



## LINETRAXX® CTUB100 series

AC/DC sensitive measuring current transformers (type B)

### Intended use


The AC/DC sensitive measuring current transformers (type B) of the CTUB100 series convert system leakage and fault currents into an evaluable measurement signal. The devices are suitable for detecting fault currents with smooth DC components. They consist of a CTBC... measuring current transformer core and a CTUB10... electronic module, which can be combined to suit the application. The measuring current transformers can be used in DC, AC, and 3(N)AC systems. The measurement signal is evaluated using devices of the RCMA4..., RCMS4..., RCMB4... or MRCD4... series, respectively EDS440/441-LAB series, to which the measuring current transformers are connected.


### General safety instructions


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

**Installation, connection and commissioning are to be carried out by electrically skilled persons only!**

It is essential to follow the existing safety instructions.

 **DANGER!** indicates a high risk of danger that will result in death or serious injury if not avoided.

 **CAUTION!** indicates a low-level risk that can result in minor or moderate injury or damage to property if not avoided.

 This symbol refers to information that is designed to help you make the best use of the product.

### Overview: Possible combinations of evaluator, electronic module and measuring current transformer core

Electronic modul	Evaluator	Meas. current transformer core	Connecting cable	Supply voltage
CTUB101	RCMA420	CTBC20(P)...60(P)	CTX... (6 wires)	DC ±12 V The evaluator supplies the measuring current transformer.
	RCMA423	CTBC20(P)...210(P)		
	RCMS460/490*	CTBC20(P)...210(P)	CTX... (5/6 wires)	DC ±12 V External power supply unit AN420
CTUB102	RCMS460/490	CTBC20(P)...210(P)	CTXS... (4 wires)	24 V External power supply unit
CTUB104	EDS440/441-LAB	CTBC20(P)...60(P)		

\* Only recommended for retrofit if an AN420 power supply unit is already available. In this case, if the ready-made connecting cable CTX... is used, the green plugs of the connecting cable (on the evaluator side) must be removed.

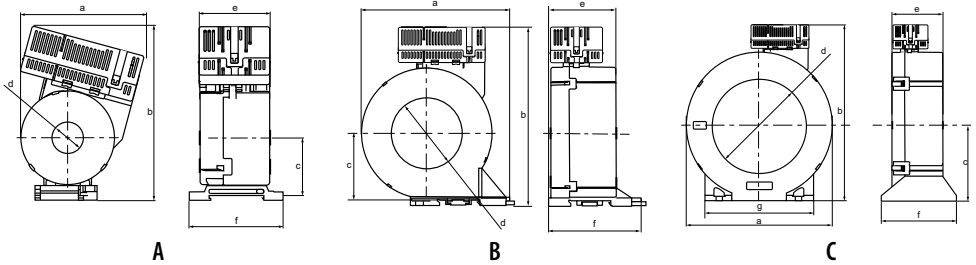
Afterwards, the individual conductors must be crimped and connected to the RCMS460/490 or the AN420. In this case, the conductor "T" is not used



### Device features

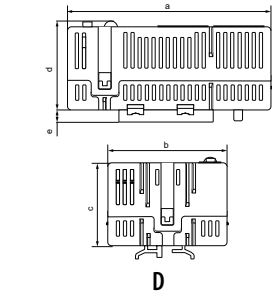
- Multicolour LED for operation, fault and status messages
- Electronic module can be exchanged without mechanical separation of the primary conductors
- Extension/retrofitting or modification of functionalities possible in case of changed monitoring requirements
- Insensitive to load currents due to full magnetic shield, can be used for high short-term system-related load currents (for CTBC...P only).
- Monitoring of the connection to the measuring current transformer

### Dimension diagrams

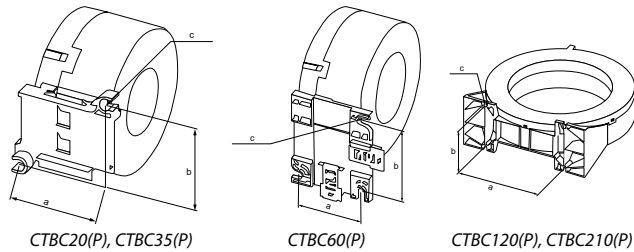


Dimensions (mm), Tolerance: ±0.5 mm

	Type	a	b	c	d	e	f	g
A	CTUB...-CTBC20(P)	75	83	37	∅ 20	46	60,5	–
	CTUB...-CTBC35(P)	97	130	47	∅ 35	46	61	–
B	CTUB...-CTBC60(P)	126	151	57	∅ 60	56	78	–
C	CTUB...-CTBC120(P)	188	225	96	∅ 120	65	96	139
	CTUB...-CTBC210(P)	302	339	153	∅ 210	67	113	277
D	CTUB...	74	44	30	32	4.6	–	–



