arteche

GENERAL TECHNICAL DATA

APPLICATION DATA

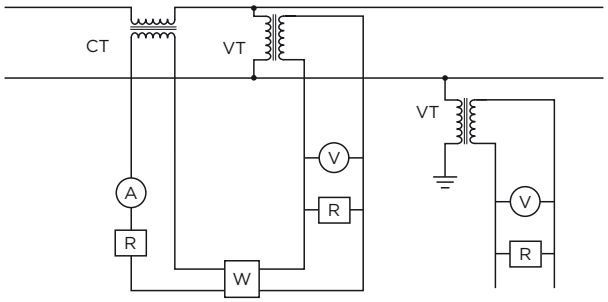
INTRODUCTION

The Purpose of instrument transformers:

- The purpose of instrument transformers is to reduce the voltage and current of an electrical network to standardized, non-hazardous levels.
- They isolate operators and instruments from the high voltage circuits allowing a less hazardous work environment. Without these transformers. measurements would require expensive insulated instrument panels.

There are two types of instrument transformer:

- Current transformers (CT): Under normal operating conditions their secondary current is practically proportional to the primary current, and its phase is shifted by an angle close to zero.
- Voltage transformers (VT): Under normal operating conditions the secondary voltage is practically proportional to the primary voltage and its phase is shifted by an angle close to zero.



- Figure 1: CT and VT diagram connection

VT VOLTAGE DESIGNATIONS

Single-phase Voltage transformers (UR/UC/UX)

The "U" in the type name and the "GY" in the primary voltage column of the data sheet indicate that the VT has one insulated bushing, making it suitable for line-to-ground connection only.

- **40250/69000GY.** This unit is rated for 40250 operating Volts. It can be connected at 40250 Volts line-to-ground on a 69000 Volt system (line-to-line Volts are 69000 V).
- **34500/34500GY.** This unit is rated for 34500 operating Volts. However, it can only be connected line-to-ground on a 34500 V system. Therefore, the actual operating voltage of the unit would be 34500/√3. The accuracy and thermal ratings of this unit are based on 34500 V. This is typical where there is a relay connected to the unit which should operate when there is a single line-to-ground fault. In this condition, the line-to-ground voltage becomes equal to the line-to-line voltage.

Phase-to-phase Voltage transformers (VR/VC/VX)

The "V" in the type name and the "Y" in the primary voltage column of the data sheet indicate that the VT has two fully insulated bushings, making it suitable for line-to-line connection.

- **27600/47804Y.** This unit is rated for 27600 operating Volts. It can be connected at 27600 Volts line-to-ground on a 47804 Volt system (line-to-line Volts are 47804 V) OR it can be connected line-to-line on a system with 27600 V line-to-line. This unit is not suitable for operation at 47804 Volts.
- **46000/46000Y**. This unit is rated for 46000 operating Volts. It can be connected at 46000 Volts line-to-line.

RATING FACTORS

Rating factors given in this brochure are standard at 30°C Characteristics for different thermal loadings on request.

STANDARDS

All the instrument transformers listed in this guide comply with the following standards where applicable:

- IEEE C57.13–2016. Standard Requirements for Instrument transformers.
- ANSI C12.11-2007. American National Standard for Instrument transformers for Revenue Metering 10kV BIL through 350 kV BIL (0.6 kV NSV through 69 kV NSV).
- CSA/IEC 61869. Instrument Transformers.
- IEC 61869. Instrument Transformers.

HOW TO SPECIFY INSTRUMENT TRANSFORMERS

There are several parameters that must be specified when ordering or requesting for proposals or quotations. If the requirements needed fits exactly into the characteristics listed in the data sheets of each model, it is enough to mention the code. However, when non-standard equipment will be needed, the following parameters must be specified:

- Highest nominal voltage system
- Basic impulse level (BIL)
- Type of service (outdoor/indoor)
- Frequency
- Ratio

Only for current transformers

- Continuous thermal current rating factor
- Short-time thermal current (kA/1s)
- Class and burden

Only for voltage transformers

- Rated continuous voltage
- Rated voltage factor (30sec)
- Total thermal burden
- Accuracy class and burden

ACCURACY STANDARDS

CURRENT TRANSFORMERS (CT)

The accuracy class of a current transformer for measuring is given by a number (class rate) representing the ratio error limit expressed as a percentage of the rated primary current when the transformer is running at its “accuracy load”.

