

Harsh Environment Elephant Power Supply Installation Guide



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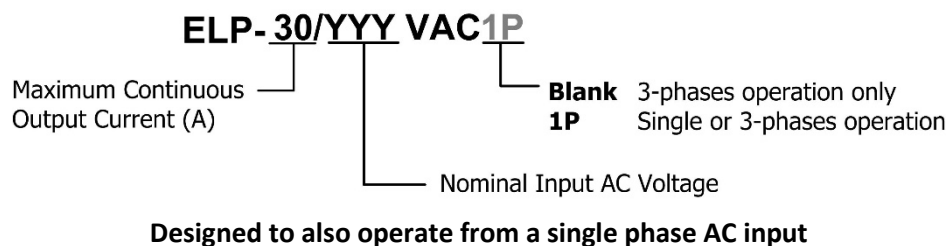
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Catalog Number





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Chapter 1: Operating Safely

In order to operate the Elephant power supply safely, it is imperative that you implement the safety procedures included in this installation guide. This information is provided to protect you and to keep your work area safe when using the Power Supply.

Please read this chapter carefully, before you begin the installation process.

Before you start, make sure that all system components are connected to earth ground. Electrical safety is provided through a low-resistance earth connection.

Only qualified personnel may install, adjust, maintain and repair the product. A qualified person has the knowledge and authorization to perform tasks such as transporting, assembling, installing, commissioning and operating power-supplies, drives and motors.

The Elephant power supply contains electrostatic-sensitive components that can be damaged if handled incorrectly. To prevent any electrostatic damage, avoid contact with highly insulating materials, such as plastic film and synthetic fabrics. Place the product on a conductive surface and ground yourself in order to discharge any possible static electricity build-up.

To avoid any potential hazards that may cause severe personal injury or damage to the product during operation, keep all covers and cabinet doors shut.

The following safety symbols are used in this manual:



Warning:

This information is needed to avoid a safety hazard, which might cause bodily injury.



Caution:

This information is necessary for preventing damage to the product or to other equipment.



1.1 Warnings

- To avoid electric arcing and hazards to personnel and electrical contacts, never connect/disconnect the Elephant power supply while the power source is on.
- Disconnect the Elephant power supply from all voltage sources before it is opened for servicing.
- The Elephant power supply contains grounding conduits for electric current protection. Any disruption to these conduits may cause the instrument to become hot (live) and dangerous.
- After shutting off the power and removing the power source from your equipment, wait as described in the tables below, before touching or disconnecting parts of the equipment that are normally loaded with electrical charges (such as capacitors or contacts). It is recommended to measure the electrical contact points with a DVM before touching the equipment.

| T.P. # | Function | Ref. | Results |
|--------|--|----------|---------|
| 1 | Discharge time with no load | VP+, VN- | 26 sec |
| 2 | Discharge time while the Elephant is connected to Elmo drive at MO=0 | VP+, VN- | 22 sec |
| 3 | Discharge time with maximum load up to 30 A | VP+, VN- | 2 msec |

Table 1: 480 VAC Model



1.2 Cautions

- The Elephant power supply contains hot surfaces and electrically charged components during operation.
- The maximum AC/DC power supply connected to the instrument must comply with the parameters outlined in this guide.
- Before switching on the Elephant power supply, verify that all safety precautions have been observed and that the installation procedures in this manual have been followed.

1.3 Directives and Safety Standards

The Elephant power supply has been developed, produced, tested and documented in accordance with the relevant standards (refer to section 2.5.2 Directives and Standards). Elmo Motion Control is not responsible for any deviation from the configuration and installation described in this documentation. Furthermore, Elmo is not responsible for the performance of new measurements or ensuring that regulatory requirements are met.



1.4 CE Mark Conformance

The Elephant power supply is intended for incorporation in a machine or end product. The actual end product must comply with all safety aspects of the relevant requirements of the European Safety of Machinery Directive 98/37/EC as amended, and with those of the most recent versions of standards **EN 60204-1** and **EN 292-2** at the least.

According to Annex III of Article 13 of Council Directive 93/68/EEC, amending Council Directive 73/23/EEC concerning electrical equipment designed for use within certain voltage limits, the Elephant power supply meets the provisions outlined in Council Directive 73/23/EEC. The party responsible for ensuring that the equipment meets the limits required by EMC regulations is the manufacturer of the end product.

1.5 Warranty Information

The products covered in this manual are warranted to be free of defects in material and workmanship and conform to the specifications stated either within this document or in the product catalog description. All Elmo power supplies are warranted for a period of 12 months from the time of installation, or 12 months from time of shipment, whichever comes first. No other warranties, expressed or implied — and including a warranty of merchantability and fitness for a particular purpose — extend beyond this warranty.



Chapter 2: Product Description



The Elephant power supply is a compact direct-to-mains power supply designed to power multiple servo drives up to 528 VAC. It was designed to complement Elmo servo drives that do not include an integrated power supply. It has the following features:

- Rectifies AC input voltages of up to 3×600 VAC (single phase operation is available for 36 VAC, 60 VAC, 120 VAC, and 230 VAC models), into filtered DC voltage with an output current of 30 A continuous and a 60 A peak.
- Operates directly from the mains when feeding isolated servo drives or via an isolation transformer when non- isolated servo drives are employed.
- Regenerating & braking capability that enables fast servo and braking operation.
- Built-in active zero crossing inrush current limiters that limit the power-on currents to low levels, reducing turn-on stress from the mains.
- Internal EMC filtering that eliminates the necessity for external devices, therefore complies with CE and other EMC regulations.
- A Book Shelf (Panel Mount) structure, enabling simple and fast mounting.

2.1 Standard Features

- 30 A continuous output current (60A peak)
- AC input DC to 500 Hz
- Three-phase operation
- Single-phase operation with "1P" suffix (available for 36 VAC, 60 VAC, 120 VAC, and 230 VAC models)
- Direct-to-mains operation
- High regenerative (braking) capability
- Active zero crossing inrush current limit
- EMC filtering "inside"
- UL, CE, compliant



2.2 Enable DC Output

This feature in the Elephant allows direct control of the Mains rectifying bridge. Whenever the Enable-input is energized, using Pins 3, 4 of the Control Connector to input DC voltage i.e **Enable** output voltage, the rectifying-bridge is activated and ready to rectifying AC voltage. Whenever the Enable-input is not active, the Mains rectifying bridge is disabled, and no high DC -voltage is present at the DC output-connector.

However, it is possible to bypass this (**Enable**), by connecting a jumper between the two pins of the Enable Bypass connector. For details refer to sections 3.3.4.13.3.4.2 and 3.3.4.33.3.4.2.

2.3 Duty Cycle Protection

The Elephant power supply includes a duty cycle limiter, which inhibits shunt whenever On and Off time exceeds 2%. This feature protects the shunt regulator when high-inertia loads are driven by the servo drive(s) or when too high AC voltage is applied to the power supply (i.e. DC output is already above the threshold of the shunt).

2.3.1 Shunt Regulator

A shunt regulator is included in the power supply section of the Elephant. The shunt regulator is a switching type, wherein dissipative elements (power resistors) are switched across the DC bus, whenever the voltage reaches a predetermined level. The function of the shunt regulator is to regulate the voltage of the DC bus during the period of motor deceleration, when there is a net energy outflow from the motor to the servo drive, to prevent the servo drive from disabling itself as a result of an "over-voltage" type reason.

When the capacitors charge-up reaches the predetermined shunt threshold level, the shunt regulator begins its regulating action. The bus is regulated to the specific model type voltage, until the regeneration-energy is dissipated.

2.4 Over Voltage Protection

The Elephant power supply has been fitted with an over-voltage protection mechanism, providing protection from very high AC input voltage than defined by the hardware. Whenever a voltage input higher than the Max Input AC Voltage occurs, the over-voltage protection mechanism shuts down the bridge rectifier and disables the output voltage.



2.5 Technical Specifications

This chapter describes the relevant technical data applicable to the Elephant.

