ETI

ELECTRONICS
TODAY INTERNATIONAL

GCSE
GROUNDING
HI-LO TIMER

4-GO ROCKET LAUNCHER
FOUR FIRINGS AND A COUNTDOWN

DIGITAL PHOTOGRAPHY COMING OF AGE ?

MIGHTY MIDGET
AUDIO METER AND SIGNAL TRACER

PLUS

- A High Performance Medium Wave Receiver
- Computer Controlled Christmas Light Show

9 770142 722153 13

FOR ENTHUSIASTS BY ENTHUSIASTS
NEXUS

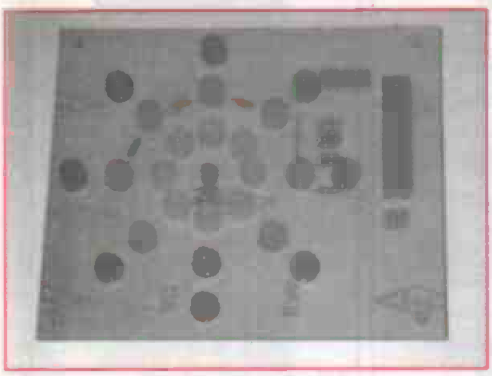
Vol 26 Issue: 13 5 December 1997 £2.50
USA $4.95

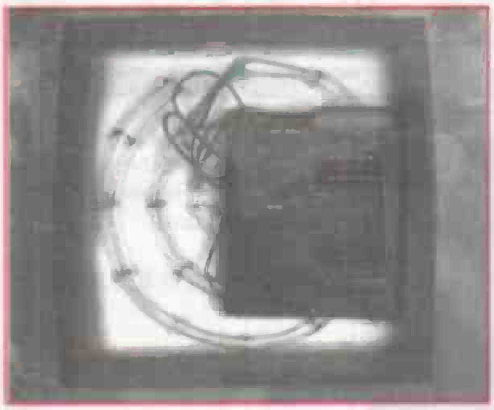
Contents

Volume 26 No.13

Features & Projects

Next Issue 2nd January 1998





Regulars

DIGITAL MULTIMETERS

CM2300 DIGITAL MULTIMETER

FEATURES
- 3.5 LCD DISPLAY
- HEIGHT 12mm
- MAX READING 1999
- HV INDICATION FOR HIGH VOLTAGE
- SINGLE MANUAL ROTARY SWITCH FOR FUNCTION AND RANGE OPERATION
- ALL RANGES OVERLOAD PROTECTED
- 10A DC CURRENT TEST.
- DC VOLTAGE 2V/20V/200V/500V.
- AC VOLTAGE 200/500V
- DC CURRENT 200mA
- RESISTANCE 2kΩ /20kΩ /200kΩ /2MΩ
- SUPPLIED WITH TEST PROBES

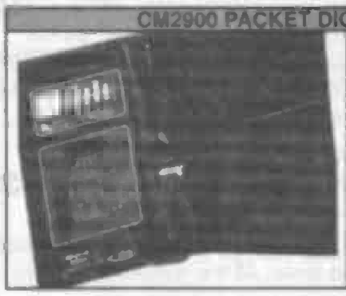
ORDER CODE: CM2300
PRICE: 975p

CM2400T DIGITAL MULTIMETER WITH TEMP MEASUREMENT

FEATURES:
- 3.5LCD DISPLAY
- HEIGHT 12mm
- MAXIMUM READING 1999
- 10A DC CURRENT TEST
- DC VOLTAGE 200mV/2V/20V/200V/1000V
- AC VOLATE 200/750V,
- DC CURRENT 0.2mA/200mA/20mA/200mA/20A
- RESISTANCE 200Ω /2KΩ /20KΩ /200KΩ /2MΩ
- SUPPLIED WITH TEST PROBES
- TEMPERATURE MEASUREMENT
- CONTINUITY TEST
- DIODE TEST & CONTINUITY CHECK
- ALL RANGES OVERLOAD PROTECTED

ORDER CODE: CM2400T
PRICE: 1450p

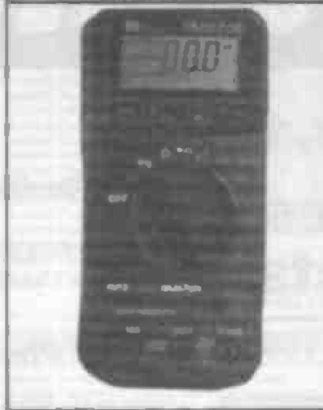
CM2900 PACKET DIGITAL MULTIMETER



FEATURES
- 3.5 LCD DISPLAY
- COMPACT AND LIGHTWEIGHT POCKET SIZE
- MAXIMUM READING 1999
- DC CURRENT 7 RESISTANCE OVERLOAD PROTECTED
- SLIDE SWITCHES FOR FUNCTION AND RANGE OPERATION
- SUPPLIED IN WALLET WITH TEST PROBES
- DC VOLTAGE 2V/20V/200V/500V
- AC VOLTAGE 200V/500V
- DC CURRENT 200mA
- RESISTANCE 2KΩ /20KΩ /200KΩ /2MΩ

ORDER CODE: CM2900
PRICE1150p

CM2700 AUTORANGING DIGITAL MULTIMETER



FEATURES
- 3.75 LCD DISPLAY WITH DECIMAL POINT
- 33 SEGMENT BARGRAPH DISPLAY
- OVERRANGE INDICATION
- ROTARY SWITCH FOR FUNCTION SELECTION
- AUTO POWER OFF (APPROX 15 mins)
- AUTO POLARITY WITH INDICATION
- DIODE TEST & CONTINUITY TEST WITH BUZZER
- ALL RANGES OVERLOAD PROTECTED
- LOW BATTERY INDICATION
- SUPPLIED WITH TEST PROBES
- DC VOLTAGE: 320mV/3.2V/32V/320V/600V
- AC VOLTAGE: 320mV/3.2V/32V/320V600V
- DC CURRENT A: 320µA/3200µA/32mA/320mA/10A
- AC CURRENT A: 320µA/3200µA/32mA/320mA/10A
- RESISTANCE: 320Ω/3.2KΩ/32KΩ/320KΩ/3.2MΩ/32MΩ

ORDER CODE: CM2700
PRICE: 4050p

CM3230 DIGITAL CAPACITANCE METER

FEATURES
- 3.5 LCD DISPLAY
- HEIGHT 18mm
- MAXIMUM READING 1999
- CAPACITANCE 9 RANGES FROM 200pF-20000µF
- MEASURING FROM 1pF - 20000µF
- SINGLE MANUAL ROTARY SWITCH FOR FUNCTION AND RANGE OPERATION
- ZERO ADJUST KNOB

ORDER CODE: CM3230
PRICE: 3950p

CM3900A DIGITAL MULTIMETER

FEATURES
- LARGE LCD DISPLAY
- HEIGHT 18mm
- MASIMUM READING 1999 + UNIT
- SINGLE MANUAL ROTARY SWITCH FOR FUNCTION AND RANGE OPERATION
- AUTO POWER OFF (APPROX 15 min)
- DIODE TEST FUNCTION
- ALL RANGES OVERLOAD PROTECTED
- SUPPLIED WITH TEST PROBES
- DC VOLTAGE: 200mV/2V/20V/200V 700V ACCURACY ±0.5%
- AC VOLTAGE: 200mV/2V/20V/200V/700V
- DC CURRENT A: 200µA/20mA/200mA/2A/20A
- AC CURRENT A: 200µA/20mA/200mA/2A/20A
- RESISTANCE : 200Ω/2kΩ/200kΩ/2MΩ/20MΩ/200MΩ

ORDER CODE: CM3900A
PRICE: 2900p

CM3920 DIGITALMETER WITH TEMP MEASUREMENT

FEATURES:
- TEMPERATURE MEASUREMENT
- DIODE & TRANSISTOR HFE TEST
- LARGE LCD DISPLAY
- HEIGHT 18mm
- MAXIMUM READING 1999 + UNIT
- SINGLE MANUAL ROTARY SWITCH FOR FUNCTION AND RANGE OPERATION
- AUTO POWER OFF (APPROX 15 mins)
- DIODE TESWT FUNCTION
- ALL RANGES OVERLOAD PROTECTED
- SUPPLIED WITH TEST PROBES
- DC VOLTAGE: 200mV/2V/20V/200V/1000V ACCURACY ±0.5%
- AC VOLTAGE: 200mV/2V/20V/200V/700V
- DC CURRENT 2mA/20mA/200mA/20A
- AC CURRENT A: 200mA/20A
- RESISTANCE : 200Ω/2KΩ/200kΩ/2MΩ/20MΩ/200MΩ
- CAPACITANCE: 2nF/20nF/200nF/2µF/20µF

ORDER CODE: CM3920
PRICE: 4100p

8 Way Preprogrammed Universal Remote Control

A single remote control to operate Television, Videos and Satellite Receivers. Plus Auxilary Options!!

- Replaces up to 8 remotes with one
- Simple 4 digit setup routine
- Controls 1000's of models
- Teletext functions with Fastext
- Clear (large key) layout
- Code Search Facility
- Stylish and easy to operate
- Replace broken or lost remotes
- Original Remote note required

Order Code: 8 WAY
Price: 1450P + VAT

GRANDATA LTD

K.P. HOUSE, UNIT 15, POP IN COMMERCIAL CENTRE,
SOUTHWAY, WEMBLEY, MIDDLESEX, ENGLAND HA9 0HB
Telephone: 0181-900 2329 Fax: 0181-903 6126
OPEN Monday to Saturday.
Times: Mon-Fri 9.00-5.30 Sat 9.00-2.00

PLEASE PHONE US FOR TYPE NOT LISTED HERE AS WE ARE HOLDING 30,000 ITEMS AND QUOTATIONS ARE GIVEN FOR LARGE QUANTITIES

Please send £1 P&P and VAT at 17.5%. Govt, Colleges, etc. Orders accepted. Please allow 7 days for delivery. Prices quoted are subject to stock availability and may be changed without notice.

TV and video parts sold are replacement parts.

Access & Visa Card accepted

WE STOCK TV AND VIDEO SPARES, JAPANESE TRANSISTORS AND TDA SERIES. PLEASE RING US FOR FURTHER INFORMATION.

TRANSISTORS

PART	PRICE
AC125	30P
AC126	30P
AC127	30P
AC128K	40P
AC141K	45P
AC176	22P
ACY18	48P
ACY19	48p
AD149	60P
AF125	50P
AF139	30P
BC107	8P
BC108	8P
BC109	8P
BC109C	10P
BC140	20P
BC142	20P
BC143	20P
BC147	8P
BC149	8P
BC159	8p
BC160	30P
BC171	10P
BC172	10P
BC177	14P
BC178	14P
BC179	14P
BC182	7P
BC182L	7P
BC183	7P
BC183L	7P
BC184	7P
BC184L	7P
BC212	7P
BC212L	7P
BC213	7P
BC213L	7P
BC214	7P
BC214L	7P
BC237	7P
BC238	7P
BC239	7P
BC300	20P
BC301	20P
BC302	20P
BC303	20P
BC304	25P
BC327	7P
BC328	7P
BC337	7P
BC338	7P
BC441	28P
BC446	8P
BC477	18P
BC516	22P
BC537	25P
BC546	8P
BC547	8P
BC548	8P
BC549	8P
BC550	8P
BC556	8P
BC557	7P
BC558	8P
BC559	8P
BC560	8P
BC637	20P
BC639	20P
BC640	20P
BCY33	200P
BCY34	200P
BCY70	16P
BCY71	16P
BCY72	16P
BD115	30P
BD124P	50P
BD131	25P
BD132	25P
BD133	50P
BD135	20P
BD136	20P
BD137	20P
BD138	20P
BD139	20P
BD140	20P
BD144	90P
BD157	38P
BD166	30P
BD175	30P
BD177	30P
BD179	32P
BD181	45P
BD182	60P
BD184	60P
BD187	30P
BD201	33P
BD202	38P
BD203	42P
BD204	42P
BD222	31P
BD225	31P
BD232	31P
BD233	30P
BD234	32P
BD235	28P
BD236	30P
BD237	21P
BD238	24P
BD239	30P
BD240	30P
BD241A	40P
BD243A	50P
BD244	50P
BD245	50P
BD246A	50P
BD266	45P
BD267	45P
BD269	45P
BD278	50P
BD311	100P
BD314	100P
BD315	150P
BD317	150P
BD331	40P
BD332	40P
BD361	60P
BD362	60P
BD370	30P
BD371	30P
BD410	50P
BD433	28P
BD434	30P
BD435	31P
BD436	30P
BD437	28P
BD438	38P
BD439	40P
BD440	40P
BD441	40P
BD533	50P
BD534	38P
BD535	38P
BD536	38P
BD537	40P
BD538	40P
BD643	50P
BD646	50P

PART	PRICE
BD647	50P
BD649	50P
BD675	40P
BD676	40P
BD677	38P
BD678	40P
BD679	40P
BD680	40P
BD681	45P
BD682	45P
BD705	50P
BD707	50P
BD709	50P
BD711	50P
BD736	50P
BD826	50P
BD828	50P
BD839	55P
BD897	50P
BD899	50P
BD977	50P
BDX33	60P
BDX37	100P
BDX44	100P
BDX47	75P
BDX54C	75P
BDX62C	150P
BDX63C	175P
BDX64C	175P
BDX65	80P
BDX66C	175P
BDX87C	275P
BDX71	70P
BDX77	175P
BDX87C	175P
BDX88C	150P
BDW24	55P
BDW93	60P
BDW94	50P
BDY29	225P
BDY56	225P
BDY58	500P
BDY90	125P
BDY92	100P
BF137	35P
BF167	30P
BF181	18P
BF183	20P
BF195	7P
BF199	8P
BF200	16P
BF225	30P
BF240	16P
BF245	25P
BF254	15P
BF255	12P
BF256	18P
BF257	18P
BF259	18P
BF262	25P
BF270	18P
BF273	15P
BF311	21P
BF336	20P
BF337	20P
BF338	20P
BF362	30P
BF387	13P
BF371	17P
BF421	18P
BF422	21P
BF423	25P
BF455	12P
BF458	19P
BF462	50P
BF471	28P
BF472	28P
BF479	30P
BF494	18P
BF495	18P
BF595	16P
BF596	16P
BF615	30P
BF617	30P
BF760	40P
BF763	40P
BF870	38P
BF871	22P
BF960	35P
BF981	38P
BF984	38P
BFQ232	75P
BFQ252A	50P
BFR90	65P
BFR91	99P
BFT43	30P
BFX29	30P
BFX84	20P
BFX85	20P
BFX87	15P
BFX88	15P
BFX89	60P
BFY50	14P
BFY51	24P
BFY52	14P
BFY56	25P
BFY64	25P
BFY90	45P
BLY48	85P
BR100	14P
BR103	37P
BR303	85P
BSX20	18P
BU105	80P
BU108	100P
BU109	80P
BU110	90P
BU111	100P
BU124	80P
BU125	100P
BU126	65P
BU128	125P
BU133	125P
BU137	150P
BU180	100P
BU184	100P
BU204	65P
BU205	70P
BU206	100P
BU207	100P
BU208	70P
BU208A	75P
BU208AT	200P
BU208B	200P
BU208D	130P
BU209	90P
BU225	120P
BU226	120P
BU312	90P
BU325	55P
BU326A	75P
BU406	60P
BU406D	85P
BU407	55P
BU407D	75P
BU408	60P
BU408D	75P

PART	PRICE
BU409	85P
BU412	175P
BU413	175P
BU414B	250P
BU415A	170P
BU426A	70P
BU433	120P
BU500	100P
BU500D	225P
BU505	90P
BU505D	90P
BU505DF	90P
BU508	100P
BU506D	70P
BU506DF	120P
BU508A	70P
BU508AF	95P
BU508APH	80P
BU508D	90P
BU508DF	115P
BU508DR	130P
BU508V	110P
BU508VF	100P
BU526	75P
BU536	100P
BU546	125P
BU803	125P
BU806D	225P
BU808D	120P
BU826	120P
BU705	130P
BU706DF	175P
BU708F	150P
BU724A	100P
BU801	70P
BU806	70P
BU807	60P
BU807F	75P
BU808DF	300P
BU810	110P
BU824	450P
BU826	120P
BU826A	160P
BU902	110P
BU903	110P
BU910	80P
BU912	100P
BU920	100P
BU922	110P
BU930	130P
BU932	175P
BU941	250P
BU2508A	130P
BU2508AF	130P
BU2508D	130P
BU2508DF	150P
BU2520AF	225P
BU2520DF	225P
BU2525A	325P
BU2525AF	325P
BU2527AF	400P
BUF405A	200P
BUH315	200P
BUH150	250P
BUH515	200P
BUH515D	250P
BUH517	275P
BUH517D	175P
BUH715	425P
BUV93	375P
BUK444/500B	200P
BUK444/800B	200P
BUK445/600B	200P
BUK446/800B	400P
BUK455/600B	200P
BUK456	200P
BUW81A	150P
BUR51	1900P
BUR52	1900P
BUS11A	200P
BUS12A	200P
BUS14A	500P
BUS23	225P
BUS48A	175P
BUT11A	55P
BUT11AF	55P
BUT12	80P
BUT13	310P
BUT18	80P
BUT18AF	80P
BUT30V	1700P
BUT56A	100P
BUT76A	80P
BUT90	1300P
BUT92	1200P
BUY18	650P
BUV20	650P
BUV21	400P
BUV23	475P
BUV24	350P
BUV25	110P
BUV26	150P
BUV27	125P
BUV28	110P
BUV37	175P
BUV46A	75P
BUV47	120P
BUV48A	175P
BUV48AF	325P
BUV48C	250P
BUV50	425P
BUV61	100P
BUV70	200P
BUV90	175P
BUZ30A	475P
BUW11A	200P
BUW1AF	225P
BUW12	125P
BUW12A	150P
BUW12F	250P
BUW13A	200P
BUW32A	500P
BUW48	550P
BUW49	560P
BUW50	400P
BUZ73AF	60P
BUW84	75P
BUW85	85P
BUX10	150P
BUX11	200P
BUX12	150P
BUX20	350P
BUX21	450P
BUX22	450P
BUX23	900P
BUX32	175P
BUX37	200P
BUX39	450P
BUX40	210P
BUX41	200P
BUX42	200P
BUX47A	200P

PART	PRICE
BUX48A	150P
BUX55	800P
BUX80	180P
BUX81	160P
BUX84	50P
BUX85	50P
BUX86	30P
BUX87	50P
BUX98A	350P
BUY18S	150P
BUY47	150P
BUY57	125P
BUY69A	200P
BUY71	250P
BUZ10	65P
BUZ11	200P
BUZ11A	175P
BUZ14	550P
BUZ20	225P
BUZ21	250P
BUZ24	350P
BUZ25	450P
BUZ32	125P
BUZ36	800P
BUZ44A	525P
BUZ45A	800P
BUZ50B	500P
BUS3A	800P
BUZ71	75P
BUZ71AF	100P
BUZ72A	100P
BUZ72AF	100P
BUZ73A	-150P
BUZ76A	110P
BUZ80	200P
BUZ80AF	200P
BUZ83	200P
BUZ90A	180P
BUZ91A	400P
BY448	20P
BYT11	25P
C106D	28P
CQY80	40P
IRF120	225P
IRF130	475P
IRF140	550P
IRF230	550P
IRF240	425P
IRF250	375P
IRF330	800P
IRF340	325P
IRF350	750P
IRF450	650P
IRF10	150P
IRF520	150P
IRF530	150P
IRF540	200P
IRF610	150P
IRF611	150P
IRF620	160P
IRF630	150P
IRF640	350P
IRF642	200P
IRF660	200P
IRF710	150P
IRF720	150P
IRF730	150P
IRF740	150P
IRF820	150P
IRF830	160P
IRF840	150P
IRF9140	1000P
IRF9510	150P
IRF9511	150P
IRF9520	150P
IRF9530	400P
IRF9531	200P
IRF9540	300P
IRF9541	200P
IRF9610	150P
IRF9620	150P
IRF9622	200P
IRF9630	325P
IRF9640	375P
IRFD9220	100P
IRFBC30	200P
IRFBC40	400P
IRFP140	250P
IRFP150	300P
IRFP240	300P
IRFP250	400P
IRFP350	325P
IRFP450	400P
IRFP460	775P
IRFP9140	1450P
IRFP9240	500P
IRFPC50	600P
IRFRC20	250P
IRFZ20	65P
IRFZ42	275P
IRFZ44	275P
MJ900	200P
MJ10001	200P
MJ1001	200P
MJ2501	100P
MJ2955	55P
MJ3000	100P
MJ3001	100P
MJ4032	175P
MJ4035	175P
MJ4502	300P
MJ10012	300P
MJ11015	250P
MJ11016	300P
MJ11032	800P
MJ11033	800P
MJ15003	250P
MJ15004	300P
MJ15015	250P
MJ15016	350P
MJ15022	250P
MJ15023	400P
MJ15024	400P
MJ15025	700P
MJE29A	30P
MJE30A	30P
MJE210	70P
MJE340	25P
MJE350	80P
MJE520	30P
MJE2955T	65P
MJE3055T	65P
MJE13004	100P
MJE13005	60P
MJE13007	100P
MJE13009	100P
MJE15028	200P
MJE15029	200P
MJE15030	250P
MJE15031	400P
MJE18004	125P
MJF18004	175P
MJF18204	350P
MPSA05	15P
MPSA06	15P
MPSA10	15P
MPSA13	15P

PART	PRICE
MPSA14	15P
MPSA20	15P
MPSA42	15P
MPSA43	15P
MPSA44	40P
MPSA55	12P
MPSA56	12P
MPSA70	15P
MPSA92	20P
MPSA93	20P
MPSU10	200P
MPSU45	550P
MPSU56	400P
MPSU60	350P
MR510	35P
MR856	36P
OC28	350P
OC29	250P
OC35	350P
OC36	250P
OC45	50P
OC200	180P
R2008B	100P
R2010B	100P
S2000A3	175P
S2000AF	175P
S2055A	175P
S2055AF	200P
S2530A	100P
S2800M	72P
TIP29	15P
TIP29A	22P
TIP29C	25P
TIP29E	40P
TIP30	25P
TIP30C	25P
TIP31A	22P
TIP31C	27P
TIP32	24P
TIP32A	21P
TIP32C	28P
TIP33	50P
TIP33C	60P
TIP34	65P
TIP34C	60P
TIP35C	65P
TIP36C	65P
TIP42A	20P
TIP41C	22P
TIP42A	20P
TIP42C	22P
TIP47	40P
TIP48	40P
TIP50	60P
TIP51	60P
TIP52	80P
TIP54	85P
TIP102	70P
TIP105	65P
TIP106	65P
TIP107	65P
TIP110	40P
TIP111	40P
TIP112	35P
TIP112H	50P
TIP115	30P
TIP116	30P
TIP117	30P
TIP120	37P
TIP121	35P
TIP122	30P
TIP125	30P
TIP126	40P
TIP127	35P
TIP130	30P
TIP131	30P
TIP132	30P
TIP136	40P
TIP137	65P
TIP162	110P
TIP141	65P
TIP143	75P
TIP145	50P
TIP146	70P
TIP147	80P
TIP150	90P
TIP151	60P
TIP2955	50P
TIP3055	50P
TIPL760	100P
TIPL762A	200P
TIPL763A	200P
TIPL791A	80P
TIS61	15P
TIS90	15P
TIS93	20P
ZTX107	11P
ZTX108	11P
ZTX109	12P
ZTX212	20P
ZTX300	10P
ZTX301	16P
ZTX302	10P
ZTX303	20P
ZTX304	10P
ZTX320	20P
ZTX501	13P
ZTX502	10P
ZTX503	18P
ZTX504	25P
2N696	26P
2N697	22P
2N698	40P
2N78	22P
2N914	28P
2N918	30P
2N930	18P
2N1131	28P
2N1132	28P
2N1304	350P
2N1305	225P
2N1613	24P
2N1711	24P
2N1893	30P
2N2102	50P
2N2218A	24P
2N2219	24P
2N2221	23P
2N2222	23P
2N2243	40P
2N2369	15P
2N2484	15P
2N2646	40P
2N2894	50P
2N2904	20P
2N2905	20P
2N2906	18P
2N2907	18P
2N3019	28P
2N3053	18P
2N3054	40P
2N3055	38P
2N3055H	50P
2N3439	40P
2N3440	45P
2N3441	175P
2N3442	85P

PART	PRICE
2N3553	100P
2N3585	650P
2N3702	9P
2N3703	9P
2N3704	9P
2N3705	9P
2N3706	9P
2N3707	9P
2N3710	12P
2N3711	12P
2N3771	85P
2N3772	90P
2N3773	100P
2N3792	150P
2N3799	18P
2N3819	29P
2N3820	70P
2N3823	40P
2N3866	110P
2N3903	11P
2N3906	11P
2N3924	375P
2N3958	375P
2N4031	25P
2N4033	25P
2N4036	29P
2N4220	175P
2N4347	130P
2N4391	60P
2N4392	50P
2N4393	55P
2N4399	200P
2N4401	12P
2N4403	12P
2N4416	120P
2N4420	75P
2N4427	75P
2N4920	50P
2N4922	30P
2N4923	30P
2N5038	175P
2N5081	20P
2N5088	20P
2N5109	100P
2N5116	175P
2N5154	150P
2N5160	600P
2N5179	40P
2N5192	50P
2N5241	500P
2N5245	45P
2N5294	30P
2N5296	30P
2N5320	50P
2N5322	55P
2N5401	10P
2N5416	40P
2N5448	12P
2N5457	45P
2N5458	55P
2N5460	55P
2N5461	75P
2N5462	45P
2N5484	55P
2N5551	12P
2N5671	350P
2N5672	400P
2N5680	55P
2N5884	175P
2N5886	325P
2N6031	250P
2N6049	55P
2N6059	150P
2N6098	50P
2N6099	45P
2N6107	40P
2N6109	40P
2N6211	400P
2N6248	150P
2N6284	250P
2N6287	225P
2N6292	40P
2N6385	120P
2N6403	160P
2N6427	25P
2N6476	250P
2N6488	90P
2N6491	90P
2N6547	300P
2N6609	375P
2N6660	375P
2N6675	175P
2N6678	225P
4N35	50P
RECTIFIER DIODES	
BY127	8P
BY133	8P
BY184	40P
BY179	35P
BY184	32P
BY206	11P
BY207	20P
BY227	19P
BY228	28P
BY298	15P
BY299	18P
BY329-1200	150P
BY448	20P
BYT11	25p
BYT13-1000	30P
BYV96E	25P
BYW96E	36P
BYX10	15P
BYX55/600	25P
OA47	10P
OA91	10P
IN4001	3P
IN4002	3P
IN4003	3P
IN4004	3P
IN4005	3P
IN4006	3P
IN4007	4P
IN4148	2P
IN5400	9P
IN5401	8P
IN5402	8P
IN5403	8P
IN5404	8P
IN5405	11P
IN5406	12P
IN5407	12P
IN5408	12P
RGP10	25P
RGP15	25P
RGP30	18P
SKE4F2/06	60P
SKE4F2/08	80P
SKE4F2/10	100P
SR2M	80P

SATELLITE POWER SUPPLY REPAIR KITS

ALBA	CODE
SAT660	SATPSU2

AMSTRAD	CODE
SRD510, SRD520, SRD540, SRD550	SATPSU3
SRDR45	
SRD500	SATPSU4
SRX320, SRX340, SRX345, SRX350	SATPSU5
SRX100	SATPSU6
SRD600	SATPSU14
SAT250, SR950, SRD700, SRD950, SRX1002, SRX2001, SRX301, SRX501, SRX502	SATPSU16
SRD2000	SATPSU18

BRITISH TELECOM	CODE
SVS300	SATPSU17

BUSH	CODE
IRD150	SATPSU12
IRD155	SATPSU19

CHURCHILL	CODE
D3MAC DECODER	SATPSU7

ECHOSTAR	CODE
SR5500 EARLY PSU WITH ADJ	SATPSU12
8500, SR7700, SR8700	SATPSU13

FERGUSON	[illegible]
SRD 5, SRD16	SATPSU1
SRV1	SATPSU2
SRDE4	SATPSU11

FINLUX	CODE
SR5700	SATPSU12

GOODMANS	CODE
ST700	SATPSU1

GRUNDIG	CODE
STR1	SATPSU1
GIRD200, FIRD3000	SATPSU2

MANHATTAN	CODE
850, 950	SATPSU1

MASPRO	CODE
SRE250S/1, SRE350S/1	SATPSU1
SRE250S, SRE350S, SRE450S	SATPSU2

MIMTEC	CODE
SOPRENSON TYPE PSU ONLY	SATPSU15

NETWORK	CODE
9000, 9200	SATPSU2

NOKIA	CODE
SAT1500	SATPSU2

PACE	[illegible]
PRD800, PRD900, PSR800, PSR900	SATPSU1
MRD920, SS9000, SS9010, SS9200, SS9210, SS9220	SATPSU2
D100, D150,	SATPSU6
MSS100	SATPSU8
APOLLO, MSS200, MSS300	SATPSU9
MSS500, MSS1000	SATPSU10

PHILIPS	CODE
STU802/05M	SATPSU1
STU801	SATPSU2

THOMSON	CODE
SRS4	SATPSU2

TOSHIBA	CODE
SAT99, TU-SDU200	SATPSU1

CODE	PRICE	CODE	[illegible]	CODE	[illegible]	CODE	PRICE
SATPSU1	650p	SATPSU6	650p	SATPSU11	835p	SATPSU16	730p
SATPSU2	650p	SATPSU7	650p	SATPSU12	1735p	SATPSU17	850p
SATPSU3	650p	SATPSU8	730p	SATPSU13	3125p	SATPSU18	1175p
SATPSU4	650p	SATPSU9	900p	SATPSU14	3135p	SATPSU19	650p
SATPSU5	650p	SATPSU10	1230p	SATPSU15	77.5p		

PACE SATELLITE TUNERS

MODELS	CODE	PRICE
PRD800, MSS200 (2GHZ) (221-2077062)	TUNER01	1650p
PRD900, MSS500, MSS1000 (2Ghz) (221-2177012)	TUNER02	1650p

PACE SWITCH MODE TRANSFORMERS

MODELS	CODE	PRICE
PACE9000	PACE9000	800p
PACEPRD800, PRD900	PRD800	550p

SATMETER

THE SATMETER IS A PROFESSIONAL PORTABLE SATELLITE STRNGTH METER DESIGNED FOR THE INSTALLATION AND MAINTENANCE OF SATELLITE TV SYSTEMS. THE SATMETER CAN BE USED AS STAND ALONE METER WITH POWERING THE LNB AS WELL AS IN LOOP. THROUGH OPERATION WITH SATELLITE RX POWERING THE LNB.

ACOUSTICAL SIGNAL: ON SIGNAL STRENGTH
INPUT IMPEDENENCE: 75 Ohm
MAX.INPUT SIGNAL: -10 DBM

LED INDICATOR: VERTICAL/HORIZONTAL
POWER AMPLIFIER: 18 DB

FREQUENCY RANGE: 900 TO 2050 MHZ
DETECTION RANGE: -60 TO -10 DBM

ORDER CODE: TOOL 22 PRICE: 8500p

SATELLITE LNB'S

MAKE & MODEL	ORDER CODE	PRICE
Cambridge AE22/AE5 0.8dB standard 10.95-11.70 GHz Gold Range	LNB1	2160p
Cambridge AE14 Universal LNB 10.7-11.7/11.7-12.75 GHz	LNB2	2500p
Cambridge AE21/AE5 Single O/P Switching LNB 1.0dB Standard	LNB3	2050p
Cambridge AE19/AE6 Single O/P Switching LNB 1.0dB Enhanced	LNB4	2050p
Cambridge AE23/AE12 0.8dB Enhanced 10.7-11.8GHz Gold Range	LNB5	2160p
Cambridge AE8 Dual O/P H-V Separate Enhanced	LNB6	4000p
Cambridge AE7 Twin O/P H+V Both Enhanced	LNB7	4000p
Cambridge AE2 Dual O/P H-V Separate Enhanced	LNB8	3560p
Grundig Super Universal 'Anis' 10.7-12.75 GHz 0.8dB	LNB9	2600p
Grundig Universal 'Anis' 10.7-12.75 GHz 1.0dB	LNB10	2250p
Cambridge AE1 Twin O/P H+V Both Standard	LNB11	4000p

FUSES

	TIME LAG (20MM)		QUICK BLOW (20MM)	
CURRENT RATING	ORDER CODE	PRICE	ORDER CODE	PRICE
100mA	FUSE36	75p	FUSE37	60P
160mA	FUSE01	75p	FUSE17	60p
250mA	FUSE02	75p	FUSE18	60p
315mA	FUSE03	75p	FUSE19	60p
400mA	FUSE04	75p	FUSE20	60p
500mA	FUSE05	75p	FUSE21	60p
630mA	FUSE06	75p	FUSE22	60p
800mA	FUSE07	60p	FUSE23	60p
IA	FUSE08	60p	FUSE24	60p
1.25A	FUSE09	60p	FUSE25	60p
1.6A	FUSE10	60p	FUSE26	60p
2A	FUSE11	50p	FUSE27	60p
2.5A	FUSE12	50p	FUSE28	60p
3.15A	FUSE13	55p	FUSE29	50p
4A	FUSE14	55p	FUSE30	50p
5A	FUSE15	60p	FUSE31	50p
6.3A	FUSE16	60p	FUSE32	50p

NB.
ALL FUSES ARE MADE IN THE UK AND FULLY MEET BS4265 & BS1362 SAFETY STANDARDS AND SHOULD NOT BE COMPARED WITH CHEAP IMPORTED TYPES.

CERAMIC PLUG TOP

CURRENT RATING	ORDER CODE	PRICE
3A	FUSE33	100p
5A	FUSE34	100p
13A	FUSE35	100p

20mm CERAMIC TIME LAG

CURRENT RATING	ORDER CODE	PRICE
6.3A	FUSE38	100p
8A	FUSE39	100p
10A	FUSE40	100p
3.15A	FUSE41	85p
4A	FUSE42	85p
5A	FUSE43	85p

38mm CERAMIC TIME LAG

CURRENT RATING	ORDER CODE	PRICE
10A	FUSE48	815P

32mm CERAMIC SLOW BLOW

CURRENT RATING	ORDER CODE	PRICE
8A	FUSE44	185P
10A	FUSE45	185p
15A	FUSE46	185p
20A	FUSE47	210p

****ALL THE ABOVE PRICES ARE FOR PACKS OF 10 FUSES****

TRANSISTORS

PART	PRICE
I.C. SOCKETS	
8 PIN	4P
14 PIN	5P
16 PIN	6P
18 PIN	9P
20 PIN	10P
22 PIN	12P
24 PIN	13P
28 PIN	13P
40 PIN	15P
ZENER DIODES	
400m	WATT
2V7 TO 39V	5P
1.3	WATT
2V7 TO 39V	9P
VOLTAGE REGULATORS	
7805	25P
7806	25P
7808	25P
7812	25P
7815	25P
7818	25P
7824	25P
7905	25P
7906	30P
7908	30P
7912	30P
7915	30P
7918	30P
7924	30P
78L05	24P
78L08	24P
78L12	24P
78L15	24P
78L18	24P
78L24	24P
79L05	35P
79L08	35P
79L12	35P
79L15	35P
LM309K	100P
LM317T	100P
LM323K	350P
78H05KC	800P
78H12KC	700P
78HGKC	800P
L.E.D.'s 3mm	
RED	5p
YELLOW	8p
GREEN	8p
5mm	
RED	5p
YELLOW	6p
GREEN	6p
RECTANGULAR LED's	
5mm x 2.5mm	
RED	5p
YELLOW	8p
GREEN	8p
BRIDGE RECTIFIER	
W005	16p

PART	PRICE
1A/50V	
W01	18p
1A/100V	
W02	19p
1A/200V	
W04	21p
1A/400V	
W06	23p
1A/600V	
W08	28p
1A/800V	
BR81D	33p
2A/100V	
BR82D	33p
2A/200V	
BR84D	37p
2A/400V	
BR86D	43p
2A/600V	
BR88D	43p
2A/800V	
BR32	43p
2A/200V	
BR34	43p
2A/400V	
BR36	44p
2A/600V	
BR62	80p
6a/200V	
BR64	72p
6A/400V	
BR251	150p
25A/100V	
BR252	165p
24A/200V	
BR254	185p
25A/400V	
BR2156	200p
25A/600V	
BR258	240p
25A/800V	
BR351	185p
35V/100V	
BR352	200p
35V/200V	
BR354	220p
35V/400V	
BR356	230p
35V/600V	
BR358	260p
35V/800V	
BY164	40p
1.5A/100V	
BY176	40p
1.5A/800V	
TRIACS	
TIC206D	60p
4A/400V	
TIC225D	69p
6A/400V	
TIC226D	68p
8A/400V	
TIC236D	85p
12A/400V	
TIC246D	105p
16A/400V	
TIC253D	190p
20A/400V	
TIC263D	205p
25A/400V	
THYRISTORS	
2N5061	20p
0.8A/60V	

PART	PRICE
TIC116C	59p
8A/300V	
TIC116D	70p
8A/400V	
TIC126D	75p
12A/400V	
TIC126M	90p
12A/600V	
C106D	28p
4A/400V	
BR103	37p
BR303	85p
BT106	180p
BT119	100p
17068	200p
17089	200p
17127	200p
15/80H	230p
15/85R	230p
SG 264	800p
SG613	1500p
COMPUTER IC's	
Z80ACPU	100p
Z80ADMA	200p
Z80ACTC	140p
Z80ASIO-1	210p
Z80ASIO-2	210p
75107	65p
75110	75p
75113	100p
75122	110p
75154	100p
75162	700p
75182	95p
75183	95p
75195	165p
2114	150p
2532	200p
26LS32	75p
2716	100p
2732	200p
2732A	220p
2764	150p
27C64	200p
27128	150p
27256-25	150p
27512	300p
4116	40p
4164-15	80p
4164-12	90p
41256-15	80p
41256-12	100p
41256-10	110p
41464-12	150p
6116	80p
6264-10	210p
62256-12	300p
6502A	360p
65C02	930p
6522	280p
6800	210p
6802	220p
6803	500p
6808	500p
6809	500p
6810	150p
6818	380p
6821	130p
6840	290p
6845	200p
6850	90p
74F244	35p
8085A	300p
8086	500p
8088	480p

PART	PRICE
8156	300p
8224	240p
8226	240p
8250	750p
8251	200p
8253	160p
8257	220p
8271	340p
8279	270p
8283	400p
8284	440p
8287	260p
8288	650p
82C206PLCC	500p
8748	700p
8755	800p
8T26	95p
8T28	110p
CMOS IC's	
4000	13p
4001	13p
4002	13p
4006	34p
4007	13p
4009	20p
4010	21p
4011	13p
4012	13p
4013	19p
4014	32p
4016	18p
4018	30p
4019	28p
4020	33p
4021	36p
4022	38p
4023	13p
4024	25p
4025	13p
4026	60p
4027	18p
4028	29p
4029	34p
4030	17p
4032	52p
4033	60p
4034	78p
4035	42p
4038	46p
4040	30p
4041	38p
4042	30p
4043	36p
4045	72p
4046	42p
4047	45p
4048	26p
4049	18p
4050	20p
4051	38p
4052	35p
4053	35p
4054	53p
4055	52p
4056	52p
4060	40p
4063	52p
4066	20p
4067	120p
4068	13p
4069	13p
4070	13p
4071	13p
4072	13p
4073	13p

PART	PRICE
4075	13p
4076	42p
4077	13p
4078	13p
4081	13p
4082	13p
4085	36p
4086	30p
4089	75p
4093	18p
4094	44p
4094	58p
4098	50p
4099	42p
4501	26p
4502	36p
4504	35p
4505	80p
4506	58p
4507	30p
4508	67p
4510	32p
4511	30p
4512	38p
4514	65p
4515	65p
4516	36p
4517	100p
4518	36p
4519	28p
4520	38p
4521	86p
4526	38p
4527	41p
4528	38p
4529	65p
4532	48p
4553	140p
4555	29p
4556	36p
4557	140p
4583	60p
4584	30p
4585	40p
40103	120p
40105	140p
40106	35p
40107	50p
40110	170p
40114	180p
40160	55p
40161	55p
40174	48p
40192	48p
40193	48p
40194	58p
40257	120p
74 SERIES	
7400	20p
7401	16p
7402	18p
7403	20p
7404	35p
7405	10p
7406	30p
7407	30p
7408	25p
7409	20p
7413	30p
7414	45p
7416	32p
7417	32p
7420	20p
7421	25p
7425	15p

PART	PRICE
7430	25p
7437	28p
7438	30p
7442	38p
7447	60p
7450	22p
7451	10p
7454	25p
7473	25p
7481	90p
7482	60p
7486	25p
7489	75p
7493	35p
7496	48p
74132	42p
74141	55p
74145	70p
74157	45p
74160	50p
74HC SERIES	
74HC03	14p
74HC08	18p
74HC10	20p
74HC11	14p
74HC14	26p
74HC20	19p
74HC27	20p
74HC51	20p
74HC73	24p
74HC74	24p
74HC76	28p
74HC77	35p
74HC85	33p
74HC86	29p
74HC107	28p
74HC123	35p
74HC125	32p
74HC126	33p
74HC132	33p
74HC133	33p
74HC137	52p
74HC138	33p
74HC147	42p
74HC153	32p
74HC154	90p
74HC157	34p
74HC158	34p
74HC160	44p
74HC161	44p
74HC162	44p
74HC163	44p
74HC164	44p
74HC165	56p
74HC166	60p
74HC174	38p
74HC175	38p
74HC190	46p
74HC192	53p
74HC193	41p
74HC194	46p
74HC195	46p
74HC221	80p
74HC238	55p
74HC240	48p
74HC241	47p
74HC242	55p
74HC243	60p
74HC245	48p
74HC251	25p
74HC257	40p
74HC259	52p
74HC273	42p
74HC280	61p
74HC283	61p

SERVICE AIDS

DESCRIPTION	VOLUME	CODE	PRICE	DESCRIPTION	VOLUME	CODE	PRICE
VIDEO HEAD CLEANER	75ML	SP01	180p	EXCEL POLISH 80	250ML	SP18	150p
VIDEO HEAD CLEANER	200ML	SP27	250p	ADHESIVE 120	400ML	SP19	190p
SWITCH CLEANER	176ML	SP02	180p	LABEL REMOVER 130	200ML	SP20	240p
SUPER 40	400ML	SP15	250p	REFURB 140	400ML	SP21	240p
SILICONE GREASE	200ML	SP03	210p	TUBE SILICON GREASE	50 GRAMMES	SP11	220p
FREEZE IT	170ML	SP04	320p	TUBE TUBE SILICON			
FREEZE IT	400ML	SP16	600p	SEALANT WHITE	75ML	SP22	280p
FOAM CLEANER	400ML	SP05	200p	TUBE SILICON SEALANT			
ANTI STATIC	200ML	SP06	190p	CLEAR	75ML	SP23	280p
AEROKLEANE	200ML	SP07	220p	TUBE HEAT SINK COMPUND	25 GRAMMES	SP12	150p
AERO DUSTER	150ML	SP08	310p	DRIVE CLEANER	200ML	SP24	150P
AERO DUSTER	400ML	SP17	550p	SCREEN CLEANER	200ML	SP25	150p
PLASTIC SEAL	200ML	SP09	250p	COMPUTER CARE KIT		SP26	2100p
GLASS CLEANER	250ML	SP10	160p	ANTI STATIC FOAM CLEANER	400ML	SP28	175p
COLDKLENE	250ML	SP13	230p	AIR DUSTER	400ML	SP29	450p

ALL THE ABOVE ITEMS ARE MANUFACTURED BY SERVISOL

IF YOU PURCHASE MORE THAN ONE SERVISOL PRODUCT POSTAGE & PACKING WILL BE CHARGED AS FOLLOWS:

300P FOR 5 CANS

450p FOR MORE THAN 5 CANS

GRANDATA LTD

K.P. HOUSE, UNIT 15, POP IN COMMERCIAL CENTRE,
SOUTHWAY, WEMBLEY, MIDDLESEX, ENGLAND HA9 0HB
Telephone: 0181-900 2329 Fax: 0181-903 6126
OPEN Monday to Saturday.
Times: Mon-Fri 9.00-5.30 Sat 9.00-2.00

PLEASE PHONE US FOR TYPE NOT LISTED HERE AS WE ARE HOLDING 30,000 ITEMS AND QUOTATIONS ARE GIVEN FOR LARGE QUANTITIES

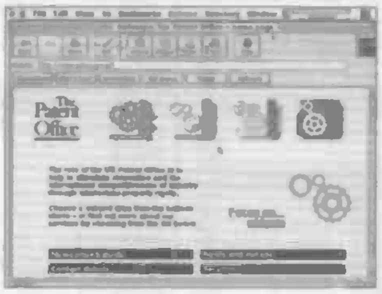
Please send £1 P&P and VAT at 17.5%. Govt. Colleges, etc.
Orders accepted. Please allow 7 days for delivery. Prices quoted are subject to stock availability and may be changed without notice.
TV and video parts sold are replacement parts.
Access & Visa Card accepted
WE STOCK TV AND VIDEO SPARES, JAPANESE TRANSISTORS AND TDA SERIES. PLEASE RING US FOR FURTHER INFORMATION.

