EN Manual

BENDER
The Power in Electrical Safety©

LINETRAXX® CMS460-D4

Load current monitor with three measuring channels for monitoring three-phase transformers with AC currents up to 32/63 A

Software-Version: D452 V1.20 / D256 V2.29

CMS460-D4_D00166_01_M_XXEN/02.2021

Manual EN

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Photos: Bender archive

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1. Important information

1.1 How to use this manual

*This manual is intended for **qualified personnel** working in electrical engineering and electronics!*

Always keep this manual within easy reach for future reference.
To make it easier for you to understand and revisit certain sections in this manual, we have used symbols to identify important instructions and information. The meaning of these symbols is explained below:

*This signal word indicates that there is a **high risk of danger** that will result in **electrocution** or **serious injury** if not avoided.*

*This signal word indicates a **medium risk of danger** that can lead to **death** or **serious injury** if not avoided.*

*This signal word indicates a **low level risk** that can result in **minor** or **moderate injury or damage to property** if not avoided.*

*This symbol denotes information intended to assist the user in making **optimum use** of the product.*

This manual has been compiled with great care. It might nevertheless contain errors and mistakes. Bender cannot accept any liability for injury to persons or damage to property resulting from errors or mistakes in this manual.

1.2 Technical support: service and support

For commissioning and troubleshooting Bender offers you:

1.2.1 First level support

Technical support by phone or e-mail for all Bender products

- Questions concerning specific customer applications
- Commissioning
- Troubleshooting

Telephone:	+49 6401 807-760*
Fax:	+49 6401 807-259
In Germany only:	0700BenderHelp (Tel. and Fax)
E-mail:	support@bender-service.de

1.2.2 Repair service

Repair, calibration, update and replacement service for Bender products

- Repairing, calibrating, testing and analysing Bender products
- Hardware and software update for Bender devices
- Delivery of replacement devices in the event of faulty or incorrectly delivered Bender devices
- Extended guarantee for Bender devices, which includes an in-house repair service or replacement devices at no extra cost

Telephone:	+49 6401 807-780** (technical issues)
	+49 6401 807-784**, -785** (sales)

Fax:	+49 6401 807-789
E-mail:	repair@bender-service.de

Please send the devices for repair to the following address:

Bender GmbH, Repair-Service,
Londorfer Str. 65,
35305 Grünberg

1.2.3 Field service

On-site service for all Bender products

- Commissioning, configuring, maintenance, troubleshooting of Bender products
- Analysis of the electrical installation in the building (power quality test, EMC test, thermography)
- Training courses for customers

Telephone:	+49 6401 807-752**, -762 **(technical issues) +49 6401 807-753** (sales)
Fax:	+49 6401 807-759
E-mail:	fieldservice@bender-service.de
Internet:	www.bender.de

*Available from 7.00 a.m. to 8.00 p.m. 365 days a year (CET/UTC+1)
**Mo-Thu 7.00 a.m. - 8.00 p.m., Fr 7.00 a.m. - 13.00 p.m

1.3 Training courses

Bender is happy to provide training regarding the use of test equipment. The dates of training courses and workshops can be found on the Internet at www.bender.de > Know-how > Seminars.

1.4 Delivery conditions

Bender sale and delivery conditions apply. For software products the "Softwareklausel zur Überlassung von Standard-Software als Teil von Lieferungen, Ergänzung und Änderung der Allgemeinen Lieferbedingungen für Erzeugnisse und Leistungen der Elektroindustrie" (software clause in respect of the licensing of standard software as part of deliveries, modifications and changes to general delivery conditions for products and services in the electrical industry) set out by the ZVEI (Zentralverband Elektrotechnik- und Elektronikindustrie e. V.) (German Electrical and Electronic Manufacturer's Association) also applies. Sale and delivery conditions can be obtained from Bender in printed or electronic format.

1.5 Inspection, transport and storage

Inspect the dispatch and equipment packaging for damage, and compare the contents of the package with the delivery documents. In the event of damage in transit, please contact Bender immediately.
The devices must only be stored in areas where they are protected from dust, damp, and spray and dripping water, and in which the specified storage temperatures can be ensured.

1.6 Warranty and liability

Warranty and liability claims in the event of injury to persons or damage to property are excluded if they can be attributed to one or more of the following causes:

- Improper use of the device.
- Incorrect mounting, commissioning, operation and maintenance of the device.
- Failure to observe the instructions in this operating manual regarding transport, commissioning, operation and maintenance of the device.
- Unauthorised changes to the device made by parties other than the manufacturer.
- Non-observance of technical data.

- Repairs carried out incorrectly and the use of replacement parts or accessories not approved by the manufacturer.
- Catastrophes caused by external influences and force majeure.
- Mounting and installation with device combinations not recommended by the manufacturer.

This operating manual, especially the safety instructions,
must be observed by all personnel working on the device. Furthermore,
the rules and regulations that apply for accident prevention at the place of use must be observed.

1.7 Disposal

Abide by the national regulations and laws governing the disposal of this device. Ask your supplier if you are not sure how to dispose of the old equipment.
The directive on waste electrical and electronic equipment (WEEE directive) and the directive on the restriction of certain hazardous substances in electrical and electronic equipment (RoHS directive) apply in the European Community. In Germany, these policies are implemented through the "Electrical and Electronic Equipment Act" (ElektroG). According to this, the following applies:

- Electrical and electronic equipment are not part of household waste.
- Batteries and accumulators are not part of household waste and must be disposed of in accordance with the regulations.
- Old electrical and electronic equipment from users other than private households which was introduced to the market after 13th August 2005 must be taken back by the manufacturer and disposed of properly.

For more information on the disposal of Bender devices, refer to our homepage at www.bender.de > Service & support.

2. Safety instructions

2.1 General safety instructions

Part of the device documentation in addition to this manual is the enclosed "Safety instructions for Bender products".

2.2 Work activities on electrical installations

*Only **qualified personnel** are permitted to carry out the work necessary to install, commission and run a device or system.*

DANGER

Risk of electrocution due to electric shock!
Touching live parts of the system carries the risk of:

- *An electric shock*
- *Damage to the electrical installation*
- *Destruction of the device*

***Before installing and connecting the device**, **make sure** that the **installation** has been **de-energised**. Observe the rules for working on electrical installations.*

If the device is used outside the Federal Republic of Germany, the applicable local standards and regulations must be complied with. The European standard EN 50110 can be used as a guide.

2.3 Intended use

Load current monitor with three measuring channels for monitoring three-phase isolating transformers with currents up to 32/63 A.
According to the standards set down for power supplies in medical locations (DIN VDE 0100-710 (VDE 0100-710), ÖVE/ÖNORM E 8007, IEC 60364-7-710), it overload protection of isolating transformers by disconnection is not allowed. Instead, monitoring of overload and high temperature is required for the medical IT transformer In combination with the isoMED427P or the 107TD47, the CMS460-D4 has the task of monitoring the load current for three-phase transformers.
In order to meet the requirements of the applicable standards, customised parameter settings must be made on the equipment in order to adapt it to local equipment and operating conditions. Please heed the limits of the range of application indicated in the technical data.

