

## - Output voltage adjustment -

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## 1. Introduction

The output voltage in PBA / ACE series can be adjusted from 0Vdc approximately by adding external circuit. The main feature of each series is shown below.

- \*PBA series is suitable for general application which requires voltage swing.
- \*ACE series is suitable for the application which requires voltage swing and multi output.
- \*ACE series -H option is for medical application.

Next, the basic method changing the output voltage in each series is shown below.

### ■PBA300F ~ 1500F, 1500T series

PBA300F ~ 1500F and 1500T series have TRM terminal to control the output voltage.

When the voltage of the terminal TRM is 2.5Vdc, the output voltage becomes the rated output.

voltage. By applying voltage to this TRM terminal, the output voltage can be adjusted from 0Vdc approximately.

The output voltage can be calculated in this case from equation below.

$$\text{Output voltage} = \frac{\text{The voltage between TRM and -S [V]}}{2.5 \text{ [V]}} \times \text{rated output voltage}$$

Please note that power supply might stop its operation or PG alarm will output, if the output voltage reaches less than 10% of rated voltage.

Output voltage adjustment range:  
 Minimum: 10% of rated output voltage  
 Maximum: See Table1-1

Table1-1 Output voltage adjustment range

No.	Rated output voltage [V]	Adjustment range [V]		
		Min.	-	Max.
1	3.3	0.33	-	3.96
2	5	0.50	-	6.00
3	7.5	0.75	-	8.25
4	12	1.20	-	13.20
5	15	1.50	-	16.50
6	24	2.40	-	26.40
7	36	3.60	-	39.60
8	48	4.80	-	56.00

■ACE series

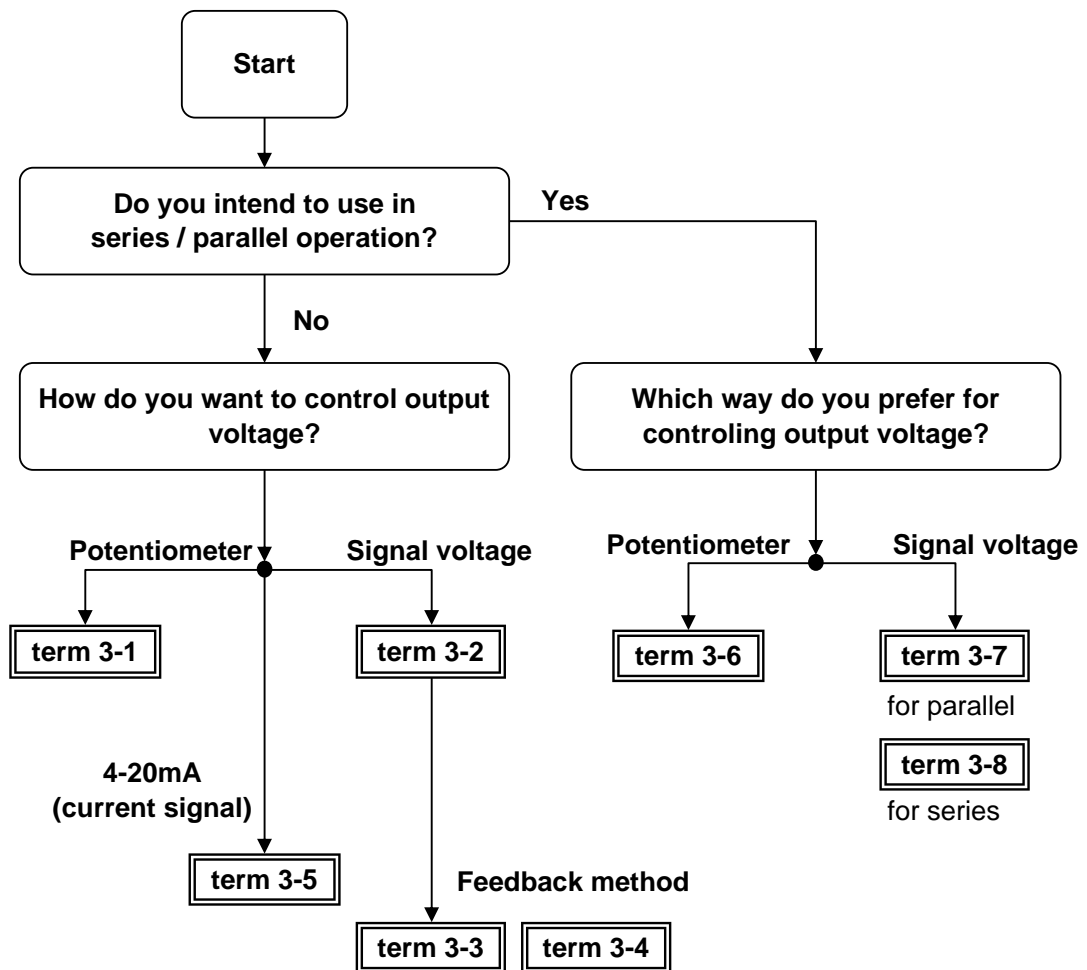
[available for module code:A-K,2A-2K]

ACE series don't have the terminal to control output voltage like TRM terminal. Therefore, in ACE series, the monitoring and the remote sensing terminals (-M and -S) is used to change the output voltage.

When the voltage between the terminal -S and -M(-V) is 0V, the output voltage becomes the rated voltage. And, in case that the rated voltage is applied to this terminals, the output voltage can be adjusted to 0Vdc approximately.

## 2. External Circuit Selection Flow Chart

■PBA series [available for PBA300F ~ 1500F and 1500T series]



■ACE series [available for module code:A-K,2A-2K]

Refer to term 4.

### 3. PBA300F ~ 1500F and 1500T series

#### 3-1. Output Voltage Adjustment by External Potentiometer

##### ■ Circuit

In PBA300F ~ 1500F and 1500T, example circuit for output voltage adjustment by external potentiometer is shown below.

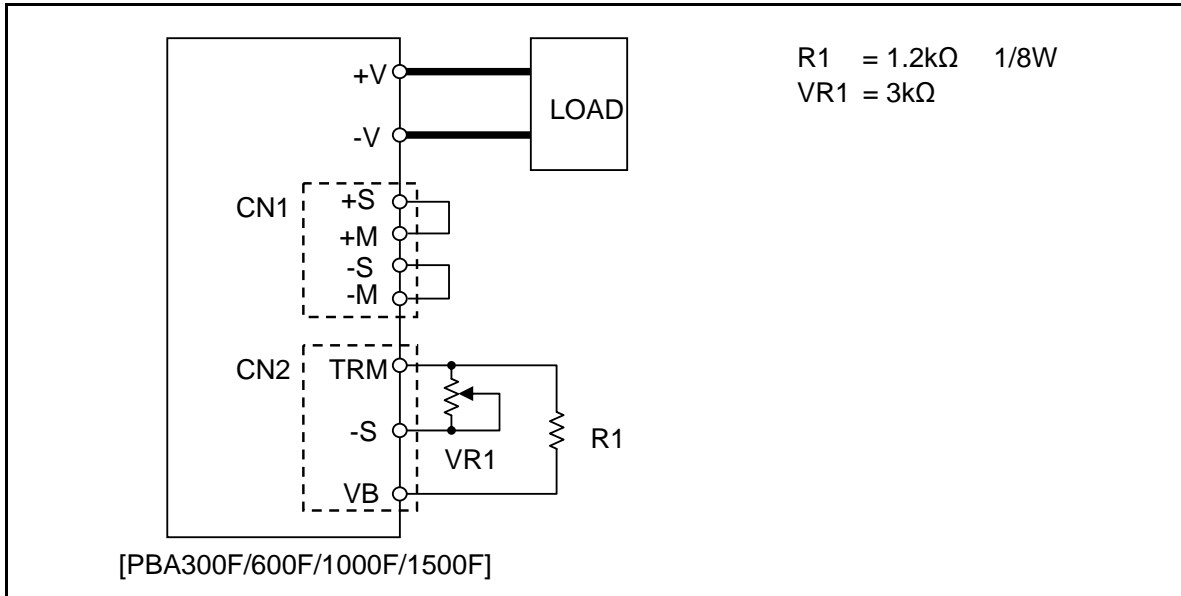


Fig.3-1-1 Adjustment by external potentiometer

##### ■ Explanation of Operation

VB provides stable 5Vdc. If it is divided by resistor (R1) and potentiometer (VR1), and applied to TRM, the output voltage can be adjusted.

