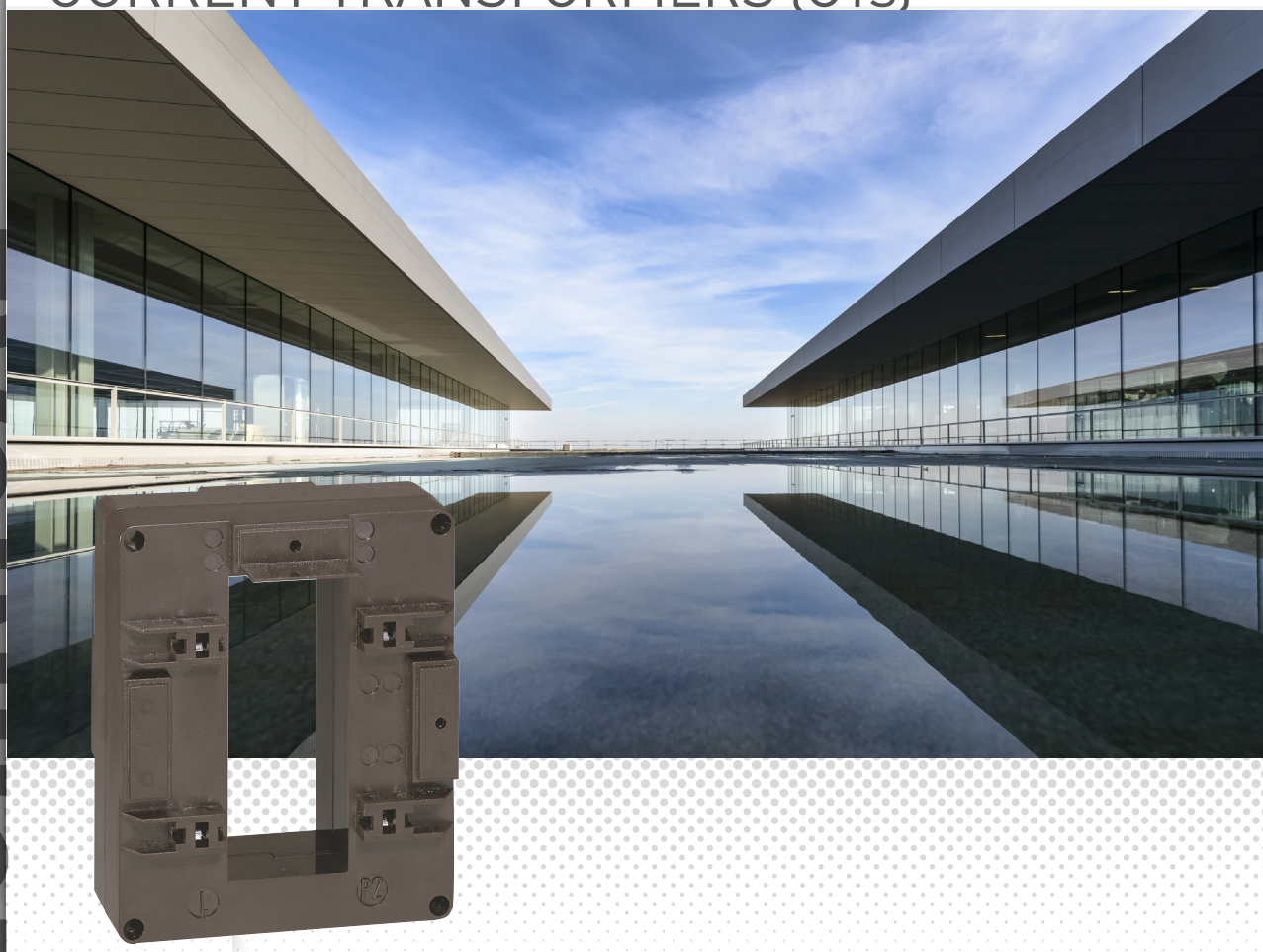
TECHNICAL GUIDE

EMDX³

CURRENT TRANSFORMERS (CTs)



THE GLOBAL SPECIALIST IN ELECTRICAL AND DIGITAL BUILDING INFRASTRUCTURES

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Legrand offers complete solutions to meet energy efficiency needs.

This technical guide provides all the essential information you need to know about **current transformers (CTs)** in order to understand how to choose them, their characteristics, installation and configuration rules, etc ...

This document can be downloaded from the online catalog and is a complete technical guide on **current transformers (CTs)** in the distribution board.

