



ARG3000

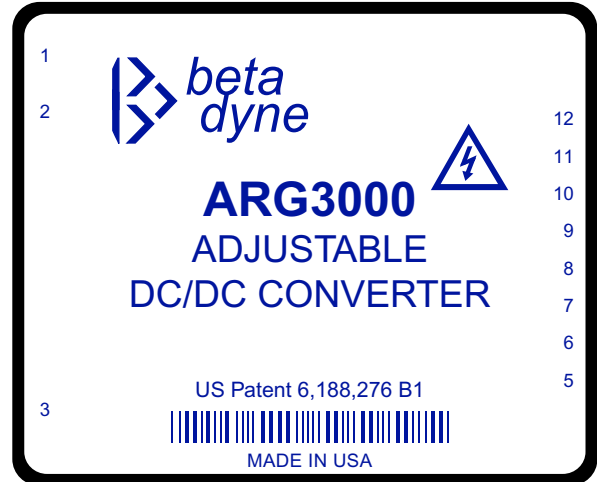
33W ADJUSTABLE DC/DC CONVERTER

5Vdc to 220Vdc Output Range

US Patent 6,188,276 B1

Key Features

- Wide input voltage range (2:1)
(Customer-defined ranges available)
- External amplitude selection 5–220Vdc
- Onboard 5Vdc reference
- Remote ON/OFF control
- 300µA off state current
- Isolated output
- Over/under input voltage protection
- Short circuit protection
- Over temperature protection
- Six-sided shielding



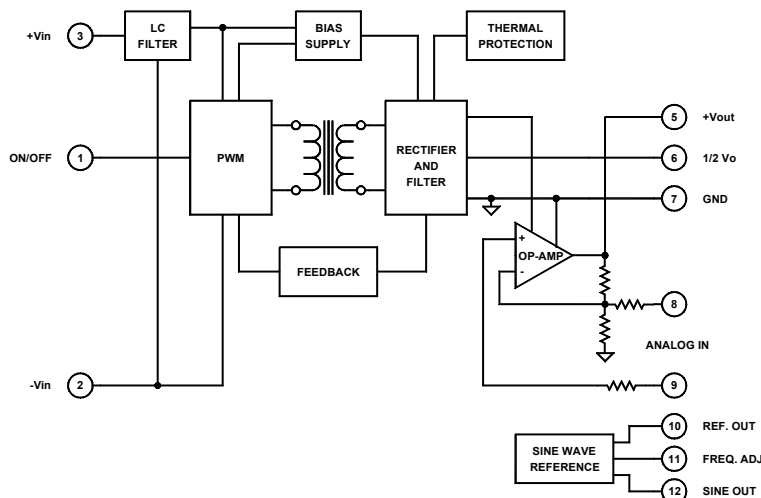
Beta Dyne is protected under various patents, including but not limited to U.S. Patent numbers: 5,777,519; 6,188,276; 6,262,901; 6,452,818; 6,473,3171.

Applications

- Adjustable Power Supply
(Unipolar or bipolar)
- Signal Generator
- Ring Generator
- Longitudinal Noise Generator

Functional Description

The ARG3000 is a 33W isolated, adjustable DC/DC converter that accepts input voltages of 12, 24 and 48V_{IN} and offers an adjustable output voltage from 5V_{OUT} to 220V_{OUT}. Its patented design allows the converter to source or sink current at its output. The converter can be driven from an external low frequency signal generator up to 1kHz to provide a 220V_{PP} output voltage. The converter is input power limited and will allow up to 33W at maximum V_O. An onboard adjustable sine wave reference can be used to provide a ringing signal for up to 15 RENS.



Typical Block Diagram

Ring Generator

Unless otherwise specified, all parameters are given under typical +25°C with nominal input voltage and under full output load conditions.

PERFORMANCE/FUNCTIONAL SPECIFICATIONS

Specifications typical at: $T_A = +25^\circ\text{C}$, $V_{IN} = 48\text{Vdc}$, Load = 250Ω Resistive, $V_{OUT} = 70V_{RMS}$, $C_1 = 100\mu\text{F}$, $R_3 = 10\text{k}\Omega$, $R_4 = 10\text{k}\Omega$
Setup according to Typical Application 1. See Application Note RG-001.

