Instruction Manual

Installation
Operation
Maintenance

Over/Under Voltage Protective Relay

Publication
351-05003-00 (05/11/2005)

Nidec
KATO ENGINEERING™

Kato Engineering, Inc. | P.O. Box 8447 | Mankato, MN USA 56002-8447 | Tel: 507-625-4011
KatoEngineering@mail.nidec.com | www.KatoEngineering.com | Fax: 507-345-2798

Note: *Because of rapid changes in designs and processes and the variability of Kato Engineering's products, information in this manual must not be regarded as binding and is subject to change without notice.*

Warning: *Dangerous voltages are present at the voltage sensor terminal board when monitoring a generator or utility. Accidental contact with live conductors could result in serious electrical shock or electrocution. Disconnect the power source before making repairs, connecting test instruments, or removing or making connections to the voltage sensor.*

Introduction

Foreword

This manual contains instructions for installing, operating and maintaining Kato Engineering over/under voltage protective relays.

Safety instructions

In order to prevent injury or equipment damage, everyone involved in installation, operating and maintenance of the equipment described in this manual must be qualified and informed of the current safety standards that govern his or her work.

While "common-sense" prevention of injury or equipment damage cannot be completely defined by any manual (nor built into any piece of equipment), the following paragraphs define warnings, cautions, and notes as they are used in this manual:

Warning: Warnings identify an installation, operating or maintenance procedure, practice, condition, or statement that, if not strictly followed, could result in death or serious injury to personnel.

Caution: Cautions identify an installation, operating or maintenance procedure, practice, condition, or statement that, if not strictly followed, could result in destruction of or damage to equipment or serious impairment of system operation.

Note: Notes highlight an installation, operating or maintenance procedure, condition, or statement and are essential or helpful but are not of known hazardous nature as indicated by warnings and cautions.

Operating principles

General Description

The voltage sensor provides generator-set under or over voltage protection. All components are mounted on a printed circuit board. The assembly includes a relay, RY1, which has two form "C" contacts (a normally open and a normally closed connected to a terminal common to both). A potentiometer, R7, permits adjustment of the trip voltage.

Sensing voltage from the generator is applied to the voltage sensor assembly: terminals 1 and 3 for single phase, terminals 1, 2, and 3 for three phase without neutral, or terminals 1, 2, 3, and 4 for three phase with neutral. This voltage is rectified by a full wave rectifier comprised of diodes D1 through D6. The rectified voltage is applied across a voltage divider comprised of resistors R5, R6, R8, R14, and set point adjust potentiometer R7. This voltage is filtered by capacitor C1, which determines the response time. A portion of the voltage across the voltage

divider, taken at the wiper of R7, provides the base voltage to transistor Q1 through resistor R15.

Resistor R13 and Zener diode Z1 in the Q1 emitter circuit provides the reference voltage for the circuit. When the base voltage of Q1 exceeds the voltage across Z1 by approximately 0.6 V, Q1 will conduct turning on Q2 due to the voltage drop across R10, and RY1 will energize. When the base voltage of Q1 drops below the voltage across Z1 plus approximately 0.6 V, Q1 will stop conducting and, due to the absence of a voltage drop across R10, Q2 will also stop conducting, and RY1 will de-energize. However, depending on the application, the sensing relay may be electrically connected to actuate controls such as a slave over voltage relay, a circuit breaker, or other devices that must be manually reset.

Installation

Make electrical connections to a terminal board on the voltage sensor assembly. When connecting the sensor assembly, follow the wiring diagram provided with the controls and the voltage sensor assembly drawing.

Operation

To check present set-point:

1. Connect an AC voltmeter across terminals 1 & 3.

2. Connect an ohmmeter or self-powered test light across terminal 5 to terminal 7 of the voltage sensor assembly. Continuity should be indicated.

3. Adjust the generator voltage to minimum before starting it. Start the generator. While observing the voltmeter, slowly increase the generator voltage until the ohmmeter or test light indicates a loss of continuity.

4. Reduce voltage until continuity is again indicated. While observing the voltmeter, again slowly decrease the generator voltage until the ohmmeter or test light indicates a loss of continuity.