LEGAL INFORMATION

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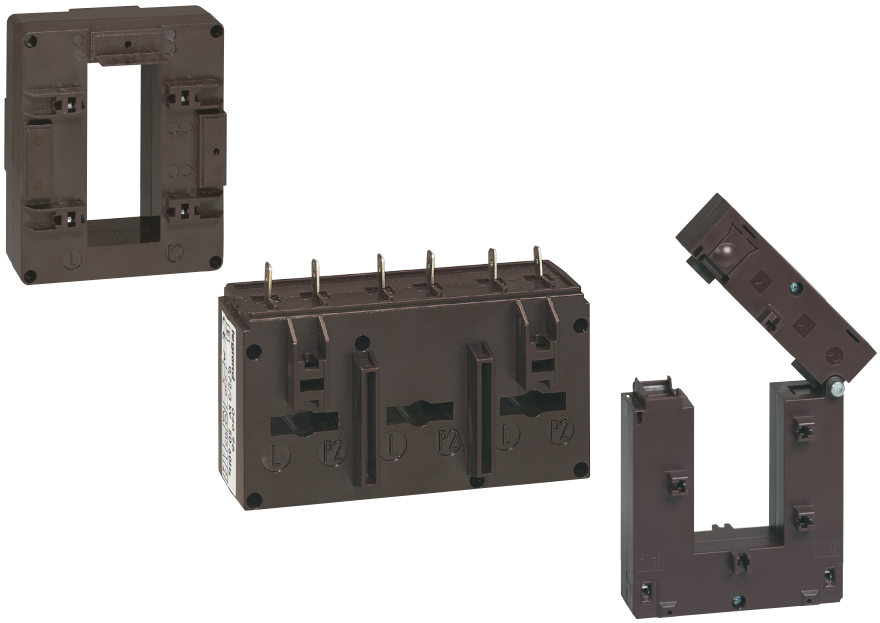
CURRENT TRANSFORMERS (CTs)

Product specifications

Current transformers (CTs) are used to convert high current values circulating in cables or busbars to current values permitted by measurement devices, usually 5 A.



CHARACTERISTICS

- **Primary current:** from 50 to 4000 A
- **Secondary current:** 5 A
- **Frequency:** 50 / 60 Hz
- **Degree of protection:** IP20
- **Accuracy:** 0.5 or 1 % depending on the model.

! As they are part of the measurement circuit all elements used to perform a measurement must be included when calculating the overall accuracy class, (details in the "Help and definition" section).

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PRODUCT SELECTION

The current transformer rating is selected according to the conductor dimensions, but also according to the maximum prospective current in the circuit to be measured. In order to minimise measurement errors, the closest possible rating to this value should be selected.

An open-type current transformer assembly is available to simplify installation and maintenance, which can be a delicate operation in some cases.

CURRENT TRANSFORMER (CT)	CAT.NO	TRANSFORMATION RATIO	FOR CABLES MAX Ø (MM)	FOR BUSBARS W X H (MM)	ACCURACY	RAIL FIXING	PLATE FIXING	CABLE OR BUSBARS DIRECT FIXING
Closed-type single-phase								
	4 121 01	50/5	21	16 x 12.5	1 %	●	●	
	4 121 02	75/5	21					
	4 121 03	100/5	21		0.5 %			
	4 121 04	125/5	21					
	4 121 05	160/5	21					
	4 121 06	200/5	21					
	4 121 07	250/5	21					
	4 121 12	400/5	27	32.5 x 10.5 25.5 x 15.5			●	●
	4 121 14	600/5	27					
	4 121 16	250/5	26	40.5 x 12.5 32.5 x 15.5			●	●
	4 121 17	400/5	26					
	4 121 19	700/5	26					
	4 121 23	250/5	32	40.5 x 10.5 32.5 x 20.5 25.5 x 25.5			●	●
	4 121 24	300/5	32					
	4 121 25	400/5	32					
	4 121 26	600/5	32					
	4 121 31	700/5	40	50.5 x 12.5 40.5 x 20.5			●	●
	4 121 32	800/5	40					
	4 121 33	1000/5	40					
	4 121 36	600/5		65 x 32			●	●
	4 121 38	800/5						
	4 121 39	1000/5						
	4 121 42	1250/5		84 x 34			●	●
	4 121 46	1600/5		127 x 38			●	●
	4 121 47	2000/5						
	4 121 49	3200/5						

PRODUCT SELECTION (CONTINUED)

