

# DUOBIAS-M

## 7SR242 - Multi-Functional Integrated Transformer Protection Relay

### Description

Based on the REYROLLE Multi-Function platform our new generation of integrated transformer protection relays are designated the 7SR24 series. The relay is the latest development of transformer protection relays and utilizes years of numeric relay protection experience with the 'DUOBIAS' family of products.

Housed in 4U high, size E8 or E10 cases, these relays provide protection, control, monitoring, instrumentation and metering with integrated input and output logic, data logging & fault reports. Communication access to relay functionality is via a front USB port for local PC connection or rear electrical RS485 port for remote connection. Additional rear port options are available.



### Standard Functionality

50BF	Circuit Breaker Fail
64H	High Impedance REF
74TC	Trip Circuit Supervision
81HBL2	Inrush Detector
81HBL5	Overfluxing Detector
87BD	Biased Differential (2Windings)
87HS	High-Set Differential
8	Settings Groups
	Password Protection – 2 levels
	User Programmable Logic
	Self Monitoring

### Optional Functionality

24	Over-Fluxing
27/59	Under/Over Voltage
37	Undercurrent
46NPS	Negative Phase Sequence Overcurrent
49	Thermal Overload
50	Instantaneous Overcurrent
50G/N	Instantaneous Earth Fault
51	Time Delayed Overcurrent
51G/N	Time Delayed Measured Earth Fault /SEF
59N	Neutral Voltage Displacement
81	Under/Over Frequency

### Data Communications

Front USB port  
Rear RS485 port

### User Interface

20 character x 4 line backlit LCD  
Menu navigation keys  
3 fixed LEDs  
16 or 24 Programmable Tri-colour LEDs (Option)

### Data Communication Options

2 Rear fibre optic + IRIG-B ports

### Protocols

IEC60870-5-103 or Modbus RTU protocols – User selectable  
Optional DNP 3.0

### Standard Monitoring Functions

Primary current phases and earth  
Secondary current phases and earth  
Relay Operate and restraint currents  
Positive Phase Sequence (PPS) Current  
Negative Phase Sequence (NPS) Current  
Zero Phase Sequence (ZPS) Current  
Thermal status  
Primary Single phase voltage\*  
Secondary single phase voltage\*  
Data logging and Demand Metering  
Frequency & fluxing\*  
Binary Input/binary output and virtual I/O status  
Trip circuit healthy/failure  
Time and date  
Fault records  
Event records  
Waveform records  
Circuit breaker trip counters  
I<sup>2</sup>t summation for contact wear

\* Optional voltage measurements from single phase VT input.

