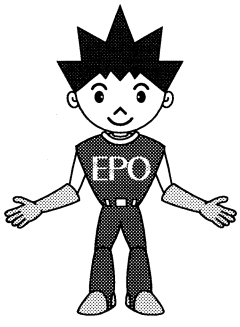
10

Maintenance

■This chapter briefs backup battery and calibration.



Backup battery

An EPO 2000S/2000X unit uses a lithium battery for backup power.

The battery can backup the unit about five years if the unit is left un-powered. However, this period varies with the temperature and working conditions.

When the battery is consumed, a message of "BACKUP MEMORY LOST" appears on the display when the unit is powered up. The unit starts up with all stored data initialized. Frequent occurrence of this condition indicates that the battery should be replaced. Contact the company or the dealer.

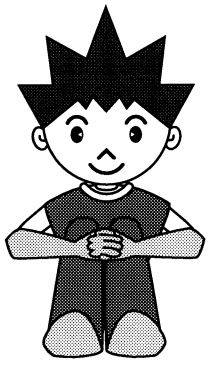
Calibration

If your EPO 2000S/2000X unit is found to be demanding calibration, contact the company or the dealer.

11

Solution of Trouble

■This chapter describes possible causes and measures when the user encounters difficulty in operation of the system.



Fault diagnosis

When the power to the unit is turned on, the unit carries out diagnosis over its parts. If any error is detected on booting, the control stops power energizing to the major internal power sections and displays an error message in order to prevent the trouble from expanding.
The following table describes causes and necessary measures for each message.

Message	Cause	Measures or description
SYSTEM FAIL 001	Corrupt contents of internal ROM (program memory)	The system will not boot up, with the message only displayed. Possibility of failure. Note the message and contact the company or the dealer.
SYSTEM FAIL 002	Errors found in result of operation check of internal RAM	
SYSTEM FAIL 003	No response from control section	
SYSTEM FAIL 004		
SYSTEM FAIL 005	Trouble found in control section	
SYSTEM FAIL 006	Trouble found in signal generation section	
SYSTEM FAIL 007	Wrong connection of system cable, or failure of power energizing to all power sections within 15 seconds.	First turn off all power switches then turn them on again.
BACKUP MEMORY LOST	Data stored in battery-backup memory has been lost.	When the message is displayed, initialize all stored data to the factory settings and boot the system. If this error frequently occurs, backup battery is deteriorated. Contact the company or the dealer because battery replacement is regarded as "repair".
	The first power up after version up of program memory	When the message is displayed, initialize all stored data to the factory settings and boot the system.
PARAMETER CLEAR	Alteration of system cable connection (message is displayed only on master unit)	When the message is displayed, initialize those contents stored by the storage function to the factory settings and boot the system.

Settings retained by backup battery

The table below lists settings that will be stored and maintained by the backup battery even when the power switch is turned off.
If the fault diagnosis function finds any problem, the control erases the data stored in the battery-backup memory and initializes the data to the factory settings according to the table below.

Settings supported by backup battery	Factory setting	Problem found by fault diagnosis		
		Damaged data in memory	Version-updated program memory	Alteration of system cable connection (only master)
Data stored by storage function	(☞5 "Versatile Use - for advanced users -")	To be erased		
Key lock	Off			
Selection of interface	GPIB	To be erased		Not to be erased
GPIB address	2			
GPIB delimiter	CR+LF			
RS-232 transfer rate	9600bps			
RS-232 delimiter	CR+LF			
RS-232 parity	None			
RS-232 stop bit	1bit			
RS-232 character length	8bits			
Beep	On			

Protective functions

These functions monitor the internal condition and they exert protective functions if any error is detected. Two types of protective functions are provided: output restraint and shutoff of power.
1. When the protective operation of output restraint is exerted, the system is protected from overload and [OVER-LOAD] lights up. When overload or other error disappears, the system automatically restored to normal output.
2. In the case of a severe error, the function shuts off the power to internal major power sections to secure safety.
If beep warning is set to ON, the system warns with beep during output restraint and power shutoff period.

