



AUSTRALIAN RAIL TRACK CORPORATION LTD

This document has been adopted by the ARTC with the permission of the NSW Government and will continue to apply under the authority of the ARTC General Manager Infrastructure, Strategy & Performance until further notice

Discipline
Engineering Standard – NSW

Category
Electrical

Title
Commissioning of Translay Pilot Wire Protection Scheme

Reference Number
PCP 01 – (RIC Standard: EP 19 00 00 03 SP)

Document Control

Status	Date	Prepared	Reviewed	Endorsed	Approved
Issue 1 Revision 1	Mar 05	Standards and Systems	Signalling Standards Engineer	GM Infrastructure Strategy & Performance	Safety Committee
		Refer to Reference Number	T Moore	M Owens	Refer to minutes of meeting 24/01/05

Disclaimer

Australian Rail Track Corporation has used its best endeavors to ensure that the content, layout and text of this document is accurate, complete and suitable for its stated purpose. It makes no warranties, express or implied, that compliance with the contents of this document shall be sufficient to ensure safe systems of work or operation. Australian Rail Track Corporation will not be liable to pay compensation in respect of the content or subsequent use of this document for any other purpose than its stated purpose or for any purpose other than that for which it was prepared except where it can be shown to have acted in bad faith or there has been willful default.

Document Approval

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.

Document Supply and Control

The Primary Version of this document is the electronic version that is available and accessible on the Australian Rail Track Corporation Internet and Intranet website.

It is the document user's sole responsibility to ensure that copies are checked for currency against the Primary Version prior to its use.

Copyright

The information in this document is Copyright protected. Apart from the reproduction without alteration of this document for personal use, non-profit purposes or for any fair dealing as permitted under the Copyright Act 1968, no part of this document may be reproduced, altered, stored or transmitted by any person without the prior written consent of ARTC.

About This Standard

The most common type of 'unit' protection used on the ARTC high voltage network is Translay pilot wire protection. This publication sets out the general requirements for the testing and the recording of test results during the commissioning of a new Translay pilot wire protection scheme. The relevant sections of this publication shall also apply when an existing Translay pilot wire protection scheme is re-commissioned following any alterations to the system.

Document History

Primary Source – RIC Standard EP 19 00 00 03 SP Version 1.0

List of Amendments –

ISSUE	DATE	CLAUSE	DESCRIPTION
1.1	11/03/2005	Disclaimer	Minor editorial change

Contents

About This Standard	3
Document History	4
1. Scope and Application	6
2. Definitions & Abbreviations	6
3. Introduction	6
4. Pre-Commissioning Procedure	7
5 Commissioning Procedure	7
5.1 Pilot Circuit Measurements and Testing	7
5.2 HMB4 Loop Resistance Compensation and Sensitivity	7
5.3 Supervision Relay Adjustment	7
5.4 Verifying Phasing Between Substations	7
6. Post Commissioning Procedure	8
6.1 Verifying Failure Alarms	8
6.2 Supervision Relay Re-Adjustment	8
7. Data Set associated with the Equipment	8

1 Scope and Application

The most common type of ‘unit’ protection used on the ARTC high voltage network is Translay pilot wire protection. This publication sets out the general requirements for the testing and the recording of test results during the commissioning of a new Translay pilot wire protection scheme. The relevant sections of this publication shall also apply when an existing Translay pilot wire protection scheme is re-commissioned following any alterations to the system.

2 Definitions & Abbreviations

ACCB Alternating Current Circuit Breaker

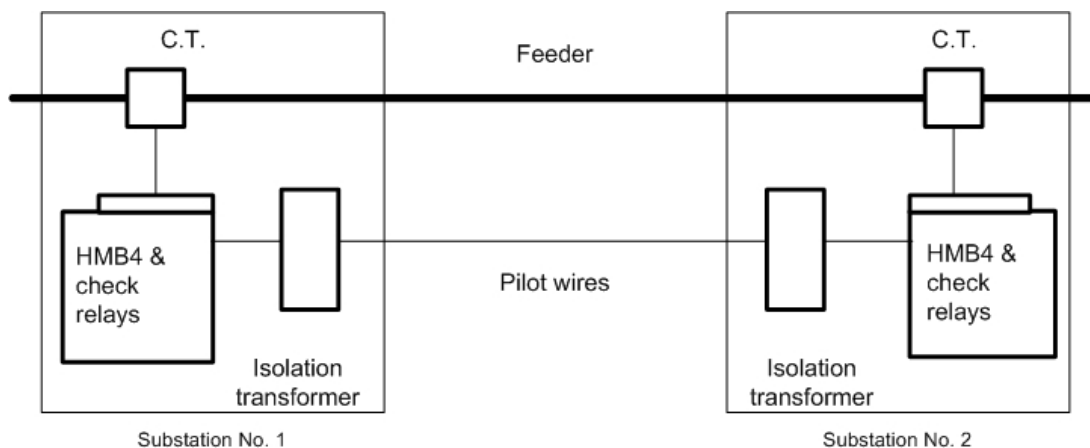
CT Current Transformer

EOC Electrical Operating Centre

3 Introduction

“Translay” protection schemes exist throughout the ARTC high voltage network and are a very important element in the overall protection of the high voltage system.

