

PM 2800 Family Programmable Power Supplies

Technical Data

Fluke Programmable Power Supplies meet the need of system builders and stand alone bench-top use. These supplies are compact, taking up only two engineering units of high. The front panel provides full access to all instrument functions, including voltage and current readback. An extensive set of protection features has been included to protect your Load or Device Under Test. Internal memory store 999 voltage and current settings. The linear series can both source and sink current. Because the sink level is programmable, the power supply can act as an electronic load.



- Autoranging for maximum versatility with V & I
- Linear Power Supplies with superior response time and noise performance programming and current source and sink capabilities
- Single, dual and triple output versions
- Rear panel outputs or front panel output option
- Only 2HE high 19" rack-mount versions
- Internal memory with 999 locations and (AUTO)STEP function allows definition of test patterns with no need for PC
- Operating modes:
 - As voltage source (Constant Voltage supply)
 - As current source (Constant Current supply)
- Easy system integration
- GPIB/IEEE-488.2 interface standard
- Extensive DUT (Device Under Test) protection functions:
- Programmable Over-Voltage and Over-Current protection
- Built-in metering (Readback) of actual measured V and I values
- Sense lines
- Coupled Protection, all outputs are limited or turned off when an error in any output occurs
- Reprogramming delay allows controlled brief overloads
- User-definable status register for error reporting

Versatile power

Fluke now offers two types of power modules :

- **Autoranging** power modules for superior voltage and current versatility. The PM 2811, PM 2812 and PM 2813 offer autoranging in 60 W and 120 W, up to 180 W per mainframe.
- **Linear power** modules with superior response time and noise performance. The PM 2831 and PM 2832 offer linear power modules from 120 W, up to 240 W per mainframe.

The PM 2800 series are built around a choice of 6 output power modules:

- 30 V, 10 A, 60 W autoranging
- 60 V, 5 A, 60 W autoranging
- 60 V, 10 A, 120 W autoranging
- 8 V, \pm 15 A, 120 W linear
- 60 V, \pm 2 A, 120 W linear
- 120 V, \pm 1 A, 120 W linear

Because of their modularity, these power supplies are available in a number of configurations, including single-, dual- and triple output versions with various combinations of power modules. Each output is independently programmable and isolated from other outputs. In total there are 36 models to choose from. See the back page for more detailed configuration and ordering information.

Reliability by design

Reliability of power supplies is of extreme importance. The PM 2800 family of programmable power supplies, with their extensive internal self-monitoring device protection features and generous cooling, are designed for years of trouble-free service.

Simple operation

Front panel operation is easy. Just set-up the desired voltage, current and protection levels, and press the Operate/Standby key to enable the power at the output terminals. Each front-panel key has only a single function, with the exception of the auxiliary (AUX) key which is used for system information such as GPIB address, display intensity, calibration mode etc.

Versatile programming

Each model is equipped with a GPIB/IEEE488.2 interface which supports the Standard Commands for Programmable Instruments (SCPI).

```
:VOLT12.34
:MEAS:VOLT?
:MEAS:CURR?
```

SCPI provides a common command set across a wide range of test and measurement instruments. By conforming to this industry standard in programming, the task of creating and supporting GPIB application programs is made easier.

Extensive protection features

An extensive set of protection features has been included to protect your load or Device Under Test. Voltage and current are constantly monitored by a separate readback circuit. This readback circuit has its own sense lines to compensate for voltage drops in the power distribution

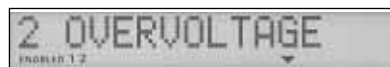
lines. The load is protected in case of an open sense line.

Pressing the Operate/Standby key removes all power from the outputs immediately. The voltage and current values can be set up in standby mode before applying power to the Device Under Test. Over-Voltage Protection (OVP) and Over-Current Protection (OCP) are both user-programmable. When a voltage or current limit is reached, power is removed from the outputs instantly.

The power supply's internal temperature is continuously monitored. If the temperature rises excessively, over-temperature protection shuts down the output power fast.

