Power supplies for medical

Medical fanless open frame PSU 300W
12 VDC / 24VDC
TPYE MNR MU 303 / 305
NR. 20303 / 20305

Pure|Power|Perfection

BF direct patient contact

EN 60601-1
IEC 60601-1

CB

c UL us

Features

- 300W convection cooled and 360W forced air cooling single output medical power supply
- Active PFC meets Class D
- Conducted EMI meets CISPR/FCC Class B
- High Efficiency up to 91%
- Adjustable output range
- Design to meet medical standard IEC 60601-1 (2nd & 3rd), EN 60601-1(3rd), UL 60601-1 type BF rated
- Two units parallel possible with worst case leakage current less than 300µA (see section 9 option)

1. Description

MNR MU30x series is a fan-less 300W, U-frame, switching power supply with active PFC function for medical application.

Model Number	Output Voltage Range (Note 1)	Min. Output Current	Rated Output Power	Max. Output Power(Note 7)	Total Regulation(Note 2)	Ripple & Noise p-p (Note 3)	Initial Setting Accuracy (Note 4)
MNR MU 303	+12-14V / 12V	0A	300W	360W	±2%	±1%	1%
MNR MU 305	+19-28V / 24V	0A	300W	360W	±2%	±1%	1%

Total Output Power: total maximum power is rated 300W, peak 360W max. 5 seconds with convection cooled; max. 360W continuously with minimum 23.3CFM (Note 5) forced air cooling at 50°C environment temperature (Note 6).

Note: 1) Output voltage can be adjusted by variable resistor with nominal 12/24V which would be adjusted at factory.

2) Total regulation is measured a setting output voltage. Input voltage is from 90-264VAC and output from 0W to 360W.
3) Measured by a 20MHz bandwidth limited oscilloscope and the each output is connected with a 10µF Electrolytic Capacitor and a 0.1µF Ceramic Capacitor.
4) Voltage setting is at nominal AC input voltage 60% rated load and 25°C.
5) Higher forced air cooling up to 40.6CFM is recommended for MNR MU 305
6) While environment temperature over 25°C, an accessory L-type heat sink (min. 30 * 12.3 + 30 * 4 cm with 2.5mm- -thickness) Is recommended to be added at the bottom of the power supply itself for MNR MU 303
7) Max. output power at 19V output is 350W.

2. Input Specification

Parameter	Conditions/Description	Min.	Nom.	Max.	Units
Input Voltage	Continuous input range	90	115/230	264	VAC
Input Frequency	AC input.	47	50/60	63	Hz
Hold Up Time		16			ms
Inrush Current				60	A

3. Output Specification

Parameter	Conditions/Description	Min.	Nom.	Max.	Units
Efficiency	AC 230V input, rated load			91	%
Minimum load		See Chart of Description			
Ripple & Noise	Rated load, 20MHz bandwidth	See Chart of Description			
Total Regulation	On condition of a setting output voltage, input voltage from 90-264VAC and output from 0W to 360W.	See Chart of Description			

4. Interface Signals and Internal Protection

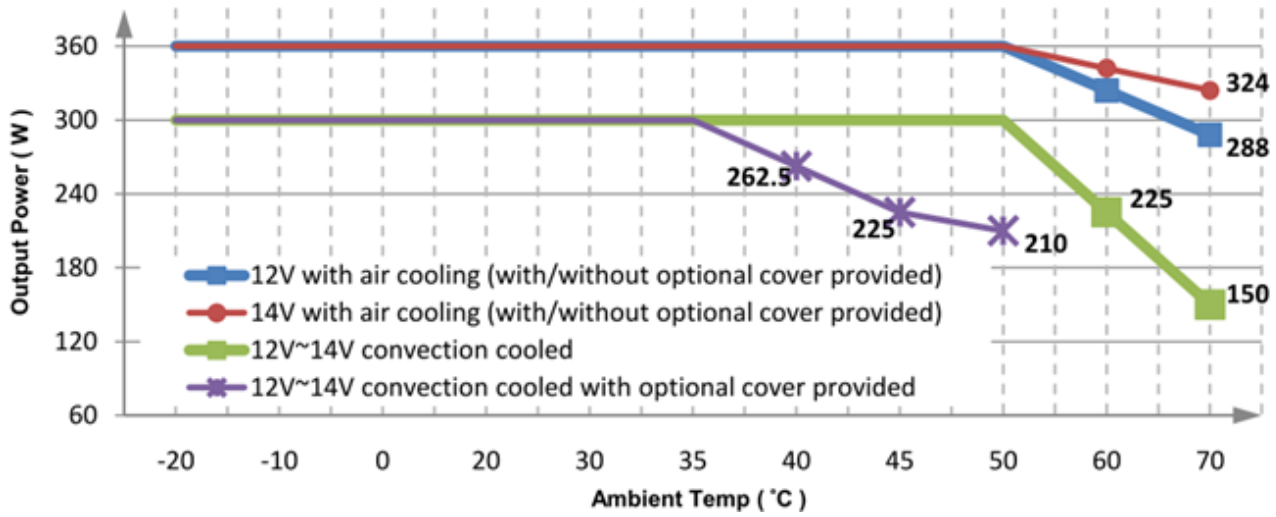
Parameter	Conditions/Description
Remote Voltage sense	Compensates for wire voltage drop.
Short Circuit Protection	Fully protected against output overload and short circuit. Automatic recovery upon of overload condition.
Over Voltage Protection	For some reason the power supply fails to control itself, the build-in over voltage protection circuit will shut down the outputs to prevent damaging external circuits.
Over Temperature Protection	When the power supply operating over the temperature or over load limit, the power supply will be shut down automatically to protect itself.