ETI News...

OVERSEAS READERS

To call UK telephone numbers, replace the initial 0 with your local overseas access code plus the digits 44.

The Patent Office puts intellectual copyright information on the Web



The UK Patent Office has launched its own Web site at http://www.patent.giv.uk, with access to over 400 pages of information about intellectual property, and the publications and services of the Patents Office. The site is held on the Patent Office's own Web server and will be updated on the day that news or other information arrives at the office.

The home page offers links into sections on Copyright, Designs, Patents and Trade Marks. There are also links to a Newcomers' Guide (which explains the differences between types of intellectual property), contact details, news pages, publications, prices and commercial search services. Users are helped by an Excite search engine within the site. A section on intellectual property tights on the Internet is intended to be useful to those providing or using on-line material.

Under each of the major headings is a description of the nature of the right described, and the protection is offers, as well as guidance on how to acquire or assert the rights and how, where necessary or appropriate, to renew them.

The Patent Office plans to develop interactive elements on the site to enable users to gain access to forms. In the long term, access to the patent and trade mark databases is under consideration.

The site was designed by the Central Office of Information to be "stylish, easy to load and use, and full of helpful cross-references and useful information." Welcoming the site, minister of state John Battle said: "... the Patent Office Web site provides a valuable resource and point of reference. Innovative businesses, university departments and schools should bookmark this site now." Isaac Asimov would like the idea of bookmarking Internet sites.

The home page also provides a link to a "Focus on a particular technology". The first technology to be featured is the widget or "device for promoting froth", starting with Guinness's first patent on the subject in 1972. The site is clearly being promoted with engineering and technology personnel in mind, although whether the marketing focus is right on target is open to debate, as observation indicates that they tend to prefer real ale and imported beers in chunky bottles.

For more information (on the Patent Office Web site) contact Dave Morgan, the Patent Office, tel. 01633 814703.

Radio Rally at Canvey Island next month

The Thirteenth South Essex Amateur Radio Society Radio and Computer Rally will be held at The Paddocks, Long Road, Canvey Island, Essex at the end of the A130 on 1st February 1998. Doors open at 10.30 am and the Rally features Amateur Radio, computer and electronic component exhibitors, Bring and Buy, RSGB Morse testing on demand (bring two passport photos if you want to take the test) and refreshments. There is free car parking, with space by the main doors for disabled visitors. "One of the biggest and best rallies in Essex, getting bigger every year!" say the organisers. Admission is £1. For more information contact David G4UVJ Tel. 01268 697978.

New Amateur 136 kHz Receiver Kit

Cambridge Kits have produced a receiver kit for the new amateur band on 136 kilohertz. This is a lower-cost version of their 60 kHz receiver, originally designed for their MSF Clock, with details for modification to 136 kHz. The compact receiver features a narrow band IF (100 Hz wide), S meter and headphone outputs, 50 dB AGC range and a built-in antenna capable of receiving stations up to 3000 miles away. The introductory price to readers quoting ETI with their order is £29.30 including UK post and packing. Contact Cambridge Kits, 45 Old School Lane, Milton, Cambridge CB4 4BS. Tel 01223 860150.

Radio Spectrum group set up by Government

Minister for Science, Energy and Industry John Battle has announced a new body, the Spectrum Management Advisory Group (SMAG), to advise Ministers on "strategic spectrum management issues" and play an important role in developing the application of spectrum pricing.

The SMAG will initially report to Barbara Roche, Minister responsible for the Radiocommunications Agency, who will also make appointments to the committee.

A summary of 60 responses to the consultative document "Implementing Spectrum Pricing", issued on May 29th this year, is available from the Radiocommunications Agency's library and information service (Tel. 0171 211 0500, fax 0171 211 0507), and with the responses in full from the Agency's Web site at http://www.open.gov.uk/radiocom/

ETI News...

New P3 cordless mini power tool

The new cordless powertool from Minicraft is compact and useful for craft and household precision tasks. The Mini Power Tool can cut, polish, grind, engrave and drill in wood, plastic, ceramics, glass and light metals, runs at 9,500 rpm and has 25 interchangeable accessories to do the tasks. The new model P3 can run for 35 minutes between recharges, considerably longer than its MB1037 predecessor.

Another feature of the new model is the Minicraft 3-grip position with Pen Grip for close work and engraving, Palm Grip for sanding, cutting and carving, and Pistol Grip for drilling. The Mini Power Tool and its 25 accessories come in a sturdy plastic carrying case and includes an overnight plug-in charger and 12 months full guarantee.

For more information, a catalogue or list of stockists, call Minicraft on 07000 6464 27238.

Memory cards for use with digital cameras

Memory maker Kingston Technology is launching two new data storage devices capable of use in, among other things, the current digital cameras from Kodak and Fuji. The Kodak Digital Science DC120 camera, the 15 MB CompactFlash memory card retails at £173, while for the Fuji DS-7 digital-camera it is offering a 2 MB Solid State Floppy Disk Card (SSFDC) for £21. Optional PCMIA type II adapters for downloading the data to a computer for processing are available for the CompactFlash Card at £17, and the adapter for the SSFDC card at £73.

The Fuji DS-7 uses the new SSFDC technology, with its postage stamp-sized cards, for data storage. The makers offer a serial link cable to connect the camera and a computer for transfer of the stored data. With the help of the SSFDC adapter, it is possible to transfer data from the floppy disk card directly without a cable, to a computer equipped with a PC Card type II slot. The floppy disk cards can be inserted into the adapter and removed again while the computer is running, as with a standard disk drive. The adapter is fully compatible with Fuji hardware, software and diagnostics, and runs under Dos and Windows 3.1 and 3.11, Windows 95, Windows NT and OS/2, and supports plug and play under Windows 95 and Windows NT.

Kingston's CompactFlash memory cards, which are likewise fully compatible with the hardware, software and diagnostics for the Kodak DC25 and DC120 digital cameras, have robust design and fast data transfer rates of up to 8 MB per second. The PC card adapters for these memory cards permit rapid, convenient transfer of data to any computer with a PC Card type II slot. The CompactFlash products support Dos/Windows 3.1 and 3.111, Windows 95, Windows NT and OS/2.

The memory devices can also be used in personal organisers, pages, games consoles and portable computers, printers and scanners. Kingston also runs a free technical support hotline.

The CompactFlash and SSFDC memory cards and adapters are distributed in the UK by Datrontech, tel. 01256 360360, Ingram Micro, tel. 01908 260422 and Simms International, tel. 0181 877 7777. Further and information and a compatibility list for the FlashCard and digital cameras can be obtained from Kingston Technology, Kingston Court, Brooklands Close, Sunbury-on-Thames, Middx TW16 7EP. Tel. 01932 738813.

Book Reviews

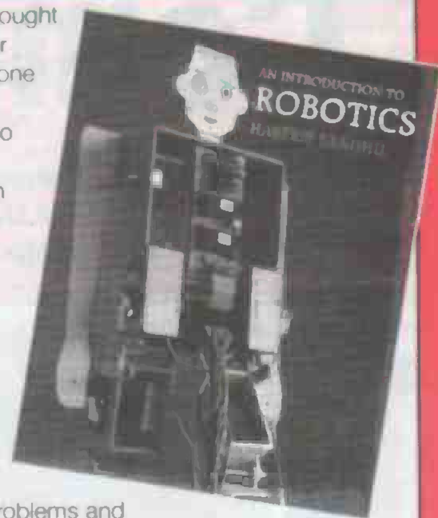
DO IT YOURSELF ROBOTICS

An Introduction to Robotics
Author: Harprit Sandhu
Publisher: Nexus Special Interests
Price: £9.95

This is a book covering the essentials of robotics, aimed at people who want to understand the technical details of how a robot can be made to function, but who may not necessarily wish to assemble one at present. Nevertheless, should you wish to assemble one, this book will help you do it.

The book starts with a brief view of ideas about robots in history, related to the technological developments required to make such robots a practical possibility. Considerable coverage is given to the software requirements, particularly robotic vision. At one point the author states that the software is the most important part of a robot, an opinion with which I would agree.

As a preliminary to addressing the general requirements for a robot, the author describes robots currently in use. Robot arms and automatically guided vehicles are the most widely used robots to date.
There are brief chapters covering motors, how to drive them (for example with pulse width modulation), and encoders to measure position. Chapter 7, about a third of the way through the book, pulls together all the requirements for a basic robot, while Chapter 8 covers the basic requirements of computer control. After that it gets rapidly more technical and detailed, dealing in turn with a software control code for robots, an vision systems. This section deals understandably with concepts sometimes thought complicated. The author explains what can be done without getting lost in mathematics, as can too easily happen when dealing with convolution and the like.



By half way through the book, the author is dealing with the assembly of a robot intended to be straightforward enough for most diy constructors to build, and good enough to illustrate some of the problems and solutions for controlling a robot. The last section of the book deals with programming the robot, making it move and walk using a programming code designed for the purpose.

Appendices include a glossary and ascii table, information on a PIC based controller for robots, assembly drawings, and other necessaries.

If you are interested in robotics, and particularly if you would like to do some practical experiments, then you may find that, with the aid of this book, you can reach the stage of having something to experiment with rapidly and efficiently.

SURFACE MOUNT FOR EVERYONE

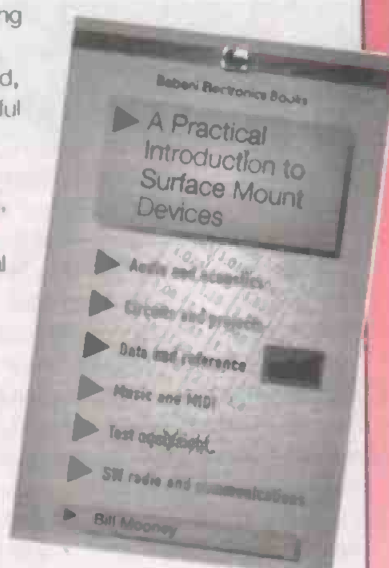
A Practical Introduction to Surface Mount Devices
Author: Bill Mooney
Publisher: Babani Electronics Books
Price: £4.99

Modern electronic equipment is more likely to be made with surface mount components than with conventional through-hole ones nowadays. A major reason is to make consumer items smaller, but in addition assembly by automatic component placement and infra red reflow soldering can be cheaper than the through hole alternative.

One consequence of this is that a number of useful component devices are only made in surface mount packages, and through-hole equivalents are not always introduced. Increasingly, in the future, it will become useful for the home constructor to be able to handle surface mount components.

Here is a book which aims to show the home constructor how to make practical use of surface mount techniques, without the need for the methods used in industry. Industrial techniques use very expensive tools, such as infra red reflow equipment, and have high setup costs but low cost per unit manufactured. This is the exact reverse of the normal amateur constructor's requirement.

This book covers prototyping, which is possible using smds, as well as design of pcbs for home manufacture. The different approach to design and etching necessary for surface mount pcbs is perfectly well explained, as are the specialist tools useful for the task.



Size codes for surface mount passives are explained, both in metric and the currently more normal imperial terms.

There are a couple of sample constructional projects - one for an audio amplifier, and one for a live wire detector, both useful modules.

The techniques and tools covered here should give a better result than techniques I have found just good enough for surface mount prototyping. Author Bill Mooney is an smd designer and constructor with long experience of small-scale prototyping and building, and knows the problems and pleasures well. Follow the guidelines in this little book, and you should have consistent success with surface mount assembly.

Digital Cameras - Coming of Age?

Now that digital cameras are within reach of the ordinary photographer, Douglas Clarkson believes that the secret of their popularity will be in the versatile output that data capture and home printing offer to users.

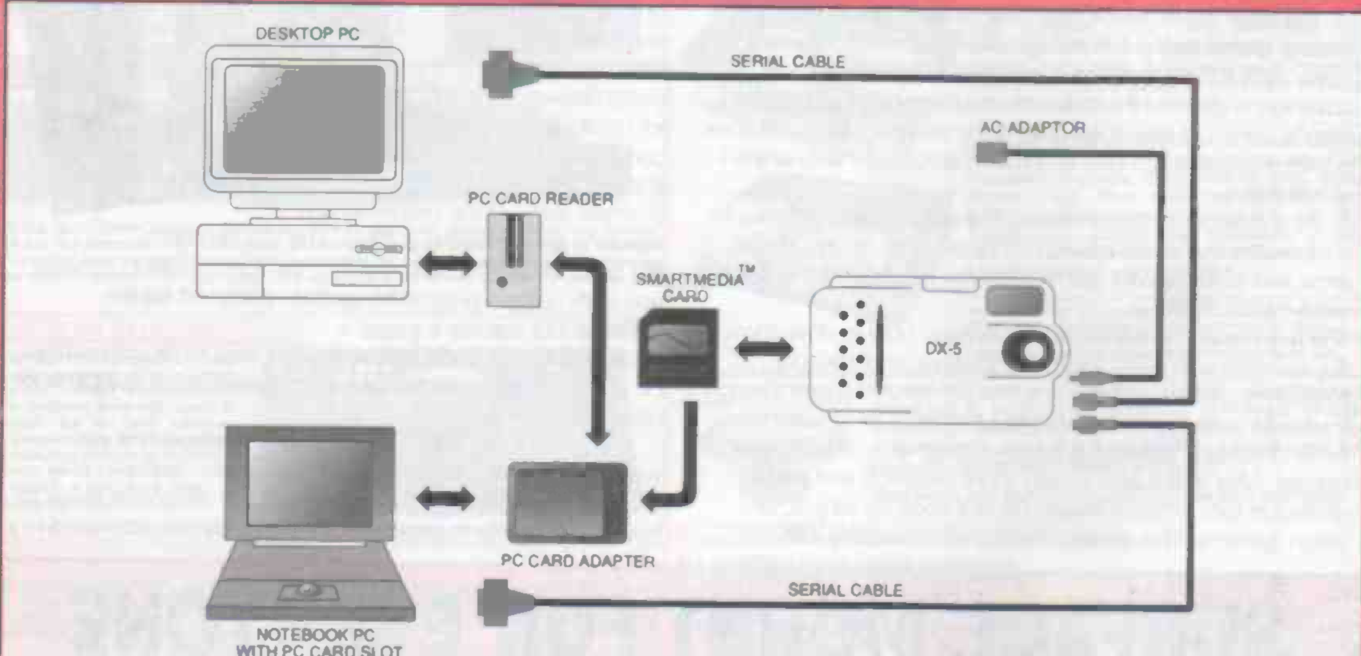


Figure 1: Basic configuration options of the DX-5

To delve into the field of emergent digital camera technology is to become aware of another tidal wave of technology being offered to us. This in itself may make the buyer beware, because, in a game with many keen players, product lifetimes are likely to be relatively short, at least at first.

While the technology of digital cameras is fascinating, an analysis of the emergence of digital cameras has more to do with understanding the integrated use of such systems than their technology alone. As the Internet expands at breakneck speed, the process of capturing images, processing and incorporating them into web sites has been fundamentally altered. Suddenly the process of conventional film developing and print/transparency/negative scanning for digital use appears slow and outdated.

Where images can be captured digitally and transferred directly and quickly to perconal computers at an acceptable quality of resolution, this is likely to become the method of choice.

In the media, newspapers from the locals to the nationals are issuing staff photographers with professional digital cameras, so that only minutes after that vital front page image is captured hundreds or even thousands of miles away, it can be incorporated into page-making software. It is the immediacy of the digital age that is leading to the use of digital cameras - where resolution and quality permit.

The uptake of digital cameras by professional photographers doing studio work tends to be determined by the resolution required. Where print sizes are relatively small, such as for catalogues, professional digital cameras provide a convenient means of rapid capture and review of images. Where the image is needed for a large glossy magazine cover, only top of the range digital cameras with a matching price tag will suffice.

It is obvious, however, that digital cameras are beginning to take off now that the cheapest are below the £200 mark. The most expensive digital cameras hover at around the £40,000 mark. It is also obvious that the very newness of the technology, and the various means of linking digital cameras to systems to process the data, can be confusing for the newcomer.

The appearance of digital camera technology is itself an indication of the maturity of a much broader marketplace in the technology that makes such systems viable. The whole field of exchangeable smart card media which simplifies the process of readout from digital cameras is itself a mushrooming processing. Advances in this field were introduced by the Kodak Photo CD technology using the standard image resolutions listed in Table 2.

Image resolution	Data size
128 x 192	72 k
256 x 384	288 k
512 x 768	1.1 Mb
1024 x 3072	18 Mb

Table 2: Standard image resolution of PhotoCD

This was the first step to providing cheap, high quality scanning to the general public. For 35 mm work the cost per image is around 60 p and up to 100 images can be stored on each disk.

This development has established CDs as a useful medium for distribution of 'stock' images for media industries such as advertising. Companies such as DigitalVision make available a wide range of royalty-free digital stock photography.

35 mm positives or negatives or film transparencies can typically be scanned over a range of densities. At the high end, the Polaroid Sprint Scan 35 Plus can scan up to 2700 dpi with the 35/LE model processing a very adequate 1950 dpi. The cost of 35 mm desktop film scanners has come down dramatically in the last 18 months, with systems costing now between £400 and £750 plus VAT. Entry level desktop scanners cost around £100.

Scanners tend to use a single-pass system, where a line of pixels has a separate colour filter. Colour data tends to be stored in 8, 10 and 12 bits, though display arrays usually handle only 8 bits per separate colour.

The Kaiser company of conventional photoenlarging fame has introduced a camera scanner for capturing digital images with 9.7 million pixel resolution, achieved by moving a scanning head with linear CCDs across the image plane. Such a process can only be used to capture images that are completely static.

With the wide range of products on the market, it is now quite possible for individuals to scan their existing 'conventional film' photographic library and store the images in data bases on PCs or MACs.

DVD

While Compact Disc has emerged as a useful storage media for Kodak's PhotoCD system and others like it, Digital Versatile Disk (DVD) could provide a significantly higher storage capacity of around 7.46 GB, initially on single sided disks, with a possible extension to 17.6 GB on double sided disks in the future. It is possible that in a few years' time dual CD ROM/DVD drives will allow CD-rom and DVD disks to be read by one format. As image quality increases, DVD systems could be a useful means of distribution of high quality images.

Post processing

Digital camera enthusiasts are replacing the spills and chills of the damp darkroom with the subtle mousework of a PC. In the broadest context, PCs and MAC photo-production and photo-editing systems can be seen as an evolution that is almost as significant as the introduction of photography itself. In the context of photography itself, however, the emphasis will be on taking care of the image once it has been captured, or shooting the same shot many times and recycling the storage space spend on unsatisfactory images - not possible with conventional film. Conventional photography aims to get the image correct as close to first time as possible, with all the relevant application of knowledge of light, field of view, depth of focus, aperture and so on.

There is always the risk that the techniques of post processing, such as red eye elimination, opening the bride'e eyes if she blinks as the wrong moment, sharpening up out of focus lines, and so on, could become, in the wrong hands, just a makeshift means of 'correcting' poor photography.

Part of the appeal of digital cameras is the degree of control that the photographer has in processing images. In post processing, where image size is increased, different types of interpolation of images, such as nearest neighbour, bilinear and bicubic, are possible. In nearest neighbour, additional pixels are added at the level corresponding to neighbouring pixels, while in bilinear, a linear correspondence of changing values is made between neighbouring pixels. In bicubic interpolation, more complex level-finding is achieved by using data from a range of nearest neighbour pixels.

Views of the popular Sony DSC-F1

Digital capture/manipulation of images from the Minolta RD-175

Advances in CCD technology

Noise in digital cameras can appear as pixels of the wrong colour appearing at random in dark areas. Under ambient dark conditions, a CCD array will produce an average background level of noise. A 'black' reference is typically stored in a given camera system to allow subtraction. One of the quality factors of a digital camera specification would be the level and variation in noise levels.

In seeking to make still camera chips ever smaller, the problem of reading the output of smaller charges leads to the introduction of extra unwanted signal noise. Systems such as Canon's Basic Stored Image Sensor (BASIS) are seeking to amplify signals using individual pixel amplifiers to overcome this problem.

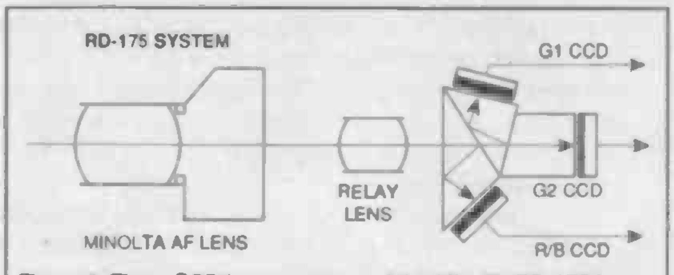


Figure 4: Three CCD image system of the Minolta RD-175 in order to achieve higher resolution

The considerably more advanced DS-300 has a 2/3 inch CCD with 1.4 million pixels, the same chip that is used in the top-of-the-range DS505/515A SLR-type digital cameras. The effective array size is 1280 x 1000 pixels, which is roughly twice the resolution (four times the pixels) of the standard 640 x 480 pixels of VGA resolution. An increasing amount of connectivity and interaction is available with this model, as outlined in figure 2. The DS-300 won the Best Digital Camera 1997/8 presented by the Technical Image Press Association (TIPA).

Still further up the ladder lies the Digital/SLR types, DS-505A and DS-515A, with the DS-515A continuous exposure model costing over £10,000. The keynote of the DS range is the use of condenser optics to increase light levels at the CCD to increase the apparent speed of the system to ISO 3200. This extends the usefulness of the camera to areas such as sport where up till now digital cameras were too slow to capture rapid events. The higher specification of the DS-515A provides a series of three frames per second in a series of seven shots, while the DS505A can record continuously at one frame per second. The condenser optics of the DS-505A and DS-515A are demonstrated in figure 3. The design concentrates the light on the CCD using specialised lens focusing optics. The sensitivity of CCDs will no doubt increase with research, allowing shorter and shorter exposure times. Compression of data is usually in JPEG form, with a variable amount of compression.

Memory cards

The conventional means of image storage can be by SmartMedia with PC adaptor, or ATA type I or II PC Card (PCM CIA release 2.1). A 10 MB Fujix memory card is supplied with the system, which can in turn accommodate four high resolution TIFF images and 16 'fine' (JPEG) images.

As an option, a SCSI extension unit can be added to connect to a PC SCSI port for high speed data transfer. The PC in this mode can also act to control the camera, effectively making the camera into a computer peripheral.

The SCSI interface allows direct output to a digital colour printer such as a Fujifilm Digital Colour Printer NC-500 or Pictography 3000. In addition, the NTSC/PAL video interface allows viewing of these images remotely.

The memory cards, however, are relatively expensive. With the current price of the DS-300 at over £2000, this is at present the domain of the very dedicated photographer.

In the present state of digital camera development it is more or less essential that the user has access to a PC or Mac to process the data through data transfer. The day may come when a SmartMedia card can be inserted into a specialised photo developing booth, and you can select which images are to be printed and in what format. Already, colour printers for the dedicated amateur are on the market which will print directly from a digital camera. The required high definition that is often required, however, is at present only abailable on professional systems available at a few selected sites.

On another front, Sony have resurrected the floppy disc as a means of data storage. One 3.5-in 2HD floppy used in the Mavica MCV-FDS and MCV-FD7 can store 20 high resolution and up to 40 standard resolution images.

Unusual features

Searching around will locate digital cameras with unusual assets. The Dimage V by Minolta has many of the standard features - a 1.8-in colour LCD monitor, 680 x 480 pixel sensitivity, and so on, but has a novel lens that can be rotated and is detachable from the main camera body. This incorporates a 2.7 x zoom lens, and the camera costs around £599.99. Minolta have identified a number of interesting applications for the system, such as business card databases, pictorial information files for property or vehicles for sale, or other catalogues that benefit from pictures, making greetings cards and creating Internet pages.

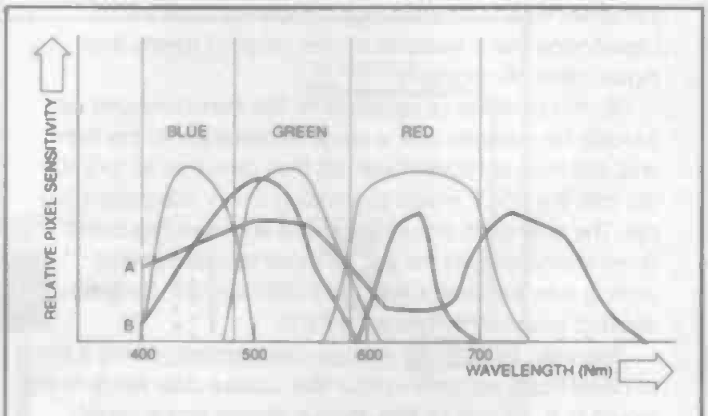


Figure 5: Colour sensitivity of RGB filters is important for rendering faithful colour rendition of, for example, two light spectra A and B

As the number of pixels in the CCD increases, the cost of the CCD rises sharply. The Minolta RD-175 uses a clever mechanism (figure 4) where three separate 380,000 pixel arrays incorporate colour filters and are diagonally shifted to 'fill in' any gaps in the image plane. The final effective resolution achieved is 1528 x 1146 pixels. Data storage is achieved with 131 MB which can record 114 image frames. This design shows considerable ingenuity and its success requires the relative registration of the CCDs to remain fixed and absolute.


User view of Fuji DS7

Multiple exposure CCDs

Among the most advanced CCD chip technology is the 2048 x 2048 pixel chip manufactured by Loral Fairchild. This device has been used in cameras intended for professional use. The technology of these cameras can capture either through multi-exposure technique where red, green and blue filters are used for separate exposures or, alternatively, via a single exposure with a mosaic filter placed over the CCD with each pixel generating a red, green or blue signal during one exposure. An interpolation algorithm produces an RGB data file using localised pixel values.

In a commercial environment, the ability to capture images, verify them quickly and print them locally saves time, so that after a day's shooting hundreds of images can be captured and transmitted to a client for comment and review on the same day. Depending on the quality of the phone lines, distance should be no object. In commercial photography, sharpness of focus in the field of view is an absolute key factor. With conventional film, this is typically improved by narrowing down the diameter of the lens iris and using fast film. With digital cameras, normally using multiple exposure, this requires high levels of either tungsten or flash illumination. It can take flash units of the order of 3000 Joules per pulse, and tungsten units with a power rating of 4 kW to give enough illumination.

The Minolta Dimage V with its remote lens

View of Minolta DS-175 which uses three separate CCD arrays to obtain higher image resolution

Rather than invent a wholly new digital camera, independent companies have developed so-called Digital Camera Backs for existing high-quality cameras such as Hasselblad. Camera chips in general offer a smaller field of view compared with conventional film. This can be a complication with studio camera systems using 'Camera backs' with front optics designed for conventional film.

Printers

A range of colour printers developed originally to meet the demand for printing of computer originated/processed images using modern graphics packages, can now be used with digital camera technology if you have the correct format and software.

To recap, Inkjet printers are low cost and usually reliable, but the fibrous nature of standard printing paper tends to blur the edges of dots so that edges appear softer and colours appear weaker. Specialist inkjet papers, however, can make a startling difference to print quality.

Colour laser printers work typically with four separate toners, cyan, magenta, yellow and black (CMYK). Each toner is separately mapped onto the final printing surface by electrostatic charge buildup on a photoelectric belt. In the final stage, the toners are heat fixed on to the paper surface. While output is fast and needs no special paper, the final quality is good but not considered to be photographic quality. Dye sublimation printers operate by moving a plastic dye ribbon under a series of print heads which can be accurately heated to varying degrees. This results in dye from the ribbon being sublimated onto the paper surface, providing fine definition copy. Full size A3/A4 printers are expensive, but small printers such as the Fargo FotoFUN are now appearing on the market for around £400.

While the printing needs of amateur photographers are fairly modest, the developments in mainstream digital colour printing are quite staggering. Various companies are now offering a data download/digital print service. The FotoNet service provided by Fujifilm in the UK allows digital images to be printed on state-of-the-art printer Pictography 3000 at 400 dpi. A choice of one, two or four images can be printed on each A4 sheet.

Printing techniques can typically give 300 dpi for high resolution colour printing on A4 to A0 sheets and with lengths up to 59 feet. It is even possible, in theory, to design your own wallpaper and have it manufactured in this way. This kind of design will see great change in the next few years. The designer can be anywhere, and the means of final production can be anywhere, and the market for such goods and services can be everywhere.

Fabric printing

The interest in digital photography is growing because the image can printed in so many forms. Among others, Interior decorators should take note. Using the technique of specialised dye sublimation printing onto fabrics, photo-quality colour images can be printed at an incredible 400 dots per inch; a lot more than you get on your souvenir t-shirt. This printing is durable, fully washable and can be ironed. (Although many of us will think it is better progress when ironing is not needed!) In the UK, a company called CPL provide a range of services from eight locations (see points of contact, below). So the new path of fabric production could be artwork, digital camera, PC image processing and dye sublimation printing. It will be interesting to see how the uptake of this kind of process interacts with conventional fabric print technology. There are abundant market opportunities for designer fabrics and designer clothes.

Scanners

Don't throw away your prints, negatives or transparencies. These conventional media with their intrinsically high analogue resolution will continue to be used for high quality digital image

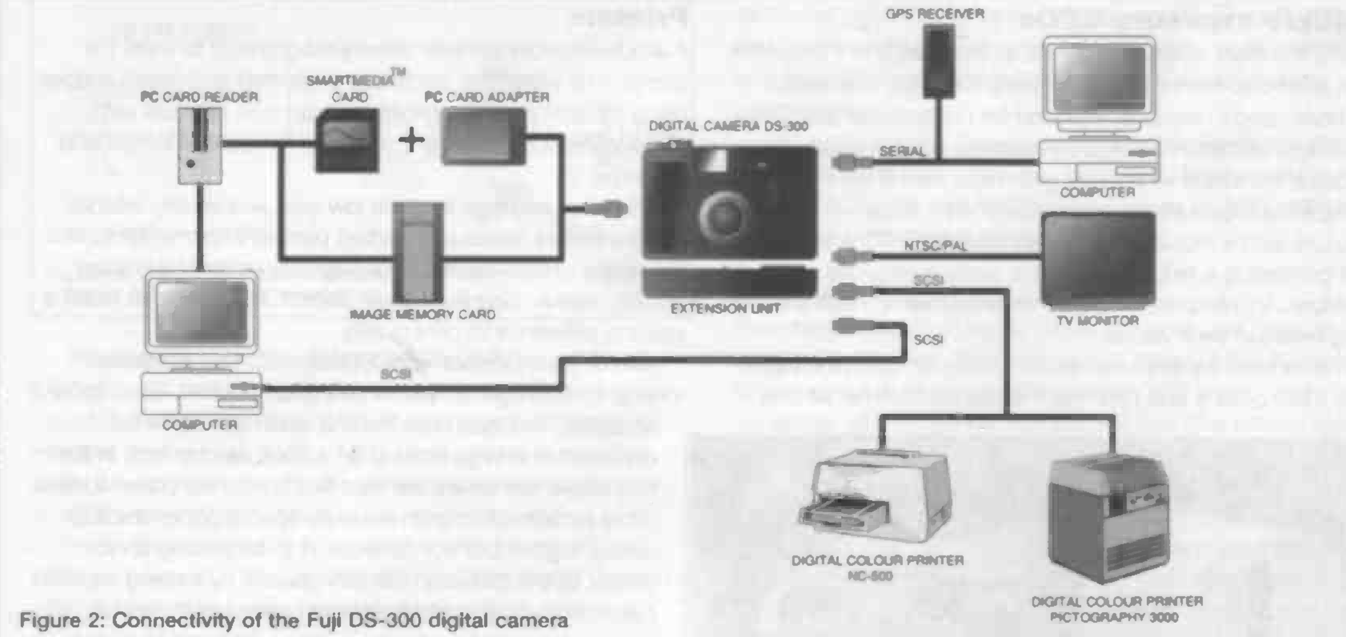


Figure 2: Connectivity of the Fuji DS-300 digital camera

industry which is shaping other areas such as mobile phone technology. Colour print systems are being developed to provide low cost and acceptable print quality directly from digital data. So digital photography has a complex interaction with a rapidly expanding product base in other areas.

The Internet is already providing one means of distributing digital images, so that before long millions of useful images will be available over the Internet. It remains to be seen, however, how great the demand for such images will be. The real market for professional photography is probably the day by day need for specific studio work.

MediaCards

In a curious twist of technology, SmartMedia Cards have been incorporated into a 3.5-inch floppy disk adaptor that can be inserted into a PC floppy disk drive. This is also being used in parallel developments such as personal security and access systems for home banking developed by Fischer International Systems. When the "lookalike" floppy disk is inserted into the disk drive it "tricks" the PC into believing that it is reading a normal floppy disk.

SCSI

The Small Computer System Interface (SCSI) has found ready application in routing data between digital cameras and computers. The first version of SCSI provided a transfer rate of 5 megabytes per second over an 8-bit bus. Table 1 shows how various enhancements of the initial standards have provided increasing performance.

Mode Transfer Rate	M bytes/sec
Original SCSI	5
Fast SCSI	10
Ultra SCSI	20
Ultra 2 SCSI	40

Table 1: Developments of Transfer rate of SCSI implementations.

The product spectrum

There are probably now over 100 digital cameras on the market, with new models announced daily. It is interesting to look across a range of products from one manufacturer to see the stages from basic to professional grade.

The Fuji range, for example, runs from the DX-5, which meets the need of the basic digital photographer, to the top of the range FUJIXC-DS-515A. Figure 1 shows the basic configuration options of the DX-5. The DX-5 is a typical entry level digital camera with the VGA resolution of 640 x 480. Data is stored in a SmartMedia Card which can be read by the PC card reader of a desktop PC, or the a PC card adaptor of a Notebook PC with a PC card slot. A serial cable also provides connectivity for PC capture and processing of data. The cable connected is a MiniDIN 9 pin for the serial interface. The basic model has a viewfinder and flash but no LCD monitor. With a 350,000 square pixel array in standard VGA 640 x 480 form, a 2 MB SmartMedia Card will store around 30 normal images and 22 'fine' images. The sensitivity of the device is equivalent to ISO 150 and shutter speeds are available between 1/4 and 1/5000 of a second.

The next member of the family, the DS-7, incorporates a 1.8-inch active matrix colour LCD as an aid to picture composition and browsing captured images. In the "live imaging" mode the screen updates at 60 frames per second using the CCD array directly. Images once recorded can also be played back immediately, providing the option to delete any that are not required. The LCD display is therefore a considerable move on from the basic glass viewfinder. At the same time, it does not give the direct one-to-one viewing of an SLR camera.

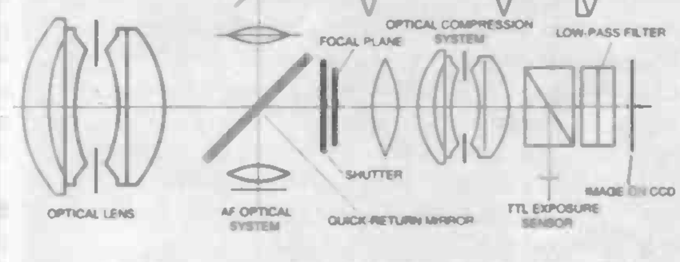


Figure 3: Condenser optics of the DS-505A and DS-515A which increases light intensity in the plane of the CCDs

A growing digital family - some with software included

The new Casio top of the range consumer QV-700 has a rotatable lens and uses removable Flash Memory cards (see other photo) that can be plugged directly into an appropriate PC slot.

The first company to introduce low-cost digital cameras was Casio, already well known for personal organisers and calculators. Examples of two ends of their range are the "entry level" QV-11, costing just under £300, which replaced their basic QV-10 earlier this year, with a reputation for good close-up focusing and ease of use. The viewfinder/ monitor consists of the 1.8-in TFT colour LCD, and the camera can store 96 images in 2 megabytes of Flash memory. The lens has a fixed focal length with a Macro position, and the CCD is 1/5 inch. PC Windows and Macintosh connection kits (software and cable) and video cable are accessories.

The £400 QV-200 has built-in special effects with 4MB internal flash memory and JPEG-based digital storage of up to 192 images in "normal" mode or 64 images in the higher-resolution "fine" mode. The CCD is 1 / 4-in with 360,000 pixels, and again the 1.8-in backlit colour LCD doubles as the viewfinder. The lens block rotates through +90 to -180 degrees, with -90 to -180 degrees for reversed images. The QV200 has a facility for camera-to-camera image data transfer between Casio cameras with an optional cable at data output resolution (fine) of 640 x 480 (VGA). The Fine images can be converted to the Normal images to expand remaining memory. Images can be automatically scrolled through for auto-demonstration, VCR recording, and so on and individual unwanted images can be deleted after verifying on the display. Software included in the UK is QV-Link, Spin/Panorama and AOL Internet connection.

The very new QV-700 checks in at around £500 and as well as a 2.5-in LCD screen - the largest size found in popular models - the QV-700 uses removable Flash Memory cards that can be plugged directly into a PC slot. It is also one of the generation that has internal image manipulation software, so that the user can do certain things without even plugging into a PC: convert an image to black and white, add labels or store in one of six named files for easier location. Software includes QV Link, Spin/Panorama for linking separate images into a single image (the our front cover) and before Christmas 1997 50 hours of free AOL Internet operation.

Lastly for Christmas - the new £330 QV-70 is a lightweight digital camera that has an optical viewfinder as well as the Casio LCD monitor. This is an interesting departure as the presence of an optical viewfinder saves battery life when the LCD is not in use, and is considered an advantage by many photographers.

While one basic limitation of CCDs is the inherent resolution, the other is that of the inherent sensitivity. Most digital cameras correspond to a film speed of ISO 150 - equivalent to a fairly slow but high resolution film. The use of micro lenses above the CCD array can concentrate light and bypass the sensitivity of the device accordingly. Most advances, however, are likely to come from improving the inherent sensitivity of each CCD element.

The information gaps

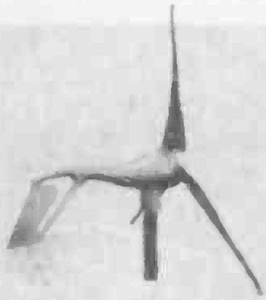
I found some gaps in the technical descriptions of standard resolution digital cameras. While the 640 x 480 resolution is quoted as applying to the three colours red/green/blue, this is not explicitly described as being obtained by means of a mosaic of RGB filters over the pixel array and with interpolation of colours as appropriate by software within the camera. It is only with 'single shot' mode, higher resolution studio cameras that this method is described in detail.

Also, the spatial design of the RGB mask must have a bearing on image quality, although these design aspects are not usually discussed in the companies' descriptive literature.

A critical part of digital camera image quality is the spectral response of each filter in the RGB mosaic filter. Figure 5 illustrates the general principle of the way an RGB filter represents colour. The spectral components of a given part of the light spectrum are separated using the various filters. Variations as part of this include the absolute spectral response of each pixel acting as a discrete detector and also the degree of uniformity of this response amongst all of the pixel components of the array.

It is quite possible for curves A and B to give the same sensitivity signal for each pixel detecting Red/Green/Blue, though they are not in fact the same colours. The quality of colour rendition is determined by the 'sharpness' of the transmission profile of each pixel. Clearly there is an effect here of the basic sensitivity of the human eye to colour - that is, how much it can of itself differentiate different colours. There is much in the way of absolute measurement that can be undertaken to identify absolute colour rendition, though such measurement techniques appear not to be over-used in photographic evaluation of digital cameras. Colour is generally described as either 'lifelike', 'dull', 'vibrant' or 'flat'.

There are even subjective claims that digital camera colour is better than film colour. Film has its own colour mapping, with colour film and CCD behaving slightly differently. Some observant professionals even indicate that CCDs can detect



WIND GENERATORS 380 WATT

1.14 metre dia blades, carbon matrix blades, 3 year warranty, 12vdc output, 24v version available, control electronics included, brushless neodymium cubic curve alternator, only two moving parts, maintenance free, simple roof top installation, start up speed 7mph, max output (30mph) 380w £499 ref AIR1

PLANS

PORTABLE X RAY MACHINE PLANS Easy to construct plans on a simple and cheap way to build a home X-ray machine! Effective device, X-ray sealed assemblies, can be used for experimental purposes. Not a toy or for minors! £6/set. Ref F/XP1.

TELEKINETIC ENHANCER PLANS Mystify and amaze your friends by creating motion with no known apparent means or cause. Uses no electrical or mechanical connections, no special gimmicks yet produces positive motion and effect. Excellent for science projects, magic shows, party demonstrations or serious research & development of this strange and amazing phychic phenomenon. £4/set Ref F/TKE1.

ELECTRONIC HYPNOSIS PLANS & DATA This data shows several ways to put subjects under your control. Included is a full volume reference text and several construction plans that when assembled can produce highly effective stimuli. This material must be used cautiously. It is for use as entertainment at parties etc only, by those experienced in its use. £15/set. Ref F/EH2.

GRAVITY GENERATOR PLANS This unique plan demonstrates a simple electrical phenomena that produces an anti-gravity effect. You can actually build a small mock spaceship out of simple materials and without any visible means- cause it to levitate. £10/set Ref F/GRA1.

WORLDS SMALLEST TESLA COIL/LIGHTENING DISPLAY GLOBE PLANS Produces up to 750,000 volts of discharge, experiment with extraordinary HV effects, 'Plasma in a jar', St Elmo's fire, Corona, excellent science project or conversation piece. £5/set Ref F/BTC1/LG5.

COPPER VAPOUR LASER PLANS Produces 100mw of visible green light. High coherency and spectral quality similar to Argon laser but easier and less costly to build yet far more efficient. This particular design was developed at the Atomic Energy Commision of NEGEV in Israel. £10/set Ref F/CVL1.

VOICE SCRAMBLER PLANS Miniature solid state system turns speech sound into indecipherable noise that cannot be understood without a second matching unit. Use on telephone to prevent third party listening and bugging. £6/set Ref F/VS9.

PULSED TV JOKER PLANS Little hand held device utilises pulse techniques that will completely disrupt TV picture and sound! works on FM too! DISCRETION ADVISED. £8/set Ref F/TJ5.

BODYHEAT TELESCOPE PLANS Highly directional long range device uses recent technology to detect the presence of living bodies, warm and hot spots, heat leaks etc. Intended for security, law enforcement, research and development, etc. Excellent security device or very interesting science project. £8/set Ref F/BHT1.

BURNING, CUTTING CO2 LASER PLANS Projects an invisible beam of heat capable of burning and melting materials over a considerable distance. This laser is one of the most efficient, converting 10% input power into useful output. Not only is this device a workhorse in welding, cutting and heat processing materials but it is also a likely candidate as an effective directed energy beam weapon against missiles, aircraft, ground-to-ground, etc. Particle beams may very well utilize a laser of this type to blast a channel in the atmosphere for a high energy stream of neutrons or other particles. The device is easily applicable to burning and etching wood, cutting, plastics, textiles etc £12/set Ref F/LC7

DYNAMO FLASHLIGHT interesting concept, no batteries needed just squeeze the trigger for instant light apparently even works under water in an emergency although we haven't tried it yet! £6.99 ref SC152

ULTRASONIC BLASTER PLANS Laboratory source of sonic shock waves. Blow holes in metal, produce 'cold' steam, atomize liquides. Many cleaning uses for PC boards, jewllery, coins, small parts etc. £6/set Ref F/ULB1.

