

# Distance Protection – OHMEGA – 7SG16

## INTRODUCTION

The OHMEGA range of numeric distance relays combines the power and flexibility of microprocessor technology with the proven measuring techniques of previous REYROLLE impedance relays.

OHMEGA relays provide mho or quadrilateral elements operating as a full scheme distance protection. All fault loops and all zones are continuously monitored providing superior fault coverage when compared to relays employing starters.

The distance protection is supplemented by integrated signalling schemes allowing OHMEGA relays to be applied as unit protections.

Complementing the distance protection is a range of protection and control features, which are combined in the various models in the range to suit different applications.

Communications facilities using the IEC 60870 standard allow remote update of settings and provide access to the instrumentation, waveform storage and data collection features of the relay.

OHMEGA 300 series relays are suitable for distribution networks.

OHMEGA 400 series relays are suitable for sub-transmission Networks.

## FEATURES

### Standard

The following features are provided on all OHMEGA distance protection models.

- 3 zone Distance protection with mho characteristics and earth fault compensation.
- Voltage Transformer supervision detects blown VT fuses by monitoring sequence components of voltage and current.
- Switch on to fault (SOTF) protection provides fast tripping if the CB is closed with earthing clamps left in place.
- Transient - free Highset overcurrent protection.
- Power swing detection can be set to block distance protection tripping.
- Fault locator provides the location of the fault in either miles, kilometres or line percentage.
- Permissive underreach and Permissive overreach Signalling Schemes are provided in addition to time stepped operation.
- Trip circuit supervision



- Data storage capability. Events and waveform records of detected faults are recorded. IEC 60870-5-103 communications are provided for interrogation by substation automation equipment or Reydisp Evolution.
- Self monitoring. Hardware and software watchdogs and data integrity checks ensure that the relay operates in the correct manner.

### Optional

- 4th distance protection zone
- Quadrilateral characteristics for earth fault
- Single-pole tripping
- Blocking, acceleration and loss of load schemes
- Stub protection
- Directional Earth-Fault (DEF) (High Resistance Earth-Fault) protection (single or dual) with Permissive Overreach and Blocking signalling schemes.
- Sensitive Earth-Fault protection
- Autoreclose (high-speed single-pole or three-pole as appropriate) with Reach extension scheme
- Check synchronising
- Overvoltage and undervoltage protection

## DESCRIPTION

### PROTECTION

#### Distance protection

OHMEGA relays use proven phase comparator techniques to provide full scheme distance protection with mho and quadrilateral characteristics. All fault loops are continuously measured, requiring no starter characteristics. This allows developing faults to be correctly cleared.

The reach of each zone is set independently with separate settings for phase and earth fault protection. Time delays may be set separately for phase and earth faults on all zones.

The distance protection can trip the CB directly, or a signalling scheme can be used to verify a trip decision. The section on 'Schemes' below describes

the standard schemes available. Other schemes are available on request.

On some models the signalling schemes include current reversal detection, circuit breaker echo and weak infeed detection to ensure correct operation of the relay.

#### **Power swing**

System power swings can lead to an apparent drop in impedance, due to heavy load variation or remote system faults, which can lead to the measured impedance entering a protection zone and causing operation. This can be detected using two dedicated impedance characteristics that encompass the protection zones. They are arranged so that one is larger than the other, a fault will cause them to pick up in quick succession while a power swing will cause a longer delay between the outer element picking up and the inner one.

Once a power swing is detected the distance protection can be inhibited.

#### **Switch on to fault**

Inadvertent closing of the circuit breaker with the earth clamps left in place causes a 3 phase short circuit fault. Switch on to fault (SOTF) protection detects this condition and provides instantaneous fault clearance. Two styles of SOTF are provided, AC SOTF is for use where line VTs are fitted, DC SOTF is for use with bus VTs.

#### **Phase-fault (highset) overcurrent**

A transient free phase-fault definite-time overcurrent element is provided, which operates with a shaped characteristic.

#### **Directional earth-fault**

To achieve effective clearance of high impedance earth-faults a directional earth-fault protection is available. This provides a directional element operating from residual current and voltage, and an overcurrent element operating from the residual current.

A second DEF element can be provided to detect faults in forward and reverse directions.

A variety of signalling schemes is available for use with DEF protection – see section on ‘Schemes’ below.

#### **Sensitive earth-fault**

A non-directional sensitive earth fault protection operating from residual current is available. It can be set down to 2% of nominal current to allow clearance of very high impedance earth faults. A definite-time delay is provided to allow the SEF to be graded with the distance protection.

#### **Overvoltage and undervoltage**

Two overvoltage elements and two undervoltage elements are available, with definite-time delays. These monitor line voltages providing alarm and trip levels of operation.

### **CONTROL**

#### **Autoreclose**

An integrated autorecloser is available. This provides delayed or high-speed autoreclose following a zone 1 or scheme-generated trip.

The OHMEGA 300, with three-pole tripping only, provides a single-shot three-pole autoreclose.

The OHMEGA 400 recloser can provide up to 2 reclosing shots. A variety of sequences may be set up, to allow trips and recloses in different combinations of single- and three-pole.

#### **Check Synchronising**

An integrated synchroniser is available, which prevents the circuit breaker being closed if the two power systems are not synchronised with one another.

