

TEST DATA OF MODULE R

(AME series)

Regulated DC Power Supply
August 20, 2020

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Prepared by : Enkyo Kaku
Enkyo Kaku Design Engineer

COSEL CO.,LTD.

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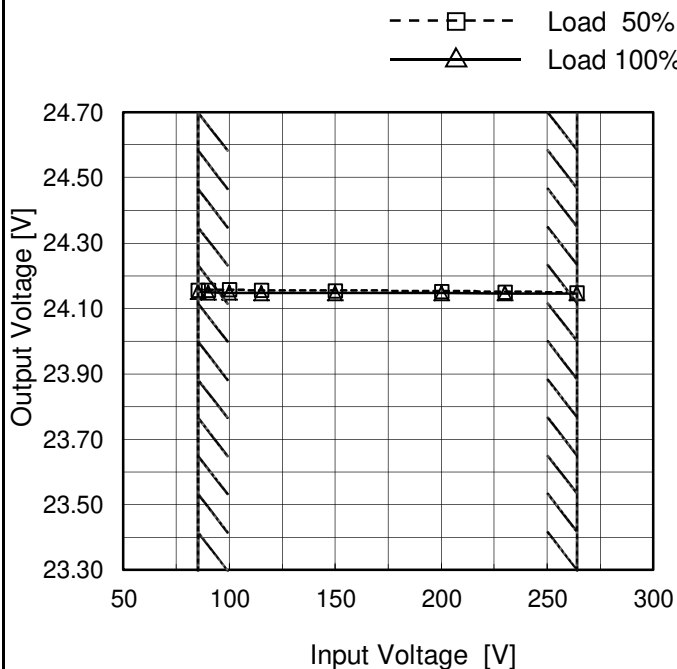
(Final Page 15)



Model	MODULE R
Item	Line Regulation
Object	V1: +24V3A

Temperature 25°C
Testing Circuitry Figure A

1.Graph

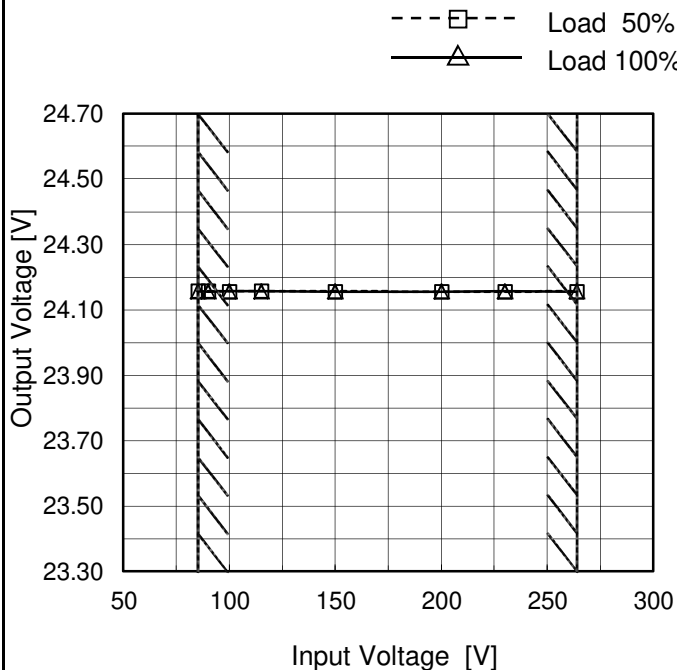


2.Values

Input Voltage [V]	Output Voltage [V]	
	Load 50%	Load 100%
85	24.157	24.151
90	24.157	24.149
100	24.157	24.147
115	24.156	24.147
150	24.154	24.147
200	24.152	24.146
230	24.150	24.146
264	24.148	24.146
--	-	-

Object	V2: +24V3A
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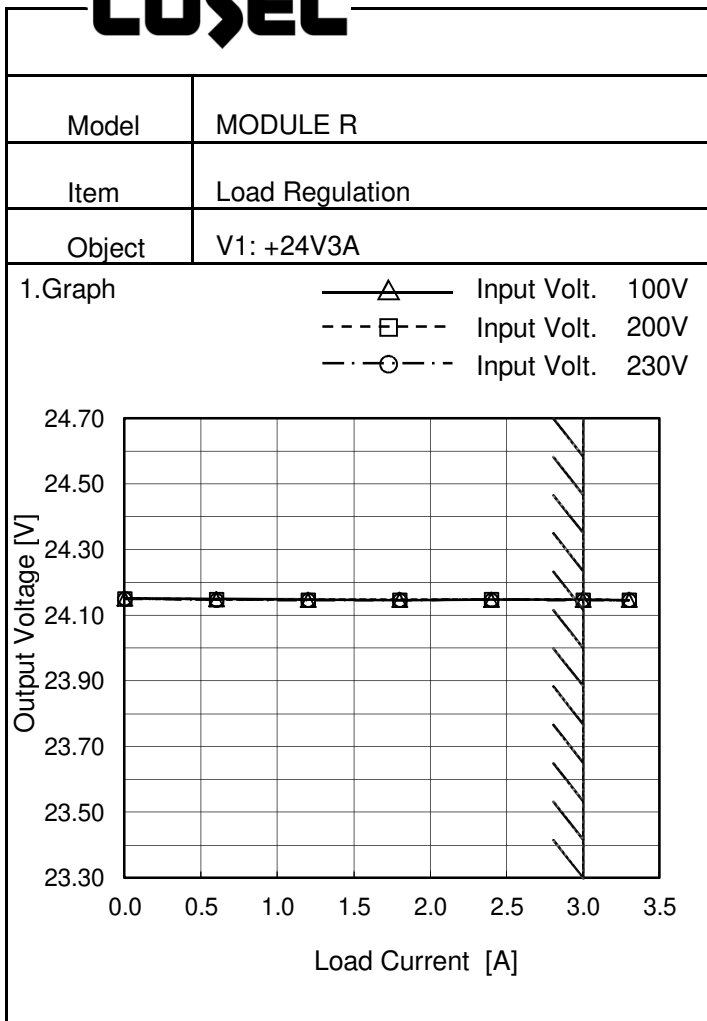
1.Graph



