

# Carbon Potentiometers

PRODUCT CODE (ASICC)	: 78989
QUALITY AND STANDARDS	: IS 8872 (Part I) :1977 for variable resistors
PRODUCTION CAPACITY	: Qty. : 3,00,000 Nos. (per annum) Value : Rs. 36,00,000
YEAR OF PREPARATION	: 2002–2003
PREPARED AND UPDATED BY	: Small Industries Service Institute, Guwahati And Office of the Development Commissioner (Small Scale Industries), Electronics and Electrical Division, 7th Floor, Nirman Bhavan, New Delhi-110011

## INTRODUCTION

Carbon Potentiometer is an electronic component classified as variable resistor. Carbon Potentiometer is used as voltage divider to provide variable output voltage. Carbon Potentiometers uses carbon as resistive element. There are also different types of Potentiometers like Wire Wound type and ceramic type using different materials on resistive element. Carbon Potentiometer can be classified into logarithmic type and linear type depending on the mode of operations. Carbon Potentiometers are of many types and sizes depending on resistance value, power rating and type of mounting.

Panel mounted type Carbon Potentiometer are widely used for volume and tone control in consumer and entertainment electronics. PCB mount

type is used as function controller, measuring and testing equipment, medical electronics, industrial electronics etc. Carbon Potentiometer is available with and without switches. There are also many varieties of spindles used for carbon potentiometer depending on the materials and sizes.

Carbon Potentiometer range includes double potentiometer at the same shaft, high voltage potentiometer, multi turn potentiometer, miniature potentiometer etc.

## MARKET POTENTIAL

Carbon Potentiometers are used for volume control, tone control and other applications in Consumer Electronics, Entertainment Electronics, Industrial Electronics, Medical Electronics, Telecommunication etc. Total Electronics

Production in the country is estimated to be valued at Rs. 627 billion in 2000-01, out of which component sector will be about Rs. 55 billion which will be growing at a faster rate and therefore more nos. of Potentiometers will be required. The cost of Carbon Potentiometer depends on the value, power rating and size. Simple type carbon potentiometer costs from Rs. 8 to Rs. 20. Special type costs from Rs. 40 to Rs.80. Most of machinery and equipment and raw material are indigenously available. Raw material like resistive material, silicon grease are imported.

There are few units in the country manufacturing Carbon Potentiometer. With high quality and competitive price and marketing tie-up, there is scope for the industry.

### BASIS AND PRESUMPTIONS

- i) The basis for calculation of production capacity has been taken on single shift basis on 75% efficiency.
- ii) The maximum capacity utilization on single shift basis for 300 days a year. During first year and second year of operations the capacity utilization is 60% and 80% respectively. The unit is expected to achieve full capacity utilization from the third year onwards.
- iii) The salaries and wages, cost of raw materials, utilities, rents, etc. are base on the prevailing rates in and around Guwahati. These cost factors are likely to vary with time and location.
- iv) Interest on term loan and working capital loan has been taken at the rate of 16% on an average. This rate may vary

depending upon the policy of the financial institutions/agencies from time to time.

- v) The cost of machinery and equipments refer to a particular make/model and prices are approximates.
- vi) The break-even point percentage indicated is of full capacity utilization.
- vii) The project preparation cost etc.whenever required could be considered under pre-operative expense.
- viii) The essential production machinery and test equipment required for the project have been indicated. The unit may also utilize common test facilities available at Electronics Test and Development Centres (ETDCs) and Electronic Regional Test Laboratories (ERTLs) set up by the State Governments and STQC Directorate of the Department of Information Technology, Ministry of Communication and Information Technology, to manufacture products conforming to Bureau of Indian Standards.

### IMPLEMENTATION SCHEDULE

The major activities in the implementation of the project has been listed and the average time for implementation of the project is estimated at 12 months:

<i>Sl. No.</i>	<i>Name of Activity</i>	<i>Period in Months (Estimated)</i>
1.	Preparation of project report	1
2.	Registration and other formalities	1
3.	Sanction of loan by financial institutions	3
4.	Plant and Machinery:	
	(a) Placement of orders	1

Sl. No.	Name of Activity	Period in Months (Estimated)
	(b) Procurement	2
	(c) Power connection/ Electrification	2
	(d) Installation/Erection of machinery/Test Equipment	2
5.	Procurement of raw materials	2
6.	Recruitment of Technical Personnel etc.	2
7.	Trial production	11
8.	Commercial production	12

### Notes

- Many of the above activities shall be initiated concurrently.
- Procurement of raw materials commences from the 8th month onwards.
- When imported plant and machinery are required, the implementation period of project may vary from 12 months to 15 months.