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
SUPPLY					
Supply Voltage (V_{IN})	Measured between $+V_{IN}$ and $-V_{IN}$ terminals		48		Vdc
Conducted Noise	220kHz, $40\text{Vdc} \leq V_{IN} \leq 60\text{Vdc}$ @20W load, Conducted current noise measured through $+V_{IN}$ terminal with DC power source impedance of maximum 0.1Ω.		200		mA_{PP}
Under Voltage Threshold, $V_{IN\ UV}$	See Model Selection Guide				
Over Voltage Threshold, $V_{IN\ OV}$	See Model Selection Guide				
Recovery from UV/OV				1	S
Current Consumption, Device Off	Pin 1 connected to Pin 2			300	μA
Current Consumption, No Load	Pin 1 = open, Vdc at Pin 1 = 10V See Model Selection Guide				
Current Consumption, Full Load	Pin 1 = open, Vdc at Pin 1 = 10V See Model Selection Guide				
Current Consumption, Peak Current ¹	$V_O = 200V_{PP}$, $R_L = 300\Omega$, $C_L = 100\mu\text{F}$, $F_O = 20\text{Hz}$		$1.8 \cdot I_{FL}$		A
Efficiency	$R_L = 330\Omega$, $C_L = 100\mu\text{F}$, $V_{OUT} = 70V_{RMS}$	65	70		%
OUTPUT					
Power	Continuous loading	17	20	25	VA
Power Factor (PF) ($\cos \theta$)	$R_L = 330\Omega$, $C_L = 100\mu\text{F}$	0.5		1	
Output Voltage		0	70	78	V_{RMS}
Amplitude TC	-40° to $+85^\circ\text{C}$, $V_O = 220V_{PP}$		0.08		$V_{PP}/^\circ\text{C}$
Output Capacitance		0.47			μF
Voltage Accuracy			± 3	± 5	%
Line Regulation	$V_{IN\ Min} \leq V_{IN} \leq V_{IN\ Max}$		± 1	± 3	%
Load Regulation	$0 \leq P_{OUT} \leq 20\text{VA}$		± 2	± 3	%
Combined Regulation			± 5	± 10	%
Output Frequency, $R_{ADJ} = \infty$			18		Hz
Output Frequency, $R_{ADJ} = 0$	Refer to the Output Frequency Setting table		80		Hz
Frequency Accuracy			1	± 2	%
THD	Selected Frequency, $40\text{Vdc} \leq V_{IN} \leq 60\text{Vdc}$, $0 \leq P_{OUT} \leq 20\text{VA}$, PF > 0.5		1.0	3.0	%
Sinewave Frequency TC	-40°C to $+85^\circ\text{C}$		0.12		$\%FS/^\circ\text{C}$
Turn On Delay			500		mS
Sine Amplitude (Reference)			6.8		V_{PP}
Offset Voltage		1.4	1.6		Vdc
5Vdc Reference Accuracy	$R_L = 2\text{mA}$		0.1	0.2	%
Reference TC			0.01	0.02	$\%FS/^\circ\text{C}$
Isolation			1500		Vdc
THERMAL					
Operating Temperature Range	$R_L = 330\Omega$, $C_L = 100\mu\text{F}$, $V_{OUT} = 70V_{RMS}$	-40		75	$^\circ\text{C}$
Derating (above 65°C)	$R_L = 330\Omega$, $C_L = 100\mu\text{F}$, $V_{OUT} = 70V_{RMS}$		0.2		$^\circ\text{C/W}$
Thermal Resistance				1.2	$^\circ\text{C/W}$
Thermal Shutdown Case Temperature			88		$^\circ\text{C}$
MTBF	per MIL-HDBK-217F (Ground benign, +25°C)		300,000		hours

TABLE 1. Output frequency settings

F	R _{ADJ}	RANGE
18Hz	∞	
20Hz	300k	±20%
25Hz	47k	±10%
30Hz	22k	±5%
35Hz	13k	±5%

F	R _{ADJ}	RANGE
40Hz	8.2k	±5%
45Hz	6.0k	±5%
50Hz	4.0k	±5%
55Hz	2.7k	±5%
60Hz	2.0k	±5%

F	R _{ADJ}	RANGE
65Hz	1.5k	±5%
70Hz	820Ω	±5%
75Hz	470Ω	±5%
>80Hz	0	

DC/DC Converter

INPUT SPECIFICATIONS (See Application Note RG-001.)

