



## **Relay Application Guide**

**ALSTOM**

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## Introduction

The relays described in this application guide fall into the following categories:

Midos	A wide range of self-contained relays each comprising module, case, terminals and cover, conforming to IEC255 and BS142 specifications. All modules are of uniform height (178mm) compliant with IEC297, allowing schemes to be built up from separately supplied Midos relays.
K Range Midos	A range of numerical relays featuring communications facilities, programmable inputs and outputs, internal instrumentation and fault records. Disturbance and event records are available when used with an external PC. Dual powered versions are available for operation from an insecure ac voltage supply and the line CTs. K Range relays are housed in Midos cases.
L series	A range of digital and numerical relays providing comprehensive protection schemes. The relays feature communications and instrumentation facilities. They are housed in full width modular cases, compatible with Midos.
S series	A range of static and microprocessor based relays, providing comprehensive protection and signalling schemes.
Rack	A range of static and numerical relays and control equipment mounted in a full 19 inch rack configuration.
Din case	A range of cases manufactured in accordance with European Standard DIN 43 700.

The remainder of the range is housed in special cases, appropriate to each particular relay.

As a part of the application description, the devices have been given numbers, where applicable. These numbers are based on the IEEE system, incorporated into the ANSI/IEEE standard C37-2-1956.

## Substation Control Equipment

Application	Details	Product	Publication	Housing Type
<i>Substation Control System</i>	MV integrated numerical control system utilising a field bus communications network incorporating: <ul style="list-style-type: none"> <li>• Self-healing fibre optic LAN</li> <li>• Full graphical representation of the substation</li> <li>• Expandable I/O capability with digital and analogue inputs</li> <li>• Time synchronised event recording with printing facility</li> <li>• For use with GECA digital relays (K Range)</li> </ul>	PSCN3020	N.1.6591	N/A
	MV Integrated numerical protection & control system, utilising a field bus communication system. <ul style="list-style-type: none"> <li>• Self-healing fibre optic LAN</li> <li>• Integrated OPN protection modules</li> <li>• Full graphical representation of the substation</li> <li>• Expandable I/O capability with digital and analogue inputs</li> <li>• Time synchronised event recording with printing facility</li> </ul>	PSCN3020 OPN	N.1.6593	N/A
	EHV, HV Integrated numerical control and supervisory system incorporating <ul style="list-style-type: none"> <li>• Multiple MMIs</li> <li>• Flexible centralised or distributed architecture</li> <li>• Control and interlocking of switchgear</li> <li>• Autoreclose</li> <li>• Voltage regulation</li> <li>• Time synchronised event recording with printing facility</li> <li>• Integrated multiple databases</li> </ul>	SPACE2000	N.1.6749	N/A
<i>Remote Terminal Unit</i>	Substation computer for system monitoring and control. <ul style="list-style-type: none"> <li>• Full graphical representation of the substation in conjunction with a PC</li> <li>• Expandable I/O capability with digital and analogue inputs</li> <li>• Time synchronised event recording with printing facility</li> </ul>	EPA2000	N.1.6918	Rack
	Substation computer for system monitoring, control and data logging <ul style="list-style-type: none"> <li>• Full graphical representation of the substation in conjunction with a PC</li> <li>• Expandable I/O capability with digital and analogue inputs</li> <li>• Time synchronised event recording with printing facility</li> </ul>	S900	45 180 012 – 103	Rack

## Event and Disturbance Recorders

Application	Details	Product	Publication	Housing Type
<i>Distance to Fault Locator</i>	Stand-alone device for measuring distance to fault in km, miles or percentage of line length	DLDS3000	N.1.6886	Rack
<i>Sequential Event Recorder</i>	Stand-alone data logger to record and time the sequence of events <ul style="list-style-type: none"> <li>• 1ms resolution</li> <li>• Up to 4032 channels</li> <li>• Expandable I/O capability with digital and analogue inputs</li> <li>• Time synchronised event recording with printing facility</li> <li>• Stores up to 2000 events</li> </ul>	S900	45180 012-103	Rack
	Stand-alone data logger to record and time the sequence of events <ul style="list-style-type: none"> <li>• Up to 1024 channels</li> <li>• 5ms resolution</li> <li>• Stores up to 500 events</li> </ul>	EMS2000	N.1.6774	Rack
<i>Disturbance Recorder</i>	Stand-alone high capacity equipment for the display and analysis of disturbances on the power system. Including: <ul style="list-style-type: none"> <li>• Up to 32 analogue inputs</li> <li>• Up to 64 digital inputs</li> <li>• Up to 16 ac/DC analogue inputs</li> <li>• Distance to fault location</li> <li>• External time synchronisation</li> <li>• Expandable I/O</li> <li>• Sequence component measurements</li> </ul>	Sorel EPMF	N.1.6757	Rack

## Event and Disturbance Recorders (continued)

Application	Details	Product	Publication	Housing Type
	<p>Stand-alone high capacity equipment for the display and analysis of disturbances on the power system. Including:</p> <ul style="list-style-type: none"> <li>• 8 analogue inputs</li> <li>• Up to 32 digital inputs</li> <li>• External time synchronisation</li> <li>• Expandable I/O</li> </ul>	TPE2000	N.1.6530	Rack