2.Values

Input Voltage [V]	Output Voltage [V]	
	Load 50%	Load 100%
85	24.158	24.156
90	24.157	24.156
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230	24.156	24.156
264	24.157	24.156
--	-	-

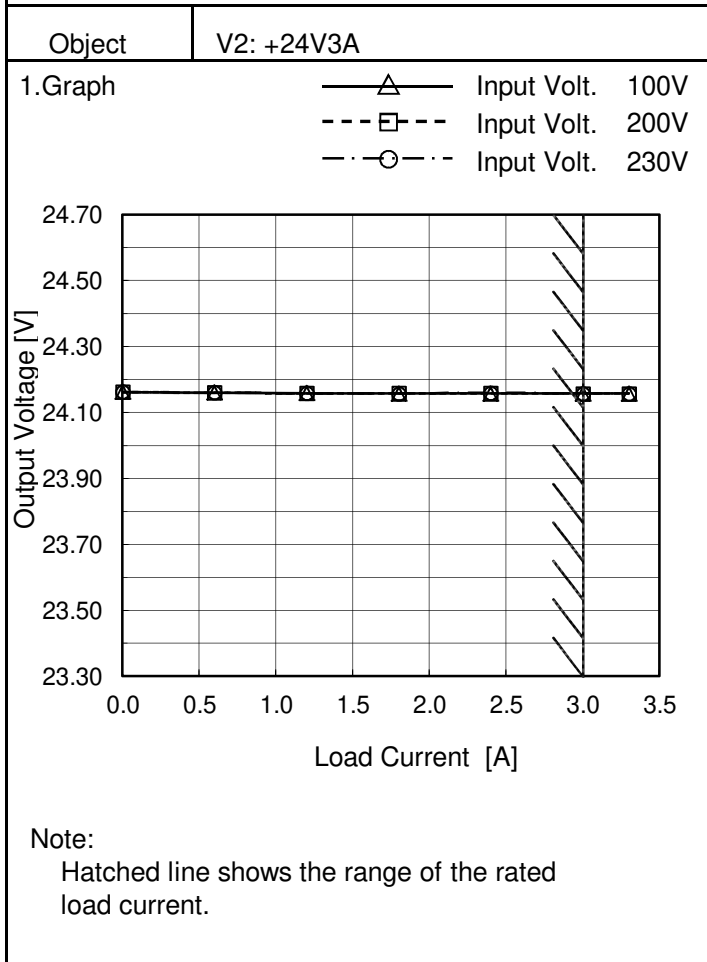
Note:
Hatched line shows the input voltage range.



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]
0.0	24.151	24.152	24.150
0.6	24.149	24.148	24.148
1.2	24.147	24.147	24.146
1.8	24.146	24.148	24.146
2.4	24.147	24.148	24.147
3.0	24.147	24.147	24.147
3.3	24.146	24.147	24.146
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-



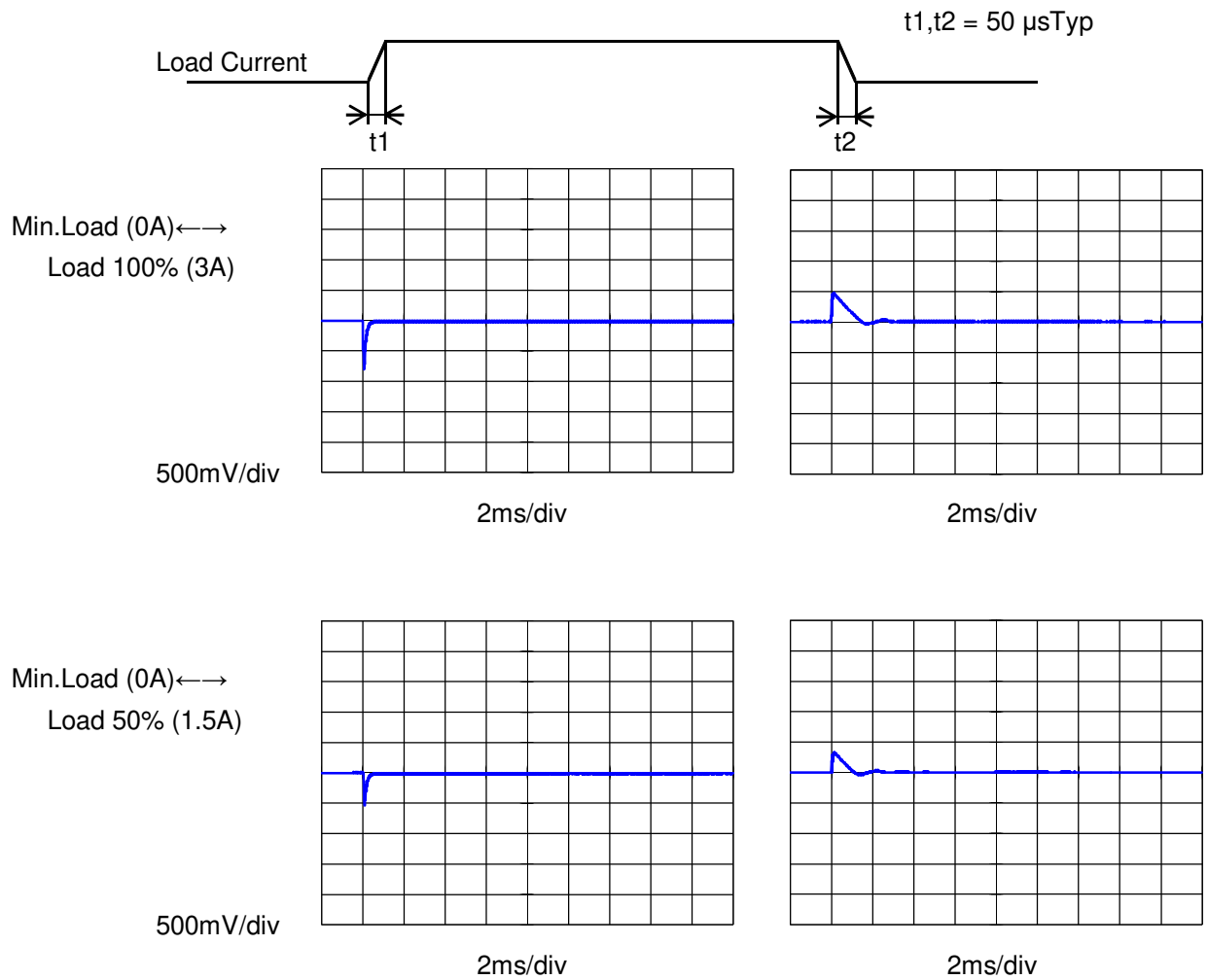
2.Values

Load Current [A]	Output Voltage [V]		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
0.0	24.162	24.162	24.162
0.6	24.160	24.160	24.160
1.2	24.158	24.158	24.158
1.8	24.158	24.158	24.158
2.4	24.157	24.158	24.159
3.0	24.157	24.157	24.157
3.3	24.157	24.157	24.157
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-