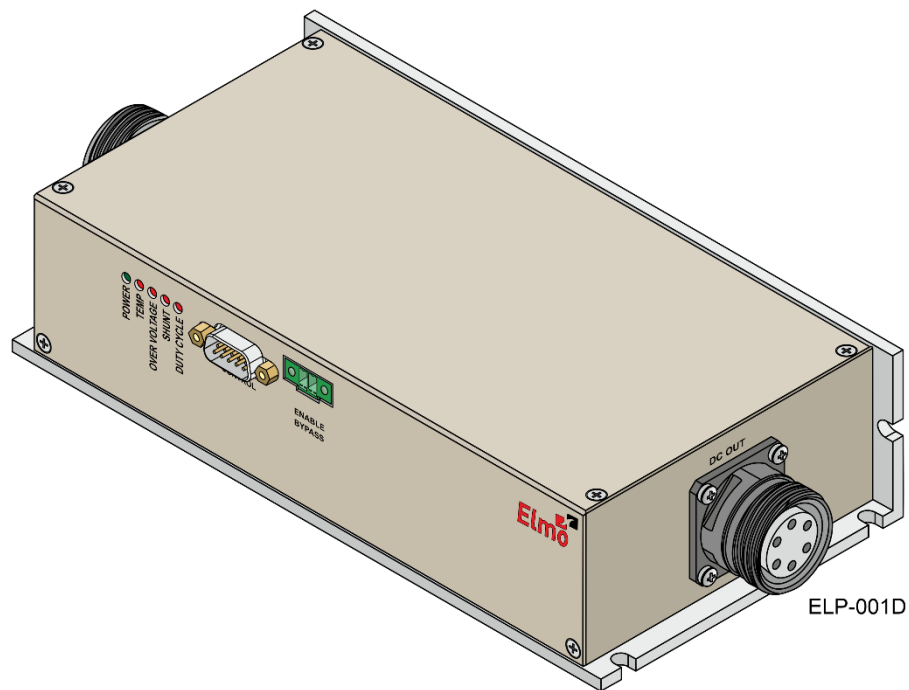


Figure 1: Elephant Power Supply



2.5.1 Environment Conditions

This product is designed, manufactured and tested to meet extreme environmental conditions. The **durability** of the Elephant is qualified, verified and tested according to the most severe environmental, EMC and safety standards supporting the following extended environmental conditions.

| Feature | Operation Conditions | Range |
|----------------------------------|--------------------------|---|
| Ambient Temperature Range | Non-operating conditions | -50 °C to +100 °C (-58 °F to 212 °F) |
| | Operating conditions | -40 °C to +70 °C (-40 °F to 160 °F) |
| Temperature Shock | Non-operating conditions | -40 °C to +70 °C (-40 °F to 160 °F) within 3 min |
| Altitude | Non-operating conditions | Unlimited |
| | Operating conditions | -400 m to 12,000 m (-1312 to 39370 feet) |
| Maximum Humidity | Non-operating conditions | Up to 95% relative humidity non-condensing at 35 °C (95 °F) |
| | Operating conditions | Up to 95% relative humidity non-condensing at 25 °C (77 °F), up to 90% relative humidity non-condensing at 42 °C (108 °F) |
| Vibration | Operating conditions | 20 Hz to 2,000 Hz, 14.6 g |
| Mechanical Shock | Non-operating conditions | ±40g; Half sine, 11 msec, 3 per direction (overall 18) |
| | Operating conditions | ±20g; Half sine, 11 msec, 3 per direction (overall 18) |



2.5.2 Directives and Standards

The following table describes the industry main and safety standards that the Elephant power supply conforms to:

| Main and Safety Standards | Item |
|---|---|
| The related standards below apply to the performance of the servo drives as stated in the environmental conditions in section 2.5.1 Environment Conditions above. | |
| In compliance with IEC/EN 61800-5-1 | Adjustable speed electrical power drive systems Safety requirements – Electrical, thermal and energy |
| In compliance with UL61800-5-1 | Adjustable speed electrical power drive systems Safety requirements – Electrical, thermal and energy |
| In compliance with UL 508C | Power Conversion Equipment |
| In compliance with UL 840 | Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment |
| In compliance with CE 2006/95/EC | Low-voltage directive 2006/95/EC |
| In compliance with CSA C22.2 No. 274-13 | Industrial Control Equipment |
| In compliance with UL 60950-1 (formerly UL 1950) | Safety of Information Technology Equipment, Including Electrical Business Equipment |
| In compliance with EN 60204-1 | Low Voltage Directive, 73/23/EEC |



2.5.3 Housing Dimensions of the Elephant Models

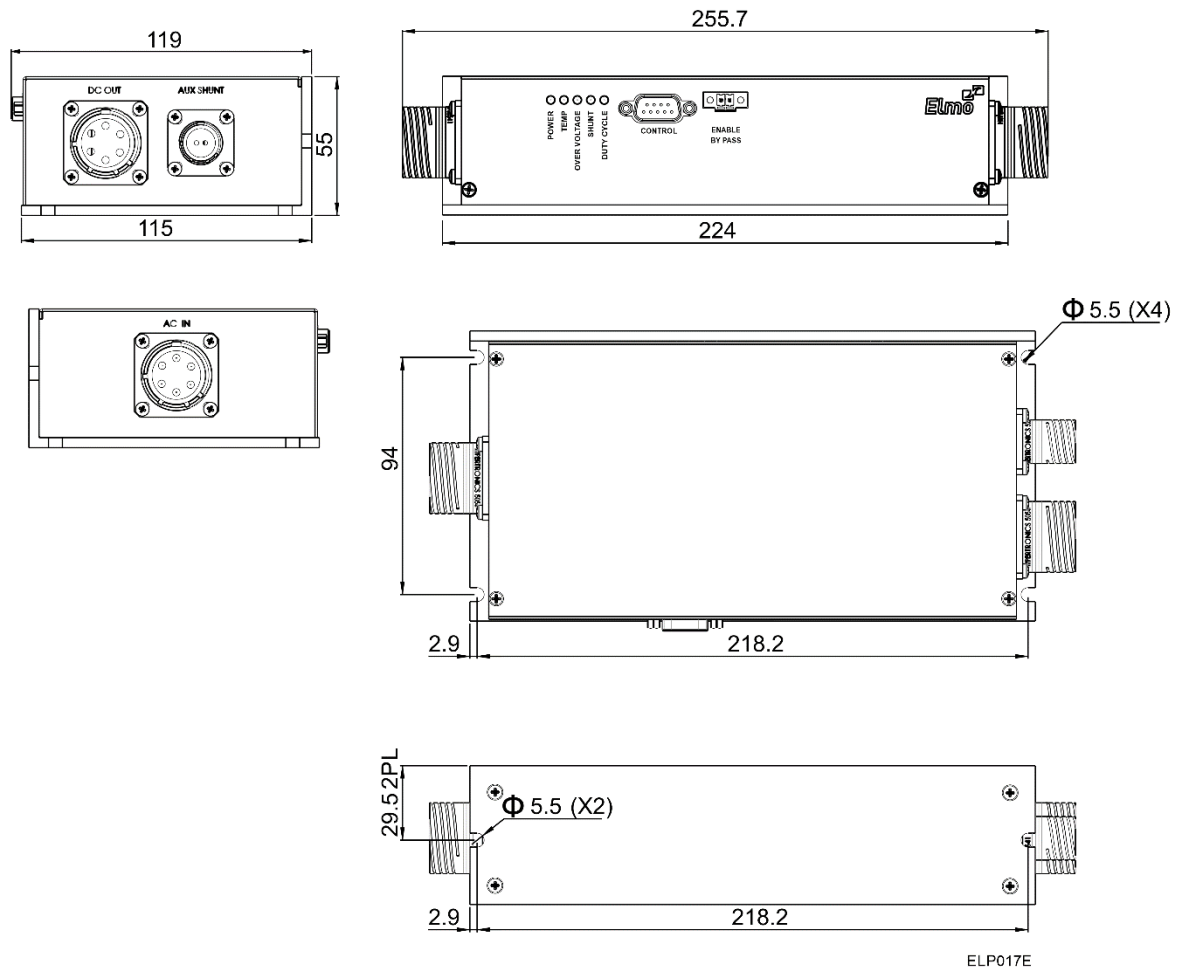


Figure 2: Elephant Dimensions - Housing



2.5.4 Electrical and Mechanical Specifications

| Power Supply | Unit | ELP-30/36VAC | | ELP-30/60VAC | | ELP-30/120VAC | |
|---|------|--------------|--------------------------|--------------|--------------------------|---------------|----------------------------|
| | | | 1P | | 1P | | 1P |
| Nominal Input AC Voltage | VAC | 3×36 | 1X36 3×36 | 3×60 | 1X60 3×60 | 3×120 | 1X120 3×120 |
| Max Input AC Voltage | VAC | 3×38 (L-L) | 1×38 (L-L) 3×38 (L-L) | 3×61 (L-L) | 1×61 (L-L) 3×61 (L-L) | 3×131 (L-L) | 1×131 (L-L) 3×131 (L-L) |
| Max Output Power Cont. | W | 1650 | | 2700 | | 5700 | |
| Max Output Power Peak | W | 3300 | | 5400 | | 11400 | |
| Nominal DC bus Output (at nominal AC Voltage) | VDC | 50 | | 85 | | 170 | |
| Shunt Power (Peak) ¹ | kW | 1.8 | | 4.5 | | 5.5 | |
| DC Output Cont. Current | A | 30 | | 30 | | 30 | |
| DC Output Peak Current | A | 60 | | 60 | | 60 | |
| Mating Drives | | XXX-YY/60 | | XXX-YY/100 | | XXX-YY/200 | |
| Weight | gr | 1155 | | 1155 | | 1155 | |

| Power Supply | Unit | ELP-30/230VAC | | ELP-30/480VAC | | ELP-30/600VAC | |
|---|------|---------------|----------------------------|---------------|--|---------------|--|
| | | | 1P | | | | |
| Nominal Input AC Voltage | VAC | 3×230 | 1x230 3×230 | 3×480 | | 3×500 | |
| Max Input AC Voltage | VAC | 3×270 (L-L) | 1×270 (L-L) 3×270 (L-L) | 3×528 (L-L) | | 3×600 (L-L) | |
| Max Output Power Cont. | W | 11400 | | 21000 | | 25200 | |
| Max Output Power Peak | W | 22800 | | 42000 | | 50400 | |
| Nominal DC bus Output (at nominal AC Voltage) | VDC | 325 | | 678 | | 707 | |
| Shunt Power (Peak) ¹ | kW | 6.0 | | 6.7 | | 8.8 | |
| DC Output Cont. Current | A | 30 | | 30 | | 30 | |
| DC Output Peak Current | A | 60 | | 60 | | 60 | |
| Mating Drives | | XXX-YY/400 | | XXX-YY/800 | | XXX-YY/900 | |
| Weight | gr | 1155 | | 1155 | | 1155 | |

Table 2: Elephant Electrical Specifications

NOTE 1: For a power supply with an additional external shunt, consult Elmo for details.



