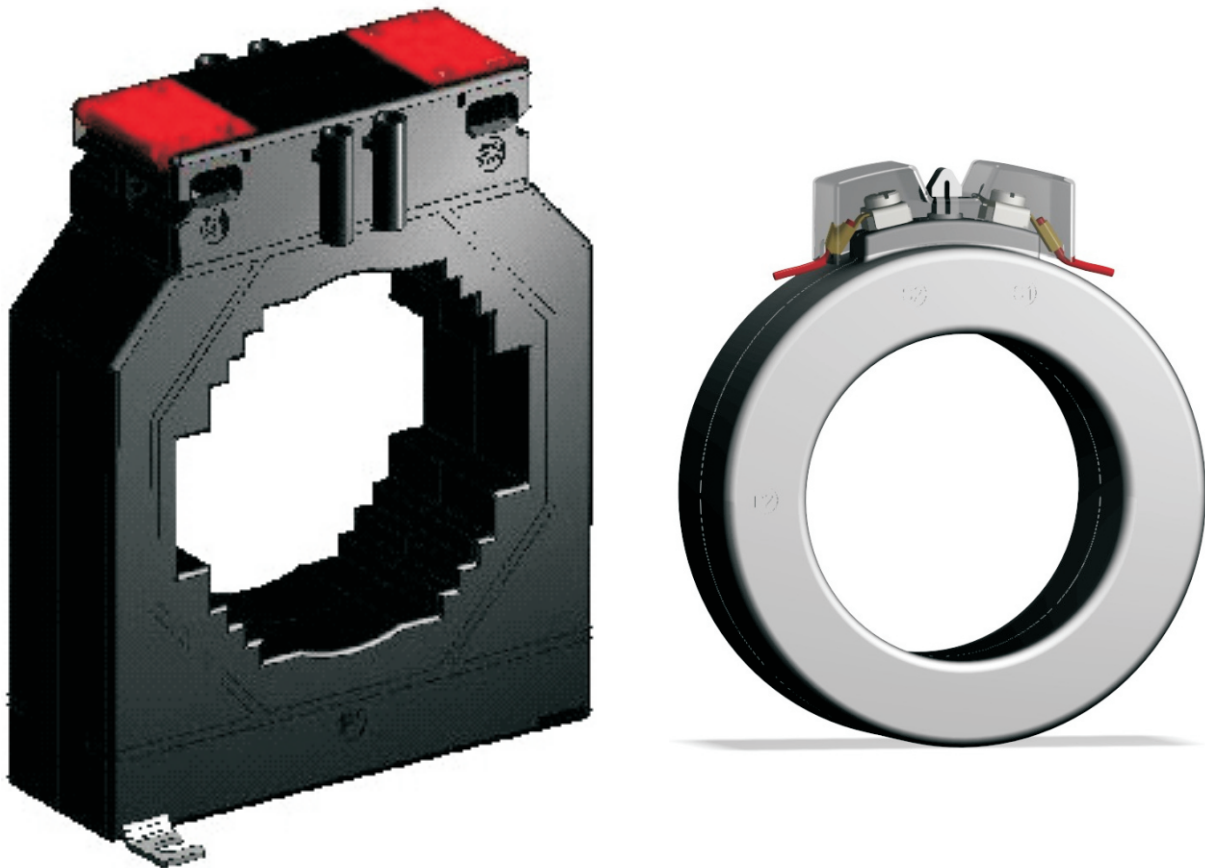


Sifam Tinsley Current Transformer Series



Characteristic Parameters

Current transformers convert an alternating current usually high in to a proportional lower one, depending on their use. Measurement type CTs are required to transform the primary current, at various classes of accuracy, as specified by the class designation, over a current range from 1 to 120 percent of its rated primary ratio. The design of this type of transformer requires the inclusion of a core and winding which will when connected to its rated burden; perform within the limits of error as indicated by the standard's specification. It is an advantage for a measurement type transformer to saturate above this range, which provides a protection against damage to instruments by limiting the secondary current when surge currents or faults appear in the primary circuit.

