

# *NVM-175*

**AC/DC Power Supply Series**

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## 1. INPUT

### AC INPUT LINE REQUIREMENTS

See datasheet for specification of input line requirements (including Input voltage range, Input frequency, Input harmonics, Input current and leakage current)

The power supply will automatically recover from AC power loss and shall be capable of start-up under peak loading at 90VAC.

Repetitive ON/OFF cycling of the AC input voltage shall not damage the power supply or cause the input fuse to blow.

- Input Fuse  
Not user serviceable. Dual fused (both live and neutral). Fast acting, high breaking capacity, ceramic fuse.
- Input Undervoltage  
The power supply is protected against the application of an input voltage below the minimum specified so that it shall not cause damage to the power supply.

## 2. DC OUTPUT

### OUTPUT VOLTAGES

See the datasheet for full specifications of the output, including adjustment range, output current, remote-sensing capability, regulation, ripple & noise and setting accuracy.

The Auxiliary/standby supply is present whilst the ac input is present, irrespective of the state of the other channels (or remote on/off). It is an independent, floating, isolated output of 12V/0.2A (S, S1, S2, S3) or 12V/0.8A (S4<sup>1</sup>).

### REMOTE SENSE

Remote sensing is provided to compensate for voltage drops in the power connections to the load. Remote sense is available for Output 1. Up to 0.5V total line drop can be compensated. The remote sense lines may be connected as follows: -

- If remote sense is not required, simply do not connect either '+sense' or '-sense'
- If remote sense is required, connect '-sense' and '+sense' to the corresponding point at the load (see Figure 1 for details)
- Note – do not connect remote sense across an output fuse.
- Care should be taken to ensure that remote sense is connected in the correct polarity and is disconnected from the load before the power connections are removed.

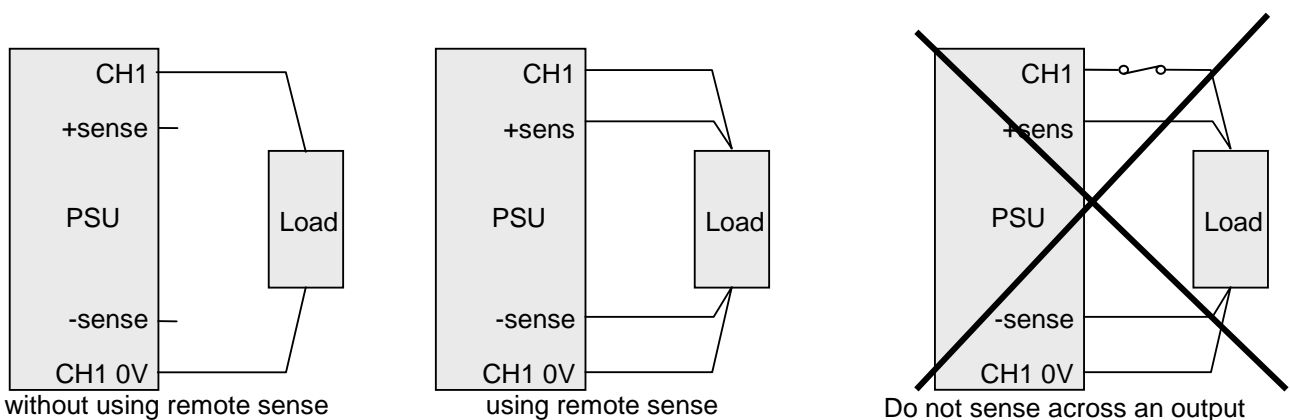


Figure 1: How to connect power supply to load

<sup>1</sup> The S4 Variant has a higher ripple of 2.5%

**EFFICIENCY**

Note that the following charts show the efficiencies when the power supply is loaded with typical customer loads (multi output).

