

**MEMS Testing Power Supply
User Manual
Team 02**



**November 2023
Version <2.0>**

MEMS Testing Power Supply	Version: 1.0
User Manual	Date: 23/10/2023

Revision History

Date	Version	Description	Author
14/10/2023	1.0	Template created	AC
14/10/2023	1.1	Introduction section added 4x4 Matrix Keypad section added Main Page section added Updating Parameters section added Error Message and causes added	AC
21/10/2023	1.3	Safety Consideration added Ethical Standards added Editing & Confirming a Value added System Overview added Maintenance added	JZ
23/10/2023	2.0	Issued for Use	LB

MEMS Testing Power Supply	Version: 1.0
User Manual	Date: 23/10/2023

Table of Contents

1. Introduction	4
2. System Overview	4
3. Safety	4
4. System Functions	5
4.1 4x4 Matrix Keypad	5
4.2 Main Page	6
4.3 Updating Parameters	6
4.4 Editing a Value	6
4.5 Confirming an Edit	6
4.6 LEDs	7
5. Error Messages and Causes	7
5.1 Voltage Increments	7
5.2 Voltage Range	8
5.3 Signal Frequency Increments	8
5.4 Signal Frequency Range	9
5.5 Modulation Frequency Increments	9
5.6 Modulation Frequency Range	10

MEMS Testing Power Supply	Version: 1.0
User Manual	Date: 23/10/2023

1. Introduction

This comprehensive user manual has been specifically curated to provide detailed instructions and guidance for users of the Micro-Electro-Mechanical Systems (MEMS) testing power supply device. Aimed at ensuring both optimal functionality and safety, this document not only elucidates the correct operating procedures but also delves into essential maintenance aspects. This user manual is targeted towards members of the Australian National Fabrication Facility – WA node (ANFF-WA), who will be using this device.

2. System Overview

The MEMS Testing Power Supply is a specialised device designed to provide a highly configurable power supply for MEMS testing. The system is capable of delivering both AC and DC voltages within a range of 0 to 200V, with additional features for signal modulation and frequency adjustments. It is equipped with a hardware interlock for safety, ensuring voltage outputs are kept within safe limits.

The device is intended for use within the ANFF-WA, serving as a critical tool for researchers and engineers involved in MEMS development and testing. It offers a user-friendly interface via a 4x4 matrix keypad and a display screen, allowing for real-time monitoring and adjustments.

In its organisational context, this power supply system is a standalone unit but can be integrated into a broader testing setup. It complements other measurement and testing equipment, providing a reliable and precise power source that meets the specific needs of MEMS testing.

3. Safety

This section outlines the safety precautions and features integrated into the MEMS Testing Power Supply. Always ensure the hardware interlock is engaged before making any adjustments to the system. Refer to the LED indicators to confirm the status of the interlock and output signal.

3.1 General Safety Precautions

- Always ensure the device is properly grounded before use.
- Do not operate the device near water or in damp conditions.
- Ensure the device is turned off when not in use.
- Keep the device away from flammable materials.
- Do not attempt to open the device casing; internal components are not user-serviceable.
- Use only the power supply adapter provided with the device.
- Ensure your hands are dry before operating the device.

3.2 Overcurrent Protection

The device is equipped with an overcurrent protection mechanism that will automatically shut off the output in under 10 milliseconds to prevent damage.

3.3 Interlock Safety

The red LED indicates the status of the hardware interlock. Make sure to engage the interlock before operating the device.

MEMS Testing Power Supply	Version: 1.0
User Manual	Date: 23/10/2023

3.4 Voltage and Frequency Limits

Always adhere to the voltage and frequency limits specified in the user interface and manual. Exceeding these limits could result in damage to the device and connected equipment.

4. Ethical Standards

Users are expected to operate the device in a manner that is consistent with ethical guidelines, including not using the device for unauthorised experiments or activities that could harm individuals or the environment.

5. System Functions

5.1 4x4 Matrix Keypad

The 4x4 matrix keypad shown in Figure 1 has been programmed to map its keys' functions as depicted in Figure 2.

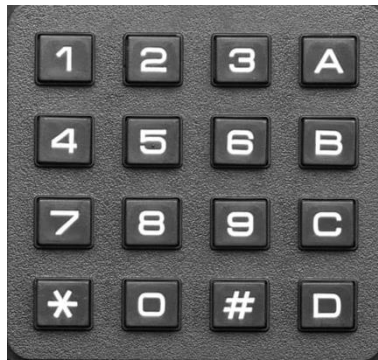


Figure 1: Original 4x4 matrix keypad.



