



# TEST DATA OF MODULE 9

(ACE series)

Regulated DC power supply  
Jun.25.2003

Approved by :   
K. Shibutani Design Manager

Prepared by :   
M. Hamaguchi Design Engineer

**COSEL CO.,LTD.**

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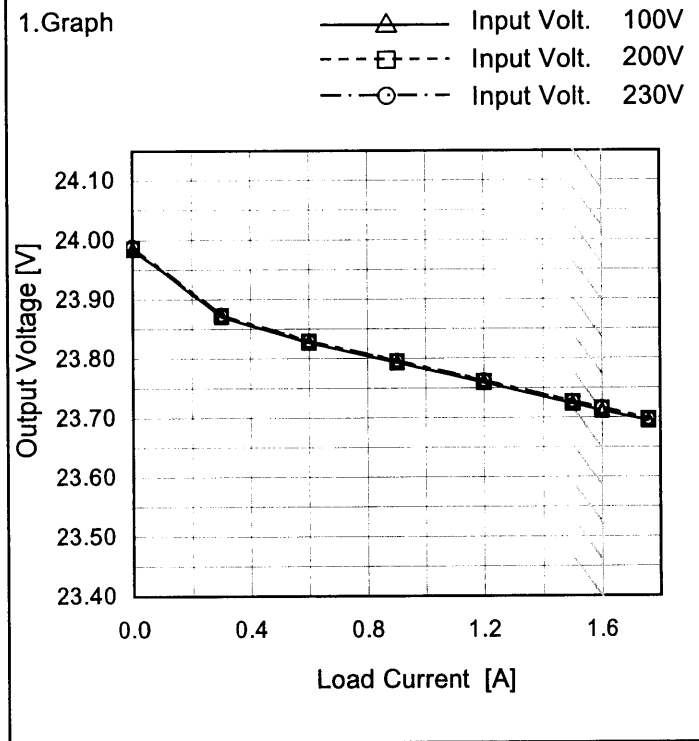


<p>Model MODULE 9</p> <p>Item Line Regulation</p> <p>Object +24V1.6A</p>		<p>Temperature 25°C</p> <p>Testing Circuitry Figure A</p>																																
<p>1.Graph</p> <p>---□--- Load 50%</p> <p>—△— Load 100%</p>		<p>2.Values</p> <table border="1"> <thead> <tr> <th rowspan="2">Input Voltage [V]</th> <th colspan="2">Output Voltage [V]</th> </tr> <tr> <th>Load 50%</th> <th>Load 100%</th> </tr> </thead> <tbody> <tr><td>85</td><td>24.049</td><td>23.986</td></tr> <tr><td>100</td><td>24.049</td><td>23.988</td></tr> <tr><td>120</td><td>24.049</td><td>23.988</td></tr> <tr><td>200</td><td>24.048</td><td>23.987</td></tr> <tr><td>230</td><td>24.048</td><td>23.988</td></tr> <tr><td>264</td><td>24.048</td><td>23.988</td></tr> <tr><td>--</td><td>-</td><td>-</td></tr> <tr><td>--</td><td>-</td><td>-</td></tr> <tr><td>--</td><td>-</td><td>-</td></tr> </tbody> </table>	Input Voltage [V]	Output Voltage [V]		Load 50%	Load 100%	85	24.049	23.986	100	24.049	23.988	120	24.049	23.988	200	24.048	23.987	230	24.048	23.988	264	24.048	23.988	--	-	-	--	-	-	--	-	-
Input Voltage [V]	Output Voltage [V]																																	
	Load 50%	Load 100%																																
85	24.049	23.986																																
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120	24.049	23.988																																
200	24.048	23.987																																
230	24.048	23.988																																
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Input Voltage [V]	Output Voltage [V]																																	
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<p>Note: Slanted line shows the range of the rated input voltage.</p>																																		



Model	MODULE 9
Item	Load Regulation
Object	+24V1.6A

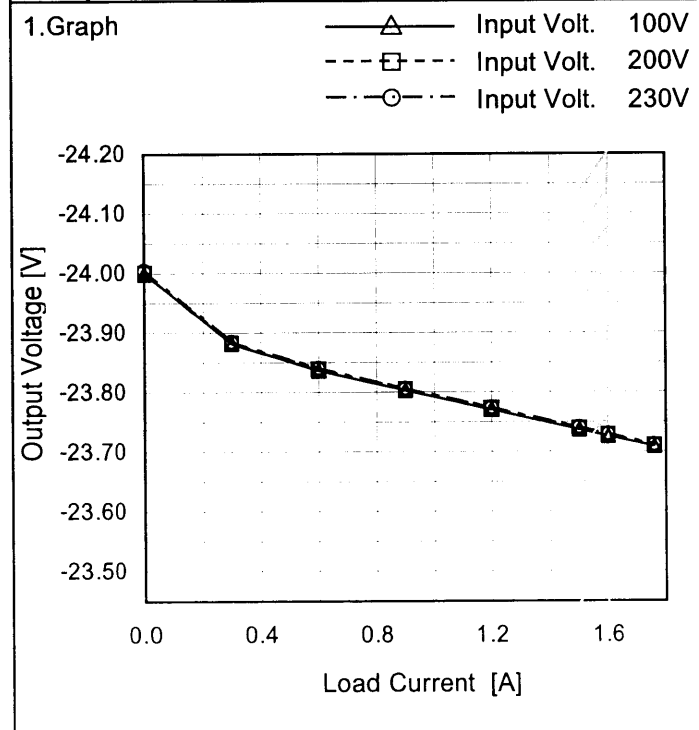
Temperature 25°C  
Testing Circuitry Figure A



