

TC17A
FREQUENCY COUNTER
Instruction Manual



Hainault Essex England

Telephone 01-500 1000

Telegrams Attenuate Ilford

Telex 263785

The TC17A Timer Counter is a six digit instrument capable of measuring frequencies from DC up to at least 80MHz with a maximum resolution of 0.1Hz. For higher resolution at frequencies below 1MHz, multiple period measurement facilities are provided.

Maximum input sensitivity is 25mV r.m.s. over the full bandwidth. A three position attenuator gives alternative sensitivities of 250mV and 2.5V.

The input impedance is $1M\Omega$ in parallel with 28pF enabling the instrument to be used with standard oscilloscope probes. The internal 1MHz crystal standard enables

a resolution of $1\mu s$ to be achieved on timing measurements, and positive or negative slope selection allows direct measurements to be made of many waveforms (e.g. pulse widths). The indicator tubes used provide an extremely bright clear display and a caption indicator displays the units of measurement.

The TC17A incorporates display storage which may be switched in or out as required.

Alternative versions of this instrument offer B.C.D. output and/or an eight digit display. A choice of crystal standard is also available.

AMENDMENT SHEET FOR TC17A

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Amend TR2 and TR3 to read 2N5179 Part No. 29925
" TR6 and TR7 " " 2N3640 " " 24128
" IC46 to read SN7490 N Decade (option)
Part No. 52134

Delete IC47 complete.

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FS1 Add '0R' 1/2A Slo-blo Fuse Size '0' Part No. 11526

Specification

Section 2

DISPLAY

6 Neon numerical indicators with decimal point and overflow indicator (8 digits optional). Gate-open lamp shows when the counter gate is open.

Caption indicator indicates units of measurement.

Display storage is fitted. This may be switched out by rear panel switch. Display Time: Adjustable from 0.2 to 5 seconds, and infinity in HOLD position, when display may be reset with manually operated front panel push button.

FREQUENCY MEASUREMENTS

D.C. to at least 80MHz at 25mV sensitivity. Typically 100MHz at 100mV.

PERIOD

Measures time between two consecutive inputs.

Time units selectable 1 μ s to 10s.

Repetition rate D.C. – 1MHz

PERIOD AVERAGE

Indicates average time of 1 to 10⁷ periods selected in decade steps.

Time units 1 μ s.

Repetition rate D.C. – 1MHz.

PULSE WIDTH

Indicates positive or negative pulse width as selected by function switch.

Input – channel A.

Range 1 μ s to 10⁷s (10⁹s with 8 digit display).

Time units 1 μ s to 10s.

Rise time limitations – none.

COUNT

Input pulses are counted during the period that 'COUNT ON' is selected. When 'COUNT OFF' is selected the count stops and holds the number accumulated.

TEST

The 1MHz clock is fed into the input and counted for the gate time selected.

INPUT A. B.N.C. SOCKET

Sensitivity: 25mV r.m.s. sine wave. 300mV pk-pk pulse. 9ns min. pulse width.

Attenuator: 3 position switched attenuator, X1, X10, X100.

Impedance: 1M Ω in parallel with 28pF.

Frequency range: D.C. coupled: D.C. – 80 MHz.

A.C. coupled: 20Hz – 50MHz. L.F. coupled: Attenuates inputs above approx. 10kHz.

Trigger level: Continuously variable $\pm 1V$, $\pm 10V$ or $\pm 100V$ depending on attenuator setting. Preset position gives zero crossover triggering.

Slope: Slope control permits triggering on positive or negative edges.

Overload Protection: 120V r.m.s. on X1 attenuator up to 1kHz, reducing to 10V r.m.s. above 10MHz. 250V r.m.s. on X10 and X100 attenuator settings.

EXTERNAL STANDARD INPUT

Rear panel B.N.C. socket selected by slider switch.

Frequency Range: 5Hz to 2MHz

Sensitivity: 1V r.m.s.

Impedance: Approximately 1K Ω

Maximum Input: + 5V – 0V

INTERNAL STANDARD INPUT

1MHz via external standard input socket with slider switch in 'internal' position, greater than 1/2Vpk-pk output, at approx. + 4V d.c. offset. T.T.L. levels, approx. 0.1 to + 3.5V when TCXO option is fitted.