Chapter 3: Installation

This chapter describes the installation of the Elephant power supply.

3.1 Before You Begin

3.1.1 Site Requirements

You can guarantee the safe operation of the Elephant by ensuring that it is installed in an appropriate environment.

| Feature | Value |
|---|------------------------------------|
| Ambient operating temperature | -40 °C to 70 °C (-40 °F to 160 °F) |
| Maximum non-condensing humidity | 90% |
| Models for extended environmental conditions are available. | |



Caution: The Elephant dissipates its heat by convection. The maximum ambient operating temperature of -40 °C to 70 °C (-40 °F to 160 °F) must not be exceeded.

3.1.2 Hardware Requirements

3.1.2.1 AC Input Requirements

| Circuit Breakers & Contacts | Three-Phase Supply Voltage | Single-Phase Supply Voltage |
|--------------------------------|---|-----------------------------|
| Circuit breaker current rating | 32 A Type C | 40 A Type C |
| Circuit breaker voltage rating | 250 VAC / 480 VAC depending upon operating AC voltage | |
| Contactor | 32 A | 40 A |

3.1.2.2 Recommended Wire Cross-Sections (All Models)

| Feature | Connection | Details |
|------------------|---------------|-------------------------------|
| AC input | AC1, AC2, AC3 | 2.08 mm ² , 14 AWG |
| DC Output | VP+, VN- | 2.08 mm ² , 14 AWG |
| Protective earth | PE | 2.08 mm ² , 14 AWG |



3.2 Unpacking the Components

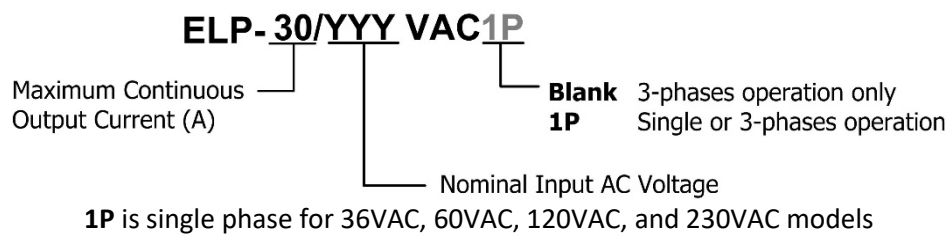
To unpack the Elephant:

1. Carefully remove the power supply from the box and Styrofoam.
2. Check the product to ensure that there is no visible damage. If any damage has occurred, report immediately to the carrier that delivered your product.
3. To ensure that the Elephant you have unpacked is the appropriate type for your requirements, locate the part number sticker on the product.



ELP-004C

The Part number provides the type designation.



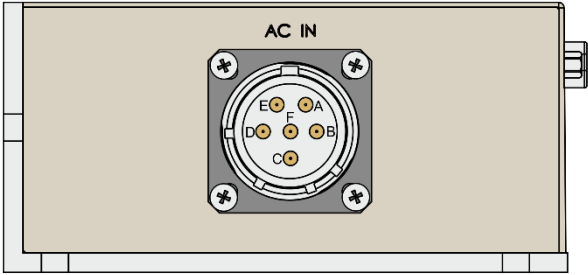
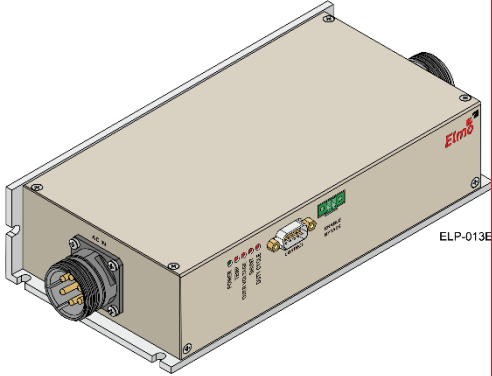
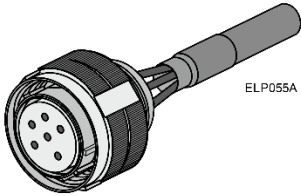
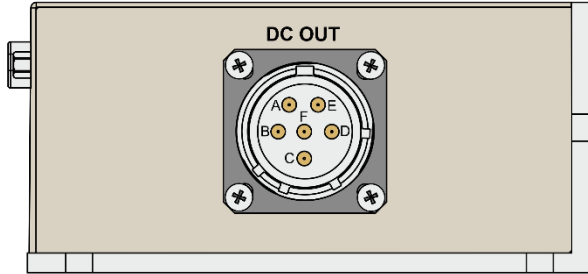
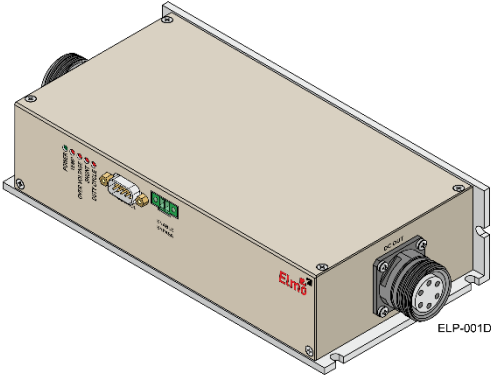
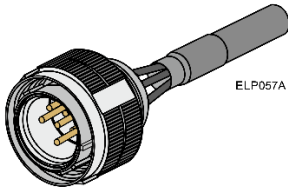
4. Verify that the Elephant model is the one you ordered, and ensure that the voltage meets your specific requirements.



3.3 Connectors

3.3.1 Connector Types for Elephant Models

The Elephant requires the following external mating connectors:

| No. Pins | Type | Function | Connector |
|--|-----------------|---------------|---|
| Input Connector | | | |
|  ELP012D | | |  ELP-013E |
| 1 × 6 pins | Amphenol Male | Main AC Input |  ELP055A 6-Pin Amphenol Female Connector (D38999/26WE6SN) |
| Output Connectors | | | |
|  ELP014E | | |  ELP-001D |
| 1 × 6 pins | Amphenol Female | DC Outputs |  ELP057A 6-Pin Amphenol Male Connector (D38999/26WE6PA) |



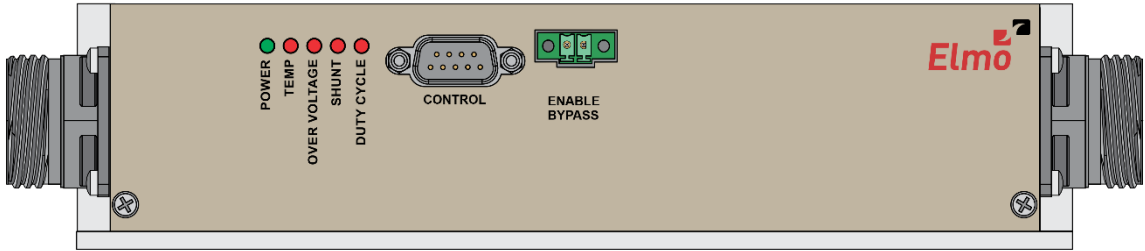
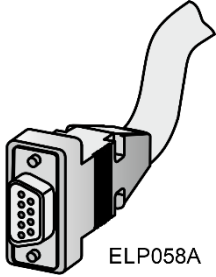

| | | | |
|--|-----------------------------|-------------------|---|
|  <p>ELP-056A</p> | | | |
| 1 x 9 pins | 9-Pin Male D-Type Connector | Control connector |  <p>ELP058A</p> <p>9-Pin Female D-Type Connector</p> |
| 1 x 2 pins | Pheonix connector | Bypass connector |  <p>2-Pin Pheonix connector (MC 1,5/2-STF-3,5)</p> |

Table 3: Connector Types for Elephant Models



3.3.2 Main AC Input Power Connector Pinout

Refer to Section 3.4.6 for details of the connections.

| Pin | Signal | Function |
|-----|---------------------------|----------|
| A | AC Input Phase - R | AC input |
| B | AC Input Phase - S | AC input |
| C | AC Input Phase - T | AC input |
| D | PE Mains Protective Earth | PE |
| E | Not Connected | N. C. |
| F | Not Connected | N. C. |