# Function Diagram showing example of external connections

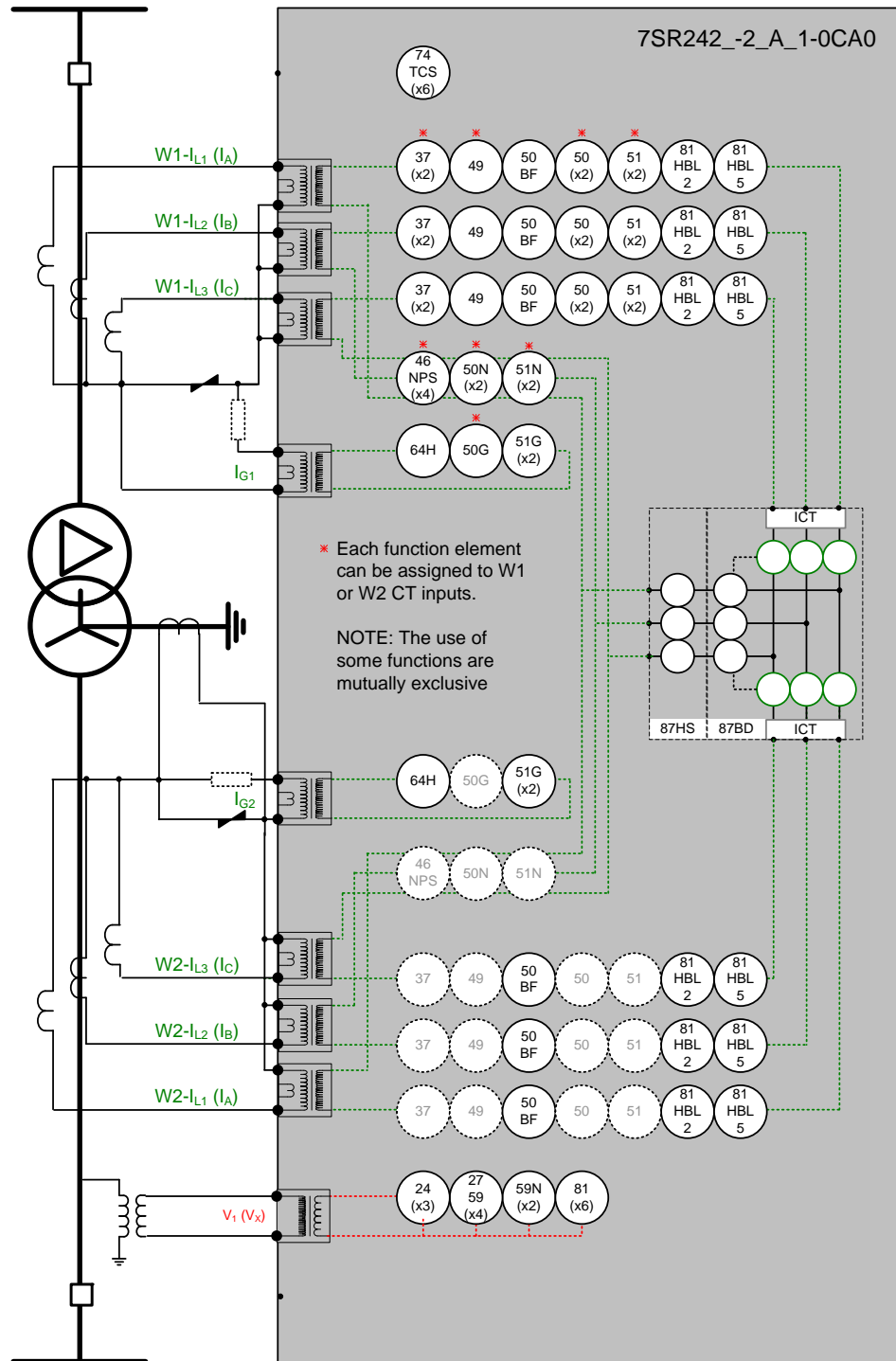


Fig. 1. Standard and Additional Functionality of Duobias - M 7SR242 Relay

## Standard Functionality

### 50BF Circuit Breaker Fail

The circuit breaker fail function may be triggered from an internal trip signal or from a binary input. Line currents are monitored following a trip signal and an output is issued if any current is still detected after a specified time interval. This can be used to re-trip the CB or to back-trip an upstream CB. A second back-trip time delay is available to enable another stage to be utilized if required.

### 64H Restricted Earth Fault - scheme

The measured earth fault input may be used in a high impedance restricted earth fault scheme. Required external series stabilising resistor and non-linear voltage limiting shunt resistor can be supplied.

### 74TC Trip Circuit Supervision

The trip circuit(s) can be monitored via binary inputs. Trip circuit failure raises an HMI alarm and output(s).

### 81HBL2 Inrush Detector

Where second harmonic current is detected (i.e. during transformer energisation) user selectable elements can be blocked.

### 81HBL5 Overfluxing Detector

Fifth Harmonic Detectors can be user selected to block the Biased Differential Elements.

### 87BD Biased Differential

The differential characteristic incorporates two bias stages – the first stage for steady state errors i.e. tap position and CT ratios the second stage for transient errors i.e. CT saturation.

### 87HS High-Set Differential

High speed differential elements provide protection against high levels of internal fault current.

### Programmable Logic

The user can map Binary Inputs and Protection operated outputs to Function Inhibits, Logic Inputs, LEDs and/or Binary Outputs.