ANTI DOG FORCE FIELD PLANS Highly effective circuit produces time variable pulses of accoustical energy that dogs cannot tolerate £6/set Ref F/DOG2

LASER BOUNCE LISTENER SYSTEM PLANS Allows you to hear sounds from a premises without gaining access. £12/set Ref F/LLIST1

PHASOR BLAST WAVE PISTOL SERIES PLANS Handheld, has large transducer and battery capacity with external controls. £6/set Ref F/PSP4

INFINITY TRANSMITTER PLANS Telephone line grabber/room monitor. The ultimate in home/office security and safety! simple to use! Call your home or office phone, push a secret tone on your telephone to access either A) On premises sound and voices or B) Existing conversation with break-in capability for emergency messages. £7 Ref F/TELEGRAB

BUG DETECTOR PLANS Is that someone getting the goods on you? Easy to construct device locates any hidden source of radio energy! Sniffs out and finds bugs and other sources of bothersome interference. Detects low, high and UHF frequencies. £5/set Ref F/BD1.

ELECTROMAGNETIC GUN PLANS Projects a metal object a considerable distance-requires adult supervision £5 ref F/EML2

ELECTRIC MAN PLANS, SHOCK PEOPLE WITH THE TOUCH OF YOUR HAND! £5/set Ref F/EMA1.

PARABOLIC DISH MICROPHONE PLANS Listen to distant sounds and voices, open windows, sound sources in 'hard to get' or hostile premises. Uses satellite technology to gather distant sounds and focus them to our ultra sensitive electronics. Plans also show an optional wireless link system. £8/set ref F/PM5

***2 FOR 1 MULTIFUNCTIONAL HIGH FREQUENCY* AND HIGH DC VOLTAGE, SOLID STATE TESLA COIL AND VARIABLE 100,000 VDC OUTPUT GENERATOR PLANS** Operates on 9-12vdc, many possible experiments. £10 Ref

COLOUR CCTV VIDEO CAMERAS,

BRAND NEW AND, CASED. FROM £99.

Works with most modern video's, TV's, Composite monitors, video grabber cards etc

Pal, 1v P-P, composite, 75ohm, 1/3" CCD, 4mm F2.8, 500x582,- 12vdc, mounting bracket, auto shutter, 100x50x180mm, 3 months warranty,1 off price £119 ref XEF150, 10 or more £99 ea 100+ £89

SUPERWIDEBAND RADAR DETECTOR 360 deg COVERAGE

Detects both radar and laser, X, K, superwide KA bands. LED signal strength display Audio and visual alerts. Alert priority, Rear and front facing optical waveguides, Triplecheck verification, city mode, tutorial mode, dark mode, aux jack, volume control. These may be illegal to use in certain countries.
1.1"x2.7"x4.6"

Superband £149 ref RD2

PLACE YOUR ORDER VIA OUR WEBSITE AT BULL-ELECTRICAL.COM

BULL ELECTRICAL

250 PORTLAND ROAD, HOVE, SUSSEX . BN3 5QT. (ESTABLISHED 50 YEARS).
MAIL ORDER TERMS: CASH, PO OR CHEQUE WITH ORDER PLUS £3.50 P&P PLUS VAT.
24 HOUR SERVICE £5.00 PLUS VAT.
OVERSEAS ORDERS AT COST PLUS £3.50
(ACCESS,VISA, SWITCH, AMERICAN EXPRESS)
phone orders : 01273 203500
FAX 01273 323077
E-mail bull@pavilion.co.uk

HELIOS PNB-2 RUSSIAN BORDER GUARD OBSERVATION BINOCULARS £1799

Intended for the medium to long range observation of air and ground targets and the determina tion of their angular co-ordinates. These giant binoculars are a tribute Russian optical ingenuity, with a performance that simply has to be seen to be believed. A large exit pupil diameter of 7.33mm provides exceptional light passing power, which when combined with its high magnification of x15 allows the user to view over vast distances with delightfully bright, crisp, high resolution images. Robust and able in construction incorporating an uncomplicated yet thoughtfully designed mechanical layout ensuring ease of operation and quick precise targeting. These binoculars have a wide variety of applications and are suitable for use by coastguards, law enforcement organizations, cus toms, farmers etc.

Specifications

x15 magnification, 110mm objective, 6 deg angle of view, Field at 100m=105m, focusing 10m-inf, fully coated precision ground optics, orange and neutral filters, rubber lens caps, rapid targetting hand grips, padded headrest, screw in silica gel cartridges, wooden tripod, operating temperatures -40 c to +50 c , weight 25kg, (15kg without tripod), supplied in wooden carrying case.

Border guard binoculars £1799 ref PNB2

TZS4 INFRARED NIGHT SIGHT

One of our top most selling night sights is the Russian TZS4. This sight enable you to see in very low light levels, or with the aid of the built in infra red illuminator- in total darkness. In 1/4 moonlight you would spot a man at 150m, in total darkness at 75m. Magnification 2.3x, 240x68x190mm,0.9kg, focusing range 1.5m-infinity, M42 camera mount included, runs on 2xAA batteries, 100mm focal length, 8 deg illuminator divergence, 50hrs continuous (no illuminator) 10hrs with, carryingcase and strap.

TZS4 Nightsight £199 ref BAR61

colour which film cannot detect. Also, some aspects of film processing can degrade the image - for instance, by scratching and nonhomogeneity in the film substrate. Again, however, there is very little 'absolute' measurement of colour quality to allow a true comparison to be made.

Business focus

It is not enough, however, to focus on the cameras alone when assessing digital photography. There are a whole range of applications that could benefit. Surveyors, builders, mobile engineers and service personnel often need to send data from the field to headquarters for verification and consultation. This can lead to shorter decision times and greater efficiency. Companies seem to be interested in maintaining image databases of staff and visitors, both for production of ID cards and for storage for longer term security.

House buying could begin in the future as an inspection of thumbnail images on the home page of an estate agent, including pcitures of rooms and perhaps the new conservatory. A lot of shopping is visual: wallpaper, curtains, tiles, jewellery, some clothing and so on. The biggest experiment in cyber shopping will probably unfold as individuals get fast access to digital images of thousands of products.

Learning the facts

There are any number of monthly publications that review and compare digital cameras with each other and with a variety of standards, including the quality of 35 mm colour film photography. The feeling is still that digital cameras will never be as good as 35 mm film, except, perhaps, in the very top of the range models. Publications like Electronic Imaging provides a more distanced view on digital camera technology, devoting more time to professional studio photographers whose digital camera is usually worth more than their R reg company car. In high street retail outlets, the correct and informative way to demonstrate digital cameras would be data links to a PC, but you would be lucky to find such a demonstration at the moment. But without the link-up, digital photography loses much of its advantages.

Internet links

The Internet supports many pages dedicated to camera technology. Table 3 provides some main addresses that can be used a starting points for information about digital cameras. This is particularly relevant if images which have been taken using a specific digital camera can be inspected.

Company	Address
Agfa	http://www.agfahome.com
Apple	http://www.apple.com
Canon	http://www.canon.com
Casio	http://www.casio.com
Epson	http://www.epson.com
Fuji	http://home.fujifilm.com
Kodak	http://www.kodak.com
Nikon	http://www.klt.co.jp/Nikon
Olympus	http://www.olympusamerica.com/digital/dhome.html
Polaroid	http://www.polaroid.com/digiworld/index.html
Ricoh	http://www.ricoh.com
Sanyo	http://www.sanyo.co.uk
Sony	http://www.sony.com

Table 3: Some useful Internet addresses.

Two pictorial disk labels made up with with the use of digital photo editing and a printer. Useful diy home-and-workshop items like this are one of the attractions of digital camera systems.

A last word

The key to digital photography at present is the inherent resolution of the CCD devices. For on screen inspection of standard resolution images, many basic 680 x 480 resolution systems provide acceptable image quality. The gap between conventional film and digital prints becomes clear when prints are produced at standard sizes.

Basic resolution digital cameras provide, however, excellent opportunity for practical applications that depend on the rapid capture and transmission of images. For many applications, basic digital cameras are already good enough to be used seriously. Cameras with improved resolution give a comfortable margin of image quality in many cases. At the high end of the market, digital cameras are increasingly used to capture high quality images with the advantage of fast turnaround.

For now, if you wish to make a collection of ultra high resolution images capable of being blown up to large sizes, a good 35 mm camera and film is still the cost-effective route. Negatives or transparencies scanned with good quality equipment can be archived digitally with their inherent resolution preserved.

Grasping the full potential of digital cameras is about seeing the scope for applications in the future.

Points of contact

Digital Vision Ltd., Chelsea Reach, 79-89 Lots Road, London SW10 0RN.
tel 0171 351 5542 fax 0171 351 6487
web http://www.digitalvision.ltd.uk

CPL (Fabric Printing)
tel 01732 862555
web http://www.cplnet.co.uk

Electronic Imaging, Market Link Publishing, The Mill, Bearwalden Business Park, Wenden's Ambo, Essex CB11 4JX. tel 01799 544212.

Photo credits

Photographs courtesy of Casio UK, Minolta UK, Sony UK and Fujifilm UK as appropriate. Thanks particularly to Casio for assistance with cover images.

Surplus always wanted for cash!

THE *ORIGINAL* SURPLUS WONDERLAND!

THIS MONTH'S SELECTION FROM OUR VAST EVER CHANGING STOCKS

Surplus always wanted for cash!

LOW COST PC's -

SPECIAL BUY
'AT 286'
40Mb HD + 3Mb Ram

LIMITED QUANTITY only of these 12Mhz HI GRADE 286 systems Made in the USA to an industrial specification, the system was designed for *total reliability*. The compact case houses the motherboard. PSU and EGA video card with single 5¼" 1.2 Mb floppy disk drive & integral 40Mb hard disk drive to the front. Real time clock with battery backup is provided as standard. Supplied in good used condition complete with enhanced keyboard, 640k + 2Mb RAM, DOS 4.01 and 90 DAY Full Guarantee. *Ready to Run !*
Order as HIGRADE 286 ***ONLY £129.00*** (E)

Optional Fitted extras: VGA graphics card	£29.00
1.4Mb 3½" floppy disk drive (instead of 1.2 Mb)	£19.95
Wordperfect 6.0 for Dos - when 3½" FDD option ordered	£22.50
NE2000 Ethernet (thick, thin or twisted) network card	£29.00

LOW COST 486DX-33 SYSTEM

Limited quantity of this 2nd user, supurb small size desktop unit. Fully featured with standard simm connectors 30 & 72 pin. Supplied with keyboard, 4 Mb of RAM, SVGA monitor output, 256k cache and integral 120 Mb IDE drive with single 1.44 Mb 3.5" floppy disk drive. Fully tested and guaranteed. *Fully expandable*
Many other options available - call for details. Only **£399.00** (E)

FLOPPY DISK DRIVES 3½" - 8"

5¼" or 3½" from only £18.95 !

Massive purchases of standard 5¼" and 3½" drives enables us to present prime product at industry beating low prices! All units (unless stated) are ***BRAND NEW*** or removed from often brand new equipment and are fully tested, aligned and shipped to you with a 90 day guarantee and operate from standard voltages and are of standard size. All are IBM-PC compatible (if 3½" supported on your PC).

3½" Panasonic JU363/4 720K or equivalent RFE	£24.95(B)
3½" Mitsubishi MF355C-L. 1.4 Meg. Laptops only	£25.95(B)
3½" Mitsubishi MF355C-D. 1.4 Meg. Non laptop	£18.95(B)
5¼" Teac FD-55GFR 1.2 Meg (for IBM pc's) RFE	£18.95(B)
5¼" Teac FD-55F-03-U 720K 40/80 (for BBC's etc) RFE	£29.95(B)
5¼" BRAND NEW Mitsubishi MF501B 360K	£22.95(B)
Table top case with integral PSU for HH 5¼" Flopp or HD	£29.95(B)
8" Shugart 800/801 8" SS refurbished & tested	£195.00(E)
8" Shugart 810 8" SS HH *Brand New*	£195.00(E)
8" Shugart 851 8" double sided refurbished & tested	£250.00(E)
Mitsubishi M2894-63 8" double sided *NEW*	£275.00(E)
Mitsubishi M2896-63-02U 8" DS slimline *NEW*	£285.00(E)
Dual 8" cased drives with integral power supply 2 Mb	£499.00(E)

HARD DISK DRIVES

End of line purchase scoop! *Brand new* NEC D2246 8" 85 Mbyte drive with industry standard SMD interface, replaces Fujitsu equivalent model. Full manual. Only £299.00 or 2 for £525.00 (E)

3½" FUJI FK-309-26 20mb MFM I/F RFE	£59.95(C)
3½" CONNER CP3024 20 mb IDE I/F (or equiv.)RFE	£59.95(C)
3½" CONNER CP3044 40mb IDE I/F (or equiv.)RFE	£69.00(C)
3½" RODIME RO3057S 45mb SCSI I/F (Mac & Acorn)	£69.00(C)
3½" WESTERN DIGITAL 850mb IDE I/F *Brand New*	£185.00(C)
5¼" MINISCRIBE 3425 20mb MFM I/F (or equiv.) RFE	£49.95(C)
5¼" SEAGATE ST-238R 30 mb RLL I/F Refurb	£69.95(C)
5¼" CDC 94205-51 40mb HH MFM I/F RFE tested	£69.95(C)
5¼" HP 9754B 850 Mb SCSI RFE tested	£99.00(C)
5¼" HP C3010 2 Gbyte SCSI *differential* RFE tested	£195.00(C)
8" FUJITSU M2322K 160Mb SMD I/F RFE tested	£195.00(C)
Hard disc controllers for MFM, IDE, SCSI, RLL etc. from	£16.95

THE AMAZING TELEBOX

Converts your colour monitor into a QUALITY COLOUR TV!!

TV SOUND & VIDEO TUNER
CABLE COMPATIBLE

The **TELEBOX** is an attractive fully cased mains powered unit, containing all electronics ready to plug into a host of video monitors made by makers such as **MICROVITEC, ATARI, SANYO, SONY, COMMODORE, PHILIPS, TATUNG, AMSTRAD etc.** The composite video output will also plug directly into most video recorders, allowing reception of TV channels not normally receivable on most television receivers* (TELEBOX MB). Push button controls on the front panel allow reception of 8 fully tuneable 'off air' UHF colour television channels. **TELEBOX MB** covers virtually all television frequencies VHF and UHF including the HYPERBAND as used by most cable TV operators. A composite video output is located on the rear panel for direct connection to most makes of monitor or desktop computer video systems. For complete compatibility - even for monitors without sound - an integral 4 watt audio amplifier and low level Hi Fi audio output are provided as standard.

TELEBOX ST for composite video input type monitors	£36.95
TELEBOX STL as ST but fitted with integral speaker	£39.50
TELEBOX MB Multiband VHF/UHF/Cable/Hyperband tuner	£69.95

For overseas PAL versions state 5.5 or 6 mHz sound specification.
*For cable / hyperband reception Telebox MB should be connected to a cable type service. Shipping code on all Telebox's is (B)

DC POWER SUPPLIES

Virtually every type of power supply you can imagine. Over 10,000 Power Supplies Ex Stock Call for info / list.

IC's -TRANSISTORS - DIODES

OBSOLETE - SHORT SUPPLY - BULK

6,000,000 items EX STOCK

For *MAJOR* SAVINGS - CALL FOR SEMICONDUCTOR HOTLIST

VIDEO MONITOR SPECIALS

One of the highest specification monitors you will *ever* see - At this price - Don't miss it!!

Mitsubishi FA3415ETKL 14" SVGA Multisync colour monitor with fine 0.28 dot pitch tube and resolution of 1024 x 768. A variety of inputs allows connection to a host of computers including **IBM PC's in CGA, EGA, VGA & SVGA modes, BBC, COMMODORE** (including Amiga 1200), **ARCHIMEDES and APPLE.** Many features: Etched faceplate, text switching and **LOW RADIATION MPR** specification. Fully guaranteed, supplied in EXCELLENT little used condition.

Tilt & Swivel Base £4.75
VGA cable for IBM PC included.
External cables for other types of computers CALL
Only £119 (E) Order as MITS-SVGA

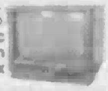
As New - Used on film set for 1 week only!!
15" 0.28 SVGA 1024 x 768 res. colour monitors.
Swivel & tilt etc. Full 90 day guarantee. £145.00 (E)

Just in - Microvitec 20" VGA (800 x 600 res.) colour monitors. Good SH condition - from £299 - CALL for info

PHILIPS HCS35 (same style as CM8833) attractively styled 14" colour monitor with **both RGB and standard composite** 15.625 Khz video inputs via **SCART** socket and separate phono jacks. Integral audio power amp and speaker for all audio visual uses. Will connect direct to Amiga and Atari BBC computers. Ideal for all video monitoring / security applications with direct connection to most colour cameras. High quality with many features such as front concealed flap controls, VCR correction button etc. Good used condition - fully tested - guaranteed
Dimensions: W14" x H12¾" x 15½" D. **Only £95** (E)

PHILIPS HCS31 Ultra compact 9" colour video monitor with standard composite 15.625 Khz video input via SCART socket. Ideal for all monitoring / security applications. High quality, ex-equipment fully tested & guaranteed (possible minor screen burns). In attractive square black plastic case measuring W10" x H10" x 13½" D. 240 V AC mains powered. **Only £79.00** (D)

KME 10" 15M10009 high definition colour monitors with 0.28" dot pitch. Superb clarity and modern styling. Operates from any 15.625 khz sync RGB video source, with RGB analog and composite sync such as Atari, Commodore Amiga, Acorn Archimedes & BBC. Measures only 13½" x 12" x 11". Good used condition. **Only £125** (E)



20" 22" and 26" AV SPECIALS

Superbly made UK manufacture, PIL all solid state colour monitors, complete with composite video & *optional* sound input. Attractive teak style case. Perfect for Schools, Shops, Disco, Clubs, etc. In EXCELLENT little used condition with full 90 day guarantee.

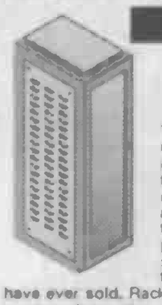
20"....£135 22"....£155 26"....£185 (F)

SPECIAL INTEREST ITEMS

MITS. FA3445ETKL 14" Industrial spec SVGA monitors	£245
2kW to 400 kW - 400 Hz 3 phase power sources - ex stock	£POA
IBM 8230 Type 1, Token ring base unit driver	£950
IBM 53F5501 Token Ring ICS 20 port lobe modules	£750
IBM MAU Token ring distribution panel 8228-23-5050N	£95
AIM 501 Low distortion Oscillator 9Hz to 330Khz, IEEE	£550
Trend DSA 274 Data Analyser with G703(2M) 64 i/o	£POA
Marconi 6310 Programmable 2 to 22 GHz sweep generator	£6500
HP1650B Logic Analyser	£3750
HP3781A Pattern generator & HP3782A Error Detector	£POA
HP APOLLO RX700 system units	£950
HP6621A Dual Programmable GPIB PSU 0-7 V 160 watts	£1800
HP3081A Industrila workstation c/w Barcode swipe reader	£175
HP6264 Rack mount variable 0-20V @ 20A metered PSU	£675
HP54121A DC to 22 GHz four channel test set	£POA
HP7580A A1 8 pen HPGL high speed drum plotter	£1850
EG+G Brookdeal 95035C Precision lock in amp	£650
View Eng. Mod 1200 computerised inspection system	£POA
Ling Dynamics 2kW programmable vibration test system	£POA
Computer controlled 1056 x 560 mm X Y table & controller	£1425
Keithley 590 CV capacitor / voltage analyser	£POA
Racal ICR40 dual 40 channel voice recorder system	£3750
Fiskers 45KVA 3 ph On Line UPS - New batts Dec.1995	£9500
ICI R5030UV34 Cleanline ultrasonic cleaning system	£POA
Mann Tally MT645 High speed line printer	£2200
Intel SBC 486/133SE Multibus 486 system. 8Mb Ram	£1200
Zeta 3220-05 A0 4 pen HPGL fast drum plotters	£1150
Nikon HFX-11 (Ephiphot) exposure control unit	£1450
Motorola VME Bus Boards & Components List. SAE / CALL	£POA
Trio 0-18 vdc linear, metered 30 amp bench PSU. New	£550
Fujitsu M3041R 600 LPM band printer	£1950
Fujitsu M3041D 600 LPM printer with network interface	£1250
Perkin Elmer 2998 Infrared spectrophotometer	£POA
VG Electronics 1035 TELETEXT Decoding Margin Meter	£3750
Andrews LARGE 3.1 m Satellite Dish + mount (For Voyager!)	£950
Sekonic SD 150H 18 channel digital Hybrid chart recorder	£1995
TAYLOR HOBSON Tallysurf amplifier / recorder	£750
System Video 1152 PAL waveform monitor	£485
Test Lab - 2 mtr square quietised acoustic test cabinets	£300
Kenwood 9601 PAL Vectorscope - NEW	£650

Please call for further details on the above items

19" RACK CABINETS



Superb quality 6 foot 40U
Virtually New, Ultra Smart
Less than Half Price!

Top quality 19" rack cabinets made in UK by **Optima Enclosures Ltd.** Units feature designer, smoked acrylic lockable front door, full height lockable half louvered back door and louvered removable side panels. Fully adjustable internal fixing struts, ready punched for any configuration of equipment mounting plus ready mounted integral 12 way 13 amp socket switched mains distribution strip make these racks some of the most versatile we have ever sold. Racks may be stacked side by side and therefore require only two side panels to stand singly or in multiple bays. Overall dimensions are: 77½" H x 32½" D x 22" W. Order as:

OPT Rack 1 Complete with removable side panels.	£335.00 (G)
OPT Rack 2 Rack, Less side panels	£225.00 (G)

32U - High Quality - All steel RakCab

Made by Eurocraft Enclosures Ltd to the highest possible spec, rack features all steel construction with removable side, front and back doors. Front and back doors are hinged for easy access and all are lockable with five secure 5 lever barrel locks. The front door is constructed of double walled steel with a 'designer style' smoked acrylic front panel to enable status indicators to be seen through the panel, yet remain unobtrusive. Internally the rack features fully slotted reinforced vertical fixing members to take the heaviest of 19" rack equipment. The two movable vertical fixing struts (extras available) are pre punched for standard 'cage nuts'. A mains distribution panel internally mounted to the bottom rear, provides 8 x IEC 3 pin Euro sockets and 1 x 13 amp 3 pin switched utility socket. Overall ventilation is provided by fully louvered back door and double skinned top section with top and side louvres. The top panel may be removed for fitting of integral fans to the sub plate etc. Other features include: fitted castors and floor levelers, prepunched utility panel at lower rear for cable / connector access etc. Supplied in excellent, slightly used condition with keys. Colour Royal blue. External dimensions mm=1625H x 635D x 603 W. (64" H x 25" D x 23¾" W)

Sold at LESS than a third of makers price !!

A superb buy at only £195.00 (G)

Over 1000 racks **- 19" 22" & 24" wide 3 to 44 U high. Available from stock !! Call with your requirements.**

TOUCH SCREEN SYSTEM

The ultimate in 'Touch Screen Technology' made by the experts - *MicroTouch* - but sold at a price below cost !! System consists of a flat translucent glass laminated panel measuring 29.5 x 23.5 cm connected to an electronic controller PCB. The controller produces a standard serial RS232 or TTL output which continuously gives simple serial data containing positional X & Y co-ordinates as to where a finger is touching the panel - as the finger moves, the data instantly changes. The X & Y information is given at an incredible matrix resolution of 1024 x 1024 positions over the entire screen size !! A host of available translation software enables direct connection to a PC for a myriad of applications including: control panels, pointing devices, POS systems, controllers for the disabled or computer un-trained etc etc. Imagine using your finger with 'Windows', instead of a mouse !! (a driver is indeed available !) ***The applications for this amazing product are only limited by your imagination!!*** Complete system including Controller, Power Supply and Data supplied at an incredible price of only: ***£145.00*** (B)
Full MICROTOUCH software support pack and manuals for IBM compatible PC's £29.95 RFE - Tested

LOW COST RAM & CPU'S

INTEL 'ABOVE' Memory Expansion Board. Full length PC-XT and PC-AT compatible card with 2 Mbytes of memory on board. Card is fully selectable for Expanded or Extended (286 processor and above) memory. Full data and driver disks supplied. RFE. Fully tested and guaranteed. Windows compatible. £59.95(A1)
Half length 8 bit memory upgrade cards for PC AT XT expands memory either 256k or 512k in 64k steps. May also be used to fill in RAM above 640k DOS limit. Complete with data.
Order as: XT RAM UG. 256k. £34.95 *or* 512k £39.95 (A1)

SIMM SPECIALS

1 MB x 9 SIMM 9 chip 120ns Only	£16.50 (A1)
1 MB x 9 SIMM 3 chip 80 ns £19.50 or 70ns	£22.95 (A1)
1 MB x 9 SIMM 9 chip 80 ns £21.50 or 70ns	£23.75 (A1)
4 MB 70 ns 72 pin SIMM *-with parity-* Only	£95.00 (A1)
INTEL 486-DX33 CPU £55.00 INTEL 486-DX66 CPU	£69.00 (A1)

FULL RANGE OF CO-PROCESSOR'S EX STOCK - CALL FOR £££

FANS & BLOWERS

EPSON DO412 40x40x20 mm 12v DC	£7.95 10 / £65
PAPST TYPE 612 60x60x25 mm 12v DC	£8.95 10 / £75
MITSUBISHI MMF-06D12DL 60x60x25 mm 12v DC	£4.95 10 / £42
MITSUBISHI MMF-08C12DM 80x80x25 mm 12v DC	£5.25 10 / £49
MITSUBISHI MMF-09B12DH 92x92x25 mm 12v DC	£5.95 10 / £53
PANCAKE 12-3.5 92x92x18 mm 12v DC	£7.95 10 / £69

EX-EQUIP AC fans. ALL TESTED 120 x 120 x 38 mm specify 110 or 240 v £6.95. 80 x 80 x 38 mm - specify 110 or 240 v £5.95
IMHOF B26 1900 rack mnt 3U x 19" Blower 110/240v NEW £79.95
Shipping on all fans (A). Blowers (B). *50,000 Fans Ex Stock CALL*

Issue 13 of *Display News* now available - send large SAE - PACKED with bargains!

DISPLAY -ELECTRONICS-

ALL MAIL & OFFICES
Open Mon-Fri 9.00-5:30
Dept ET. 32 Biggin Way
Upper Norwood
LONDON SE19 3XF

LONDON SHOP
Open Mon - Sat 9:00 - 5:30
215 Whitehorse Lane
South Norwood
On 68A Bus Route
Nr. Thornton Heath & Selhurst Park SR Rail Stations

DISTEL©
The Original
FREE On line Database
Info on 20,000 + stock items!
RETURNING SOON !

ALL ☎ ENQUIRIES
0181 679 4414
FAX 0181 679 1927

SWITCH EST 25 YEARS

4-Go Rocket Launcher

Fire up your ingenuity! For the more ambitious rocket modeller, Robin Abbott has made a four-rocket launch controller to work with popular rocket kits.

This project was inspired by my interest in model rocket building. Model rockets made up from kits are available in a wide variety of sizes and configurations from small 6-inch rockets up to 4 feet or more. The rockets are launched with a small cartridge engine which is electrically fired. Model rocketry company Estes provide a simple kit which includes a controller. The controller is a very simple 6V powered unit with a safety key, a launch button, a small bulb which illuminates to indicate that the igniter is connected, and 8 metres of cable to connect to the rocket. The connection to the igniter is made with crocodile clips. The controller does not fire more than one rocket, or fire rockets with more than one engine cartridge, so for more ambitious modellers this project was devised to provide a more comprehensive controller.

Rocket Modelling

Model rocket flying in the UK is dominated at the less ambitious end of the market by the Estes company of America. Estes manufacture the rocket cartridge engines, igniters and kits for the rockets which are available from large model shops. The home constructor cannot manufacture engines or igniters, but the rockets are quite straightforward to construct with or without a kit.

Most rockets are made of two stages (see figure 1). The stages slot into each other at the launch and are connected by a length of elastic cord. The upper stage has a simple plastic parachute tied to it, the lower stage has the fins for stability. The lower stage has a simple engine cartridge holder with a metal clip which allows engines to be replaced easily and to allow the rocket to be fired a number of times. On firing, a new rocket engine cartridge is inserted into the holder, and fireproof parachute wadding is pushed into the rocket. The parachute is folded and tucked in below the top stage of the rocket which is plugged into the lower stage.

The rocket has a small length of drinking straw glued vertically to its side. This is slotted over the "launch pad" which is a length of piano wire held vertically in at stand with a metal blast plate at the bottom. The igniter is pushed into the engine cartridge, and held in place with a small rubber stopper. At this point the launch controller may be clipped to the igniter, ensuring that the safety key is held by the rocket operator so that the controller cannot fire the engine while it is being connected.

When the engine fires, the igniter is connected to its power supply. The igniter has a resistance of around 1.2 ohms and is surrounded by a chemical similar to a match head which lights due to the heat of the igniter. The igniter then lights the rocket engine which fires pushing the igniter plug out of the engine and the rocket lifts off to height which may exceed several hundred metres when small rockets are fired with larger engines.

The cartridge engine is a three stage system. The first stage is the power stage which lifts the rocket to the majority of its final height and speed. Next the engine continues with a delay stage which has considerably less thrust, but shows its presence with a plume of smoke following the rocket. During this stage the rocket normally has enough speed from the first stage to continue climbing vertically. Without this delay the whole flight seems very short. Finally the ejection charge fires. This pushes a jet of gas out of the back of the engine into the body of the rocket. This pushes out the parachute wadding (hence the need for fireproof wadding), and the top of the rocket pops off, the parachute opens, and the rocket floats gently to earth. It may then be recovered and fired again.

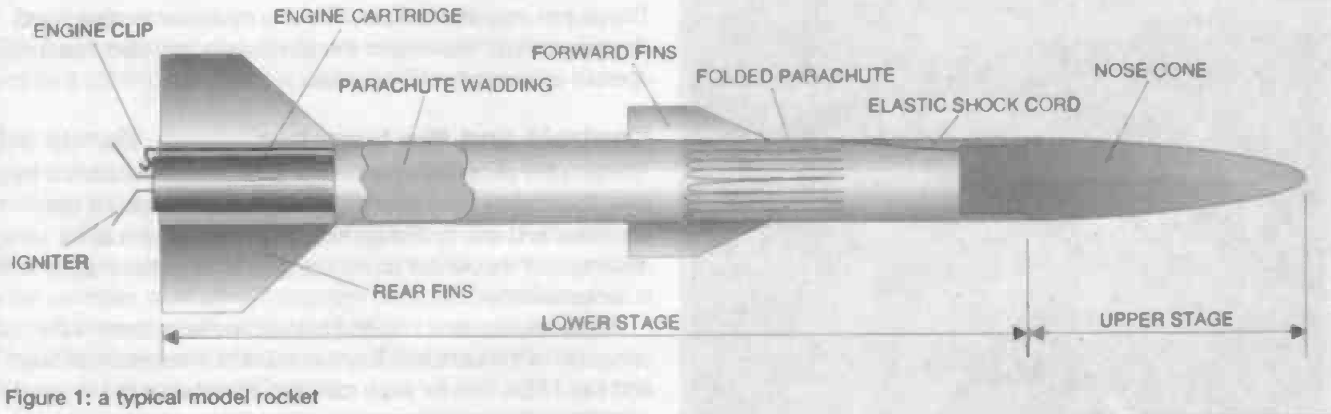


Figure 1: a typical model rocket

Types of rocket

There are many different types of rocket available, and they are identified by three parameters: for example, A8-3, or D10-2.

The first is the engine power - A, B, C, and D. The letter represents the total power of the engine: each letter is twice the power of the one before it. Thus B engines have twice the total power of A engines and D engines have 8 times the total power of A engines. A engines are small, B and C engines are both medium size (70mm long by 18mm diameter), D engines are bigger again.

Each engine has a thrust number in Newtons, so an A4 engine will have a thrust of 8 Newtons, and will burn for half as long as a B4 engine, and for the same length of time as a B8 engine.

The final parameter associated with the engine is the delay time in seconds, this is the time taken between the end of the first stage, and the ejection charge firing during which smoke is ejected.

Thus for our example the engine has a total power rating of A, a thrust of 8 Newtons, and a cruising delay time of 3 seconds. Typically B and C rocket engines cost about £1.50 per flight.

In general bigger rockets require bigger engines and higher thrusts. Thus a small rocket will fly higher as the thrust may be lower, will take it higher, and will burn longer. Also bigger rockets will cruise for less time before they turn over and start heading earthwards, so the delay time should be shorter in general.

A rocket leaves the launch site Photos courtesy of Sven Knudson

The launcher

This launcher provides for firing of up to four rocket engines. There are four firing modes:

- All four rockets may be fired simultaneously when the firing button is pressed (allowing for more than one engine on a single rocket). The launcher detects when rocket igniters are connected by the low resistance (approximately 1 ohm) of the igniters, and shows the status of each rocket on its own LED.
- Rockets may be fired in sequence, the next rocket being fired each time that the firing button is pressed.
- Rockets may be fired automatically at one second intervals in sequence.
- One or more rockets may be fired at the end of a traditional 10 second count down.

The firing pulse given to the rocket is limited in duration to 3 seconds. This means that even if a rocket connection is shorted out, the batteries will not be rapidly drained - a common problem on the launchers, where accidentally shorted crocodile clips can drain the batteries through the igniter detection lamp.

If PC control is added it allows specialist applications (note that hardware is included for PC control, but the software is not yet developed).

Safety

Safety in a project such as this is of great importance, and the project provides a number of safety features. The intention is that any single failure should not cause the rocket to fire while the operator is connecting the rockets, and to this end the following features are provided:

There is a single safety key. This connects power to the relay switches, and is also used by the firing logic to disable the firing button when it is not present.
Once the launcher detects that a rocket has been connected, the fire button is disabled for 3 seconds afterwards regardless of the presence of the safety key. This allows operators to get away even if the safety ke y is connected.
The launcher will only fire the rockets detected when the firing sequence was started. For example with a 10 second count down, then once it has started even if additional rockets are connected during the countdown they will not be fired.

The project may also be used for firing other electrically ignited devices such as fireworks or thunderflashes, provided that they operate on a supply of 24V or less.

Controls and the launcher

The launcher is battery operated, and for reasons which will be described below there are two sets of batteries, one for the controller, and one for the igniters. The batteries should be alkaline, and should last an very long time, provided that the unit is turned off after use.

There are two switches on the launcher which control the operation of the launcher. There is a 2-digit 7-segment display, and four LEDs, one for each rocket to show when the rocket is connected. There is a connection for a PC input, which connects directly to another socket which may be used to chain launchers. From the back of the launcher there are four 8-metre cables with crocodile clips, one for each rocket. As the safety key is inserted directly into the launcher, the launcher should be located with the operator, and not with the rockets. The firing button is on a short cable connected to the launcher.

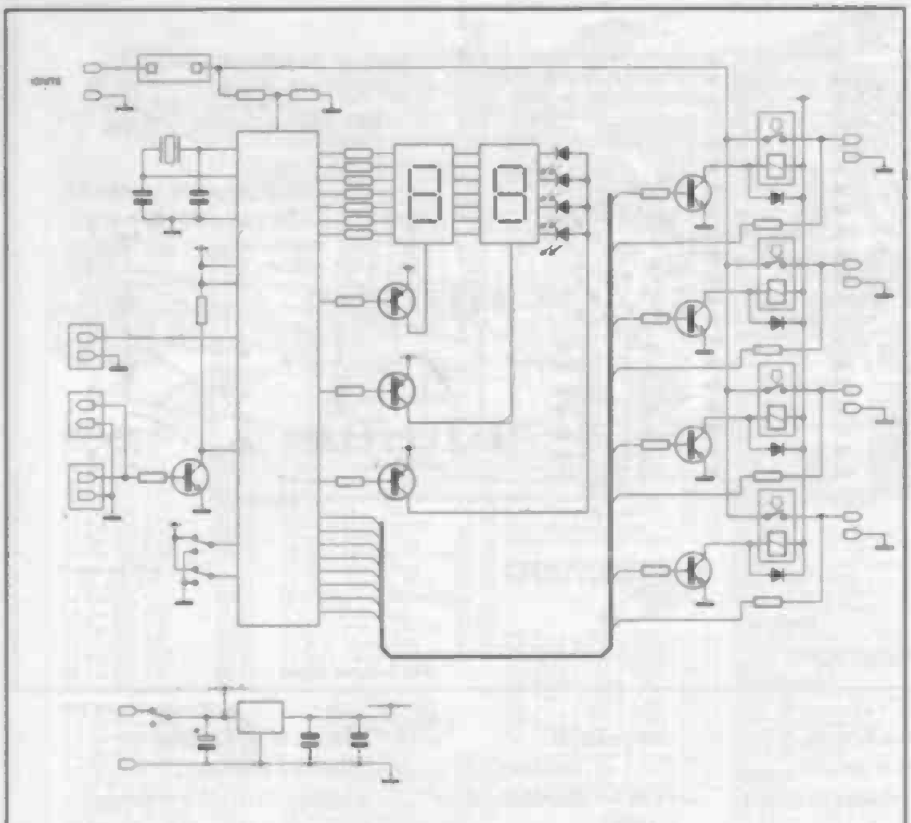


Figure 2: the circuit of the rocket launcher

The power supply for the controller is separate from the igniter supply. This is due to the extremely low resistance of the igniter (which drops as the igniter heats). If the controller and igniter share the same supply the voltage drop as the igniter draws current was sufficient in the prototype to cause the relay to drop out, and to crash the PIC controller. The igniter never lit! The supply for the controller module may be 9V (for example,. PP3), or as in the prototype may be four AA batteries (the regulator used is an extremely low dropout device. The igniter supply may be any voltage from 1.5V (used for some thunderflashes), 6V (used for rocket igniters) up to a maximum of 24V, which is the DC limit switch voltage of the relays. The safety key is in series with the igniter battery, and therefore completely isolates the igniter relays, even if a controller fault pulls in the relays there will be no supply to the igniters.

The sense input for the safety key is driven from R12 and R13. The input is normally low, and pulled high when the safety key is inserted. Note that the input/output pins of the PIC (in common with most CMOS devices) have static protection diodes down to the Vdd supply pins. Therefore resistor R12 is required to limit the current drawn from the igniter power supply, especially when the igniter supply is 12V.

There are four igniter relays which are driven by transistors Q5-8. The diodes in parallel with the relays quench the inverse voltage generated by the relay coils as the transistors turn off. The igniters are sensed by resistors R15 to R18, these drive the port B inputs which are configured with the internal pullups enabled. Thus when the igniter is connected the sense input is pulled low. The resistor is required for the same reason as for the safety key input - to protect the PIC inputs when the relays pull in connecting the input to the igniter supply.

Finally, the mode of the launcher is set by switches Mode1

The mode switches have the following function:

Switch 1	Switch 2	Function
Down	Down	All rockets fired immediately when the firing button is pressed. Seven-segment display is not used.
Down	Up	Fire rockets one at a time in sequence. One rocket on each firing key press. The display shows the rocket fired.
Up	Down	Fire rockets at the end of the 10 second time-out. The display shows the 10 second countdown.
Up	Up	Fire rockets at one second intervals. The display shows the rocket number as each is fired.

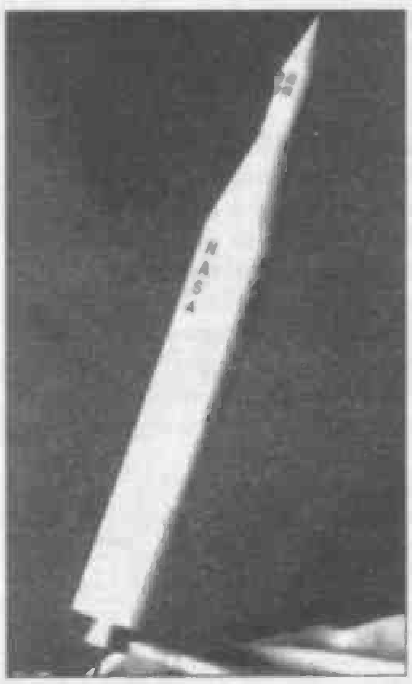
The LEDs light when a rocket is connected to the launcher. This may be used to confirm correct connection of each igniter.

The 7-segment displays show 00, and the displays and the LEDs flash when the safety key is not connected. This may be used as a confirmation that the safety key is removed.

The circuit

Figure 2 shows the circuit diagram of the launcher. As the project comprises a fairly complex logic sequence, and drives an LED display, a PIC microcontroller was an obvious choice. A device with a large number of I/O connections is required for this project as the controller must drive 7-segment displays, digit drives, four relays, four sense inputs, and the mode and fire keys. In fact, 24 of the I/O pins are used, thus implying one of the 40-pin PIC devices - in this case the PIC16C74.

The LEDs used to show which igniters are connected and the 2-digit 7-segment displays are all multiplexed on a common 7-bit drive. The port pins used for driving the displays may seem to be randomly distributed, but in fact were chosen for the easiest PCB layout, as I find it easier to modify software to handle out of order LED segment drives than to lay out PCBs. The display common anodes are driven from PNP driver transistors.



This Juno II was built using the instructions in Peter Alway's The Art of Scale Model Rocketry. Modeller Sven Knudson scribed card stock for the corrugations at the base of the rocket. He was unsatisfied with the way they showed up after painting, so he marked each corrugation with a pencil to emphasise it. The decals are from the Saturn Press decal set. Photos courtesy of Sven Knudson

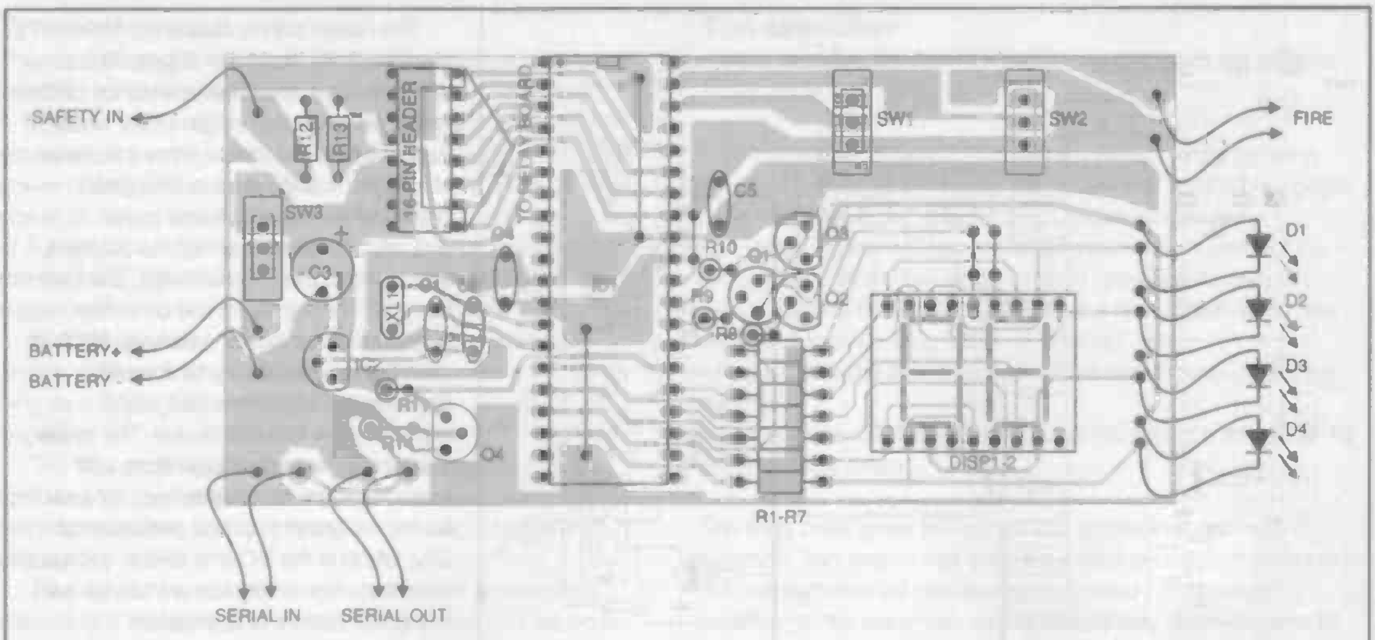


Figure 5: the component layout for the main circuit board

and Mode2, and the serial input from the PC is a simple transistor buffer/inverter. The oscillator shown is a ceramic resonator, but for this application it would be possible to use an RC oscillator, as timing is not critical.