### Mountings (mm)

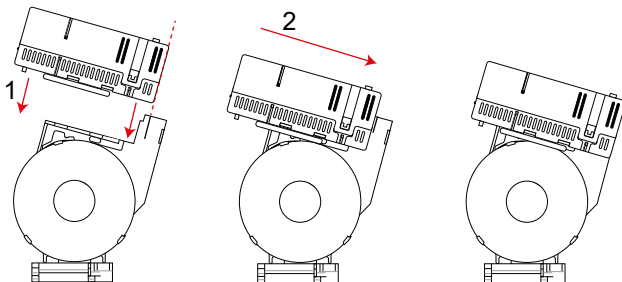


Typ	a	b	c
CTBC20(P)	31.4	49	2 x ∅ 5.5
CTBC35(P)	49.8	49	2 x ∅ 5.5
CTBC60(P)	56	66	3 x ∅ 6.5
CTBC120(P)	103	81	4 x ∅ 6.5
CTBC210(P)	180	98	4 x ∅ 6.5

### Assembly

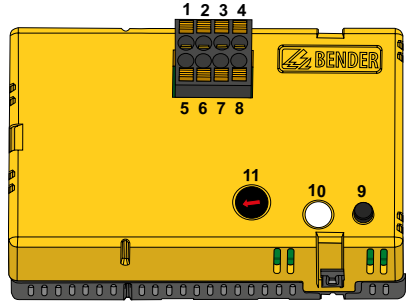
Slide the electronic module onto the plug contacts of the measuring current transformer.

**i** Avoid repeated plugging and unplugging of the electronics (10 plugging cycles).



**Device view**

No.	CTUB101	CTUB102	CTUB104	Note												
1	Terminal	S1 (k)		Connection measuring current transformer core												
2		S2 (l)														
3		–		Not in use												
4		–														
5		+12V	24V	24V	Supply voltage $U_S$											
6		GND														
7		-12V	–	–												
8		T	–	–	Connection external test											
9	Test button T			a) Offset calibration * b) Internal functional test **												
10	Combined LED			Lights green normal operation Flashes red device error ***												
11	Potentiometer for adjusting the measuring range	–	–	<table border="1"> <thead> <tr> <th></th> <th>Response value RCM... <math>I_{Dn} \leq 0.1 \text{ A}</math></th> <th>Measuring range peak 0...900 mA</th> </tr> </thead> <tbody> <tr> <td></td> <td><math>I_{Dn} \leq 0.1 \text{ A}</math></td> <td>0...900 mA</td> </tr> <tr> <td></td> <td><math>0.1 \text{ A} &lt; I_{Dn} \leq 0.5 \text{ A}</math></td> <td>0...3.5 A</td> </tr> <tr> <td></td> <td><math>I_{Dn} &gt; 0.5 \text{ A}</math></td> <td>0...20 A</td> </tr> </tbody> </table>		Response value RCM... $I_{Dn} \leq 0.1 \text{ A}$	Measuring range peak 0...900 mA		$I_{Dn} \leq 0.1 \text{ A}$	0...900 mA		$0.1 \text{ A} < I_{Dn} \leq 0.5 \text{ A}$	0...3.5 A		$I_{Dn} > 0.5 \text{ A}$	0...20 A
					Response value RCM... $I_{Dn} \leq 0.1 \text{ A}$	Measuring range peak 0...900 mA										
					$I_{Dn} \leq 0.1 \text{ A}$	0...900 mA										
					$0.1 \text{ A} < I_{Dn} \leq 0.5 \text{ A}$	0...3.5 A										
	$I_{Dn} > 0.5 \text{ A}$	0...20 A														
Select the measuring range according to the response value $I_{Dn}$ set on the RCM... evaluator. If a larger measuring range is selected, the accuracy will decrease.																


**\* Test button T: Offset calibration**

**i** For measuring current transformer cores with an **internal diameter  $\geq 120 \text{ mm}$** , an **offset calibration** should always be carried out before the first commissioning. Note that during the offset calibration the system is switched off and no current flows through the measuring current transformer.

