Product overview

Power quality and energy measurement

Electronic measuring and monitoring relays

Universal measuring devices and measuring relays to monitor electrical installations

Safe power supply

To ensure safety for man and machine, the operating conditions of electrical installations must be continuously monitored. However, the physical quantities of current and voltage are not visible to humans without the use of suitable measuring devices.

PEM series universal measuring devices (Power Quality and Energy Measurement) record all relevant parameters of electrical supply systems such as current, voltage, frequency, power, harmonics, energy consumption, and many more.

LINETRAXX® monitoring relays cover a broad spectrum: from single-channel current relays (CME420) and loop monitoring (GM420) to three-phase voltage relays (VMD460-NA) for power generation systems in accordance with VDE-AR-N 4105. For specific applications, Bender also offers special solutions such as fully analogue devices (VMD258).

High availability despite network interferences

Increasing demands for high availability of electrical installations and ever more complex production and automation processes conflict with an increased use of power electronics. Network interferences become a topic of increasing concern to both operators and suppliers. Therefore, digital universal measuring devices record much more than just RMS current and voltage values. They also replace analogue display instruments in switchboard and distribution cabinet doors. Harmonic components, neutral conductor currents and many other measured quantities are recorded, evaluated and forwarded via communication interfaces. Exceeding of configurable threshold values can also be signalled via relay outputs. The **Bender Condition Monitoring System** makes all relevant data of the electrical installation available centrally via a convenient browser-based access.

Power Quality and Energy Measurement PEM

In practice

Products

Measuring and monitoring relays

In practice

Products

Power quality and energy measurement

Transparency for electrical installations

Electrical supply systems are becoming larger over time. Frequently, failures and disturbances are caused by overloaded networks. By means of a monitoring system with universal measuring devices from the PEM series, potential impacts on protective measures, hazards due to overload or changes in power consumption can be evaluated already before reaching the next expansion stage.

Structure of the monitoring system
A granular structure of the monitoring system allows:

- Cost centre specific energy data acquisition
- Faster localisation in the event of a fault
- Economic pyramid structure

The aim of a monitoring system must always be to detect even small changes in the relevant measured quantities, such as leakage current or harmonic content, and issue a prewarning in the event of deviations as early as possible.
Trends of relevant measured quantities for voltage quality or leakage currents cannot be effectively monitored with one single measuring point in an electrical installation. Several measuring points are required which must be adjusted to the system structure.

Distorted shape of current

Analysis of the harmonics

Fundamental component
3rd harmonic
5th harmonic
7th harmonic

Spectrum of harmonics

1.   3.   5.   7.   harmonic
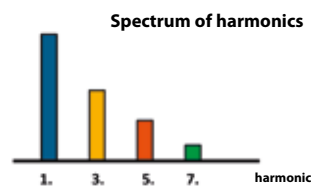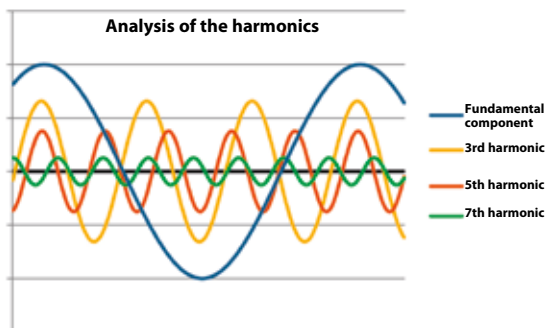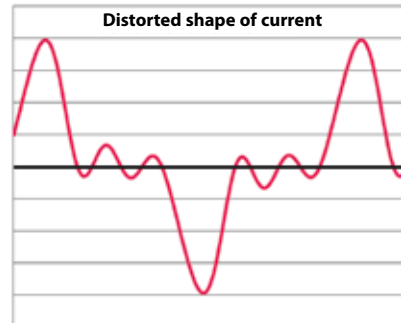
Example for system set-up

Labels visible in the diagram:

PEM — Modbus RTU (multiple instances)

Ethernet

Database

CP9...-I
COM465xP

BMS

Modbus RTU

1…12

RCMS

1…12

RCMS

LVMD

L
PEN
PE

PAS

L
N
PE

Subdistribution 1

Subdistribution 2

U I

G

Universal measuring devices
Power Quality and Energy Measurement PEM

**LINETRAXX®
PEM353**
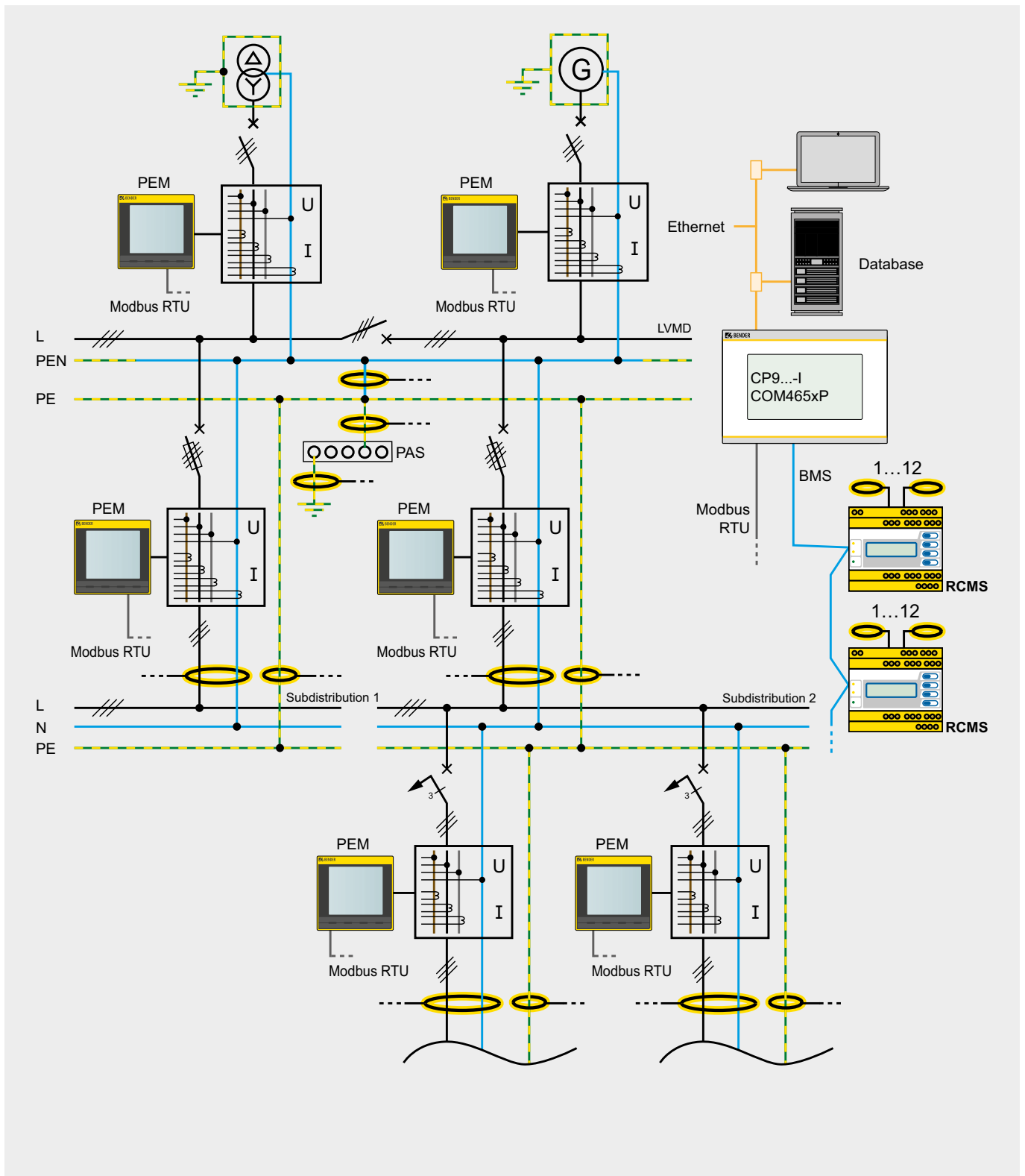
		LINETRAXX® PEM353
Normative requirements	Accuracy class of the active energy acc. to IEC 62053-22	0.5 S
	DIN EN 50160 (report)	–
	DIN EN 61000-4-7 (harmonic)	Class II
	DIN EN 61000-4-15 (flicker) DIN EN 61000-4-30 (PQ measurement method)	–
Measured quantities	Phase voltages/line-to-line voltages	■
	Phase currents	■
	Neutral current I_4	■ (PEM353-N only)
	Neutral current I_4 (calculated)	■
	Frequency/phase angle	■
	Reactive and active power import/ Reactive and active power export	■
	Voltage unbalance/current unbalance	■
	Power	per phase and total S in kVA, P in kW, Q in kvar
	Displacement factor cos (φ) / power factor λ	■
	Total harmonic distortion (THD$_U$/THD$_I$)	up to the 31st
	Harmonic components voltage	up to the 31st
	Harmonic components current	up to the 31st
	Transient detection	–
	Overvoltage (swell)	–
	Undervoltage (sag)	–
	Flicker severity P_{ST}	–
Features	Data recorder / HighSpeed data recorder	5/0 (PEM353-N only)
	Waveform recorder	–
	Digital inputs	4
	Digital outputs	2x pulse and/or solid-state (PEM353-P only)
	Relay outputs (RO)	2 (PEM353, PEM353-N only)
Technical aspects	Supply voltage	AC/DC 95…250 V (47…440 Hz)
	Sampling rate	3.2 kHz
	Temperature	-25…+55 ℃
	Communication	Modbus RTU, BACnet MS/TP, DNP

