The 3000AP Plus combines the computing power of a microprocessor with the OE10 high-speed counter IC to provide unparalleled counting capabilities. The 3000AP Plus can capture off-the-air signals and reduce spurious counting. All the microprocessor digitally filters the RF signal measurements and reduces spurious counting. All of this is done without relying on the signal strength to exceed some arbitrary level, ensuring reliable performance in today's dense signal environments. Proprietary software monitors the incoming RF for stable coherent signals, and only when these conditions are satisfied will the count be presented to the user. Internal memory allows the 3000AP Plus to store the last three filtered frequencies for extended monitoring period. At any time later, the 3000AP Plus memories can be recalled to check the results of an examination.

The 3000AP Plus has four separate input amplifiers to push sensitivity to new levels. This was done for a very simple reason: the wider the bandwidth of a counters front end, the higher its inherent noise floor and the lower the sensitivity. However, the input circuitry has been designed to cover the 10Hz-3GHz range in bands, chosen to optimize sensitivity for each application.
To order the C2232 and two optional accessories, the C2232 data cable and Opollog Software. To order the C2232 and interface is accessible via 3.5mm stereo phone jack. Connection to a serial port is required using

Digital Communications Port

The 3000AVplus handheld frequency counter is equipped with an RS232 interface which allows the user to communicate directly to a personal computer for the purpose of real time data logging. The UHF two-way radio. The higher frequency band covers 500MHz to 3GHz. By blocking out lower frequency signals like broadcast FM and TV, weak signals can be isolated and mea-

The next higher band includes the 10 - 800+ MHz region, choose to include most common VHF and UHF through VHF communications. Here, a high gain preamplifier yields sensitivities like-

The direct I to 200MHz input is used primarily for selecting crystal oscillators on frequency and mon-
# Specifications

<table>
<thead>
<tr>
<th>Amplifier</th>
<th>Input A</th>
<th>Input B</th>
<th>50 Ohm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impedance</td>
<td>1 Meg Ohm</td>
<td>1 Meg Ohm</td>
<td>50 Ohm</td>
</tr>
<tr>
<td>Range</td>
<td>1 Meg Ohm, 30 pF</td>
<td>1 Meg Ohm, 30 pF</td>
<td>50 Ohm vsr &lt;2:1</td>
</tr>
<tr>
<td>Range</td>
<td>10Hz - 50MHz</td>
<td>10MHz - 220MHz</td>
<td>10MHz - 220MHz</td>
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<tr>
<td>Sensitivity</td>
<td>&lt;25mV 10Hz - 10MHz</td>
<td>&lt;25mV 10Hz - 10MHz</td>
<td>500MHz - 3GHz</td>
</tr>
<tr>
<td></td>
<td>&lt;30mV 10MHz - 50MHz</td>
<td>&lt;5mV @ 10MHz</td>
<td>500MHz - 3GHz</td>
</tr>
<tr>
<td></td>
<td>200MHz Range</td>
<td>&lt;25mV 10Hz - 10MHz</td>
<td>500MHz - 3GHz</td>
</tr>
<tr>
<td></td>
<td>800MHz Range</td>
<td>&lt;25mV 10Hz - 10MHz</td>
<td>500MHz - 3GHz</td>
</tr>
<tr>
<td></td>
<td>&lt;800uV @ 200MHz</td>
<td>&lt;800uV @ 400MHz</td>
<td>500MHz - 3GHz</td>
</tr>
<tr>
<td></td>
<td>&lt;3mV @ 700MHz</td>
<td></td>
<td>500MHz - 3GHz</td>
</tr>
</tbody>
</table>

Time Interval Mode: “A” Start “B” Stop Minimum pulse width is 200 ns. Triggers on rising edge.

Period /TI Max Resolution: Single Shot - 100ns. Averaged - 1ns. Max Display: 999 999 999.9us.

Period TI Average: Averages 10, 100, or 1000 measurements for increased resolution.

Time Base: 10MHz. Stability: +/-1ppm 20-40 degrees C Aging: 1ppm/yr.

Display: 10 digit (120 segment) Liquid Crystal Display. Decimal at MHz position.

Low Battery Indicator: “LOW BATT” displayed when battery pack is no longer usable and must be recharged.

Annunciators: Frequency, Period, Interval, Ratio, Average, MHz, mS, uS, Low Batt, PRESCALE, A, B, Intervals/Periods Averaged.

Size: 5.3” high x 3.9"wide x 1.4" deep. Weight: 15oz.

