

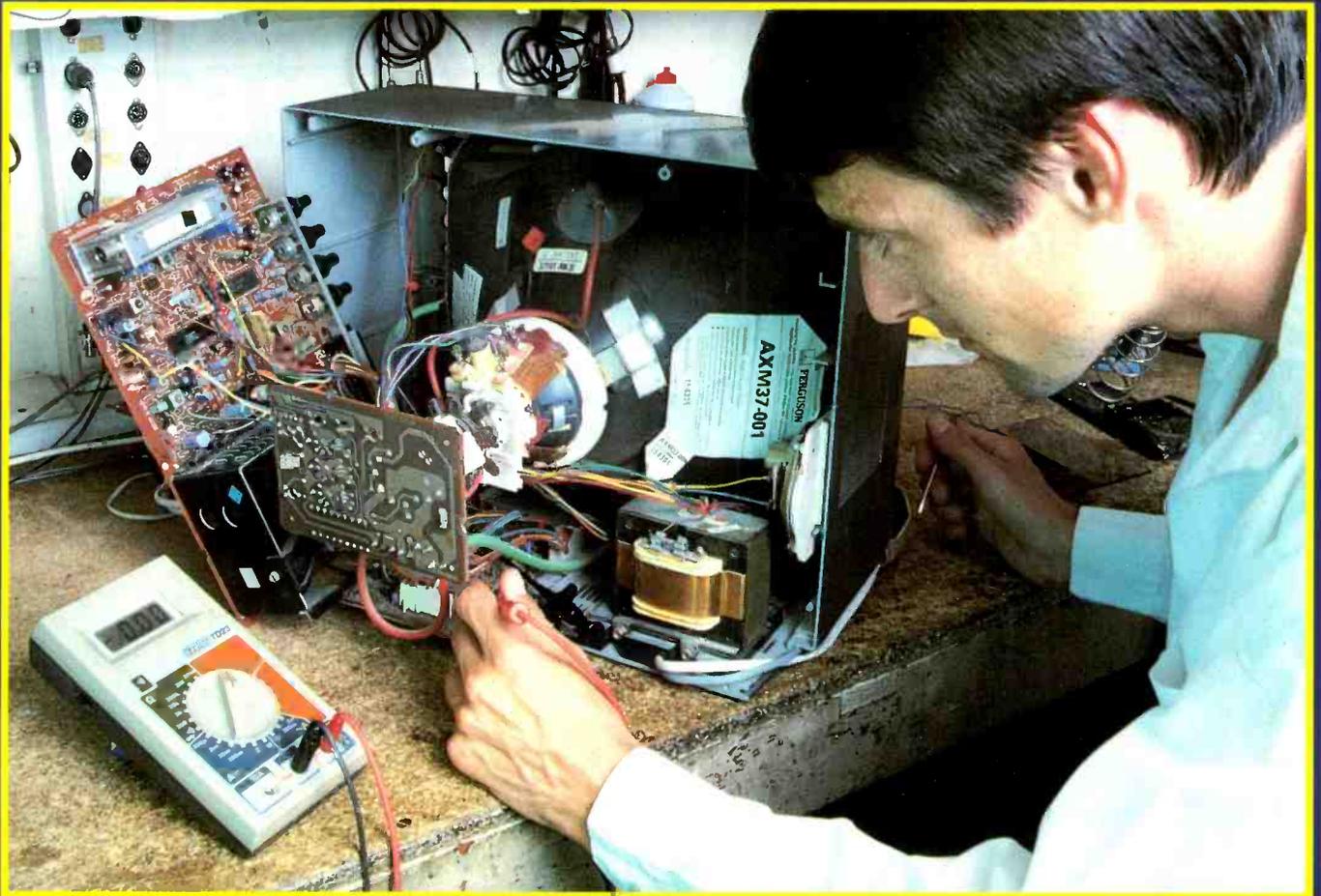
SEPTEMBER 1992

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TELEVISION

SERVICING · VIDEO · SATELLITE · DEVELOPMENTS

FREE COVER-MOUNTED GIFT



**Servicing the Ferguson TX90 Chassis
Dealing with Surface-Mounted Chips
Satellite TV Polarisation Systems
The Electricity at Work Act • DX-TV
VCR Clinic • TV Fault Finding**