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Supply Voltage Range	See Model Selection Guide				
Input Current, No Load	See Model Selection Guide				
Input Current, Full Load	See Model Selection Guide				
Short Circuit Current	Input Current Limit	I _{IN FL}			
Input Reflected Ripple	See Model Selection Guide and Footnote 2				
Switching Frequency	PWM frequencies		250		kHz
Start Up Threshold	See Model Selection Guide				
Under Voltage Shutdown			10		Vdc
Input Filter Type	π Filter				
Off State Current			300		μA
Remote ON/OFF Control, ON	Pin open, 10Vdc@100μA, internal pullup				
Remote ON/OFF Control, OFF	Jumper pin to -V _{IN}				

OUTPUT SPECIFICATIONS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Voltage, Single Output	Pin 7 = GND, Pin 5 = V _{OUT} , See Application Note DC-019	0	100	220	Vdc
Voltage, Dual Output	Pin 6 = GND, See Application Note DC-019	0	±50	±110	Vdc
Voltage Imbalance				1	%
Output Current	See Model Selection Guide & Footnote 3				
Short Circuit Protection	Indefinite				
Load Step Response within 1% of V _{OUT}	50% FL to FL to 50% FL		50	100	μS
Turn On Delay			8		mS
Output Ripple & Noise	20MHz bandwidth (See App. Note RG-001)		1		% of V _{OUT}
Load Regulation	Minimum to Full Load, See Footnote 3		1		% of V _O
Line Regulation	Minimum to maximum input voltage			±0.5	%
Temperature Coefficient	Nominal line, Full Load		±0.01	±0.02	%/°C
Efficiency	Full Load, See Model Selection Guide				
Derating	No derating -40° to +75°C				
Transient Response	50% FL to FL to 50% FL to within 1% of V _{OUT} (See App. Note RG-003)		75		μS
Isolation			1500		Vdc

TABLE 2

V _{OUT}	I _o	P _o
5	2.00A	10W
10	2.00A	20W
30	1.10A	33W Max
60	0.55A	33W Max
220	0.15A	33W Max

Isolated Power Amplifier

The ARG3000 can be configured as a unipolar isolated power amplifier with 0V to 10V inputs at either inverting or non-inverting inputs that produces 0V to 220V outputs. See Application Note RG-001.

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Input Voltage Range	Pin 9 short to Pin 7, $V_o = 0V$ to 220V	0.079		0.662	Vdc
Inverting Input (Pin 8)	Pin 9 open, $V_o = 0V$ to 220V	1.25		10.4167	Vdc
Non-inverting (Pin 9)	Pin 8 open, Pin 8 Voltage = 5.238V				Vdc
Input Resistance Inverting	Pin 8		3.3		k Ω
Input Resistance Non-inverting	Pin 9		5.1		k Ω
Input Offset Voltage	Pin 8 resistive reference		5.238		Vdc
Gain Inverting Input (Pin 8)	See Figure 1				
	Pin 9 open, $V_o = -24V_{IN} + 250$ (See App. Note RG-003)				
Gain Non-inverting ¹ (Pin 9)	Pin 8 open, See Figure 1				
Gain Bandwidth Small Sign ¹	Pin 8 = V_{IN} , Pin 9 = open (See App. Note RG-003)			2000	Hz
Gain Bandwidth Full Power ¹	Pin 9 = V_{IN} , Pin 8 = open		200	350	Hz
Slew Rate		1			V/ μ S
Settling Time to $\pm 1\%V_o$	Including Slew Rate		300		μ S
Gain TC	Including Reference TC		0.01	0.025	%/ $^{\circ}$ C
Isolation			1500		Vdc

