



# TEST DATA OF MODULE M

(RB series)

Regulated DC Power Supply  
November 5, 2018

Approved by : Jun Uchida  
Jun Uchida Design Manager

Prepared by : Hideaki Douguchi  
Hideaki Douguchi Design Engineer

**COSEL CO.,LTD.**



## CONTENTS

1.Line Regulation . . . . .	1
2.Load Regulation . . . . .	2
3.Dynamic Load Response . . . . .	3
4.Ripple Voltage (by Load Current) . . . . .	4
5.Ripple-Noise . . . . .	5
6.Ripple Voltage (by Ambient Temperature) . . . . .	6
7.Ambient Temperature Drift . . . . .	7
8.Output Voltage Accuracy . . . . .	8
9.Time Lapse Drift . . . . .	9
10.Overcurrent Protection . . . . .	10
11.Overvoltage Protection . . . . .	11
12.Figure of Testing Circuitry . . . . .	12

(Final Page 12)



<b>COSEL</b>																																			
Model	MODULE M	Temperature	25°C																																
Item	Line Regulation	Testing Circuitry	Figure A																																
Object	+48V0.65A																																		
<p>1.Graph</p> <p style="text-align: right;">             ---□--- Load 50%              —△— 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>48.316</td><td>48.309</td></tr> <tr><td>90</td><td>48.316</td><td>48.309</td></tr> <tr><td>100</td><td>48.317</td><td>48.310</td></tr> <tr><td>120</td><td>48.317</td><td>48.311</td></tr> <tr><td>200</td><td>48.314</td><td>48.310</td></tr> <tr><td>230</td><td>48.315</td><td>48.310</td></tr> <tr><td>264</td><td>48.315</td><td>48.310</td></tr> <tr><td>280</td><td>48.316</td><td>48.311</td></tr> <tr><td>--</td><td>-</td><td>-</td></tr> </tbody> </table>		Input Voltage [V]	Output Voltage [V]		Load 50%	Load 100%	85	48.316	48.309	90	48.316	48.309	100	48.317	48.310	120	48.317	48.311	200	48.314	48.310	230	48.315	48.310	264	48.315	48.310	280	48.316	48.311	--	-	-
Input Voltage [V]	Output Voltage [V]																																		
	Load 50%	Load 100%																																	
85	48.316	48.309																																	
90	48.316	48.309																																	
100	48.317	48.310																																	
120	48.317	48.311																																	
200	48.314	48.310																																	
230	48.315	48.310																																	
264	48.315	48.310																																	
280	48.316	48.311																																	
--	-	-																																	
<p>Note: Slanted line shows the range of the rated input voltage.</p>																																			

