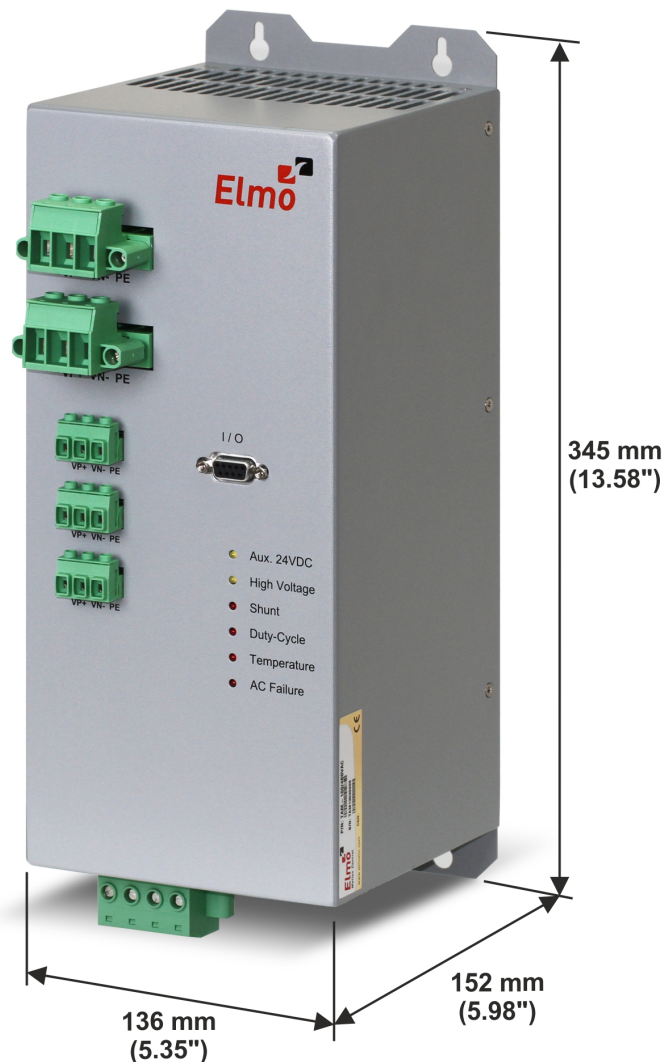


Tambourine 100 Power Supply Installation Guide



Notice

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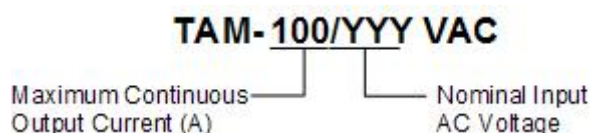
Document no. MAN-TAM-100IG (Ver. 1.101)

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Catalog Number



Revision History

Version	Release Date	Changes/Remarks
1.0	April 2012	Initial Release
1.1	Jan 2013	Updated
1.101	Jan 2014	Updated Format and table section 1.1



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Chapter 1: Operating Safely

In order to operate the Tambourine 100 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 Tambourine 100 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 Tambourine 100 power supply while the power source is on.
- Disconnect the Tambourine 100 power supply from all voltage sources before it is opened for servicing.
- The Tambourine 100 power supply contains grounding conduits for electric current protection. Any disruption to these conduits may cause the instrument to become hot (live) and dangerous.
- When the Tambourine 100 is connected directly to the Mains, VN- must not be connected to the PE!
- 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 wires or contacts). It is recommended to measure the electrical contact points with a DVM before touching the equipment.

	Function	Ref.	Results
1	Discharge time with no load	VP+, VN-	3 mins
2	Discharge time with more than 20A load	VP+, VN-	1 min

Table 1: Safe Discharge Time



1.2. Cautions

- The Tambourine 100 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 Tambourine 100 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 Standards

The Tambourine 100 power supply conforms to the following industry safety standards:

Safety Standard	Item
In compliance with UL 508C	Power Conversion Equipment
In compliance with UL 840	Insulation Coordination, Including Clearance and Creepage Distances of Electrical 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

The Tambourine 100 power supply has been developed, produced, tested and documented in accordance with the relevant 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 Tambourine 100 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.

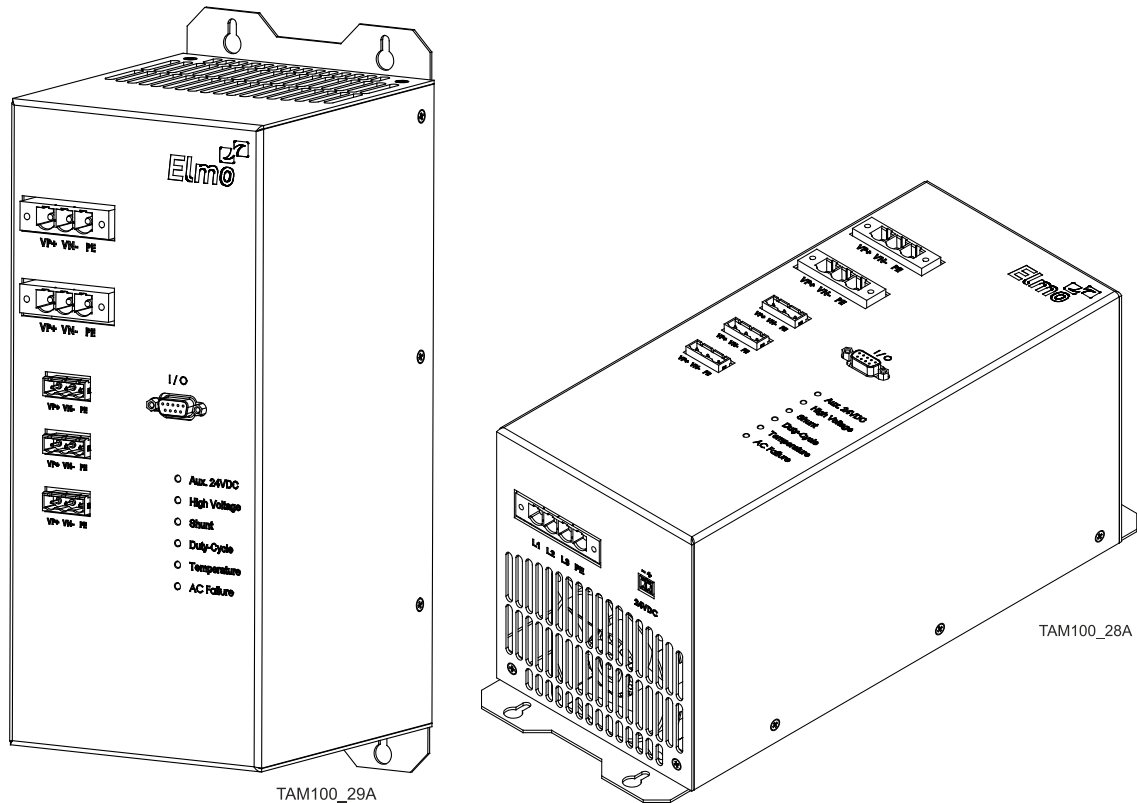
According to Annex III of Article 13 of Council Directive 93/68/EEC, amending Council Directive 73/23/EEC concerning electrical equipment designed for use within certain voltage limits, the Tambourine 100 power supply meets the provisions outlined in Council Directive 73/23/EEC. The party responsible 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 drives are warranted for a period of 12 months from the time of installation, or 18 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 Tambourine 100 power supply is a smart and compact three phase direct-to-mains power supply designed to power multiple servo drives. 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 3×528 VAC into filtered DC voltage with an output current of 100A continuous and a 200 A peak.
- The number of servo drives powered by a single Tambourine 100 power supply is limited only by the total power consumption of the servo drives and not by the output current of the Tambourine 100. Therefore, a number of servo drives can be powered by a single Tambourine 100, as long as the total sum of these drives' power-consumption is below 100A.
- Either operates directly from the mains when feeding isolated servo drives or via an isolation transformer when non- isolated servo drives are employed.
- Has regenerating braking capability that enables fast braking of high inertia.
- Has built-in active zero crossing inrush current limiters that limit the power-on currents to low levels, reducing turn-on stress from the mains.
- Has internal EMC filtering that eliminates the necessity for external devices, therefore complies with CE and other EMC regulations.
- Has a metallic book shelf (panel mount) structure, enabling simple and fast mounting.



