# MAGCOM Series

## Line Conditioners, Constant Voltage Transformers and DC Power Supplies

CIRCLE-C
TRANSFORMERS

# Principle of Operation

The Line Conditioner is designed to provide relatively constant output voltage when there are substantial fluctuations in the supply voltage. It is also used to isolate the critical load from both common-mode and transverse-mode electrical noise. The Line Conditioner may be considered as a combination of a voltage regulator and an electrical noise filter. Fluctuating supply voltage and electrical noise cause 99.5% of power related computer problems.

The basic component of the Line Conditioner is a ferroresonant transformer. A schematic circuit diagram of the ferroresonant transformer is shown in Fig. D1 and an outline drawing of a typical ferroresonant transformer is shown in Fig. D2.

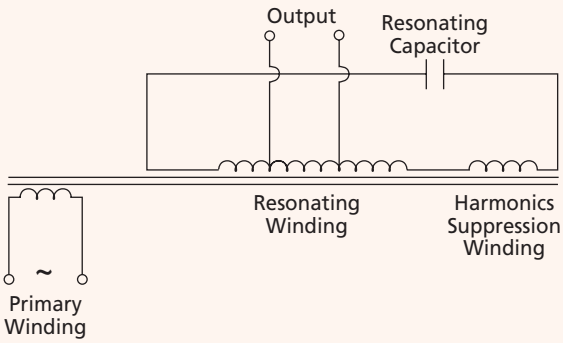



**Fig. D1 Schematic circuit diagram of a ferroresonant transformer**

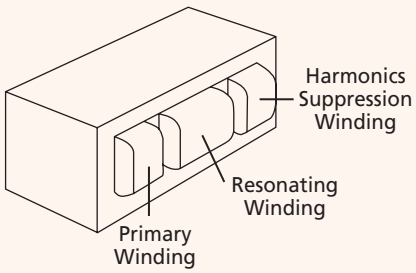



**Fig. D2 Typical physical arrangement of a ferroresonant transformer**

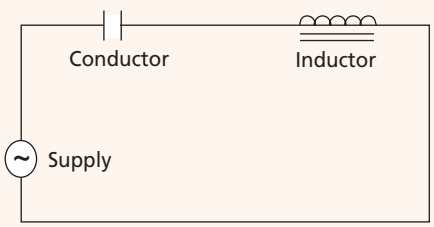



**Fig. D3 Series circuit that can exhibit ferroresonance**

## Brief description of ferroresonance

Ferroresonance is a saturated magnetic state that occurs under certain circumstances when an inductor having a ferromagnetic core is operated with a capacitor. Consider a series circuit consisting of an inductor and a capacitor shown in Fig. D3. The volt-ampere characteristic of the capacitor is illustrated in Fig. D4(a), and in Fig. D4(b) is shown the volt-ampere characteristic of the inductor. Note that the inductor exhibits saturation, i.e. the V/A curve flattens out. Illustrated in Fig. D4(c) is the volt-ampere characteristic of the series combination of capacitor and inductor. Note that there is a negative impedance region.