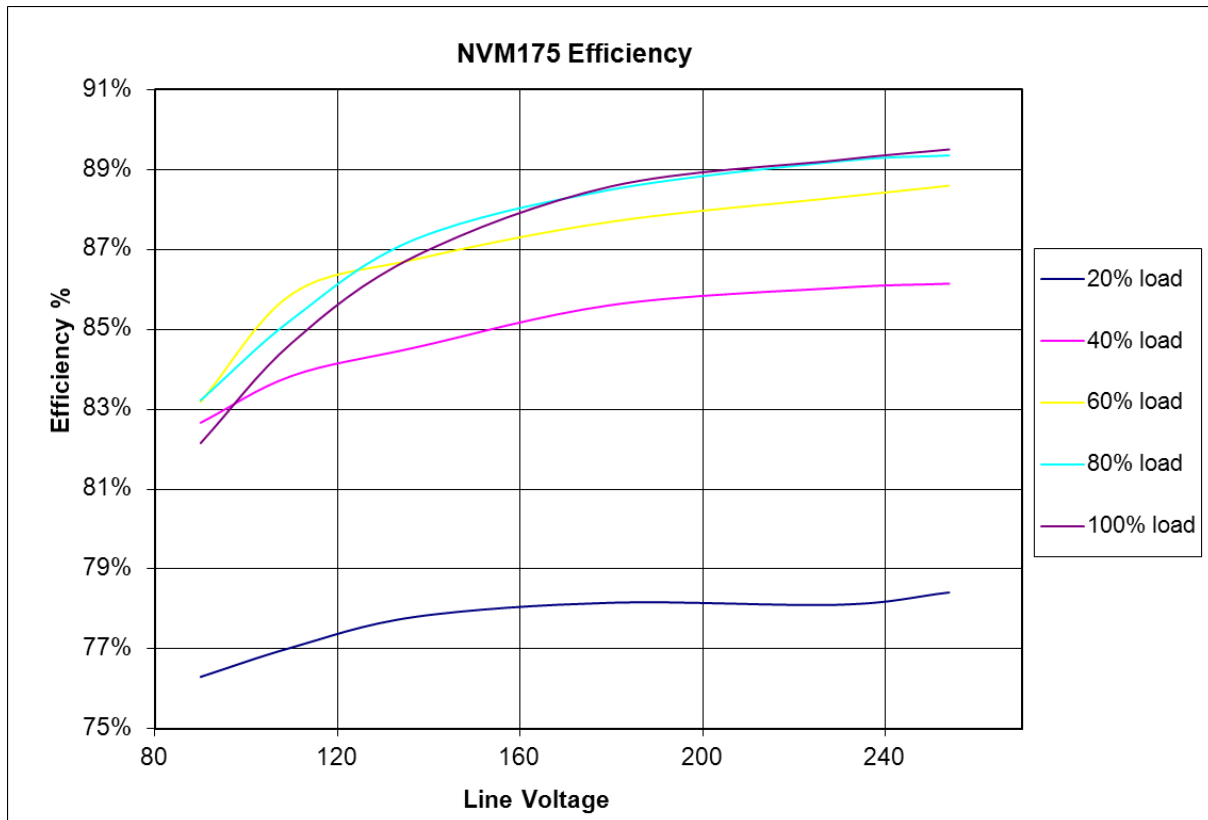


Figure 2. Efficiency Chart

**NO LOAD OPERATION**

No minimum load is required for the power supply to operate within specification.

**SERIES/PARALLEL CONNECTION**

It is possible to connect multiple NVM-175 in series.

The outputs connected in series are non-SELV (Safety Extra Low Voltage) if the total output voltage + 30% of the highest maximum rated output voltage exceeds 60V (the 30% addition allows for a single fault in any one individual channel). Please consider also that each power supply will have the leakage current specified so 2 power supplies connected in series will have double this value.

Outputs must not be connected in parallel.

**OUTPUT CHARACTERISTICS**

**Ripple/Noise**

Ripple and noise is defined as periodic or random signals over a frequency range of 10Hz to 20MHz. Measurements are to be made with an 20MHz bandwidth oscilloscope. Measurements are taken at the end of a 150mm length of a twisted pair of cables, terminated with a 100nF ceramic capacitor and a 120µF electrolytic capacitor. The earth wire of the oscilloscope probe should be as short as possible, winding a link wire around the earth collar of the probe is the preferred method.