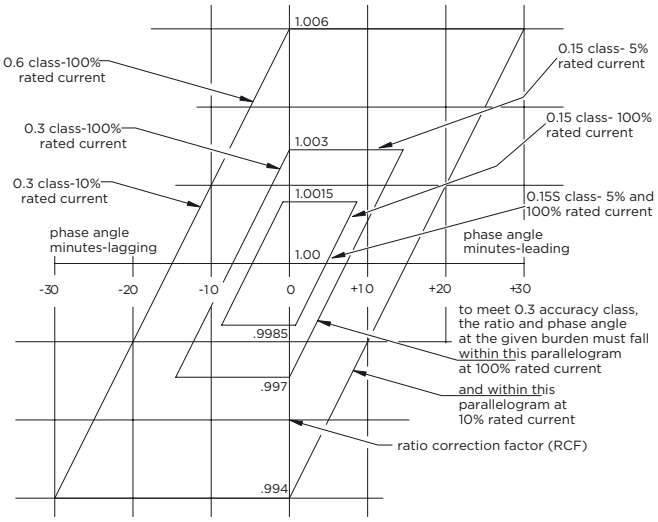
Accuracy classes for current transformers are: 0.15S; 0.15; 0.15N; 0.3S; 0.3; 0.6 and 1.2. For Accuracy class 0.3, 0.6, 0.15N and 1.2 the ratio correction factor must fall within the parallelograms for 100% and 10% respectively. For accuracy class 0.15, 0.15S and 0.3S the ratio correction factor must fall within the parallelograms for 100% and 5% respectively.

The following example calculates the correction factor for a current transformer with the following characteristics:

- 0.3 accuracy class
- 100% rated current
- Ratio correction factor: 1.003
- Maximum allowable phase angle: +15.6 minutes

Transformer Correction Factor = RCF – (β/2600) = 1.003-(15.6/2600) = **0.997**

The ratio correction factor and phase angle for any point inside the 0.3 class parallelogram for 100% rated current will always produce a TCF between 0.997 and 1.003.



› Figure 2: CT Equivalent Parallelogram.

VOLTAGE TRANSFORMERS (VT)

The accuracy class of a voltage transformer for measuring is given by a number (class rate) representing the ratio error limit expressed as a percentage of the rated primary voltage when the transformer is running at its “accuracy load”.

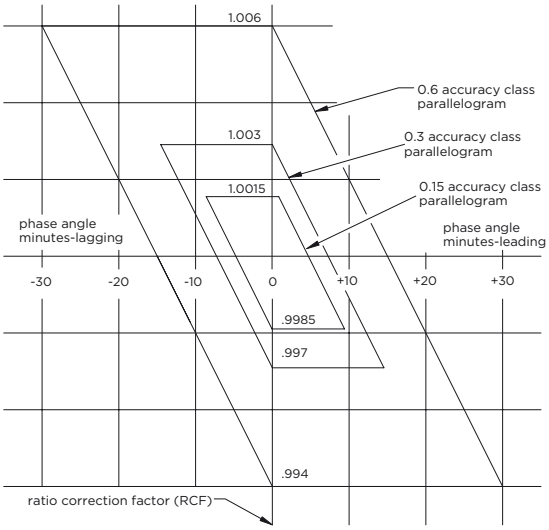
Accuracy classes for voltage transformers are: 0.15; 0.3; 0.6 and 1.2.

The following example calculates the correction factor for a voltage transformer with the following characteristics:

- 0.3 accuracy class
- 100% rated voltage
- Ratio correction factor: 1.003
- Maximum allowable phase angle: -15.6 minutes

Transformer Correction Factor = RCF + (γ/2600) = **1.003 + (-15.6/2600) = 0.997**

The ratio correction factor and phase angle for any point inside the 0.3 class parallelogram, will always produce a TCF between 0.997 and 1.003.



› Figure 3: VT Equivalent Parallelogram.

ACCURACY STANDARDS

HIGH ACCURACY EXTENDED RANGE CURRENT TRANSFORMERS

Extended range current transformers are designed for modern power generation systems. They accurately measure a wider range of current without making physical changes in the primary or in the secondary connections of a current transformer.

To ensure the best performance on nominal primary current readings from 1% to Rating factor (please, see charts below), these current transformers have been designed using magnetic materials that minimize excitation losses and a winding distribution that virtually eliminates stray losses.

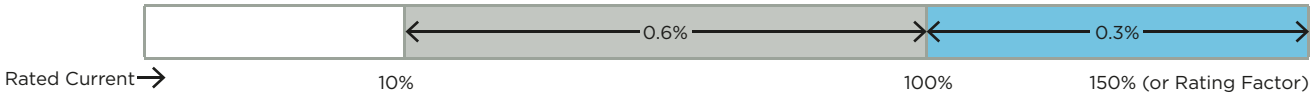
High accuracy extended range current transformers can increase utility revenue through improved metering. This occurs on systems with variable currents such as wind or solar power generation. In the past, current transformers were designed to accurately measure down to 10% of the current rating on the name plate of the transformer.

However, the recent deployment of variable generation has created a need to accurately measure a new range of currents produced by these systems; especially below the rated current of the transformer.