**Offset calibration sequence**

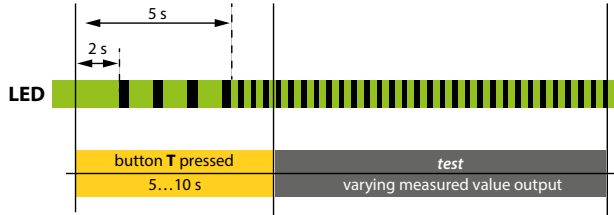
	Action	LED
1	Install the measuring current transformer in the system, assemble the electronic module and the measuring current transformer core, $U_S$ disconnected	off
2	Press and hold the "T" button	off

	Action	LED
3a	Press and hold "T", supply the electronic module with supply voltage $U_S$	lights red permanently (not ready for operation)
3b		flashes red <b>slowly</b> after approx. 2 s (ready for calibration)
3c		flashes red <b>quickly</b> after a total of 5 s (calibration mode)
4	Start calibration: release "T" when the LED flashes red quickly	flashes red quickly
5	Calibration in progress	flashes red quickly
6a	Calibration successful, values are accepted	lights green permanently
6b	Calibration not successful. Calibration value is not accepted. The device is in an error state. Either carry out another offset measurement or clear the error by switching the device off and on again.	flashes red slowly

**\*\* Test button T:  
Internal functional test**

Press test button "T" for 5... 10 s.  
When the LED flashes green quickly, release the button.  
Function test begins, varying measured values are output. Their amplitude depends on the setting of the detent potentiometer.

After completion of the function test, the LED lights up green.



**\*\*\* Device error**

**i** In the event of a device error, a high DC residual current (in the level of the respective measuring range end value) is additionally output so that the error is visible at the evaluator.

Possible cause of error	Action
Connection between CTUB... and CTBC... is not correct	Check connection or disconnect CTUB... and CTBC... and reconnect
Error after offset calibration (possibly system not switched off and therefore DC residual current too high)	Either carry out an offset calibration again or clear the error by switching the device off and on again. either carry out an offset calibration again or clear the error by switching the device off and on again
Supply voltage $U_s$ incorrect ( $\pm 12V$ or $24V$ )	Apply correct supply voltage $U_s$

Possible cause of error	Action
Detent potentiometer (11) is not correctly engaged in one position, but is between two positions	Engage the detent potentiometer correctly
Detent potentiometer is not set correctly, evaluators display error E.01 (CT error)	Set correct response value on detent potentiometer

If the fault cannot be eliminated, contact Bender Service.

**Wiring diagrams**

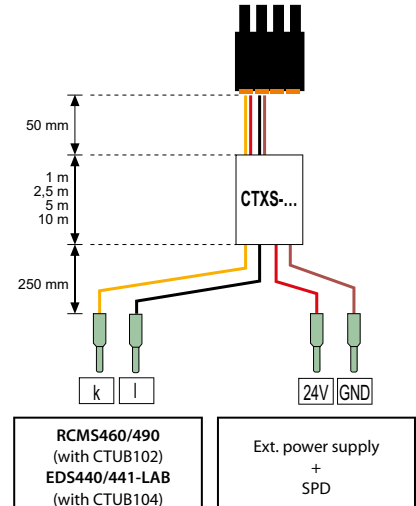
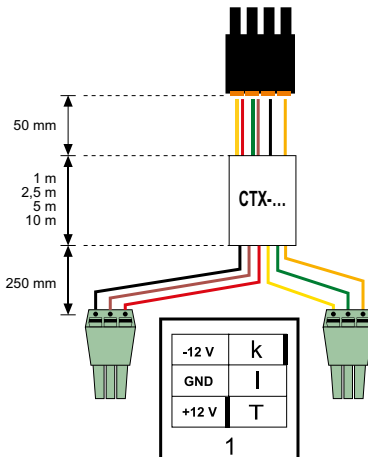
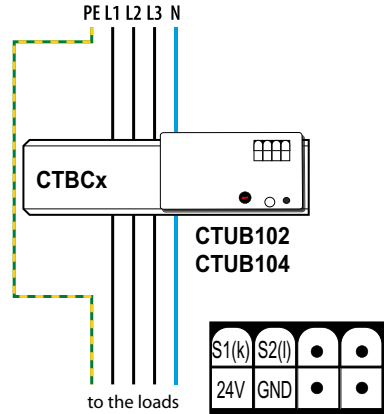
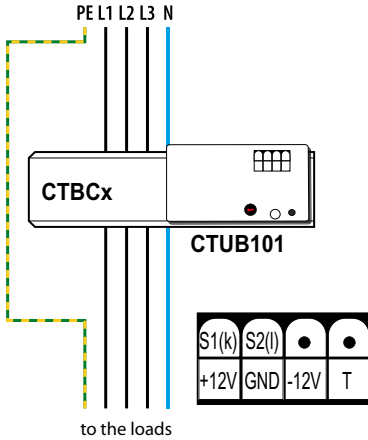
**!** **DANGER** of electrocution due to electric shock!  
Touching live parts of the system carries the risk of:  
- An electric shock  
- Damage to the electrical installation  
- Destruction of the device  
**Before installing and connecting the device, make sure that the installation has been de-energised.** Observe the rules for working on electrical installations. Observe the information on rated voltage and supply voltage specified in the technical data!