Model		MODULE R	Temperature 25°C Testing Circuitry Figure A
Item		Dynamic Load Response	
Object		V1: +24V3A	

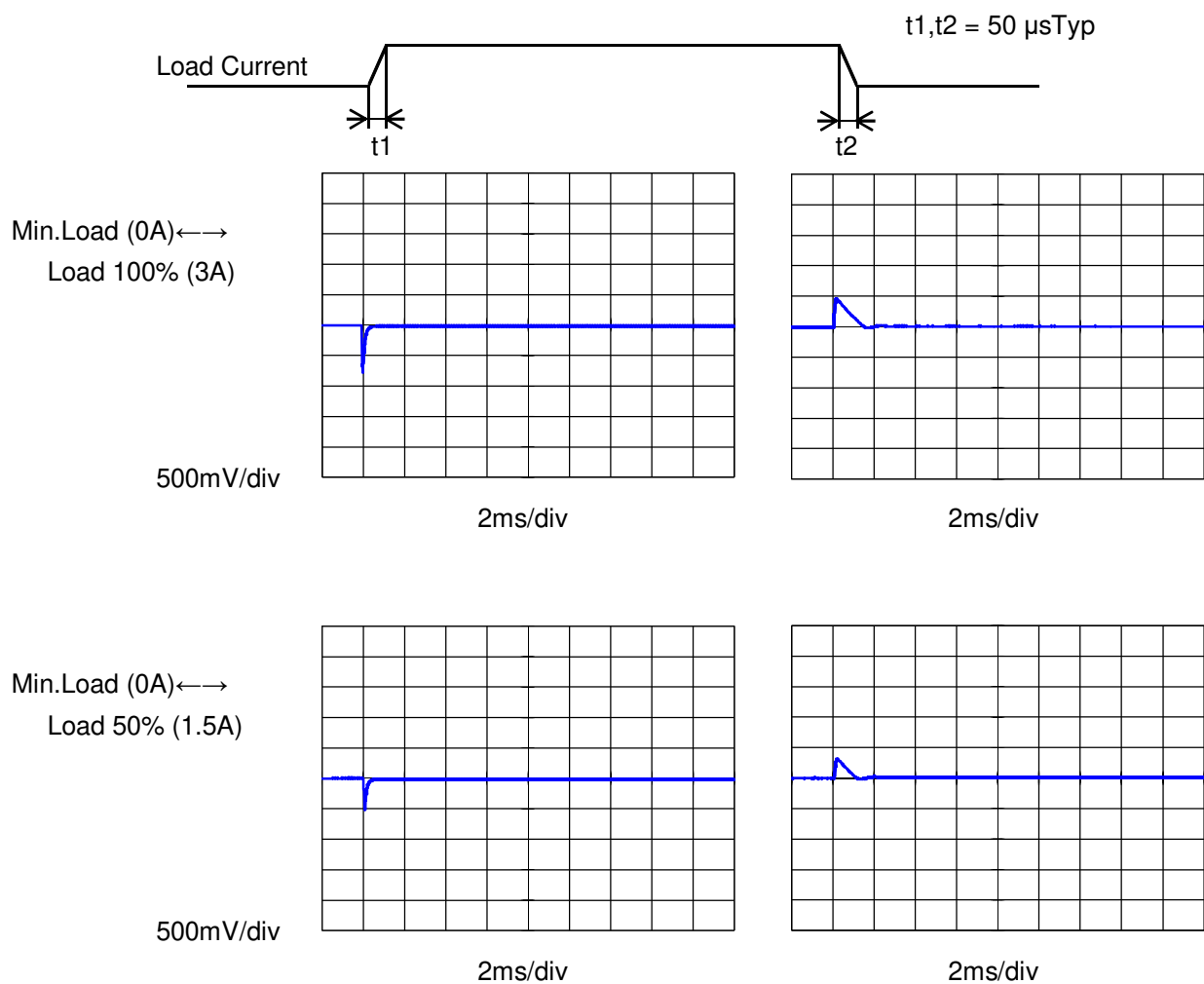
Input Volt. 100 V
Cycle 1000 ms





Model		MODULE R	Temperature 25°C Testing Circuitry Figure A
Item		Dynamic Load Response	
Object		V2: +24V3A	

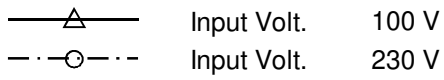
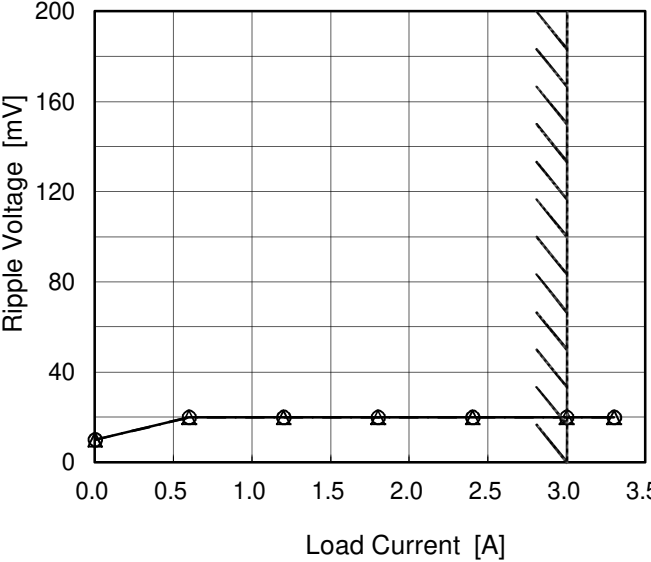
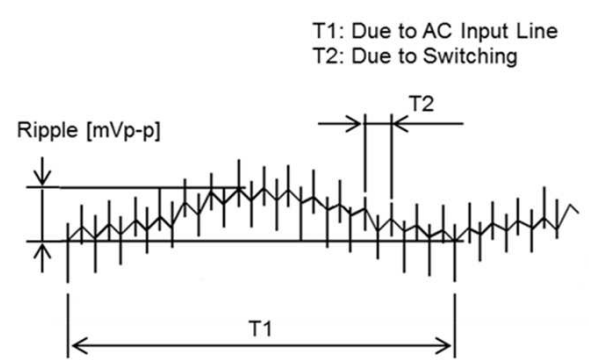
Input Volt. 100 V
Cycle 1000 ms





