Test Report issued under the responsibility of:

TEST REPORT
IEC 61010-1
Safety requirements for electrical equipment for measurement, control, and laboratory use
Part 1: General requirements

Report Number .....:	E331788-D1003-2/A0/C0-CB
Date of issue .....:	2021-11-16
Total number of pages.....:	148
Name of Testing Laboratory preparing the Report.....:	UL International Germany GmbH Admiral-Rosendahl-Strasse 23, Zeppelinheim 63263 Neu-Isenburg , Germany
Applicant's name.....:	TDK-LAMBDA UK LTD
Address .....:	KINGSLEY AVE ILFRACOMBE DEVON EX34 8ES UNITED KINGDOM
Test specification:	
Standard.....:	IEC 61010-1:2010, IEC 61010-1:2010/AMD1:2016
Test procedure .....:	CB Scheme
Non-standard test method……..:	N/A
TRF template used .....:	IECEE OD-2020-F1:2020, Ed.1.3
Test Report Form No.....:	IEC61010_1P
Test Report Form Originator.....:	VDE Prüf- und Zertifizierungsinstitut GmbH
Master TRF.....:	2021-04-12

If this Test Report Form is used by non-IECEE members, the IECEE/IEC logo and the reference to the CB Scheme procedure shall be removed.

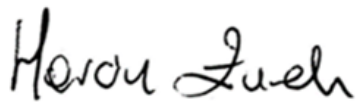
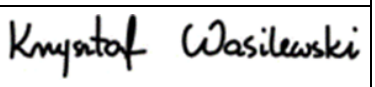
This report is not valid as a CB Test Report unless signed by an approved IECEE Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.

General disclaimer:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing NCB. The authenticity of this Test Report and its contents can be verified by contacting the NCB, responsible for this Test Report.

Test item description.....:	Switch mode power supply
Trade Mark.....:	TDK-LAMBDA
Manufacturer.....:	Same as Applicant
Model/Type reference.....:	NV175 Series; NV-175 Series; NV1-1G000 (See Model Differences for details)
Ratings.....:	NV175 Series; NV-175 Series: 100-240Vac (Nominal), 90-264V (Full Tolerance), 45-440Hz, 3Arms NV1-1G000 only: 88.9-240Vac (Nominal), 80-264V (Full Tolerance), 45-440Hz, 3Arms (See Model Differences for details)

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):

[X] **CB Testing Laboratory:**		
Testing location/ address .....:	UL International Germany GmbH Admiral-Rosendahl-Strasse 23, Zeppelinheim 63263 Neu-Isenburg , Germany	
Tested by (name, function, signature) .....:	Marcin Zurek, Project handler	
Approved by (name, function, signature) ....:	Krzysztof Wasilewski, Review	
[ ] **Testing procedure: CTF Stage 1:**		
Testing location/ address .....:		
Tested by (name, function, signature) .....:		
Approved by (name, function, signature) ....:		
[ ] **Testing procedure: CTF Stage 2:**		
Testing location/ address .....:		
Tested by (name, function, signature) .....:		
Witnessed by (name, function, signature) ...:		
Approved by (name, function, signature) ....:		
[ ] **Testing procedure: CTF Stage 3:**		
[ ] **Testing procedure: CTF Stage 4:**		
Testing location/ address .....:	TDK LAMBDA UK LTD. KINGSLEY AVENUE, ILFRACOMBE DEVON EX34 8ES, UNITED KINGDOM	

Tested by (name, function, signature) .....:	M.Carter/ N.Marsh	See Original Test report for signatures.
Witnessed by(name, function, signature) ....:		
Approved by (name, function, signature) ....:	T.Burgess	See Original Test report for signatures.
Supervised by (name, function, signature) ..:	Walter Hofmair	See Original Test report for signatures.

List of Attachments (including a total number of pages in each attachment)		
Document No.	Documents included / attached to this report (description)	Page No.
	Refer to Appendix A of this report. All attachments are included within this report.	

Documents referenced by this report (available on request):		
Document Name or No.	Documents description	Page No.
	Refer to Appendix A of this report. All attachments are included within this report.	