Figure 2: Modified 4x4 matrix keypad.

The functionality of each key is shown in Table 1.

Keys	Functionality
0-9	Used to enter numbers to update numeric system parameters, such as voltage and frequency.
*	Used to switch between pages on the display
#	Used to enter a decimal place
A	Used to scroll up
B	Used to scroll down
C	Used as a backspace
D	Used as an enter key

Table 1: Description of the functionality of each key on the matrix keypad.

MEMS Testing Power Supply	Version: 1.0
User Manual	Date: 23/10/2023

5.2 Main Page

The main page of the system is the one shown in Figure 3. This page displays the six main parameters of the system and their chosen values. When the device is displaying this page, the device is simultaneously outputting a signal with the displayed values.

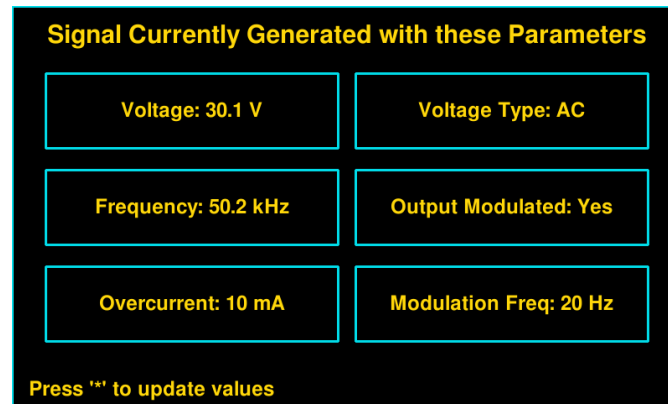


Figure 3: Main page displaying device parameters.

5.3 Updating Parameters

The updating of parameters page is the one shown in Figure 4. To get to this page, follow the prompt at the bottom of the main page and press the asterisks '*' key on the keypad. Upon pressing the key, the voltage box turns red with red arrows '>>' next to it. Use the up and down arrows, shown in Figure 2 to move between the boxes. Once at the desired box, press the enter key to update it. The asterisks '*' key can be pressed at any time whilst on this page to return back to the main page.

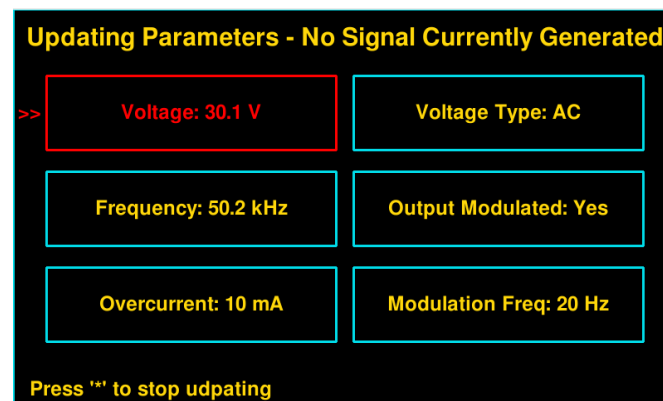


Figure 4: Updating parameters page with a red box and arrows highlighting the currently selected parameter.

5.4 Editing a Value

To edit a value, navigate to the desired parameter box and press the 'D' key to enter the editing mode. Input the new value using the numeric keys and confirm by pressing 'D' again.

5.5 Confirming an Edit

After editing a value, press the 'D' key to confirm the changes. The system will validate the input

MEMS Testing Power Supply	Version: 1.0
User Manual	Date: 23/10/2023

against the allowed ranges and increments. If the input is valid, it will be updated; otherwise, an error message will appear (Figure 6).

5.6 LEDs

There are two LEDs on the device, as shown in Figure 5. The red LED represents whether the interlock has been engaged or disengaged. If the LED is turned on, this means that the interlock is engaged. The green LED represents whether the device is outputting a voltage signal or not. If the LED is turned on, this means that the device is currently outputting a voltage signal.



Figure 5: MEMS PSU Interlock LEDs (Circled in red)

6. Troubleshooting: Error Messages and Causes

6.1 Voltage Increments

The voltage of the device can be changed only in 0.05 V increments. Therefore, if a user enters a voltage that is not an increment of 0.05, then an error message appears in the bottom right corner as shown in Figure 6. This prevents the user from going to the next page to confirm the value. This error message prompts the user to enter a value that is an increment of 0.05.

