

# MiCOM

## P543, P544, P545 & P546

Current Differential Protection Relay

P54x/EN M/Ka4+Kb4

Software Version 45, 47, 55 & 57  
Hardware Suffix K

### Technical Manual

Contains: P54x/EN AD/Kb4 V47 & 57 K Addendum  
P54x/EN M/Ka4 V45 & 55 K Manual

**Note:** The technical manual for this device gives instructions for its installation, commissioning, and operation. However, the manual cannot cover all conceivable circumstances or include detailed information on all topics. In the event of questions or specific problems, do not take any action without proper authorization. Contact the appropriate Schneider Electric technical sales office and request the necessary information.

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Update Documentation

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# **UPDATE DOCUMENTATION**



## P54x UPDATE DOCUMENTATION

In the firmware version 45 and 55K of P54x, several changes on existing features have been added. These are described with reference to the documentation listed below:

Release	Version	Documentation
16.03.2009	P54x/EN M/Ka4	Technical Manual

Document Ref.	Section	Page No.	Description
P54x/EN IT/Ga4	3.1	1-7	<b>Functional overview</b> 64 REF protection added Corrected 67/46 to show 4 stages
	3.2	1-10 1-11	<b>Ordering options</b> Hardware options updated Redundant Ethernet Options added Software number updated
P54x/EN TD/Ja4	-	2-7	<b>Protection functions</b> Phase and ground (earth) Overcurrent modified to Three Phase Overcurrent Protection. Addition of Accuracy claims. Earth Fault added REF Added
	-	2-12 2-15	<b>Settings, measurements and records list</b> Configuration updated EIA(RS)232 Teleprotection added INTERMiCOM conf. added Prot comms/IM64 updated
	-	2-17 2-19	<b>Protection functions</b> Phase current differential protection updated Sensitive earth fault updated
	-	2-24 2-26	<b>Measurements list</b> Measurements 1 updated Fault Record Proforma updated
P54x/EN ST/Ba4	1.1	4-4	<b>Relay settings configuration</b> Sensitive E/F modified to SEF/REF PROT'N
		4-6	IREF>Stage added Restricted Earth Fault Protection added Read Only mode feature added
	1.2	4-6	<b>Integral teleprotection settings</b> New section
	1.2.1	4-6	<b>EIA(RS)232 InterMiCOM</b> New section
	1.3	4-8	<b>Protection communication configuration</b> GPS Sync updated Char Mod Time updated Char Mod Ex feature added Char Mod Ex Time feature added
1.4.2	4-17	<b>Distance setup (only for models with distance option)</b> Cells under DELTA DIRECTION updated	

Document Ref.	Section	Page No.	Description
<b>P54x/EN ST/Ba4 Continued</b>	1.4.4	4-23	<b>Phase differential</b> Compensation: Vector group text changed to Transformer Inrush Restraint updated to add blocking feature Ih (2) & (5) features added Id High Set updated
	1.4.12	4-38 4-39	<b>Sensitive earth fault</b> Sensitive E/F modified to SEF/REF HI Z REF Protection added IREF> Is setting added
	1.5.1	4-68	<b>System data</b> Software Ref.1 and 2 updated
<b>P54x/EN OP/Ba4</b>	1.1.1.2	5-18	<b>Time alignment of current vectors with GPS input (all models)</b> Section updated to reflect changes to GPS SYNC setting.
	1.2	5-20	<b>Protection of transformer feeders (P543 and P545)</b> Previously 1.1.4 Section updated
	1.2.1	5-20	<b>Enabling or disabling differential protection for in-zone power transformer</b> New section
	1.2.2	5-20	<b>Transformer magnetizing inrush (P543/P545)</b> Previously 1.1.4.1 Heading and section updated
	1.2.2.1	5-20	<b>Second harmonic restraint (P543/P545)</b> New section
	1.2.2.2	5-20	<b>Second harmonic blocking (P543/P545)</b> New section
	1.2.2.3	5-20	<b>Fifth harmonic blocking (P543/P545)</b> New section
	1.2.2.4	5-20	<b>High set differential (P543/P545)</b> Section split: previously part of 1.1.4.1
	1.6.2	5-27	<b>Tripping mode - selection of single or three phase tripping</b> Previously 1.5.2 Figure 17 updated
	1.29	5-84	<b>Earth fault, Sensitive Earth Fault (SEF) and Restricted Earth Fault (REF) protection</b> Previously 1.28 Heading and section updated
	1.29.2	5-84	<b>Restricted Earth Fault protection (REF)</b> New section
	1.32	5-90	<b>Undervoltage protection</b> Figure 67 updated
	1.33	5-91	<b>Overvoltage protection</b> Figure 68 updated
	1.35.1	5-96	<b>Reset mechanisms for breaker fail timers</b> Figure 71 updated Figure 72 updated