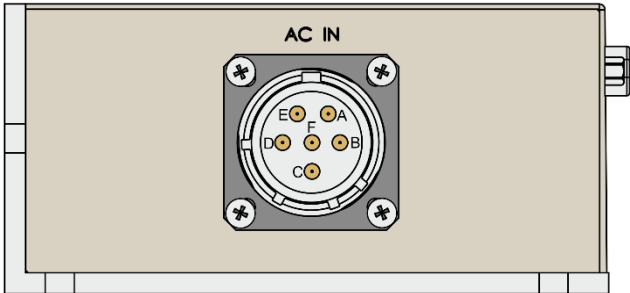
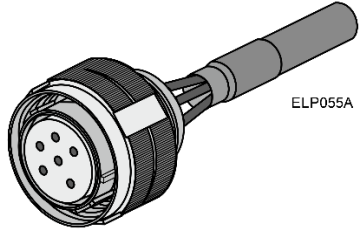
| | |
|--|--|
|  <p>ELP012D</p> <p>6-Pin Amphenol Male Connector</p> |  <p>ELP055A</p> <p>6-Pin Amphenol Female Connector (D38999/26WE6SN)</p> |
|--|--|

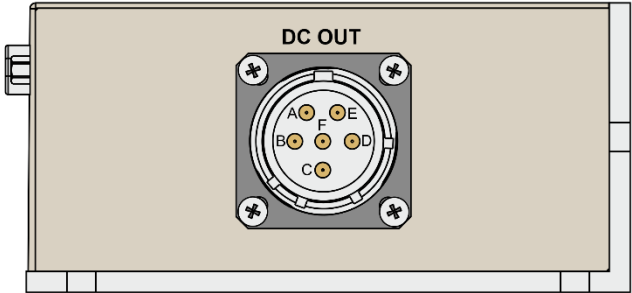
Table 4: Main AC Input Connector Pinout



3.3.3 DC-Output Connector Pinout

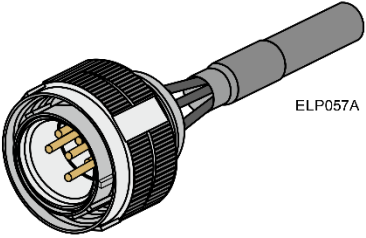
Refer to Section 3.4.7 for details of the connections.

| Pin | Signal | Function |
|-----|----------------------------|----------------------------|
| A | VP+, Positive Power output | DC output cable to a drive |
| B | VN-, Negative Power output | DC output cable to a drive |
| C | PE (Protective Earth) | DC output cable to a drive |
| D | PE (Protective Earth) | DC output cable to a drive |
| E | VP+, Positive Power output | DC output cable to a drive |
| F | VN-, Negative Power output | DC output cable to a drive |



ELP014E

6-Pin Amphenol Female Connector



ELP057A

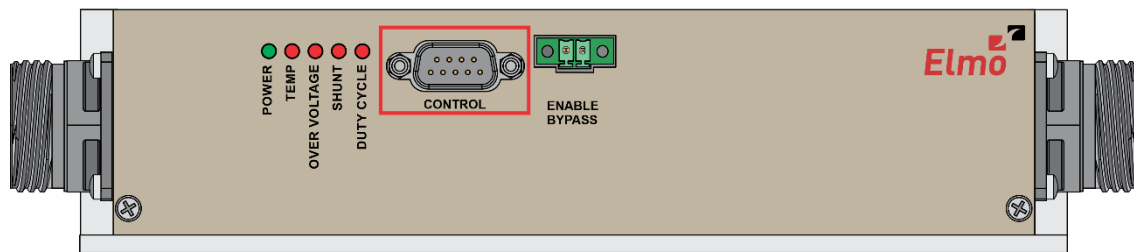
**6-Pin Amphenol Male Connector
(D38999/26WE6PA)**

Table 5: DC- Output Connector to Drive Pinout

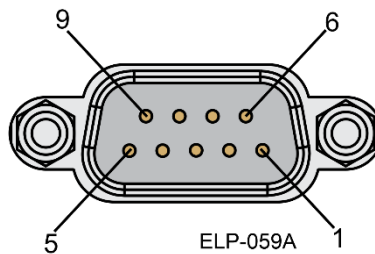


3.3.4 Control Connector Pinout

| Pin | Signal | Function |
|-----|------------------------------|----------------------------------|
| 1 | "Power On" indication return | Opto emitter |
| 2 | "Power On" indication | Opto collector via resistor |
| 3 | ENABLE return | ENABLE NEGATIVE |
| 4 | ENABLE | ENABLE POSITIVE |
| 5 | N.C. | Not connected |
| 6 | N.C. | Not connected |
| 7 | N.C. | Not connected |
| 8 | AC Fault detection signal | Darlington opto collector output |
| 9 | AC Fault detection return | Darlington opto emitter output |



ELP-056A-A



ELP-059A

9 Pin D-Type Male Connector



3.3.4.1 AC Fault Detection

The Elephant is equipped with an internal "AC phase loss" detector, which changes its output signal under the following conditions:

- Whenever the Main AC source is shut down permanently or temporary
- When any of the Main three phases is not present
- When the three AC source is significantly unbalanced

Note: When operating with a single phase supply this output is not applicable and must not be used for indication.

Whenever any relevant event ends – the detector returns to its **OK** state. The detector has an open-collector based indication-output, within the "control" D-sub connector.

To utilize the detector's output externally (Figure 3):

Install a pull-up resistor between pin 8 of the "control" D-sub connector and a positive pole of a voltage source, then connect pin 9 to the negative pole of that voltage source.

It is recommended for the user to further implement an additional processing stage at the detector's output.

| Feature | Details |
|--|---|
| Type of output | Optically isolated Open collector and open emitter (Darlington) |
| Maximum Ext. supply range (V _{cc}) | 30v |
| Max.output current I _{out} (max) (V _{out} =Low) | I _{out} (max) ≤ 10mA |
| VOL | V _{out} (on) ≤ 1v |
| RL | External resistor RL must be selected to limit output current to no more than 10 mA $RL = \frac{VCC - VOL}{Io(max)}$ |

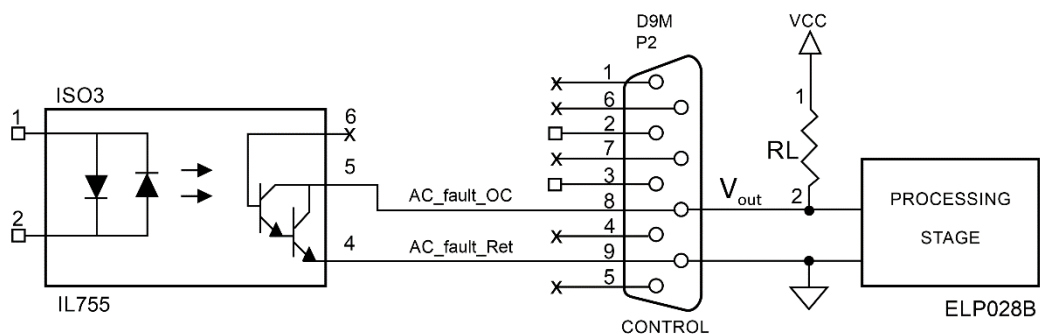
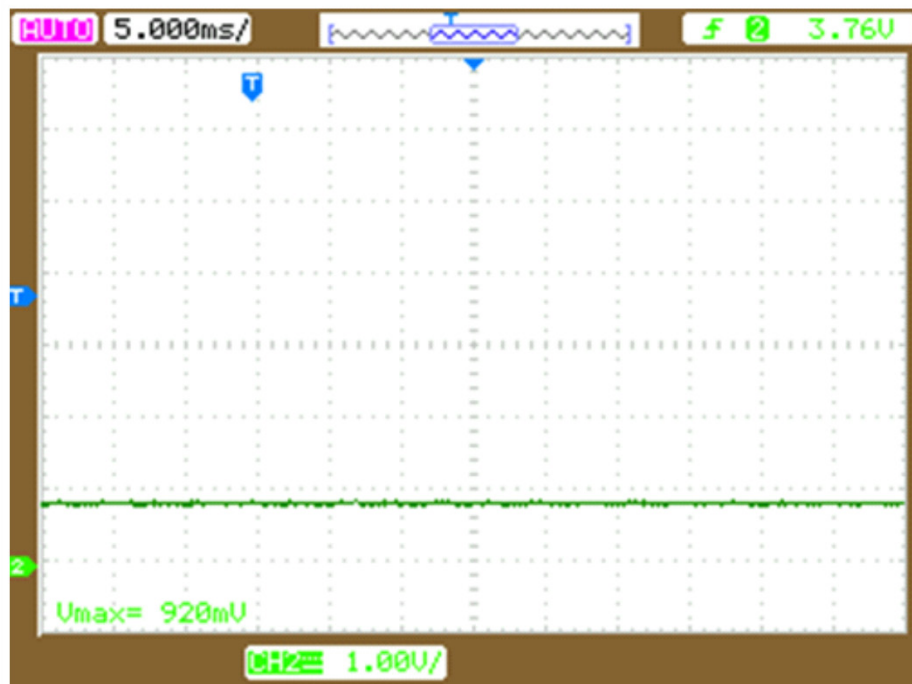