Please note that if the external circuit is removed, the voltage higher than rated voltage might be generated, and it would cause the unit shut-down by overvoltage protection circuit.

##### ■ Note

Output voltage adjustment range:  
 Minimum: 10% of rated output voltage  
 Maximum: See Table1-1

Potentiometer (VR1) : 3k $\Omega$   
 Cermet type, coefficient less than  $\pm 300ppm/^{\circ}C$   
 Resistor (R1) : 1.2k $\Omega$ , 1/8W or more  
 Metal film type, coefficient less than  $\pm 100ppm/^{\circ}C$

Please note that internal potentiometer should not be adjusted because there is possibility the intended voltage could not be set up correctly.

CN1, CN2 are connected each other internally. Therefore, it is also possible to connect external circuit on CN1.

##### ■ Characteristic

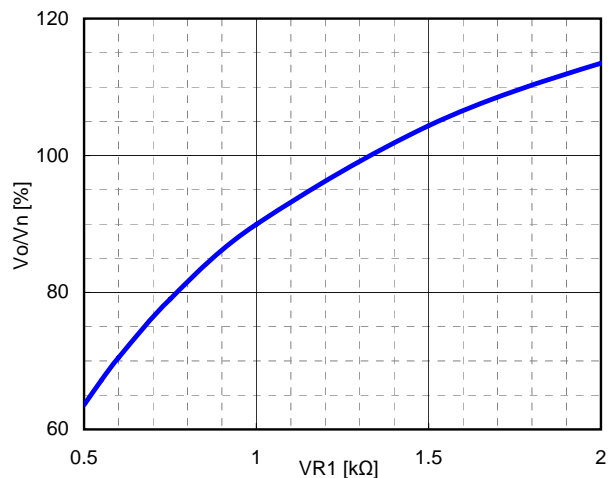


Fig.3-1-2 VR1 - Vo/Vn

\*Vn : Rated output voltage

\*Vo : Adjusted output voltage

## 3-2. Output Voltage Adjustment by Signal Voltage

### ■ Circuit

In PBA300F ~ 1500F and 1500T, example circuit for output voltage adjustment by signal voltage is shown below.

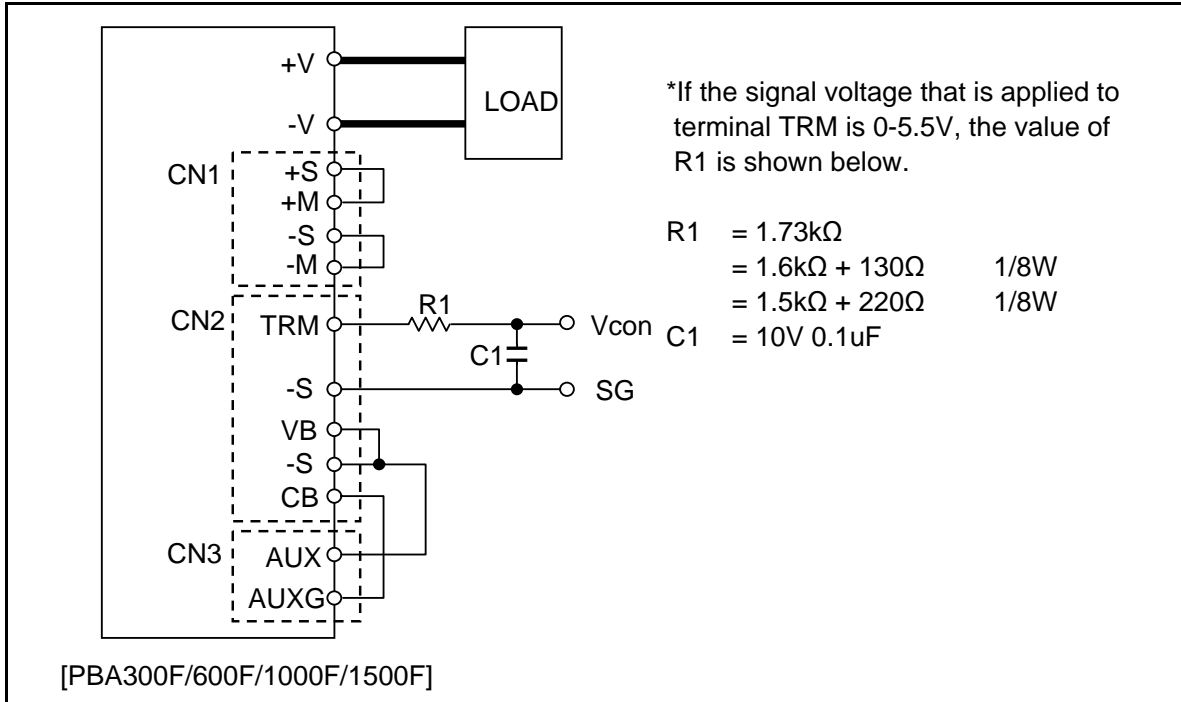


Fig.3-2-1 Adjustment by Signal Voltage

### ■ Explanation of Operation

The output voltage in PBA series can be adjusted from 0Vdc approximately by adding external resistor. By changing value of this external resistor, the output voltage could be adjusted by any signal voltage. And, the relationship between the external resistor and the signal voltage is shown in Fig.3-2-2.

For example, when the signal voltage is 5V, 1.73kΩ is required as external resistor. In this case, characteristic of "Vcon-Vout" is shown in Fig.3-2-3.

### ■ Note

Output voltage adjustment range:

\*Minimum: 10% of rated output voltage

\*Maximum: \*See Table1

CN1, CN2 are connected each other internally. Therefore, it is also possible to connect external circuit on CN1.

If signal voltage is less than 2.5V, the output voltage becomes less than the rated output voltage even if external resistor uses 0Ω.

### ■ Characteristic

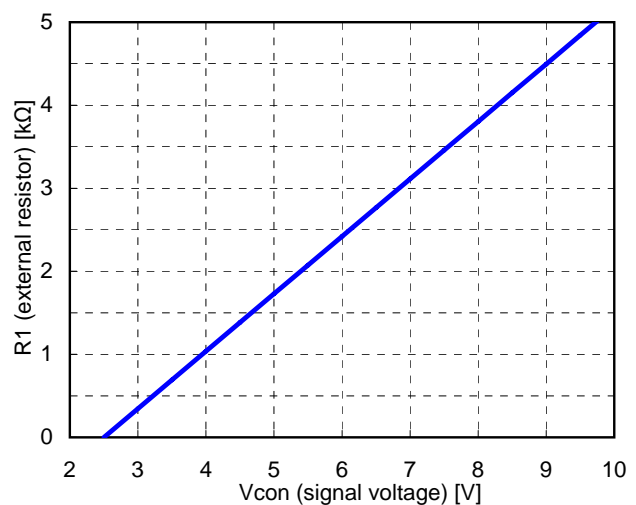


Fig.3-2-2 Vcon - R1

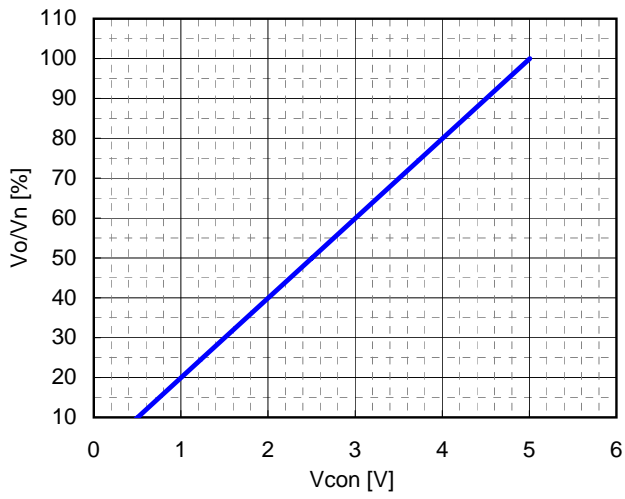


Fig.3-2-3 Vcon - Vo/Vn

\*Vn : Rated output voltage

\*Vo : Adjusted output voltage

### 3-3. Output Voltage Adjustment by Signal Voltage with Feedback

#### ■ Circuit

In PBA300F ~ 1500F and 1500T, example circuit for output voltage adjustment by signal voltage with feedback is shown below.