Ordering information

Digital inputs/outputs	Nominal system voltage	Interface		Current input	Type	Art. No.
		RS-485	Ethernet			
4/2	3(N) AC 230/400 V 3(N) AC 400/690 V [1]	■	–	5 A [2]	PEM353	B93100355
					PEM353-P	B93100354
					PEM353-N	B93100353

[1]   TN and TT systems

[2]   Note: In principle, measuring current transformers can also be operated with 1 A secondary current on measuring devices with 5 A current input.
    In this case, the accuracy class is expected to be reduced by one class (e.g. 0.5 to 1).

Energy meters and measuring current transformers

Energy meters

Along with numerous measured values, all PEM series devices can measure energy and power values. If, however, a measuring point is used for billing purposes, special requirements must be met (subject to obligatory calibration). Energy meters with the Measurement Instrument Directive (MID) compliance marking meet these requirements.
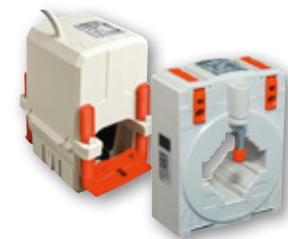
Ordering information

Description	Type	Art. No.
Energy meter 1PH./32A MID MODBUS RTU	ALD1	B93101005
Energy meter 3PH./65A MID MODBUS RTU	ALE3	B93101006
Energy meter 3PH./6A MID MODBUS RTU	AWD3	B93101007
S0 pulse counter (four-fold) with MODBUS RTU	PCD7	B93101008
Sealable cover for ALD1 (two per meter)	–	B93101009
Sealable cover for ALE3/AWD3 (four per meter)	–	B93101010

Measuring current transformers

All PEM series measuring devices can be operated with standard measuring current transformers (1A or 5A). To comply with an accuracy class (e.g. 0.5 S), the measuring device and the measuring current transformers used must comply with class 0.5 S or better. (See DIN EN 61557-12, annex E.2)

Ordering information

| Primary current	Secondary current	Accuracy	Type	Model	Art. No.	Primary current	Secondary current	Accuracy	Type	Model	Art. No.
60	5	1	WL605 KL. 1	CTB31	B98086001	400	5	1	WL4005 KL. 1	CTB41	B98086026
	1	1	WL601 KL. 1	CTB31	B98086002			0,5	WL4005 KL. 0,5	CTB41	B98086027
75	5	1	WL755 KL. 1	CTB31	B98086003		1	1	WL4001 KL. 1	CTB41	B98086028
	1	1	WL751 KL. 1	CTB31	B98086004			0,5	WL4001 KL. 0,5	CTB41	B98086025
125	5	0,5	WL1255 KL. 0,5	CTB31	B98086005	500	5	1	WL5005 KL. 1	CTB41	B98086029
		1	WL1255 KL. 1	CTB31	B98086007			0,5	WL5005 KL. 0,5	CTB41	B98086031
	1	0,5	WL1251 KL. 0,5	CTB31	B98086006		1	1	WL5001 KL. 1	CTB41	B98086032
		1	WL1251 KL. 1	CTB31	B98086008			0,5	WL5001 KL. 0,5	CTB41	B98086033
150	5	0,5	WL1505 KL. 0,5	CTB31	B98086009	600	5	1	WL6005 KL. 1	CTB51	B98086034
		1	WL1505 KL. 1	CTB31	B98086011			0,5	WL6005 KL. 0,5	CTB51	B98086035
	1	0,5	WL1501 KL. 0,5	CTB31	B98086010		1	1	WL6001 KL. 1	CTB51	B98086036
		1	WL1501 KL. 1	CTB31	B98086012			0,5	WL6001 KL. 0,5	CTB51	B98086037
200	5	0,5	WL2005 KL. 0,5	CTB31	B98086013	800	5	1	WL8005 KL. 1	CTB51	B98086038
		1	WL2005 KL. 1	CTB31	B98086015			0,5	WL8005 KL. 0,5	CTB51	B98086039
	1	0,5	WL2001 KL. 0,5	CTB31	B98086014		1	1	WL8001 KL. 1	CTB51	B98086040
		1	WL2001 KL. 1	CTB31	B98086016			0,5	WL8001 KL. 0,5	CTB51	B98086041
250	5	0,5	WL2505 KL. 0,5	CTB41	B98086017	1000	5	1	WL10005 KL. 1	CTB51	B98086042
		1	WL2505 KL. 1	CTB41	B98086019			0,5	WL10005 KL. 0,5	CTB51	B98086043
	1	0,5	WL2501 KL. 0,5	CTB41	B98086018		1	1	WL10001 KL. 1	CTB51	B98086044
		1	WL2501 KL. 1	CTB41	B98086020			0,5	WL10001 KL. 0,5	CTB51	B98086045
300	5	0,5	WL3005 KL. 0,5	CTB41	B98086021	50	1	3FS5	WLS501 KL. 3FS5	KBR18	B98086046
		1	WL3005 KL. 1	CTB41	B98086023	100	1	3FS5	WLS1001 KL. 3FS5	KBR18	B98086047
	1	0,5	WL3001 KL. 0,5	CTB41	B98086022	150	1	3FS5	WLS1501 KL. 3FS5	KBR18	B98086048
		1	WL3001 KL. 1	CTB41	B98086024	250	1	3FS5	WLS2501 KL. 3FS5	KBR32	B98086049
						500	1	3FS5	WLS5001 KL. 1FS5	KBR32	B98086050

Condition monitor with display for Bender systems

COMTRAXX® CP9...I

In a monitoring system, several thousand measured values are generated per second. This information is collected automatically, evaluated according to the system and for specific user groups.

