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Westrace Computer Based Interlocking

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The technical content of this document has been approved by the relevant ARTC engineering authority and has also been endorsed by the ARTC Safety Committee.

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About This Standard

This Standard defines the procedures and tests to be followed when maintaining Westrace Computer based Interlocking.

This document is uncontrolled when printed.

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

Contents

1 General

The following instructions relate to Westrace computer based interlocking equipment. A Westrace card file can be considered as having the equivalent function as a rack of relays, with the interlocking logic programmed in Boolean.

1.1 Introduction and Scope

Westrace can be configured in various ways from a single card file interfacing to standard relay circuits, to a series of distributed card files connected with vital serial communication links, and direct lamp driver modules.

Some installations use the Westrace only as the central interlocking with the interface to external equipment using conventional relays.

Westrace can operate from a local control panel via a panel multiplexer or can operate from a remote control centre.

At Wyong a Westinghouse S2 system provides the interface to the Westrace and can be considered as equivalent to a non-vital relay panel and telemetry system.

1.2 References

The Westrace and S2 systems are detailed in the following Westinghouse publications:

Westrace First Line Maintenance Manual - Wyong

Document CI WRTOWYON, Issue 1.0 27th July 1995 and Westrace first line Maintenance Manual Issue 5.0, 3/8/01

Westrace System Overview Manual

Document CI WRTOOVER, Issue 1.2 19th May 1995 to Issue 4.0, 29/9/00 **The**

maintenance procedures detailed in these manuals must be followed.

The Westrace First Line Maintenance Manual - Wyong is specifically tailored to the Westrace installation at Wyong. Future installations will have a generic First Line Maintenance Manual with an attached supplement for each particular installation.

2 Westrace Procedures

2.1 General

Where there is a conflict between this document and the two Westinghouse manuals listed in 1.2, this document is to take precedence. The procedures given hereunder are those specific to Westrace. They are supplementary to other procedures contained within this manual, which are to be followed where relevant.

2.2 Module handling

The integrity of Westrace modules being placed into service is paramount. All modules must be handled, transported and stored with care, and not in any manner, condition or circumstance that would subject them to damage or deterioration. Westrace modules must be in enclosed buildings or locations in a clean, dry non corrosive environment. The Anti-Static Protection handling procedures listed in the Maintenance Manual are to be followed when handling the modules.

3 Responsibility in the Event of an Irregularity

3.1 Signalling Maintainer

The signalling maintainers first duty is protection of the line in accordance with Procedure SMP 03 and Paragraph 4 herein.

Incident reporting, inspections and examinations shall also be carried out in accordance with Procedure SMP 03.

The technicians event log stored on the PC (or PC's if more than one) should be examined for evidence of equipment failure or malfunction. The PC based Diagnostic Module (DM) Technician Interface or Moviola PC should be used to determine the errors listed by the Diagnostic Module (s).

All unexpected activity shall be recorded in the Westrace log book provided for the purpose at each location where Westrace is used.

Evidence of system operation during the incident is recorded on the Westrace DM PC Logging Package or Moviola PC. The signalling maintainer is solely responsible for ensuring that the logger is not touched or tampered with in any manner, prior to the arrival of a Signal Engineer.

The indications displayed on all Westrace modules, shall be recorded, along with their associated serial numbers. It may be necessary for these modules to be removed later for investigation. Ensure that all of the panel indications, S2 indications, relevant relay positions, field equipment etc are also recorded as they may provide valuable information.

3.2 Signal Engineer

3.2.1 Log Analysis

A Signal Engineer is responsible for investigating the incident.

The Signal Engineer shall copy the relevant log files from all the event loggers to floppy disk, and then, using the edit/view program, analyse the event data to check what events occurred in the Westrace interlocking during the time of the incident.

An incident report shall be produced from the analysis. In the event of an irregularity being detected the ARTC Corridor Manager or nominated Signalling representative is to be immediately contacted. The signalling control tables and application data listings will be examined and appropriate instructions for any further action will be given. The Configuration Check Sub System (CCSS) software may be used to download the application data to do a Configuration Check of the Application Data.