1.6. Standard Features

- 100 A continuous output current
- AC input (50 to 500 Hz)
- Three-phase operation only
- Direct-to-mains operation capability
- High regenerative (braking) capability
- Active zero crossing inrush current limit
- EMC filtering “inside”
- Use I/O level to control On/Off output power
- UL, CE, compliant

1.7. Protection

1.1.1 Shunt duty-cycle limit

The shunt regulator system within the Tambourine 100 power supply includes a duty cycle limiter, which inhibits the shunt whenever the shunt "On- time" exceeds 1.5% of the application's repetitive motion-cycle, or when a continuous braking duration of about 500msec occurs.

1.1.2 Phase Missed Detector Circuit

Phase missed detector circuit which halts the operation of the rectifier bridge, either, whenever any of the three Mains phases is not present, or when the three phase AC source is significantly unbalanced. The detector attempts to revive the power supply with a cycle of about 1 sec.

1.1.3 Levels of Temperature Management

Three levels of temperature management:

- 1st Fan operation occurs at about 70°C.
- 2nd Digital output – “temperature forewarn alert” occurs at around 75°C.
- 3rd Bridge shutdown occurs at around 85°C.

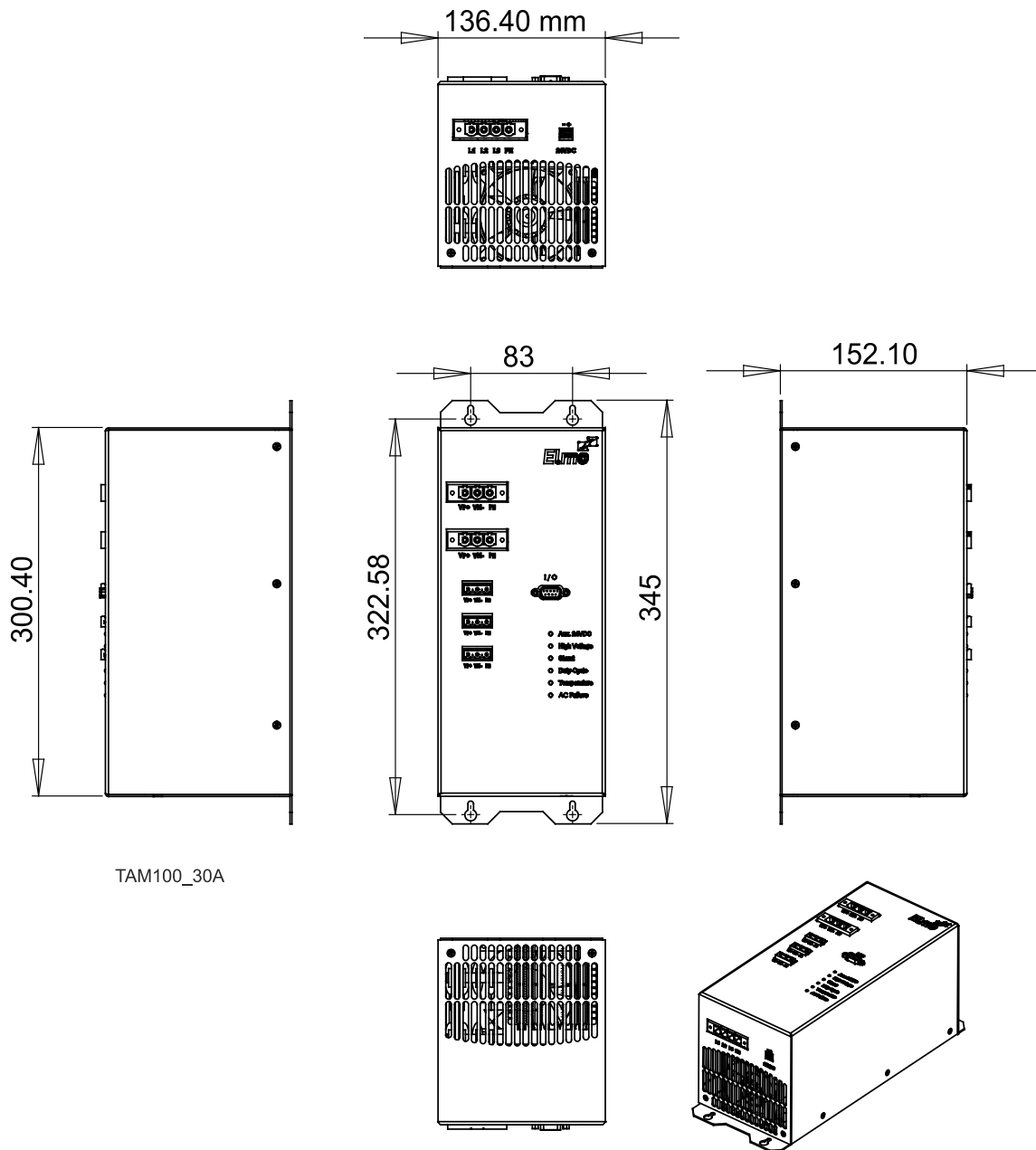
Note :

The integrated Fan is triggered either by the Temperature-sensor located on the Heat sink, or by the shunt duty-cycle limiter. Once triggered, the Fan will continuously rotate at interval-lengths of about 5 minutes each, as long as one of the triggers exists.



1.8. Technical Specifications

1.8.1. Dimensions



TAM100_30A

Figure 1: Tambourine 100 Power Supply



1.8.2. Electrical and Mechanical Specifications

Power Supply	TAM-100/120VAC	TAM-100/230VAC	TAM-100/480VAC
Nominal Input AC Voltage	3X120VAC	3X230VAC	3X480VAC
Max Input AC Voltage	3X125VAC	3X270VAC	3X528VAC
Max Output Power Cont.	18KW	38KW	75KW
Max Output Power Peak	36KW	76KW	150KW
Nominal DC bus Output (at nominal AC Voltage)	170 VDC	325 VDC	560VDC for 400VAC input 680VDC for 480VAC input
Shunt Power (Peak)	9KW	11KW	23KW
Shunt trip voltage (V)	182 to 189	382 to 386	747 to 758
DC Output Cont. Current	100A	100A	100A
DC Output Peak Current	200A	200A	200A
Mating Drives	XXX-YYY/200	XXX-YYY/400	XXX-YYY/800
Aux Power supply Voltage & power	20VDC to 27.5VDC 12W (including fan)	20VDC to 27.5VDC 12W (including fan)	20VDC to 27.5VDC 12W (including fan)
Weight	5Kg	5Kg	5Kg
Operating temperature	0°C to 40°C	0°C to 40°C	0°C to 40°C

Table 2: Tambourine 100 Electrical and Mechanical Specifications

1.8.3. Shunt Regulator

A shunt regulator is included in the power supply section of the Tambourine 100. 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.



Chapter 3: Installation

This chapter describes the installation of the Tambourine 100 power supply.

1.9. Site Requirements

You can guarantee the safe operation of the Tambourine 100 by ensuring that it is installed in an appropriate environment.

Feature	Value
Ambient operating temperature	0 °C to 40 °C (32 °F to 104 °F)
Maximum non-condensing humidity	90%
Operating area atmosphere	No flammable gases or vapors permitted in area
Models for extended environmental conditions are available.	



Caution:

The Tambourine 100 dissipates its heat by driven fan convection. The maximum ambient operating temperature of 0 °C to 40 °C (32 °F to 104 °F) must not be exceeded.