## TECHNICAL ASPECTS

### Process of Manufacture

Carbon Potentiometer Consists of :

- Substrate with resistive element
- Wiper contact with mechanism for movement of wiper
- Housing

Carbon resistive element is formed on a substrate, which is usually a ceramic material (plastic substrates are also used) by a series of processes like screen printing, brushing, spraying, dipping and vacuum depositions.

A mask is used to form desired pattern of carbon track. The value of resistance depends on the pattern and thickness of the deposited carbon track.

For better control of value spray guns are used for carbon track. After forming curing is done in an oven. The terminations are soldered for external connections. The wiper contact terminal, which is attached to rotating shaft, determines contact resistance, resolution, noise power rating, operative life and stability. The wiper contact is insulated from the rotating shaft. The substrate with terminals and bush mounting shaft are housed in metal casing. Oxidation is prevented by spraying lubricants (lacquer) on metal and resistive element.

### Quality Control and Standards

Resistance Range : 470 Ohm to 1 Mega Ohm  $\pm$  20%

Power Rating : 0.05 Watt to 1 Watt

Insulation : 250 V DC - 100 M

Withstand Voltage: 300 V AC - 1 Minute

Production Capacity (per annum)

Quantity	Value (Rs.)
3,00,000 Nos.	36,00,000

Motive Power 20 KVA (approx.)

### Pollution Control

The Govt. accords utmost importance to control environmental pollution. The small-scale entrepreneurs should have an environmental friendly attitude and adopt pollution control measures by process modification and technology substitution.

India having acceded to the Montreal Protocol in Sept. 1992, the production and use of Ozone Depleting Substances (ODS) like Chlorofluoro Carbon (CFC), Carbon Tetrachloride, Halons and Methyl Chloroform etc. need to be phased out immediately with alternative chemicals/

solvents. A notification for detailed Rules to regulate ODS phase out under the Environment Protection Act, 1986 have been put in place with effect from 19th July 2000.

The following steps are suggested which may help to control pollution in electronics industry wherever applicable:

- i) In electronic industry fumes and gases are released during hand soldering / wave soldering/Dip soldering, which are harmful to people as well as environment and the end products. Alternate technologies may be used to phase out the existing polluting technologies. Numerous new fluxes have been developed containing 2-10% solids as opposed to the traditional 15-35% solids.
- ii) Electronic industry uses CFC, carbon Tetrachloride and Methyl Chloroform for cleaning of printed circuit boards after assembly to remove flux residues left after soldering, and various kinds of foams for packaging.

Many alternative solvents could replace CFC-113 and Methyl Chloroform in electronics cleaning. Other Chlorinated solvents such as Trichloroethylene, Perchloroethylene and Methylene Chloride have been used as effective cleaners in electronics industry for many years. Other organic solvents such as Ketones and Alcohols are effective in removing both solder fluxes and many polar contaminants.

### Energy Conservation

With the growing energy needs and shortage coupled with rising energy

cost, a greater thrust in energy efficiency in industrial sector has been given by the Govt. of India since 1980s. The Energy Conservation Act, 2001 has been enacted on 18th August 2001, which provides for efficient use of energy, its conservation and capacity building of Bureau of Energy Efficiency created under the Act.

The following steps may help for conservation of electrical energy:

- i) Adoption of energy conserving technologies, production aids and testing facilities.
- ii) Efficient management of process/manufacturing machineries and systems, QC and testing equipments for yielding maximum Energy Conservation.
- iii) Optimum use of electrical energy for heating during soldering process can be obtained by using efficient temperature controlled soldering and desoldering stations.
- iv) Periodical maintenance of motors, compressors etc.
- v) Use of power factor correction capacitors. Proper selection and layout of lighting system; timely switching on-off of the lights; use of compact fluorescent lamps wherever possible etc.