**i** Application in railway vehicles/  
DIN EN 45545-2:2016!  
If the horizontal or vertical distance to adjacent components which do not meet the requirements in table 2 of DIN EN 45545-2 is less than 20 mm or less than 200 mm respectively, they are to be regarded as grouped. Refer to DIN EN 45545-2 chapter 4.3 Grouping rules.

**i** The wires can be routed in any direction.

Connect the device according to the wiring diagram. Please observe the technical data.

## Wiring diagram



The use of a type 2 surge protection device (SPD) is mandatory due to possible impulse voltages and in order to comply with normative requirements. The surge protection device must be connected upstream of the power supply unit on the supply side (not required for CTUB104).

Features of the surge protection device:

- Nominal discharge current  $I_n$  (8/20  $\mu$ s): 20 kA
- Response time: 25 ns
- two-stage: 1 varistor + 1 spark gap

Alternatively, the power supply unit must be connected to a CAT II supply without a surge protection device.



### CAUTION!

When using several CTUB100 measuring current transformers, the power supply (24V, GND) must not be daisy-chained from current transformer to current transformer but should be star-shaped (e.g. using a potential distributor).

## Installation instructions measuring current transformer



**CAUTION!** Existing protective conductors and low-resistance conductor loops must not be routed through the measuring current transformer! Otherwise, high currents could be induced into the conductor loop due to the AC/DC sensitive measuring technology used.



**CAUTION!** The connecting cable (supply, secondary connection etc.) must not be routed directly past the current transformer core, otherwise interference pulses may occur.

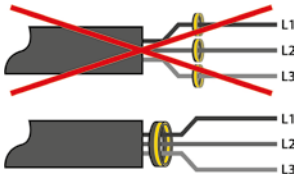


**CAUTION!** The measuring current transformer must be connected to the corresponding evaluator before the first use and before commissioning of the monitored installation.

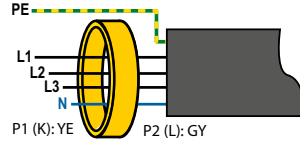


Do not route any shielded cables through the measuring current transformer.

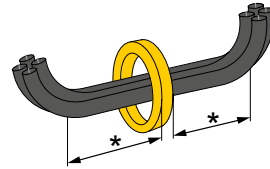
Pay attention to the following:



All current-carrying cables must be routed through the measuring current transformer.

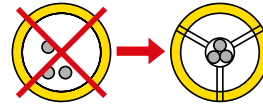


Never route an existing protective conductor through the measuring current transformer.



The primary conductors may only be bent from the specified minimum distance. The minimum bending radius specified by the manufacturers for the conductors used must be observed.

\* Distance to 90° angle = 2 x outer diameter.



The cables must be aligned with the centre of the measuring current transformer.

## Technical data

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

#### Definitions

Measuring circuit (IC1) .....	
.....primary conductors routed through the current transformer	
Secondary (IC2) .....	connections terminal block
Rated voltage.....	800 V
Overvoltage category.....	III
Area of application .....	≤ 2000 m AMSL
Rated impulse voltage (IC1/IC2) .....	8 kV
Rated insulation voltage (reinforced insulation; IC1/IC2) .....	800 V
Pollution degree .....	2

#### Supply voltage

CTUB101	
Description .....	+12 V, GND, -12 V
Supply voltage $U_s$ .....	DC ±12 V

Operating range of $U_s$ .....	±2 %
Ripple $U_s$ .....	≤ 1 %
Power consumption.....	≤ 2.5 W
CTUB102 and CTUB104	
Description .....	24 V, GND
Supply voltage $U_s$ .....	DC 24 V
Operating range of $U_s$ .....	±20 %
Ripple $U_s$ .....	≤ 1 %
Power consumption.....	≤ 2.5 W
Inrush current.....	1 A for 1 ms