<p>Model MODULE R</p>		<p>Temperature 25°C</p>																																							
<p>Item Ripple Voltage (by Load Current)</p>		<p>Testing Circuitry Figure B</p>																																							
<p>Object V1: +24V3A</p>																																									
<p>1. Graph</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <p>—△— Input Volt. 100 V</p> <p>- - -○- - - Input Volt. 230 V</p> </div> </div>		<p>2. Value</p> <table border="1"> <thead> <tr> <th rowspan="2">Load Current [A]</th> <th colspan="2">Ripple Voltage [mV]</th> </tr> <tr> <th>Input Volt. 100[V]</th> <th>Input Volt. 230[V]</th> </tr> </thead> <tbody> <tr><td>0.0</td><td>10</td><td>10</td></tr> <tr><td>0.6</td><td>15</td><td>15</td></tr> <tr><td>1.2</td><td>15</td><td>15</td></tr> <tr><td>1.8</td><td>15</td><td>15</td></tr> <tr><td>2.4</td><td>15</td><td>15</td></tr> <tr><td>3.0</td><td>15</td><td>15</td></tr> <tr><td>3.3</td><td>15</td><td>15</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> <tr><td>--</td><td>-</td><td>-</td></tr> </tbody> </table>		Load Current [A]	Ripple Voltage [mV]		Input Volt. 100[V]	Input Volt. 230[V]	0.0	10	10	0.6	15	15	1.2	15	15	1.8	15	15	2.4	15	15	3.0	15	15	3.3	15	15	--	-	-	--	-	-	--	-	-	--	-	-
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<div style="text-align: center;"> <p>T1: Due to AC Input Line</p> <p>T2: Due to Switching</p> <p>Ripple [mVp-p]</p> <p>Fig. Complex Ripple Wave Form</p> </div>																																									



Model		MODULE R	Temperature 25°C																																							
Item		Ripple Voltage (by Load Current)	Testing Circuitry Figure B																																							
Object		V2: +24V3A																																								
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COSEL																																								
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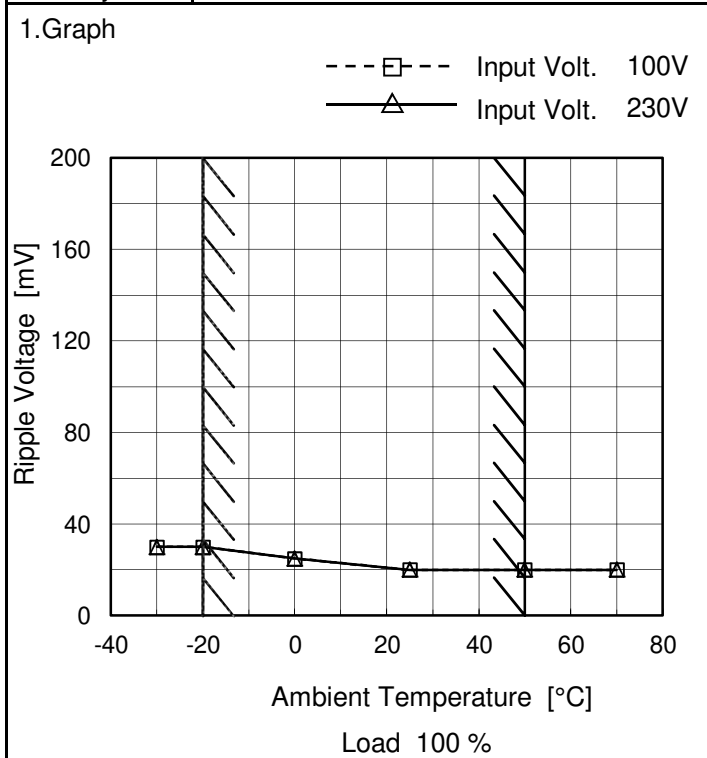


COSEL																																								
Model	MODULE R																																							
Item	Ripple-Noise	Temperature 25°C Testing Circuitry Figure B																																						
Object	V2: +24V3A																																							
<p>1. Graph</p> <div style="text-align: right;"> <p>—△— Input Volt. 100 V</p> <p>- - ○ - - Input Volt. 230 V</p> </div> <p style="text-align: center;">Ripple-Noise [mV]</p> <p style="text-align: center;">Load Current [A]</p>		<p>2. Values</p> <table border="1"> <thead> <tr> <th rowspan="2">Load Current [A]</th> <th colspan="2">Ripple-Noise [mV]</th> </tr> <tr> <th>Input Volt. 100[V]</th> <th>Input Volt. 230[V]</th> </tr> </thead> <tbody> <tr><td>0.0</td><td>15</td><td>15</td></tr> <tr><td>0.6</td><td>25</td><td>25</td></tr> <tr><td>1.2</td><td>25</td><td>25</td></tr> <tr><td>1.8</td><td>25</td><td>25</td></tr> <tr><td>2.4</td><td>25</td><td>25</td></tr> <tr><td>3.0</td><td>25</td><td>25</td></tr> <tr><td>3.3</td><td>25</td><td>25</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> <tr><td>--</td><td>--</td><td>--</td></tr> </tbody> </table>	Load Current [A]	Ripple-Noise [mV]		Input Volt. 100[V]	Input Volt. 230[V]	0.0	15	15	0.6	25	25	1.2	25	25	1.8	25	25	2.4	25	25	3.0	25	25	3.3	25	25	--	--	--	--	--	--	--	--	--	--	--	--
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<p style="text-align: center;">T1: Due to AC Input Line T2: Due to Switching</p> <p style="text-align: center;">Ripple-Noise [mVp-p]</p> <p style="text-align: center;">T1</p> <p style="text-align: center;">T2</p>																																								
<p>Fig. Complex Ripple Wave Form</p>																																								