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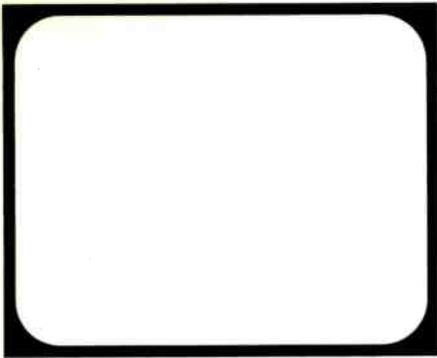
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**OUR NEXT ISSUE DATED OCTOBER WILL
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BC107	8p	BD828	50p	R2098B	100p	2N6385	120p	EV86	70p	AN7145	195p	LA2001	150p	NE555	20p	STK41821	800p	STR4190	500p	T06230AP	200p	LINEAR IC's	
BC108	8p	BD896	50p	R2102	100p	2N6403	160p	EV87	70p	AN7146	210p	LA2001	270p	NE555	20p	STK41821	800p	STR4190	500p	T062382	200p	Cont.	
BC109	8p	BD901	50p	S2800M	52p			EV88	80p	AN7154	180p	LA2200	190p	NE555	110p	STK4192	800p	STR4111	650p	T06270	200p	DA362A	350p
BC109C	10p	BD901	50p	S2800M	72p			PC97	100p	AN7156	240p	LA3160	120p	NE568	110p	STK42311	900p	STR4111	700p	T06270S	250p	DA3650	350p
BC140	20p	BD937	50p	T2800D	82p			PCF801	80p	AN7166	260p	LA3201	60p	NE567	115p	STK4272	720p	STR5020	550p	T06304AP	300p	DA3651	200p
BC141	20p	BD937	50p	T2800M	72p			PCF801	80p	AN7166	260p	LA3220	200p	NE571	120p	STK4273	720p	STR5052	550p	T06306P	300p	DA3652	200p
BC142	20p	BD937	50p	T2800M	72p			PCF801	80p	AN7166	260p	LA3220	200p	NE582	85p	STK4300	85p	STR5052	550p	T06306P	300p	DA3653	150p
BC143	20p	BD965	50p	TIP29A	25p			PCF801	80p	AN7166	260p	LA3220	200p	NE582	85p	STK4300	85p	STR5052	550p	T06306P	300p	DA3654	150p
BC147	8p	BW263	55p	TIP29C	25p			PCF801	80p	AN7166	260p	LA3220	200p	NE582	85p	STK4300	85p	STR5052	550p	T06306P	300p	DA3655	150p
BC148	8p	BW263	55p	TIP29C	25p			PCF801	80p	AN7166	260p	LA3220	200p	NE582	85p	STK4300	85p	STR5052	550p	T06306P	300p	DA3656	150p
BC149	8p	BW263	55p	TIP29C	25p			PCF801	80p	AN7166	260p	LA3220	200p	NE582	85p	STK4300	85p	STR5052	550p	T06306P	300p	DA3657	150p
BC157	8p	BW934	50p	TIP31A	25p			PCF801	80p	AN7166	260p	LA3220	200p	NE582	85p	STK4300	85p	STR5052	550p	T06306P	300p	DA3658	150p
BC159	8p	BDY92	100p	TIP31C	25p			PCF801	80p	AN7166	260p	LA3220	200p	NE582	85p	STK4300	85p	STR5052	550p	T06306P	300p	DA3659	150p
BC160	8p	BF137	35p	TIP32	24p			PCF801	80p	AN7166	260p	LA3220	200p	NE582	85p	STK4300	85p	STR5052	550p	T06306P	300p	DA3660	150p
BC161	8p	BF163	35p	TIP32A	24p			PCF801	80p	AN7166	260p	LA3220	200p	NE582	85p	STK4300	85p	STR5052	550p	T06306P	300p	DA3661	150p
BC172	10p	BF180	140p	TIP32C	24p			PCF801	80p	AN7166	260p	LA3220	200p	NE582	85p	STK4300	85p	STR5052	550p	T06306P	300p	DA3662	150p
BC177	14p	BF181	18p	TIP33	21p			PCF801	80p	AN7166	260p	LA3220	200p	NE582	85p	STK4300	85p	STR5052	550p	T06306P	300p	DA3663	150p
BC178	14p	BF183	20p	TIP33C	21p			PCF801	80p	AN7166	260p	LA3220	200p	NE582	85p	STK4300	85p	STR5052	550p	T06306P	300p	DA3664	150p
BC179	14p	BF195	7p	TIP34	50p			PCF801	80p	AN7166	260p	LA3220	200p	NE582	85p	STK4300	85p	STR5052	550p	T06306P	300p	DA3665	150p
BC182	7p	BF199	8p	TIP35	60p			PCF801	80p	AN7166	260p	LA3220	200p	NE582	85p	STK4300	85p	STR5052	550p	T06306P	300p	DA3666	150p
BC182L	7p	BF200	16p	TIP35C	65p			PCF801	80p	AN7166	260p	LA3220	200p	NE582	85p	STK4300	85p	STR5052	550p	T06306P	300p	DA3667	150p
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BC184	7p	BF240	16p	TIP41A	22p			PCF801	80p	AN7166	260p	LA3220	200p	NE582	85p	STK4300	85p	STR5052	550p	T06306P	300p	DA3669	150p
BC184L	7p	BF245	16p	TIP42A	22p			PCF801	80p	AN7166	260p	LA3220	200p	NE582	85p	STK4300	85p	STR5052	550p	T06306P	300p	DA3670	150p
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BC212	7p	BF255	12p	TIP42C	22p			PCF801	80p	AN7166	260p	LA3220	200p	NE582	85p	STK4300	85p	STR5052	550p	T06306P	300p	DA3672	150p
BC217	7p	BF256	18p	TIP47	40p			PCF801	80p	AN7166	260p	LA3220	200p	NE582	85p	STK4300	85p	STR5052	550p	T06306P	300p	DA3673	150p
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BC302	20p	BF336	20p	TIP109	65p			PCF801	80p	AN7166	260p	LA3220	200p	NE582	85p	STK4300	85p	STR5052	550p	T06306P	300p	DA3680	150p
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BC338	7p	BF450	25p	TIP120	37p			PCF801	80p	AN7166	260p	LA3220	200p	NE582	85p	STK4300	85p	STR5052	550p	T06306P	300p	DA3686	150p
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BC537	25p	BFX89	60p	TIP141	90p			PCF801	80p	AN7166	260p	LA3220	200p	NE582	85p	STK4300	85p	STR5052	550p	T06306P	300p	DA3694	150p
BC546	8p	BFY10	30p	TIP145	65p			PCF801	80p	AN7166	260p	LA3220	200p	NE582	85p	STK4300	85p	STR5052	550p	T06306P	300p	DA3695	150p
BC548	8p	BFY50	14p	TIP146	90p			PCF801	80p	AN7166	260p	LA3220	200p	NE582	85p	STK4300	85p	STR5052	550p	T06306P	300p	DA3696	150p
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BC556	8p	BFY64	25p	TIP295S	42p			PCF801	80p	AN7166	260p	LA3220	200p	NE582	85p	STK4300	85p	STR5052	550p	T06306P	300p	DA3699	150p
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BC558	8p	BL448	85p	TIP305B	42p			PCF801	80p	AN7166	260p	LA3220	200p	NE582	85p	STK4300	85p	STR5052	550p	T06306P	300p	DA3701	150p
BC567	8p	BR103	37p	TSE45	42p			PCF801	80p	AN7166	260p	LA3220	200p	NE582	85p	STK4300	85p	STR5052	550p	T06306P	300p	DA3702	150p