#### Measuring circuit

Internal diameter measuring current transformer .....	
..... see dimension diagrams	
Rated current $I$ .....	RCM application / MRCD application
CTBC20 at $I_{Dn} \geq 30$ mA .....	63 A / 40 A
CTBC20 at $I_{Dn} \geq 300$ mA .....	80 A / 63 A
CTBC20P .....	80 A / 80 A

CTBC35 at $I_{\Delta n} \geq 30$ mA .....	125 A / 80 A
CTBC35 at $I_{\Delta n} \geq 300$ mA .....	160 A / 125 A
CTBC35P .....	160 A / 160 A
CTBC60 at $I_{\Delta n} \geq 30$ mA .....	200 A / 160 A
CTBC60 at $I_{\Delta n} \geq 300$ mA .....	400 A / 250 A
CTBC60P .....	400 A / 320 A
CTBC120 at $I_{\Delta n} \geq 100$ mA .....	400 A / 330 A
CTBC120P at $I_{\Delta n} \geq 100$ mA .....	630 A / 630 A
CTBC210 at $I_{\Delta n} \geq 300$ mA .....	630 A / 630 A
CTBC210P at $I_{\Delta n} \geq 100$ mA .....	630 A / 630 A
CTBC210P at $I_{\Delta n} \geq 300$ mA .....	1000 A / 1000 A
Measurement accuracy .....	$\pm 1\%$ of full scale value
Test winding .....	yes
Rated continuous thermal current <sup>1)</sup> $I_{th}$ .....	125 A
at UL applications .....	30 A
Rated short-time thermal current <sup>1)</sup> $I_{th}$ .....	2.4 kA/1 s
Rated dynamic current <sup>1)</sup> $I_{dyn}$ .....	6 kA/40 ms
<sup>1)</sup> refers to the residual current	

#### Possible response values (set on the evaluator)

CTBC20, CTBC20P .....	10 mA .. 500 mA
CTBC35, CTBC35P, CTBC60, CTBC60P .....	30 mA .. 10 A
CTBC120, CTBC120P, CTBC210P .....	100 mA .. 10 A
CTBC210 .....	300 mA .. 10 A

#### Measuring ranges CTUB101, CTUB102

Measuring range 1 ( $I_{\Delta n} \leq 0.1$ A) .....	0 .. 900 mA (peak)
Measuring range 2 ( $0.1$ A < $I_{\Delta n} \leq 0.5$ A) .....	0 .. 3.5 A (peak)
Measuring range 3 ( $I_{\Delta n} > 0.5$ A) .....	0 .. 20 A (peak)

#### Measuring range CTUB104

Measuring range .....	DC 0 .. 70 mA
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#### Indication

Multicolour LED .....	see pages 3/4
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#### Output

Name .....	S1 (k), S2 (l)
Scaling .....	400 mV/1 A
Max. voltage .....	$\pm 10$ V
Max. connector length .....	10 m
Output resistance .....	172 $\Omega$

#### Input

Name .....	T (for CTUB101 only)
Current load .....	< 300 mA

#### Environment/EMC

EMC (CTUB101, CTUB102) .....	IEC 62020-1
EMC (CTUB104) .....	IEC 61326-2-4
Operating temperature .....	-25 .. 70 °C

#### Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3) .....	3K22
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

Max. connection length .....	10 m
<i>Connecting cables are optionally available.</i>	
<i>Use 60/75 °C copper lines only.</i>	

#### Terminal block

Manufacturer .....	Phoenix Contact
Type .....	DFMC 1.5/4-ST-3.5 BK
The connection conditions of the manufacturer apply.	

#### Connection properties

rigid .....	0.2 .. 1.5 mm <sup>2</sup> (AWG 24 .. 16)
flexible .....	0.2 .. 1.5 mm <sup>2</sup>
with ferrule .....	0.25 .. 0.75 mm <sup>2</sup>