CURRENT TRANSFORMER (CT)	CAT.NO	TRANSFORMATION RATIO	FOR CABLES MAX Ø (MM)	FOR BUSBARS W X H (MM)	ACCURACY	RAIL FIXING	PLATE FIXING	CABLE OR BUSBARS DIRECT FIXING
Closed-type single-phase (continued)								
	4 121 50	1600/5		127 x 54	0.5 %		●	●
	4 121 51	2000/5						
	4 121 52	2500/5						
	4 121 53	3200/5						
	4 121 54	4000/5						
Open-type single-phase								
	4 121 62	400/5		50 x 80	0.5 %			●
	4 121 63	750/5						
	4 121 64	1000/5		80 x 120				●
	4 121 65	1500/5						
	4 121 66	2000/5		80 x 160				●
	4 121 67	2500/5						
	4 121 68	3000/5						
	4 121 69	4000/5						
Closed-type three-phase								
	4 121 57	250/5		20.5 x 5.5	1 %			●
	4 121 58	400/5		30.5 x 5.5				●

! CTs cannot be used with DC supply.

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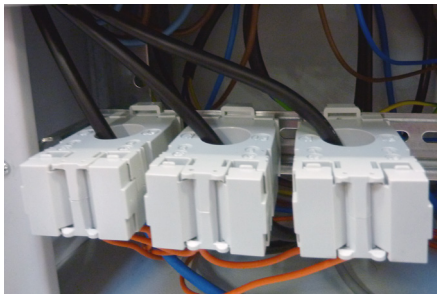
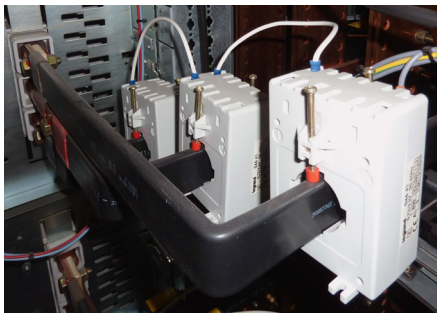
MOUNTING

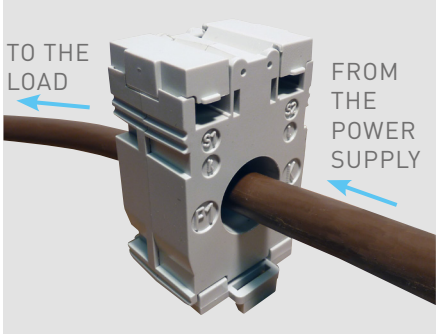
Current transformers are available with several types of fixing. CTs taking cables can be clipped onto DIN rails. CTs taking busbars, should be fixed in place by tightening the dedicated screw. They can also be fixed on a plate using the fixing points located at the bottom.



Current transformers for cables mounted on DIN rail



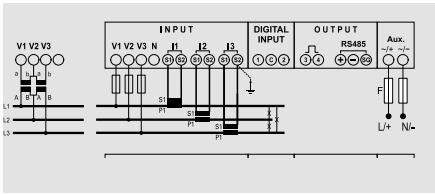
Current transformers mounted directly on flexible busbars



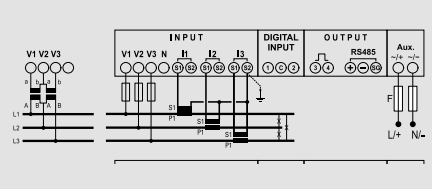
The value sent to the electricity meter or measurement control unit depends on the direction of mounting on the busbar or cable.
To avoid errors, it is essential to make sure that the CT is working properly. The current flow must enter at P1 (coming from the power supply) and exit at P2 (going towards the load).

CONNECTION

The secondary terminals (S1 and S2) should be connected to the corresponding inputs on the measurement device (electricity meter, measurement control unit).



To reduce the number of cables, the S2 outputs on the CT secondary can be grouped together.



If an on-load CT has its secondary open, a high voltage may appear. It is therefore vital to short-circuit the CT secondary when the rating is changed, for example, or to intervene by cutting the power supply to the load.

CT/MEASUREMENT DEVICE CABLE LENGTH :

Here is the method for calculating the maximum length of the cable connecting the CT and the measurement instrument (electricity meter, control unit, etc) in order to comply with the requested accuracy class.

L max = (Sr – Sinst) x k

Lmax: Maximum length of connection wire (m).

Sr: CT rated load in the selected accuracy class (VA).

Sinst: Device consumption, indicated on the CT nameplate (VA).

K: Constant value as a function of the cable cross-section (see table) at an ambient temperature of 20°C.