BC638	20p	BR303	85p	TSE50	15p			PCF801	80p	AN7166	260p	LA3220	200p	NE582	85p	STK4300	85p	STR5052	550p	T06306P	300p	DA3703	150p
BC639	20p	BR49	38p	TSE53	20p			PCF801	80p	AN7166	260p	LA3220											

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1420CA 450p		25A1252 150p		25C699 150p		25C1645 100p		25C2350 120p		25C2957 400p		25C3560 200p		25D-807 100p		25D-1442 125p		25K-236 100p		2822 150p		8775 800p	
1420CA 450p		25A1253 150p		25C700 150p		25C1646 100p		25C2351 120p		25C2958 400p		25C3561 200p		25D-808 100p		25D-1444 125p		25K-237 100p		2828 150p		8776 800p	
1420CA 450p		25A1254 150p		25C701 150p		25C1647 100p		25C2352 120p		25C2959 400p		25C3562 200p		25D-809 100p		25D-1446 125p		25K-238 100p		2834 150p		8777 800p	
1420CA 450p		25A1255 150p		25C702 150p		25C1648 100p		25C2353 120p		25C2960 400p		25C3563 200p		25D-810 100p		25D-1448 125p		25K-239 100p		2840 150p		8778 800p	
1420CA 450p		25A1256 150p		25C703 150p		25C1649 100p		25C2354 120p		25C2961 400p		25C3564 200p		25D-811 100p		25D-1450 125p		25K-240 100p		2846 150p		8779 800p	
1420CA 450p		25A1257 150p		25C704 150p		25C1650 100p		25C2355 120p		25C2962 400p		25C3565 200p		25D-812 100p		25D-1452 125p		25K-241 100p		2852 150p		8780 800p	
1420CA 450p		25A1258 150p		25C705 150p		25C1651 100p		25C2356 120p		25C2963 400p		25C3566 200p		25D-813 100p		25D-1454 125p		25K-242 100p		2858 150p		8781 800p	
1420CA 450p		25A1259 150p		25C706 150p		25C1652 100p		25C2357 120p		25C2964 400p		25C3567 200p		25D-814 100p		25D-1456 125p		25K-243 100p		2864 150p		8782 800p	
1420CA 450p		25A1260 150p		25C707 150p		25C1653 100p		25C2358 120p		25C2965 400p		25C3568 200p		25D-815 100p		25D-1458 125p		25K-244 100p		2870 150p		8783 800p	
1420CA 450p		25A1261 150p		25C708 150p		25C1654 100p		25C2359 120p		25C2966 400p		25C3569 200p		25D-816 100p		25D-1460 125p		25K-245 100p		2876 150p		8784 800p	
1420CA 450p		25A1262 150p		25C709 150p		25C1655 100p		25C2360 120p		25C2967 400p		25C3570 200p		25D-817 100p		25D-1462 125p		25K-246 100p		2882 150p		8785 800p	
1420CA 450p		25A1263 150p		25C710 150p		25C1656 100p		25C2361 120p		25C2968 400p		25C3571 200p		25D-818 100p		25D-1464 125p		25K-247 100p		2888 150p		8786 800p	
1420CA 450p		25A1264 150p		25C711 150p		25C1657 100p		25C2362 120p		25C2969 400p		25C3572 200p		25D-819 100p		25D-1466 125p		25K-248 100p		2894 150p		8787 800p	
1420CA 450p		25A1265 150p		25C712 150p		25C1658 100p		25C2363 120p		25C2970 400p		25C3573 200p		25D-820 100p		25D-1468 125p		25K-249 100p		2900 150p		8788 800p	
1420CA 450p		25A1266 150p		25C713 150p		25C1659 100p		25C2364 120p		25C2971 400p		25C3574 200p		25D-821 100p		25D-1470 125p		25K-250 100p		2906 150p		8789 800p	
1420CA 450p		25A1267 150p		25C714 150p		25C1660 100p		25C2365 120p		25C2972 400p		25C3575 200p		25D-822 100p		25D-1472 125p		25K-251 100p		2912 150p		8790 800p	
1420CA 450p		25A1268 150p		25C715 150p		25C1661 100p		25C2366 120p		25C2973 400p		25C3576 200p		25D-823 100p		25D-1474 125p		25K-252 100p		2918 150p		8791 800p	
1420CA 450p		25A1269 150p		25C716 150p		25C1662 100p		25C2367 120p		25C2974 400p		25C3577 200p		25D-824 100p		25D-1476 125p		25K-253 100p		2924 150p		8792 800p	
1420CA 450p		25A1270 150p		25C717 150p		25C1663 100p		25C2368 120p		25C2975 400p		25C3578 200p		25D-825 100p		25D-1478 125p		25K-254 100p		2930 150p		8793 800p	
1420CA 450p		25A1271 150p		25C718 150p		25C1664 100p		25C2369 120p		25C2976 400p		25C3579 200p		25D-826 100p		25D-1480 125p		25K-255 100p		2936 150p		8794 800p	
1420CA 450p		25A1272 150p		25C719 150p		25C1665 100p		25C2370 120p		25C2977 400p		25C3580 200p		25D-827 100p		25D-1482 125p		25K-256 100p		2942 150p		8795 800p	
1420CA 450p		25A1273 150p		25C720 150p		25C1666 100p		25C2371 120p		25C2978 400p		25C3581 200p		25D-828 100p		25D-1484 125p		25K-257 100p		2948 150p		8796 800p	
1420CA 450p		25A1274 150p		25C721 150p		25C1667 100p		25C2372 120p		25C2979 400p		25C3582 200p		25D-829 100p		25D-1486 125p		25K-258 100p		2954 150p		8797 800p	
1420CA 450p		25A1275 150p		25C722 150p		25C1668 100p		25C2373 120p		25C2980 400p		25C3583 200p		25D-830 100p		25D-1488 125p		25K-259 100p		2960 150p		8798 800p	
1420CA 450p		25A1276 150p		25C723 150p		25C1669 100p		25C2374 120p		25C2981 400p		25C3584 200p		25D-831 100p		25D-1490 125p		25K-260 100p		2966 150p		8799 800p	
1420CA 450p		25A1277 150p		25C724 150p		25C1670 100p		25C2375 120p		25C2982 400p		25C3585 200p		25D-832 100p		25D-1492 125p		25K-261 100p		2972 150p		8800 800p	
1420CA 450p		25A1278 150p		25C725 150p		25C1671 100p		25C2376 120p		25C2983 400p		25C3586 200p		25D-833 100p		25D-1494 125p		25K-262 100p		2978 150p		8801 800p	
1420CA 450p		25A1279 150p		25C726 150p		25C1672 100p		25C2377 120p		25C2984 400p		25C3587 200p		25D-834 100p		25D-1496 125p		25K-263 100p		2984 150p		8802 800p	
1420CA 450p		25A1280 150p		25C727 150p		25C167																	

