

The MBK-401 Rejistor Calibration Tool is an extremely low-cost tool for adjusting the resistance of Low-TCR Rejistors. The tool is primarily intended for Rejistor demonstrations. It can also be used as a stand-alone device for coarse resistance adjustment in applications where high-precision is not necessary. Observed long-term stability of resistance for Low-TCR Rejistors adjusted with the MBK-401 will be lower (i.e. less stable) than typically achievable with Rejistor Calibration Tools with Rejust-it Software (for example the MBK-408).

APPLICATIONS

- Product demonstrations
- Coarse Low-TCR resistance adjustment
- Resistance-only adjustments when no computer is available
- In-circuit adjustment for Low-TCR Rejistors

FEATURES

- ZIF socket for 8-Pin SOIC Low-TCR Rejistors
- DOWN button to decrease resistance
- FINE-DOWN button to slightly decrease resistance
- UP button to slightly increase resistance
- Jumper selection for R1 or R2
- Connections for external (in-circuit) Rejistors
- Diagnostic LEDs

BENEFITS

- Easy to use
- No external computer required
- Low cost

MBK-401

GENERAL DESCRIPTION

The MBK-401 is a PCB with a ZIF (zero insertion force) socket to accommodate an 8-pin SOIC Low-TCR Rejistor. Three buttons are provided to control adjustment.

The MBK-401 decreases the resistance of the Rejistor in steps each time the **DOWN** button is pressed. These steps decrease as the resistance decreases. **FINE-DOWN** is intended for use close to the target value. Like the DOWN button, the step sizes decrease each time the **FINE DOWN** button is pressed.

UP adjustment is limited (0% to 2%) and should only be used as a last resort if the resistance over-shoots the target. Note that the resistance will decrease the first few times the button is pressed but will subsequently begin to slightly increase resistance.

The MBK-401 does not apply adjustment techniques for drift stability of Rejistors. Consequently, Rejistors adjusted with the MBK-401 will exhibit long-term resistance drift greater than specified in the Rejistor Product Datasheet. The MBK-401 is intended to adjust Rejistors that require neither high-precision nor high-stability.

The MBK-401 requires an external 15Vdc (>250mA) power supply (not provided). An ohmmeter is required to measure the resistance of the Rejistor during adjustment.

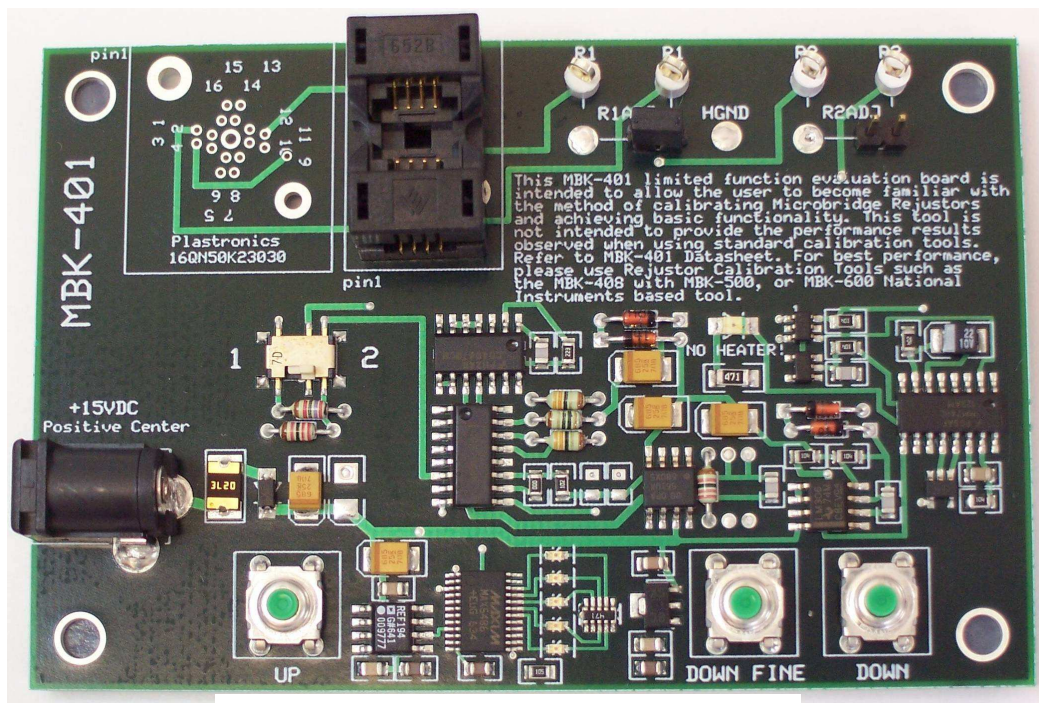


Figure 1: MBK-401 Low-cost Rejistor Tool

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ELECTRICAL SPECIFICATIONS

Table 1: RATINGS – Rejutors 0°C < T_A < +70°C; unless otherwise noted

Item	Conditions	Typical Specifications
Supply Voltage		15Vdc
Supply Current	Minimum	250mA

