



# INSTALLATION • OPERATION • MAINTENANCE INSTRUCTIONS

## TYPE HZ-1 IMPEDANCE RELAY

**CAUTION:** Before putting protective relays into service, remove all blocking which may have been inserted for the purpose of securing the parts during shipment, make sure that all moving parts operate freely, inspect the contacts to see that they are clean and close properly, and operate the relay to check the settings and electrical connections.

### APPLICATION

The type HZ-1 relay is a single unit high speed impedance relay with an impedance unit of the balanced beam type and a high speed directional unit. The relay is used for directional phase fault protection over 80 to 90% of the transmission line section and supplements the existing slow speed relays which protect the remaining 20 to 10% and provide back up protection.

### CONSTRUCTION

The type HZ-1 Relay contains an instantaneous impedance unit, a directional unit, a contactor switch, and an operation indicator. The units are constructed as follows:

#### Impedance Unit

Construction details of this unit are shown in Fig. 1. A balanced beam is pulled downward on the contact end by a current coil and on the other end by two voltage coils. The fluxes of these two potential coils are shifted out of phase with respect to each other to produce a steady pull so that practically a constant balance can be obtained regardless of the phase angle between the current and voltage coil fluxes. A tap screw on the front of the unit permits changing the number of turns on the current coil, and a core screw on the bottom of the unit changes an air gap in the magnetic path. These two adjustments make it possible to set the unit.

A rectangular silver contact is flexibly fastened on the forward end of the beam. As the beam trips, the contact bridges two silver stationary hemispherical contacts mounted on the free end of a short leaf

spring. A small set screw determines the position of the leaf spring and provides means for adjusting the contact gap.

#### Directional Unit Single Loop

The voltage coil of the directional unit serves as the primary winding of a small transformer. The secondary winding consists of a one turn movable coil, or loop, pivoted along its center line. This loop carries a current which is proportional to and substantially in phase with the voltage applied to the primary winding. The pivoted loop has a portion of its length lying in a magnetic field established by the current coils of the directional unit. The interaction of the current in the loop with the flux established by the current coils produces torque which rotates the loop in one of two directions, depending upon the phase angle relationship between the applied current and the applied voltage.

A ceramic arm extends from the moving loop and supports a rectangular silver contact which bridges two stationary contacts located on the right of the loop. The stationary contacts are silver hemispheres mounted on the lower end of vertically-hanging spring leaves. The contact separation is adjustable by a small screw near the upper end of the rigid stationary contact supporting arm. One of these supporting arms hangs parallel to each of the two stationary contacts. The set screw on the lower end of this arm provides the contact follow adjustment. An additional screw on the movement frame beneath the current coil iron limits the movement of the one-turn loop to the left.

#### Contactor Switch

This is a small solenoid type d.c. switch. A cylindrical plunger with a silver disc mounted on its lower end moves in the core of the solenoid. As the plunger travels upward the disc bridges three silver stationary contacts.