5. If necessary to obtain accurate voltmeter readings, repeat steps 3 and 4 while observing the voltmeter . Step 3 will provide you with the trip setting as an over voltage sensor; step 4 as an under voltage sensor.

6. Reconnect any wiring disconnected in step 1.

Note: *If a utility voltage or some other voltage is being monitored, disconnect the voltage sensor from this source, and connect a variable-voltage supply of the correct phase and voltage.*

Caution: *Any other wires connected to terminals 5, 6, & 7 must be disconnected and insulated.*

To change volage set point:

Caution: *Any other wires connected to terminals 5, 6, & 7 must be disconnected and insulated.*

1. Connect an AC voltmeter across terminals 1 & 3.

2. Connect an ohmmeter or self-powered test light across terminal 5 to terminal 7 of the voltage sensor assembly. Continuity should be indicated.

3. Start the generator, and adjust the voltage to the desired set point of the voltage sensor.

   To set the voltage sensor to trip on an under-voltage condition, turn R7 fully clockwise, and then turn R7 counterclockwise until the ohmmeter or test light indicates a loss of continuity, and then then turn it slowly clockwise until continuity is again indicated.

   To set the voltage sensor to trip on an over-voltage condition, turn R7 to its fully counterclockwise position, and then turn R7 clockwise until the ohmmeter or test light indicates continuity, and then turn it slowly counterclockwise until a loss of continuity is indicated.

4. Check the set-point by slowly varying the generator voltage while observing the ohmmeter or test light,as detailed above. Readjust as necessary to obtain the desired set-point.

5. Reconnect any wiring disconnected in step 1.

Asssembly part number	Sensing			Response	Trip adjust range (Vac)
	Phase/Wire	Volts ac (nominal)	Hertz		
511-00922-00	1/2	12	50-400	Fast	9-15
511-00022-02	1/2	12	50-400	Fast	9-15
511-00010-00	1/2	120	50-400	Slow	90-150
511-00020-00	1/2	120	50-400	Fast	110-190
511-00020-01	1/2	120	50-400	Slow	110-190
511-00020-30	1/2	120	50-400	Slow	120-200 (CB output)
511-00022-00	1/2	208	50-400	Fast	160-310
511-00011-00	1/2	240	50-400	Slow	150-210
511-00021-00	1/2	240	50-400	Slow	250-350
511-00021-01	1/2	240	50-400	Fast	250-350
511-00018-00	3/3	95	50-400	Fast	67-95
511-00018-01	3/3	95	50-400	Slow	67-95
511-00028-00	3/3	95	50-400	Fast	95-142
511-00028-01	3/3	95	50-400	Slow	95-142
511-00016-00	3/3	120	50-400	Fast	70-120
511-00016-01	3/3	120	50-400	Slow	70-20
511-00026-00	3/3	120	50-400	Slow	110-190
511-00026-02	3/3	120	50-400	Fast	110-190
511-00017-00	3/3	208	50-400	Fast	125-165
511-00027-00	3/3	220	50-400	Slow	160-350
511-00015-00	3/3	240	50-400	Slow	130-380
511-00014-00	3/4	120/208	50-400	Fast	145-220
511-00014-01	3/4	120/208	50-400	Slow	145-220
511-00024-00	3/4	120/208	50-400	Fast	200-300
511-00024-01	3/4	120/208	50-400	Slow	200-300
511-01019-00	1/2	28 Vdc	-	-	18-31 Vdc

Kato Engineering Support

The brand you trust, the power you depend on. Include the serial number and model number for your machine in the email subject line.

Field Service	KatoService@mail.nidec.com
Parts	KatoParts@mail.nidec.com
Remanufacturing	KatoRemanufacturing@mail.nidec.com
Warranty/Quality Assurance	KatoWarranty@mail.nidec.com

Nidec
KATO ENGINEERING™

Kato Engineering, Inc. | P.O. Box 8447 | Mankato, MN USA 56002-8447 | Tel: 507-625-4011
KatoEngineering@mail.nidec.com | www.KatoEngineering.com | Fax: 507-345-2798

6638 en - 2025.04 / a