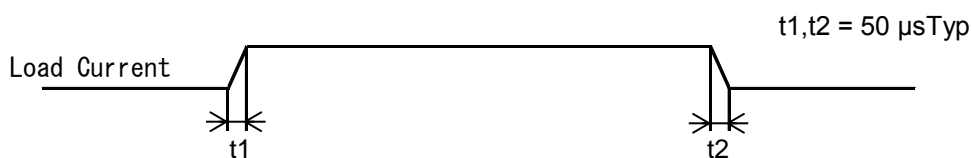


<b>COSEL</b>																																																						
Model	MODULE M	Temperature	25°C																																																			
Item	Load Regulation	Testing Circuitry	Figure A																																																			
Object	+48V0.65A																																																					
<p>1.Graph</p> <p>                     —△— Input Volt. 100V                      - - - □ - - - Input Volt. 200V                      - · - ○ - · - - Input Volt. 230V                 </p> <p>Output Voltage [V]</p> <p>Load Current [A]</p>		<p>2.Values</p> <table border="1"> <thead> <tr> <th rowspan="2">Load Current [A]</th> <th colspan="3">Output Voltage [V]</th> </tr> <tr> <th>Input Volt. 100[V]</th> <th>Input Volt. 200[V]</th> <th>Input Volt. 230[V]</th> </tr> </thead> <tbody> <tr><td>0.000</td><td>48.321</td><td>48.319</td><td>48.322</td></tr> <tr><td>0.100</td><td>48.317</td><td>48.316</td><td>48.318</td></tr> <tr><td>0.200</td><td>48.316</td><td>48.315</td><td>48.317</td></tr> <tr><td>0.300</td><td>48.314</td><td>48.312</td><td>48.314</td></tr> <tr><td>0.400</td><td>48.314</td><td>48.314</td><td>48.315</td></tr> <tr><td>0.500</td><td>48.312</td><td>48.312</td><td>48.313</td></tr> <tr><td>0.600</td><td>48.311</td><td>48.310</td><td>48.312</td></tr> <tr><td>0.650</td><td>48.310</td><td>48.310</td><td>48.310</td></tr> <tr><td>0.715</td><td>48.308</td><td>48.308</td><td>48.309</td></tr> <tr><td>--</td><td>-</td><td>-</td><td>-</td></tr> <tr><td>--</td><td>-</td><td>-</td><td>-</td></tr> </tbody> </table>		Load Current [A]	Output Voltage [V]			Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	0.000	48.321	48.319	48.322	0.100	48.317	48.316	48.318	0.200	48.316	48.315	48.317	0.300	48.314	48.312	48.314	0.400	48.314	48.314	48.315	0.500	48.312	48.312	48.313	0.600	48.311	48.310	48.312	0.650	48.310	48.310	48.310	0.715	48.308	48.308	48.309	--	-	-	-	--	-	-	-
Load Current [A]	Output Voltage [V]																																																					
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]																																																			
0.000	48.321	48.319	48.322																																																			
0.100	48.317	48.316	48.318																																																			
0.200	48.316	48.315	48.317																																																			
0.300	48.314	48.312	48.314																																																			
0.400	48.314	48.314	48.315																																																			
0.500	48.312	48.312	48.313																																																			
0.600	48.311	48.310	48.312																																																			
0.650	48.310	48.310	48.310																																																			
0.715	48.308	48.308	48.309																																																			
--	-	-	-																																																			
--	-	-	-																																																			
<p>Note: Slanted line shows the range of the rated load current.</p>																																																						



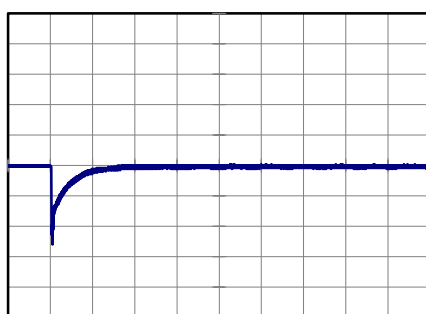
Model		MODULE M	Temperature 25°C Testing Circuitry Figure A
Item		Dynamic Load Response	
Object		+48V0.65A	

Input Volt. 100 V  
Cycle 1000 ms

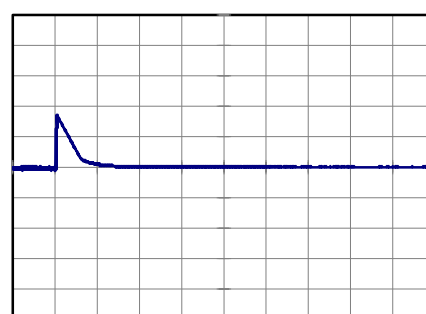


Min. Load (0A) ←→  
Load 100% (0.65A)

200 mV/div



10 ms/div



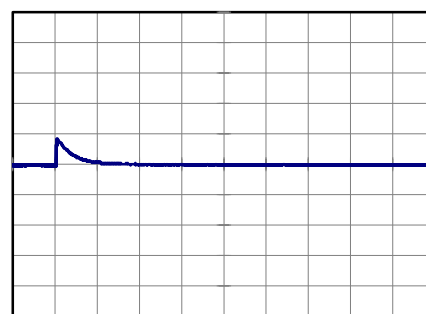
10 ms/div

Min. Load (0A) ←→  
Load 50% (0.325A)