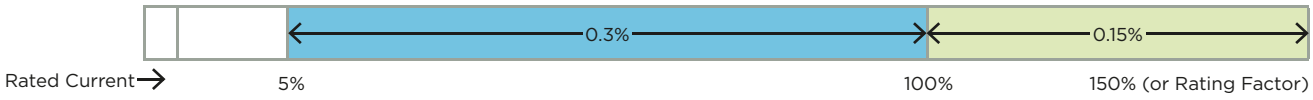
Historically, some energy usage revenue went unmeasured. Today Arteche's high accuracy extended range current transformers accurately measure these variable loads.

Extended range current transformers answer "Standard CT's problem" by expanding the amperage load that can be accurately measured. The wider current range helps to reduce the number of different ratios, reducing the amount of inventory needed to respond to customer demands.

› **"Standard Class 0.3"** means that from 100% of nominal current through the rating factor, accuracy is guaranteed to be ±0.3%. and from 10% of nominal current through 100% of nominal current accuracy is guaranteed to be ±0.6%.

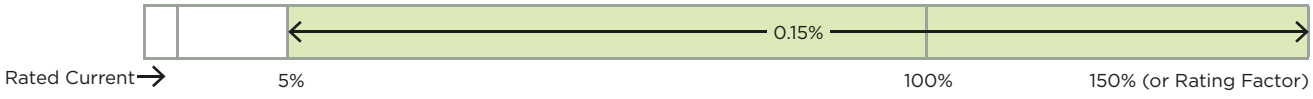


› **"High Accuracy Class 0.15"** means that from 100% of nominal current through the rating factor, accuracy is guaranteed to be ±0.15%, and from 5% of nominal current through 100% of nominal current accuracy is guaranteed to be ±0.3%.

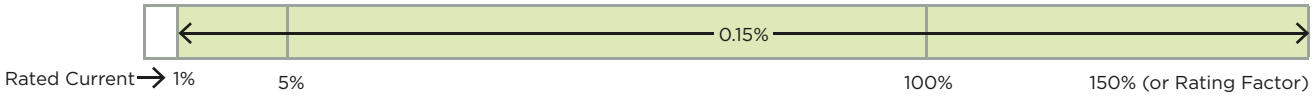


› **"Accuracy Class 0.3S"** means that from 5% of nominal current through the rating factor, accuracy is guaranteed to be ±0.3%.

› **"Accuracy Class 0.15S"** means that from 5% of nominal current through the rating factor, accuracy is guaranteed to be ±0.15%.



› **"High Accuracy. Extended Range Class 0.15"** means that from 1% of nominal current through the rating factor, accuracy is guaranteed to be ±0.15%. This goes beyond IEEE C57.13 requirements.



OTHER INFORMATION

CURRENT TRANSFORMERS

Standard burden characteristics @ 60Hz and 5Amps secondary

Burden designation	Resistance (ohms)	Inductance (millihenrys)	Impedance (ohms)	Volt-Amperes	Power factor
METERING BURDENS					
B-0.1	0.09	0.116	0.1	2.5	1.0
B-0.2	0.18	0.232	0.2	5.0	0.9
B-05	0.45	0.580	0.5	12.5	0.9
B-0.9	0.81	1.040	0.9	22.5	0.9
B-1.8	1.62	2.080	1.8	45.0	0.9
RELAYING BURDENS					
B-1	0.5	2.3	1.0	25	0.5
B-2	1.0	4.6	2.0	50	0.5
B-4	2.0	9.2	4.0	100	0.5
B-8	4.0	18.5	8.0	200	0.5

As per IEEE C57.13-2016. Tables 10 and 13.

VOLTAGE TRANSFORMERS

Standard burden @ 60Hz

Burden designation	Secondary Volt-Amperes	Burden Power Factor
W	12.5	0.10
X	25.0	0.70
M	35.0	0.20
Y	75.0	0.85
Z	200.0	0.85
ZZ	400.0	0.85

As per IEEE C57.13-2016. Table 19.

CROSS REFERENCE OF MOST COMMONLY USED TYPES

INDOOR

Current transformer				Voltage transformer			
ARTECHE	GE	ABB	KUHLMAN	ARTECHE	GE	ABB	KUHLMAN
CID-17	JKM-5.5A	KIR-11	CID-17	U/VCE-17	JVM-4.5	VIZ-11	U/VCD-17