# Impedance Relay Manual

**Association of American Railroads.  
Signal Section**



## **Impedance Relay Manual:**

**Electric Relays** Vladimir Gurevich, 2018-10-03 Electric relays pervade the electronics that dominate our world They exist in many forms fulfill many roles and each have their own behavioral nuances and peculiarities To date there exists no comprehensive reference surveying the broad spectrum of electric relays save one *Electric Relays Principles and Applications* This ambitious work is not only unique in its scope but also in its practical approach that focuses on the operational and functional aspects rather than on theory and mathematics Accomplished engineer Dr Vladimir Gurevich builds the presentation from first principles unfolding the concepts and constructions via discussion of their historical development from the earliest ideas to modern technologies He uses a show not tell approach that employs nearly 1300 illustrations and reveals valuable insight based on his extensive experience in the field The book begins with the basic principles of relay construction and the major functional parts such as contact and magnetic systems Then it devotes individual chapters to the various types of relays The author describes the principles of function and construction for each type as well as features of several relays belonging to a type that operate on different principles Remarkably thorough and uniquely practical *Electric Relays Principles and Applications* serves as the perfect introduction to the plethora of electric relays and offers a quick reference guide for the experienced engineer *Technical Manual* United States Department of the Army, 1954 **Technical Manual** United States. War Department, 1959 **Power Control Circuits Manual** R. M. Marston, 2016-01-22 *Power Control Circuits Manual* presents a comprehensive review of electronic power control The book is comprised of eight chapters that deal with a specific aspect of power control The text first discusses the basic principles of electrical electronic power control and then proceeds to presenting practical control circuits using conventional switches and relays Chapter 3 discusses ways of using CMOS devices as low power electronic switches while Chapters 4 and 5 deal with AC and DC power control systems Next the book presents ways of controlling DC motors and the remaining two chapters deal with audio power control and DC power supply systems respectively The book will be of great use to design engineers and technicians Undergraduate students of electronics related degree will also find this book interesting *The Relay Testing Handbook #9D*: Chris Werstiuk, 2012-02-28 *The Relay Testing Handbook* was created for relay technicians from all backgrounds and provides the knowledge necessary to test most modern protective relays installed over a wide variety of industries Basic electrical fundamentals detailed descriptions of protective elements and generic test plans are combined with examples from real life applications to increase your confidence in any relay testing situation A wide variety of relay manufacturers and models are used in the examples to help you realize that once you conquer the sometimes confusing and frustrating man machine interfaces created by the different manufacturers all digital relays use the same basic fundamentals and most relays can be tested by applying these fundamentals This package provides a step by step procedure for testing the most common distance protection applications used by a variety of manufacturers Each chapter follows a logical progression

to help understand why distance protection is used and how it is applied Testing procedures are described in detail to ensure that the distance protection has been correctly applied Each chapter uses the following outline to best describe the element and the test procedures ApplicationSettingsPickup TestingTiming TestsTips and Tricks to Overcome Common ObstaclesReal world examples are used to describe each test with detailed instructions to determine what test parameters to use and how to determine if the results are acceptable Thank you for your support with this project and I hope you find this and future additions of The Relay Testing Handbook to be useful

**The Relay Testing Handbook #2D** Chris Werstiuk,2007-06 As modern protective relays become increasingly more powerful and complex many relay testers continue to use test procedures and philosophies that are based on previous generations of relays and their limitations Modern relays have very different characteristics that require a different testing philosophy to ensure that they will operate when required As the second of The Relay Testing Handbook series Relay Testing Fundamentals builds on the electrical theory principles introduced in the first package Electrical Fundamentals for Relay Testing In this in depth discussion of protective relays you will learn about the history of protective relaying including Electromechanical relays Solid state relays Simple microprocessor relays Multifunction microprocessor relays Relay testers of all skill levels can benefit from a solid foundation of relay testing fundamentals the foundational elements included in this book include Reasons for relay testing Essential relay testing equipment The importance of using different test techniques for various relay generations Traditional test procedures for element testing Logic and dynamic testing Combining test techniques for more efficient and effective relay testing Applying test techniques that take advantage of modern test equipment and software This book is included in the hardcover book The Relay Testing Handbook Principles and Practice or it can be ordered by itself as a soft cover book Adobe Acrobat PDF digital download or both Paperback 86 pages Trim Size 8 5x11 Publisher Valence Electrical Training Services LLC Language English ISBN 13 978 1 934348 05 5 LCCN 2012934618

**The Relay Testing Handbook #4D** Chris Werstiuk,2007-10 As modern protective relays become increasingly more powerful and complex many relay testers continue to use test procedures and philosophies that are based on previous generations of relays and their limitations Modern relays have very different characteristics that require a different testing philosophy to ensure that they will operate when required The Relay Testing Handbook Creating and Implementing Test Plans outlines step by step procedures that will enable you to create and implement protective relay test plans for modern relay systems ensuring accurate and efficient relay testing for nearly every application Use the information in this book to Collect and compare drawings settings and engineering studies to evaluate the application Compare all of the available documentation to the manufacturer s literature Prepare to test the relay by correctly isolating it from the rest of the system Establish communication with the relay and apply the settings Properly connect your test set to the relay Perform acceptance tests Design your test plan using conventional test techniques or implement more efficient and effective ones Implement your test plan or apply common test plans for feeder generator or