2.Values

Load Current [A]	Output Voltage [V]		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
0.00	23.985	23.986	23.989
0.30	23.871	23.873	23.874
0.60	23.827	23.829	23.830
0.90	23.793	23.796	23.796
1.20	23.759	23.761	23.763
1.50	23.723	23.727	23.727
1.60	23.712	23.716	23.717
1.76	23.694	23.698	23.698
--	-	-	-
--	-	-	-
--	-	-	-

Object	-24V1.6A
--------	----------



2.Values

Load Current [A]	Output Voltage [V]		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
0.00	-23.999	-24.001	-24.004
0.30	-23.882	-23.883	-23.885
0.60	-23.837	-23.839	-23.840
0.90	-23.803	-23.805	-23.806
1.20	-23.771	-23.774	-23.774
1.50	-23.737	-23.740	-23.741
1.60	-23.726	-23.729	-23.730
1.76	-23.709	-23.711	-23.712
--	-	-	-
--	-	-	-
--	-	-	-

Note: Slanted line shows the range of the rated load current.



Model		MODULE 9	Temperature 25°C	
Item		Dynamic Load Response	Testing Circuitry Figure A	
Object		+24V1.6A		

Input Volt. 100 V  
 Cycle 1000 mS

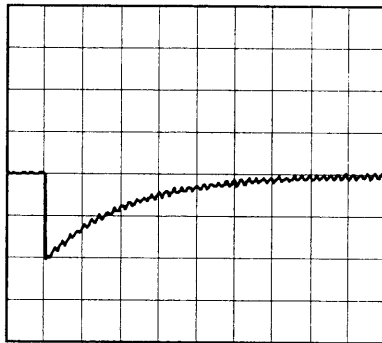
Load Current



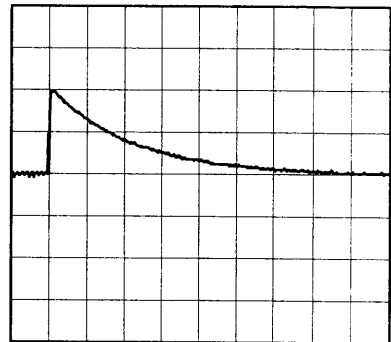
Min. Load (0A) ←→

Load 100% (1.6A)

200 mV/div



100 ms/div



100 ms/div

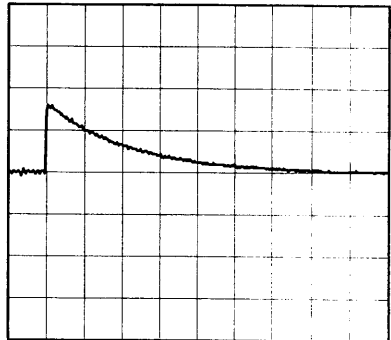
Min. Load (0A) ←→

Load 50% (0.8A)

200 mV/div



100 ms/div



100 ms/div

\* The characteristic of AC200V is equal.

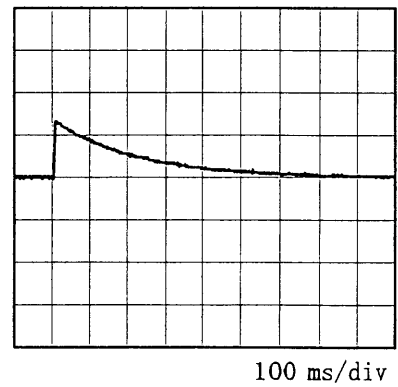
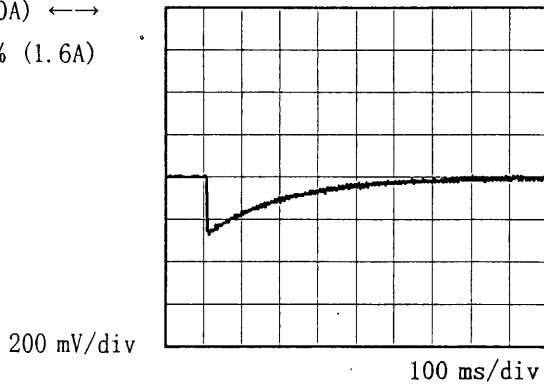


Model		MODULE 9	Temperature 25°C Testing Circuitry Figure A
Item		Dynamic Load Response	
Object		-24V1.6A	

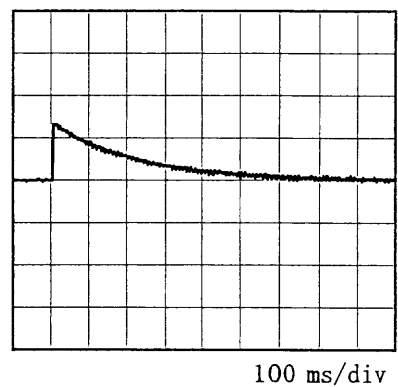
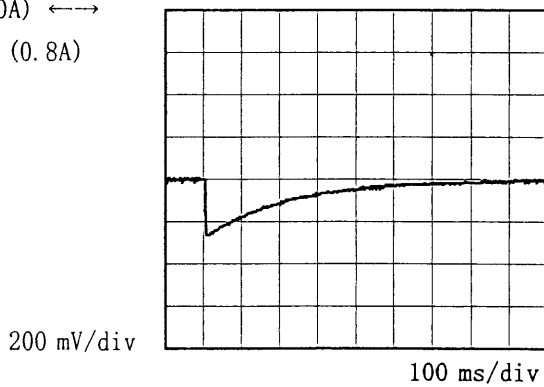
Input Volt. 100 V  
Cycle 1000 mS



Min. Load (0A) ←→  
Load 100% (1.6A)



Min. Load (0A) ←→  
Load 50% (0.8A)



\* The characteristic of AC200V is equal.



