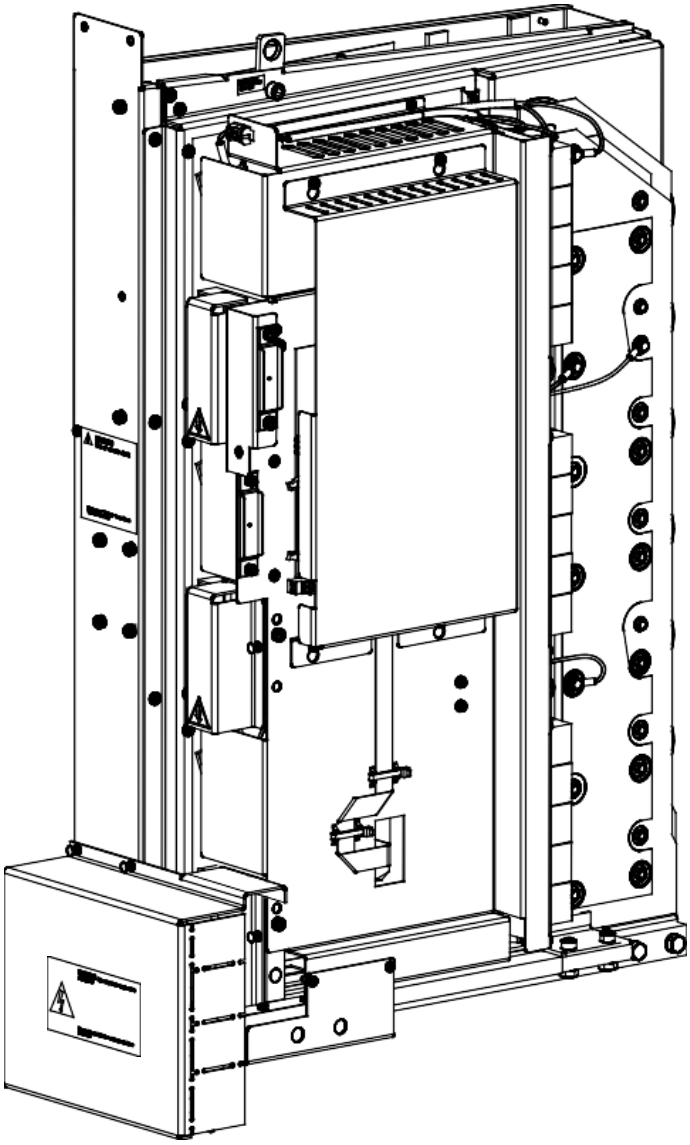


REV 01
DATE: AUG 2, 2021

Avid Controls Inc.
41261 Park 290 Drive, Waller, TX 77484, USA
info@avidcontrolsinc.com
(+1) (281) 640-8600

INTENTIONALLY BLANK

AVID Controls Inc. pursues a policy of continuous product improvement and innovation. This may not be the latest revision of this publication and may not reflect all current product changes. Contact AVID Controls Inc. for the latest revision of this data sheet and information on other product enhancements.

Contents

1. Introduction

- The PED500-4501-A and PED500-4701-A are manufactured by Avid Controls Inc, Waller, Texas, USA under license from the General Electric Company.
- The PED500 is an AC Inverter power module made under license for use in a PED variable speed drive system for the control of AC motors and other applications. It is controlled by a PECe controller.
- Maximum current: 550A AC
- Operational Voltages - PED500-4501-A
    - Working AC Voltage: up to 525 V AC
    - Maximum Nominal Internal Voltage: 900 V DC
- Operational Voltages – PED500-4701-A
    - Working AC Voltage: up to 690 V AC
    - Maximum Nominal Internal Voltage: 1200 V DC
- IGBT based Transistor Bridge Module
- Air Cooled
- Weight: 71 kg (156 lbs.)
- Fits in the standard air cooled DELTA mounting frame on 250 mm (9.8”) pitch

2. Safety Instructions

- Care has been taken with the design of this product to ensure that it is safe. However, in common with all products of this type, misuse can result in injury or death. Therefore, it is very important that the instructions in this technical data sheet and the manual as well as on the product are observed during transportation, commissioning, operation, maintenance and disposal.
- This technical data sheet and the manual must be regarded as part of the product. It should be stored with the product and must be passed on to any subsequent owner or user.
- Local safety laws and regulations must always be observed.
- Persons working on the product must be suitably skilled and should have been trained in that work for these products.
- The product is a component designed for incorporation in installations, apparatus and machines.
- The product must not be used as a single item safety system. In applications where mal-operation of the product could cause danger, additional means must be used to prevent danger to persons.
- Product approvals and certifications will be invalidated if the product is transported, used or stored outside its ratings or if the instructions in the manual are not observed.
- In the European Union:
    - Products within the scope of the Low Voltage Directive, 2006/95/EC are CE marked.
    - The product complies with the essential protection requirements of the EMC directive 2004/108/EC, when installed and used as described in the manual.
    - The requirements of the EMC Directive should be established before any installation, apparatus or machine, which incorporates the product, is taken into service.
    - A machine must not be taken into service until the machine has been declared in conformity with the provisions of the Machinery (Safety) Directive, 2006/42/EC.