Any use other than that described in this manual is regarded as improper.

3. System description

In buildings and industrial installations, a fault or failure of the power supply involves high costs. In installations which require high fault tolerance and good safety, three-phase isolating transformers should be monitored continuously for overload.

3.1 Features

- Three true r.m.s. measuring channels for measuring the three load currents of three-phase isolating transformers
- Determination of the maximum load current of the three measured values
- Selectable measuring current transformer types: STW2/STW3/STW4
- Adjustable response value
  STW2 , STW3: 1…32 A
  STW4 1…63 A
- Measuring range
  STW2 , STW3: 1…55 A
  STW4 1…110 A
- Alarm on channel 4 when 100 % of the response value are reached or exceeded on at least one of the channels 1…3
- Adjustable time delay t_{on}
- History memory with date and time stamp for 300 data records
- Data logger 300 data records per channel
- Analysis up to the 40th harmonic (THF)
- Two alarm relays with changeover contact; N/O or N/C operation selectable
- Connection possibility for external test and reset buttons
- Backlit graphic display and alarm LEDs

- Data exchange via BMS bus
- Parameterisation with password protection
- RoHS-compliant

3.2 Description of function

The currents are detected and evaluated as true r.m.s. values in the frequency range of 42…2000 Hz. All channels are scanned simultaneously so that the maximum scanning time for the three channels is ≤ 180 ms if 1x the response value is exceeded and ≤ 30 ms if 5x the response value is exceeded.

The CMS460-D4 determines the maximum current of the three measuring channels and outputs these as a load value, which is represented as percentage of the response value.
The currents of the three measuring channels are shown on the display in bar graph format and are available via the BMS bus on the channels 1…3.
The maximum load value currently measured is available via the BMS bus on channel 4.

If the maximum response value of the load current is reached or exceeded the relays will be activated and an alarm is signalled via the BMS bus on channel 4 as soon as the response delay t_{on} has elapsed.
Both alarm LEDs on the device light up.

In addition to the load current measurement, the CMS460-D4 analyses the harmonics of the measuring channels 1…3 up to the 40^{th} harmonic and indicates it as a THF value (THF=Total Harmonic Factor).

CT connection faults are indicated via LED (Alarm 1) and can be queried via the BMS bus (channels 1…3).

3.3 Connecting measuring current transformers

Fig. 3.1: STW2…4

The CMS460-D4 can only be operated with STW2, STW3 and STW4 measuring current transformers. For details refer to ordering information.

History memory

The device utilises a history memory for failsafe storing of up to 300 data records (date, time, channel, event code, measured value), so that all data about an outgoing circuit or an area can be traced back at any time (what happened when).

Analysis of harmonics

The channel displaying the harmonics of the measured currents can be selected via the menu item ("Menu" - "4. Harmonic"). There, both the THF and the current value of the harmonics (1…40 at 50/60 Hz) is displayed numerically and graphically. In addition, the DC component is displayed.

The THF describes the harmonics the r.m.s value of an alternating quantity in proportion to the fundamental r.m.s. value. The smaller the THD factor, the more sinusoidal the current signal.

The THF is determined and indicated for the channels 1…3.

4. Installation and connection

4.1 Unpacking

- Unpack all the parts supplied with the system. Avoid sharp-edged tools that may damage the content of the packaging.
- Compare your order with our delivery note to check that you have received all products in full. The article numbers and type designation printed on the nameplates provides an easy means of uniquely identifying each device.
- Check all parts supplied for any evidence of damage in transit. Do not use devices damaged in transit. If a device has sustained damage, please contact Bender. Details of who to contact are indicated on the delivery documents.
- When storing the devices in a cold environment as it is in winter the following is to be considered: Leave the devices to stand for 3 to 4 hours at room temperature before connecting the power supply. When the devices are moved from a cold to a warm environment, condensation will be evident on all parts. Putting damp devices into operation risks damaging electrical components and there is a danger of electric shock on contact.

4.2 Fuses, max. voltage, cable lengths

- Equip the supply voltage of all system components with fuses. IEC 60364-4-43 requires protective devices for short-circuit protection. We recommend the use of 6 A fuses.
- When using busbar systems, please note: The maximum voltage of the monitored system must not exceed the nominal insulation voltage of the measuring current transformers used in the CMS460-D4.

- Select the cables and cable lengths according to the technical data on page 62. If you use cables that are longer than those specified here, Bender cannot guarantee that the equipment will function safely.
- For UL-application:
  - Use at least 60/70 °C copper lines!

4.3 Notes on mounting

Danger of electric shock!
Before fitting the device and prior to working on the device connections, make sure that the power supply has been disconnected and the system is dead.
The electrical installation may sustain damage and the device be destroyed beyond repair.

Risk of electric shock due to open current transformer connections!
*When operating **incorrectly connected** measuring **current transformers** there is the risk of an **electric shock** and/or flashovers.*
*Avoid open transformer connections and ensure that the electrical **installation** is **de-energised**!*

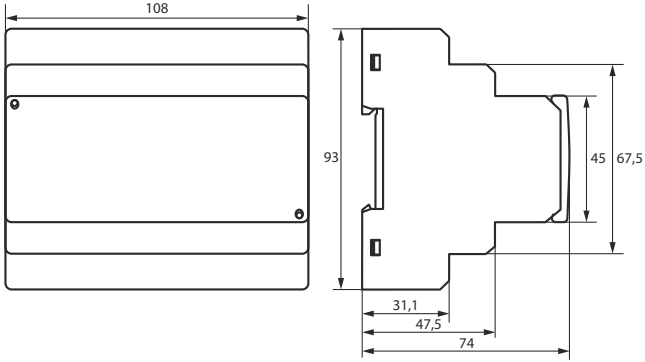
The devices are suitable for the following installation methods:

- Standard distribution panels according to DIN 43871
- DIN rail mounting according to IEC 60715
- Screw mounting using M4 screws

Mount the measuring current transformers in accordance with the notes in the "Transformer installation“ technical information. When connecting the measuring current transformers, it is essential that you observe the maximum cable lengths, the conductor cross section and that you use shielded cables.

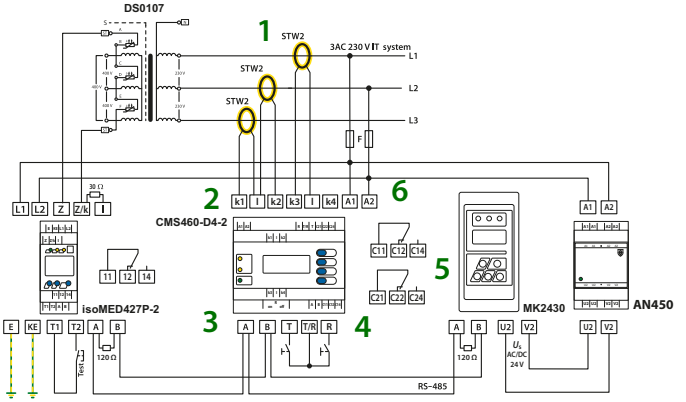
4.4 Connection

4.4.1 Dimension diagram



All dimensions in mm.

