Title
FAST DUAL SCALE-DOWN MODULE (LBL#21X7981P-1)

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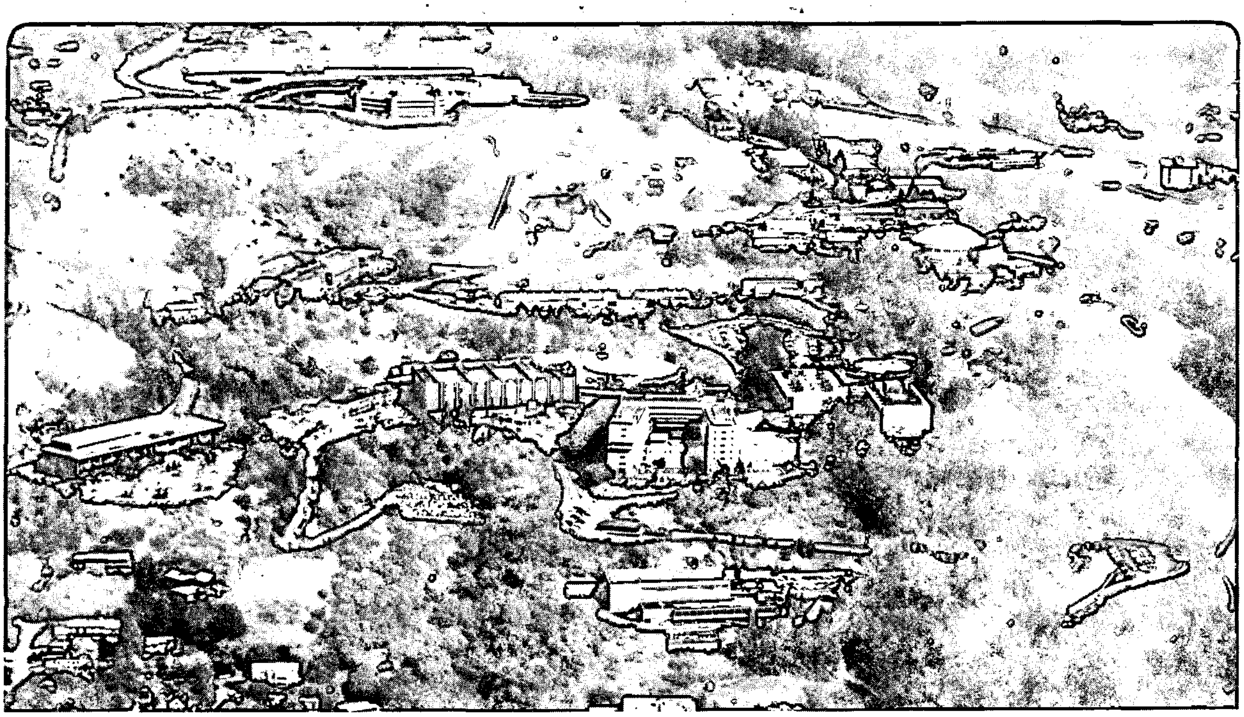

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LBL-21930

Fast Dual Scale-down Module (LBL #21X7981P-1)*

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Abstract

Two fast NIM logic scale-down units have been designed and packaged in a single-width NIM module. The scale-down factor "N" is set via an octal DIP switch located on the front panel. Each unit accepts input pulses of width > 50 ns up to a maximum rate of 15 Mhz. The output pulses are produced at a rate of 1/N th of the input rate where N is an integer between 1 and 255. The time difference between the input and output signals is ~10 ns and remains constant regardless of the scale-down factor. LEDs attached to the input and output pulses give a visual indication of the relative rates.

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1. Introduction:

Experiments in nuclear and atomic physics often involve the measurement of several classes of events which occur at significantly different rates. A simple example involves data which consists of "singles" from two or more detectors and "coincidence" data between pairs of detectors. It is not uncommon for these data rates to differ by a factor of 100. The total volume of data collected may be reduced by taking the coincidence data plus a sample of the singles. A preset fraction of the singles can be selected by using a scale-down module. In the example above, one may only want to take 1/100 th of the singles data to obtain comparable statistics for both singles and coincidence data. Such scale-down modules have been constructed before (LBL 71X204), but they utilized slow TTL logic and provided limited scale-down ranges. Thus, a new and faster module was needed to work with the negative NIM logic signals and provide a larger range of scale-down factors.