### **MONITORING**

#### **Voltage transformer supervision**

Loss of supply from the VTs can cause unwanted operations of the distance protection. To avoid this the sequence component voltages present on the voltage inputs are monitored. During healthy conditions no residual or NPS voltage is present. If a VT fuse fails, residual and NPS voltage are generated with no increase in the corresponding sequence current. The VT supervision operates and raises an alarm. If required, it can also inhibit operation of the distance protection.

### **SYSTEM DATA**

#### **Sequence of Event records**

Up to 500 events are stored and time tagged to 1ms resolution, and are available via the communications.

#### **Fault records**

The last 10 fault records are available from the OHMEGA fascia with time and date of trip, indication of the nature of the fault and fault location (when applicable).

#### **Disturbance recorder**

The waveform recorder may be triggered from a protection function or external input and has a configurable pre-fault trigger. Up to 10 fault waveforms may be stored with associated analogue and digital values.

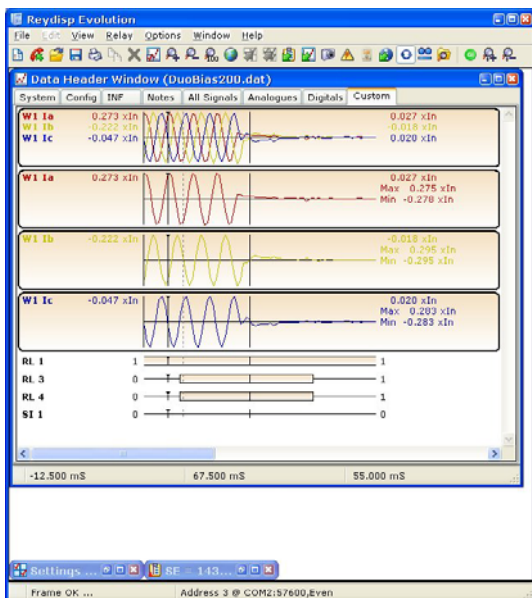
## Communications

Two fibre-optic communications ports are provided on the rear of the relay. They are optimised for 62.5/125µm glass-fibre using ST® (BFOC/2.5) connectors.

The Reydisp Evolution software described below allows the user to interrogate the OHMEGA locally with a laptop PC and the RS232 port on the front of the relay.

The OHMEGA uses IEC 60870-5-103 as its communications standard.

## Reydisp Evolution

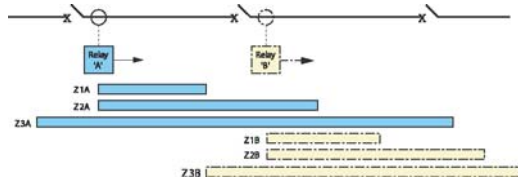


Reydisp Evolution is common to the entire range of REYROLLE numeric products. It provides the means for the user to apply settings to the OHMEGA, interrogate settings and retrieve events and disturbance waveforms from the OHMEGA.

## SCHEMES

### Time Stepped Distance

Time delayed Zones 2,3 & 4. Direct intertripping can be applied.

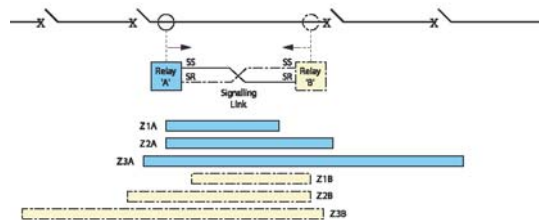


### Permissive Underreach (PUR)

Zone 1 is set to give instantaneous coverage up to 80% of the line length and aided tripping using accelerated Zone 3 (OHMEGA 300) or Zone 2 (OHMEGA 400) for the remaining 20%.

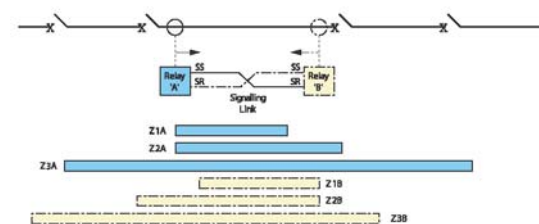
## Zone 2 Accelerated (PA)

Zone 1 is set to give instantaneous coverage up to 80% of the line length and aided tripping using accelerated Zone 2 for the remaining 20%.



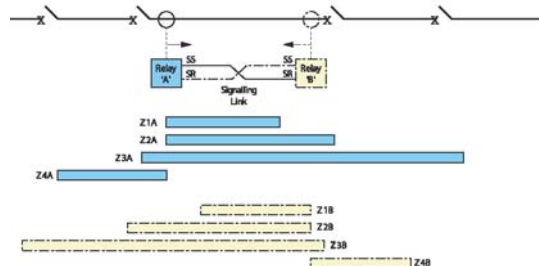
### Blocking Overreach Type 1 (without Z4)

Zone 2 is set to overreach giving instantaneous coverage over 100% of the line length. It is blocked for out of zone faults by the remote Z3.Z2 elements.



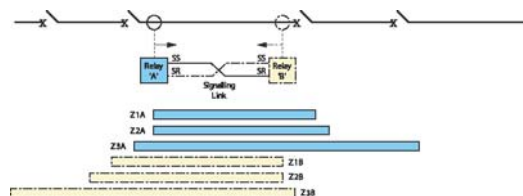
### Blocking Overreach Type 2 (Zone 4)

Zone 2 is set to overreach giving instantaneous coverage over 100% of the line length. It is blocked for out of zone faults by the remote Zone 4 reverse element.