## EHV/HV Feeder Protection

Application	Details	Product	Publication	Housing Type
<i>Distance protection for extra high voltage transmission systems</i> 21	<p>High-speed numerical distance relay providing up to 5 zones of protection and a choice of scheme options. Provides Mho phase fault characteristics with a choice of shaped Mho or quadrilateral earth fault characteristics. The relay has the following standard features:</p> <ul style="list-style-type: none"> <li>– independent overcurrent element</li> <li>– directional earth fault (DEF) element with scheme options</li> <li>– circuit breaker failure monitoring</li> <li>– 8 independent setting groups</li> <li>– fault location</li> <li>– instrumentation</li> <li>– fault records</li> <li>– disturbance records</li> <li>– sequence of events recorder</li> <li>– K-Bus communications</li> <li>– alternative IEC870 based communications</li> <li>– software is available to facilitate the setting of the relay (see software section)</li> </ul> <ul style="list-style-type: none"> <li>• Single or three phase tripping version with additional input and output facilities.</li> <li>• Spare line relaying version with three phase tripping and Scada controlled setting group selection.</li> <li>• Three phase tripping version</li> </ul>	LFZR	R4117	Modular
		LFZR111		
		LFZR112		
		LFZR113		
	<p>Ultra high-speed full scheme distance relay providing three zone protection. It provides mho phase and earth fault characteristics and a choice of scheme options.</p> <p>The relay is available with the following optional features:</p> <ul style="list-style-type: none"> <li>– three phase or single and three phase tripping</li> <li>– power swing blocking</li> <li>– directional earth fault element with scheme options</li> <li>– mutual compensation for parallel lines</li> <li>– voltage transformer supervision</li> <li>– lenticular zone 3 to prevent load encroachment</li> </ul>	Micromho (SHNB)	R5406*	Modular
	<p>High speed numerical distance relay with four zones of protection with quadrilateral characteristics and a choice of scheme options.</p> <p>The relay has the following standard features:</p> <ul style="list-style-type: none"> <li>– Single or three phase tripping, voltage transformer supervision (VTS), power swing blocking (PSB).</li> <li>– Autorecloser</li> <li>– Event recording</li> <li>– Fault locator</li> </ul> <p>The relay has the following options:</p> <ul style="list-style-type: none"> <li>– Standard model</li> <li>– Model for double circuit lines</li> </ul>	PXLN	N.1.6869	Rack
		PXLN3001		
		PXLN3002		

## EHV/HV Feeder Protection (continued)

Application	Details	Product	Publication	Housing type
	<p>Numerical distance relay with five zones of protection with a quadrilateral characteristic and a choice of scheme options.</p> <p>The relay has the following standard features:</p> <ul style="list-style-type: none"> <li>– Single or three phase tripping, voltage transformer supervision VTS.</li> <li>– Instrumentation.</li> <li>– Four setting groups.</li> </ul> <p>The relay is available with the following options:</p> <ul style="list-style-type: none"> <li>– Overload, over voltage and under voltage protection.</li> <li>– Autoreclose</li> <li>– Check synchronising</li> <li>– Direction earth fault</li> <li>– Power swing blocking and tripping</li> <li>– Fault location</li> <li>– Disturbance recording</li> <li>– IEC870-S, K-Bus or VDEW, communications</li> </ul>	EPAC3100	N.1.6873	
<p><i>Distance protection for transmission, sub-transmission and distribution systems</i></p> <p>21</p>	<p>A range of high-speed static/digital full scheme distance relays providing single or multiple zone protection. They provide shaped Mho phase and earth fault characteristics (except where indicated), 8 independent setting groups and a choice of scheme options. K-Bus communications are available with the use of an external KITZ03 module (see communications equipment section) or alternatively, IEC870 based communications are also included. Software is available to facilitate the setting of the relay (see software section).</p> <ul style="list-style-type: none"> <li>• Selectable quadrilateral earth fault characteristic, single or three phase tripping, voltage transformer supervision (VTS) power swing blocking (PSB) and options of sensitive directional earth fault element with scheme options (DEF) and fault locator with instrumentation. For application to overhead (O/H) lines. <ul style="list-style-type: none"> <li>– 18 measuring elements</li> </ul> </li> <li>• Single or three phase tripping, VTS, PSB and options of DEF and fault locator with instrumentation. For application to O/H lines. <ul style="list-style-type: none"> <li>– 18 measuring elements</li> </ul> </li> <li>• Single or three phase tripping, VTS, PSB and optional instrumentation. For application to underground (U/G) cables. <ul style="list-style-type: none"> <li>– 18 measuring elements</li> </ul> </li> <li>• Single or three phase tripping, VTS and optional DEF and fault locator with instrumentation. For application to O/H lines. <ul style="list-style-type: none"> <li>– 12 measuring elements</li> </ul> </li> <li>• Selectable quadrilateral earth fault characteristic, three phase tripping, VTS and optional fault locator with instrumentation. For application to O/H lines. <ul style="list-style-type: none"> <li>– 12 measuring elements</li> </ul> </li> <li>• Three phase tripping, VTS and optional fault locator with instrumentation. For application to O/H lines. <ul style="list-style-type: none"> <li>– 12 measuring elements</li> </ul> </li> <li>• Three phase tripping, VTS and optional instrumentation. For application to U/G cables. <ul style="list-style-type: none"> <li>– 12 measuring elements</li> </ul> </li> <li>• Phase distance elements only with DEF, three phase tripping and ability to operate from two phase-phase or 3 limb type voltage transformers (VT). For application to O/H lines. <ul style="list-style-type: none"> <li>– 9 measuring elements</li> </ul> </li> <li>• Phase distance elements only with DEF, three phase tripping and ability to operate from two phase-phase or 3 limb type VT. For application to O/H lines. <ul style="list-style-type: none"> <li>– 6 measuring elements</li> </ul> </li> </ul>	<p>Optimho (LFZP)</p> <p>LFZP111</p> <p>LFZP112</p> <p>LFZP113</p> <p>LFZP114</p> <p>LFZP121</p> <p>LFZP122</p> <p>LFZP123</p> <p>LFZP131</p> <p>LFZP132</p>	R4056*	Modular