SOLDERING IRONS		GRUNDIG		NATIONAL Cont.		TRIUMPH		HITACHI				
ANTEX	25 Watt 240Vac SOLDERING IRON (KS25W 240V) £7.00	VS4140/450/460/500/505/510/520/521/530	£17.00	NV850/NV950	£35.00	VR9500/VR9501/VR9525	£13.00	VT11, VT14, VT16, VT17, VT19, VT33, VT330, VT34, VT37, VT38, VT39, VT52, VT58, VT60, VT64, VT69, VT70, VT71, VT80, VT800, VT8500, VT8700, VT9000	£2.50			
15 Watt 240Vac SOLDERING IRON (KS15W 240V) £7.00	VS505/510/518/800/810	£25.00		NV830/NV831/NV840/NV830	£38.00	TX6000/V309/316/320/321/323/326/4100/4200/4300/4305/3067/3068/3098/3101/3127/4107/4117	£6.50	VT61, VT62, VT63, VT64, VT65, VT66, VT68, VT110, VT122, VT120, VT128, VT130, VT135, VT138, VT150, VT168, VT220, VM200, VM500, VM600, VT100, VT111, VT113, VT115, VT118, VT125, VT148, VT175, VT225, VT250, VT255, VT258, VT260, VT265, VT268, VT270, VT275, VT280, VT285, VT290, VT310, VT315, VT318, VT320, VT325, VT330, VT335, VT340, VT345, VT350, VT355, VT360, VT365, VT370, VT375, VT380, VT385, VT390, VT395, VT400, VT405, VT410, VT415, VT420, VT425, VT430, VT435, VT440, VT445, VT450, VT455, VT460, VT465, VT470, VT475, VT480, VT485, VT490, VT495, VT500, VT505, VT510, VT515, VT520, VT525, VT530, VT535, VT540, VT545, VT550, VT555, VT560, VT565, VT570, VT575, VT580, VT585, VT590, VT595, VT600, VT605, VT610, VT615, VT620, VT625, VT630, VT635, VT640, VT645, VT650, VT655, VT660, VT665, VT670, VT675, VT680, VT685, VT690, VT695, VT700, VT705, VT710, VT715, VT720, VT725, VT730, VT735, VT740, VT745, VT750, VT755, VT760, VT765, VT770, VT775, VT780, VT785, VT790, VT795, VT800, VT805, VT810, VT815, VT820, VT825, VT830, VT835, VT840, VT845, VT850, VT855, VT860, VT865, VT870, VT875, VT880, VT885, VT890, VT895, VT900, VT905, VT910, VT915, VT920, VT925, VT930, VT935, VT940, VT945, VT950, VT955, VT960, VT965, VT970, VT975, VT980, VT985, VT990, VT995	£2.50			
25 Watt SPARE ELEMENT £3.80	VS105/185/220/255/262/MT625/626	£18.00		NV620/NV621/NV622/NV625/NV628	£25.00			VT11, VT13, VT15, VT18, VT20, VT22, VT24, VT26, VT28, VT30, VT32, VT34, VT36, VT38, VT40, VT42, VT44, VT46, VT48, VT50, VT52, VT54, VT56, VT58, VT60, VT62, VT64, VT66, VT68, VT70, VT72, VT74, VT76, VT78, VT80, VT82, VT84, VT86, VT88, VT90, VT92, VT94, VT96, VT98, VT100, VT102, VT104, VT106, VT108, VT110, VT112, VT114, VT116, VT118, VT120, VT122, VT124, VT126, VT128, VT130, VT132, VT134, VT136, VT138, VT140, VT142, VT144, VT146, VT148, VT150, VT152, VT154, VT156, VT158, VT160, VT162, VT164, VT166, VT168, VT170, VT172, VT174, VT176, VT178, VT180, VT182, VT184, VT186, VT188, VT190, VT192, VT194, VT196, VT198, VT200, VT202, VT204, VT206, VT208, VT210, VT212, VT214, VT216, VT218, VT220, VT222, VT224, VT226, VT228, VT230, VT232, VT234, VT236, VT238, VT240, VT242, VT244, VT246, VT248, VT250, VT252, VT254, VT256, VT258, VT260, VT262, VT264, VT266, VT268, VT270, VT272, VT274, VT276, VT278, VT280, VT282, VT284, VT286, VT288, VT290, VT292, VT294, VT296, VT298, VT300, VT302, VT304, VT306, VT308, VT310, VT312, VT314, VT316, VT318, VT320, VT322, VT324, VT326, VT328, VT330, VT332, VT334, VT336, VT338, VT340, VT342, VT344, VT346, VT348, VT350, VT352, VT354, VT356, VT358, VT360, VT362, VT364, VT366, VT368, VT370, VT372, VT374, VT376, VT378, VT380, VT382, VT384, VT386, VT388, VT390, VT392, VT394, VT396, VT398, VT400, VT402, VT404, VT406, VT408, VT410, VT412, VT414, VT416, VT418, VT420, VT422, VT424, VT426, VT428, VT430, VT432, VT434, VT436, VT438, VT440, VT442, VT444, VT446, VT448, VT450, VT452, VT454, VT456, VT458, VT460, VT462, VT464, VT466, VT468, VT470, VT472, VT474, VT476, VT478, VT480, VT482, VT484, VT486, VT488, VT490, VT492, VT494, VT496, VT498, VT500, VT502, VT504, VT506, VT508, VT510, VT512, VT514, VT516, VT518, VT520, VT522, VT524, VT526, VT528, VT530, VT532, VT534, VT536, VT538, VT540, VT542, VT544, VT546, VT548, VT550, VT552, VT554, VT556, VT558, VT560, VT562, VT564, VT566, VT568, VT570, VT572, VT574, VT576, VT578, VT580, VT582, VT584, VT586, VT588, VT590, VT592, VT594, VT596, VT598, VT600, VT602, VT604, VT606, VT608, VT610, VT612, VT614, VT616, VT618, VT620, VT622, VT624, VT626, VT628, VT630, VT632, VT634, VT636, VT638, VT640, VT642, VT644, VT646, VT648, VT650, VT652, VT654, VT656, VT658, VT660, VT662, VT664, VT666, VT668, VT670, VT672, VT674, VT676, VT678, VT680, VT682, VT684, VT686, VT688, VT690, VT692, VT694, VT696, VT698, VT700, VT702, VT704, VT706, VT708, VT710, VT712, VT714, VT716, VT718, VT720, VT722, VT724, VT726, VT728, VT730, VT732, VT734, VT736, VT738, VT740, VT742, VT744, VT746, VT748, VT750, VT752, VT754, VT756, VT758, VT760, VT762, VT764, VT766, VT768, VT770, VT772, VT774, VT776, VT778, VT780, VT782, VT784, VT786, VT788, VT790, VT792, VT794, VT796, VT798, VT800, VT802, VT804, VT806, VT808, VT810, VT812, VT814, VT816, VT818, VT820, VT822, VT824, VT826, VT828, VT830, VT832, VT834, VT836, VT838, VT840, VT842, VT844, VT846, VT848, VT850, VT852, VT854, VT856, VT858, VT860, VT862, VT864, VT866, VT868, VT870, VT872, VT874, VT876, VT878, VT880, VT882, VT884, VT886, VT888, VT890, VT892, VT894, VT896, VT898, VT900, VT902, VT904, VT906, VT908, VT910, VT912, VT914, VT916, VT918, VT920, VT922, VT924, VT926, VT928, VT930, VT932, VT934, VT936, VT938, VT940, VT942, VT944, VT946, VT948, VT950, VT952, VT954, VT956, VT958, VT960, VT962, VT964, VT966, VT968, VT970, VT972, VT974, VT976, VT978, VT980, VT982, VT984, VT986, VT988, VT990, VT992, VT994, VT996, VT998, VT1000	£2.50			
30 Watt 220/100 Volts SOLDERING IRON £3.50	VT4000/4200/5000/5500	£15.00		AG-6800/6810	£25.00			VT11, VT13, VT15, VT18, VT20, VT22, VT24, VT26, VT28, VT30, VT32, VT34, VT36, VT38, VT40, VT42, VT44, VT46, VT48, VT50, VT52, VT54, VT56, VT58, VT60, VT62, VT64, VT66, VT68, VT70, VT72, VT74, VT76, VT78, VT80, VT82, VT84, VT86, VT88, VT90, VT92, VT94, VT96, VT98, VT100	£2.50			
40 Watt 220/100 Volts SOLDERING IRON £3.50	VT4000/4200/5000/5500	£15.00		AG-6100/6200/6300	£30.00			VT11, VT13, VT15, VT18, VT20, VT22, VT24, VT26, VT28, VT30, VT32, VT34, VT36, VT38, VT40, VT42, VT44, VT46, VT48, VT50, VT52, VT54, VT56, VT58, VT60, VT62, VT64, VT66, VT68, VT70, VT72, VT74, VT76, VT78, VT80, VT82, VT84, VT86, VT88, VT90, VT92, VT94, VT96, VT98, VT100	£2.50			
60 Watt 220/100 Volts SOLDERING IRON £3.50	VT4000/4200/5000/5500	£15.00		AG-6100/6200/6300	£30.00			VT11, VT13, VT15, VT18, VT20, VT22, VT24, VT26, VT28, VT30, VT32, VT34, VT36, VT38, VT40, VT42, VT44, VT46, VT48, VT50, VT52, VT54, VT56, VT58, VT60, VT62, VT64, VT66, VT68, VT70, VT72, VT74, VT76, VT78, VT80, VT82, VT84, VT86, VT88, VT90, VT92, VT94, VT96, VT98, VT100	£2.50			
SOLDERING IRON STAND		HINARI		N.E.C.		VCR		PINCHROLLERS				
SOLDERING STAND (Made by ANTEX) £2.80		VXL2/VXL3/VXL4/VXL20/VXL25/VXL35	£11.50	N9011/N9012/N9013/N9014/N9015/N9016/N9017/N9018/N9019/N9020/N9021/N9022/N9023/N9024/N9025/N9026/N9027/N9028/N9029/N9030/N9031/N9032/N9033/N9034/N9035/N9036/N9037/N9038/N9039/N9040/N9041/N9042/N9043/N9044/N9045/N9046/N9047/N9048/N9049/N9050/N9051/N9052/N9053/N9054/N9055/N9056/N9057/N9058/N9059/N9060/N9061/N9062/N9063/N9064/N9065/N9066/N9067/N9068/N9069/N9070/N9071/N9072/N9073/N9074/N9075/N9076/N9077/N9078/N9079/N9080/N9081/N9082/N9083/N9084/N9085/N9086/N9087/N9088/N9089/N9090/N9091/N9092/N9093/N9094/N9095/N9096/N9097/N9098/N9099/N9100	£11.00		N9011/N9012/N9013/N9014/N9015/N9016/N9017/N9018/N9019/N9020/N9021/N9022/N9023/N9024/N9025/N9026/N9027/N9028/N9029/N9030/N9031/N9032/N9033/N9034/N9035/N9036/N9037/N9038/N9039/N9040/N9041/N9042/N9043/N9044/N9045/N9046/N9047/N9048/N9049/N9050/N9051/N9052/N9053/N9054/N9055/N9056/N9057/N9058/N9059/N9060/N9061/N9062/N9063/N9064/N9065/N9066/N9067/N9068/N9069/N9070/N9071/N9072/N9073/N9074/N9075/N9076/N9077/N9078/N9079/N9080/N9081/N9082/N9083/N9084/N9085/N9086/N9087/N9088/N9089/N9090/N9091/N9092/N9093/N9094/N9095/N9096/N9097/N9098/N9099/N9100	£11.00				
SPARE SPONGE £0.56		VXL5/V20H	£18.00									
		VXL7	£22.00									
		VXL8/VXL9/VXL10/VXL11/VT100	£18.50									
		VXL12	£22.00									
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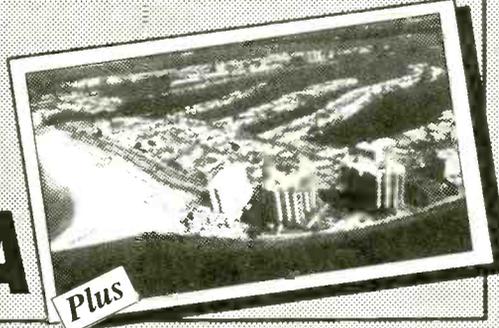
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LAST DATES FOR RECEIPT OF ENTRIES: Competition 3: August 10th. Competition 4: August 29th.

