A Users Guide to the

Model **3000A** MICRO HANDI-COUNTER

A straight forward guide to help the operator start using the 3000A as quickly as possible. Step by step instructions are provided for using the counter for antenna pick up measurements, using the Digital Auto Capture feature, conventional counting and multi-function measurements. Notes, background comments as well as suggested strategies are included where appropriate.

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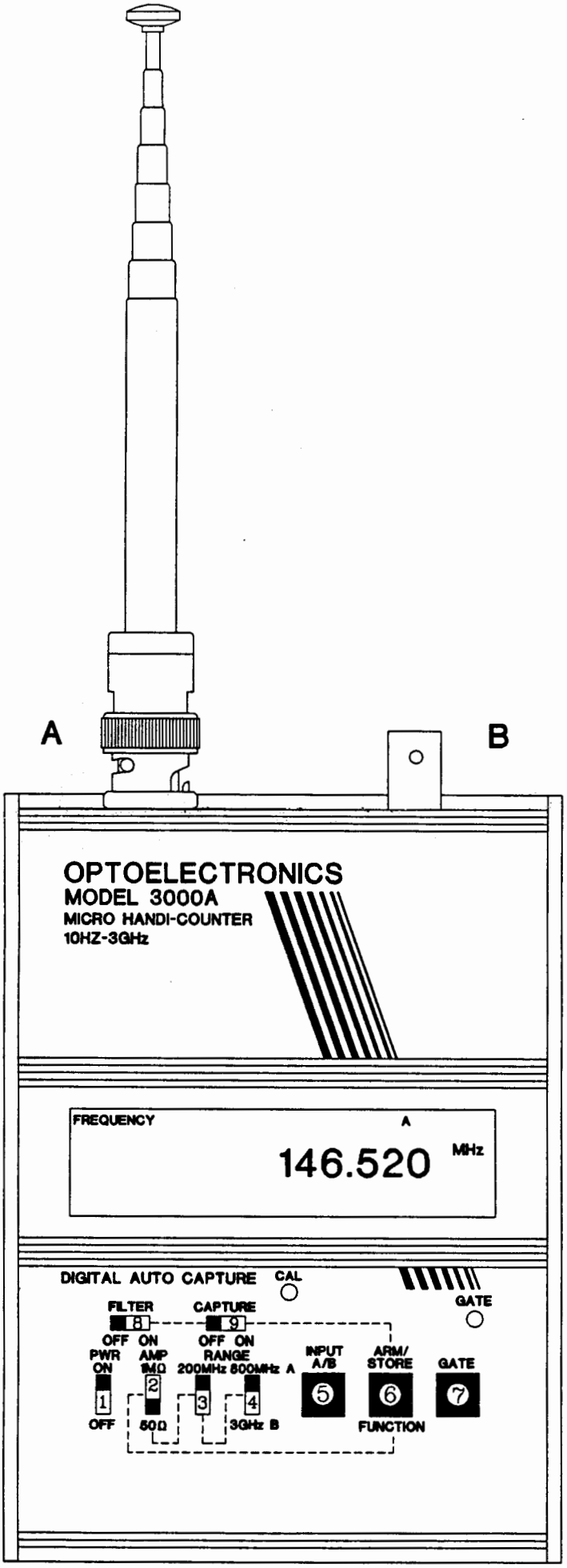

A
B
OPTOELECTRONICS
MODEL 3000A
MICRO HANDI-COUNTER
10HZ-3GHz
FREQUENCY
A
146.520
MHz
DIGITAL AUTO CAPTURE
CAL
GATE
FILTER
CAPTURE
8
9
OFF ON
OFF ON
PWR ON
AMP 1MΩ
RANGE 200MHz 800MHz A
INPUT A/B
ARM/ STORE
GATE
1
2
3
4
5
6
7
OFF
50Ω
3GHz B
FUNCTION

Step 1 - Select the Amplifier (Switch #2)

Use 50 Ohm Amplifier for frequencies above 20MHz. (Switch #2 Down)
Use 1Meg Ohm Amplifier for frequencies below 20MHz. (Switch #2 Up) Note 1

Step 2 - Put the Antenna on the appropriate input. (BNC Connector *A* or *B*)

Put antenna on input ***A*** for frequencies below 1000MHz. (*Most often used*)
Put antenna on input ***B*** for frequencies above 1000MHz

Step 3 - Choose the appropriate Range. (Switches #3 and #4)

(Skip this Step unless you selected the 50 Ohm Amplifier in Step 1.)