\* indicates inclusion in product catalogue R4126

## EHV/HV Feeder Protection (continued)

Application	Details	Product	Publication	Housing Type
	<ul style="list-style-type: none"> <li>Single zone relay with three phase tripping and VTS. For back-up protection of O/H lines, transformers, etc.               <ul style="list-style-type: none"> <li>– 6 measuring elements</li> </ul> </li> </ul>	LFZP151		
<i>Distance protection for transmission and sub-transmission systems</i> 21	<p>High-speed full scheme distance relay providing three zone protection. It provides shaped mho phase characteristics and an option of either mho or quadrilateral earth fault characteristics. It has single or three phase tripping, voltage transformer supervision, power swing blocking and a choice of scheme options.</p> <p>Static switched distance relay providing four zones of protection. The relay has a circular starting element and resistance characteristics. The relay has single and three phase tripping, voltage transformer supervision and a selection of scheme options.</p> <p>The following optional functions are available:</p> <ul style="list-style-type: none"> <li>– Autorecloser</li> <li>– Power swing blocking</li> <li>– Voltage memory</li> <li>– Transformer saturation detection</li> </ul> <p>Static distance relay providing five zones of protection. The relay has a lenticular starting element and reactance characteristics. The relay has single and three phase tripping, voltage transformer supervision and a selection of scheme options.</p> <p>The following optional functions are available:</p> <ul style="list-style-type: none"> <li>– Independant Zone 2</li> <li>– Independant Zone 3</li> <li>– Power swing blocking</li> <li>– Autorecloser</li> </ul> <p>The relay is available in two options:</p> <ul style="list-style-type: none"> <li>– Standard</li> <li>– For double circuit lines</li> </ul>	Quadramho (SHPM)  PXLC3000  PXLP  PXLP3000 PXLP3000-1	R5580*  1.6866  1.6867	Modular  Rack  Rack
<i>Directional comparison</i>	<p>Numerical directional comparison protection relays for complete phase and ground fault protection for all types of ehv and uhv transmission lines.</p> <p>For single circuit breaker applications</p> <p>For dual circuit breaker applications</p> <ul style="list-style-type: none"> <li>– Alternative to distance as high speed main protection</li> <li>– Single or three phase tripping</li> <li>– Optional distance zone for back up protection</li> <li>– Voltage transformer supervision</li> <li>– Optional directional earth fault</li> </ul>	LFDC  LFDC101 LFDC102	R4078*	Modular
<i>Current differential</i> 87	<p>Numerical biased differential protection for use with a digital communication system between feeder ends:</p> <p>for two ended feeders</p> <p>for three ended feeders</p> <p>for two ended feeders with dual redundant communications channels</p> <p>Additional versions are available for systems with 1½ breaker configurations:</p> <p>for two ended feeders</p> <p>for three ended feeders</p> <p>for two ended feeders with dual redundant communications channels</p>	LFCB  LFCB102 LFCB103 LFCB202  LFCB122 LFCB123 LFCB222	R4054*	Modular
<i>Differential line protection</i>	<p>Static current differential relay with starting elements utilising <math>I_0</math>, <math>I_1</math>, or <math>I_2</math> overcurrent; <math>V_0</math>, <math>V_1</math>, or <math>V_2</math> overvoltage; <math>V_1</math> undervoltage; or impedance starting.</p> <p>For use with a voice frequency communication system between feeder ends:</p> <p>for two ended feeders</p> <ul style="list-style-type: none"> <li>with periodic self-checking</li> </ul> <p>for three ended feeders</p> <ul style="list-style-type: none"> <li>with periodic self-checking</li> </ul>	DIFL  DIFL3002 DIFL3012 DIFL3003 DIFL3013	N.1.6836	Rack

## EHV/HV Feeder Protection (continued)

Application	Details	Product	Publication	Housing Type
<i>Phase comparison</i>	Unit protection by phase angle comparison of the fault current at both ends of the line, via high frequency carrier.	P10, P40	R5247	Modular
<i>Signalling</i>	Refer to General Applications Section			

## Traction Feeder Protection

Application	Details	Product	Publication	Housing Type
<i>Single phase 3 zone distance for railway lines 21</i>	High-speed distance scheme with mho and offset mho characteristics, communications, optional O/H fault locator and instrumentation designed for the protection of ac electrified railway systems. For 50/60Hz systems For 25Hz systems	LFZP141 LFZP142	R4061	Modular