### Permissive Overreach Type 1 (POR1)

Zone 1 is set to overreach giving instantaneous coverage of 100% of the line length with a permissive signal from the remote Zone 1.

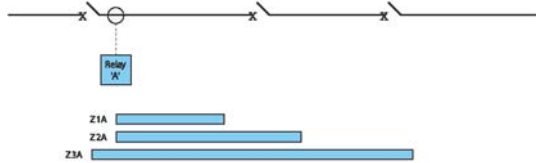


### Permissive Overreach Type 2 (POR2)

Zone 2 is set to overreach giving instantaneous coverage of 100% of the line length with a permissive signal from the remote Zone 2.

### Reach extension (RE)

Instantaneous coverage up to Zone 1 extended setting for the first fault detected with delayed stepped distance for persistent faults. For relays with autoreclose, instantaneous coverage with Zone 1 can be extended for the initial fault. Time stepped distance is applied for persistent faults.



### DEF Permissive Overreach (DPOR)

Overreach DEF to give short time delayed coverage over 100% of the line length for earth faults, with a permissive signal from the remote DEF.

### Current Reversal Logic

This logic is used in conjunction with permissive overreach schemes applied to dual circuit lines. Tripping of the faulted feeder at one end may result in sudden reversal of fault current in the adjacent feeder. This may otherwise cause false tripping of the healthy adjacent feeder due to delayed resetting of the permissive signal.

## TECHNICAL INFORMATION

### Characteristic energising quantities

AC Current	3 Phase 1, 2 or 5 A
AC Voltage	3 Phase 63.5 V line-neutral

### Auxiliary energising quantity

#### DC Power supply

Nominal Voltage	Operating Range V dc
24, 30 V	18.0 to 37.5
48, 110 V	37.5 to 137.5
220 V	176.0 to 280.0

#### DC Status inputs

Nominal Voltage	Operating Range V dc
30, 34 V	18.0 to 37.5
48, 54 V	37.5 to 60.0
110, 125 V	87.5 to 137.5
220, 250 V	175.0 to 280.0

The status voltage need not be the same as the main energising voltage.

#### Electricity Association ESI48-4

The 30/34V and 48/54V inputs meet the requirements of ESI48-4 ESI 1. However, the 110/125V and 220/250V inputs will operate with a DC current of less than 10mA. If 110/125V or 220/250V inputs compliant with ESI48-4 ESI 1 are required, an OHMEGA with 48/54 V status can be supplied with external dropper resistors as follows:

Nominal Voltage	Resistor Value	Wattage
110, 125 V	2k7 ± 5%	2.5 W
220, 250 V	8k2 ± 5%	6.0 W

#### Status input performance

Parameter	Value
Minimum DC current for operation (30/34V and 48/54V inputs only)	10 mA
Reset/Operate Voltage Ratio	90 %
Typical response time	< 5 ms
Typical response time when used to energise an output relay contact	< 15 ms
Minimum pulse duration	40 ms

Status inputs will not respond to the following:

- 250V RMS 50/60 Hz applied for two seconds through a 0.1F capacitor.
- 500 V RMS 50/60 Hz applied between each terminal and earth.
- Discharge of a 10 µF capacitor charged to maximum DC auxiliary supply voltage.

### Indication

Relay Healthy	
Method	Green LED
Healthy	Steady
Failure	Flashing or extinguished
Trip and Status Indication	
Method	32 programmable red LEDs
Settings and Instrumentation	
Method	2x20 character backlit LCD

### Sub-station communications

Protocol	IEC 60870-5-103
RS-232 interface	
Location	Fascia
Form	25-pin female D-type connector
Fibre interface (2 ports)	
Location	Rear
Form	BFOC/2.5 (ST®) bayonet connector
COM1	
Baud rate	75-115200 baud
Interface	Fibre-optic port
COM2	
Baud rate	75-115200 baud
Interface	Auto-switches between Fibre-optic and Fascia RS-232 ports

## GENERAL ACCURACY

### Reference conditions

General	IEC 60255-6, 6A and 16
Impedance setting	6.0 Ω
Line Angle	75 °
Z <sub>0</sub> /Z <sub>1</sub>	2.5
Auxiliary supply	Nominal
Frequency	50 Hz
Ambient temperature	20 °C

### Accuracy Influencing Factors

#### Temperature

-10 °C to +55 °C	≤ 5 % variation
------------------	-----------------

#### Frequency

47 Hz to 52 Hz or 57 Hz to 62 Hz	Settings: ≤ 5 % variation Operating time: ≤ 5 % variation
--	--

## PROTECTION ELEMENTS

### Distance protection

Impedance reach		
$Z_N$	Setting	0.1 to 250.0 $\Omega$
$\Phi_N$	Angle	0 to 90° step 5°
Accuracy ( $Z_N = 6\Omega$ , mho characteristic, 3-phase fault)		
$Z_N^I$	( $\Phi = \Phi_N \pm 3^\circ$ )	$Z_N \pm 5\%$ or 0.1 $\Omega$ for $SIR < 30$ $Z_N \pm 10\%$ or 0.1 $\Omega$ for $SIR \geq 30$
$Z$	( $\Phi = \Phi_N \pm 10^\circ$ )	$Z_N^I \times \cos(\Phi_N - \Phi) \pm 0.05Z_N \Omega$
	( $0^\circ \leq \Phi \leq 90^\circ$ )	$Z_N^I \times \cos(\Phi_N - \Phi) \pm 0.1Z_N \Omega$
Accuracy (all $Z_N$ ) class index plus an error not exceeding class index		
Transient overreach class index plus an error not exceeding class index		
Operating time (see Technical Manual)		
Operating time		min. 17 ms (OHMEGA 400 series) min. 35 ms (OHMEGA 300 series)
Delay (additional to operating time)		
Setting		0 to 10 s step 10 ms
Accuracy		Setting $\pm 1\%$ or 10 ms