The protection mode has a programmable delay that allows it to ignore short-term overloads such as power-up current surges for intervals of up to 60 seconds. For dual- and triple-output power models, the Coupled Protection mode ensures that all outputs shut down simultaneously when a fault is detected in one output. This is an important feature for applications requiring positive and negative balanced voltages such as an operational amplifier.

When a fault such as Over-Voltage or Over-Current occurs, the power supply can generate a GPIB service request (SRQ). The faults that generate the interrupt are user-selectable by setting SRQ mask bits either remotely or from the front panel. Fault conditions are clearly displayed on the front panel.

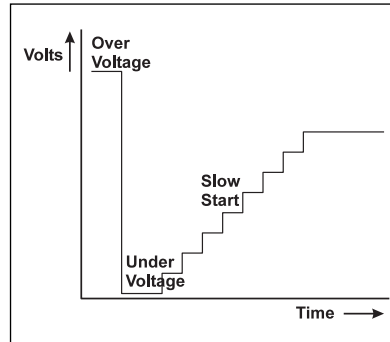


Voltage source or current source

The power supply can act either as voltage source or as current source, depending on the load conditions and the selected values of Vset (voltage setting) and Iset

(current setting).

Internal Memory and Autostep Up to 999 settings can per output be stored and recalled from the internal memory of the power supply.



The voltage and current settings of all outputs are stored in a non-volatile memory with battery back-up. The last instrument settings are automatically stored on power-down.

External trigger lines

The power supplies are equipped with external trigger lines which can be used to recall voltage and current settings from the internal memory. This allows accurate synchronization with other equipment, and results in less GPIB bus traffic.

(AUTO)STEP function

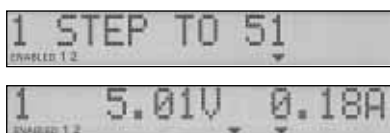
The STEP function allows the voltage and current settings stored in the internal memory to be recalled successively, and to be activated if the supply is in Operate mode, by pressing a single key. The following setting is recalled and activated each time the STEP key is pressed. This function allows the user to create test patterns (complete with repetitive loops). Test patterns can be executed automatically using the AUTOSTEP mode, without the need for a PC. The time between two successive recalls can be defined by the user (min. 0.01s, max. 60 s).

Coupled Parameters

The power supplies can be set up to deliver maximum power to your load by automatically adjusting the voltage and current settings. For example, a resistive load is connected to your power supply with 6 V and 10 A; a total of 60 W power. If the voltage were increased to 7 V, the current would have to be readjusted manually to 8.6 A to continue getting 60 W delivered to your load in normal mode. Using coupled parameters mode, the current setting is adjusted automatically to 8.6 A by the power supply to get the full 60 W.

Parameter display

Each power supply has a 16-character frontpanel display with a 5x7 dot character matrix, using super twisted LCD technology. The display allows presentation of alphanumeric data and is backlit for easy readout.



Easy calibration

The power supply does not need to be removed from a rack or system for calibration. All you need is a calibrated multimeter. Access to the power supply calibration mode is protected with a user-programmable password.

Fit for many applications

The PM 2800 family offers convenient, single-box solutions for a wide range of applications. Programmable Power Supplies are an essential requirement for many test & measurement applications. During the test process the Device Under test (DUT) must be powered. In many cases it is necessary to test the effects of power variations on operation, for example with

battery-powered equipment. These effects can be simulated using a PM 2800 series Programmable Power Supply.

The PM 2800 family is ideal for automated test systems. On the production line, their extensive programming and device protection features provide dependable performance. Triple output units

only 2HE (Engineering Heights) 19 inch rack-mount, provide compact system building.

