

# CURRENT TRANSFORMER

## 1. INTRODUCTION:

A current transformer (CT) is a type of transformer that is used to measure AC current. It produces an alternating current (AC) in its secondary which is proportional to the AC current in its primary. Current transformers, along with voltage or potential transformers are Instrument transformer. Instrument transformers scale the large values of voltage or current too small, standardized values that are easy to handle for instruments and protective relays. The instrument transformers isolate measurement or protection circuits from the high voltage of the primary system. A current transformer provides a secondary current that is accurately proportional to the current flowing in its primary. The current transformer presents a negligible load to the primary circuit.

Current transformers are the current sensing units of the power system. Current transformers are used at generating stations, electrical substations, and in industrial and commercial electric power distribution.

## 2. PRODUCT & ITS APPLICATION:

### ***Current Transformer***

Current Transformers are providing measuring and protective class accuracies. Low tension bar primary CT in moulded case is housed in an attractive & rigid abs case (color as required). These CT's are suitable for bus bars up to 40 x 12mm and round conductors up to 35mm.

### ***Instrument Transformers***

Instrument Transformers are manufactured using high quality raw materials and advanced technology with state-of-the-art infrastructure facility. These transformers are easy to install

owing to their light-weight design and compact size. Their rugged structure makes them suitable for repeated use.

### ***L.T. Current Transformer***

The low tension current transformer is used mainly for the conversion of the primary current on its secondary side & thus extends the range of instruments/protective devices connected in its secondary circuit. A C.T. by its very nature of application isolates the devices connected in its secondary circuit from the network system into which the C.T. is connected.

There are three basic types of current transformers: **wound, toroidal** and **bar**.

- Wound Current Transformer – The transformer's primary winding is physically connected in series with the conductor that carries the measured current flowing in the circuit. The magnitude of the secondary current is dependent on the turn's ratio of the transformer.
- Toroidal Current Transformer – These do not contain a primary winding. Instead, the line that carries the current flowing in the network is threaded through a window or hole in the toroidal transformer. Some current transformers have a "split core" which allows it to be opened, installed, and closed, without disconnecting the circuit to which they are attached.
- Bar-type Current Transformer – This type of current transformer uses the actual cable or bus-bar of the main circuit as the primary winding, which is equivalent to a single turn. They are fully insulated from the high operating voltage of the system and are usually bolted to the current carrying device.

### **USES:**

Current transformers are used extensively for measuring current and monitoring the operation of the power grid. Along with voltage leads, revenue-grade CTs drive the electrical utility's watt-hour meter on virtually every building with three-phase service and single-phase services greater than 200 amperes. High-voltage current transformers are mounted on porcelain or polymer insulators to isolate them from ground. Some CT configurations slip around the bushing of a high-voltage transformer or circuit breaker, which automatically canters the conductor inside the CT window. Current transformers can be mounted on the low voltage or high voltage leads of a power transformer. Sometimes a section of a bus bar

can be removed to replace a current transformer. Often, multiple CTs are installed as a "stack" for various uses. For example, protection devices and revenue metering may use separate CTs to provide isolation between metering and protection circuits, and allows current transformers with different characteristics (accuracy, overload performance) to be used for the devices. The burden (load) impedance should not exceed the specified maximum value to avoid the secondary voltage exceeding the limits for the current transformer. The primary current rating of a current transformer should not be exceeded or the core may enter its nonlinear region and ultimately saturate. This would occur near the end of the first half of each half (positive and negative) of the AC sine wave in the primary and would compromise the accuracy.

### **3. DESIRED QUALIFICATIONS FOR PROMOTER:**

Graduate in any discipline. The knowledge of engineering design and electrical parts and the characteristic of transformer are necessary.