5. Environment Specification

Parameter	Conditions/Description	Min.	Nom.	Max.	Units
Storage Temperature		-20		+85	˚C
Relative Humidity	Non-condensing.	5		95	%RH
Altitude	Operating			3K	Meter
	Non-operating			4K	
Operating Temperature	Could be start up at -20˚C. Derate above 50˚C to a maximum temperature of 70˚C as curves below:	-20		+50 +70	˚C

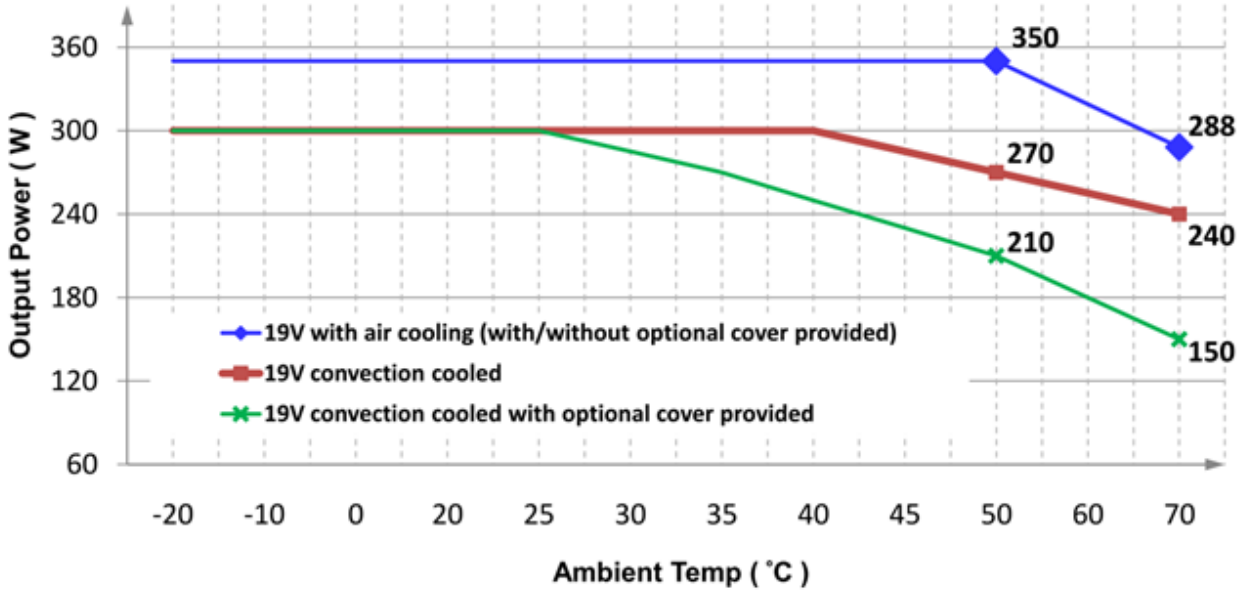
Derating curves

1. MNR MU 305:

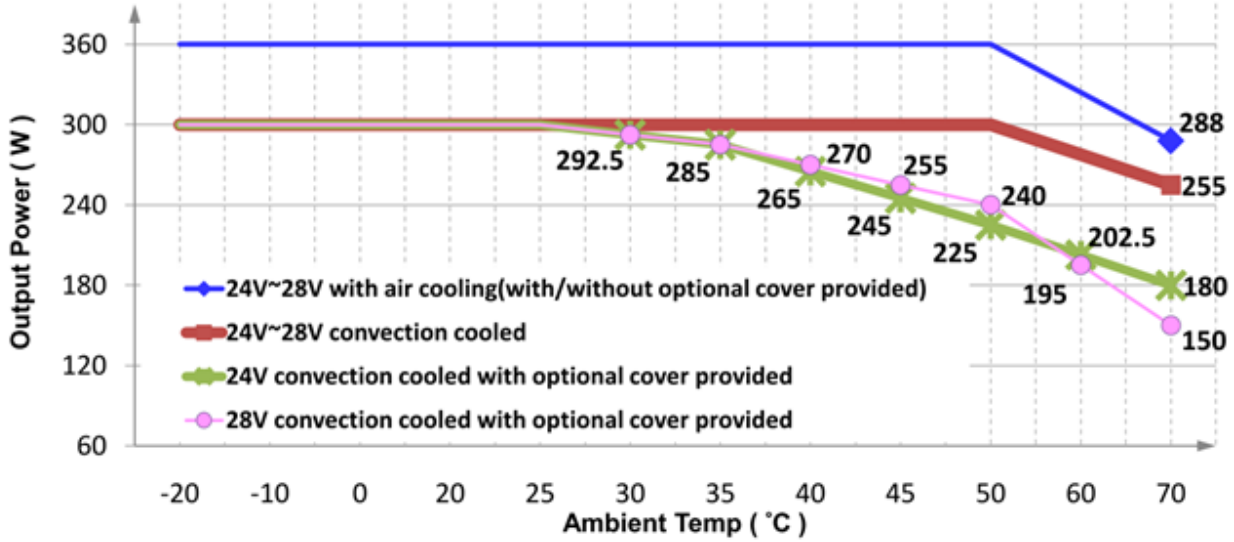


2. MNR MU 305

a. Output from 19V ~ 24V



b. Output from 24V ~ 28V



6. Safety Approvals, EMI and EMS Specification

Parameter	Conditions/Description	Min.	Nom.	Max.	Units
Approvals	IEC 60601-1: 1988+A1+A2 (2nd edition)		TUV approved		
	IEC 60601-1: 2005 (3rd edition)		TUV approved		
	EN 60601-1: 2006 (3rd edition)		TUV approved		
	UL 60601-1, 1st Edition, 2006-04-26		UL approved		
	CAN/CSA-C22.2 No. 601.1-M90, 2005		cUL approved		
Leakage Current	Patient Leakage Current at 264Vac, 63Hz normal condition	BF			Type
	(Primary to Earth GND)			150	uA
	(Secondary to Earth GND)			100	uA
EMI (Note 1)	EN 60601-1-2: 2001	B			
	EN 55011 / EN 55022	B			Class
	EN 61000-3-2: 2000 & EN 610003-3: 2001				
PFC		D			
EMS	IEC 61000-4-2: 2001, 8KV air discharge, 6KV contact discharge	A			
	IEC 61000-4-3: 2002, 10V/m	A			
	IEC 61000-4-4: 2004, 2KV line & PE	A			
	IEC 61000-4-5: 2001, 1KV line to line, 2KV line to PE	A			
	IEC 61000-4-6: 2004, 10V/m	A			
	IEC 61000-4-8: 2001, 3A/m	A			**Criteria**
	IEC 61000-4-11: 2004, Voltage dips >95%, 0.5 cycle	A			
	Voltage dips 30%, 25 cycles	A			
	Voltage dips 60%, 5 cycles	A-B*			
	Voltage interruptions >95%, 250 cycles	B			

*** Criteria A option by request separately, find section 9 for detail.**

Note: 1) As a build-in type power supply, the power supply needs to be installed in a suitable enclosure to pass the EMI/EMC tests. The final assembly has to comply with the valid EMI/EMC and safety.