Figure 3: Utilizing the detectors output externally



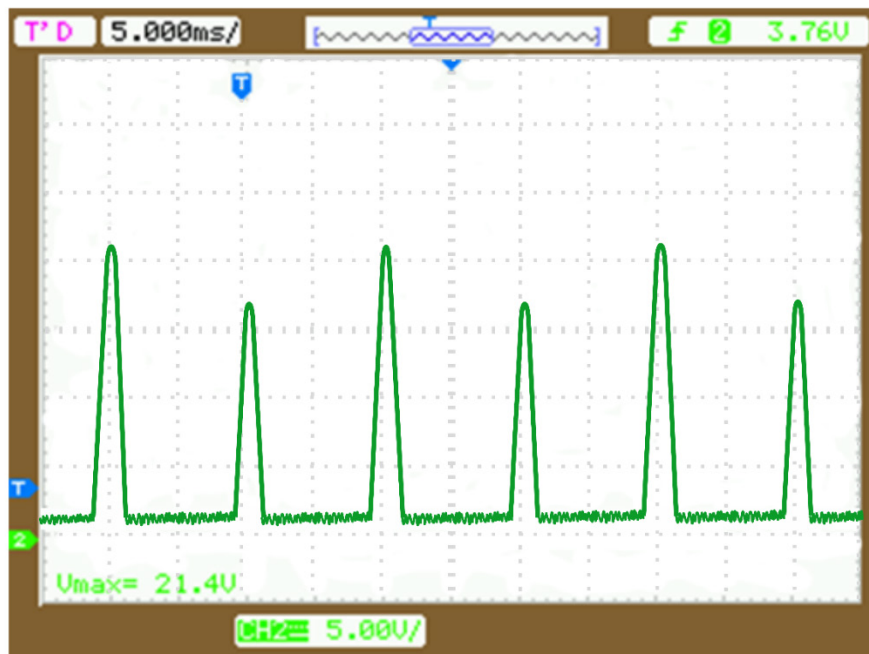
The next two plots show typical output signals, while using a pull-up resistor of 2.4 k Ω , together with a 24 VDC source. Whenever all the three phases are present the output of the AC fault shows the DC level ($\leq 1\text{V}$).



ELP061A-A

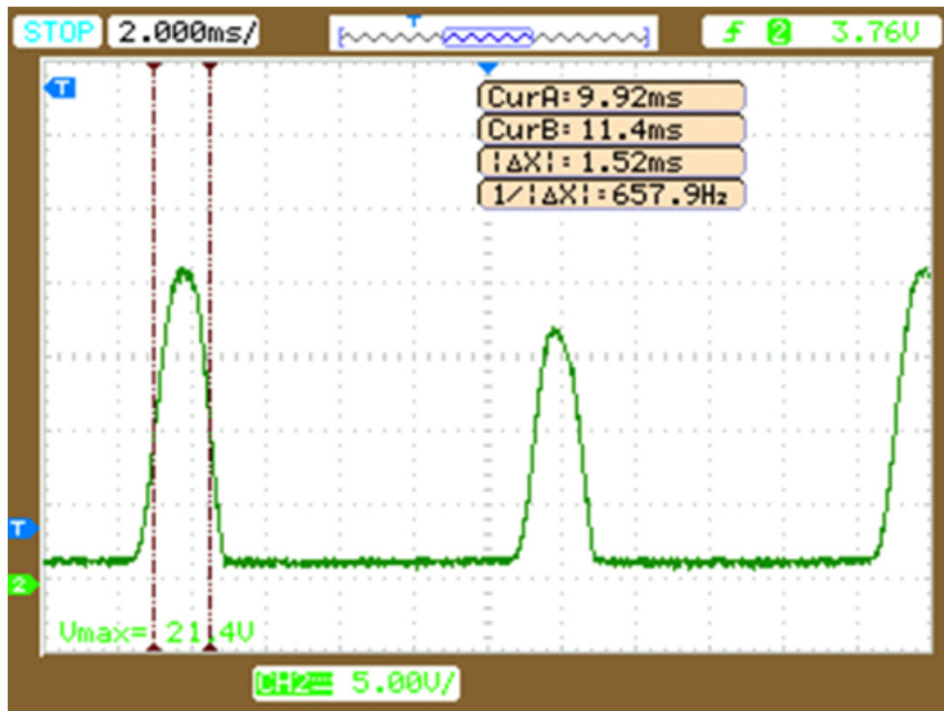
Figure 4: AC Signal

Whenever one AC phase fails, the AC fault output pulses will be as shown in Figure 5.



ELP061A

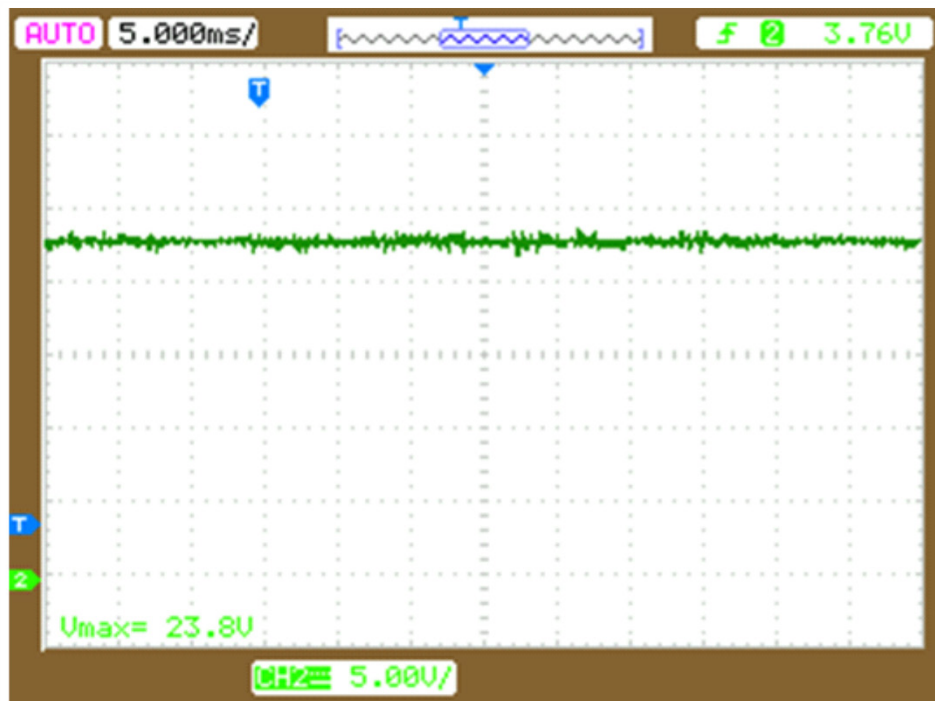
Figure 5: AC Fault Signal



ELP061A-B

Figure 6: AC Fault Signal – expanded graph

Whenever two or three phases fail, the VCC DC level (of the pull up resistor) will be as shown in Figure 7.



ELP061A-C

Figure 7: Two or Three Phase AC Fault Signal



3.3.4.2 “Enable” Feature

Whenever pins 3, 4 of the Control connector are active (**Enable**), and the Enable Bypass connector pins remain open, High DC voltage is output to the DC output connector.

The following table describes the electrical details of the Enable input.

| Feature | Details |
|------------------------------|--|
| Type of input | Optically isolated |
| Input current for all inputs | $I_{in} = 2 \text{ mA @ } V_{in} = 12 \text{ V}$ |
| High-level input voltage | $12 \text{ V} < V_{in} < 30 \text{ V}$ |
| Low-level input voltage | $0 \text{ V} < V_{in} < 7 \text{ V}$ |

Figure 8: Enable Input Schematic

3.3.4.3 Power ON Indication Output

| Feature | Details |
|---|---|
| Type of output | Optically isolated Open collector and open emitter (Darlington) |
| Maximum Ext. supply range (V_{cc}) | 30v |
| Max.output current $I_{out} \text{ (max) (} V_{out}=\text{Low)}$ | $I_{out} \text{ (max)} \leq 10\text{mA}$ |
| VOL | $V_{out} \text{ (on)} \leq 1\text{v}$ |
| RL | External resistor RL must be selected to limit output current to no more than 10 mA $RL = \frac{VCC - VOL}{Io(max)}$ |

At POWER-ON = LOW
At POWER-OFF = HIGH



3.3.5 "Enable Bypass Connector Feature"



Warning: Do not implement the "Enable Bypass" Connector option described in this section before taking the following safety precautions:

- The required jumper is a high voltage wire, which, if exposed, and touched, can cause electrocution. Therefore, the jumper must have an isolating jacket over it.
- Do not manually plug or unplug this connector while there is still high voltage inside the product.

Following are the "Enable Bypass" connector pinouts.

| Pin | Signal | Function |
|-----|-----------------|---|
| 1 | Enable Bypass 1 | Shorting to Pin #2 bypasses the "Enable" function |
| 2 | Enable Bypass 2 | Shorting to Pin #1 bypasses the "Enable" function |

The Enable function in the Control connector can be ignored (if necessary) by connecting an isolated jumper between the two terminals of the "Enable Bypass" connector.