Summary of testing:

Refer to the Test List in Appendix B of this report if testing was performed as part of this evaluation.

Clause	Comment
Refer to the Test List in Appendix B of this report if testing was performed as part of this evaluation.	*Refer to the Test List in Appendix B of this report if testing was performed as part of this evaluation.*

Test Report History:
This report may consist of more than one report and is only valid with additional or previous issued reports:

Report Ref. No.	Item
Refer to Report Modifications under General product information for any modifications made to this report.	

Tests performed (name of test and test clause):	**Testing location:**
Refer to the Test List in Appendix B of this report if testing was performed as part of this evaluation.	*Refer to the Test List in Appendix B of this report if testing was performed as part of this evaluation.*

Summary of compliance with National Differences (List of countries addressed):

USA, Canada, EU Group

[X] The product fulfils the requirements of IEC 61010-1:2010, IEC 61010-1:2010/AMD1:2016.

Statement concerning the uncertainty of the measurement systems used for the tests

(may be required by the product standard or client)

[ ] **Internal procedure used for type testing through which traceability of the measuring uncertainty has been established:**

Procedure number, issue date and title:

Calculations leading to the reported values are on file with the NCB and testing laboratory that conducted the testing.

[ ] **Statement not required by the standard used for type testing**

(Note: When IEC or ISO standard requires a statement concerning the uncertainty of the measurement systems used for tests, this should be reported above. The informative text in parenthesis should be delete in both cases after selecting the applicable option)

Copy of marking plate
The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.

Refer to the enclosure(s) titled Marking Label in the Enclosures section in Appendix A of this report for a copy.

Test item particulars :	
Type of item:	Laboratory
Description of equipment function:	Switch mode power supply
Connection to mains supply:	To be determined in the end use equipment or IEC inlet
Overvoltage category:	II
Pollution degree:	2
Means of protection:	Class I (PE connected)
Environmental conditions:	Extended (Specify): Temperature: 0 to 50°C (From 50 to 65°C the total output power and the module current ratings are both derated at 2.5% per deg C); Humidity: 5 to 95% RH, non-condensing; Air Pressure: 70kPa to 106kPa; Altitude: -200m to 3000m (-H and -HR models, 5000m).
For use in wet locations:	No
Equipment mobility:	Built-in
Operating conditions:	continuous
Overall size of equipment (W x D x H)	174 x 103 x 41 mm
Mass of equipment (kg):	0.6 kg max
Marked degree of protection to IEC 60529:	none
Possible test case verdicts:	
- Test case does not apply to the test object .....:	N/A (Not Applicable)
- Test object does meet the requirement .....:	P (Pass)
- Test object does not meet the requirement .....:	F (Fail)
Testing:	
Date of receipt of test item .....:	2018-09-13 to 2018-10-29
Date(s) of performance of tests .....:	2018-09-17 to 2019-01-10

General remarks:

The test results presented in this report relate only to the object tested.
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Throughout this report a point is used as the decimal separator.

Manufacturer's Declaration per sub-clause 4.2.5 of IECEE 02:

The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided .....: Yes

When differences exist; they shall be identified in the General product information section.

Name and address of factory (ies)..... : Same as Applicant

PANYU TRIO MICROTRONIC CO. LTD
SHIJI INDUSTRIAL ESTATE
DONGYONG
NANSHA
GUANGZHOU, GUANGDONG CHINA

TRIO-TRONICS (THAILAND) LTD.
"7/295 MU.6, MAP YANG PHON SUB-DISTRICT,
PLUAK DAENG DISTRICT"
RAYONG PROVINCE THAILAND

General product information and other remarks:

Report Summary

All applicable tests according to the referenced standard(s) have been carried out.

Refer to the Report Modifications for any modifications made to this report.

Product Description

NV175 or NV-175 series . Switch mode power supplies for building into end equipment.

Additional Information

Cooling for NV175 or NV-175 series units with customer supplied air (open frame, U and C options):

The following method must be used for determining the safe operation of PSUs.