### Directional earth-fault protection

Level	
Setting	0.05 to 4.00 xIn
Operate	Setting $\pm 5\%$
Reset	> 95 % of Operate level
Delay	
Setting	0 to 20 s step 1 ms
Accuracy	Setting $\pm 1\%$ or 5 ms

### Phase-fault (highset) overcurrent protection

Level	
Setting	0.1 to 35.0 xIn
Operate	Setting $\pm 5\%$
Reset	> 95 % of Operate level
Delay	
Setting	0 to 1000 ms step 1 ms
Accuracy	Setting $\pm 1\%$ or 10 ms

## THERMAL WITHSTAND

AC Current Inputs	
continuous	12 A
10 minutes	15 A
2 minutes	30 A
2 seconds	240 A
1 second	340 A
1 cycle	625 A
AC Voltage Inputs	
continuous	3.5 xVn

## BURDENS

### Measuring Inputs

AC Current Inputs	
1A input	$\leq 0.025$ VA
2A input	$\leq 0.1$ VA
5A input	$\leq 0.625$ VA
AC Voltage Inputs	
	$\leq 0.01$ VA

### Auxiliary supply

Quiescent (Typical)	15 W
Maximum	27 W

Burdens are measured at nominal rating.

## OUTPUT CONTACTS

### Contact rating IEC 60255-23

<b>Carry Continuously</b>	5 A AC or DC
<b>Make and Carry</b>	(L/R $\leq 40$ ms and V $\leq 300$ volts)
0.5 seconds	20 A AC or DC
0.2 seconds	30 A AC or DC
<b>Break</b>	(I $\leq 5$ A and V $\leq 300$ volts)
ac resistive	1250 VA
ac inductive	250 VA @ PF $\geq 0.4$
dc resistive	75 W
dc inductive	30 W @ L/R $\leq 40$ ms 50 W @ L/R $\leq 10$ ms

### Number of Operations

Minimum number of operations	1000 at maximum load
------------------------------	----------------------

### Recommended load

Minimum recommended load	0.5 W, limits 10 mA or 5 V
--------------------------	----------------------------

## ENVIRONMENTAL

### Temperature IEC 68-2-1/2

Operating	-10 °C to +55 °C
Storage	-25 °C to +70 °C

### Humidity IEC 68-2-3

Operational test	56 days at 40 °C and 95% RH
------------------	-----------------------------

### Transient Overvoltage IEC 60255-5

Between all terminals and earth or between any two independent circuits without damage or flashover	5 kV 1.2/50 $\mu$ s 0.5 J
---	---------------------------------

### Insulation IEC 60255-5

RMS levels for 1 minute

Between all terminals and earth	2.0 kV
Between independent circuits	2.0 kV
Across normally open contacts	1.0 kV

### Immunity

<b>Auxiliary DC Supply IEC 60255-11</b>	
Allowable superimposed ac component	$\leq 12\%$ of dc voltage
Allowable breaks/dips in supply (collapse to zero from nominal voltage)	$\leq 20$ ms
<b>High Frequency Disturbance IEC 60255-22-1 Class III</b>	
2.5kV, Longitudinal mode	$\leq 3\%$ variation
1.0kV, Transverse mode	
<b>Electrostatic Discharge IEC 60255-22-2 Class III</b>	
8kV, Contact discharge	$\leq 5\%$ variation
<b>Radio Frequency Interference IEC 60255-22-3</b>	
10 V/m, 80 to 1000 MHz	$\leq 5\%$ variation
<b>Fast Transient IEC 60255-22-4 Class IV</b>	
4kV, 5/50ns, 2.5 kHz, repetitive	$\leq 3\%$ variation
<b>Conducted RFI IEC 60255-22-6</b>	
10 V, 0.15 to 80 MHz	$\leq 5\%$ variation