200 mV/div



10 ms/div



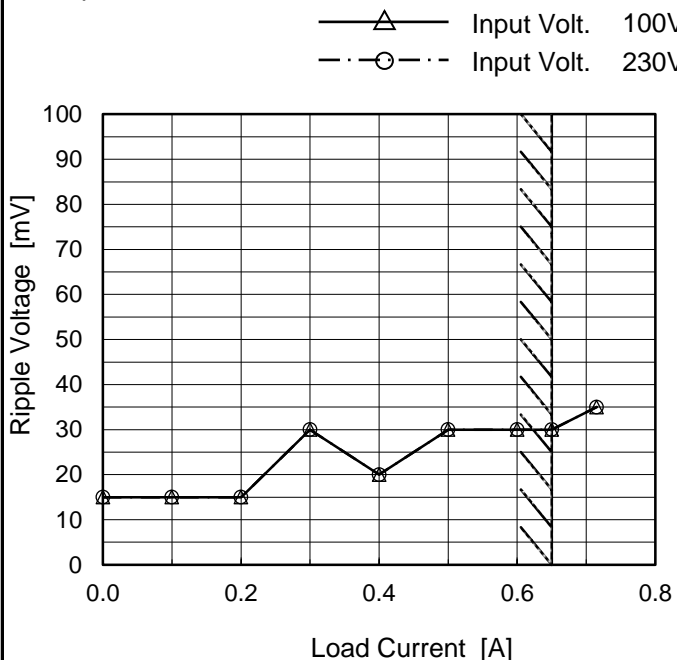
10 ms/div



Model	MODULE M
Item	Ripple Voltage (by Load Current)
Object	+48V0.65A

Temperature 25°C  
Testing Circuitry Figure B

1. Graph



2. Values

Load Current [A]	Ripple Voltage [mV]	
	Input Volt. 100 [V]	Input Volt. 230 [V]
0.000	15	15
0.100	15	15
0.200	15	15
0.300	30	30
0.400	20	20
0.500	30	30
0.600	30	30
0.650	30	30
0.715	35	35
--	-	-
--	-	-