## Feeder Protection

Application	Details	Product	Publication	Housing Type
<i>Overcurrent and/or earth fault 50, 51</i>	K Range three stage overcurrent/earth fault relay with multiple inverse and definite time characteristics, two setting groups, circuit breaker control and internal breaker failure feature.	KCGG	R6551	Midos
	Microprocessor based relay with instantaneous elements and a complete range of selectable inverse and definite time characteristics.	MCGG	R6054*	Midos
	Instantaneous overcurrent/earth fault relays - attracted armature electromechanical	MCAG11, 12 13	R6025*	Midos
	As above with low transient overreach, high drop-off/pick-up ratio and high thermal rating.	MCAG19	R6035*	Midos
<i>Sensitive earth fault 50</i>	Static definite time delayed sensitive earth fault relay with 3rd harmonic rejection	MCSU	R6018*	Midos
<i>Earth fault indication 30</i>	Electromechanical relay for use on cable circuits. Contacts available for alarm purposes. – hand/electrically reset	MVAZ06	R8104	Midos
<i>Directional phase and/or earth fault 67</i>	Static, single and three phase relays used to directionalise MCGG and MCSU relays	MET11, 12 13, 31	R6003*	Midos
<i>Directional overcurrent and/or earth fault 67</i>	K Range directional three stage relay with multiple inverse and definite time characteristics, two setting groups, circuit breaker control and internal breaker failure feature. A dual powered version is available.	KCEG	R6551	Midos
	Instantaneous stand-alone directional earth fault relay	MET114	R6099	Midos
<i>Directional earth fault 67</i>	K Range directional three stage relay with multiple inverse and definite time characteristics, two setting groups, circuit breaker control and internal breaker fail feature.	KCEG112	R6551	

\* indicates inclusion in product catalogue R4126

## Feeder Protection (continued)

Application	Details	Product	Publication	Housing Type
<i>Overcurrent and directional earth fault</i> 50, 51, 67	K Range three stage relay with multiple inverse and definite time characteristics, two setting groups, circuit breaker control and internal breaker failure feature.	KCEG152	R6551	Midos
<i>Pilot wire differential (plain feeders)</i> 87	Static high-speed biased differential relay for use with private or telephone type pilots with loop resistances of up to 1000Ω/2500Ω with pilot insulation levels of 5kV/15kV respectively. 15kV isolation is achieved using pilot isolation transformers.	Translay S MBCI	R6011*	Midos
	Electromechanical, high-speed biased differential relay. For use with private pilots with loop resistance up to 1000Ω and pilot isolation 5kV.	MHOR04	R6042*	Midos
<i>Pilot wire supervision</i>	Static relay for supervision of ac pilot circuits and supply. Suitable for use with MBCI relay.	M RTP	R6026*	Midos
<i>Destabilising and intertripping (with pilot wire protection)</i> 85	Remote operation of pilot wire feeder protection can be initiated by destabilising or intertripping via the pilot wires. Destabilising causes remote operation when current above differential setting is present. Intertripping causes remote operation by injecting ac current into the pilots and is independent of line current.			
	Suitable for use with MBCI relay but not when overcurrent starting/check relay type MCRI is applied.			
	Destabilising	MVTW01	R6027*	Midos
	Destabilising and intertripping	MVTW02	R6027*	Midos
	Destabilising and intertripping with inverter	MVTW03	R6027*	Midos
<i>Overcurrent start/check relay (for pilot wire protection)</i> 50	Static instantaneous overcurrent start/check relay. May be used to prevent operation in the event of pilot failure. Can only be used on lines where the minimum fault current is larger than the maximum full load current. Suitable for use with MBCI relay, but not when destabilising/intertripping relay type MVTW feature is applied.	MCRI	R6028*	Midos
<i>Inrush detection</i>	Static relay detects zero period in magnetizing inrush current waveform and initiates blocking relay. It can be used with MBCI for transformer feeder protection	MCTH	R6066*	Midos

## Auto Reclose

Application	Details	Product	Publication	Housing Type
<i>Auto-reclose</i> 79	One or two shot, high-speed or delayed, single or 3 phase auto-reclose relays for all feeder protection schemes. Wide choice of logic options with communications: – for single circuit breaker application – for dual circuit breaker application – for mesh corner applications  K Range static, single or multi-shot high-speed schemes with communications  Static microcomputer based, 3 phase, multi-shot delayed auto-reclose relay.	LFAA101	R4076*	Modular
		LFAA102	R4076*	Modular
		LFAA103	R4098	Modular
		KVTR	R6505	Midos
		MVTR51	R6057*	Midos
		MVTR52	R6071*	Midos
<i>Check synchronising</i> 25	K Range numerical relay which ensures that two systems are sufficiently in synchronism before being connected together by manual or auto-reclose.  Static check synchronising relay	KAVS	R6506	Midos
		MAVS	R6045*	Midos
<i>Combined auto-reclose and check synchronising</i> 79, 25	K Range single or multi-shot auto-reclose schemes with combined check synchronising.  K Range single or multi-shot, single or three phase auto-reclose schemes with combined check synchronising and communication.	KAVR100	R6507	Midos
		KAVR130	R6507	Midos