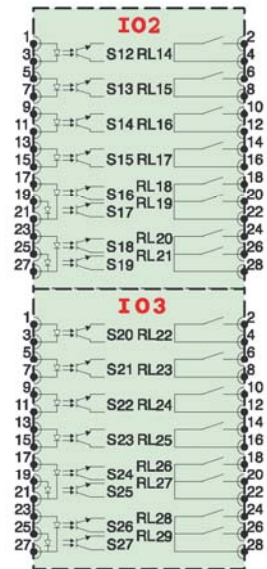
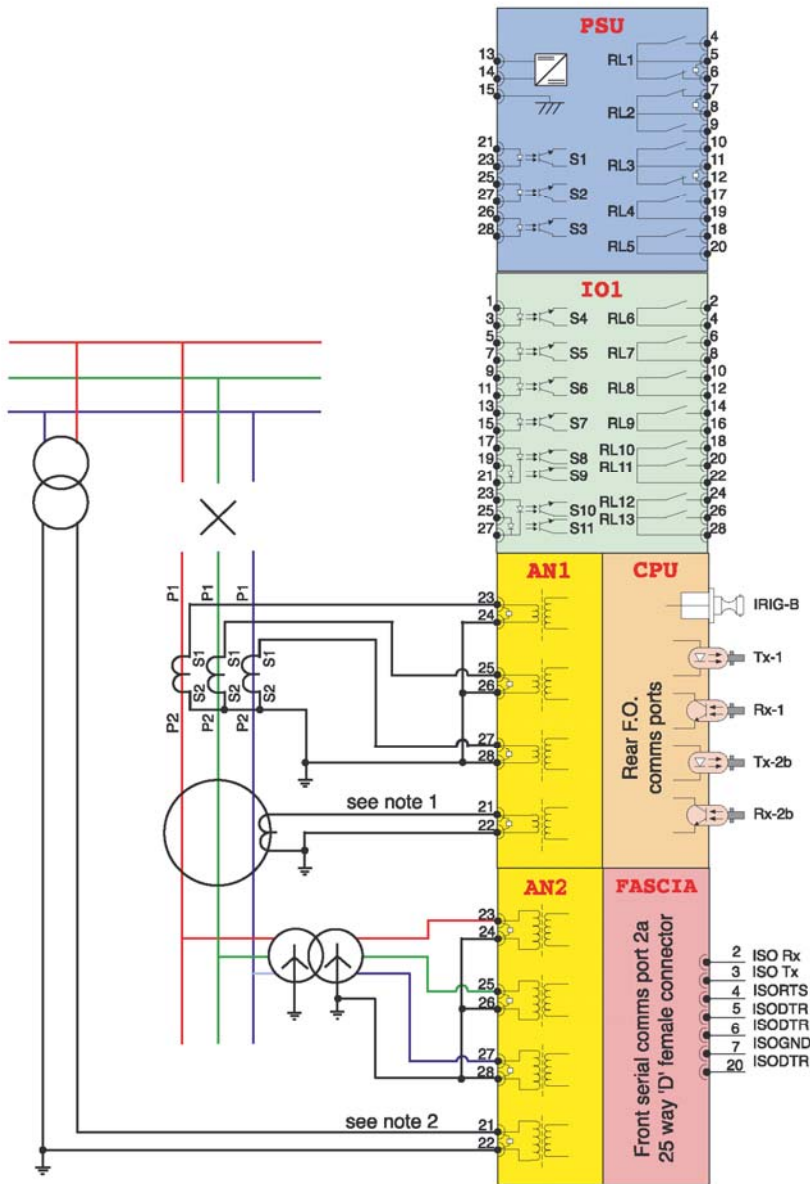
## Emissions

<b>Vibration (Sinusoidal) IEC 60255-21-1 Class 1</b>	
0.5 gn, Vibration response	$\leq 5\%$ variation
1.0 gn, Vibration endurance	
<b>Shock and Bump IEC 60255-21-2 Class 1</b>	
5 gn, Shock response, 11ms	$\leq 5\%$ variation
15 gn, Shock withstand, 11ms	
10 gn, Bump test, 16ms	
<b>Seismic IEC 60255-21-3 Class 1</b>	
1 gn, Seismic Response	$\leq 5\%$ variation
<b>Mechanical Classification</b>	
Durability	In excess of $10^6$ operations

## Mechanical

<b>Conducted limits IEC 60255-25</b>		
Frequency Range	Limits dB(mV)	
	Quasi-peak	Average
0.15 to 0.5 MHz	79	66
0.5 to 30 MHz	73	60
<b>Radiated limits IEC 60255-25</b>		
Frequency Range	Limits at 10 m Quasi-peak, dB(mV/m)	
30 to 230 MHz	40	
230 to 10000 MHz	47	

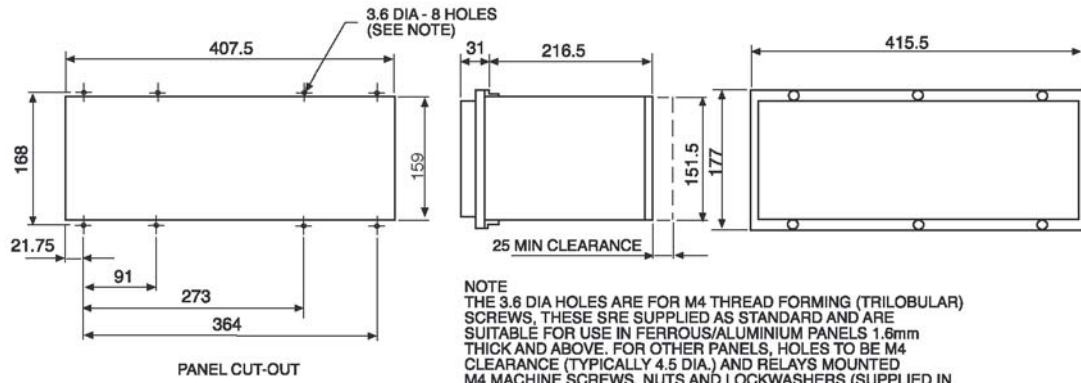
# TYPICAL CONNECTION DIAGRAM



## Notes

- The fourth CT input is required only for the sensitive earth-fault and directional earth-fault functions. It is recommended that a ring-core CT is used.
- The fourth VT input is required only for synchronising. Any phase-relationship may be used.
- Modules IO2 and IO3 are optional, dependent on the model ordered.