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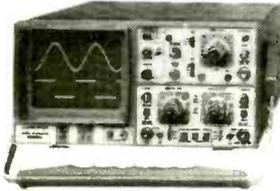
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HM203-7 20MHz STANDARD



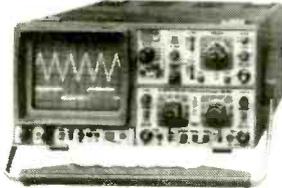
- SPECIFICATION**
- 2 Channels
 - Bandwidth: DC - 20MHz
 - Sens: Ch.1, Ch.2, 1mV/cm
 - Timebase: 0.1s - 20ns/cm
 - Triggering: DC - 40MHz
 - Active TV - Sync - Separator
 - Variable hold-off
 - Trigger LED indicator
 - Calibrator: 1KHz Square wave
 - Component tester
 - Plus many features

Price £338.00 + £59.15 V.A.T. FREE Specialist Carrier Delivery

SPECIFICATIONS

- 2 Channels
- Bandwidth: DC - 60 MHz
- Sens: Ch.1, Ch.2, 1mV/cm
- Timebase: 2.5s - 5ns/cm
- Triggering: DC - 80MHz
- Active TV - Sync - Separator
- After delay trigger
- Sweep delay
- Delay line
- Trigger LED indicator
- Calibrator: 1KHz & 1MHz Sq. Wave
- Component tester

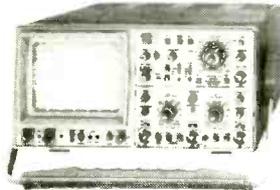
HM604 60MHz UNIVERSAL



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HM1005 100MHz UNIVERSAL

3 CHANNELS - UP TO 6 TRACES



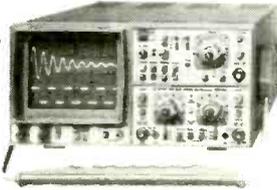
- SPECIFICATION**
- 3 Channels
 - Bandwidth: DC - 100MHz
 - Sens: Ch.1, Ch.2, Ch.3, 1mV/cm
 - Timebase A: 2.5s - 5ns/cm
 - Timebase B: 0.2s - 5ns/cm
 - Triggering DC - 130MHz
 - After delay trigger
 - Delay line
 - Trigger LED indicator
 - Overscan LED indicator
 - Active TV - Sync - Separator
 - Calibrator: 1KHz & 1MHz Sq. Wave

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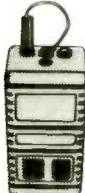
HM205-3 20MHz DIGITAL STORAGE

SPECIFICATION

- Digital Storage
- Analogue real time (Same as 203-7)
- Bandwidth: DC - 20MHz
- Sens: Ch.1, Ch.2, 1mV/cm
- Timebase Digital: 5s-1µs/cm
- Triggering DC - 40MHz
- Active TV - Sync - Sampling
- Max sampling rate: 2 x 20MHz
- Memory: 2 x 2048 x 8 Bit
- Dot joiner
- Printer/plotter output



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Price £34.00 + £5.95 V.A.T.

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- High accuracy.
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- LCD display.
- 8 ranges.
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- Full scale +/- 1 digit.
- Inc. protective case.



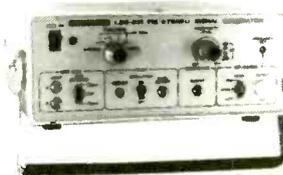
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At last! A generator specifically designed for testing and fault finding on FM stereo and monaural VHF receivers including stereo multiplex circuits.

FEATURES

- Carrier frequency 100 +/- 1MHz (adjustable).
- Output level 0.1mV - 10mV.
- Pilot signal 19KHz +/- 2Hz.
- L & R separation over 50dB.
- External Modulation 50Hz - 15KHz.
- Pre-emphasis 50µs, 75µs & off.
- Comprehensive test lead set included.
- Mains powered.
- Size: 80 x 200 x 250mm.



Price £299.00 + £52.33 V.A.T.

LEADER HIGH VOLTAGE METERED EHT PROBE

Light weight, easy-to-grip high-impact plastic handle with arc-over protection and no need of extra equipment. An indispensable item in your TV service kit. Measures up to 40kV DC with safety and the greatest of ease. Entirely self-contained. Connect the lead clip to chassis and probe tip to the check point, read the meter for voltage.

A must for the Health and Safety at Work Acts. Price £66.00 + £11.55 V.A.T.



B & K PRECISION CRT ANALYSER-RESTORER

The number one CRT Test Instrument. Over 5000 U.K. Television engineers wouldn't be without it.



- All CRT's checked identically, including all in-line and one gun types
- Tests all three guns of colour CRT's simultaneously under actual operating conditions (model 490)
- Exclusive multiplex technique (model 430)
- Measure true dynamic beam current that actually passes through G1 aperture to screen
- Measures all shorts and leaks - preserving more CRT's
- Tests focus electrodes lead continuity finding faults that other testers miss
- Uses most powerful restoration method known with minimum danger to CRT
- Rejuvenated CRT's guaranteed as new for two years
- Obsolescence proof - perpetual set up chart updated and new adaptors developed
- Tests and rejuvenates VDU's and oscilloscope tubes
- A range of over 40 CRT base adaptors available
- Increase profit
- Pays for itself in months.

Prices

Model 490 Tri-dynamic three meter instrument inc. 6 common adaptors	£509.00 + £89.08 V.A.T.
Without adaptors	£446.00 + £78.05 V.A.T.
Model 480 Single meter instrument inc. 6 common adaptors	£375.00 + £62.63 V.A.T.
Without adaptors	£310.00 + £54.25 V.A.T.

SADELTA SIGNAL STRENGTH METERS

The Sadelta Field Strength Meters have been designed to facilitate the dish alignment of satellite TV systems and aerial alignment of VHF/UHF television and radio systems. Signal levels can be accurately measured on the TC402-C and the TC90, allowing the evaluation of signal conditions for satisfactory operation. Both models have a clear LCD direct frequency readout, coupled to a multiturn tuning control enabling precise channel identification.

TC402-C VHF & UHF

FEATURES

- Three bands:
 - Low VHF: 45-110MHz
 - High VHF: 110-300MHz
 - UHF: 470-862MHz
- Digital display for direct frequency readout.
- Built-in monitor loudspeaker AM/FM.
- Signal measurement from 20µV to 100mV.
- Powered by eight 1.5 AA batteries.
- Fully portable with sturdy carrying case.



Price £259.00 + £45.33 V.A.T.

TC90 VHF-UHF-SAT.

FEATURES

- Five bands:
 - Low VHF: 45-110MHz
 - High VHF: 110-300MHz
 - Hyper VHF: 300-470MHz
 - VHF: 470-862MHz
 - Satellite: 950-1750MHz.
- Digital display for direct frequency readout.
- Signal measurement VHF/UHF 20µV to 3V.
- Signal measurement satellite -70dBm to -10dBm.
- Audible indication of satellite signal level.
- Built-in-monitor loudspeaker AM/FM (not satellite).
- Powered by rechargeable battery (complete with charger 220/240V AC).
- Fully portable with sturdy carry case.



Price £499.80 + £87.47 V.A.T.

BLACK STAR COLOUR PATTERN GENERATOR

THE 'ORION' THREE-IN-ONE

PAL VHF/UHF - PAL VIDEO COMPOSITE - R.G.B.

The Orion is a compact, bench instrument offering a wide range of patterns and facilities at a truly low cost.