4.4.2 Wiring diagram



Legend to wiring diagram

No.	Terminal CMS460-D4/ Device	Meaning
1	STW	Standard measuring current transformers (use the same transformer type for each of the three phases).
2	k1, l k2, l k3, l	Connection STW measuring current transformer For the measuring channels k1…3. only one type of measuring current transformer from the STW 2…4 series can be selected.

3	A, B	BMS bus (RS-485 interface with BMS protocol)
4	R, T/R	External reset button (N/O contact). The external reset buttons of several devices must not be connected to each other.
	T, T/R	External test button (N/O contact). The external test buttons of several devices must not be connected to each other.
5	C11, C12, C14	Common alarm relay K1: ALARM 1, common alarm for alarm, device error
	C21, C22, C24	Common alarm relay K2: ALARM 2, common alarm for alarm, device error
6	A1, A2	Connection of supply voltage U_S (see ordering information), 6 A fuse recommended
	120 Ω	(slide switch on the underside of the device) Activate or deactivate the terminating resistor of the BMS bus (120 Ω).
	DS0107	Three-phase isolating transformer
	isoMED427P-2	Isometer® for medical locations
	MK2430	Remote alarm indicator and test combination for Bender monitoring systems with BMS.
	AN450	Power supply unit for MK2430

4.4.3 Commissioning

*At the associated **MK** (or tableau) , in addition to the address of the isoMED427P also the **address of the CMS460-D4** must be added to the **alarm address table** and the **test address table**.*
Type in the test address table:
CMS460-D4 : "IND-iso"
isoMED427P: "MED-iso"

Using the arrow on the bottom left-hand corner of the panel as a reference, lift the panel cover in an upward direction. The cover can also be removed completely. Refit the front panel cover as soon as the adjustments are completed.

4.5 Before switching on

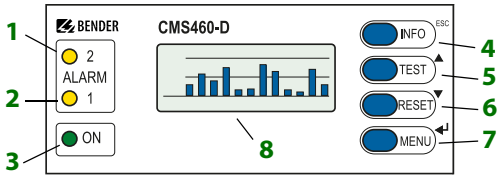
1. Does the connected supply voltage U_S match the information on the device nameplate? ☐
2. Only when busbar systems are used: Has the maximum permissible nominal insulation voltage of the measuring current transformers been observed? ☐
3. In mounting the measuring current transformers, have any magnetic fields that are nearby and could cause interference been taken into account? ☐
4. Does the maximum permissible cable lengths comply with the measuring current transformer? ☐
5. Is a 120 Ω resistor connected at the beginning and end of the BMS bus? ☐
6. Is the interface cable length and the number of BMS nodes within the limits specified, i.e. 1,200 m and 32 respectively? ☐
7. In respect of the BMS bus node address settings, has each address only been assigned once? Is address 001 assigned, meaning that the master function has been assigned? ☐

4.6 Switching on

1. Connect the supply voltage of all devices connected to the BMS bus. Initially, the "ON" LED flashes on the CMS460-D4 and the graphic display of the CMS460-D4 shows the Bender welcome screen. Then the "ON" LED lights up permanently.
2. Set the BMS bus addresses. Never assign one address twice.
3. Select the appropriate national language English, Deutsch or Français (see page 50).
4. Select the type of measuring current transformer. The same current transformer type must be used for all channels.The settings of one channel always have an impact on all channels.
5. If a response value is exceeded the device error messages are indicated at the CMS460-D4 by illuminated alarm LEDs and and a respective message on the graphic display. Information concerning the alarms are available on the CMS460-D4 in the "Alarm/Meas.value" menu.

5. Operation

5.1 Operator control and display elements



Legend to operator control and display elements

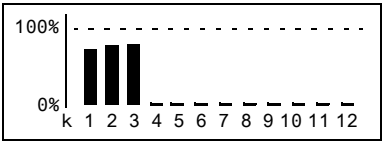
1	The LED "ALARM 2" lights up if the measured value exceeds the response value on one channel.	
2	The LED "ALARM 1" lights up if the measured value in one channel has exceeded the response value. In the event of a device error, the LED lights up.	
3	The LED "ON" lights up when the device is switched on and flashes during power on until the device is ready for operation.	
4	INFO button: ESC button:	Calls up standard information. Exits the menu function without changing parameters.
5	TEST button: ▲ button:	Starts an automatic test. Parameter change, scroll
6	RESET-button: ▼ button:	To acknowledge alarm and fault messages. Parameter change, scroll
7	MENU button: ↵ button:	To toggle between the standard display, menu and alarm display. Confirms parameter changes

8	Illuminated graphic LCD

5.2 Working in operating mode

5.2.1 Standard display

In operating mode, the CMS460-D4 displays a bar graph, which shows what percentage of the set response value has been reached for each of the three measuring channels.



Channel not used (height = 1 graduation r

Channel enabled

Channel enabled, current is flowing. (height ≥ 2 graduation r

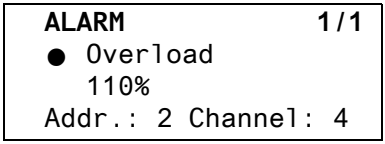
5.2.2 Alarm and fault condition

Possible causes of alarm messages:

- The set response value is exceeded.
- Fault measuring current transformer or measuring current transformer connection.
- Device error (see „Device error display“ on page 58)

The CMS460-D4 signals the alarm:

- LED "ALARM 1" and LED "ALARM 2" light.
- Associated common alarm relays (C…) switch.
- An alarm message is being sent via the BMS bus on channel 4.
- An entry is made in the history memory.
- An entry is made in the data logger.
- An alarm message is indicated on the display.



Line 1: ALARM or FAULT,
ALARM 1 of 1 pending alarms

Line 2: Alarm status and alarm text (e. g. overload, no master).
○ No alarm
● Alarm, fault

Line 3: Currently measured overload of the three-phase isolating transformer.

Line 4: BMS bus address of the CMS460-D4 and measuring channel on which the alarm occurred.

5.2.3 Test procedure

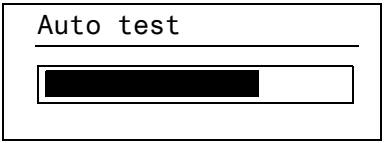
A test serves to check the device function (hardware components) of the CMS. There are different possibilities of starting a test:

- Select the standard display, then press the "TEST" button on the front plate of the CMS460-D4 for at least one second.
- Press a test button externally connected to the CMS460-D4.
- Send a test command via the BMS bus.
- Select the "TEST" function from the Control menu.