FREQUENCY STANDARD

Internal 1 MHz crystal oscillator.

Ageing rate: Less than 2 parts in 10⁶ per month.

Temperature coefficient: Less than 5 parts in 10⁷ per °C from 0°C to 40°C

Supply Voltage Coefficient: Less than 6 parts in 10⁷ for $\pm 10\%$ supply voltage change.

POWER SUPPLY

Voltage: 115 $\pm 10\%$, or 200V to 256 volts.

Frequency: 48Hz to 400Hz.

Dissipation: 25 Watts.

OPERATING TEMPERATURE RANGE

0°C to + 50°C

DIMENSIONS AND WEIGHT

Height: 3 1/2" (88mm)

Width: 8 3/8" (212mm)

Depth: 12 1/2" (317mm)

Weight: 7lb. (3.2Kg)

OPTIONS

8 digit display.

Temperature Compensated Crystal: Giving accuracy of ± 1 in 10⁶ over the range 0°C – 40°C. Ageing better than 1 in 10⁶ per year.

B.C.D. output

Form: 1-2-4-8 code, 4 line positive true.

Impedance: T.T.L. outputs with 2.2Kohm pull-up resistors.

Logic levels: "1" state level: 5 $\pm 0.5V$, "0" state level: 0.25V approx. at – 1mA.

Print Command: Positive pulse of 5 Volt, d.c. coupled.

Source Impedance is 5Kohm when in the "high" state and 500 ohms when in the "low" state. The pulse duration is 1ms approx.

Inhibit Input: A positive voltage of 3 volt minimum and 50 volt maximum will inhibit the recycling circuitry of the counter.

ABBREVIATIONS USED FOR COMPONENT DESCRIPTIONS

RESISTORS

CC	Carbon Composition	$\frac{1}{2}$ W	10%	unless otherwise stated
CF	Carbon Film	$\frac{1}{8}$ W	5%	unless otherwise stated
MO	Metal Oxide	$\frac{1}{2}$ W	2%	unless otherwise stated
MF	Metal Film	$\frac{1}{4}$ W	1%	unless otherwise stated
WW	Wire Wound	6W	5%	unless otherwise stated
CP	Control Potentiometer		20%	unless otherwise stated
PCP	Preset Potentiometer Type MPD, PC		20%	unless otherwise stated

CAPACITORS

CE(1)	Ceramic		+ 80%	
			- 25%	
CE(2)	Ceramic	500V	$\pm$ 10%	unless otherwise stated
SM	Silver Mica			
PF	Plastic Film		$\pm$ 10%	unless otherwise stated
PS	Polystyrene			
PE	Polyester		$\pm$ 10%	unless otherwise stated
PC	Polycarbonate			
E	Electrolytic (Aluminium)		+ 50%	
			- 10%	
T	Tantalum		+ 50%	
			- 10%	