3. Disposal

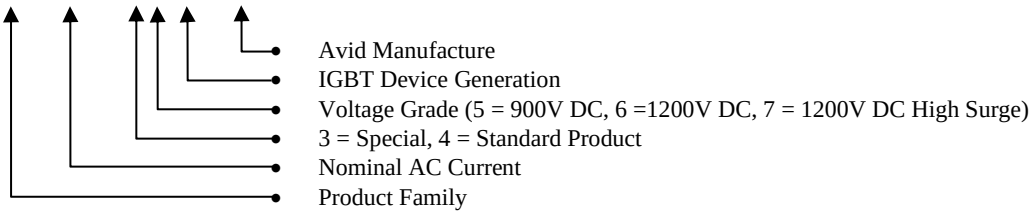
- This equipment or any part of the equipment should be disposed of in accordance with the laws of the country of use.
- Modern high technology materials have been used in the manufacture of the equipment to ensure optimum performance. Care has been taken with the selection of these materials to minimize risks to health and safety. However, some materials require special consideration during the disposal.
- In common with all products of this type, the high voltage electrolytic capacitors contain an electrolyte, which must be disposed of as hazardous waste. The electrolytes are solutions of organic and/or boric acid. The major solvents in the capacitors are butyrolactone and ethylene glycol. The electrolyte is non- carcinogenic, but may cause irritation to the skin if contact is prolonged.
- Liquid coolant is subject to special considerations during handling, storage and disposal. Refer to the manufacturer's instructions.

4. Related Documents

- This module is one component out of a range of components used for the PED drive system. This data sheet gives details specifically for the items listed at the start of this document.
- For additional information on the installation, commissioning, operation, maintenance and performance of the complete drive system, please refer to the following documents:
    - T2061EN, Technical Manual for PED DELTA Air Cooled Drive System.

5. Product Variants

Type Numbers – Example: PED 500 – 4 7 01 - A



6. Specifications

6.1 Electrical Specifications

6.1.1 Characteristics

Function	Specification
Supply Voltage - PED500-4501-A:	400/480/525 V AC RMS. (nominal), +/- 10% long term, +/-15% for 0.5 to 30 cycles with loss of performance but no trip.
Supply Voltage – PED500-4701-A:	575/600/690 V AC RMS. (nominal), +/- 10% long term, +/- 15% for 0.5 to 30 cycles with loss of performance but no trip.
Operational Supply Frequency Range:	45 to 63 Hz
Output Frequency Range:	0 to 200 Hz
Maximum Continuous Operating Voltage:	PED500-4501: 875 V DC PED500-4701: 1170 V DC
Maximum DC Surge and DC Link Capacitor Bank Voltage:	PED500-4501: 900 V DC PED500-4701: 1275 V DC
Maximum Continuous DC Link Capacitor Bank:	PED500-4501: 877 V DC PED500-4701: 1315 V DC
Maximum Silicon Voltage (V_{CES}):	1700 V DC
Heatsink/IGBT Sensor Over-Temperature Trip:	112°C
Current Rating with 1.1 x Overload:	500 A AC RMS (1)
Current Rating with 1.5 x Overload:	367 A AC RMS (1)
Instantaneous IGBT over-current Trip Level:	1250 A (peak)
Brick-wall Current Level (2):	934 A (peak)
Suitable for Use on a Circuit Capable of Delivering not More Than:	30,000 A 690 V AC RMS
DC Link Capacitance:	PED500-4501-A: 18,800 µF PED500-4701-A: 7,833 µF
DC Link Discharge Time (Maximum Voltage to < 50V)	225 s

Notes:
(1) Refer to Avid Controls for de-rating factors at different PWM switching frequencies and ambient temperatures.
(2) Also known as current clipping. This is the instantaneous current that will cause the PECe controller to limit the peak current to below the instantaneous trip current