line protection Prepare your report and test sheets This book is included in the hardcover book *The Relay Testing Handbook Principles and Practice* or it can be ordered by itself as a soft cover book Adobe Acrobat PDF digital download or both Paperback 98 pages Trim Size 8 5x11 Publisher Valence Electrical Training Services LLC Language English ISBN 13 978 1 934348 07 9 LCCN 2012934620 **The Relay Testing Handbook #8D** Chris Werstiuk, 2012-11-08 The Relay Testing Handbook was created for relay technicians from all backgrounds and provides the knowledge necessary to test most of the modern protective relays installed over a wide variety of industries Basic electrical fundamentals detailed descriptions of protective elements and generic test plans are combined with examples from real life applications to increase your confidence in any relay testing situation A wide variety of relay manufacturers and models are used in the examples to help you realize that once you conquer the sometimes confusing and frustrating man machine interfaces created by the different manufacturers all digital relays use the same basic fundamentals and most relays can be tested by applying these fundamentals This package provides a step by step procedure for testing the most common differential protection applications used by a variety of manufacturers Each chapter follows a logical progression to help understand why differential protection is used and how it is applied Testing procedures are described in detail to ensure that the differential protection has been correctly applied Each chapter uses the following outline to best describe the element and the test procedures 1 Application 2 Settings 3 Pickup Testing 4 Timing Tests 5 Tips and Tricks to Overcome Common Obstacles We will review techniques to test differential relays with 3 or 6 channels so that readers can test nearly any differential application with any modern test set

**Field and Depot Maintenance Manual**, 1989 Manual of Recommended Practice Association of American Railroads. Signal Section, 1925 *Protection Technologies of Ultra-High-Voltage AC Transmission Systems* Bin Li, Yongli Li, Jiali He, Yuping Zheng, 2020-01-28 Protection Technologies of Ultra High Voltage AC Transmission Systems considers the latest research on UHV transmission line electromagnetic field transmission line parameters and tower structures with a focus on protective relaying of UHV transmission systems This book gives insights into protective relaying of UHV AC transmission systems and sheds light on the conundrum of protective relaying for the EHV systems In addition it elaborates on both traditional relaying and the application of new type current differential protection distance protection and automatic reclosing as well as protective schemes for transformers and reactors in UHV transmission systems This resource will serve as an important reference for technical personnel in network design and operation as well as students and engineers in related engineering areas The Relay Testing Handbook #7: End-to-End Testing Chris Werstiuk, 2013 This package provides an overview of End to End testing and answers the most common questions a relay tester should ask before performing their first End to End test A basic introduction of this test technique is followed by a step by step procedure for performing a successful end to end test This package also includes an overview of the most common communication assisted protection schemes to help the reader understand how these schemes operate Go to <http://relaytraining.com> product end to