Web server

Ethernet

CP9...-I

Modbus RTU   BMS bus

PEM

	Application	Condition monitor/gateway
	Protocol input	BMS (internal)/ BCOM / Modbus RTU/TCP
	Protocol output	Ethernet / Modbus RTU/TCP / SNMP
	Indication	7" or 15.6" display
Functions	Alarm messages	◼ 1, 2, 3)
	Measured values	◼ 1, 2, 3)
	Device parameter setting	◼ 1, 2, 3)
	Alarm list	◼ 1, 3)
	History memory	◼ 1, 3)
	Diagrams	◼ 1, 3)
	Visualisation	◼ 1, 3)
	E-mail notification	◼ 1, 4)
	Device tests	◼ 1, 2, 3)
	Data logger	◼ 1, 3)
Connection	BMS, Modbus RTU	Pluggable screw-type terminal
	Ethernet, BCOM, Modbus TCP, SNMP	RJ45
System requirements	Supply voltage U_S	DC 24 V
	Browser	Chrome, Edge, etc.
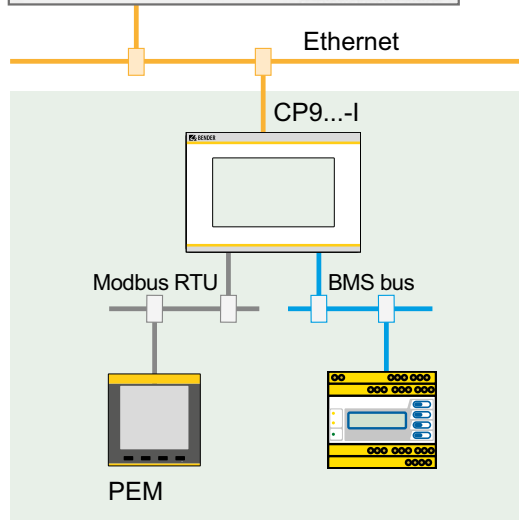
[1] Available functions on the web server – accessible via a PC with a browser
[2] Available via the protocol
[3] On the device-internal LC display
[4] TLS/SSL support

Ordering information

Type	Display size	Supply	Device dimensions (W x H x D)	Weight	Enclosure	Display unit	Art. No.
CP907-I	7" (17.6 cm)	DC 24 V, < 15 W	226 x 144 x 78 mm	1.1 kg	Flush-mounted enclosure	Glass, tempered, white	**B95061031**
			226 x 144 x 65 mm	1.0 kg	Control cabinet door mounting	Glass, tempered, white	**B95061032**
CP915-I	15.6" (38.6 cm)	AC 100…240 V, < 30 W	505 x 350 x 92 mm	6.1 kg	Flush-mounted enclosure	Glass, tempered, white	**B95061033**
						Glass, tempered, grey	**B95061034**

Scope of delivery: display unit, control cabinet door mounting or flush-mounted enclosure incl. mounting plate with electronics, CP9…-I connecting cable and plug kit.

Measuring and monitoring relays

Voltage monitoring, phase monitoring

Multifunctional voltage and frequency monitoring relays are available for monitoring various parameters in main and auxiliary circuits. They provide essential information well in advance to detect faults and malfunctions at an early stage and to take appropriate action before time-consuming and cost-intensive operational interruptions and installation damage occur.

Device overview voltage monitoring

	VME420 Page 12	VME421H Page 12	VMD420 Page 14	VMD421H Page 14	VMD423 Page 16	VMD423H Page 16	VMD460-NA Page 16	VMD461 Page 18	VMD258 Page 19
DC	$U<, U>$	$U<, U>$							
AC	$U<, U>$	$U<, U>$					$U<, U<<, U>, U>>, U_{10min}>$	$U<, U<<, U<<<, U>, U>>, U>>>$	
3 AC			$U<, U>$	$U<, U>$			$U<, U<<, U>, U>>, U_{10min}>$	$U<, U<<, U<<<, U>, U>>, U>>>$	$U<, U>$
3/N AC			$U<, U>$	$U<, U>$	$U<, U>, U_{10min}>$	$U<, U>, U_{10min}>$	$U<, U<<, U>, U>>, U_{10min}>$	$U<, U<<, U<<<, U>, U>>, U>>>$	
Frequency	$f<, f>$	$f<, f>$	$f<, f>$	$f<, f>$	$f<, f>$	$f<, f>$	$f<, f<<, f>, f>>$	$f<, f<<, f<<<, f>, f>>, f>>>$	
Phase sequence			■	■	■	■	■	■	
Phase failure			■	■	■	■	■	■	
Unbalance			■	■	■	■	■	■	
Supply voltage U_s	external	system	external	system	external	system	external	external	system

Application examples voltage monitoring, phase monitoring

Measured quantity	Common causes of faults	Possible effects
Undervoltage	Voltage fluctuations Blown fuses Wire breakage	Failure or destruction of motors due to overheating Accidental reset of a device Undefined switching and system states Accidental restart
Overvoltage	Voltage fluctuations	Damage to system components due to overvoltage Accidental switching on of an installation
Phase sequence	Reversed conductors Faulty extension cables	Incorrect rotation direction of a motor, destruction of roller drives, hazardous situations to man and machine when using mobile devices and systems
Phase failure	Blown fuse(s)/control voltage failure Wire breakage	Overheating of motors due to single-phase operation
Phase unbalance	Unbalanced distribution of the load Phase failure with energy recovery	Overheating of motors due to unbalanced voltages Failure of system parts

Current monitoring

Current relays are mainly used to monitor the load on motors and the function of electrical loads. They also provide essential information well in advance to detect faults and malfunctions at an early stage and to take appropriate action before time-consuming and cost-intensive operational interruptions and installation damage occur.

Special monitoring tasks

Loop monitoring devices monitor conductor loops for interruptions and short circuits, e.g. supply lines of mobile machines and devices.