Document Ref.	Section	Page No.	Description
<b>P54x/EN OP/Ba4</b> <b>Continued</b>	2.1.6	5-105	<b>Switched communication networks</b> Char Mod Ex feature added
	2.1.12.1	5-111	<b>Pilot isolation</b> Section deleted
	2.1.12.2	5-111	<b>Baseband modem and P590 specification</b> Section deleted
	2.1.12.3	5-112	<b>Baseband modem propagation delay</b> Section deleted
	2.1.12.4	5-112	<b>Baseband modem and relay configuration</b> Section deleted
	2.1.13	5-111	<b>Unconditioned 2 wire pilot communications for distances greater than 1.2 km</b> New section
	2.2	5-117	<b>InterMiCOM</b> New section
	2.2.1	5-117	<b>Protection signaling</b> New section
	2.2.2	5-117	<b>InterMiCOM variants</b> New section
	2.2.3	5-117	<b>InterMiCOM features</b> New section
	2.2.4	5-117	<b>Definition of teleprotection commands</b> New section
	2.3	5-117	<b>MODEM InterMiCOM, EIA(RS)232 InterMiCOM or Copper InterMiCOM</b> New section
	2.3.1	5-117	<b>Communications media</b> New section
	2.3.2	5-117	<b>General features and implementation</b> New section
	2.3.3	5-117	<b>EIA(RS)232 physical connections</b> New section
	2.3.4	5-117	<b>Direct connection</b> New section
	2.3.5	5-117	<b>EIA(RS)232 modem connection</b> New section
	2.3.6	5-117	<b>RS422 connection</b> New section
	2.3.7	5-117	<b>Fiber optic connection</b> New section
	2.3.8	5-117	<b>InterMiCOM functional assignment</b> New section
	2.3.9	5-117	<b>InterMiCOM statistics and diagnostics</b> New section
	3.8	5-132	<b>Read Only mode</b> New section
	3.8.1	5-132	<b>Protocol/port implementation:</b> New section

Document Ref.	Section	Page No.	Description
<b>P54x/EN OP/Ba4</b> Continued	3.8.1.1	5-132	<b>IEC 60870-5-103 protocol on rear port 1:</b> New section
	3.8.1.2	5-132	<b>Courier protocol on rear port 1/2 and Ethernet</b> New section
	3.8.1.3	5-132	<b>IEC 61850</b> New section
	3.8.2	5-132	<b>Courier database support</b> New section
	3.8.3	5-132	<b>New DDB signals</b> New section
<b>P54x/EN AP/Ja4</b>	2.1.4	6-11	<b>Transformers in-zone applications (P543 and P545 models)</b> Paragraph two amended Paragraph after Note deleted
	2.1.4.1	6-12	<b>Magnetizing inrush stabilization (P543 and P545)</b> New section
	2.1.4.2	6-12	<b>Second harmonic restraint (P543 and P545)</b> New section
	2.1.4.3	6-12	<b>Second harmonic blocking (P543 and P545)</b> New section
	2.1.4.4	6-12	<b>Fifth Harmonic blocking (P543 and P545)</b> New section
	2.1.4.7	6-13	<b>High set differential setting (P543 and P545)</b> Heading and paragraph one amended
	2.8.4	6-39	<b>Restricted earth fault protection</b> New section
	2.8.4.1	6-39	<b>Setting guidelines for high impedance Restricted Earth fault (REF)</b> New section
	2.18.4.2	6-19	<b>Use of METROSIL non-linear resistors</b> New section
	2.17	6-47	<b>Integral intertripping</b> New section
	2.17.1	6-47	<b>EIA(RS)232 InterMiCOM (“Modem InterMiCOM”)</b> New section
	4.4	6-76	<b>Read Only mode</b> New section

Document Ref.	Section	Page No.	Description
<b>P54x/EN PL/Ba4</b>	1.7	7-16-54	<b>Description of logic node</b> DDB 80 added DDBs 87 to 88 added DDB 95 added DDBs 365 to 368 DDBs 460 to 461 updated DDB 682 added DDBs 737 to 740 updated DDBs 1016 to 1019 updated DDBs 1021 to 1023 added DDBs 1437 to 1440 updated DDB 1616 added DDBs 1665 to 1671 added DDB 1696 to 1697 added DDB 1710 to 1711 added DDB 1728 added DDBs 1759 to 1760 added DDB 1791 added
<b>P54x/EN MR/Ba4</b>	1.4.1	8-11	<b>Measured voltages and currents</b> Paragraph one updated
	1.4.8	8-14	<b>Measurement display quantities</b> CT1 and CT2 Magnitude added CT1 and CT2 Phase angle added
<b>P54x/EN VH/I84</b>	-	16-1-46	<b>Firmware and service manual version history</b> Updated with latest relay software details