# CASE



NOTE  
THE 3.6 DIA HOLES ARE FOR M4 THREAD FORMING (TRILOBULAR) SCREWS, THESE ARE SUPPLIED AS STANDARD AND ARE SUITABLE FOR USE IN FERROUS/ALUMINIUM PANELS 1.6mm THICK AND ABOVE. FOR OTHER PANELS, HOLES TO BE M4 CLEARANCE (TYPICALLY 4.5 DIA.) AND RELAYS MOUNTED M4 MACHINE SCREWS, NUTS AND LOCKWASHERS (SUPPLIED IN FIXING KIT).PANEL

Product description	Variants	Order No.
---------------------	----------	-----------

**OHMEGA (300 series)**

Distance protection for sub-transmission and distribution networks.

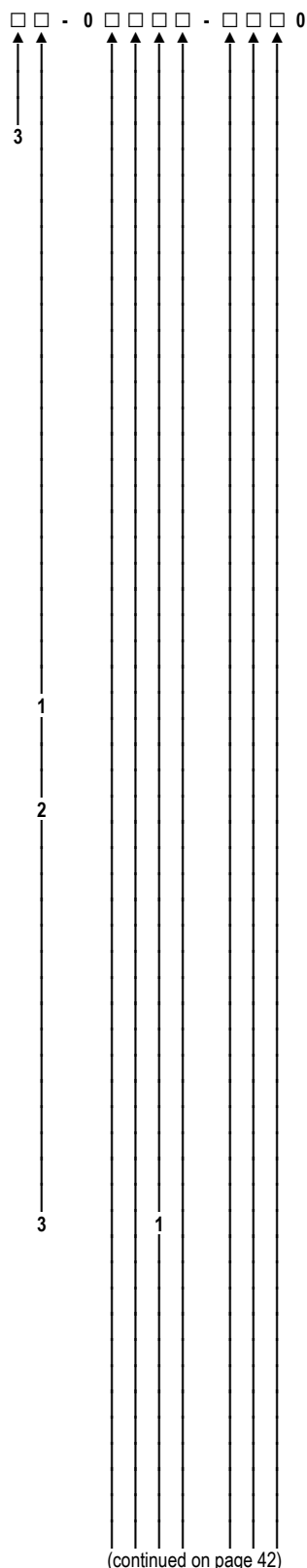
7 S G 1 6 □ □ - 0 □ □ □ □ - □ □ □ 0

- Relay type  
**OHMEGA 300 series - Standard functionality**  
 Numeric distance protection with a range of integrated standard functions.  
 All relays can accommodate 1, 2 and 5A inputs and communications using IEC60870-5-103 protocol.
- Distance Protection (21/21N)  
 - Phase and earth-fault mho characteristics  
 - Loss of load  
 - Power swing blocking (68)  
 - Switch on to fault  
 - Fault locator (21FL)
- Distance signalling schemes  
 - Time-stepped distance, permissive underreach, permissive overreach  
 - Accelerated underreach  
 - Current reversal, CB echo, weak infeed
- Auxiliary functions  
 - VT supervision  
 - Phase-fault overcurrent (50)  
 - Trip circuit supervision (74TC)

- Protection options  
**OHMEGA 305 - Relay specific functionality**  
Distance Protection (21/21N)  
 - Three mho impedance zones

- OHMEGA 308 - Relay specific functionality**  
Distance Protection (21/21N)  
 - Three mho impedance zones  
 - Earth-fault quadrilateral characteristics  
Directional (high impedance) earth-fault (67N)  
 - IDMTL direct tripping and permissive overreach schemes  
 - Current reversal and CB echo
- Auxiliary functions  
 - Single shot auto-reclose (79)  
 - Check synchronising (25)  
 - Sensitive earth-fault (50G)  
 - Power swing blocking (68)  
 - Two stage DTL undervoltage (27)  
 - One stage DTL overvoltage (59)

- OHMEGA 311 - Relay specific functionality**  
Distance Protection (21/21N)  
 - Three mho impedance zones  
Directional (high impedance) earth-fault (67N)  
 - IDMTL direct tripping and permissive overreach schemes  
 - Current reversal and CB echo
- Auxiliary functions  
 - Single shot auto-reclose with reach extension scheme (79)  
 - Check synchronising (25)  
 - Broken conductor  
 - Circuit breaker fail (50BF)



(continued on page 42)

Product description	Variants	Order No.
---------------------	----------	-----------

**OHMEGA (300 series)**

(continued from page 41)

7 S G 1 6 □ □ - 0 □ □ □ □ - □ □ □ 0

Protection options

OHMEGA 314 - Relay specific functionality

Distance Protection (21/21N)

- Four mho impedance zones
- Earth-fault quadrilateral characteristics

Distance signalling schemes

- Blocking overreach

Dual directional (high impedance) earth-fault (67N)

- IDMTL direct tripping and permissive overreach schemes
- Blocking scheme
- Current reversal, CB echo, weak infeed