Power: 9VDC, approx. 250mA using model AC90 wall plug adapter. 5+ hours operation from internal 5 cell NiCad Pack.
<table>
<thead>
<tr>
<th>Range</th>
<th>Gate Select</th>
<th>Gate Time</th>
<th>Measurement Time</th>
<th>LSD Res.</th>
<th>Sample Display</th>
</tr>
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<tr>
<td>200</td>
<td>1</td>
<td>100μS</td>
<td>13mS</td>
<td>10kHz</td>
<td>150.00</td>
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<tr>
<td></td>
<td>2</td>
<td>1mS</td>
<td>13mS</td>
<td>1kHz</td>
<td>150.0000</td>
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<td></td>
<td>3</td>
<td>10mS</td>
<td>13mS</td>
<td>100Hz</td>
<td>150.000000</td>
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<tr>
<td></td>
<td>4</td>
<td>100μS</td>
<td>110mS</td>
<td>1Hz</td>
<td>150.00000000</td>
</tr>
<tr>
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<td>5</td>
<td>1S</td>
<td>1S</td>
<td>0.1Hz</td>
<td>150.0000000000</td>
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<tr>
<td></td>
<td>6</td>
<td>10S</td>
<td>10S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>800</td>
<td>1</td>
<td>400μS</td>
<td>13mS</td>
<td>10kHz</td>
<td>440.00</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>4μS</td>
<td>13mS</td>
<td>1kHz</td>
<td>440.0000</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>40μS</td>
<td>50μS</td>
<td>100Hz</td>
<td>440.000000</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>400μS</td>
<td>410μS</td>
<td>1Hz</td>
<td>440.00000000</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>4μS</td>
<td>4μS</td>
<td></td>
<td>440.0000000000</td>
</tr>
<tr>
<td>3000</td>
<td>1</td>
<td>1.6μS</td>
<td>13μS</td>
<td>10kHz</td>
<td>3000.00</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>16μS</td>
<td>25μS</td>
<td>1kHz</td>
<td>3000.0000</td>
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<tr>
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<td>160μS</td>
<td>170μS</td>
<td>100Hz</td>
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<td>1.6μS</td>
<td>1.6μS</td>
<td>10Hz</td>
<td>3000.00000000</td>
</tr>
</tbody>
</table>
Operation

Counting with an Antenna

Step 1 - Select the Amplifier
Use the 50 Ohm Amplifier for frequencies above 20MHz.
Use 1 Meg Ohm Amplifier for frequencies below 20MHz.

NOTE: The 3000A+ actually has two 1 Meg Ohm amplifiers (also called Hi Impedance amplifiers) which give you some interesting possibilities. If you select the 1M Ohm amp you can put an antenna on either input A or B and use the input A/B push-button 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 the input A/B button is not active unless you select the 1M Ohm amplifier.

Step 2 - Put the antenna on the appropriate input (BNC connector A or B)
Put the antenna on input A for frequencies below 1000MHz (most often used)
Put the antenna on input B for frequencies above 1000MHz

Step 3 - Choose the appropriate Range (Skip this step unless you selected the 50 Ohm Amp)
If you know the approximate frequency that you want to count then:
A. Between 10MHz and 250MHz slide the first range switch to the up position. It doesn’t matter what position the second range switch is in.
B. Between 250MHz and 1000MHz the first range switch is in the down position and the second range switch is in the up position
C. Between 1000MHz and 3000MHz both range switches must be down.
In order to best understand how DCC operates you should have a conventional source of RF available. This could be a

3000AVPlus will automatically be in frequency mode and the function push-button will operate as ARM/STORE only.

NOTE: DCC works in frequency measurement mode only. If you engage the FILTER and CAPTURE switches then the

DCC Auto Capture (DAC) involves the use of the FILTER and CAPTURE slide switches as well as the ARM/STORE push button. If you have not already set up the 3000AVPlus for antenna operation.

Using the Digital Auto Capture Feature

The accuracy:

The accuracy of the measuremets is the sum of the base error (sensitivity - 1 ppm) and plus or minus one count in the

least significant digit. Therefore accuracy is dependent on the number of digits displayed. More digits displayed =

greater accuracy.

Pressing the field button to get back to the original time you started with.

For example, you want 10kHz resolution or at least two digits displayed in the time of the decimal point: 1.00

Every time you push the field button you will increase the measurement time and increase the num-

Step 4 - Select a Clear of Measurement Period

the range switches in seting C.

If you are just checking what’s out there and don’t have a particular frequency in mind then the best

strategies is to move between both range switches. You will probably only really find frequencies with


Step 1 - Slide the FILTER switch on. The CAPTURE switch 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 Auto Filter will keep most of the random self oscillations from 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 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 as explained in step 2.

Step 2 - Turn ON both the FILTER switch and the CAPTURE switch.
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.
Notice that upon arming the DAC, the FREQUENCY annunciator in the LCD display begins to flash indicating an armed condition. Unless you see FREQUENCY flashing, the DAC is not armed.
Step 4 - ARM the DAC again by pressing the ARM/STORE push-button.  

As soon as a measurement passes the filter the flashing stops indicating that the measurement is saved.  

To store a second measurement go to step 4.  

You will lose this measurement unless you turn off the counter or go out of the DAC mode.  