Make sure that no cover closes the grids at both ends of the power supply.

1.10. Hardware Requirements

1.1.1.1. AC Input Requirements

Circuit Breakers & Contacts	Three-Phase Supply Voltage
Circuit breaker current rating	80 A Type C
Circuit breaker voltage rating	250 VAC / 480 VAC depending upon operating AC voltage
Contactor	80 A

1.1.1.2. Recommended Wire Cross-Sections (All Models)

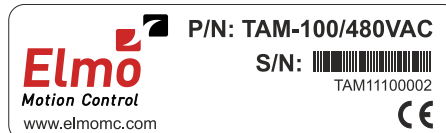
Feature	Connection	Details	
		High Current (large conn.)	Medium current (small conn.)
AC input	AC1, AC2, AC3	18 to 6 AWG	24 to 14 AWG
DC Output	VP+, VN-	18 to 6 AWG	24 to 14 AWG
Protective earth	PE	18 to 6 AWG	24 to 14 AWG



1.11. Unpacking the Components

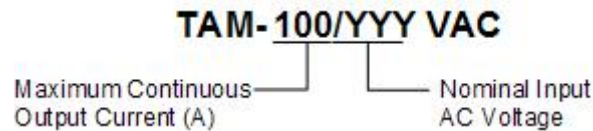
To unpack the Tambourine 100:

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 Tambourine 100 you have unpacked is the appropriate type for your requirements, locate the part number sticker on the product.



TAM100_16A

The Part number provides the type designation.



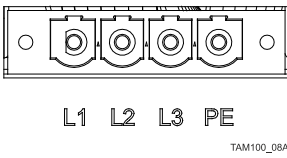
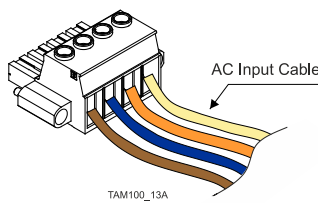
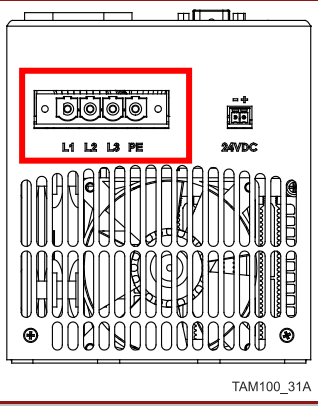
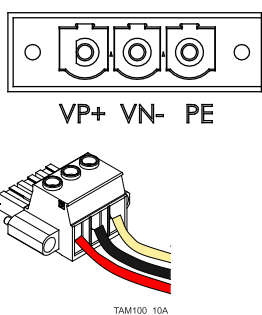
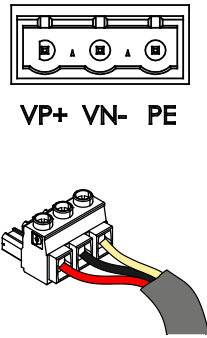
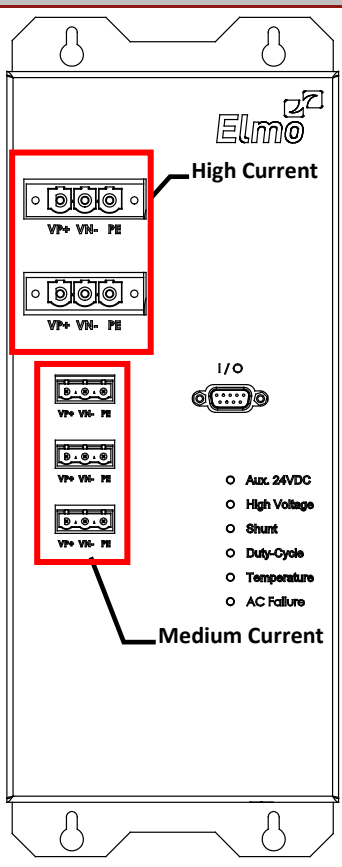
4. Verify that the Tambourine 100 model is the one you ordered, and ensure that the voltage meets your specific requirements.



1.12. Connectors

1.12.1. Connector Types

The Tambourine 100 is delivered with the following external mating connectors:

No. Pins	Type	Function	
Input Connector x1			
			
1 x 4 pins	Phoenix P/N 1967472 (PC 16/4-STF-10,16)	Main AC Input	
Output Connectors x5			
			
High Current		Medium Current	
2 x 3 pins	Phoenix P/N 1967469 (PC 16/3-STF-10,16)	High Current DC Output	
3 x 3 pins	Phoenix P/N 1714281 (GMSTB 2.5 HCV/3-ST-7.62)	Medium Current DC Output	<ul style="list-style-type: none"> ○ Aux. 24VDC ○ High Voltage ○ Shunt ○ Duty-Cycle ○ Temperature ○ AC Failure



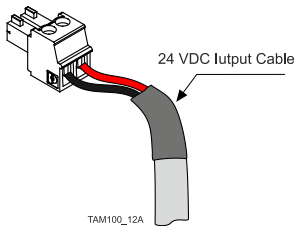
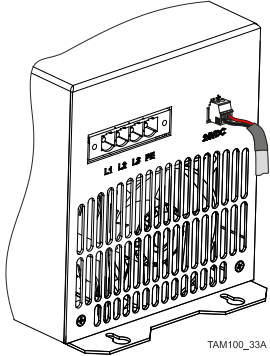
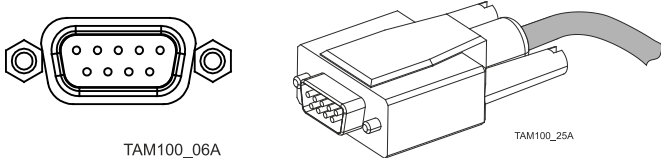
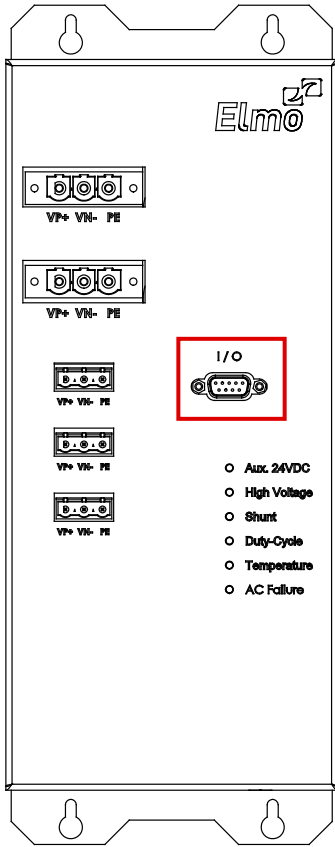
No. Pins	Type	Function	
External 24V DC			
			
1 x 2 pins	Phoenix P/N 1803578 (MC 1.5/2-ST-3,81)	24 V DC Input	
I/O Connection			
			
1 x 9 pins	D-Type 9-pin Male	I/O connector	

Table 3: Connector Types



1.12.2. Main AC Input Power Connector Pinout

Refer to section 3.6.6 for details of the connections.

Terminal	Function	Cable
L1	AC Input phase #1	AC input
L2	AC Input phase #2	AC input
L3	AC Input phase #3	AC input
PE	Protective Earth	AC input

Table 4: Main AC Input Connector Pinout

1.12.3. 5x DC-Output Connectors Pinout

Refer to section 3.6.8 for details of the connections.