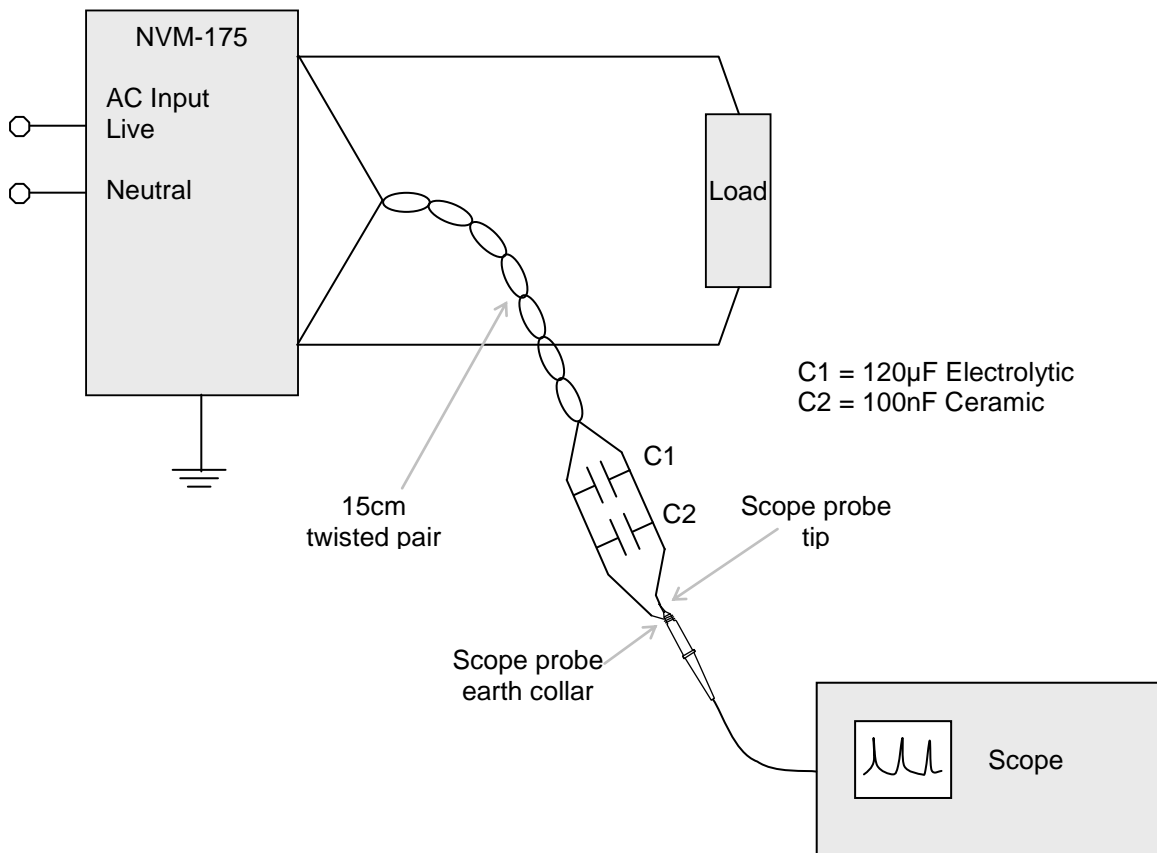
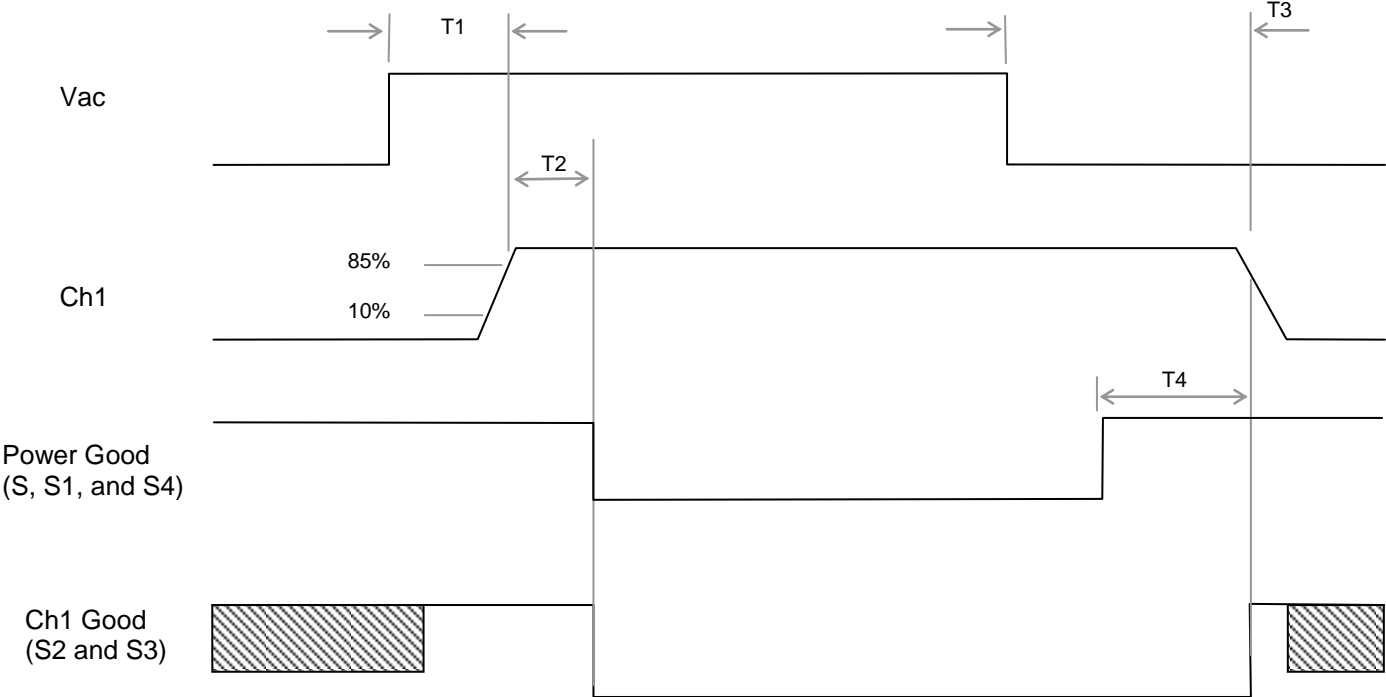