## INTRODUCTION (P54x/EN IT/Ga4)

### 3.1 Functional overview

The P54x distance relay contains a wide variety of protection functions. The protection features are summarized below:

ANSI	FEATURE	Models			
		P543	P544	P545	P546
	Optocoupled digital inputs	16	16	24	24
	Standard relay output contacts	14	14	32	32
	Standard and high break output contacts	(11)	(11)	(24)	(24) (20)
	Dual rated 1A and 5A CT inputs	•	•	•	•
	Tripping Mode - single or three pole	•	•	•	•
	ABC and ACB phase rotation	•	•	•	•
	Multiple password access control levels	•	•	•	•
87	Phase segregated current differential	•	•	•	•
	2 and 3 terminal lines/cables	•	•	•	•
	Feeders with in-zone transformers	•		•	
	Control of dual circuit breakers		•		•
	Suitable for use with SDH/SONET networks (using P594)	•	•	•	•
	InterMiCOM <sup>64</sup> teleprotection for direct relay-relay communication	•	•	•	•
21P/21G	Distance zones, full-scheme protection	(5)	(5)	(5)	(5)
	Characteristic	Phase elements	Mho and quadrilateral		
		Ground elements			
	CVT transient overreach elimination	•	•	•	•
	Load blinder	•	•	•	•
	Easy setting mode	•	•	•	•
	Mutual compensation (for fault locator and distance zones)	•	•	•	•
85	Communication-aided schemes, PUTT, POTT, Blocking, Weak Infeed	•	•	•	•
	Accelerated tripping - loss of load and Z1 extension	•	•	•	•
50/27	Switch on to fault and trip on re-close - elements for fast fault clearance upon breaker closure	•	•	•	•
68	Power swing blocking	•	•	•	•
78	Out of step	•	•	•	•
67N	Directional earth fault (DEF) unit protection	•	•	•	•
50/51/67	Phase overcurrent stages, with optional directionality	4	4	4	4
50N/51N/ 67N	Earth/ground overcurrent stages, with optional directionality	4	4	4	4
51N/67N/SEF	Sensitive Earth Fault (SEF)	4	4	4	4
64	High impedance Restricted Earth Fault	•	•	•	•
67/46	Negative sequence overcurrent stages, with optional directionality	4	4	4	4
46BC	Broken conductor (open jumper), used to detect open circuit faults	•	•	•	•
49	Thermal overload protection	•	•	•	•

ANSI	FEATURE	Models			
		P543	P544	P545	P546
27	Undervoltage protection stages	2	2	2	2
59	Overvoltage protection stages	2	2	2	2
59 Remote	Remote overvoltage protection stages	2	2	2	2
59N	Residual voltage stages (neutral displacement)	2	2	2	2
81U/O/R	A 4-stage underfrequency, 2-stage overfrequency and an advanced 4-stage rate of change of frequency element as well.	•	•	•	•
50BF	High speed breaker fail. Two-stage, suitable for re-tripping and backtripping	•	•	•	•
CTS	CT supervision (including differential CTS, patent pending)	•	•	•	•
VTS	Current and voltage transformer supervision	•	•	•	•
79	Auto-reclose - shots supported	4	4	4	4
25	Check synchronism, 2 stages	•	•	•	•
	Alternative setting groups	4	4	4	4
FL	Fault locator	•	•	•	•
	SOE event records	512	512	512	512
	Disturbance recorder, samples per cycle. For waveform capture	48	48	48	48
	Circuit breaker condition monitoring	•	•	•	•
	Graphical programmable scheme logic (PSL)	•	•	•	•
	IRIG-B time synchronism	•	•	•	•
	Second rear communication port	•	•	•	•
	High speed, high break (HB) contacts	•	•	•	•

The P54x supports the following relay management functions in addition to the functions illustrated above.

- Measurement of all instantaneous & integrated values
- Circuit breaker control, status & condition monitoring
- Trip circuit and coil supervision
- Programmable hotkeys (2)
- Control inputs
- Programmable allocation of digital inputs and outputs
- Fully customizable menu texts
- Power-up diagnostics and continuous self-monitoring of relay