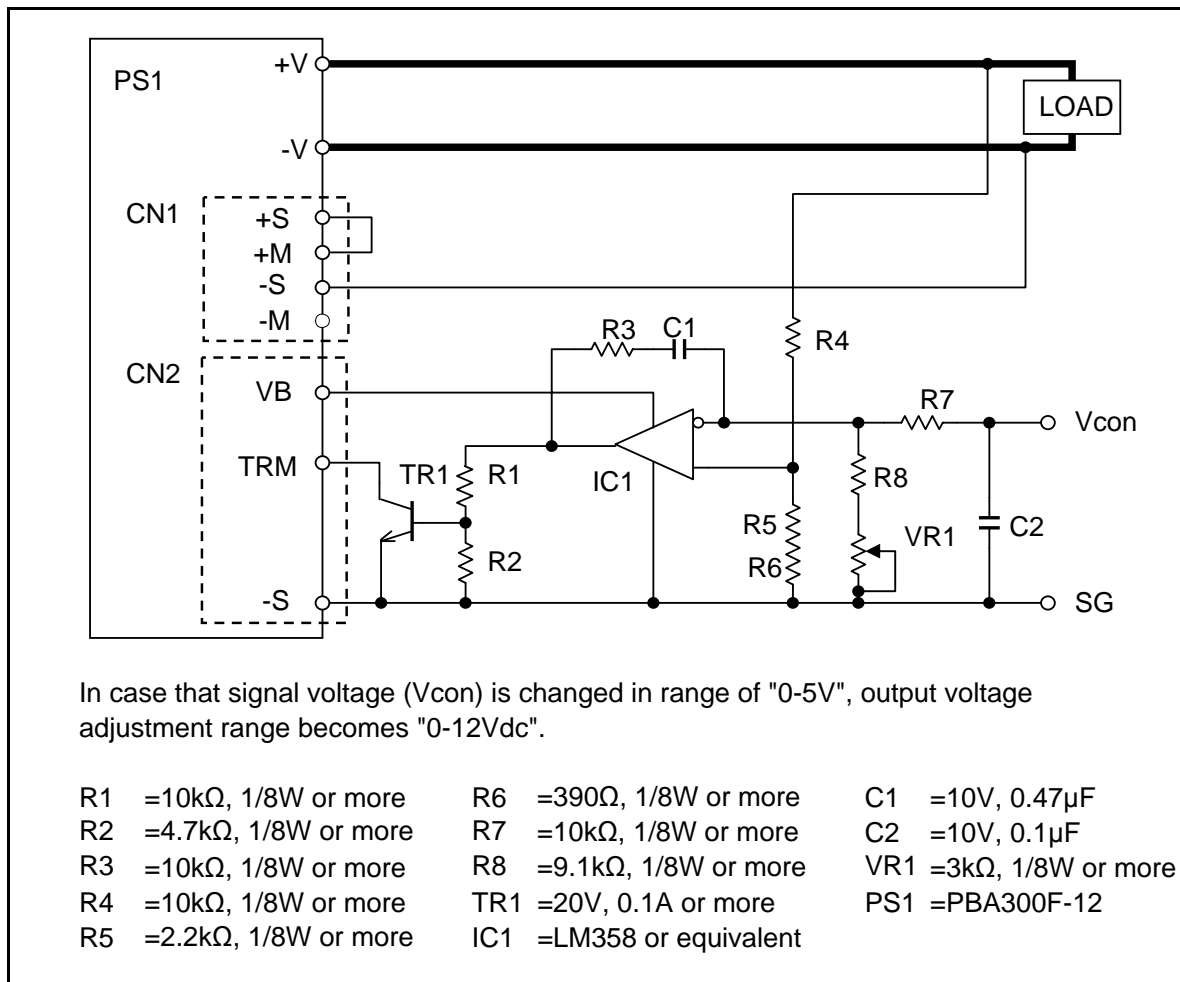


Fig.3-3-1 Adjustment by signal voltage with feedback

#### ■ Explanation of Operation

The output voltage can be adjusted by the voltage of Vcon.

In this circuit, the feedback control is used to keep the output voltage constant. Therefore, the output voltage could be high accuracy by the feedback control.

#### ■ Note

Please note that internal potentiometer should not be adjusted because there is possibility the intended voltage could not be set up correctly.

CN1, CN2 are connected each other internally. Therefore, it is also possible to connect external circuit on CN1.

Please note that if CN1 or CN2 is removed, the voltage higher than rated voltage might be generated, and it would cause the unit shut-down by over voltage protection circuit.

If the output voltage becomes unstable when the power supply is set in your system, please try to change value of R3 or C1 bigger.

### ■ Characteristic

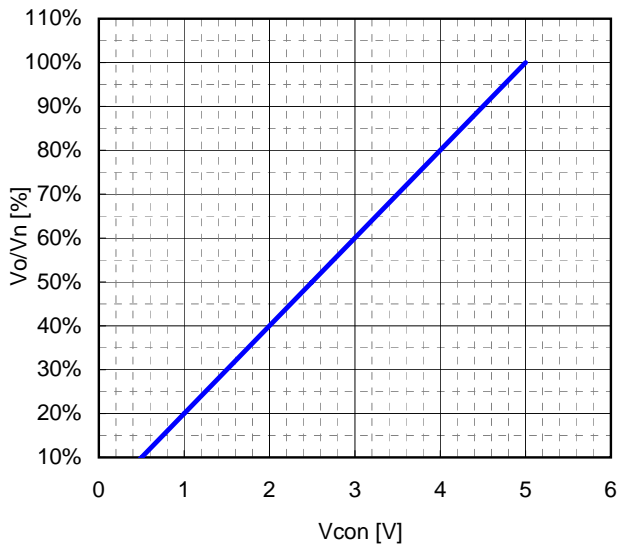


Fig.3-3-2 Vcon - Vo/Vn

\*Vn : Rated output voltage

\*Vo : Adjusted output voltage

### 3-4. Output Voltage Adjustment by Signal Voltage

#### with Indirect Feedback

##### ■ Circuit

In PBA300F ~ 1500F and 1500T, example circuit for output voltage adjustment by signal voltage with feedback is shown below.