The user can also enter up to 16 equations defining scheme logic using standard functions e.g. Timers, Latches, AND/OR gates, Inverters and Counters.

Each Protection element output can be used for Alarm & Indication and/or tripping.

### Circuit Breaker Maintenance

For each winding two circuit breaker operations counters are provided. The Maintenance Counter records the overall number of operations and the Delta Counter the number of operations since the last reset.

I<sup>2</sup>t summation Counters provide a measure of the contact wear indicating the total energy interrupted by the circuit breaker contacts.

Each counter has a user set target operations count which, when reached, can be mapped to raise Alarms/ Binary Outputs.

These counters assist with maintenance scheduling.

## Data Records - accessible via Data Comms ports

### Sequence of event records

Up to 5000 events are stored and time tagged to 1ms resolution.

### Fault Records

The last 10 fault records are displayed on the HMI, with time and date of trip, measured quantities and type of fault.

### Waveform recorder

The waveform recorder stores analogue data for all phases, the states of protection functions, Binary Inputs, LEDs and Binary Outputs with pre & post trigger data. A record can be triggered from Protection function, Binary input or via data communications. 1 record of 10sec, 2 of 5sec, 5 of 2sec or 10 records of 1 second are stored. The ratio of pre-fault to post fault storage can be set by the user.

### Data Log

Provides a rolling record of line currents and voltage (where applicable) over a user selectable period of time.

## Optional Functionality

### 24 Over-Fluxing

Two elements each provide a definite time lag (DTL) characteristic, the third element provides a user defined characteristic. Operates if Volts/Hertz ratio is above setting for duration of delay.

### 27/59 Under/Over Voltage

Each element has settings for pickup level, drop-off level and Definite Time Lag (DTL) delays. Operates if voltage 'exceeds' setting for duration of delay. Can be applied in load shedding schemes.

### 37 Undercurrent

Each element has settings for pickup level and Definite Time Lag (DTL) delays. Operates if current falls below setting for duration of delay.

### 46NPS Negative Phase Sequence Overcurrent

Two DTL and two inverse/DTL elements are provided. NPS Current elements can be used to detect unbalances on the system or remote earth faults when a delta-star transformer is in circuit.

### 49 Thermal Overload

The thermal algorithm calculates the thermal states from the measured line currents. Outputs are available for thermal overload and thermal capacity.

### 50/51 Phase Fault

50 INST/DTL and 51 IDMT/DTL elements provide overcurrent protection, each with independent settings for pickup current, time-multiplier (51) and time-delays. User can select IEC or ANSI Time Current Characteristics. The IDMT stage has a user programmable DTL or shaped current/time reset characteristic, to improve grading with electromechanical protection.

### 50G/51G/50N/51N Earth Fault/Sensitive Earth Fault

Two earth fault measurement modes are available. One mode directly measures the earth current from an independent CT, or the residual connection of the 3 line CTs. This input can be set to either earth fault or sensitive earth fault (50G/51G). The second mode derives the earth current internally from the 3 phase CTs (50N/51N). 50 INST/DTL and 51 IDMT/DTL elements provide overcurrent protection, each with independent settings for pickup current, time-multiplier (51) and time-delays. User can select IEC or ANSI Time Current Characteristics. The IDMT stage has a user programmable reset characteristic either DTL or shaped current/time reset characteristic to improve grading with electromechanical protection

### 59N Neutral Overvoltage

One element provides a definite time lag (DTL) characteristic; the second element provides an inverse/DTL characteristic. Operates if Neutral voltage exceeds setting for duration of delay. Neutral overvoltage can be used to detect earth faults in high impedance earthed or isolated systems.

### 81 Under/Overfrequency

Each element has settings for pickup level, drop-off level and Definite Time Lag (DTL) delays. Each element operates if frequency exceeds setting for duration of delay. Typically applied in load shedding schemes.



Fig. 4. Tri-colour LED's

### Tri-colour LED's

16 or 24 user programmable LED's are available eliminating the need for expensive panel mounted pilot lights and associated wiring. Each LED is tri-color (red, green, yellow) allowing for clear indication of the associated function's state.