Terminal	Function	Cable
VP+	Positive Power output	DC output cable to a drive
VN-	Negative Power output	DC output cable to a drive
PE	Protective earth	DC output cable to a drive

Table 5: DC- Output Connector to Drive Pinout



1.13. I/O Port

Pin	Signal	Pin Positions
1	IN1: Main_Enable / Disable	
2	IN2: VDCBUS Discharge	
3	Not in use	
4	OUT1: Temperature forewarn alert	
5	OUT2: AC_phase failure alert	
6	INRET1: Main Enable / Disable RET	
7	INRET2: VDCBUS Discharge RET	
8	OUTRET1: Temperature_forewarn alert_RET	
9	OUTRET2: AC_phase failure alert_RET	

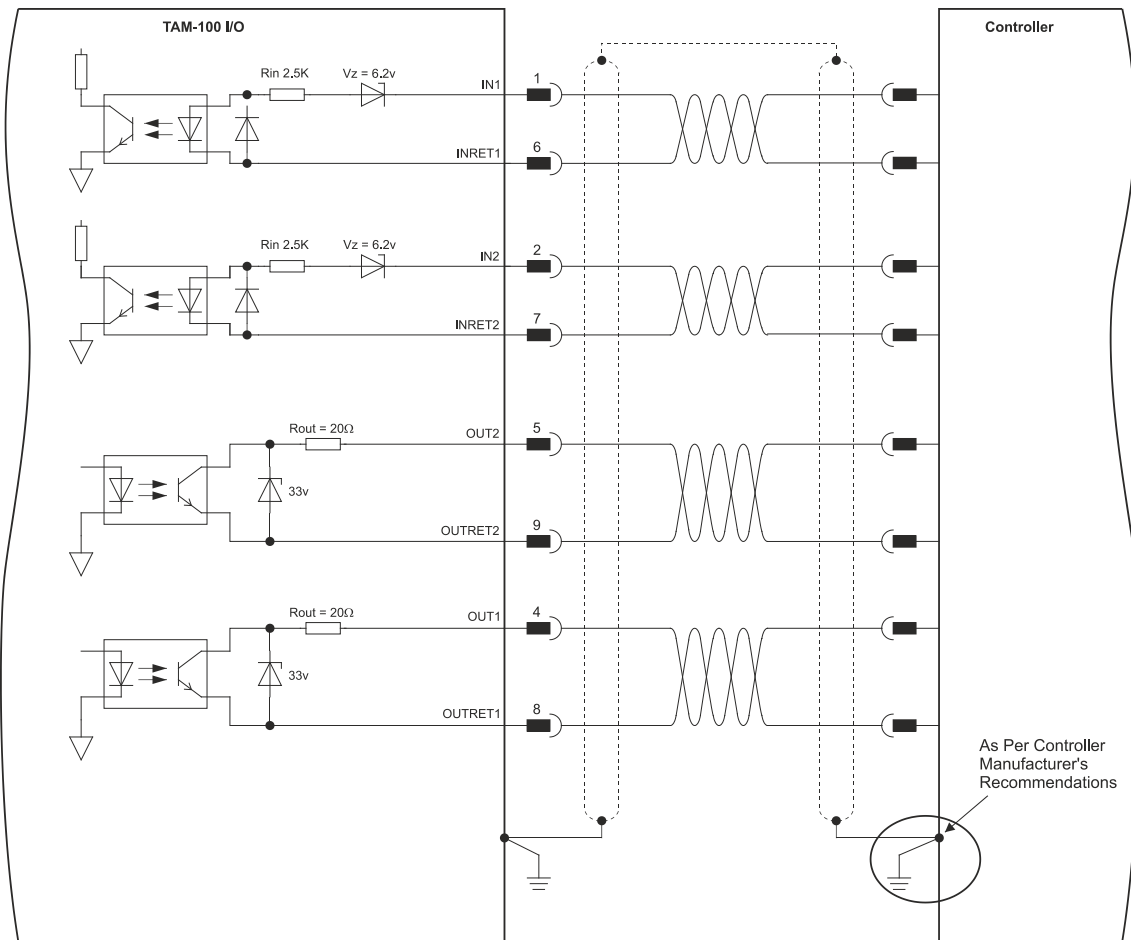


Figure 2: TAM 100 I/O Connector



1.14. Mounting and Wiring the Tambourine 100

For optimum heat dissipation, the Tambourine 100 should be installed with the heat sink attached to the machine's chassis. It is recommended to mount the Tambourine 100 in the vertical position as shown in Figure 3.

1.14.1. Mounting

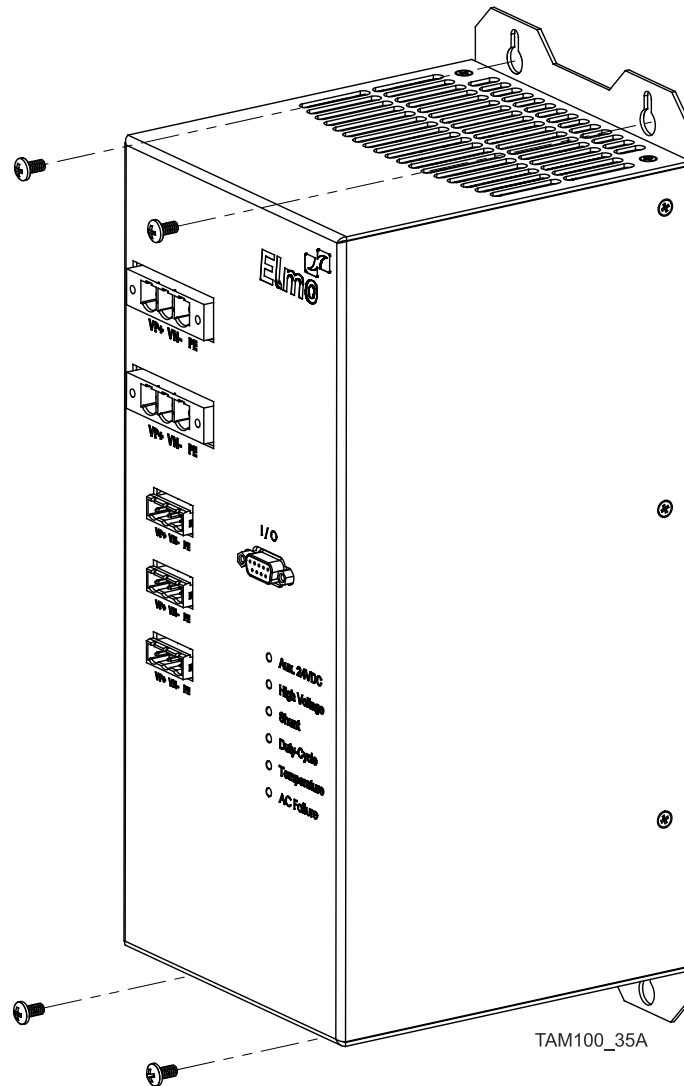


Figure 3: Mounting the Tambourine 100

The Tambourine 100 is designed for a standard wall mounting (Figure 3), along the back (can also be mounted horizontally on a metal surface).

Use M4 x 8 round head screws, one through each of the specific holes drilled.

Tighten the screws to just tight between 2 – 4 Nm.



1.14.2. Wiring Guidelines

Use flexible wires with the proper cross-section to handle the unit current. Color coding is recommended. Refer to section 3.2 paragraph 2.

After the wiring is completed, carefully inspect all connections in order to ensure tightness.

1.14.3. AC Power Source

The three-phase AC voltage supply must be of any voltage within the range defined in the Tambourine 100 technical specifications. It must be able to deliver power to the servo drives (including peak power), without significant drops (especially when using transformer).

Active zero crossing inrush current control is included within the Tambourine 100 power supply, which makes the Tambourine 100 capable to be fed directly from the mains, whenever it supplies isolated drives.