Software

The PIC is hardly stretched in this application, the system operates two interrupt timers. The first is roughly once every 4 milliseconds used for the multiplexed display drive. The second interrupt operates 10 times a second and is used for all system timing and for scanning the press buttons. For the rest of the time the PIC operates in simple loops waiting for buttons to be pressed, or for timers to expire.

For interest the logic flow diagram for the main software loops is shown in figure 3.

Although timing for this application is not critical, the system actually operates on a very accurate clock which causes an interrupt every 100ms. This is not the most difficult part of the software, but it is worth showing how it is achieved with a 4MHz clock, as the author has been consulted on this subject on a number of occasions. The reason why it seems difficult at first is that the internal timers of the PIC may be set to cause an interrupt when they overflow, and this will only happen on a multiple of 256us with a 4MHz clock.

The solution to this problem is to use the Compare facility of the 74. This allows the system to generate an interrupt every time that the 16-bit counter/timer reaches a value which is the same as the compare register. The interrupt routine should then update the compare register to generate another interrupt at the end of the next time period.

The code in figure 4 is a self-standing program which demonstrates this as an example to other programmers. It performs no function, but simply increments a variable called IntCount exactly once every 100ms with a 4MHz clock.

Figure 4: example code for accurate timing on the 74

```
#include "d:\pic\p16c74.inc"
#define TIMER1TIME .12500  ; 12500 counts of timer 1 is
100mS

cblock 0x20                          ; Block of RAM variables
         IntCount                    ; Counts interrupts
         STATUS_TEMP                 ; Stores STATUS in interrupt
routine
         W_TEMP                      ; Stores W in interrupt routine
endc

         org 0                       ; Reset vector
         call init
         goto MainLoop

         org 4
inthand  goto introutine

;
; This is the main loop, replace with application code !
;
MainLoop         goto MainLoop

;
; Initialisation routine
;
init     bcf INTCON,GIE              ; Interrupts off
         movlw 0x30I@TMR1ON          ; Timer 1 on, 8us clock
         movwf T1CON
         clrf TMR1L                  ; Clear timer 1
         clrf TMR1H
         movlw TIMER1TIME            ; Write to compare register
         movwf CCPR1L
         movlw TIMER1TIME>>8
         movwf CCPR1H
         movlw 0x0a
         movwf CCP1CON               ; Set timer 1 to Compare
                                     mode
         bsf STATUS,RP0
         bsf PIE1,CCP1IE             ; Enable compare interrupt
         bcf STATUS,RP0
         clrf IntCount
         bsf INTCON,PEIE             ; Enable peripheral
                                     interrupts
         bsf INTCON,GIE              ; Enable interrupts
```

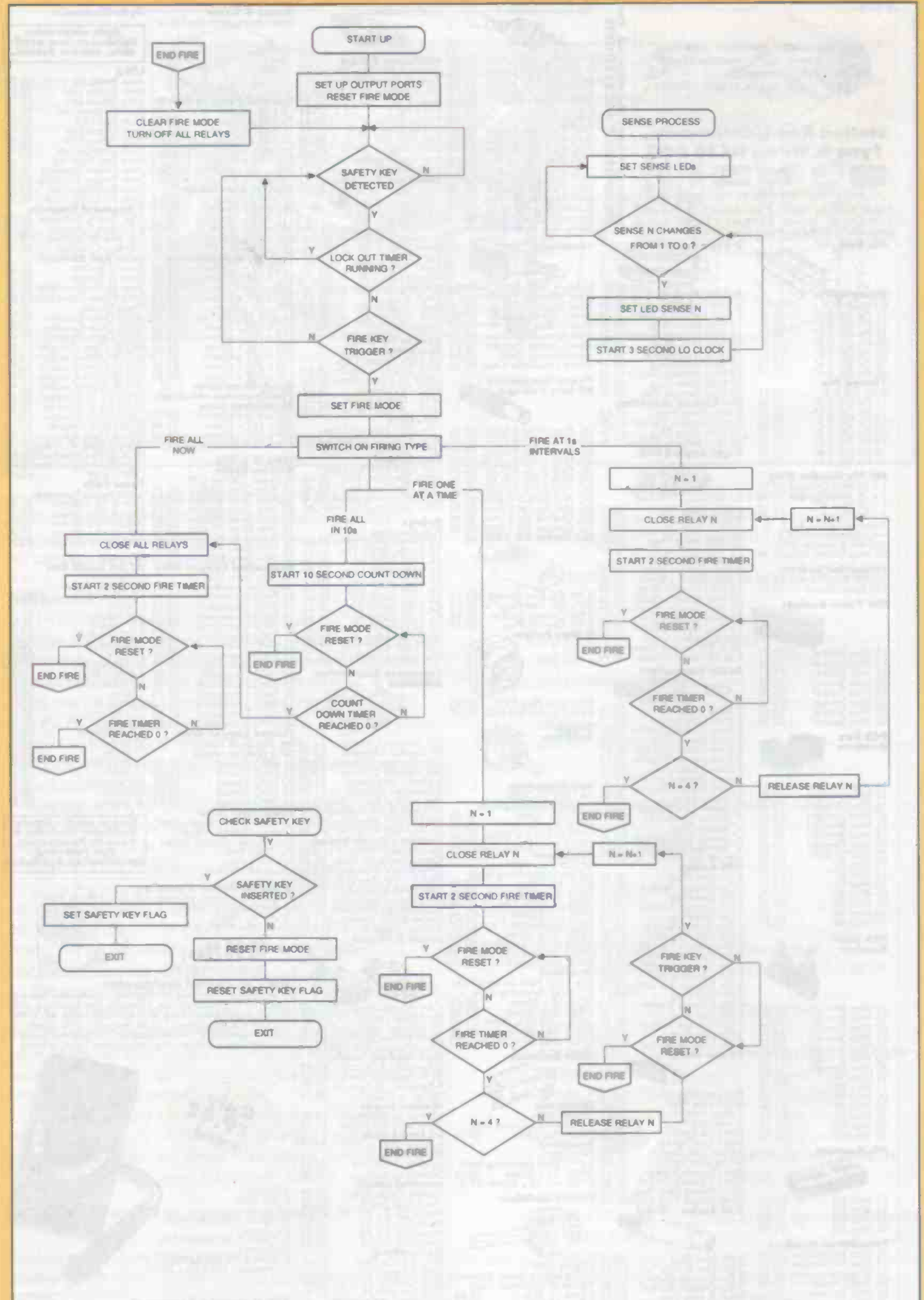


Figure 3: a firing sequence flow diagram

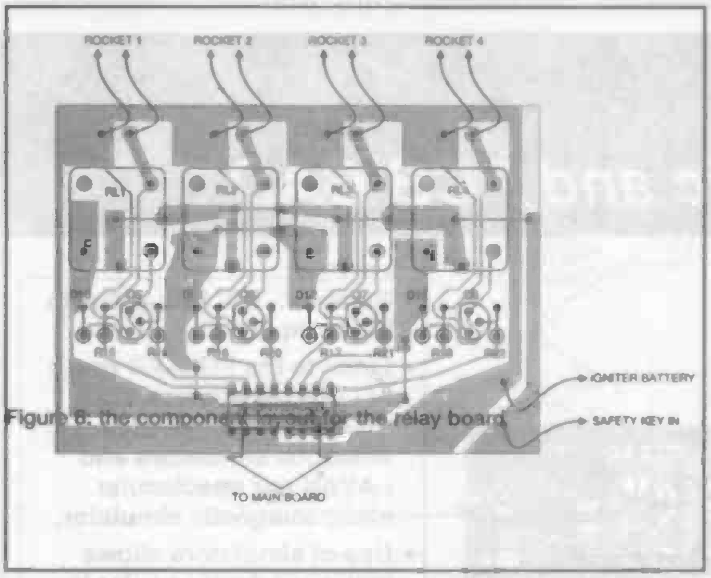


Figure 8: the component layout for the relay board

```
        return
;
; This is the code which deals with interrupts,
;
introutine MOVWF W_TEMP                  ; Microchip's
status save routine
        SWAPF STATUS,W
        BCF STATUS,RP0
        MOVWF STATUS_TEMP

        btfss PIR1,CCP1IF ; Test for compare interrupt
        goto NotCompare1        ; Not a compare interrupt
        incf IntCount           ; Add one to the interrupt
                                  count
        bcf PIR1,CCP1IF         ; Clear the interrupt flag
        movlw TIMER1TIME        ; Set up the new compare
                                  value
        addwf CCPR1L            ;
        skpnc                   ; 16 bit add
        incf CCPR1H             ;
        movlw TIMER1TIME>>8
        addwf CCPR1H
;
; Other interrupts are actioned here !
;
NotCompare1

intret  SWAPF STATUS_TEMP,W
        MOVWF STATUS
        SWAPF W_TEMP,F
        SWAPF W_TEMP,W
        retfie
```

Construction

The circuit board

referring to the Parts List, note that the relays shown are 5V devices, and the coils of the relays are driven directly from the main board power supply. If the main board uses a 9V battery then the relay coils should be uprated to 9V, although in practice the system will probably operate correctly even if they are not uprated.

There are two circuit boards, one of which holds the relays and relay drivers, the other of which holds the main processor, switches, displays and LEDs. Two boards are used for the project, because the processor and display board is mounted directly to the front panel, and there is insufficient clearance for the relays to be mounted on this board.

The main board overlay is shown in figure 5, note that if the

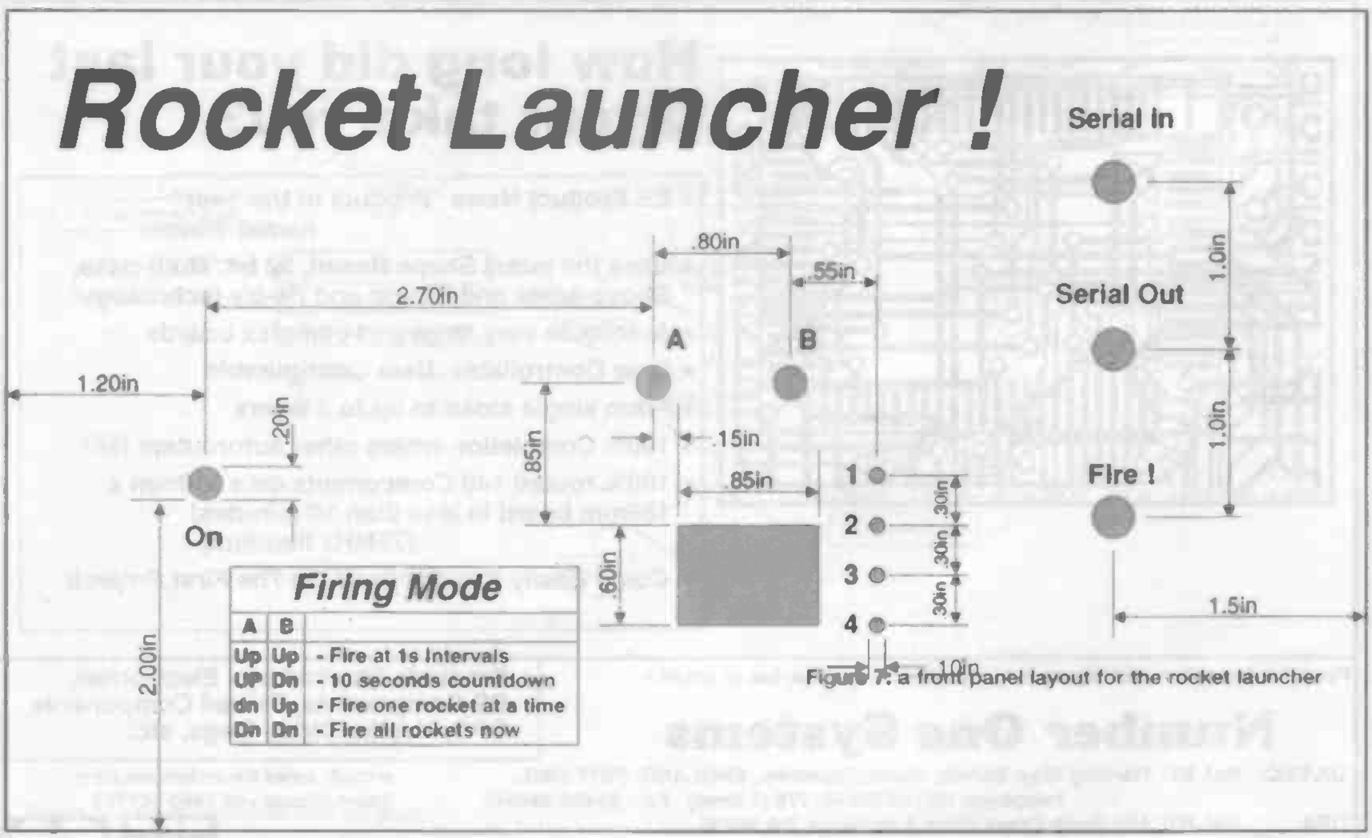
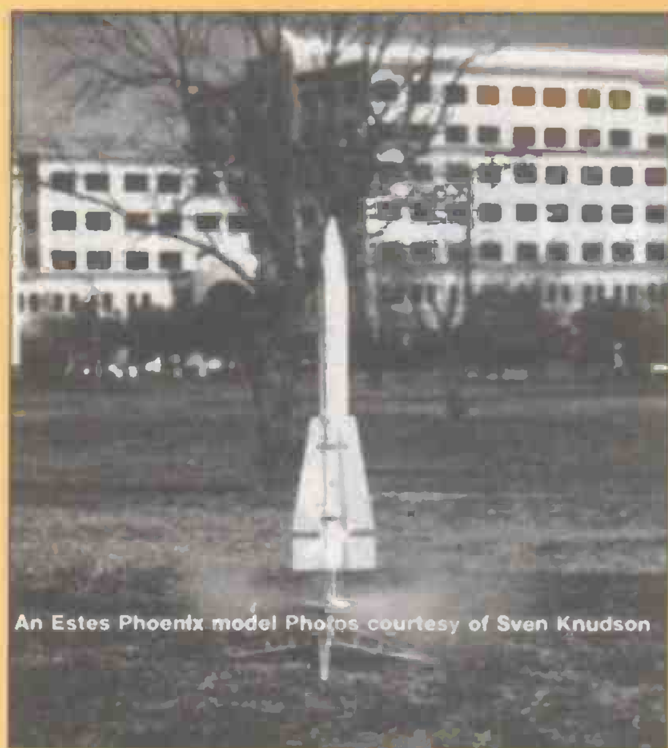


Figure 7: a front panel layout for the rocket launcher


An Estes Phoenix model Photos courtesy of Sven Knudson

serial link is not to be used the main circuit board will not require R14 and Q4. The main circuit board has five links, use snipped component leads for the links, and insert these first. The ic sockets are inserted next. Use an ic socket for IC1, and also for Display 1, the connector for the relay board is also a 16-pin ic socket. Next, solder in the resistors and the capacitors, finally the transistors and IC2. For testing purposes the LEDs (D1 to D4) should be soldered in, but leave them sticking out of the board to the length of the leads as they will be adjusted later. Switches SW1, 2 and 3 are mounted on Veropins soldered into the board to ensure adequate clearance when they are used to mount the board. The centre of the three switch leads needs snipping so that all switch leads are of identical length. The leads must be carefully soldered directly onto the top of the Veropins. All external connections to the board are made by Veropins.

The relay board overlay is shown in figure 6. There are seven links on the board, again these should be soldered first. Follow with the discrete components, the ic socket, Veropins, and finally the relays. If less than four rocket engines are to be driven, the associated circuitry may be left out and included at a later date.

The lead for the connection between the main processor board and the relay board is made from 16-way flat ribbon cable. The connectors are IDC 16-pin headers which fit well into standard ic sockets. IDC connector assemblers are quite expensive, however a simple alternative may be constructed. Solder a scrap 16-pin ic socket into a piece of Veroboard. Press the IDC header pins into the socket and assemble the header around the flat cable. Press the top of the header down by hand, and then complete the assembly by gently squeezing the complete unit with a mole wrench, or in a vice. Note that the headers should be assembled on opposite sides of the cable to ensure that pin 1 is connected to pin 1.

The safety key used in the prototype was a US mains plug and socket with the plug shorted out. Clearly this key would be completely unacceptable in countries which use this kind of plug and socket for mains supply, and in these countries a different plug/socket must be used. The safety key may be any plug and socket which allows a physical method of breaking the circuit, and which can carry the currents drawn, which can reach two or more amps with larger igniter batteries. Do not use a key switch unless the key cannot be removed in the on position. This is very important, as it is vital that the safety key cannot be enabled while the key is removed from the launcher.

Testing

For testing purposes the project should be assembled outside the main case allowing faults to be rectified far more easily. Directly solder the firing push button to the veropins, and use test leads with crocodile clips to connect test resistors to the rocket connections. Connect the safety key. Cable up the batteries for the main processor board and relay board, and connect the boards with the ribbon cable. Insert IC1 and the display, and power up the system.

Check that the system operates as described above. To simulate rocket igniters being connected to the system, the test leads should be connected to 100-ohm resistors. The voltage across the resistor may be measured to verify relay operation. Remember that the fire button is disabled for 3 seconds following power up, and for 3 seconds following connection of a rocket.

Case

The case used for the project is a Maplin type M1006. This case has an offset aluminium front panel on which the processor and display board is mounted. The drilling pattern for the front panel of the case is shown in figure 7. The holes for the firing button and serial input/output sockets are on the right, all the other mounting holes are for the switches. Glue a small piece of red filter over the display hole. This is essential for viewing in daylight. Four holes need drilling in the rear of the case for the grommets for the rocket cables, and for the prototype the safety key was also mounted on the back panel of the case. The relay board and battery holders are fixed to the base of the case using double sided adhesive pads.

Unsolder the LEDs D1 to D4, but leave them loosely fitted into the board holes, connect short cables to all pins on the main board, and plug in the ribbon cable. Fit the main board to the front panel and fix it firmly in case by screwing on the switch nuts. Now carefully move the LEDs so that the top of the LED fits snugly behind the front panel hole. Solder the leads of the LEDs into the board.

The firing button is connected through a phono socket. The lead used was a single cored microphone lead, and the button mounted in a 35mm plastic film canister. Do not use a jack plug for the lead, as the plug may cause a short - and an accidental rocket firing - when it is inserted.

Resolder all the cables and check that the project still operates properly before assembling the case.

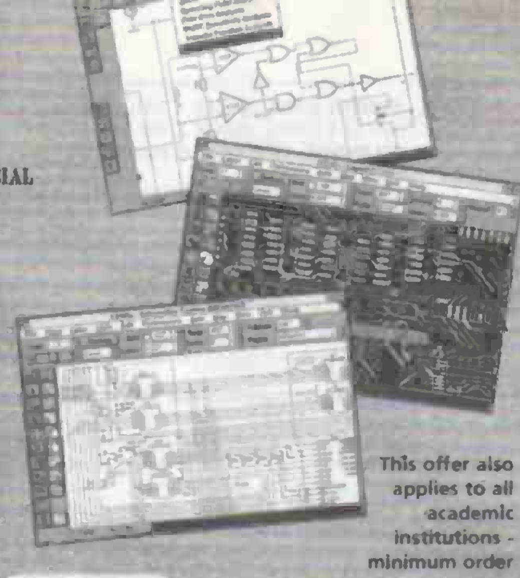
Using the launcher safely

As with any rocket launching system (be it electrical or simply a match), the safety of the system depends on the operator displaying common sense and taking all sensible precautions. With this system the operator must take out the safety key whenever connecting rockets to the launcher. This provides a strong guarantee of safety. The display will flash whenever the key is removed, and this may be used as confirmation that the key is removed and that there is no internal short that might fire the rocket. The unit should be powered up whenever connecting rockets to allow the three second safety time-out to operate when new rockets are connected, although the time-out operates automatically on power up.

Please follow the instructions provided with the rocket

EDWIN NC

ELECTRONIC DESIGN FOR WINDOWS   NON COMMERCIAL



TEACHERS... STUDENTS... HOME USERS... etc.

Your opportunity to save £££££'s

With this non commercial version of our software produced for single users, this is your dream come true!

Software as you are probably aware has no real material-value, but is priced to recover the enormous costs of development. The software house tries to evaluate how many units will sell at a specific price to generate the amount needed and produce a healthy profit.

As the electronics marketplace shrinks, due to expanding competition, it means that, in reality, powerful user friendly software, such as EDWin, must be very highly priced and therefore remains inaccessible to the individual and small businesses.

Until today ... Norlinvest, one of the biggest software houses in the electronics sector, has decided to put onto the market a "Non Commercial" version of their EDWin software, which is known worldwide.

This is the first truly seamlessly integrated suite of software running in all Windows formats ... simulation, schematics and PCB design. At last allowing amateurs, teachers, students, ... in a work "individual" to take advantage of current technology, without any restriction.

To avoid misunderstanding, there is no difference between the industrial version of the software and our Non-commercial version, except the price. In other words; industry is subsidising the development cost and now the individual can take full advantage of this.

Computer Compatibility

To run the program you will need:

- Windows 3.x, Win95 or Win NT,
- a min. 386 processor (486+ rec.)
- 8mb of RAM
- CD-ROM Drive

This offer also applies to all academic institutions - minimum order two systems.

Card Price

1. ***EDWinNC Basic:*** Schematics, PCB Layout with Basic Autorouter and Postprocessing. Max. 100 component database and 500 symbol Device Library. £49.00

The ***De Luxe 1*** version has the above, but also includes Professional Libraries and unlimited database components. £79.00

De Luxe 2 is the same as the basic version, but with Professional Libraries and adds Mix-mode Simulation. £79.00

De Luxe 3 all the above plus the Arizona Autorouter. £114.00

Options: Professional Libraries £24.00
Professional Database
(Unlimited components) £24.00
Mix-mode Simulation £24.00
Arizona Autorouter £24.00
EDSpice Simulation £49.00
Thermal Analysis £19.00

Post and Packing £5.00 UK. Overseas £10.00 Prices include VAT

All Major Credit Cards Accepted

EDWIN NC

ELECTRONIC DESIGN FOR WINDOWS NON COMMERCIAL

YES! Please Rush Me My EDWIN NC Program.

Swift Designs Ltd., Dept.ETI, Business & Technology Centre, Bessemer Drive, Stevenage, Herts, SG1 2DX.

Name: ....

Address: ....

....

.... Postcode: ....

Tel: (Day) ....

(Evening) ....

Version Required: Basic De Luxe 1 2 3 (please circle)

I enclose £.............+ p.p. £5.00 UK (p.p. £10.00 outside UK)

Cheque/P.P./Credit Card: Visa/Access/Mastercard:

Nº: ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ Expiry Date: ☐☐☐☐

Signature:

PLEASE ALLOW 10-15 DAYS FOR DELIVERY.

Tel: 01438 310133 Fax: 01438 722751 Email: designs@swiftdesigns.co.uk Web: www.swiftdesigns.co.uk

System Features

Complete End-to-End CAE/CAD system.
Simultaneous Schematic and Layout generation.
Automatic Front and back annotation.
Intuitive hierarchical menu structure.
Mouse or keyboard commend activation.
Macro operations.
Real-time display of: ratsnest, active nodes, single line or true trace width.
On-line help.
Auto reconnect.
Full Integration of Schematic and Layout.
Automatic file backup.
User definable text sizes.
DXF in and output.
Screen hardcopy.
Library viewer with editing possibility.
Switching on/off possibility for tool and scroll bars.
Visible schematic and PCB symbols by editing.
Monochrome mode for better print resolution.
Bitmap support for loading logos, documentation, etc. Can be used in hierarchical as well as in simple schematic or PCB design.
Maximum number of nets: 16,000.
Maximum number of nodes: 32,000.
Maximum number of bend points: 64,000.
Maximum number of connections: 64,000.
Maximum number of symbols: 32,000.
Maximum number of components: 32,000.
Maximum number of multi-segment traces: 32,000, with a total of 64,000 trace segments.
ANSI/IEC libraries.
Full Gerber, NCD, pic and place output.

Schematic Capture

Up to 100 schematic sheets.
Up to 64" x 64" sheet size.
Industry standard sheet sizes.
Rotate, scale and mirror symbols.
Real-time dragging of components and wires.
Automatic package and pin assignment.
Orthogonal and free mode manual routing.
Automatic bus annotation.
Block save, load, move and delete.
Direct access to mixed mode simulation.
Autorouting of connections.
Merging and splitting of nets possibility.
Definable line width, also for bus-lines.
Swapping of component positions.
Automatic component renumbering by swapping.

PCB Layout

32 layers (28 route layers, 2 silk-screen layers (front and back), 2 soldermask layers (front and back)).
User definable trace sizes.
User definable pads.
Curved traces.
1 mil grid resolution - Fine grid 10 micron.
SMT, fine line, analog support.
Component repeat, rotate and mirror.
Components "Move by name".
Component, gate and pin swap.
Automatic component renaming.
Trace repeat.
On-line, multi-layer routing with automatic via insertion.
Pin-to-pin, free or 45 degree routing.
Change segment side and width, trace side and width.
Fast interactive generation of ground planes with user definable cross-hatch or solid fill.
Automatic ground plane with thermal relief insertion.
Automatic DRC with user specified parameters.
Electrical connectivity checking.
Linear rotation of symbols.
Gerber input read and use possibility.
Built-in interface for Spectra 6.0, Max route 6.0 and Arizona Autorouter.
Bitmap functions (logos, drawings, ...).
Sophisticated database viewer.

Mixed Mode Simulation

AC analysis (Frequency domain).
DC analysis (Linear/non-linear).
TD analysis (Time domain).
Diagram generator.
Dynamic parameter definition of active and passive components.
Output graphs displayed on screen, hardcopy or placed on schematic.
Oscilloscope function.
DLL based analog/digital simulation primitives, modelling language and library creation tools.
Built-in model generator for discrete devices.

Please Note: Some of the above are ONLY provided on the De Luxe 3 Version. EdSpice and Thermal Analysis are available as bolt-on extras.

£1 BARGAIN PACKS

– List 5

One item only per pack unless otherwise stated.

TEST PRODS FOR MULTIMETERS with 4mm sockets. Good length very flexible lead, ref D86

8 OHM PM SPEAKERS, size 8 x 4", pack of 2. These may be slightly rusty and that is why they are so cheap, but are electrically OK, Ref D102.

PAXOLIN PANELS size 6 x 6", approximately 1/16" thick, pack of two, ref D103.

13A SOCKET, virtually unbreakable, ideal for trailing lead, ref D95.

PIEZO BUZZER with electronic sounder circuit, 3 to 9V DC operated, Ref D76.

DITTO but without internal electronics, pack of 2, Ref D64.

LUMINOUS ROCKER SWITCH, approximately 30mm sq, pack of 2, Ref D64.

ROTARY SWITCH, 9 pole 6 way, small size and ¼" spindle, pack of 2, Ref D54.

FERRITE RODS, 7" with coils for Long and Medium waves, pack of 2, Ref D52.

DITTO but without the coils, pack of 3, Ref D52.

SLIDE SWITCHES, SPDT, pack of 20, Ref D50.

MAINS DP ROTARY SWITCH with ¼" control spindle, pack of 5, Ref D49.

ELECTROLYTIC CAP, 800uf at 6.4V, pack of 10, Ref D48.

ELECTROLYTIC CAP, 1000 + 1000uf 12V, pack of 10, Ref D47.

MINI RELAY with 5V coil, size only 26 x 19 x 11mm, has 2 sets changeover contacts, Ref D42.

MAINS SUPPRESSOR CAPS, 1uf 250V AC, pack of 10, Ref 1050.

TELESCOPIC AERIAL, chrome plated, extendable and folds over for improved FM reception, Ref 1051.

MES LAMP HOLDERS, slide on to ¼" tag, pack of 10, Ref 1054.

PAX TUBING, ¼" internal diameter, pack of 2, 12" lengths, Ref 1056.

ULTRA THIN DRILLS, .4mm, pack of 10, Ref 1042.

20A TOGGLE SWITCHES, centre off, part spring controlled, will stay on when pushed up but will spring back when pushed down, pack of 2, Ref 1043.

HALL EFFECT DEVICES, mounted on small heat sink, pack of 2, Ref 1022.

12V POLARISED RELAY, 2 changeover contacts, Ref 1032.

PAXOLIN PANEL, 12 x 12" ⅛" thick, Ref 1033.

MINI POTTED TRANSFORMER, only 1.5VA 15-0-15V or 30V, Ref 964.

ELECTROLYTIC CAP, 32uf at 350V and 50uf section at 25V, in aluminium can for upright mounting, pack of 2, Ref 995.

PRE-SET POTS, 1 meg, pack of five, Ref 998.

WHITE PROJECT BOX, with rocker switch in top left-hand side, size 78 x 115 x 35mm, unprinted, Ref 1006.

6V SOLENOID, good strong pull but quite small, pack of 2, Ref 1012.

FIGURE 8 MAINS FLEX, also makes good speaker lead, 15m, Ref 1014.

HIGH CURRENT RELAY, 24V AC or 12V DC, 3 changeover contacts, ref 1016.

LOUD SPEAKER, 8 ohm 5W, 3.7" round, Ref 962.

NEON PILOT LIGHTS, oblong for front panel mounting, with internal resistor for normal mains operation, pack of 4, Ref 970.

3.5MM JACK PLUGS, pack of 10, Ref 975.

WONDER PLUGS, pack of 10, Ref 986.

PSU, mains operated, 2 outputs, 1 9..5V at 550mA and the other 15V at 150mA, Ref 988.

ANOTHER PSU, mains operated, output 15V AC at 320mA, Ref 989.

PHOTO CELLS, silicon chip type, pack of 4, Ref 939.

LOUD SPEAKER, 5" 4 ohm 5W rating, Ref 946.

230V ROD ELEMENTS, 500W terminal ended 10" long, pack of 2, Ref 943.

LOUD SPEAKER, 7 x 5" 4 ohm, 5W, Ref 949.

LOUD SPEAKER, 4" circular 6 ohm 3W, pack of 2, Ref 951.

FERRITE POT CORES, 30 x 15 x 25mm, matching pair, Ref 901.

PAXOLIN PANEL, 8 ½ x 3 ½ with electrolytics 250uf and 100uf, Ref 905.

CAR SOCKET PLUG, with PCB compartment, Ref 917.

4 CORE FLEX, suitable for telephone extensions, 10m, Ref 918.

VERO OFF CUTS, approximately 30 square inches of useful sizes, Ref 927.

PROJECT CASE, 95 x 66 x 23mm with removal lid held by 4 screws, pack of 2, Ref 976.

SOLENOIDS, 12 to 24V, will push or pull, pack of 2, Ref 877.

2M MAINS LEAD, 3 core with instrument plug moulded on, Ref 879.

TELESCOPIC AERIAL, chrome plated, extendable, pack of 2, Ref 884.

MICROPHONE, dynamic with normal body for hand holding, Ref 885.

CROCODILE CLIPS, superior quality flex, can be attached without soldering, 5 each red and black, Ref 886.

BATTERY CONNECTOR FOR PP3, superior quality, pack of 4, Ref 887.

LIGHTWEIGHT STEREO HEADPHONES, Ref 898.

PRESETS, 470ohm and 220K, mounted on single panel, pack of 10, Ref 849.

THERMOSTAT, for ovens with ¼" spindle, to take control knob, Ref 857.

12-0-12V 10 W MAINS TRANSFORMER, Ref 811.

18-0-18V 10W MAINS TRANSFORMER, Ref 813.

AIR SPACED TRIMMER CAPS, 2 to 20pf, pack of 2, Ref 818.

AMPLIFIER, 9 or 12V operated Mullard 1153, Ref 823.

2 CIRCUIT MICRO SWITCHES, Lincoln, pack of 4, Ref 825.

LARGE SIZED MICRO SWITCHES (20 x 6 x 10mm), changeover contacts, pack of 2, Ref 826.

MAINS VOLTAGE PUSH SWITCH with white dolly through panel mounting by hexagonal nut, Ref...

POINTER KNOB, for spindle which is just under ¼", like most thermostats pack of 4, Ref 833.

TOROIDAL MAINS TRANSFORMERS

All with 220/240V primary winding.

0-30V + 0-30V at 120VA would give you 30A at 4A or 60V at 2A, price £8, Order Ref 8PG2.

0-110V + 0-110V at 120VA would give you 110V at just over 1A or 220V at ½A, price £8, Order Ref 8PG3.

0-35V + 0-35 at 150VA would give 35V at 4A or 70V at 2A, price £8, Order Ref 8PG9.

0-35V + 0-35V at 220VA would give 35V at 6 ½A or 70V at 3 ½A, price £9, Order Ref 9PG4.

0-110V + 0-110V at 220VA would give 110V at 2A or 220V at 1A, price £10, Order Ref 10PG5.

0-45V + 0-45V at 500VA would give 45V at 11A or 90V at 5 ½A, price £20, Order Ref 20PG7.

0-110V + 0-110V at 500VA would give 110V at 5A or 220V at nearly 3A, price £25, Order Ref 25PG8.

NORMAL MAINS TRANSFORMERS

5V 45A, £20, Order Ref 20P16
6V 1A, 2 for £1, Order Ref 9
8V 1A, £1, Order Ref 212
9V ½A, 2 for £1, Order Ref 266
9V 1A, £1, Order Ref 236
9V 3A, £2, Order Ref 2P408.
10V 1A, £1, Order Ref 492
12V ½A, 2 for £1, Order Ref 10
12V 1A, £1, Order Ref 436
12V 2A, £2, Order Ref 2P337.
12V 3A, £3, Order Ref 3P181.
15V 1A, £1, Order Ref 267
17V 1A, £1, Order Ref 492
18V 1 ½A, £1, Order Ref 491
20V 4A £3 Order Ref 3P106
24V ½A £1 Order Ref 337
24V 1A, £2, Order Ref 2P413.
24V 1 ½A, £2.50, Order Ref 2.5P15.
25V 10A, £20, Order Ref 20P33.
28V 2 ½A, £4, Order Ref 4P24.
30V 25VA, £2.50, Order Ref 2.5P25.
40V 2A, £3 Order Ref 3P107.
43V 3 ½A, £5, Order Ref 5P262.
50V 15A £20 Order Ref 20P2.
675V 100mA, £5, Order Ref 5P166.
4kV 2mA, £5, Order Ref 5P139
6-0-6V 5VA, 2 for £1, Order Ref 612.
6-06V 10VA, £1, Order Ref 281
7.5-0-7.5V 8VA, £1, Order Ref D104.
7.5-0-7.5V 50VA, £4, Order Ref 4P98.
8-0-8V 8VA, £1, Order Ref 212.
12-0-12V 3VA, £1, Order Ref 636.
12-0-12V 6VA, £1, Order Ref 811.
12-0-12V 30VA, £2.50, Ref 2.5P15.
15-0-15V 1VA, £1, Order Ref 937.
15-0-15V 15VA, £2.50, Ref 2.5P24.
18-0-18V 10Va, £1, Order Ref 813.
20-0-20V 10VA, £1, Order Ref 812.
20-0-20V 10VA, £2, Order Ref 2P85.
20-0-20V 20VA, £2, Order Ref 2P138.
20-0-20V 40VA, £3, Order Ref 3P205.
20-0-20V 80VA, £4, Order Ref 4P36.
25-0-25V 40VA, £3, Order Ref 3P206.
36-0-36V 20VA, £2, Order Ref 2P156.

SPECIAL TRANSFORMERS

15VA gives 1V 7V 8V 9V or 10V, £1, Order Ref 744.

38-0-38V 150VA with regulated winding, £10, Order Ref 10P36.

230-115V auto auto transformer 10VA, £1, Order Ref 822.

230-115V auto transformer 1kVA, £20, Order Ref 20P29.

230-115V auto transformer 300VA can be made from our Ref 4P97. This is a big mains transformer but it has 1 115V tapping on its primary, £4.

SUPER WOOFER LOUDSPEAKERS

Two available. The first is a 10" 4 ohm with a power rating of 250W music and normal 150W. Has a very heavy magnet and is beautifully made and finished by Challenger. Normal selling price for this is £55 + VAT, you can buy at £29 including VAT and carriage, Order Ref 29P7.

The second one is a 8" 4 ohm, 200W music, 100W normal. Again, by Challenger, price £18. Order Ref 18P9. Incidentally, as these are so heavy, if you collect, then you will make a saving of £2 on the 10" and £1.50 on the 8".

LOUDSPEAKERS

2" round 50ohm coil ½W speaker, pack of 2, £1, Order Ref 908.
2 ¼" 8 ohm, pack of 2, £1, Order Ref 454.
2 ½" 35 ohm, pack of 2, £1, Order Ref 514.
3 ½" 8 ohm, pack of 2, £1, Order Ref 682.
5" 4 ohm, pack of 2, £1, Order Ref 136.
6 ½" 4 ohm with tweeter, £1, Order Ref 895.
6 ½" 6 ohm, £1, Order Ref 896.
6 ½" 8 ohm with tweeter, £1, Order Ref 897.
6 ½" 4 ohm 12W (superior make with Hitachi tools), £1, Order Ref 900.
6 x 4" 4 ohm, £1, Order Ref 242.
5 x 5" 15 ohm, £1, Order Ref 906.
5 x 3" 16 ohm, pack of 2, £1, Order Ref 684.
8" 15 ohm Audax, £1, Order Ref 504.
3" 4 ohm tweeter, £1, Order Ref 433.
6 ½" 4 ohm Sanyo speaker 10W, £1.50 Order Ref 1.5P11.
6 x 4" 15 ohm 10W, £2, Order Ref 2P167.
6 ½" 4 ohm Hitachi speaker with tweeter, £2, Order Ref 2P301.
20W tweeter 4 ohm, £1.50, Order Ref 1.5P9.
Tweeter on flange with crossover, £3, Order Ref 3P86.
Horn speaker, £3, Order Ref 3P82.
5" 20W loudspeaker by Goodmans for Ford, £3, Order Ref 3P145.
8" 8 ohm Amstrad 15W speaker with matching tweeter, £4, Order Ref 4P57.
Midi speaker in cabinet 4 ohm 5W, £5, Order Ref 5P137.
Boxed speakers 4 ohm, £5 each or pair for £8, Order Ref 8/14L.
Double wound voice coil 25W speaker, ITT, £7, Order Ref 7P12.
Bulkhead speaker, metal cased, £10, Order Ref 10P43.
25W 2 way crossover, pack of 2, £1, Order Ref 22.
40W 3 way crossover, £1, Order Ref 23

BIG BUYERS DISCOUNT

Many of the items on this page are are available in quantity and if you order 10 of an item, you can deduct 10%, 50 of an item 15%, 100 of an item 25%, or a mixed order totalling £200 from items on this page, again 25% discount.

TERMS

Send cash, PO, cheque or quote credit card number – orders under £25 add £3.50 service charge.

J & N FACTORS
Pilgrim Works (Dept. E.E.)
Stairbridge Lane, Bolney,
Sussex RH17 5PA
Telephone: 01444 881965

engines, in particular the recommendation that the rockets are used only under responsible adult supervision, and are fired only in suitable locations. Estes recommend that rockets are fired at least 5m away, and in the event of a launch failure the rocket must be left for at least one minute before approaching it to attempt to re-launch it.

If less than four rockets are connected, attach the rockets to the lower numbered cables: therefore with two rockets to launch, connect them to cables 1 and 2.

Figure 8: the code for the 16C74

```
:04000000A720052808
:10000800E9287B20A4102411241A0C28072824117D
:10001800A001A101241E0528A708031D0B28241DE3
:100028000C282411A4142C08AD002E08033C031935
:1000380059282E08023C031964282E08013C03198C
:100048003E28A0010130A90029088E202908A10016
:100058001E30A200A41C3A28A208031D2E287B20CB
:1000680029080430C03193A28A90A2828A4107B2047
:10007800A7010C28A0010130A900A10029088E20A1
:100088002908A1001E30A200A41C3A28A208031DBA
:1000980048287B202908043C03193A28A41C3A283C
:1000A800241D52282411A90A4228A001A101802058
:1000B8001E30A200A41C3A28A208031D5E283A2874
:1000C8000A30AB000130A000A101A411A41C3A28F9
:1000D800A41D6A28A411A008031DA003A108031DDC
:1000E80077280A30A100A103031D6A2859280510A2
:1000F80085100511851108000B0012D183014AD18B0
:10010800B0142D193015AD19B0150508FC053004CB
:1001180085000800B000043C031D9428AD1985151E
:100128003008033C031D9A282D1905153008023C98
:10013800031DA0288514AD183008013C031D0800D4
:100148002D18051408008B137B20FF30FF30850025
:1001580086008700880007308900831605108510FF
:10016800051185110712071387108711071187 12C8
:100178000710081288120813831287000816 8816B9
:1001880008170330831681008312313090008E01E6

:100198008F01D4309500303096000A3097008B16C6
:1001A8000B1783160C158312A401AA01A701A2013B
:1001B800AC01A501A601AF01A801A001A10111216F
:1001C8000A30AB008B1748210800B100030E8312D8
:1001D800B2000C1D0529AF0AAB0BF528A4150A308F
:1001E800AB0011210C11D43095070318960A303052
:1001F80096072414A708031DA703A208031DA2033A
:100208000C290B1D0C290B11A50A0319A60A4B2151
:1002180032 0E8300B10E310E0900AE01061BAE147A
:10022800861A2E1486191D292C142A1C48212A14D2
:100238001F292C102A1006192629AC14AA1C48219B
:10024800AA142829AC10AA1086182F292C152A1DA3
:10025800482 12A1531292C112A1106183829AC15DC
:10026800AA1D4821AA153A29AC11AA11861B4029B2
:100278002A1E24152A1641292A12051A462924124B
:10028800A41047292416 08001E30A7000800A80A51
:1002980028080 33C0319A8010816881608 17241A09
:1002A8005729AF180800A80803195F2928186329D7
:1002B800A81867290813081220080027692988 1236
:1002C8002108002769290813 2C08B000FF3087008F
:1002D800301807 12B01807133019871 0B019871192
:0E02E800301A0711B01A8712301B07100800D9
:100E0000B0000A3C031C003407308A003008093E59
:100E100082003F3406345B344F3466346D347D34A5
:080E200007347F346F34003405
:00000001FF
```

Obtaining programmed chips

The code for the 16C74 is shown in figure 8. A disk containing the object and source code for the project may be obtained by sending an SAE and a cheque for £5 to Forest Electronic Developments,10 Holmhurst Avenue, Christchurch, Dorset BH23 5PQ. They will take credit card orders on 01425 275962. Alternatively a pre-programmed 16C74 is available from FED for £15.00.

Estes model rockets can be found at most good model shops. A catalogue is available from Estes in the USA at: Estes Industries, 1295 H Street, Penrose, CO 81240, USA. Tel. from UK (for other origins, add the appropriate international code): 00 1 (800) 820 0202; fax 00 1 (800) 820 0203, or on the World Wide Web at http://www.service.com/estes/ estes.html .

All photographs courtesy of rocket builder Sven Knudson. Sven's web site can be found at www.dtm-corp.com/~sven. His email is sven@dtm-corp.com .

PARTS LIST for the Rocket Launcher

Resistors

All 1 percent, 0.25 watt

R1-7	360R
R8-10	10k
R11,14	22k
R12	4k7
R13	100R
R15-18	1k5
R19-22	2k

Capacitors

C1,2	22p disc ceramic
C3	100u 10V electrolytic radial
C4-5	100n disc ceramic

Semiconductors

IC1	PIC16C74 - see text
IC2	5V regulator HT7250, Maplin Code LE79
Disp1-3	Dual 7-digit display, 0.5in, CA, Maplin Code BY66
Q1-3	BC557
Q4,5-8	BC548
D1-4	Green LED
D5-D9	Not fitted
D10-13	1N4148

Other components

PL1,2,3	chassis mounted phono sockets
RL1-4	5V, 70ohm coil, 5A relays, Maplin code SD94
SW1,2,3	Miniature SPDT switch, Maplin code FH98

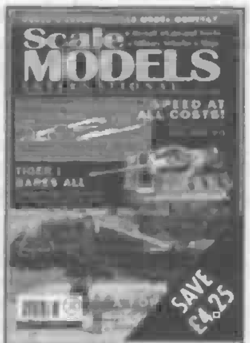
US-type mains plug, safety key
US-type mains socket, safety key

XL1	4MHz resonator

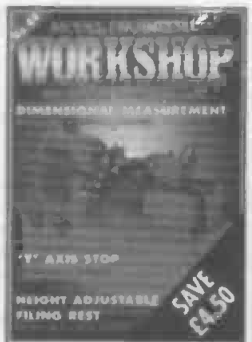
16pin DIL header; 4 x AA type battery clips, see text; twin core cable, 35 mm; case M1006, Maplin code LH64; fire switch - push to make; ic sockets, DIL 16 pin; ic sockets, DIL 18 pin, 0.6in; ic sockets, DIL 40 pin; 1-metre microphone cable for Fire key; PCB; Veropins; phono plug for Fire key; red filter; 30 cm 16-way ribbon cable.