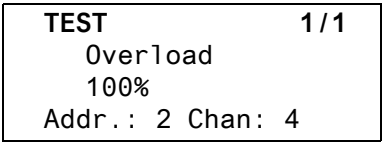
The CMS460-D4 responds as follows:

- LED "ALARM 1" and LED "ALARM 2" light.
- All alarm relays switch (function can be deactivated, see page 47).
- A test alarm message is sent via the BMS bus on channel 4.
- An entry with the suffix "TEST" is stored in the history memory.

- The progress of the test is shown on the display.



The CMS460-D4 then indicates the functioning measuring channel with the highest response value set.
Use the "▼" button to display the functionality of the other measuring channels.



Following a successful test, all LEDs must go out again, with the exception of the LED "ON" and the alarm relays must return to their initial position.

5.2.4 Resetting saved alarm messages (RESET)

In the event of an internal device error, the alarm status will remain until a "RESET" is carried out. The alarm messages will only be reset when the faults causing the alarm messages have been eliminated.

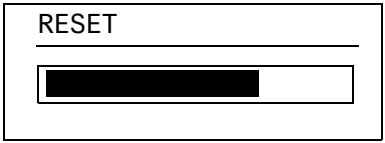
First press the "ESC" button to exit the display of the current alarm message. Only when the standard display (bar chart) appears, can the "RESET“ button be pressed.

A RESET is carried out in the following way:

- Select the standard display, then press "RESET" button on the front plate of the CMS460-D4 for at least one second.
- Press a reset button externally connected to the CMS460-D4.
- Send a reset command via the BMS bus.
- Select the "RESET" function from the Control menu.

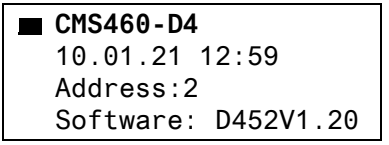
Saved alarm messages that are no longer pending are deleted. The alarm relay drops out, the alarm LEDs go out and there are no longer any alarm messages on the BMS bus.

The CMS460-D4 indicates the progress of the reset operation.



5.2.5 Displaying standard information

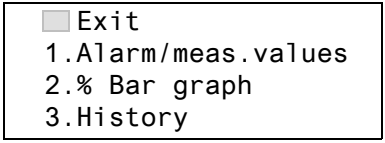
Press the "INFO" button. The display of the CMS460-D4 shows information on the device and software. Press the "▼" several times to display all the information. Please have this information to hand if you should need to contact us for assistance by telephone.



Line 1:	Device type
Line 2:	Date, time
Line 3:	BMS bus address of the CMS460-D4
Line 4:	Software version D452V1.x for measurement technique processes
Line 5:	Date of software version measurement technique
Line 6:	Software version D256V2.x for communication processes
Line 7:	Date of software version communication
Lines 8…10:	Bender address, homepage
Line 11:	Exit. Exit standard information

6. Main menu

Press the "MENU" button to open the main menu.

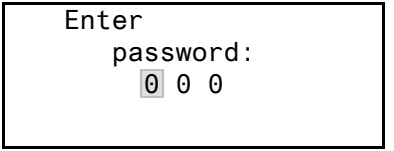


Use the following buttons in the main menu:

ESC	To exit this function without storing or to move up one menu level.
▲, ▼	To select menu items
↵	To confirm the selected menu item (Enter)

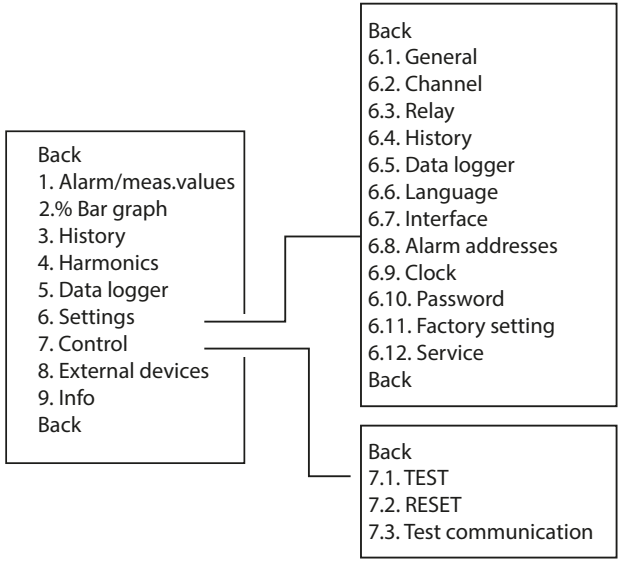
The menu mode is exited automatically if no button is pressed for more than five minutes.
Exceptions:
The "Test" and "Test communication" function.

Settings can be password protected. When an attempt is made to change settings, the password enty screen appears automatically:



Details „Settings menu 10: Password“ on page 52.
If you can't remember your password, contact the Bender Service.

6.1 Menu overview diagram



6.2 Main menu functions

Menu item	Function	Page
Exit	Exit menu mode	-
1. Alarm/ meas.values	Displays the following for each measuring channel, if applicable: Alarm, measured value, response value	37

Menu item	Function	Page
2.% Bar graph	The percentage of the total set response value which has been reached by each of the three measuring channels is displayed.	37
3. History	Displays the history (300 data records) with information about messages, acknowledgements and associated times. Displays the minimum and maximum overcurrent and the associated address and channel after the occurrence of an alarm.	38
4. Harmonics	Displays the following for the selected measuring channel: Measured value, THF (Total Harmonic Factor), DC component, fundamental oscillation and harmonics in mA.	40
5. Data logger	Displays the recorded measured values (300 data records/channel) for each measuring channel.	41
6. Settings	Settings for this CMS460-D4 are made here.	42
7. Control	This menu offers various control options, such as TEST, RESET, Test communication.	53
8. External devices	Settings for devices externally connected to the BMS bus (z. B. RCMS460D/-L, RCMS490-D/-L, CMS460-D4).	55
9. Info	Information about the device. The same display as in the case of pressing the INFO button in the operating mode (see „Displaying standard information“ on page 32).	56

6.3 Menu 1: Alarm/meas.values

CMS460-D4 displays the following for each measuring channel: Measured value, response value. Alarms will only be displayed on channel 4.

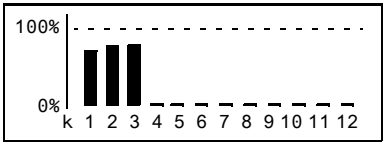
	I(d)	I(dn)
2. ○	2.6A	1A
3. ○	<10mA	1A
4. ●	2.6A	1A

Column 1: Channel No. 1…4
Column 2: Alarm status:
○ No alarm
● Alarm, fault
Column 3: I(d): Currently measured r.m.s. *I* of the load current
Column 4: I(dn): Set response value I_n

Channels 1…3 *provide the load current measurement values.*
Channel 4 *outputs the maximum value of the three measuring channels as a load value, which is represented as a percentage of the response value.*

6.4 Menu 2: % Bar graph

The CMS460-D4 indicates for each of the three measuring channels, the percentage of the set response value the measured value has reached.