1.14.4. Direct-to-Mains (No Isolation Transformer) Wiring Diagrams

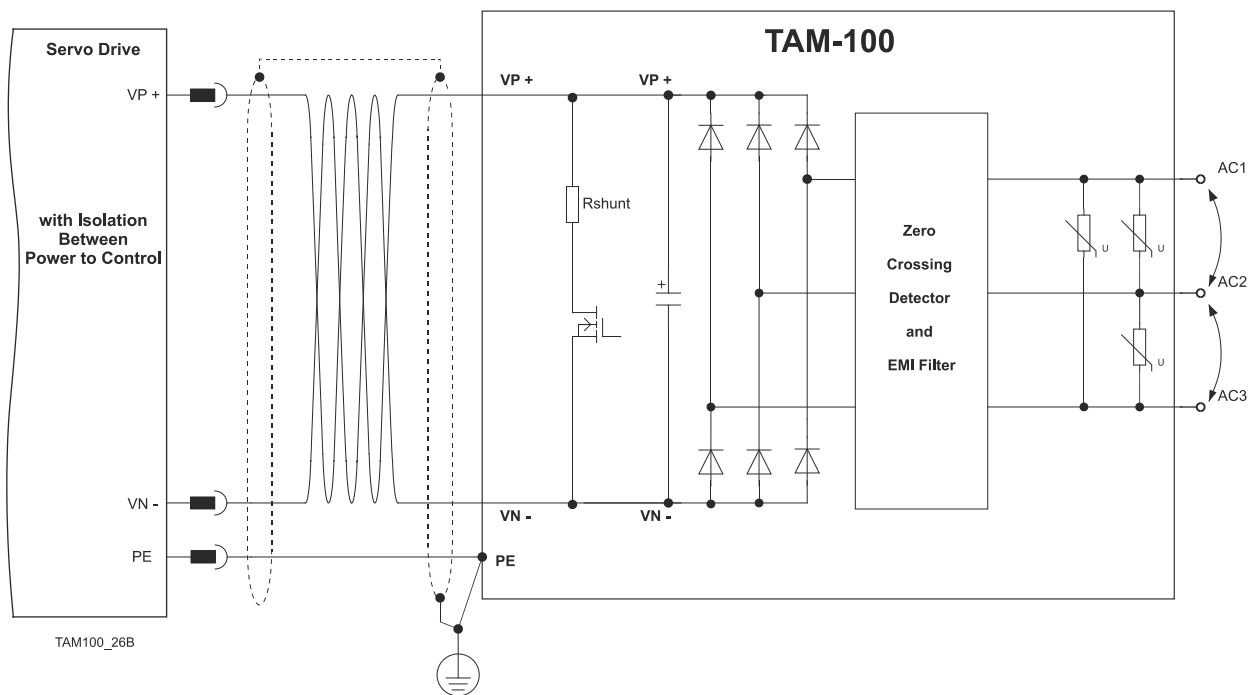
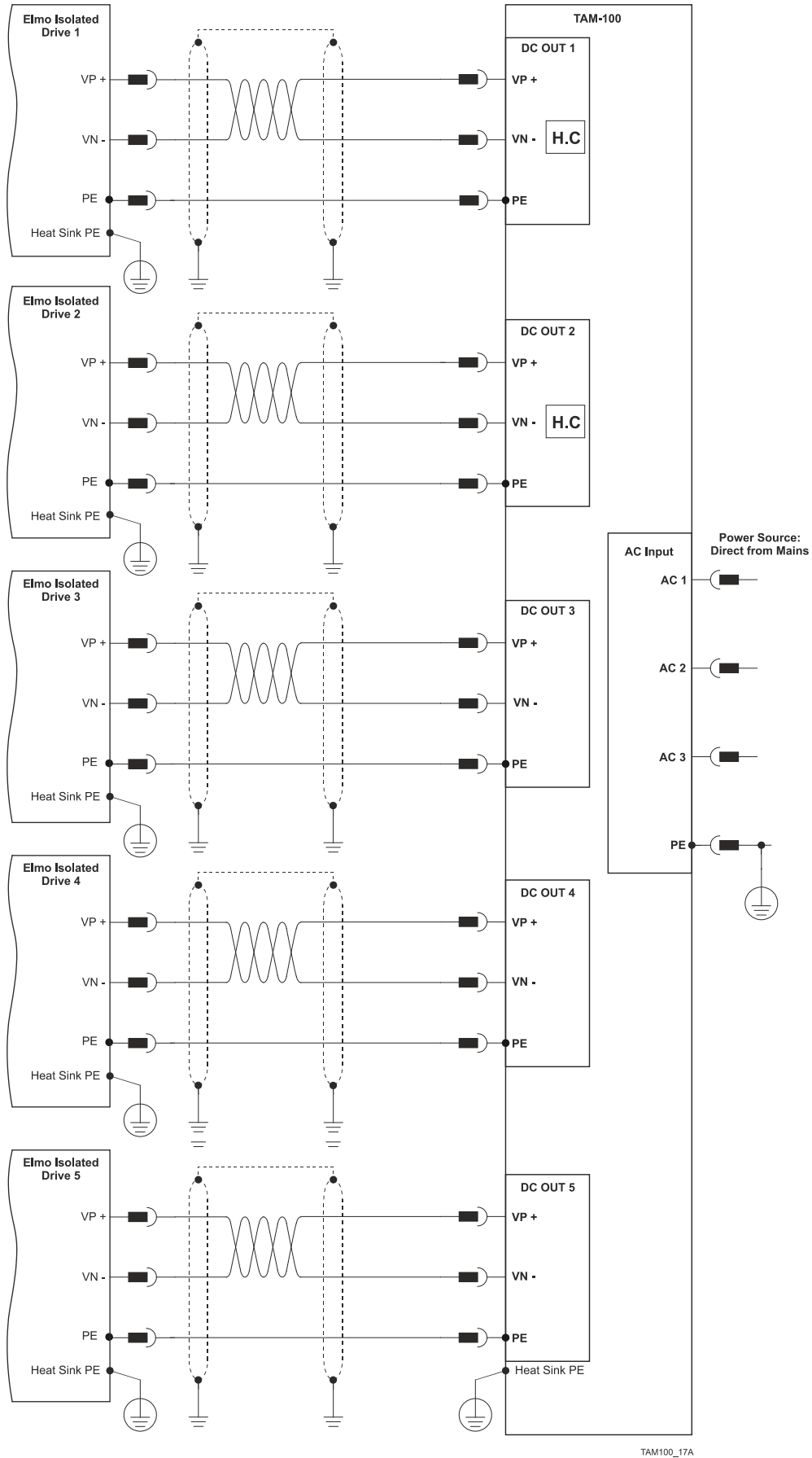


Figure 4: Three-Phase Direct-to-Mains Connection



Warning:

When connected directly to the Mains, VN- must not be connected to the PE!