Auxiliary functions

- Single shot auto-reclose with reach extension scheme (79)
- Check synchronising (25)
- Sensitive earth-fault (50G)
- Two stage DTL undervoltage (27)
- Two stage DTL overvoltage (59)

OHMEGA 315 - Relay specific functionality

Distance Protection (21/21N)

- Four mho impedance zones
- Earth-fault quadrilateral characteristics
- Overcurrent guard

Distance signalling schemes

- Blocking overreach

Dual directional (high impedance) earth-fault (67N)

- IDMTL direct tripping and permissive overreach schemes
- Blocking scheme
- Current reversal, CB echo, weak infeed

Auxiliary functions

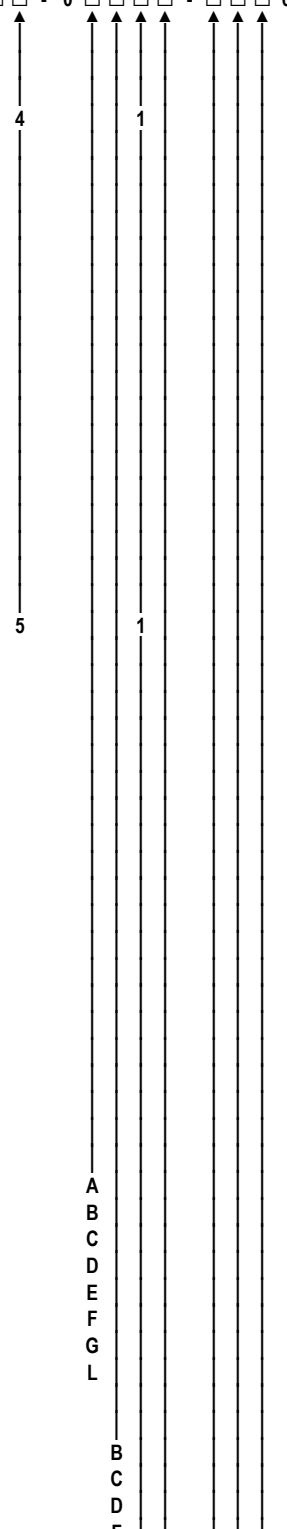
- Single shot auto-reclose with reach extension scheme (79)
- Check synchronising (25)
- Sensitive earth-fault (50G)
- Two stage DTL undervoltage (27)
- Two stage DTL overvoltage (59)

Auxiliary supply /binary input voltage

- 30 V DC auxiliary, 30 V DC binary input
- 30 V DC auxiliary, 48 V DC binary input
- 48/110 V DC auxiliary, 30 V DC binary input
- 48/110 V DC auxiliary, 48 V DC binary input <sup>1)</sup>
- 48/110 V DC auxiliary, 110 V DC low burden binary input
- 220 V DC auxiliary, 110 V DC low burden binary input
- 220 V DC auxiliary, 220 V DC low burden binary input
- 110/220 V DC auxiliary, 110 V DC low burden binary input

I/O range

- 11 Binary Inputs / 13 Binary Outputs (incl. 3 changeover)
- 19 Binary Inputs / 21 Binary Outputs (incl. 3 changeover) <sup>2)</sup>
- 27 Binary Inputs / 29 Binary Outputs (incl. 3 changeover) <sup>2)</sup>
- 11 Binary Inputs /29 Binary Outputs (incl. 3 changeover) <sup>2)</sup>



A  
B  
C  
D  
E  
F  
G  
L

B  
C  
D  
F

(continued on page 43)

Product description	Variants	Order No.
---------------------	----------	-----------

**OHMEGA (300 series)**

7 S G 1 6 □ □ - 0 □ □ □ □ □ □ □ 0

(continued from page 42)

Frequency

50Hz  
60Hz



Nominal current

1, 2 or 5 A



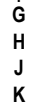
Voltage inputs

63/110 V AC



Housing size

Case size E12 (4U high)  
Case size E12 (4U wide, vertical)  
Case size E16 (4U high)  
Case size E16 (4U wide, vertical)



Communication interface

Fibre optic (ST-connector) / IEC 60870-5-103



<sup>1)</sup> High burden 110/125V & 220/250V binary inputs compliant with ES148-4 ESI 1 available via external dropper resistors with 48V binary input version 110/125 V application, order combination of the following resistor boxes to suit number of binary inputs

- 2512H10064 (9 inputs, 110V)
- 2512H10065 (5 inputs, 110V)
- 2512H10066 (1 inputs, 110V)

220/250 V application, order resistor box 2512H10066 in addition

- 2512H10067 (5 inputs, 220V)
- 2512H10068 (1 inputs, 220V)

<sup>2)</sup> Case size E16

Product description	Variants	Order No.
---------------------	----------	-----------

**OHMEGA (400 series)**

Distance protection for sub-transmission networks.

7 S G 1 6 □ □ - 0 □ □ □ □ - □ □ □ 0

Relay type

OHMEGA 400 series - Standard functionality

Numeric distance protection (Sub-transmission) with a range of integrated standard functions. All relays can accommodate 1, 2 and 5A inputs and communications using IEC60870-5-103 protocol.