### **4. INDUSTRY LOOK OUT AND TRENDS**

Electric equipment industry contributes over 2% of GDP which is projected to increase to about 12% in 2015 according to a study by Frost & Sullivan. During the period, consumption of electrical equipment is estimated to increase from over USD 28 bn now to USD 363 bn, growing at a CAGR of about 30%. It is also expected that during 2010-2015, the Indian equipment manufacturing will grow at 5.5 times the growth rate of global electronic equipment production.

The electrical equipment and accessories industry, with its highly diversified content, may be broadly segmented into (i) generation equipment, (ii) transmission equipment, and (iii) distribution equipment. The equipments and accessories under these segments include motors, turbines, gene-rators, switchgears, transformers, circuit breakers, induction motors, power capacitors, meters, transmission towers. Besides these, the spectrum covers a whole range of power cables including XLPE and AAC and ACSR conductors and electrical consumer

products like fans, electric lamps, exhausts and domestic appliances and accessories. Inverter, gensets, UPS also fall under its domain.

The growth of the industry is directly related to the development of power generation and distribution. India's generation capacity of 2,300 MW in 1950 expanded to over 116,500 MW including non-utilities at the end 2000-01. The total installed capacity of electric power generation further increased to 141,080 MW in 2007-08 (up to January 2008) compared to a capacity of 128,000 MW during the same period in 2006-07. The Eleventh Plan has targeted a capacity addition of 78,570 MW.

With some fast moves at launching fast track projects to augment supplies, the Indian industry needs to improve its competitiveness. The Indian market is growing and multinationals with newer technologies are now more active.

## **5. MARKET POTENTIAL AND MARKETING ISSUES, IF ANY:**

The Instrument Transformers industry in India manufactures current transformers and voltage transformers of various rating from 0.66 kV to 765 kV, for indoor and outdoor applications. The industry also exports instrument transformers in the range of indoor up to 36 kV and outdoor above 12 kV. Over the past 2 years, the industry has also demonstrated its capabilities by manufacturing 1200 kV CVT for 1200 kV test station. Over the last year, generally there was slowdown in the requirement of equipment and hence no improvement in the industry scenario. Even the market size was observed to be shrinking in 400 kV segment as well as 220/120 and 66 kV segments. The reduction in 765 kV segment was observed, mainly due to shift from AIS to GIS. However no major threat was observed due to exports. In the changed industry scenario, many surge arrester players have started manufacturing CTs and many players have entered the field with manufacturing of CTs up to 220 kV range. It was also observed that the customers raising the quality standards and imposing stringent quality acceptance criteria for these products.

## **6. RAW MATERIAL REQUIREMENTS:**

The basic raw material 'Cold Rolled Grain Oriented (CRGO) Steel' is used for manufacturing both Lamination and Wound Cores. The same is imported from reputed overseas mills of Japan, Korea, Russia, Germany, France, U.K., Brazil and U.S.A, in various grades of different permeability. . Basically, there are many types of CRGO Steel eg. M-3, M-4, M-5 and M-6 grade and HI-B Material. These raw materials are imported in the forms of mother coils having standard width of 750/1100 mm. CRGO material has the least figure of maximum core loss in the rolling direction. With the increased shearing angle to the rolling direction, the core loss at any particular flux density goes up and becomes generally highest in the transverse direction. Because of this it is possible to use CRGO in static electrical machines which include all types of power transformers, distribution transformers, reactors, audio transformers and current transformer.

The case of CT's is made of polycarbonate, which is flame retardant and non-drip and conforms to UL 94 V-0. Polycarbonate is a very tough and lightweight engineering plastic material which has got the best mechanical properties very close to a metallic housing.