SUBSCRIBE TO ANY MA


SAVE £4.90
The World's best selling military modelling magazine. Published every 4 wks.
13 ISSUES


SAVE £4.25
The World's leading scale model monthly. Published every 4 wks.
13 ISSUES

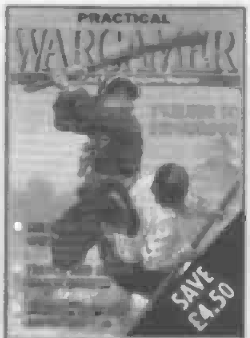

SAVE £4.50
The military heritage collection Published every 8 wks.
10 ISSUES

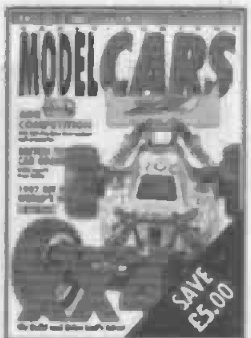

SAVE £4.50
The hobby magazine for all workshop enthusiasts. Published every 8 wks.
10 ISSUES


SAVE £4.60
The World's most respected model engineering magazine. Published every 2 wks.
16 ISSUES


SAVE £6.50
The original, the best and still the only Dolls House magazine worth reading.
Published every 4 wks.
9 ISSUES


SAVE £2.95
State of the art model making from Tamiya. Published every 8 wks.
13 ISSUES


SAVE £4.50
Embracing all aspects of the wargaming hobby. Published every 8 wks.
10 ISSUES


SAVE £5.00
The UK's best selling R/C car magazine. Published every 4 wks.
12 ISSUES


SAVE £3.80
Britain's best - selling radio control model magazine - and it's easy to see why! Published every 4 wks.
12 ISSUES


SAVE £3.80
Building, news, reviews, reports - all in the best selling Model Boats magazine. Published every 4 wks.
12 ISSUES

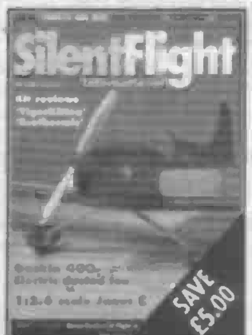

SAVE £4.50
The International magazine for horological collectors and restorers. Published every 4 wks.
10 ISSUES

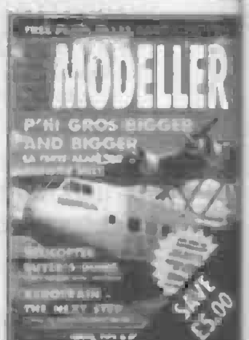

SAVE £2.50
The UK's premier ham radio and listener magazine. Published every 4 wks.
11 ISSUES

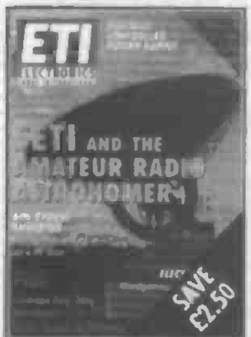
29 MAGAZINES TO CHOOSE FROM 1 BARGAIN PRICE!

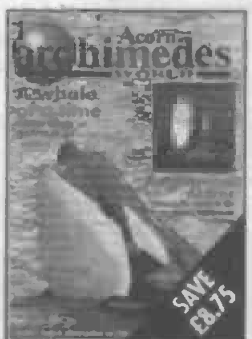

SAVE £4.50
The leading magazine for all lovers of flying scale models. Published every 8 wks.
10 ISSUES

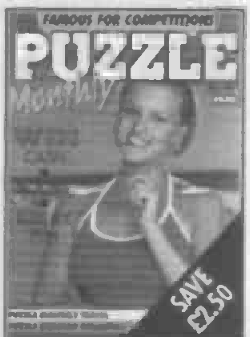

SAVE £3.80
Britain's original free flight and control line magazine, launched in 1935. Published every 4 wks.
12 ISSUES

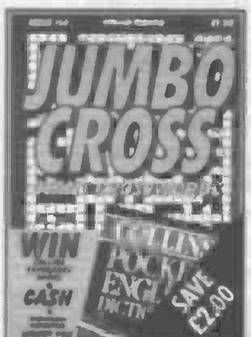

SAVE £5.00
The no.1 magazine for model gliders and electric powered soarers. Published every 8 wks.
10 ISSUES

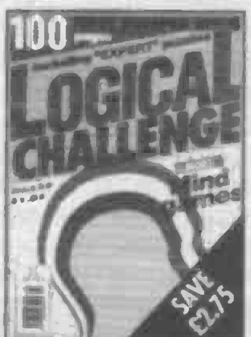

SAVE £3.00
The practical magazine for all model flyers. Published every 4 wks.
15 ISSUES


SAVE £2.50
The project magazine for all electronics constructors. Published every 4 wks.
11 ISSUES


SAVE £8.75
Britain's most respected computing magazine devoted to all Acorn 32-bit RISC OS systems. Published every 4 wks.
9 ISSUES


SAVE £2.50
Mixed Puzzles and super prizes. Published every 4 wks.
25 ISSUES


SAVE £2.00
Larger grids for bigger challenges. Published every 4 wks.
18 ISSUES


SAVE £2.75
Worldwide favourite with logic solvers. Published every 4 wks.
15 ISSUES

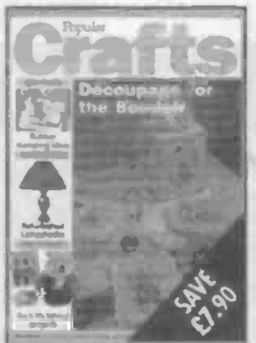
BE REMEMBERED FOR MONTHS AFTER CHRISTMAS A SUBSCRIPTION IS THE PERFECT GIFT.

CHRISTMAS SUBSCRIPTION OFFER - SAVE

GAZINE FOR ONLY £25

...tain's biggest and most ...pected patchwork magazine ...blished every ... wks.

11 ISSUES



Packed with projects, expert advice and wonderful creative ideas. Published every 4 wks.

14 ISSUES

Whether you are looking for a magazine subscription for yourself or as a superb Christmas gift, this offer is unbeatable. And it couldn't be simpler:

NOW YOU CAN SUBSCRIBE TO ANY OF THESE MAGAZINES FOR ONLY £25! (UK only)

So whatever your passion, you can have the magazine (or magazines!) of your choice delivered directly to your door, post free*, for only £25. Remember, a subscription is always cheaper than buying your copies from the newsagent*. In this case, you can save anything from £2.00 to £8.75, depending on your magazine choice.

TO ORDER, simply select your favourites from the 29 magazines we have available and fill in the details on the coupon below. The number of issues you will receive and the saving you are making are shown with each magazine, so you can see what a sensational deal you are getting! If you would like to give a subscription as a Christmas present, please make sure that you also fill in the gift recipients details.

SO ORDER NOW, and don't miss out on these exceptional Christmas subscription savings!

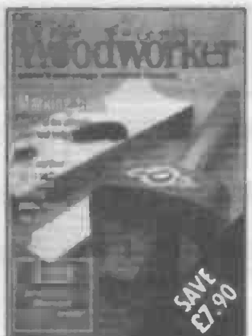
Important Deadlines

If you would like to give a subscription as a Christmas present to a friend or relative, it is important that we receive your order no later than the 8th December. This will ensure that they receive their first issue in January and also gives us time to send you a gift acknowledgement letter if you require (please tick the box on the order form).
The closing date for this offer is 31 January 1998. This offer is open to all readers. Photocopies of this page are acceptable. Not to be used in conjunction with any other offer.

Please allow up to 4 weeks for the delivery of your first issue

* All savings are based upon buying the same number of issues from your newsagent, UK only.

REMEMBER, A MAGAZINE SUBSCRIPTION MAKES A GREAT CHRISTMAS GIFT THAT WILL LAST FOR MONTHS!



Britain's best selling magazine for all serious woodworkers Published every 4 wks.

14 ISSUES

Please order all your goods using the coupon below ensuring you fill in all sections OR simply use our order hotline. Thank you.

YES! I would like to take advantage of this Special Christmas offer and subscribe to ANY magazine shown for only:

£25 UK - £34 EUROPE
£37 OVERSEAS
$62 USA

SUBSCRIPTIONS CHOICE

Magazine	Please tick box if subscription is a gift	No. of issues	Price
....	❑	....	£...........
....	❑	....	£...........
....	❑	....	£...........
....	❑	....	£...........
....	❑	....	£...........
....	❑	....	£...........
	Total Subscription Value		£...........

METHOD OF PAYMENT
The total value of my order is £ .... I enclose a Cheque/P.O. made payable to Nexus Special Interests Ltd. or please debit my Access/Mastercard/Visa/AMEX account

Card No | | | | | | | | | | | | | | | | Expiry ....../......

Signature ....

Your Details (PLEASE USE CAPITALS) Name: (Mr/Mrs/Miss)
Initial .... Surname ....
Address: ....
....
Postcode .... Telephone: ....

Gift Subscription - Please fill in the recipients details below (PLEASE USE CAPITALS)
Name: (Mr/Mrs/Miss)
Initial .... Surname ....
Address: ....
....
Postcode .... Telephone: ....

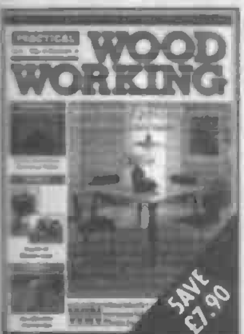
Please tick this box if you would like to receive a gift acknowledgement letter ❑

Please send this completed form together with your payment to:
NEXUS SUBSCRIPTIONS, TOWER HOUSE, SOVEREIGN PARK, LATHKILL STREET, MARKET HARBOROUGH, LEICS., LE16 9EF

CLOSING DATE: 31/01/98

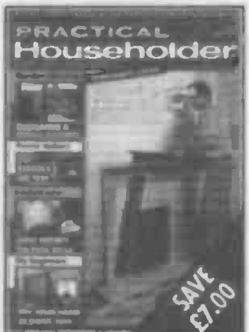
Please tick this box if you do not wish to receive direct mail from other companies ❑

CODE 3000



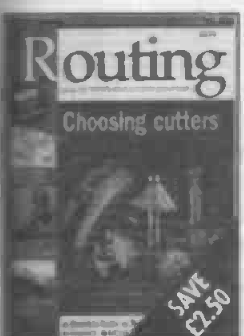
...ith more projects, hints, tips and ...ndly advice than ever. ...blished every ... wks.

14 ISSUES



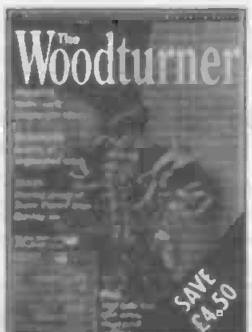
The UK's only dedicated home and garden DIY magazine. Published every 4 wks.

16 ISSUES



...e magazine dedicated to the ...e of the world's most versatile ...wer tool. Published ...ery 8 wks.

10 ISSUES



A new magazine, taking a fresh, innovative look at this growing hobby. Published every 12 wks.

10 ISSUES

Christmas Subscription Express Order Hotline:

01858 435344

(PLEASE QUOTE CODE 3000)

9am - 5.30pm Monday - Friday Fax order line: 01858 434958

Closing date: 31/01/98

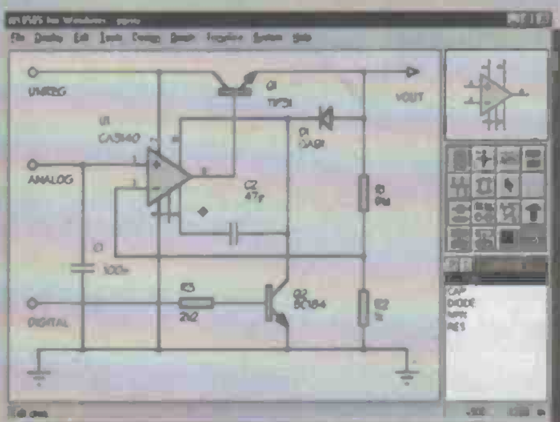
UP TO £8.75

PROTEUS

The IV th Generation

Schematic Capture

NEW Version IV



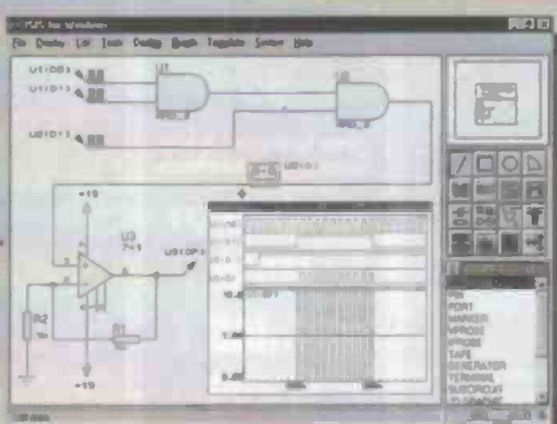
●Produces attractive schematics like you see in the magazines. ●Netlist, Parts List & ERC reports. ●Hierarchical Design. ●Full support for buses including bus pins. ●Extensive component/model libraries. ●Advanced Property Management. ●Seamless integration with simulation and PCB design.

New Features

Component Auto-Placer
Pinswap/Gateswap Optimizer
Background Regeneration of Power Planes
Enhanced Autorouting with Tidy Pass
Full Control of Schematic Appearance
Extensive New Component Libraries

Available in 5 levels - prices from £295 to £1625 + VAT.
Call now for further information & upgrade prices.

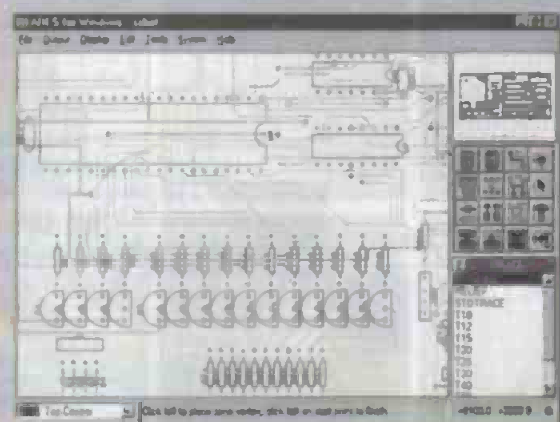
Simulation



●Non-Linear & Linear Analogue Simulation. ●Event driven Digital Simulation with modelling language. ●Partitioned simulation of large designs with multiple analogue & digital sections. ●Graphs displayed directly on the schematic.

PCB Design

NEW Version IV



●Automatic Component Placement. ●Rip-Up & Retry Autorouter with tidy pass. ●Pinswap/Gateswap Optimizer & Backannotation. ●32 bit high resolution database. ●Full DRC and Connectivity Checking. ●Shape based gridless power planes. ●Gerber and DXF Import capability.

"PROTEUS is particularly good with its rip-up-and-retry autorouter"

EWW January 1997

Labcenter Electronics

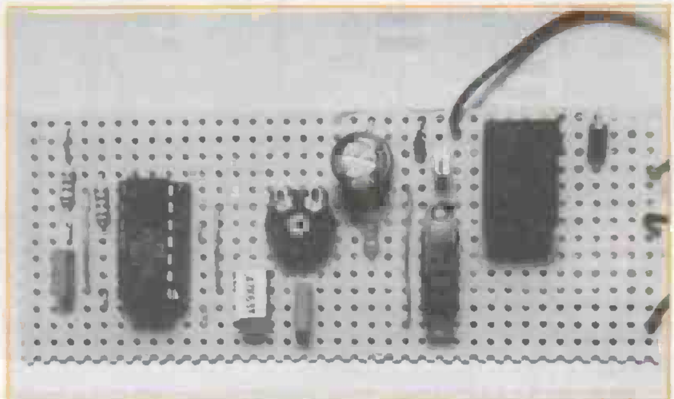
Write, phone or fax for your free demo disk, or ask about our full evaluation kit.
Tel: 01756 753440. Fax: 01756 752857. EMAIL: info@labcenter.co.uk
53-55 Main St, Grassington. BD23 5AA. WWW: http://www.labcenter.co.uk

Fully interactive demo versions available for download from our WWW site.
Call for educational, multi-user and dealer pricing - new dealers always wanted.
Prices exclude VAT and delivery. All manufacturer's trademarks acknowledged.

High-Low Timer Module

GCSE Grounding

Terry Balbirnie continues his series of adaptable circuits for GCSE projects with an adjustable delayed timer module



The purpose of this series is to describe some electronic modules which will be of interest to students and hobbyists, particularly those studying for GCSE Technology and similar examinations. All the devices may be used as they stand, or modified to suit a particular application. All have possibilities for experimental work built in to challenge the more ambitious student.

No frills

The circuits are given without frills - they are not built into a box, and there is no on-off switch, for example. These details are left to the constructor. The way in which each device works is described with the aid of the circuit diagram.

Construction is based on a stripboard (Veroboard) layout. Veroboard is preferred by many students and it is readily available. Also, the inherent "in-line" arrangement of components inherent in stripboard more nearly resembles the arrangement of a circuit diagram than a true PCB does, and is therefore more easy to match to the circuit under study. The relay output means that the circuits are able to control other battery-operated devices such as lamps or motors using a separate supply. They are also able to switch other electronic circuits on or off without any care needed over interfacing.

Note that these circuits must not be used to control mains equipment as this would be very dangerous.

Just in time

This month we shall look at a time delay module which may be used to switch some external device on or off during operation. The "high/low" aspect is provided by a switch on the circuit panel. In one position, the timings may be adjusted from about 30 seconds to 11 minutes. In the alternative position, they may range from about 4 minutes to 2 hours. This makes the circuit suitable for a wide variety of purposes. For example, it could be used for process timing (possibly for photographic work or cookery). It could also be used to operate a radio for a preset time at night so that it will switch off after the user has gone to sleep. The timings are easily changed if required and details for doing this are given later. The total current requirement is about 80mA while timing. This is not important for short timings. However, over long periods the battery would soon be drained. It would then be better to use a commercial plug-in power supply unit. More about this will be said later.

The circuit is shown in figure 1. Power is obtained from a PP9 battery or six AA size cells in a suitable holder (or from a plug-in supply). Diode D2 allows current to flow from supply positive to charge up capacitor C4 which then provides a supply for the circuit. The capacitor provides a reserve of charge and helps to provide stable operation. This is especially useful when the battery is becoming old or when a poorly-smoothed plug-in supply is used. D2 also provides protection if the supply were to be connected with incorrect polarity since then it would be reverse biased and would not allow current to flow.

The principle component is the integrated circuit timer, IC1. This functions with very few external components to provide reasonably accurate time delays. The chip incorporates a digital counter and logic circuitry which enables it to give very long timings with relatively low value components. It operates as follows. Current from the battery positive line flows through resistor R2 to pins 4 and 5. An on-chip 5V regulator then provides a stabilised supply for the ic. The excess voltage - that is, the difference between the nominal 9V input and 5V - appears across R2. Decoupling capacitor C3 is essential for stable operation of the ic. On powering-up, timing begins and pin 3 goes high.

Pin 14 provides a precision 2.5V supply for the timing components (RV1, R1, C1 and C2). Assume that switch SW1 is open (off) for the moment so C1 is disconnected and has no effect. Current flows from pin 14 through preset RV1 and resistor R1 and charges capacitor C2. When the voltage across C2 reaches a certain value, this is detected by pin 13 and the on-chip counter registers "one". The capacitor is then discharged by internal circuitry. The charging process then starts again with the counter keeping a record of the number of charge/discharge cycles. When this reaches 4095, pin 3 goes low and timing is terminated. The ic is then ready to begin a further cycle when the supply is switched off then on

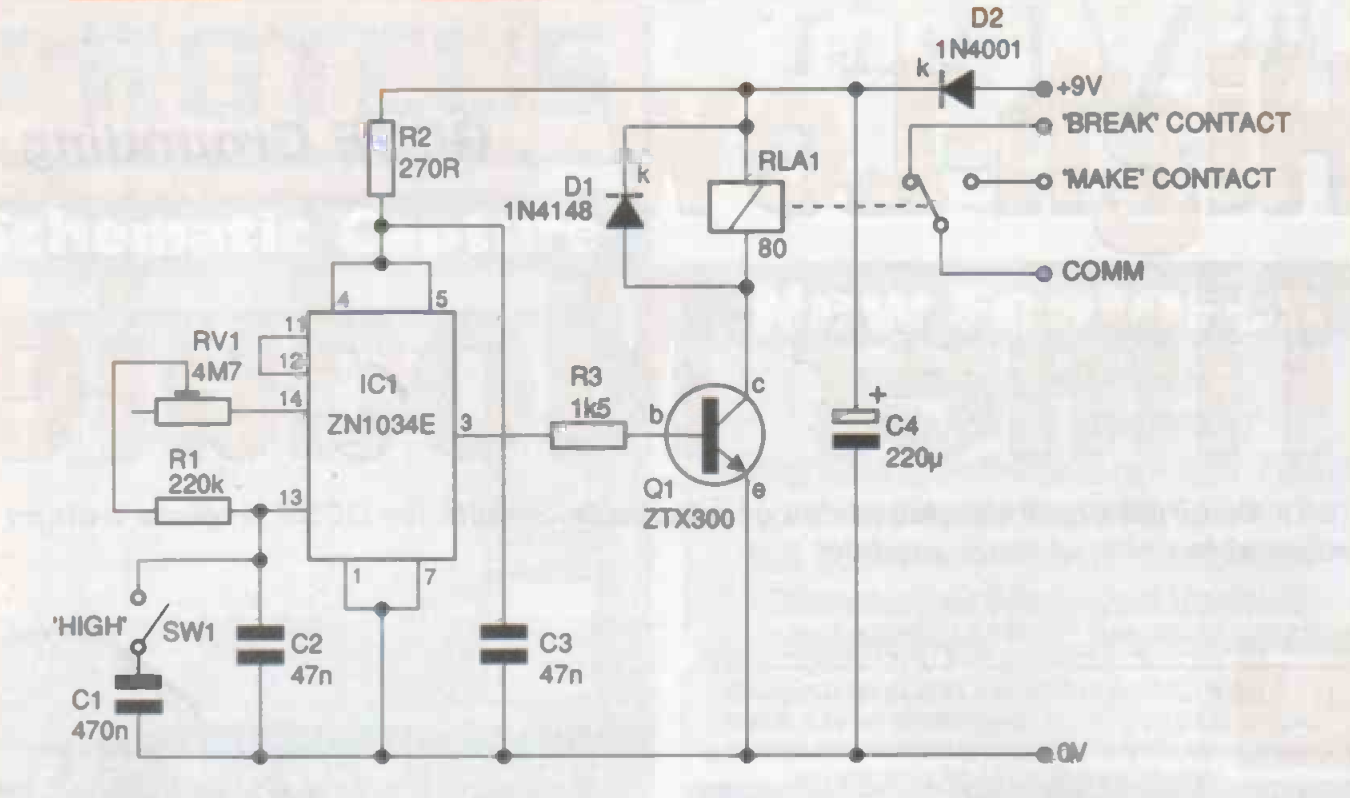


Figure 1: the circuit of the High-Low timer module

again. When SW1 is closed (on), capacitor C1 is connected in parallel with C2 and the overall value is increased. This extends the timings.

While pin 3 is high, current flows through resistor R3 to the base of transistor Q1. This allows collector current to flow through the relay coil. The relay has SPDT contacts and access is provided to both the normally-open ("make") and the normally-closed ("break") ones so that external devices may be switched either on or off during the timing cycle. D1 bypasses the reverse high-voltage pulse which appears across the relay coil when it switches off. Without this, the high voltage could damage semiconductor devices in the circuit.

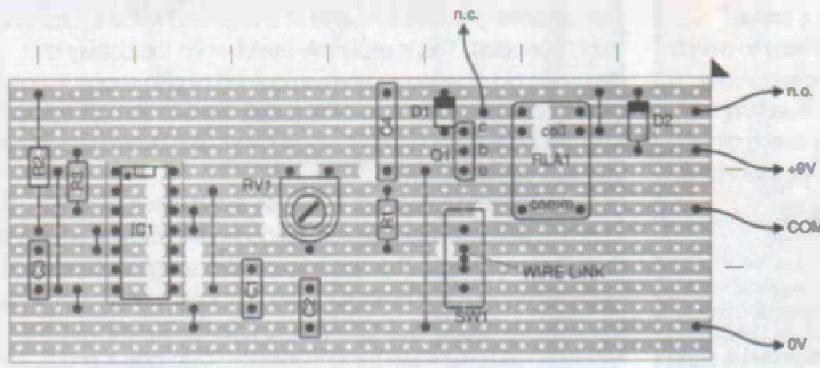


Figure 2: the stripboard layout of the High-Low timer module

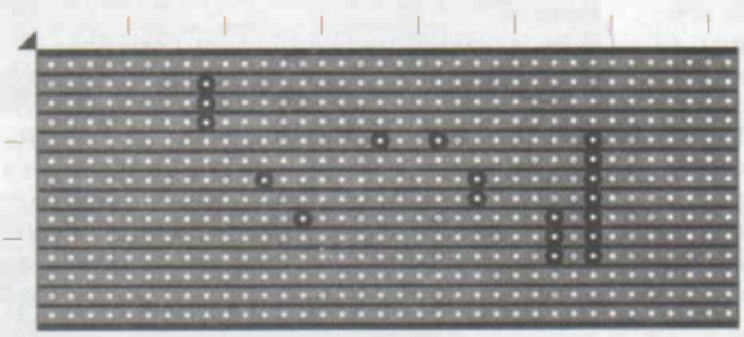


Figure 3: the back of the stripboard layout

Construction

The topside stripboard layout (component side view) is shown in figure 2. Note that a large number of track breaks and inter-strip links are needed. Make the track breaks first, using a proper spot face cutter, then attend to the links. Most causes of malfunction are due to strips not being broken completely, a break or link wire being left out, a break in the wrong place or a blob of solder or sliver of copper bridging adjacent tracks. Some of these mistakes are invisible to the naked eye, so check with a magnifying glass!

Next, solder the switch in position. With the specified unit, the centre tag will not fit the 0.1in. matrix. It will be necessary to drill a small hole between the tracks as indicated. The centre tag is connected to the copper strips on each side of it by soldering a short link wire between them. Do not rely on a blob of solder to do this. Follow by soldering the ic socket in position, the relay, then all remaining components. Take care to mount the transistor, diodes and capacitor C4 the correct way round. Solder battery connectors to the +9V and 0V tracks as indicated. If a plug-in supply is to be used, use the appropriate connector. Solder wires to the required relay contact tracks - the common and either the N/O (normally-open or "make") or N/C (normally-closed or "break"). Probably the "make" contacts are more useful and these are accessible from the edge of the board. Note, however, that the photograph shows wires soldered to the "break" contacts.

Adjust RV1 fully clockwise and switch SW1 off (lever adjusted upwards). This will give minimum timing which is best for testing purposes. Insert the ic taking care over the orientation. This is a CMOS device and could be damaged by static charge - earth yourself by touching a water tap or other earthed point before handling the pins.

Testing

Connect the battery and listen for a click from the relay. It should then switch off again some 30 seconds later. Disconnect the battery. Advance RV1 to give longer timings and switch on again. Check the higher timing range by switching SW1 on (lever downwards).

If you are using a plug-in power supply, make sure that its voltage output does not exceed 12V. If it is of the stabilised type there will be no problem. The inexpensive non-stabilised type will need to be checked since the output voltage is usually stated for full-load conditions and with this circuit it will be loaded only lightly. You may find that a 6V nominal supply provides 9V under a light load. If it has a polarity reversing plug, it is quite in order to try it one way round and if the circuit does not work, reverse it.

Ideas for experiments

Remember, this circuit must not be used to operate mains devices.

To extend to time periods, capacitors C1 or C2 could be increased in value. Alternately, increase the value of RV1 or R1. If the timings need to be adjusted from outside the case, remove RV1 and connect wires from a standard panel-mounting potentiometer to the same positions. If a motor or a lamp requiring more than about 1A is to be operated, it will be necessary to up-rate the relay with one having appropriately rated contacts.

PARTS LIST for the High-Low Timer

Resistors

R1	220k
R2	270R
R3	1k5
RV1	4M7 min horizontal preset

Capacitors

C1	470n min metallised polyester
C2	47n min metallised polyester
C3	100n min metallised polyester
C4	220u 16V PCB electrolytic

Semiconductors

IC1	ZN1034E
Q1	ZTX300
D1	1N4148
D2	1N4001

Miscellaneous

RLA1 Miniature relay with 6V coil and 2A "make" contacts; 0.1 in matrix stripboard; PP9 battery and connectors; 14-pin dil socket.

The relay used in the prototype was type FM91Y from Maplin.
The switch was type FF77J from Maplin.

Computer-controlled Christmas Light Show

Pel An uses his Centronics port to drive a "melody" of programmable light patterns

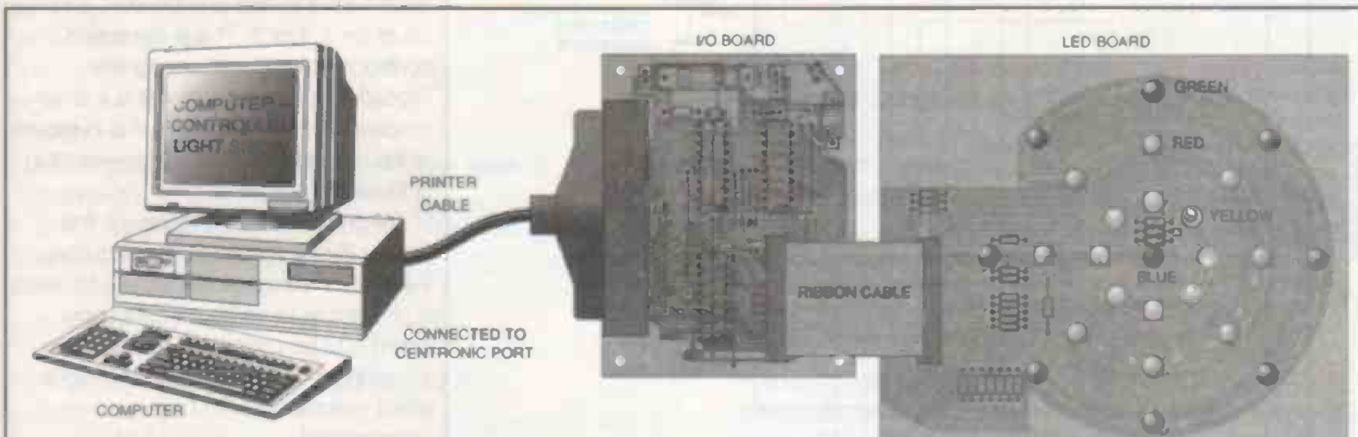


Figure 1: the computer-controlled LED light show

This article describes a computer-controlled LED light show system. There are 24 LEDs (8 red, 8 green and 8 yellow) arranged in three concentric circles on the display board (see Figure 1). with one blue LED in the centre. The board is connected to an I/O control board via a 26-way ribbon cable. The control board is then connected to the computer's Centronics port using a printer cable. The lighting sequence for each LED is programmable. Users can write software to output different lighting sequences and thus achieve various visual effects.

The project can be a fancy hi-tech decoration at home. If you have several such devices running, you probably can just about bring the Blackpool Illuminations into your home.

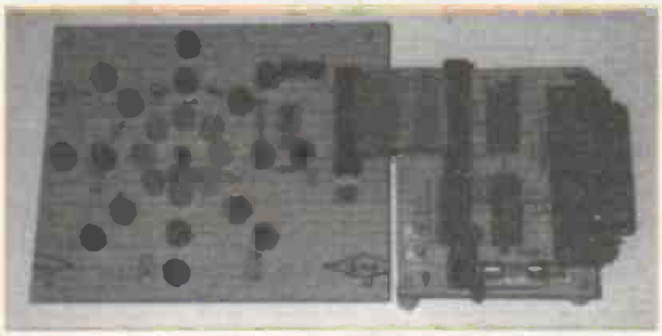
The hardware principle is very easy to understand and the project is easy to construct. Programming the light sequence is great fun. You can use your imagination to create any visual effects you like. If you are a bit lazy, you could let your computer to 'compose' its own melody of lights...

The works

The system consists of two boards: the I/O board and the LED (display) board. The I/O boards is connected to the printer port of a PC, and provides 24 output lines. The LED board contains 25 LEDs of 10mm diameter.

The details of the Centronics port are described in the article 'Centronics Mini-Data Lab' in ETI Volume 26 Issue 2, earlier this year.

The circuit diagram of the I/O board is shown in Figure 2. It contains three 74LS374 octal latches (IC1, IC2 and IC3). The pin-out of the 74LS374 is given in Figure 3. When latching a data to the output, firstly, the data is applied to the inputs (D). The a low-to-high-then-low pulse is applied to the CLK pin (pin



11). At the low-to-high transition, the input data is latched to the output. In the circuit, data inputs to the three latches are provided by the Data port of the Centronic port. DB0, DB1 and DB2 of the Control port are connected to CLK inputs of IC1, IC2 and IC3, respectively. The output ports A, B and C are available from J1 and the pin-out functions of the connector are shown in figure 5.

The I/O board requires an 8 to15V DC 1A power supply. The voltage is converted to +5V using an on-board voltage regulator. A fuse is used to limit the total current consumption within 500 mA.

The circuit diagram of the LED display board is shown in Figure 4. Each LED is driven by one output of the 74LS374 latches. A resistor is connected in series with the LED to limit the LED current below 15 mA. The LEDs used are 10mm-diameter LEDs, and there are 24 of them arranged in three circles of 8 LEDs each, with a blue LED in the centre. In my display, the inner circle has yellow LEDs; the middle circle has red LEDs and the outer circle has green LEDs. They are controlled by Port B, Port C and Port A, respectively.

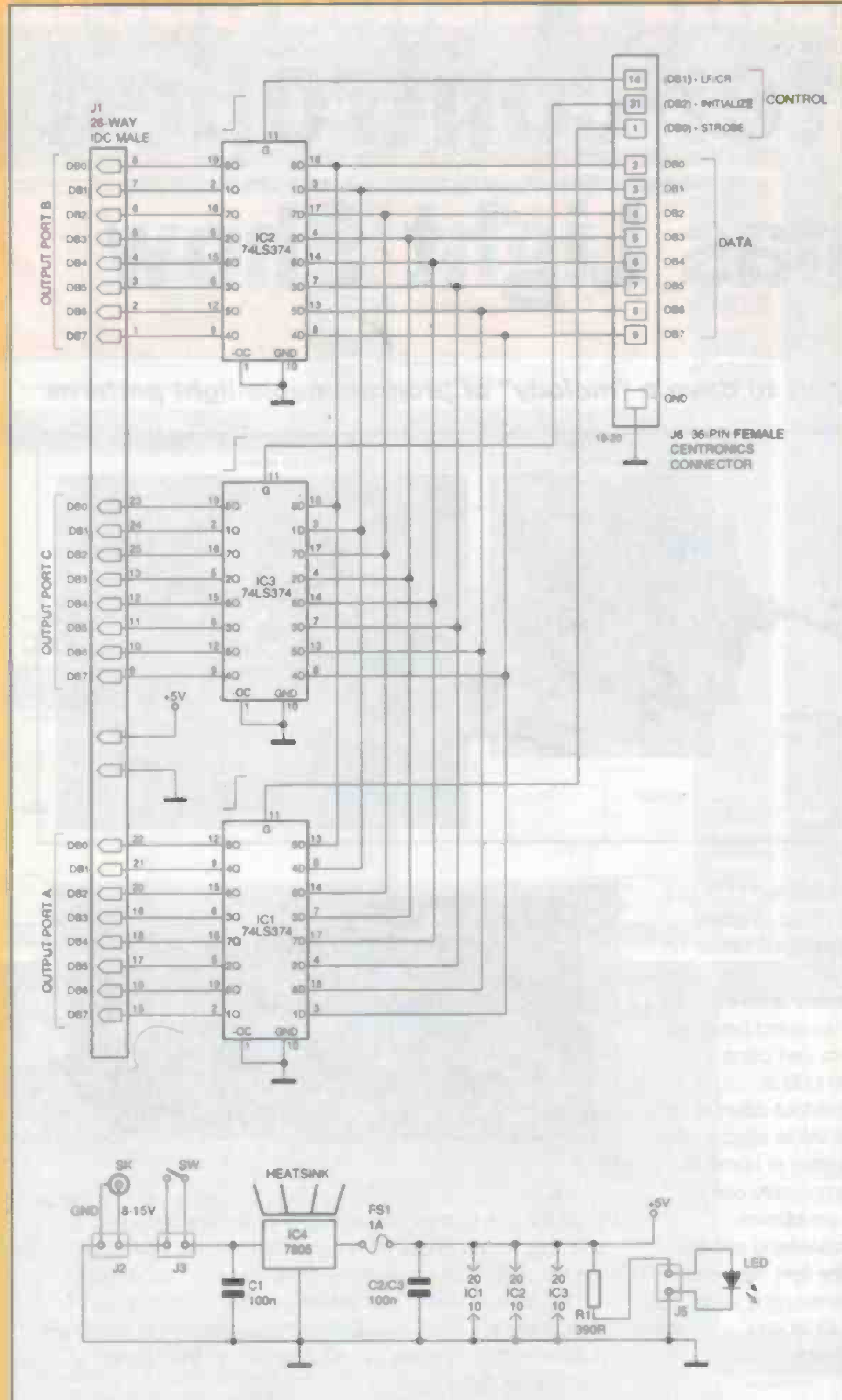


Figure 2: the circuit diagram of the Centronics I/O card

Programming

The Turbo Pascal 6 program for the project is listed below. Readers can convert the program into Basic or other programming languages.

The present program contains some useful functions and procedures. Procedure Input_printer_address reports the number of Centronics ports installed on your pc and allows you to select a printer port. Procedure write_port(port_number,port_data:byte) writes port_data into one of the three 74LS374 latches specified by port_number. The port_data could be a value from 0 to 255 and the port_address could be 0, 1 or 2. This is the only I/O control procedure in this program. Procedure Timer(second:real) is a timer procedure. If the time elapsed is in excess of the second, it will set the time-out flag (a Boolean number) true.

When you run the program, it first reports the number of Centronics ports installed on you pc and asks you to select a printer port to which the light show board is to be connected to. After this, the program will play a number of light-effect melodies which I have programmed.

In this demonstration program, I have written some light effect procedures. They are designed to work as follows:

Procedure All_on_off (second) puts all the LEDs on or off at the same time. The time period of this effect is determined by the variable: second. The details of the procedure are given in the program list.

Procedure Binary (second) simply sends binary data from 0 to 255 to the three ports. The lighting sequence of the LEDs is like a binary counter. This is a good demo of binary data.

Procedure Chase (No, effect1, effect2,second) gives an LED chase effect. To find out the functions of parameters, type the program and try it.

Procedure Red_Green (second) illuminates one red LED and one green LED. The two LEDs rotate in a circle.

Construction

The two boards are constructed on single-sided PCBs. The component layout of the I/O board and the LED board are shown in figure 5.

Construction of the boards is straightforward. Care should be taken to ensure that the polarity of the LEDs is right. When soldering LEDs on the PCB, keep the soldering time as short as you can to make a good connection, as LEDs can be heat-sensitive.

Procedure Explode (second) makes the yellow LEDs (the inner circle) light up first, then the green LEDs (the middle circle), and finally the red LEDs (the outer circle) lights up last. It will repeat this action again and again. The effect is exploding circles in different colours.

Procedure All_off will switch off all the LEDs.

This also 'switches off' the descriptions of my demo program.

```
Program Light_show;
{Software driver for PCcontrolled Light Show Pei An 1997}

uses
  dos, crt, graph;
var
  bitnumber,outputbyte:byte;
  P_address, Delaynumber_delay:integer;
  bit:array[1..8] of byte;
  timeoutflag:boolean;
  h1,m1,s1,s1001,h2,m2,s2,s1002:word;
  time1,time2: real;

Procedure find_delay_number_2;
{Check pc speed and find the delaynumber for 1 ms}
var
  time1,time2,dt:real;
  t,h1,m1,s1,s1001,h2,m2,s2,s1002:word;
begin
    clrscr;
    gotoxy(25,24); write('Checking computer speed');
    gettime(h1,m1,s1,s1001);
    time1:=3600*h1+60*m1+s1+s1001/100;
    for t:=1 to 1000 do delay(1);
    gettime(h2,m2,s2,s1002);
    time2:=3600*h2+60*m2+s2+s1002/100;
    dt:=time2-time1;
    delaynumber_delay:=round(1000/dt*0.001);
    clrscr;
    gotoxy(30,24); write('Finished...');
    clrscr;
end;

Procedure Input_printer_address;
{Universal auto detection of printer base address}
{ $000:$0408 holds the printer base address for LPT1
  $000:$040A holds the printer base address for LPT2
  $000:$040C holds the printer base address for LPT3
  $000:$040e holds the printer base address for LPT4
  $000:$0411 number of parallel interfaces in binary format}

var
  lpt:array[1..4] of integer;
  number_of_lpt,LPT_number,code:integer;
  kbchar:char;
begin
    clrscr;
    LPT_number:=1; {defaut printer}
    number_of_lpt:=mem[$0000:$0411]; {read number of
    parallel ports}
    number_of_lpt:=(number_of_lpt and (128+64)) shr 6;
    lpt[1]:=memw[$0000:$0408];  {Memory read procedure}
    lpt[2]:=memw[$0000:$040A];
    lpt[3]:=memw[$0000:$040C];
    lpt[4]:=memw[$0000:$040E];
    textbackground(blue); clrscr;
    textcolor(yellow); textbackground(red); window(10,22,70,24);
clrscr;

    writeln('Number of LPT installed    : ',number_of_lpt:2);
    writeln('Addresses for LPT1 to LPT 4:  ',lpt[1]:3,'   ', lpt[2]:3,'
    ', lpt[3]:3,'   ', lpt[4]:3);
    write('Select LPT to be used (1,2,3,4)   :  ');
    delay(delaynumber_delay*1000);
```

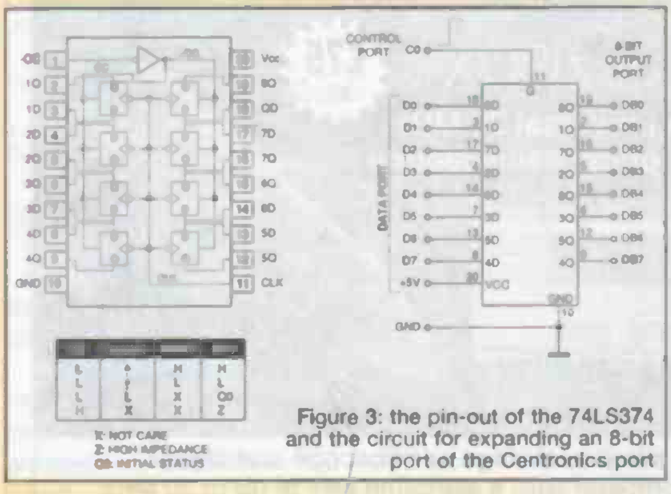
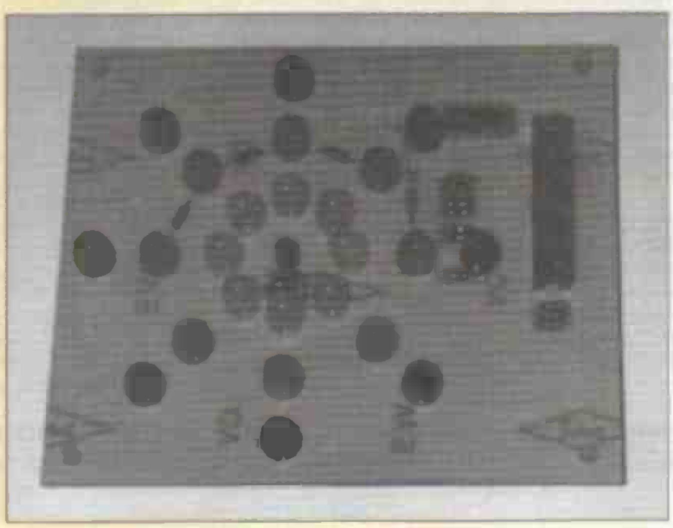


Figure 3: the pin-out of the 74LS374 and the circuit for expanding an 8-bit port of the Centronics port

```
    if number_of_lpt>1 then begin {select LPT1 through LPT4 if
    more than 1 LPT installed}
      repeat
          kbchar:=readkey;              {read input key}
          val(kbchar, LPT_number, code);   {change character
                                            to value}
    until (LPT_number>=1) and (LPT_number<=4) and
(lpt[LPT_number]<>0);
                    end;
    clrscr;
    P_address:=lpt[LPT_number];
    writeln('Your selected printer interface: LPT',LPT_number:1);
    write('LPT  Address                  :  ',P_address:3);
    delay(delaynumber_delay*1000);
    textbackground(black); window(1,1,80,25); clrscr;
                end;

Procedure timedelay;
{A short time delay}
var
  dummy:real;
  I:integer;
begin
        for I:=1 to 50 do dummy:=0;
end;

Procedure initialization;
begin
        port[P_address+2]:=0+2+0; {DSL=1, data load #1=0,
data load #2=0}
```



A slimline storage oscilloscope and digital voltmeter with a sampling rate of up to 20 MHz. Inclusive software enables the recorded signals to be displayed simultaneously on a PC screen.