Model	MODULE R
Item	Ripple Voltage (by Ambient Temp.)
Object	V1: +24V3A

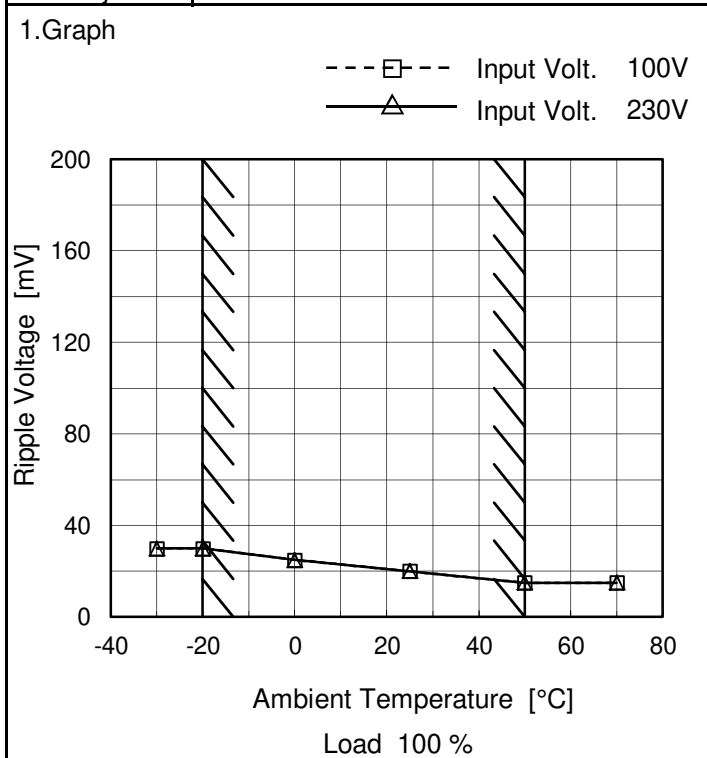
Testing Circuitry Figure B



2.Values

Ambient Temperature [°C]	Ripple Voltage [mV]	
	Input Volt. 100 [V]	Input Volt. 230 [V]
-30	30	30
-20	30	30
0	25	25
25	20	20
50	20	20
70	20	20
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

Object	V2: +24V3A
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2.Values

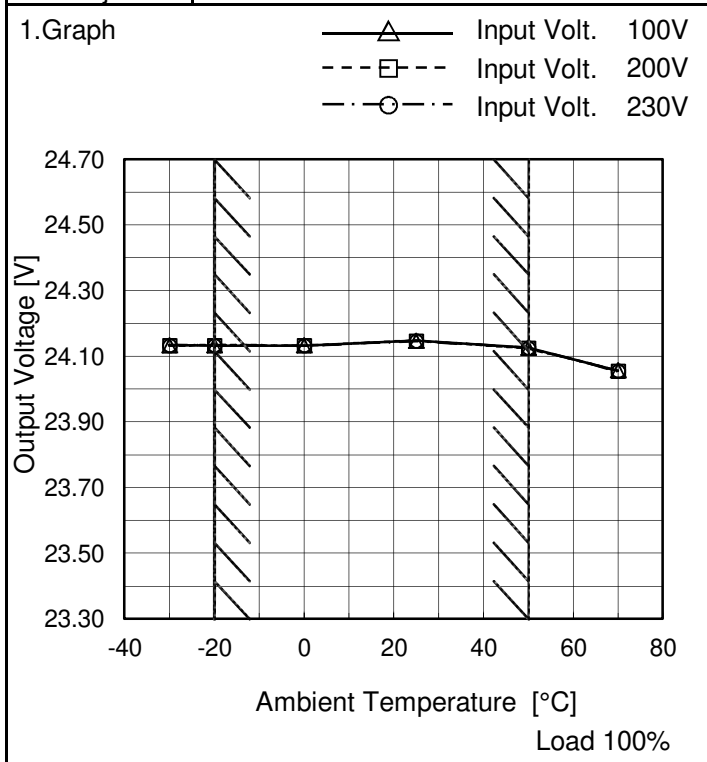
Ambient Temperature [°C]	Ripple Voltage [mV]	
	Input Volt. 100 [V]	Input Volt. 200 [V]
-30	30	30
-20	30	30
0	25	25
25	20	20
50	15	15
70	15	15
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

Measured by 20 MHz Oscilloscope.
 Note: Hatched line shows the range of the rated operating temperature.