Cu cable cross-section (mm²)	K
1	1
1.5	1.46
2.5	2.44
4	3.94
6	5.92

For each 10°C temperature variation, the maximum cable length Lmax must be reduced by 4%.

CAPACITIES (VA) :

Represents the max. load that can be connected to the secondary terminals of the CT. The load consists of the self-consumption of the measurement device + losses in connection cables between the CT and the device. For the operation of a given class of measurement, the maximum load must always be less than or equal to the rated capacity/class of the CT.

Power consumption (VA) of the connection cables between the CT and the measurement device		
Cu cable cross-section (mm²)	*VA by meter of bipolar cable at 20 °C	
	Secondary 5 A	Secondary 1 A
1	1	0.045
1,5	0.685	0.0274
2,5	0.41	0.0164
4	0.254	0.0102
6	0.169	0.0068
10	0.0975	0.0039
16	0.062	0.0025

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DETERMINATION OF THE MAX. CABLE LENGTH

It is important to keep the current transformers and measurement devices as far as possible. The table below indicates both the cable length and cross-section for compliance with th stated accuracy class.

Detail of how to calculate the maximum cable length: «Help and definitions» section.

RATING (A)	CAT.NO	MAX. CT POWER		MAX. CABLE LENGTH BETWEEN CT/MEASUREMENT DEVICE (M)		
		CLASS 0,5 (VA)	CLASS 1 (VA)	CABLE 1,5 MM²	CABLE 2,5 MM²	CABLE 6 MM²
50	4 121 01	-	1	1,1	1,8	4,4
75	4 121 02	-	1,5	1,5	2,4	5,9
100	4 121 03	1,5	2,5	2,2	3,7	8,9
125	4 121 04	2	3,5	2,9	4,9	11,8
160	4 121 05	3	4	3,7	6,1	14,8
200	4 121 06	4	5,5	5,1	8,5	20,7
250	4 121 07	5	6	6,6	11,0	26,6
400	4 121 12	10	12	13,9	23,2	56,2
600	4 121 14	15	20	16,8	28,1	68,1
250	4 121 16	3	4	3,7	6,1	14,8
400	4 121 17	6	8	8,0	13,4	32,6
700	4 121 19	8	10	11,0	18,3	44,4
250	4 121 23	3	5	3,7	6,1	14,8
300	4 121 24	5	8	6,6	11,0	26,6
400	4 121 25	8	10	11,0	18,3	44,4
600	4 121 26	12	15	16,8	28,1	68,1
700	4 121 31	8	10	11,0	18,3	44,4
800	4 121 32	8	12	11,0	18,3	44,4
1000	4 121 33	10	12	13,9	23,2	56,2
600	4 121 36	8	12	11,0	18,3	44,4
800	4 121 38	12	15	16,8	28,1	68,1
1000	4 121 39	15	20	21,2	35,4	85,8
1250	4 121 42	12	15	16,8	28,1	68,1
1600	4 121 46	10	15	13,9	23,2	56,2
2000	4 121 47	15	20	21,2	35,4	85,8
3200	4 121 49	25	30	35,8	59,8	145,0
1600	4 121 50	20	30	28,5	47,6	115,4
2000	4 121 51	25	30	35,8	59,8	145,0
2500	4 121 52	30	50	43,1	72,0	174,6
3200	4 121 53	30	50	43,1	72,0	174,6
4000	4 121 54	30	50	43,1	72,0	174,6
3 x 250	4 121 57	-	2,5	3,7	6,1	14,8
3 x 400	4 121 58	-	3	5,1	8,5	20,7
400	4 121 62	1,5	3	1,5	2,4	5,9
750	4 121 63	3	7	3,7	6,1	14,8
1000	4 121 64	5	10	6,6	11,0	26,6
1500	4 121 65	8	15	11,0	18,3	44,4
2000	4 121 66	15	20	21,2	35,4	85,8
2500	4 121 67	15	20	21,2	35,4	85,8
3000	4 121 68	20	25	28,5	47,6	115,4
4000	4 121 69	20	25	28,5	47,6	115,4

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Help and definitions

RATED CURRENT OF THE INSTALLATION

Is used to determine the primary current of the transformer, e.g.: rated current of the installation: 425 A = CT 500/5 A.

CABLE DIMENSION/BUSBAR

Allows to choose a CT with an opening accepting the passage of the cable/busbars. The tendency is always to choose a slightly larger opening in order to maintain a slight clearance required during installation. E.g.: for a 120 mm² cable (max. outer diameter 21.5 mm), choose a model with a 27mm diameter opening.