In addition to a switchable sound carrier facility which allows use with the majority of PAL TV systems, the Orion provides highly flexible RGB outputs, ensuring compatibility with most video monitors.

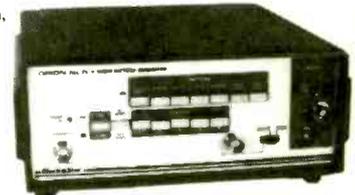
More than 50 pattern combinations can be selected, including those for testing static and dynamic divergence, video amplifier linearity, colour purity, general colour performance, focus etc.

A separate video input to modulate camera signals; fully variable RF and video output levels facilitating AGC testing; trigger output allowing easy triggering of difficult oscilloscope waveforms; external sound modulation input via DIN connector for frequency response testing of TV sound systems; adjustable wide frequency coverage of VHF and UHF TV bands.

Just some of the features making the Orion Pattern Generator an indispensable tool in the manufacture, test, and servicing of televisions, and computer and video monitors.

FEATURES

- Colour bars, purity, greyscale, crooshatch, dots, focus, etc.
- VHF/UHF Channels.
- 5.5MHz, 6.0MHz, 6.5MHz Sound Carriers.
- Internal/External Sound.
- External Video Output.
- Trigger Output.
- PAL B,D,G,H,I,K.
- Separate R, G, B and sync. O/P's.
- RGB @ TTL & 1V.
- Green + 0.3V Syncs.
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- Mains powered 220/240V AC 50/60Hz.
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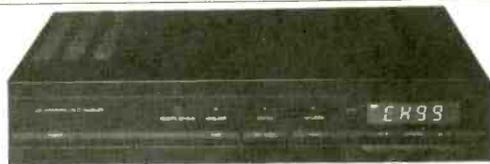


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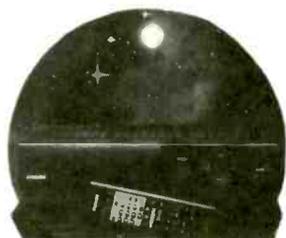
* The JSR3300 is a multi-satellite receiver which comes with a dish drive unit



AMSTRAD SRD500



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Specially imported by EEC

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		TA7299	350p	25A-798	55p	25B-566	110p	25C-1399	60p	25D-2427	80p	25E-531	20p
		TA8201	350p	25A-798	55p	25B-566	110p	25C-1399	60p	25D-2427	80p	25E-532	20p
		TA8205	350p	25A-811	15p	25B-568	80p	25C-1413	240p	25D-2458	30p	25E-533	20p
		TA8210	350p	25A-844	15p	25B-596	75p	25C-1417	20p	25D-2462	40p	25E-534	20p
		TA8215	350p	25A-854	50p	25B-597	50p	25C-1445	250p	25D-2500	30p	25E-535	20p
		TA8215	590p	25A-861	50p	25B-597	50p	25C-1445	250p	25D-2500	30p	25E-536	20p
		TA8215	140p	25A-872	20p	25B-631	40p	25C-1446	60p	25D-2501	85p	25E-537	20p
		TA8216	275p	25A-893	10p	25B-632	40p	25C-1447	75p	25D-2502	90p	25E-538	20p
		TA8216	275p	25A-896	35p	25B-633	50p	25C-1454	320p	25D-2537	450p	25E-539	25p
		TA8217	150p	25A-899	60p	25B-641	20p	25C-1473	30p	25D-2546	20p	25E-540	25p
		TA8218	250p	25A-900	35p	25B-643	20p	25C-1474	45p	25D-2550	70p	25E-541	25p
		TA8219	100p	25A-905	20p	25B-644	25p	25C-1475	45p	25D-2555	150p	25E-542	25p
		TA8220	130p	25A-915	30p	25B-647	30p	25C-1507	50p	25D-2564	230p	25E-543	25p
		TA8220	130p	25A-916	30p	25B-648	55p	25C-1509	45p	25D-2565	260p	25E-544	25p
		TA8220	130p	25A-917	35p	25B-649	40p	25C-1514	40p	25D-2570	50p	25E-545	25p
		TA8220	340p	25A-921	10p	25B-673	10p	25C-1520	85p	25D-2575	25p	25E-546	25p
		TA8220	200p	25A-940	50p	25B-681	250p	25C-1550	60p	25D-2577	125p	25E-547	25p
		TA8220	250p	25A-950	25p	25B-686	120p	25C-1567	60p	25D-2579	130p	25E-548	25p
		TA8220	575p	25A-958	70p	25B-688	130p	25C-1568	60p	25D-2581	175p	25E-549	25p
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		TA8220	350p	25A-965	25p	25B-716	30p	25C-1584	600p	25D-2603	20p	25E-552	25p
		TA8220	300p	25A-966	25p	25B-717	70p	25C-1627	30p	25D-2611	40p	25E-553	25p
		TA8220	200p	25A-968	70p	25B-718	70p	25C-1667	150p	25D-2631	40p	25E-554	25p
		TA8220	250p	25A-978	30p	25B-738	30p	25C-1669	85p	25D-2634	40p	25E-555	25p
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		TA8220	400p	25A-992	30p	25B-757	350p	25C-1677	80p	25D-2753	50p	25E-558	25p
		TA8220	395p	25A-1015	20p	25B-764	25p	25C-1708	20p	25D-2781	50p	25E-559	25p
		TA8220	375p	25A-1016	20p	25B-772	45p	25C-1722	60p	25D-2785	50p	25E-560	25p
		TA8220	250p	25A-1048	20p	25B-792	20p	25C-1756	40p	25D-2791	325p	25E-561	25p
		TA8220	300p	25A-1020	35p	25B-793	35p	25C-1758	50p	25D-2792	275p	25E-562	25p
		TA8220	500p	25A-1060	90p	25B-817	200p	25C-1760	85p	25D-2944	175p	25E-563	25p
		TA8220	300p	25A-1062	125p	25B-837	60p	25C-1775	20p	25D-3078	40p	25E-564	25p
		TA8220	180p	25A-1094	190p	25B-856	60p	25C-1815	15p	25D-3156	325p	25E-565	25p
		TA8220	400p	25A-1095	275p	25B-857	60p	25C-1819	50p	25D-3179	200p	25E-566	25p
		TA8220	399p	25A-1102	180p	25B-857	60p	25C-1819	50p	25D-3179	200p	25E-567	25p
		TA8220	210p	25A-1104	200p	25B-861	60p	25C-1845	70p	25D-3182	175p	25E-568	25p
		TA8220	220p	25A-1106	200p	25B-866	65p	25C-1846	45p	25D-3298	140p	25E-569	25p
		TA8220	248p	25A-1110	60p	25B-789	50p	25C-1848	45p	25D-3298	140p	25E-570	25p
		TA8220	40p	25A-1123	40p	25C-790	80p	25C-1875	260p	25D-3306	250p	25E-571	25p
		TA8220	250p	25A-1141	200p	25C-815	15p	25C-1890	20p	25D-3281	299p	25E-572	25p
		TA8220	350p	25A-1142	60p	25C-828	25p	25C-1906	30p	25D-198	180p	25E-573	25p
		TA8220	199p	25A-1145	190p	25C-829	20p	25C-1909	250p	25D-200	210p	25E-574	25p
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		TA8220	190p	25A-1156	60p	25C-829	20p	25C-1914	30p	25D-235	40p	25E-576	25p
		TA8220	525p	25A-1160	200p	25C-941	25p	25C-1922	275p	25D-288	80p	25E-577	25p
		TRANSISTORS	80p	25A-1220	50p	25C-945	20p	25C-1923	20p	25D-299	160p	25E-578	25p
		TIPI791A	80p	25A-1232	175p	25C-959	85p	25C-1941	40p	25D-313	40p	25E-579	25p
		BUT11AF	120p	25A-1262	85p	25C-984	40p	25C-1942	190p	25D-315	75p	25E-580	25p
		BUT11A	85p	25A-1265	150p	25C-998	30p	25C-1962	30p	25D-325	210p	25E-581	25p
		BUT156A	120p	25A-1282	35p	25C-1162	35p	25C-1969	160p	25D-331	80p	25E-582	25p
		BUS808AF	100p	25A-1302	299p	25C-1172	150p	25C-1980	25p	25D-400	20p	25E-583	25p
		BUS808DF	130p	25B-507	100p	25C-1173	45p	25C-1986	60p	25D-401	50p	25E-584	25p
		S2000AF	150p	25B-511	100p	25C-1195	200p	25C-2003	60p	25D-414	40p	25E-585	25p
		S2055AF	150p	25B-516	80p	25C-1212	60p	25C-2009	25p	25D-421	150p	25E-586	25p
		S6613	550p	25B-512	100p	25C-1213	60p	25C-2022	60p	25D-424	350p	25E-587	25p
		25A473	35p	25B-514	100p	25C-1214	40p	25C-2026	45p	25D-427	300p	25E-588	25p
		25A673	30p	25B-528	40p	25C-1226	75p	25C-2068	50p	25D-428	300p	25E-589	25p
		25A677	60p	25B-531	200p	25C-1306	75p	25C-2073	50p	25D-438	45p	25E-590	25p
		25A683	25p	25B-534	200p	25C-1317	25p	25C-2120	15p	25D-461	100p	25E-591	25p
		25A684	45p	25B-537	60p	25C-1318	25p	25C-2153	40p	25D-468	25p	25E-592	25p
		25A697	35p	25B-544	60p	25C-1327	20p	25C-2229	25p	25D-471	30p	25E-593	25p
		25A715	35p	25B-545	150p	25C-1328	25p	25C-2230	30p	25D-476	60p	25E-594	25p
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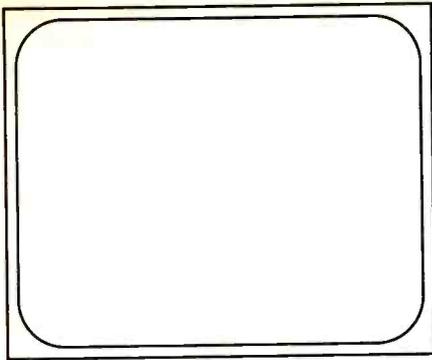
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TELEVISION

