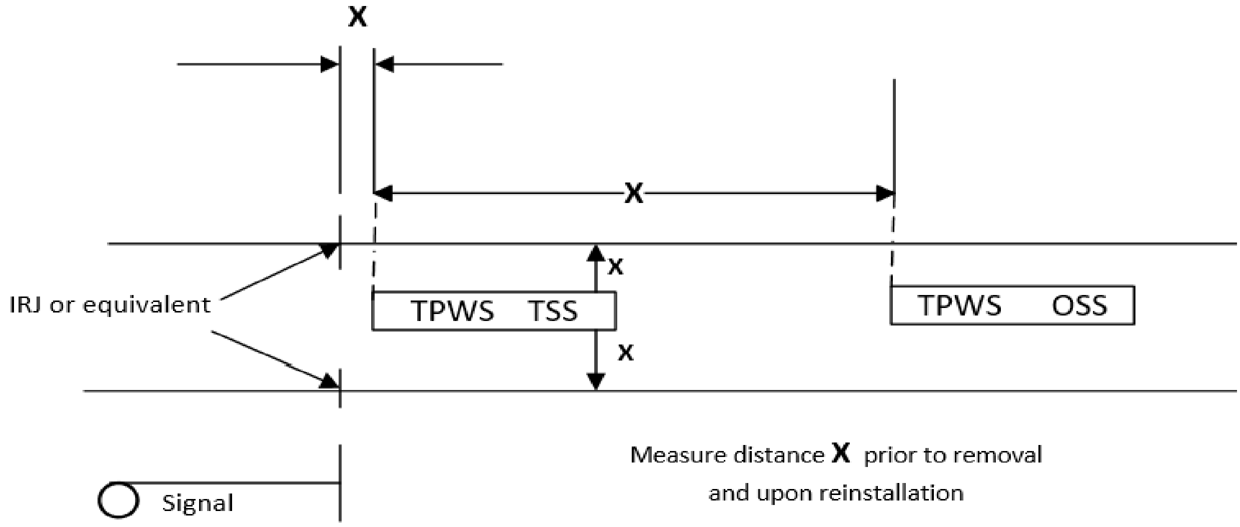


Figure 4 TPWS measurements

8.1.2 Removal of the TPWS loop and cabling

1. The cable connecting to the TPWS loop shall be disconnected at the TPWS loop plug coupler and placed in a secure position away from the track and civil type works to prevent damage.
2. The TPWS loop and fittings to rail or sleepers shall be removed and stored securely during the track and civil type works

8.1.3 Final measurements and reinstallation of the TPWS loop and cabling

1. The TPWS loop shall be reinstalled in the exact same position from where it was removed, using the measurements taken prior to removal, to ensure the TPWS loop is installed correctly.
2. Reconnect TPWS cabling to the TPWS loop.
3. If there is any doubt on the positioning of the TPWS loops, the current signal plans should be referred to.

8.1.4 Tests undertaken after reinstallation of the TPWS loop

Tests to ensure the safe operation of the TPWS system shall be undertaken after the installation of the TPWS loop and cabling.

9 Decommissioning

The following detail the steps and actions required decommissioning of the TPWS.

The TPWS system provides a safety enforcement function for trains equipped with the onboard TPWS equipment. The removal of this safety function should first be assessed to ensure that the "safe SFAIRP' requirement is met.

Where alternative systems are to be implemented, then the commissioning of these systems should be coordinated with the decommissioning of the TPWS.

9.1 Decommissioning Process

The trackside sub-system for the ARTC network is interfaced to the signalling system. This is a vital interface and any changes shall have approved and verified designs.

The initial TPWS interface is proposed to be designed to accept outputs from the signalling circuits. It is not proposed to have inputs from the TPWS into the signalling system. However, there will be inputs from the TPWS into the non-vital train control system (Phoenix). The decommissioning design shall cover the signalling system and the train control system.

Following are the steps for the decommissioning of TPWS.

Step 1 - Removal of power. The first step is to remove power to the TPWS signalling circuits. This is usually done by the removal of fuses. This includes the interface circuits from the vital signalling system. With the power removed from the TPWS the track aerials will not be operational at the location. They will have no impact on the trains (TPWS equipped) travelling over the non-energised aerials. This assists in the orderly decommissioning of the TPWS equipment distributed along a line. The onboard systems can remain in use for the TPWS aerials that are still operational elsewhere on the line.

Step 2 – Removal of track equipment. Remove the aerial from the track. In this case they are permanently removed.

Step 3 – Removal of Lineside equipment. Following the removal of the power (Step 1) the equipment within the lineside signalling Location Case can be de-commissioned from service. This will include the TPWS modules and any additional signalling circuits associated with them. It also includes circuits and equipment to generate alarms and output these to the train control system.

Step 4 – Removal of vital signalling interface. The signalling system has vital signalling outputs to the TPWS system. These are generally associated with the Signal aspect (for TSS) and the signal aspect or points detection (for OSS). These vital signalling circuits will be within the signalling location. These circuits are then de-commissioned from service. All of the associated wiring for the circuits is removed.

Step 5 – Certify design circuits for removals. The final step is the testing and certification of all of the circuit drawings for the completed removals.