PHYSICAL CHARACTERISTICS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Dimensions (LxWxH)	3.00x2.54x0.77 in. (76.20x64.52x19.43mm)				
Weight	7.48 oz. (212g)				
Case Material	Coated metal				
Shielding Connection, 12, 24V _{IN}	-V _{IN} (Pin 2)				
Shielding Connection, 48V _{IN}	+V _{IN} (Pin 3)				

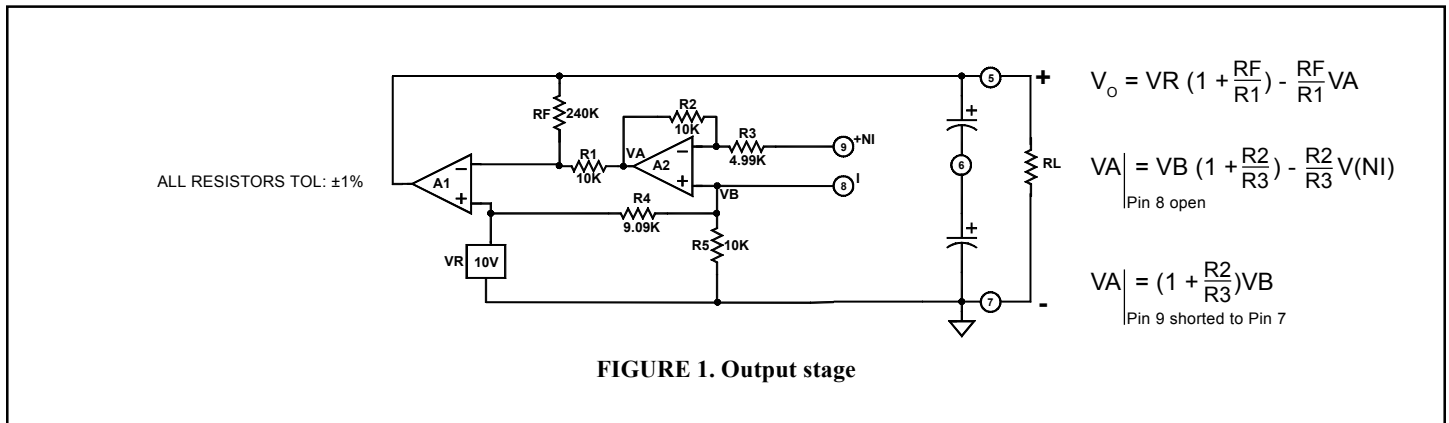
Model Selection Guide

-MODEL NUMBER	INPUT						OUTPUT			
	Voltage (Vdc)			Current (mA)			Reflected Ripple ² (mA _{PP})	Voltage (Vdc)	Current ³ @220V (mA)	Efficiency Full Load (%)
	Nominal	Range	Voltage Threshold	No Load	Full Load	Under (V _{IN UV})				
ARG3000-12	12	10-18	10	20	60	3481	300	5-220	150	79
ARG3000-24	24	18-36	17	38	40	1680	250	5-220	150	81
ARG3000-48	48	40-60	38	60	30	735	200	5-220	150	85

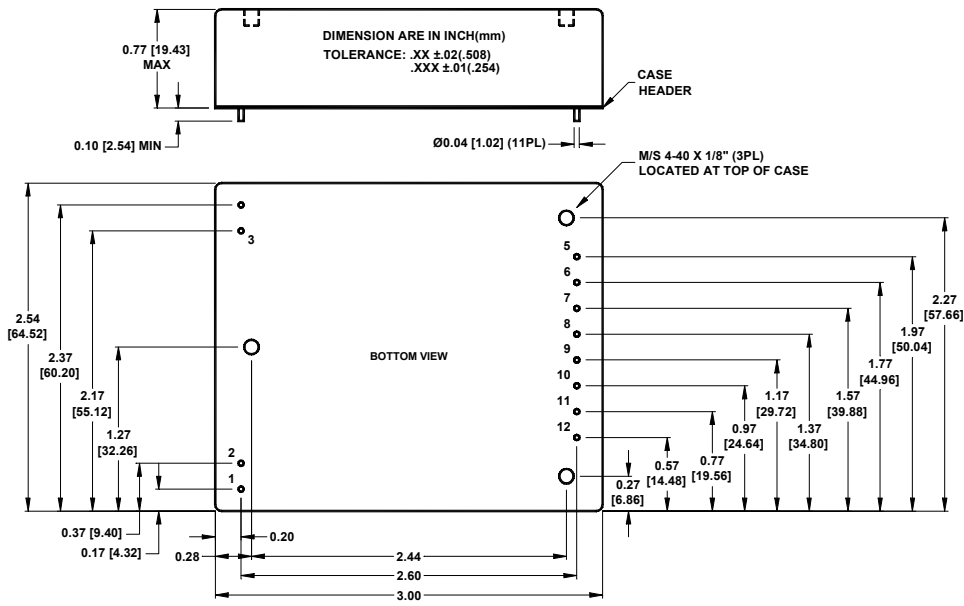
¹ When the ARG3000 is used as a DC/DC converter where low ripple & noise is required, LC differential node filters can be used to reduce ripple & noise (see Figure 1). It is recommended to first try to reduce the noise with C1 and C2, then if you must, install the rest of the filters. The same filters can be used in a ringer or power amplification application, however the bandwidth of the unit will be reduced and the internal power dissipation will be increased. (The converter must charge/discharge output capacitance (C_o)).