The components listed in the following table must not exceed the temperatures given. To determine the component temperatures the heating tests must be conducted in accordance with the requirements of the standard concerned. Consideration should also be given to the requirements of other safety standards. Test requirements include: PSU to be fitted in its end-use equipment and operated under the most adverse conditions permitted in the end-use equipment handbook/specification and which will result in the highest temperatures in the PSU. To determine the most adverse conditions consideration should be given to the end use equipment maximum operating ambient, the PSU loading and input voltage, ventilation, end use equipment orientation, the position of doors & covers, etc. Temperatures should be monitored using type K fine wire thermocouples (secured with cyanoacrylate adhesive, or similar) placed on the hottest part of the component (out of any direct airflow) and the equipment should be run until all temperatures have stabilized. See handbooks for component locations.

Circuit Ref.	Description	Max. Temperature (°C)
L3, L7	Common mode choke winding	140
C1, C4	X capacitors	100
C6, C12	Capacitor	105
L2	Boost choke winding	130
C7	Electrolytic capacitor	70 (105)
T1, T2	Transformer winding	130
XU3	Control board optocoupler	100
TX701	Global option transformer	90
L5	Channel 1 Output choke	125
XL401	Channel 2 Output choke	125
XL601	5L channel 2 output choke	125
XU601	5L channel 2 IC	115
XL501 or XL601	Channel 3 and 4 output choke	125
IC1*	Channel 4 Voltage regulator	110
XQ406	Ch2 highside FET (SMA 2)	115
XV504	Ch3 highside FET (SMA 3)	115
XU601	Ch4 IC (SMA 4)	115
Various	All other electrolytic capacitors	90 (105)

* 1A channel 4 only

Higher temperatures limits (in brackets) may be used but product life may be reduced.

No tests conducted under this investigation due to reissue of CB Test Report Ref. No.EE331788-D1003-1/A0/C0-ULCB. All required tests were carried out under the original investigation
This report is a reissue of CBTR Ref. No.E331788-D1003-1/A0/C0-ULCB and CB Test Certificate Ref. No. DK-80454-UL. Based on the previously conducted testing and the review of product technical documentation including photos, schematics, wiring diagrams and similar, has been determined that the product continues to comply with the standard.
The original report was modified to include the following changes:
- The standard has been ugraded to the latest revision date.
- Standards were updated on critical omponent list
- Components licenses were attached to the report
- Factory TRIO-TRONICS (THAILAND) LTD.was added to the report
- Capacitor Murata SA series and RA series with the same electrical ratings has been added as alternate to critical component list.
No testing was deemed necessary.

Technical Considerations

- The product was investigated to the following standards:

  Main Standard(s):

  IEC 61010-1:2010/AMD1:2016/COR1:2019

  From Country Differences:

  - USA: UL 61010-1, 3rd Edition, May 11, 2012, Revised July 19, 2019
  - Canada: CAN/CSA-C22.2 No. 61010-1(2012-05), 3rd Edition, with revisions through 2018-11
  - EU Group: EN 61010-1:2010/A1:2019 (Edition 3.1)

  Additional Standards:

  N/A

- The following additional investigations were conducted: N/A
- The product was not investigated to the following standards or clauses: N/A
- The following accessories were investigated for use with the product: N/A
- Equipment class: Class I

  Equipment type: For building in

  The product was submitted and tested for use at the maximum recommended ambient temperature (Tmra) of 50°C (full load): 65°C maximum (output de-rated 2.5% /°C above 50°C)

  Evaluated for a maximum altitude of 3000m (5000m for the -H and -HR models)

For any non-certification testing - Unless specified otherwise in this report, the compliance “Decision Rule” is based on Simple Acceptance (Measurement Uncertainty is not taken into account when making a statement of conformity)

Engineering Conditions of Acceptability

When installed in an end-product, consideration must be given to the following:

This component has been judged on the basis of the creepage and clearances required in the indicated Standards, which would cover the component itself if submitted for Listing: UL 61010-1, 3rd Edition, May 11, 2012, Revised July 19, 2019, CAN/CSA-C22.2 No. 61010-1(2012-05), 3rd Edition, with revisions

through 2018-11, IEC 61010-1:2010/AMD1:2016/COR1:2019, EN 61010-1:2010/A1:2019 (Edition 3.1)
The end-product shall consider that: The enclosure does not serve as a fire/electrical/mechanical enclosure (except the IEC inlet version end cover)
The need for the following shall be considered in the end-product: Bonding to protective earthing terminal (Class I construction)
MAINS disconnect device (except the IEC inlet)
The output connectors are Not investigated for field wiring