## FINANCIAL ASPECTS

### A. Fixed Capital

(i) Land and Building	
Built-up Area	300 Sq.Mts.
Assembly, Testing and Stores	250 Sq.Mts.
Office	50 Sq.Mts.
Rent Payable (per annum)	Rs. 48,000

## (ii) Machinery and Testing Equipments

Sl. No.	Particulars	Qty. Nos.	Imp/ Ind.	Price (Rs.)
<i>(a) Machinery</i>				
1.	Carbon Track Making Plant	1	Ind.	1,00,000
2.	Power Press (15 Tonnes)	1	Ind.	30,000
3.	Rivetting Press (Spring Type)	2	Ind.	16,000
4.	Doggle Press (Spring Type)	2	Ind.	40,000
5.	Bench Lathe (4 sft)	2	Ind.	28,000
6.	Shearing Machine	1	Ind.	10,000
7.	Drilling Machine (1/4" cap)	1	Ind.	3,000
8.	Grinder (4" dia)	2	Ind.	6,000
9.	Oven	1	Ind.	30,000
10.	Punching Machine	2	Ind.	20,000
<i>(b) Testing Equipment</i>				
1.	Digital Micro Ohm Meter	2	Ind.	37,000
2.	High Voltage Tester	2	Ind.	50,000
3.	Milli Mega Ohm Meter	2	Ind.	32,000
4.	Decade Resistance Box	10	Ind.	30,000
5.	Digital Multimeter	1	Ind.	10,000
6.	Insulation Resistance Tester	2	Ind.	20,000
7.	Analog Multimeter	4	Ind.	24,000
8.	Travel Measurement /Shaft Positioning/ Constant Speed Dive Setup	1 set	Ind.	50,000
9.	Variac	1	Ind.	4,000
10.	Electrification Charges @ 10% of Cost of Machinery and Equipments			54,000
11.	Tools, Jigs and Fixtures		Ind	60,000
12.	Office Equipment and Furniture			50,000
(iii) Pre-operative Expenses				10,000
Total Fixed Capital				7,14,000

## B. Working Capital (per month)

## (i) Staff and Labour

Sl. No.	Designation	Nos.	Salary (Rs.)	Total (Rs.)
1	Manager	1	5,000	5,000
2	Supervisor	2	3,500	7,000
3	Clerk/Typist	1	2,500	2,500
4	Peon	1	1,500	1,500
5	Watchman	1	1,500	1,500
6	Skilled Workers	5	2,500	12,500
7	Semi-Skilled Workers	5	2,000	10,000
			Total	40,000
Add Perquisites @ 15% of Total Salary				6,000
			Total	46,000

## (ii) Raw Material Requirements (per month)

Sl. No.	Particulars	Cost for 25,000 Nos. (Rs.)
1	Resistive Element Material (Carbon)	12,500
2	Substrate (Ceramic/Plastic)	20,000
3	Silicon Grease	20,000
4	M.S. Rods (6 mm dia)	30,000
5	Metal Bush	35,000
6	Phosphorous Bronze Trip, MS Sheet, Varnish, Thinner and Other Hardware	50,600
Total		1,67,500

Note: The Quality and Quantity of Raw Material requirement vary with the type of Carbon Potentiometer.

(iii) Utilities (per month)	(Rs.)
Power	3,000
Water	500
Total	3,500

(iv) Other Contingent Expenses	(Rs.)
Rent	4,000
Postage and Stationery	2,500
Repair and Maintenance	3,000
Telephone	2,000

(iv) Other Contingent Expenses	(Rs.)
Transport Charge	4,500
Advertisement/Publicity	4,000
Insurance	200
Miscellaneous Expenses	2,800
<b>Total</b>	<b>23,000</b>

(v) Total Recurring Expenditure Rs. 2,40,000  
(i) + (ii) + (iii) + (iv)

### C. Total Capital Investment

Fixed Capital	Rs. 7,14,000
Working Capital for 3 months	Rs. 7,20,000
<b>Total</b>	<b>Rs. 14,34,000</b>

## FINANCIAL ANALYSIS

(1) Cost of Production (per annum)	(Rs.)
Total Recurring Expenditure	28,80,000
Depreciation on machinery and equipment @ 10%	54,000
Depreciation on office equipment and furniture @ 20%	10,000
Depreciation on Jigs and fixtures @ 20%	12,000
Interest on total capital investment @ 16%	2,29,440
<b>Total</b>	<b>31,85,440</b>
<b>Say</b>	<b>31,85,000</b>

(2) Sales Turnover (per annum)

Item	Qty.	Rate (Rs)	Value (Rs.)
Carbon Potentiometer	3,00,000 Nos.	12/ Unit	36,00,000

