

# UP/DOWN PRESETTABLE COUNTER

- \* 4 digit
- \* up/down counting
- \* drives LEDs directly
- \* latch
- \* presettable
- \* second register
- \* equal and zero outputs
- \* DC to 2MHz
- \* 5V operation

THE THREE DIGIT display (ETI 533) we previously published has proved to be one of our most popular projects. We have used it in a number of projects and we know of several commercial companies using it in their own equipment.

Many people have asked us for a 4 digit version and we have been looking round at ICs available. We have chosen this Intersil device because we believe it offers the best versatility at the moment. Apart from being a 4-digit counter-latch-decoder driver needing no external components except the displays, it also is an up-down counter and can be preset to any number. In addition, it has a separate register which also can be set to any number and comparators which give outputs when the counter is equal to the register and when it is zero - all in one IC!

### Construction

The unit is built on two small pc boards which are connected together with short links of tinned copper wire. Be careful to orientate the IC correctly as it is expensive!

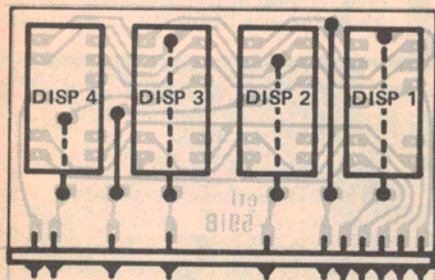
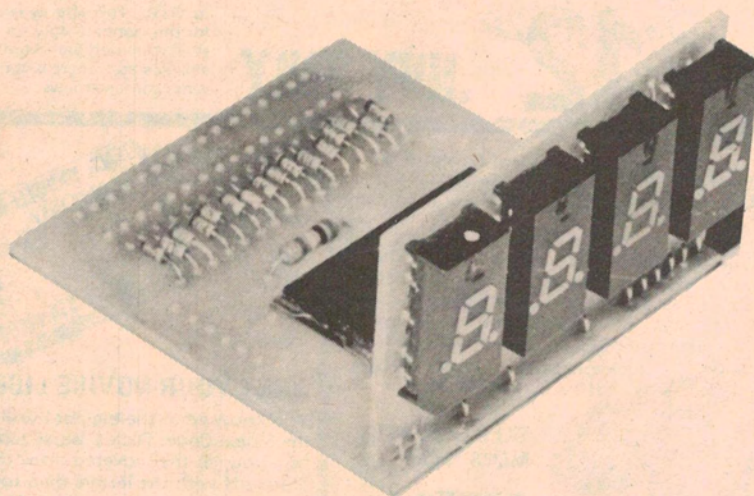


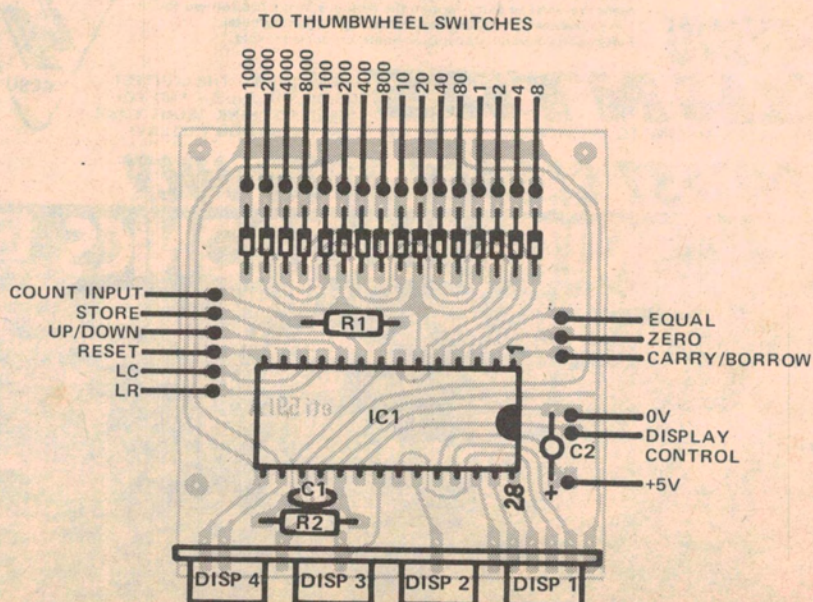
Fig. 1. The positioning of the displays and the links which must be installed before the displays.

Fig. 2. The component overlay for the main board. The common connection from each of the thumbwheel switches goes to the track next to the other connections.



The preset system is designed to use a 4 digit BCD thumbwheel switch (closed = '1') but individual switches can be used if required. Input is in BCD, therefore the switches will have the weighted values 8, 4, 2 and 1. If the

preset is not needed then the diodes can be left out. If a preset is needed, but always to a fixed number, links can be inserted to replace the "on" switches and the other diodes left out.





## HOW TO USE IT - ETI 591

This section is normally How it Works but as it is only one IC there is not much to be said!

### Count Input - Pin 8

The counter is incremented or decremented on the leading edge of this input. A schmitt trigger is provided with a 500 mV hysteresis on a 2V trigger point. For high speed operation, or operation from a digital output, delete R2 and C1 and short out R1. Maximum frequency of operation is about 2 MHz.