Channel not used (height = 1 graduation r
Channel enabled
Channel enabled, current is flowing. (height ≥ 2 graduation r

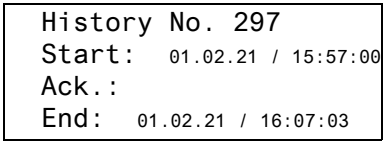
100 % Response value (alarm)
0 % Channel not used

The indication in the display is dependent on the set response value:

Response value	***Indication 0 mA***
10 mA…2 A	*for measured values ≤ 10 mA;*
2 A…20 A	*for measured values ≤ 0.5 % of the response value*

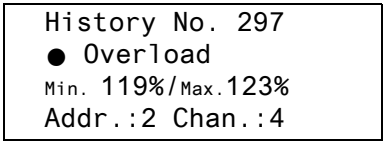
6.5 Menu 3: History

The failsafe history memory saves up to 300 events (alarms, tests). If the history memory is full, the oldest entry will be deleted in each case in the event of an alarm, to create space for the new entry. For details about erasing the entire history memory refer to „Settings menu 4: History“ on page 48.



Line 1: Number of the event (if applicable): TEST.
Line 2: Start of the event: Date/time
Line 3: Event acknowledgement (e.g. by pressing the "Buzzer off" button at the TM…, MK2430, MK800): Date/time
Line 4: End of the event: Date/time

If you are **searching** for an event that occurred at a **specific time**, navigate through the different entries using the arrow buttons.
Use the "↵" button to display information about the current entry in the history memory.



Line 1: Number of data record
Line 2: Alarm state and alarm text (e. g. overload)
- ○ No alarm
- ● Alarm, fault

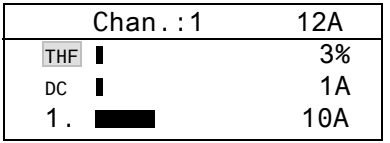
Line 3: Minimum and maximum measured value during the alarm.
Line 4: Address and measuring channel of the device sending the message.

6.6 Menu 4: Harmonics

The analysis of the harmonics of the measured currents is displayed as a bar or a current value. Harmonics are multiples of the nominal frequency. Example: Rated frequency = 50 Hz, 2nd harmonic = 100 Hz.

The CMS460-D4 can only determine the harmonics currents correctly if the rated frequency in menu "6.Settings > General > Rated frequency" has been selected to match the current being monitored.

At 50 or 60 Hz, the current value of harmonics 1…40 is displayed;



THF: The THF describes the harmonics the r.m.s value of an alternating quantity in proportion to the fundamental r.m.s. value.The smaller the THD factor, the more sinusoidal the current signal.

Column 1: Identifies THF, DC component and number of harmonics.

Column 2: Bar display of the THF (% of the r.m.s.), bar display of the current value.

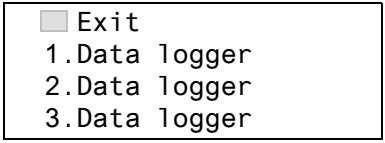
Column 3: Current r.m.s., THF/load current of this measuring channel. Harmonics current values are updated one after another. Updating of all harmonics takes up to 15 seconds.

Select a measuring channel to display harmonics:

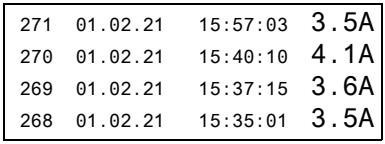
- Use the "▲" arrow button to select a measuring channel. Press the "↵" button.
- Use the "▲ ▼" buttons to select a measuring channel. Press the "↵" button to confirm your selection.
- Now you can navigate through the current harmonic values of this measuring channel using the "▲ ▼" buttons.

6.7 Menu 5: Data logger

Up to 300 data records can be recorded for each of the 3 measuring channels. A new measured value is stored if it differs from the previous measured value by a defined percentage. You define this percentage in menu "6.Settings > 5.Data logger > Change". You also make settings for overwriting and deleting measured values here.



1. Use the Up/Down buttons to select the required measuring channel (measuring channel number k1…k3). Press the "↵" button.



2. You can use the "▲ ▼" buttons to navigate through the recorded data records of this measuring channel (data record number, date, time, measured value).

6.8 Menu 6: Settings

The settings for the CMS460-D4 can be made using the following menu items:

Menu item	Function	Page
Exit	Exit settings	-
1. General	Prewarning, hysteresis, rated frequency, start-up delay $t_{(start)}$	43
2. Channel	Response value, response delay $t_{(ON)}$, transformer, transformer monitoring	45
3. Relay	Set the relay mode and type of fault that causes switching operation for the common alarm relay.	47
4. History	Erase the history memory	48
5. Data logger	Set change in %, activate/deactivate, overwrite or delete data.	49
6. Language	Select language for menu and alarm texts.	50
7. Interface	Set the BMS bus address for the CMS460-D4.	50
8. Alarm addresses	Set the bus addresses for devices whose alarm messages are to be displayed on this CMS460-D4.	50
9. Clock	Set date format, date, time and summer time changeover.	51
10. Password	Changing and activating the password.	52
11. Factory setting	Resets all settings to factory settings.	52
12. Service	For Bender service staff only	52

6.8.1 Settings menu 1: General

In this menu you make settings that apply to this device and therefore to all measuring channels.

1. Prewarning

Setting as a percentage of the response value.

Setting range: 10…100 %, resolution of setting 1 %.

2. Hysteresis

If the measured value is relatively close to the response value, the CMS460-D4 would constantly switch between the alarm and normal states. If a hysteresis of 20 % is set, the alarm state will not be exited until the measured value is 20 % below the response value.

Setting range: 2…40 %, resolution of setting 1 %.

3. Frequency

The correct rated frequency must be selected for the CMS460-D4 to properly determine the harmonic current values.

Setting options: 50 Hz, 60 Hz

4. Start-up delay *t* (start)

Time delay after switching the CMS460-D4 on.
No alarm message is generated during this period. This time delay is required if the CMS460-D4 and the system to be monitored are switched on simultaneously. Currents caused by switching operations are ignored.

Setting range: 0…99 s.
Resolution of settings as follows:

Setting range	Resolution of setting
0…50 ms	5 ms
60…200 ms	10 ms
250…500 ms	50 ms
600 ms …2 s	100 ms
2.5…5 s	0.5 s
6…20 s	1 s
25…50 s	5 s
60…99 s	10 s

6.8.2 Settings menu 2: Channel

In this menu, you make the settings for the measuring channels. The settings to all three measuring channels can only be made simultaneously .

The settings for one channel have an impact on all other channels. Therefore, all channels must use the the same measuring current type.

1. Response value (Resp.value)

The response value is the measured value upon which an alarm has to be signalled when the limit value is reached.

For each measurement tolerances have to be considered (measuring current transformers, CMS460-D4). According to IEC 62020, the set response value must not be exceeded. Therefore, the CMS460-D4 must be activated when 50…100 % of this value have been reached
The current measuring channels k1…k3 have positive tolerances as regards the response values.