If you know the approximate frequency that you want to count then:

A. Between 10MHz and 250MHz Slide Switch #3 to the ***UP*** Position. It doesn't matter what position Swtich #4 is in.
B. Between 250MHz and 1000MHz Slide Switch #3 ***DOWN*** and Switch #4 ***UP***.
C. Between 1000MHz and 3000MHz Switches #3 and #4 must be ***Down***.

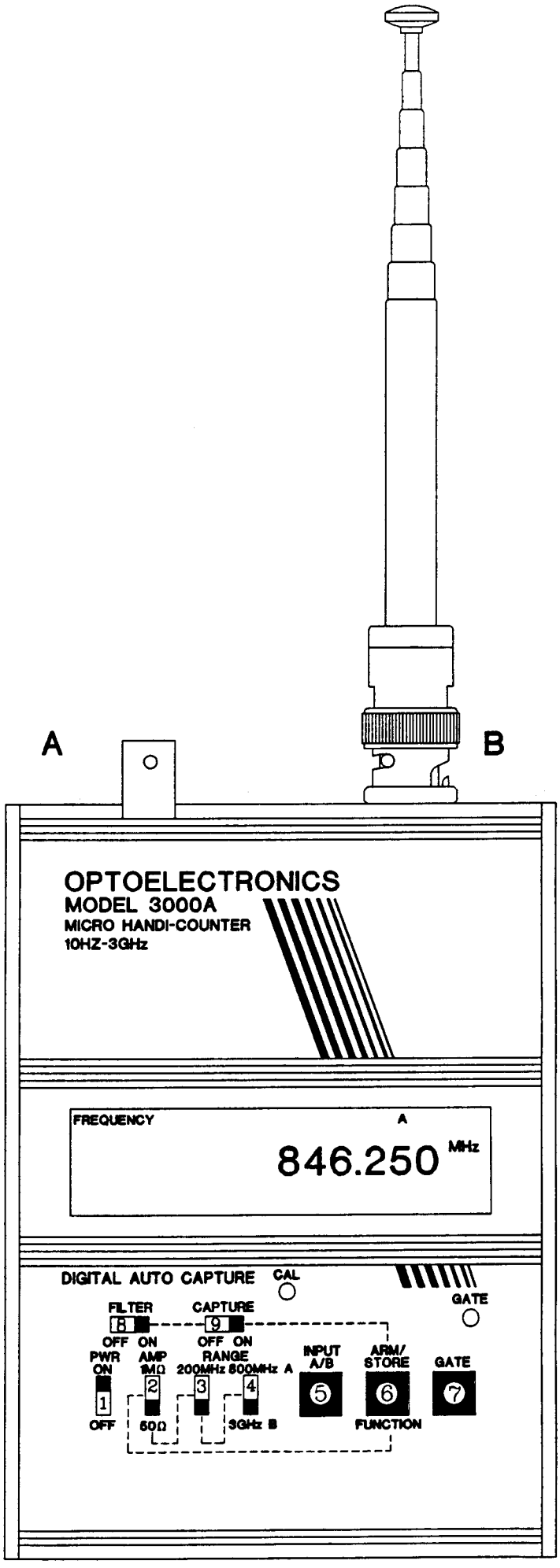
If you are just checking what's out there and don't have a particular Frequency in mind then the best strategy is to move between A and B above. You will probably only rarely find something with the Range switches in setting C above.

Step 4 - Select a Gate or Measurement Period.

Every time you push the Gate button you will increase the measurement time and increase the number of digits displayed. Usually in antenna mode (unless you are attempting to calibrate a transmitter) you will want 10KHz resolution or at least two digits displayed to the right of the decimal point. For the display shown on the opposite page, press Push-button Switch #7 (GATE) one time. However feel free to pick what ever Gate time/display resolution you feel comfortable with. Keep pushing the button to get back to the gate time you started with. Note 2.