Subject of protection	Status under protection			Description
	Message on power shutoff	Output restraint	Power shutoff	
Output current restraint	(Power will not be shut off.)	○		Restrains the output current to a constant level or lower. Particularly, waveform clips when AC output is supplied.
Output power restraint				Restrains the output power to a constant level or lower. Particularly, waveform clips when AC output is supplied.
Power amplifier input voltage error	SYSTEM DOWN FL0201 (last two digits indicate the unit number)	○	○	Turns off the output or shut off the input depending on the degree.
Overcurrent in power amplifier	SYSTEM DOWN FL0301 (last two digits indicate the unit number)	○	○	
Overheated internal heat sink	SYSTEM DOWN FL0601 (last two digits indicate the unit number)	○	○	Shuts off the input.
DC power section inoperative	SYSTEM DOWN FL0101 (last two digits indicate the unit number)		○	Shuts off the input by detecting suspended operation due to blown fuse etc.
No response from unit	SYSTEM DOWN FL0400 (last two digits are always 00)		○	Disconnection arouse inside.

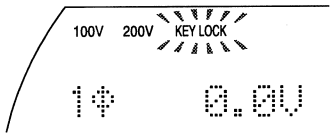
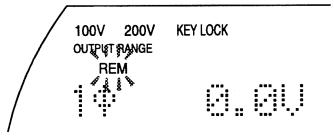
Troubleshooting

If the user experiences a condition that would lead to potential system failure during EPO 2000S/2000X operation, refer to the following section to check for wrong operation, procedure, or connection.
If any of the following descriptions does not apply to the condition, do not turn on the power and contact the company or the dealer.

Phenomenon on power turning on

Phenomenon	Cause or conditions	Measures or description
Will not start any action on power turning on.	Is the power input positively supplied?	Ensure the power input is positively supplied.

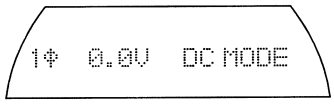
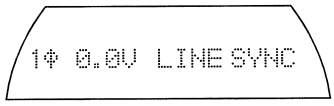
Buttons are inoperable

Phenomenon	Cause or conditions	Measures or description
Almost all buttons do not work.	Is KEYLOCK lighting? 	Turn off key lock. (☞See the section of "Key lock", Chap. 7 "Useful Functions".)
	Is REM lighting? 	If RS-232 is selected for interface, then change it to GPIB. (☞See "Setting for GPIB use", Chap. 8 "GPIB Interface".)
		If GPIB is selected for interface, the keypad of the unit is inoperable when the system is controlled by the PC.

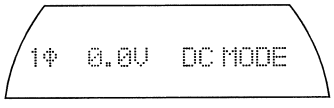
Phenomenon relating to voltage setting

Phenomenon	Cause or conditions	Measures or description
Cannot switch voltage range from 200V to 100V.	If AC output has been selected, is the setting of output voltage higher than the phase voltage of 150V?	Set the voltage to 150V or lower.
	If DC output has been selected, is the setting of output voltage higher than 212V?	Set the voltage to 212V or lower.

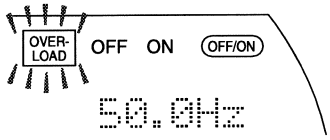
Phenomenon relating to frequency setting

Phenomenon	Cause or conditions	Measures or description
Cannot set frequency.	Is DC output selected? 	Select AC output before going ahead. (☞See "Using the unit as a DC power supply", Chap. 5 "Versatile Use".)
	Is line synchronization enabled? 	Disable line synchronization before going ahead. (☞See "Line synchronization", Chap. 7 "Useful Functions".)

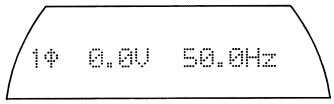
Phenomenon relating to line synchronization

Phenomenon	Cause or conditions	Measures or description
Cannot enable line synchronization.	Is the reset frequency for the line synchronization OFF moment (50 Hz or 60 Hz) out of the range between the upper limit and lower limit to the frequency?	Change the value of upper and/or lower limit frequency. (☞See "Setting limits to output", Chap. 4 "Fundamental Use".)
	Is DC output selected? 	Change to AC output. (☞See "Using the unit as a DC power supply", Chap. 5 "Versatile Use".)

Phenomenon relating to overload

Phenomenon	Cause or conditions	Measures or description
Overload lamp lights up. 	Is the system in overloaded condition?	Check the load and ensure the load is within the rated ranges.
	Was it noticed on an output turning ON occasion?	Lamp lighting for a short time is normal. A rush current triggered the protective function and the output was restrained. However, the measurement of rush current is not correct because waveform clips.