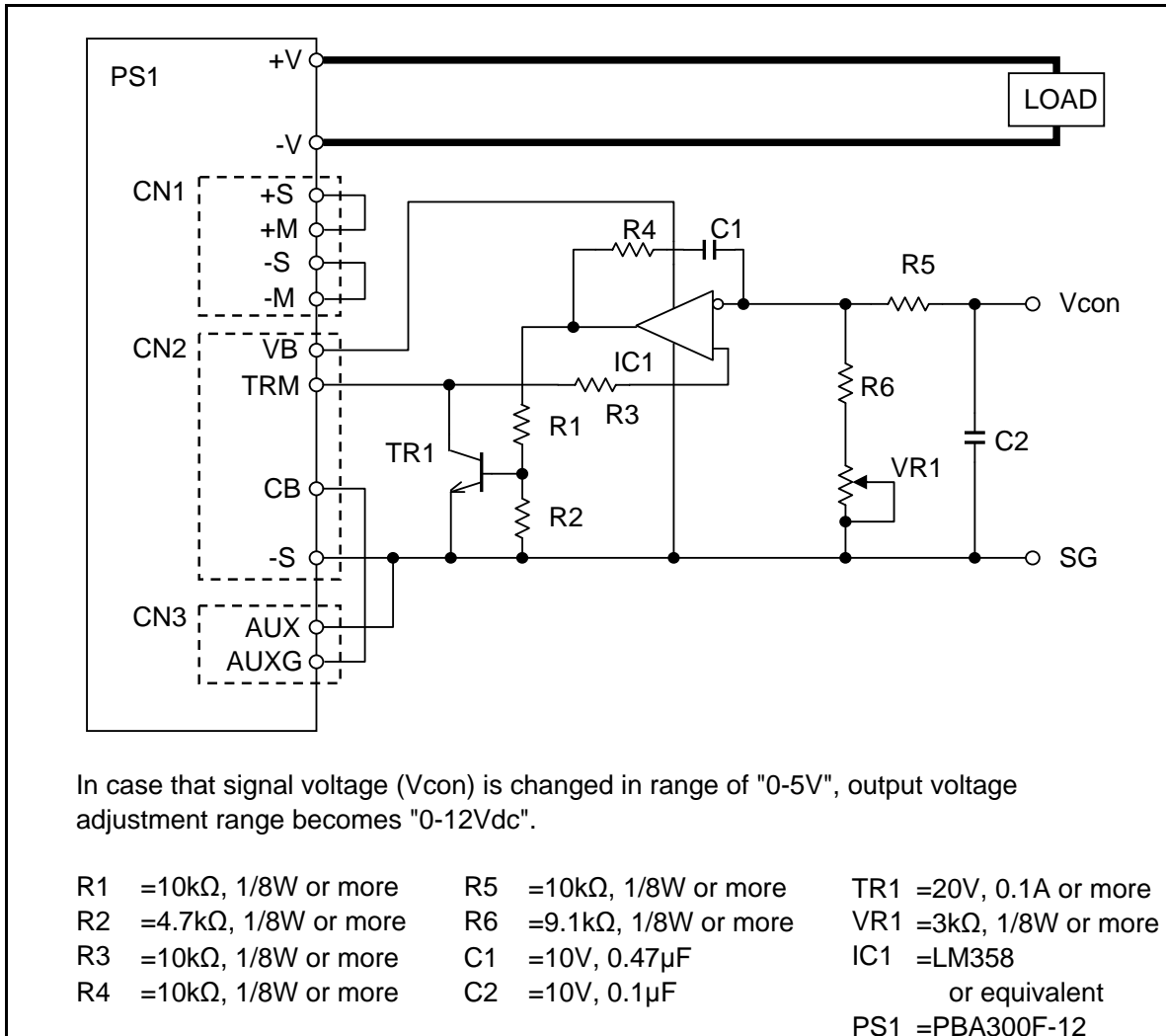


Fig.3-4-1 Adjustment by signal voltage with feedback

##### ■ Explanation of Operation

The output voltage can be adjusted by the voltage of Vcon.

In this circuit, IC1 compare TRM and Vcon voltage to keep the output voltage constant. TRM voltage is proportional to output voltage. Therefore, the output voltage can be controlled and more stable than the circuit shown in Fig.3-3-1.

##### ■ Note

If internal potentiometer is adjusted, the adjusted output voltage should be considered as Vn (rated output voltage).

CN1, CN2 are connected each other internally. Therefore, it is also possible to connect external circuit on CN1.

Please note that if CN1 or CN2 is removed, the voltage higher than rated voltage might be generated, and it would cause the unit shut-down by over voltage protection circuit.

If the output voltage becomes unstable when the power supply is set in your system, please try to change value of R4 or C1 bigger.



### ■ Characteristic

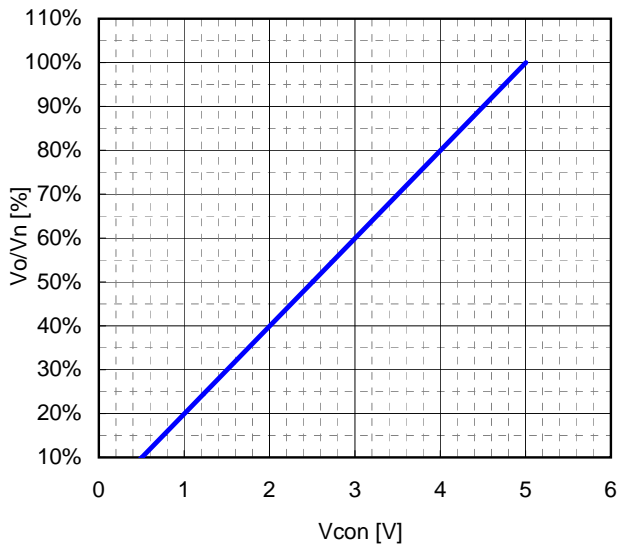


Fig.3-4-2 Vcon - Vo/Vn

\*Vn : Rated output voltage

\*Vo : Adjusted output voltage

### 3-5. Output Voltage Adjustment by 4 - 20 mA Current Signal

#### ■ Circuit

In PBA300F ~ 1500F and 1500T, example circuit for output voltage adjustment by 4 - 20 mA current signal is shown below.

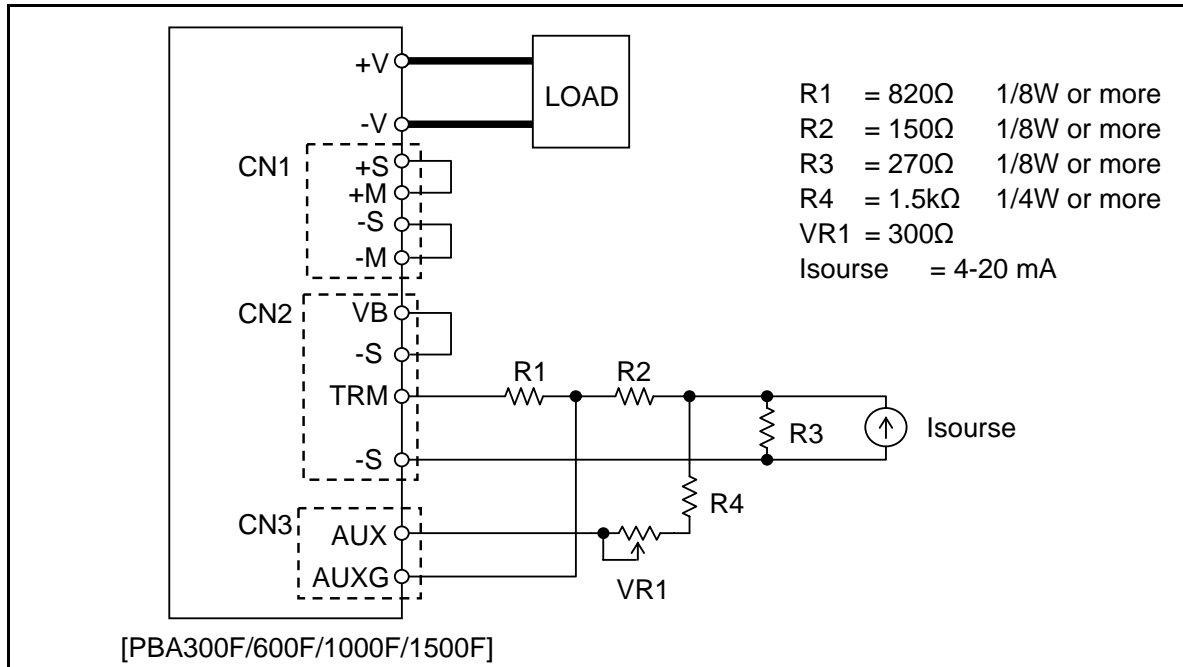


Fig.3-5-1 Adjustment by 4 -20 mA current signal

#### ■ Explanation of Operation

The output voltage can be adjusted by 4 - 20mA current signal. When the current signal of the Isource is 4mA, the output voltage becomes the 0V approximately. Also, the current is 20mA, the output voltage becomes the rated output voltage.