Note 1. The 3000A actually has two 1Meg Ohm amplifiers (also called Hi Impedance amplifiers) which gives you some interesting possibilities. If you select the 1M Ohm amp you can put an antenna of either input A or B and use the Input A/B push-button (Switch #5) to select which input you want to count. You could then use two antennas and select between the 1M Ohm and 50 Ohm amplifiers to achieve optimum results below 30MHz. Keep in mind that Switch #5 is not active unless you select the 1M Ohm amplifier.

Note 2. The accuracy of the measurement is the sum of the time base error (+/- 1 PPM) and plus or minus one count in the least significant digit. Therefore accuracy is dependant on the number of digits displayed. More digits displayed - greater the accuracy.


A
B
OPTOELECTRONICS
MODEL 3000A
MICRO HANDI-COUNTER
10HZ-3GHz
FREQUENCY
A
846.250
MHz
DIGITAL AUTO CAPTURE
CAL
GATE
FILTER
CAPTURE
8
9
OFF ON
OFF ON
PWR
AMP
RANGE
INPUT
ARM/
GATE
ON
1MΩ
200MHz 800MHz A
A/B
STORE
1
2
3
4
5
6
7
OFF
50Ω
3GHz B
FUNCTION

Using the Digital Auto Capture Feature

Digital Auto Capture (DAC) involves the use of Slide Switches #8 (FILTER) and #9 (CAPTURE) as well as the ARM/STORE Push-button Switch #6. If you haven't already set up the 3000A for antenna operation, do so as shown on the previous section. Note 3.

In order to best understand how DAC operates you should have a convenient source of RF available. This could be a cordless phone, CB Radio, Cellular Phone or some other source of near-by RF. (Garage Door Openers and Car Alarm Remotes will not work)

Step 1 - Slide the Filter Switch #8 ON. The Capture Switch #9 should be OFF.

Turn on your test source of RF and notice that the Gate LED turns on and flashes only when the display updates. Even when the display is not changing, the counter is counting and the digital filter is sampling measurements behind the scene and looking for consistent coherent measurements. The Digital Filter will keep most of the random self-oscillations form being displayed. Occasionally a false reading may pass through the filter but statistically not very often. Use the Gate Push-Button to increase the number of digits displayed and to reduce false readings.

When a source of RF is near by you will see the Gate LED begin to flash rapidly (this will probably be accompanied by an increase in the number of segments on in the Signal Strength Bargraph) The new frequency measurements will now be displayed. When the RF signal stops then the display will stop updating and the most recent measurement will be retained. If the filter passes any new measurement at this point the previous measurement will be lost. Remove the antenna to stop new signal from being received or better yet use the Capture function Switch #9 as explained in step 2.

Step 2 - Turn ON both the Filter Switch #8 and the Capture Switch #9.

You are now in the full Digital Auto Capture Mode. Absolutely nothing can happen until the DAC is armed in step 3 below.

Step 3 - ARM the DAC Function by pressing the ARM/STORE Push-Button #6.

Notice that upon Arming the DAC, the FUNCTION annunciator in the LCD display begins to flash indicating an armed condition. Unless you see FUNCTION flashing, the DAC is not Armed. As soon as a measurement passes the filter, the flashing stops indicating that the measurement is stored. You will not loose this measurement unless you turn off the counter or go out of the DAC mode. To store a second measurement go to step 4.

Step 4 - ARM the DAC again by pressing the ARM/STORE Push-button #6.

The previously stored measurement in now rotated into the storage stack and the FUNCTION annunciator is once again flashing. This time if a new measurement passes the filter, the 3000A will capture it and retain the previous measurement. You can repeat Step 4 one more time keeping two measurements in storage and one on the display. If you depress the ARM/STORE button again now you will loose the first measurement that you stored.

Step 5 - Turn OFF the FILTER Switch #8 and leave the Capture Switch #9 ON.

You are now in ***Recall Mode***. No new measurements will be displayed. You can leave the 3000A in this setup and all data will be retained as long as the batteries have charge (about 6 hours) or indefinately from the plug transformer. To review the measurements in the stack go to step 6.