3.3.5.1 "Power On" Indication

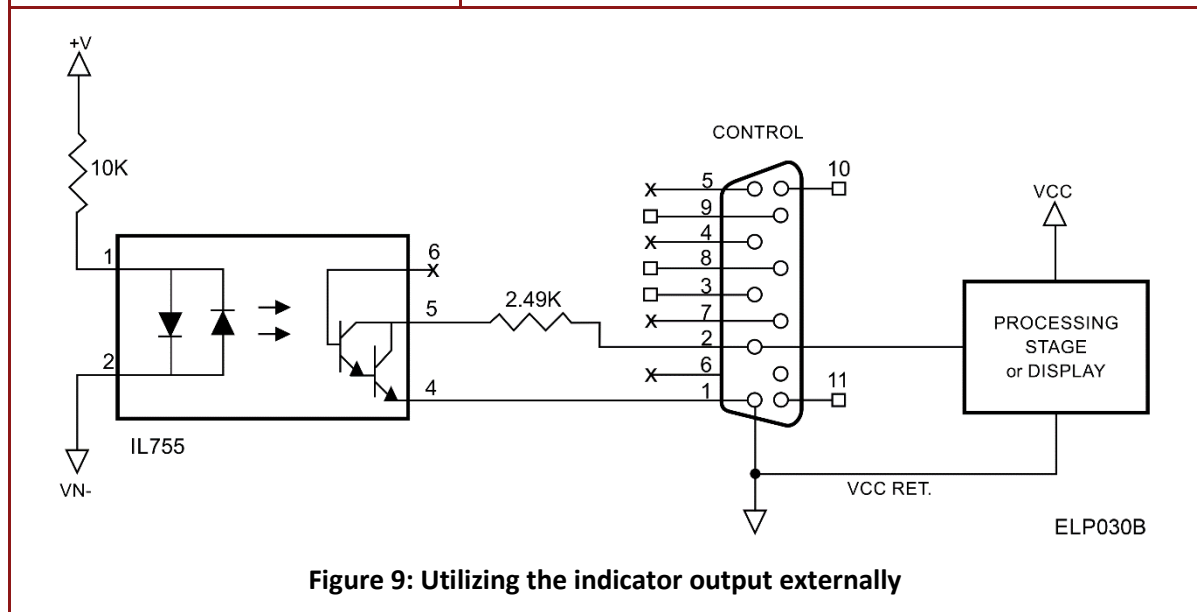
The Elephant has an integral "POWER-ON" green LED, at its front panel.



Caution: Be aware that in case of malfunction, although the green LED is off, the line power must be disconnected. It may retain residual high voltage at the output.

In addition, the Elephant is also equipped with an option to externally connect a duplicate "POWER-ON" indication. The user has the option to use an external "POWER-ON" signal within his controller, or any other "POWER-ON" display indication.

| Feature | Details |
|--|--|
| Type of output | Optically isolated Open collector and open emitter (Darlington) |
| Maximum Ext. supply range (V _{cc}) | 30v |
| Max.output current | I _{out} (max) ≤ 12mA |
| VOL | V _{out} (on) ≤ 1v |
| R _L | External resistor is not required (Due to internal resistor R _L existence of 2.49kohm). $R_L = \frac{V_{CC} - V_{OL}}{I_o(\max)}$ |





3.4 Mounting and Wiring the Elephant

For optimum heat dissipation, the Elephant should be installed with the heat sink attached to the machine's chassis. When mounting the Elephant, make sure to leave about 1 cm (0.4") outward from the heat-sink, to enable free air convection around the power supply.

3.4.1 Mounting

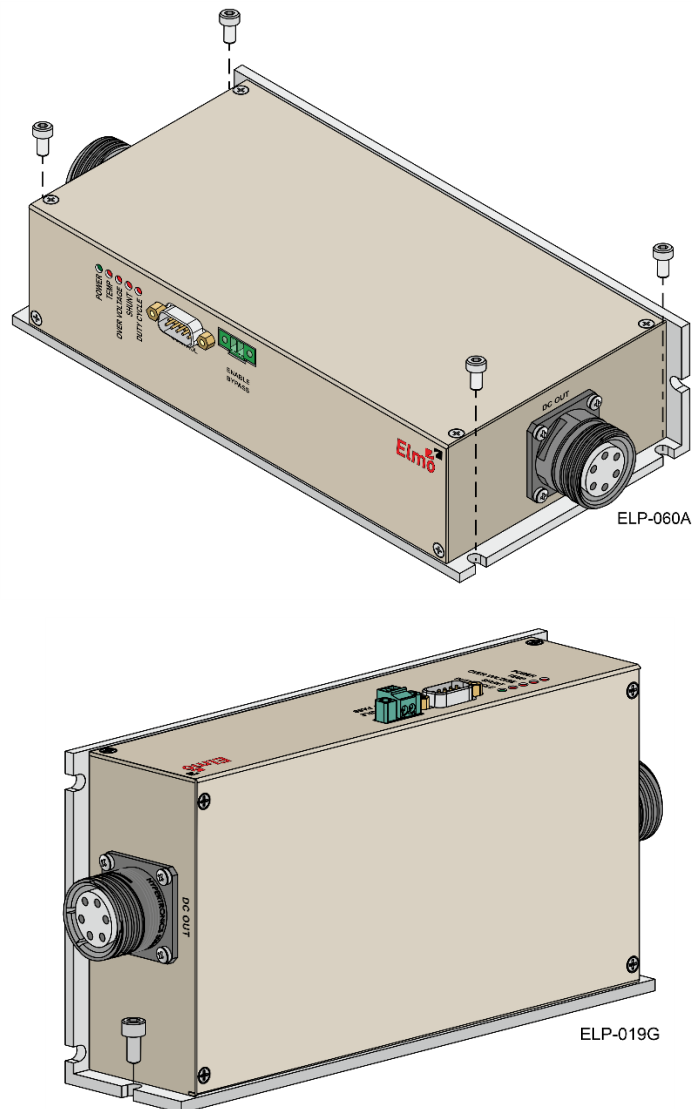


Figure 10: Mounting the Elephant

The Elephant is designed for two standard mounting options (Figure 10):

- Wall Mount along the back (can also be mounted horizontally on a metal surface)
 - Book Shelf along the side
1. Use 10/32 or M5 round head screws, one through each opening in the heat sink, to mount the Elephant in position opposite the specific holes drilled.
 2. Tighten the screws to just tight. Do not tighten the screws too much.



3.4.2 Wiring Guidelines

1. Use flexible wires with the proper cross-section to handle the unit current. Color coding is recommended.
2. After the wiring is completed, carefully inspect all connections in order to ensure tightness.

3.4.3 AC Power Source

The three-phase AC voltage supply must be of any voltage within the range defined in the Elephant technical specifications. It must be able to deliver power to the servo drives (including peak power), without significant drops (especially when using transformer).

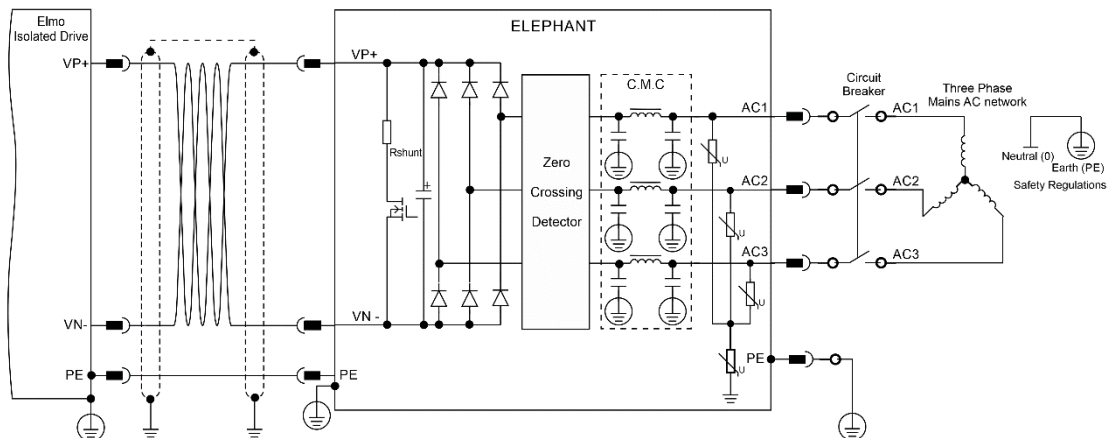
A single phase operation is possible for the 36VAC, 60VAC, 120VAC, 230VAC models with the **ELP-30\XXXVACP1**

Active zero crossing inrush current control is included within the Elephant power supply, which makes the Elephant capable to be fed directly from the mains, whenever it supplies isolated drives.

3.4.4 Direct-to-Mains (Non Isolated Transformer) Wiring Diagrams



Caution: VN- and PE must not be connected together on the Elephant side.