## Generator and Generator/Transformer Protection

Application	Details	Product	Publication	Housing Type
<i>Integrated generator protection relay</i> 27, 32, 40, 46 51, 59, 60, 67 81, 87	The LGPG is a digital integrated protection relay combining the following protection functions: – generator differential – stator earth fault – neutral displacement – sensitive directional earth fault – voltage dependent overcurrent – reverse power – low forward power – negative phase sequence – field failure – under and over voltage – under and over frequency – voltage balance  The relay has instrumentation, fault and event records, programmable inputs and outputs, alternative setting group and communication. Disturbance records are available with an external PC.	LGPG	R4106	Modular
<i>Differential</i> 24, 64, 87	K Range numerical high-speed biased differential relay with inrush blocking and internal ratio and vector compensation for the protection of combined generator and transformer units  Static high-speed, biased differential relay with inrush blocking feature. For the protection of combined generator and transformer units.  Electromechanical, instantaneous relays using the high impedance circulating current principle for use on generator stator windings. – current calibration – voltage calibration – static	KBCH	R6530	Midos
		MBCH	R6070*	Midos
		MCAG34	R6008*	Midos
		MFAC34	R6007*	Midos
		MCTI34	R6123	Midos
<i>Overcurrent and earth fault</i> 50, 51	K Range three stage overcurrent/earth fault relay with multiple inverse and definite time characteristics, two setting groups, circuit breaker control and internal breaker failure feature. A dual powered version is available.  Microprocessor based relay with instantaneous elements and a complete range of selectable inverse and definite time characteristics.	KCGG	R6551	Midos
		MCGG	R6054*	Midos

\* indicates inclusion in product catalogue R4126

## Generator and Generator/Transformer Protection (continued)

Application	Details	Product	Publication	Housing Type
<i>Negative phase sequence</i> 46	Static inverse time delayed relay for protection of generators against damage caused by unbalanced loads.	MCND04	R6115*	Midos
<i>Stator earth fault</i> 50, 51	For solidly earthed generators (on lv systems) Microprocessor based relay with instantaneous elements and a complete range of selectable inverse and definite time characteristics.	MCGG	R6054*	Midos
59	Static neutral voltage displacement relays For generators using resistance earthing, delta/star step-up transformers: – inverse time voltage operated – definite time voltage operated The above relays have third harmonic rejection. For low resistance earthed generators used with delta/star step-up transformers: instantaneous current operated.	MVTD13 MVTU13	R6051* R6041*	Midos Midos
64 50	– with third harmonic rejection – without third harmonic rejection	MCAG14 MCAG19	R6008* R6035*	Midos Midos
<i>Restricted earth fault</i> 64 64 50	Electromechanical, instantaneous for generator or transformer with ct in neutral connection – current calibrated – voltage calibrated – static	MCAG14 MFAC14 MCTI14	R6008* R6007* R6123*	Midos Midos Midos
<i>Standby earth fault</i> 50, 51	Long time delay to protect neutral earthing resistor K Range three stage overcurrent/earth fault relay with multiple inverse and definite time characteristics, two setting groups, circuit breaker control and internal breaker failure feature.  Microprocessor based relay with instantaneous elements and a complete range of selectable inverse and definite time characteristics.	KCGG  MCGG	R6551  R6054*	Midos  Midos
<i>Sensitive earth fault</i> 51	Static, definite time delay relay with high third harmonic rejection.	MCSU	R6018*	Midos
<i>Rotor earth fault</i> 64	AC injection type voltage relay to detect a single earth fault on the rotor circuit. For rotors which are fed from dc or thyristor excitation dc source.	MRSU04	R6119*	Midos
<i>Voltage</i> 59	Static, definite time delay overvoltage relay. Static inverse time delay overvoltage relay Static instantaneous overvoltage relay	MVTU12 MVTD12 MVTI12	R6041* R6051* R6033*	Midos Midos Midos
<i>Power</i> 32	Static, single phase reverse power relay with definite time delay for protection of generators against motoring. Static, 3 phase directional power relay for prevention of motoring in synchronous machines.	MWTU11 MWTU14	R6127 R6122*	Midos Midos
<i>Frequency</i> 81	Static, two stage definite time under/over frequency relay Static, definite time under and over frequency relay	MFVU21 MFVU14	R6061* R6118*	Midos Midos
<i>Loss of excitation</i> 40	Static field failure relay with offset mho characteristics	MYTU04	R6115*	Midos
<i>Back-up impedance</i> 21	Static under-impedance relay with three phase impedance measurement	MZTU34	R6120*	Midos

## Generator and Generator/Transformer Protection (continued)

Application	Details	Product	Publication	Housing Type
<i>Check synchronising</i> 25	K Range numerical relay ensures that two systems are sufficiently in synchronism before being connected together either manually or by auto-reclose.	KAVS	R6506	Midos
	Static check synchronising relay	MAVS	R6045*	Midos
<i>Thermal</i> 46	Static relay which provides thermal replica protection	MCHD04	R6117*	Midos