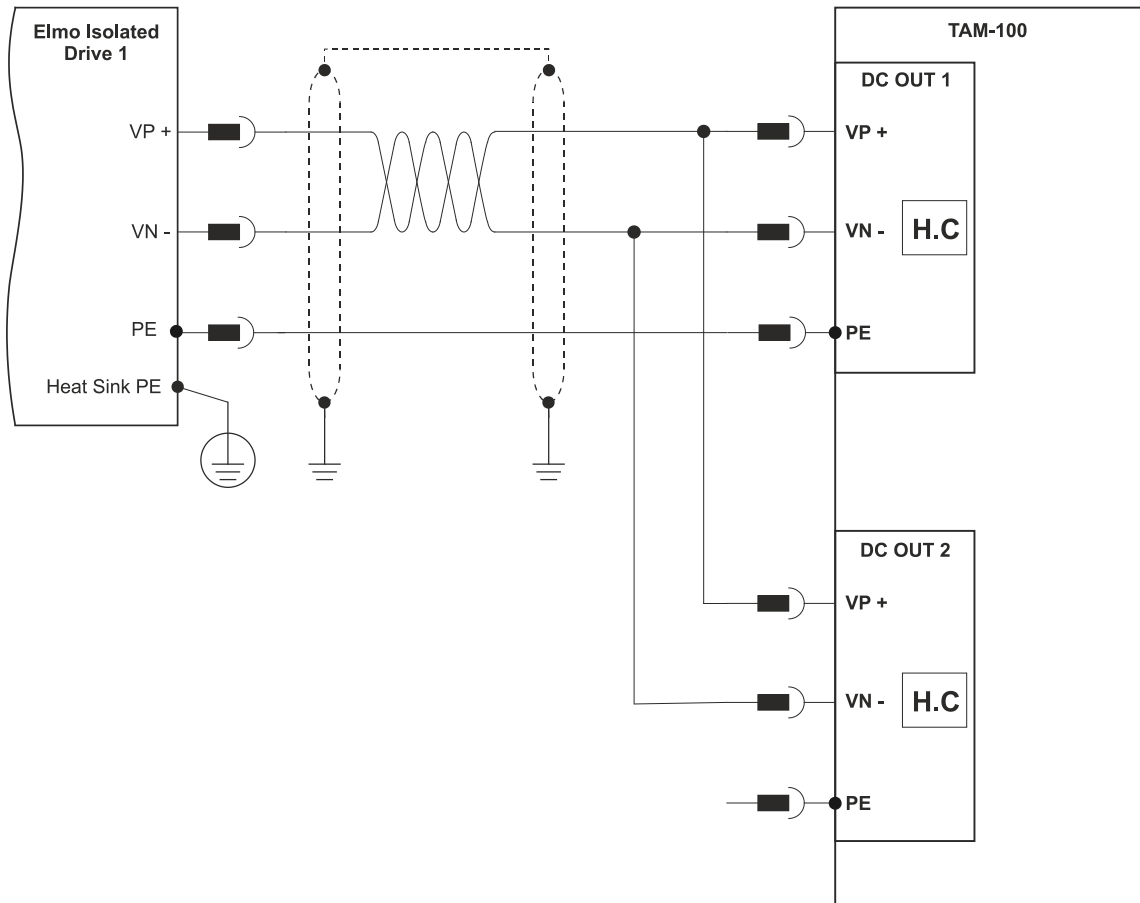


TAM100_17A

Figure 5: Multiple Direct-to-Mains Connection



When a single load is drawing an output between 55A to 100A, it is necessary to connect the two High Current outputs in parallel to the load as shown in Figure 6.



TAM100_20A

Figure 6: Connection for 55 A to 100 A output



1.14.5. Isolated AC Supplies (with an Isolation Transformer) Wiring Diagrams

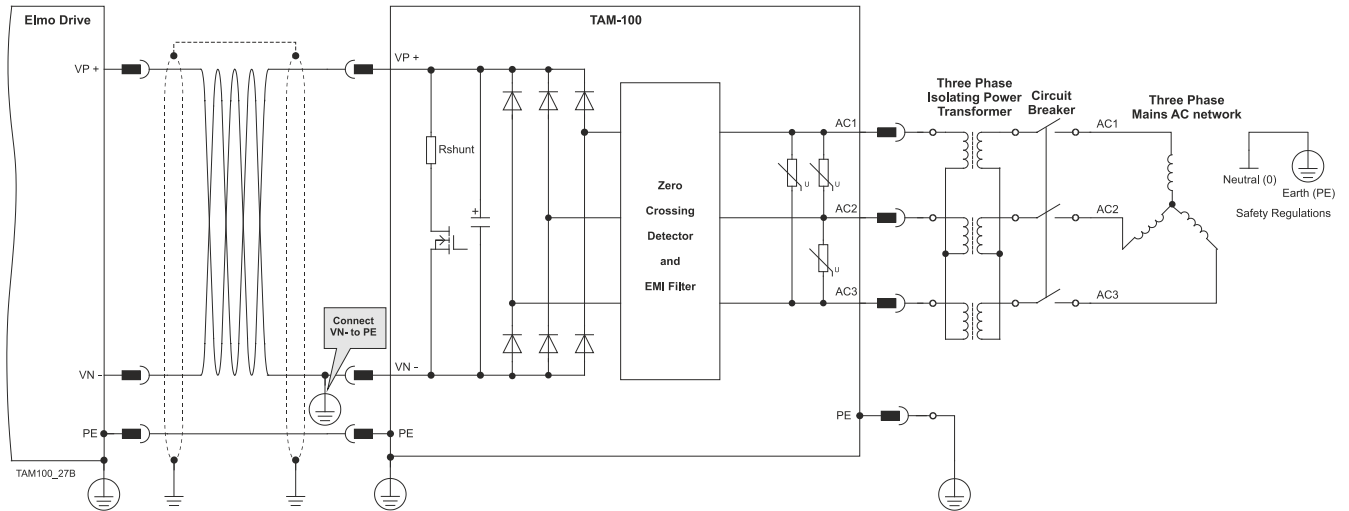


Figure 7: Three-Phase Isolated Source Connection



Caution:

When using an isolation transformer, VN- and PE must be connected together on the Tambourine 100 side.



All wiring guidelines for supply connections described previously apply to multiple-Tambourine 100 connections.