Creepage and clearance distances were based on a maximum working voltage of 337 Vrms; 616 Vpeak Primary to Secondary
337 Vrms; 608 Vpeak Primary to Earth
Insulation between primary circuits and accessible dead metal complies with the requirements for Basic insulation
Insulation between primary and secondary circuits complies with the requirements forReinforced insulation
The following tests shall be performed in the end-product evaluationDielectric Strength
Temperature (customer air models)
The unit is considered acceptable for use at on a max branch circuit of 20 A
The unit is considered acceptable for use in a max ambient of 50°C (full load): 65°C maximum (output de-rated 2.5% /°C above 50°C)
End-product temperature tests for power supplies shall consider that the following transformers employ the indicated insulation system Transformer T1, T2, TX701 Class F (155 °C)
End-product dielectric strength tests shall be based on the maximum working voltage of 337 Vrms; 616 Vpeak Primary to Secondary
337 Vrms; 608 Vpeak Primary to Earth
At input frequencies above 63Hz Clause 6.4.4a requires investigation in the end application
Customer air models must be thermally tested as described in the Additional Information
Input connector is: Not investigated for field wiring
Input connector J2 pin 1 was investigated as the protective bonding terminal for the product
The risk associated with clause 5.4.5 requires assessment in the end equipment
Multilayer PWB's accepted under CBTR Ref. No.: E349607-A23 dated 2014-07-31 and letter report, Enclosure Multi-layer PWB Letter Reports of this report.

Report Modifications

Date Modified *(Year-Month-Day)*	Modifications Made (include Report Reference Number)	Modified By
2019-01-25	This report is a reissue of CBTR Ref. No.: E331788-A18-CB-1-1, CB Test Certificate Ref. No.DK-34077-A1-UL dated 2015-08-14 to include the following changes and additions: 1. Updates to the list of critical components include fuse F1 (add Schurter AG: SPT series), C1,C4 X capacitors (add interchangeable), C8 Y capacitor (deleted Kemet ERP 610 series and add interchangeable), Y-Capacitors C2 and C3 (deleted Kemet ERP 610 series and add interchangeable); 2. Addition of 12V alternative fan (Sunonwealth: MF40201VX); 3. Addition of alternative fuse (Schurter AG: SPT series); 4. Updates to the enclosures as applicable include diagrams (for Supplement ID 4-01, change description to "T1 and T2 main transformers", Update to latest diagram set; for Supplement ID 4-02, Add diagram set with description "TX701 standby transformers"), manuals (for Supplement ID 6-01 and 6-02, Update with latest revision), marking plate (for Supplement ID 13-01 and 13-02, Update with latest revision), manufacturers factory location declaration (for Supplement ID 7-01, Update with latest revision) and Photographs (for Supplement ID 3-01, Change description to external with cover; for Supplement ID 3-04, Change description to IEC	Jay Lu

	inlet), no technical changed. Additional tests of clause 4.4.1, 4.4.2.5, 4.4.2.10, 6.8 and 10.1-10.4 were carried out on the appliance which matched alternative components. All other required tests were conducted under the original investigation in CB Test Reports Ref. E331788-A18-CB-1 & CB Certificate No. DK-34077-UL, E331788-A18-CB-1-1 & CB Test Certificate Ref. No.DK-34077-A1-UL . Based on the previously conducted testing, limited testing for this report and the review of product technical documentation including photos, schematics, wiring diagrams and similar, it has been determined that the product complies with the standard.	
2021-11-16	No tests conducted under this investigation due to reissue of CB Test Report Ref. No.EE331788-D1003-1/A0/C0-ULCB. All required tests were carried out under the original investigation This report is a reissue of CBTR Ref. No.E331788-D1003-1/A0/C0-ULCB and CB Test Certificate Ref. No. DK-80454-UL. Based on the previously conducted testing and the review of product technical documentation including photos, schematics, wiring diagrams and similar, has been determined that the product continues to comply with the standard. The original report was modified to include the following changes: - The standard has been ugraded to the latest revision date. - Standards were updated on critical omponent list - Components licenses were attached to the report - Factory TRIO-TRONICS (THAILAND) LTD.was added to the report - Capacitor Murata SA series and RA series with the same electrical ratings has been added as alternate to critical component list. No testing was deemed necessary.	Marcin Zurek