Current transformer: - An instruments transformer in which the secondary current, in normal condition of use, is substantially proportional to the primary current and differs in phase it by an angle which is approximately zero for an appropriate direction of connections.

Measuring transformer: - A current transformer intended to supply indicating instruments integrated meter, relay and similar apparatus.

Protective Current Transformer: - A current transformer intended to supply protective relays.

Rated transformation ratio: - The ratio of the rated primary current to the rated secondary current.

Rated primary current: - The value of primary current which appears in the designation of the transformer and on which the performance of the currant transformer is based.

Rated secondary current: - The value of secondary current which appears in the designation of the transformer and on which the performance of the currant transformer is based.

Current error (ratio error):- The error with a transformer introduces into the measurement of a current and which arises from the fact that actual transformation ratio is not equal to the rated transformer ratio.

The current error expressed in percentage is given by the formula:

$$\text{Current error, percent} = (K_a \cdot I_s - I_p) \times 100 / I_p$$

Where K_a = rated transformation ratio

I_p = actual primary current

I_s = actual secondary current when I_p is flowing under the conditions of measurement

Accuracy Limit Factor (ALF): - The ratio of the rated accuracy limit primary current to the rated primary current.

Phase displacement: - the difference in phase between the primary and secondary current vectors, the direction of the vectors being so chosen that the angle is zero for the perfect transformer. The phase displacement is said to be positive when the secondary current vector leads the primary current vector. It is usually express in minutes.

Composite Error: - Composite error is the resulting limitation of the harmonic content of the secondary current which is necessary for the correct operation of certain types of relays.

Accuracy class: - A designation assigned to a current transformer the errors of which remain within specified limit under prescribed conditions of use.

Burden: - The impedance of the secondary circuit in ohms and power factor.

Rated burden: - The impedance of the secondary circuit on which the accuracy requirements are based. It is usually expressed as apparent power (in VA), at the rated secondary current and at a specified power factor.

Rated output :- The value of the apparent power (in volt-amperes at a specified power factor) which the current transformer is intended to supply to the secondary circuit at the rated secondary current and with rated burden connected to it.

Highest system voltage: - The highest rms line to line voltage which can be sustained under normal operating conditions at any time and at any point on the system. It excludes temporary voltage variations due to fault condition and the sudden disconnection of large loads.

Rated insulation level: - That combination of voltage values (power frequency and lightning impulse, or where applicable, lightning and switching impulse) which characterizes the insulation of a transformer with regard to its capability to withstand by dielectric stresses. For low voltage transformer the test voltage 4kV, at power-frequency, applied during 1 minute.

Rated short-time thermal current (I_{th}):- The rms value of the primary current which the current transformer will withstand for a rated time, with their secondary winding shortcircuited without suffering harmful effects.

Rated dynamic current (I_{dyn}):- The peak value of the primary current which a current transformer will withstand, without being damaged electrically or mechanically by the resulting electromagnetic forces, the secondary winding being short-circuited.

Rated continuous thermal current: - The value of current which can be permitted to flow continuously in the primary winding, the secondary windings being connected to the rated burdens, without the temperature rise exceeding the specified values.

Instrument security factor (ISF):- The ratio of rated instrument limit primary current to the rated primary current. The times that the primary current must be higher than the rated value, for the composite error of a measuring current transformer to be equal to or greater than 10%, the secondary burden being equal to the rated burden. The lower this number is, the more protected the connected instrument are against.

Routine test: - Tests carried out on each current transformer to check requirements likely to vary during production.

The following tests apply to each individual transformer:

- A. Verification of terminal markings
- B. Power-frequency withstands test on primary winding.
- C. Power-frequency withstand test on secondary windings.
- D. Power-frequency withstand test, between sections.
- E. Inter-turn over voltage test
- F. Determination of errors.

The order of the tests is not standardized, but determination of error shall be performed after the other test.