Phenomenon relating to measurement function

Phenomenon	Cause or conditions	Measures or description
L1/L2/L3 ○ does not function.	Is it on EPO 2000S?	This button has no effects on EPO 2000S unit.
	Is single-phase selected for phase-mode? 	This button has no effects in single-phase mode.

Phenomenon relating to storage function and preset

Phenomenon	Cause or conditions	Measures or description
Cannot recall memory.	Is the phase mode being recalled different from the current phase mode on your EPO 2000X unit?	EPO 2000X does not allow recalling an address at which different phase mode is stored.
Pressing (PRESET) does not recall.		

Phenomenon on power turning off

Phenomenon	Cause or conditions	Measures or description
The unit persists operation for a while after turning off the power.	This is normal. Operation automatically stops when the internal voltage has lowered down to a sufficiently safe level.	Do nothing and wait for a while. Operation will stop about five second later.

If a motor is connected as load

Phenomenon	Cause or conditions	Measures or description
When the unit is supplying power to the motor, output occasionally stops by some chance. Or, the power input is unexpectedly shut off.	When the system is providing power to a motor, the rotor generally continues to run by the inertia even after stop of the power supply. At this moment, a reverse voltage is applied to the terminal that has been supplying the power. If the user turns on the output of P-STATION/EPO in this situation, this voltage may flow back to EPO depending on the condition. This may cause abnormal rise of power supply voltage within the EPO unit, and, at worst, resulting in equipment damage. To protect the unit from this, detection of an abnormal rise of internal voltage automatically turns off the output and, depending on the degree, shuts off the input power.	Do not turn on the output when the motor continues turning after turning off the output. Wait until the rotation stops before turning on the output. Take extreme care because the operation is likely to give impact in the EPO unit.

If a transformer is connected as load

Phenomenon	Cause or conditions	Measures or description
Current seems abnormal and saturated in the load of transformer.	Although the output of P-STATION/EPO is controlled by its electronic circuitry to prevent abnormal DC voltage from arising, complete 0V is not achieved due to the limit of control. This small DC voltage excites the core by the force of DC and thus the exciting current of the transformer sometimes presents abnormal level depending on the transformer connected.	The DC offset voltage of EPO is typically ±30mV. When to connect a transformer as load, take into consideration the effects of this value.

Frequently asked questions and answers to them

(Questions)	(Answers and explanation)
Can I superimpose AC on DC?	No, you cannot do that with P-STATION/EPO units. However, you can do it with our P-STATION/series [Q].
I want to perform a test to give quick change of voltage or frequency to the load. What should I do?	You can do it using the storage function. You can change the condition with the output kept ON when recalling the memory if you have stored in memory settings of which a set of three parameters ("output voltage range", "line synchronization" and "AC/DC mode") are the same as the current parameters respectively in advance. * For more complicated tests, it is recommended to use our P-STATION/series [Q].
I want to use the unit around power supply voltage of 100V AC. Is this possible?	It is possible to use the unit in the range of 85 to 132V power supply voltage although there is no stipulation on rating. However, output power is restricted to about 800VA in order to restrain the power supply current to about 15A or lower to ensure safety even if wiring from power outlet is permitted taking into consideration possibility of a common 100V power distribution system.
I need a system of 4 or 6 kVA but do not have to change the connection. Is there any system configuration that is less expensive?	Our product, EPO 2000X, is intended to allow extension between master units. One of major advantages of the unit is to allow capacity augmentation or three-phase configuration through simple system enhancement only on as-necessary basis and, on ordinary occasions, they are used in different places separately for independent use. If your plan is to use your units in a particular intention without modifying connection, then our family products, EPO 4000S (single-phase 4 kVA) and EPO 6000M (multi-phase system 6kVA) are ready for your configuration.

(Questions)	(Answers and explanation)
Our system consists of two EPO 2000X units. Can we operate the system from the operation panel on which "SLAVE" is shown on the display?	You can operate the system from only one unit (the unit whose display does not show "SLAVE") in the system consisting of two or three EPO 2000X units.
Our system consists of two EPO 2000X units. We want to separate the units to use them individually. What will be the contents in memory after separation?	The unit on which "SLAVE" is displayed stores the settings that were used when that unit worked as a single unit. If the unit is powered independently, the original settings will be retrieved for operation. In the master unit, however, the data in memory will be initialized to the factory settings because the change of system configuration is detected. Further, interface related data is not affected by the above alteration and remains unchanged.
We are using the system for three-phase load and our desire is to monitor not only the line-to-line voltage but also line-to-line current. What can we do?	The units do not have a function to display line-to-line current. Only phase current is measured and displayed.