<p>Model      MODULE 9</p>		<p>Temperature      25°C Testing Circuitry      Figure A</p>																																						
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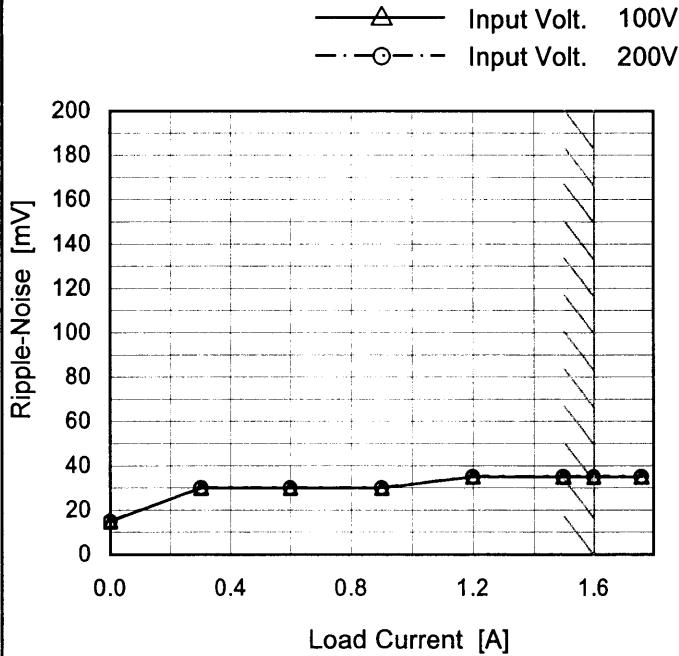
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<p>T1: Due to AC Input Line T2: Due to Switching</p> <p>Ripple [mVp-p]</p> <p>Fig. Complex Ripple Wave Form</p>																																								





Model	MODULE 9	Temperature	25°C
Item	Ripple-Noise	Testing Circuitry	Figure A
Object	+24V1.6A		

1. Graph



2. Values

Load Current [A]	Ripple-Noise [mV]	
	Input Volt. 100 [V]	Input Volt. 200 [V]
0.00	15	15
0.30	30	30
0.60	30	30
0.90	30	30
1.20	35	35
1.50	35	35
1.60	35	35
1.76	35	35
--	-	-
--	-	-
--	-	-

Measured by 20 MHz Oscilloscope.  
 Ripple-Noise is shown as p-p in the figure below.  
 Note: Slanted line shows the range of the rated load current.

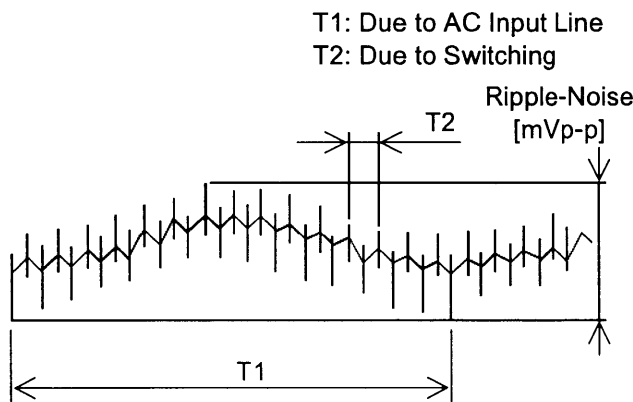
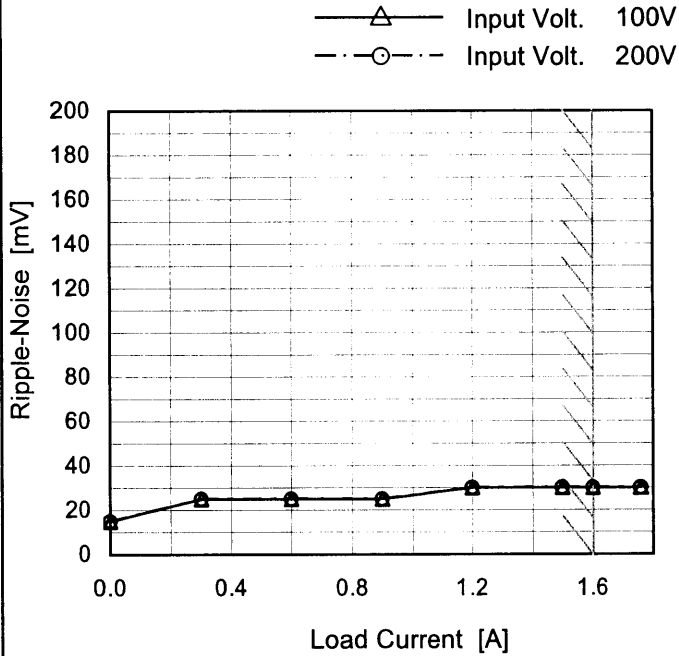


Fig. Complex Ripple Wave Form



Model	MODULE 9	Temperature	25°C
Item	Ripple-Noise	Testing Circuitry	Figure A
Object	-24V1.6A		

1. Graph



Measured by 20 MHz Oscilloscope.  
 Ripple-Noise is shown as p-p in the figure below.  
 Note: Slanted line shows the range of the rated load current.