6.1.2 Electrical Supply

Function	Specification
Network Type	TN or TT (i.e. earthed/grounded neutral) or IT# network (i.e. isolated neutral) # The IT network must be: Separated from the public mains supply by an isolating transformer. Protected against transients Have earth/ground fault reference and monitor. Refer to the PED DELTA ACD manual "Special Requirements for IT Network" for details.
Voltage Unbalance	Negative sequence voltage not to exceed 3%.
OUTPUT SWITCHING FREQUENCY	
Default Setting	1.25 kHz and 2.5 kHz for all drives.
OUTPUT	
Overload Current	50% or 10% for one minute, once every 10 minutes, as selected.
INSULATION	
Voltage to Ground (Earth)	Recurring peak voltage not to exceed 1600 V (Common mode filtering may be required)
Standards	EN 50178, IEC61800-5-1, UL 840: Pollution Degree 2, TN or TT network : Overvoltage Category III IT network : Overvoltage Category II For full compliance with UL 508C, transient suppressers complying with UL 1449 must be fitted external to the drive.

6.2 Mechanical Specifications

The unit is designed to slide in between a lower guide plate and an upper cross member of an Air Cooled DELTA mounting frame.

Width: 245 mm (9.7 in)

Depth: 578.5 mm (22.7 in), including dc shroud

Height: 875 mm (34.4 in)

Weight: 71 kg (156 lbs.)

CAUTION

- **The DELTA module will not fit into the right hand slot of the 600mm wide mounting frame.**