Description of model differences:

NV175 or NV-175 models as described below:

Units may be marked with a Product Code: K1x or Q1x where x may be any number of letters and/or numbers 0 to 9.

Unit Configuration (Description :) Code may be prefixed by NS # followed by / or - (where # may be any number of characters indicating non- safety related model differences).

Unit Configuration Code:

NVx-abcde-f-g-h-ijk

where:

x = 1 for 175
a = Number of Outputs : 1, 2, 3 or 4
b = Channel 1 Output Voltage†: 5, T, F, E or G
c = Channel 2 Output Voltage†: 1 , 2, 3, 5, 5L, 7, F or 0
d = Channel 3 Output Voltage†: 3L, 5L, 7, TL, FL, T, F, G followed by Y for negative output or 0

e = Channel 4 Output Voltage†: 3H, 5H, 7, T, F, TH, FH, 0H (fan only channel 4 output) followed by V for variable output followed by P for positive output or 0
f = Global Option : N for 5V version, N1 for 12V version, N2 for 13.5V version, N3 for 5V version with ATX compatibility, N4 for 12V version with ATX compatibility, N5 for 13.5V version with ATX, N6 for 12-13.5V version, N7 for 12-13.5V version with ATX or nothing for no Global Option present
g = U for U chassis, C for U chassis and cover, F for U chassis and cover with fan, I for U chassis and cover with fan and IEC inlet or nothing for Open Frame
h = Blank is the standard upright output connector, R is for the right angle output connector, H is for high altitude, HR is for high altitude with right angle output connector, M is for IEC60601-1, MR is for IEC60601-1 spacings with right angle connector
ijk = Three numbers from 0 to 9 which denotes various output voltages and currents within the specified ranges of each output for a particular unit or blank for standard output settings

† Table1: Output Voltage Cross Reference

Designation	Output Voltage
0	Omit output
A	1.5
1	1.8
B	2
2	2.7
3	3.3
5	5
7	7
T	12
F	15
E	18
G	24

Output channels and Global Options ratings are in accordance with the following table subject to variations and limitations of use below:

Output Channel	Designation	Vout	Adj. Range	Output Current
CH1	5	5	5 - 5.5	25A
	T	12	12 - 15.5	15A
	F	15	12 - 15.5	15A
	E	18	16 - 20	10A
	G	24	24 - 28.5	7.5A
CH2	1	1.8	0.9 - 3.8	15A
	2	2.7	2.5 - 3.8	15A
	3	3.3	2.5 - 3.8	15A
CH2 (CH1 12V)	5	5	3.3 - 5.5	10A
CH2 (CH1 15V)	5	5	3.3 - 5.5	10A
CH2 (CH1 24V)	5L	5	Fixed	2A
	5	5	3.3 - 5.5	8A
	7	7	5.5 - 8	5.5A
	F	15	12-15.5	6A
CH3	7	+/-7	7 - 8	5A
	T	+/-12	12 - 15	5A
	F	+/-15	12 - 15	5A
	G	+/-24	18 - 24.5	2.5A
	3L	+/-3.3	Fixed	2A
	5L	+/-5	Fixed	2A
	TL	+/-12	Fixed	2A
	FL	+/-15	Fixed	2A
CH4	3H	+/-3.3	Fixed	2A
	5H	+/-5	Fixed	2A
	7	+/-7	7 - 8	1A
	T	+/-12	Fixed	1A
	F	+/-15	Fixed	1A

	TH	+/-12	Fixed	2A	
	FH	+/-15	Fixed	2A	
	THV	+/-12	12 - 15		2A
	FHV	+/-15	12 - 15		2A
CH4 (fan output)	OH		-	-	-
Global Option	N		5	Fixed	2A
	N1		12	Fixed	1A
	N2		13.5	Fixed	1A
	N3		5(ATX)	Fixed	2A
	N4		12(ATX)	Fixed	1A
	N5		13.5(ATX)	Fixed	1A
	N6		12	12-13.5*	1A
	N7		12(ATX)	12-13.5*	1A

Channels 1 and 2 combined output currents must not exceed 25A
*Can only be set at the factory.