7. Mechanical

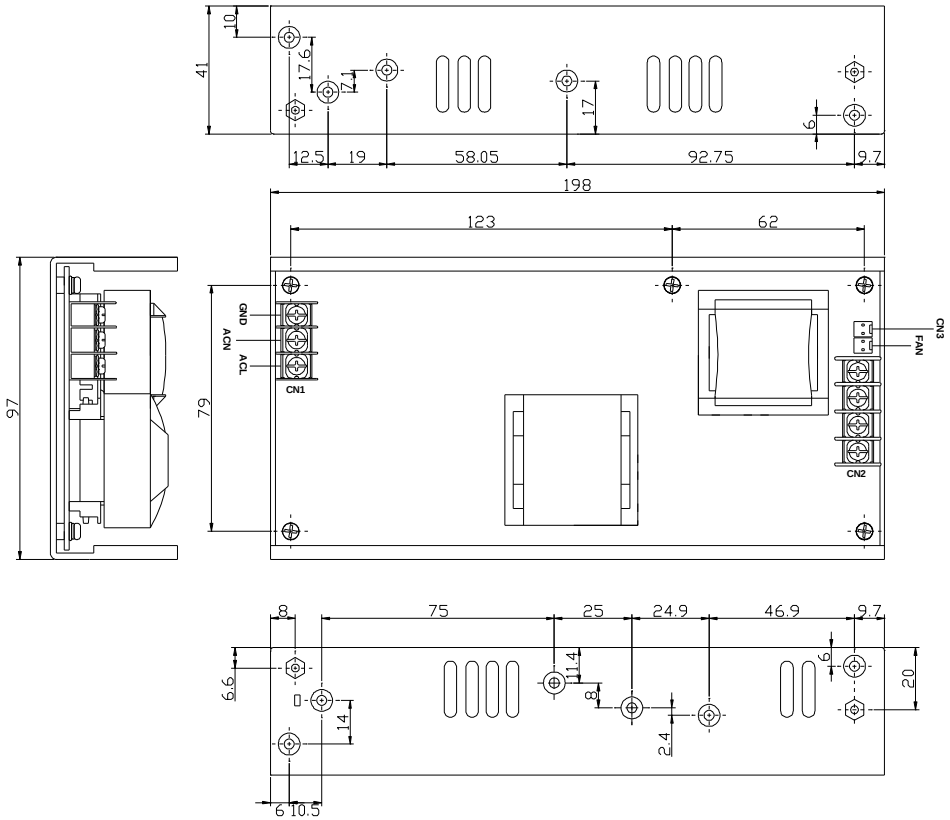
Parameter	Conditions/Description
Dimension (Note 2)	198 (L) x 97 (W) mm, tolerance +/- 0.4mm, with (H) 41 mm, tolerance +0/-0.5 mm.
Connector	CN1 --- AC input: 3 Positions Terminal Blocks, European type by request. CN2 --- DC output: 4 Positions Terminal Blocks, European type by request. CN3 --- Output remote sense: 2 Positions
Pin Assignment	CN1 Pin 1. L 2. N 3.GND CN2 Pin 1. V+ 2. V+ 3. V- 4. V- CN3 Pin 1. Remote Sense + 2. Remote Sense – FAN (Note 1) Pin 1. + 2. -

Note: 1) The voltage of fan is the same with the output voltage of power supply.

2) The tolerance of height would be ± 0.5mm when with cover provided (model number with suffix code: -C).

Mechanical drawing

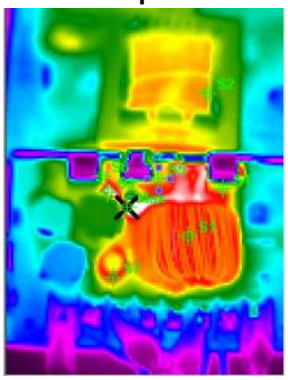
Without cover provided:



8. Performance

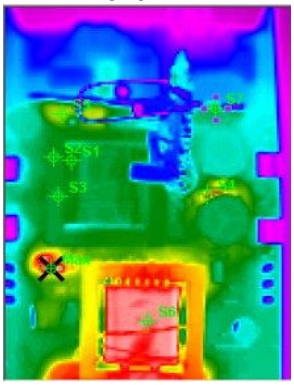
Thermal (input 115V/50Hz, output 24Vdc / full load, ambient temperature 25˚C)

#	Temp.
S1	84.0°C
S2	87.4°C
S3	99.7°C
S4	93.3°C
S5	92.6°C
S6	87.6°C
S7	89.2°C
Primary part	

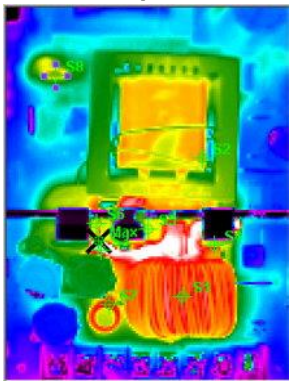


#	Temp.
S1	96.4°C
S2	90.6°C
S3	104.1°C
S4	89.0°C
S5	88.2°C
S6	82.3°C
S7	94.3°C
Secondary part	

Thermal (input 230V/50Hz, output 24Vdc / full load, ambient temperature 25˚C)