Device overview current monitoring

		CME420 Page 20	CMD420/CMD421 Page 21	CMS460 Page 22
1 AC	with U_S	$I<, I>$		$I<, I>$
3 AC	with U_S		$I<, I>$	$I<, I>$

Device overview special applications

	GM420 Page 23	CD440 Page 18	ES258 Page 19
Loop monitoring	■		
Coupling device		■	
Energy storage			■

Application examples

Measured quantity	Application
Current monitoring	Power consumption of motors, e.g. in crane systems, pumps, lifts
	Monitoring of lighting systems, heating circuits, charging stations
	Overload control of hoisting gear and means of transportation
	Monitoring of locking devices, driving to end stops
	Monitoring of emergency lighting
	Monitoring of position lighting in high-rise buildings
	Monitoring of screw conveyors, e.g. in sewage treatment plants, in case of blocking of conveyor systems
	Dust removal in wood working
	Monitoring of small currents, e.g. small motors, indicator lamps

Voltage and frequency monitoring relays for AC and DC systems
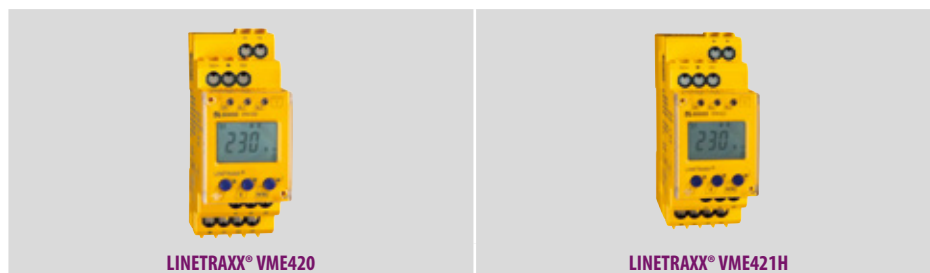
		LINETRAXX® VME420	LINETRAXX® VME421H
Mains voltage	AC	■	■
	DC	■	■
Function	Undervoltage/overvoltage $U<$, $U>$	■	■
	Underfrequency/overfrequency $f<$, $f>$	■	■
	Preset function	■	■
	Password protection	■	■
	History memory (first alarm value)	■	■
	Supply voltage U_S	DC 9.6…94 V/AC 16…72 V, AC/DC 70…300 V	U_n
	Integrated energy storage device	–	■
Response values	Undervoltage/Overvoltage $U<$, $U>$	AC/DC 6…300 V	AC/DC 70…300 V
	Hysteresis U	1…40 %	1…40 %
	Underfrequency/overfrequency $f<$, $f>$	10…500 Hz	70…500 Hz
	Hysteresis f	0.1…2 Hz	0.1…2 Hz
	Rated frequency	DC, 15…460 Hz	DC, 15…460 Hz
	Operating time, voltage	DC/AC 16.7 Hz: ≤130 ms, AC 42…460 Hz: ≤ 70 ms	DC/AC 16.7 Hz: ≤ 130 ms, AC 42…460 Hz: ≤ 70 ms
	Operating time, frequency	AC 15…460 Hz: ≤ 310 ms	AC 15…460 Hz: ≤ 310 ms
	Response delay t_{on}	0…300 s	0…300 s
	Delay on release t_{off}	0…300 s	0…300 s
	Start-up delay t	0…300 s	0…300 s
Indicator LEDs	Power On LED	■	■
	Alarm LEDs	■	■
Switching elements	Number	2 x 1 changeover contacts, programmable	2 x 1 changeover contacts, programmable
	Operating principle	N/O or N/C operation, programmable	N/O or N/C operation, programmable
	Enclosure dimensions in mm (H x W x D)	90 x 36 x 70.5	90 x 36 x 105.5
	Accessories	Mounting clip	Mounting clip
	Interface option	M	M
	Standards, approvals and certifications	UL, Lloyd's Register	UL, Lloyd's Register

The voltage and frequency monitoring relays monitor the upper and lower limits of one or several set response values. The devices are suitable for AC and DC systems.
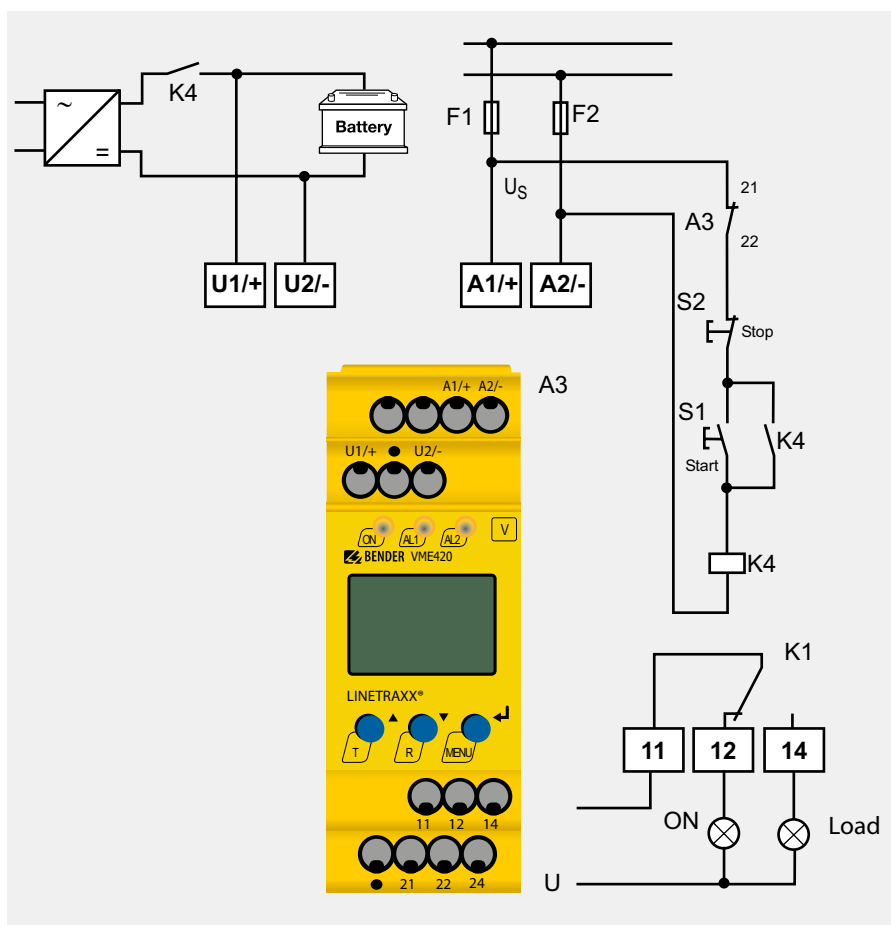
Ordering information

Nominal system voltage [1] U_n	Supply voltage [1] U_S	Type	Art. No.	
			Screw-type terminal	Push-wire terminal
AC 16…72 V/DC 9.6…94 V	AC 16…72 V, 15…460 Hz/DC 9.6…94 V	**VME420-D-1**	**B93010001**	**B73010001**
AC/DC 70…300 V	AC 70…300 V, 15…460 Hz/DC 70…300 V	**VME420-D-2**	**B93010002**	**B73010002**
AC 9.6…150 V, 15…460 Hz/DC 9.6…150 V	U_n	**VME421H-D-1**	**B93010003**	**B73010003**
AC 70…300 V, 15…460 Hz/DC 70…300 V	U_n	**VME421H-D-2**	**B93010004**	**B73010004**