Model	MODULE R
Item	Ambient Temperature Drift
Object	V1: +24V3A

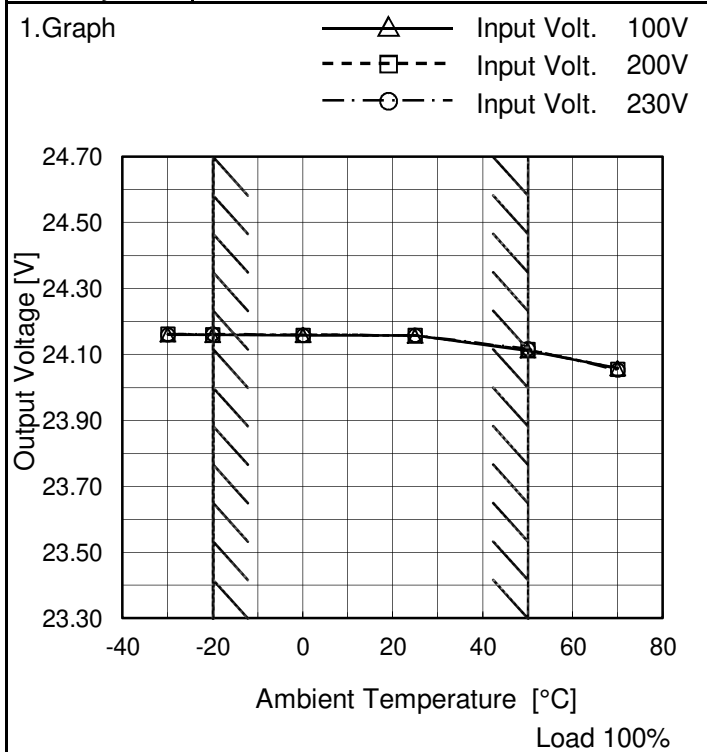
Testing Circuitry Figure A



2.Values

Ambient Temperature [°C]	Output Voltage [V]		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
-30	24.134	24.133	24.133
-20	24.133	24.133	24.133
0	24.133	24.133	24.133
25	24.147	24.147	24.146
50	24.126	24.125	24.125
70	24.056	24.055	24.055
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-

Object	V2: +24V3A
--------	------------



2.Values

Ambient Temperature [°C]	Output Voltage [V]		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
-30	24.161	24.163	24.161
-20	24.159	24.161	24.162
0	24.159	24.159	24.159
25	24.157	24.159	24.158
50	24.112	24.115	24.118
70	24.058	24.056	24.054
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-

Note:

Hatched line shows the range of the rated operating temperature.



COSEL		Testing Circuitry Figure A
Model	MODULE R	
Item	Output Voltage Accuracy	

1. Output Voltage Accuracy

This means the output voltage fluctuation of the time the ambient temperature, the input voltage and/or the load current are varied arbitrarily in the range below.

Temperature : -20 - 50°C

Input Voltage : 90 - 264V

Load Current (AVR 1) : 0 - 3A (AVR 2) : 0 - 3A

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

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

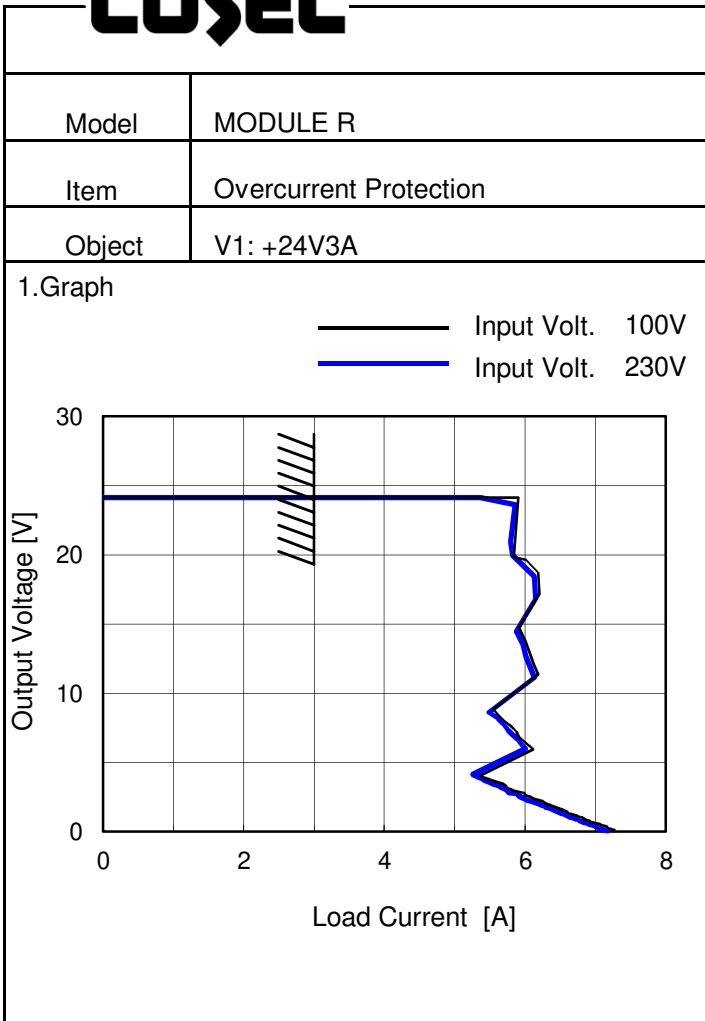
2. Values

Object		V1: +24V3A				
Item	Temperature [°C]	Input Voltage[V]	Output		Output Voltage Accuracy	
			Current[A]	Voltage[V]	Value [mV]	Ratio [%]
Maximum Voltage	25	200	0	24.152	±13	±0.1
Minimum Voltage	50	100	3	24.126		

Object		V2: +24V3A				
Item	Temperature [°C]	Input Voltage[V]	Output		Output Voltage Accuracy	
			Current[A]	Voltage[V]	Value [mV]	Ratio [%]
Maximum Voltage	25	200	0	24.162	±25	±0.1
Minimum Voltage	50	100	3	24.112		