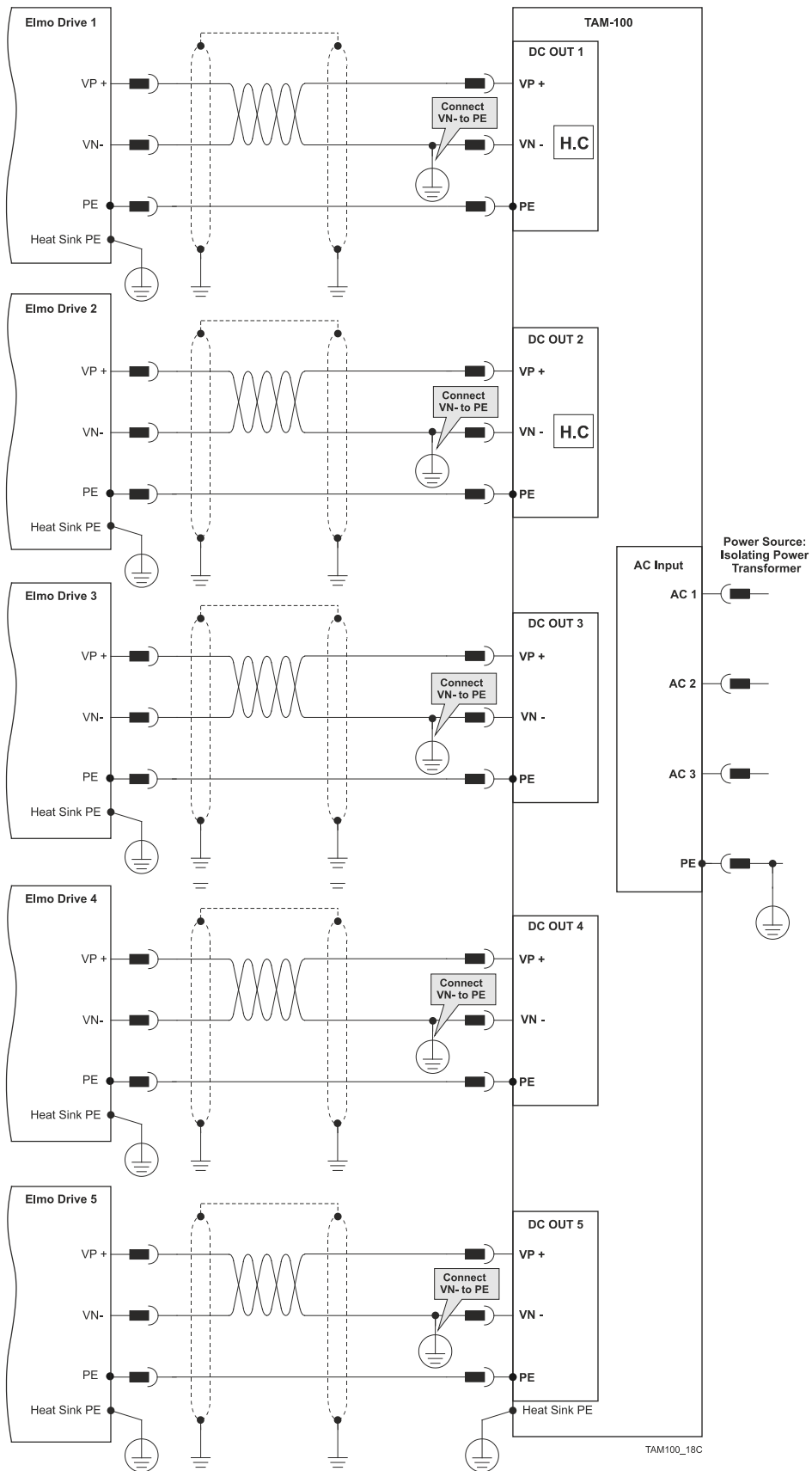


Figure 8: Multiple Isolated Source Connection



1.14.6. Connecting External 24 V DC source to the Control System

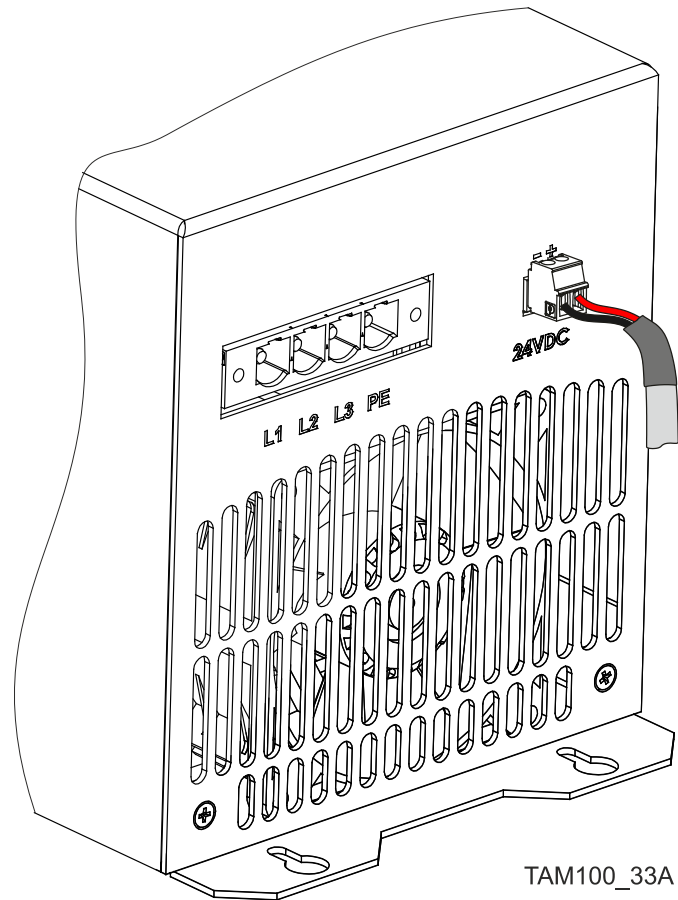


Figure 9: 24V DC External Connection

An external 24 V DC connection supplied by the user must be connected to the Control system to provide power to the Zero Crossing Detector, fan, and other internal functions. Otherwise the power supply will not operate.



1.14.7. Connecting the Main Power Cable

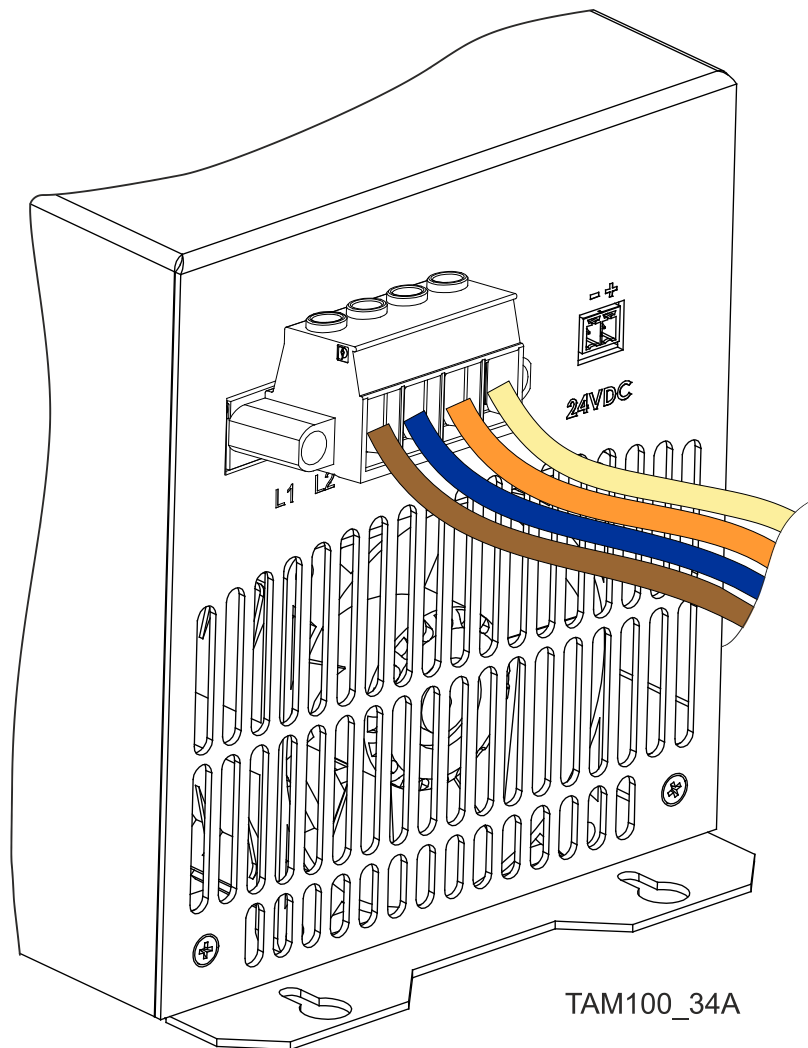


Figure 10: Main Power Cable Connection

To connect the AC power cable(Figure 10)

1. For best noise immunity, a shielded (not twisted) 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 L1, L2 and L3 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 Tambourine 100.