Table 2: TYPICAL REJUTOR ADJUSTMENT PERFORMANCE

Item	Conditions	Typical Specifications
Adjustment accuracy (down)	Beyond the first 5% of the adjustment range	1%
Adjustment range (down)		30%
Adjustment range (up)	Beyond the first 10% of the adjustment range	2%

ORDERING INFORMATION

Table 3: ORDERING INFORMATION

Part Number	Order Code	Package	Part Marking	Delivery	Quantity
MBK-401					

FUNCTIONAL DESCRIPTION

The MBK-401 is a full-function PCB with a ZIF (zero insertion force) socket for 8-pin SOIC Low-TCR Rejutors. It adjusts the resistance of each of the two Rejutors in a Low-TCR Rejutor. Only one Rejutor is adjustable at a time, as selected by jumper settings. Three buttons are provided to control resistance adjustment on the Rejutor:

- “Down” (decreases Rejutor value);
- “Fine-Down” (decreases Rejutor resistance in small steps); and
- “Up” (slightly increases Rejutor value).

The MBK-401 is a non-intelligent adjustment tool¹. Since Rejutors are analog devices (not digi-pots), some restrictions apply:

- Only standard-product Low-TCR Rejutors can be adjusted.
- Adjustment steps are not regular or “equidistant”
The MBK-401 gives essentially only one-directional adjustment – down-only from as-manufactured value (R₀ down to 0.7R₀, typical). Upward adjustment is very limited (typically 0% to 2%), and should only be used as a “last resort” if one misses the target using “Down” and “Fine-Down” buttons. Note also that the first few presses of the “Up” button may decrease resistance → one should keep pressing it until the resistance eventually increases to its final value (which may be only a very small increase.)
- Adjustment resolution is typically 1% (not representative of adjustment precision available with other Rejutor Calibration Tools with Rejust-it software).
- Adjusted resistance stability – Rejutor long-term resistance drift from this eval board is significantly greater than (not representative of) the drift-stability in Rejutor data sheets. This MBK-401 limited function evaluation board is intended to allow the user to become familiar with the method of calibrating Microbridge Rejutors and achieving basic functionality. This tool is not intended to provide the performance results observed when using standard calibration tools. For best performance, please use Rejutor Calibration Tools such as the MBK-408 with MBK-500, or MBK-600 National Instruments based tool

ADJUSTMENT FUNDAMENTALS

Each time a button is pressed, the MBK-401 applies controlled voltage pulses to the heater element in the Rejutor. The magnitude and pulse width are dependant on the function (**DOWN**, **FINE-DOWN** or **UP**). The resistance of the Rejutor should be measured with an ohmmeter during the adjustment to monitor the adjustment process towards the target.

The resistance of the Rejutor can be reduced at least 30% from the as-manufactured value. Progress bars are provided to give a rough idea of the adjustment progress. The MBK-401 assumes that it starts with a new sample each time the board is powered-up or a device is installed in a socket. If a device is re-installed in the socket after it has already been adjusted, the MBK-401 does not know this and will assume it is a fresh device.

¹ Rejutor Calibration Tools from Microbridge (such as the MBK-408A) provide the best performance in terms of accuracy, stability and adjustment time using Microbridge patented adaptive algorithm. This algorithm requires an analog feedback path and user-developed transfer functions specific to the application. The MBK-401 is a simple to use device which does not have closed-loop feedback. Instead it uses a “generic curves” which were developed to suit the majority of standard Rejutors. The cost of simplicity is reduced performance.

The inability of the MBK-401 to distinguish a new device from a device that has already been adjusted and because the tool applies controlled voltage signals it creates the possibility that the heater in the Rejutor can be inadvertently burnt-out. Like the resistive element in the Rejutor, the resistance of the heater is also reduced as the part is adjusted. Because the resistance is lower for the same voltage, the power dissipation increases, eventually causing damage to the heater element – creating an open-circuit. Note that Rejutor Calibration Tools, from Microbridge, provide superior precision while significantly reducing the risk of damage to the heater element.