(3) Profit (per annum) (Before Taxes) Rs. 4,15,000

(4) Net Profit Ratio

$$\begin{aligned}
 &= \frac{\text{Profit (per annum)} \times 100}{\text{Sales (per annum)}} \\
 &= \frac{415000 \times 100}{3600000} \\
 &= 11.53\%
 \end{aligned}$$

(5) Rate of Return

$$\begin{aligned}
 &= \frac{\text{Profit (per annum)} \times 100}{\text{Total capital investment}} \\
 &= \frac{415000 \times 100}{1434000} \\
 &= 28.94\%
 \end{aligned}$$

(6) Break -even Point

Fixed Cost (per annum)	(Rs.)
Rent	48000
Depreciation on machinery and equipment @ 10 %	54000
Depreciation on tools, jigs and fixtures @ 20%	12000
Depreciation on office furniture @ 20%	10000
Interest on total capital investment @ 16%	229440
Insurance	2400
40% of Salaries and wages	220800
40% of other contingent expenses and utilities (excluding rent and insurance)	107040
<b>Total</b>	<b>683680</b>
<b>or Say</b>	<b>684000</b>

B.E.P.

$$\begin{aligned}
 &= \frac{\text{Fixed cost} \times 100}{\text{Fixed cost} + \text{Profit}} \\
 &= \frac{684000 \times 100}{684000 + 415000} \\
 &= 62.24\%
 \end{aligned}$$

### Additional Information

- (a) The Project Profile may be modified/tailored to suit the individual entrepreneurship qualities/capacity, production programme and also to suit the locational characteristics, wherever applicable.
- (b) The Electronics Technology is undergoing rapid strides of change and there is need for regular monitoring of the national and international technology scenario. The unit may, therefore, keep abreast with the new technologies in order to keep them in pace with the developments for global competition.

- (c) Quality today is not only confined to the product or service alone. It also extends to the process and environment in which they are generated. The ISO 9000 defines standards for Quality Management Systems and ISO 14001 defines standards for Environmental Management System for acceptability at international level. The unit may therefore adopt these standards for global competition.
- (d) The margin money recommended is 25% of the working capital requirement at an average. However, the percentage of margin money may vary as per bank's discretion.

#### Addresses of Machinery/Equipment Suppliers

1. M/s. PBJ Industrial Electronics Pvt. Ltd.  
G-9, Shalimar Industrial Estate,  
Matunga, Mumbai-400019  
(Carbon tracking Plant)
2. M/s. Agronic Instruments  
DDA Flats, 197,  
Pocket - A-4, Kalkaji Extn.  
New Delhi-19  
(Testing and Measuring Equipments)
3. M/s. Phillips India  
No-7, Justice Chandra Madhab  
Road, Ganguly Street,  
P.O. Box-7803,  
Kolkata-700012  
(Testing and Measuring Equipments)
4. M/s. Sushma Industries  
No. 18-E, Block-B, Ist-C Main  
Road, 2nd Phase, PIA, Peenya,  
Bangalore-58.  
(Travel and position Measuring  
Instrument)
5. M/s. R. B. Mehra and Sons  
P. O. Box-2704, Bentinck, Street,  
Kolkata-700001  
(Auto Transformer and Decade  
Resistance box)
6. M/s. Feed Back Controls  
26-E, Chandra Nath Chatterjee  
Street, Kolkata-700025  
(Constant Speed Drive)
7. M/s. Batliboi and Company  
Mahindra Spicer Building,  
J. N. Herdia Marg, Ballard Pier,  
Mumbai-38.  
(Tools, Press, Fixtures and Machines)

#### Addresses of Raw Material Suppliers

1. M/s. Electronics Components  
Manufacturing Company  
Kirti Nagar Indl. Area,  
New Delhi-110015  
(Carbon Tracks and 3/19, Parts  
for Potentio meter.)
2. M/s. Aerotech  
Flat No. 202, Shivam Complex,  
New Delhi-110015  
(Silicon Grease)
3. M/s. Resistor India Mfg. Company  
No. 10, Mudichor Road, West  
Thambharam, Chennai-600045  
(Resistance Element)
4. M/s. Kailagh Pottery Works,  
Bagh Rasaldar, Buland Sahar,  
Khurja-203131  
(Ceramic Substrate)
5. M/s. Choudhury Trading Company  
1681-11, 1795, 2nd Floor,  
Bhagirath Palace,  
Chandni Chowk, Delhi-110006  
(Mechanical Hardware)
6. M/s. North East Chemicals  
S. G. Goswamy Road, Panbazar,  
Guwahati  
(Varnish and Thinner)