Matsusada Precision

Sequence Function Installed
Bipolar Power Supply

DOEF Series

NEW

Applicable to various tests with high speed response of
DC to 200 kHz and sequence function.

High Speed Four-Quadrant Bipolar Power Supply

▶ DOEF20-20 : 0 to ±20 V / 0 to ±20 A / 400 W
▶ DOEF40-10 : 0 to ±40 V / 0 to ±10 A / 400 W
▶ DOEF60-10 : 0 to ±60 V / 0 to ±10 A / 600 W
▶ DOEF60-20 : 0 to ±60 V / 0 to ±20 A / 1200 W

DOEF series

・High speed response of DC to 200 kHz.
・Extremely sophisticated quality to output programmed wave.
・Ultimate in accurate sequence operation.

www.matsusada.com

DOEF series

Sequence Function Installed
Bipolar Power Supply

"High speed response of DC to 200 kHz"

"Programmed wave is output in high quality"

"Highly accurate sequence operation"

Four-quadrant bipolar power supplies are developed up to followings.

DOEF series are four-quadrant power supplies possible to source and sink current.
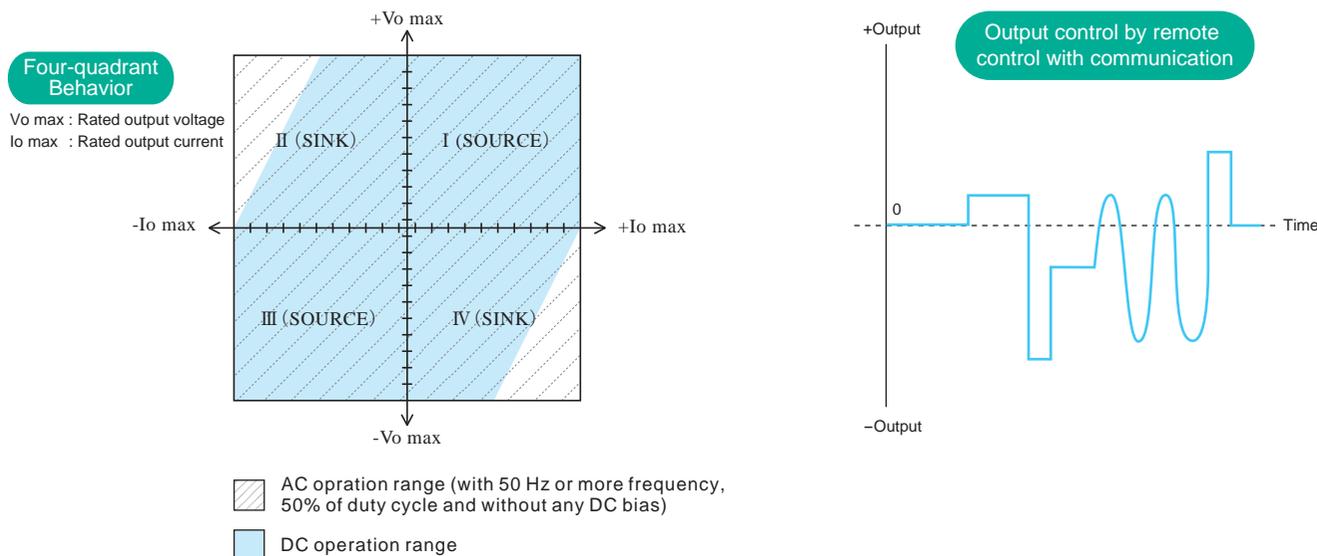
They can be applied widely according to the usage from transient response test to various evaluation tests as they realize

high speed response of DC to 200 kHz (at constant voltage mode) and can generate basic waves such as sine wave,

rectangular wave and programmed waves by embedded function generator.

And, as they provide also sequence function as standard, you can program output patterns in detail.

Moreover, as their generation of wave and setting sequence can be made all with the simplified operation on the front panel,

you can make full use of various functions easily.