The terminal AUX always applies the constant voltage of about 12Vdc. This 12Vdc is needed to use output voltage adjustment in 4-20mA.

#### ■ Note

Output voltage adjustment range:

\*Minimum: 10% of rated output voltage

\*Maximum: \*See Table1

Please adjust the external potentiometer so the output voltage is set to the rated voltage when signal current is about 20mA.

Please note that internal potentiometer should not be adjusted because there is possibility the intended voltage could not be set up correctly.

CN1, CN2 are connected each other internally. Therefore, it is also possible to connect external circuit on CN1.

Please note that if the external circuit is removed, the voltage higher than rated voltage might be generated, and it would cause the unit shut-down by overvoltage protection circuit.

### ■ Characteristic

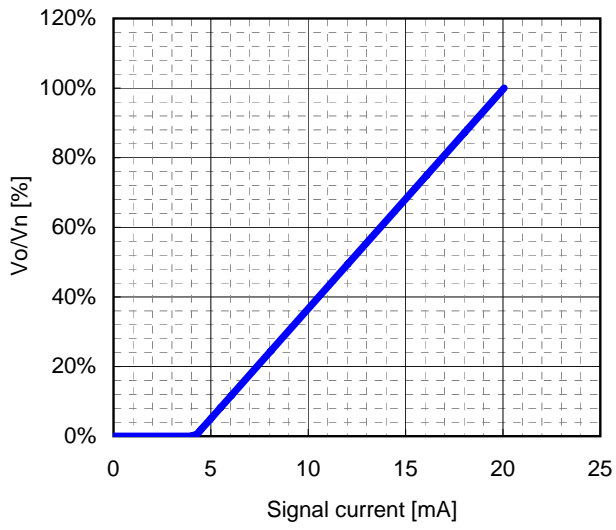


Fig.3-5-2 Signal current - Vo/Vn

\*Vn : Rated output voltage

\*Vo : Adjusted output voltage

### 3-6. Output Voltage Adjustment by External Potentiometer in Parallel Operation

#### ■ Circuit

In PBA300F ~ 1500F and 1500T, example circuit for for output voltage adjustment by external potentiometer is shown below.

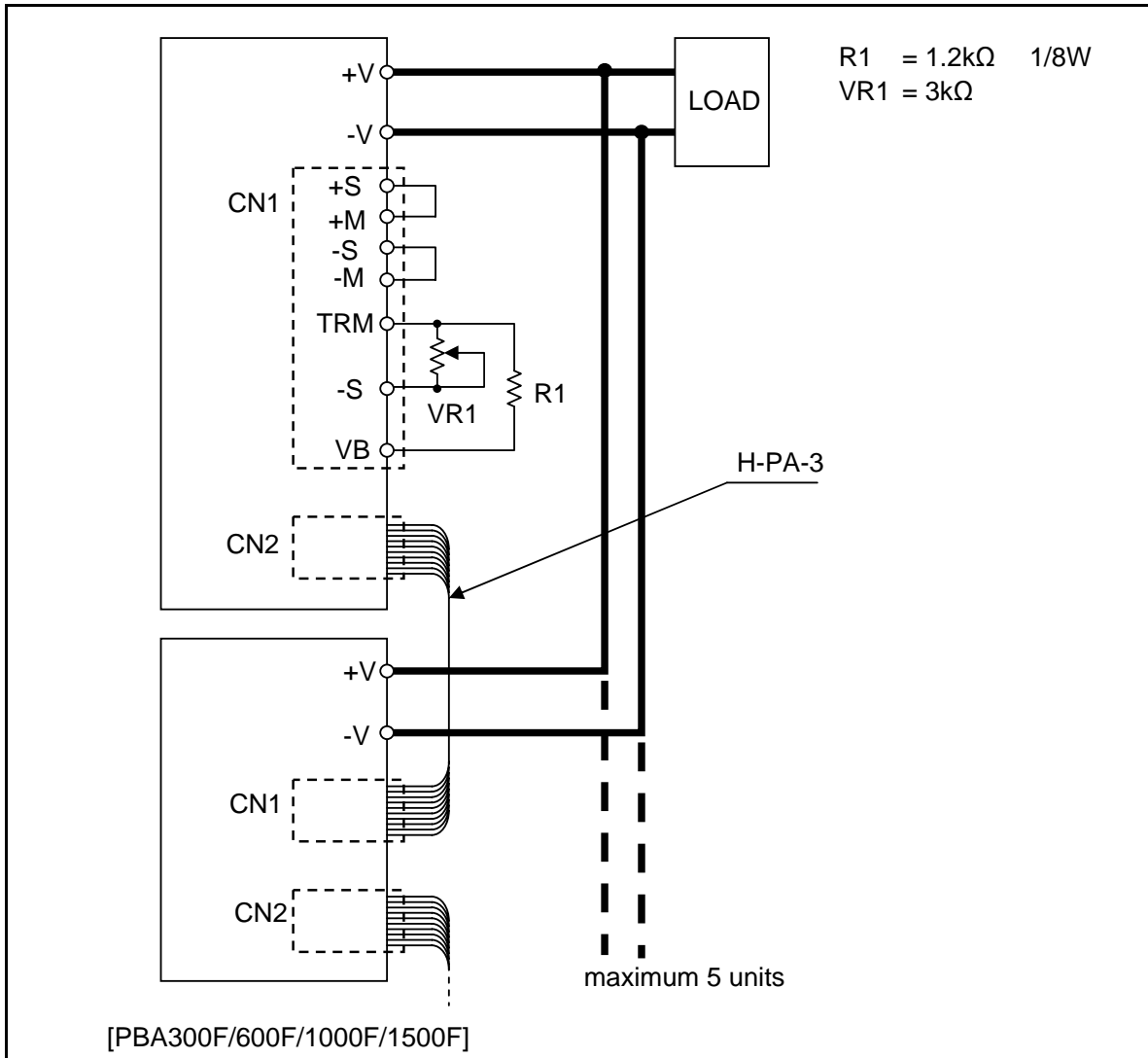


Fig.3-6-1 Adjustment by external potentiometer

#### ■ Explanation of Operation

VB provides stable 5Vdc. If it is divided by resistor (R1) and potentiometer (VR1), and applied to TRM, the output voltage can be adjusted.

#### ■ Note

Please parallelly connect  $\pm S$ , VB and CB of each power supplies in parallel operation. In this case, an optional harness (H-PA-3) can be used to connect each terminals.

Output voltage adjustment range:

\*Minimum: 10% of rated output voltage

\*Maximum: \*See Table1

Potentiometer (VR1) : 3k $\Omega$

Cermet type, coefficient less than  $\pm 300\text{ppm}/^\circ\text{C}$

Resistor (R1) : 1.2k $\Omega$ , 1/8W or more

Metal film type, coefficient less than  $\pm 100\text{ppm}/^\circ\text{C}$

Please note that internal potentiometer should not be adjusted because there is possibility the intended voltage could not be set up correctly.

Please note that if the external circuit is removed, the voltage higher than rated voltage might be generated, and it would cause the unit shut-down by overvoltage protection circuit.

