

7SG164 Ohmega 400 Series

Distance Protection Relays

Document Release History

This document is issue 2010/02. The list of revisions up to and including this issue is:
Pre release

2010/02	Document reformat due to rebrand

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1 Commissioning

A separate commissioning guide is available for each model of the relay which details the testing of each function.

1.1 Required Test Equipment

1000V Insulation resistance test set.

Digitally controlled automatic test equipment suitable for distance relay testing (3 phase o/ps)

Primary injection equipment 5KVA with variable 500A output

Phase sequence meter

A d.c. supply with nominal voltage within the working range of the relays d.c. auxiliary supply rating.

A d.c. supply with nominal voltage within the working range of the relays d.c. input rating.

Additional equipment for testing the communications channel:
Portable PC with fibre optic modem, or RS232 connections.

2 Inspection

Ensure that all connections are tight and in accordance with the relay wiring diagram and the scheme diagram. Check the relay is correctly programmed and fully inserted into the case. Refer to the Description of Operation for programming the relay.

3 Applying Settings

The relay settings for the particular application should be applied before any secondary testing occurs. If they are not available then the relay has default settings which can be used for pre-commissioning tests. Note the input and output relays must be programmed correctly before any scheme tests are carried out. See the Relay Settings section of this manual for the default settings.

The relay feature eight alternative settings groups. In applications where more than one settings group is to be used then it may be necessary to test the relay in more than one configuration.

When using settings groups it is important to remember that the relay need not necessarily be operating according to the settings which are currently being displayed. There is an "active settings group" on which the relay operates and an "edit/view settings group" which is visible on the display and which can be altered. This allows the settings in one group to be altered while the protection continues to operate on a different unaffected group. This "active settings group" and the "edit settings group" are selected in the "System Configuration Menu".

Elsewhere in the settings menu system, those settings which can be altered for different groups are indicated by the symbols G1, G2 etc in the top left of the display. Other settings are common to all groups.

4 Precautions

Before testing commences the equipment should be isolated from the current and voltage transformers and the CT's short circuited in line with the local site procedures. The tripping and alarm circuits should also be isolated where practical. Ensure that the correct d.c. supply voltage and polarity is applied. See the relevant scheme diagrams for the relay connections.

5 Tests

5.1 Insulation

Connect together all of the C.T. terminals and measure the insulation resistance between these terminals and all of the other relay terminals connected together and to earth.

Connect together all of the V.T terminals and measure the insulation resistance between these terminals and all of the other relay terminals connected together and to earth.

Connect together the terminals of the DC auxiliary supply circuit and measure the insulation resistance between these terminals and all of the other relay terminals connected together and to earth.

Connect together the terminals of the DC status input circuits and measure the insulation resistance between these terminals and all of the other relay terminals connected together and to earth.

Connect together the terminals of the output relay circuits and measure the insulation resistance between these terminals and all of the other relay terminals connected together and to earth.

Satisfactory values for the various readings depend upon the amount of wiring concerned. Where considerable multi-core wiring is involved a reading of 2.5 to 3.0 Megaohms can be considered satisfactory. For short lengths of wiring higher values can be expected. A value of 1.0 Megaohm or less should not be considered satisfactory and should be investigated.

Remove temporary connections.

5.2 Secondary Injection

Select the required relay configuration and settings for the application.

Configure the status input and output relays to the requirements of the schematic diagrams. Also select the scheme logic applicable to the protected circuit from the system configuration menu, as well as the relevant CT and VT ratios.

The relay is equipped with comprehensive self testing routines which automatically check correct initialisation and processing operation. The "Protection Healthy" LED is under software control and if, after application of the correct DC supply, it gives a steady light this is an indication that the relay is functioning correctly. A flashing LED, or no LED light indicates faulty equipment. As there are no user serviceable components in the withdrawable modules, faulty relays must be returned to Siemens.

Using the automatic test equipment, inject 1 amp 3 phase into the current circuits of the relay and apply 63.5 volts 3 phase to the voltage circuits. Check that the fascia display indicates the correct corresponding primary currents and voltages applicable to the relevant instrument transformer ratios selected. If the metering displays on the fascia are correct all the relay operations under load and fault conditions will be correct.

