REL 352
Phase Comparison Line Protection System

BASIC SYSTEM
Standard Features
Numerical Processing (Fully Digital)
Multiple Microprocessor Design
Phase Comparison Protection Algorithm
Current Change (Di) Detectors and Select-
able Voltage Change (DV) Detectors
Four High Set Overcurrent Units for Direct
Trip
Fault Locator Function
Self Checking Function
Sampling Techniques:
• 7 Incoming Analog Waveforms
• 12 Samples per Cycle
High Speed Operation
Loss of Potential Supervision
Loss of Current Monitoring
Close Into Fault Detection
1 or 5 ampere Current Transformer Operation
50 or 60 Hz Operation
Contact Outputs for:
• Breaker Trip
• General Start
• Breaker Failure Initiate
• Reclose Initiate, Reclose Block
• System Failure Alarm
• Channel Alarm
• Trip Alarm
RS232C Communications Port
Communication Channel Delay Measurement
Digital Fault Recording
Local Man-Machine Interface
19 Inch Rack Mounting; 4-Rack Units High

Optional Features
FT-14 Test Switches
Distance Backup Function
Power Swing Block or Trip
Dual Power Supplies
Extended Contact Output (6 Trip, 6 BFI, 2 RB)
RS232C Communications Port with IRIG
Input Port

APPLICATION
The REL 352 relay is a numerical (fully digi-
tal) phase comparison transmission line pro-
tection system, with optional distance back-
up protection.

The REL 352 is a dual-microprocessor based,
composite sequence filter, phase comparison
protection system. The REL 352 operates on
the principles inherited from previous suc-
cessful phase comparison relaying systems;
but, adapted and improved using numerical
techniques.

The REL 352 is a communication channel
dependent system optimized for operating
with power line carrier equipment. Either ON-
OFF or FSK (frequency shift) power line car-
rier equipment can be used to interface with
the REL 352.

The REL 352 is a high speed relaying system
suitable for application to any voltage level.
Its principle of operation makes it ideal for
short lines and tapped lines with a power
transformer, where traditional distance pro-
tection fails.

An optional distance-type relaying system can
be included to provide back-up for a loss of
communication channel. This back-up sys-
tem is similar to a zone 2 and zone 3 distance
units and logic for a distance non-pilot relay-
ing system.

The REL 352 has the capability of communi-
cation channel propagation delay measure-
ment, which is very important for the correct
operation of the relaying system. Once this
delay has been measured, it will be entered
as a system setting.

CONSTRUCTION
The REL 352 relay assembly consists of an
outer-chassis and an inner-chassis which
slides into the outer-chassis. All of the relay
circuitry, with the exception of the input iso-
lation transformers and first-line surge pro-
tection, are mounted on the inner chassis, to
which the front panel is attached. The outer
chassis has a backplate, which is a recep-
tacle for all external connections. Two optional
FT-14 switches are mounted in the two pe-
ripheral areas of the outer chassis.
REL 352 SPECIFICATIONS

TECHNICAL

Principle of Operation
Phase Comparison, Single-Comparer and Dual Comparer using Low Speed Power Line Carrier (ON-OFF and FSK), Audio Tone and Microwave

INPUT RATINGS

Nominal ac Voltage (VLN) at 60 Hz 69.3 V rms
Nominal ac Current (In) 1 or 5 A rms
Rated Frequency 50 or 60 Hz

Maximum Permissible ac Voltage
Continuous 160 V rms
10 Second 240 V rms

Maximum Permissible ac Current
Continuous 15 A rms
1 Second Operational 160 A rms-5A nominal
32 Arms-1A nominal
Thermal 500 A

dc Battery Voltages
Nominal Input Range
60/48 V dc 38 - 70 V dc
110/125 V dc 88 - 150 V dc
220/250 V dc 176 - 280 V dc

dc Burdens
Battery 15 W normal
40 W tripping

ac Burdens
Volts per Phase 0.02 VA at 70 V ac
Current per Phase 0.45 VA at 5 A

EXTERNAL CONNECTIONS

CONTACT DATA

Trip Contacts - make and carry 30 A for 1 second, 10 A continuous capability, break 50 watts resistive or 25 watts with L/R = .045 seconds
Non-Trip Contacts - 1 A dc make and continuous, break 25 watts resistive or 10 watts with L/R = 0.045 from 38 to 280 V dc