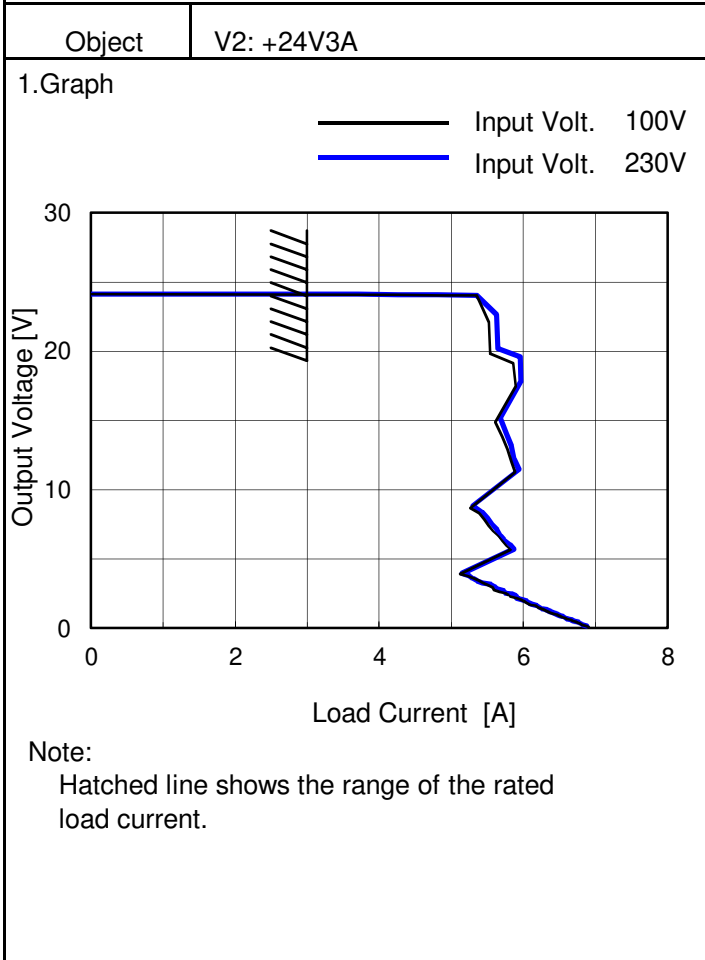
COSEL																								
Model	MODULE R																							
Item	Time Lapse Drift	Temperature 25°C Testing Circuitry Figure A																						
Object	V1: +24V3A																							
<p>1.Graph</p> <p style="text-align: center;">Time [H]</p> <p style="text-align: center;">Input Volt. 100V 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>24.146</td></tr> <tr><td>0.5</td><td>24.143</td></tr> <tr><td>1.0</td><td>24.144</td></tr> <tr><td>2.0</td><td>24.144</td></tr> <tr><td>3.0</td><td>24.144</td></tr> <tr><td>4.0</td><td>24.144</td></tr> <tr><td>5.0</td><td>24.145</td></tr> <tr><td>6.0</td><td>24.145</td></tr> <tr><td>7.0</td><td>24.145</td></tr> <tr><td>8.0</td><td>24.145</td></tr> </tbody> </table>	Time since start [H]	Output Voltage [V]	0.0	24.146	0.5	24.143	1.0	24.144	2.0	24.144	3.0	24.144	4.0	24.144	5.0	24.145	6.0	24.145	7.0	24.145	8.0	24.145
Time since start [H]	Output Voltage [V]																							
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8.0	24.145																							
Object	V2: +24V3A																							
<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>24.157</td></tr> <tr><td>0.5</td><td>24.119</td></tr> <tr><td>1.0</td><td>24.120</td></tr> <tr><td>2.0</td><td>24.120</td></tr> <tr><td>3.0</td><td>24.121</td></tr> <tr><td>4.0</td><td>24.121</td></tr> <tr><td>5.0</td><td>24.120</td></tr> <tr><td>6.0</td><td>24.122</td></tr> <tr><td>7.0</td><td>24.122</td></tr> <tr><td>8.0</td><td>24.122</td></tr> </tbody> </table>	Time since start [H]	Output Voltage [V]	0.0	24.157	0.5	24.119	1.0	24.120	2.0	24.120	3.0	24.121	4.0	24.121	5.0	24.120	6.0	24.122	7.0	24.122	8.0	24.122
Time since start [H]	Output Voltage [V]																							
0.0	24.157																							
0.5	24.119																							
1.0	24.120																							
2.0	24.120																							
3.0	24.121																							
4.0	24.121																							
5.0	24.120																							
6.0	24.122																							
7.0	24.122																							
8.0	24.122																							



Temperature 25°C
Testing Circuitry Figure A

2.Values

Output Voltage [V]	Load Current [A]	
	Input Volt. 100[V]	Input Volt. 230[V]
22.8	5.52	5.68
21.6	5.58	5.78
19.2	5.86	6.00
16.8	5.82	6.04
14.4	5.61	5.77
12.0	5.83	5.89
9.6	5.52	5.52
7.2	5.52	5.65
4.8	5.53	5.67
2.4	5.75	5.83
0.0	6.91	6.92
--	-	-



2.Values

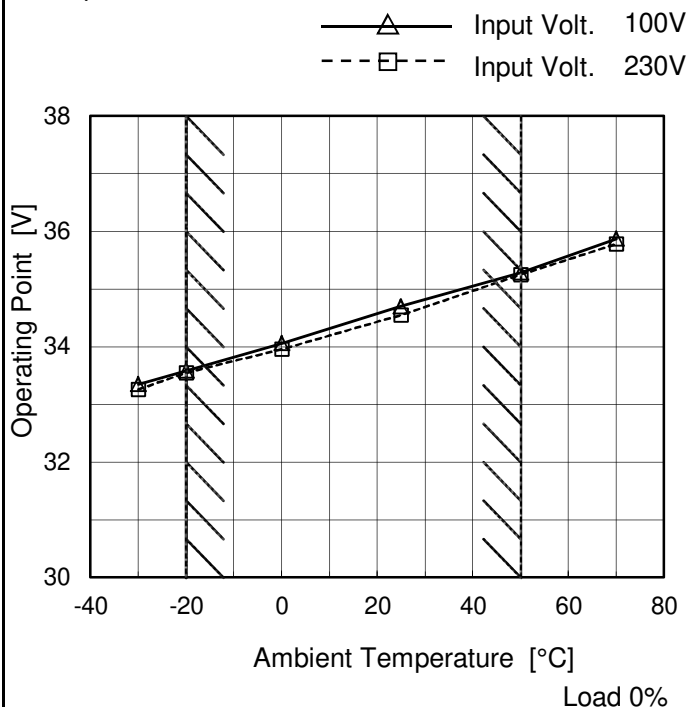
Output Voltage [V]	Load Current [A]	
	Input Volt. 100[V]	Input Volt. 230[V]
22.8	5.95	5.75
21.6	5.97	5.71
19.2	6.04	6.07
16.8	6.16	6.09
14.4	5.91	5.83
12.0	6.12	6.05
9.6	5.65	5.66
7.2	5.88	5.73
4.8	5.48	5.35
2.4	6.08	5.97
0.0	7.27	7.21
--	-	-