The previously stored measurement is now stored into the storage stack and the FREQUENCY annunciator is once again flashing.  

You can repeat Step 4 once more to keep taking measurements.  

You can recall the display press the ARM/STORE push-button.  

If you depress the ARM/STORE push-button again you will capture it and retain the previous measurement.  

You can recall Step 4 once more to keep taking measurements.  

Step 2 - Turn OFF the FILTER switch and leave the CAPTURE switch on.  

Step 6 - Depress the ARM/STORE switch to recall memory contents to display.  

There are three measurements held in memory, one on the display and one in register A and one in register B.  

Notice the A and B annunciators change in the LCD display as you depress the ARM/STORE push-button.  

If the FILTER switch is turned back on then new measurements will overwrite the memory locations.  

Step 5 - Turn OFF the FILTER switch and leave the CAPTURE switch on.  

You will lose the first measurement that you stored.  

To review the measurements in the stack go to step 6.  

You are now in Recall Mode.  No new measurements will be displayed.  You can leave the 3000APM plus  

in this stack and all data will be retained as long as the batteries have a charge or indefinitely from the power transformer.  To review the measurements in the stack go to step 6.  

If you depress the ARM/STORE push-button again you will capture it and retain the previous measurement.  You can recall Step 4 once more to keep taking measurements.  

The annunciator is once again flashing.  

This line is a new measurement passes the filter.  

As soon as a measurement passes the filter the flashing stops indicating that the measurement is saved.  

To store a second measurement go to step 4.  

You will lose this measurement unless you turn off the counter or go out of the DAC mode.  

The previously stored measurement is now stored into the storage stack and the FREQUENCY annunciator is once again flashing.  

You can recall the display press the ARM/STORE push-button.  

If you depress the ARM/STORE push-button again you will capture it and retain the previous measurement.  You can recall Step 4 once more to keep taking measurements.  

You can repeat Step 4 once more to keep taking measurements.  

You can recall Step 4 once more to keep taking measurements.
CONVENTIONAL MEASUREMENTS

When the High Impedance Amplifiers (1M Ohm) are selected, standard Oscilloscope Probes (Model P30) can be used to directly connect the 3000APlus 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.

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

**STEP 3** - Use the INPUT Push-Button Switch to select which input to count.

**STEP 4** - Depress the FUNCTION Push-Button Switch to select Function. Capture and Filter must be off.

A. Frequency - measurement units is in MHz.
B. 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 its own 10MHz clock between cycles of the input signal.
C. Interval - Time interval, the time between the rising edge of a pulse on input A and the rising of a pulse on input B. Units are the same as for Period. This measurement is useful for projectile velocity measurements.
D. 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 1.0000... is obtained.

**STEP 5** - Depress the Gate Push-Button to change Gate or Average.

A. In Frequency mode, the number of digits displayed increases with increasing gate or measurement period.
B. In Period mode the Gate button will average 10, 100, or 1000 cycles for greater measurement precision.
C. In Interval mode the Gate button will average 10, 100, or 1000 intervals.
D. In Ratio Mode the Gate button will increase the number of decimal places from 5, 6, 7, or 8 places.
may damage the NICd batteries. If the counter becomes excessively hot, it should be removed from the power supply. For some models of counters the fuse may be located inside the battery compartment. Remove the fuse(s), then remove the battery pack and adapter supplied with the counter. Replace the fuse(s) and adapter. Replace the battery pack and adapter. The counter can operate several hours from fully charged internal NICd batteries when the power adapter is supplied with the 3000APlus. Fully charged will occur in 12-16 hours. The batteries are charged when the unit is powered by the AC-Charger/Adapter. Battery

CAUTION

Notes:
- Before inserting or removing the battery pack, take care not to pinch any of the battery wires. Also, make sure to remove the battery from the counter when it is not in use.
- The counter is protected by a fuse. This is accomplished by removing the fuse while the fuse is still warm.
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Calibration

The calibration adjustment opening in the bottom of the front panel, permits access to the trimmer capacitor which provides about a 10 parts per million adjustment range of the time base oscillator. Use the slow gate time for maximum resolution and read a stable signal of known frequency adjusting the trimmer for correct frequency display. Calibrate at 10MHz or higher. The higher the calibration frequency, the more accurately the instrument can be calibrated.

Accuracy
Frequency mode: = +/- Time Base Inaccuracy +/- 1 count
Period mode: = +/- Time Base Inaccuracy +/-1 count +/- trigger error
Trigger error: is < .3% per period for sine waves of 40dB signal to noise ratio and amplitude equal to sensitivity of counter. For any waveshape, trigger error is less than +/- .0025 microseconds divided by the signal slope in volts per microsecond for signal to noise ratio of 40 dB.

Factory Calibration Service
Optoelectronics' Service Department provides a calibration service at the factory. Counters may be shipped for this service using the Factory Service & Return policy explained later in this manual.