Sample Rates: From 50 ns to 1 ms.
Input Voltage: 1 V, 10 V, 100 V.
Trigger: ±Internal, ±External, Auto.
Voltmeter: AC and DC.
Supply Voltage: 9 V to 13 V DC, 13 mA, external.
Trigger, ground, power & serial cables included.

Purveyors of Quality Electronic Thingies at Very Friendly Prices

No Nuts Limited
2 Chase Cottages,
New Road, Aldham,
Essex CO6 3QT Tel. & Fax 01206 213322

Also Available;
CCD Camera Modules from £60
Complete CCD Kits, with housing, cable and connectors. Ready to run.
B/W + Audio CCD Kit £85
Colour + Audio CCD Kit £150
Please add £2 p&p to all orders.

Program your PIC12C508/9s

Visible Sound's Pentium Friendly PIC programmer will program the PIC12C508/9, PIC16C71/84. The programmer includes a ZIF socket to easily mount the device to be programmed. (H137A).

All this for only £25 inc. P&P (UK Only) and VAT.
25 way M/M cable £6 (A057A). Power Supply £5 (A061A).

Christmas Special PIC Programmers Starter Kit

This value for money Special Offer, consists of our PIC programmer (H137A), parallel connection cable (A057A) and Power supply (A061A) AND 10! PIC12C508-04/P.
Incredible value at £49.99 inc. VAT and (UK) P&P.

PIC12C508-04/P 1x£2.30, 10x£2.00, 50x£1.88 and 100x£1.76 (C504A).
PIC12C508/JW 1x£13.50 (C503A). PIC16C84 1x£6.00 (C500A).

Voice Command Module £60

Based on the Sensory Devices RSC neural network speech recognition processor. 20 individual digital word ID outputs on IDC header. Each output with an 'on' word and 'off' word giving you up to 99% speaker dependent recognition. Simply train the module with up to 40 words. H138A

VCM low cost microphone (A060A) £6.50, VCM low cost Speaker (A062A) £5.00, VCM serial cable (A059A) £9.00.

Voice Command module Christmas Value Pack £67.49 inc. VAT and (UK) P&P.

This pack contains VCM (H138A), VCM microphone (A060A), VCM speaker (A062A) and Power Supply (A061A).

ALL prices INCLUSIVE of vat and delivery (UK only) Same day despatch.

Visible Sound Ltd., 151s The Exchange Building, Mount Stuart Square, Cardiff, CF1 6EB. Tel (01222) 458417, Fax (01222) 480325
email info@vsltec.demon.co.uk. WWW http://www.vsltec.demon.co.uk

Microchip PIC and Motorola HC11 based development Tools

PIC Microcontroller Programmers **Original** - This is our original programmer for 16C5X, 16C55X,16C6X, 16C7x, 16C8x, 16F8X devices. Price : £40 for the kit, or £50 ready built. **Serial** - This programmer programs the newest PIC devices in a single 40 pin multi-width ZIF socket. Will program: 16C55X, 16C6X, 16C7X, 16C8x, 16F8X, 12C508, 12C509, PIC 14000. Also In-Circuit programming. **Price : £40 for the kit, or £50 ready built. Introductory** - Will program 8 pin and 18 pin devices : 16C55X, 16C61, 16C62X, 16C71, 16C71X, 16C8X, 16F8X, 12C508, and 12C509. **Price £22 for the kit (not available ready built).** Note : All our programmers operate on a PC, using a standard RS232 serial interface (COM1, 2, 3, or 4). No hard to handle parallel cable swapping ! All programmers are supplied with instructions, Windows programming software, MPASM, MPSIM and PICDE (Windows based PIC assembler)

PIC or HC11 Windows Based Development: PICDESIM and HC11DE allows assembly and simulation of your PIC or HC11 projects in one Windows program. Incorporate multiple files, view help file information directly from the code, edit within project, build and track errors directly in the source, then simulate. Simulator allows 3 breakpoint types, follow code in the source window, set breakpoints directly in code. Run programs, or single step, or step over subroutines. Track variable values and trace for display on the Trace Analyser. Input stimuli include clocks, direct values and asynchronous serial data. Profile your program - examine frequently called routines which are timed and use the information to optimise out bottle necks. PIC Version Simulates up to 50 times faster than MPSIM ! NEW ! - 32 bit version allows full use of Windows '95/NT4.0 facilities. ***Cost £30.00, or £25.00 for existing and new purchasers of any of our programmers. Please specify Windows 3.1, or Windows '95 (32 bit) and either PIC or HC11 version***

PIC BASIC FED's PIC BASIC products - straightforward, capable, powerful, rapid development. Operating in a Windows Development Environment our modules need no assembler or UV eraser to program your PIC's, and operate from a serial link to your PC. The 16C74 module features - 8k EEPROM, up to 2000 lines of BASIC, 27 lines of programmable I/O, 8 A/D inputs, Interrupt driven serial RS232 interface. Peripheral I2C bus interface, LCD display driver routines, up to 178 bytes for variables and stack, extendible with optional external RAM and all the standard 16C74 features. Ask about the 16C57 version.

Compiler - The FED PIC BASIC compiler for the 16C74. It produces hex code to program your 16C74 directly with no need for external EEPROM. Compatible with the EEPROM versions of PIC 16C74 BASIC modules - develop on an EEPROM based module then compile and program your PIC chips directly.

16C57 Module Kit (8k EEPROM, 4MHz) £25.00, Pre-built £30.00 16C57 Module Kit (8k EEPROM, 10MHz) £31.00, Pre-built £37.00
16C74 Module Kit (8k EEPROM, 4MHz) £35.00, Pre-built £42.00 16C74 Module Kit (8k EEPROM, 20MHz) £40.00, Pre-built £46.00
16C84 chip programmed with BASIC - £25.00 Compiler - £60.00, or £50.00 when ordered with a module

PIC and HC11 devices

PIC16C74/JW	Erasable	20MHz	£24.00	PIC16C558			£5.00
PIC16C74-04P	OTP	4MHz	£8.00	PIC16C74-20P	OTP	20MHz	£11.00
PIC16C57-04P	OTP	4MHz	£5.00	PIC16C57-10P	OTP	10MHz	£6.00
PIC16C84-04P		4MHz	£6.00	PIC16C84-10P		10MHz	£8.00
PIC16F84-04P		4MHz	£6.00	PIC12C508-04P	OTP	4MHz	£2.20
PIC14000-04P	OTP	4MHz	£10.00	PIC14000/JW		Erasable	£23.00
PIC12C508-04P	OTP	4MHz	£2.70	Motorola MC68HC811E2		Ring for details	

Ask about other chips!

VISA

Forest Electronic Developments

10 Holmhurst Avenue, Christchurch, Dorset, BH23 5PQ 01425-270191 (Voice/Fax) .
http://www.lakewood.win-uk.net/fed.htm e-mail: fed@lakewood.win-uk.net Prices are inclusive, please add £3.00 for P&P and handling to each order.
Cheques/POs payable to Forest Electronic Developments, or phone with credit card details. Serial Cables - £7.50

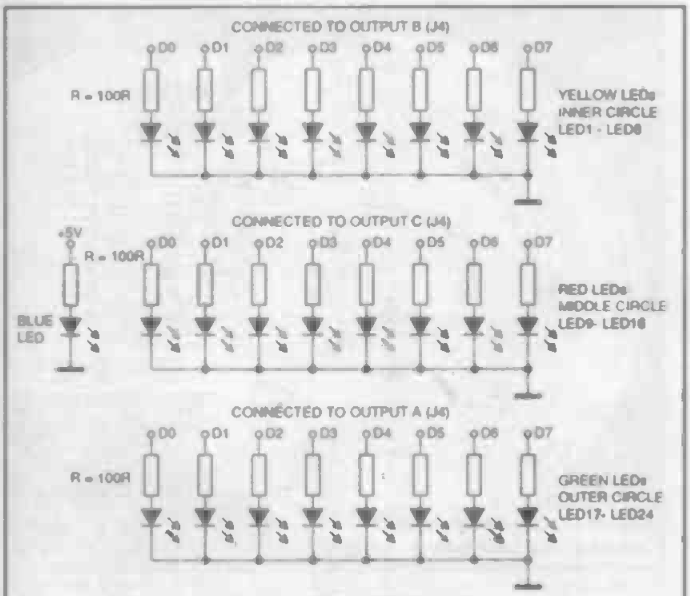


Figure 4: the circuit diagram of the LED board

```
end;

Procedure write_port(port_number,port_data:byte);
{write port_data into one of the 74LS373 D-type latches}
begin
   port[P_address]:=port_data;   {output a byte to the data
port}
   timedelay;
   if port_number=0 then begin
         port[P_address+2]:=0+2+4;  {load data #1=1}
         timedelay;
         port[P_address+2]:=0+2+0;   {load data #1=0,
loading data}
         timedelay;
                  end;
   if port_number=1 then begin
         port[P_address+2]:=0+0+0; {load data #2=1}
         timedelay;
         port[P_address+2]:=0+2+0; {load data #2=0, loading
data}
         timedelay;
                  end;
   if port_number=2 then begin
         port[P_address+2]:=0+0+0; {load data #2=1}
         timedelay;
         port[P_address+2]:=1+0+0; {load data #2=0, loading
data}
         timedelay;
                  end;
end;

Procedure find_bit_weight;
{find the bit weight}
begin
         bit[1]:=1;
         bit[2]:=2;
         bit[3]:=4;
         bit[4]:=8;
         bit[5]:=16;
         bit[6]:=32;
         bit[7]:=64;
         bit[8]:=128;
end;

Procedure Timer(second:real);

begin
  time1:=3600*h1 + 60*m1 + s1 + s1001/100;
  gettime(h2,m2,s2,s1002);
  time2:=3600*h2 + 60*m2 + s2 + s1002/100;
  if (time2-time1>second) then timeoutflag:=true else
timeoutflag:=false;
end;

Procedure All_on_off(second:real);
begin
gettime(h1,m1,s1,s1001);
repeat
         write_port(0, 255);
         write_port(1, 255);
         write_port(2, 255);
         delay(delaynumber_delay*300);
         write_port(0,0);
         write_port(1,0);
         write_port(2,0);
         delay(delaynumber_delay*300);
         timer(second);
until timeoutflag;
end;

Procedure binary(second:real);
var
```

PARTS LIST for the Computer Controlled Light Show

I/O board

R1	390R 0.25W resistor
C1-C3	100 nF ceramic capacitor
IC1-IC3	74LS374 octal latches (Maplin or Electromail)
IC4	+5V 1A voltage regulator (Maplin or Electromail)
J1	26-way IDC dil connector
J2, J3, J5	2-way PCB connectors
J6	36-way Centronix-type female connector
FS1	Fuse holder
Fuse	500 mA fuse

Heat sink for IC4
PCB (see Technical support for availability and prices.)
26-way ribbon cables with heaters
Pillars to support the PCB

LED board

R2-26	100R 0.25W carbon film resistors
LED1-8	10 mm yellow LEDs (Maplin or Electromail)
LED9-16	10 mm red LEDs
LED17-24	10 mm green LEDs
LED25	10 mm blue LED
J4	26-way IDC dil male connector

PCB (see Technical support for availability and prices.)
Pillars to support the PCB
PCB mounting header for the ribbon cable

```
            i:Integer;
  begin
  gettime(h1,m1,s1,s1001);
  repeat
     for i:=1 to 255 do begin
            write_port(0, i);
            write_port(1, i);
            write_port(2, i);
               delay(delaynumber_delay*10);
                    end;
     timer(second);
  until timeoutflag;
  end;

Procedure chase(no,effect1,effect2:integer;second:real);
var
        i,data1,data2,j:Integer;
begin
        gettime(h1,m1,s1,s1001);
repeat
        for i:=1 to 7 do begin
        data1:=bit[i];
        data2:=bit[abs(effect2*8-i)];
        for j:=1 to no-1 do begin
          data1:=data1+bit[i+j];
          data2:=data1+bit[abs(effect2*8-i-j)]
                 end;
        write_port(0, abs(effect1*255-data1));
        write_port(1, abs(effect1*255-data2));
        write_port(2, abs(effect1*255-data2));
          delay(delaynumber_delay*100);
                 end;
  timer(second);
until timeoutflag;
end;

Procedure red_green(second:byte);
var
  i:integer;
begin
  gettime(h1,m1,s1,s1001);
  repeat
     for i:=1 to 4 do begin
        write_port(0,bit[2*i-1]);
        write_port(2,bit[2*i-1]);
        delay(delaynumber_delay*100);
        write_port(1,bit[2*i]);
        write_port(2,bit[2*i]);
        delay(delaynumber_delay*100);
        timer(second);
              end;
until timeoutflag;
end;

Procedure explode(second:real);
var
  i,data:integer;
begin
gettime(h1,m1,s1,s1001);
repeat
        write_port(0, 255);
        delay(delaynumber_delay*200);
        write_port(1, 255);
        write_port(0,0);
```

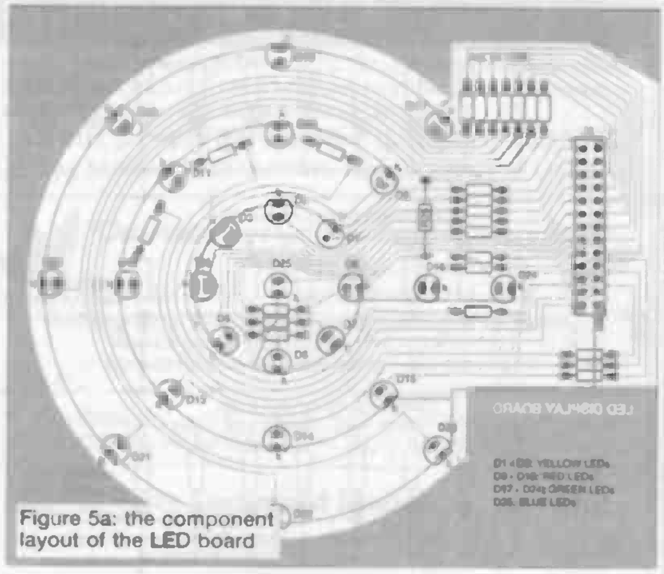


Figure 5a: the component layout of the LED board

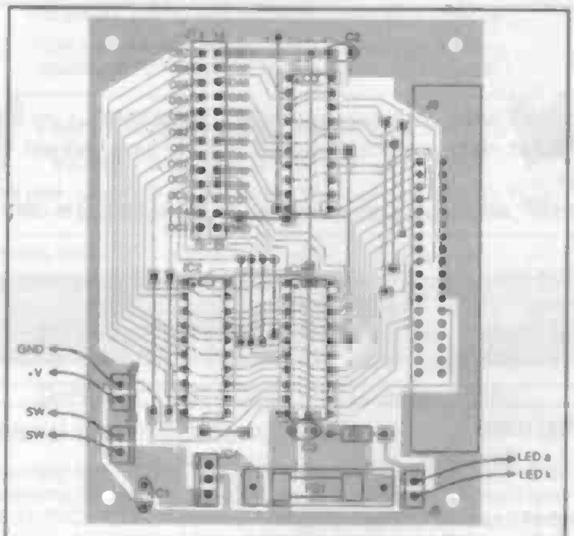


Figure 5b: the component layout of the I/O card

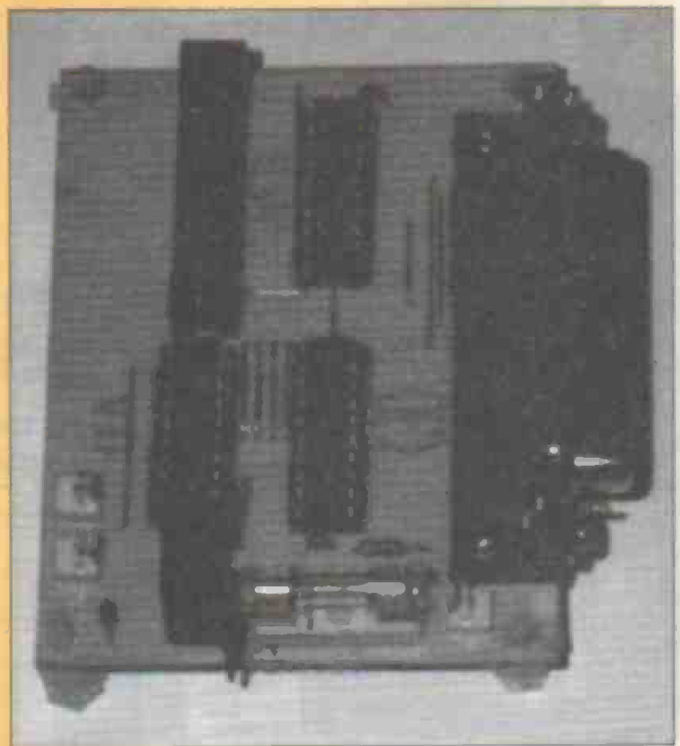
```
        delay(delaynumber_delay*200);
        write_port(2,255);
        write_port(1,0);
        delay(delaynumber_delay*200);
        write_port(2,0);
        timer(second);
until timeoutflag;
end;

Procedure all_off;
begin
        write_port(0,0);
        write_port(1,0);
end;

{************Main program**********}
begin
     find_bit_weight;
     find_delay_number_2;
     Initialisation;
input_printer_address;
repeat
        red_green(4);
        chase(1,0,0,2);
```

```
        all_on_off(2);
        chase(1,1,1,2);
        explode(2);
        chase(3,0,0,2);
        explode(2);
        chase(3,0,1,2);
        explode(2);
        chase(1,0,0,2);
        explode(2);
        all_on_off(2);
        binary(2);
until keypressed

end.
```



Some ideas

Constructors may find that the LEDs are too small and the light emitted is not bright enough for their preferences. You could improve this by using bigger lights. If the current required by each light is too high, a power driver should be provided. You could also add more lights on your display to give more complicated visual effects. This however requires extra circuitry to expand the outputs of the I/O board.

Now, it's time for you to think about your light effects and write your own procedures!

Technical support

Constructors should be able to obtain most of the components from Maplin, PO Box 3, Rayleigh, Essex SS6 8LR, UK (catalogues from main newsagents) or Electromail, PO Box 33, Corby, Northants NN17 9EL, UK (Tel. 01536 204555). The TP6 software driver (source code and EXE files) is available for £5.00 pounds from the address below. The price of the two PCB together is £15.00. I also have a limited number of kits which put everything together in a package. Please direct your enquiry to Dr. Pei An, 11 Sandpiper Driver, Stockport, SK3 8UL, UK. My telephone and answer phone number is 44+(0)161-477-9583 and my e-mail is PAN@FS1.ENG.MAN.AC.UK.

THE MIGHTY Midget

This little device for repair and development of audio equipment is Bob Noyes' way of getting an audible indication for audio signal tracing as well as a meter reading.

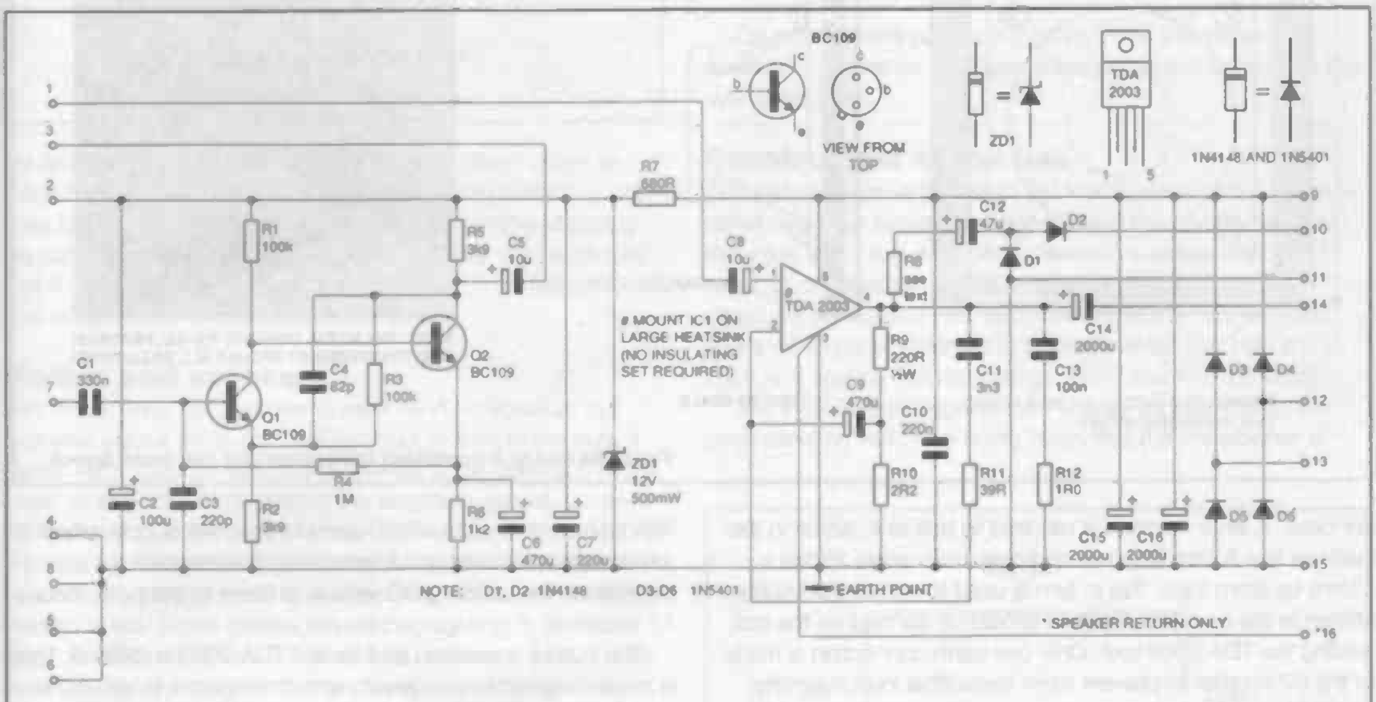


Figure 1: the circuit diagram of the Mighty Midget

For many years I have had an audio signal tracer (or amplifier and speaker) consisting of a good old LM 386 audio amplifier IC and a single transistor pre amp. The LM 386, although a great little amp not requiring many external components, has one drawback: its output is limited to half a watt or so. This limitation is not a problem when using it to trace signals in radios, tape recorders and, dare I say it, record players where the level of signal is fairly constant; but with equipment such as synthesisers and guitar effects units a much greater dynamic range is produced, so in order to reproduce loud and quiet sounds without distortion a more powerful amplifier is needed. A Marshall 4x12 200 watt with KT88s all aglow is ideal, but for bench use something a little smaller and a lot cheaper is required.

Enter the Mighty Midget. The output is capable of some six watts and, although not suitable for stage work, its output is really surprising. Remember, human hearing is not linear, but more logrithmic, so to double the effective volume the power must be increased ten-fold. This is a major problem for groups and discos wanting more and more volume, but it is an advantage coming down the scale, where only a few watts can sound very loud, as my neighbours will testify; combined with a good low impedance speaker or speakers, this will more than do the trick.

PIN NO.	FUNCTION	NOTES
1	POWER AMP INPUT	FROM VOLUME CONTROL
2	+12 VOLTS OUT	5mA MAX
3	PRE-AMP OUTPUT	TO VOLUME CONTROL
4	0V	VOLUME 0V
5	0V	
6	0V	
7	PRE-AMP INPUT	TIP CONTACT JACK SOCKET
8	PRE-AMP INPUT RETURN	SLEEVE CONTACT 0V JACK
9	+18V OUT OR IN	DC ONLY
10	METER +VE OUT	
11	METER -VE OUT	
12	12 VOLTS AC IN	#
13	12 VOLTS AC IN	#
14	POWER AMP OUT	SPEAKER (LIVE)
15	POWER 0V	#
16	POWER AMP OUT RETURN	SPEAKER (RETURN)

Figure 2: the input/output pin connections to the PCB. # - see transformer options

The output stage of the Mighty Midget is a TDA 2003, not to be confused with the more popular TDA 2030 hi-fi amp. The 2003 is about the same size as a TO 220 transistor but has five legs; these are not on 0.1-in spacing, so to aid layout the legs are rearranged and spread out a little so as to conform with it. The metal tab or heatsink is at pin 3 potential, or 0V in

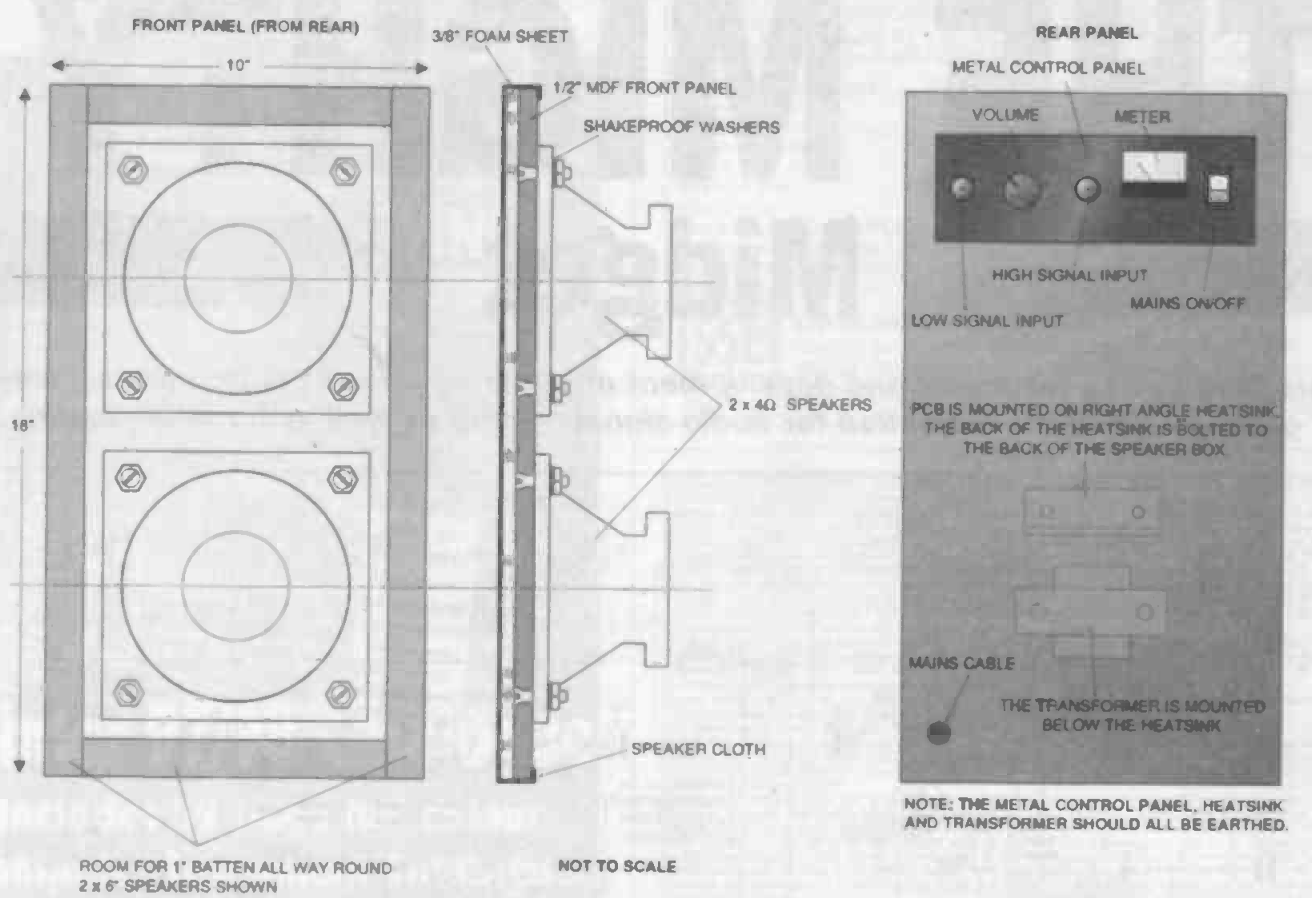


Figure 3a and b: a suggested front panel and rear panel layout

our case. A large heatsink is required to bolt to it, which in this instance is a 85mm long piece of aluminium angle 25mm x 25mm by 3mm thick; this in turn is used to mount the Mighty Midget in the box. The heatsink should be earthed on the bolt holding the TDA 2003 to it. Only one earth connection is made to the 0V in order to prevent earth leaps (that loud humming noise).

NICad batteries

The gain of the TDA 2003 has been set at around 100 by the ratio of R9 and R10. This ic is a handy little device originally designed for car radios, etc., where it can develop around four watts into 4 ohm speakers without the need for bridging or the use of output transformers.

The only drawback is that the ic is a little inefficient and not suitable for dry battery operation; large capacity nicads can be used, connected into pin 9 via a forward-biased IN 5401 to give the Midget a battery option for field use. Ten to sixteen 1.2 volt batteries will be required, or alternatively a 12 volt alarm battery would do.

On anything over a few watts consumption an external non-regulated supply is not recommended as the voltage fluctuates depending upon the current being drawn. External regulated supplies are OK, but can get hot in operation, which is never ideal and needs extra ventilation. The advantage of external regulated supplies is that they plug directly into the wall socket, eliminating the risk of any problems associated with exposed mains. However, I chose a built-in (internal) mains supply as the best option, but anyone not familiar with working with mains should seek help from someone qualified. This internal supply is not regulated, but the use of 4,400uF of reservoir capacitor keeps the supply voltage close to 17 volts or so.

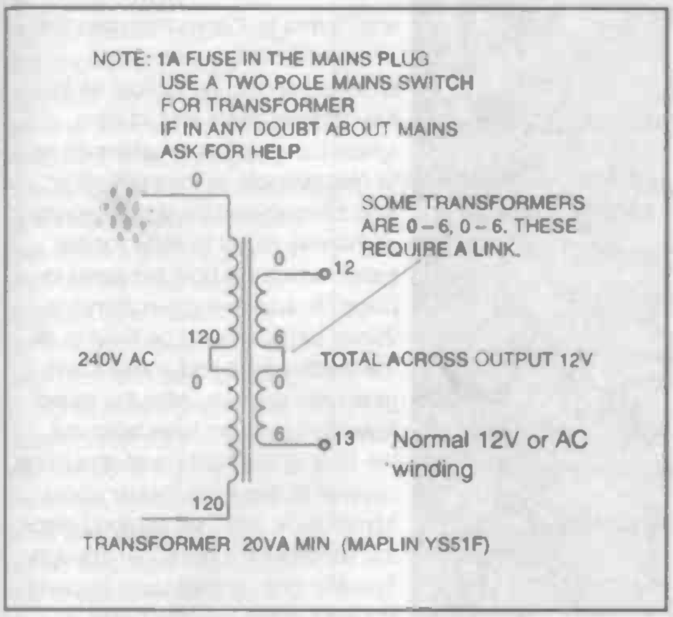
Although only 12 volts AC is used in the power supply, after full wave rectification and good smoothing (the reservoir capacitors) the resulting DC voltage is close to the peak, hence 17 volts,

The output capacitor used for the TDA 2003 is 2200uF. This is to give a good low frequency response, as the ic rolls off at about 40Hz; to avoid more attenuation at low frequencies a large capacitor is required.

The pre amp is a typical two transistor directly coupled amplifier. Transistors were chosen over an ic because they are far more tolerant of accidental overload. C3 and C4 have been added to reduce the noise generated in the pre amp. This high end loss is not a problem as the TDA 2003 has a roll off at about 15kHz; after all this is a piece of test equipment not a hi-fi system.

If required a passive tone control can be fitted between the output of the pre amp and the volume control [figure ?]. As this is a passive tone control, that is, it does not amplify the bass or treble, only reduces the level of the unwanted frequencies, there will be an overall loss. The preamp has a gain of around 30 and the power amp around 100, so the total gain is around 30 x 100 (or 3000) which means for a frill output of about 15 volts peak to peak an input of around 5mV peak to peak is required. If more gain is required, R2 can be reduced down to 1k or so, but increasing the gain also increases the background noise as well as hum pick up.

A basic audio meter has been included in the Mighty Midget. As can be seen, this is a passive monitor with no active elements. It will indicate anything coming out of the amp, even high frequencies above the normal hearing range. Audio amplifiers under development often oscillate at frequencies above the audio range. This can cause damage to



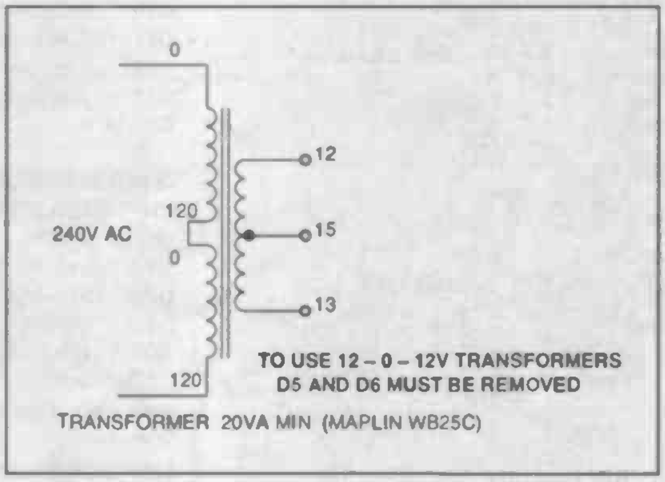
the amplifier, or to the loudspeaker, and if it does neither of these things it can cause distortion the source of which is not easy to determine. The audio meter included in the Midget is capable of registering frequencies much higher than audio so that it can give you evidence of high frequency oscillation if it is occurring. This is invaluable for fault finding.

Meters and speakers

This meter does not conform to peak or VU calibration, but indicates output although it will jig about in time to the output signal. R8 should be selected to give full scale deflection of the meter at the point of clipping of the amplifiers output. Its value will depend upon the type of meter and the current required to produce full scale in it. A cheap meter will do, as there is no advantage in having one that is accurately calibrated when the reading is not. Some meters require backlighting to illuminate them; for this the 12 volt AC should be used on a 14 volt bulb. Having a higher voltage bulb than the supply will extend its life.

Because of the limited frequency response of the 2003 it is not worth using a large, expensive bass speaker. I would suggest one with an 8-in maximum diameter, and again the use of a crossover and tweeter is of limited use due to the high frequency roll off.

To maximise the power out, the speaker (or speakers') impedance should be as near to 2 ohms as possible. To achieve this, two small 4-ohm speakers can be connected in parallel. 4-in or 6-in speakers will do fine, and can normally be obtained as car radio speakers, a lot cheaper than hi-fi speakers.

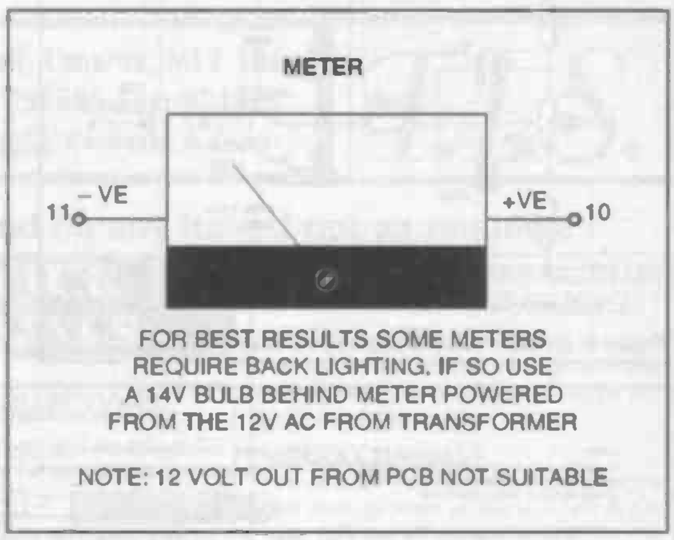


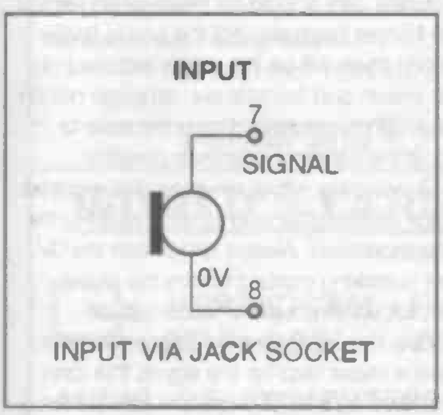
Do not build the box for the project until the speaker or speaker-combination has been selected, as this will dictate the size of the box.

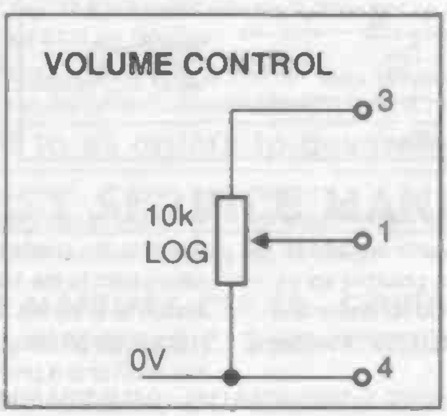
Construction of the box

One easy solution is to use an old loudspeaker cabinet from an obsolete stereo system, as this will have the speaker already mounted, but if it is an 8-ohm speaker the power will be reduced dramatically; a 4-ohm speaker is good, and two 4-ohms are even better. The back panel can then be removed and a metal panel mounted in its place which can hold the input jack socket, volume control, meter and mains switch.

The PCB and transformer can also be mounted onto the back panel as well, care being taken that the transformer is







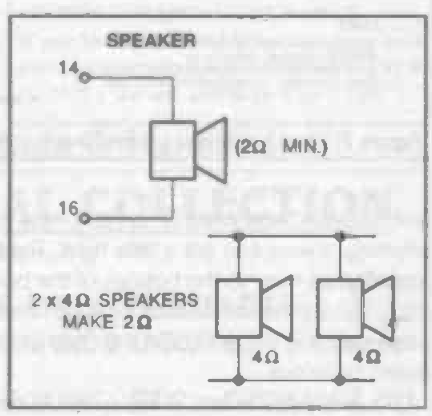


Figure 4a-f: Input and output connections to specific components

PARTS LIST

Resistors

All 0.25 W unless otherwise stated

R1	100k
R2; R5	3k9
R3	100k
R4	1M
R6	1k2
R7	680R
R8	See text 18k nom.
R9	220R
R10	2R2
R11	39R
R12	1R
VR1	10k log volume pot.
R13	100k #
R14	4k7 #

Attenuator lead

Capacitors

C1	330n
C2	100n 25V axial
C3	220p disc
C4	82p disc
C5	10u 25V axial or radial
C6	470n 16V radial
C7	220u 25V radial
C8	10u 25V axial or radial
C9	470u 25V radial
C10	220n 35V disc
C11	3.3n poly
C12	47n 25V radial
C13	100n 25V disc
C14,15,16	2,200u 25V radial

Semiconductors

IC1	TDA 2003H (horizontal mount)
Q1, Q2	BC109
D1,2	IN4148
D3,4	INS401 3 amp
D5,6	INS401 3 amp**
ZD1	12V 500mW or 1 watt

** Do not fit if 12-0-12V transformer is used (see diagram)

Transformer	12V 20V A min
Loudspeakers	See text. 2x6 in 4 ohm in parallel
Meter	Any cheap peak of VU audio type
Jack skt	25 standard mono 1 or 2 (see text)
Mains switch	2-pole on/off 250V 2 amp

Ready-built speaker box, or materials to build one.
Size and type to suit chosen speakers.
Metalwork to suit. Jackplugs as required.

Heatskink	Details not critical, but the larger the better. Use suitable materials to hand.

well mounted and there is no risk of the mains wiring touching anything, things can get a little tight. The transformer should be mounted as near to the bottom of the box as possible so as not to be top heavy. A small hole can be drilled for the mains cable and a knot tied inside the cabinet to stop the cable being pulled back out.

If a ready made box is not available one can be made out of MDF (medium density fibreboard). This material come in sheets and 10mm to 12mm thickness will be best. To find the size the speakers should be laid out as in the diagram, there should be a space between the speakers so as to give strength to the front panel. Also there should be enough room all the way round to allow for the batten which will hold the panel in place. To add strength a 25mm x 25mm batten should be fixed to all the Inside edges and corners and glued into position. After the round holes for speakers have been cut the front of the front panel should be covered in thin foam rubber about 10mm thick and then sprayed black, the speakers will not show through. Speaker cloth is then used to cover the front of the speaker panel, it should be secured using staples and glue. A weight should be applied to the back of the speaker when doing this so as to keep the foam rubber under tension. When the weight is removed the front of the speaker cloth should be tight and not subject to vibration in use.

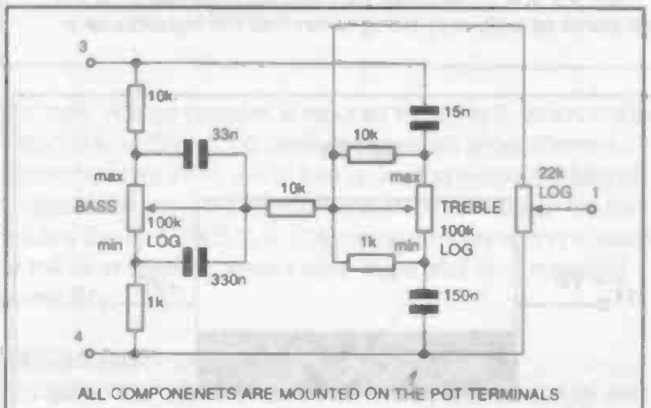


Figure 5: an external tone and volume control circuit

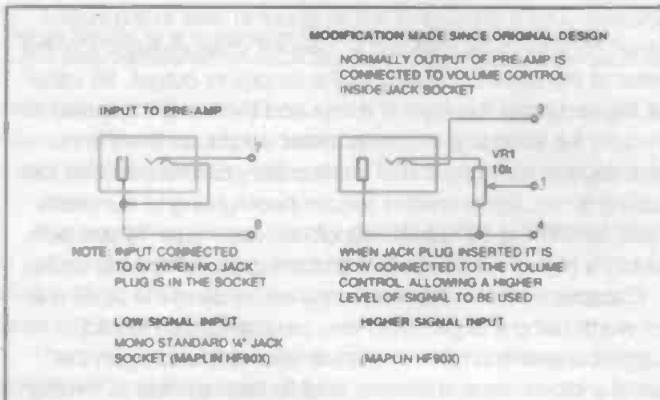


Figure 6a and b: Low signal input and a higher signal input mod

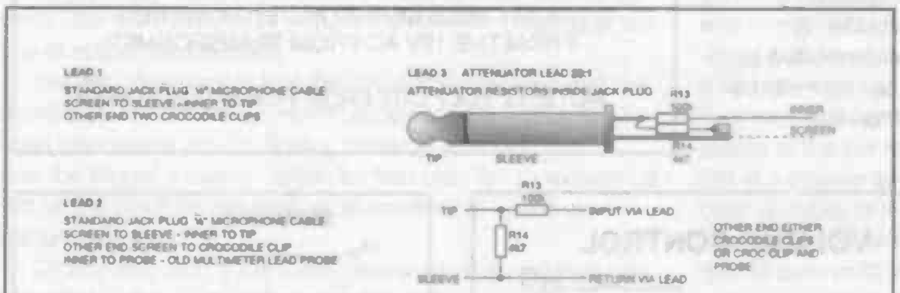


Figure 7: Input leads and connecting the jack plugs

The speakers are held in position with countersunk bolts through from the front, these go through the speaker fixing holes and shakeproof washers prevent the nuts from coming loose through vibration.

