

### Type RADSB **Transformer differential** relay

### 1MDB04301-YN

Page 1 Issued Dec 2003 changed since Oct 2001 Data subject to change without notice



#### Abstract Complete phase and ground protection Fifth harmonic restraint from all three Static measuring circuits with active filters for phases for overexcitation security optimum utilization of harmonics in the current Sensitivity can be set to 20, 25, 35 or 50 per cent of rated current 1 A or 5 A circuits Up to three kilometer of high voltage cable can Unrestrained operation does not respond to be included in the differential zone dc offset and can be set 8, 13 or 20 times Harmonic restrained operating time 30 ms at 3 relay rated current times pick-up current Provided with separate auxiliary CTs for ratio Unrestrained operating time 10-20 ms at 2 times and phase angle matching and containment pick-up current with minimum impulse time of of zero sequence current 3 ms No restrictions on the type of main CT connections Variable percentage restraint for external fault security and on-load tap-changer transformer Long CT secondary leads are feasible with protection 1 A relay Second harmonic restraint from all three Built-in trip relay, indicator and test switch phases for inrush security Application The RADSB is a protective relay intended for all The second and fifth harmonic restraint voltages types of auto-transformers and multiple winding for each phase are paralleled and the sum used transformers. By including additional input restraint for harmonic restraint for each phase. The modules, up to 6 transformer windings can be polyphase harmonic restraint circuitry prevents connected. The relay is also well suited for generator and step-up transformer overall protection, often including the auxiliary transformer in the protected zone. The non-linear percentage restraint characteristic provides the required restraint for external faults. This makes the relay suitable for use with multiwinding transformers, auto-transformers or in a characteristic). system where one transformer winding is directly connected to two or more breakers. The ratios. In addition auxiliary CTs may be used to characteristics are designed to provide excellent internal fault sensitivity; RADSB is virtually unaffected by load restraint.

The RADSB relay also has an unrestrained instantaneous module which responds to the total differential current (less any dc component). This module will provide redundant operation for severe internal faults.

the relay from operating on inrush currents yet has a minimum effect on relay sensitivity if an internal fault occurs during energization. The fifth harmonic is used to prevent operation of the relay due to possible overexcitation of the transformer. Overexcitation protection should be provided by a V/Hz relay (preferably type RATUB which has an inverse-time operating Auxiliary CTs are used to balance the main CT

reduce the effective lead burden of long secondary leads. The differential zone of the relay can include up to three kilometre of high voltage cable since adequate filtering provides security against high current oscillations.

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Application

The RADSB relay is available with two, three, five or six through-fault restraint inputs and can be used for dual-winding or multi-winding transformers which have one or more circuit-breakers for each winding.

The relay comprises the following modules:

With or without test switch (Screw type termination) DC-DC converter type RXTUG 22H Transformer unit type RTQTB 060 and 061 Measuring unit type RXDSB 4 Tripping relay type RXMS 1 Indicator type RXSGA 1

In RXSGA 1, LEDs indicate unrestrained operation and restrained operation and also the phase which caused the latter operation.

The RADSB relay can be connected directly to the main current transformers; however, when this is not practical, auxiliary CTs are used for ratio and phase-angle matching purposes. Auxiliary CTs also provide an additional point of insulation so that the main CTs can be grounded independent of the



Fig. 2 Operating times for restrained and unrestrained operation, with RXMS 1 as the tripping relay.

ground at the relay location in addition to main CT secondary grounding. In the case of long CT leads, auxiliary current transformers can be used to reduce the secondary CT lead burden to the relay or the 1 A relay can be used.

When internal faults such as short circuits between phases, groundfaults or inter-turn short circuits occur, the differential relay rapidly disconnects the supply to the transformer. On the other hand, the RADSB restraints for differential currents which are caused by external faults, inrush currents or overvoltages. The operating values for restrained and unrestrained operations are set with switches on the measuring unit. The operating times of the relay are shown in fig. 2.

RADSB has static measuring circuits with active filters to enable optimum utilization of the harmonics in the differential current when restraining to inrush currents and overvoltages. The restraint limits in the case of external faults are shown in fig. 3.



- Fig. 3 The restraint of the relay for external faults is variable and is adapted to the magnitude of the through current
  - $\frac{I_x + I_y}{2}$  where  $I_x$  and  $I_y$  are the highest incoming and outgoing currents, respectively, of the transformer.