[1] Absolute values

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	**B98060008**

Voltage and frequency monitoring relays for 3(N)AC systems

		LINETRAXX® VMD420	LINETRAXX® VMD421H
Mains voltage	3AC	■	■
	3NAC	■	■
Function	Undervoltage/overvoltage $U<$, $U>$	■	■
	Underfrequency/overfrequency $f<$, $f>$	■	■
	Phase sequence	■	■
	Phase failure	■	■
	Asymmetry	■	■
	Preset function	■	■
	Password protection	■	■
	History memory (first alarm value)	■	■
Supply voltage U_S		DC 9.6…94 V/AC 16…72 V, AC/DC 70…300 V	U_n
Integrated energy storage device		–	min. 2.5 s
Response values	Undervoltage/Overvoltage $U<$, $U>$	AC 6…500 V/6…288 V	AC 70…500 V/70…288 V
	Hysteresis U	1…40 %	1…40 %
	Underfrequency/overfrequency $f<$, $f>$	10…500 Hz	10…500 Hz
	Hysteresis f	0.1…2 Hz	0.1…2 Hz
	Asymmetry	5…30 %	5…30 %
	Rated frequency	15…460 Hz	15…460 Hz
	Operating time, voltage/frequency	$\leq$ 140 ms/335 ms	$\leq$ 140 ms/335 ms
	Response delay t_{on}	0…300 s	0…300 s
	Delay on release t_{off}	0…300 s	0…300 s
	Start-up delay t	0…300 s	0…300 s
Indicator LEDs	Power On LED	■	■
	Alarm LEDs	■	■
Switches/buttons	Undervoltage/Overvoltage	–	–
	AC/DC switch	–	–
	Buttons	TEST/RESET/MENU	TEST/RESET/MENU
Switching elements	Number	2 x 1 changeover contacts, programmable	2 x 1 changeover contacts, programmable
	Operating principle	N/O or N/C operation, programmable	N/O or N/C operation, programmable
Enclosure dimensions in mm (H x W x D)		90 x 36 x 70.5	90 x 36 x 105.5
Accessories		Mounting clip	Mounting clip
Interface option		M	M
Standards, approvals and certifications		UL, Lloyd's Register	UL, Lloyd's Register

The voltage and frequency monitoring relays of the VMD420/421H series monitor the upper and lower limits of one or several set response values. The devices can be used for three-phase systems with or without an N conductor. Furthermore, the devices feature additional monitoring functions such as phase sequence, phase failure, frequency and asymmetry monitoring.
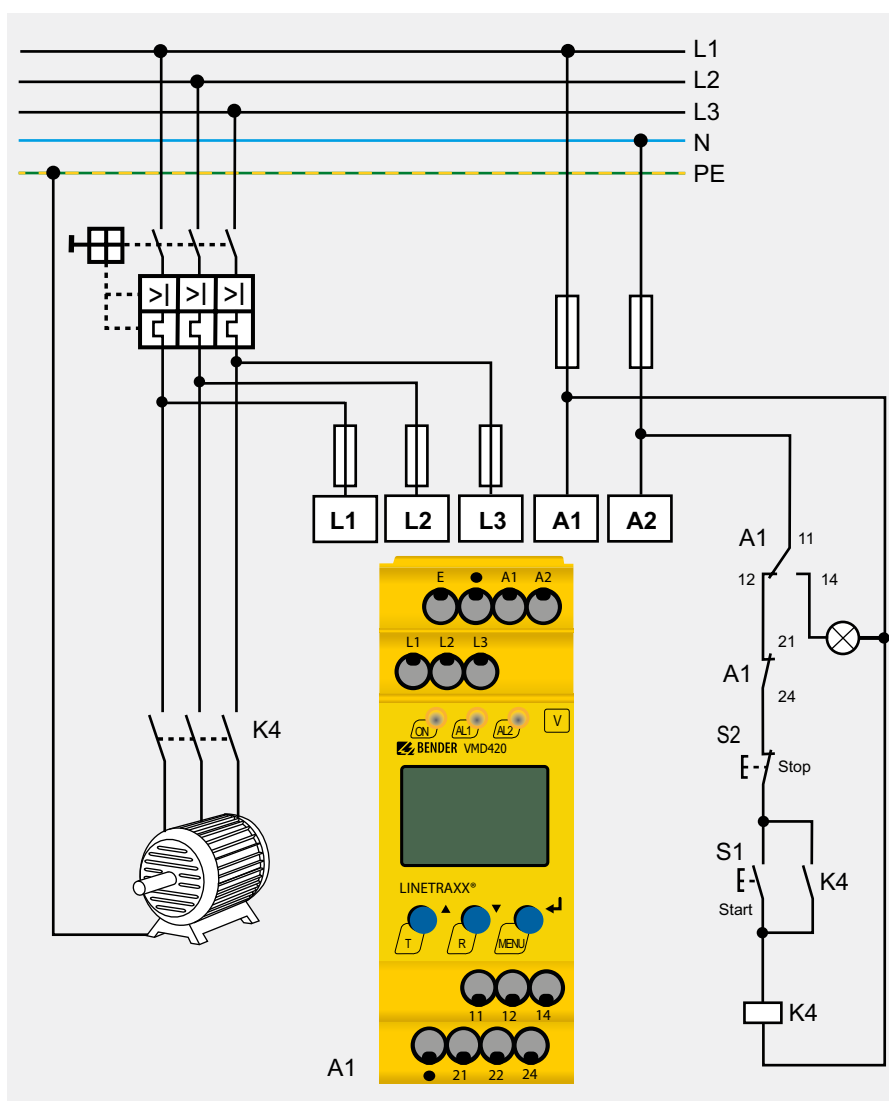
Ordering information

Nominal system voltage [1] U_n	Supply voltage [1] U_S	Type	Art. No.	
			Screw-type terminal	Push-wire terminal
3(N)AC 0…500/288 V	AC 16…72 V/DC 9.6…94 V, 15…460 Hz	VMD420-D-1	B93010005	B73010005
	AC/DC 70…300 V, 15…460 Hz	VMD420-D-2	B93010006	B73010006
3(N)AC 70…500 V, 15…460 Hz	U_n	VMD421H-D-3	B93010007	B73010007

[1] Absolute values

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B98060008

# Voltage and frequency monitoring relays for mains decoupling of power generation systems

		LINETRAXX® VMD423	LINETRAXX® VMD423H	LINETRAXX® VMD460-NA
Mains voltage	3AC	■	■	■
	3NAC	■	■	■
Function	Undervoltage/Overvoltage $U<$, $U>$, $U>$10min	■	■	■
	Undervoltage/Overvoltage $U<<$, $U>>$	–	–	■
	Underfrequency/overfrequency $f<$, $f>$	■	■	■
	Underfrequency/overfrequency $f<<$, $f>>$	–	–	■
	Phase sequence	■	■	■
	Phase failure	■	■	■
	Asymmetry	■	■	■
	ROCOF df/dt	–	–	■
	Vector shift	–	–	■
	Password protection	■	■	■
	History memory	■	■	■
Supply voltage U_S		DC 9.6…94 V/AC 16…72 V, AC/DC 70…300 V	U_n	AC/DC 100…240 V
Integrated energy storage device		–	min. 2.5 s	–
Rated frequency		40…65 Hz	40…65 Hz	45…65 Hz
Indication	Power On LED	■	■	■
	Alarm LED undervoltage	■	■	■
	Alarm LED overvoltage	■	■	■
Switching elements	Number	2 x 1 changeover contacts, programmable	2 x 1 changeover contacts, programmable	2 x 1 changeover contacts
	Operating principle	N/O or N/C operation, programmable	N/O or N/C operation, programmable	N/C operation, programmable
Enclosure dimensions in mm (H x W x D)		90 x 36 x 70.5	90 x 36 x 105.5	90 x 108 x 74
Accessories		Mounting rail	Mounting rail	Mounting rail
Standards, approvals and certifications		UL 508	UL 508	UL 508, VDE-AR-N 4105:2018-11, VDE-AR-N 4105:2011-08, VDE-AR-N 4110:2018-11, BDEW technical guideline 2008 incl. amendments until 01.2013, G99/1:2019, G59/2, G59/3, G98/1:2019, G83/2, CEI 0-21 (:2012-06, :V1:2012-12, :V2:2013-12, :2014-09, :V1:2014-12, :2016-07, V1:2017-07), C10/11:2012-06, DIN V VDE V 0126-1-1 (:2016-06, / A1:2012-02)
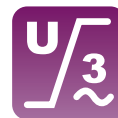
Application examples VMD423(H)

