

Selection Guide for Control Transformers

How to size a transformer

Inrush VA: Helps choose final VA

Sealed VA: helps choose FLA

REGULATION DATA CHART

Inrush VA at 20% Power Factor

VA	NEMA / IEC		
	95% Sec. Voltage	90% Sec. Voltage	85% Sec. Voltage
25 ¹	100 / ----	130 / ---	150 / ---
50 ¹	170 / 190	200 / 220	240 / 270
75 ¹	310 / 350	410 / 460	540 / 600
100 ¹	370 / 410	540 / 600	730 / 810
150 ²	780 / 850	930 / 1030	1150 / 1270
200 ²	810 / 900	1150 / 1270	1450 / 1600
250 ²	1400 / 1540	1900 / 2090	2300 / 2530
300 ²	1900 / 2090	2700 / 2970	3850 / 4240
350 ²	3100 / 3410	3650 / 4020	4800 / 5280
500 ²	4000 / 4400	5300 / 5830	7000 / 7700
750 ²	8300 / 9130	11000 / 12100	14000 / 15400
1000 ²	15000 / 16500	21000 / 23000	27000 / 29500
1000 ³	9000 / 9900	13000 / 14300	18500 / 20300
1500 ³	10500 / 11500	15000 / 16500	20500 / 22500
2000 ³	17000 / 18900	25500 / 27300	34000 / 36400
3000 ³	24000 / 25700	36000 / 38500	47500 / 50200
5000 ³	55000 / 58800	92500 / 98900	115000 / 122000

SELECTION PROCESS

Selecting a transformer for industrial control circuit applications requires understanding the relationships between the following terms.

INRUSH VA is the product of the *load voltage (V)* multiplied by the *current (A)* that is required during start-up. This is also known as *magnetizing current*. It is calculated by adding together the inrush VA of all components that might be energized simultaneously. Inrush VA is available from the component manufacturer.

SEALED VA also called *Steady State VA* is the product of the *load voltage (V)* multiplied by the *current (A)* that is required during normal operation. It is calculated by adding together the sealed VA of all components that might be operating simultaneously. Sealed VA is available from the component manufacturer.

PRIMARY VOLTAGE is the voltage available from the distribution system and its operational frequency, which is connected to the transformer *supply voltage (H)* terminals.

SECONDARY VOLTAGE is the voltage required for load operation, which is connected to the transformer *load voltage (X)* terminals.

¹ For units with class 105° C insulation system.

² For units with class 130° C insulation system.

³ For units with class 180° C insulation system.

Once the circuit variables have been determined, transformer selection is a simple four step process:

- 1) Based on the industry accepted formula: **Application Inrush VA = $\sqrt{((\text{Inrush VA})^2 + (\text{Sealed VA})^2)}$**
- 2) Refer to the regulation data chart. **If the load can tolerate a 10% voltage sag upon start-up select from the 90% secondary voltage column;** if only 5%, select from the 95% column.
- 3) After determining the proper secondary voltage column, read down until a value equal or greater than the Application Inrush VA is found. The numbers indicate the *maximum* Application Inrush VA that will still generate the required secondary voltage upon start-up.
- 4) Read left to the transformer VA column and select the proper transformer for the application. *As a final check make sure that the Transformer VA is equal or greater than the total Sealed VA requirements.*

Pick the VA rating requested + the secondary voltage. ie: 250VA @ 24 volts. The chart indicates a maximum 15 amp fuse

Pick the VA rating requested + the primary voltage. ie: 250Va @ 480 volts. The chart indicates a maximum 1-1/4 amp fuse.