Great care should be taken when testing the Midget because until the box is finally closed there will be live mains exposed on the switch and transformer, although not on the PCB or speakers. Close the case or cover the opening whenever possible.

A jack plug with a co-ax lead is required. A couple of crocodile clips on the other end allow contact to be made to the points being monitored. Always check that the 0V return lead to the Midget is making contact before the signal lead, this limits the hum pick up. A couple of leads can be made, one as stated above. the other having a crocodile clip for the earth and a probe like a meter lead for the signal; this then can be used to make contact on a PCB more accurately than a crocodile clip.

A jack mod

A modification made since the original construction consists of mounting another jack socket, such that with no jack plug in it the output of the pre amp goes to the volume control, but when a jack plug is inserted the connection is broken. Now the volume control is connected to the jack plug and lead enabling a higher level signal to be applied without the volume control being right on minimum. When the jack plug and lead are withdrawn from this socket the circuit is remade via the switched tip contact in the jack socket and the pre amp circuit is connected back to the volume control.

Another way round this is to make an attenuated lead with a 100k resistor in series and a 4k7a resistor across the input of the pre amp, this then reduces the input by roughly 20 to 1.

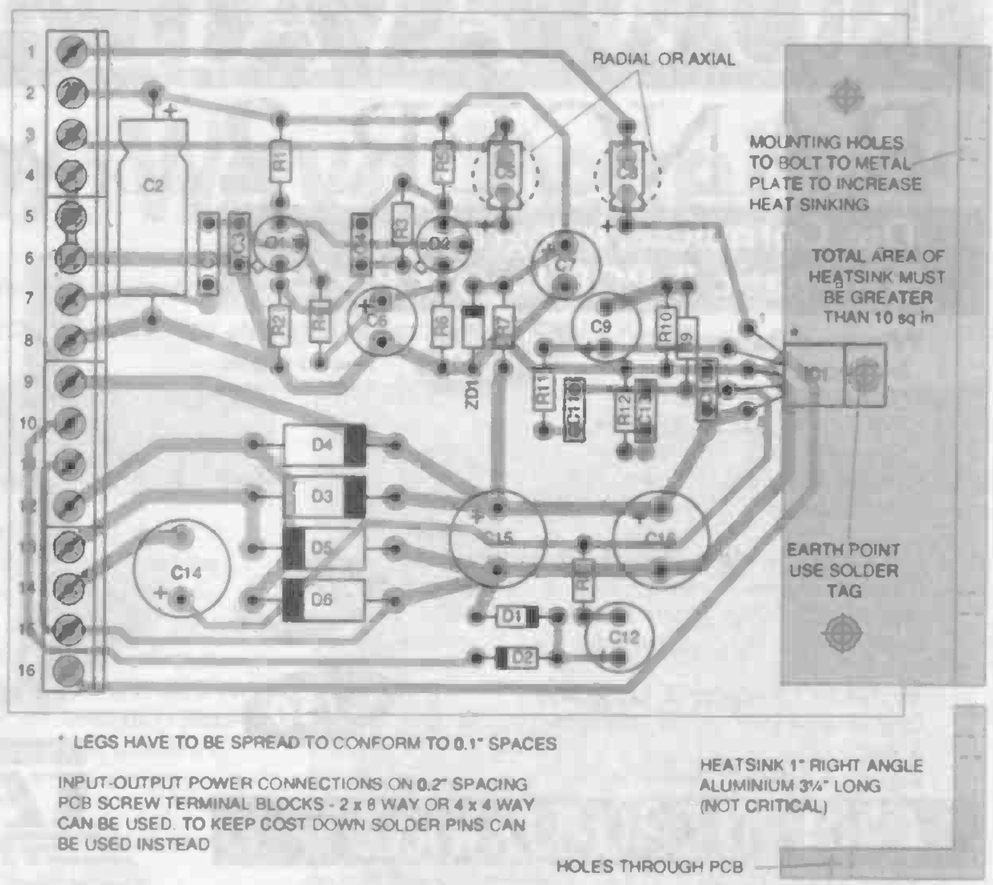


Figure 8: the component layout for the Mighty Midget

A High Performance Medium Wave Receiver

In Part 2 of this selective design for Medium Wave, Raymond Haigh describes the construction, setting up and operation of his radio.

Part 2

In the last Issue of ETI, we described the High Performance Medium Wave Radio and printed the circuit diagrams and the component layouts for the three main PCBs, as well as a constructional diagram for the special four-gang tuning capacitor (which is described in more detail in this part). The Parts List also appeared in the first part. This month, we round up with information about the specialised components, constructional descriptions of the boards and other hardware, and the testing, alignment and operation of the radio.

To recap on last month, the High Performance receiver here has been specially designed for medium wave, with alterable selectivityto to suit different reception conditions, and signal frequency amplification that can be set manually to achieve the best signal-to-noise ratio. The AGC system acts ahead of the mixer to help to avoid receiver overload. Output is reasonably steady over wide variations in signal input, and I have been very pleased with the audio quality. I employed a modular construction so that constructors could use other audio amplifiers or power supplies if they wish. Suggestions are made ifor simplifying the circuit for those who would prefer to start with a less complicated receiver.

Simplifying the receiver

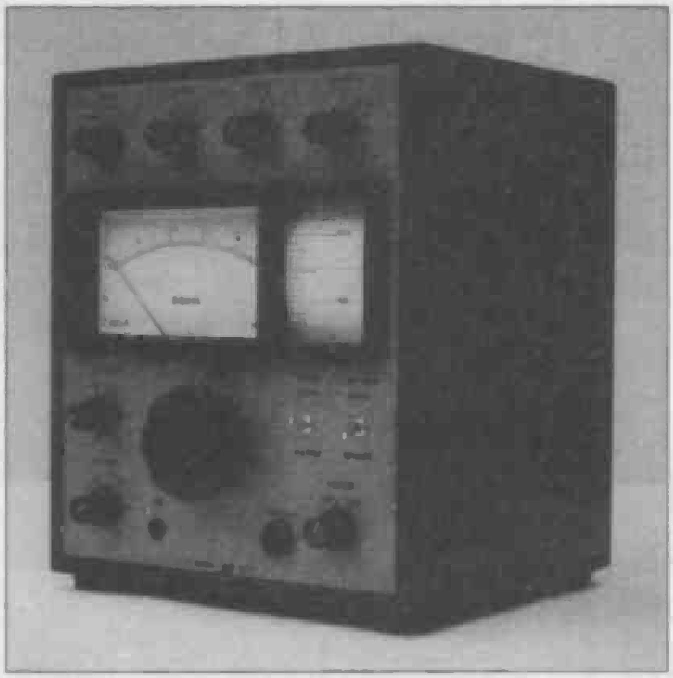
Some of you may not want all the features shown in the circuit diagrams, or you may wish to build a basic radio and add to it later. Constructed as described, this is a very pleasant and effective receiver, but it will continue to perform well if some reductions are made to the specification. The following possibilities are suggested:

(1) Delete the front-end bandpass tuning unit and AGC circuitry, and connect the input attenuator and aerial switching to L3. More care will have to be taken with the attenuator setting when long aerials are used, and the receiver will be more prone to spurious responses.

(2) Delete the 2.6 kHz ceramic filter, the relay and its activating switch, and wire the 4kHz mechanical filter permanently into circuit.

(3) Delete the tone control circuitry and the pre-amplifier stage Q8, and connect C29 to the 'top' of the AF gain control.

(4) Delete the mains power supply and use a pack of eight 'D' cells to power the receiver. R56 will need reducing to 3k9 ohms and R57 should be reduced to 270 ohms. The receiver will



function with supply voltages as low as 6V, but the signal strength meter zero adjustment drifts when the voltage falls significantly.

Components

The Toko solid dielectric variable capacitors and plastic spindle extenders are available from Cirkit (Cirkit Distribution Ltd., Park Lane, Broxbourne, Herts EN10 7NQ. Tel. 01992 448899) who also supply the tuning coils, IFTs and filters. The signal switching relay is listed in the Maplin catalogue, and the remaining components are available from many sources.

An inexpensive speaker is to be preferred, and it should be as large as your cabinet space permits (a 200 x 130mm unit is fitted in my prototype). Please note that hi-fi speakers can be insensitive, and should be avoided.

A signal strength meter of reasonable size will be helpful, when setting a loop aerial, to check the bearing of a transmitter. An 120 x 90mm unit is installed in my prototype.

Brass strip for the tuning capacitor linkage is sold in most model shops and is also listed in the Maplin catalogue. Steel shaft needed to ensure the perfect alignment of the capacitor couplings is sold by most large DIY outlets.

The tuning capacitor assembly

The four-gang tuning capacitor is made up from two x polythene dielectric variables. These units have a very low minimum capacitance and this makes it easy to extend the coverage of the receiver to above 1700kHz.

Figure 2 and the photographs give a view of the arrangement. The tuning capacitors are mounted on small PCBs which are fixed

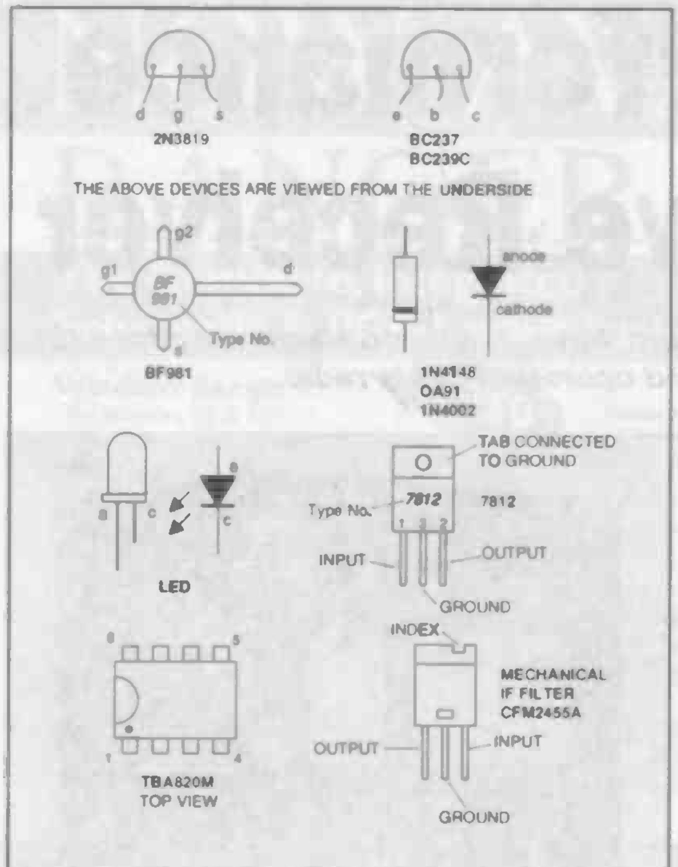


Figure 7: semiconductor and IF filter lead connection details

at right angles to the main receiver PCB by aluminium brackets. The plastic spindle extenders are connected by brass spindle couplers. Experienced users can use a gas stove or plumber's blowtorch to heat the items if a heavy duty soldering iron is not available.

Slide the couplers and the cranked brass strip onto a length of 6.3mm diameter steel shafting, then re-heat the items to sweat them together. The steel shaft ensures the perfect alignment of the coupling system.

Mount the capacitors onto the small PCBs with their three-tag-side towards the bottom, and fit Vero pins at the lead-out points. Fix the capacitor PCBs to the brackets with 8BA nuts and bolts.

Loosely bolt the brackets to the main PCB. Slide the coupling system onto the plastic spindle extenders, check the entire assembly for perfect alignment, and then tighten the fixings to the main PCB.

Set both capacitors at minimum, position the cranked arm, then tighten the grub screws in the spindle couplers. The assembly is now complete.

Trimmer capacitors are included in the tuning capacitor casings, but they are difficult to access with this arrangement, and separate trimmers are mounted on the PCB.

The solid dielectric capacitors are inexpensive, closely matched, and function well in this application. Some constructors may, however, wish to use air-spaced variables, and there is just sufficient space on the PCB for two Jackson Type O twin-gang capacitors. This alternative was not tried during the development of the receiver, but it should work well and it should still be possible to extend the coverage to 1700kHz, despite the increased minimum capacitance (10 instead of 5pF). The dimensions of the cranked brass strip may need changing slightly. Jackson capacitors are retailed by Cirkit and Maplin.

Constructing the RF, IF and detector circuits

With the exception of the switches, the signal strength meter, and R1 - R9, all of the parts are assembled on a printed circuit board. The layout of the components is given in figure 3. Vero pins, inserted from the component side of the board, soldered to the copper side and then cropped, can be used to form connection points for the dual gate mosfets, Q2, 4, and 5. It is a good idea to re tin the heads of the pins, and to grip the leads of the devices with metal tweezers during the soldering process.

Mounting these transistors in this way, rather than by soldering them to the copper tracks, permits removal without the need for access to the underside of the board.

Note that Q2 is located with its type number towards the PCB. Q4 and 5 have their type numbers uppermost. The 2.6kHz filter is orientated by means of the soldering tag on its can. The 4kHz filter has an indentation in its plastic case.

With this and the other PCBs, Vero pins inserted at the lead-out points will simplify the task of off-board wiring, and the use of IC sockets for the relay and IC1 will make it easy to check these components by substitution and avoid any resoldering.

The aerial switching and attenuator circuit

The attenuator resistors are mounted directly onto the tags of S1. Figure 4 gives details of the arrangement, and also the wiring between the aerial selector switch and the receiver. The tag identification numbers and letters in this figure correspond with those on the specified Lorlin switches. Try and keep the wiring to the short aerial socket as distant as possible from earthed components, to avoid placing too much stray capacitance across L1.

A DIN plug and socket are suitable for the loop aerial connection.

The audio amplifier

Again, most of the parts are mounted on a PCB, and the component side is illustrated in figure 5. Bass, treble and AF gain controls are, of course, located on the front panel of the receiver. Use screened leads between the sliders and the "hot" ends of these controls and the PCB, and connect the metal cases of the potentiometers to the 0V rail via the screening braid.
The loudspeaker is connected to +12V as this results in some economy in components. With this arrangement, it is wise to isolate the speaker chassis from the 0V rail.

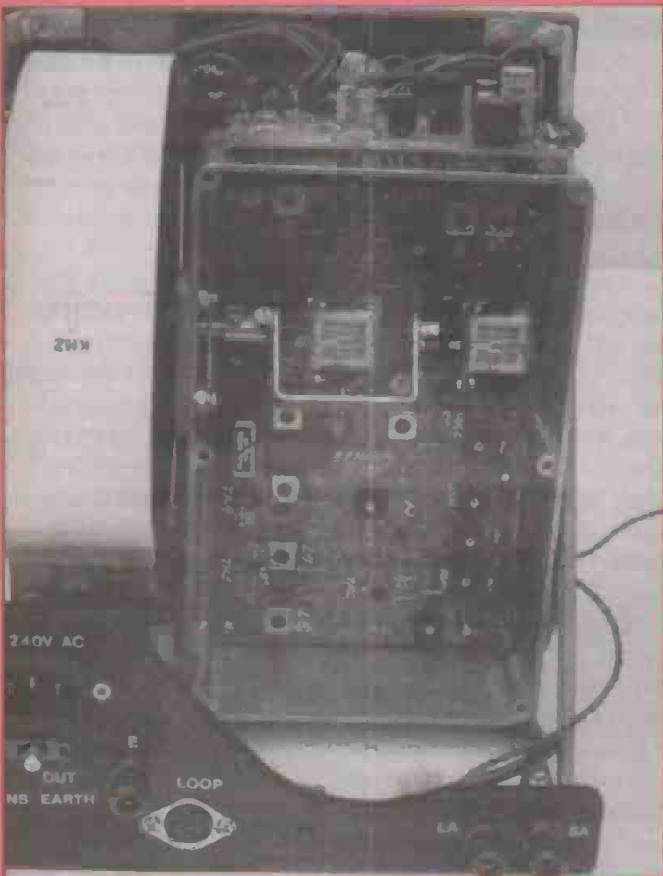
The power supply

Readers who have no experience of building or commissioning mains-powered equipment (as per our publisher's normal warning!) should note that the voltages involved are lethal. Extreme care must be taken when building and testing this part of the circuit, and if the constructor has any doubts about his ability he should use batteries to power the receiver.
The component side of the power supply board is shown in figure 6. Provision is made for both axial and radial lead versions of the large reservoir capacitor C47. If the board must have the lowest possible profile to suit your particular cabinet layout, choose an axial lead component.
A heat sink must be fitted to the regulator IC - any one designed for a TO220 package will be suitable.

The use of a Euro style inlet plug and line socket to connect the unit to the mains supply is a wise safety feature.

Initial testing.

The PCBs can be wired up on the bench for initial testing and alignment before being mounted in a cabinet. First of all, check the boards for poor soldered joints or bridged copper tracks, check the orientation of all semiconductors, polarised capacitors (electrolytic



and tantalum), and filters. Set all potentiometers to mid travel. Do not connect the signal strength meter at this stage.

With the power supply output disconnected from the equipment, switch on the mains supply. The voltage across reservoir capacitor C47 should be approximately 23V. The voltage at the regulator output should be precisely 12V. Connect the 12V output to the RF, IF and detector board. Current consumption should be of the order of 10mA. Actuating the filter relay should make current consumption rise to around 40mA. Series resistor R57 limits the voltage across the specified relay coil to about 8V.

Connect the audio amplifier. Under no-signal conditions, current consumed by this part of the circuit is approx. 12mA. When music is reproduced at good volume, current rises to around 100mA.

Setting up and alignment

While it should be possible, with care and patience, to bring the receiver into a reasonable state of alignment without a signal generator, it will not be possible to optimise its performance. Guidance on alignment will, therefore, assume access to a simple signal generator. A multimeter, preferably a high-impedance digital or electronic model, will also be required. Some advice on aligning the receiver without a signal generator is given later for constructors who wish to try.

Before attempting the setting-up and alignment process, it is as well to remember that the HF tuning limit is mainly determined by the setting of oscillator trimmer **C15**, and that LF coverage is controlled largely by the setting of the oscillator coil core (L4). The oscillator must run at 455kHz above the signal frequency tuned circuits over the entire tuning range. This is achieved by using an oscillator coil of lower inductance than the signal frequency coils, and by placing a padder capacitor C16 in series with the oscillator tuning capacitor C18 to reduce its swing. The optimum value of the padder is related to the inductance of the oscillator coil, and **C17** is included so that the padder can be adjusted slightly.

With modulation switched on and the signal generator output kept as low as possible all times, proceed as follows:

(1) Switch in the manual IF gain control and set it to half travel. Set the AF gain control to half travel also. Apply a 455kHz signal to the drain of the mixer Q2, and adjust the cores of the IFTs for maximum response in the loudspeaker. The IF is determined by the filters and not the signal generator, so rock the generator output gently around 455kHz to ensure that it is set to the required frequency. If the transformer cores are so out of position that alignment proves elusive, apply the signal to the drain of Q5, adjust the core of IFT4 first, and then work back. This was not found to be necessary with either of the two prototype receivers.

(2) Connect a multimeter reading 0 - 1mA to the signal strength meter output, set the slider of R32 to the meter end of the potentiometer, and set R31 to minimum resistance. Adjust R36 to zero the meter pointer. Connect up the signal strength meter, or switch the multimeter to a range in the 50 - 100uA region, and refine the zero adjustment.

(3) Inject a 455kHz signal at the drain of Q2. The meter should swing over. Increase the value of R31 to reduce the reading and reduce the setting of the IF gain control, as necessary. Switch in the 2.6kHz filter and use the visual indication of signal strength to refine the adjustment of the IFT cores. Final adjustments to peak the response will be quite critical.

(4) Switch IF gain control to automatic, connect the testmeter across the IF AGC line, and adjust R38 to give a reading, under no-signal conditions, of 4V. (If a meter of only moderate sensitivity is used, set the reading to, say, 3.5V to allow for the shunting effect.) The precise setting is not excessively critical. Inject a 455kHz signal at the drain of Q2. The AGC voltage should drop almost to zero if the signal is sufficiently strong.

(5) Connect the testmeter to the slider of **R12**, and set the potentiometer to give a reading of 1V (a little less if a low sensitivity instrument is used). Set **R13** for maximum input to the gate of **Q1**.

(6) Set all trimmer capacitors to half-mesh, set the tuning capacitors to the fully open (clockwise) position, connect the signal generator to the low-impedance primary on **L1**, and sweep it around 1700kHz until a note is heard in the speaker and the signal strength meter kicks. Adjust the trimmer capacitors (but not **C17**) to peak the output, gradually opening out oscillator-stage trimmer **C15** if necessary, to bring the peak above 1700kHz.

(7) Fully close the ganged tuning capacitors, inject a 480kHz signal, and adjust the core of L4 until the meter pointer rises. Adjust the cores of **L1**, L2 and L3 to peak the output. The receiver is now in a state of approximate alignment and, if an aerial is connected, signals should be heard as it is tuned across the band.

(8) Check that the tuning range still extends to 1700kHz or above, opening out **C15** a little more, if necessary, to restore coverage, and adjusting the trimming capacitors to peak alignment.

(9) The tracking of the oscillator and signal frequency circuits must now be optimised. Set the signal generator to 900kHz and tune the receiver to this frequency (the ganged tuning capacitors should be at about half-mesh). Adjust the cores of **L1**, L2 and **L3** to peak output. Set the generator to 600kHz, and tune in the signal. Gently rock trimmer **C10** to establish the state of the tracking. If reducing the value of this trimmer increases output, the padder capacitance is too low and **C17** must be increased in value. If increasing the value of **C10** increases output, the padder capacitance is too high and the vanes of trimmer, **C17**, must be opened slightly. Make any

necessary adjustments to the cores of L1, L2 and L3 to peak output at the 600kHz tuning setting.

(10) Set the generator to 1500kHz and make any necessary adjustments (they should only need to be slight) to C1, C5 and C10 to peak output, Do not make any further adjustments to oscillator trimmer, C15, unless HF coverage has fallen below the 1700kHz limit (most unlikely).

(11) Repeat the check on tracking described in (9), above, refining the adjustments until no further improvement can be obtained and alignment is close to perfect at 600, 900, and 1500kHz. A check at other points around the dial should reveal that changing the setting of the cores and trimmers does not produce any significant improvement in response.

(12) If it proves difficult to optimise the tracking (most unlikely), reset the oscillator coil core and try again (coverage need not go below 510kHz or so). Note that instability will probably be encountered if the core is driven too far down as this will permit the receiver to be tuned to its IF.

Alignment without a signal generator

(13) Turn the IF and AF gain controls up to maximum, connect an aerial to the 'hot' end of L3, and adjust the IFTs for maximum noise in the speaker. It should now be possible to tune in a strong signal. If not, adjust the core of L4 until a station can be heard at some setting of the tuning capacitors.

(14) Make the signal strength meter operational, all as described in (2), above, and use it, and the incoming signal, to refine the adjustment of the IFT cores.

(15) Tune in a station as close as possible to the HF end of the band, and adjust C1, C5 and C10 to peak output. Tune in a station at the LF end of the band and adjust the cores of L1, L2 and L3 to peak output. The receiver should now be quite responsive.

(16) Use a known transmission to set the oscillator coil trimmer C15, so that the HF tuning limits are around 1700kHz. (In the UK the handsets of cordless 'phones operate on channels between 1600 and 1800kHz). Use a known transmission at the LF end of the band to set the core of the oscillator coil. (Try Spectrum International from Crystal Palace, London, on 558kHz, or RTE from Tullamore, Ireland, on 567kHz).

(17) When the coverage has been set, use steady transmissions to carry out the procedure described in (9), (10) and (11), above. Care and patience will be required but, with the aid of the signal strength meter, it should be possible to bring the receiver to an acceptable state of alignment.

Tuning drive

Enhanced selectivity makes the adjustment of the tuning control more critical than usual, especially when the narrow filter is switched in and one or other of the sidebands is being selected. Some form of reduction drive is, therefore, essential. A tuning knob of decent size and a slow-motion drive with a reduction of at least 6:1 should be considered minimum requirements. Connecting two epicyclic drives in tandem to give a 36:1 reduction, or using a cord drive and drum salvaged from an old receiver, are better alternatives.

Housing the receiver

Unscreened, the receiver is sufficiently sensitive to pick up a number of stations without an aerial connection, and some form of metal enclosure is desirable, at least for the RF, IF and detector board, or signal nulling with a loop aerial will be impaired. The input attenuator and aerial selector switches should be mounted as close as possible to the input point on the PCB to avoid unwanted signal pick-up.

The arrangement adopted for my prototype is indicated in the various photographs. The RF and IF PCB is enclosed in a die cast box, and the entire receiver is assembled behind a plywood front panel. The tuning dial is wrapped around an 170mm diameter drum built up from fibreboard disks, to which is secured a hardboard pulley for the cord drive. Whatever dial and drive system is adopted, take care not to impose excessive loading on the bearings of the tuning capacitors, and fit end stops to prevent any stressing of the moving parts. The loudspeaker faces rearwards, and large vents, formed in the sides of the cabinet, ensure a clear pleasant tone, which is free from 'boxiness'.

This arrangement enables an easily read dial, a large signal strength meter, and a speaker of decent size, to be accommodated in a cabinet measuring 250 x 220 x 190mm. The front panel is finished with car spray paint and annotated with rub-down lettering. The plywood case is stained and French polished. The bezel which links the dial aperture and the signal strength meter is cut from hardboard and sprayed mat black.

Not all constructors will have the time, inclination or resources to house the receiver in this traditional way, and one of the stylish metal enclosures retailed by component suppliers would do just as well. It would also be cheaper if the construction and finishing materials are not to hand.

Final adjustments

After the receiver has been enclosed in a cabinet, carry out a last check on the alignment and make any final adjustments.Adjust R31 to fix the sensitivity of the signal strength meter, and set R32 to prevent the strongest signals driving the pointer against the end stop. Carry out any last adjustments to the AGC system pre-sets, and the pre-sets which control AF gain (R33 and R54), in order to make the 'feel' of the receiver suit the operator.

Calibration

On medium waves it is not too difficult to calibrate a receiver dial by tuning in transmissions of known frequency. However, a quicker and less tedious method is to use a crystal calibrator. The dial of the prototype receiver was marked out with a unit of this kind which has outputs at 1MHz and 100, 50, 25 and 10kHz. A signal generator can, of course, be used, but the accuracy of calibration will be limited to that of the generator.

Operating the receiver

The receiver can be used with short (up to, say, 3 metres); long (10 metres plus); and loop aerials; It is a good idea to try all three and using S2 to select the one that performs best. Listeners with back yards several hundred metres long could try a Beverage aerial: details of these are given in relevant textbooks. Earthing the receiver via a 1 metre length of copper pipe driven into damp ground usually improves reception. The mains earth can be used, but may introduce electrical interference. Test for this by switching it in and out with S5.

Under normal conditions, the selectivity provided by the 4kHz filter is perfectly adequate. Reducing bandwidth by switching in the 2.6kHz filter will, however, greatly improve reception when electrical noise is severe. This narrower filter will also eliminate co-channel interference (splatter), and enable the receiver to be tuned to either the upper or lower sideband when attempting to resolve 'difficult' signals. It is, of course, particularly useful when picking out transmissions that are close to the noise floor, or weak signals tightly sandwiched between strong ones. Turning down the bass and treble controls can also improve the clarity of signals that are overlaid by noise.

The receiver is reasonably immune to overload, but if a very long aerial is connected and the problem is encountered on strong signals, use the attenuator to reduce input. Switching in the manual IF gain control makes it possible to optimise the receiver noise factor, and inter-station noise when tuning across the band can be largely eliminated when maximum sensitivity is not needed.

Performance

Instruments capable of measuring the sensitivity, selectivity, dynamic range and other parameters of the medium wave radio were not available. It was, however, possible to directly compare it with a high-performance, multiple-conversion communications receiver.

The test was carried out in a town-centre location, not much more than 1km away from the 70m mast of a commercial radio station operating at 250W, and where man-made electrical interference is often severe. A long (30m) aerial was switched between the two sets during the comparison test, which involved the receivers being carefully tuned, in step, across the band, over the period of a summer afternoon and evening.

All of the stations picked-up by the communications receiver could be resolved by the dedicated medium wave radio described here. Indeed, several signals that were lost in noise with the communications receiver could be heard clearly on the medium wave set.

There were no overloading problems, even with IF gain switched to automatic and the input attenuator switched out. (Most simple receivers are badly overloaded by the local transmitter when a 30 metre long aerial is used.)

The medium wave radio did not have any discernible image responses. Only one heterodyne was evident, located close to twice the IF, that is, 910kHz. It could be tuned to zero beat with the incoming signal and did not spoil reception. There were neither images nor heterodynes with the communications receiver.

The above results would seem to confirm the view that, at medium frequencies, a single conversion superhet with good front-end selectivity can outperform more complex communications receivers.

A future aerial

In a future issue we will be describing a Medium Wave loop aerial, designed with Medium Wave radio very much in mind.

MODMODMODMODMODMOD

There are two small errors in the drawings in Part 1: in figure 1a, page 34, the Aerial Selector, the left hand connection from S2A to the Loop Aerial is shown wired to terminal 1 of S2A; it should be wired to terminal 3 of S2A. That line is shown correctly crossing the Ground line. The middle connection from the Loop Aerial to terminal 1 of S2B is connected correctly at each end, but should also be shown connected to the Ground line (the crossing point should be marked with a dot), unlike the other two lines from the Loop Aerial.

In figure 1b, page 35, on the far right, the line from D4/C2 is shown crossing the line between R26/R27: It should be connected to it. (That is, the crossing point should be marked with a dot. The PCB foils are correct.

Fast Fivers

Adaptable, affordable - handy circuits for around £5. By Owen Bishop

7. Animated light starburst

This is a 'animated' light display. Hang it on the wall, fix it to the front door, or suspend it from a Christmas tree. It features an array of 25 LEDs, arranged in three concentric circles, with a jumbo-sized LED in the centre. The display runs through its sequence about once a second. First the central LED comes on - the star. Then it 'bursts' - the star goes out and the concentric circles light up one at a time, starting with the inner one, then the middle one and finally the outer one. After a short period of darkness the sequence begins again. The effect is as if the star bursts and an explosive wave of light spreads outward from it.

Although this is described as a fast Fiver, it is fast only in the sense that the display runs rapidly. There is rather more wiring in this one than has been usual in this series (figure 1). This project will give you 2 or 3 hours of fun in assembling it, yet costs less than £5 (if you shop around). It also offers you scope for your own ingenuity in modifying the design. And, not least, it is a decorative object to be brought out every festival for several years ahead.

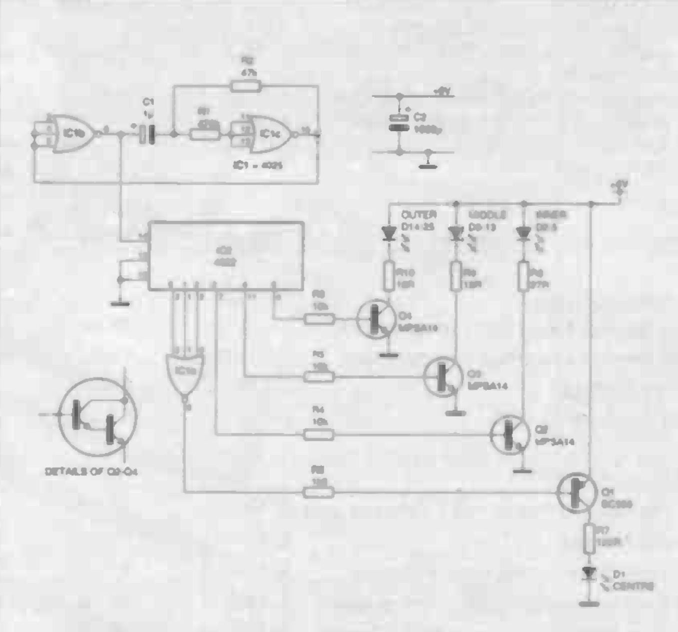
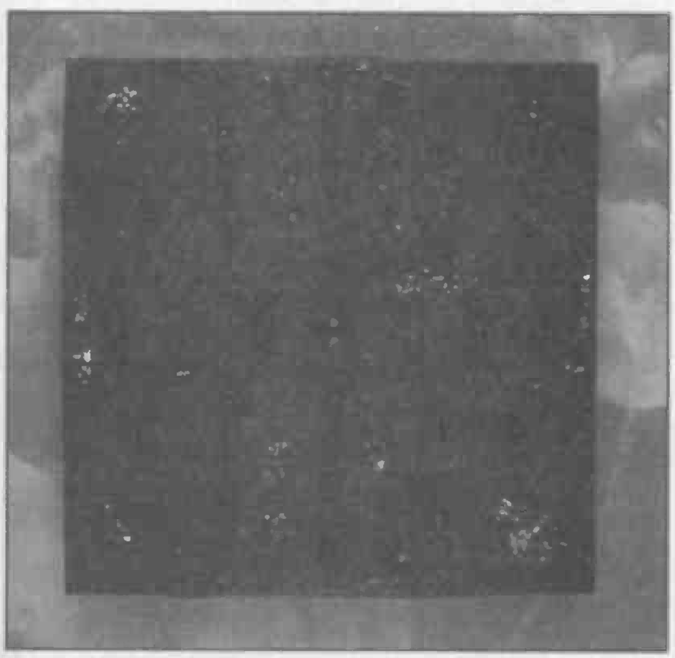
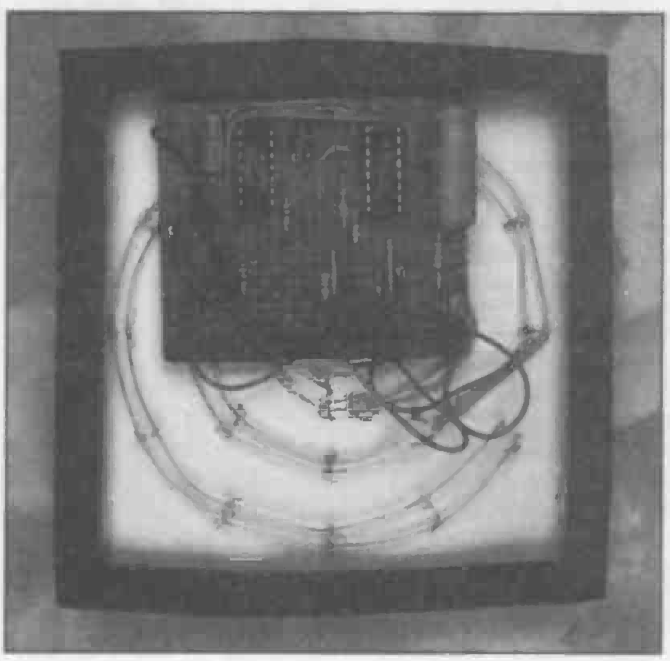


Figure1: the Starburst schematic

How it works

The circuit is driven by a clock built from two 3-input NOR gates. We employ these gates instead of the usual simple inverters because we need a single 3-input gate for the programming logic. With the values given in figure 1 the clock runs at about 10Hz. The output from the clock goes to IC2 which is a divide-by-eight counter with 1-of-8 outputs. It has 8 outputs (numbered from 0 to 7) which are normally low (0V). As the counter is clocked, the outputs go high (6V) one at a time, in numerical order. The result of





ETI ELECTRONICS TODAY INTERNATIONAL PCB Service

ETI can supply printed circuit boards for most of our current projects - see the list below for boards available. For recent boards not listed, check the constructional article for an alternative supplier.

Please use this order form or a copy of it. Check that all relevant information is filled in, including the Unit Order Code, and that you have signed the form if sending a credit card number. Overseas customers please add postage appropriate to the number of units you are ordering. Make cheques/POs/money orders, in £ sterling only, payable to Nexus Special Interest Limited. Please allow 28 days for delivery. Access/Visa orders may be made on 01442 66551 (ask for Readers Services).

Only boards listed here are available from our PCB Service. For past issues of magazines, copy articles or binders, please see the admin panel (page 74) or contact Readers Services (see below) for information.

Name and issue of project	Unit code	Price
ETI Issue 13 1997		
4-Go Rocket Launcher - main board	E/1397/1	£5.64
4-Go Rocket Launcher - relay board	E/1397/2	£6.22
Mighty Midget	E/1397/3	£9.54
Auto Cupboard Light	E/1397/4	£5.64
ETI Issue 12 1997		
PC Phonecard Reader: ITT Cannon only	E/1297/1	£8.22
Minute Minder	E/1297/2	£13.98
Medium Wave Receiver - RF board	E/1297/3	£11.76
Medium Wave Receiver - Tuning board	E/1297/4	£5.09
Medium Wave Receiver - Audio board	E/1297/5	£5.09
Medium Wave Receiver - PSU board	E/1297/6	£6.77
All four MWR boards (this month only)	E/1297/3/4/5/6	£25.00
ETI Issue 11 1997		
Total Harmonic Distortion Meter	E/1197/1	£13.43
Alphanumeric Morse Touchkey	E/1197/2	£5.09
Mighty Midget	E/1197/3	£8.99
PC Phonecard Reader - ITT Cannon	E/1197/4	£8.22
Minute Minder	E/1197/5	£13.98
ETI Issue 10 1997		
The IQ Tester	E/1097/1	£5.64
Fake Flasher	E/1097/2	£5.00
DC Motors (Part 2)	E/1097/3	£6.77
Valve Tester - Main Board	E/1097/4	£21.22
Valve Tester - Socket Board	E/1097/5	£5.09
Valve Tester - Heater Regulator	E/1097/6	£5.09
All three Valve Tester boards (Due to price breaks there is a small discount on this item.)	E/1097/4/5/6	£30.30
The IQ Tester (previously E/897/20	E/1097/7	£5.64
ETI Issue 9 1997		
Eprom Emulator	E/997/1	£16.49
The Power Supply	E/997/2	£5.09
Electronic Door Chimes	E/997/3	£5.09
Digital Power Supply	E/997/4	£10.11
ETI Issue 8 1997		
The Brake Light Tester	E/897/1	£5.09
DC Motors (3 experimental boards)		
DC Motors: The first Control Unit	E/897/3	£5.09
DC Motors: The 4046 Circuit	E/897/4	£5.09
DC Motors: The Crystal Drive Circuit	E/897/5	£5.09
All three DC Motors boards	E/897/3/4/5	£11.50
ETI Issue 7 1997		
Eprommer: main board (double sided)	E797/1	£13.32
Eprommer: PSU board	E797/2	£5.64
Eprommer: personality modules (double sided)	E797/3	
Any ONE module board		£5.09
Any two modules		£7.90
Any three modules		£11.85
Any four modules		£15.80
Any five modules		£19.75
All six modules		£23.70

Please specify which Eprom modules you require. Modules are for 2716, 2732, 2764, 27128, 27256 or 27512. One order overseas postal charge applies whether a selection or all six personality module boards are ordered.

Name and issue of project	Unit code	Price
Are Your Lights On?	E/797/4	£5.09
Peak Reading VU Meter	E/797/5	£5.09

Terms of trade

Terms strictly payment with order. We cannot supply credit orders, but will supply a proforma invoice if requested. Proforma orders will not be processed until payment is received. All boards are manufactured from the foils that appear in the ETI Foils Pages for the appropriate issue. Please check that our foils are suitable for the component packages you intend to use before ordering as we cannot supply modified boards or replace boards that have been modified or soldered. Boards are only supplied in the listed units. Sorry, we cannot break units. Prices and stock may be altered without prior notice. Prices and stock listed in this issue supersede prices and stock appearing in any previous issue. ETI, Nexus Special Interests and their representatives shall not be liable for any loss or damage suffered howsoever arising out of or in connection with the supply of printed circuit boards or other goods or services by ETI, Nexus Special Interests or their representatives other than to supply goods or services offered or refund the purchaser any money paid in respect of goods not supplied.

Please supply:

Quantity	Project	Unit Order Code	Price	Total price

Prices are inclusive of post and packing in the UK. Overseas Post and Packing (if applicable): Add £1 per unit

Name ....

Address ....

I enclose payment of £ .... (cheque/PO/money order in £ Sterling only) to:

PCB Service, READERS SERVICES DEPARTMENT, Nexus Special Interests Ltd., Nexus House, Boundary Way, Hemel Hempstead, Herts HP2 7ST UK.

Signature: ....

Card expiry date: ....

this is as follows:

1 For the first 3 counts, output 0 goes high, followed by output 1 and output 2. If any one of these is high, the output of the NOR gate (IC1a) is low. At all other times it is high. When it is low, it turns on the pnp transistor (Q1) and current flows to D1, which is the large LED in the centre of the display. So this LED is lit for the first 3 counts and is dark for the remainder.

2 For the next 3 counts, outputs 3, 4 and 5 go high in turn. These turn on transistors Q2, Q3 and Q4 one at a time. Actually these are not simple transistors, even thought they are drawn as such in figure 1, which shows that the MPSA14 contains two npn transistors connected

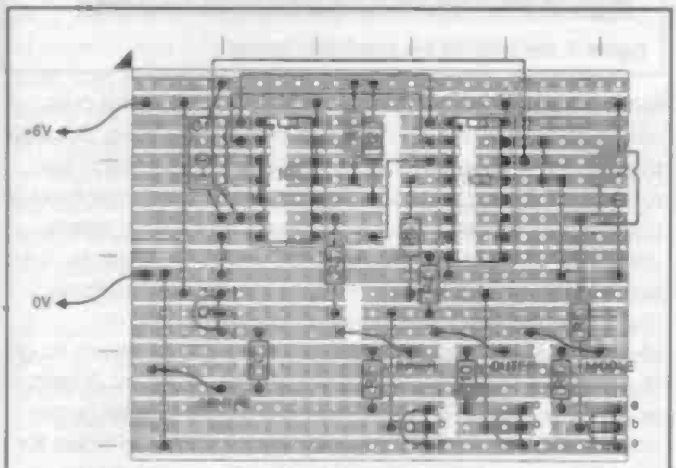


Figure 2: the Starburst stripboard layout

as a Darlington pair . The emitter current of the first transistor flows to the base of the second transistor. The gain of the pair of transistors is the product of their individual gains. This gives Darlington transistors gains of the order of 5000 to 10000, compared with only 100 for a typical single transistor. We have used Darlingtons here so that the small current (0.44mA) available from the cmos outputs of IC2 are able to switch the rather large currents flowing through the LEDs. Allowing 20mA per LED, the inner circle of four LEDs needs 80mA, the middle circle (eight LEDs) needs 160mA and the outer circle (twelve LEDs) needs 240mA.

For the final two counts of the 8-stage sequence, outputs 6 and 7 go high but, as there are no connections to these, the display goes dark in preparation for the next 'burst'.

Construction

This circuit requires an average current of a little over 60mA and it is likely to be run for several hours at a time. The most appropriate power supply is a 6V DC plug-in mains adapter unit. A 300mA unregulated one would be suitable. If you prefer batteries, the best sources are a 6V 'lantern' battery (HP992) or a battery holder with 4 size D cells.