## Reydisp Evolution

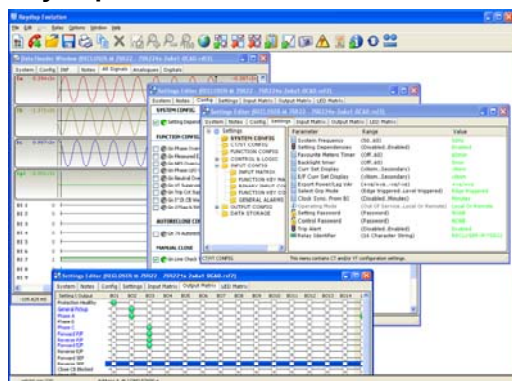


Fig. 3. Typical ReyDisp Evolution screenshot

Reydisp Evolution is common to the entire range of Reyrolle numeric products. It provides the means for the user to apply settings interrogate settings and retrieve events and disturbance waveforms from the DUOBIAS-M multi-functional relays.

## Service Conditions and Performance Data

### Temperature

IEC 60068-2-1/2

Type	Level
Operating Range	-10 °C to +55 °C
Storage range	-25 °C to +70 °C

### Humidity

IEC 60068-2-3

Type	Level
Operational test	56 days at 40 °C and 95 % relative humidity

### Insulation

IEC 60255-5

Type	Level
Between any terminal and earth	2.0 kV AC RMS for 1 min
Between independent circuits	2.0 kV AC RMS for 1 min
Across normally open contacts	1.0 kV AC RMS for 1 min
Impulse Voltage Type test	5 kV (peak) 1.2 / 50 $\mu$ s

### IP Ratings

Type	Level
Installed with cover	IP 51
Installed with cover removed	IP 30

### Auxiliary DC Supply Variation

Type	Level
Allowable superimposed ac component	12% of DC voltage
Allowable breaks/dips in supply (collapse to zero)	20ms

### High Frequency Disturbance

IEC 60255-22-1 Class III

Type	Level	Variation
Common (longitudinal)	2.5 kV	$\leq 5\%$
Series (transverse) mode	1.0 kV	$\leq 5\%$

### Electrostatic Discharge

IEC 60255-22-2 Class IV

Type	Level	Variation
Contact discharge	8.0 kV	$\leq 5\%$

### Radiated Immunity

IEC 60255-22-3 Class III

Type	Level	Variation
80 MHz to 1000 MHz	10 V/m	$\leq 5\%$

### Fast Transients

IEC 60255-22-4 Class IV

Type	Level	Variation
5/50 ns 2.5 kHz repetitive	4kV	$\leq 5\%$

### Surge Immunity

IEC 60255-22-5

Type	Level	Variation
Between all terminals and earth, or between any two independent circuits	4.0 kV, 1.2/50 $\mu$ s or 8/20 $\mu$ s	$\leq 10\%$

### Conducted Radio Frequency Interference

IEC 60255-22-6

Type	Level	Variation
0.15 to 80 MHz	10 V	$\leq 5\%$

### Emissions

IEC 60255-25

### Radiated Radio Frequency

Type	Limits at 10 m, Quasi-peak
30 to 230 MHz	40 dB( $\mu$ V)
230 to 10000 MHz	47 dB( $\mu$ V)

### Conducted Radio Frequency

Type	Limits	
	Quasi-peak	Average
0.15 to 0.5 MHz	79 dB( $\mu$ V)	66 dB( $\mu$ V)
0.5 to 30 MHz	73 dB( $\mu$ V)	60 dB( $\mu$ V)

### Mechanical

#### Vibration (Sinusoidal)

IEC 60255-21-1 Class I

Type	Level	Variation
Vibration response	0.5 gn	$\leq 5\%$
Vibration endurance	1.0 gn	$\leq 5\%$

#### Shock and Bump

IEC 60255-21-2 Class I

Type	Level	Variation
Shock response	5 gn, 11 ms	$\leq 5\%$
Shock withstand	15 gn, 11 ms	$\leq 5\%$
Bump test	10 gn, 16 ms	$\leq 5\%$