² Measured with C_{IN} = 100 μ F for 12V, 47 μ F for 24V, 47 μ F for 48V.

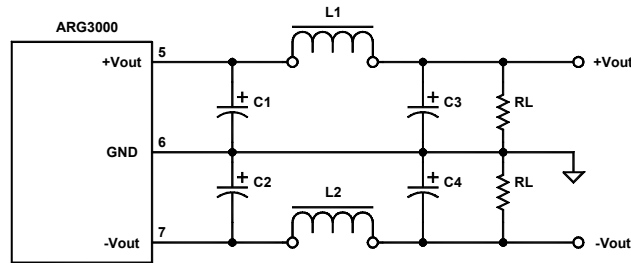
³ Due to the power limiting circuit at the input and the wide output voltage range at the output, the maximum output current at any voltage setting is 2A or 33W of output power (see Table 2).



MECHANICAL SPECIFICATIONS



Pin	Function
1	ON/OFF
2	-V _{IN}
3	+V _{IN}
4	No Pin
5	+V _{OUT}
6	GND
7	-V _{OUT}
8	INV INPUT
9	NON-INV INPUT
10	REF. OUT
11	FREQ. ADJ
12	SINE OUT



$C_1, C_2 = 1$ to $3.3\mu\text{F}$ @ 200V

$C_3, C_4 = 1$ to $3.3\mu\text{F}$ @ 200V

$L_1, L_2 = 1$ to $10\mu\text{H}$

$I_{L\text{Sat}} \geq 1.5I_O$

FIGURE 2. Output filter for Bipolar Adjustable DC/DC Converter

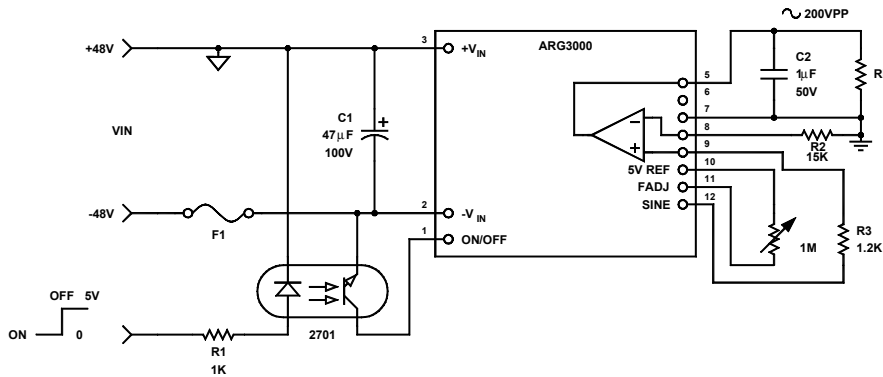


FIGURE 3. Ring Generator with 200V_{pp}, 18 to 80Hz non-inverting input connection