## Transformer Protection and Control

Application	Details	Product	Publication	Housing Type
<i>Differential</i> 87	K Range high-speed biased differential relay with 2, 3 or 4 bias windings, inrush blocking feature, internal ratio and vector compensation and communications facility. Opto-isolated inputs accept signals from external plant .	KBCH	R6530	Midos
	Static, high-speed biased differential relay, with inrush blocking feature and external correction facility for CT mismatch. With 2, 3 or 6 bias windings	MBCH	R6070*	Midos
<i>Overcurrent and/or earth fault</i> 50, 51	K Range three stage overcurrent/earth fault relay with multiple inverse and definite time characteristics, two setting groups, circuit breaker control and internal breaker failure feature.	KCGG	R6551	Midos
	Microprocessor based relay with instantaneous elements and a complete range of selectable inverse and definite time characteristics.	MCGG	R6054*	Midos
	Electromechanical instantaneous	MCAG19	R6035*	Midos
<i>Earth fault</i> 50, 51	K Range three stage overcurrent/earth fault relay with multiple inverse and definite time characteristics, two setting groups, circuit breaker control and internal breaker failure feature.	KCGG	R6551	Midos
	Microprocessor based relay with instantaneous elements and a complete range of selectable inverse and definite time characteristics.	MCGG	R6054*	Midos
64	Restricted earth fault protection in transformer windings.	MCAG14 MFAC14 MCT114	R6008* R6007* R6123*	Midos Midos Midos
51	Static sensitive earth-fault relay for supplies earthed through a high value resistor.	MCSU	R6018*	Midos
<i>Voltage regulator</i> 90	For use with on-load tap changers. Features include: – inverse or definite time operating characteristics, – integral line drop compensation – undervoltage – overvoltage and overcurrent supervision – reverse reactance or circulating current compensation for parallel transformers to minimise circulating current. – voltage reduction which can be selected locally or remotely	MVGC	R6021*	Midos
<i>Indication</i> 30, 63, 74	Auxiliary relays for trip and indication from Buchholz relay and winding/oil temperature devices.	MVAA	R6009*	Midos
		MCAA	R6047	Midos

\* indicates inclusion in product catalogue R4126

## Breaker Fail

Application	Details	Product	Publication	Housing Type
<i>Breaker fail</i> 62	K Range overcurrent relays have integral breaker failure protection	KCGG KCEG	R6551 R6551	Midos Midos
50	Static schemes comprising single or multiple overcurrent elements Fast reset, static overcurrent relay	MCTI	R6037*	Midos
62	Definite time delay relays	MVT	R6012*	Midos

## Busbar Protection

Application	Details	Product	Publication	Housing Type
	Static medium-impedance biased current differential busbar protection scheme. Suitable for use with current transformers of equal or unequal ratio. Adaptable for different busbar configurations	DIFB	N.1.6913	Cubicle
	Compact static medium impedance biased current differential busbar protection suitable for use with current transformers of equal or unequal ratio. Adaptable for different busbar configurations	DIFB-CL	N.1.6913	Cubicle
<i>Low impedance differential</i> 87	Static high-speed low impedance biased differential busbar protection schemes. For use with current transformers of equal or unequal ratio. Modular design adaptable to different busbar arrangements.	MBCZ10	R6059*	Cubicle
<i>High impedance differential</i> 87	Electromechanical instantaneous, unbiased, circulating current differential relay suitable for discrimination and check zones. – current calibrated – voltage calibrated – static	MCAG34 MFAC34 MCTI34	R6008* R6007* R6123*	Midos Midos Midos
<i>Bus wire supervision</i> 59	Time delayed static overvoltage relay for indication of open circuited transformer secondaries associated with high impedance busbar differential protection. Incorporates a bus wire shorting relay.	MVTP	R6023*	Midos
<i>DC supply supervision</i> 27	Electromechanical relay for the supervision of trip and alarm circuit supply.	MVAX12	R6010*	Midos
<i>Indication</i> 30	Electromechanical zone indication flagging relay with contacts for remote indication.	MVAA13	R6009*	Midos
<i>Trip relay</i> 86	Electromechanical hand reset multi-contact trip relay.	MVAJ13	R6015*	Midos
<i>Frame leakage</i> 64	Electromechanical overcurrent relay connected between switchgear frame and earth.	MCAG12	R6025*	Midos
<i>Blocking scheme</i> 68	K Range overcurrent relays have integral start contacts and blocking inputs that can be combined to form simple busbar protection schemes.	KCGG	R6551 R4012 R4014	Midos

## Rectifier Protection

Application	Details	Product	Publication	Housing Type
<i>Overcurrent protection</i> 50, 51	K Range three stage overcurrent/earth fault relay with multiple inverse and definite time characteristics, two setting groups, circuit breaker control and internal breaker failure feature.	KCGG	R6551	Midos
	Microprocessor based relay with instantaneous elements and a complete range of selectable inverse and definite time characteristics.	MCGG	R6054*	Midos
	K Range overcurrent relays have a special inverse time curve suitable for protection of silicon rectifiers	KCGG122	R6551	Midos
	Special inverse, static IDMT relay, suitable for Class III traction service rectifiers	MCTD	R6038*	Midos
<i>Short circuit</i> 50	Electromechanical, instantaneous untuned relay to detect heavy fault currents on the ac breaker.	MCAG19	R6035*	Midos
<i>Earth fault</i> 50 64	Instantaneous balanced and restricted earth fault protection for rectifier transformers.			
	– current calibrated	MCAG14	R6008*	Midos
	– voltage calibrated	MFAC14	R6007*	Midos
	– static	MCT114	R6123*	Midos