1.14.8. Connecting the DC Output Cable

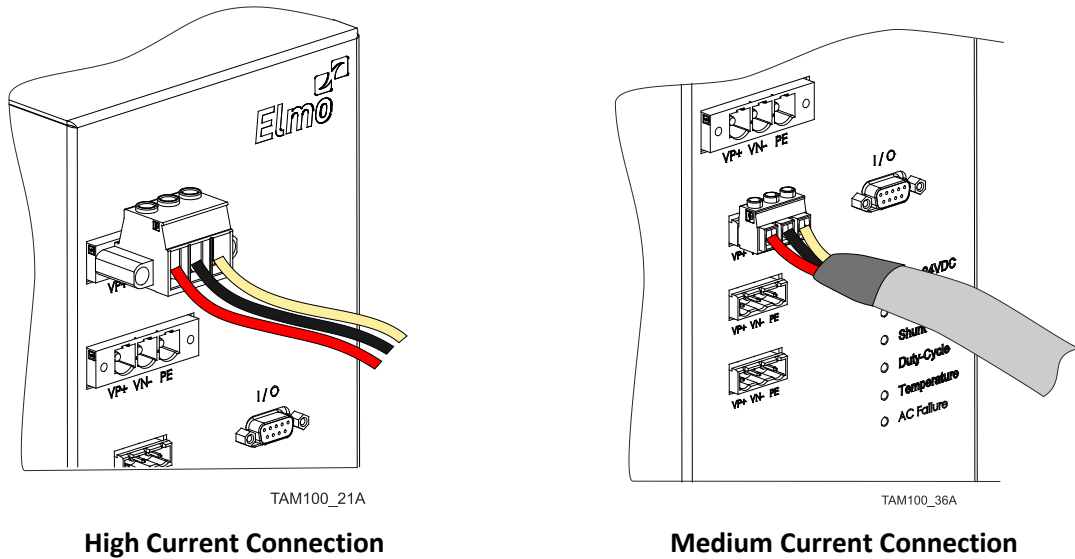


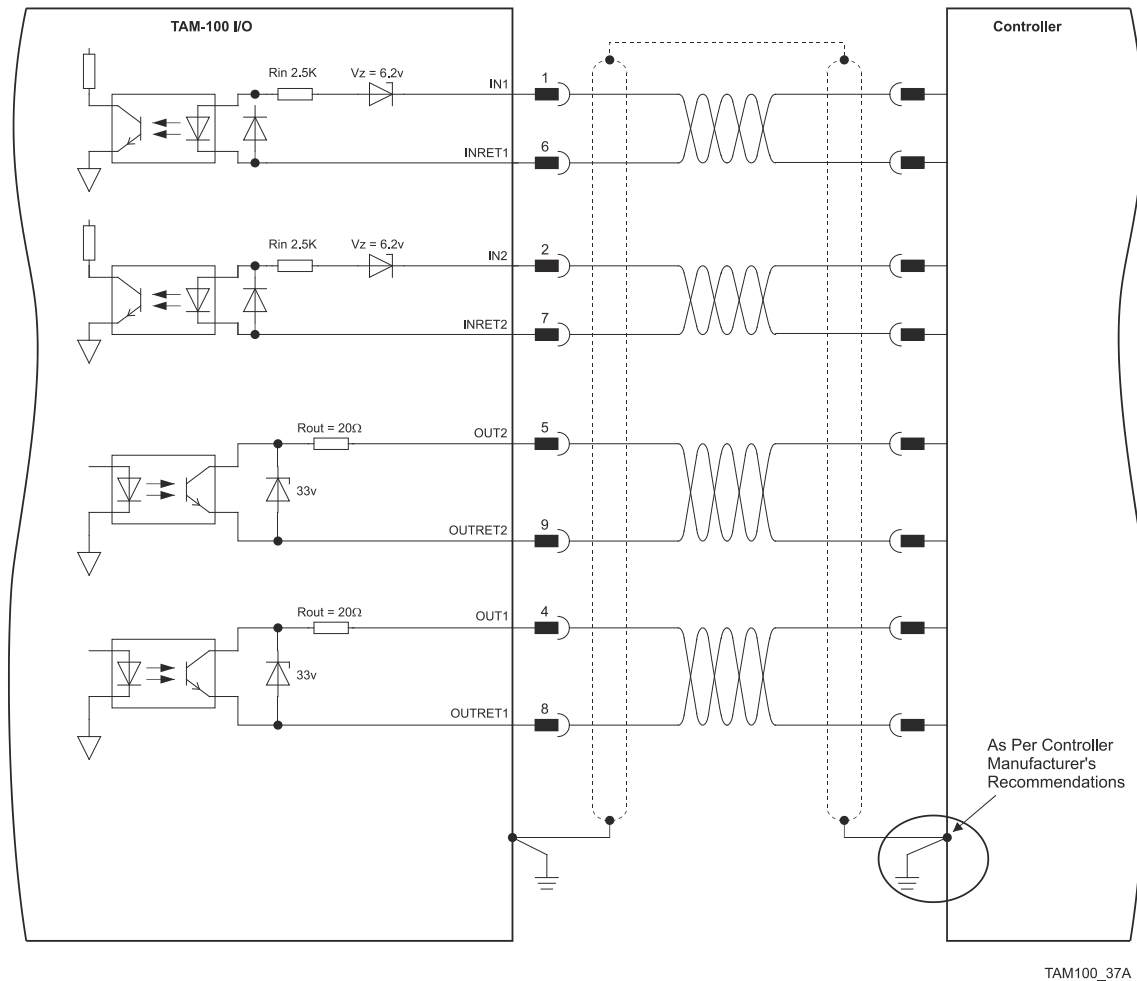
Figure 11: DC Output Connections

To connect the DC output cable (Figure 11)

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 Tambourine 100:
 - 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 Tambourine 100 is fed from an isolation transformer, from the safety and EMI aspects, the VN- junction must be connected to PE junction.



Chapter 4: I/O and Diagnostics Initialization



TAM100_37A

Figure 12 Digital I/O Electrical Scheme

1.15. Digital Inputs

IN1: Enable/Disable

This input serves as the primary Enable / Disable logic-switch of the rectifying bridge.

In order to activate the rectifying bridge of the Tambourine 100, and maintain it in operation, the IN1 input must be kept energized.

Whenever this input is disabled, the main bridge is being shut down and the DC BUS output voltage is diminished to zero.

IN2 : VDCBUS Discharge

Whenever there is an applicative need in an immediate-discharge of the DC BUS voltage, upon any AC failure – then, this input must be kept energized.

When AC loss event occurs (either temporary or permanent), this input activates the shunt regulator, for draining the voltage from the DCBUS capacitors.



1.16. Digital Outputs

OUT1 : Temperature forewarn alert

Whenever the FAN is unable to restrict the Heat sink temperature from rising, and the Heat sink temperature is exceeding 75 C deg. this output becomes conductive.

This output can be used to inform and warn the user about approaching thermal shutdown of the machine, so he can take prevention steps, such as start cooling the control chamber, etc.

OUT2 : AC Failure

This output becomes conductive, and can be used to inform the user whenever the Mains AC source is being shut down temporarily or permanently from any reason, or when one of the mains phase is missing temporarily or permanently, or when the three phases are significantly unbalanced.



1.17. LED Diagnostics

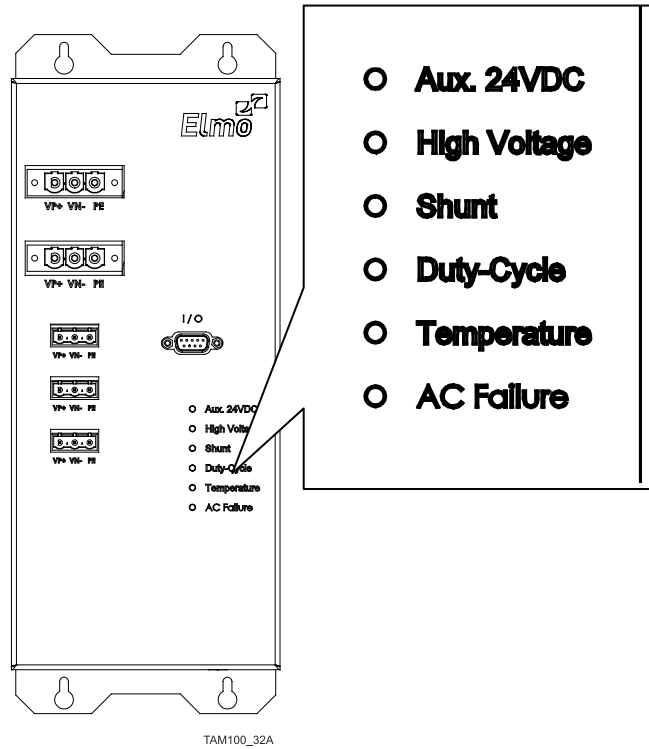


Figure 13: Power LED Indicators

The following indication LEDs are mounted on the front panel of the Tambourine 100 (Figure 13):

LED	Color	Indication
AUX 24V DC	Yellow	24V OK. The auxiliary 24 VDC is present.
High Voltage	Yellow	High Voltage is present at the DC outputs
Shunt	Red	Blink when Shunt is active.
Duty Cycle	Red	The Shunt is disabled when exceeding the limited duty cycle threshold (overvoltage protection may occur within the Drive).
Temperature	Red	Light is on when the temperature rises above 85 °C. The rectifier is Disabled, and thus there is no DC output.
AC Failure	Red	Light is on when either one of the AC mains phases is missing, or when the three phases are significantly un-balanced. Whenever the AC failure is ON, the main rectifier bridge is switched OFF.



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