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Rating

■ Rating of EPO 2000S/2000X

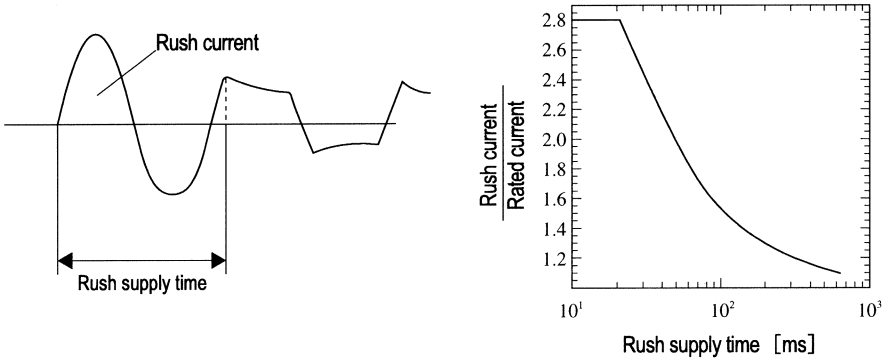
				EPO 2000S	EPO 2000X (allows two or three unit combination)		
					One unit	Two units connected	Three units connected
Output (AC mode)	Capacity			2kVA	2kVA	4kVA	6kVA
	Phase mode correspondence			Single-phase		Single-phase or single-phase three-wire	Single-phase or three-phase
	Voltage setting range *1		100V range	0V～150.0V		Phase voltage: 0 to 150.0V Line-to-line voltage: 0 to 300.0V	Line-to-line voltage: 0 to 259.8V
			200V range	0V～300.0V		Phase voltage: 0 to 300.0V Line-to-line voltage: 0 to 600.0V	Line-to-line voltage: 0 to 519.6V
	Maximum current *2	Single-phase	100V range	20A		40A	60A
			200V range	10A		20A	30A
		Single-phase three-wire *3	100V range	—		20A	—
			200V range			10A	
		Three-phase *3	100V range	—			20A
			200V range				10A
	Maximum rush current (RMS in short time)			2.8 times the maximum current (RMS)			
	Maximum peak current (peak value) *4			4 times the maximum current (RMS)			
	Power factor of load			0 to 1 (leading or lagging phase)			
	Distortion factor			0.5% or less			
	Starting phase on output turn-ON			Either of 0, 90, 180 and 270 degree by selection			
	Frequency			Setting range: 5.0 to 550.0Hz (resolution 0.1Hz) Setting accuracy: within ±0.01% of the setting ; Stability: within ±0.005% of the setting			
	Line synchronization			Supplies AC output synchronized to power line frequency			
Output (DC mode) *5	Voltage setting range		100V range	0 to 212.0V (resolution of 0.1V)			
			200V range	0 to 424.0V (resolution of 0.1V)			
	Maximum current		100V range	9A		18A	27A
			200V range	4.5A		9A	13.5A
	Maximum output power			1.3kW		2.6kW	3.9kW
Output voltage stability	Current fluctuation to load			40.0 to 120.0Hz: within ±0.1%, 120.1 to 500.0Hz: within ±0.5% (typ)			
	Input voltage fluctuation to power supply			within ±0.2%			
	Fluctuation to ambient temperature			within ±100ppm/°C (typ)			
Input	Voltage and frequency			170 to 250V *6, 48 to 62 Hz			
	Number of phases			Single-phase			
	Efficiency and power factor			Efficiency 76% or higher (typ), power factor 97% or higher (typ) with input voltage of 200V			
	Input current *7			14A or less		14A or less (per unit)	
	Power consumption			2.8 kVA or less		5.6 kVA or less	8.4 KVA or less
Function	Measuring function *8	AC mode *9	Voltage	RMS : 170V/340V range (self switching), resolution 0.1V, accuracy within ±1% FS Peak : 240V/480V range (self switching), resolution 0.1V, accuracy within ±3%			
			Current	RMS: 14A/78A/70A range (self switching), resolution 0.01A, accuracy within ±1% FS Peak: 20A/40A/100A/200A/400A range (self switching), resolution 0.01A (0.1 A for 200 A/400 A), accuracy within ±3% FS			
			Effective power	2.2 kW/22 kW range, resolution 0.01 kW (at 2.2 kW)/0.1 kW (at 22 kW), accuracy within ±3% FS			
			Apparent power and power factor	Calculated from voltage, current and effective power measurements and displayed			
			Peak current holding function	20A/40A/100A/200A/400A range, resolution 0.01A (0.1A for 200A/400A), accuracy within ±5% FS			
		DC mode	Voltage	Mean value: 240V/480V range (self switching), resolution 0.1V, accuracy within ±1% FS			
			Current	Mean value: 20A/40A/100A/200A/400A range (self switching), resolution 0.01A (0.1A for 200A/400A), accuracy within ±1% FS			
			Power	Calculated from voltage and current measurements and displayed			
	Others			Fault diagnosis function, protective function, storage function, preset function limiter function, GPIB/RS-232 interface, external keypad entry, key lock function, beep warning			
Environment, mass etc.	Withstand voltage *10			1.5 kV AC, 50/60 Hz for one minute			
	Insulation resistance (at 500V DC) *10			10MΩ or higher		5MΩ or higher	3.3MΩ or higher
	Ambient temperature and humidity			Operation: 0 to 40°C; Storage: -10 to 50°C, 10 to 90% RH (no condensation)			
	Mass *11			25kg		25kg(per unit)	
	Dimensions			448W × 176 (191) H × 651 (685) D (per unit) * Units in mm; values in parentheses include projections			