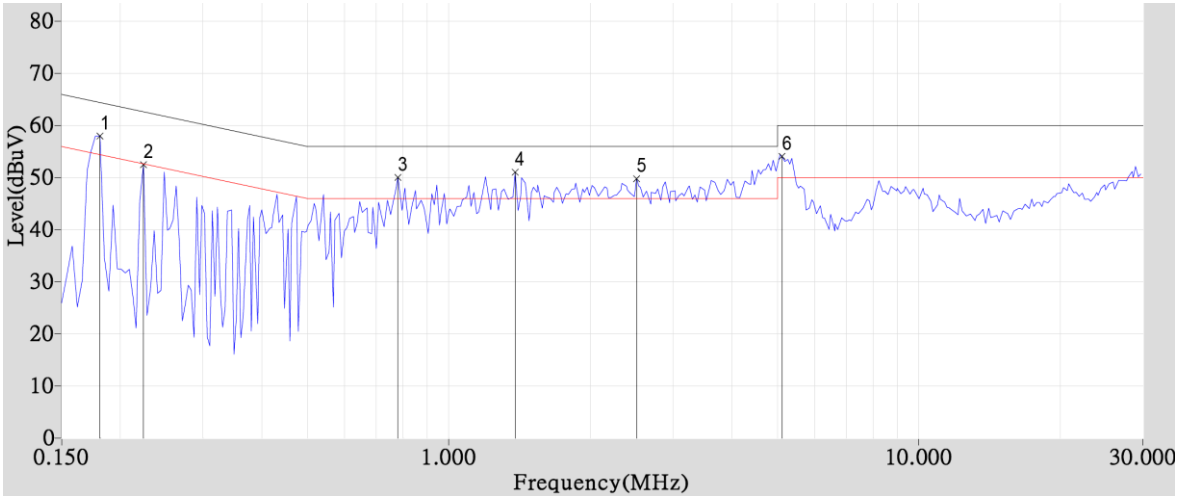


#	Temp.
S1	65.5°C
S2	63.8°C
S3	62.8°C
S4	83.7°C
S5	73.7°C
S6	88.9°C
S7	62.5°C
Primary part	



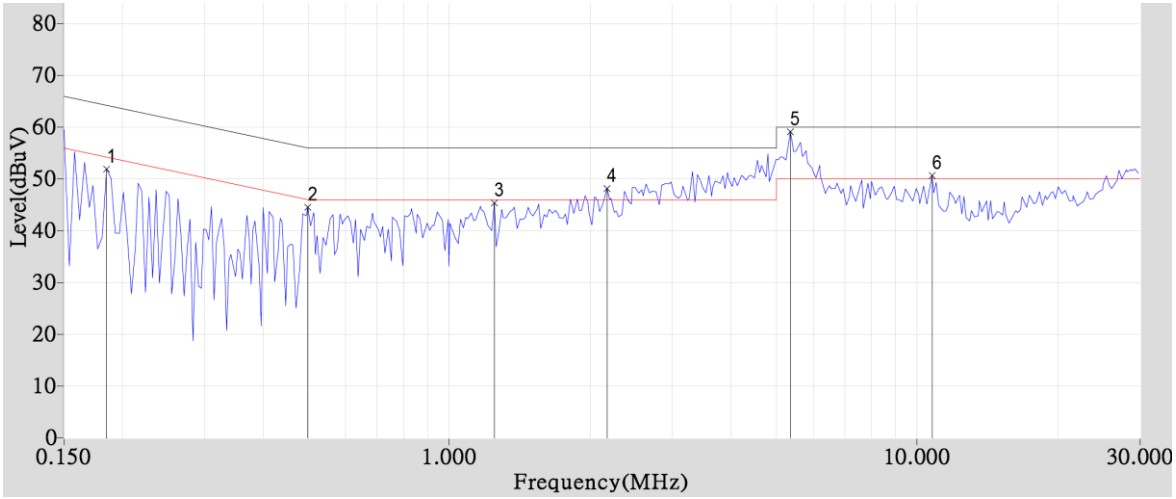
#	Temp.
S1	96.6°C
S2	91.9°C
S3	103.1°C
S4	89.5°C
S5	87.5°C
S6	88.8°C
S7	95.0°C
Secondary part	

Conduction Line (input 230V/50Hz, output 24Vdc, and full load)