General Specifications

Safety

According to CE-regulation 73/23 EN61010-1 CAT II, Pollution Degree 2.
UL 3111.1 (no approval) CSA-C22.2, No. 1010-1 (including approval)
For 300 V CAT II, Pollution Degree 2

EMC

Emission EN 50081-1
Susceptibility EN 50082-1

Supplemental Characteristics

Isolation: 240 V above ground

Power Requirements

Line Voltage 115 V ac ± 10 % ; 230 Vac ± 10 %
Line Frequency 50 or 60 Hz

Power Consumption (at maximum load)

PM 2811 1.4 A/110 V, 0.8 A/220 V
PM 2812 2.6 A/110 V, 1.4 A/220 V
PM 2813 3.7 A/ 110 V, 2.0 A/220 V
PM 2831 2.4 A/115 V, 1.2 A/230 V
PM 2832 4.8 A/115 V, 2.4 A/230 V

Environmental Data

MIL-T-28800D, Type III, Class 5, Style E
Operating Temp. 0 °C to 50 °C
Storage Temp. -20 °C to +70 °C

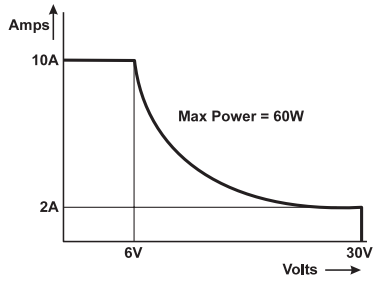
Mechanical Data

Height: (excl., feet): 87 mm (3.43 in) Feet: 18 mm (0.71 in)
Width: For PM 2811 210 mm (8.27 in);
For PM 2812, PM 2813, PM 2831 and PM 2832 420 mm (16.54 in)
Depth: 381 mm (15.0 in)
Weight: For PM 2811: 5.5 kg (12lb);
For PM 2812 and PM 2813: 9.5 kg (21lb)
For PM 2831 10 kg (22lb)
For PM 2832 14 kg (31lb)

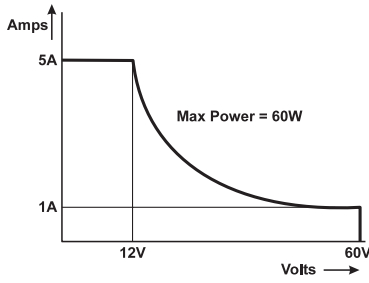
Output Module Specifications

Autoranging Power Supplies PM2811, PM2812 and PM2813

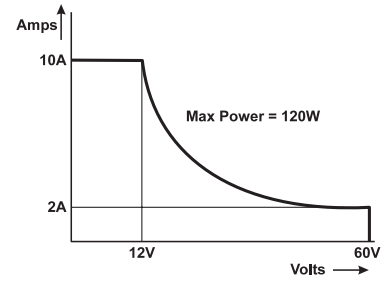
OUTPUT module	30 V - 10 A - 60 W	60 V - 5 A - 60 W	60 V - 10 A - 120 W
Output Voltage range	0 to 30 V	0 to 60 V	0 to 60 V
Output Current range	0 to 10 A	0 to 5 A	0 to 10 A
Output Power	60 W	60 W	120 W
Overvoltage protection range	2 to 32 V	2 to 62 V	2 to 62 V
Accuracy	(at calibration temperature)	(at calibration temperature)	(at calibration temperature)
Output Voltage	± (0.04 % of setting + 10 mV)	± (0.04 % of setting + 20 mV)	± (0.04 % of setting + 20 mV)
Output Current	± (0.1 % of setting + 50 mA)	± (0.1 % of setting + 25 mA)	± (0.1 % of setting + 50 mA)
Over Voltage Protection	± (0.5 % of setting + 150 mV)	± (0.5 % of setting + 250 mV)	± (0.5 % of setting + 250 mV)
Temperature coefficient			
Output Voltage	(0.016 % of setting + 2 mV)/K	(0.016 % of setting + 2 mV)/K	± 0.016 % of setting + 2 mV)/K
Output Current	(0.05 % of setting + 2 mA)/K	(0.05 % of setting + 2 mA)/K	± 0.05 % of setting + 2 mA)/K
Long term drift	(in an 8 hour period)	(in an 8 hour period)	(in an 8 hour period)
Output Voltage	0.04 % of setting + 5 mV	0.04 % of setting + 5 mV	0.04 % of setting + 5 mV
Output Current	0.05 % of setting + 10 mA	0.05 % of setting + 10 mA	0.05 % of setting + 10 mA
Programming Resolution	(12bit)		
Output Voltage	7.5 mV/LSB	15 mV/LSB	15 mV/LSB
Output Current	2.5 mA/LSB	1.25 mA/LSB	2.5 mA/LSB
Over Voltage Protection	7.5 mV/LSB	15 mV/LSB	15 mV/LSB
Source Effect	(for any line voltage change within rating)		
Voltage	± (0.01 % of setting + 2 mV)	± (0.01 % of setting + 2 mV)	± (0.01 % of setting + 2 mV)
Current	± (0.02 % of setting + 2 mA)	± (0.02 % of setting + 2 mA)	± (0.02 % of setting + 2 mA)
Load Effect	(load change 10 % to 90 % or 90 % to 10 % full load)	(load change 10 % to 90 % or 90 % to 10 % full load)	(load change 10 % to 90 % or 90 % to 10 % full load)
Constant Voltage	± (0.01 % of setting + 5 mV)	± (0.01 % of setting + 5 mV)	± (0.01 % of setting + 5 mV)
Constant Current	± (0.02 % of setting + 5 mA)	± (0.02 % of setting + 5 mA)	± (0.02 % of setting + 5 mA)
Load cross regulation	Negligible for both voltage and current		
Output Noise (PARD)			
Constant Voltage pp/rms (40 Hz to 30 MHz)	15 mV/3 mV	30 mV/6 mV	30 mV/6 mV
Constant Current rms	10 mA	10 mA	10 mA
Switching Frequency	approx. 20 kHz	approx. 20 kHz	approx. 20 kHz