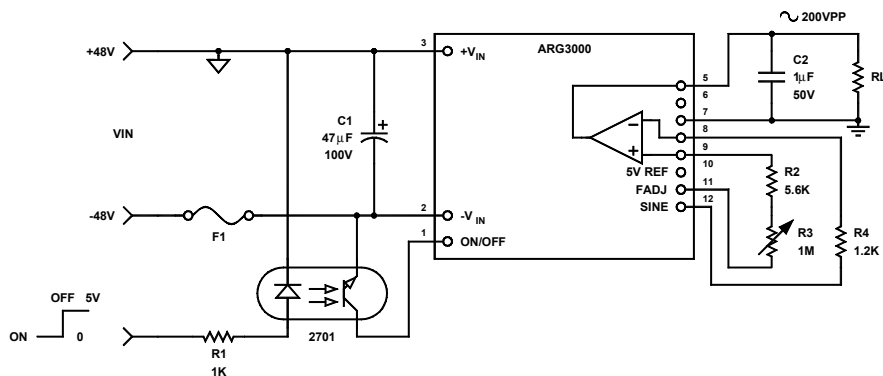


FIGURE 4. Ring Generator with 200V_{pp}, 18 to 80Hz inverting input connection

V _{IN}	F1
12V	8A
24V	4A
48V	2A

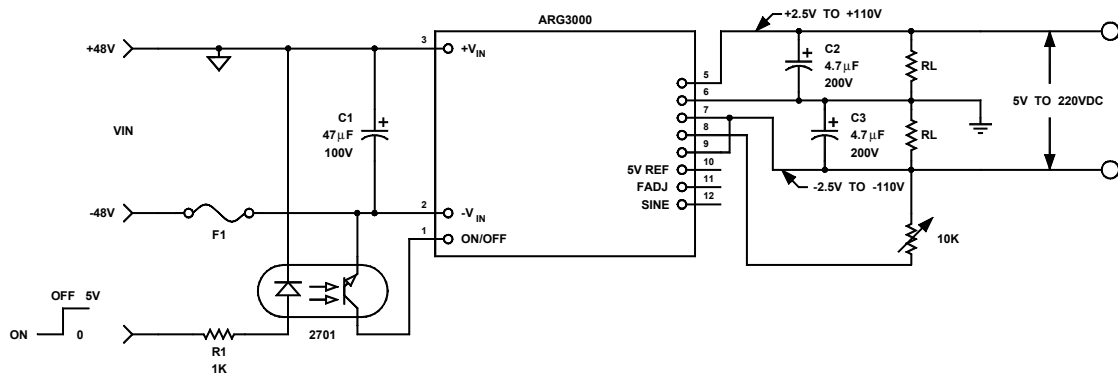


FIGURE 5. Unipolar 5V to 220V, bipolar ±2.5V to ±110V DC/DC Converter

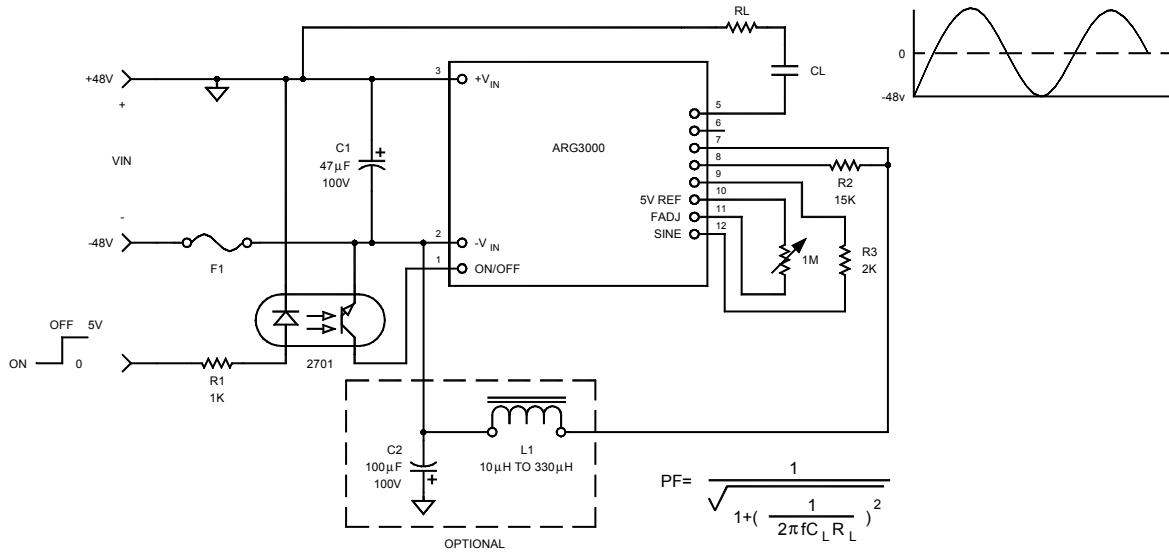