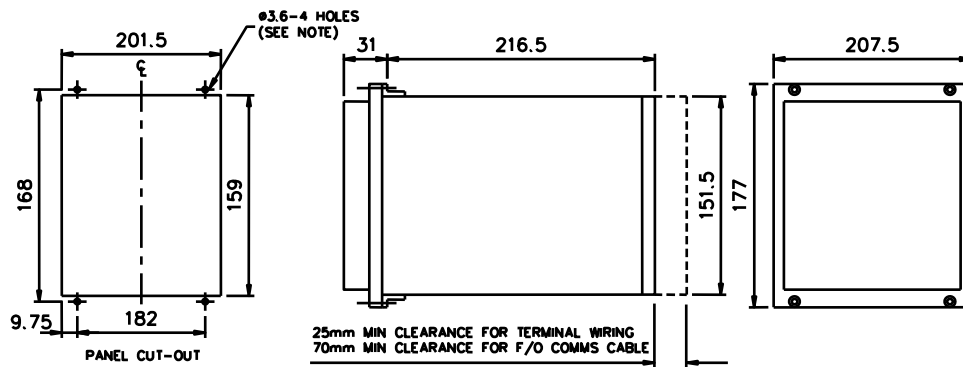
#### Seismic

IEC 60255-21-3 Class I

#### Mechanical Classification

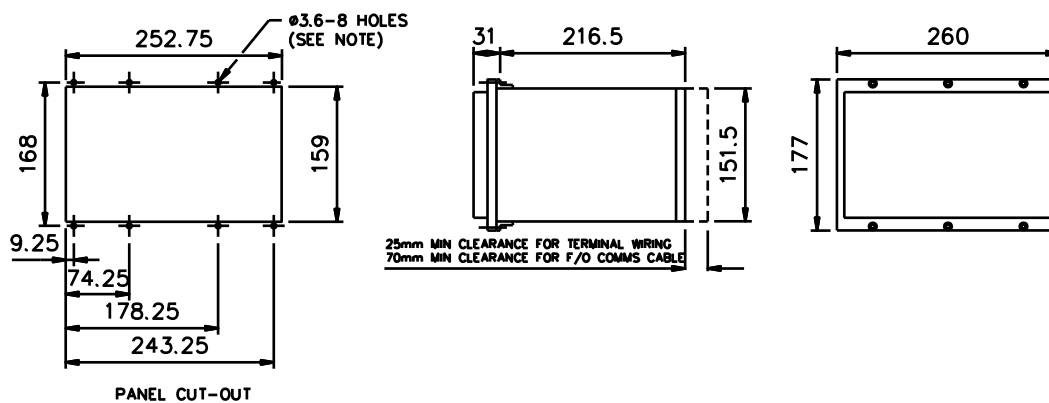
Type	Level
Durability	$> 10^6$ operations

## E8 Case Dimensions



NOTE:  
 THE  $\phi 3.6$  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  $\phi 4.5$ ) AND RELAYS MOUNTED USING M4 MACHINE SCREWS, NUTS AND LOCKWASHERS (SUPPLIED IN PANEL FIXING KIT).