- Monitoring of automatic disconnection devices between generators and the public low-voltage grid

- Applications according to DIN V VDE V 0126-1-1 (VDE V 0126-1-1): 2006-02, C 10/11, EN 50438:2007

- Universally applicable for photovoltaic systems, CHPs (Combined Heat and Power plants), wind power and hydro power plants

Application examples VMD460-NA

- Central NS protection (VDE-AR-N 4105)

- Protective disconnection (VDE-AR-N 4110, BDEW)

- Interface Protection (IP) (Engineering Recommendations; EREC G99, G59, G83, G59)

- Protezione di interfaccia (CEI 0-21)

- Automatic disconnection device between a generator and the public grid

- Universal for generating plants for safe network decoupling

Ordering information

Supply voltage [1] U_S	Response value	Type	Art. No.	
			Screw-type terminal	Push-wire terminal
AC 16…72 V, 15…460 Hz/DC 9.6…94 V	AC 10…500 V	VMD423-D-1	B93010020	B73010020
AC 70…300 V, 15…460 Hz/DC 70…300 V	AC 10…500 V	VMD423-D-2	B93010021	B73010021
U_n	AC 70…500 V	VMD423H-D-3	B93010022	B73010022
AC/DC 100…240 V	AC 400/230 V	VMD460-NA-D-2	B93010045	–

[1] Absolute values

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B98060008

Multifunctional voltage relays for AC, DC, 3(N)AC systems

LINETRAXX® VMD461

The multifunctional voltage monitoring relay VMD461 monitors frequencies, undervoltages and overvoltages in DC, AC and 3(N)AC systems. The phase voltages and/or line-to-line voltages are measured as an RMS value and are continuously shown on the device display. The measured value required to trigger the alarm relay is stored.

Ordering information

Supply voltage U_S	Type	Art. No.
AC/DC 100…240 V	VMD461-D-2	B93010047

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B98060008
Coupling device CD440	B73010046

Mains voltage	3AC	■
	3NAC	■
Function	Undervoltage/Overvoltage $U<, U<<, U<<<, U>, U>>, U>>>$	■
	Underfrequency/Overfrequency $f<, f<<, f<<<, f>, f>>, f>>>$	■
	Phase sequence	■
	Phase failure	■
	Asymmetry	■
	ROCOF df/dt	■
	Vector shift	■
	Password protection	■
	History memory	■
Supply voltage U_S		AC/DC 100…240 V
Indication	Power On LED	■
	Alarm LED undervoltage	■
	Alarm LED overvoltage	■
Switching elements	Number	2 x 1 changeover contacts
	Operating principle	N/C or N/O operation
Enclosure dimensions in mm (H x W x D)		90 x 108 x 74
Accessories		CD440
Standards, approvals and certifications		UL508

Coupling device

CD440

Monitored voltage range	DC/3AC 1200; 1AC/3NAC 690 V
Enclosure dimensions in mm (H x W x D)	93 x 71.7 x 62.5

Voltage relays for 3AC systems

LINETRAXX® VMD258

Voltage relays monitor the upper and lower limits of set response values in 3AC systems up to 690 V.
The VMD258 is designed as a fully analogue voltage relay without microcontroller technology.

Mains voltage 3AC		■
Function	**Undervoltage/overvoltage** $U<$, $U>$	■
	Supply voltage U_S	U_n
	Energy storage	External energy storage device ES258
Measuring circuit	**Measuring range/Nominal system voltage** U_n	3AC 690/500/480/440/400/230/110/100 V
	Rated frequency	45…66 Hz
	Response values	adjustable $U>$, $U<$
	Hysteresis	< 3 %
	Response time undervoltage/Overvoltage	100 ms/60 ms
	Response delay	0…5 s ± 10 %
	Delay on release	100 ms ± 20 %
Indicator LEDs	**Power On LED**	■
	Alarm LED undervoltage	■
	Alarm LED overvoltage	■
Potentiometer	**Undervoltage**	■
	Overvoltage	■
	Response value	■
Switching elements	**Number**	2 x 2 changeover contacts
	Operating principle	N/C operation (undervoltage) N/O operation (overvoltage)
Enclosure dimensions in mm (H x W x D)		93 x 107.5 x 110.1
Accessories		ES258

Ordering information

Connection	Type	Art. No.
3AC 100 V	**VMD258 3AC 100 V**	**B93010060**
3AC 110 V	**VMD258 3AC 110 V**	**B93010061**
3AC 230 V	**VMD258 3AC 230 V**	**B93010062**
3AC 400 V	**VMD258 3AC 400 V**	**B93010063**
3AC 440 V	**VMD258 3AC 440 V**	**B93010064**
3AC 480 V	**VMD258 3AC 480 V**	**B93010065**
3AC 500 V	**VMD258 3AC 500 V**	**B93010066**
3AC 690 V	**VMD258 3AC 690 V**	**B93010067**

Accessories

Description	Art. No.
Additional mounting clips (screw mounting)	**B98060008**
External storage device ES258	**B93010068**

Energy storage device

ES258

Supply voltage U_S	DC 41…47 V
Enclosure dimensions in mm (H x W x D)	85 x 52.5 x 70

Current relays for AC currents

LINETRAXX® CME420

Current relays are designed to monitor the upper and lower limits of one or several set response values.

Mains voltage AC		■
Function	**Undercurrent/Overcurrent $I<$, $I>$**	■
	Window discriminator function	■
	Password protection	■
	History memory (first alarm value)	■
Supply voltage U_S		DC 9.6…94 V/AC 16…72 V, AC/DC 70…300 V
Response values	**Current**	AC 0.05…16 A true RMS
	Rated frequency	42…2000 Hz
	Setting range	0.1…16 A x transformation ratio n
	Transformation ratio n	1…2000
	Hysteresis	10…40 %
	Operating time	≤ 70 ms
	Response delay	0…300 s
	Delay on release	0…300 s
Indicator LEDs	**Operation**	■
	Alarm undercurrent	■
	Alarm overcurrent	■
Switching elements	**Number**	2 x 1 changeover contacts, programmable
	Operating principle	N/O or N/C operation, programmable
Enclosure	**Enclosure dimensions in mm (H x W x D)**	90 x 36 x 70.5
	Accessories	Mounting clip
	Interface option	M
	Standards, approvals and certifications	UL508

Ordering information

Setting range	Supply voltage U_S[1]	Type	Art. No.	
			Screw-type terminal	Push-wire terminal
AC 0.1…16 A	AC 16…72 V, 42…460 Hz/DC 9.6…94 V	CME420-D-1	B93060001	B73060001
AC 0.1…16 A	AC 70…300 V, 42…460 Hz/DC 70…300 V	CME420-D-2	B93060002	B73060002

[1] Absolute values

Accessories

Description	Art. No.
Mounting clip for XM420 enclosure	B98060008

Current relays for 3AC currents

LINETRAXX® CMD420/CMD421

AC current relays are designed to monitor the upper and lower limits of one set response value.