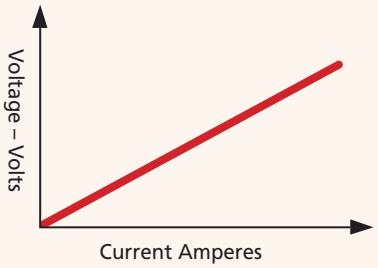



**Fig. D4(a) Capacitor V/A Characteristics**

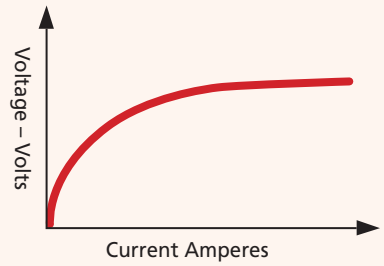



**Fig. D4(b) Inductor V/A Characteristics**

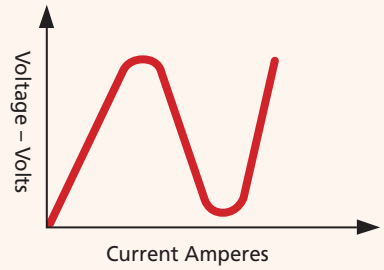



**Fig. D4(c) Volt-Ampere characteristics of the series combination of the inductor and capacitor**

This unusual volt-ampere characteristic results from the inductor having a nonlinear characteristic while the capacitor has a linear characteristic. The magnitude of the supply voltage is the difference between the amplitudes of the capacitor and inductor voltages since they are 180° out of phase with each other. Fig. D5 illustrates the relationship between the supply voltage and the inductor voltage of Fig. D3. Referring to Fig. D5, as the supply voltage is increased, the voltage across the inductor jumps to point B: this is the so-called"JUMP" phenomena associated with an inductor entering ferroresonance. If the supply is further increased to, say, point C, the voltage across the inductor is increased only slightly, i.e. for a substantial change in supply voltage, the voltage across the inductor has remained almost constant.

If the supply is gradually reduced, the voltage across the inductor remains almost constant until it reaches point D, at which time it drops to point E. Further reductions of the supply voltage also cause a reduction of the inductor voltage. Note that, when lowering the supply voltage from point C, the inductor voltage stays at high value beyond its "jump-up" point B. It remains in resonance until the supply is reduced to a relatively low value (point D) before there is a substantial drop in inductor volts.

The ferroresonance principle is used in the operation of the special transformer in line conditioners. The output section of the transformer is operated in a ferroresonant state where the output voltage changes only slightly for a large change in supply voltage. This slight change in output voltage can be reduced to almost zero by the series connection of a small voltage of opposite polarity in the output circuit. This is normally accomplished by a "bucking" winding wound over the primary winding, see Fig D6. The small reverse voltage counteracts the slight changes in output voltage as the supply voltage varies. While the inclusion of a "bucking" winding slightly improves the line regulation of the ferroresonant transformer, it reduces the transverse-mode electrical noise rejection capability and consequently it is rarely used in line conditioners.

The output waveform of a ferroresonant transformer (consisting of a primary and resonating winding) contains a substantial amount of harmonic content and tends to be relatively square. Since most computer installations require a sinusoidal supply, a harmonics suppression winding has been included in these ferroresonant transformers to achieve a sine wave output voltage.

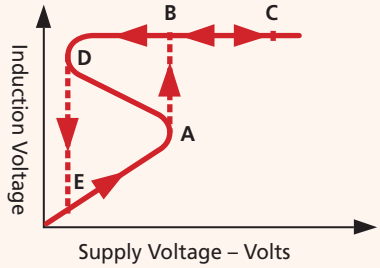



**Fig. D5 Relationship between the supply voltage and the inductor voltage for the circuit shown in Fig. D3**

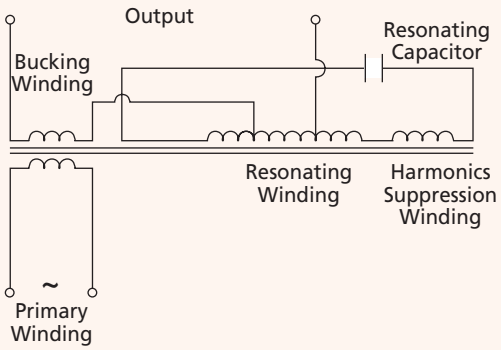



**Fig. D6 Schematic circuit diagram of a ferroresonant transformer including the "bucking" winding**

# Constant Voltage Transformers

## Line Conditioner

## Open Gear Tray type

## Features

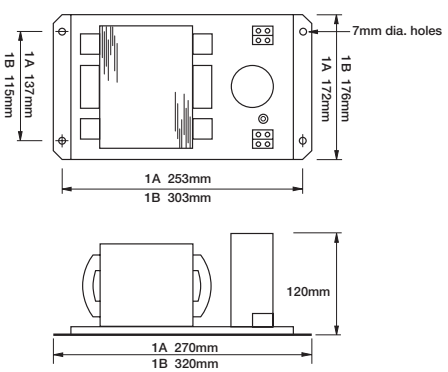
- Supply voltage 240VAC ±15%
- Output voltage regulated to 240VAC ±3%
- Other power rating (VA) sizes and non-standard voltage options available on request
- Power levels from 120VA~7500VA
- Inherent short circuit protection
- Safety to AS61558
- Provides a sinusoidal output with <3% harmonic distortion, irrespective of supply voltage distortion
- Durable ferro-resonant style transformer design
- High efficiency, typically 90%
- Available in open frame or enclosed style
- Higher rating models available on application