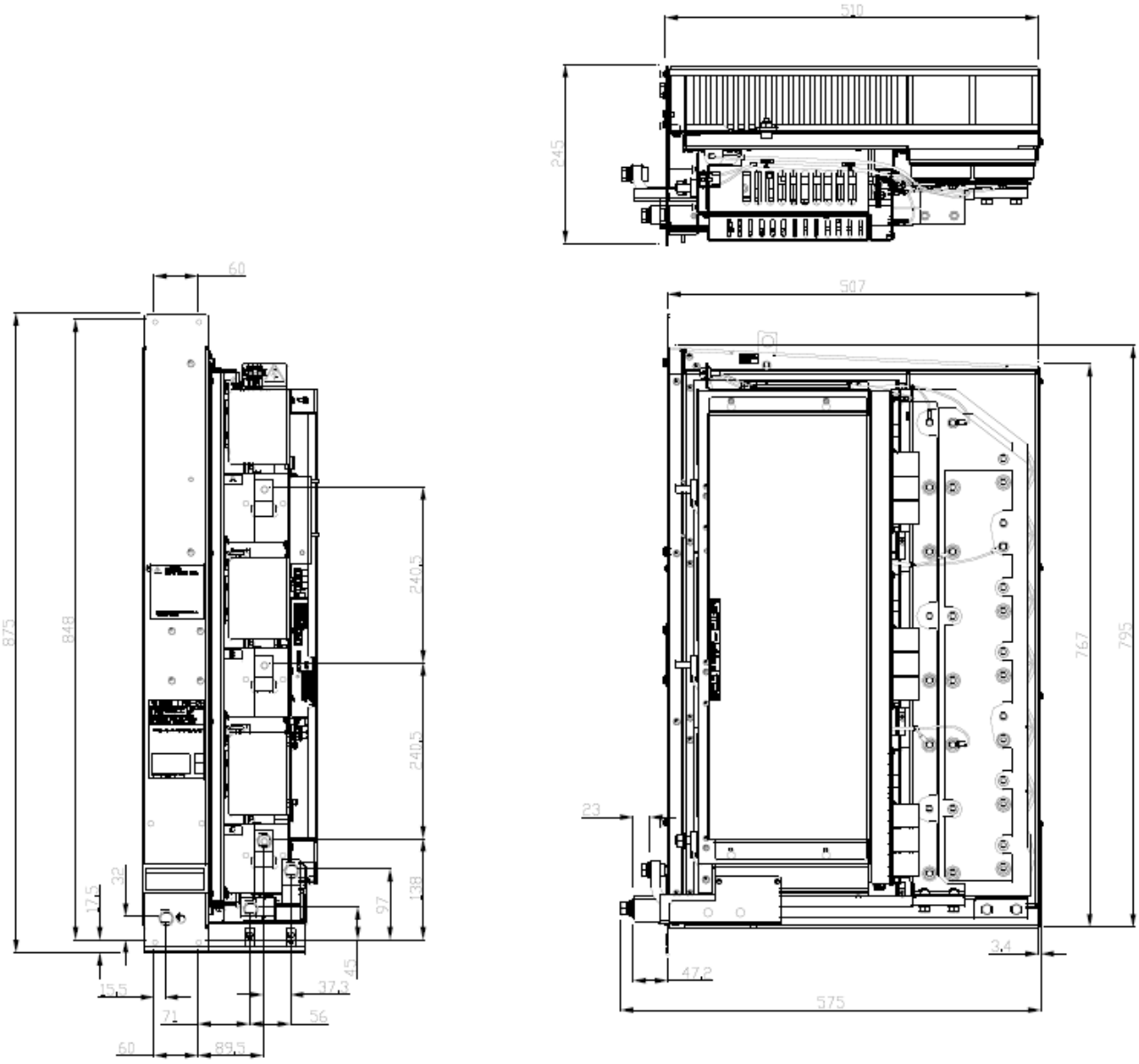


Figure 3–1. – PED500 Dimensions (shrouds not shown)

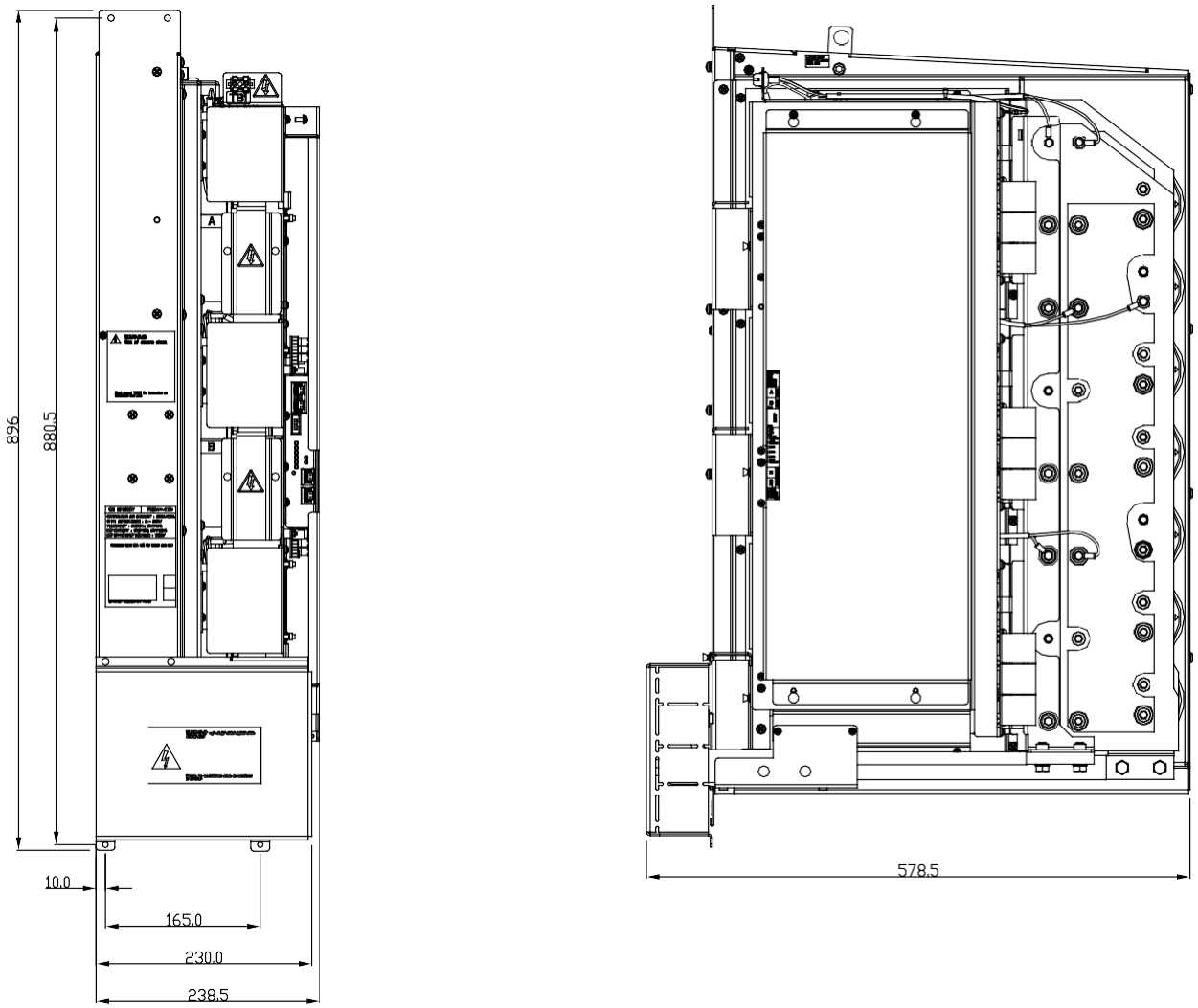


Figure 3–2. – PED500 Dimensions including shrouds

6.3 Power and Control Connections

Power	Connector	Typical Cable Size	Maximum cable Size
AC Power Connections:	1 x M10 stud per phase	120 mm^2 (250 MCM) per phase	120 mm^2 (250 MCM) per phase
DC Power Connections:	1 x M10 stud per connection	120 mm^2 (250 MCM) per connection	150 mm^2 (300 MCM) per connection
Ground Connection:	1 x M10 bolt	Note 2	