3.2.2 Removal of Equipment

Westrace modules suspected of mal-operation shall be initially subjected to functional tests insitu. These tests shall simulate, as accurately as possible, the events leading to the irregularity, and module behaviour shall be observed and recorded. If the incident warrants, the module in question shall be removed and returned to Westinghouse for a detailed examination. Full details shall be recorded of any modules removed.

4 Protection of the Line

4.1 Disconnection's

When it is required to disconnect signalling apparatus, the necessary safe working procedures shall be strictly observed as stipulated in
SMP 09.

4.1.1 Disconnection of Signals

Signals operated by Westrace can be controlled using BRB Q style relays via a Vital Relay Output Module (VROM) or they may be directly driven from a Vital Lamp Output Modules (VLOM)

>   a)   For Signals using BRB Q style relays use the conventional method for disconnecting the signal and placing at stop.

>   b)   For Signals Controlled by a VLOM use the following method for disconnecting the signal and placing it at stop:

Westrace interlockings will have the boolean application logic arranged so that the cold lamp proving of the yellow and green lamps will prevent the signal clearing up if both these lamps are not present.

This allows the holding of a signal at stop by the removal of the pins feeding the higher aspects. Where this method of disconnection is used, a listing of the pins that need to be removed is to be provided in each location, for the signals fed from that location. Pins must always be completely removed.

When disconnected, and the location is to be left unattended, tape is to be applied over the links and the disconnection's clearly labelled to prevent inadvertent reconnection.

Ensure a lever sleeve is applied to the lever on the panel (or a non vital route block for a VDU based system).

When reconnecting, test that the higher aspects function and cancel the error messages that indicate the lamps were out.

4.1.2 Disconnection of Points

All Westrace systems use conventional BRB Q relay based interface circuits for points operation and detection. The disconnection of the points is the same as a conventional relay based interlocking.

5 Failures

The Westrace First Line Maintenance Manual contains detailed procedures for dealing with faults within the Westrace equipment. The information given in this section outlines the module failure modes and principal actions required.

5.1 Panel Processors

Failure of both S2 panel processors or WestCad will result in loss of communication between the signalling panel and the Westrace interlocking.

Panel indications may freeze. This failure should be indicated by an audible and visual alarm on the signaller's panel.

The Westrace interlocking will continue to function normally. Routes that are already set will remain set with signals cleared as appropriate, and trains will be moving in response to the signalling. It will not be possible to set or cancel any routes.

This failure will persist until a serviceable panel processor(s) is installed in place of the faulty equipment.

5.2 Failure of Westrace

All signals will remain at stop and all points will remain in their current position. This situation will persist until serviceable modules are installed in place of the faulty equipment.

When a Westrace interlocking is first switched on after successful repair there is approximately 28 seconds to start up followed by a 2 minute application data delay before normal working can be resumed.

5.3 Reporting

The failure reporting requirements are detailed in SMP 04.

A further Westrace Equipment Failure Report Form, as detailed in the Westinghouse First Line Maintenance Manual, must be completed with the appropriate information associated for each failure at the Westrace installation. This form shall be signed and attached to the associated Failure Report Form.

A copy of this Westrace Equipment Failure Report is to be sent to the Signal Maintenance Engineer responsible.

Westinghouse Brake & Signal South Melbourne must be sent a copy of the Westrace Equipment Failure Report as specified in the maintenance manual.

5.4 Track Circuits

Westrace interlockings do not allow for conventional methods to manually release route holding or approach locking.

Track circuit failures will need to be rectified and affected traffic operated under the appropriate Safeworking Unit procedures.

6 Maintenance Policy

6.1 Test Equipment

6.1.1 Use of Special Westrace Test Equipment

Test equipment specifically designed for Westrace is provided, and shall be operated in accordance with the manufacturers instructions.

6.1.2 Westrace GO/NO-GO tester

This is provided to enable Westrace system modules to be functionally tested before being installed, for example as a replacement for a failed module.

All modules shall be tested on the GO/NO-GO tester before being installed on a working installation.