Mains voltage 3AC		■
Function **Undercurrent/Overcurrent** $I<$, $I>$		■
Window discriminator function		■
Supply voltage U_S		DC 9.6…94 V/AC 16…72 V, AC/DC 70…300 V
Response values **Current**		AC 0.05…16 A true RMS
Rated frequency		42…2000 Hz
Setting range		0.1…16 A x transformation ratio n
Hysteresis		1…40 %
Operating time		≤ 130 ms
Response delay		0…300 s
Delay on release		0…300 s
Indicator LEDs **Operation**		■
Alarm undercurrent		■
Alarm overcurrent		■
Alarm window discriminator function		■
Switching elements **Number**		2 x 1 changeover contacts, programmable
Operating principle		N/O or N/C operation
Enclosure **Enclosure dimensions in mm (H x W x D)**		90 x 36 x 70.5
Accessories		Mounting clip

Ordering information

Supply voltage U_S[1]	Type	Art. No.	
		Screw-type terminal	Push-wire terminal
AC 16…72 V/DC 9.6 V…94 V, 15…460 Hz	**CMD420-D-1**	**B93060006**	**B73060006**
AC/DC 70…300 V, 15…460 Hz	**CMD420-D-2**	**B93060007**	**B73060007**
AC 16…72 V/DC 9.6 V…94 V, 15…460 Hz	**CMD421-D-1**	**B93060008**	**B73060008**
AC/DC 70…300 V, 15…460 Hz	**CMD421-D-2**	**B93060009**	**B73060009**

[1] Absolute values

Accessories

Description	Art. No.
Mounting clip for XM420 enclosure	**B98060008**

Current relays for AC currents

AC current relays are designed to monitor the upper and lower limits of set response values on 12 channels.

LINETRAXX® CMS460

Mains voltage AC		■
AC current/pulsed current		■
Function	**Undercurrent/Overcurrent $I<$, $I>$**	■
Supply voltage U_S		DC 16…94 V/AC 16…72 V, 42…460 Hz DC70…276 V/AC 70…276 V, 42…460 Hz
Measuring circuit	**Measuring channels per device**	12
	Rated frequency	42…2000 Hz
	Hysteresis approx.	2…40 %
	Operating time	≤ 180 ms
	Response delay	0…999 s
	Delay on release	0…999 s
Indicator LEDs	**LC display**	■
	Operation	■
	Alarm undercurrent	■
	Alarm overcurrent	■
Switching elements	**Number**	2 x 1 changeover contacts
	Operating principle	N/O or N/C operation
Enclosure	**Enclosure dimensions in mm (H x W x D)**	90 x 108 x 74
	Accessories	–

Ordering information

Supply voltage U_S[1]	Type	Art. No.
AC 16…72 V, 42…460 Hz/DC 16…94 V	**CMS460-D-1**	**B94053017**
AC 70…276 V, 42…460 Hz/DC 70…276 V	**CMS460-D-2**	**B94053018**

[1] Absolute values

Monitoring relays for special applications

Loop monitoring
 LINETRAXX® GM420

Loop monitoring devices monitor conductor loops for interruptions and short circuits, e.g. supply lines of mobile machines and devices.

	Supply voltage U_S	AC 16…72 V/DC 9.6…94 V, AC/DC 70…300 V
Measuring circuit	**Loop resistance $R>$**	■
	Rated frequency	42…460 Hz
	Hysteresis approx.	1…40 %
	Response time	in case of open loop connection ($R > 50$) ≤ 40 ms in case of closed loop connection ($R >$) ≤ 500 ms in case of extraneous voltage ($> U$) ≤ 100 ms
	Response delay	0.1…10 s
	Response value U_A	0.1…100 Ω
Indicator LEDs	**Operation**	■
	Alarm	■
	Loop resistance $R>$	■
	Extraneous voltage $U_f>$	■
Switching elements	**Switches/buttons**	TEST/RESET/MENU
	Number	2 x 1 changeover contacts
	Operating principle	N/O or N/C operation
Enclosure	**Enclosure dimensions in mm (H x W x D)**	90 x 36 x 70.5
	Accessories	Mounting clip

Ordering information

Supply voltage U_S[1]	Type	Art. No.	
		Screw-type terminal	**Push-wire terminal**
AC 16…72 V, 15…460 Hz/DC 9.6…94 V	**GM420-D-1**	**B93082001**	**B73082001**
AC 70…300 V, 15…460 Hz/DC 70…300 V	**GM420-D-2**	**B93082002**	**B73082002**

[1] Absolute values

Accessories

Description	Art. No.
Mounting clip for XM420 enclosure	**B98060008**

Retrofit
Untested devices and installations pose a safety risk

Is your installation still state-of-the-art?

Even the most modern electrotechnical systems are not immune to the effects of time. Whether it is decreasing operational reliability, changing legal conditions or rising energy costs: Upgrading to the respective current state of the art is indispensable. Products for monitoring energy quality and fault search are typically retrofitted.

Risk assessment according to the German Ordinance on Industrial Safety and Health (BetrSichV): Does your currently installed monitoring system detect symmetrical and asymmetrical insulation faults?

Symmetrical and asymmetrical insulation faults pose a high risk potential. With Bender insulation monitors, your systems are continuously monitored, insulations faults are detected and reported. Bender insulation monitors comply with IEC 61557-8.

Let us check your electrical installations and provide you with suggestions for the next steps.

Bender provides flexible solutions for retrofitting projects

Modern monitoring methods can also be integrated in old systems even during ongoing operation. Retrofitting is made possible by devices such as split-core current transformers, for the installation of which the power supplies do not have to be switched off and cable systems do not have to be disconnected.

Successor devices from Bender can easily replace old devices.

Your advantages

- Well prepared for the standards of tomorrow
- Compliance with legal requirements
- Increased availability
- Update to the latest safety standard
- Cut costs and reduce energy consumption
- Ensure spare parts supply in the long term

Systematic and efficient modernisation at a low cost!

POWERSCOUT®
Find out today what won't happen tomorrow

Malfunctions occur in every electrical installation due to moisture, ageing, dirt, mechanical damage or faults caused by the impact of current, voltage and temperature. The web-based software solution POWERSCOUT® helps you detect these at an early stage and eliminate the causes in an economically reasonable way. This guarantees high system and operational safety and reduces costs.