FIGURE 6. 200V_{pp} sine wave on -48V bus

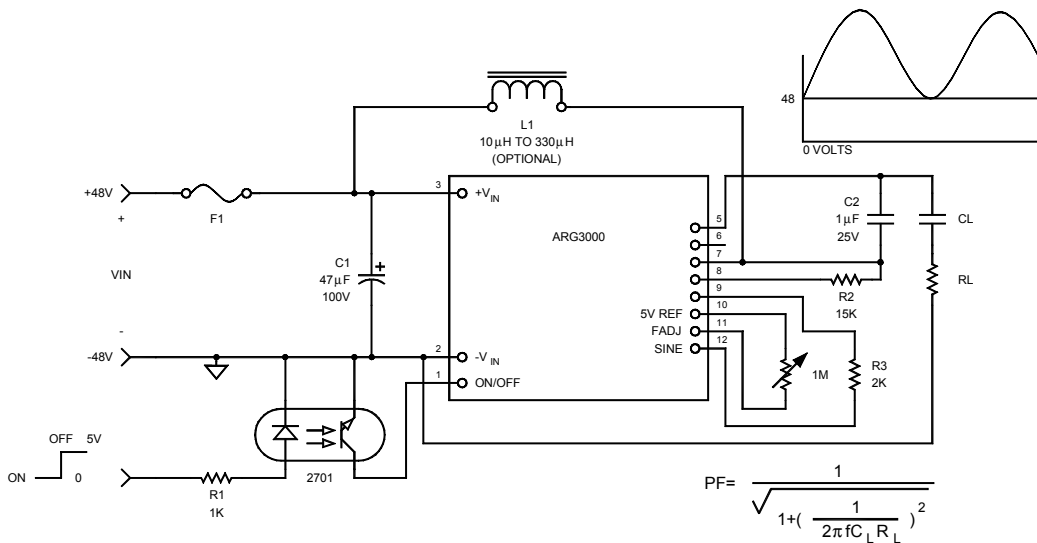


FIGURE 7. 200V_{pp} sine wave on +48V bus

V _{IN}	F1
12V	8A
24V	4A
48V	2A

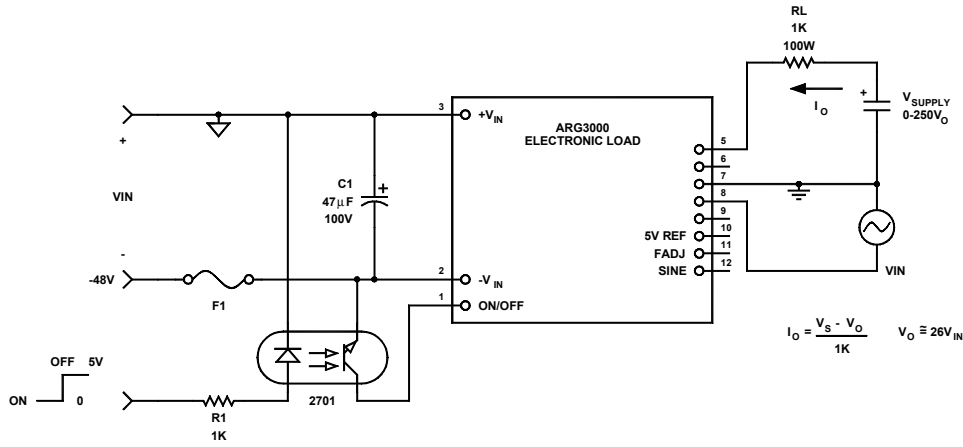


FIGURE 8. Electronic Load

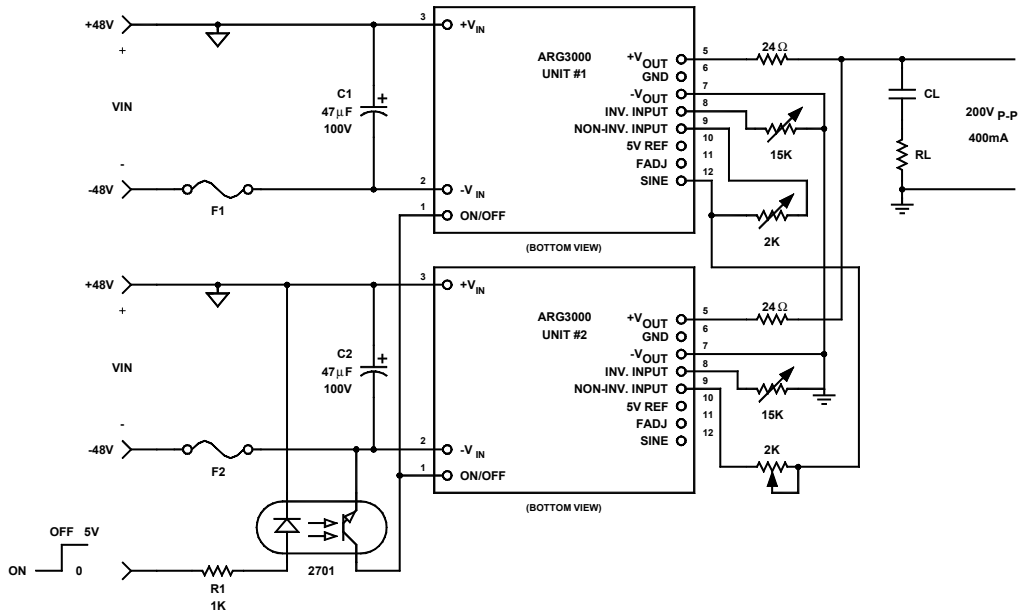


FIGURE 9. Parallel connection diagram of RG3000