MEMS Testing Power Supply	Version: 1.0
User Manual	Date: 23/10/2023

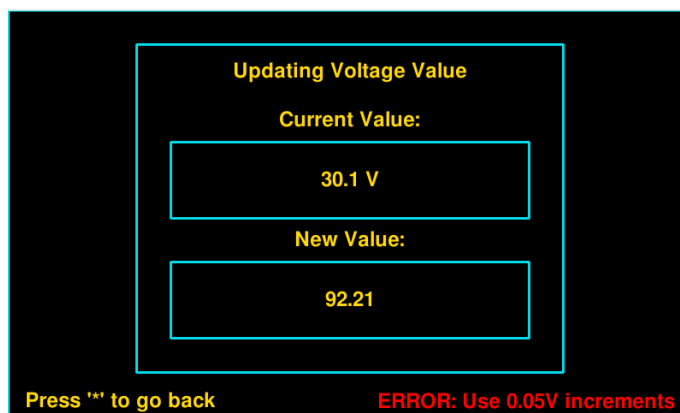


Figure 6: Voltage increments error message.

6.2 Voltage Range

The voltage output of the device is between 0 and 200 V for when in DC mode. The voltage output range of the device is between 0 and 200 V_{RMS} for when in AC mode. Therefore, if a user enters a voltage that is not within this range, then an error message appears in the bottom right corner as shown in Figure 7. This prevents the user from going to the next page to confirm the value. This error message prompts the user to enter a value that is within the specified range.

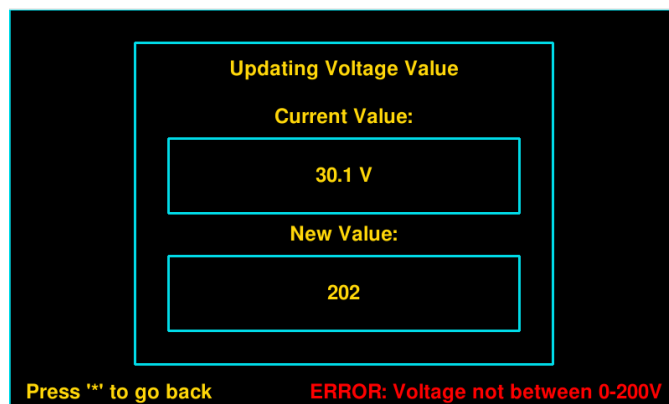


Figure 7: Voltage range error message.

6.3 Signal Frequency Increments

The signal frequency of the device can be changed only in 10 kHz increments. Therefore, if a user enters a frequency that is not an increment of 10 kHz, then an error message appears in the bottom right corner as shown in Figure 8. This prevents the user from going to the next page to confirm the value. This error message prompts the user to enter a value that is an increment of 10 kHz.

MEMS Testing Power Supply	Version: 1.0
User Manual	Date: 23/10/2023

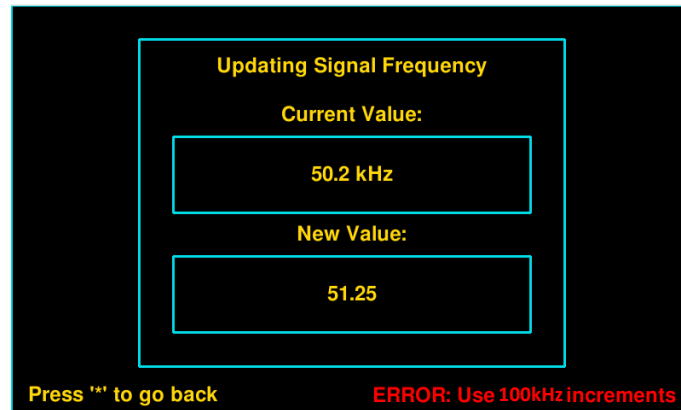


Figure 8: Signal frequency increments error message.

6.4 Signal Frequency Range

The signal frequency output of the device is between 50 and 300 kHz. Therefore, if a user enters a frequency that is not within this range, then an error message appears in the bottom right corner as shown in Figure 9. This prevents the user from going to the next page to confirm the value. This error message prompts the user to enter a value that is within the specified range.