| Power VA | Style | Weight Kg | Power VA | Style | Weight Kg |
|---|---|---|---|---|---|
| 120 | 1A | 5.5 | 750 | 2 | 23 |
| 150 | 1A | 6.5 | 1000 | 2 | 24 |
| 200 | 1A | 8 | 1200 | 2 | 26 |
| 250 | 1A | 9 | 1500 | 2 | 30 |
| 300 | 1B | 13 | 2000 | 2 | 33 |
| 350 | 1B | 14 | 2500 | 3 | 38 |
| 400 | 1B | 17 | 3000 | 3 | 44 |
| 500 | 1B | 19 | 3500 | 3 | 51 |
| 600 | 1B | 22 | 4000 | 3 | 58 |
| 650 | 2 | 23 | 4500 | 3 | 66 |
| 700 | 2 | 23 | 5000 | 3 | 70 |

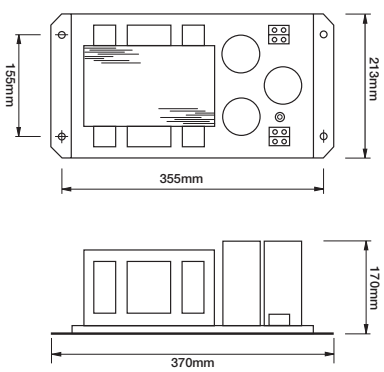
## Specifications

| | |
|---|---|
| INPUT VOLTAGE: | 240VAC ±15% |
| OUTPUT VOLTAGE: | 240VAC ±3% sinusoidal |
| OTHER VOLTAGES: | Up to 1000V on application |
| INPUT POWER FACTOR: | At full load, the input power factor will be greater than 0.9 when the input voltage is within the rated operating range and typically 0.98 at nominal supply voltage |
| LOAD POWER FACTOR: | The output voltage is influenced by the load power factor. A leading PF marginally increases the output voltage while a lagging PF decreases the output |
| FREQUENCY CHANGE: | The output voltage will change by 1.5% for 1% change in nominal supply frequency |
| OVERLOAD: | The line conditioner can tolerate overloads of up to 150% and still maintain output voltage. With a complete short circuit on the output, it will limit the output current to 200%, thereby protecting the unit from damage |
| HARMONIC DISTORTION: | The output waveform is sinusoidal with maximum distortion of less than 3%, even if the supply waveform is distorted |
| RESPONSE TIME: | The line conditioner will respond immediately to slow changes in load and supply voltage and within 30 milliseconds for abrupt changes. Stored energy in the capacitor circuit of the ferro-resonant transformer allows the unit to maintain full output for a total loss of up to 3 milliseconds |
| NOISE REJECTION: | Common mode rejection greater than 120dB for frequencies up to 1MHz and transverse mode rejection greater than 60dB for 10KHz~1MHz frequencies |
| OPERATING TEMPERATURE: | -20°C to +55°C at 100% load |
| REGULATION: | ±3% for variations of ±15% at input |
| CONSTRUCTION: | Open frame, gear plate mounting for hard wiring |
| EMC: | AS4251 |