Two fast NIM logic scale-down units have been packaged in a single-width NIM module as shown in figure 1. Each unit accepts pulses of width >50 ns up to a rate of 15 Mhz and provides two negative NIM and one TTL output pulses at a rate 1/N th of the input rate where N is an integer between 1 and 255. The scale-down factor "N" is set via an octal DIP switch. Following each output pulse, an internal counter is set to "N" and each input pulse causes the counter to decrease by one until it reaches "1". At the time of the trailing edge of this pulse, a gate is opened and the next input pulse is passed through to the output. In this way, the timing of the input signals is preserved regardless of the scale-down factor. This is critical in experiments where the scale-down factor changes during the experiment as some physical parameter, e.g. detector angle, changes. One does not want the logic circuit timing to change when the scale-down factor is changed. Also, since the scale-down module acts as a gate, the width of the output pulses is equal to the width of the input pulse. LEDs attached to the input and output pulses give a visual indication of the relative rates. Figure 2 shows the input and output signals from the unit and figure 3 is a schematic.

2. Operation:

The input to the dual scale-down module must be a negative NIM logic signal with a width >50 ns and a rate <15 Mhz. (For even (2,4,...) scale-down-factors only , the pulse need be only 25 ns wide and the rate may be up to 25 Mhz.) Three (2 NIM and 1 TTL) outputs are provided. The scale down factor is selected via the octal DIP switch on the front panel. This switch loads a binary counter with a number between 1 and 255 depending on which switches are in the "in" position. For example, if only the first switch (1) is in, the output and input rates are equal. If only the second switch (2) is "in", the output rate is 1/2 the input rate. If both the first and second switches are in, the output rate is 1/3 the input rate. At the other end of the scale, if all switches are in, the output rate is 1/255 th of the input rate. As mentioned in the introduction, the timing relationship between the input and output signals is preserved for all scale-down factors. There is a delay of ~10 ns between the leading edge of the input and output pulses and the width of the output pulses (both NIM and TTL) is equal to the width of the input pulse. Naturally, these units can be used in series to obtain larger scale-down factors. The number of input pulses may be calculated from the number of scale-down pulses by multiplying the number of output pulses times the scale-down factor "N", and the uncertainty is ± (N-1) corresponding to an uncertainty of ±1 in the number of scale-down pulses.

3. Specifications:

Input: Negative NIM logic signal having a width >50 ns and at a rate of less than 15 Mhz for all scale-down factors. For even (2,4,...) scale-down factors only , the pulse width need be only 25 ns and the rate may be up to 25 Mhz.

Outputs: Two NIM, one TTL. The output pulse is delayed ~10 ns from the input pulse. The widths of both negative NIM and positive TTL outputs are equal to the width of the input pulse.

Range: Scale-down ranges between 1 and 255 are set via an octal DIP switch on the front panel.

Indicator lights: LEDs on both input and output.

Power: +6 (40 mA), -6 (700 mA), +12 (80 mA), -12 (170 mA)

Figure Captions

Figure 1. Picture of the dual scale-down module from the front (left picture) and from the back and side (right picture). One cover is removed to show the details of construction.

Figure 2. a) Input and output pulses from the dual scale-down module on a time scale of 20 ns / div showing the ~10 ns delay between the input and output pulse. Note that the input and output pulse widths are the same.

b) Input and output pulses for a scale-down factor of 4. The time scale is 200 ns / cm.

Figure 3. Schematic drawing of the circuit of the dual scale-down module. EF= Emitter follower; OS= One shot; and LS= Level Shifter