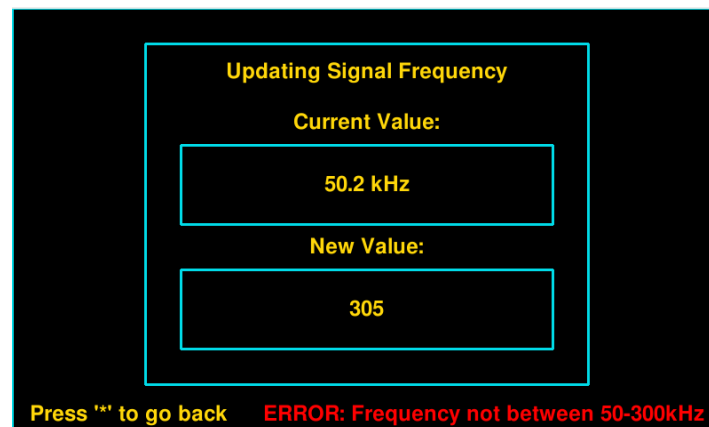


Figure 9: Signal frequency range error message.

6.5 Modulation Frequency Increments

The modulation frequency of the device can be changed only in 10 Hz increments. Therefore, if a user enters a frequency that is not an increment of 10, then an error message appears in the bottom right corner as shown in Figure 10. This prevents the user from going to the next page to confirm the value. This error message prompts the user to enter a value that is an increment of 10.

MEMS Testing Power Supply	Version: 1.0
User Manual	Date: 23/10/2023

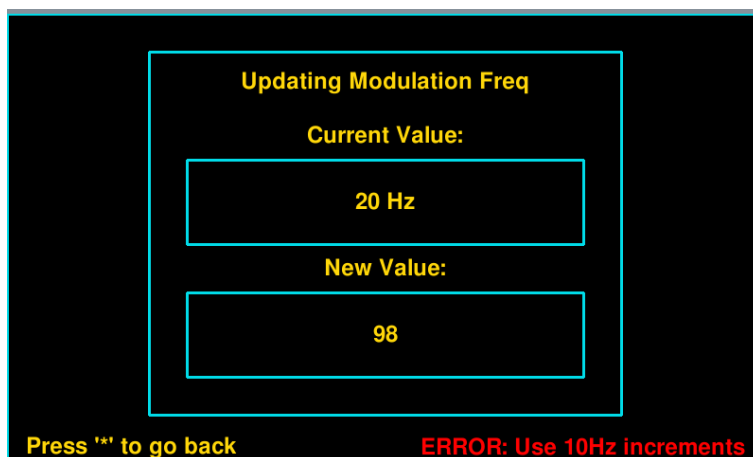


Figure 10: Modulation frequency increments error message.

6.6 Modulation Frequency Range

The modulation frequency output of the device is between 10 and 100 Hz. Therefore, if a user enters a frequency that is not within this range, then an error message appears in the bottom right corner as shown in Figure 11. This prevents the user from going to the next page to confirm the value. This error message prompts the user to enter a value that is within the specified range.

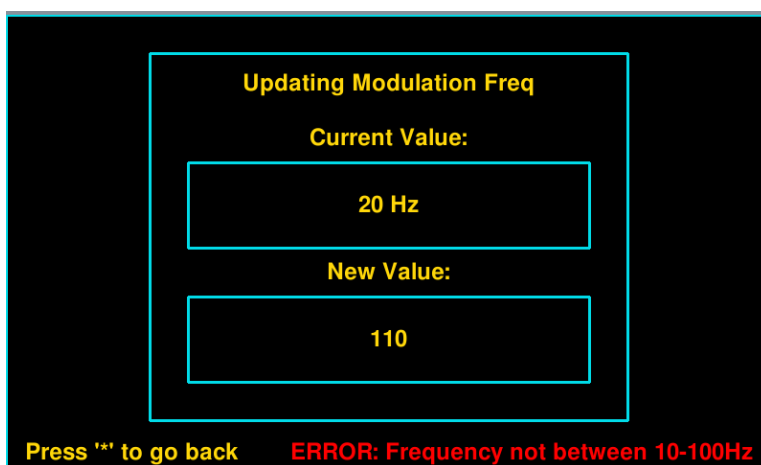


Figure 11: Modulation frequency range error message.

6.7 Overcurrent Protection Increments

The overcurrent of the device can be changed only in 2 mA increments. Therefore, if a user enters a current that is not an increment of 2, then an error message appears in the bottom right corner as shown in Figure 12. This prevents the user from going to the next page to confirm the value. This error message prompts the user to enter a value that is an increment of 2.