Features

- High speed of DC to 200 kHz is realized.
- Four-quadrant behavior is able to source and sink current.
- It is possible to generate non-distortional wave such as sine wave, rectangular wave.
- It is possible to set and operate highly accurate sequence of 1024 steps.
- Individual setting of DC and AC is possible. Superior usability is realized together with the simplified operability.
- 2 modes operation of constant voltage (CV) and constant current (CC) are applicable.
- It is possible to connect 3 power supplies in parallel (synchronized trigger) by coinciding accuracy of frequency (synchronized clock) in synchronized operation.
- External digital control is available (option).
- It is possible to output voltage/current in 16 bits and optional waves of resolution of 1024 in one cycle by using dedicated software.

Four-quadrant Behavior

Vo max : Rated output voltage
Io max : Rated output current

+Vo max

II (SINK)　　I (SOURCE)

-Io max　　　　　　+Io max

III (SOURCE)　　IV (SINK)

-Vo max

AC opration range (with 50 Hz or more frequency, 50% of duty cycle and without any DC bias)

DC operation range

Output control by remote control with communication

+Output

0　　　　　　　　Time

−Output

Typical applications

- Voltage fluctuation tests for automotive electrical components such as car navigation system
- Voltage fluctuation tests for automotive battery (Simulation of waveform of cranking)
- As Constant current power supply for electromagnet
- Tests of various DC motors.
- The test which apply ripple current to a capacitor

- Examination to evaluate the characteristic of the magnetic material
- As high speed power supply for pulse plating
- For measuring the loss of a transformer or a reactor
- The test which apply transient current to a breaker or relay
- To drive piezoelectric elements
- Evaluation of power conditioners

This product is not designed for charge and discharge of battery. Please contact nearby sales if unit is used for charge and discharge application.

Lineup

★We can manufacture one other specified than voltage, current and frequency band written as followings.
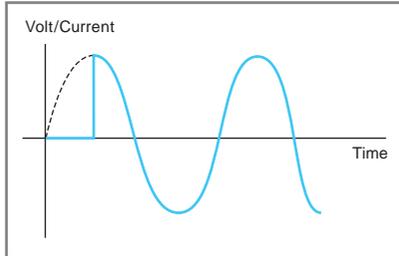
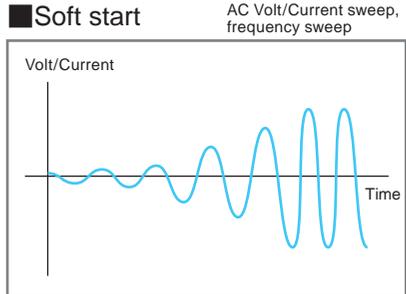| Model	Maximum output voltage	Maximum output current	Maximum output power	Frequency Bandwidth kHz (-3dB)		Dimension inch (mm) (Excluding protrusions)	Weight kg (typ.)
				At CV mode	At CC mode		
DOEF20-20	±20 V	±20 A	400 W	DC to 200	DC to 100	W19(483) x H5.24(133) x D21.65(550)	17
DOEF40-10	±40 V	±10 A	400 W			W19(483) x H5.24(133) x D21.65(550)	17
DOEF60-10	±60 V	±10 A	600 W			W19(483) x H6.97(177) x D24.01(610)	23
DOEF60-20	±60 V	±20 A	1200 W			W19(483) x H10.47(266) x D24.01(610)	40

▶ Basic Wave Generation Function

DOEF is equipped with a built in function generator that produces basic waves such as sine, rectangular and triangle waves. Frequency range can be set between 0.01 Hz and 200 kHz (resolution of 0.01 Hz). Easy adjustments/edition of amplitude, initial phase (for sine wave), phase shift (for sine wave), and duty ratio (for rectangular/triange wave) are possible. DOEF has special feature of "soft start" and "soft stop" which enable to program initial rise and fall characteristics of the output.
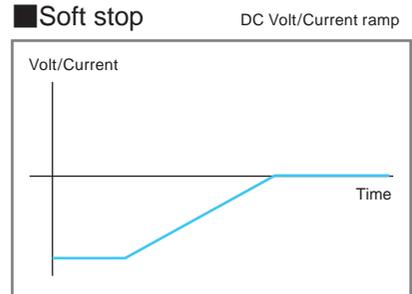
■Starting phase