Analysis – as individual as your installation – as easy as possible

Predictive maintenance prevents failures, saves costs and personnel deployment. POWERSCOUT® informs you about the condition of your electrical installation at all times, since the meaningful visualisations with flexible dashboards can be retrieved via any display device: smartphone, laptop, computer. On request, POWERSCOUT® will send you these graphically processed reports at specified intervals.

Continuous monitoring instead of random checks

Manual data acquisition is time consuming, error-prone and only provides random results. POWERSCOUT® gives you an insight into the entire data of your system at any time, since all measured values are automatically and continuously saved. Your data is stored reliably and remains available for years.

Basis for periodic verification

The automated POWERSCOUT® report on residual currents forms the basis for measuring without switch-off by means of periodic verification. In order to maintain the correct status for electrical installations and stationary electrical equipment, periodic verification must be carried out.

This can be ensured, for example, by means of continuous monitoring of the installation carried out by qualified personnel. In this case, it would be smart to rely on continuous monitoring with multi-channel residual current monitoring systems (RCMS) and an evaluation adapted to the system (COMTRAXX® series).
The automatic reports from POWERSCOUT® based on this enable the responsible electrically skilled person to adjust the deadlines for insulation testing as part of the periodic verification.

Analysis
- Continuous recording of insulation values
- Identify connections and optimise processes
- Cross-plant evaluation options
- Access from any location
- Support of investment decisions

Predictive maintenance
- Higher availability
- Continuous monitoring
- Early detection of gradually developing insulation faults
- Detect short-term deteriorations in insulation values at an early stage
- Less costs due to unexpected malfunctions and shutdowns
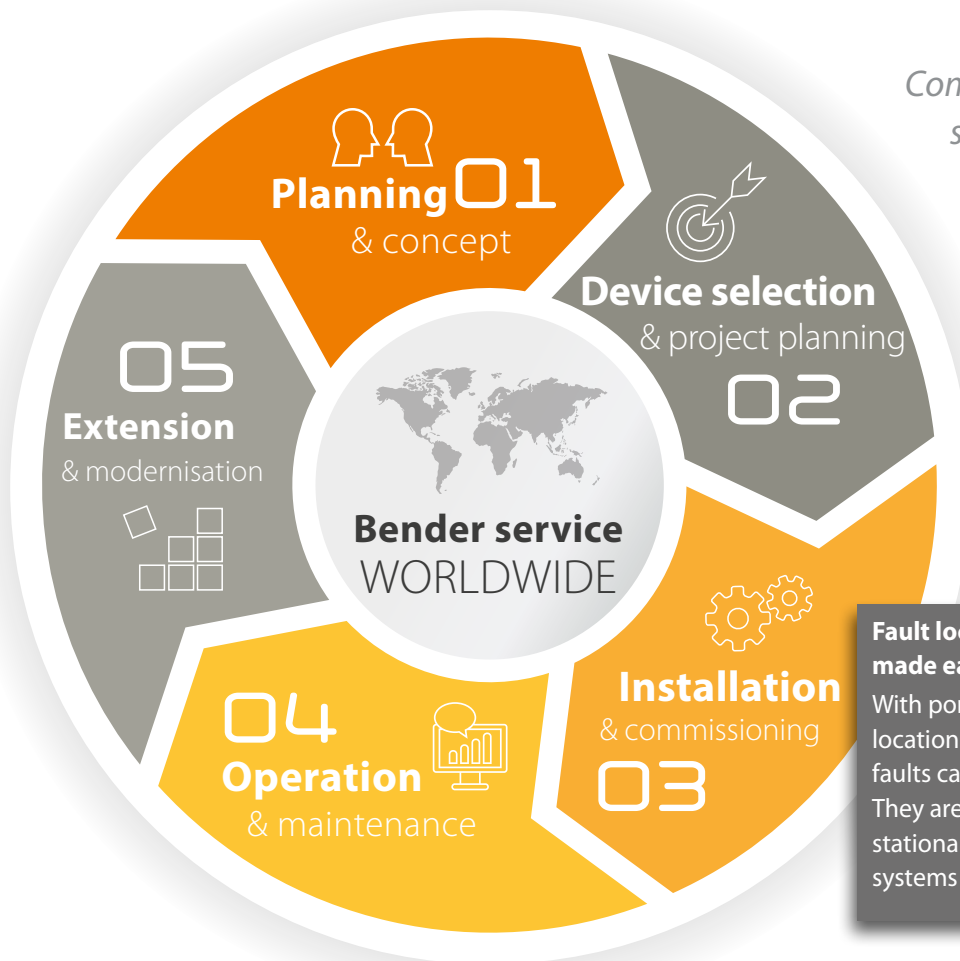
Report
- Historical comparisons
- Reliable storage of measured values
- Event and alarm statistics

Web-based software solution POWERSCOUT®

Support during all stages
Comprehensive service for your installation: remote, by phone, on site

Planning 01
& concept

Device selection
& project planning
02

Installation
& commissioning
03

Operation
& maintenance
04

Extension
& modernisation
05

Bender service
WORLDWIDE

Competent service for maximum safety and high availability of your installation

Fault location – made easy
With portable insulation fault location systems, existing insulation faults can be quickly located.
They are the best alternative if no stationary insulation fault location systems are available.

From planning to modernisation – Our extensive know-how is at your disposal during all project phases.

Furthermore, with our first-class service we guarantee maximum safety for your electrical installations.
We offer services ranging from support over telephone to repairs and on-site service – with modern measuring devices and competent employees.

Secure yourself:

- High availability of your installation thanks to fast reaction to fault messages
- Increased profitability of your capital expenditure (CAPEX) via optimised maintenance processes
- Targeted operating expenditure (OPEX) due to less downtimes and shorter service visits
- Support for your predictive system monitoring and regular tests of your system/power quality/monitoring devices
- Automatic control, analysis, correction, new settings/updates
- Competent assistance with setting changes and updates

Bender Remote Assist
Bender Remote Assist offers you support via remote access, high-quality service and advice for your challenging task consisting in ensuring consistent high safety in your systems.

Many service visits, fault clearance but also analysis and controls can be carried out remotely – without the expenses of time and money that an on-site visit of a technician implies.

This fast, efficient help and advice by our expert network allows the highest possible availability of your system.

Bender. Making your world safe.

Our world is networked on a global scale; it is digital, mobile and highly automated. And no matter whether in hospitals, in industry, inside or outside buildings, in power stations, in trains, underwater or underground: it never stands still and it is more dependent than ever on a reliable and, above all, safe electrical power supply.

And exactly that is our mission: we make electricity safe. With our technologies, we ensure that electricity is permanently available and guarantee faultless protection against the hazards of electric shock. We protect buildings, plants and devices and therefore your investments and plans. But what we primarily protect are the lives of the people who are involved with electricity.

Mechanical and plant engineering

Oil, gas

Renewable energy

Healthcare

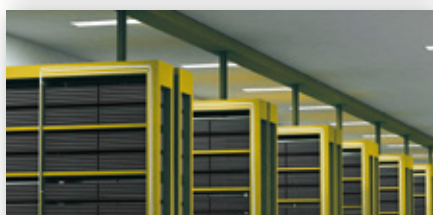**Public power supply network**

Mobile power generation

Ships and ports

Railway

eMobility

Data centres

Mining

Battery energy storage systems (BESS)

www.bender.de

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