Step 6 - Depress the ARM/STORE Switch #6 to rotate memory contents to display .

There are three measurements held in memory, one on the display and one in register ***A*** and one in ***B***. Notice the A and B annunciators change in the LCD display as you depress Switch #6. If the Filter switch is turned back on then new measurements will over write the memory locations.

Note 3 - DAC works in frequency measurement mode only and if you engage the Filter Switch #6 then the 3000A will automatically be in Frequency mode and the Function Push-button Switch #6 will operate as ARM/STORE only.

Some Additional Comments and some Strategy Suggestions

The purpose behind DAC is to provide a means to show the operator when the counter is counting an actual signal and when it is simply displaying some meaningless count. In order to pick up a signal at the maximum distance it is necessary to provide about 50 to 60 dB of broad band gain. This is a radical departure from traditional frequency counter design practices. When this much gain is present, the entire front end has a tendency to self-oscillate, especially when an antenna is placed on the input. Some times the self-oscillation has absolutely no relationship to any near by RF signal but some times the oscillation is being influenced and the measurement is significant. The Digital Filtering looks for consistent and coherent readings. This gives the 3000A the ability to literally pull frequencies out of the air when the operator would not have been able to see them.

The counter begins to count when there is one dominant signal that is about 20dB stronger than any other signal or the RF floor. You might think that the counter would always count the strongest signal. The reality is that the signal counted will not necessarily be the strongest but will most likely be the closest one. The principle is that by moving closer to a signal you will be able to count it even when there are more powerful transmitters in the area.

Multi-path cancellation occurs as the frequency increases. This is caused by the transmitted signal being reflected off of buildings or other structures and arriving at the counter out of phase. This accounts for what appear to be null or dead spots within the near field of a transmitter. Move around a little to move out of the null area.

When the High Impedance Amplifiers (1M Ohm) are selected, standard Oscilloscope Probes (Mode P30) can be used to directly connect the 3000A to circuitry test points. In this mode you have a choice of two different inputs and amplifiers.

Step 1 - Select the 1M Ohm Amplifier using the AMP Switch #2.

Step 2 - Select the desired BNC input A or B and connect a probe.

Step 3 - Use the INPUT Push-Button Switch #5 to select which input to count.

Step 4 - Depress FUNCTION Push-Button Switch #6 to select Function.

1. ***Frequency*** - measurement units is in MHz or millions of cycles per second.
2. ***Period***. Reciprocal of Frequency, units are micro seconds or nano seconds. This function is useful for greater resolution for signals below 10KHz. The counter is really counting it's own 10MHz clock between cycles of the input signal.
3. ***Interval***. Time interval, the time between the rising edge of a pulse on input A and the rising edge of a pulse on input B. Units are the same as for Period. This measurement is useful for projectile velocity measurements.
4. ***Ratio***. The ratio of two frequencies A/B is a measurement without any units. This is useful when attempting to calibrate something against a known reference. Connect the reference frequency into the B input and adjust the A input frequency until a reading of 1.00000.... is obtained.

Step 5 - Depress the Gate Push-Button Switch #7 to change Gate or Average.

1. In Frequency mode, the number of digits displayed increases with increasing gate or measurement period.
2. In Period mode the Gate button will average 10, 100, or 1000 cycles for greater measurement precision.
3. In Interval mode the Gate button will average 10, 100 or 1000 intervals.
4. In Ratio Mode the Gate button will increase the number of decimal places from 5 to 6, 7 or 8 places.

Some Additional Hints on Conventional Counting

The 3000A counter does real well counting digital pulses or sine waves. In the real world signals to be counted are often not ideal. Some times you may experience difficulties counting signals and there will be no apparent explanation. The counter's own sensitivity can cause problems because any noise content that exceeds the minimum sensitivity can cause wrong counts. Use a 1X/10X scope probe such as the P30 to attenuate large signals to reduce the associated noise below the input sensitivity level.

A similar problem is due to the fact that the counter input may have DC to 100MHz bandwidth. You may be interested in counting an audio signal but may have RF interference or a high frequency component present. In these situations it is often effective to reduce the counter's bandwidth by using a Low Pass Filter Probe such as the Model P101.