2. Values

Load Current [A]	Ripple-Noise [mV]	
	Input Volt. 100 [V]	Input Volt. 200 [V]
0.00	15	15
0.30	25	25
0.60	25	25
0.90	25	25
1.20	30	30
1.50	30	30
1.60	30	30
1.76	30	30
--	-	-
--	-	-
--	-	-

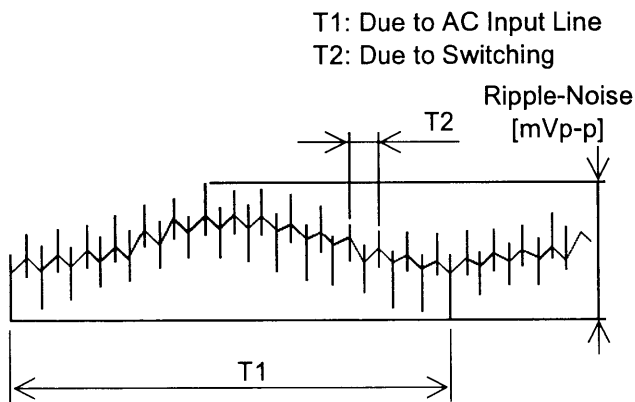


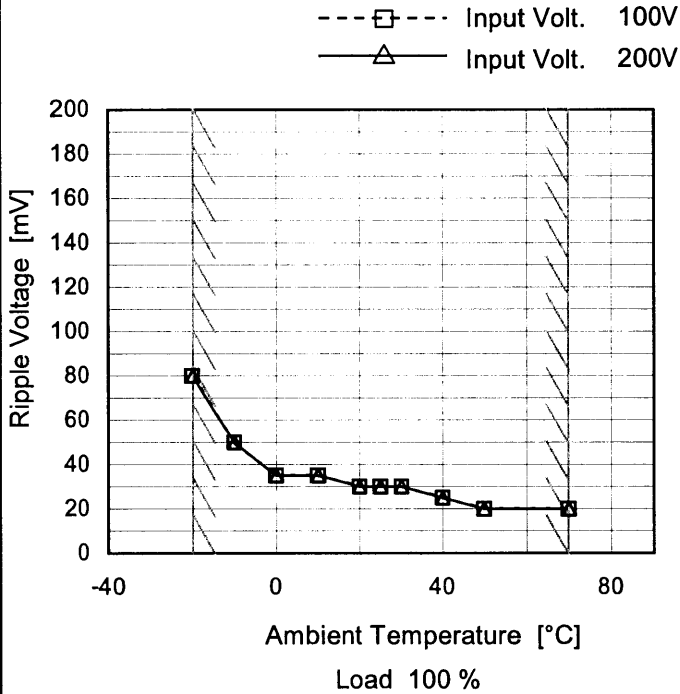
Fig. Complex Ripple Wave Form



Model	MODULE 9
Item	Ripple Voltage (by Ambient Temp.)
Object	+24V1.6A

Testing Circuitry Figure A

1.Graph

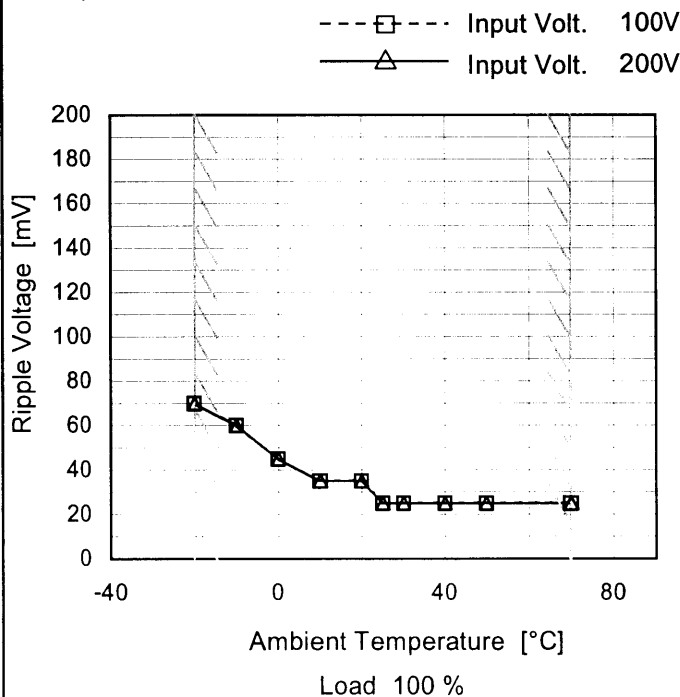


2.Values

Ambient Temperature [°C]	Ripple Voltage [mV]	
	Input Volt. 100 [V]	Input Volt. 200 [V]
-20	80	80
-10	50	50
0	35	35
10	35	35
20	30	30
25	30	30
30	30	30
40	25	25
50	20	20
70	20	20
--	-	-

Object	-24V1.6A
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1.Graph



2.Values

Ambient Temperature [°C]	Ripple Voltage [mV]	
	Input Volt. 100 [V]	Input Volt. 200 [V]
-20	70	70
-10	60	60
0	45	45
10	35	35
20	35	35
25	25	25
30	25	25
40	25	25
50	25	25
70	25	25
--	-	-

Measured by 20 MHz Oscilloscope.