COMMUNICATION EQUIPMENT INTERFACE

Inputs
Optoisolated (7500 V peak) jumper configurable for 20 V, 48 V, 125 V external dc Power Supply Operation
“On” State Current:
20 V 15 mA
48 V 6 mA
125 V 6 mA

Interfaces to Power Line Carrier (ON-OFF and FSK) Audio Tone and Microwave
Mark 1
Space 1
Channel Failure 1
Mark 2
Space 2
Channel Failure 2

Output
Optoisolated (7500 V peak) Power Transistor Output (Rated 400 V) supporting external dc power supply operation in the range of 20 - 150 V dc

Interfaces to
Carrier on/off (for ON-OFF PLC) or Carrier mark / space (for FSK PLC) control

OPTIONAL COMPUTER NETWORK INTERFACE

RS232/PONI - with IRIG input port for single point computer communications
INCOM/PONI - for local network communications using INCOM network

CHASSIS DIMENSIONS AND WEIGHT

Height 7” (177.8 mm) 4 Rack Units (See Figure 1)
Width 19” (482.6 mm)
Depth 14” (356 mm) including terminal blocks
Weight 38 lb. (17.5 kg)

ENVIRONMENTAL DATA

Ambient Temperature Range
For Operation -20ºC to +60ºC
For Storage -40ºC to +80ºC

Insulation Test Voltage 2.8 kV, dc, 1 minute (3.2 kV dc, 1 sec) ANSI, C37.90 IEC-255-5
Open contacts 1400 Vdc continuous
Impulse Voltage Withstand 5 kV Peak, 1.2/50 microseconds, 0.5 Joule, (IEC-225-5)
Surge Withstand Voltage 3 kV, 1 MHz (ANSI C37.90.1, IEC-255-22-1)
Fast Transient Voltage 4 kV, 10/100 ns (ANSI C37.90.1, IEC 255-22-4)
EMI Field Strength Withstand 25 MHz-1GHz, 10V/m Withstand (ANSI C37.90.2)
Electrostatic Discharge Tests (IEC 255-22-2, IEC, 801-Y) 8/12 kV test voltage
Emission Tests (EN 55022, Class A)

3-Terminal Application

3-Terminal Application

January, 1998
Figure 1. REL 352 Outline Drawing
### REL 352 RELAY SYSTEM

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<th>Catalog Digit #</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<td>Typical REL 352 Catalog #</td>
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<td>P</td>
<td>2</td>
<td>B</td>
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<td>R</td>
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#### CATALOG NUMBERING SCHEME

**TRIP / BFI / RI / RB / CONTACTS**

- [6] = 6 Trip, 6 BFI, 4 RI, 2 RB Contacts
- [2] = 2 Trip, 2 BFI, 4 RI, 2 RB Contacts

**CURRENT INPUT**

- [A] = 1 AMP CT
- [B] = 5 AMP CT
- [C] = MOCT Inputs (Not Available - Future Release)

**BATTERY SUPPLY VOLTAGE**

- [1] = 48/60 V dc Single Supply
- [4] = 48/60 V dc Dual Supplies
- [5] = 110/125 V dc Dual Supplies
- [6] = 220/250 V dc Dual Supplies

**DISTANCE BACKUP RELAYING**

- [P] = Backup Distance Protection
- [N] = No Backup Protection

**PILOT SYSTEM COMMUNICATION CHANNEL INTERFACE**

- [B] = Binary I/O Interface to PLC (AM & FM), Audio Tone, Analog Microwave (Optoisolated 24, 48, 125 V dc External Power Supply)

**TEST SWITCHES**

- [F] = FT-14 Switches
- [N] = No FT-14 Switches

**REMOTE COMMUNICATION DEVICE**

- [R] = RS232C PONI
- [C] = INCOM PONI
- [B] = RS232C W/IRIG Port

**ADDITIONAL FEATURES**

- [G] = Oscillographic Data Storage