The stripboard layout (figure 2) is compact so that the board can be small and easily concealed behind the display. For this reason, the various subcircuits are more mixed up than usual, so take special care that the wire links and resistors are soldered into the correct holes. Solder in the sockets for the two ICs first, together with

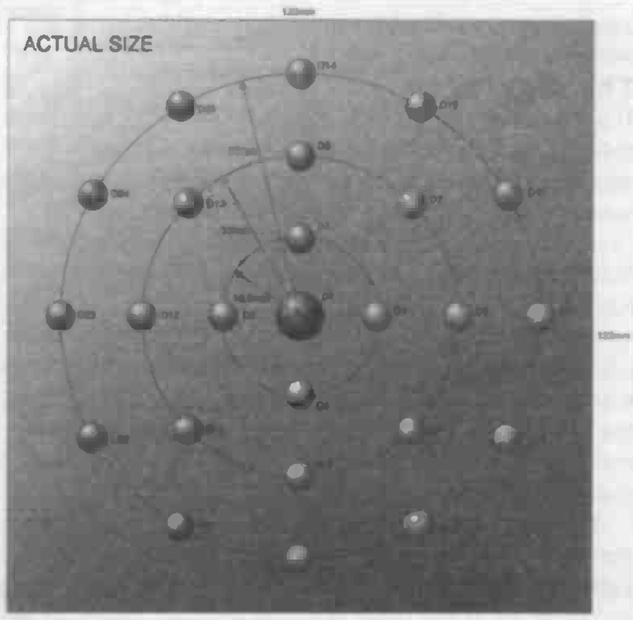


Figure 3: the Starburst display panel with dimensions in millimetres

R1, R2, C1, all the wire links and the terminal pins at B1 and L1. Note that the copper strips are cut beneath the board at C8 to F8, H8, J8, C14 to J14, C18 to K18, M12 to 012, P17, P22, S17, S22, T17, and T22. Solder blobs are used to bridge adjacent strips, joining: E8 to F8 to G8, B10 to C10, D10 to E10 to F10, K17 to L17, and B20 to C20. Insert the ICs in their sockets, apply power, and use a test meter to check that the clock is running. Also test the outputs of IC2 and the output at pin 9 of IC1 to confirm that output signals are as expected.

Now add the large capacitor (C2), which is provided to smooth out spikes on the power lines produced when large numbers of LEDs are switched on or off simultaneously. Without this smoothing, the counter operates erratically. Complete assembly by soldering in the

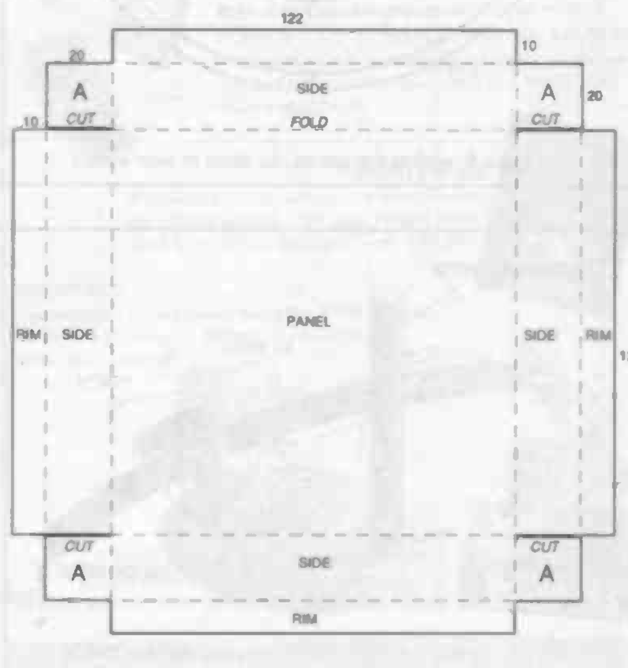


Figure 4: the Starburst - a pattern for a cardboard case/panel

transistors (Q1 is the pnp transistor) and the remaining resistors and terminal pins.

The display

This can take many forms, depending on your taste and skills, but we describe the one we designed as a decoration to hang on the Christmas tree. It does not have room for a battery. We wrapped the battery up in Christmassy paper to look like a 'present' and lodged it firmly in the fork of one of the lower branches, with wires running to the hanging display.

It is worth mentioning at this stage that this circuit could be the basis of a large-size 'Piccadilly lights' display. If you have experience of mains wiring, you can replace the groups of LEDs with four relays rated to take mains current. Then these relays can be used to switch banks of mains-voltage lamps.

The LED display panel (figure 3) is the bottom of a square shallow box made from thin card (we used red). Later you can decorate the surface of the box with tinsel or 'glitter' or in any other way that appeals to you. The sides of the box are 20mm deep to allow room for the wiring and circuit board, and there is a 10mm rim around the top edge of each side to stiffen the sides. First mark

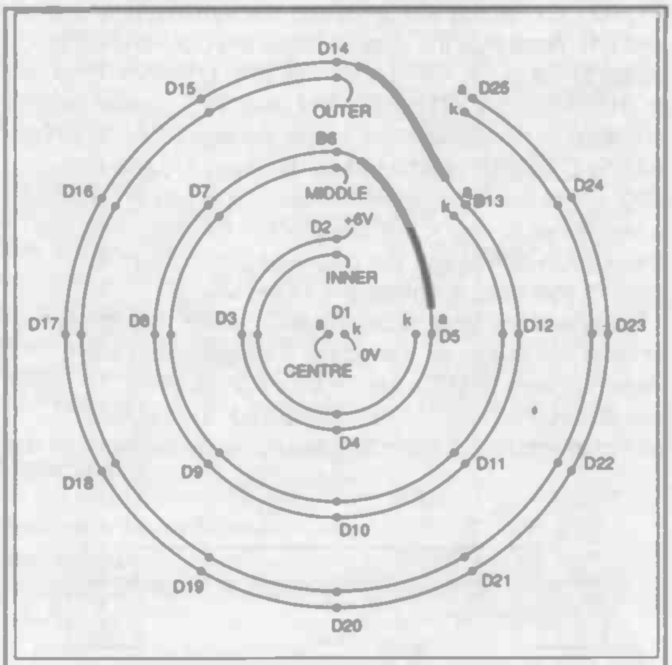


Figure 5: wiring the panel, as seen in rear view

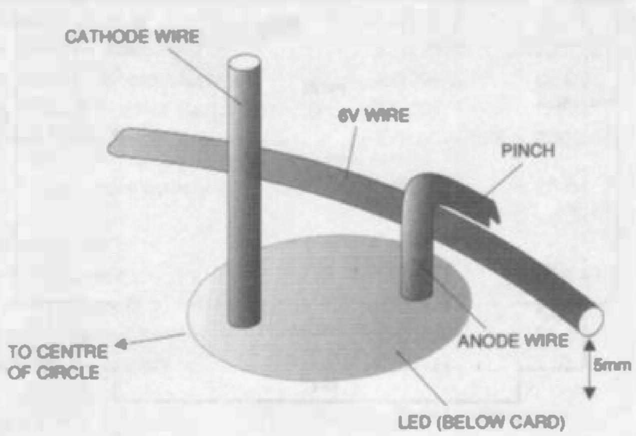


Figure 6: soldering the power supply wire to the anode wires of the LEDs

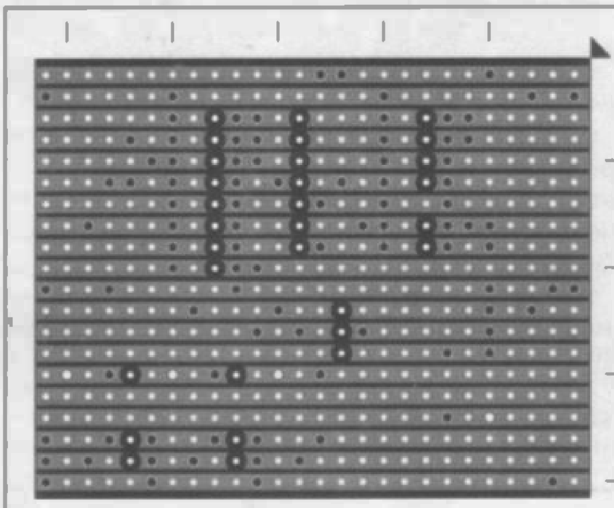


Figure 7: the back of the stripboard layout

out the pattern of (figure 4) on the thin card; make cuts where indicated and score along the dashed lines. Fold up the sides and glue the flaps marked A to adjacent sides, to form the box. Leave the rims until later. You now have a box 122mm square and 20mm deep. The panel needs stiffening from behind (that is, from inside the box) so cut out a 120mm square of thick (1.5mm - 2mm) cardboard. You could instead use plastic-board, hardboard or plywood. Mark this out to show where the LEDs are to go (figure 5). The LEDs are to be in circles 16.5mm, 33mm and 50mm radius, so draw circles that are 1.5mm larger and smaller than this to show where to prick the holes for the LED leads. Across these draw radii spaced 90 degrees apart on the inner circles, 45 degrees apart on the middle circle and 30 degrees apart on the outer circles. There are also two holes to be marked in the centre, spaced 3mm apart for the jumbo LED. Now coat the back of the card evenly with glue and drop it into the box (it is a loose fit). Let it dry under firm pressure. Use a stout pin to prick through all the points where the circles intersect the radii (the dots in (figure 5). If you are using hardboard or plywood you will need a fine (0.8 or 1mm) drill for this.

Insert the 12 LEDs in the holes for the outer circle. If you like, you can give the base of each LED a drop of glue to fix it to the panel, but this is not essential as the wiring helps to hold the LEDs in place when it has been soldered. Check very carefully that the LEDs are arranged with their anode wires through the holes in the outermost circle. With most (though not all) makes of LED this means that the 'flat' on the rim of each LED faces toward the centre of the circle. Strip a 350mm length of single-stranded connection wire, which is to be the +6V supply wire. Beginning at D25, solder it to the anode (a) wires of D25 to D14. Before soldering, cut each terminal wire of the LED so that it protrudes about 8-10mm from the card. Bend the end of the anode wire over the supply wire and pinch it tightly (figure 6). This leaves a few millimetres between the supply wire and the card so that you can grip the anode with a heat shunt. This is a precaution against damaging the LED while soldering. Apply a small amount of solder to the joint, making sure it flows on to both the anode wire and the supply wire. Repeat this procedure with a second wire joining the cathode wires (k) of the LEDs. You now have 12 LEDs wired in parallel.

It is worth while to check the connections as you proceed so, when you have finished the outer circle, connect the supply wire to +6V, temporarily connect an 18-ohm resistor to the cathode wire and the 0V supply to the other end of this resistor. All LEDs should light up brightly. If any fail to do so, check the soldering and also re-check that the LEDs are the right way round. Repeat the above operation of soldering and testing for the middle and inner circles. Solder connections to join all the power supply wires together, as shown in figure 5. Use insulated wire, or wire covered by plastic sheathing. Connect the other wire ends and also the terminals of the jumbo LED to the terminal pins on the circuit board, using light-duty multistranded wire. Note that Q2, Q3 and Q4 are NOT in numerical order on the board.

At this point the circuit is ready for its final testing, with the circuit board not yet placed inside the box. Just switch on and watch the display burst about once a second. Now fix a piece of double-sided adhesive foam ('Sticky Fixer') at each corner of the circuit board on the copper-strip side. Cut a rectangle of thin card the same size as the board and press this on to the under-surface. This is to prevent short-circuits between the board and the base wiring. Fold the rim strips inward, overlapping at the corners and glue them together there. Tuck the circuit board under one rim; this is not a very secure fastening but adequate for most purposes.

To complete the project you may like to add some form of decoration. Perhaps cover part of the panel with glue and sprinkle coloured glitter on it. Add a few strands of tinsel and in any other way you like add sparkle to its bursting brightness.

PARTS LIST for the Starburst

Resistors

All 0.25W, 5 percent tolerance

R1	470k
R2	47k
R3	1.8k
R4 - R6	10k
R7	120R
R8	27R
R9 - R10	18R

Capacitors

C1	1uF axial electrolytic
C2	1000 uF axial electrolytic

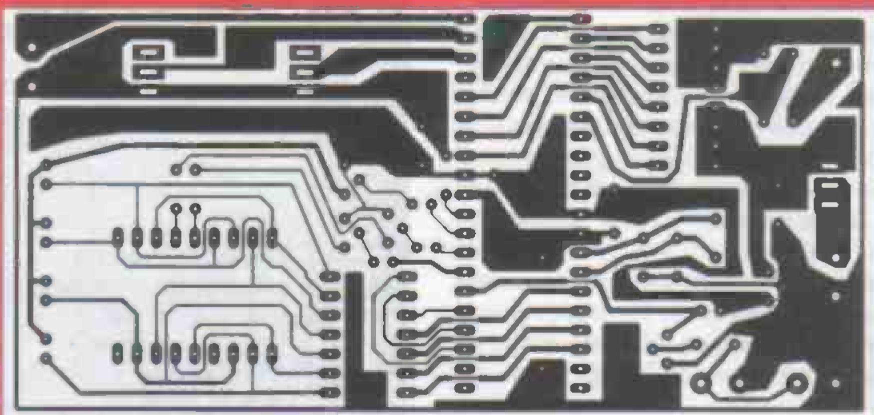
Semiconductors

D1	10mm LED
D2 - D25	5mm LED (24 off)
IC1	CMOS 4025 triple 3-input NOR gate
IC2	CMOS 4022 divide-by-8 counter with 1-of-8 outputs
Q1	BC558 pnp transistor
Q2 - Q4	MPSA14 npn Darlington transistor (3 off)

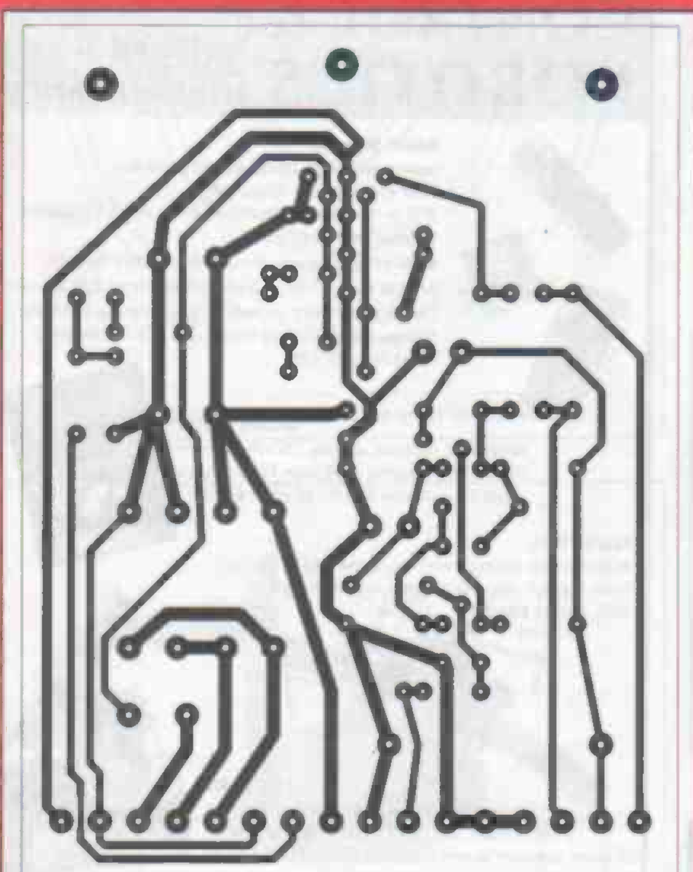
Miscellaneous

Stripboard 52mm x 68mm (20 strips x 26 holes); 1mm terminal pins (6 off); 14-pin dil ic socket, 16-pin dil ic socket; materials for making and decorating display box.

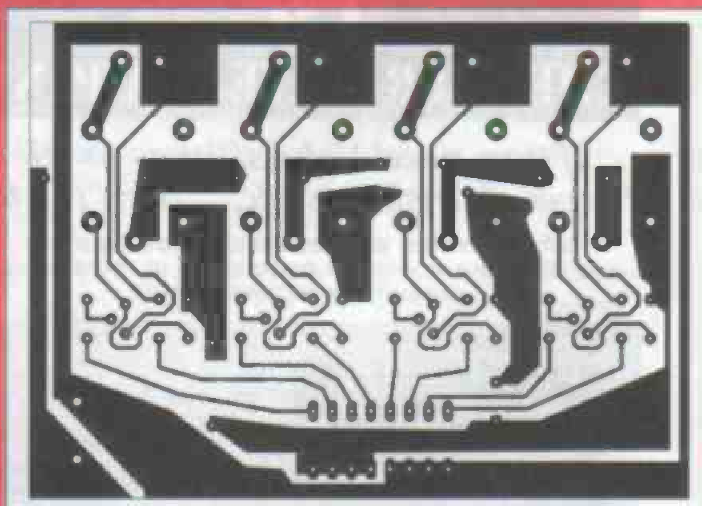
FOILS FOR THIS ISSUE



4-Go Rocket Launcher - main board



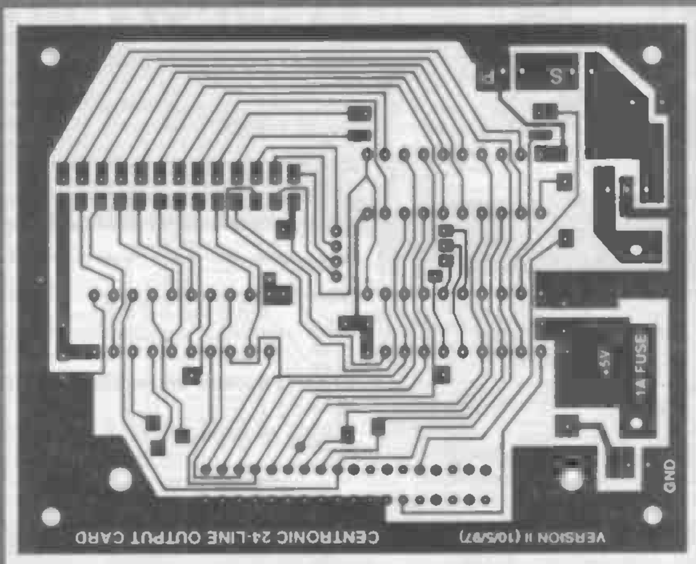
Mighty Midget



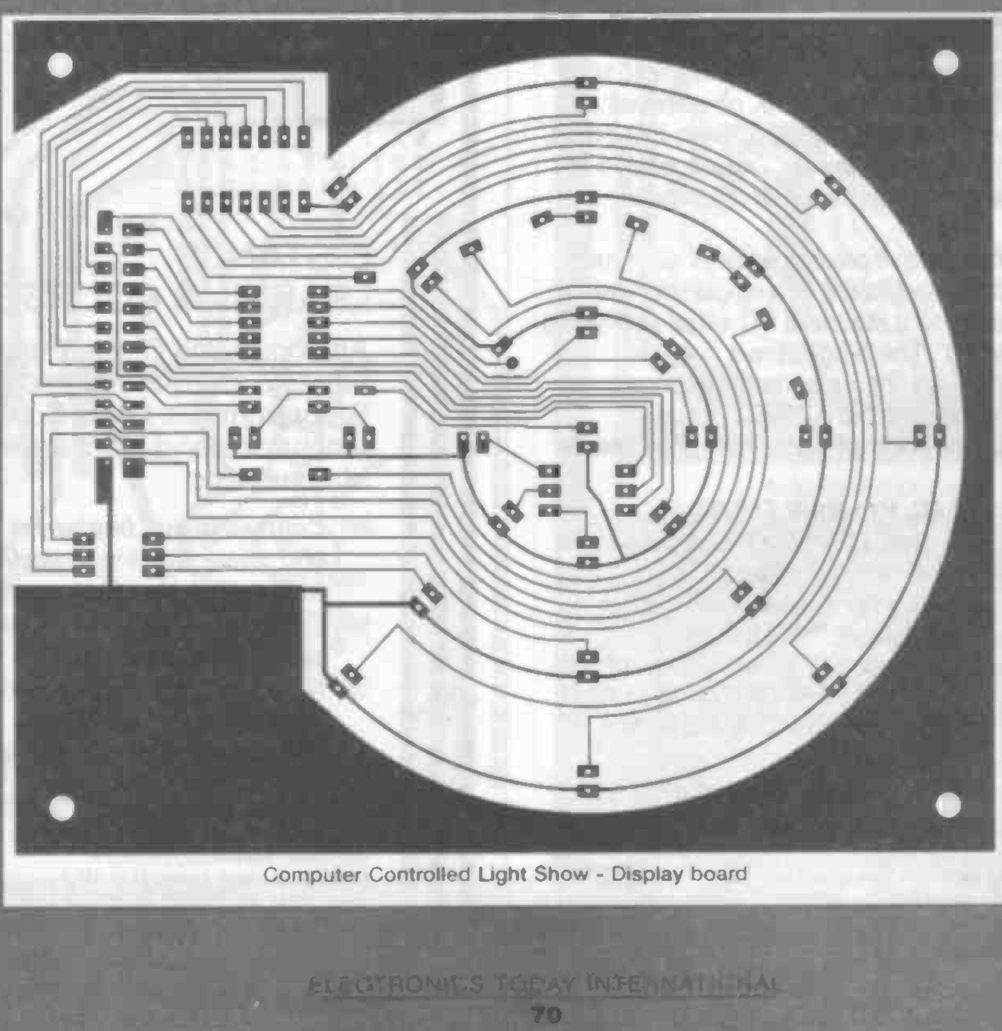
4-Go Rocket Launcher - relay board

ETI
ELECTRONICS
TODAY INTERNATIONAL

FOILS FOR THIS ISSUE



Computer Controlled Light Show - Output board


Computer Controlled Light Show - Display board

ADVERTISERS INDEX

ETI Classified

Kelly Helsey
01442 266551

Send your requirements to:
ETI Classified Department, Nexus, Nexus House, Boundary Way, Hemel Hempstead, HP2 7ST
Lineage: 85p per word (+VAT) (minimum 20 words)
Semi display: (minimum 3cms)
£12.50 + VAT per single column centimetre
Ring for information on series bookings/discounts.
All advertisements in this section must be pre-paid.
Advertisements are accepted subject to the terms and conditions printed on the advertisement rate card (available on request).

FOR SALE

VARIABLE VOLTAGE TRANSFORMERS

INPUT 220/240V AC 50/60
OUTPUT 0-260V

	Price	P&P	
PANEL MOUNTING			
0.5KVA 2.5 amp max	£33.00	£6.00	(£45.83 inc VAT)
1KVA 5 amp max	£45.25	£7.00	(£61.39 inc VAT)
SHROUDED			
0.5KVA 2.5 amp max	£34.00	£6.00	(£47.00 inc VAT)
1KVA 5 amp max	£46.25	£7.00	(£62.57 inc VAT)
2KVA 10 amp max	£66.00	£8.00	(£86.36 inc VAT)
3KVA 15 amp max	£86.50	£9.00	(£111.63 inc VAT)
5KVA 25 amp max	£150.00	Plus Carriage & VAT	
10KVA 45 amp max	£300.00	Plus Carriage & VAT	
6KVA 3 PHASE Star	£265.00	Plus Carriage & VAT	

Buy direct from the importers. Keenest prices in the country

COMPREHENSIVE RANGE OF TRANSFORMERS-LT-ISOLATION & AUTO
(110-240V Auto transfer either cased with American socket and mains lead or open frame type. Available for immediate delivery

500VA ISOLATION TRANSFORMER
New manuf. surplus 'C' Core Encapsulated with top plate and solder connections. 0-240V AC Prim. 5-0-100-110-120V & Screen Sec. 60 10.5A. Size H195 x 156 x 135mm. Price £35.00 Carr £7.00 (£49.94 incl)

RANGE OF XENON FLASHTUBES
Write/Phone your enquires

ULTRA VIOLET BLACK LIGHT BLUE FLUORESCENT TUBES

4ft 40 watt £14.00 (callers only)	(£16.45 inc VAT)
2ft 20 watt £9.00 (callers only)	(£10.58 inc VAT)
12in 8 watt £4.80 + 75p p&p	(£6.52 inc VAT
9in 6 watt £3.96 + 50p p&p	(£5.24 inc VAT)
6in 4 watt £3.96 + 50p p&p	(£5.24 inc VAT)

230V AC BALLAST KIT
For either 6in, 9in or 12in tubes £6.05 + £1.40 p&p (£8.75 inc VAT)
The above Tubes are 3500/4000 angst. (350-400um) ideal for detecting security markings, effects lighting & Chemical applications.
Other Wave Lengths of U.V. TUBE available for Germicidal & Photo Sensitive applications.
Please telephone your enquiries

400 WATT BLACK LIGHT BLUE UV LAMP
GES Mercury Vapour lamp suitable for use with a 400W P.F. Ballast
£39.95 INCL P&P & VAT

12V D.C. BILGE PUMPS
500 GPH 15ft head 3 amp £19.99
1750 GPH 15ft head 9 amp £34.55
Also now available 24V D.C. 1750 GPH 15ft head 5 amp £35.55
All designed to be used submerged. PRICES INCLUDE P&P & VAT

SUPER HY-LIGHT STROBE KIT
Designed for Disco, Theatrical uses etc.
Approx 16 joules. Adjustable speed £50.00 + £3.00 p&p (£62.28 inc VAT)
Case and reflector £24.00 + £3.00 p&p (£31.73 inc VAT)
SAE for further details including Hy-Light and Industrial Strobe Kits.

5KVA ISOLATION TRANSFORMER
As New Ex-equipment fully shrouded Line Noise Suppression. Ultra Isolation Transformer with terminal covers and Knock-out cable entries. Primary 120/240V Secondary 120/240V 50/60 Hz. .005 pF Capacitance Size L.37 x W.19 x H.16cm Weight 42 Kilos. PRICE £120.00 +VAT
ex-warehouse. Carriage on request

24V DC SIEMENS CONTACTOR
Type 3TH8022 DB 2 x NO and 2 x NC 230V AC 10A contacts. Screw or Din Rail fixing. Size H 120 x W 45 x 0.75mm. Brand New Price £7.63 incl. P&P and VAT.

240V AC WESTOOL SOLENOIDS
TT2 Mod 1 Rat. 1 MAx stroke 1/4 in. Base mounting 1/2in. stroke 5lbs pull approx. TT6 Mod 1 Rat. 2 Max stroke 1/8 in. Front mounting 1/2in. Front mounting 1/2 in. stroke 15lbs pull approx. Price incl. p&p & VAT. TT2 £5.88, TT6 £8.81, SERIES 400 £7.64.

AXIAL COOLING FAN
230V AC 120mm square x 38mm 3 blade 10 watt Low Noise fan. Price £7.29 incl. P&P and VAT. Other voltages and sizes available from stock. Please telephone your enquiries.

INSTRUMENT CASE
Brand new Manuf. by Imhof L31 x H18 x 19cm deep. Removeable front and rear panel for easy assembly of components. Grey finish complete with case feet.
PRICE £16.45 INCL. P&P &VAT 2 off £28.20 Inclusive.

DIE CAST ALUMINIUM BOX
with internal PCB guides. Internal size 265 x 165 x 50mm deep. Price £9.93 incl p&p & VAT. 2 off £17.80 incl.

230V AC SYNCHRONOUS GEARED MOTORS
Brand new Ovoid Gearbox Crouzet type motors H 65mm x W 55mm x D 35mm 4mm dia shaft x 10mm long. 6 RPM anti cw £9.99 incl p&p & VAT.
20 RPM anti cw Depth 40mm £11.16 incl p&p & VAT.

SOLID STATE EHT UNIT
Input 230/240V AC, Output approx 15KV. Producing 0mm spark. Built-in 10 sec timer. Easily modified for 20sec, 30 sec to continuous. Designed for boiler ignition. Dozens of uses in the field of physics and electronics, eg supplying neon or argon tubes etc. Price less case
£8.50 + £2.40 p&p (£12.81 inc VAT) NMS

EPROM ERASURE KIT
Build your own EPROM ERASURE for a fraction of the price of a made-up unit kit of parts less case includes 12in 8 watt 2537 Angst Tube Ballast unit, pair of bi-pin leads, neon indicator, on/off switch, safety microswitch and circuit £15.00 + £2.00 p&p (£19.98 inc VAT)

WASHING MACHINE WATER PUMP
Brand new 240V AC. fan cooled. Can be used for a variety of purposes. Inlet 1½in. outlet 1 in. dia. Price includes p&p & VAT. £11.20 each or 2 for £20.50 inclusive.

SERVICE TRADING CO
57 BRIDGMAN ROAD, CHISWICK, LONDON W4 5BB
TEL 0181-995 1560 FAX 0181-995 0549
ACCOUNT CUSTOMERS MIN. ORDER £10
Open Monday-Friday
Ample Parking Space

'C' FOR MICROCONTROLLERS

Phone: **01974 282670** or
Sales@kanda-systems.com

KANDA

www.kanda-systems.com

??? PCB DESIGN OVERLOAD ???

– EDWIN –
– EED3 –
– CAPSTAR –

WE COULD BE THE ANSWER.
CONTACT SWIFT DESIGNS LTD

Email:
Designs@SwiftDesigns.co.uk
Phone:
01438 310133 - 01438 821811
Web:
www.swiftdesigns.co.uk

£50 BT INSTRUMENT FOR ONLY £7.50

We refer to the BT insulation tester and multi-meter with which you can read insulation directly in megohms, AC volts up to 230, 4 ranges of DC volts up to 500, 3 ranges of milliamps and one 5A range and 3 ranges of resistance. These are in perfect condition, have had very little use, if any, tested and fully guaranteed. Complete with leads and prods £7.50, Order Ref 7.5P4. Carrying case which will take small tools as well, £2 extra. Postage £3 unless your order is £25 and over.
J & N Factors
Dept ETI, Pilgrim Works, Stairbridge Lane, Bolney, Sussex, RH17 5PA
Telephone: (01444) 881965

SWC SCIENTIFIC WIRE COMPANY

ENAMELLED COPPER WIRE TINNED WIRE SILVER PLATED COPPER WIRE SOLDER EUREKA WIRE NICKEL CHROME WIRE BRASS WIRE LI TZ WIRE BIFILAR WIRE MANGANIN WIRE TEFZEL WIRE NICKEL
SAE BRINGS LIST 18 RAVEN RD LONDON E18 1HW
FAX 0181 559 1114

£12 per page
Think Web Designs
Contact Us For Details:
184 St. Albans Road
Lytham St. Annes
Lancashire FY8 3HU
thinker@dial.pipex.com

ETI, ISSUE 1 to present, first 15 years in binders. Buyer collects. Offers to Dave. Daytime 0181-443-8697, Evenings 0181-443-2289.

PRINTED CIRCUIT BOARDS

PRINTED CIRCUIT BOARDS
DESIGNED & MANUFACTURED
- PROTOTYPE OR PRODUCTION QUANTITIES
- FAST TURNROUND AVAILABLE
- PCBs DESIGNED FROM CIRCUIT DIAGRAMS
- ALMOST ALL COMPUTER FILES ACCEPTED
  EasyPC / Aries / VuTrax / CadStar
  Gerber / HPGL / tDraw and many others
- ASSEMBLY & TEST AVAILABLE

TELEPHONE 01232 738897
INTERNATIONAL +44 1232 738897
agar Circuits
FAX - 01232 738897
Email - agar@argonet.co.uk
Unit 5, East Belfast Enterprise Park, 308 Albertbridge Road, Belfast, BT5 4GX

QUARTZ CRYSTALS

QUARTZ CRYSTALS 100 KH2 - 100 MHZ at low cost. Full list available and technical advice. Electronic Design Associates. Tel: 0181-391-0545. Fax: 0181-391-5258.

Veronica KITS

88-108MHz FM TRANSMITTERS

Professional PLL transmitter, Stereo Coder, and Compressor/Limiter kits licensable in the U.K. Also very stable VFO transmitter kits. Prices from under £10 and a 'Ready Built' service is available. Contact us for a free brochure including prices and more detailed information.

18 Victoria St, Queensbury, BRADFORD, BD13 1AR
Tel 01274 816200 Email veronica@legend.co.uk

To Advertise in the next months issue of ETI call Kelly Helsey
01442 266551

CCTV

PCB CAMERA

B/W MODULES

£39.00 + VAT

32mm Pinhole or 3.5 lens just £39 + VAT with sound. 42mm lens version add £10

(UK carr./pack/ins. £4 up to 10pcs)

DISCOUNTS FOR QUANTITY

Open 6 days a week for callers, mo and email.

HENRYS

404 Edgware Road, London W2 1ED
Tel. 0171 258 1831
Fax: 0171 724 0322
Email: sales@henrys.demon.co.uk
Internet: www.henrys.co.uk

PLANS

ELECTRONIC PLANS, laser designs, solar and wind generators, high voltage teslas, surveillance devices, pyrotechnics and com-puter graphics tablet. 150 projects. For catalogue, SAE to Plancentre Publications, Unit 7, Old Wharf Industrial Estate, Dymock Road, Ledbury, Herefordshire, HR8 2HS.

WILSON VALVES

(PROP JIM FISH G4MH)
Over 50,000 valves stocked
2000 different types,
vintage, military, audio, etc.
Fast service. Send SAE for list
VALVES WANTED FOR CASH
28 Banks Avenue, Golcar, Huddersfield,
West Yorks HD7 4LZ
Tel: 01484 654650
Fax: 01484 655699
Email: wilsonvalves@surflink.co.uk

PROGRAMMES

MICRO - ISP

In-system 8051 Programming in a FLASH!

Now supports the AVR Microcontroller Family

Code development for the 8051 family could not be easier. Simply plug the "Socket Stealer Module" into your existing 8051 socket and then use the Micro-ISP Programmer to download code (and data) to your target microcontroller without even removing it from the target socket.

EQUINOX
TECHNOLOGIES
The Embedded Solutions Company

Sales: 01204 492010 Technical: 01204 491110 Fax: 01204 494883
Visit our web page at: www.equinox.tech.com
Email: sales@equinox.tech.com

All adverts must be prepaid.
Cheques payable to:
Nexus Special Interests Ltd.

Name ....

Address ....

....

Daytime Tel: No: ....

....

Signature ....

Date ....

PLEASE DEBIT MY ACCESS/BARCLAY CARD No.

EXPIRY DATE ....

FOR SALE   COMPONENTS   PLANS   OTHER–PLEASE STATE
Please ring the required heading.

ETI

ELECTRONIC TODAY INTERNATIONAL
CLASSIFIED ADVERTISEMENT DEPARTMENT
NEXUS HOUSE, BOUNDARY WAY,
HEMEL HEMPSTEAD HP2 7ST

20 words lineage
£19.97 *inc vat*

3 x 1
£44.06 *inc vat*

ATTENTION ALL NORTH AMERICAN READERS!

Did you know that you can order an annual subscription to this magazine direct from our official U.S. subscription representative?

For more information and rates contact:
Wise Owl Worldwide Publications   4314 West 238th Street, Torrance, CA 90505 4509   Tel: (310) 375 6258

Around the Corner

Until recently, the major advances in DVD (digital versatile disc) seemed to have been in the area of hype. Now we can see that a clear standard and development path has been laid out, and already some PCs incorporate DVD drives instead of CD-rom drives. Of course, the DVD drives can also read CD-roms.

The basic single sided single layer DVD, which is available now, holds seven times the data of one Compact Disc: 4.7 gigabytes per single side, as compared to 680 megabytes for CD. There are other options for the future: a dual-layer, single-side option, for even higher capacity: 8.5 gigabytes on a single side, or 17.0 gigabytes on a double-sided disc.

Are CDs obsolete?

Refinements incorporated in DVD as compared with CD-rom include smaller pit dimensions, a more closely-spaced track and a shorter-wavelength laser (visible red 650 and 635 nanometre for DVD, as against 780 nanometre infra red for CD-rom). The lens system has also been improved to give sharper focussing.

The improvements in the error correcting technology are of great importance. The Reed Solomon Product Code error correction system on DVD is approximately ten times more robust than the one on the current CD system.

At least some DVD systems are to be rewriteable. Apart from the facts that DVD is not yet widely available, and certainly not in portable form, and that DVD discs are larger than Minidiscs (see last month's Round the Corner), DVD should be a more attractive proposition for consumers.

Whichever system is widely accepted, so long as one of them is, then it may be possible to buy your recorded music in a different way in the future. For example, you might choose your own track list and have the computer in the record shop make a custom Minidisc or DVD for you. Or perhaps you would purchase and download individual tracks over the Internet (legally, of course).

DVD is also for video, but the CCIR-601 digital video standard specifies a video rate of 167 megabits per second. At this bit rate, the 4.7 gigabyte capacity of a standard DVD could only store roughly four minutes of digital video. The answer to this is MPEG compression, which can store over two hours of video on a single sided, single layer disc.

MPEG2 works by analysing the video picture for repetition. Over 97 percent of the digital data that represent a video signal is redundant, and can be removed without visibly harming picture quality.

As implemented for DVD, MPEG2 encoding is a two-stage process, where the signal is first evaluated for complexity. Then, higher bit rates are assigned to complex pictures and lower bit rates to simple pictures, using an "adaptive," variable bit-rate process. The DVD format uses variable bit rates with a range of up to 10 megabits per second. Although the "average" bit rate for digital video is often quoted as 3.5 megabits per second, the actual figure will vary according to movie length, picture complexity and the number of audio channels required.

The picture is stored as component video rather than in an encoded form, which should open the door to higher resolution television pictures. Certainly the PAL system, as it is normally implemented, loses almost half the horizontal detail which could be available. Perhaps this is one reason for the slow takeup of wide screen televisions: the picture is big, but blurred and short on detail. I have heard sour comments that some people can get that sort of picture just by taking off their glasses, so that the magic of wide-screen has some way to go yet.

On the other hand, most people seem to be happy with standard VHS recordings, which lose much of the detail available in PAL pictures, so maybe if DVD takes off as a consumer music and video standard, it will be because it is conveniently backwards-compatible with CDs.

Next Month...

Volume 27 no. 1 of *Electronics Today International* will be in your newsagent nearly as fast as 1998 itself - on 2nd January 1998 ... our leading feature will be packed with details about the current ranges of microcontrollers ... Ray Haigh's custom Loop Aerial for medium wave and portable radios ... a new switched mode Power Supply from Bob Noyes ... Robert Penfold's four-channel infra red remote controller... a multi purpose one-shot timer ... plus all the regulars, and more.

Contents are in preparation but are subject to space and availability.

ELECTRONICS TODAY INTERNATIONAL

Published by
Nexus Special Interests Limited
Nexus House, Boundary Way
Hemel Hempstead, Herts HP2 7ST
Tel 01442 266551 Fax 01442 266998

Sorry, we cannot answer queries about projects or other technical question on the phone. Please write to the address above. Our admin assistant can often help with other queries about this issue

EDITORIAL

Editor
Helen Armstrong

Administration Assistant
Beverley Walden

Consultant
Andrew Armstrong

PRODUCTION

Designer
Mark Dodgson

Technical Illustrator
John Puczynski

Production Executive
Marie Quilter

Printed By
Wiltshire Ltd., Bristol

Origination by
Atelier, St. Austell

SALES

Midland and Southern Area Sales
Alison Weatherill
01442 266551x322

Northern Area Sales
Denise Barrow
0161 776 4460

Group Advertisement Manager
Diane Farnham

MANAGEMENT

Divisional Managing Director
John Bridges

Business Manager
Stuart Cooke

Senior Editor
David Watkins

Circulation Manager
William Pearson

Copy Sales Manager
David Pagendam

SUBSCRIPTIONS

UK Orders 01858 435344
Enquiries 01858 435322
USA: Wise Owl Worldwide Publications, 4314 West 238th Street, Torrance, CA90505-4509, USA. For VISA/Mastercard orders phone (310) 375 6258 Fax (310) 375 0548. Pacific Time 9am - 9pm weekdays 10am - 6pm weekends Visa/MC/Discover accepted.

READERS SERVICES
Back issues(last 12 months) £3.20 per issue if available. Older issues: photocopies of older articles often available. Write to The Photocopy Service, Readers Services Department, at Nexus House, Boundary Way, Hemel Hempstead, Herts HP2 7ST. Binders for ETI: £7.50 each including UK post and packing. Overseas please add £1.50. Cheques to Nexus Special Interest at Nexus House, or phone VISA/Mastercard orders to Readers Services Department 01442 266551

FOR ENTHUSIASTS BY ENTHUSIASTS
NEXUS

ISSN 0142-7229

The Ultimate 8051
Microcontroller Programmer
• Supports Atmel FLASH 89C +89S, Generic 87C51/52/FA/FB/FC microcontroller derivatives
• FLASH & E2 libraries also available as chargeable update
NOW from only £125.00
£125.00 Order Code: MPW-SYS
AVR support now
MICRO-PRO
8051 2K Starter System
For C51 Project Development...in a FLASH
Includes: Programmer, Evaluation module and PK51-2K
£199.00 Order Code: AT-89C-2K-ST
MICRO-ISP
In-System Programming (ISP)
"Now you can program the 8051 or the AVR™ without removing the device from the socket!"
MICRO-ISP
£39.95 Order Code: UISP-V2-SYS
Programmer Interface Software for Windows™
KEIL SOFTWARE
Keil 8051 C compiler, Assembler, Simulator (2K code), Windows™ IDE
£99.00 Order Code: PK51-2K
89S Socket Stealer Module
Simply plug this into your existing 8051 or AVR™ socket for INSTANT In-System Programming
NO Target System redesign required.
£49.00 Order Code: SS-89S-DIL40
AVR™ Professional Starter System
Order Code: AVR-ST £59.95
FEATURES
• Supports Atmel 90S (AVR) RISC microcontroller family
• Supports Parallel Programming mode in ZIF socket
• Supports In-System Programming via ribbon cable (provided)
• Equinox FAST ISP Programming Algorithm
• All on-chip facilities supported e.g. RC Osc.
SYSTEM CONTENTS
• Professional Device Programmer
• Atmel AVR™ Assembler
• AVR™ Basic Lite Compiler (NEW)
• Atmel Databook on CD ROM
• Power Supply
• ISP Ribbon Cable (to target)
• Serial Cable (to host PC)
NOW SUPPLIED WITH AVR BASIC LITE
Write in BASIC, Run in a FLASH
NEW
From Only £24.95!
• Compiled BASIC generates tight AVR™ machine code
• Not a Run-Time Interpreter, NO code overhead!
• Target speeds comparable with assembler
• Breaks the cost barrier for small projects
• Ideal for educational, hobbyist and professional use
AVR BASIC LITE
• AVR™ BASIC LITE only supports the AT90S1200 (512 words code)
• 8K version also available
Order Code: AVR-BAS-LIT £24.95
EQUINOX TECHNOLOGIES
EQUINOX TECHNOLOGIES UK LIMITED
The Embedded Solutions Company
PROVIDING THE SOLUTIONS TO YOUR PROBLEMS!
Tel: +44 (0) 1204 491110
Fax: +44 (0) 1204 494883
For product information visit our web site at:
www.equinox-tech.com
E-mail: sales@equinox-tech.com
229 Greenmount Lane Bolton BL1 5JB UK
EQUINOX DISTRIBUTORS: AUSTRALIA Farnell +61 2 9645 8888 AUSTRIA Farnell +43 0660 87 75 BELGIUM Alcom Electronics NV/SA +32 3 227 36 47 Farnell +32 03 227 36 47 BRAZIL Hastec +55 11 522 1799 Anacon +55 11 453 5588 DENMARK Farnell +45 44 53 66 44 EIRE Farnell +353 1 8309277 FINLAND Farnell +358 9 3455 400 FRANCE Farnell +33 474 65 94 66 Newtek +33 1 4687 2200 GERMANY Farnell +49 89 61 39 39 39 Inelek GmbH +49 7321 93850, MSC Vertriebs GmbH +49 08 9945532 12 GREECE Microtec +30 1 5395042 4 HONG KONG Farnell 800 968 280 (HK Direct Toll Free) ITALY Farnell +44 113 231 1311 Grifo Italian Technology +39 51 89 20 52, Newtek Italia +39 2 33 10 53 08 MALAYSIA Farnell +60 3 773 8000 NETHERLANDS Alcom Electronics BV +31 10 4519533 Farnell +31 30 241 2323 NEW ZEALAND Farnell +64 9 357 0646 NORWAY ACTE NC +47 63898900 Jakob Hatteland Electronic AS +47 53763000 PORTUGAL Anatronic +35 119 371 834 Farnell +44 113 289 0040 SINGAPORE Farnell +65 788 0200 SPAIN Anatronic SA +34 1 366 01 59 Farnell +44 113 231 0447 SWEDEN ACTE NC +46 8 445 28 70 Farnell +46 8 730 50 00 SWITZERLAND Anatec Ag +41 41 748 32 41 Farnell +41 1 204 64 64 UNITED KINGDOM Abacus Polar +44 1925 626626, Farnell +44 113 263 6311 GD Technik +44 1734 342277 Rapid Electronics +44 1206 751166 Quarndon Electronics +44 1332 332651 USA Hitools Inc +1 408 298 9077 Newark Electronics +1 800 718 1997, Peachtree Technology +1 770 888 4002 Pioneer Standard +1 888 832 3976
Equinox reserves the right to change prices & specifications of any of the above products without prior notice. E&OE. All prices are exclusive of VAT & carriage. AVR™ is a trademark of the Atmel Corporation