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

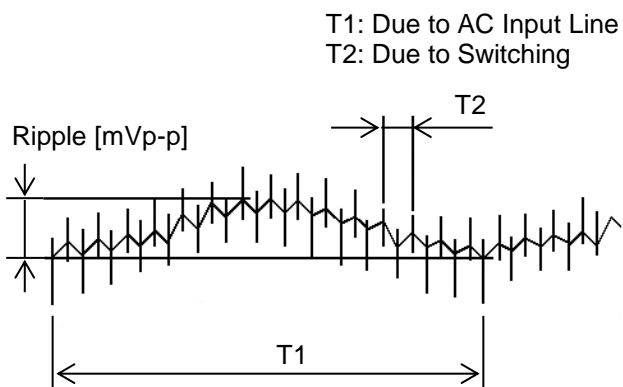


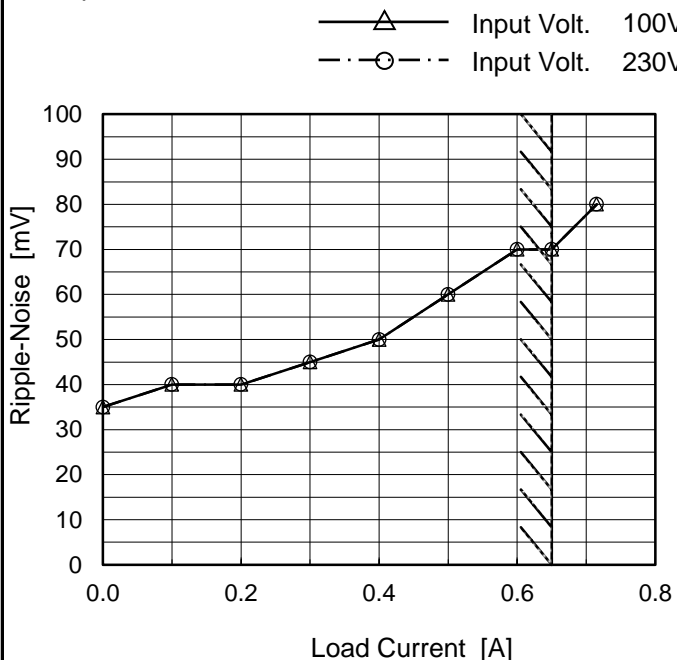
Fig. Complex Ripple Wave Form



Model	MODULE M
Item	Ripple-Noise
Object	+48V0.65A

Temperature 25°C  
Testing Circuitry Figure B

1.Graph



2.Values

Load Current [A]	Ripple-Noise [mV]	
	Input Volt. 100 [V]	Input Volt. 230 [V]
0.000	35	35
0.100	40	40
0.200	40	40
0.300	45	45
0.400	50	50
0.500	60	60
0.600	70	70
0.650	70	70
0.715	80	80
--	-	-
--	-	-

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.

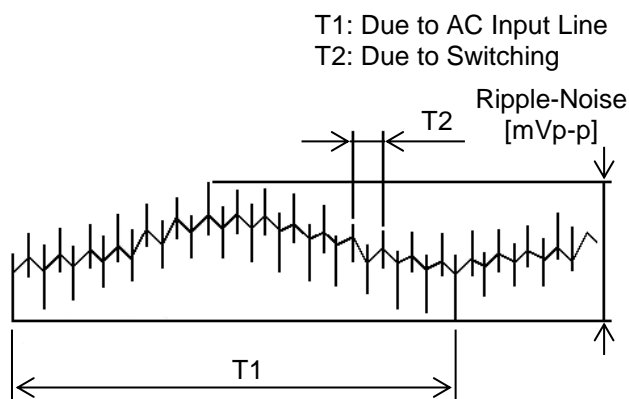


Fig. Complex Ripple Wave Form



<b>COSEL</b>																																											
Model	MODULE M																																										
Item	Ripple Voltage (by Ambient Temp.)	Testing Circuitry Figure B																																									
Object	+48V0.65A																																										
<p>1.Graph</p> <div style="text-align: right;"> <p>---□--- Input Volt. 100V</p> <p>—△— Input Volt. 230V</p> </div> <p style="text-align: center;">Ambient Temperature [°C] Load 100 %</p>		<p>2.Values</p> <table border="1"> <thead> <tr> <th rowspan="2">Ambient Temperature [°C]</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>-30</td><td>210</td><td>210</td></tr> <tr><td>-20</td><td>130</td><td>130</td></tr> <tr><td>0</td><td>65</td><td>65</td></tr> <tr><td>25</td><td>35</td><td>35</td></tr> <tr><td>50</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> <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>	Ambient Temperature [°C]	Ripple Voltage [mV]		Input Volt. 100 [V]	Input Volt. 230 [V]	-30	210	210	-20	130	130	0	65	65	25	35	35	50	25	25	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-
Ambient Temperature [°C]	Ripple Voltage [mV]																																										
	Input Volt. 100 [V]	Input Volt. 230 [V]																																									
-30	210	210																																									
-20	130	130																																									
0	65	65																																									
25	35	35																																									
50	25	25																																									
--	-	-																																									
--	-	-																																									
--	-	-																																									
--	-	-																																									
--	-	-																																									
--	-	-																																									
--	-	-																																									
<p>Measured by 20 MHz Oscilloscope. Note: Slanted line shows the range of the rated ambient temperature.</p>																																											