Component List and Illustrations

Section 6

Ref	Value	Description	Tol %±	Part No.	Ref	Value	Description	Tol %±	Part No.
RESISTORS					R53	56	CF		28715
R1	1M	CF		31840	R54	5k6	CF		21806
R2	100k	CF		21819	R55	390	CF		28722
R3	10k	CF		21809	R56	390	CF		28722
R4	100k	CF		21819	R57	2k2	CF		21802
R5	47	CF		28714	R58	2k2	CF		21802
R6	10k	CF		21809	R59	2k2	CF		21802
R7	100	CF		21794	R60	2k2	CF		21802
R8	560	CF		21798	R61	4k7	CF		21805
R9	100	CF		21794	R62	4k7	CF		21805
R10	20	PCP	5	34510	R63	4k7	CF		21805
R11	10k	CF		21809	R64	4k7	CF		21805
R12	820	CF		28724	R65	4k7	CF		21805
R13	100	CF		21794	R66	4k7	CF		21805
R14	100	CF		21794	R67	4k7	CF		21805
R15	1M	CF		31840	R68	4k7	CF		21805
R16	560	CF		21798	R69	1k	CF		21799
R17	4k7	CF		21805	R70	390	CF		28722
R18/S3	5k Lin	CP		34516	R71	8k2	CF		21808
R19	560	CF		21798	R72	1k	CF		21799
R20	4k7	CF		21805	R73	1k	CF		21799
R21	10	CF		21793	R74	10k	CF		21809
R22	560	CF		21798	R75	3k3	CF		21803
R23	560	CF		21798	R76	1k	CF		21799
R24	10	CF		21793	R77	4k7	CF		21805
R25	10	CF		21793	R78	4k7	CF		21805
R26	470	CF		21797	R79	390	CF		28722
R27	470	CF		21797	R80	100	CF		21794
R28	82	CF		28717	R81	1k	CF		21799
R29	56	CF		28715	R82	4k7	CF		21805
R30	470	CF		21797	R83	4k7	CF		21805
R31	470	CF		21797	R84	100	CF		21794
R32	10	CF		21793	R85	680	CF		28723
R33	33	CF		28712	R86	330	CF		28721
R34	220	CF		21796	R87	4k7	CF		21805
R35	120	CF		28718	R88	4k7	CF		21805
R36	470	CF		21797	R89	390	CF		28722
R37	1k	CF		21799	R90	390	CF		28722
R38	470	CF		21797	R91	3k3	CF		21803
R39	1k	CF		21799	R92	1k	CF		21799
R40	2k2	CF		21802	R93	4k7	CF		21805
R41	470	CF		21797	R94	100	CF		21794
R42	330	CF		28721	R95	680	CF		28723
R43	560	CF		21798	R96	680	CF		28723
R44	2k2	CF		21802	R97	680	CF		28723
R45	2k2	CF		21802	R98	2k2	CF		21802
R46	2k2	CF		21802	R99	2k2	CF		21802
R47	470	CF		21797	R100	2k2	CF		21802
R48	470	CF		21797	R101	2k2	CF		21802
R49	470	CF		21797	R102	330	CF		28721
R50	2k2	CF		21802	R103	4k7	CF		21805
R51	2k2	CF		21802	R104	4k7	CF		21805
R52	1k	CF		21799	R105	1k	CF		21799