Rush current versus supply time

* Vo = 100.0V (100V range) or 200.0V (200V range), f = 50Hz, at Power-ON phase 0°

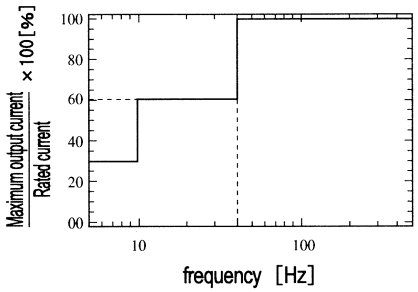
This indicates the time (rush supply time) spent until the output is restrained by the protective circuit operation when rush current is applied to a resistance load.

Rated current = 20A (100V range), 10A (200V range)



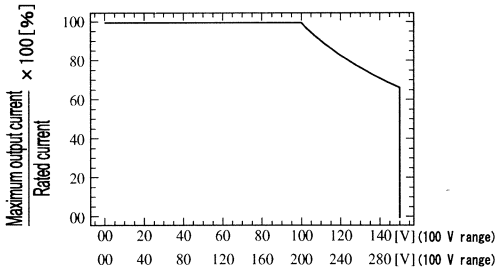
Maximum output current versus frequency

* Maximum current decreases at frequency lower than 40Hz.



Maximum output current versus output voltage (AC mode)

* Maximum current decreases at voltage higher than 100.0V (for 100V range) or 200.0V (for 200V range).



Remarks: [A] means [Arms], [V] means [Vrms] unless any other special description is given. Signal waveform is a sinusoidal wave.

*1 Setting resolution is 0.1V for phase voltage and 0.2V for line-to-line voltage.

*2 With sinusoidal wave. Output current decreases if output frequency is 40 Hz or lower.

*3 With phase current.

*4 A short period until mean value protection operates. However, repeated application is allowed to capacitor input type rectifying load (at 48 to 62 Hz).

*5 DC mode cannot be used in single-phase three-wire or three-phase system.

*6 EPO 2000S and EPO 2000X units are operable at 100V although the output is limited to 800 VA.

*7 At input voltage of 200V.

*8 Measurement accuracy is for full scale (FS) of each measurement range.

*9 Effective measurement range of voltage and current is 40 to 500 Hz.

Effective measurement range of effective power is 45 to 65 Hz.

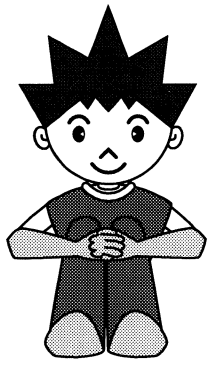
*10 Stipulated with chassis - power supply input in package versus output, chassis - output in package versus power supply input.