SECONDARY AND PRIMARY OVERCURRENT PROTECTION

Secondary Voltage	VA RATING															
	25	50	75	100	150	200	250	300	350	500	750	1000	1500	2000	3000	5000
12	3-2/10	6-1/4	10	12	15	20	25	30	--	--	--	--	--	--	--	--
23	1-8/10	3-1/2	5	7	10	12	15	17-1/2	20	30	--	--	--	--	--	--
24	1-6/10	3-2/10	5	6-1/4	10	12	15	17-1/2	20	30	--	--	--	--	--	--
25	1-6/10	3-2/10	5	6-1/4	10	12	15	15	17-1/2	25	--	--	--	--	--	--
90	4/10	8/10	1-1/4	1-8/10	2-1/2	3-1/2	4-1/2	5	6-1/4	9	12	15	20	25	--	--
95	4/10	8/10	1-1/4	1-6/10	2-1/2	3-1/2	4	5	6	8	12	15	17-1/2	25	--	--
100	4/10	8/10	1-1/4	1-6/10	2-1/2	3-2/10	4	5	5-6/10	8	12	15	17-1/2	25	--	--
110	3/10	3/4	1-1/8	1-1/2	2-1/4	3	3-1/2	4-1/2	5	7-1/2	10	12	17-1/2	25	--	--
115	3/10	6/10	1	1-4/10	2	2-8/10	3-1/2	4	5	7	10	12	17-1/2	25	--	--
120	3/10	6/10	1	1-1/4	2	2-1/2	3-2/10	4	4-1/2	6-1/4	10	12	17-1/2	25	--	--
220	3/16	3/10	1/2	3/4	1-1/8	1-1/2	1-8/10	2-1/4	2-1/2	3-1/2	5-6/10	7-1/2	10	12	17-1/2	30
230	15/100	3/10	1/2	6/10	1	1-4/10	1-8/10	2	2-1/2	3-1/2	5	7	10	12	17-1/2	30
240	15/100	3/10	1/2	6/10	1	1-4/10	1-6/10	2	2-1/4	3-2/10	5	6-1/4	10	12	17-1/2	30

Primary Voltage	VA RATING															
	25	50	75	100	150	200	250	300	350	500	750	1000	1500	2000	3000	5000
115	1/2	1	1-6/10	2	3-2/10	4	5	6-1/4	7-1/2	10	15	20	30	--	--	--
120	1/2	1	1-1/2	2	3	4	5	6-1/4	7	10	15	20	30	--	--	--
200	3/10	6/10	8/10	1-1/4	1-8/10	2-1/2	3	3-1/2	4	6-1/4	9	12	17-1/2	25	--	--
208	3/10	6/10	8/10	1-1/8	1-8/10	2-1/4	3	3-1/2	4	6	9	12	17-1/2	20	--	--
220	1/4	1/2	8/10	1-1/8	1-6/10	2-1/4	2-8/10	3-2/10	3-1/2	5-6/10	8	10	15	20	30	--
230	1/4	1/2	8/10	1	1-6/10	2	2-1/2	3-2/10	3-1/2	5	8	10	15	20	30	--
240	1/4	1/2	3/4	1	1-1/2	2	2-1/2	3	3-1/2	5	7-1/2	10	15	20	30	--
277	2/10	4/10	6/10	8/10	1-1/4	1-8/10	2-1/4	2-1/2	3	4-1/2	6-1/4	9	12	17-1/2	25	--
380	15/100	3/10	4/10	6/10	8/10	1-1/4	1-6/10	1-8/10	2-1/4	3-2/10	4-1/2	6-1/4	9	12	17-1/2	30
400	15/100	3/10	4/10	6/10	8/10	1-1/4	1-1/2	1-8/10	2	3	4-1/2	6-1/4	9	12	17-1/2	30
415	15/100	3/10	4/10	6/10	8/10	1-1/8	1-1/2	1-8/10	2	3	4-1/2	6	9	12	17-1/2	30
440	1/8	1/4	4/10	1/2	8/10	1-1/8	1-4/10	1-6/10	1-8/10	2-8/10	4	5-6/10	8	10	15	25
460	1/8	1/4	4/10	1/2	8/10	1	1-1/4	1-6/10	1-8/10	2-1/2	4	5	8	10	15	25
480	1/8	1/4	3/10	1/2	3/4	1	1-1/4	1-1/2	1-8/10	2-1/2	3-1/2	5	7-1/2	10	15	25
550	1/10	2/10	3/10	4/10	6/10	8/10	1-1/8	1-1/4	1-1/2	2-1/4	3-2/10	4-1/2	6-1/4	9	12	20
575	1/10	2/10	3/10	4/10	6/10	8/10	1	1-1/4	1-1/2	2	3-2/10	4	6-1/4	8	12	20
600	1/10	2/10	3/10	4/10	6/10	8/10	1	1-1/4	1-4/10	2	3	4	6-1/4	8	12	20

- If the rated secondary current is less than 9 amps, the secondary rating of overcurrent protection is 167% maximum of rated secondary current.
- If the rated secondary current is 9 amps or greater, the secondary rating of overcurrent protection is 125% maximum of rated secondary current
- Primary rating of overcurrent protection is 250% maximum of rated primary current when secondary is protected by overcurrent protection.

Reference: NEC 450.3(B)

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