Variations and limitations of use:

All NV175 or NV-175 PSUs can output 180W except 5V channel 1 models which can output 175W. These power ratings are for channels 1 to 4. The global option output can be run in addition to the channel 1 to 4 maximum power outputs.

Units with channel 1 T and G outputs (no other channels fitted) have a peak power output of 200W including the global option with the following duty cycles:

In any 5 minutes 30% at 200W followed by 70% at 171W (average 180W)
In any 5 minutes 20% at 200W followed by 80% at 175W (average 180W)

Options -H and -HR meet spacings for 5000m.

Options -M and -MR meet IEC60601-1 Edition 2 Reinforced spacing's with the following limitations (interpolated creepage spacings):

Channel 1 cannot be 5V model (T1 and T2 with foils)
Channel 2 cannot be fitted
Cannot be global option variants

Fan versions:

Channel 1 with G output, 25V maximum with 5V channel 2 maximum output current of 7A.
Channel 1 with G output, 25V maximum with 7V channel 2 maximum output current of 5.5A.
Channel 1 with G output, 5L channel 2 maximum output current 1.8A.
Channel 2 with T and F outputs, channel 2 maximum output current of 9A.
Channel 4 maximum output current of 1.5A

Model NV1-1G000 (with or without global option or -M/-MR option) may also be run with Channel 1 output voltage range 22.5V to 28V with maximum current of 7.5A and maximum power of 180W

Model NV1-1G000 (with or without -M option) may also be run at 80Vac to 264Vac input, output: 24V to 28V at 6.25A maximum current and 150W maximum power.

The products listed in the following table are typical examples:

Model	CH1	CH2	CH3	CH4	Global Option
NV1-453FF	5V/25A	3.3V/15A	15V/5A	15V/1A	-
NV1-4G5FFH-N3	24V/7.5A	5V/8A	15V/5A	15V/2A	5V/2A
NV1-350TT-N	5V/25A	-	12V/5A	12V/1A	5V/2A
NV1-453TT-N1	5V/25A	3.3V/15A	12V/5A	12V/1A	12V/1A
NV1-250T0-N2	5V/25A	-	12V/5A	-	13.5V/1A

Custom Models:

All ratings as per standard models unless otherwise stated.

Model: NS-LAM/NV1-453TTH-N2-H-C (K10035)
Rated to 4600m altitude
Input voltage range from 90Vac to 264Vac

Model: NS-LAMF/NV1-4G5TTH-F (K10066)
5L low current channel 2 fitted.
Channel 2 rated: 5V, 1.4A
ELECTRICAL AND THERMAL RATINGS

Nominal Input Voltage	100 - 240 Vac
Input Voltage Range	90 - 264Vac
Input Frequency Range	45 - 440Hz
Maximum Input Current	3A rms

All ratings apply for ambient temperatures up to 50°C. From 50 to 65°C the total output power and the module current ratings are both derated at 2.5% per deg C.

ENVIRONMENTAL PARAMETERS

Operation

Temperature:	0 to 50°C (From 50 to 65°C the total output power and the module current ratings are both derated at 2.5% per deg C)
Humidity:	5 to 95% RH, non-condensing
Air Pressure:	70kPa to 106kPa
Altitude:	-200m to 3000m (-H and -HR models, 5000m)

Storage and Transportation

Temperature:	-40°C to +70°C
Humidity:	5 to 95% RH, non-condensing
Air Pressure:	54kPa to 106kPa
Altitude:	-200m to 5000m

Mounting Aspects

Orientations:	All except PCB uppermost

Description of special features:
(HV circuits, high pressure systems etc.)

See additional information above.