The GO/NO GO tester does not fully test all functions of all modules. It is possible although unlikely for a module to work correctly in the tester but fail to operate in a Westrace system.

When a module is suspected of having failed, test it in the Westrace GO/NO GO tester to confirm the fault before sending for repair in accordance with Section 3. If the module is not initially proven defective in the Westrace Go-No Go Test Unit, then the module is to be left operating continuously for 7 days in the test unit. If no errors occur then it may be returned to service, otherwise return for repair with details of the errors.

6.2 Exchange of Modules

6.2.1 Repair

Field repairs are not to be carried out on any vital Westrace modules. These items must be returned to Westinghouse Brake & Signal (WBSA) South Melbourne, or their agent, for repair. The NVC module and the S2 modules although non-vital are not to be repaired in the field. These modules must also be returned to WBSA South Melbourne, or their agent, for repair.

6.2.2 Removal of Modules

DO NOT remove any modules for routine maintenance unless a failure has occurred and there has been a need to replace a Westrace module. **Always power off** the Westrace and follow the Anti-Static Protection handling procedures listed in the Maintenance Manual before removing or inserting any modules.

Should any module be replaced as being initially considered faulty, and the fault not be rectified by the replacement module, the original module should be returned to the card file, prior to further testing.

Any time a module is removed and replaced, inspect the module for damage and ensure the backplane connectors are not loose or damaged. As a general rule, modules should not be removed or replaced unless fault finding.

After any module is replaced, the inputs or outputs of that module are to be checked for correct operation. For VROM modules, ensure that the procedure (First Line Maintenance Manual section 6.2.2) for testing the VROM outputs for short circuits is carried out.

After changing a lamp driver module, the lamp voltages for the lamps operated by the module are to be checked and adjusted if necessary. In the case of other modules, ensure the Westrace system as a whole is functional by coming out of reset with no errors. Full details of tests are provided in the first line maintenance manual.

6.3 Failure of HVLC Module

In the event of a HVLC module failure, the Application Data EPROMs must be removed from the defective module and inserted into the new module. Ensure that the Anti-Static Protection procedures are followed as specified in the First Line Maintenance Manual.

Only remove and install one EPROM at a time. Take care to ensure they are inserted into the correct place and that the notch position is correct (ie. not installed backwards). Ensure that EPROMs are not damaged during changing. Use the supplied EPROM removal and insertion tools. Ensure that the Configuration DIP switch on the new module is adjusted to be the same as the configuration documentation in the circuit book. After startup of the Westrace a check of the configuration should be made using the Diagnostic Module Technician Terminal Interface to confirm that the Westrace has been configured as specified by the documentation.

It is not necessary to re-check the application logic EPROMS using the ICS software as any EPROM errors will result in failure of the Westrace system.

6.4 Failure of EPROMs

Westrace Application Data EPROMs are vital EPROMs as they contain the interlocking data. Spare Application data EPROMs must be registered and kept in a secured place under strict version control by the Maintenance Supervisor and in accordance with the manufacturers recommendations.

The Signal Engineer is to attend and supervise the installation of replacement EPROM's

Care must be taken that the correct EPROM is installed by checking the details shown on the labels, and ensuring that they are identical with the failed EPROMs and the circuit book documentation. The correct version number, date and checksum must be verified.

After installation, ensure the system comes out of reset and that no errors occur.

An EPROM change report is to be made to the Principal Design Engineer Signals at the same time as a replacement EPROM is requested. The defective EPROM from site is to be labelled "DEFECTIVE" on the underside and on the topside (the version details are to remain visible) and is to be returned to the Principal Design Engineer Signals for cancellation. **Under no circumstances are vital EPROMs to be duplicated by maintenance staff.**

6.5 Application Logic Changes

Application Logic changes can only be done by a suitably accredited supplier. Upgrade of version numbers, etc must only be done in conjunction with a full design integrity test, and will require updating of the Configuration DIP switch on the HVLC module and documentation.

6.6 Failure Log

The suitably accredited signalling maintainer is to maintain a log of Westrace module failures and Westrace system shutdowns for future analysis of reliability and as a record of the age of the installed modules.