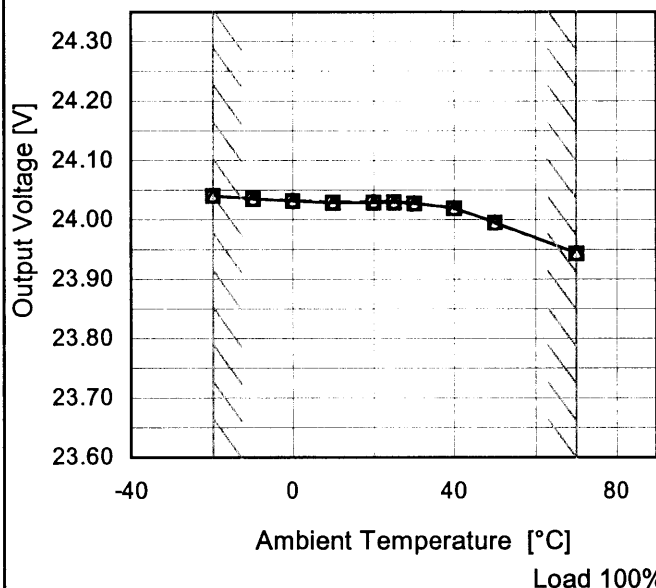
Note: Slanted line shows the range of the rated ambient temperature.



Model	MODULE 9
Item	Ambient Temperature Drift
Object	+24V1.6A

Testing Circuitry Figure A

1.Graph  
 —△— Input Volt. 100V  
 - - - □ - - - Input Volt. 200V  
 - - ○ - - - Input Volt. 230V

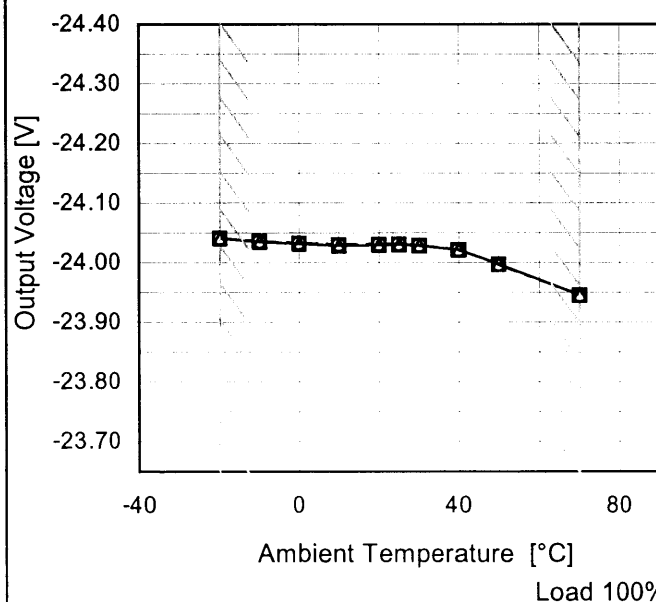


2.Values

Ambient Temperature [°C]	Output Voltage [V]		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
-20	24.041	24.041	24.041
-10	24.035	24.035	24.036
0	24.032	24.032	24.033
10	24.029	24.029	24.030
20	24.029	24.029	24.030
25	24.029	24.030	24.030
30	24.028	24.028	24.028
40	24.020	24.020	24.020
50	23.996	23.995	23.995
70	23.944	23.944	23.943
--	-	-	-

Object	-24V1.6A
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1.Graph  
 —△— Input Volt. 100V  
 - - - □ - - - Input Volt. 200V  
 - - ○ - - - Input Volt. 230V



2.Values

Ambient Temperature [°C]	Output Voltage [V]		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
-20	-24.041	-24.041	-24.041
-10	-24.035	-24.035	-24.035
0	-24.032	-24.032	-24.033
10	-24.029	-24.029	-24.030
20	-24.029	-24.030	-24.031
25	-24.030	-24.030	-24.031
30	-24.029	-24.029	-24.029
40	-24.021	-24.022	-24.021
50	-23.998	-23.997	-23.997
70	-23.946	-23.945	-23.945
--	-	-	-

Note: Slanted line shows the range of the rated ambient temperature.



<b>COSEL</b>		Testing Circuitry Figure A
Model	MODULE 9	
Item	Output Voltage Accuracy	

1. Output Voltage Accuracy

This is defined as the value of the output voltage, regulation load, ambient temperature and input voltage varied at random in the range as specified below.

Temperature : -20 - 70°C

Input Voltage : 85 - 264V

Load Current (AVR 1) : 0 - 1.6A (AVR 2): 0 - 1.6A

\* Output Voltage Accuracy =  $\pm(\text{Maximum of Output Voltage} - \text{Minimum of Output Voltage}) / 2$

\* Output Voltage Accuracy (Ration) =  $\frac{\text{Output Voltage Accuracy}}{\text{Rated Output Voltage}} \times 100$

2. Values

Object		+24V1.6A					
Item	Temperature [°C]	Input Voltage[V]	Output		Output Voltage Accuracy		
			Current[A]	Voltage[V]	Value [mV]	Ration [%]	
Maximum Voltage	25	200	0	24.294	±328	±1.4	
Minimum Voltage	70	85	1.6	23.639			

Object		-24V1.6A					
Item	Temperature [°C]	Input Voltage[V]	Output		Output Voltage Accuracy		
			Current[A]	Voltage[V]	Value [mV]	Ration [%]	
Maximum Voltage	25	85	0	-24.306	±326	±1.4	
Minimum Voltage	70	85	1.6	-23.654			