The most common “Translay” scheme used in the ARTC network is that using HMB4 relays made by GEC Alsthom. Refer to figure 1. These relays use the output of current transformers (CT’s) to represent the 3 phase currents in the form of a single phase voltage. The voltages produced by each relay are proportional to the current flowing in the transmission line being protected. A relay is installed on each end of the line. Under normal conditions, the voltages produced by the HMB4 relay at each end of the feeder should have the same magnitude and phase and negligible ac current should flow around the pilot circuit.



Note: Pilot wire relay detects faults between CT1 and CT2 only.

Fig. 1 – HMB4 pilot wire scheme between two substations

When a fault occurs on a feeder, ac current flows in the pilots due to the imbalance of the currents at each end and the corresponding difference in pilot voltage produced by each relay.

A d.c. pilot supervision current does, however, normally flow around the pilot circuit. This is injected onto the pilots at a pilot isolation transformer at one of the

substations. The substation at which the current is injected is referred to as the “sending end” substation.

In addition, ARTC has adopted the practice of installing current check relays in pilot wire schemes. By installing the trip contacts of these current check relays in series with the trip contacts of the HMB4 relays, the circuit breakers are then only operated when both relays detect a fault. This practice effectively ensures that no ACCB trips arise from the pilots being tampered with or failing.

Hence an ACCB will only trip if the HMB4 operates and the fault current is of sufficient magnitude to pick-up the current check relays.

4 Pre-Commissioning Procedure

In substations where one bus section ACCB provides protection for two feeders, a check shall be carried out to ensure the connections between the bus section and the rectifier current transformers are correct.

5 Commissioning Procedure

5.1 Pilot Circuit Measurements and Testing

Measure and record the pilot insulation resistance.

- Pilot no.1 to earth.
- Pilot no.2 to earth.
- Pilot no.1 to Pilot no.2.

The insulation resistance shall be greater than 5 MΩ.

Measure and record the pilot circuit capacitance. The pilot capacitance shall be in the order of 0.05 μF/km.

Measure and record the pilot loop resistance.

5.2 HMB4 Loop Resistance Compensation and Sensitivity

Compensation shall be set on the HMB4 relay to ensure the relay is working within its designed loop resistance of 1000 Ω.

5.3 Supervision Relay Adjustment

Adjust the SJA pilot supervision unit to ensure that the output from its Wheatstone bridge circuit is at a minimum under normal pilot conditions. The voltage shall be set as close to zero as possible achievable, at least within 20 mV.

Measure and record the voltage from the SJA pilot supervision unit.

5.4 Verifying Phasing Between Substations

Tests shall be conducted to verify that, for each phase, current entering the feeder at one end and leaving the feeder at the other results in the output of both HMB4 relays being of essentially the same phase and magnitude.

6 Post Commissioning Procedure

6.1 Verifying Failure Alarms

Verify, and record, by means of simulated failures, such as opening links and fuses, all relevant alarms and flags, including:

- pilot circuit failure relay flag
- open pilot alarm at EOC
- supervisory supply failure relay flag
- HMB4 flags
- current check relay flag

6.2 Supervision Relay Re-Adjustment

Check and record the dc voltage across the test terminals of the supervision relay to ensure that the voltage has not changed significantly.

Adjust and record the voltage if the potentiometer is required to be readjusted for minimum dc voltage.

7 Data Set associated with the Equipment

The results of the Pre-commissioning, Commissioning and Post Commissioning procedures shall be recorded and maintained by the Maintenance Provider responsible for the installation in which the pilot wire protection equipment is installed. These results include:

- Pilot insulation resistance;
 - Pilot no. 1 to earth;
 - Pilot no. 2 to earth;
 - Pilot no. 1 to Pilot no. 2;
- Pilot circuit capacitance;
- Pilot loop resistance;
- SJA pilot supervision voltage;
- Verification of alarms and flags;
 - pilot circuit failure relay flag;
 - open pilot alarm at EOC;
 - supervisory supply failure relay flag;

- HMB4 flags;
- current check relay flag;
- Supervision relay dc test voltage.