MEASUREMENT CLASS

Classes 0.5/1 are recommended for power, energy and cos φ measurements. Class 3 is reserved for current measurements on ammeters only.

CURRENT DEFINITIONS

The various publications available give different abbreviations for currents.
This is the definition:

DISPLAY	PARAMETER
Ist starting current	Minimum current value at which the PMD* starts and continues to record (no accuracy)
Ib basic current	Current value according to which the performance of a PMD is set with a direct connection (PMD* Dx)
In rated current	Current value according to which the performance of a PMD is set when operated by an external current sensor (PMD* Sx)
I min minimum current	Current at which the PMD ensures accuracy

*PMD: Performance measuring and monitoring device.

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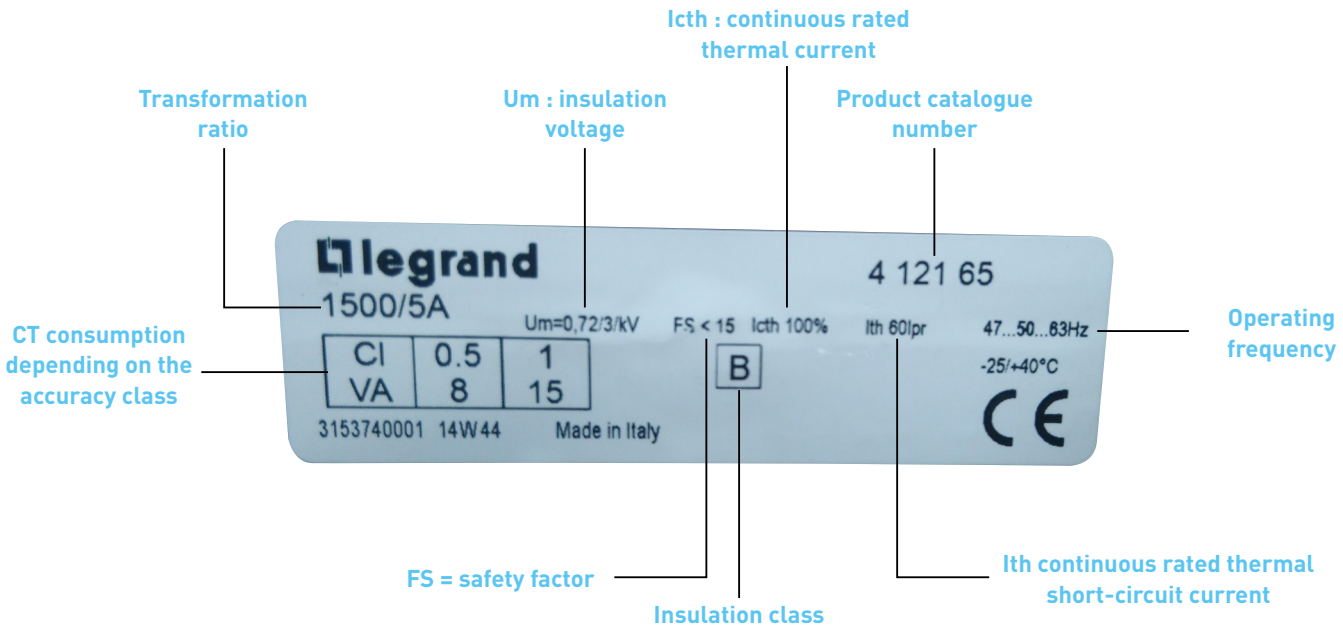
READING AN IDENTIFICATION LABEL



Um: Maximum reference insulation voltage, in this example 0.72 kV rms value, 3 kV being the rated insulation voltage level.

FS: Safety factor.
Ratio between the maximum primary rated current and the primary rated current.

B: Insulation class.
This should be noted if it is not Class A. Class A corresponds to a reference temperature of 40°C.
Class B corresponds to an increase in permitted temperature to 80°C.

Icth: Continuous rated thermal current. Value of the current which can circulate indefinitely in the primary winding without the temperature rise exceeding the specified limits, with the secondary winding connected to the rated load. In this example: Icth < 100% Ipr, therefore 100% of the primary rated current.

Ith: Rated thermal short-circuit current. Maximum value of the primary current which a transformer can withstand without being damaged for a short specified period, with the secondary winding short-circuited. In this example: Ith < 60 Ipr, therefore 60 times the primary rated current.

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EXB20060 - February 2021