*11 Accessories and optional items are excluded.

13

Terminology

■ In this chapter, I will try to elucidate terms related to AC power supply.



Elucidation of terms

■AC power supply/AC stabilizing power supply

When electricity is transferred through power transmission lines from power stations of power companies via substations to power switchboards and wall outlets to provide power, the value and waveform of voltage are deformed by effects of impedance of the supplying wires and loads.

To solve the above problem, we have some means to stabilize the power at the reception end. Conventionally used solutions include devices that use saturable reactors and method that controls slide regulators by servo, which had such remarkable defects that response speed is slow and waveform is not improved yet. To replace these methods, various devices that use electronic circuitry have been proposed recently.

Among others, our P-STATION/EPO employs a power amplifier system and provides AC voltage of low distortion and high stability by means of incorporated signal generator.

■Higher harmonic current

Household appliances and industrial applications often use switching power sources. A capacitor input rectifying circuit, which is used in their power input section has a drawback that the input current is greatly distorted and deformed so that it contains a number of harmonics.

If high volume of such current flows into power lines, the voltage will be distorted so that other equipment malfunctions, transformers are overheated and other problems are caused, possibly resulting in accidents.

P-STATION/EPO, which adopts a circuit to effectively restrain this harmonic current, controls the level of harmonics down to almost the regulatory value and, at the same time, markedly improves the power factor (about 97%, typ).

■Immunity to power supply harmonic components

The product has immunity to harmonic components contained in power supply so that the output will not be affected by them even when harmonic components are contained in the power supply voltage due to harmonic current generated by other electric equipment.

■Rush current (or inrush current)

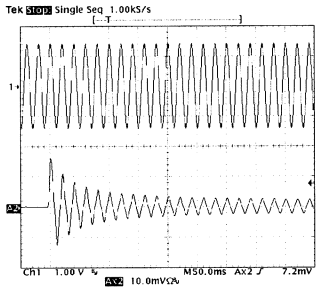
In motors and other electrical products that use capacitor input rectifying circuit in the power input section, a considerably high current flows in a short time immediately after turning on the power switch compared to the rating condition. This current is called a rush current.

If the power supply cannot afford to provide this current sufficiently, some products, without getting necessary power, may not be started depending on the condition.

If this high current runs, the impedance of the power supply line causes a voltage drop so that the supply voltage may be lowered. Therefore, we have a certain regulation that limits this effect to a constant level or lower. This test, however, must be performed with a power supply that has a sufficient rush supplying capacity.

To support such forms of application, our P-STATION/EPO series have ability to provide rush current that is 2.8 times the rated current. Users do not have to furnish their facilities with another power supply of excessive capacity to provide rush current.

* Example of rush current
  Power drill
  (rated to 100V AC 260W)
  Top: voltage (100V/div)
  Bottom: rush current (10A/div)



Even in a small power drill, a 15 Apk (about 10 Arms) rush current flows just after power charging. This rush current is four times the rated current of 2.6 Arms.

■Capacitor input load

Most of switching power supply units used in different equipment adopt an input rectifying circuit of capacitor input type because of the simplicity and low-cost of the circuit. Input current to the equipment in this configuration has such waveform that the current flows only around the peak value of the given sinusoidal voltage. This waveform contains many harmonic components and the ratio of peak value to RMS value (Crest Factor, CF value) is as high as 1.5 to 2 times that of resistance or other linear loads (CF = 1.41)

To supply low-distortion voltage to these loads, therefore, deliberate measures have been taken in P-STATION/EPO so that current of CF = 4 will be supplied at the maximum (for output capacity 2 kVA in precision mode).

■Output stability (output voltage stability)

Various types of performance are required in power supply. Among them, particular one is the resistance to the effects of load fluctuation and power input voltage fluctuation. This characteristic is called "Output stability".

●Current fluctuation versus load change

This means the fluctuation of output voltage due to the change of load condition. In general, the ratio of the voltage change in a load-connected condition against the voltage in a no-load condition (no load connected) is expressed in [%].