ELP006H

Figure 11: Three-Phase Direct-to-Mains Connection

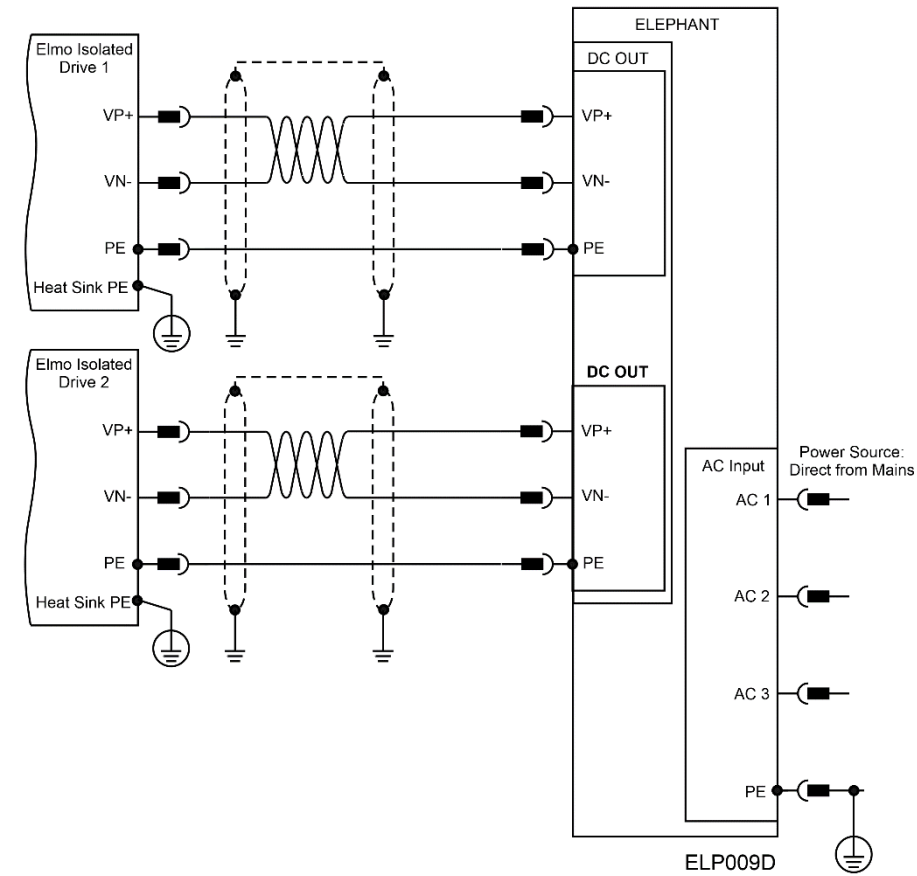


Figure 12: Multiple Direct-to-Mains Connection



3.4.5 Isolated AC Supplies (with an Isolation Transformer) Wiring Diagrams



Caution: When using an isolation transformer, VN- and PE must be connected together on the Elephant side.

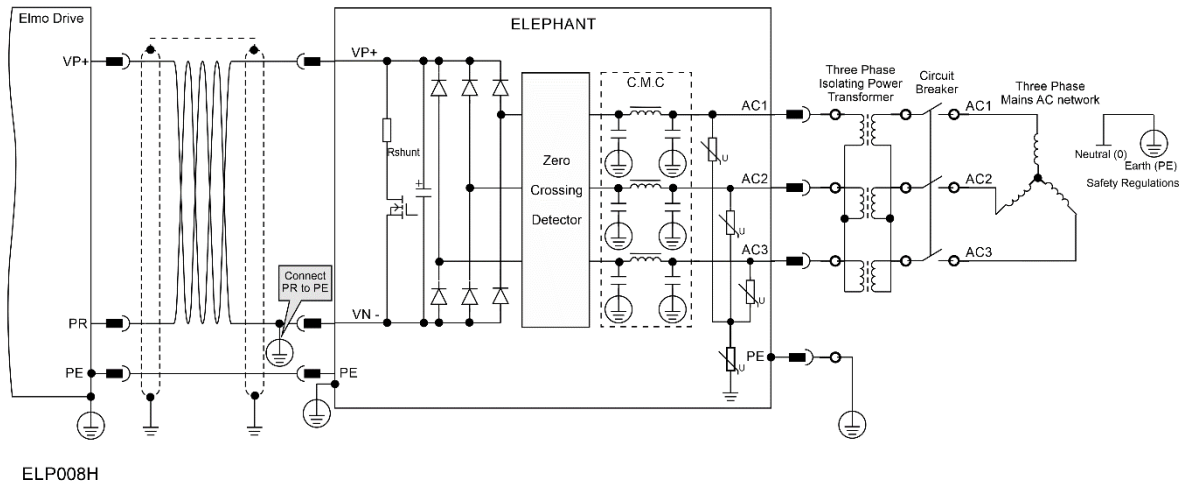


Figure 13: Three-Phase Isolated Source Connection



Caution: When using an isolation transformer, VN- and PE must be connected together on the Elephant side.

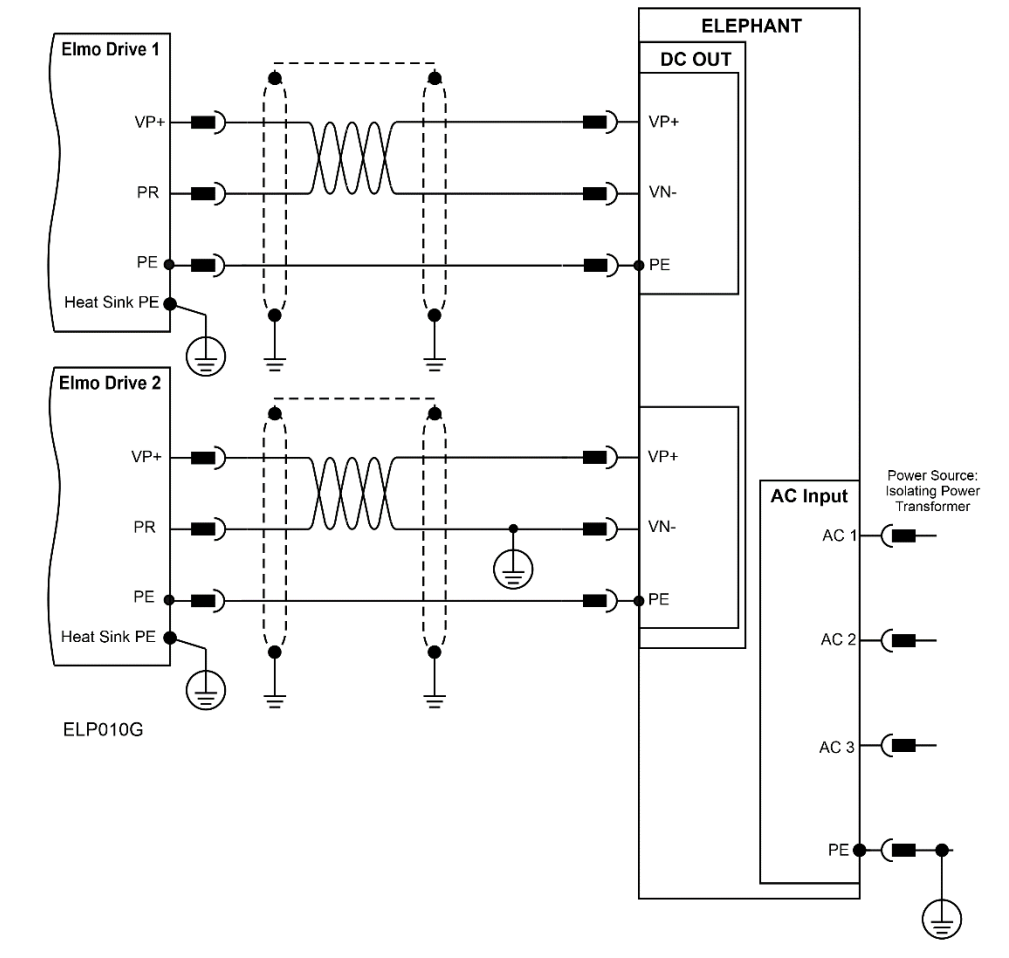
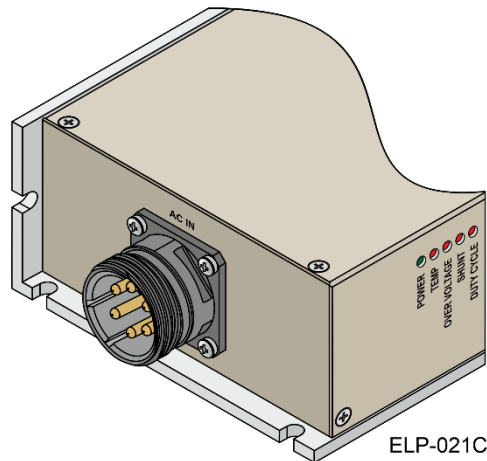


Figure 14: Multiple Isolated Source Connection

All wiring guidelines for supply connections described previously apply to multiple-Elephant connections.



3.4.6 Connecting the Main Power Cable

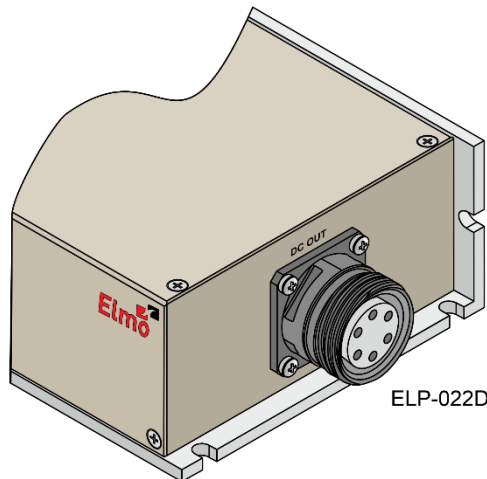


To connect the AC power cable

1. For best noise immunity, a shielded cable is recommended (not mandatory) for the AC input cable.
2. A 4-wire shielded cable should be used:
 - a. Connect the 3-phase leads of the main input cable to the AC1, AC2 and AC3 terminals of the main input connector.
 - b. For safety requirements, the green/yellow-wire must be connected to the protective earth (PE terminal). Connect the Protective Earth wire to the PE terminal on the main input connector.
3. The gauge of the cable strands is determined by the sum of the actual current consumption of the drives being fed by the Elephant.