### ■ Characteristic

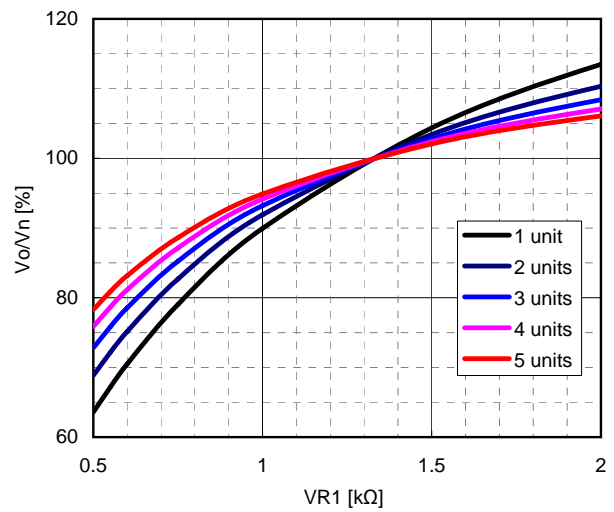


Fig.3-6-2 Vo/Vn - VR1

\*Vn : Rated output voltage

\*Vo : Adjusted output voltage

### 3-7. Output Voltage Adjustment by Signal Voltage with Feedback in Parallel Operation

#### ■ Circuit

In PBA300F ~ 1500F and 1500T, example circuit for output voltage adjustment by signal voltage with feedback is shown below.

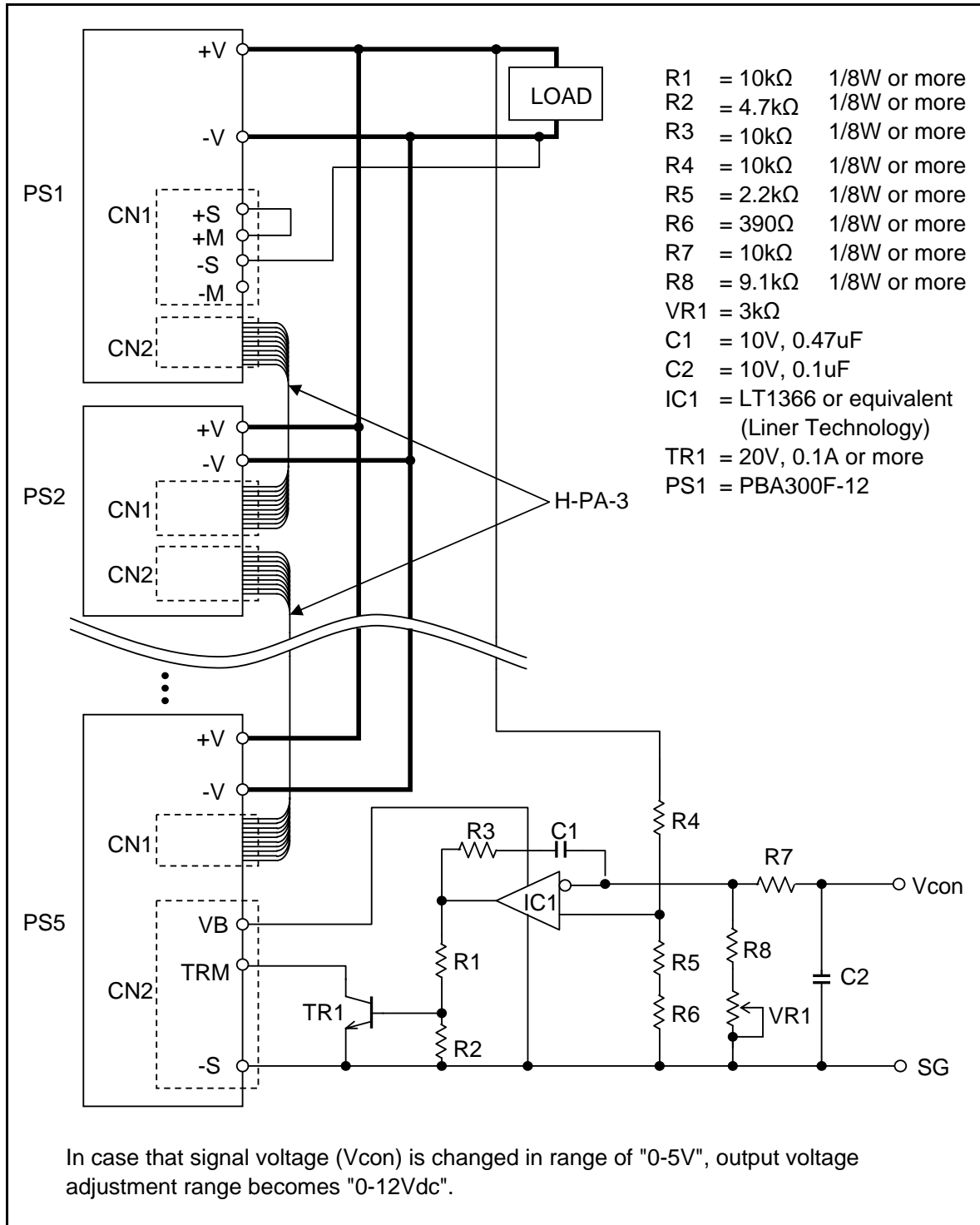


Fig.3-7-1 Adjustment by Signal Voltage with Feedback

### ■ Explanation of Operation

The output voltage can be adjusted by the voltage of  $V_{con}$ . In this circuit, the feedback control is used to keep the output voltage constant. Therefore, the output voltage could be high accuracy by the feedback control.

### ■ Note

Output voltage adjustment range:

\*Minimum: 10% of rated output voltage

\*Maximum: \*See Table1

Please note that internal potentiometer should not be adjusted because there is possibility the intended voltage could not be set up correctly.

Please note that if the external circuit is removed, the voltage higher than rated voltage might be generated, and it would cause the unit shut-down by overvoltage protection circuit.

If the output voltage becomes unstable when the power supply is set in your system, please try to change value of  $R_3$  or  $C_1$  bigger.

### ■ Characteristic

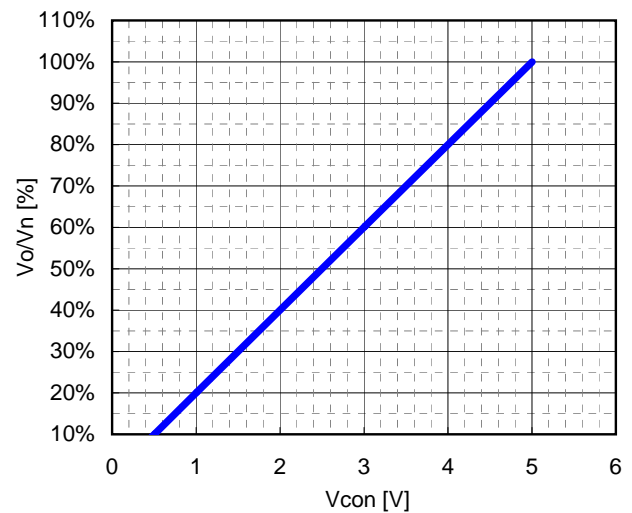


Fig.3-7-2  $V_{con}$  -  $V_o/V_n$

\* $V_n$  : Rated output voltage

\* $V_o$  : Adjusted output voltage

### 3-8. Output Voltage Adjustment by Signal Voltage with Indirect Feedback in Series Operation

#### ■ Circuit

In PBA300F ~ 1500F and 1500T, example circuit for output voltage adjustment in series operation is shown below.