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Ref	Value	Description	Tol %±	Part No.	Ref	Value	Description	Tol %±	Part No.
R106	2k7	CF		28726	C24	.1μF	CE(2)		34518
R107	150	CF		28719	C25	10μF	T		34511
R108	220k	CF	5	½ W 18578	C26	.022μF	CE(2)	30V	2663
R109	0.25	CF	10	2 W 34530	C27	10μF	T	20 35V	34511
R110	1k5	CF	10	⅛ W 21801	C28	.1μF	CE(2)	20 50V	34518
R111	560	CF		21798	C29	.1μF	CE(2)	20 50V	34518
R112	560	CF		21798	C30	10μF	T	20 35V	34511
R113	3k3	CF		21803	C31	.1μF	CE(2)	20 50V	34518
R114	18k	CF	5	21811	C32	10μF	T	20 35V	34511
R115	18k	CF	5	21811	C33	7-25pF	Trimmer		23593
R116	18k	CF	5	21811	C34	2-10pF	Trimmer		34535
R117	18k	CF	5	21811	C35	18pF	AOT		
R118	18k	CF	5	21811	C36	.01μF	CE(2)	500V	22387
R119	18k	CF	5	21811	C37	.022μF	CE(2)	30V	2663
R120	18k	CF	5	21811	C38	1.5μF	T	20 35V	34512
R121	18k	CF	5	21811	C39	10μF	T	20 35V	34511
R122	1k5	CF	5	21801	C40	150pF	CE(2)	10 500V	22378
R123/ S10	250k	CP		34517	C41	100pF	CE(2)	10 500V	22376
R124	220	CF		21796	C42	.022pF	CE(2)	30V	2663
R125	4k7	CF		21805	C43	150pF	CE(2)	10 500V	22378
R126	4k7	CF		21805	C44	150pF	CE(2)	10 500V	22378
R127	AOT				C45	100μF	E	6V	32168
R128	470	CF		21797	C46	220pF	CE(2)	500V	22379
R129	470	CF		21797	C47	1.5μF	T	35V	34512
R130	470	CF		21797	C48	.047μF	CE(2)	12V	19657
R131	470	CF		21797	C49	100μF	E	6V	32168
R132	470	CF		21797	C50	.022μF	CE(2)	30V	2663
R133	27	CF		28711	C51	10μF	T	35V	34511
CAPACITORS					C52	4.700pF	CE(2)	500V	22393
C1	.022μF	PF	20	400V 31390	C53	32μF	E	6V	32173
C2	1500pF	CE(2)		22388	C54	4700pF	CE(2)	500V	22393
C3	4.7pF	CE(2)	20	500V 29649	C55	1.5μF	T	35V	34512
C4	47pF	CE(2)		22372	C56	16μF	E	350V	19895
C5	470pF	CE(2)		22383	C57	220μF	E	40V	32190
C6	4.7pF	CE(2)	20	500V 29649	C58	.022μF	CE(2)	30V	2663
C7	.1μF	CE(2)	20	50V 34518	C59	10μF	T	35V	34511
C8	10μF	T	20	35V 34511	C60	100μF	E	16V	32175
C9	68pF	CE(2)	20	500V 22374	C61	470μF	E	6.3V	32164
C10	.1μF	CE(2)	20	50V 34518	C62	4700μF	E	16V	34533
C11	1.5μF	T	10	35V 34512	C63	220μF	E	40V	32190
C12	.1μF	CE(2)	20	50V 34518	C64	.022μF	CE(2)	30V	2663
C13	.01μF	CE(2)	10	250V 22395	C65	10μF	T	35V	34511
C14	10μF	T	20	35V 34511	C66	.01μF	CE(2)	500V	22387
C15	.1μF	CE(2)	20	50V 34518	C67	.022μF	CE(2)	30V	2663
C16	.1μF	CE(2)	20	50V 34518	C68	.022μF	CE(2)	30V	2663
C17	10μF	T	20	35V 34511	C69	.022μF	CE(2)	30V	2663
C18	.1μF	CE(2)	20	50V 34518	C70	.022μF	CE(2)	30V	2663
C19	.1μF	CE(2)	20	50V 34518	C71	.022μF	CE(2)	30V	2663
C20	.1μF	CE(2)	20	50V 34518	C72	.022μF	CE(2)	30V	2663
C21		Not fitted			C73	.022μF	CE(2)	30V	2663
C22	3.3pF	CE(2)		34529					
C23	68pF	CE(2)	20	22374					