OUTDOOR

Current transformer				Voltage transformer			
ARTECHE	GE	ABB	KUHLMAN	ARTECHE	GE	ABB	KUHLMAN
CRB-17	JCK-5	KOR-11	BB-15-972	VRL-17	JVW-3	VOY-60	PTT-110-977
CRE-17	JKW-3.4	KOR-60.75	BB-15-971 & BB-15-971H	URJ-17	JVW-4.5	VOZ-75	PTT-110-9710G
				VRJ-17	JVW-4.5	VOZ-75	PTT-110-9710
CRE-24	JKW-6	KON-12	BB-25-974	URN-17	JVW-6	VOG-12	PTT-150-9710G
CRF-24	JKW-6	KOR-15C	BB-25-973 & BB-25-973H	VRN-17	JVW-4.5	VOZ-75	PTT-110-9710
				URN-24	JVW-6	VOY-15G	PTT-150-9710G
CRF-36	JKW-7	KOR-20	BB-34-975 & BB-34-976	VRN-24	JVW-6	VOY-15	PTT-150-9710
				URS-36	JVW-7	VOY-20G	PTT-200-9710G
CE-034-E2	JKW-150.200	KOTD-150.200	LG(X)	VRS-36	JVW-7C	VOY-20	PTT-200-9710
				URU-52	JVS-250	VOZZ-25G	--
CE-046-E2	JKW-250	KOTD-250	CE-046	VRU-52	JVT-250	VOZZ-25	--
CE-069-E2	JKW-350	--	CE-069	URU-72	JVS-350	--	--

OTHER INFORMATION

IT TYPE DESIGNATIONS

	ARTECHE Design	1st position	2nd position	3rd position*	4th&5th position
5kV - 36kV					
CT's Indoor	ACA-36	A=CT Indoor transformer Up to 36 kV with DIN standard	C=insulation of resin	A=0.3 B0.1 up to B0.5	Insulation class: 12=8.7/26/75 kV 17=15/34/110 kV 24=25/50/150 kV 36=34.5/70/200 kV
	ACD-12. ACD-17. ACD-24			D=0.3 B0.1 up To B0.9 depending on the ratio	
	ACI-17			I=0.3 B0.5 up To B0.9 depending on the ratio	
	ACH-17. ACH-24			H=0.3 B0.5 up To B1.8 depending on the ratio	
	ACF-36			F=burden B0.5 up To B1.8 depending on the ratio	
	AGPE-12	A=CT Indoor transformer Up to 36 kV toroidal	G=insulation resin. window type	P=Burden B0.1 up to B1.8 C-200	E= indoor & outdoor service 12=8.7/26/75 kV
	CID-17	C=CT Indoor up to 34.5 kV only for America	I=insulation and molded in resin	D=0.3 B1.8 C-200	
VT's Indoor	VCE-7. VCE-17	V=Line To Line connection U=line to ground connection	C=insulation and molded in resin X=insulation and molded in resin with relief valve	Accuracy and burden: E=0.3WX. 0.3WXY Accuracy and burden: I.L.J.N=0.3WXY	Insulation class: 12=8.7/26/75 kV 17=15/34/110 kV 24=25/50/150 kV 36=34.5/70/200 kV 52=46/95/250 kV 72=69/140/350 kV
	UCE-7. UCE-17				
	UXI-12				
	UCI-17				
	VCL-17. VCL-24				
	UXL-17				
	UCJ-24				
	VCN-36				
	UXN-36				
	UEI-24	U=line to ground connection	E=Insulation and molded in resin with metal coated body	I=0.3WXY	24=25/50/150 kV
5kV - 72kV					
CT's Outdoor	CRB-17	C=CT Outdoor up to 69 kV. post type	R=insulation of cycloaliphatic resin	B=0.3B0.5	Insulation class: 17=15/34/110 kV 24=25/50/150 kV 36=34.5/70/200 kV 52=46/95/250 kV 72=69/140/350 kV
	CRE-17. CRE-24			E=0.3B1.8 T-150	
	CRF-24. CRF-36			F=0.3B1.8 T-200	
	CRH-36. CRH-52. CRH-72			H=0.3B1.8 T-200	
	CRK-36. CRK-52. CRK-72			K=0.3B1.8 T-400	
	CE-034-E2	C=CT Outdoor up to 69 kV. top-core with metal coated head	E=Insulation of cycloaliphatic resin and top-core with metal coated head	3rd.4th&5th position Insulation level: 034= 34.5/70/200 kV 046= 46/95/250 kV 069= 69/140/350 kV	6th position Accuracy and burden E2=0.3B1.8 T-400
	CE-046-E2				
	CE-069-E2				
VT's Outdoor	VRL-17	V=line To Line connection U=line to ground connection	R=insulation Of cycloaliphatic resin	Accuracy and burden L.J.N.S=0.3WXY	Insulation class: 17= 15/34/110 kV 24=25/50/150 kV 36=34.5/70/200 kV
	URL-17				
	VRJ-17. VRJ-24				
	URJ-17				
	VRN-17. VRN-24				
	URN-17. URN-24				
	VRS-36				
	URS-36				
	VRU-52			U=0.3WXYZ	52=46/95/250 kV 72=69/140/350 kV
	URU-52				
	URU-72				

*The letter in the 3rd position is the size of the CT. each letter means a different size. increasing the size in alphabetical order.