MBK-401 BASICS

Power is provided to the MBK-401 from an external adapter to the PJ-202A DC Power Jack (connector shown on the left side of the board in Figure 1). The external power source must be 15VDC with minimum 250mA current with a P5 barrel jack connector, center-tip positive (outer ring negative, inner ring positive as shown in Figure 2).

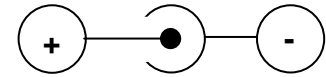


Figure 2: Positive Tip Polarity

An external ohmmeter is required to measure the resistance of the Rejutor during adjustment. The ohmmeter is connected to the loop test-points. The user is required to select which Rejutor to adjust within the dual-package using a jumper connector on **R1ADJ** or **R2ADJ**. Figure 3, below, shows the jumper position **R1ADJ**, to adjust the resistance of R1 (pins 1 and 2) of the Rejutor, and the loop test-points to connect the ohmmeter to measure the resistance of R1 during adjustment.

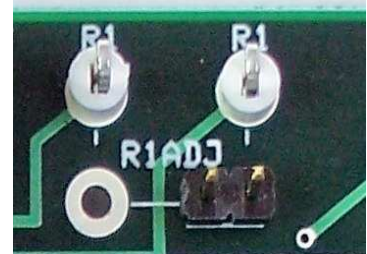


Figure 3: R1 Selection Jumper and Loop test-points

Obviously better accuracy requires smaller steps. It is better to repeatedly press the **DOWN FINE** to approach the target than to press the **DOWN** button and risk over-shooting the target. In most cases, approach the target value using the **DOWN FINE** button until it stops reducing the resistance of the Rejutor (see Figure 9). Then press **DOWN** once, then continue with **DOWN FINE** again, repeating the cycle until the target is reached

Install the Rejutor in the ZIF socket by pressing on the top. This will open the pins to allow device insertion. Note that Pin 1 must be oriented to the bottom left corner (with the board positioned as shown in Figure 1). Releasing the lid places the electrical contacts on the leads of the SOIC-8 pin device.

A red indicator light is provided to indicate whether there is continuity in the heater element of the Rejutor. The indicator light may illuminate to indicate the following problems:

1. No device in the socket
2. Mis-aligned part in socket
3. No jumper installed to select either **R1ADJ** or **R2ADJ**
4. Damaged heater element

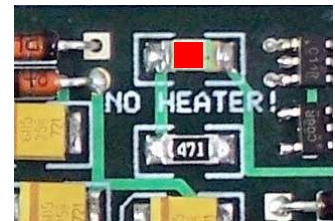


Figure 4: No Heater Indicator

Each time the **No Heater** LED illuminates, the internal new-sample counter is reset. For example, changing the jumper from **R1ADJ** to **R2ADJ** and back will cause the MBK-401 to assume a new device is installed, resetting the progress bars and the amplitude of the adjustment signals applied to the heater. The counter is also reset each time power is applied to the MBK-401.

Adjustment **progress bars** are provided for convenience near the bottom of the board, as shown in Figure 5. Initially all LEDs are illuminated. The illumination of the **progress bars** diminishes as the resistance of the Rejutor is decreased. All the indicators are extinguished as the adjustment approaches the bottom of the adjustment range. Note also that the level of the **progress bars** is reset each time the **No Heater** LED illuminates, whether or not a new device has been installed.

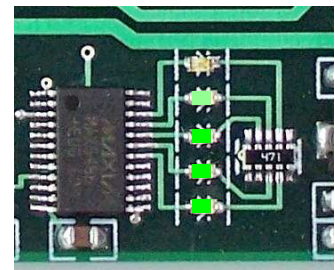


Figure 5: Progress Bars

The **DEEP ADJUSTMENT** switch (Figure 6) is a slide marked 1 and 2. The switch should be in position 1 for normal operation. For very deep adjustment (i.e. in order to reduce the resistance of the Rejutor down to 70% of the as-manufactured value) the switch should be in position 2. Always remember to reset the switch to position 1 to reduce the risk of damage to the heater element.

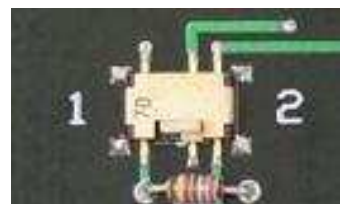


Figure 6: Slide switch

External (In-circuit) Adjustment

It is possible to adjust the resistance of the Rejutors that can not be installed in the ZIF socket. For example, the MBK-401 can be used for in-circuit adjustment. Instead of placing the Rejutor in the ZIF socket, a wire must be connected between the output of the MBK-401 and the auxiliary input pin on the corresponding Rejutor. The wire is connected to the MBK-401 in the through-hole pad next to the **R1ADJ** and **R2ADJ** jumpers; the hole is

highlighted in Figure 3. The ground signal is next to the jumper. It is still necessary to monitor the progress of the circuit being adjusted to reach the correct value. A very simple example of such In-Circuit adjustment of a user's circuit could be a voltage divider connected to a voltage source, with at least one of the divider-resistors being a Rejistor, and where the divider output voltage is monitored while applying adjustment signals to the heater of the Rejistor via the above-mentioned External Heater Terminals.