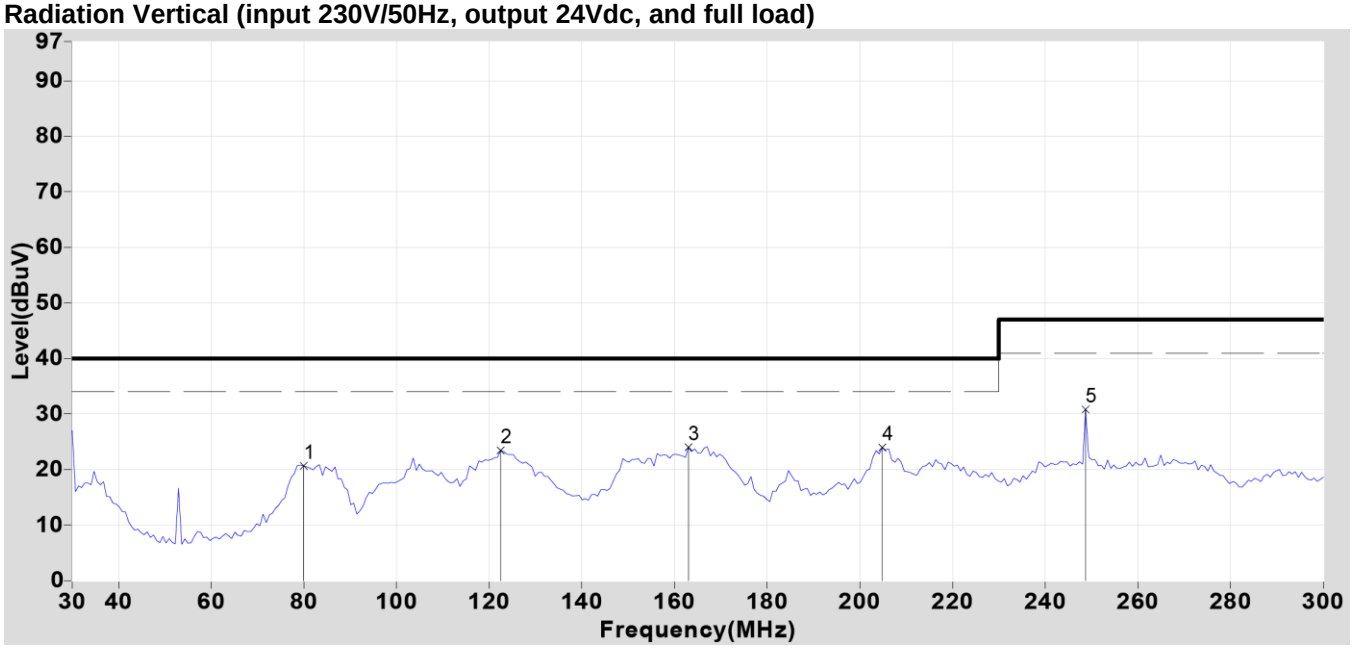
	QP/AV Freq.	QP/AV Level	Margin	Limit Level	Read Level	Total Factor	Ant. Factor	Cable Factor	Other Factor	Det. Mode
	MHz	dBuV	dB	dB	dBuV	dB	dB	dB	dB	
1	0.181	52.17	-12.27	64.44	52.00	0.17	0.07	0.10	0.00	QP
1	0.181	35.37	-19.07	54.44	35.20	0.17	0.07	0.10	0.00	AV
2	0.224	47.86	-14.81	62.67	47.71	0.15	0.06	0.09	0.00	QP
2	0.224	27.89	-24.78	52.67	27.74	0.15	0.06	0.09	0.00	AV
3	0.779	44.52	-11.48	56.00	44.43	0.09	0.06	0.03	0.00	QP
3	0.779	32.92	-13.08	46.00	32.83	0.09	0.06	0.03	0.00	AV
4	1.384	43.08	-12.92	56.00	43.01	0.07	0.07	0.00	0.00	QP
4	1.384	32.84	-13.16	46.00	32.77	0.07	0.07	0.00	0.00	AV
5	2.509	44.35	-11.65	56.00	44.26	0.09	0.09	0.00	0.00	QP
5	2.509	36.88	-9.12	46.00	36.79	0.09	0.09	0.00	0.00	AV
6	5.115	49.31	-10.69	60.00	49.13	0.18	0.18	0.00	0.00	QP
6	5.115	42.11	-7.89	50.00	41.93	0.18	0.18	0.00	0.00	AV

Conduction Line (input 110V/60Hz, output 24Vdc, and full load)