3.4.7 Connecting the DC Output Cable



To connect the DC output cable:

1. For best noise immunity, a shielded and twisted cable is recommended (not mandatory) for the DC output cable. A 3-wire shielded cable should be used. The gauge is determined by the actual current consumption of the drives being fed by the relevant DC output.
2. Connect the three wires of the DC output cable to the DC output connector of the Elephant:
 - a. Connect the DC leads to the VP+ and VN- terminals of the DC output connector.
 - b. For safety requirements, the third green/yellow-wire must be connected to the protective earth (PE terminal). Connect the Protective Earth wire to the PE terminal on the DC output connector.
3. When the Elephant is fed from an isolation transformer, from the safety and EMI aspects, the PR (VN-) junction must be connected to PE junction.



Caution:

- Do not connect VN- to PE. **In a direct-to-mains connection the VN- must *not* be connected to the PE**, as this will cause irreparable damage to the system.
- Take care and note that in a direct-to-mains connection the Neutral point is *not* the most negative voltage level. It is the mid-point level of the rectified DC bus.



3.5 Heat Dissipation

For full power output capability the Elephant is designed to be mounted on an external heat-sink. It is highly recommended that the “Wall” on which the Elephant is mounted will have heat dissipation capabilities. The Elephant at “free air convection” (without an additional heat-sink) can dissipate around 12 W for 40°C ambient temperature and not exceeding 80 °C on the heat sink.

When “Free Air Convection” is sufficient for the application it is recommended to leave approximately 10 mm of space between the Elephant's heat sink and any other assembly.

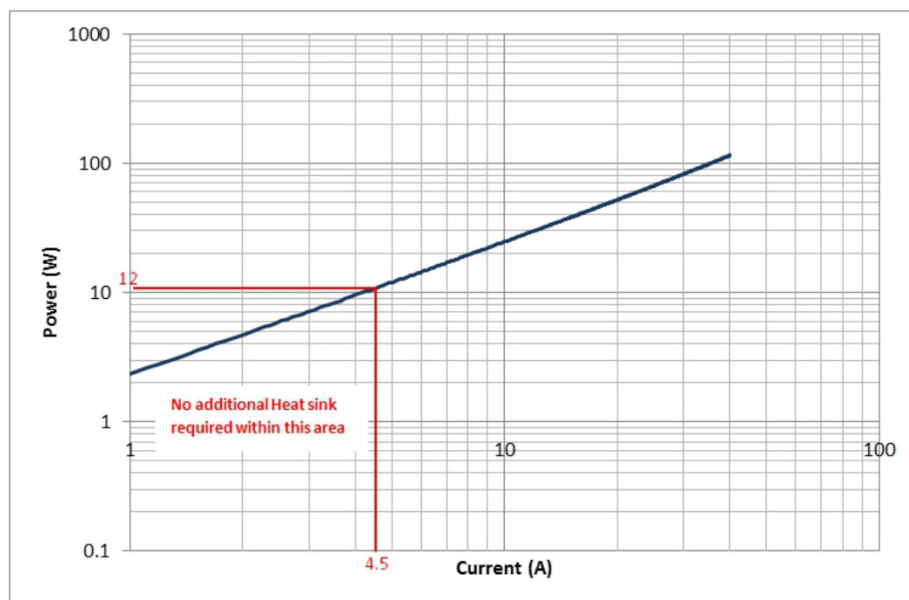
When attaching to an external heat-sink, it is recommended to use N5-N7 surface treatment and thermal foil or smearing thermal compound.

3.5.1 Elephant Thermal Data

- Free air convection thermal resistance (θ): Approximately 5 to 6°C/W.
- Thermal time constant: Approximately 20 minutes/ 1200 seconds (thermal time constant means that the Elephant will reach 2/3 of its final temperature after 20 minutes).
- Self-heat dissipation capability (no external heat sink): 12 W for 40°C/W temperature rise.
- The thermal resistance when connecting to an external heat sink using a thermal conductive compound/foil. By proper smearing of the surface a significant improvement of the thermal resistance is achieved: 0.03°C/W.

3.5.2 Heat Dissipation Data

Heat Dissipation is shown graphically below:



ELP062A

Figure 15: Dissipation versus Current Graph



3.5.3 How to Use the Charts

The charts above are based upon theoretical worst-case conditions. Actual test results show 30% to 50% better power dissipation.

To determine if your application needs a heat sink:

1. Allow maximum heat sink temperature to be 80 °C or less.
2. Determine the ambient operating temperature of the Elephant as $\leq 40^{\circ}\text{C}$.
3. Calculate the allowable temperature increase according to the following example: For an ambient temperature of 40 °C, $\Delta T = 80 \text{ to } 40^{\circ}\text{C} = 40^{\circ}\text{C}$
4. Use the chart to find the actual dissipation power of the Elephant. Follow the curve to the desired output current and then find the dissipated power.



3.5.4 DC-Link Shared Connection

Each Elephant contains a shunt. Its purpose is to "absorb" regenerated energy created by the motor during braking and convert that energy into heat. If the energy regenerated by the motor exceeds the capacity of the shunt, the drive is inhibited and an overvoltage message is sent.

To prevent this from happening, the braking-capacity of the shunt system can be extended by connecting the DC output of several Elephants in parallel. When two or more Elephants are connected, by DC Link cables, the regenerated energy is distributed among them. This spreads the energy spikes over several shunts and enables the application to continue normal operation, and avoid overvoltage interruptions.

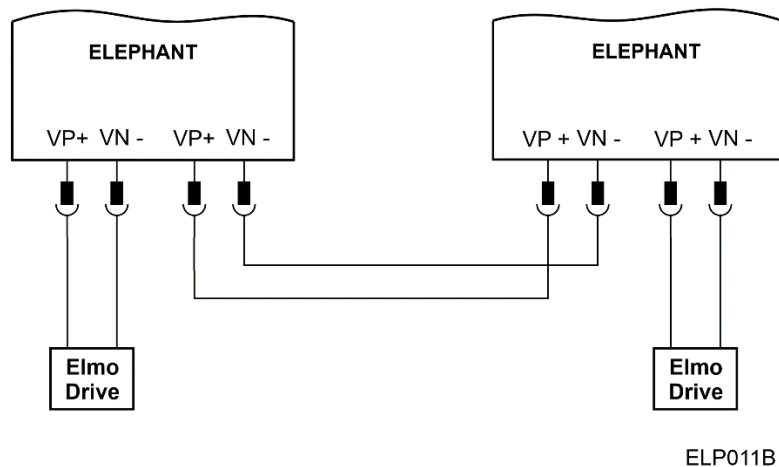


Figure 16: The Elephant's External DC Link Option



Caution: The two Elephant power supplies must have an identical voltage rating.



Chapter 4: Initialization

4.1 Powering Up

After the Elephant is connected to its device, it is ready to be powered up.

4.2 LED Diagnostics

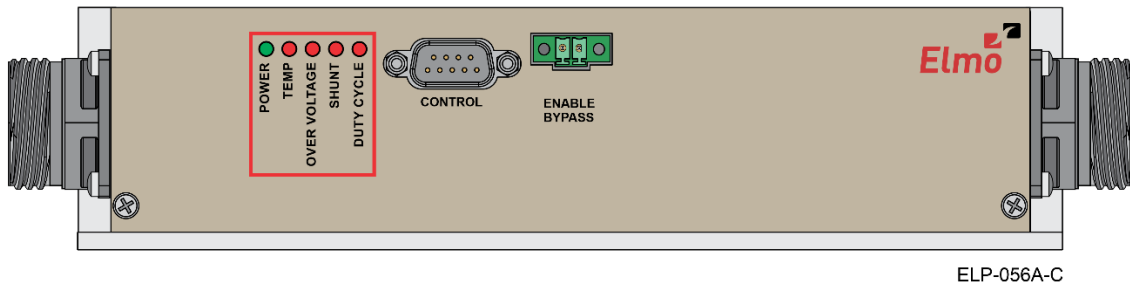


Figure 17: Power LED Indicators

The following indication LEDs are mounted on the front panel of the Elephant (Figure 17):

| LED | Color | Indication |
|--------------|-------|--|
| POWER | Green | Internal supply presence |
| TEMP | Red | Light is on when the temperature rises above 80 °C. When lit, the rectifier is Disabled, and thus there is no DC output. |
| OVER VOLTAGE | Red | The AC input voltage exceeds the allowed voltage. When lit, the rectifier is Disabled, and thus there is no DC output. |
| SHUNT | Red | Shunt is on (blinks whenever the shunt is activated) |
| DUTY CYCLE | Red | The Shunt is disabled when exceeding the limited duty cycle threshold (overvoltage protection may occur within the Drive). |