Notes:
(1) The AC and DC Power connections (above) are intended for inter-connection within the enclosure (not field wiring terminals). Sizes are based on High Temperature Cable up to a maximum allowed conductor temperature of 125 °C (257 °F). Examples of high temperature cable are: silicon rubber (e.g. Nexans type SIWO-KUL) or polyolefin (e.g. Huber and Schüner type Radox 125).
(2) The recommended grounding for the DELTA is by direct connection (see T2061 for details).

Control	Type	Description
DC High Voltage Control Connection:	3-way Amp 'Mat-n-lok'	Connector 'TB1' for voltage monitoring (Pin 1 = DC+, 2=n/c, 3=DC-)
Low Voltage Control Connections:	16-way Ribbon Connector EtherCAT EtherCAT Shielded Cable EtherCAT	PCB connector PL27 on MVM to PL7 on DIBe Connect PIBe EtherCAT "out" port to DIBe1 EtherCAT "in" port Connect DIBe1 EtherCAT "out" port to DIBe2 EtherCAT "in" port Connect PIBe fault loop to DIBe1 fault loop Connect DIBe1 fault loop to DIBe2 fault loop

6.4 Environmental

Function	Specification
Operating Ambient Temperature	0 to 40°C (32°F to 104°F) de-rate to 50°C **Note:** If clean/dirty air is segregated, the control electronics and fan transformers can withstand 60°C (140°F). Open Type assembly (UL 508C): Maximum surrounding air temperature 60°C
Operating Relative Humidity	5 to 95% (non-condensing)
Operating Altitude	Normal operating altitude up to 1000 m (3280 ft.) above sea level. From 1000 m (3280 ft.) to a maximum of 2000 m (6551 ft.) de-rate by 7.3% per 1000 m
Operating Cooling air	Pollution Degree 2 (IEC 60664-1, UL 840 and CSA C22.2 No. 0.2-93) i.e. clean, free from dust, condensation and conductive or corrosive gases. If conductive pollution or condensation are expected (Pollution Degree 3), the drive must be placed in an enclosure which achieves Pollution Degree 2 by: - excluding the conductive pollution e.g. by the use of filtered air; - preventing condensation e.g. by use of anti-condensation heaters. In extreme environments dual circuit heat exchangers are recommended.

Function	Specification				
Operating and Storage Chemicals (max.)	15 ppm H_2S 25 ppm NO_2 25 ppm SO_2				
Storage Temperature	-25 to +55°C (-13°F to 131°F)				
Storage Relative Humidity	5 to 95% non-condensing				
Storage Altitude	Up to 3000 m (9842 ft.) above sea level				
Transport Temperature	-25 to +70°C (-13°F to 158°F)				
Transport Relative Humidity	5 to 95% (non-condensing)				
Transport Altitude	Will withstand air transport				
Enclosure Ingress Protection	IP00 (to IEC 60529; BS EN 60529), Open Type product (to UL508C, IEC 618005-1) These modules must always be installed in an appropriate enclosure with restricted access.				
Vibration - Operational	Type tested against the worst combination of the requirements of IEC 61800-2 (which specifies 'Class 3M1' of IEC 60721-3-3), EN 50178, IEC 61800-5-1 and DNV Rules for Ships, Jan. 2010 Part 4, Ch. 8, Section 3; summarized by the 'composite' column below:				
	Frequency	IEC 61800-2	IEC 81800-5-1 EN 50178	DNV	Composite
	2 to 5 Hz	0.3 mm amplitude			0.3 mm amplitude
	5 to 9 Hz	0.3 mm amplitude		20 mm amplitude	20 mm amplitude
	9 to 50 Hz	1 m/s^2	0.075 mm (from 10 Hz)	20 mm amplitude	20 mm amplitude
	50 to 57 Hz	1 m/s^2	0.075 mm		1 m/s^2
	57 to 150 Hz	1 m/s^2	9.81 m/s^2		9.81 m/s^2
	150 to 200 Hz	1 m/s^2			1 m/s^2
Vibration - Storage and transport	To IEC 61800-2 which specifies Class 2M1 of IEC 60721-3-2 when equipment is packed for transport: 2 to 9 Hz 3.5 mm amplitude 9 to 200 Hz 10 m/s^2 200 to 500 Hz 15 m/s^2				
Drop - Transport	To IEC 61800-2 which specifies Class 2M1 of IEC 60721-3-2 when equipment is packed for transport: mass < 100 kg = 0.25 m; mass > 100 kg = 0.10 m				
Inclination	- Static conditions; list 15°, trim 5° - Dynamic conditions; rolling ± 22.5°, pitch ± 7.5° (may occur simultaneously)				