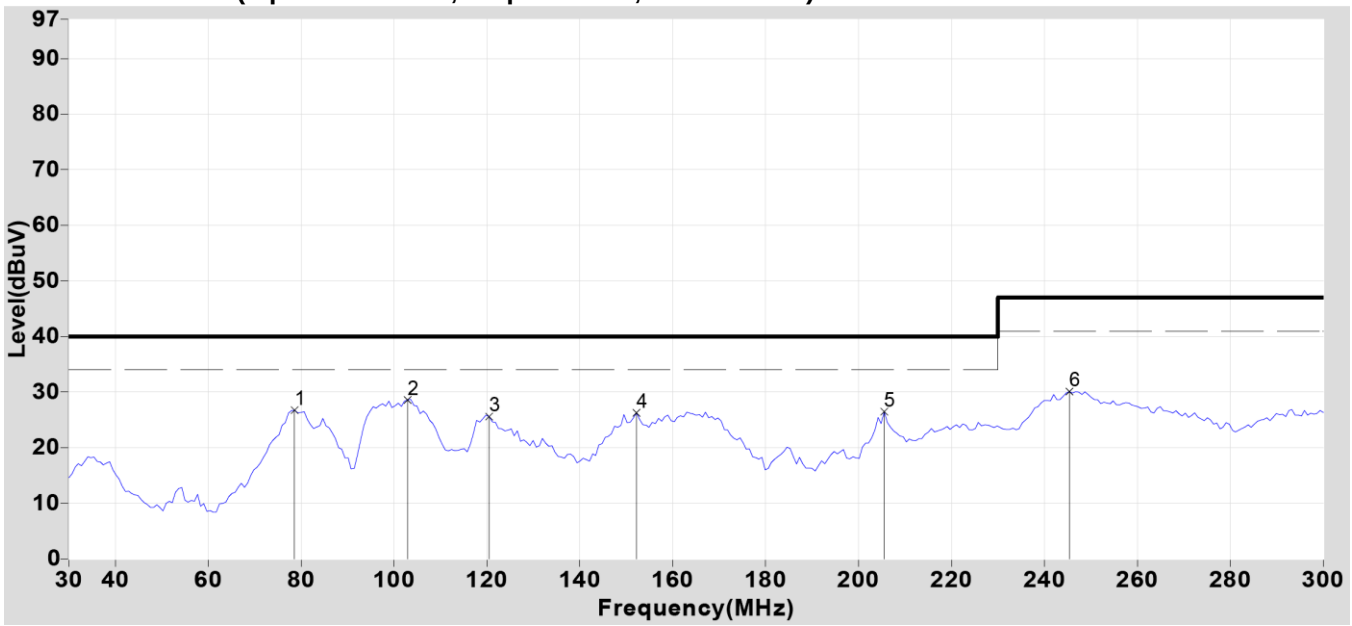


	QP/AV Freq.	QP/AV Level	Margin	Limit Level	Read Level	Total Factor	Ant. Factor	Cable Factor	Other Factor	Det. Mode
	MHz	dBuV	dB	dB	dBuV	dB	dB	dB	dB	
1	0.185	50.25	-14.01	64.26	50.08	0.17	0.07	0.10	0.00	QP
1	0.185	41.37	-12.89	54.26	41.20	0.17	0.07	0.10	0.00	AV
2	0.498	43.04	-12.99	56.03	42.93	0.11	0.05	0.06	0.00	QP
2	0.498	33.01	-13.02	46.03	32.90	0.11	0.05	0.06	0.00	AV
3	1.248	41.26	-14.74	56.00	41.20	0.06	0.06	0.00	0.00	QP
3	1.248	31.76	-14.24	46.00	31.70	0.06	0.06	0.00	0.00	AV
4	2.173	42.78	-13.22	56.00	42.70	0.08	0.08	0.00	0.00	QP
4	2.173	34.25	-11.75	46.00	34.17	0.08	0.08	0.00	0.00	AV
5	5.357	51.99	-8.01	60.00	51.80	0.19	0.19	0.00	0.00	QP
5	5.357	44.29	-5.71	50.00	44.10	0.19	0.19	0.00	0.00	AV
6	10.767	41.62	-18.38	60.00	41.10	0.52	0.42	0.10	0.00	QP
6	10.767	36.40	-13.60	50.00	35.88	0.52	0.42	0.10	0.00	AV

Radiation Vertical (input 230V/50Hz, output 24Vdc, and full load)



Radiation Vertical (input 110V/60Hz, output 24Vdc, and full load)



SPECIFICATION

For

SWITCHING POWER SUPPLY

MNR MU 30x series

Revisions History

REV.	Nov. 11th 2008	Adding mechanical drawing
REV.	Nov. 20th 2008	Adding RoHS conform logo.
REV.	Nov. 25th 2008	Updated Feature “Two units parallel possible with worst case leakage current less than 300μA which is BF upper limitation (see point 8 option)”
REV.	Dec. 9th 2008	Update photo and adding point 9 “part number coding”
REV.	Feb. 23 th 2009	Update derating curves.
REV.	Mar. 16th 2009	Update mechanical dimension (Height).
REV.	Apr. 20th 2009	Update Description of point 1, 3, and 5 ~ 9.
		Update derating curves.
REV.	Jul. 15th 2009	Update the information of Safety Approvals in section 6.
		Adding description of two optional requirements in section 8.
REV.	Aug. 19th 2009	Update the photograph of power supply.
		Adding the voltage of fan at section 7.
REV.	Oct. 8th 2009	Adding detailed description of the special condition of criteria A.
REV.	Oct. 13rd 2009	Revised the min. output current of the model name MNR MU 303
REV.	Oct. 22nd 2009	Correcting descriptions and revising the derating curves.
REV.	Dec. 16th 2009	Cancel the no minimum load version.
REV.	Feb. 9th 2010	Updating derating curves with start up at -20°C and adding mechanical drawing with cover provided.
REV.	Mar. 15th 2010	Adding the drawing and spec of screws for fix bottom enclosure.
REV.	May. 6th 2010	Revising the max. output power of 19V.
REV.	Aug. 20th 2010	UL 60601-1 1st edition approved.
REV.	Aug. 25th 2010	Changing the part number coding.
REV.	Nov. 4th 2010	Updating spec of fixed screws.
REV.	Nov. 10th 2010	Revising part number coding.
REV.	Mar. 28th 2011	Update the safety approved status.
REV.	Nov. 7th 2011	Revised the derating curves.
REV.	Apr. 5th 2012	Revised the height dimension with cover provided.