## **7. MANUFACTURING PROCESS:**

Bar-type current transformers have terminals for source and load connections of the primary circuit, and the body of the current transformer provides insulation between the primary circuit and ground. By use of oil insulation and porcelain bushings, such transformers can be applied at the highest transmission voltages. Ring-type current transformers are installed over a bus bar or an insulated cable and have only a low level of insulation on the secondary coil. To obtain non-standard ratios or for other special purposes, more than one turn of the primary cable may be passed through the ring. Where a metal shield is present in the cable jacket, it must be terminated so no net sheath current passes through the ring, to ensure accuracy. Current transformers used to sense ground fault (zero sequence) currents, such as in a three-phase installation, may have three primary conductors passed through the ring. Only the net unbalanced current produces a secondary current - this can be used to detect a

fault from an energized conductor to ground. Ring-type transformers usually use dry insulation systems, with a hard rubber or plastic case over the secondary windings. For temporary connections, a split ring-type current transformer can be slipped over a cable without disconnecting it. This type has a laminated iron core, with a hinged section that allows it to be installed over the cable; the core links the magnetic flux produced by the single turn primary winding to a wound secondary with many turns. Because the gaps in the hinged segment introduce inaccuracy, such devices are not normally used for revenue metering. Current transformers, especially those intended for high voltage substation service, may have multiple taps on their secondary windings, providing several ratios in the same device. This can be done to allow for reduced inventory of spare units, or to allow for load growth in an installation. A high-voltage current transformer may have several secondary windings with the same primary, to allow for separate metering and protection circuits, or for connection to different types of protective devices. For example, one secondary may be used for branch over current protection, while a second winding may be used in a bus differential protective scheme, and a third winding used for power and current measurement.

## 8. MANPOWER REQUIREMENT:

The enterprise requires 33 employees as detailed below:

Sr. No.	Designation Employees	Of Person	Salary Per Monthly Salary ₹	Number of employees required				
				Year-1	Year-2	Year-3	Year-4	Year-5
1	Production Manager	18000	18000	1	1	1	1	1
2	Operators	12000	84000	7	7	7	9	9
3	Helpers	10000	70000	7	7	7	9	9
2	Admin Manager	15000	15000	1	1	1	1	1
3	Accounts/Stores Assistant	12500	37500	3	3	3	4	4
	Office Boy	9000	27000	3	3	3	3	3
	Total		251500	22	22	22	27	27

## 9. IMPLEMENTATION SCHEDULE:

The project can be implemented in 4 months' time as detailed below:

Sr. No.	Activity	Time Required (in months)
1	Acquisition of premises	1.00
2	Construction (if applicable)	1.00
3	Procurement & installation of Plant & Machinery	2.00
4	Arrangement of Finance	2.00
5	Recruitment of required manpower	1.00
	Total time required <i>(some activities shall run concurrently)</i>	4.00

## 10. COST OF PROJECT:

The project shall cost ₹ **77.37**lacs as detailed below:

Sr. No.	Particulars	₹ in Lacs
1	Land 1000 sq.mtr@ 1000	10.00
2	Building	18.00
3	Plant & Machinery	27.00
4	Furniture, Electrical Installations	3.00
5	Other Assets including Preliminary / Pre-operative expenses	2.70
6	Working Capital	16.67
	<b>Total</b>	<b>77.37</b>

## 11. MEANS OF FINANCE:

Bank term loans are assumed @ 75 % of fixed assets.

Sr. No.	Particulars	₹ in Lacs
1	Promoter's contribution	19.34
2	Bank Finance	58.03
	<b>Total</b>	<b>77.37</b>

## 12. WORKING CAPITAL CALCULATION:

Sr. No.	Particulars	Gross Amt	Margin %	Margin Amt	Bank Finance
1	Inventories	8.33	0.25	2.08	6.25
2	Receivables	4.17	0.25	1.04	3.13
3	Overheads	4.17	100%	4.17	0.00
4	Creditors	-		0.00	0.00
	<b>Total</b>	16.67		7.29	9.38

## 13. LIST OF MACHINERY REQUIRED:

Coil Winding Machines, Brazing Machines, Milling machines, Lathe machines, Shaping machines, Welding machines, Polishing machines, Shearing Machine (Cutting Machine), Press Brake (Bending Machine), Co2 Welding Equipment, Corner Notching Machine, and Power Punch Press.