Type test: - Tests carried out to prove the general qualities and design of a given type of current transformer in accordance with the requirements of the applicable standards Tests may be carried out on a prototype which may incorporate special arrangements for the measurements required by applicable standard.

The following tests are type test:

- A. short time current test
- B. temperature rise test
- C. determination of errors

All the dielectric type test should be carried out on the same transformer, unless otherwise specified.

Special tests / optional tests: - Test which may be in the nature of type tests or routine tests, and are carried out only by agreement between manufacturer and purchaser.

Short time current test: - For the thermal short time current I_{th} test the transformer shall be at a temperature 10°C to 40°C. The test shall be made with the secondary winding short circuited and at the current I for a time t, so that (I²t) is not less than (I_{th}²) and provided t has a value between 0,5 s and 5 s.

The dynamic test shall be made with the secondary winding (s) short-circuited, and with a primary current the peak value of which is not less than the rated dynamic current (I_{dyn}) for at least one peak.

The dynamic test may be combined with the thermal test above, provided the first major peak current of that test is not less than the rated dynamic current (I_{dyn}).

The transformer shall be deemed to have passed these tests if, after cooling to ambient temperature (between 10°C and 40°C), it satisfies the following requirements:

- A. It is not visibly damaged;
- B. Its errors after demagnetization do not differ from those recorded before the tests by more than half the limits of error appropriate to its accuracy class
- C. It withstands the dielectric tests specified in 8.2, 8.3 and 8.4 but with the test voltage or currents reduced to 90% of those given.
- D. On examination, the insulation next to the surface of the conductor dose not show significant deterioration (e.g. carbonization).

Temperature-rise test:- A test shall be made to prove compliance with the requirement of 4.6. for the purpose of this test, current transformers shall be deemed to have attained steady temperature when the rate of temperature rise dose not exceed 1 K per hour.

The test-site ambient temperature shall be between 10°C and 30°C. For the test the transformer shall be mounted in a manner representative of the mounting in service.

The temperature rise of winding shall, when practicable, be measured by the increase in resistance method, but for winding of very low resistance, thermocouples may be employed.

The temperature rise of parts other than windings may be measured by thermometer or thermocouples.

Verification of terminal markings:- It shall be verified that the terminal markings are correct.

Power-frequency test:- The power frequency withstand test shall be performed in accordance with IEC 60060-1.

The test voltage shall have the appropriate value given in table 3 or 5 (in IEC 60044-1 standard) depending on the highest voltage for equipment. The duration shall be 60 s.

The test voltage shall be applied between the short-circuited primary winding and earth. The short-circuited secondary winding (s), the frame, case (if any) and core (if there is a special earth terminal) shall be connected to earth.

Inter-turn over voltage test:- The inter-turn over voltage test shall be performed in accordance with one of the following procedures.

Procedure B : with the primary winding open-circuited, the prescribed test voltage (at same suitable frequency) shall be applied for 60 s to the terminals of each secondary winding, providing that the r m s value of the secondary current dose not exceed the rated secondary current (or rated extended current).

The value of the test frequency shall be not greater than 400 Hz.

At this frequency if the voltage value achieved at the rated secondary current (or rated extended current) is lower than 4.5 kV peak the obtained voltage is to be regarded as the best voltage.

When the frequency exceeds twice the rated frequency, the duration of the test may be reduced from 60 s.

(Note:- The tests which are applicable to ring type/ window type, low tension, [LT] C.T. are given here. For remaining test procedure, please refer applicable standard.)

Rishabh instruments offer a complete range of high quality current transformer offering comprehensive measuring class accuracy.

The range offers wide selection of system current ratings, bus bar sizes, case widths, apertures and mounting options to every application.

Quality, accuracy, reliability has been the hall mark of Rishabh for more then two decades. The CTs are being used by switchgear manufacturers, as well as electricity distributing agencies.