### Up-Down - Pin 10

If this pin is left open or taken to +5V the counter will be incremented by the count input. If it is taken to 0V the counter will be decremented by the count input.

### Reset - Pin 14

If this pin is left open or taken to +5V the counter is free to be incremented or decremented. If it is taken to 0V the counters will be reset to zero and held there until reset is taken high again.

### Store - Pin 9

If this input is left open or taken to +5V the latches are "closed" and the information which was in the counters at the time the store input went high will be remembered, decoded and displayed. The counters can be reset, incremented or decremented without affecting the display.

If it is taken to 0V the counter contents will continuously be displayed for as long as this input is at 0V. Any change in the counter contents will be shown on the display.

### Load Counter - Pin 12

This is a 3 level input. If it is left open the counter works normally. If it is taken to +5V the counter is loaded with the BCD data which is set on the thumbwheel switches. If the latch is open, this number will also be displayed. If this input is taken to 0V the BCD I/O pins become high impedance. If a 3 level input is to be controlled by other logic outputs they must be tristate devices.

### Load Register - Pin 11

This is also a 3 level input. If it is left open the counter works normally. If it is taken to +5V the register is loaded with the BCD data. If taken to 0V the circuit goes to a low power state with the multiplexing oscillator stopped, the display off and the BCD I/O pins in a high impedance state. The operation of the counter is unaffected except that there is no display.

### Display Control - Pin 20

This is also a 3 level input. If it is left open, leading edge blanking occurs. If all digits are zero then all are blanked. If it is connected to +5V the display is completely blanked irrespective of the value. If taken to 0V all digits are ON irrespective of value.

## SPECIFICATION - ETI 591

Number of digits	4
Readout	LED
Maximum frequency	2MHz
Input impedance	100k
Output drive	1 TTL load
Supply voltage	4.5 - 5.5V
Supply current	
low power mode	500µA
all eights	100mA

## PARTS LIST - ETI 591

### Resistors all ½W, 5%

R1 . . . . . 100k  
R2 . . . . . 1M

### Capacitors

C1 . . . . . 33n polyester  
C2 . . . . . 1µ0 35V tantalum

### Semiconductors

IC1 . . . . . ICM 7217A  
D1-D16 . . . 1N914  
DISPLAYS. DL704

### Miscellaneous

PC boards ETI 591A, ETI 591B

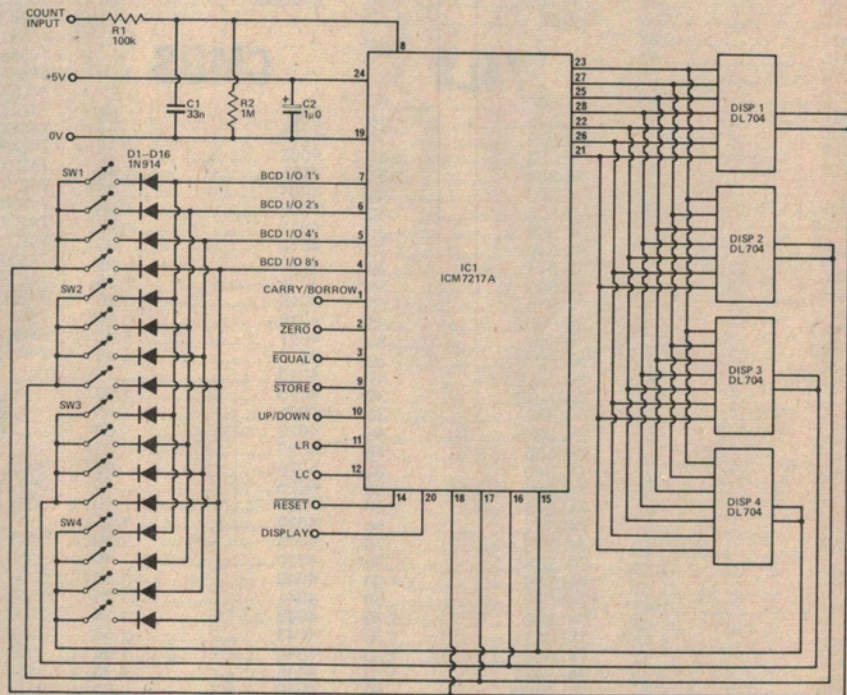


Fig. 3. The circuit diagram for the counter board.

### Scan - Pin 13

The internal multiplexing frequency is nominally 10 kHz giving a digit repetition rate of 2.5 kHz. With a 20 pF capacitor from this point to 0V the frequency drops to 5 kHz and with 90 pF it is about 1 kHz.

### BCD I/O - Pin 4-7

This is a multiplexed data port, normally an output which can drive 1 TTL load. It becomes an input when either LC or LR is at +5V. Pin 7 is the least significant bit.

### Digit Drives - Pins 15-18

These are used both to drive the LEDs and to provide data indicating which digit is being presented at the BCD I/O port. Pin 18 is the least significant digit.

### Zero - Pin 2

If the value of the counter is zero this output will be at 0V.

### Equal - Pin 3

If the value of the counter is equal to the value of the register this output will be at 0V.

### Carry/Borrow - Pin 1

When the counter goes from 9999 to 0000 or from 0000 to 9999 a 500 ns positive pulse occurs on this output. This is connected to the count input of a second unit when an eight digit display is needed.