## Capacitor Protection

Application	Details	Product	Publication	Housing Type
<i>Capacitor protection</i> 51	K Range three stage overcurrent/earth fault relay with multiple inverse and definite time characteristics, two setting groups, circuit breaker control and internal breaker failure feature.	KCGG	R6551	Midos
	Microprocessor based relay with instantaneous elements and a complete range of selectable inverse and definite time characteristics.	MCGG	R6054*	Midos
	Static relay with built-in biasing feature for the protection of double star capacitor banks.	MCVI	R6048	Midos

## Motor Protection

Application	Details	Product	Publication	Housing Type
<i>Differential</i> 87	Electromechanical, instantaneous relay using the high impedance circulating current principle. For the protection of large motor windings.			
	– current calibrated	MCAG34	R6008*	Midos
	– voltage calibrated	MFAC34	R6007*	Midos
	– static	MCT134	R6123*	Midos
<i>Thermal overload, unbalance, excessive starting time, stalling, high set overcurrent and earth fault</i> 46, 49, 50, 51, 56	Numerical relay which provides thermal overload protection with selectable thermal operating characteristics. High set overcurrent, sensitive unbalance and earthfault elements are available, which can be disabled if not required. The relay also provides protection against excessive starting time and locked rotor during running.	MOPN	R6121*	Midos

\* indicates inclusion in product catalogue R4126

## Motor Protection (continued)

Application	Details	Product	Publication	Housing Type
<i>Thermal overload, unbalance, single phasing and earth fault</i> 46, 49, 50	Static relay which gives thermal overload, single phasing/unbalance and earth fault protection for induction motors. Suitable for motors fed by fused contactors.	Motormaster MM200	I7-013	DIN
<i>Undervoltage</i> 27	May be used to disconnect the motor in the event of serious loss of supply when restoration is undesirable. – definite time – inverse	MVTU11 MVD11	R6041* R6051*	Midos Midos

## Additional Protection of Synchronous Motors

Application	Details	Product	Publication	Housing Type
<i>Undervoltage</i> 27	May be used to disconnect the motor in the event of serious loss of supply when restoration is undesirable. – definite time – inverse	MVTU11 MVD11	R6041* R6051*	Midos Midos
<i>Out-of-step</i> 68	Electromechanical relay which detects unsynchronised running of synchronous motors. Used to isolate the motor from the supply or to remove the field excitation prior to resynchronising.	MFOS24	R6101*	Midos
<i>Reverse power</i> 32	Detects motor generation on loss of supply. For use when power reversal cannot occur during normal operation and when other loads are connected to the motor busbars.	MWTU11	R6127	Midos
<i>Overvoltage</i> 59	Static relay, which can be used to detect loss of supply where the connected load on the busbar is small and the resultant voltage generated is excessive. – inverse time – definite time	MVD12 MVTU12	R6051* R6041*	Midos Midos
<i>Under frequency</i> 81	Static relay used to detect loss of supply when the motor is on load and fairly rapid deceleration occurs. – definite time – two stage definite time	MFVU14 MFVU21	R6118* R6061*	Midos Midos

## General Applications

Application	Details	Product	Publication	Housing Type
<i>Overcurrent and earth fault</i> 50, 51	K Range three stage overcurrent/earth fault relay with multiple inverse and definite time characteristics, two setting groups, circuit breaker control and internal breaker failure feature.  Microprocessor based relay with instantaneous elements and a complete range of selectable inverse and definite time characteristics.  Electromechanical relays: – instantaneous	KCGG	R6551	Midos
		MCGG	R6054*	Midos
		MCAG11, 12, 13	R6025*	Midos
		MCAG19	R6035*	Midos
<i>Directional overcurrent or earth fault</i> 67	Static single and three phase relays for directional control of MCGG relays. K Range three stage overcurrent/earth fault relay with multiple inverse and definite time characteristics, two setting groups, circuit breaker control and internal breaker failure feature.	METI KCEG	R6003* R6551	Midos Midos

## General Applications (continued)

Application	Details	Product	Publication	Housing Type
<i>Sensitive earth fault</i> 51	Static, definite time delayed sensitive earth fault relay with high 3rd harmonic rejection.	MCSU	R6018*	Midos
<i>High impedance (differential, balanced and restricted earth fault protection)</i> 87	Electromechanical circulating current relays: – current calibrated – voltage calibrated – static	MFAC14, 34 MCAG14, 34 MCTI14, 34	R6007* R6008* R6123*	Midos Midos Midos
<i>Overvoltage and undervoltage</i> 27, 59	Static relays: – instantaneous undervoltage or overvoltage – definite time undervoltage – definite time overvoltage – definite time neutral displacement – inverse time undervoltage – inverse time overvoltage – inverse time neutral displacement  Electromechanical relays: – instantaneous undervoltage or overvoltage	MVTI MVTU11 MVTU12 MVTU13 MVTD11 MVTD12 MVTD13  MVAG	R6033 R6041* R6041* R6041* R6051* R6051* R6051*  R6049	Midos Midos Midos Midos Midos Midos Midos  Midos
<i>Power</i> 32	Static, definite time single phase reverse/ low forward power relay Static, definite time, three phase reverse/low forward power	MWTU11 MWTU14	R6127 R6122*	Midos Midos
<i>Frequency</i> 81	Static, two stage definite time under/over frequency relay. Static definite time under and over frequency relay	MFVU21 MFVU14	R6061* R6118*	Midos Midos
<i>Check synchronism</i> 25	K Range relay used to ensure that two systems are sufficiently in synchronism before being connected together manually or via auto-reclose. Static check synchronising relay	KAVS MAVS	R6506 R6045*	Midos Midos
<i>Signalling</i>	Voice frequency (VF) permissive intertrip and blocking with external test facilities for use with distance protection.  VF equipment with internal test facilities for use with distance protection or for direct intertripping  HF power line carrier blocking for use with distance protection  VF digital intertripping equipment	SD15  SD15  K10 MJTW	R5556  R5579  R5250 R6124	Modular  Modular  Modular Modular
<i>Fuse failure</i> 60	Electromechanical relay used to supervise voltage transformer secondary circuits which operates if the voltage is interrupted or becomes unbalanced due to failure of primary or secondary fuses. Used to provide an alarm.	MVAP22	R6052	Midos
<i>Power supply</i>	DC/DC converter for general applications DC/DC converter for heavy duty applications  AC/DC power supply	MSTZ02 MSTZ04 MSTZ41	R6006* R6128* R6093*	Midos Midos Midos
<i>Auxiliary relays</i> 94	Electromechanical attracted armature relays. Voltage operated Voltage operated with static time delay circuit Current operated	MVAA MVUA MCAA	R6009* R6039* R6047	Midos Midos Midos