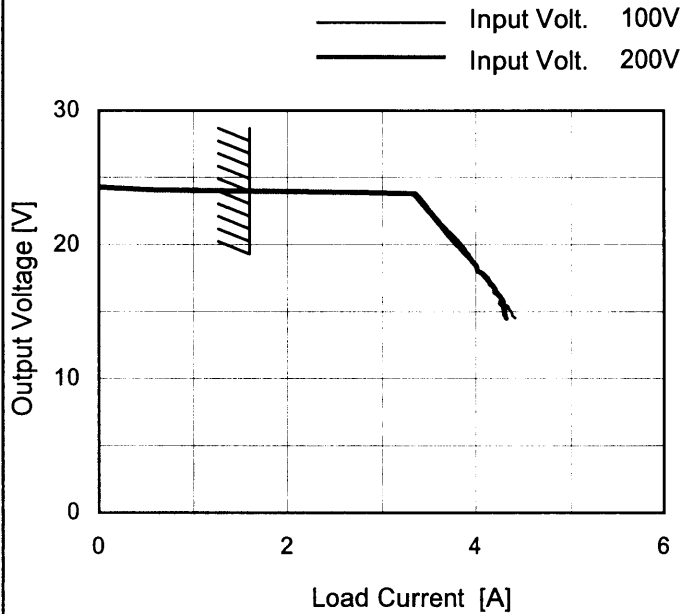
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Item	Time Lapse Drift	Testing Circuitry	Figure A																						
Object	+24V1.6A																								
<p>1.Graph</p> <p style="text-align: center;">Time [H]</p> <p style="text-align: center;">Input Volt. 100V Load 100%</p>		<p>2.Values</p> <table border="1"> <thead> <tr> <th>Time since start [H]</th> <th>Output Voltage [V]</th> </tr> </thead> <tbody> <tr><td>0.0</td><td>23.991</td></tr> <tr><td>0.5</td><td>23.989</td></tr> <tr><td>1.0</td><td>23.990</td></tr> <tr><td>2.0</td><td>23.992</td></tr> <tr><td>3.0</td><td>23.993</td></tr> <tr><td>4.0</td><td>23.993</td></tr> <tr><td>5.0</td><td>23.994</td></tr> <tr><td>6.0</td><td>23.994</td></tr> <tr><td>7.0</td><td>23.994</td></tr> <tr><td>8.0</td><td>23.994</td></tr> </tbody> </table>		Time since start [H]	Output Voltage [V]	0.0	23.991	0.5	23.989	1.0	23.990	2.0	23.992	3.0	23.993	4.0	23.993	5.0	23.994	6.0	23.994	7.0	23.994	8.0	23.994
Time since start [H]	Output Voltage [V]																								
0.0	23.991																								
0.5	23.989																								
1.0	23.990																								
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<p>1.Graph</p> <p style="text-align: center;">Time [H]</p> <p style="text-align: center;">Input Volt. 100V Load 100%</p>		<p>2.Values</p> <table border="1"> <thead> <tr> <th>Time since start [H]</th> <th>Output Voltage [V]</th> </tr> </thead> <tbody> <tr><td>0.0</td><td>-23.990</td></tr> <tr><td>0.5</td><td>-23.995</td></tr> <tr><td>1.0</td><td>-23.996</td></tr> <tr><td>2.0</td><td>-23.998</td></tr> <tr><td>3.0</td><td>-23.998</td></tr> <tr><td>4.0</td><td>-23.999</td></tr> <tr><td>5.0</td><td>-24.000</td></tr> <tr><td>6.0</td><td>-24.000</td></tr> <tr><td>7.0</td><td>-24.000</td></tr> <tr><td>8.0</td><td>-24.000</td></tr> </tbody> </table>		Time since start [H]	Output Voltage [V]	0.0	-23.990	0.5	-23.995	1.0	-23.996	2.0	-23.998	3.0	-23.998	4.0	-23.999	5.0	-24.000	6.0	-24.000	7.0	-24.000	8.0	-24.000
Time since start [H]	Output Voltage [V]																								
0.0	-23.990																								
0.5	-23.995																								
1.0	-23.996																								
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6.0	-24.000																								
7.0	-24.000																								
8.0	-24.000																								
<p>* The characteristic of AC200V is equal.</p>																									



Model	MODULE 9
Item	Overcurrent Protection
Object	+24V1.6A

Temperature 25°C  
Testing Circuitry Figure A

1.Graph



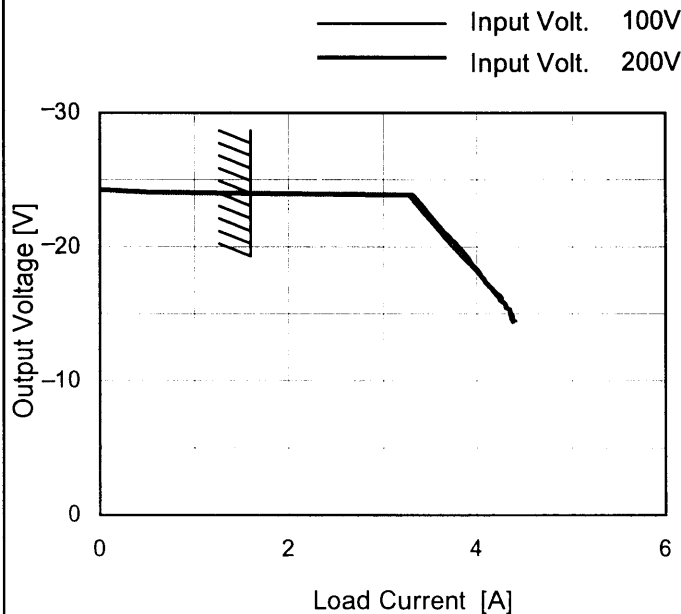
Intermittent operation occurs when the output voltage is from 14.4V to 0V.