end testing print for more information This paper will NOT be part of the final Relay Testing Handbook Switchgear and Power System Protection Ravindra P. Singh,2009-12 Besides the book contains a detailed treatment of protective schemes used to encounter fault conditions that may occur individually in generators motors transformers busbars and distribution circuits Protection against switching surges and lightning is also discussed The final chapter on power system management provides a simple introduction to that important area in order to emphasize the importance of optimal economic operation of power systems in which protective schemes under fault conditions play a crucial role towards continuity of electrical supply with minimum damage to life equipment and property **The Relay Testing Handbook #6D** Chris Werstiuk,2009-08 As modern protective relays become increasingly more powerful and complex many relay testers continue to use test procedures and philosophies that are based on previous generations of relays and their limitations Modern relays have very different characteristics that require a different testing philosophy to ensure that they will operate when required The Relay Testing Handbook Testing Overcurrent Protection 50 51 67 provides step by step procedures for testing the most common overcurrent protection applications This volume is designed to help you understand and test Instantaneous overcurrent protection 50 Inverse time overcurrent protection 51 Directional overcurrent protection 67 Each chapter explains the following topics for each element with realistic practical examples and detailed instructions Understanding the application Determining which settings are most important Recommended steps to correctly plan perform and evaluate pickup tests Recommended steps to correctly plan perform and evaluate timing tests Preventing interference from other settings inside the relay Tips and tricks to overcome common obstacles This book is included in the hardcover book The Relay Testing Handbook Principles and Practice or it can be ordered by itself as a soft cover book Adobe Acrobat PDF digital download or both Paperback 70 pages Trim Size 8 5x11 Publisher Valence Electrical Training Services LLC Language English ISBN 13 978 1 934348 13 0 LCCN 2012934622 *Power Systems Protection, control & automation* Maty Ghezelayagh,2020-03-05 This book provides practical applications of numerical relays for protection and control of various primary equipment namely distribution and transmission networks HV and EHV transformers and busbars reactive and active power plants Unlike other books attempts have been made to address the subject from practical point of view rather than theoretical one which can otherwise be found in most of other text books The setting design and testing philosophy of numerical relays as discussed in this book have been successfully applied in the fields on various projects and consequently can be used as a practical guideline for implementation on future projects The book covers the followings subjects Fundamental concepts in the field of power system protection and control Required system modelling and fault level analysis for the design and setting of protection and control devices Setting and design philosophy of numerical relays of different primary equipment Practical application of anti Islanding schemes for two different systems namely distribution generation DG and transmission generation TG Challenges and solutions which are encountered during secondary equipment refurbishment replacement in

brown field substations with inclusion of two practical case studies Required tests for factory acceptance tests FAT site acceptance tests SAT and commissioning tests of numerical relays in conventional and digital substations Causes analysis and proposed mitigation techniques of more than 100 worldwide disturbances which have occurred in different type of primary equipment which have resulted to major system black out or plant explosion or even fatality and New and future trend of application of numerical relays including application of super IED for protection and control of multi primary equipment implementation of digital substation remote integrations self and remote testing of IED distribution networks fault location techniques and fault locators using travelling waves synchro phasors time domain line protection using travelling waves adaptive slope characteristics of differential protection protection and control schemes of micro grids mitigation technique for prevention of loss of reactive power plants and transformers due to solar storms      *Test Manual* General Electric Company,1951      **The Relay Testing Handbook #3D:** Chris Werstiuk,2012 As modern protective relays become increasingly more powerful and complex many relay testers continue to use test procedures and philosophies that are based on previous generations of relays and their limitations Modern relays have very different characteristics that require a different testing philosophy to ensure that they will operate when required The Relay Testing Handbook Understanding Digital Logic explains the different forms of relay logic used in modern microprocessor based relays Each type of relay logic is described in detail with practical examples to demonstrate how relay manufacturers use common relay logic principles applied with different style interfaces such as Individual element schemes General Electric SR and Beckwith Electric Company relays Binary relays Alstom and Siemens relays Arithmetic math schemes Schweitzer Engineering Laboratories relays Logic schemes General Electric UR relays Use the practical examples outlined in this volume to help you Understand and use logic gates such as AND OR NOT NOR NAND and more Use logic comparators and timers Convert relay settings from one logic format to another Convert logic schemes into DC schematics to help understand and commission logic systems Understand the protective relay logic used in nearly every in service relay today This book is included in the hardcover book The Relay Testing Handbook Principles and Practice or it can be ordered by itself as a soft cover book Adobe Acrobat PDF digital download or both Paperback 90 pages Trim Size 8 5x11 Publisher Valence Electrical Training Services LLC Language English ISBN 13 978 1 934348 06 2 LCCN 2012934619      **Federal Airways Manual of Operations** United States. Civil Aeronautics Administration,1946      *Handbook of Air Conditioning, Heating, and Ventilating* Eugene Stamper,Richard L. Koral,1979 This comprehensive and acclaimed volume provides a wealth of practical information on the design installation and operation of air conditioning heating and ventilating systems      **Manual of Electrical Control** Frank Edgar Reeves,1951

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