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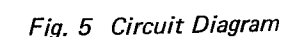
Ref	Value	Description	Tol %±	Part No.	Ref	Value	Description	Tol %±	Part No.
C74	.022μF	CE(2)	30V	2663	IC5		SN 7441AN Decoder		31835
C75	.022μF	CE(2)	30V	2663	IC6		SN 7441AN Decoder		31835
C76	.022μF	CE(2)	30V	2663	IC7		SN 7441AN Decoder		31835
C77	.022μF	CE(2)	30V	2663	IC8		SN 7441AN Decoder		31835
C78	.022μF	CE(2)	30V	2663	IC9		SN 7441AN Decoder		31835
C79	.022μF	CE(2)	30V	2663	IC10		SN 7441AN Decoder		31835
C80	.022μF	CE(2)	30V	2663	IC11		SN 7441AN Decoder		31835
C81	.022μF	CE(2)	30V	2663	IC12		SN 7475N Quad Latch		31834
C82a/b	.1μF +				IC13		SN 7475N Quad Latch		31834
	2500pF	Filter Capacitor	250V a.c.	33445	IC14		SN 7475N Quad Latch		31834
					IC15		SN 7475N Quad Latch		31834
					IC16		SN 7475N Quad Latch		31834
					IC17		SN 7475N Quad Latch		31834
					IC18		SN 7475N Quad Latch		31834
					IC19		SN 7475N Quad Latch		31834
					IC20		N 8H22B Dual Flip Flop		34521
					IC21		N 8290A Decade		29462
					IC22		SN 7490N Decade		52134
					IC23		SN 7490N Decade		52134
					IC24		SN 7490N Decade		52134
					IC25		SN 7490N Decade		52134
					IC26		SN 7490N Decade		52134
					IC27		SN 7490N Decade		52134
					IC28		SN 74S112N		33447
							Dual JK Flip Flop		
					IC29		SN 7400N Quad Lip Gate		52038
					IC30		SN 7400N Quad Lip Gate		52038
					IC31		SN 7400N Quad Lip Gate		52038
					IC32		SN 7410N Triple 3 input Gate		52043
					IC33		SN 7410N Triple 3 input Gate		52043
					IC34		SN 7450N and/or Invert Gates		34513
					IC35		SN 7400 Quad 2 input Gate		52038
					IC36		SN 7474N Dual D Flip Flop		52098
					IC37		SN 7450N and/or Invert Gates		34513
					IC38		SN 7410N Triple 3 input Gate		52043
					IC39		MC 1035 Dual Diffn Amplifier & Schmitt Trigger		34515
					IC40		SN 7400N Quad 2 Input Gate		52038
					IC41		SN 7400N Quad 2 Input Gate		52038
					IC42		SN 7400N Quad 2 Input Gate		52038
					IC43		SN 7400N Quad 2 Input Gate		52038
					IC44		MK 5009P Time Base		34522
					IC45		SN 7400N Quad 2 Input Gate		52038
					IC46	Mod note	830CF SN 7496		34528
					IC47		830CF		34528
TRANSISTORS									
TR1		2N 3955 Selected		35633					
TR2	Mod note	2N 2369/BSX20 2N5179		23307					
TR3		2N 2369/BSX20 2N5179		23307					
TR4		2N 2369/BSX20		23307					
TR5		2N 2369/BSX20		23307					
TR6	Mod note	2N 2369/BSX20 2N3640		23307					
TR7		2N 2369/BSX20-2N2640		23307					
TR8		2N 2369/BSX20		23307					
TR9		2N 3904		24146					
TR10		2N 3904		24146					
TR11		2N 4871 Uni-junction		29509					
TR12		2N 3904		24146					
TR13		2N 3904		24146					
TR14		2N 3904		24146					
TR15		2N 4410		20388					
TR16		2N 4410		20388					
TR17		2N 3904		24146					
TR18		2N 3904		24146					
TR19		2N 4410		20388					
TR20		2N 4410		20388					
TR21		2N 3904		24146					
TR22		2N 4126		29327					
TR23		2N 4126		29327					
TR24	15V	830CE Teledyne	Reg. I.C.	34528					
TR25		MJE 520		24739					
TR26		830CE Teledyne	Reg. I.C.	34528					
TR27		2N 1613		19323					
TR28		2N 2369/BSX20		23307					
TR29		2N 2369/BSX20		23307					
TR30		2N 3904		24146					
TR31		2N 3904		24146					
TR32		2N 3904		24146					
TR33		2N 3904		24146					
TR34		2N 3904		24146					
INTEGRATED CIRCUITS									
IC1		MC10116		33449					
IC2		SN 74S00		34519					
		Quad 2I/P Gate							
IC3		N 8233B	Signature	34514					
		2 I/P 4 bit multiplexer							
IC4		SN 7441AN Decoder		31835					