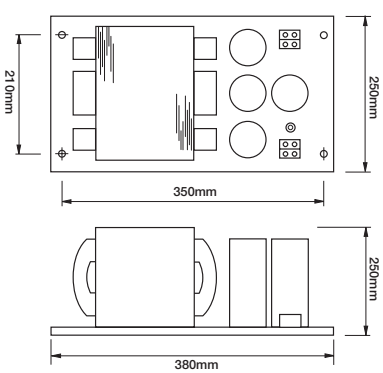
STYLE 1




STYLE 2




STYLE 3



Volt Meter optional

# Enclosed Line Conditioners

## Features

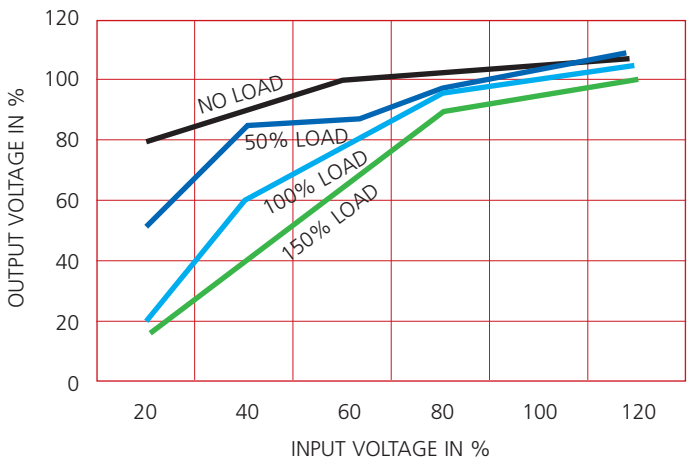
- Supply voltage 240VAC ±15%
- Output voltage regulated to 240VAC ±3%
- Power levels from 100VA~5000VA
- Inherent short circuit protection
- Safety to AS61558
- Provides a sinusoidal output with <3% harmonic distortion, irrespective of supply voltage distortion
- Durable ferro-resonant style transformer design
- High efficiency, typically 90%
- Available in open frame or enclosed style
- Other non-standard voltage options available on request

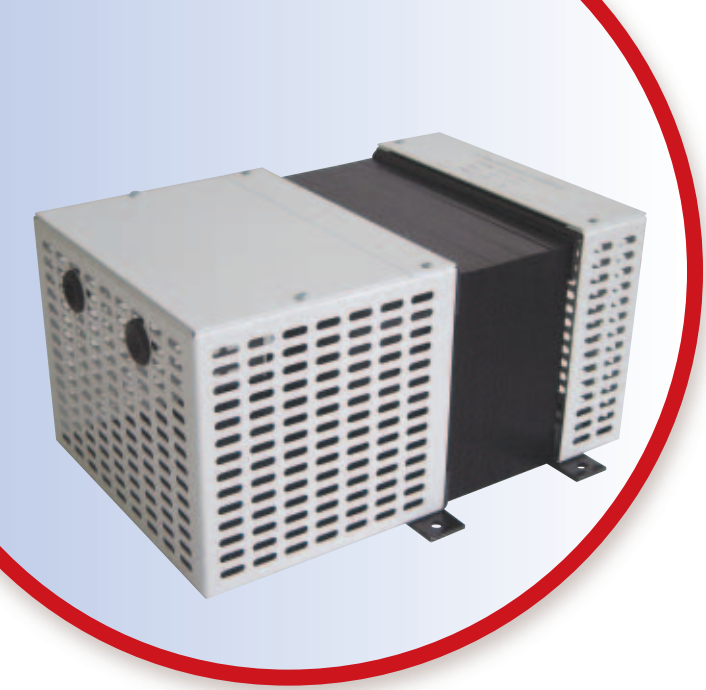
| Model | Input VAC | Output VAC | Power VA | Case |
|---|---|---|---|---|
| LC350E | 240VAC | 240VAC | 350VA | 2 |
| LC400E | 240VAC | 240VAC | 400VA | 2 |
| LC500E | 240VAC | 240VAC | 500VA | 2 |
| LC600E | 240VAC | 240VAC | 600VA | 2 |
| LC750E | 240VAC | 240VAC | 750VA | 2 |
| LC1000E | 240VAC | 240VAC | 1000VA | 2 |
| LC1200E | 240VAC | 240VAC | 1200VA | 3 |
| LC1500E | 240VAC | 240VAC | 1500VA | 3 |
| LC2000E | 240VAC | 240VAC | 2000VA | 3 |
| LC2500E | 240VAC | 240VAC | 2500VA | 3 |
| LC3000E | 240VAC | 240VAC | 3000VA | 3 |
| LC3500E | 240VAC | 240VAC | 3500VA | 3 |
| LC4000E | 240VAC | 240VAC | 4000VA | 3 |
| LC4500E | 240VAC | 240VAC | 4500VA | 3 |
| LC5000E | 240VAC | 240VAC | 5000VA | 3 |