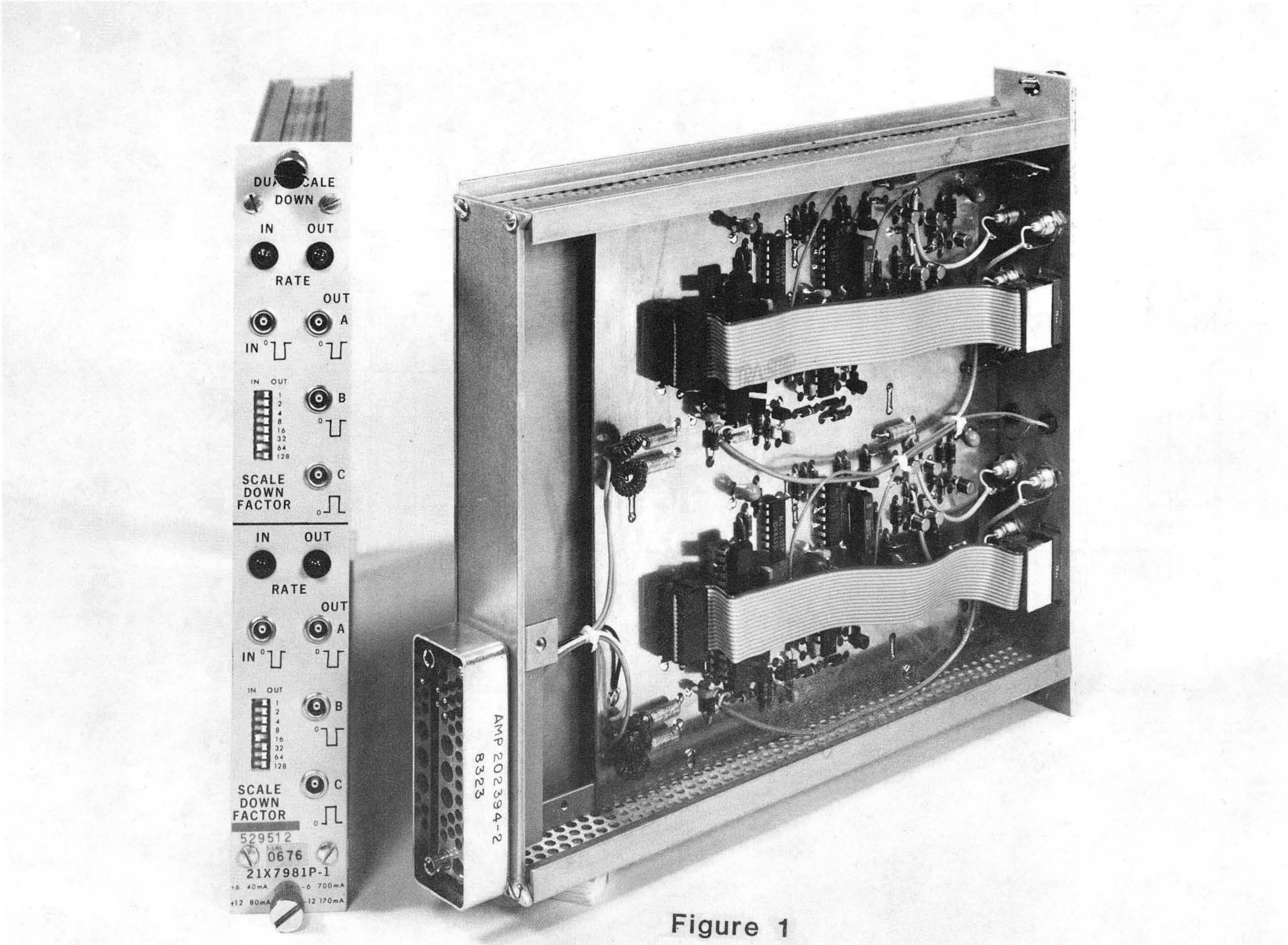

Figure 1

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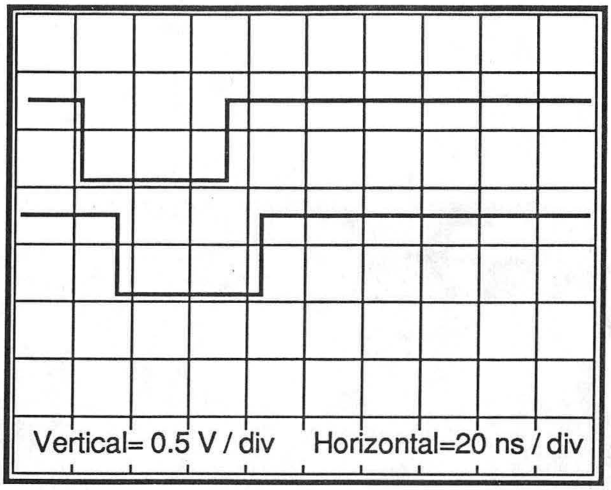
a)


Vertical= 0.5 V / div   Horizontal=20 ns / div

b)