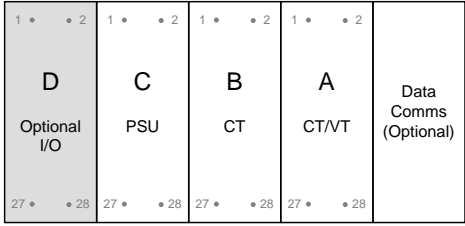
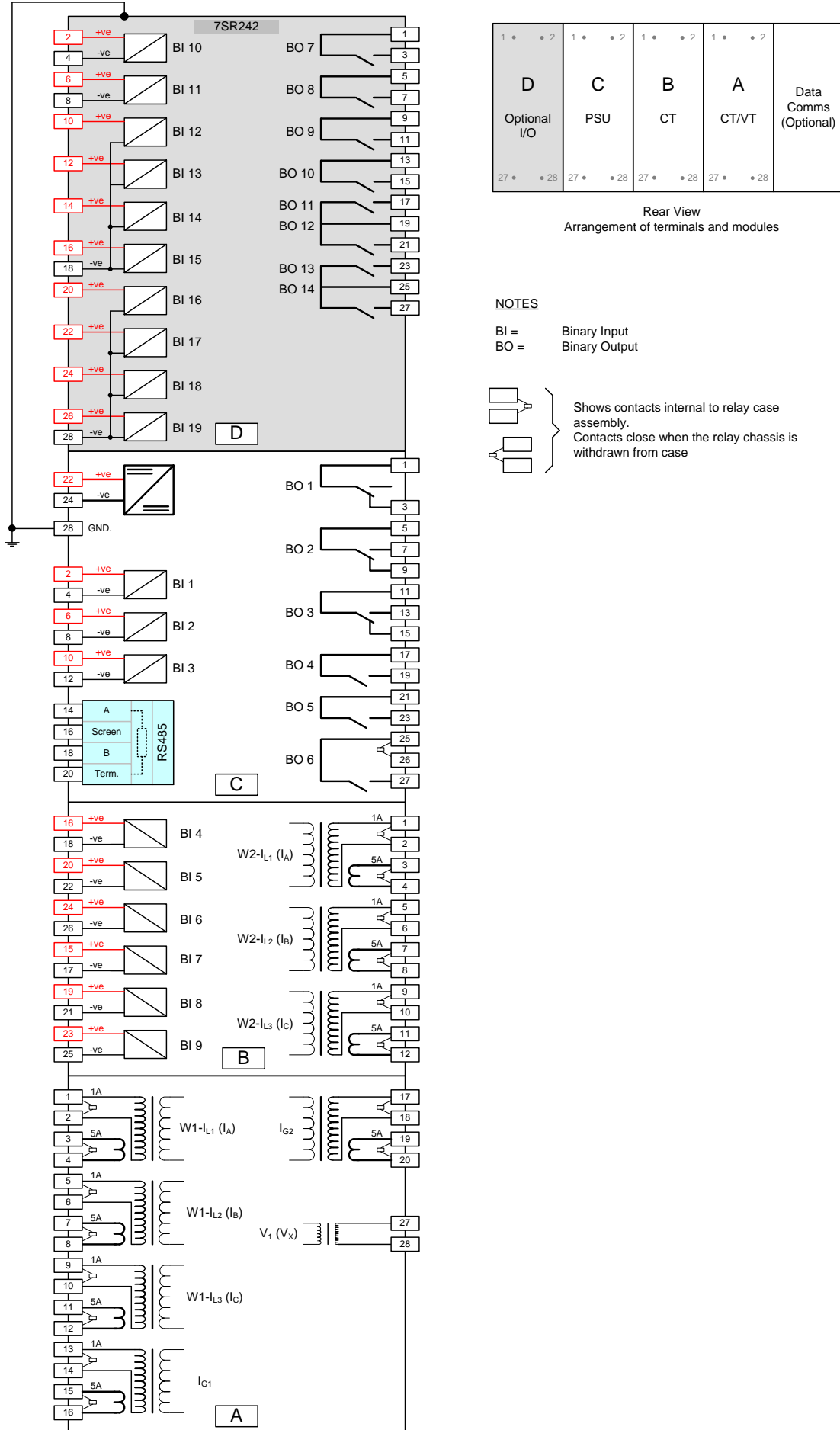
## E10 Case Dimensions



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# Connection Diagram – DUOBIAS-M 7SR242 2-winding transformer protection

Diagram showing relay with 9 binary inputs and 6 binary outputs (E8 Case size) and optional 19 binary inputs and 14 binary outputs (E10 case size)