Excessive Pessimism?

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COVER PHOTO

This month's cover photograph shows a set fitted with the Ferguson TX90 chassis: see servicing article on pages 786-791.



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It seems that this column has a bit of a reputation for being pessimistic. Well, the situation over the past couple of years hardly justifies anything else: one prolonged, deep recession. There can be no point in pretending that things are other than they are. But your committed pessimist will be pointing to the dangers ahead when others are making the best of the good times. When might a bit of optimism be justified?

There's no little bell that rings to tell us that an upturn has started - likewise no little bell indicates that the peak of an expansionary period has been reached. It's often very difficult to tell when an economy has started to move from one state to the other. The experiences of different firms can vary widely. Some firms continue to do well even when conditions are extremely difficult. Alba for example managed to achieve a twenty per cent profit increase in the year ending on March 31st, with just a very small decrease in turnover. Profits would have been up 73 per cent had not Hinari Deutschland, which has now been closed down, contributed a substantial loss. In the UK the Alba, Bush and Hinari brands all recorded strong performances. But Alba is the exception and no one seems to be particularly optimistic just now. One problem in assessing the situation at any point in time is the fact that the statistics are always out of date. They tell us roughly what was happening say a couple of months ago, not what's happening right now let alone what might be happening in a couple or six months' time. Government and other forecasters take these lagging indicators and project them forwards. That's one reason why they make so many mistakes, some really bad. This is why greater emphasis is nowadays being placed on surveys carried out by organisations such as the CBI. At least businessmen should know what the current state of their order books is, what enquiries they are getting that are likely to lead to future business and how their stocks stand. But their guesses about what the situation will be like in say six months' time are unlikely to be much better than anyone else's. And like anyone else they can be pessimistic, especially when the hoped-for upturn continues to falter.

Company news of late has not been exactly encouraging. Dixons reported a profit fall of fourteen per cent for the year to May 2nd, but this was largely due to the extraordinarily difficult conditions experienced by its US offshoot Silo. In the UK Dixons recorded an increase of a third in operating profits to £71.9m on sales eleven per cent higher at £1.2bn. Sales of consumer electronic products in general remained weak, the improvement being seen in computer games, business computers and camcorders. Now for the pessimistic bit. In January Stanley Kalms reported that consumers in some parts of the country were showing considerable enthusiasm, with sales increases running in the "mid-teens". In early July he reported that sales over the previous nine weeks had weakened, though they were still "slightly ahead" of last year. He saw no real signs of any sustained economic upturn in either the UK or the USA.

Dixons may have done reasonably well out of computers but for Amstrad this has been something of a disaster area, largely responsible for losses that are likely to be around £65m in the year to June 30th against taxable profits of some £20m in the previous year. The company mentions plummeting personal computer prices and weak demand. It did well on the satellite TV front however, selling some 950,000 receivers during the year, but expects to remain in overall loss in the coming year to June 1993.

The High Street has seen little improvement in trading conditions so far. With interest rates remaining high and the chance of mortgage rate increases, also a continuing increase in unemployment, there is little reason to expect much of an improvement in the immediate future. One problem is that lack of consumer confidence tends to be a self-sustaining factor. Purchases put off represent poorer prospects for others' incomes. This feeds through to the banks who see poorer business prospects and in consequence become increasingly reluctant to lend as their worries about being paid back increase, and so on. It's all too easy to be pessimistic.

The main cause of all this worry is the excessive borrowing that occurred during the last boom, much of it based on expectations arising from asset inflation (rising house prices), a factor that's gone into reverse. This sort of thing corrects itself eventually. The problem is the damage that occurs in between the start of a recession and the start of an upturn. Things tend to get progressively worse the longer it takes for the upturn to start. Once it does, the mood can change rapidly and dramatically. It's then that us pessimists start to worry about when things will get worse again!

TV Fault Finding

Reports from Philip Blundell, AMIEE, John C. Priest, Ed Rowland, John Edwards, Stephen Leatherbarrow, Michael Dranfield, Roger Burchett, Roy S. Porter, J.S. Ruwala, Adrian Farnborough and S.R. Dixon

Philips CP90 Chassis

This set was dead with no activity at all from the power supply. Initial checks showed that there were no short-circuits across the outputs, also that there was no start-up voltage (normally 2.1V) at the collector of transistor 7673 in the chopper control circuit. This transistor was being turned on because the optocoupler was leaky. A new CNX62 restored normal operation.

P.B.

Grundig CUC720

The job card said "on/off switch faulty". It wasn't, of course, though the power supply was dead. There was 300V at the collector of the chopper transistor and needle drive pulses were present, but there was no output to speak of – about 2V on the 150V line. Voltage checks around the TDA4600 chopper control chip showed that the 4.3V reference voltage at pin 1 was missing. C642 (100µF) was open-circuit.

P.B.

Philips 2A Chassis

Here's a cautionary tale – don't always believe the circuit diagram! This set had been to another dealer because it was dead. He had solved that problem but then found that the picture was too wide and couldn't be adjusted. He'd tried everything! The line output transformer, coils 5601 and 5611 and all the capacitors in the relevant sections of circuit had been replaced. The resistors had all been removed and checked out of circuit. The transistors in the EW correction circuit had also been replaced.