Features

- comprehensive measurement of class accuracy
- cost effective moulded case current transformer
- wide range of system current ratings bus bar sizes, case widths and apertures
- various mounting options like wall mounting, cable mounting, bas bar mounting, DIN rail mounting
- wire sealable terminal covers

General specification

Applicable standard: - IEC-61869-1&2 / IEC- 60044 -1, BS 3938, IS 2705 -1,2&3.

Case: - 10% glass filled polycarbonate, flame retardant grades classified UL 94V-0.

Connection: - Two connection on each side. M4 screws with self lifting clamp strap assembly for RishXmer series and 1 connection on each side M4 screws with self lifting clamp strap for Rish CT series.

Insulation class: - E (120°C max)

System voltage: - 720V maximum

Test voltage: - For Ring (Window) type CT : 4KV 50 Hz for 1 min (except for 50/30 CT type and 50/50 CT type where test voltage is 3KV 50 Hz for 1 min)
For Wound type CT : 3KV 50 Hz for 1 min

Operating frequency: - 50Hz / 60 Hz

Rated primary rating: - 1A to 7500A

Rated secondary output: - 5A standard (1A on request)

Rated burden: - 1, 1.25, 1.5, 2.5, 3.75, 5, 7.5, 10, 12.5, 15, 20, 30, 45, 60, 100 VA

Class of accuracy: - 0.2, 0.2S for laboratory and power measurement
0.5, 0.5S for accurate measuring, kWh
1 for general measurement
3 for indicating instruments

Ambient temperature: - -25°C to +40°C

Storage temperature: - -50°C...+80°C

Thermal short circuit current (I_{th}): - 40xI_n for Wound type CT and 60xI_n for Bus Bar type CT.

Dynamic short circuit current (I_{dyn}): - 2.5xI_{th}

Instrument security factor (FS): - 2.5, 5, 10

Limits of current error and phase displacements for measuring current transformers (Classes from 0.1 to 1)

Accuracy class	+/- percentage current (ratio) error at percentage of rated current shown below				+/- phase displacements at percentage of rated current shown below							
					Minutes				Centiradians			
	5	20	100	120	5	20	100	120	5	20	100	120
0.1	0.4	0.2	0.1	0.1	15	8	5	5	0.45	0.24	0.15	0.15
0.2	0.75	0.35	0.2	0.2	30	15	10	10	0.90	0.45	0.3	0.3
0.5	1.5	0.75	0.5	0.5	90	45	30	30	2.7	1.35	0.9	0.9
1.0	3.0	1.5	1.0	1.0	180	90	60	60	5.4	2.7	1.8	1.8

**Limits of current error and phase displacements for measuring current transformers
(For special application)**

Acc. class	+/- percentage current (ratio) error at percentage of rated current shown below					+/- phase displacements at percentage of rated current shown below									
						Minutes					Centiradians				
	1	5	20	100	120	1	5	20	100	120	1	5	20	100	120
0.2S	0.75	0.35	0.2	0.2	0.2	30	15	10	10	10	0.9	0.45	0.3	0.3	0.3
0.5S	1.5	0.75	0.5	0.5	0.5	90	45	30	30	30	2.7	1.35	0.9	0.9	0.9

**Limits of current error and phase displacements for measuring current transformers
(Classes 3 and 5)**

Class	+/- percentage current (ratio) error at percentage of rated current shown below	
	50	120
3	3	3
5	5	5

Limits of phase displacement are not specified for class 3 and 5.

Limits of current error and phase displacements for Protection Class CT (5P and 10P)

Accuracy class	Current error at rated primary current	Phase displacement at rated primary current		Composite error at rated accuracy limit primary
		Minutes	Centiradians	
	100%			%
5P	± 1.0	± 60	± 1,8	5
10P	± 3.0	-	-	10