Figure 3: RIPPLE AND NOISE MEASUREMENT METHOD

**POWER SUPPLY TIMING**



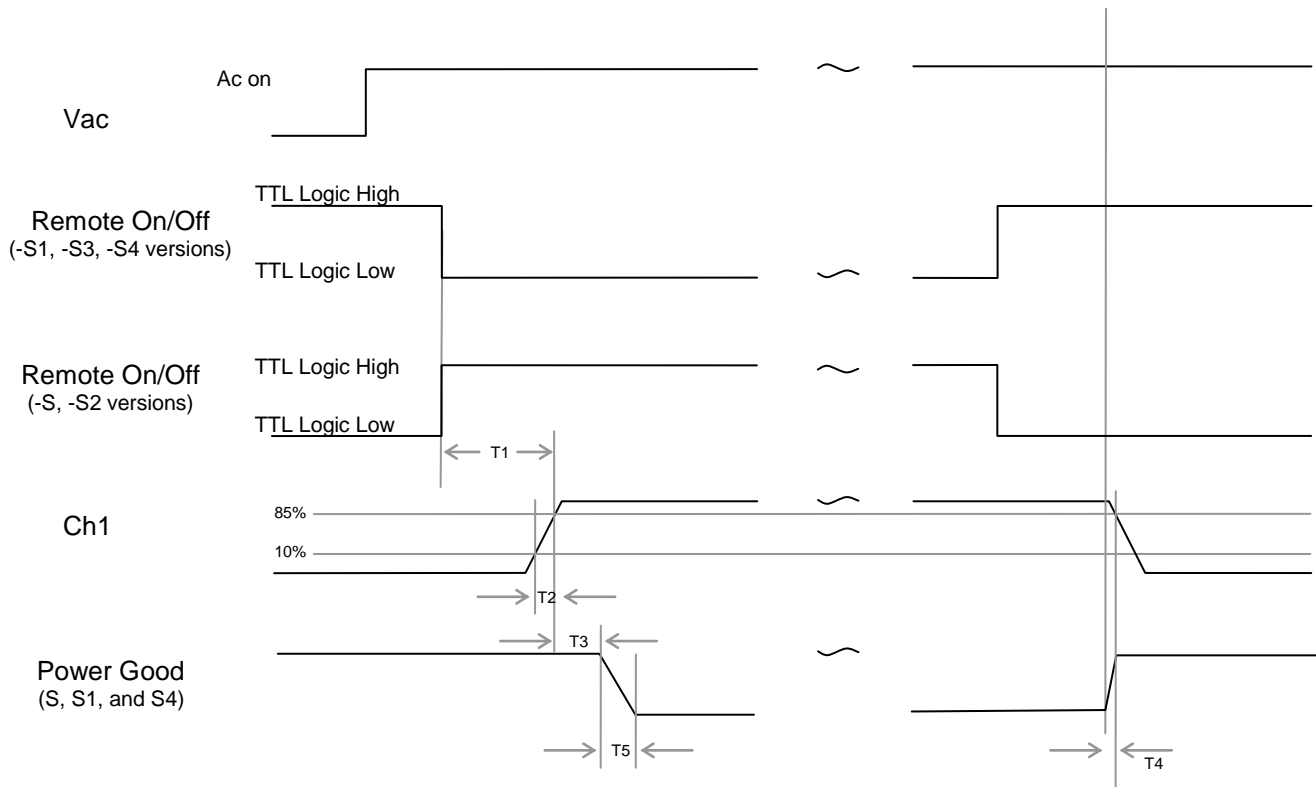
**Remote On/Off**

TTL Logic Low (S1, S3, S4.)  
 TTL Logic High (S, S2)

	min	Typical	max	Description
T1		1.5s	2.0s	Turn on time
T2	200ms		500ms	Output good hold off time
T3	16ms			Hold up time
T4	3ms			Power good warning time