Distance Protection (21/21N)

- Four mho impedance zones
- Phase and earth-fault mho characteristics
- Power swing blocking (68)
- Switch on to fault
- Fault locator (21FL)

Distance signalling schemes

- Time-stepped distance, permissive underreach, permissive overreach
- Blocking overreach

Auxiliary functions

- VT supervision
- Phase-fault overcurrent (50)

Protection options

OHMEGA 402 - Relay specific functionality

Distance Protection (21/21N), three pole tripping

- Stub protection

OHMEGA 406 - Relay specific functionality

Distance Protection (21/21N)

- Earth-fault quadrilateral characteristics
- Single pole tripping
- Loss of load
- Stub protection

Distance signalling schemes

- Current reversal, CB echo, weak infeed

Directional (high impedance) earth-fault (67N)

- DTL direct tripping and permissive overreach schemes
- Current reversal and CB echo
- Weak infeed

Auxiliary functions

- Two shot 1P/3P auto-reclose with reach extension scheme (79)
- Check synchronising (25)

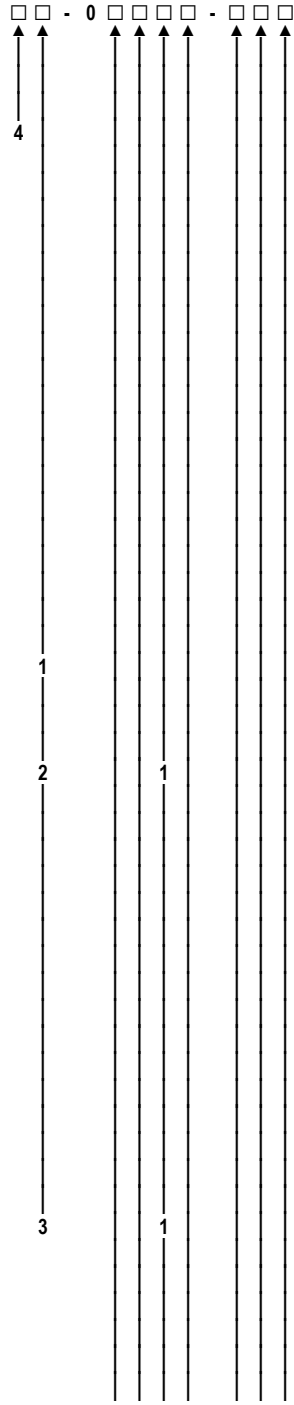
OHMEGA 408 - Relay specific functionality

Distance Protection (21/21N)

- Earth-fault quadrilateral characteristics
- Single pole tripping

Distance signalling schemes

- Current reversal, CB echo, weak infeed
- Thermal overload



(continued on page 45)

Product description	Variants	Order No.
---------------------	----------	-----------

**OHMEGA (400 series)**  
(continued from page 44)

7 S G 1 6 □ □ - 0 □ □ □ □ - □ □ □ 0

Auxiliary supply /binary input voltage

- 30 V DC auxiliary, 30 V DC binary input
- 30 V DC auxiliary, 48 V DC binary input
- 48/110 V DC auxiliary, 30 V DC binary input
- 48/110 V DC auxiliary, 48 V DC binary input <sup>1)</sup>
- 48/110 V DC auxiliary, 110 V DC low burden binary input
- 220 V DC auxiliary, 110 V DC low burden binary input
- 220 V DC auxiliary, 220 V DC low burden binary input
- 110/220 V DC auxiliary, 110 V DC low burden binary input

A  
B  
C  
D  
E  
F  
G  
L

I/O range

- 11 Binary Inputs / 13 Binary Outputs (incl. 3 changeover)
- 19 Binary Inputs / 21 Binary Outputs (incl. 3 changeover) <sup>2)</sup>
- 27 Binary Inputs / 29 Binary Outputs (incl. 3 changeover) <sup>2)</sup>
- 11 Binary Inputs /29 Binary Outputs (incl. 3 changeover) <sup>2)</sup>

B  
C  
D  
F

Frequency

- 50Hz
- 60Hz

1  
2

Nominal current

- 1, 2 or 5 A

1

Voltage inputs

- 63/110 V AC

1

Housing size

- Case size E12 (4U high)
- Case size E12 (4U wide, vertical)
- Case size E16 (4U high)
- Case size E16 (4U wide, vertical)

G  
H  
J  
K

Communication interface

- Fibre optic (ST-connector) / IEC 60870-5-103

A

<sup>1)</sup> High burden 110/125V & 220/250V binary inputs compliant with ESI48-4 ESI 1 available via external dropper resistors with 48V binary input version

110/125 V application, order combination of the following resistor boxes to suit number of binary inputs

2512H10064 (9 inputs, 110V)

2512H10065 (5 inputs, 110V)

2512H10066 (1 inputs, 110V)

220/250 V application, order resistor box 2512H10066 in addition

2512H10067 (5 inputs, 220V)

2512H10068 (1 inputs, 220V)

<sup>2)</sup> Case size E16

## **Qualifications**

Siemens Protection Devices Limited operates a quality system accredited to ISO9001. **CE** Compliant to relevant EU Directives.

Siemens Protection Devices Limited  
PO Box 8  
North Farm Road  
Hebburn  
Tyne & Wear  
NE31 1TZ  
United Kingdom  
Tel: +44 (0)191 401 5555  
Fax: +44 (0)191 401 5575

PTD 24hr Customer Support  
Tel: +49 180 524 7000  
Fax: +49 180 524 2471  
E-mail: [support.energy@siemens.com](mailto:support.energy@siemens.com)

**August 2007**