The setting options for the response value are dependent on the selected settings in the menu "Channel > transformer":

STW2	1…32 A
STW3	1…32 A
STW4	1…63 A

Resolution of setting: 1 A

2. Response delay $t_{(ON)}$

The response delay $t_{(ON)}$ starts every time when a new alarm occurs.

Setting range: 0…10 s.
Resolution of settings as follows:

Setting range	Resolution of setting
0…50 ms	5 ms
60…200 ms	10 ms
250…500 ms	50 ms
600 ms …2 s	100 ms
2.5…5 s	0.5 s
6…10 s	1 s

3. CT

Select the appropriate measuring current transformer STW2…4.

4. CT MONITOR·

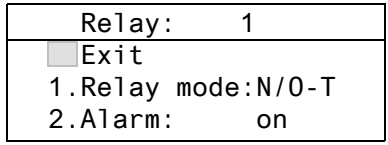
This menu is used to switch the CT monitoring on (factory setting) or off. With the CT monitoring switched on, missing transformers are recognised ("Fault: connection transformer"). The transformer is not checked for short-circuit.

6.8.3 Settings menu 3: Relay

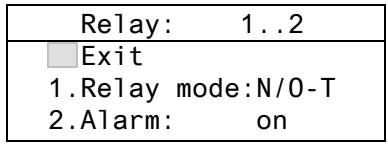
In this menu, you make the settings for the two common alarm relays K1 (C11, C12, C14) and K2 (C21, C22, C24) individually or in common. Select the relay:

1. Use the "▲" button to set the relay. Press the "↵" button.
2. Use the Up/Down buttons to select one relay (1, 2) or both relays (1…2). Press the "↵" button to confirm your selection.

Set a single relay:



Set both relays:



1. Relay mode

Set the relay mode:

N/O	operation. Relay only switches in the event of an alarm.
N/C	operation. Relay only switches in the event of an alarm.
N/O-T	operation. Relay switches in the event of an alarm or a test.
N/C-T	operation. Relay switches in the event of an alarm or a test.
off	Relay contacts are always open*
on	Relay contacts are always closed*

* *This function can also be activated via the BMS bus. Sending the command "off" or "on" via the BMS bus may cause the relay to switch. This relay does not respond to alarms. It serves merely as a signal converter BMS bus/relay contact message.*

2. Alarm

on	Relay switches in the event of an alarm.
off	Relay does not switch in the event of an alarm.

3. Prewarning

on	Relay switches in the event of a prewarning.
off	Relay does not switch in the event of a prewarning.

In the default setting a prewarning is not activated (prewarning = 100 % of the response value). When you change this value, you can configure the relays to switch before the response value is reached.

4. Device error

on	Relay switches in the event of a device error.
off	Relay does not switch in the event of a device error.

5.Ext. alarm

on	Relay switches in the event of an external alarm*.
off	Relay does not switch in the event of an external alarm*.

* *Alarm on an external device the address of which is set to "on" in the "Alarm addresses" menu („Settings menu 8: Alarm addresses“ on page 50).*

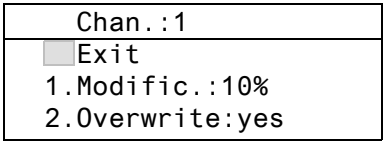
6.8.4 Settings menu 4: History

Here the history memory can be deleted completely. Use the "↵" button to confirm that the memory has to be deleted.

6.8.5 Settings menu 5: Data logger

In this menu, you make the settings for the measured value data logger recording for the three measuring channels.

The data logger settings of one channel are automatically applied for the two other measuring channels. Separate settings are not possible.



1. Modific.

A new measured value is saved if it differs from the previous measured value by the percentage defined here.
Setting range: 0…100 %, resolution of setting 1 %.

2. Overwrite

Yes	If the memory (300 measuring values) for this measuring channel is full, the oldest measured value is deleted to create space for the new measured value entry.
No	Data logger records 300 measured values then stops.

3. Delete

To prevent unwanted execution of this function, the entry must be confirmed once more.

6.8.6 Settings menu 6: Language

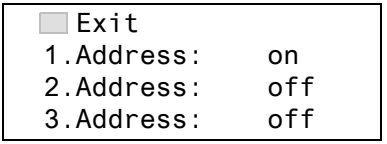
Select the language for the menu and the alarm texts.
Setting options: English, Deutsch or Français.

6.8.7 Settings menu 7: Interface

Set the BMS Bus address for the CMS460-D4. The device with address 1 has the master function on this bus. There must be one device with address 1 in each CMS460-D4.
Setting range: Adresses 1…90.

6.8.8 Settings menu 8: Alarm addresses

Setting of the bus addresses (1…150) externally connected to the BMS bus the alarm messages of which are to be displayed as standard messages on this CMS460-D4. Set the addresses of devices whose messages are to be displayed to "on". Addresses set to "on" are monitored for presence on the BMS bus; if a device cannot be found on the bus, a corresponding message will appear. The address of this device is automatically set to "On".



on	Messages of this device will be displayed.
off	Messages of this device will not be displayed.

6.8.9 Settings menu 9: Clock

Set the date format, date, time, and summer time changeover.

Set the time and date at the BMS bus master (addr. 1). These settings are adopted by all the slaves. The setting is synchronised every hour.
The "Clock" menu setting remains stored for approx. 2 h after power supply failure.

1. Format

Select the German or American format.

d.m.y	German format (day.month.year)
m-d-y	American format (month-day-year)

2. Date

Set the date (e. g. 20.02.2021).

3. Time

Set the time (e. g. 16:44).

4. Summertime

Setting for automatic switchover to Central European Summer Time (CEST).

CEST	Automatic switchover
OFF	No switchover (wintertime is retained)

6.8.10 Settings menu 10: Password

Change password, activate/deactivate password.

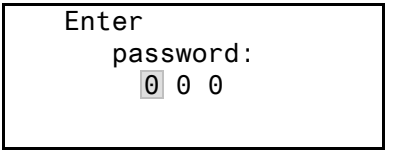
1. Password

Change password. Factory setting: 000

2. Status

Activate or deactivate password protection.

Settings can be password protected. If the password is activated (enabled), all settings continue to be displayed. When an attempt is made to change settings, the password enty screen appears automatically:



Once a valid password has been entered, access will be granted to settings in all menus (except the Service menu) until the menu mode is exited.
If you can't remember your password, contact the Bender Service.

6.8.11 Settings menu 11: Factory settings

Resets every setting to its factory settings. Factory settings are given in parentheses „( )*“ in the technical data.

6.8.12 Settings menu 12: Service

This menu is intended for Bender-Service staff only.

6.8.13 Menu 7: Control

This menu offers various options for controlling the CMS:

Exit	Exit settings
1. TEST	Call a test
2. RESET	Call a reset
3. Test communication	Test the communication between the CMS460-D4 and other BMS devices.