Autorangeing Curve for 30 V/10 A/60 W Power Module



Autorangeing Curve for 60 V/5 A/60 W Power Module



Autorangeing Curve for 60 V/10 A/120 W Power Module

READBACK ACCURACY (referred to the output terminals)	30 V - 10 A - 60 W	60 V - 5 A - 60 W	60 V - 10 A - 120 W
Accuracy	(at calibration temperature)		
Voltage	± (0.05 % + 25 mV)	± (0.05 % + 50 mV)	± (0.06 % + 30 mV)
Current	± (0.1 % + 30 mA)	± (0.1 % + 15 mA)	± (0.2 % + 50 mA)
Measuring Resolution	(12 bit)		
Voltage resolution to interface	7.5 mV	15 mV	15 mV
Current resolution to interface	2.5 mA	1.25 mA	1.25 mA
Voltage resolution to display	10 mV	10 mV	10 mV
Current resolution to display	10 mA	10 mA	10 mA
Max. Current at Reverse voltage	10 A	5 A	10 A
REMOTE SENSE	> 0.25 Volt drop per lead (at open sense connections, the output voltage will not be more than 3 V above the programmed value)		
DYNAMIC OPERATION	ΔI=1 A between 1 and 10 A	ΔI=0.5 A between 0.5 and 5 A	ΔI=0.5 A between 1 and 10 A
Settling band	± 50 mV	± 50 mV	± 50 mV
dI/dt	< 1 A/μs	< 0.5 A/μs	< 1 A/μs
Overshoot	< 150 mV	< 150 mV	< 150 mV
Recovery time	< 1 ms	< 2 ms	< 2 ms
Programming response	(measured with resistive load)		
Up (0 V to max. output)	100 ms @ 2 A	200 ms @ 1 A	200 ms @ 2 A
Up (0 V to max. output)	50 ms @ (no load)	100 ms @ (no load)	100 ms @ (no load)
Down(max. output to 1 V)	100 ms @ 2 A	200 ms @ 1 A	200 ms @ 2 A
Down (max. output to 1 V)	50 ms @ (no load)	500 ms @ (no load)	500 ms @ (no load)
Reprogramming delay			
Range	50 ms to 60 s	100 ms to 60 s	100 ms to 60 s
Resolution	1 ms	1 ms	1 ms
Default	50 ms	100 ms	100 ms
Step Interval time	up to 60 s	up to 60 s	up to 60 s