Volt/Current

Time

■Soft start

AC Volt/Current sweep, frequency sweep

Volt/Current

Time

■Soft stop

DC Volt/Current ramp

Volt/Current

Time

■Applications : Power activation test, various start-up tests of motor, etc, fluctuation test of wave shape and so on.
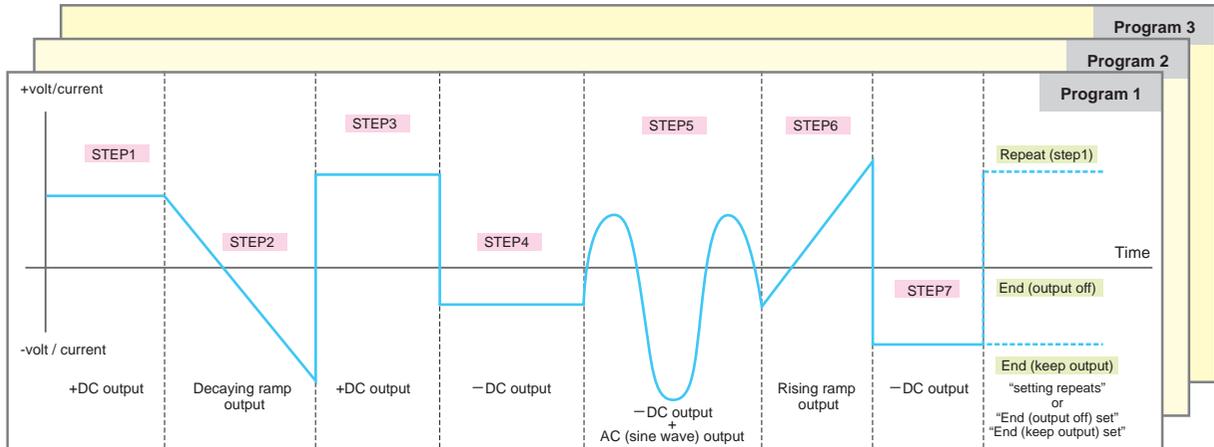
▶ Sequence Function

DOEF is equipped with sequence function that can program parameters such as step length, step amplitude ramp, DC voltage and current ramping, AC voltage and current ramping, frequency sweep, AC superposition, step jump, and jump times. These useful functions help to program the desired waves in very flexible manner, resulting to support efficient laboratory and research works.

· Step setting length 0.1 ms to 1000 h (resolution of 0.1 ms)
· Maximum 1,024 steps per program.
· Maximum 64 programs can be stored in memory for each CC/CV operation
· Program repeat can be set by "endless repeat" or "1 to 10,000 times"
· Multiple programs can be converted to activate

Very complex sequence can be created easily with the easily understandable display.
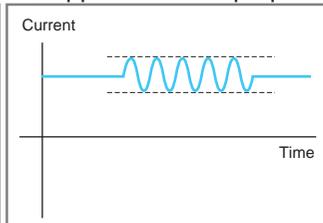
■Image of Programs

Program 3
Program 2
Program 1

+volt/current

STEP1
STEP2
STEP3
STEP4
STEP5
STEP6
STEP7

Repeat (step1)

Time

End (output off)

End (keep output)

-volt / current

+DC output

Decaying ramp output

+DC output

−DC output

−DC output + AC (sine wave) output

Rising ramp output

−DC output

"setting repeats" or "End (output off) set" "End (keep output) set"

Sequence functions help to create complicated waves like below to be simply and easily edited.