6.8.14 Control menu 1: TEST

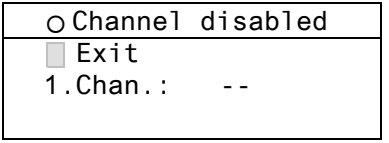
Call a test (also refer to „Test procedure“ on page 29). To prevent this function being used accidently, the entry has to be confirmed once again.

6.8.15 Control menu 2: RESET

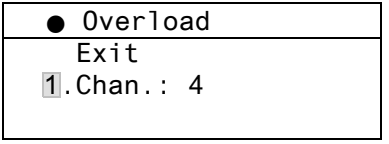
Call a reset (also refer to „Resetting saved alarm messages (RESET)“ on page 31). To prevent this function being used accidently, the entry has to be confirmed once again.

6.8.16 Control menu 3: Test communication

This function can be used to test the communication between the CMS460-D4 and other BMS devices. For this purpose, the CMS460-D4 sends an alarm message via the BMS bus until the "Test communication" function is exited. A connected evaluating device (COM…, CP700, MK2430, MK800, TM…) must indicate this alarm.



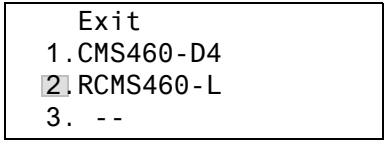
1. Use the arrow button "▼" to adjust the measuring channel. Press the "↵" button.
2. Use the Up/Down buttons to select a measuring channel. Press the "↵" button to confirm your selection.
   The alarm is sent on the BMS bus. This is indicated by the alarm indication ●. Depending on the function set for the measuring channel, an "overload" alarm will be indicated and sent. Example: Alarm "Overload" on channel 4.



3. Press the "ESC" button to exit the function.

6.9 Menu 8: External devices

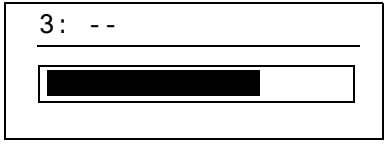
This menu can be used for setting and operating external devices connected via the BMS bus to this CMS460-D4. In this way, for example, RCMS460-L or other CMS460-D4 devices can be set. The menu items of the external devices available via this function are indicated on the CMS460-D4 display. Settings modified at the external device are automatically stored in the external device.
After calling this menu, the address and device type of devices already known will be displayed. The display is updated every five minutes.



Use the "▲ ▼" buttons to select the address of the external device and confirm with the "↵" button.

Newly connected to the BMS bus or external devices started for the first time will not be displayed immediately by the CMS460-D4 in the external devices list.The list will be updated only after a few minutes. However, it is not necessary for the list to appear in order to select and set . the external device, which can be achieved via the address.

The device is being searched:

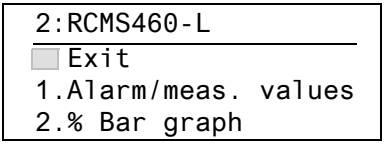


If "no access to the menu" appears, press the "ESC“ button to exit the display. Possible causes are:

- No device with this address available.
- Connected device does not support this programming function.
- Access not possible at the moment.

The "External devices" menu is not suitable to program your own device. If you still attempt do do this, the error message "Own address" will appear. Press the "ESC" button to exit this menu.

When the device has been recognised, the CMS460-D4 reads the current settings of the connected device. The address and the device type is displayed in the first line.



6.10 Menu 9: Info

The "Info" menu displays standard information about this CMS460-D4 (for details refer to „Displaying standard information“ on page 32).

7. Tests, service, troubleshooting

7.1 Periodic verification

The CMS460-D4 monitors itself during operation. We recommend to activate the test function on each CMS460-D4 . There are different possibilities of starting a test:

- Select the standard display and press the "TEST" button on the front plate of the CMS460-D4 for at least one second.
- Press a test button externally connected to the CMS460-D4.
- Send a test command via the BMS bus.
- Call up the "TEST" function in the Control menu.

Observe the applicable national and international standards which require regular testing of electrical equipment.

7.2 Maintenance and service

The CMS460 D4 system does not contain any parts that must be maintained. Bender would be delighted to provide on-site service for commissioning and also offers service personnel training on site.

Please contact our Service Department for more information.

7.3 Troubleshooting

7.3.1 Device error display

An "Error code" is displayed in the event of a fault. Please have this device information to hand if you should need to contact us for assistance by telephone.

Error code	Description
1	Measurement technique: Fault parameter memory (EEPROM/FLASH)
2	Measurement technique: Fault data memory (RAM)
4	Measurement technique: No boot loader available
11	Measurement technique: Device not calibrated
12	Measurement technique: Wrong measurement p.c.b., incorrect mounting
13	Measurement technique: Hardware error after performing a self test
71	BMS interface: No master available resp. has not been queried by a master for five minutes
72	BMS interface: Fault RS-485 interface

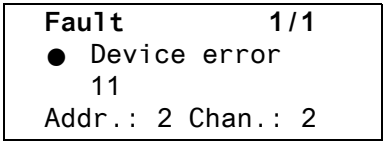
Display in the event of a fault

Device error: xx

xx = Error code

7.3.2 Device error display (channel-related)

LED "ALARM 1" lights up. The programmed common alarm relay switches. The following text appears on the display of the CMS460-D4:



Line 1: FAULT, Alarm 1 of 1 pending alarms
Line 2: Alarm status and alarm text
○ No alarm
◐ Prewarning
● Alarm, fault
Line 3: Error code (refer to „Device error display“ on page 58)
Line 4: BMS bus address of the CMS460-D4 and measuring channel on which the alarm has occurred.

Possible causes:

- Incorrect basic programming of the CMS460-D4
- Defective component
- Internal memory fault
- Faulty channels after test

The device errors remain saved until the "RESET" button is pressed. An entry is made in the history memory with the suffix "device error".
if a device error continues to exist after a RESET, the CMS460-D4 has to be replaced.

7.3.3 External alarm

LED "ALARM 2“ lights up. The programmed common alarm relay switches.
Possible causes:

- Alarm message from an external device
- Device failure

8. Technical Data

8.1 Standards

The operating manuals for the individual system components provide you with information about the standards that apply to that particular device.