Figure 4: Output timing diagram

**POWER SUPPLY TIMING**



	min	max	Description
T1		1.5s	Power-on time (enable to Ch1 in regulation)
T2	0.1ms	20ms	Ch1 rise time
T3	100ms	500ms	Power Good delay
T4	1ms		Power down warning
T5		10ms	Power Good rise time

Figure 5: Signal timing diagram

**SIGNALS**

**Important note:** The pin numbers referenced in this section relate to the standard (vertical) output connector version. For pin numbering of the right angled output connector variant, please see the “Pin Definition” section.

STANDBY SUPPLY (+ Output) (J1-10)

STANDBY SUPPLY 0V (return) (J1-20)

12V/0.2A (S, S1, S2, S3) or 12V/0.8A (S4) output, isolated from channel 1.

POWER GOOD SIGNAL (J1-9) (available on ‘-S’, ‘-S1’, ‘-S4’)

The Power Good signal shows logic low to indicate that the ac supply is good and that output 1 is operating within its regulation limits. It is delayed after start-up to ensure that sufficient primary side energy is stored by the power supply for continuous power operation within the specified hold-up time. The 0V standby return and the main output return must be common to use this signal. When the AC power is removed the Power Good Signal will go to a logic high state. The specifications for the Power Good Signal are contained below.

Signal Type	+5V TTL compatible
Logic Level Low	< 0.4V while sinking 4mA
Logic Level High	Between 2.4 VDC and 5VDC output while sourcing 200µA
High State Output Impedance	1kOhm from output to common
Power Good delay	100ms < T <sub>3</sub> < 500ms
Power Good rise time	T <sub>5</sub> ≤ 10ms
Power down warning	T <sub>4</sub> > 1ms

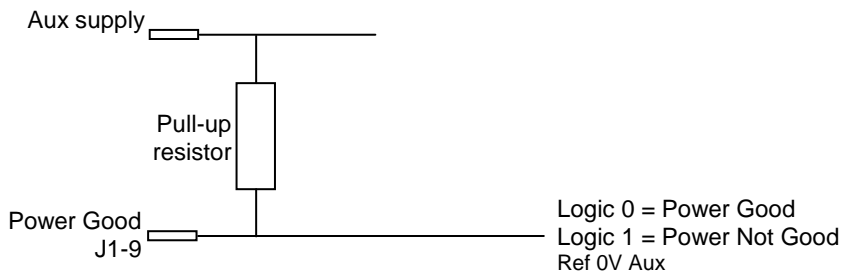


Figure 6: Example use of ‘Power Good’



**CH1 POWER GOOD – CHANNEL 1 GOOD (J1-18)**

The Channel 1 Good signal is an open collector output which is turned on to indicate that output 1 is operating within its regulation limits. It is delayed after start-up to ensure that sufficient primary side energy is stored by the power supply for continuous power operation for the specified hold-up time. When Channel 1 falls to below 85% of nominal, the Channel 1 Good Signal will go to an open circuit state. The specifications for the Channel 1 Good Signal are contained below

Signal Type	Open collector output. Emitter connected to CH1 0V.
Maximum Current	5mA
Maximum voltage (collector to 0V)	30V
Logic low (when signal is turned on)	<0.4V when sinking 5mA

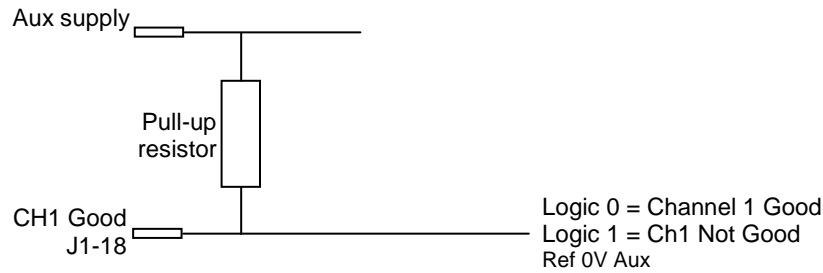


Figure 7: Example use of 'Channel 1 Good'

**REMOTE ON/OFF – GLOBAL ON/OFF (J1-19)**

**-S1, -S3 and -S4 versions only**

Pulling the Remote On/Off to the Standby Return will enable (-S1, -S3 and -S4 versions) pulling it high or leaving it open will inhibit all outputs (except Standby).