2.Values

Output Voltage [V]	Load Current [A]	
	Input Volt. 100[V]	Input Volt. 200[V]
24.0	2.38	2.37
22.8	3.44	3.47
21.6	3.59	3.62
19.2	3.88	3.92
16.8	4.18	4.19
14.4	4.41	4.32
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

Object	+24V1.6A
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1.Graph



Note: Slanted line shows the range of the rated load current.

Intermittent operation occurs when the output voltage is from 14.4V to 0V.

2.Values

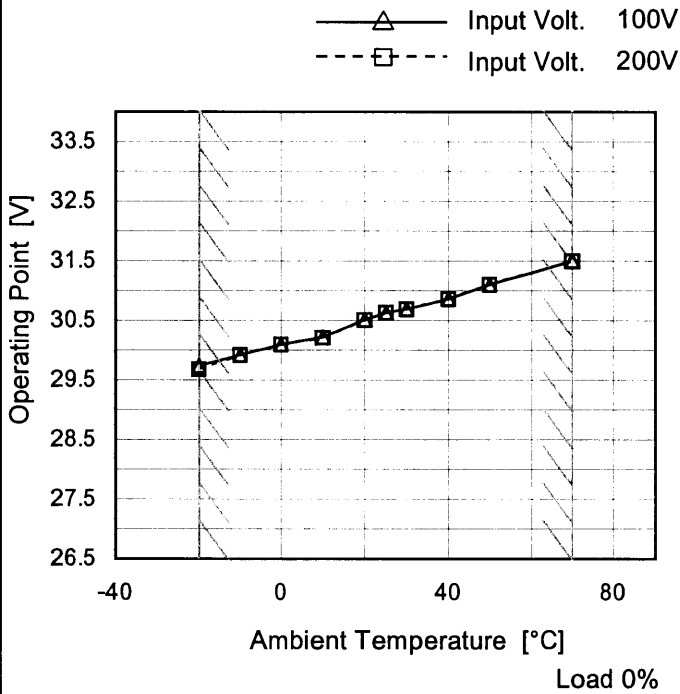
Output Voltage [V]	Load Current [A]	
	Input Volt. 100[V]	Input Volt. 200[V]
-24.0	2.01	1.64
-22.8	3.38	3.43
-21.6	3.53	3.58
-19.2	3.85	3.91
-16.8	4.16	4.16
-14.4	4.41	4.37
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-



Model	MODULE 9
Item	Overvoltage Protection
Object	+24V1.6A

Testing Circuitry Figure A

1.Graph

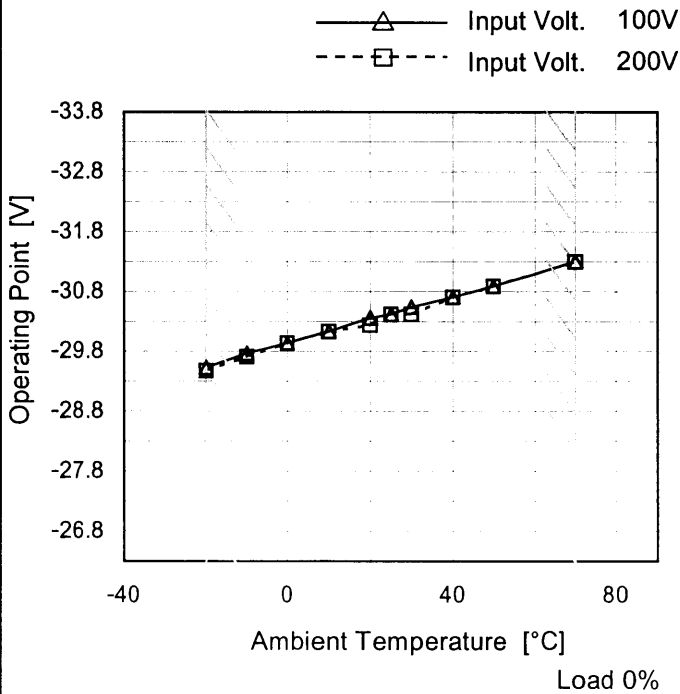


2.Values

Ambient Temperature [°C]	Operating Point [V]	
	Input Volt. 100[V]	Input Volt. 200[V]
-20	29.72	29.66
-10	29.90	29.90
0	30.08	30.08
10	30.20	30.19
20	30.49	30.49
25	30.61	30.61
30	30.67	30.67
40	30.84	30.84
50	31.08	31.08
70	31.48	31.48
--	-	-

Object	-24V1.6A
--------	----------

1.Graph



2.Values

Ambient Temperature [°C]	Operating Point [V]	
	Input Volt. 100[V]	Input Volt. 200[V]
-20	-29.48	-29.43
-10	-29.72	-29.66
0	-29.89	-29.89
10	-30.08	-30.08
20	-30.31	-30.19
25	-30.37	-30.37
30	-30.49	-30.37
40	-30.66	-30.66
50	-30.84	-30.84
70	-31.25	-31.25
--	-	-

Note: Slanted line shows the range of the rated ambient temperature.