<b>COSEL</b>																																																						
Model	MODULE M																																																					
Item	Ambient Temperature Drift	Testing Circuitry Figure A																																																				
Object	+48V0.65A																																																					
<p>1.Graph</p> <p>                     —△— Input Volt. 100V                      - - - □ - - - Input Volt. 200V                      ···○··· Input Volt. 230V                 </p> <p style="text-align: center;">Ambient Temperature [°C] Load 100%</p>		<p>2.Values</p> <table border="1"> <thead> <tr> <th rowspan="2">Ambient Temperature [°C]</th> <th colspan="3">Output Voltage [V]</th> </tr> <tr> <th>Input Volt. 100[V]</th> <th>Input Volt. 200[V]</th> <th>Input Volt. 230[V]</th> </tr> </thead> <tbody> <tr><td>-30</td><td>48.070</td><td>48.072</td><td>48.075</td></tr> <tr><td>-20</td><td>48.121</td><td>48.124</td><td>48.127</td></tr> <tr><td>-10</td><td>48.179</td><td>48.180</td><td>48.182</td></tr> <tr><td>0</td><td>48.226</td><td>48.227</td><td>48.230</td></tr> <tr><td>10</td><td>48.263</td><td>48.264</td><td>48.265</td></tr> <tr><td>25</td><td>48.310</td><td>48.310</td><td>48.310</td></tr> <tr><td>30</td><td>48.327</td><td>48.327</td><td>48.328</td></tr> <tr><td>40</td><td>48.347</td><td>48.347</td><td>48.348</td></tr> <tr><td>50</td><td>48.361</td><td>48.361</td><td>48.361</td></tr> <tr><td>60</td><td>48.393</td><td>48.393</td><td>48.392</td></tr> <tr><td>--</td><td>-</td><td>-</td><td>-</td></tr> </tbody> </table>		Ambient Temperature [°C]	Output Voltage [V]			Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	-30	48.070	48.072	48.075	-20	48.121	48.124	48.127	-10	48.179	48.180	48.182	0	48.226	48.227	48.230	10	48.263	48.264	48.265	25	48.310	48.310	48.310	30	48.327	48.327	48.328	40	48.347	48.347	48.348	50	48.361	48.361	48.361	60	48.393	48.393	48.392	--	-	-	-
Ambient Temperature [°C]	Output Voltage [V]																																																					
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]																																																			
-30	48.070	48.072	48.075																																																			
-20	48.121	48.124	48.127																																																			
-10	48.179	48.180	48.182																																																			
0	48.226	48.227	48.230																																																			
10	48.263	48.264	48.265																																																			
25	48.310	48.310	48.310																																																			
30	48.327	48.327	48.328																																																			
40	48.347	48.347	48.348																																																			
50	48.361	48.361	48.361																																																			
60	48.393	48.393	48.392																																																			
--	-	-	-																																																			
<p>Note: Slanted line shows the range of the rated ambient temperature.</p>																																																						



<b>COSEL</b>		Testing Circuitry Figure A
Model	MODULE M	
Item	Output Voltage Accuracy	
Object	+48V0.65A	

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 - 50°C

Input Voltage : 85 - 264V

Load Current : 0 - 0.65A

\* 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

Item	Temperature [°C]	Input Voltage[V]	Output		Output Voltage Accuracy	
			Current[A]	Voltage[V]	Value [mV]	Ratio [%]
Maximum Voltage	50	230	0	48.345	±134	±0.3
Minimum Voltage	-20	85	0.65	48.077		



<b>COSEL</b>																								
Model	MODULE M																							
Item	Time Lapse Drift	Temperature 25°C Testing Circuitry Figure A																						
Object	+48V0.65A																							
<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>48.267</td></tr> <tr><td>0.5</td><td>48.311</td></tr> <tr><td>1.0</td><td>48.312</td></tr> <tr><td>2.0</td><td>48.312</td></tr> <tr><td>3.0</td><td>48.314</td></tr> <tr><td>4.0</td><td>48.315</td></tr> <tr><td>5.0</td><td>48.315</td></tr> <tr><td>6.0</td><td>48.315</td></tr> <tr><td>7.0</td><td>48.315</td></tr> <tr><td>8.0</td><td>48.315</td></tr> </tbody> </table>	Time since start [H]	Output Voltage [V]	0.0	48.267	0.5	48.311	1.0	48.312	2.0	48.312	3.0	48.314	4.0	48.315	5.0	48.315	6.0	48.315	7.0	48.315	8.0	48.315
Time since start [H]	Output Voltage [V]																							
0.0	48.267																							
0.5	48.311																							
1.0	48.312																							
2.0	48.312																							
3.0	48.314																							
4.0	48.315																							
5.0	48.315																							
6.0	48.315																							
7.0	48.315																							
8.0	48.315																							
<p>* The characteristic of AC230V is equal.</p>																								