Rear View  
Arrangement of terminals and modules

**NOTES**

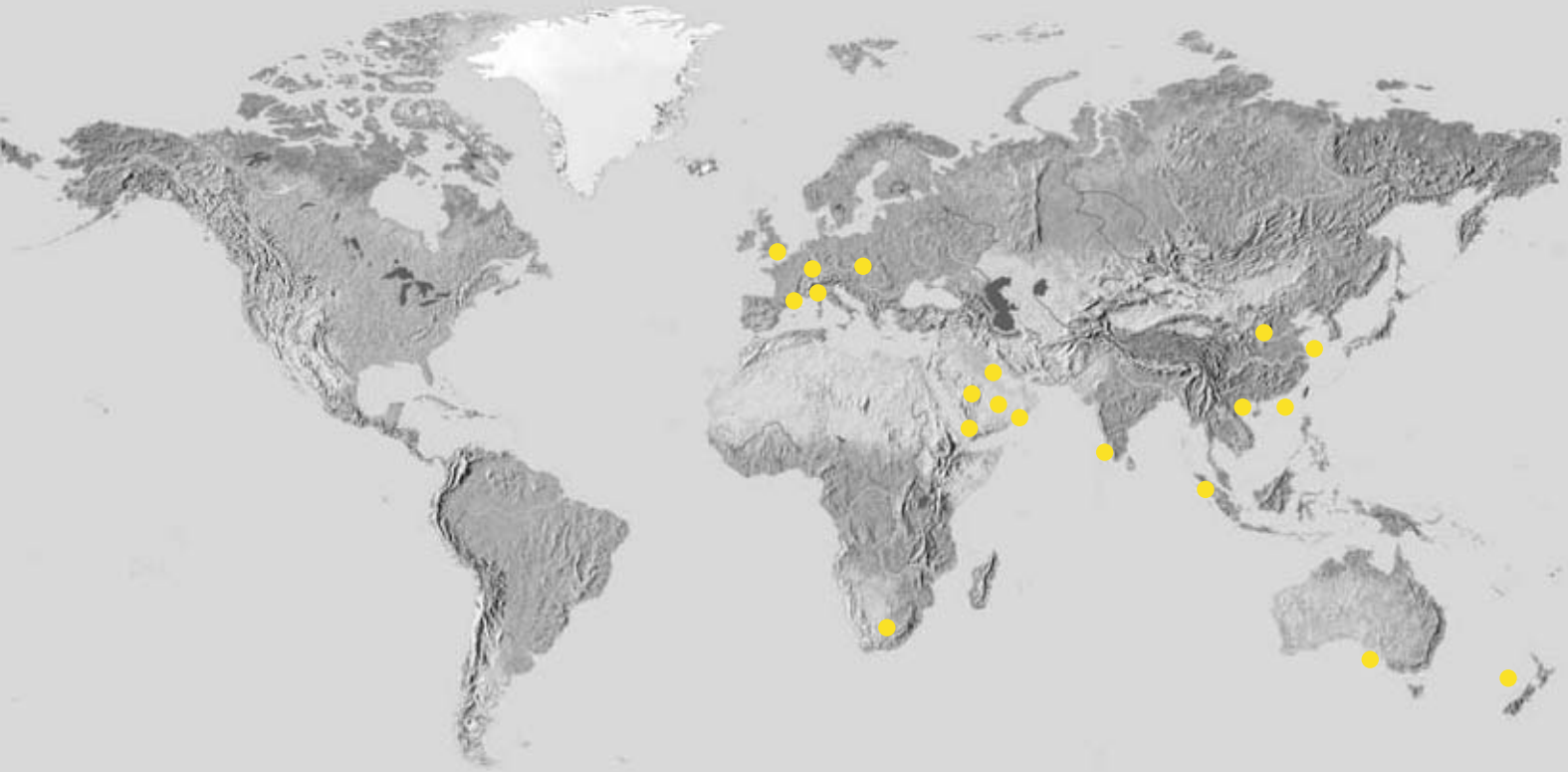
BI = Binary Input  
BO = Binary Output

Shows contacts internal to relay case assembly.  
Contacts close when the relay chassis is withdrawn from case



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Visit our Australian partner, Relay Monitoring Systems Pty Ltd at:

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