VA Burden Guide

• Moving iron ammeter (frame dimension of 48, 72, 96, 144)	1.0	VA
• Bimetal instruments (.../5A)	3.0	VA
• Bimetal and Moving iron instruments (.../5A)	3.5	VA
• Wattmeter's	3.5...5.5	VA
• Power factor meter	4.0	VA
• Current transducer	0.5	VA
• Power transducer	0.5	VA
• kWh-meter	2.5	VA
• Trivector meter	5.0	VA

q=wire Cross section (mm ²)	Connection- wire consumption in [VA] (Pwire)																			
	For secondary current Isec=5A									For secondary current Isec=1A										
	L= distance from CT to measuring point									L= distance from CT to measuring point										
	1m	2m	4m	6m	8m	10m	15m	20m	1m	2m	4m	6m	8m	10m	15m	20m	30m	40m	50m	
2x0.5	1.837	3.67	7.35	11.02	...	...	...	...	0.074	0.15	0.30	0.44	0.59	0.74	1.11	1.48	2.22	2.96	3.7
2x0.75	1.235	2.47	4.94	7.41	9.88	...	...	...	0.049	0.1	0.20	0.29	0.39	0.49	0.74	0.98	1.47	1.96	2.45
2x1	0.918	1.84	3.67	5.51	7.34	9.18	...	...	0.037	0.07	0.15	0.22	0.30	0.37	0.56	0.74	1.11	1.48	1.85
2x1.5	0.613	1.23	2.45	3.68	4.94	6.13	9.20	...	0.025	0.05	0.10	0.15	0.2	0.25	0.38	0.50	0.75	1.00	1.25	
2x2.5	0.368	0.74	1.47	2.21	2.94	3.68	5.52	7.36	0.015	0.03	0.06	0.09	0.12	0.15	0.23	0.30	0.45	0.60	0.75	
2x4	0.233	0.47	0.93	1.4	1.86	2.33	3.50	4.66	0.009	0.02	0.04	0.05	0.07	0.09	0.14	0.18	0.27	0.36	0.45	
2x6	0.149	0.3	0.6	0.89	1.19	1.49	2.23	2.98	0.003	0.006	0.012	0.018	0.024	0.03	0.045	0.06	0.09	0.12	0.15	

Allowable load capacity of painted copper and aluminum bars Bar section vertical. Bars are separated the thickness of one bar						
Dimensions (mm)	Maximum current in A					
	1 bars		2 bars		3 bars	
	Copper	Aluminum	Copper	Aluminum	Copper	Aluminum
12 X 2	150	80	232	140	262	
15 X 2	180	95	275	170	300	
15 X 3	282	115	364	210	440	
20 X 2	230	120	348	270	360	
20 X 3	290	145	453	350	520	
20 X 5	319	254	560	446	728	570
20 X 10	497	393	924	730	1320	1060
25 X 3	350	180	540	330	600	
25 X 5	470	230	760	430	965	
30 X 3	410	205	625	385	680	
30 X 5	447	356	760	606	944	739
30 X 10	676	536	1200	956	1670	1340
40 X 3	530	280	800	500	835	
40 X 5	573	456	952	762	1140	898
40 X 10	850	677	1470	1180	2000	1650
50 X 5	697	556	1140	916	1330	1050
50 X 10	1020	815	1720	1400	2320	1940
60 X 5	826	655	1330	1070	1510	1190
60 X 10	1180	951	1960	1610	2610	2200
80 X 5	1070	851	1680	1360	1830	1460
80 X 10	1500	1220	2410	2000	3170	2660
100 X 5	1300	1050	2010	1650	2150	1730
100 X 10	1810	1480	2850	2390	3720	3110
120 X 10	2570	1350	3780	2400	4600	3250
160 X 10	3290	1750	4750	3000	5800	4150
200 X 10	4000	2150	5700	3650	6950	4950
200 x 15		2550		4200		5600

Limits of temperature rise of the winding

Class of insulation (in accordance with IEC 60085)	Maximum temperature rise k
All classes immersed in oil	60
All classes immersed in oil and hermetically sealed	65
All classes immersed in bituminous compound	50
Classes not immersed in oil or bituminous compound :	
Y	45
A	60
E	75
B	85
F	110
H	135
NOTE :- with some products (e.g.resin) the manufacturer should specify the relevant insulation class	