DIN VDE 0100-710 (VDE 0100-710)
Errichten von Niederspannungsanlagen - Teil 7-710: Anforderungen für Betriebsstätten, Räume und Anlagen besonderer Art - Medizinisch genutzte Bereiche
DIN VDE 0100-718 (VDE 0100-718)
Errichten von Niederspannungsanlagen - Anforderungen für Betriebsstätten, Räume und Anlagen besonderer Art; Teil 718: Bauliche Anlagen für Menschenansammlungen (Low voltage electrical installations - Part 7-718: Requirements for special installations or locations - Communal facilities and workplaces)
ÖVE/ÖNORM E 8007
Starkstromanlagen in Krankenhäusern und
medizinisch genutzten Räumen außerhalb von Krankenhäusern (Electrical installations in hospitals and locations for medical use outside hospitals)
IEC 60364-7-710
Electrical installations of buildings – Part 7-710: Requirements for special installations or locations – Medical locations

8.2 Approvals

8.3 Tabular data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Supply voltage U_S ..... AC/DC 100 . . . 240 V (-20 . . . +15 %)
Supply voltage frequency ..... DC, 50/60 Hz

Rated insulation voltage ..... **250 V**
Overvoltage category/pollution degree III/3
Rated impulse voltage ..... **6 kV**
Protective separation (reinforced insulation) between ..... (A1, A2) - (k1, l . . . k4, R, T/R, T, A, B), (C11, C12, C14), (C21, C22, C24)
Protective separation (reinforced insulation) between ..... (C11, C12, C14) - (C21, C22, C24)
Voltage test acc. to IEC 61010-1 ..... 3.536 kV

Rated insulation voltage ..... **250 V**
Overvoltage category/pollution degree III/3
Rated impulse voltage ..... **4 kV**
Basic insulation between: ..... (k1, l . . . k3, R, T/R, T, A, B) - (C11, C12, C14), (C21, C22, C24)
Voltage test acc. to IEC 61010-1 ..... 2.21 kV

Measuring circuit

Number of measuring channels 3
External measuring current transformer ..... STW2 . . . 4
Load ..... 68 Ω
Rated insulation voltage (measuring current transformer) ..... 800 V
Rated frequency ..... 42 . . . 2,000 Hz
Measuring range ..... 1 . . . 110 A
Crest factor
- up to 10 A 4
- up to 110 A 2

Rated operating current I_{n2} (alarm) ..... 1 . . . 60 A (1 A overload)*
Preset for alarm ..... 100 %*
Relative uncertainty ..... +10 . . . -20 %
Hysteresis ..... 2 . . . 40 % (5 %)*

Time response

Start-up delay $t_{(start\text{-}up)}$ per device ..... 0 . . . 99 s (3 s)*
Response delay t_{on} per channel ..... 0 . . . 10 s (1 s)*
Operating time t_{ae} at $I_n = 1 \times I_{n1/2}$ ..... ≤ 180 ms
Operating time t_{ae} at $I_n = 5 \times I_{n1/2}$ ..... ≤ 30 ms
Response time t_{an} tan for current measurement ..... $t_{an} = t_{ae} + t_{on1/2}$
Scanning time for all measuring channels (current measurement) ..... ≤ 180 ms
Recovery time t_b ..... 500 . . . 600 ms

Displays, memory

Display range, measuring value ..... < 10 mA . . . 110 A
Operating uncertainty ..... ± 10 %
LEDs ..... ON/ALARM
LC display ..... backlit graphical display
History memory ..... 300 data records
Data logger ..... 300 data records per measuring channel
Password ..... off/0 . . . 999 (off)*
Language ..... D, GB, F (GB)*

Inputs/outputs

Test/reset button ..... internal/external
Cable length for external test/reset button ..... 0 . . . 10 m

Interface

Interface/protocol RS-485/BMS
Baud rate ..... 9.6 kbit/s
Cable length ..... 0 . . . 1200 m
Cable: twisted pair, one end of shield connected to PE ..... J-Y(St)Y min. 2x0.8
For UL applications: Copper lines ..... at least 60/70 °C
Terminating resistor ..... 120 Ω (0.25 W) connectable via DIP switch
Device address, BMS bus ..... 1 . . . 90 (2)*

Cable lengths for measuring current transformers STW

Single wire ≥ 0.75 mm² ..... 0 . . . 1 m
Single wire, twisted ≥ 0.75 mm² ..... 0 . . . 10 m
Shielded cable ≥ 0.5 mm² ..... 0 . . . 40 m
Recommended cable
(shielded, shield connected to terminal l at one end, must not be earthed) ..... J-Y(St)Y min. 2x0.8

Switching elements

Number of changeover contacts ..... 2 x 1 changeover contacts
Operating principle ..... N/C or N/O operation (N/O operation)*
Electrical endurance, number of cycles 10,000

Contact data acc. to IEC 60947-5-1

Utilisation category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current (common alarm relay)	5 A	3 A	1 A	0.2 A	0.1 A
Rated operational current (alarm relay)	2 A	0.5 A	5 A	0.2 A	0.1 A

Minimum contact load (relay manufacturer's reference) ..... 10 mA/5 V DC

Environment/EMC

EMC ..... IEC 61326-1
Operating temperature ..... –25 . . . +55 °C
Climatic class acc. to IEC 60721 (except condensation and formation of ice)
- Stationary use (IEC 60721-3-3) 3K23
- Transport (IEC 60721-3-2) 2K11
- Long-term storage (IEC 60721-3-1) 1K22

Classification of mechanical conditions acc. to IEC 60721
- Stationary use (IEC 60721-3-3) 3M11
- Transport (IEC 60721-3-2) 2M4
- Long-term storage (IEC 60721-3-1) 1M12

Connection screw-type terminals

Connection properties

Rigid/flexible/conductor sizes ... 0.2 . . . 4 / 0.2 . . . 2.5 mm^2/AWG 24 . . . 12

Multi-conductor connection (2 conductors with the same cross section)

Rigid/flexible ... 0.2 . . . 1.5 / 0.2 . . . 1.5 mm^2

Stripping length ... 8 . . . 9 mm

Tightening torque ... 0.5 . . . 0.6 Nm

Other

Operating mode ... continuous operation

Mounting ... display-oriented

Degree of protection, internal components (IEC 60529) ... IP30

Degree of protection, terminals (IEC 60529) ... IP20

Enclosure material ... polycarbonate

Flammability class ... UL94V-0

Screw fixing ... 2 x M4

DIN rail mounting acc. to ... IEC 60715

Software version measurement technique ... D0452 V1.2

Software version display ... D256 V2.29

Power consumption ... ≤ 10 VA

... < 5 W

Weight ... ≤ 300 g

( )* Factory setting

8.4 Ordering information

Load current monitor

Type	Supply voltage U_S*	Article No.
CMS460-D4-2	DC 100…240 V AC 100…240 V, 50/60 Hz	B94053030

Accessories

Type	Article No.
XM460-mounting frame, 144 x 72 mm	B990995

Measuring current transformers

Type	Measuring range	Article No.
STW2	AC 0…50 A	B942709
STW3	AC 0…100 A	B98021000
STW4	AC 0…200 A	B98021001

8.5 Document revision history

Date	Document version	Valid from software version	State/Changes
11.2014	00	D0452 V1.x	First edition
02.2021	01	D0452 V1.2	*Editorial revision* Chapter 2.3: Intended use Chapter 4.4.2: Wiring diagram Chapter 5., Chapter 6.: Display representation Chapter 8.1: Designation of standards Chapter 8.3: Min. contact load, Climatic classes, operating temperature, power consumption, weight *Added* Chapter 8.2: Logo UKCA

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