Sr. No.	Particulars	UOM	Qty	Rate (₹)	Value
					(₹ in Lacs)
	<b>Plant &amp; Machinery / equipments</b>				
<b>a)</b>	<b>Main Machinery</b>				
i.	WINDING DEPARTMENT	NO	1	12.00	12.00
ii.	MACHINING DIVISION	NO	1	6.00	6.00
iii.	MILLING AND OTHER DIVISION	NO	1	4.50	4.50
iv.	FINISHNG DIVISION	L.S.	1	1.50	1.50
v.	LABORATORY DIVISION	NO	1	1.00	1.00
vi.	Installation, Electrification, taxes and transportation.	L.S.	1	2.00	2.00
	<i>sub-total Plant &amp; Machinery</i>				<b>27.00</b>
	<b>Furniture / Electrical installations</b>				
a)	Office furniture	LS	1	50000	0.50
b)	Stores Almirah	LS	1	0	0.00
c)	Computer & Printer	L. S.	5	50000	2.50
	<i>sub total</i>				<b>3.00</b>
	<b>Other Assets</b>				
a)	preliminary and preoperative				2.70
	<i>sub-total Other Assets</i>				2.70
	<b>Total</b>				<b>32.70</b>

All the machines and equipment are available from local manufacturers. The entrepreneur needs to ensure proper selection of product mix and proper type of machines and tooling to have modern and flexible designs. It may be worthwhile to look at reconditioned imported machines, dies and tooling. Some of the machinery and dies and tooling suppliers are listed here below:

1. Sagar Engineering Works  
A-129, Road No. 9 D,  
V. K. I. Area, Jaipur - 302013,  
Rajasthan, India  
Phone: +91-9829024358, +91-141-4064876
2. Uday Enterprises  
Khasra No. 1108, Village Makanpur, Behind Indian Child School  
Opposite Janta Flat No. 433, Nyay Khand 1,  
Indirapuram, Ghaziabad - 201010, Uttar Pradesh, India  
Phone: +91-9212320224.
3. Ranoson Machines Private Limited  
A-153, Sector 80, Phase 2,  
Back Side of Moser Baer Factory, Noida - 201301,  
Uttar Pradesh, India  
Phone: +91-9811636750, +91-9811080803
4. Krishna Engineering Works  
28, Madhuvan, Near Prestige Bungalows  
Punit Nagar Crossing Road,  
Ghodasar, Ahmedabad - 380050, Gujarat, India  
Phone: +91-9824323439

#### 14. PROFITABILITY CALCULATIONS:

Sr. No.	Particulars	UOM	Year-1	Year-2	Year-3	Year-4	Year-5
1	Capacity Utilization	%	60%	70%	80%	90%	100%
2	Sales	₹. In Lacs	60.00	70.00	80.00	90.00	100.00
3	Raw Materials & Other direct inputs	₹. In Lacs	48.12	56.14	64.16	72.18	80.20
4	Gross Margin	₹. In Lacs	11.88	13.86	15.84	17.82	19.80
5	Overheads except interest	₹. In Lacs	4.59	4.88	5.45	5.63	5.74
6	Interest	₹. In Lacs	5.80	5.80	3.87	2.90	2.32
7	Depreciation	₹. In Lacs	18.90	13.50	9.45	6.75	6.08
8	<b>Net Profit before tax</b>	₹. In Lacs	<b>-17.41</b>	<b>-10.32</b>	<b>-2.93</b>	<b>2.54</b>	<b>5.66</b>

The basis of profitability calculation:

The growth of selling capacity will be increased 10% per year. (This is assumed by various analysis and study; it can be increased according to the selling strategy.)

Energy Costs are considered at Rs 7 per Kwh and fuel cost is considered at Rs. 65 per liter. The depreciation of plant is taken at 10-12 % and Interest costs are taken at 14 -15 % depending on type of industry.