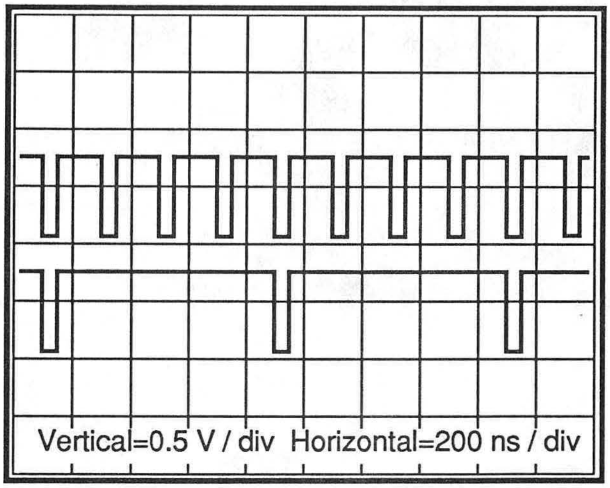

Vertical=0.5 V / div Horizontal=200 ns / div

Figure 2

Dual Scaledown Module
21X 7981 - P2

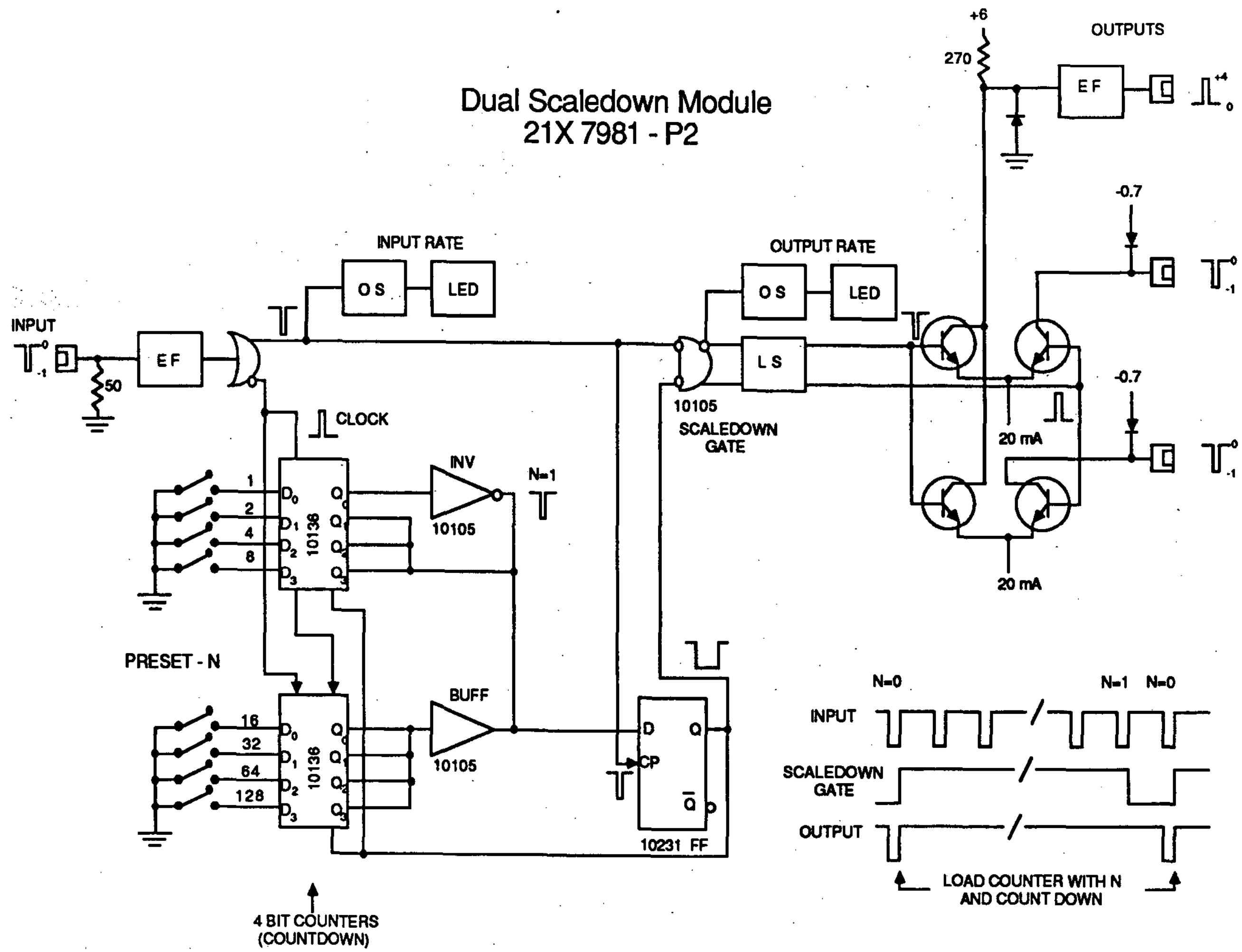


Figure 3

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