MEMS Testing Power Supply	Version: 1.0
User Manual	Date: 23/10/2023

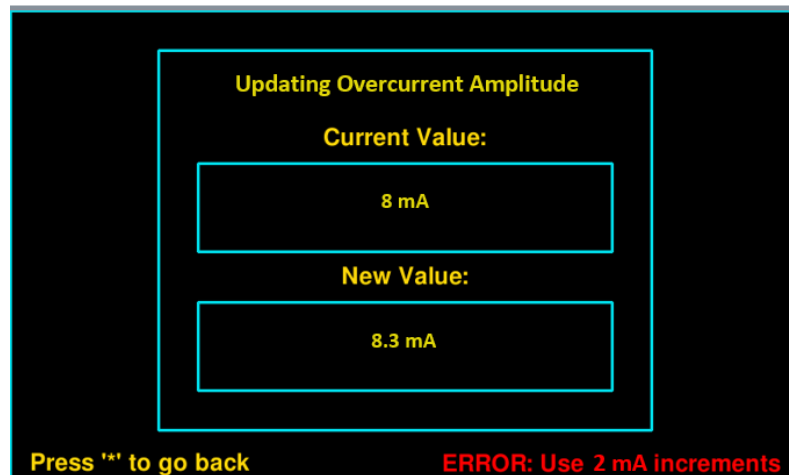
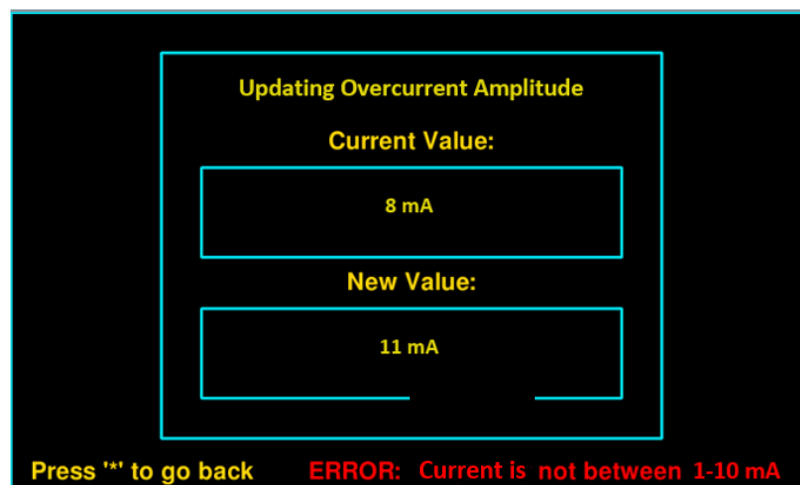


Figure 12: Overcurrent increments error message.

6.8 Overcurrent Protection Range

The overcurrent output of the device is between 1 and 10 mA. Therefore, if a user enters a current that is not within this range, then an error message appears in the bottom right corner as shown in Figure 13. This prevents the user from going to the next page to confirm the value. This error message prompts the user to enter a value that is within the specified range.



MEMS Testing Power Supply	Version: 1.0
User Manual	Date: 23/10/2023

Figure 13: Overcurrent range error message.

7. Maintenance

Regular maintenance is crucial for the longevity and optimal performance of the device. It is recommended to perform a full system check every six months. Ensure all components are securely connected and inspect for any signs of wear or damage.

7.1 Cleaning

- Use a soft, dry cloth to wipe down the exterior of the device.
- Do not use any abrasive cleaners or solvents as these can damage the casing.
- Ensure the device is turned off and unplugged before cleaning.

7.2 Electrical Connections

- Inspect all cables, connectors, and power supply units for any signs of wear, fraying, or damage.
- Replace any components that show signs of wear or damage immediately.

7.3 Calibration

- It's advisable to recalibrate the device annually to ensure accurate output.
- Follow the calibration procedures outlined in the 'Calibration' section of this manual.

7.4 Component Inspection

- Open the device casing only if you are qualified to do so.
- Check for any loose internal connections or signs of corrosion.
- If any components require replacement, consult the 'Parts List' section for specifications.

7.5 Troubleshooting

- If you encounter any issues during operation, refer to the 'Troubleshooting' section of this manual for guidance on resolving common problems.

8. Recommended Tests

8.1 During Operation:

Monitor the output voltage and current to ensure they are within the specified ranges. Check the LED indicators for the status of the hardware interlock and output signal.

8.2 During Maintenance:

Run a diagnostic test using the built-in software tools to check the functionality of all components.