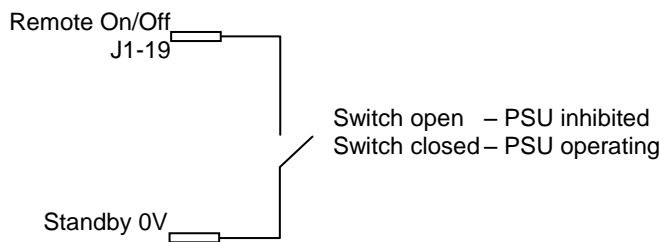


Figure 8a: Example use of 'Remote On/Off' (-S1, -S3 and -S4)

**-S and -S2 versions only**

Pulling the Remote On/Off to the Standby +Ve will enable (-S, and -S2 versions) pulling it low or leaving it open will inhibit all outputs (except Standby).

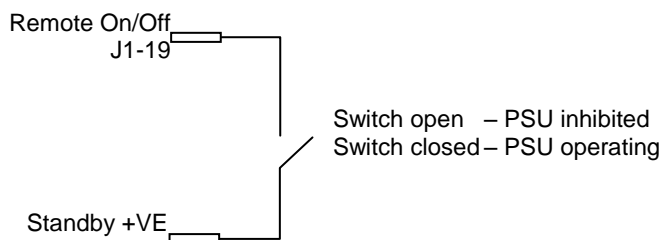


Figure 8b: Example use of 'Remote On/Off' (-S and -S2)

**OUTPUT PROTECTION**

**Over temperature protection**

If the NVM-175 is operated without adequate cooling, it will cause an over temperature condition and the power supply will shut down. To restart the PSU, remove the ac supply for at least 2 seconds and then reapply.

**Over voltage protection**

An overvoltage on CH1 will cause the whole power supply to shutdown (except for standby supply). To restart the PSU, remove the ac supply for at least 10 seconds and then reapply.

**Short-Circuit Protection**

A short circuit is defined as an impedance of <0.1 Ohms placed between the DC return and any output. A short circuit will cause no damage to the power supply and will cause it to shutdown. The power supply will attempt to restart every 150ms (approximately) until the short-circuit is removed. After removal of the short circuit, the power supply will maintain normal operation.

**Overcurrent Protection**

Overload currents applied to each output will cause the output to trip before reaching or exceeding the SELV level of 240VA.

**No Load Operation**

The power supply will operate with no load on all outputs with no damage, hazardous condition or reduction in performance.

**COOLING REQUIREMENTS**

**Forced Air Cooling**

The maximum continuous rating of all DC outputs combined is 180Watts with a minimum of 2m/s of forced-air cooling across the power supply. The recommended air flow direction is from input to output.

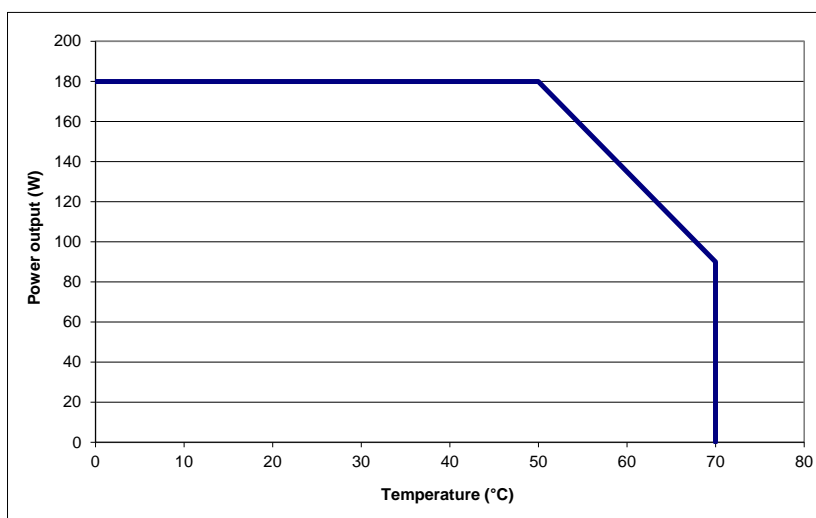
**Natural Convection**

The exact performance available under convection cooling varies considerably by installation (and amount of free air circulation available). To determine if the power supply is suitable for the application, TDK-Lambda are able to supply a unit fitted with thermocouples on the critical components to enable accurate measurement and assessment.