Model	MODULE R
Item	Oversvoltage Protection
Object	V1: +24V3A

Testing Circuitry Figure A

1.Graph

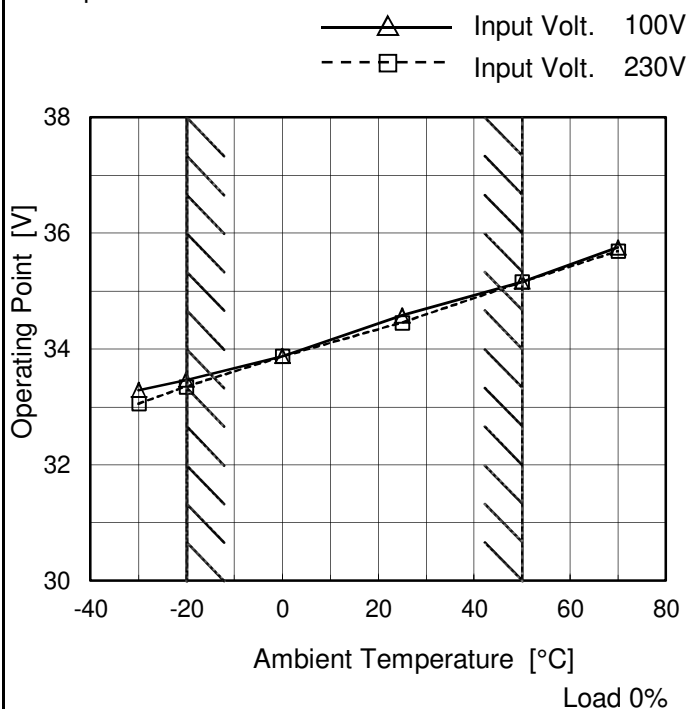


2.Values

Ambient Temperature [°C]	Operating Point [V]	
	Input Volt. 100[V]	Input Volt. 230[V]
-30	33.35	33.26
-20	33.58	33.55
0	34.06	33.96
25	34.70	34.55
50	35.28	35.25
70	35.87	35.78
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

Object	V2: +24V3A
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1.Graph

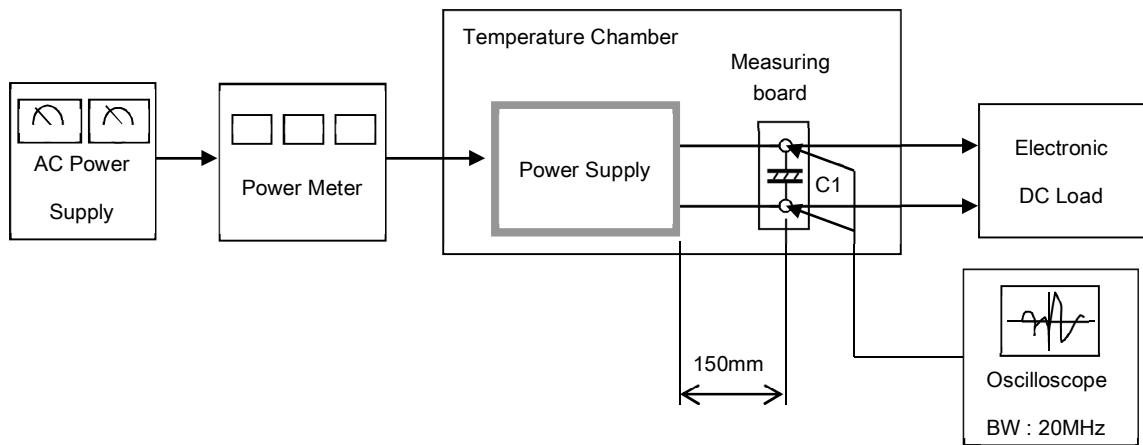
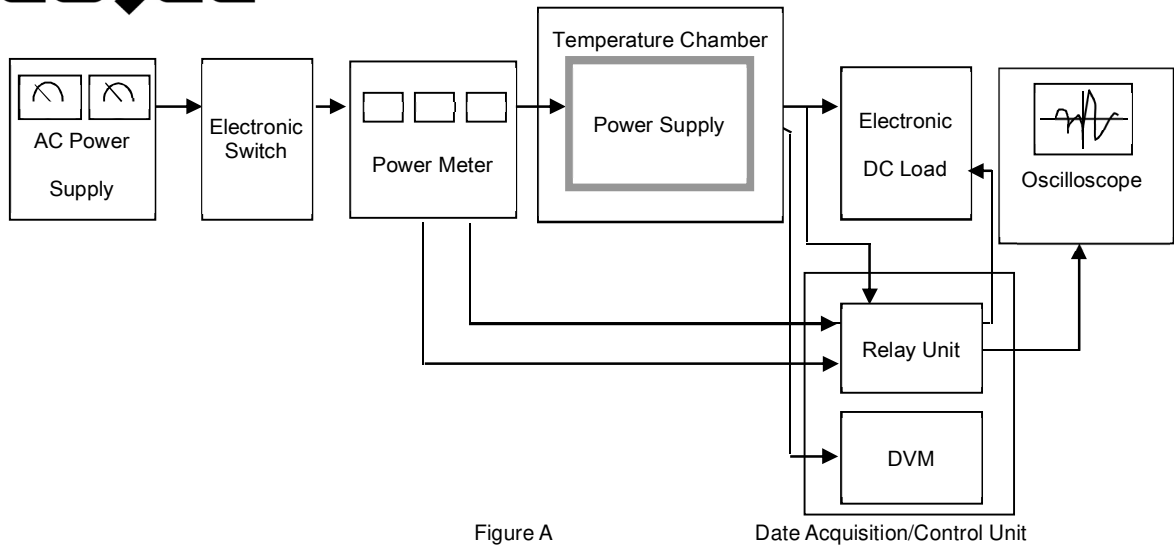


2.Values

Ambient Temperature [°C]	Operating Point [V]	
	Input Volt. 100[V]	Input Volt. 230[V]
-30	33.29	33.06
-20	33.47	33.35
0	33.88	33.88
25	34.58	34.46
50	35.16	35.16
70	35.75	35.69
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

Note:

Hatched line shows the range of the rated operating temperature.



C1 = 22 μ F
(Electrolytic capacitor)