This record should be on the attached Westrace failure form and a entry should be made in the Westrace log book kept on-site with the Westrace interlocking and is additional to the normal SIGCOM failure report.

6.7 Insulation Testing

Care is to be taken that wiring connected directly to the Westrace is not insulation tested. However, testing must be carried out on wiring which can be isolated from the Westrace by the removal of plugs, fuses, links or by the de-energisation or removal of relays.

6.8 Monthly Maintenance

Every month the following tasks are to be conducted:

a) Check event logger or Moviola by viewing the log and confirm that the logger is operating correctly. Any errors are to be noted and their causes determined and resolved. The PC time/date and the DM module time/date are to be checked and adjusted as required.

Error codes are provided with explanations in the first line maintenance manual. All critical errors and errors that may indicate a possible safety related problem are to be referred immediately to the ARTC General Manager ISP or nominated Signalling representative by the Signal Maintenance Engineer.

Reliability related codes are to be referred to the Maintenance Supervisor. Codes that reflect a failure rectified by a signalling maintainer (eg. lamp out) need not be referred.

b) **For areas with cold standby Westrace interlockings:**

Ensure all routes are cancelled and points are normalised while the Westrace is operating from the 'A' side.

Power up 'B' side Westrace and switch to 'B' side and also switch event logger PC to 'B' side. Confirm that the Westrace 'B' system and the event logger is operating correctly. This confirmation is done by clearing some signals and confirming that the event changes are in the event log file. The error log file is to be checked to confirm that no errors are present with the 'B' system.

When correct operation has been achieved from the 'B' side the Westrace system and the event log PC are to be switched back to the 'A' side. The system is then to be checked to see that the Westrace system is now correctly operating on the 'A' side. The 'B' side is then to be switched off.

c) Record the Westrace 24V battery supply and check the charger for correct operation.

6.9 Every 3 Months

Every 3 months the following tasks are to be conducted:

a)   Ensure all modules are firmly home in the cardfile.

b)   Visually check all wiring terminations and plugs for looseness or defective connections and rectify as necessary. If necessary, confirm tightness by a gentle wire pull.

c)   Delete all event log files older than 4 weeks

6.10 Equipment Records

6.10.1 Hardware Records

Each Westrace interlocking area shall maintain a database containing the detailed records of all Westrace equipment associated with the area. This record should contain all module serial numbers and operating days for each module as well as information on module failures and stocks of spare modules.

6.10.2 Software Records

All Westrace interlockings shall maintain proper documentation for the Application data configurations and of the Westrace vital application logic currently in use.

6.11 Spares

The level of spares holdings is determined by the type and number of installed modules.

Full lists of the spares provided for the control centre shall be made available and maintained at the appropriate depot.

   It is important to ensure that any spare module installed is of the correct version for the system.

Spare modules should be tested on a 2 yearly basis to ensure the spares remain viable. All spare modules shall be fully tested and certified as operational before being placed into the

stock of spares. Spare modules are to be appropriately stored in a secured place, in their protective envelopes.

On receipt of a new spare module or a repaired module, test the module in the Westrace Go-No Go Test Unit provided before storage. Label the module envelope with the date of the test and whom it was performed by.

7 S2 Panel Processor

The S2 forms the non-vital part of the Westrace system. A failure of both sides of the S2 will result in loss of controls and loss of indications for the entire interlocking.

All faulty modules are to be returned to the manufacturers for repair.

All failures of the S2 are to be recorded and a copy of the failure report is to be sent to WBSA South Melbourne and to Signal Maintenance Engineering. The standard equipment failure report form and associated procedures are to be utilised.

8 Glossary of Terms - Abbreviations

VPIM	Vital Parallel Input Card
VROM	Vital Relay Output Module
VLOM	Vital Lamp Output Module
HVLC	Hot standby Vital Logic Card
HVLM	Hot standby Vital Logic Module
DM	Diagnostic Module
ICS	Integrated Configuration System
S2	System 2 Telemetry system capable of panel processing (Westinghouse)
EPROM	Erasable Programmable Read Only Memory