Typically, the unit is able to provide 75W of output power with unrestricted natural convection cooling and an ambient temperature of 40°C or less.

**TEMPERATURE DERATING**

NVM-175 achieves full power output up to 50°C. Above this temperature, the total output power (and individual output currents) must be derated by 2.5%/°C up to 70°C. See diagram below.



**ELECTROMAGNETIC COMPATIBILITY**

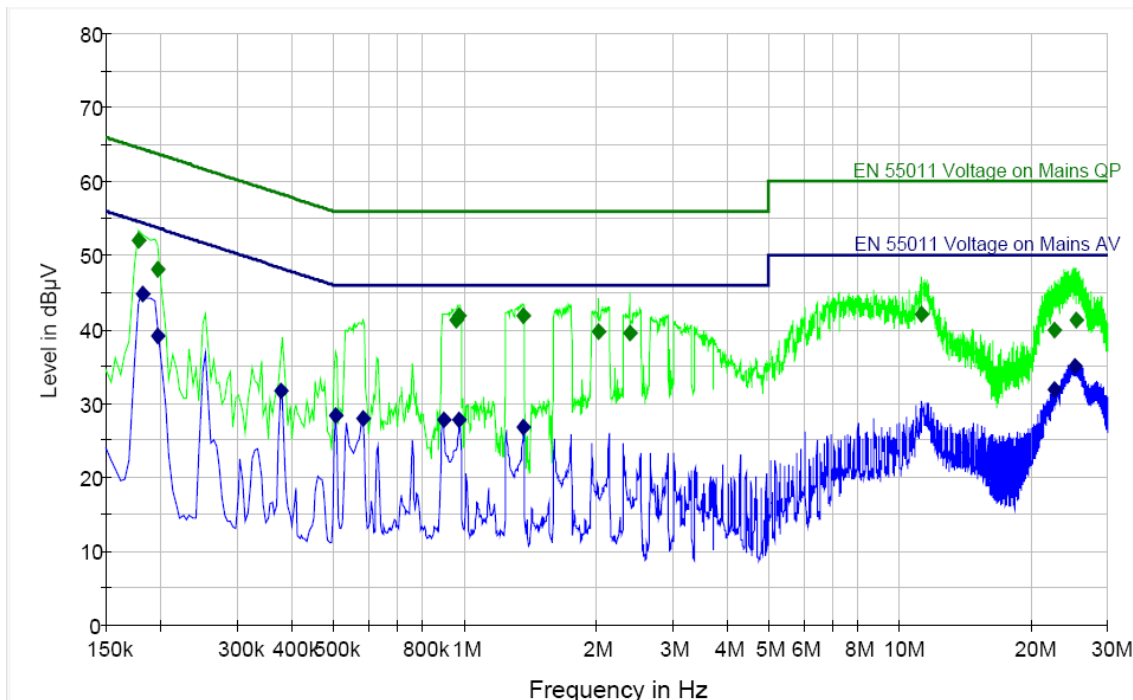


Figure 10: Sample plot of NVM1-1G000-S1  
Measured at 240Vac input, 24V / 7.5A, 12V / 0.2A

**Installation for optimum EMC performance**

**Mounting**

All equipment should be mounted inside an earthed metal box.

If this is not possible then use an earthed metal plane to mount the power supply and load.

All 4 corners (of the uncased unit) should be connected to earth.

**Cables**

All cables (both ac input and dc output) should be run as close as possible to the earthed metal box/plane. AC input cable should be twisted group laid as flat to the earthed metal box/plane as possible.

All output cables should be routed as far away from input cables as possible.

If the input and output cables must be run close to each other then screen one or other (or ideally both).

The positive and negative supply cables should be twisted together.

The remote sense wires (if used) should be twisted together and run alongside their related supply cables.

All cable run loops should be kept as small as possible (this should be implemented in PCB design also).

**Connecting between boxes**

If cables must be connected between equipment boxes then at the closest possible point to the port where the cables exit the 1<sup>st</sup> enclosure connect 100nF decoupling Y caps (between the output and earth). Note that these capacitors must be rated at the working voltage. Ideally these capacitors should be between all signal cables which have to connect between boxes although this may not be practical if fast switching [digital] signals are involved (if this is the case then smaller value Y capacitors should be used).