■ Pulse current variation

Current

Time
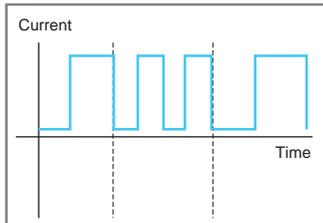
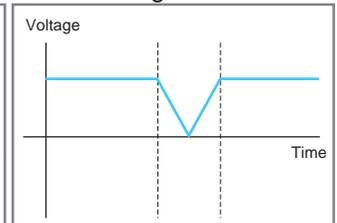■ Ripple current superpose

Current

Time

■ AC voltage variation

Voltage

Time

■ DC voltage cutoff

Voltage

Time
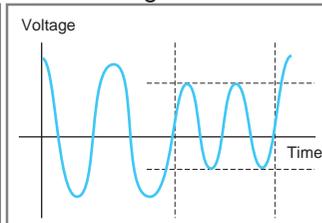
▶ Measurement Function

DOEF is equipped with measurement function that can measure DC value, RMS value, AC value and Max/Min value, likewise, it is possible to automatically measure wide range bandwidth from DC to 200 kHz. There are 4 parameters which are simultaneously displayable, each of these parameters are individually programmable. This sophisticated feature will reduce time for editing output waves and bring up work efficiency.

Ex.) Measurement of AC wave   Ex.) Measurement of DC+AC wave
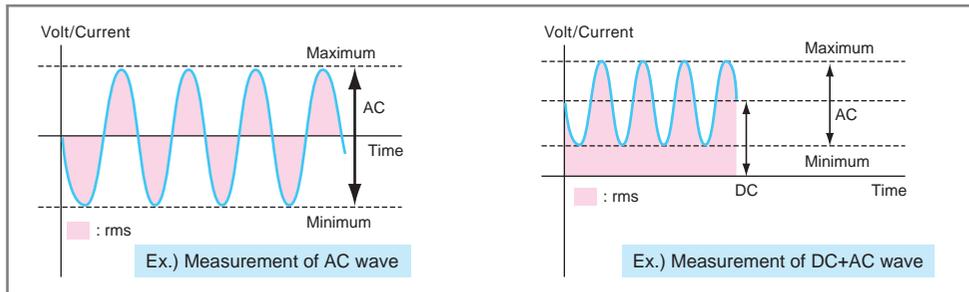
▶ Synchronized Operation (-Lso option)

The following DOEF operations are available for up to three units.

【Synchronous Trigger】

Through a single operation of the master unit, it is possible to match the output timing of ON/OFF in one or two slave units. In turning the output on, the output starting gap between the master and the slave is less than 0.5 μs
*When this option is selected, we provide two meters of dedicated cables for synchronized trigger function used for two or three devices.

【Synchronous Clock】

By providing the clock input of 10 MHz, the individual difference between the oscillators installed on each unit is removed (In the case of this, there are a few ppm up to several tens ppm in general).
What is more, frequency accuracy and sequence-step time are completely unified through the operation.

Moreover, the product is also available for setting the phase shift difference for sine wave toward each unit.
(*Please prepare the coaxial cable on both ends of BNC connectors which is not included but required for synchronous clock.)

*When the slave unit is required to synchronize in accordance with the waveform set by the master unit, -LMs option must be taken (in master/slave control). Meanwhile, selecting -LSo option and -LMs option simultaneously is not allowed.

Other functions:

**Protection Function (Cut-off, Individually Settable Limiter Protection),
Key Lock Function, Switching CV/CC and Memory function (up to 99)** are installed as standard.

Operability
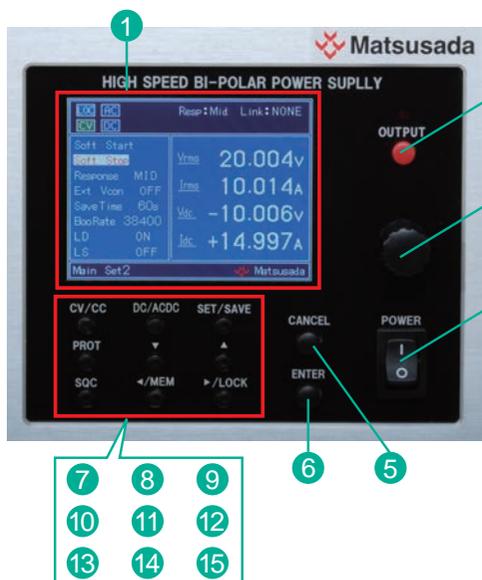
No.	Name	Description
1	Display	: Display various settings and measurements.
2	OUTPUT switch	: ON/OFF for output
3	Rotary encoder	: Change value
4	POWER switch	: ON/OFF for main power
5	CANCEL switch	: Cancel settings
6	ENTER switch	: To confirm and key in
7	CV/CC switch	: Switchover CV/CC mode
8	DC/ACDC switch	: Switch DC/AC + DC mode
9	Setting/Storage switch	: Make to setting change menu, store memory
10	Protection switch	: To switch protection setting menu
11	Shift down switch	: Shift down each setting items
12	Shift up switch	: Shift up each setting items
13	Sequence switch	: Use for switchover of sequence screen or interrupt or restart of sequence operation
14	Shifting left/ Memory switch	: Shift digits of settings to left and also use switchover memory screens
15	Shifting right/ LOCK switch	: Shift digits of settings to right and also use key lock function