6.5 Ratings

Fan *1	400V			480V			525V		
	Amps	Motor Power (kW)	Losses (kW)	Amps	Motor Power (kW)	Losses (kW)	Amps	Motor Power (kW)	Losses (kW)
H	500	296	3.80	500	355	4.02	500	389	4.13
L	435	257	3.14	420	298	3.18	410	319	3.17

Table 3–1. – Ratings and losses for PED500-4501-A (110% overload)

Fan *1	575V			600V			690V		
	Amps	Motor Power (kW)	Losses (kW)	Amps	Motor Power (kW)	Losses (kW)	Amps	Motor Power (kW)	Losses (kW)
H	500	427	4.31	495	440	4.32	475	485	4.34
L	405	345	3.26	395	351	3.22	380	389	3.28

Table 3–2. – Ratings and losses for PED500-4701-A (110% overload)

Fan *1	400V			480V			525V		
	Amps	Motor Power (kW)	Losses (kW)	Amps	Motor Power (kW)	Losses (kW)	Amps	Motor Power (kW)	Losses (kW)
H	367	218	2.44	367	261	2.60	367	285	2.67
L	360	213	2.43	345	245	2.45	340	264	2.45

Table 3–3. – Ratings and losses for PED500-4501-A (150% overload)

Fan *1	575V			600V			690V		
	Amps	Motor Power (kW)	Losses (kW)	Amps	Motor Power (kW)	Losses (kW)	Amps	Motor Power (kW)	Losses (kW)
H	367	313	2.78	367	326	2.83	367	375	3.03
L	330	281	2.43	325	289	2.44	315	322	2.53

Table 3–4. – Ratings and losses for PED500-4701-A (150% overload)

*1 H = Using high capacity cooling fan, L = Using low capacity cooling fan. See section 7.4

Rating Notes:

- Rectifier fed (Diode Front End): DC link voltage = 1.35xV AC Nominal Supply Voltage
- Assumed Motor Efficiency = 0.95 & Power Factor = 0.9
- Ambient = 40 °C (104 °F)
- Altitude = 1000 m (3280 ft.)
- PWM frequency = 1.25 kHz
- No sharing reactor in DELTA air stream
- Typical device characteristics
- 50,000 hours continuous use for DC. capacitor bank
- Overloads are for 60 s every 10 minutes. The current must be reduced between overloads so that the RMS current does not exceed the rated current shown.

7. System Design

- Refer to the manuals in Related Documents (Section 1.4) for general information. This section gives details specifically for the version of the DELTA module that is not included in the related documents.

7.1 Fusing

- Semiconductor devices have a high power concentration in a very small physical size. Due to their relatively small mass, their capacity to withstand overloads and over-voltages is limited. Normal protection of the DELTA semiconductors is provided by internal solid –state switching. If this fails then standard fuses or circuit-breakers will not operate fast enough to prevent some or even complete damage to the device. The packaging surrounding the semiconductor may open, with the potential to cause damage external to the DELTA module. The extent of this damage depends on the correct co-ordination between the system's energy level, the protective devices (e.g. fuses) and the design of the enclosure (arc-containment).
- For these reasons high speed fuses (also called semiconductor fuses) must be used. The selection of these depend on many factors, including the current/time loading conditions, number of starts per hour/day, fuse cooling, ambient temperature, continuous or intermittent running and fuse connection/mounting arrangements.
- For multi-DELTA systems these must be fitted on the DC connections (DC+ and DC-) as detailed below.

