

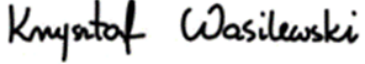




Test Report issued under the responsibility of:



TEST REPORT IEC 61010-1 Safety requirements for electrical equipment for measurement, control, and laboratory use Part 1: General requirements	
Report Number	E331788-D1002-2/A0/C0-CB
Date of issue	2021-11-10
Total number of pages	163
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
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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:	Trademark image(s): 	
Manufacturer	Same as Applicant	
Model/Type reference:	EFE400 or EFE-400, EFE400R or EFE-400R series. (may be followed by characters as described in Model Differences, see Model Differences for details)	
Ratings:	100-240 Vac nom, 45-440 Hz 6.1 Arms max (see Model Differences for details)	
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
<input checked="" type="checkbox"/> 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 (Handler)	
Approved by (name, function, signature)	Krzysztof Wasilewski, reviewer	
[] 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)		
[X] Testing procedure: CTF Stage 3:		
[] Testing procedure: CTF Stage 4:		
Testing location/ address	TDK-LAMBDA UK LTD. IILFRACOMBE, DEVON DEVON, EX34 8ES. UK	

Tested by (name, function, signature)	Nick Marsh (Tester)	See Original Test report for signatures.
Witnessed by(name, function, signature)		
Approved by (name, function, signature)	Marcin Zurek (Reviewer)	See Original Test report for signatures.
Supervised by (name, function, signature) ..	Onome Sanomi (Handler)	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
<i>Refer to the Test List in Appendix B of this report if testing was performed as part of this evaluation.</i>	<i>Refer to the Test List in Appendix B of this report if testing was performed as part of this evaluation.</i>

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
<i>Refer to Report Modifications under General product information for any modifications made to this report.</i>	
Tests performed (name of test and test clause): <i>Refer to the Test List in Appendix B of this report if testing was performed as part of this evaluation.</i>	Testing location: <i>Refer to the Test List in Appendix B of this report if testing was performed as part of this evaluation.</i>
Summary of compliance with National Differences (List of countries addressed): USA, Canada, EU Group [X] The product fulfils the requirements of <u>IEC 61010-1:2010, IEC 61010-1:2010/AMD1:2016.</u>	

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:	via host equipment
Overvoltage category:	II
Pollution degree:	2
Means of protection:	Class I (PE connected)
Environmental conditions:	Normal
For use in wet locations:	No
Equipment mobility:	N/A, for building into host equipment
Operating conditions:	continuous
Overall size of equipment (W x D x H)	85 x 198 x 41 with end fan and cover
Mass of equipment (kg):	less than 1kg
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	2018-08-06
Date(s) of performance of tests	2018-08-22
General remarks:	
<p>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.</p>	
Throughout this report a point is used as the decimal separator.	
Manufacturer's Declaration per sub-clause 4.2.5 of IECEE 02:	
<p>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</p>	
<p>.....: Yes</p>	
When differences exist; they shall be identified in the General product information section.	
Name and address of factory (ies)..... :	
Same as Applicant	
<p>PANYU TRIO MICROTRONICS CO LTD SHIJI INDUSTRIAL ESTATE DONGYONG NANSHA, GUANGZHOU GUANGDONG, 511453 CHINA</p>	
<p>Trio-Tronics (Thailand) Ltd 7/295 MU. 6, MAP YANG PHON SUB-DISTRICT,</p>	

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

The EFE400 or EFE-400 and EFE400R or EFE-400R Series are switch mode power supplies for building into host equipment.

Additional Information

Cooling for units with customer supplied air (all except EC models):

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 IEC61010-1. 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.

COMPONENTS TO BE MONITORED

Circuit Ref.	Description	Max. Temperature (°C)
J1	Input connector	75* (105)
L1, L2	Common mode choke	core 115, wire 140
C7, C8	X capacitors	100
C9	Reservoir capacitor (electrolytic)	70 (105)
L3 (EFE400)	Boost choke	core 115, winding 140
L3 (EFE400R)	Boost choke/TRX	core 115, winding 120
TX2	Transformer winding	120
TX2	Transformer core	120
TX2	Transformer braid (to pin 13)	120
U2	Optocoupler	75
C11	Channel 1 output capacitor	90 (105)
L7	Channel 1 Output choke	115
L4	Primary choke (24V model only)	120 (130)
XU8	Fan regulator	95
XQ225	Boost FET (IMS board)	115
Q1(EFE400)	Channel 1 output FET	115
Q2(EFE400R)	Channel 1 output FET	115
XU3	Main driver IC	100
Various	All other electrolytic capacitors	90 (105)

See components to be monitored diagram in the handbook.