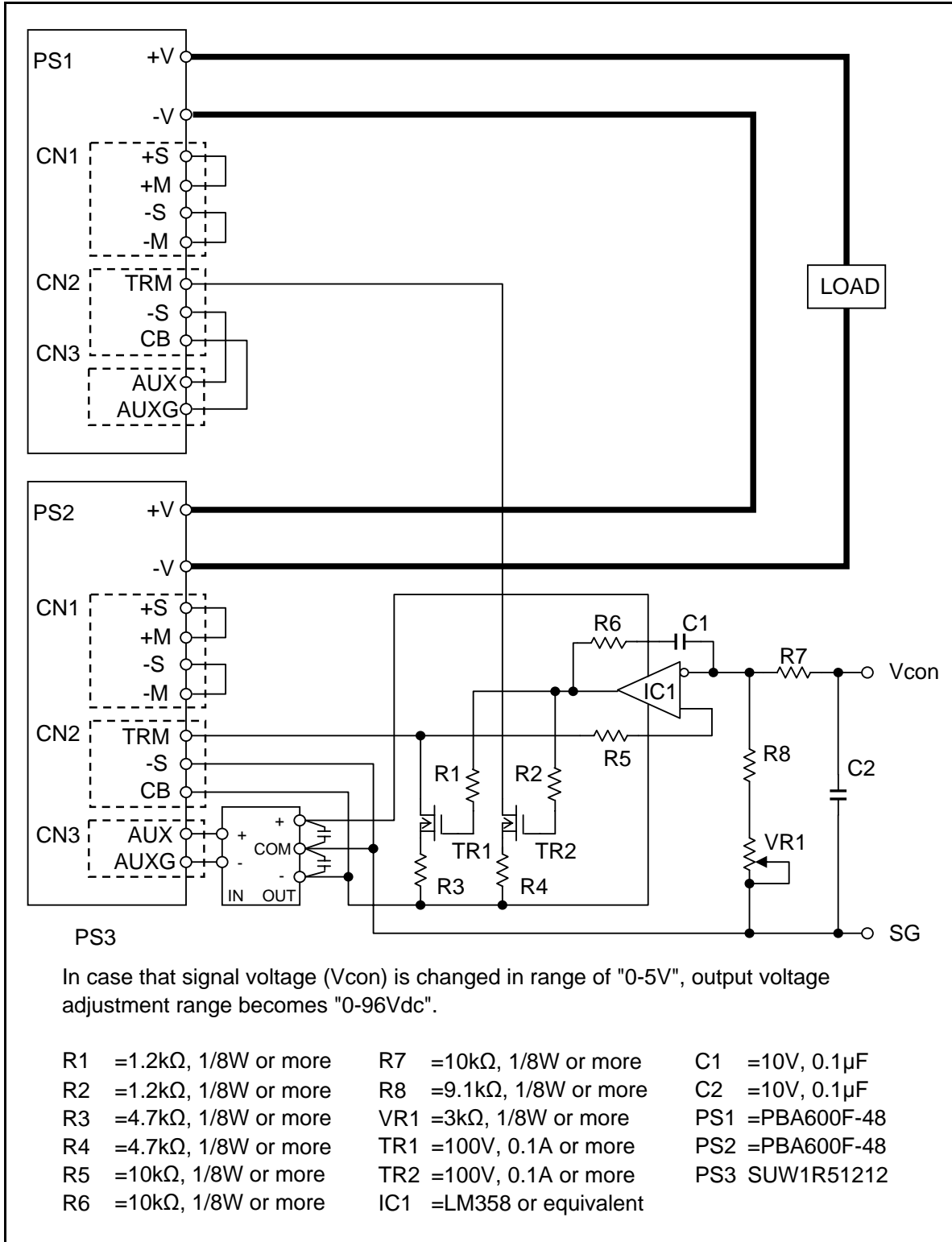


Fig.3-8-1 Adjustment by signal voltage with feedback



### ■ Explanation of Operation

The output voltage can be adjusted by the voltage of Vcon.

In this circuit, IC1 compare PS1's TRM and Vcon voltage to keep the output voltage constant. TRM voltage is proportional to output voltage. Therefore the output voltage can be controlled by adjusting TRM voltage in each units concurrently.

### ■ Note

If internal potentiometer is adjusted, the adjusted output voltage should be considered as Vn (rated output voltage).

CN1, CN2 are connected each other internally. Therefore, it is also possible to connect external circuit on CN1.

Please note that if CN1 or CN2 is removed, the voltage higher than rated voltage might be generated, and it would cause the unit shut-down by over voltage protection circuit.

If the output voltage becomes unstable when the power supply is set in your system, please try to change value of R6 or C1 bigger.

### ■ Characteristic

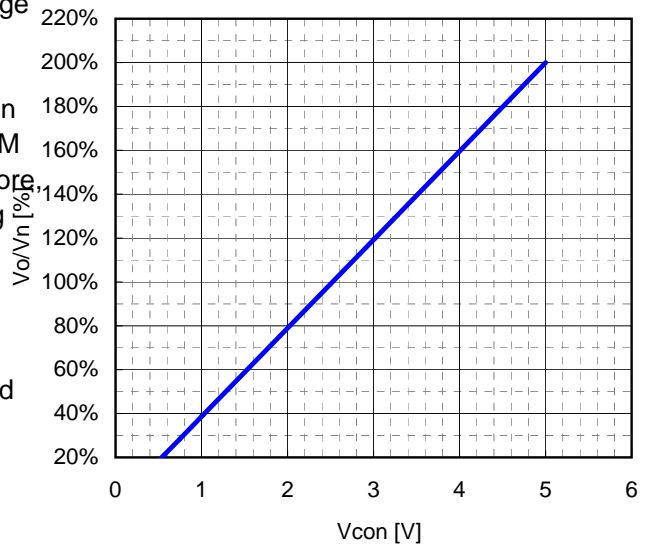


Fig.3-8-2 Vcon - Vo/Vn

\*Vn : Rated output voltage  
\*Vo : Adjusted output voltage

## 4. ACE series Output Voltage Adjustment by External Potentiometer

### 4-1. Output Voltage Adjustment by Signal Voltage

#### ■ Circuit

In ACE300F/450F/650F/900F, example circuit for output voltage adjustment by external voltage is shown below.