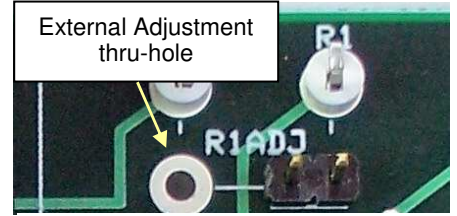


Figure 7: External Adjustment Connection

APPLICATION EXAMPLE

The following examples use the MBK-401 to adjust the resistance of R1 in an MBD-153-AS. Note that when a button is pressed, the resistance immediately increases before settling to a final value. This is part of the normal adjustment process for Rejistors.

In the first example (Figure 8), the resistance was reduced using the **DOWN** button. Notice that each step decreases the resistance although the step-size is not necessarily uniform.

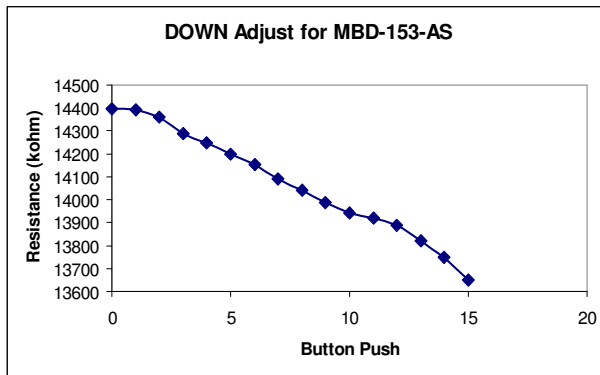


Figure 8: DOWN Adjustment of MBD-153-AS

The second example uses only the **FINE DOWN** button. Notice here that eventually the **FINE DOWN** button stops reducing the resistance of the Rejistor. At that point it is necessary to press the **DOWN** button and the **FINE DOWN** button can be used after that.

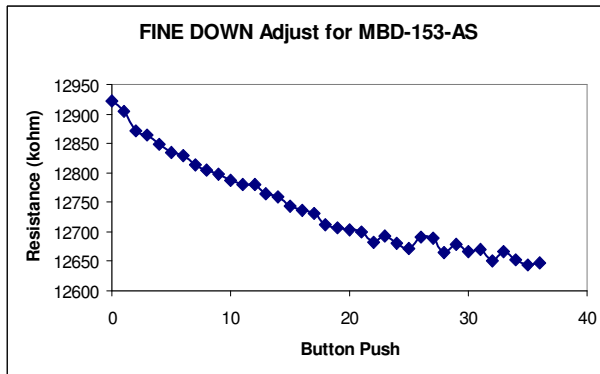


Figure 9: FINE DOWN Adjustment of MBD-153-AS

Finally, the **UP** button was used to demonstrate its functionality. As discussed, the resistance initially decreases and then begins to increase. Like the **FINE DOWN** button, the up adjustment eventually plateaus. It is not possible to further increase the resistance of the Rejistor with the MBK-401 at this point.

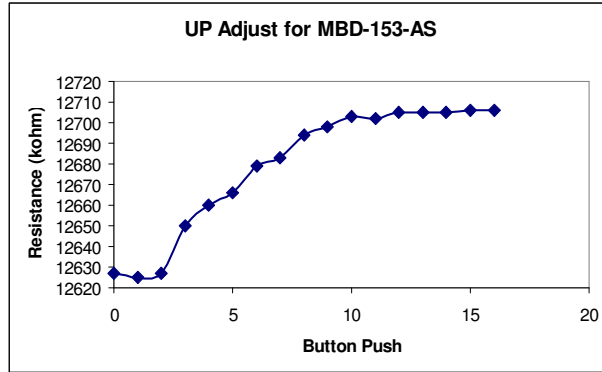


Figure 10: UP Adjustment of MBD-153-AS

PHYSICAL DIMENSIONS

- Length 9.5cm (3.75")
- Width 6.4cm (2.5")
- Height 1.9cm (0.75") from bottom of feet to top of closed socket

Please check with Microbridge Technologies Inc prior to design to ensure you have the latest revision of the datasheet for this part.