NOTE: Only one sine wave reference is used to drive both generators. The 24Ω resistor at the positive outputs is required to compensate for any mismatch in the turn delays, gain, or offset.

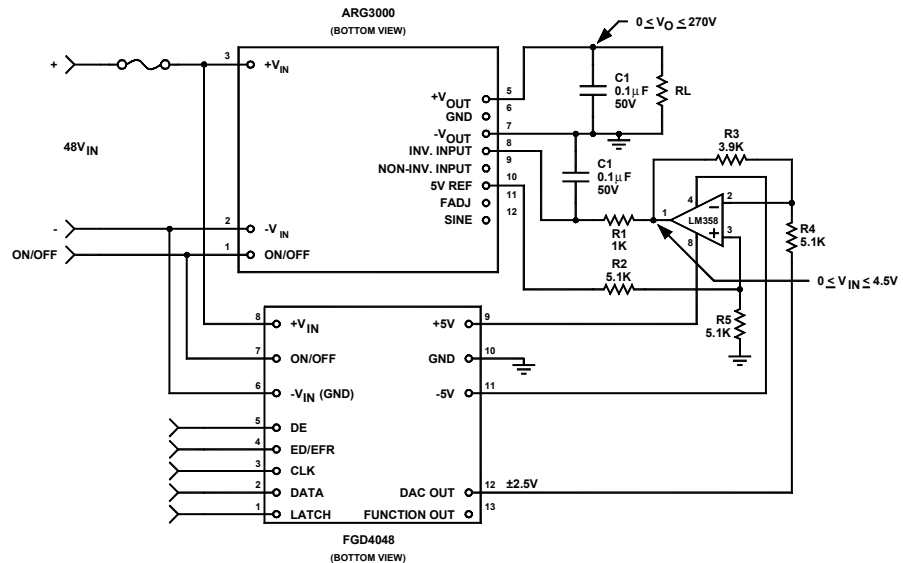


FIGURE 10. Precision high-voltage programmable Function Generator

V _{IN}	F1
12V	8A
24V	4A
48V	2A