Specifications

Input Voltage/Current	**Models**	**Input Voltage**	**Input Current**	**Recommended Breakers**
	400 W	100 to 240 Vac	10 A	100 Vac/15 A
	600 W	200 to 240 Vac	7 A	200 Vac/15 A
	1.2 kW		13 A	200 Vac/20 A

Wave Generation Function	Sine wave, Rectangular wave and pre-programmed wave
Accuracy of frequency setting	$\leqq$0.03%
Settable Frequency of Waves	DC, 1 Hz to 200 kHz (CV), 100 kHz (CC)
External Input Control Voltage	−5 to +5 V (Input Impedance$\geqq$10 kΩ)
Range of Output Setting	DC : -100 to +100% AC : 0 to +100%
Ripple	0.02% rms
Stability	0.016%/H typ.
Accuracy of Setting	DC : ±0.5% F.S AC : ±0.5% F.S (at frequency DC to 20 kHz)
Input Regulation	0.05% (at ±10% input change)
Load Regulation	0.05% (at 0 to 100% load change)
Protection	Over Voltage/Over Current (OV/OC variable limit), output short-circuit
Temperature Coefficient	0.02%/ºC
Output Display	Output Voltage Monitor 5 digits, Output Current Monitor 5 digits by LCD on the front panel (DC, RMS, AC, MAX and MIN, but MAX and MIN indicated 4 digits)
Accuracy of Output Display	DC : ±0.5% F.S ± 1 digit AC : ±0.5% F.S ± 1 digit (at Frequency $\leqq$ 20 kHz)
Wave Output on Monitor	Output voltage : −5 to +5 V ±1% F.S. (output Impedance 1 kΩ) Output current : −5 to +5 V ±1% F.S. (output Impedance 1 kΩ)
Preset Function	99 memories
Operation Temperature	0 to +40ºC
Storage Temperature	−20 to +70ºC
Storage Humidity	20 to 80% RH (no condensation)
Accessories	Input cable, 2.5 m length : 1 (115 V input type : 3 pins connector, 230 V input type : Flying lead) Instruction Manual : 1

Sequence Function		
Number of Sequences		64 programs for each CV and CC
Number of Steps		1 to 1024 (in one sequence)
Step Time		0.1 ms to 1000 h (resolution 0.1ms)
Actions in Steps		Constant, Linear Sweep or Ramp
Parameter	CV mode	DC voltage, Superposed AC voltage, Frequency, Waveform, 2 bits Synchronized Step Output
	CC mode	DC current, Superposed AC current, Frequency, Waveform, 2 bits Synchronized Step Output
Number of Jumps		1 to 999 or continuous
Sequence Control	Start	Start sequence
	Stop	Stop sequence
	Hold	Keep the setting at the time, Restart by start of the sequence.
	Jump	Branch into the specified step.

Options

-LGob ＊ **Optical Interface Board**

-LGob : Optical interface board + optical cable 2 m
-LGob(Fc5)   : Optical interface board + optical cable 5 m
-LGob(Fc10) : Optical interface board + optical cable 10 m
-LGob(Fc20) : Optical interface board + optical cable 20 m
-LGob(Fc40) : Optical interface board + optical cable 40 m

Insulation control is made with optical communication. As perfect insulation is made by optical fiber it is able to forestall miss operation by transient phenomenon caused by surge, dielectric thunder or foreign noise, etc.
OUTPUT ON/OFF, variable voltage/current (AC and DC), switching constant voltage/constant current, variable frequency, setting of waveform (sine wave, rectangular wave, triangle wave), setting of phase (sine wave),
setting of duty (rectangular wave, triangle wave).
(Adapter is required otherwise. Please inquire our sales staff.)