* For temperatures above 75°C a suitably temperature rated mating connector must be used.

Higher temperatures limits for electrolytic capacitors (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.E331788-D1002-1/A0/C0-CB. All required tests were carried out under the original investigation
 This report is a reissue of CBTR Ref. No. E331788-D1002-1/A0/C0-CB and CB Test Certificate Ref. No. DK-77750-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 report was modified to include the following changes:

1. Standard edition has been upgraded to the latest revision date.
2. Updates to the LoCC - standards has been updated, Licenses attached to the report and alternate Y capacitor Murata RA series with the same ratings was added
3. Updates to the Enclosures - Licenses.
4. Addition of alternate factory address Trio-Tronics (Thailand) Ltd
5. Non-safety related nomenclature option added under Model Differences section.

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:

-

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

Equipment type: For building-in

The product was submitted and tested for use at the maximum recommended ambient temperature (T_{mra}) of 50°C (70°C de-rated above 50°C, see Model Differences)

Evaluated for a maximum altitude of 3000m

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

The need for the following shall be considered in the end-product: Bonding to protective earthing terminal (Class I construction), MAINS disconnected device

The output connectors are Not investigated for field wiring

Creepage and clearance distances were based on a maximum working voltage of 349 Vrms; 666 Vpeak Basic, 286 Vrms; 768 Vpeak Reinforced

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 for Reinforced insulation

The following tests shall be performed in the end-product evaluation Dielectric Strength (in accordance with the handbook)

Temperature (for customer air models, see Additional Information)

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 70°C (de-rated above 50°C, see Model Differences for details)

End-product temperature tests for power supplies shall consider that the following transformers employ the indicated insulation system Transformer TX2, Class F (155 °C)

End-product dielectric strength tests shall be based on the maximum working voltage of 349 Vrms; 666 Vpeak primary to earth, 286 Vrms; 768 Vpeak primary to secondary

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 J2 pin 1 has been investigated as the protective bonding terminal for the product

The risk associated with clause 5.4.5 requires assessment in the end equipment

Input connector is: Not investigated for field wiring

Report Modifications

Date Modified (Year-Month-Day)	Modifications Made (include Report Reference Number)	Modified By
2018-10-17	<p>This report is a reissue of CBTR Ref. No. E331788-A19-CB-2 & CB Test Certificate Ref. No. DK-47769-UL issued 2015-08-14 and replaces the previous E331788-A19-CB-2 report in its entirety. The re-issue also includes the following updates:</p> <ol style="list-style-type: none"> 1. Addition of discharge resistors in the input circuit 2. Addition of alternate interchangeable components in the Critical Components table having similar or better ratings to those previously listed <p>Based on the previously conducted testing and the review of product technical documentation including photos, schematics, wiring diagrams and similar, only testing in accordance with Clause 6.10.3 was deemed necessary.</p>	Onome Sanomi
2021-11-10	<p>No tests conducted under this investigation due to reissue of CB Test Report Ref. No.E331788-D1002-1/A0/C0-CB. All required tests were carried out under the original investigation</p> <p>This report is a reissue of CBTR Ref. No. E331788-D1002-1/A0/C0-CB and CB Test Certificate Ref. No. DK-77750-UL.</p> <p>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.</p> <p>The report was modified to include the following changes:</p> <ol style="list-style-type: none"> 1. Standard edition has been upgraded to the latest revision date. 2. Updates to the LoCC - standards has been updated, Licenses attached to the report and alternate Y capacitor Murata RA series with the same ratings was added 3. Updates to the Enclosures - Licenses. 4. Addition of alternate factory address Trio-Tronics (Thailand) 	Marcin Zurek

	Ltd 5. Non-safety related nomenclature option added under Model Differences section. No testing was deemed necessary.	

Description of model differences:

EFE400 or EFE-400 models as described below:

Units may be marked with a Product Code: U4x or Y4x where x may be any number of characters.

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

Unit Configuration Code may be prefixed by SP followed by / or – (SP represents a sales code).