REO Elektronik AG
Im Halbiacker 5a · CH-8352 Elsau

Tel.: +41 (0)52 363 2820
Fax: +41 (0)52 363 1241
E-Mail: info@reo.ch

Internet: www.reo.ch
Shop: shop.reo.ch

Divisions:

REO Vibratory Feeding and Power Electronics Division

REO Vibratory Feeding and Power Electronics Division
Brühler Straße 100 · D-42657 Solingen
Tel.: +49 (0)212 8804 0 · Fax: +49 (0)212 8804 188
E-Mail: info@reo.de

REO Train Technologies Division

REO Train Technologies Division
Erasmusstraße 14 · D-10553 Berlin
Tel.: +49 (0)30 3670236 0 · Fax: +49 (0)30 3670236 10
E-Mail: zentrale.berlin@reo.de

REO Drives Division

REO Drives Division
Holzhausener Straße 52
D-16866 Kyritz
Tel.: +49 (0)33971 485 0 · Fax: +49 (0)33971 485 90
E-Mail: info@reo.de

REO Medical and Current Transformer Division

REO Medical and Current Transformer Division
Schuldholzinger Weg 7 · D-84347 Pfarrkirchen
Tel.: +49 (0)8561 9886 0 · Fax: +49 (0)8561 9886 40
E-Mail: info@reo.de

REO Test and PowerQuality Division

REO Test and PowerQuality Division
Brühler Straße 100 · D-42657 Solingen
Tel.: +49 (0)212 8804 0 · Fax: +49 (0)212 8804 188
E-Mail: info@reo.de

PRODUCTION+SALES:

China
REO Shanghai Inductive Components Co., Ltd
No. 536 ShangFeng Road · Pudong, 201201 Shanghai · China
Tel.: +86 (0)21 5858 0686 · Fax: +86 (0)21 5858 0289
E-Mail: info@reo.cn · Internet: www.reo.cn

India
REO GPD INDUCTIVE COMPONENTS PVT. LTD
2/202 Luna Road · Village Luna · Taluka Padra
Vadodara - 391440 · India
Tel.: +91 (2662) 221723
E-Mail: info@reogpd.com · Internet: www.reo-ag.in

USA
REO-USA, Inc.
8450 E. 47th St · USA-Indianapolis, IN 46226
Tel.: +1 317 8991 395 · Fax: +1 317 8991 396
E-Mail: info@reo-usa.com · Internet: www.reo-usa.com

SALES:

France
REO VARIAC S.A.R.L.
ZAC Du Clos aux Pois 1 · 6/8 rue de la Closerie-LISSES· F-91048 Evry Cédex
Tel.: +33 (0)1 6911 1898 · Fax: +33 (0)1 6911 0918
E-Mail: reovariac@reo.fr · Internet: www.reo.fr

Great Britain
REO (UK) Ltd.
Units 2-4 Callow Hill Road · Craven Arms · Shropshire SY7 8NT · UK
Tel.: +44 (0)1588 673 411 · Fax: +44 (0)1588 672 718
E-Mail: main@reo.co.uk · Internet: www.reo.co.uk

Italy
REO ITALIA S.r.l.
Via Treponti, 29 · I-25086 Rezzato (BS)
Tel.: +39 030 279 3883 · Fax: +39 030 279 0600
E-Mail: info@reoitalia.it · Internet: www.reoitalia.it

Poland
REO CROMA Sp.zo.o
ul. Pozaryskiego 28, bud 20 · PL-04-703 Warszawa
Tel.: +48 (0)22 812 3066 · Fax: +48 (0)22 815 6906
E-Mail: croma@croma.com.pl · Internet: www.croma.com.pl

Spain
REO ESPAÑA 2002 S.A.
C/Manuel Ventura i Campeny 21B · local 9 · E-08339 Vilassar de Dalt (Barcelona)
Tel.: +34 937 509 994 · Fax: +34 937 509 995
E-Mail: info@reospain.com · Internet: www.reospain.com

Turkey
REOTURKEY ELEKTRONİK San. ve Tic. Ltd. Şti.
Halil Rıfatpasa Mah. · Darülceze CD Perpa Tic Merkezi
B Blok Kat 8 No:1095 · TR-34384 Sisli – Istanbul
Tel.: +90 (0)212 2215 118 · Fax: +90 (0)212 2215 119
E-Mail: info@reo-turkey.com · Internet: www.reo-turkey.com