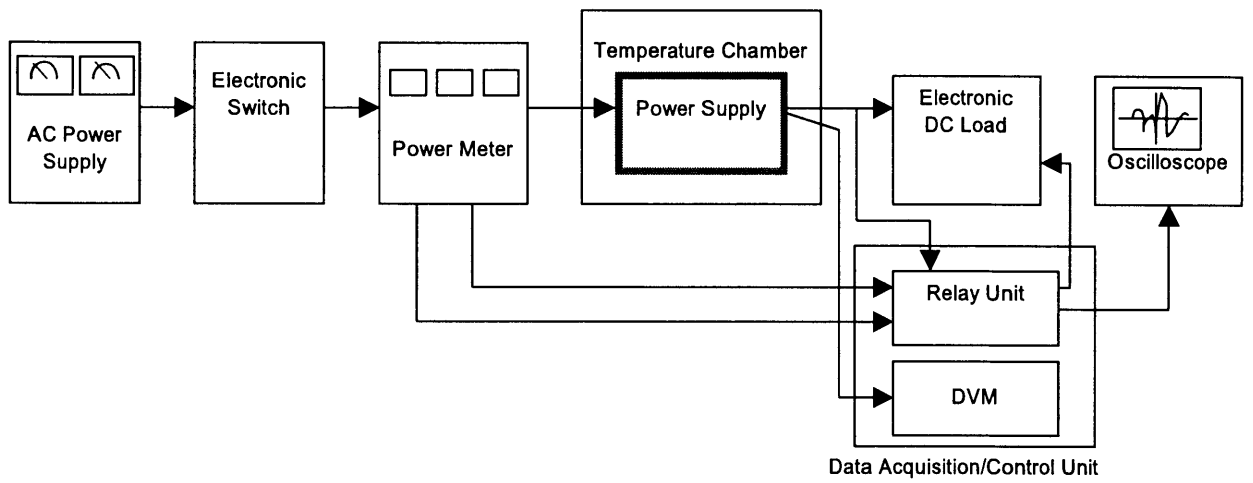


Figure A

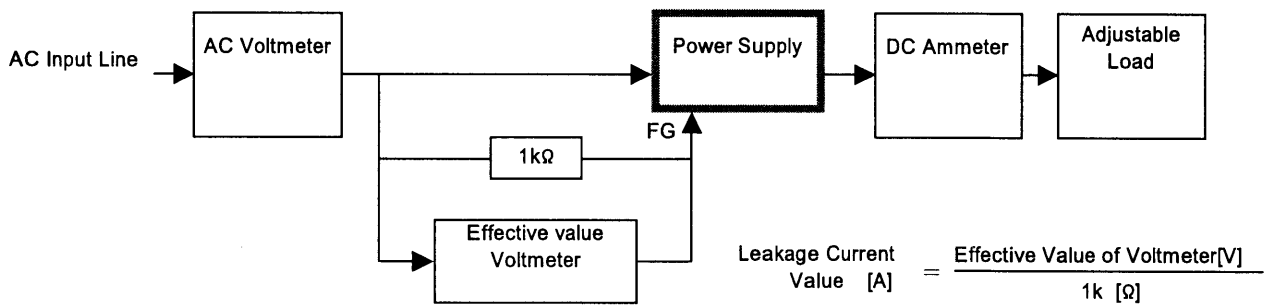


Figure B ( DEN-AN )

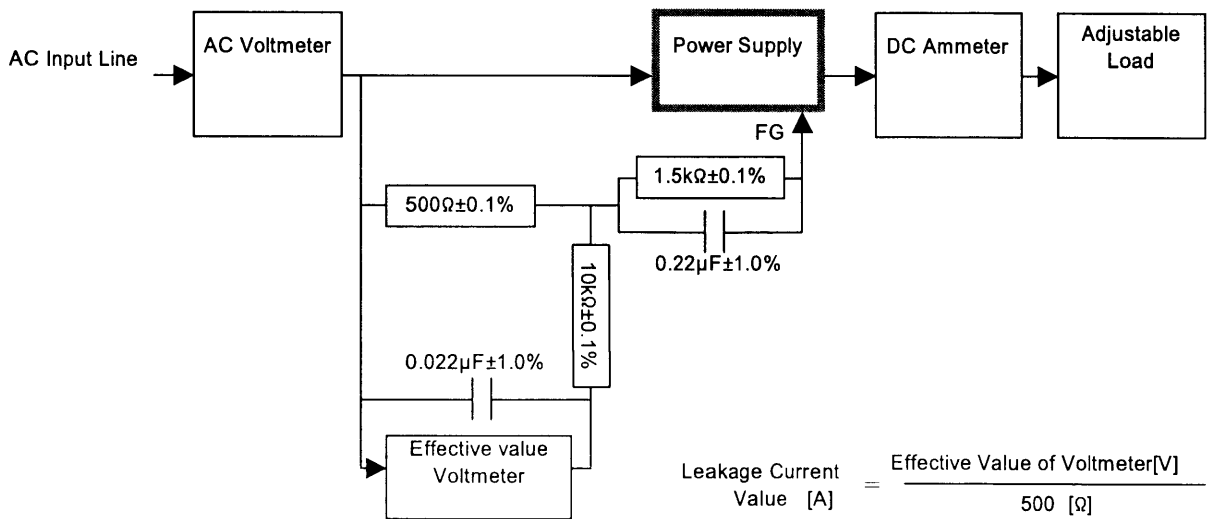


Figure B ( IEC60950 )