## **Earth star point**

Where the ac supply enters the equipment, this should be taken to a 'star point' chassis mounted earth point (Note compliance with EN609050 practices which require own star point washer and nut) as close as possible to the IEC inlet. All other earth points should be taken back to this point only.

## **ESD Protection**

Where signal or control ports are connected to a user accessible panel (for example PSU inhibit to a switch, module good to an indicator circuit, etc), these ports must be protected from electrostatic discharges. This can be done by selecting suitable panel controls or by fitting ESD suppression devices to the connections on the panel

## **RELIABILITY**

Calculated using Telcordia Issue 1, Case 3. Numbers below TBC.

### **FPMH (Failures per million hours)**

Temperature	<b>0°C</b>	<b>30°C</b>	<b>40°C</b>	<b>50°C</b>	<b>60°C</b>	<b>70°C</b>
Main Assembly	0.548	1.267	1.703	2.319	3.205	4.498
Fan	2.396	1.941	3.067	4.845	7.656	12.096

To calculate MTBF, sum the FPMH for all component parts at the required temperature. This gives total failures per million hours (FPMH). Convert this to MTBF by dividing 1000000 by the FPMH.

For example: -

Require the MTBF for NVM1-1T000-S1 at 30°C

Main Assembly 1.267

Total FPMH 1.267

Therefore MTBF =  $1000000 / 1.267 = 789266$  hours (789k hours)

## CONNECTION

### **Input**

Input housing is Molex part number 09-50-8051 (or equivalent part from alternative manufacturer)  
 The Molex part number for the crimps is 08-52-0113 (or equivalent part from alternative manufacturer)  
 1 housings and 3 crimps are available as a single part number from TDK-Lambda. The part number is 94910.

### **Pin Definition**

Pin	Function	Molex
J2-1	Earth – chassis/safety ground	J2-1
J2-2	Do not connect	J2-2
J2-3	Live	J2-3
J2-4	Do not connect	J2-4
J2-5	Neutral	J2-5

### **Output**

Output housing is Molex part number 39-01-2205 (or equivalent part from alternative manufacturer)  
 The Molex part number for the crimps is 44476-3112 (or equivalent part from alternative manufacturer)  
 1 housings and 20 crimps are available as a single part number from TDK-Lambda. The part number is 94668

### **Pin Definition (standard [vertical] output connector)**

Pin	Channel	Function
J1-1		Do not connect
J1-2		Do not connect
J1-3	1	0V (DC Return)
J1-4	1	0V (DC Return)
J1-5	1	Positive sense
J1-6	1	+ Output
J1-7	1	+ Output
J1-8	1	+ Output
J1-9		Power good (S, S1 and S4 variants only)
J1-10	Standby	Standby output (+ Output)
J1-11		Do not connect
J1-12	1	0V (DC Return)
J1-13	1	0V (DC Return)
J1-14	1	0V (DC Return)
J1-15	1	Negative sense
J1-16	1	+ Output
J1-17	1	+ Output
J1-18		Channel 1 Good (S2 and S3 variants only)
J1-19		Remote On/Off
J1-20	Standby	Standby return

**Pin Definition** (variants fitted with right angled output connector)

Pin	Channel	Function
J1-1	Standby	Standby return
J1-2		Remote On/Off
J1-3		Channel 1 Good (S2 and S3 variants only)
J1-4	1	+ Output
J1-5	1	+ Output
J1-6	1	Negative sense
J1-7	1	0V (DC Return)
J1-8	1	0V (DC Return)
J1-9	1	0V (DC Return)
J1-10		Do not connect
J1-11	Standby	Standby output (+ Output)
J1-12		Power good (S, S1 and S4 variants only)
J1-13	1	+ Output
J1-14	1	+ Output
J1-15	1	+ Output
J1-16	1	Positive sense
J1-17	1	0V (DC Return)
J1-18	1	0V (DC Return)
J1-19		Do not connect
J1-20		Do not connect

**MOUNTING**

The NVM-175 can be mounted in any orientation but must be mounted on all four corners. 'C' (covered) and 'U' (U chassis) versions to be mounted using all four fixings on the bottom of the unit or the fixing holes on the side of the unit. Uncovered versions should be mounted on stand-offs that are at least 6.35mm tall.

**TEST RESULTS**

Detailed test results are available online from: -

<http://testcert.emea.tdk-lambda-europe.com/>

You will need the serial number and product code of the unit to retrieve the test results for the unit. Test results will not be packaged with the unit. This ensures that the test results will be available for the NV-Power unit for the whole life of the power supply (not just when the unit is unpacked as with the more traditional printed test results).