If possible each status input should be energised in turn and checked for correct operation and fascia display.

Check the operation of each output relay by selecting it in the "Test Plant Control" setting.

Correct operation of all the above checks will ensure that the relay will perform correctly. If added confidence is required, each element can be individually tested with the appropriate current and voltage from the test set, and the settings verified.

5.3 Primary Injection

Current Transformer Connections

Check that the supply links and fuses are arranged as follows:-

- Trip links removed
- Voltage transformer links removed
- Earth links inserted
- Current transformer connected for normal operation
- To test the current transformers for ratio, relative polarity and soundness of the secondary leads, connect the circuit as shown in figure 1. Inject at least 50% of the rated primary current into the red-yellow phases - record the ammeter readings in Table 1. Check that:-
- Meters A, A1, A2 and relay meter readings Ia and Ib give the same reading (corrected if necessary, for different C.T ratios).
- Meters A3, A4 and relay meter readings Ia and Ix give negligible current readings
- Repeat the above test, but with primary current injected into the yellow-blue phases. Record current recordings in Table 1. Check that:-
- Meters A, A2 and A3 and relay meter readings Ib and Ic give the same reading (corrected if necessary, for different C.T. ratios).
- Meters A1 and A4 and relay meter readings Ia and Ix give negligible current readings.

- Inject at least 50% of the rated primary current into the red phase (figure 1b). Record the ammeter readings in Table 1. Check that:-
- Meters A, A1, A4 and relay meter readings Ia and Ix give the same reading.
- Meters A2, A3 and relay meter readings Ib and Ic give negligible current readings.

Table 1 Current Transformer Connections

Current Transformer Secondary Levels									
	Ammeter Readings								
Current Injection	A	A1	A2	A3	A4	Ia	Ib	Ic	Ix
R-Y Phases									
Y-B phases									
R Phase									

Primary Current =

Test CT Ratio =

Line CT Ratio =

Relay set CT Ratio =

Table 2 Voltage Transformer Connections

Voltage Transformer Secondary Voltages									
R-N	Y-N	B-N	R-Y	Y-B	B-R	Va	Vb	Vc	Vx

Primary Voltage =

V.T Ratio =

Check that the supply links and fuses are arranged as follows:-

- Trip links removed
- Voltage transformer fuses and links inserted
- Current transformers connected for normal operation
- Earth links inserted
- Measure the phase to neutral and phase to phase voltages at the relay terminals and also the phase to phase voltages on the relay terminals and also the phase to neutral voltages on the relay display Tabulate the results in table 2.
- Check the phase sequence of the voltage transformer supply.

5.4 Load Checks

Directional Check

Check that the arrangement of supply links and fuses are arranged as follows:-

- Trip links removed
- Voltage transformer fuses and links inserted
- Current transformers connected for normal operation
- Earth links inserted

For this test a three-phase load current is required. Select the fascia display to INSTRUMENT MODE. Scroll in this mode until the power flow direction meter is displayed.

This meter indicates the direction of power flow forward or reverse, of each phase. If three dashes appear on the display, this indicates that the power flow is too small to accurately give direction. If power flows from busbars to feeder, the direction displayed is forward.

If the directions are opposite to those expected, the relay is incorrectly connected and a careful check should be made of the schematic and wiring diagrams and the necessary wiring alternatives made and the test repeated.

5.5 Tripping Tests

Having established the validity of the relay connections it is advisable to check the d.c. wiring to the trip and control circuits.

To do this repeat the zone 1 secondary injection tests above with the trip links inserted. Check that for phase-phase faults all three phases of the circuit breaker are tripped and any associated signalling and repeat relay

operations occur correctly. If possible, using a P.C. or laptop computer loaded with Reydisp Evolution software, check the current and voltage waveforms and relay operations. For phase-earth faults, check that correct tripping as per scheme is obtained i.e. either single pole tripping or three pole tripping with the associated control operations.

6 Putting Into Service

- Remove the external test connections and heavy duty test plugs
- Check that the current and voltage transformer are wired for normal operation
- Check that all a.c. and d.c. supply links and fuses are inserted
- Check that the earth links are inserted
- Check that all the relay settings are as recommended.
- Test and reset the LED indication display
- Replace the relay cover
- Insert the trip link