●Input fluctuation versus power supply change

This means the fluctuation of output voltage caused by the change of power input voltage. In P-STATION/EPO, the ratio of the output voltage change (at rated output) against input voltage variance (170 to 250V) is expressed in [%], which is stipulated as the rating.

●Fluctuation versus ambient temperature change

This means the fluctuation of output voltage against the change of ambient temperature.

■Tolerance to instantaneous power interruption and fluctuation of power supply voltage

In general commercial power supply lines, power companies provide power environments of a constant quality. Even if an unexpected natural disaster such as lightning takes place and causes trouble in power transmission lines, they change lines in a second in order to minimize the influence of power failure.

However, in this short period of time to be spent for the line change, the power supply voltage becomes 0 (this is called an instantaneous power interruption), or lowers to an abnormal level. Those electrical products that are not able to endure this interruption cannot continue proper operation.

Our P-STATION/EPO units have sufficient tolerance ability against these phenomena even in a relatively poor power environment, and they can minimize the impact in the output.

■Stability to capacitive load

If your AC power source is of power amplifier type, such as P-STATION/EPO, it provides feedback via an electronic circuit to compensate the fluctuation in output voltage due to load variances. However, if a capacitive load of extremely high level is connected, stability may be broken, causing oscillation and other abnormal phenomena.

Therefore, our P-STATION/EPO is provided with a consideration so that users can select the compensation mode to cope with the trouble in the above situation. The tolerance against capacitive load is about 10 μF in "Precision mode" to ensure high accuracy while "High stability mode" allows the user to connect a load of maximum 150 μF to secure stability.

■Application to RF anechoic chamber

An RF anechoic chamber (or a shielded room), which is a facility to measure unnecessary radio noise produced from various electronic devices and verify the legitimacy of the device to EMC standards, is required to have an extremely low noise environment so that the detection and measurement of electromagnetic wave emitted from the subject device will not be affected by noise.

Therefore, a noise filter with particularly high restraining effects is used in the power input section of the anechoic chamber. However, in general, operation may become unstable under conditions of the capacity being several tens μF or higher capacitance, with the power supply unit of power amplifier type providing only insufficient compensation.

In high stability mode, even in the above situation, our P-STATION/EPO will ensure high stability, which does not prevent selection of filter.

■ Effective power and apparent power

Assuming that an AC power supply is providing power to the load, let the load current as I_L and voltage as V_L (here both I_L and V_L are RMS) and calculate the product ($|I_L|$ $|V_L|$) of absolute values of the both by multiplication. This is called apparent power and is expressed in [VA].

Thus, the following term out of the power provided from the power supply :

$$\frac{1}{T}\int_0^T i_L v_L \, dt$$

(i_L v_L : instantaneous value)

is called effective power and is expressed in [W].

The ratio of these two values ([W]/[VA]) is called power factor.

In other word, it is considered that apparent power is the power that the AC power supply is going to provide, effective power is the power utilized as certain energy in the load, and power factor is the rate of the used power out of the supplied power in the load.

P-STATION/EPO determines these values by calculation, similar to the above, from the instantaneous value of detected voltage and current.

■RMS value and peak value

To express the magnitude of voltage, for example, we have several forms of expression available in the case of AC voltage.

Most common one is RMS value. This expresses the magnitude with the DC voltage that exerts the same work. A common expression of "100V AC" means an AC current that has an RMS value of 100V. To indicate that the value is in RMS, notation of 100 [Vrms] is used.

A peak value is the voltage at the instant at which the voltage is the highest in the course of waveform. Notation of [Vpk] is used to express this.

Also for AC current, RMS values in [Arms] and peak values in [Apk] are used similarly to AC voltage.

WARRANTY

NF CORPORATION certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from our factory.

All ***NF*** products are warranted against defects in materials and workmanship for a period of one year from the date shipment. During the warranty period of, ***NF*** will, at its option, either will repair the defective product without any charge for the parts and labor, or either repair or replace products which prove to be defective. For repair service under warranty, the product must be returned to a service center designated by ***NF***. Purchaser shall be prepay shipping charge, duties, and taxes for the product to ***NF*** from another country, and ***NF*** shall pay shipping charge to returned the product to purchaser.

This warranty shall not apply to any defect, failure or damage caused by improper use, improper or inadequate maintenance and care or modified by purchaser or personnel other than ***NF*** representatives.

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EPO 2000S/EPO 2000X Instruction Manual

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