-LCk ＊ **CC-Link Interface Board**

It enables digital remote control via network of CC-Link. We may accept optimization for specific industrial network such as Device NET. Please inquire our sales staff for details.

-LMsm
-LMss **Master/slave control (parallel operation)**

Maximum 3 units including master unit are hooked. "-LMsm" for the master unit and "-LMss" for slave units.
Please order required number of units. Every master unit and slave units are exclusive use, but operating individually is also available.
When change the combination of master/slave, they should be readjusted in our shop.
In addition, either communication option (-LGob, -LCk or -LUs1) is necessary for a master unit when the power supplies in master/slave connection are controlled by digital communication. Slave units also require these options for their individual operation.
(-LGob, -LCk or -LUs1) (It is impossible for this to select -LSo option simultaneously.)

-LSo **Synchronized Operation**

Maximum 3 units can be operated in parallel. Accuracy of output frequency and sequence time coincide by synchronizing with multi units and it is possible to output the same wave all together. Only in case of sine wave, it can output with phase difference given.
One dedicated cable (length : 2-meter) for synchronized trigger is attached, except a cable used for synchronized clock function.
(It is impossible for this to select -LMs option simultaneously.)

-LVs **Shifting Function for Output Voltage**

Optional 120 Vp-p within the range of −115 to +115 V (only for DOEF60-10 and 60-20).

-LUs1 ＊ **USB interface board**

Enable digital control with USB. One power supply can be connected per one USB port which computer equipped.
In case USB port which computer equipped is not enough, please use USB hub.
However, depending on USB hub, it may not work correctly.

OS：Microsoft Windows XP/Vista/7/8/10
　　（Both 32-bit version and 64-bit version are available.）

Microsoft Windows is a registered trademark of Microsoft Corporation in the United States and other countries.

When ordering, suffix the above option number to the model number.
<e.g.> DOEF40-10-LMsmSoUs1Vs,
　　　　DOEF60-10-LGob(Fc5)MssSoVs   (Alphabetical order)

As for characteristics of amplifiers

Rising time

(step time) : responsiveness may be expressed with rise time.
(see right figure)
Rise time for amplifiers in fc (Hz) of response time (=frequency band) is calculated with following equation generally.
$tr \fallingdotseq 0.35 / fc$
Decay time tf is equal to tr.
Frequency band : to 200 kHz, tr = tf $\fallingdotseq$ 1.8 μs
: to 100 kHz, tr = tf $\fallingdotseq$ 3.5 μs

Response speed

When accurate output wave is required, please select an amplifier in sufficiently higher frequency band than applied one. Generally, speedy frequency band as 3 to 5 times of applied frequency for sine wave and 10 times for rectangular wave are required. If frequency band is in lacking, as not only output oscillation is reduced but also phase difference of input and output become larger, consideration to apply it monitoring output wave is required.

For Capacitive Loads

In case of capacitive load, oscillation may be caused.
If so, please insert a power resistance to the output in series.
And, in capacitive load, please attend to that frequency band is limited by the resistance and capacity inserted in series

For Inductive Loads

At CC mode, oscillation may be caused by inductance of inductive loads.
If so, please connect C-R straight circuit between output terminals so as not to cause oscillation.

Customer Inquiry Sheet (DOEF series)

Please copy this page and above fax number after filling out form below.

◼ I would like

☐ A quotation　☐ An explanation of product　☐ A demonstration　☐ To purchase

☐ Other (　　　　　　　　　　　　　　　　　　　　　　　　　　　　　)

◼ Give us your requirement / comment

◼ Please fill in below.

Address:	
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Dept.:	Title:
Name:	
Tel:	Fax:
E-mail:	