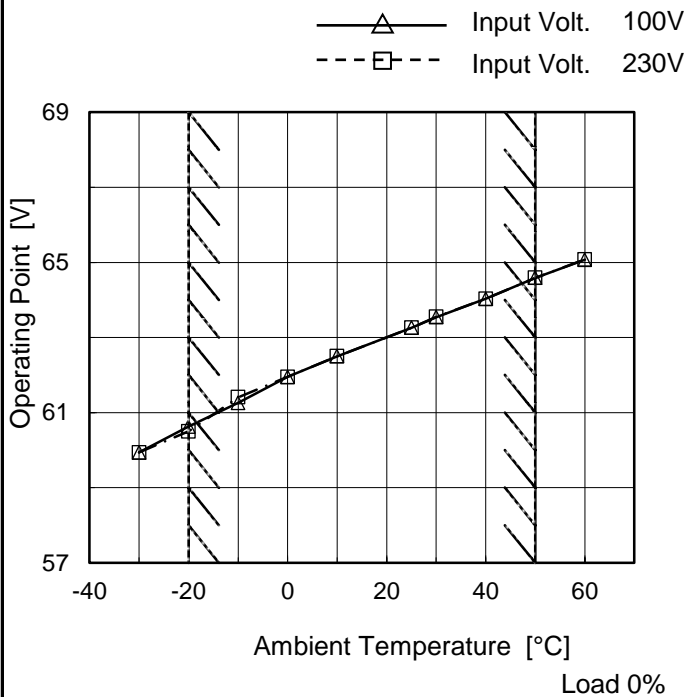
<b>COSEL</b>																																																														
Model	MODULE M	Temperature	25°C																																																											
Item	Overcurrent Protection	Testing Circuitry	Figure A																																																											
Object	+48V0.65A																																																													
<p>1.Graph</p> <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> <p>—△ Input Volt. 100V</p> <p>—□ Input Volt. 200V</p> <p>—○ Input Volt. 230V</p> </div> </div> <p style="text-align: center;">Load Current [A]</p> <p>Note: Slanted line shows the range of the rated load current.</p> <p>Intermittent operation occurs when overcurrent protection is activated.</p>		<p>2.Values</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th rowspan="2">Output Voltage [V]</th> <th colspan="3">Load Current [A]</th> </tr> <tr> <th>Input Volt. 100[V]</th> <th>Input Volt. 200[V]</th> <th>Input Volt. 230[V]</th> </tr> </thead> <tbody> <tr> <td>48</td> <td>0.78</td> <td>0.78</td> <td>0.78</td> </tr> <tr> <td>--</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>--</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>--</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>--</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>--</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>--</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>--</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>--</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>--</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>--</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>--</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>--</td> <td>-</td> <td>-</td> <td>-</td> </tr> </tbody> </table>		Output Voltage [V]	Load Current [A]			Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	48	0.78	0.78	0.78	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-
Output Voltage [V]	Load Current [A]																																																													
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]																																																											
48	0.78	0.78	0.78																																																											
--	-	-	-																																																											
--	-	-	-																																																											
--	-	-	-																																																											
--	-	-	-																																																											
--	-	-	-																																																											
--	-	-	-																																																											
--	-	-	-																																																											
--	-	-	-																																																											
--	-	-	-																																																											
--	-	-	-																																																											
--	-	-	-																																																											
--	-	-	-																																																											