- **Standard models with 240VAC 50Hz input and output with standard GPO sockets.**
- Many other options such as 240V/115V, 415V/240V available on request
- Add "H" for hard wired option (no sockets)

## Specifications

| | |
|---|---|
| INPUT VOLTAGE: | 240VAC ±15% |
| OUTPUT VOLTAGE: | 240VAC ±3% sinusoidal |
| INPUT POWER FACTOR: | At full load, the input power factor will be greater than 0.9 when the input voltage is within the rated operating range and typically 0.98 at nominal supply voltage |
| LOAD POWER FACTOR: | The output voltage is influenced by the load power factor. A leading PF marginally increases the output voltage while a lagging PF decreases the output |
| FREQUENCY CHANGE: | The output voltage will change by 1.5% for 1% change in nominal supply frequency |
| OVERLOAD: | The line conditioner can tolerate overloads of up to 150% and still maintain output voltage. With a complete short circuit on the output, it will limit the output current to 200%, thereby protecting the unit from damage |
| HARMONIC DISTORTION: | The output waveform is sinusoidal with maximum distortion of less than 3%, even if the supply waveform is distorted |
| RESPONSE TIME: | The line conditioner will respond immediately to slow changes in load and supply voltage and within 30 milliseconds for abrupt changes. Stored energy in the capacitor circuit of the ferro-resonant transformer allows the unit to maintain full output for a total loss of up to 3 milliseconds |
| NOISE REJECTION: | Common mode rejection greater than 120dB for frequencies up to 1MHz and transverse mode rejection greater than 60dB for 10KHz~1MHz frequencies |
| OPERATING TEMPERATURE: | -20°C to +55°C at 100% load |
| REGULATION: | ±3% for variations of ±15% at input |
| CONSTRUCTION: | Fully enclosed with GPO sockets or fixed wiring |
| EMC: | AS4251 |
| DIMENSIONS & WEIGHT: | Case size 1: 300 x 215 x 220mm, 8-12kg<br>Case size 2: 395 x 280 x 280mm, 13-28kg<br>Case size 3: 490 x 320 x 360mm, 30-70kg |





# Caged Line Conditioners

## Constant Voltage Transformer

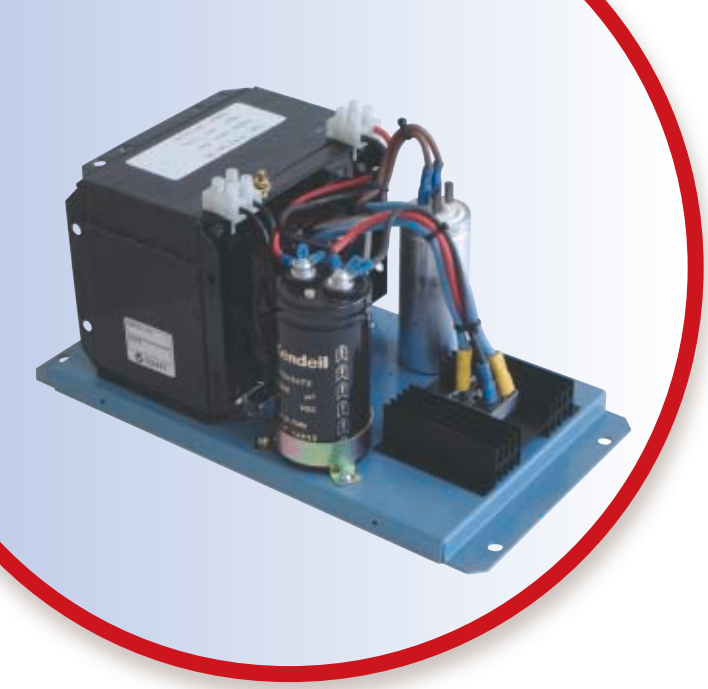
## Features

- Supply voltage ±15% of nominated voltage
- Output voltage regulated to ±3% of nom. voltage
- Power levels from 400VA~2000VA
- Inherent short circuit protection
- Safety to AS61558
- Provides a sinusoidal output with <3% harmonic distortion, irrespective of supply line distortion
- Durable ferro-resonant style transformer design
- High efficiency, typically 90%
- Higher rating models available on application

| Power Rating | Length | Width | Height | Weight |
|---|---|---|---|---|
| 400VA | 267mm | 205 | 165 | 18kg |
| 500VA | 280mm | 205 | 165 | 20kg |
| 600VA | 293mm | 205 | 165 | 23kg |
| 750VA | 312mm | 205 | 165 | 24kg |
| 1000VA | 318mm | 205 | 165 | 26kg |
| 1200VA | 337mm | 205 | 165 | 28kg |
| 1500VA | 347mm | 205 | 165 | 31kg |
| 2000VA | 375mm | 205 | 165 | 38kg |