From Rating Tables Above, Fuses for Ratings up to 340A		
Manufacturer Part Number Nominal fuse rating	Ferraz Shawmut (Mersen) 12,5URD73TTF0500 500A	2 off per DELTA
From Rating Tables Above, Fuses for Ratings up to 500A		
Manufacturer Part Number Nominal fuse rating	Ferraz Shawmut (Mersen) 12,5URD73TTF0700 700A	2 off per DELTA
Suitable micro-switches for fuse indication		
Ref. Number	For Ferraz Shawmut (Mersen) MS 7V 1-5 BS	2 off per DELTA

Typical fuses for 40˚C ambient

7.2 DC Link Inductor Details

Part No	DC Rating (A)	Suitable for AC Ratings (From Table 3–1 to Table 3–4) (A RMS.)
50Z0038/01	423	360
MV3DCL250A4#	507	430
MV3DCL280A4#	568	480
MV3DCL315A4#	639	540
50Z0038/02	846	720
50Z0038/03	1270	1080
50Z0156/02	1700	1445
50Z0156/03	2550	2170
50Z0156/04	3400	2890
Notes: # Rated to 690 V AC RMS		

DC Link Inductor for 6-pulse applications

Part No	DC Rating (A)	Suitable for AC Ratings (From Table 3–1 to Table 3–4) (A RMS)
50Z0043/01	476	405
50Z0043/02	953	810
50Z0043/03	1430	1215

DC Link Inter-Bridge Transformer for 12-pulse Applications

7.3 Sharing Reactor Details

- To ensure current sharing between multiple DELTA transistor modules, sharing reactors are required. Two choices are available:

MVC4017-4001

- Mounted under the DELTA module and fastened to the mounting frame. All losses from this reactor are ducted through the 'dirty-air' path. Note these losses may reduce the rating of the DELTA module, due to increasing the inlet air temperature.

50Z0126/01

- Iron cored reactor, for mounting inside the drive enclosure. The support and fixings for this reactor are defined by the system builder. All losses from this reactor go in to the enclosure (not through the 'dirty-air' path and so additional enclosure ventilation may be required).

Reactor Part Number	Style	Mounting	Cooling	Rating (AC RMS)	Weight	
					(kg)	(lbs.)
MVC4017-4001	Air cored	Under DELTA cross-rail	Force ventilation losses in to the 'dirty air' path	415A (low capacity fan) 500A (high capacity fan)	39.5	87
50Z0126/01	Iron cored	In the enclosure	Natural ventilation losses in to the enclosure	645 A	30	66

Sharing Reactor Summary

7.4 Cooling Fan

- The following table shows the available cooling fans

Model No	Description
31V5200/10	Low capacity cooling fan, 230Vac, 1 phase, 50/60 Hz
MVC3017-4001	High capacity cooling fan, 500/575Vac, 3 phase, 50/60 Hz
MVC3014-4001A	High capacity cooling fan, 230Vac, 1 phase, 50/60 Hz

7.5 Miscellaneous Assemblies

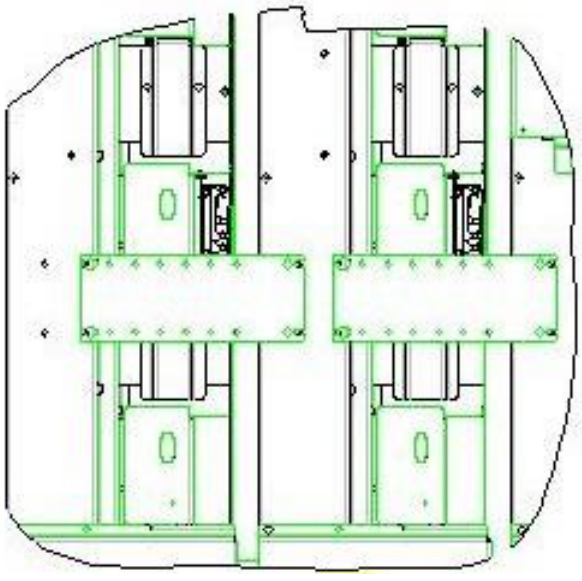
This version of DELTA module uses the same mounting frames, cooling systems (fan boxes and supply transformers) and control and I/O modules as the other Air-Cooled DELTA modules. Please refer to related documents for details of these assemblies.

7.6 System Design Requirements to Satisfy UL508C

- UL 508C has several requirements that must be satisfied:
    - Motor over-temperature monitoring is required. Details of the required connections to the User I/O panel are given in T1689;
    - Semiconductor fuses should be located within the same enclosure as the DELTA module;
    - The integral short circuit protection provided by the DELTA module does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electric Code and any additional local codes.

7.7 EMC Bonding for Electromagnetic Compatibility

- The DELTA power modules must be bonded together and to the drive control module.
- A bonding plate is supplied with the DELTA module to aid with this EMC bonding.
    - These plates form a single metal highway providing a low resistive, low inductive path between the modules and the controller.
    - This arrangement forms a ground plane, against which the control ribbon cables are run, improving the noise immunity of the system.
    - The plate is secured using the screws supplied, pre-fitted to the front of the DELTA module.