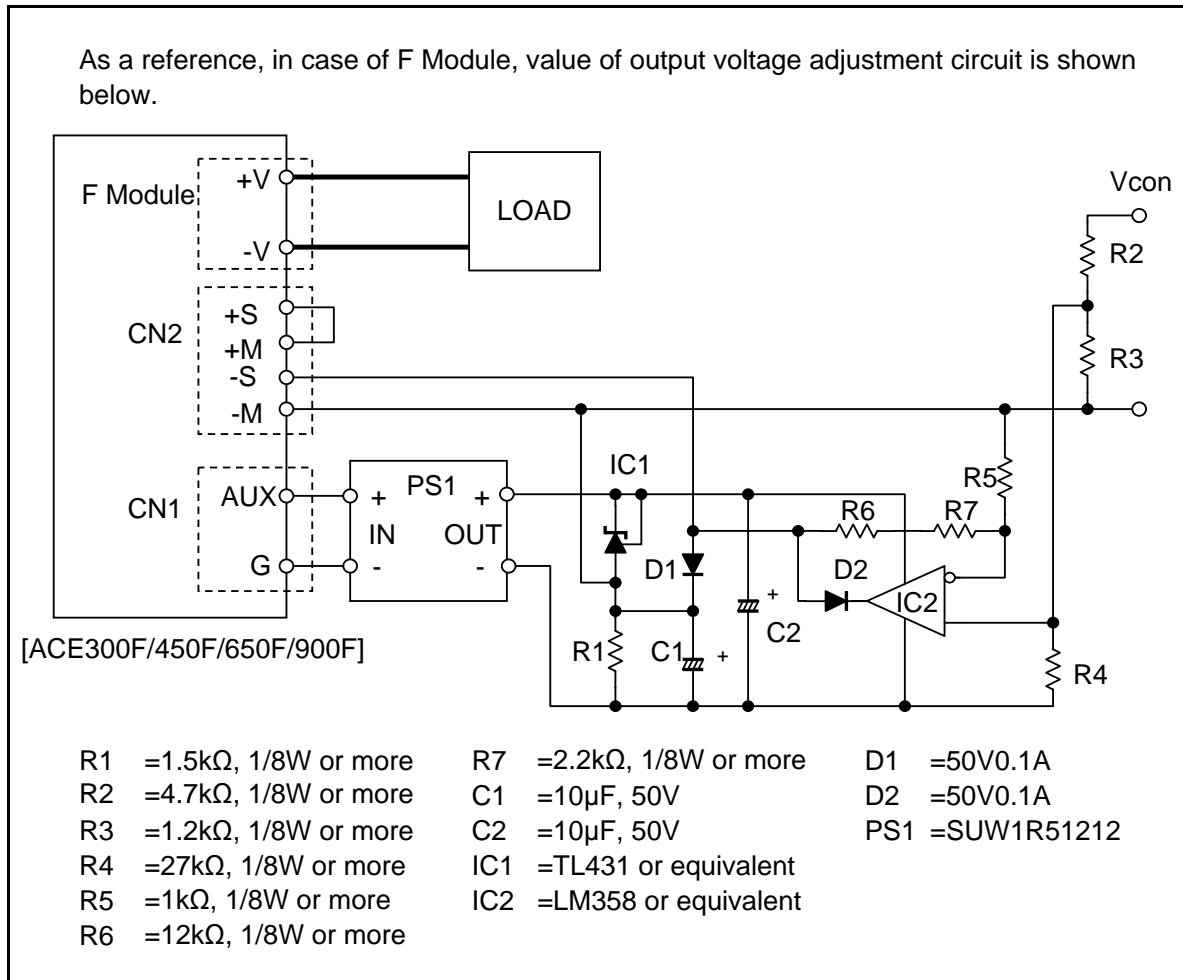


Fig.4-1 Adjustment by signal voltage

#### ■ Explanation of Operation

In ACE series, the monitoring and the remote sensing terminals (-M and -S) is used to change the output voltage. When the voltage between the terminal -S and -M(-V) is 0V, the output voltage becomes the rated output voltage. And, in case that the rated voltage is applied to this terminals, the output voltage can be adjusted to 0Vdc approximately.

An operational amplifier could be used to transfer any signal voltage to the needed voltage.

#### ■ Note

The output voltage accuracy will be  $\pm 5\%$  approximately. It depends on components used for external circuit.

Please do not remove CN1, CN2 or any other wiring during operation due to safety reason.

### ■ Characteristic

Characteristic of example circuit in Fig.4-1 is shown below.

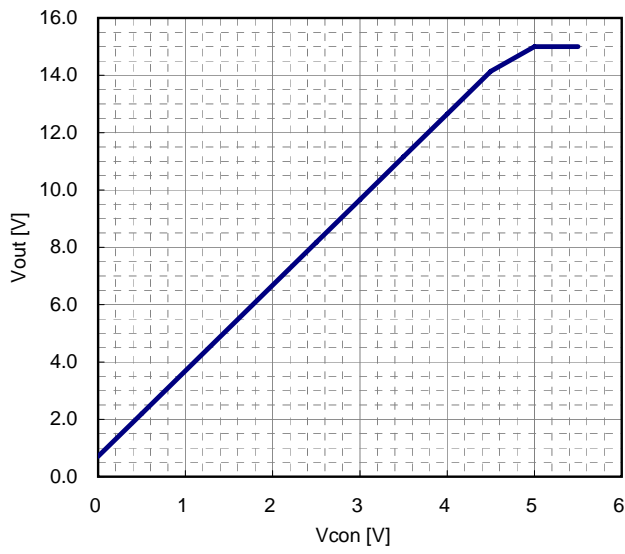


Fig.4-2 Vcon - Vout

## 4-2. Output Voltage Adjustment with X-version module

### ■ Circuit

In ACE series, the output voltage can be adjusted simply by using X-version 300W module (2A - 2K), example circuit for output voltage adjustment by signal voltage is shown below.

As a reference, in case of F Module, value of output voltage adjustment circuit is shown below.

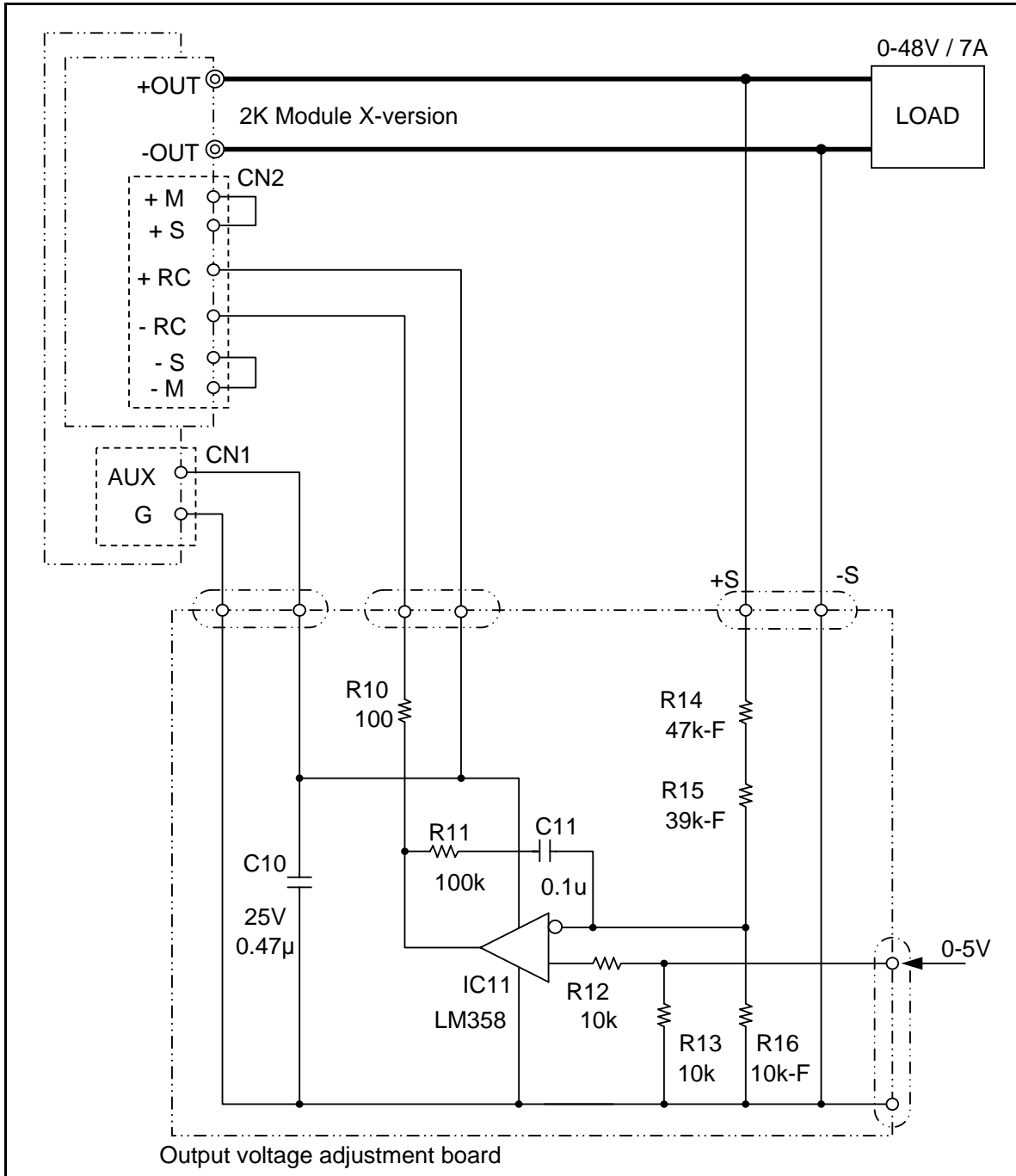


Fig.4-3 Adjustment by signal voltage