## Specifications

| | |
|---|---|
| INPUT VOLTAGE: | 240VAC ±15% (standard) or 110V (standard) (non-standard voltages available) |
| OUTPUT VOLTAGE: | 240VAC ±3% sinusoidal (standard) (non-standard voltages available) |
| OTHER VOLTAGES: | Up to 1000V on application |
| INPUT POWER FACTOR: | At full load, the input power factor will be greater than 0.9 when the input voltage is within the rated operating range and typically 0.98 at nominal supply voltage |
| LOAD POWER FACTOR: | The output voltage is influenced by the load power factor. A leading PF marginally increases the output voltage while a lagging PF decreases the output |
| FREQUENCY CHANGE: | The output voltage will change by 1.5% for 1% change in nominal supply frequency |
| OVERLOAD: | The line conditioner can tolerate overloads of up to 150% and still maintain output voltage. With a complete short circuit on the output, it will limit the output current to 200%, thereby protecting the unit from damage |
| HARMONIC DISTORTION: | The output waveform is sinusoidal with maximum distortion of less than 3%, even if the supply waveform is distorted |
| RESPONSE TIME: | The line conditioner will respond immediately to slow changes in load and supply voltage and within 30 milliseconds for abrupt changes. Stored energy in the capacitor circuit of the ferro-resonant transformer allows the unit to maintain full output for a total loss of up to 3 milliseconds |
| NOISE REJECTION: | Common mode rejection greater than 120dB for frequencies up to 1MHz and transverse mode rejection greater than 60dB for 10KHz~1MHz frequencies |
| OPERATING TEMPERATURE: | -20°C to +55°C at 100% load |
| REGULATION: | ±3% for variations of ±15% at input |
| CONSTRUCTION: | Cable entries for hard wiring or flex and plug input with output GPO sockets |
| EMC: | AS4251 |



# AC/DC Ferroresonant Power Supplies

## Features

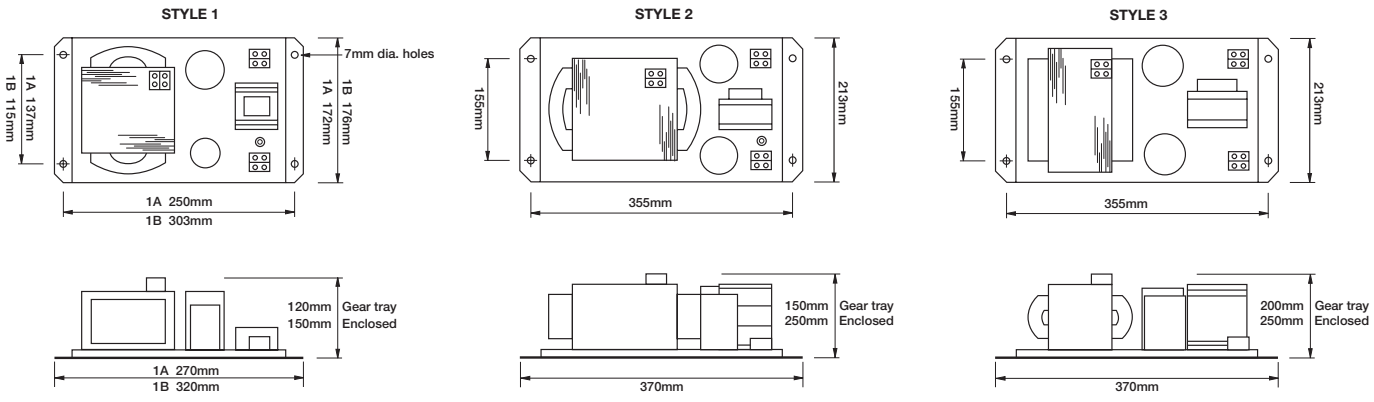
- Ferro-resonant transformer, does not need to be fused
- Withstands indefinite overload and short circuit conditions
- Electrostatic shielding between primary and secondary windings
- Can be connected in parallel for high power systems
- Battery charging option
- Convection cooling, fans not required
- Simple design, high reliability
- Transformer input can handle mains surges of up to 55% and transients up to 2000V
- 60W to 1000W models
- Not to be used with unstable frequency such as generators
- Higher rating models available on application