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## General Applications (continued)

Application	Details	Product	Publication	Housing Type
<i>High-speed auxiliary relay</i> 94	Electromechanical relay, typically for use as a carrier send/receive interface for distance protection schemes.	MVAA16	R6050	Midos
<i>Trip and lockout</i> 86	Multi-contact tripping and lockout relays available in hand, electrical or self reset models.	MVAJ	R6015*	Midos
<i>Interposing relay</i>	Electromechanical relay, suitable for remote operation over long pilot wires	MVAW	R6005*	Midos
<i>Trip circuit supervision</i> 74	DC supply supervision	MVAX12	R6010*	Midos
	Detects open circuit trip coil or trip circuit wiring with circuit breaker closed. Also detects loss of dc trip supply.	MVAX21	R6010*	Midos
	Detects open circuit trip coil or trip circuit wiring with circuit breaker closed or open. Also detects loss of dc trip supply.	MVAX31	R6010*	Midos
<i>Time delay</i> 62	Static, delay on pick-up or drop-off relays.	MVTT	R6012*	Midos
<i>Auxiliary relays</i> 94	Prima is a range of plug in auxiliary relays with sockets suitable for rear rack mounting or front connected DIN rail mounting. For ac or dc operation			
	Self reset relays	PRS...N	R4107	Special
	Hand and electrically reset relays	PRH...N	R4107	Special
	Electrical reset	PRE...N	R4107	Special
	For dc operation			
	Time delayed relays, self reset – delay on drop-off	PRS...D	R4107	Special
	Time delay relays, self reset – delay on pick-up	PRS...P	R4107	Special
	Rear connected socket	PSR	R4107	
Front connected socket	PSF	R4107		

## Test Equipment

Application	Details	Product	Publication	Housing Type
<i>Test equipment</i>	Test block suitable for Midos	MMLG	R6004*	Midos
	Test plugs suitable for Midos	MMLB	R6004*	Midos

## Monitoring and Control

Application	Details	Product	Publication	Housing Type
<i>Battery monitoring</i>	The battery alarm provides continuous monitoring of substation batteries which gives local and remote indication of alarm conditions, impedance alarm and earth fault alarm.	BA300	I6-009	Panel
<i>Power factor correction</i>	Microprocessor based relay controlling capacitor switching with simple setting controls.	N300	I6-010 I6-011	Panel
<i>Control and selector switches</i>	Complete range of control, auxiliary and instrument switches	ODS	I7-001	Special

## Measuring Instruments

Application	Details	Product	Publication	Housing Type
<i>Indicating instruments</i>	Complete range of indicating instruments for both panel and switchboard mounting to monitor all power system parameters.	METRIK	I3-G21	DIN
<i>Electrical transducers</i>	High accuracy electrical transducers providing local and remote indication in conjunction with instruments, recorders, data loggers and SCADA systems	ISTAT300	I4-028 I4-025	Special
		ISTAT200	I4-019	Special
<i>Current transformers</i>	Comprehensive range of moulded case current transformers for use with electrical measuring instruments.	TA Series	I7-015	Special

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## General Publications

Details	Publication
Electronic module housing (M3)	R5234
Draw-out and M3 modular relay weights	R3843
Midos system	R6001*
Midos assembly instructions	R7012*
Midos relay weights	R6055*
Midos connectors: suppliers list	R6014

## Application Guides

Details	Publication
REF protection using K Range overcurrent relays	R4120
MV single busbar protection with K Range relays	R4112
MV double busbar protection with K Range relays	R4114
K Range breaker fail	R4115
Application Guide for Electrical Transducers	I9-113

## Software

Application	Software name
LFZR setting programme (Windows)	LFZRCOM
OPTIMHO setting programme	OPTICOM
K Range setting and control software	Protection access software and toolkit
K Range off-line setting software (Windows)	Courier-Comm
EMPF disturbance recorder configuration software	UG5
TPE disturbance recorder configuration software	WINTPE

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