Model	MODULE M
Item	Oversvoltage Protection
Object	+48V0.65A

Testing Circuitry Figure A

1.Graph



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

2.Values

Ambient Temperature [°C]	Operating Point [V]	
	Input Volt. 100[V]	Input Volt. 230[V]
-30	59.94	59.94
-20	60.63	60.50
-10	61.26	61.41
0	61.95	61.95
10	62.50	62.50
25	63.26	63.26
30	63.54	63.55
40	64.03	64.03
50	64.59	64.59
60	65.07	65.08
--	-	-

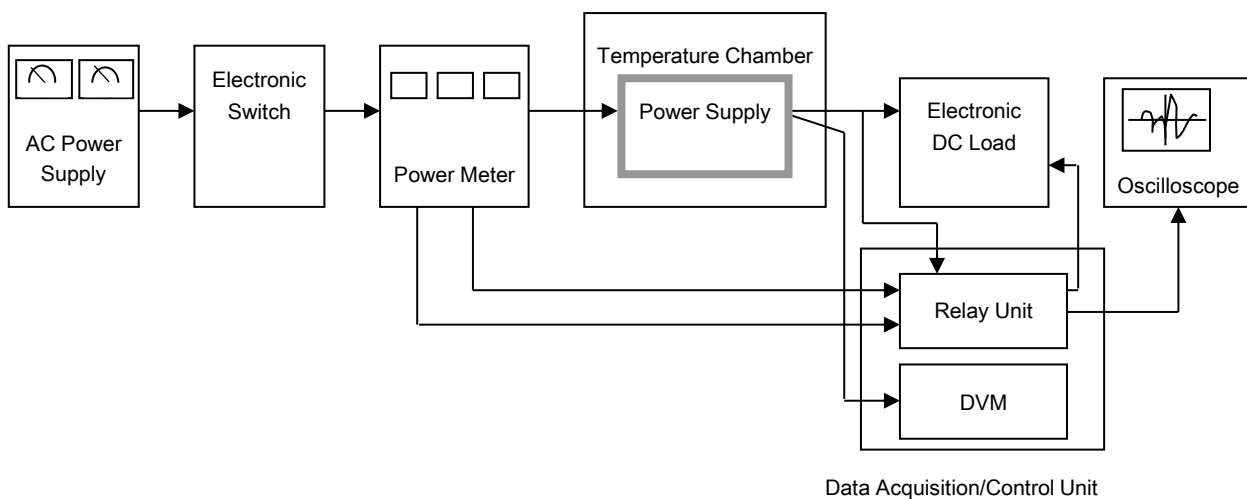
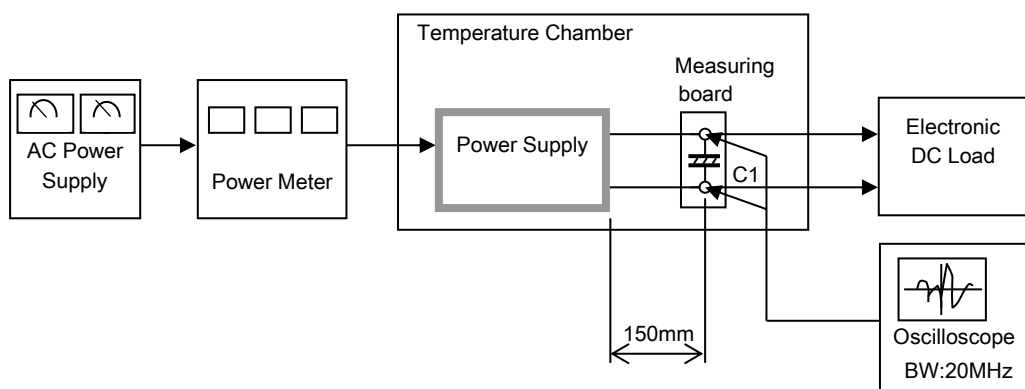


Figure A



C1= 22  $\mu$ F  
(Electrolytic capacitor)

Figure B