## Specifications

| | |
|---|---|
| INPUT VOLTAGE: | 240VAC (190~275V)<br>415VAC (350~470V) |
| FREQUENCY: | 50Hz, other options on request |
| EFFICIENCY | Model dependent 75~80% |
| LINE REGULATION: | ±1.5% over ±15% mains input swing |
| LOAD REGULATION: | <4.0% for 20% to 100% load |
| RIPPLE: | <1.5V pk-pk at rated load |
| CURRENT LIMIT: | Set at 120~150% of rated current |
| OUTPUT VOLTAGE: | 12V and 24V are standard, other options on request |
| OUTPUT POWER: | 60~720 watts, other options on request |
| OPERATING TEMPERATURE: | -10°C to +70°C at 100% load open frame |
| HUMIDITY: | 10~95% RH non-condensing |
| CONNECTIONS: | Screw terminal type |
| PACKAGE: | Open frame or enclosed |
| SAFETY: | Designed to comply with AS61558 |
| PARALLEL OPERATION: | Yes |
| SERIES OPERATION: | Yes |

| Model | Output V | Output A | Voltage Range | Power W | Weight | Style |
|---|---|---|---|---|---|---|
| CVT12-5 | 12V | 5A | 12/13.8V | 60W | 6kg | 1A |
| CVT12-10 | 12V | 10A | 12/13.8V | 120W | 7kg | 1A |
| CVT12-20 | 12V | 20A | 12/13.8V | 240W | 10kg | 1B |
| CVT24-5 | 24V | 5A | 24/28V | 120W | 7kg | 1A |
| CVT24-10 | 24V | 10A | 24/28V | 240W | 10kg | 1B |
| CVT24-15 | 24V | 15A | 24/28V | 360W | 15kg | 2 |
| CVT24-20 | 24V | 20A | 24/28V | 480W | 17kg | 3 |
| CVT24-30 | 24V | 30A | 24/28V | 720W | 21kg | 3 |

- Output transformer tap allows 12V models to be set to 13.8V and 24V to 28V
- Models illustrated at right are 240VAC input
- **For enclosed type add "E" to model: CVT24-10-E**
- **For 415VAC input add"415" to Model: CVT24-10-415**



# AC Line Conditioners Ordering Code

## Sample Order

LC 2500/120/110 GT

- LC — LINE CONDITIONER (CVT)
- 2500 — POWER RATING (VA)
- 120 — PRIMARY VOLTAGE
- 110 — SECONDARY VOLTAGE
- GT — MOUNTING METHOD

GT = Open Gear Tray Mounted
C = Cage Type Enclosures
E = Totally Enclosed

## Other Circle-C Manufactured Products

- Single Phase Heavy Duty Mining Type Transformers to 100kVA up to 1000V and 3.3 kV, 50kVA up to 6.6kV and 11kV
- Three Phase Heavy Duty Mining Type Transformers to 250kVA up to 1000V, up to 200kVA, 3.3kV and 150kVA, 6.6kV and 11kV
- Single Phase General Industry Transformers to 20kVA
- Three Phase General Industry Transformers to 25kVA up to 1000V
- Single and Three Phase Reactors up to 11kV (up to 3.3kV 3 phase)
- Cast Resin, Taped, Oil Immersion Current Transformers to 33KV – Protection and Metering types
- Voltage Transformers Dry and Oil Immersion type to specified class to 33kV
- Neutral Earthing and Zig-Zag and special application transformers up to 11kV
- Pole/Platform Mounting Metering Units for accurate measurement of voltage, current – oil filled
- Many other special application wire wound products to customer specification

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