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Technical data	Rated current I	1 or 5A	Power consumption	
	Rated frequency	50 or 60 Hz	total at rated current (approximately)	
	Restrained operating value I <sub>sr</sub>	Settable 20, 25, 35, or	$I_n = 1 A$ $I_n = 5 A$	0.02 VA/phase 0.14 VA/phase
	Unrestrained instantaneous opreating value I <sub>su</sub>	50% of I <sub>n</sub> Reconnectible : 8, 13 and 20 times I <sub>n</sub>	In diff. circuit 0.25 x I <sub>n</sub> I <sub>n</sub> = 1 A I <sub>n</sub> = 5 A In auxiliary voltage circuit before operation	0.003 VA/phase 0.02 VA/phase 10 W
	Operating time: at $I_d = 3 \times I_{sr}$ at $I_d = 2 \times I_{su}$	RXMS 1RXME 1830 ms50 ms10-20 ms40 ms	at operation1Dielectric testscurrent circuitsremaining circuitsJimpulse votlage test1Power frequency testFast transient test1MHz burst test2Auxiliary CTs type	14 W 50 Hz, 2.5 kV, 1 min 50 Hz, 2.0 kV, 1 min
	Overload capacity: withstands 1 A version	10 A continuously 100 A for 1 s		1.2/50μs, 5.0 kV, 0.5 J 50 Hz, 0.5 kV, 2 min 4–8 kV, 2s 2.5 kV, 2s
	5 A version	20 A continuously 250 A for 1 s		
	Permitted ambient temperature Auxiliary voltage U	–25 to 55° C dc 24 – 36 V, 48 – 60 V	SLCE 12, taps from 0.75 – 0.95 and 4 – 4.8 in one per cent ste	
	(EL)	or 110 – 250 V + 10% – 20%		

To order

Specify : • Type RADSB

Quantity

• Ordering no. from table 1 for COMBIFLEX version & refer page 7 for screw type version.

No. of restraint input	Rated current	Freq.	Aux. Voltage	Modular size	Ordering No.	Circuit diagram
2	1A	50 Hz	110 VDC / 220 VDC	4 S, 36 C	IN 330-021-CA	IN 7454-3344-CE
3	1A	50 Hz	110 VDC / 220 VDC	4 S, 42 C	IN 330-041-CA	7454-356-CC
5	1A	50 Hz	110 VDC / 220 VDC	4 S, 60 C	IN 330-051-CA	7454-359-CC
2	5A	50 Hz	110 VDC / 220 VDC	4 S, 36 C	IN 330-021-CB	IN 7454-3344-CE
3	5A	50 Hz	110 VDC / 220 VDC	4 S, 42 C	IN 330-041-CB	7454-356-CC
5	5A	50 Hz	110 VDC / 220 VDC	4 S, 60 C	IN 330-051-CB	7454-359-CC

## Table 1, RADSB Selection:

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7454-359-CC - Circuit diagram for RADSB with 5 restraint inputs

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#### Mounting:

The following versions of mounting arrangement are available for mounting the relays

- 19" Rack mounting with equipment frame (apparatus frame+door) IN5628-3003-A
- Flush mounting system (RHGX20) IN5609-1200-D

#### Specify the mounting arrangement as per requirement during ordering



Panel cutout details for 19" rack mounting and flush mounting are as shown below



#### Sample provided set at 8, 13 or 20 times rated current. Three-phase harmonically restrained transformer Specification Minimum operating current of restraint module to differential relay having second harmonic restraint be set at 25 to 50 per cent of rated current in three for security against transformer inrush current and fifth harmonic restraint against over excitation. steps. The protected differential zone shall be able to include up to one kilometre of high voltage cable. The relay shall have a variable through-current Auxiliary current transformers shall be used and restraint feature. For security reasons, the restraint should be summed from all three phases. An supplied separately for ratio and phase angle instantaneous unrestrained function is to be correction purposes. Reference Buyer's Guide No. DC-DC converter type Test system COMBITEST B03-9510E RXTUG 22 H 1MRK 513001-BEN Dimensions 1MDB14315-YN Auxiliary relay type RXMS 1 1MDB08307-YN Further information : Auxiliary relay data table 1MDB08301-YN User's Guide 1MDU04007-EN Indicator type RXSGA 1 B03-9150E



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### **OPTIONAL VERSION:** Screw type connectivity for two winding application

With flush mounting in RHGX12 case.



RHGX12 -CASE



Rear view of screw type termination



Panel cut-out Detail

No. of restrai nt inputs	Rated current	Aux.Voltage	Ordering No.
2	1A ,50Hz	110/220VDC	1MYN745031-A
2	5A, 50Hz	110/220VDC	1MYN745031-B

Ordering table for screw type RADSB



RADSB - Circuit diagram for screw type termination