#### Mounting CTBC ...

##### Screw type

CTBC20 ... 60(P) .....	DIN EN ISO 7045 - M5
CTBC120 ... 210(P) .....	DIN EN ISO 7045 - M6

##### Washer type

CTBC20 ... 60(P) .....	DIN EN ISO 7089/7090 - 5
CTBC120 ... 210(P) .....	DIN EN ISO 7089/7090 - 6

##### Tightening torque

CTBC20 ... 35 (P) .....	0.6 Nm
CTBC60 ... 210(P) .....	1 Nm

#### Other

Operating mode .....	continuous operation
Mounting .....	any position
Degree of protection, built-in components (DIN EN 60529) .....	IP40
Degree of protection, terminals (DIN EN 60529) .....	IP20
Flammability class .....	UL94 V-0
Software .....	D591
<b>Weight</b>	

CTUB10x-CTBC20 .....	$\leq 230$ g
CTUB10x-CTBC20P .....	$\leq 290$ g
CTUB10x-CTBC35 .....	$\leq 310$ g
CTUB10x-CTBC35P .....	$\leq 390$ g
CTUB10x-CTBC60 .....	$\leq 530$ g
CTUB10x-CTBC60P .....	$\leq 690$ g
CTUB10x-CTBC120 .....	$\leq 1460$ g
CTUB10x-CTBC120P .....	$\leq 1820$ g
CTUB10x-CTBC210 .....	$\leq 4290$ g
CTUB10x-CTBC210P .....	$\leq 4940$ g

The use of the power supply units listed at "Accessories" is recommended. The use of a surge protection device is mandatory for these power supply units (not required for CTUB104).

### Ordering details

$U_s$	ø CT's	Shielding	Type	Art. No.	
<b>Consistent with RCMA420 / RCMA423</b>					
DC ±12V	20 mm		CTUB101-CTBC20	B78120010	
		■	CTUB101-CTBC20P	B78120020	
	35 mm		CTUB101-CTBC35	B78120012	
		■	CTUB101-CTBC35P	B78120022	
	60 mm		CTUB101-CTBC60	B78120014	
		■	CTUB101-CTBC60P	B78120024	
	120 mm		CTUB101-CTBC120	B78120016	
		■	CTUB101-CTBC120P	B78120026	
	210 mm		CTUB101-CTBC210	B78120018	
		■	CTUB101-CTBC210P	B78120028	
	<b>Consistent with RCMS460 / RCMS490</b>				
	DC 24V	20 mm		CTUB102-CTBC20	B78120011
■			CTUB102-CTBC20P	B78120021	
35 mm			CTUB102-CTBC35	B78120013	
		■	CTUB102-CTBC35P	B78120023	
60 mm			CTUB102-CTBC60	B78120015	
		■	CTUB102-CTBC60P	B78120025	
120 mm			CTUB102-CTBC120	B78120017	
		■	CTUB102-CTBC120P	B78120027	
210 mm			CTUB102-CTBC210	B78120019	
		■	CTUB102-CTBC210P	B78120029	
<b>Consistent with EDS440 / EDS441</b>					
DC 24V		20 mm	■	CTUB104-CTBC20P	B78120033
	35 mm	■	CTUB104-CTBC35P	B78120034	
	60 mm	■	CTUB104-CTBC60P	B78120035	

### Accessories

#### Voltage supply DC 24 V for CTUB102 and CTUB104

max. connected CT's	Type	Art. No.
4	STEP-PS/1 AC/24 DC/0.5	B94053110
14	STEP-PS/1 AC/24 DC/1.75	B94053111
34	STEP-PS/1 AC/24 DC/4.2	B94053112

### Connecting cables

Length (m)	Connection to	Name	Art. No.
1	RCMA42x	CTX-100	B98110080
2.5		CTX-250	B98110081
5		CTX-500	B98110082
10		CTX-1000	B98110083
1	RCMS46x EDS44x	CTXS-100	B98110090
2.5		CTXS-250	B98110091
5		CTXS-500	B98110092
10		CTXS-1000	B98110093

### Replacement parts

#### Measuring current transformer cores

ø CT's	Type	Art. No.
20 mm	CTBC20	B98120001
	CTBC20P	B98120002
35 mm	CTBC35	B98120003
	CTBC35P	B98120004
60 mm	CTBC60	B98120005
	CTBC60P	B98120006
120 mm	CTBC120	B98120007
	CTBC120P	B98120020
210 mm	CTBC210	B98120008
	CTBC210P	B98120021

### Electronic modules

$U_s$	Type	Art. No.
DC ±12 V	CTUB101	B78120050
DC 24 V	CTUB102	B78120051
DC 24 V	CTUB104	B78120053

Required terminals or connecting cables are optionally available.

### Standards

The measuring current transformers of the CTUB10x series comply with the requirements of the standard DIN EN 45545-2.



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