#### 15. BREAKEVEN ANALYSIS:

The project shall reach cash break-even at 40.71 % of projected capacity as detailed below:

Sr. No.	Particulars	UOM	Value
1	Sales at full capacity	₹. In Lacs	100.00
2	Variable costs	₹. In Lacs	80.20
3	Fixed costs incl. interest	₹. In Lacs	8.06
4	$BEP = FC/(SR-VC) \times 100 =$	% of capacity	40.71%

## **16. STATUTORY / GOVERNMENT APPROVALS**

As per the allocation of business rules under the Constitution, labour is in the concurrent list of subjects. It is dealt with by the MOLE at the Central and Departments of Labour under State Governments in respective States / UTs. The MOLE has enacted workplace safety and health statutes concerning workers in the manufacturing sector, mines, ports and docks and in construction sectors.

Further, other Ministries of the Government of India have also enacted certain statutes relating to safety aspects of substances, equipment, operations etc. Some of the statutes applicable in the manufacturing sector are discussed below:

### **The Manufacture, Storage and Import of Hazardous Electronic Rules (MSIHC), 1989**

These MSIHC Rules are notified under the Environment (Protection) Act, 1986. These rules are aimed at regulating and handling of certain specified hazardous chemicals. The rules stipulate requirements regarding notification of site, identification of major hazards, taking necessary steps to control major accident, notification of major accident, preparation of safety report and on-site emergency plan; prevention and control of major accident, dissemination of information etc. These rules are notified by the Ministry of Environment and Forests (MOEF) but enforced by the Inspectorates of Factories of respective States / UTs in the manufacturing sector. Entrepreneur may contact State Pollution Control Board where ever it is applicable.

## **17. BACKWARD AND FORWARD INTEGRATIONS**

Both forward and backward integration for any Electrical Industry are strategies to gain better control over the supply chain, reduce dependency on the suppliers and increase their competitiveness. The two strategies can help companies reduce their dependency on suppliers and increase their influence over the customers. The benefits of these strategies

can be big. Both impact the bottom line directly. Integration happens if a company moves upward or downward in its supply chain. Starting from the suppliers from whom the raw materials are obtained, the chain moves downstream towards the distributors and the retailers. If the suppliers' power is very high, it can create financial burdens for the company. Suppose the number of suppliers of a company is low, then the control in their hands would be low. The burden in that case will fall upon company's shoulders. Its expenditure on raw materials will be high.

## **18. TRAINING CENTERS AND COURSES**

There is no such training required to start this business but, basic Electrical or IC bachelor's degree is plus point for enterpriser. Promoter may train their employees in such specialized institutions to grow up the business. There are few specialized Institutes provide degree certification in chemical Technology, few most famous and authenticate Institutions are as follows:

1. Department OfElectrical LD College Of Engineering  
No.120, Circular Road, University Area, Navrangpura,  
Opposite Gujarat University, Ahmedabad, Gujarat 380015
2. MIT College OfEngineering, Pune  
Gate.No.140, Raj Baugh Educational Complex,  
Pune Solapur Highway,  
Lonikalbhor, Pune – 412201  
Maharashtra, India

Udyamimitraportal ( link : [www.udyamimitra.in](http://www.udyamimitra.in) ) can also be accessed for handholding services viz. application filling / project report preparation, EDP, financial Training, Skill Development, mentoring etc.

Entrepreneurship program helps to run business successfully is also available from Institutes like Entrepreneurship Development Institute of India (EDII) and its affiliates all over India.

**Disclaimer:**

Only few machine manufacturers are mentioned in the profile, although many machine manufacturers are available in the market. The addresses given for machinery manufacturers have been taken from reliable sources, to the best of knowledge and contacts. However, no responsibility is admitted, in case any inadvertent error or incorrectness is noticed therein. Further the same have been given by way of information only and do not carry any recommendation.