Component List and Illustrations

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Ref	Value	Description	Tol %±	Part No.	Ref	Value	Description	Tol %±	Part No.
DIODES					LAMPS				
D1		IN4151		1949	ILP1		Neon Indicator ZM1332k		30727
D2		IN4151		1949	ILP2		Neon Indicator ZM1332k		30727
D3		ZF10V Zener		33935	ILP3		Neon Indicator ZM1332k		30727
D4		IN4151		1949	ILP4		Neon Indicator ZM1332k		30727
D5		HP2800		32671	ILP5		Neon Indicator ZM1332k		30727
D6		IN281		23802	ILP6		Neon Indicator ZM1332k		30727
D7		IN4151		1949	ILP7		Neon Indicator ZM1332k		30727
D8		IN4151		1949	ILP8		Neon Indicator ZM1332k		30727
D9		ZF3.3V Zener		33923	ILP9		Filament Lamp		52224
D10		IN281		23802	ILP10		Filament Lamp		52224
D11		IN281		23802	ILP11		Filament Lamp		52224
D12		IN4151		1949	ILP12		Filament Lamp		52224
D13		IN4005		52337	ILP13		Filament Lamp		52224
D14		IN4999	3A	34531	ILP14		Filament Lamp		52224
D15		IN4999	3A	34531					
D16		MV5023 L.E.D.		33460	MISCELLANEOUS				
D17		MV5023 L.E.D.		33460	MR1	1.5 Amps	Rectifier Bridge W02		19725
D18		IN4003		23462	MR2	1.5 Amps	Rectifier Bridge W02		19725
D19		IN4003		23462					
D20		IN4003		23462	T1		Transformer Mains		34523
D21		IN4003		23462	XTL1	1.000000 MHz	Crystal		33454
D22		IN4003		23462					
D23		IN4003		23462	XLR1	10MHz	Oscillator RXO	Optional	34488
SWITCHES					FS1		½A Slo-blo Fuse Size 20mm		33685
S1		Switch Slider DP/TT		33458					
S2		Switch Slider DP/TT		33458					
S3/R18		Switch Pot		34516					
S4		Switch Slider DP/DT		34532					
S5		Switch Slider DP/DT		35768					
S6		Switch Rotary Function		34524					
S7		Switch Rotary Time Base		34525					
S8		Switch Slider DP/DT		34532					
S9		S.P. Switch Push Button		33457					
S10/R123		Switch Pot		34517					
S11		Switch Slider DP/DP		33459					

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SIGNETICS

8233/34/35

2-INPUT 4-BIT DIGITAL MULTIPLEXER

8233/34/35

DESCRIPTION

These devices are 2-input, 4-bit Digital Multiplexers designed for general purpose data-selection applications.

The 8233 features *non-inverting* data paths; and, the 8234 features *inverting* data paths. The 8235 is designed for input to address, registers and general parallel data handling due to its capability to perform **CONDITIONAL COMPLEMENTING (TRUE/COMPLEMENT)**. When the two inputs for each bit position (A_i, B_i) are connected together, the f output will provide either the *True* or *Complement* of the input data. This capability is especially useful for transferring data into parallel adders where both true data for adding or multiplying and also complemented data for subtracting or dividing are needed.

The 8234 and 8235 designs have open collector outputs which permit direct wiring to other open collector outputs (collector logic) to yield "wired" four-bit words. As many as one hundred four-bit words can be multiplexed by using filty 8234/8235s in the WIRED-AND mode.

The inhibit state $S_0 = S_1 = 1$ can be used to facilitate transfer operations in an arithmetic section.

TRUTH TABLE

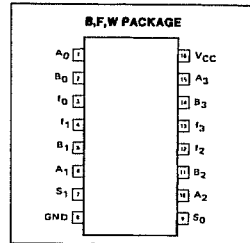
	S_0	S_1	f_n
8233/82533	0	0	B
	1	0	A
	0	1	B
	1	1	0
8234/82534	0	0	$\bar{B}$
	1	0	$\bar{A}$
	0	1	$\bar{B}$
	1	1	1
8235	0	0	$\bar{A}_n B_n$
	0	1	B_n
	1	0	$\bar{A}_n$
	1	1	1

V_{CC} = (18)

GND = (8)

() = denotes pin numbers

PIN CONFIGURATION

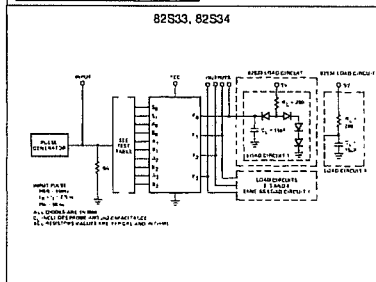
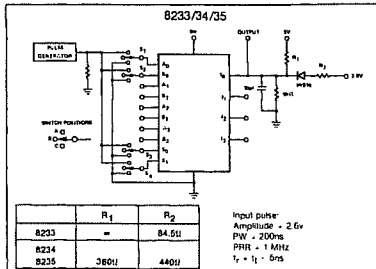


SPEED/PACKAGE AVAILABILITY

8233, 34, 35—B, F, W

82533, 534—B, F

AC TEST FIGURE



LOGIC DIAGRAMS