Bonding plates linking adjacent DELTAs

- The installer of the modules into the enclosure must complete the bonding path (and cable routing) of the DELTA modules to the PECe controller unit.
- The dimensions of this plate depend on the location of the controller and so cannot be supplied with the module.
- The ribbon cable between the Mains Voltage Monitor (if fitted) and the DIBe must be screened and bonded at both ends.
- Cables must be run along grounded metal, not through 'mid-air'. Cable lengths must be selected to allow this routing.
- A low inductance, direct electrical bond is required and so an unpainted panel (e.g. plated or galvanized) must be used.

CAUTION
• **The control components are supplied with limited cable lengths. Ensure that they are sufficiently close to allow the use of these pre-terminated cables.**

7.8 Enclosure

- This module is as an 'open type' product (IP00) for installation into an enclosure (cabinet / cubicle).

7.8.1 Enclosure Requirements

- The essential requirements for the enclosure are:
  - Protection of personnel against direct contact of hazardous parts:
    - Electrical – all hazardous live parts, e.g. the DELTA module power circuit
    - Thermal - hot parts (on the DELTA module, the heatsink and busbars; for the system these plus high temperature cables, reactors, etc.)
    - Moving parts – on the DELTA none; on the system: the impellers of the cooling fans
    - Energy hazards – Electrical (including the stored energy in the dc capacitor bank, which takes up to eight minutes to discharge), the rotational mechanical energy in the fan (this stops within a few seconds) and the energy that could be supplied into the enclosure during catastrophic failure of any part of the system 'arc-containment'.
  - Protection of the enclosed equipment against the environmental conditions
    - Mechanical impact against the enclosure
    - Environmental control against the ingress of water, dust and solid objects
    - Condensation control to meet the requirements of Pollution Degree 2 (see Section **Error! R eference source not found.**)
  - Reduction of radiated emissions form the drive and protection of the drive from radiating sources.

7.8.2 DELTA Module Construction

- The front of the unit is supplied with terminal shrouds to aid in the requirement to provide accidental protection to personnel against direct electrical contact during 'proving dead' procedures.
- All the insulation materials used in the DELTA module have a low flammability rating when tested against UL 94 (limited burn rate; will self-extinguish and do not drop burning particles when the source of ignition is removed).

- The DC link capacitor bank has discharge resistors fitted to discharge the capacitors to below 50V in less than 8 minutes after the isolation of the supply.

7.8.3 Enclosure Construction

Steel Enclosure

- To provide a conductive and magnetic screen in addition to safety segregation.

Earthing / Grounding

- To be locally earthed/grounded for both safety and for EMC.
- Note converters contain high leakage current equipment.
- Panels to be bonded together for earth/ground continuity and continuation of conductive screen/shield

Openings

- Designed to protect personnel (and equipment) against hazards listed in Section 7.8.1.
- Avoid all unnecessary apertures.

All doors and covers to hazardous parts to be closed when the equipment is energized

8. Installation, Commissioning, Operation and Maintenance

- Refer to the specific instructions, WARNINGS and CAUTIONS in the relevant Manual(s).
- In addition, for DELTA based systems, it is recommended that:
    - Individual phase currents from each module are measured to ensure that the 3 phase currents are balanced and that the phase currents between each DELTA share the current equally. The current sharing between DELTAs should be within 4%.
    - During routine maintenance, that the DELTA module is visually inspected for overheating / damaged components.

9. Glossary of Terms

AC	Alternating Current
ACD	Air Cooled Delta
DC	Direct Current
DIBe	Delta Interface Board for PECe
DNV	Det Norske Veritas
IEC	International Electro-Technical Committee
IGBT	Insulated Gate Bipolar Transistor
MVM	Mains Voltage Monitor
PCB	Printed Circuit Board
PECe	Power Electronics Controller with EtherCAT
PIBe	Power Interface Board for PECe

10. Contact Details for Sales, Service and Support

- Please refer to your local technical support center if you have any queries about this product.

Avid Controls Inc.
41261 Park 290 Drive, Waller, TX 77484, USA
info@avidcontrolsinc.com
(+1) (281) 640-8600

11. Document Revision History

Rev.	Date	Author	Changes
00	Oct 16, 2017	Mark Woods	Document created from GE document T2189EN Rev. 02
01	Aug 2 2021	Gary Pace	DC discharge time changed from 5 to 8 minutes