Output Module Specifications

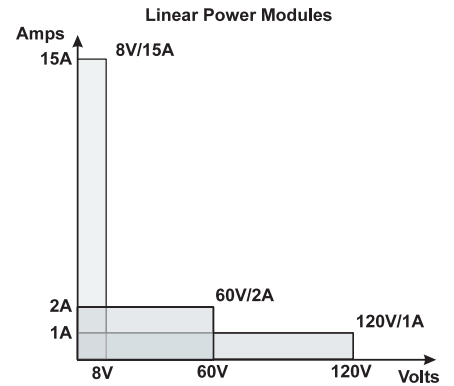
Linear Power Supplies PM2831 and PM2832

Output Module	8 V - 15 A - 120 W	60 V - 2 A - 120 W	120 V - 1 A - 120 W
Ranges			
Output Voltage range	0 to 8 V	0 to 60 V	0 to 120 V
Output Current range	-15 A to + 15 A	-2 A to + 2 A	-1 A to + 1 A
Input / Output Power	120 W	120 W	120 W
Overvoltage protection range	0 to 10 V	0 to 62 V	0 to 122 V
Minimum output voltage at maximum sink current	1.0 V at -15 A	1.5 V at -2 A	1.5 V at -1 A
Accuracy	(at calibration temperature)		
Output Voltage	± (0.04 % + 4 mV)	± (0.04 % + 15 mV)	± (0.04 % + 30 mV)
Output Current (+ and -)	± (0.24 % + 8 mA)	± (0.04 % + 0.5 mA)	± (0.04 % + 0.25 mA)
Over Voltage Protection	± (0.04 % + 4 mV)	± (0.04 % + 15 mV)	± (0.04 % + 30 mV)
Temperature coefficient			
Output Voltage	0.01 % /K	0.01 % /K	0.01 % /K
Output Current	0.01 % /K	0.01 % /K	0.01 % /K
Long term drift (8 hour period)			
Voltage	0.02 %	0.02 %	0.02 %
Current	0.02 %	0.02 %	0.02 %
Programming Resolution	(12 bit)		
Voltage	2 mV	15 mV	30 mV
Current	3.75 mA	0.5 mA	0.25 mA
OVP	2.5 mV	15.5 mV	30 mV
Source Effect	(for any line voltage change within rating)		
Voltage	1 mV	2 mV	2 mV
Current	4 mA	1 mA	0.5 mA
Load Effect	(load change 10 % to 90 % or 90 % to 10 % full load)	(load change 10 % to 90 % or 90 % to 10 % full load)	(load change 10 % to 90 % or 90 % to 10 % full load)
Constant Voltage	1 mV	2 mV	2 mV
Constant Current	4 mA	1 mA	0.5 mA
Load cross regulation	Negligible for both voltage and current		
Output Noise (PARD)	(40 Hz..20 MHz)		
Constant Voltage (pp/rms)	4 mV/1 mV	6 mV/1 mV	6 mV/1 mV
Constant Current (rms)	15 mA	2 mA	2 mA

PM 2831/32 Linear Series Power Supplies

- **Single and dual output modules**
- **Low ripple and noise**
- **Fast up and down programming**
- **Current source and sink capabilities**

The PM 2830 series can sink as well as source current. Because the current sink level is programmable, the power supply can act as an electronic load.