Unit Configuration Code:

EFE400x-a-bcde-f-g-hij

Where:

x = Nothing or J for Japanese models (may have non-safety differences)

a = Channel 1 Output Voltage: any voltage within the Adjustment Range for the Vout (nom) from the Output Table below, e.g. 12.8 for 12.8V output (12Vout nom), 24.6 for 24.6V output (24Vout nom).

b = CN for Open Frame with fan output, CU for U chassis with fan output, CC for U chassis and cover with fan output, EC for U chassis and cover with fan (temperature controlled).

c = M for Molex input connector or equivalent, J for JST connector or equivalent.

d = D for dual fused input, FL for single fuse input in the Live Line.

e = S for Standard Leakage, L for Low Leakage, R for Reduced Leakage, T for Tiny Leakage.*

f = Nothing for horizontal output connector, V for vertical output connector.

g = Nothing for standard channel 1 output voltage, xD or xPD where D is for units with programmed negative load regulation, PD is for units with programmed positive load regulation, x is the voltage of the regulation in 100mVolts and is within the Output Adjustment range (example, 7D = 0.7V of negative load regulation, 24PD = 2.4V of positive load regulation).

hij = Three numbers from 0 to 9 which denotes various output voltage/current settings within the specified ranges of each output for a particular unit or blank for standard output settings. (may define non-safety related parameters/feature, e.g. reduced primary current limit, reduced OVP).

Output Parameters

Standard models:

Output Channel	Vout Nom.	Adjustment Range (V)	Output Current (A)	Maximum Power (W)
Channel 1	12	11.4 - 13.2*	33.33	400 (530**)
	24	22.8 - 26.4*	16.7	400 (530**)
Fan output (optional)	12	Fixed	0.25	3

Variations and limitations of use:

1. Maximum ambient 70°C (de-rating output power 2.5% per °C above 50°C).
2. * Can be adjusted at the factory only.
3. Maximum continuous power output 400W (excluding fan output).
4. ** Peak power for 10 seconds maximum, maximum rms power of 400Wrms.

EFE400R or EFE-400R models as described below:

Units may be marked with a Product Code: U4x or Y4x where x may be any number of characters.

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

Unit Configuration Code may be prefixed by SP followed by / or – (SP represents a sales code).

Unit Configuration Code:

EFE400Rx-a-bcde-km-f-g-hij

Where:

x = Nothing or J for Japanese models (may have non-safety differences)

a = Channel 1 Output Voltage: any voltage within the Adjustment Range for the Vout (nom) from the Output Table below.

b = CN for Open Frame with fan output, CU for U chassis with fan output, CC for U chassis and cover with fan output, EC for U chassis and cover with fan (temperature controlled), NN for open frame with no fan output.

c = M for Molex input connector or equivalent, J for JST connector or equivalent.

d = D for dual fused input, FL for single fuse input in the Live Line.

e = S for Standard Leakage, L for Low Leakage, R for Reduced Leakage, T for Tiny Leakage.*

f = Nothing for horizontal output connector, V for vertical output connector.

g = Nothing for standard channel 1 output voltage, xD or xPD where D is for units with programmed negative load regulation, PD is for units with programmed positive load regulation, x is the voltage of the regulation in 100mVolts and is within the Output Adjustment range (example, 7D = 0.7V of negative load regulation, 24PD = 2.4V of positive load regulation).

hij = Three numbers from 0 to 9 which denotes various output voltage/current settings within the specified ranges of each output for a particular unit or blank for standard output settings. (may define non-safety related parameters/feature, e.g. reduced primary current limit, reduced OVP).

k = Y for or-ing device or N for none fitted.

m = E for enable or T for inhibit.

Output Channel	Vout Nom.	Adjustment Range (V)	Max Output Current (A)	Maximum Power (W)
Channel 1	48	47-50*	8.5	400 (470**)
Fan output (optional)	12	Fixed	0.25	3

Variations and limitations of use:

1. Maximum ambient 70°C (de-rating output power 2.5% per °C above 50°C).
2. * Can be adjusted at the factory only.
3. Maximum continuous power output 400W (excluding fan output).
4. ** Peak power for 10 seconds maximum, maximum rms power of 400Wrms.

Description of special features:

(HV circuits, high pressure systems etc.)

See additional information above.