Output Module	8 V - 15 A - 120 W	60 V - 2 A - 120 W	120 V - 1 A - 120 W
READBACK Accuracy	(referred to output terminals)(at calibration temperature)		
Voltage	0.05 % + 4 mV	0.05 % + 15 mV	0.05 % + 30 mV
Current (+ and -)	0.05 % + 8 mA	0.05 % + 1 mA	0.05 % + 0.5 mA
RESOLUTION to interface	(12 bit)		
Voltage	2 mV	15 mV	30 mV
Current	3.75 mA	0.5 mA	0.25 mA
RESOLUTION to display	(12 bit)		
Voltage	1 mV	10 mV	10 mV
Current	1 mA/10 mA	1 mA	1 mA
REMOTE SENSE	>1 V/Lead		
Maximum allowable voltage drop per lead	2 V if $V_{set} \leq 4 V$ (8 V - V_{set})/2 if $V_{set} > 4 V$	1 V	1 V
Output voltage above programmed voltage when sense is open	$\leq 2 V$	$\leq 1 V$	$\leq 1 V$
DYNAMIC OPERATION			
Load transition (@ $di/dt = 5 A/\mu s$)	I = 3.75 A to 1.5 A	I = 0.5 A to 1.5 A	I = 0.25 A to 0.75 A
Settling band (0.1 % of range)	8 mV	60 mV	120 mV
Overshoot	100 mV	100 mV	100 mV
Recovery time	100 μs	100 μs	100 μs
Programming response	(Maximum Rise and Fall times for the output to change from 10 % to 90 % or 90 % to 10 % of its total excursion)		
T_{rise}/T_{fall} no load	500 μs	500 μs	500 μs
T_{rise}/T_{fall} with load (50 %)	1 ms @ load 7.5 A	1 ms @ load 1 A	1 ms @ load 0.5 A
Source/sink switching time			
Source to sink	1 ms	1 ms	1 ms
Sink to source	1 ms	1 ms	1 ms
Source to sink level	0.6 V	0.6 V	0.6 V
Hysteresis	150 mV	150 mV	150 mV
Reprogramming delay			
Range	0 ms to 60 s	0 ms to 60 s	0 ms to 60 s
Resolution	1 ms	1 ms	1 ms
Default	1 ms	1 ms	1 ms

Ordering information

PM 2811/12/13 Autoranging Series Programmable Power Supplies

- Single, dual and triple output versions
- 60 W, 120 W Power Output Options
- Autoranging for maximum versatility with V & I
- Front & Rear Panel Outputs

Front Rear	PM 2811/_5_ PM 2811/_1_	30 V 10 A 60 W	60 V 5 A 60 W	60 V 10 A 120 W
Single	PM 2811/0_n	1	-	-
	PM 2811/1_n	-	1	-
Dual	PM 2812/0_n	2	-	-
	PM 2812/1_n	-	2	-
	PM 2812/2_n	1	1	-
	PM 2812/3_n	1	-	1
	PM 2812/4_n	-	1	1
Triple	PM 2813/0_n	3	-	-
	PM 2813/1_n	-	3	-
	PM 2813/2_n	2	1	-
	PM 2813/3_n	1	2	-

PM 2831/32 Linear Series Power Supplies

- Single and dual output modules
- Low ripple and noise
- Fast up and down programming
- Current source and sink capabilities

Front Rear	PM 2831/_5_ PM 2831/_1_	8 V ±15 A 120 W	60 V ±2 A 120 W	120 V ±1 A 120 W
Single	PM 2831/0_n	-	1	-
	PM 2831/1_n	-	-	1
	PM 2831/2_n	1	-	-
Dual	PM 2832/0_n	-	2	-
	PM 2832/1_n	-	-	2
	PM 2832/2_n	-	1	1
	PM 2832/3_n	2	-	-

PM 28xx/_ _ n Country version

- 1** Universal Euro 220 V/16 A, 50 Hz
- 3** Standard North American 120 V/15 A, 60 Hz
- 4** UK 240 V/13 A, 50 Hz
- 5** Switzerland 220 V/16 A, 50 Hz
- 8** Australia 240 V/10 A, 50 Hz

Included with instrument

Operator's manual and line cord
Rackmount ears for PM 2812, PM 2813, PM 2831, PM2832

Accessories

PM 9280/004 Rack Mount Kit for PM 2811

Front Panel Output Connectors

Available for any power supply in the PM 2800 family and must be ordered factory installed only. The part number of each power supply ordered with front panel outputs is as follows: PM 28xx/x5x

Example

PM 2813/053 Triple Output, 30 V /10 A /60 W with front panel connectors, US version.

Fluke Corporation

P.O. Box 9090, Everett, WA 98206

Fluke Europe B.V.

P.O. Box 1186,
5602 BD Eindhoven,
The Netherlands

For more information call:

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or Fax: (425) 356-5116

In Europe/M-East:

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