To check that the correct parts had been fitted I compared the faulty set with a stock one. The stock set didn't have a capacitor in the 2608 position. When this capacitor was removed from the faulty set the picture size was brought back to normal. Just because a capacitor is shown in the circuit diagram doesn't mean that it was fitted in later production!

P.B.

Toshiba 285T8BZ

Here's a warning about jumping to conclusions. We had two of these sets in with very similar fault symptoms but different causes. The first one came in under warranty with acute field overscan – about 200 per cent. Even with the vertical amplitude control turned to minimum the field scan was excessive to the extent of about 50 per cent. The linearity wasn't much to write home about either, with cramping at the bottom of the screen. A look at the circuit diagram showed that the TA8659N chip IC501 on the main board is responsible for most of the signal processing. It produces field drive pulses at pin 29 for feeding to pin 1 of the TDA8170 field output chip IC303 on the power/deflection panel. Height and linearity are controlled by feedback to pins 31 and 32 respectively of IC501 from RC networks in the scan current path. There's a height control (R351) connected to pin 31 but no linearity control.

Our first suspects were the zener diodes D814 and D815 connected to pins 29 and 31 of IC501. I've had them cause scan problems in other Toshiba chassis but this time they

were o.k. The voltages at pins 31 and 32 were low, pin 32 being at 2.7V instead of 6.6V. As the components in the feedback network all seemed to be o.k. when checked I began to suspect IC501 itself. As this is a 64-pin device however I decided to check IC303 and its few peripheral components first. All were o.k. After a brief word with Toshiba to confirm my suspicions I ordered a replacement TA8659N chip. Fitting this restored correct field scan amplitude and linearity.

The second set came in a few days later. We were about to order another TA8659N chip when we noticed that this time the overscan wasn't quite so bad – only about 150 per cent. So we started to check the discrete components. Everything was all right until we came to transistor Q363 (BC547A) on the power panel. Its emitter voltage was high at 6.6V instead of 0.3V. When it was removed for test we found that there was emitter-collector leakage. A new transistor restored normal operation. One odd thing: the circuit shows that there's a direct connection between the collector of this transistor and pin 31 of IC501, but under the fault condition there was a difference of nearly 0.5V between the two points though a cold resistance check produced a reading of zero ohms.

J.C.P.

Cathay CTV3000

The owner of this colour portable complained that the picture had been distorted since we repaired his VCR. On test we found that the sound was o.k. but there were two hum bars on the screen. It was nothing to do with the VCR of course. Replacing the main smoothing block C507 (100µF, 400V) cured the fault.

E.R.

Ferguson TX9 Chassis

This old set produced a perfectly good picture but the sound was badly distorted. Experience suggested that this was quadrature trouble: slight adjustment of L62 restored normal sound.

E.R.

Akai CT2870

Results were perfectly all right when this set was switched on. After about half an hour however it developed crackling on sound. An assault on suspect components with a can of freezer suggested that the APU2470T chip IC3201 was the culprit. There was no further trouble after we'd fitted a replacement.

E.R.

Hitachi CPT2240

No sound was the result of R462 (22Ω) having gone open-circuit.

E.R.

Saisho CT149TXA

This fault caused some consternation with much meeting of eyebrows. The basic problem was intermittent failure to start from cold. Checks showed that at switch on the line drive waveform was of low amplitude and distorted. You

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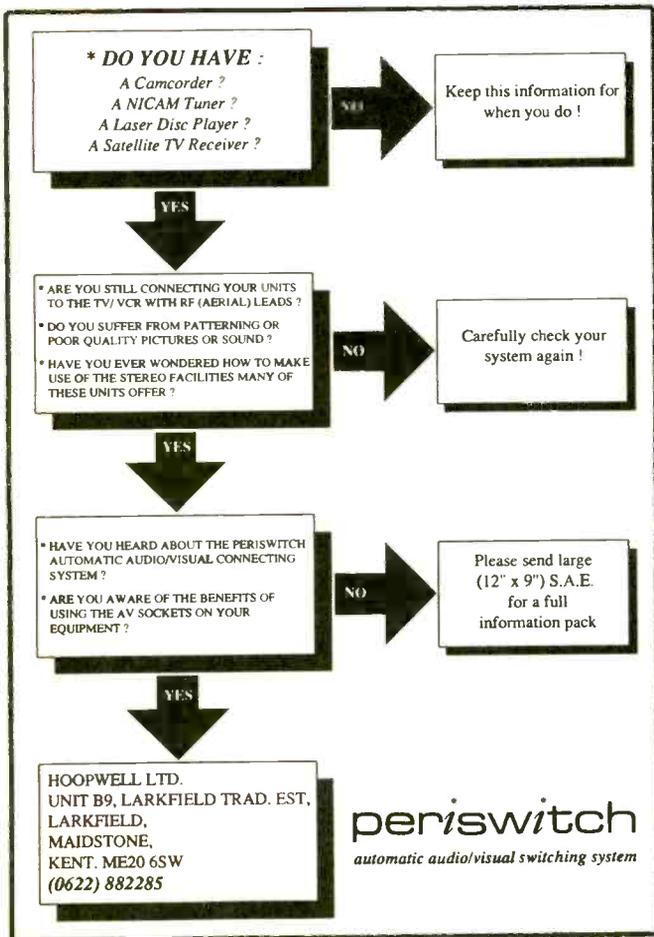
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could then see it slowly correct itself in both shape and amplitude. The cause of the trouble was R414. Heating and freezing it altered the value from the normal 15k Ω by some 5k Ω .
S.L.

Ferguson TX100 Chassis

This set was fitted with the PC1564-311 remote control/sweep tune panel. The fault was no signals, with the 30V rail measuring just that. Tuning is carried out by the M293B1 chip IC2001 which has a 455kHz crystal connected across pins 13 and 14. The crystal oscillator was working normally and the two 5V regulators on the panel were both o.k. The next check should be at pin 19, which was ramping correctly under the action of the tuning system. A check on transistor TR2018, which produces the tuning voltage from this ramp, proved that it was open-circuit. A BC639 turned out to be a suitable replacement.

While the channels could now be tuned in, pressing the store button made them disappear again! I eventually found that there was a splash of solder across pins 5 and 6 of PL175. This effectively shorted pins 22 and 24 of IC2001 when store was pressed, initiating the search down command. Some stupid engineer had probably done this when he changed TR2018. We get there in the end – sometimes.
S.L.

Hinari CT5

The usual cause of a dead set is failure of the remote/standby supply transformer. This set was no exception but after fitting a replacement we found that it was stuck on ch. 8 and that no analogue or tuning functions worked. The relevant circuitry is mounted on the front panel, which is a real pain to remove and refit and just about impossible to work on. The cause of the trouble was several open-circuits between the front panel and the small analogue function panel to which it is, or should be, hard wired.
S.L.

Finlux 51590

The fault on this set, which uses the TDA4600 type power supply, would put in an appearance about ten minutes after it had been switched on. The set would then either trip and go dead or the picture size would reduce after which the set would go dead. We found that CU15 (100 μ F, 50V) was open-circuit. It's one of the yellow electrolytics that regularly cause problems in Grundig chassis. In view of this I decided to change the other 100 μ F capacitor of the same type in the power supply (CU13).
S.L.

Toshiba 210R6B

Dry-joints on the scan coil plug (socket connections to the main PCB) seem to be common on these sets.
R.B.

Rediffusion Mk 3 Chassis

The fault was intermittent absence of the signals, curable by a good thump on the cabinet. Not an unusual fault, but we'd spent some time resoldering the power supply and line scan panels as the original report was that the set was dead. Plug and socket OPLA on the signals panel was next accused. We cleaned and resoldered it but the owner still had to resort to a good thump occasionally. What finally seems to have cleared the fault is to have cleaned the pins and the holder of the TCA270S demodulator chip 01C1.

With another of these sets the cause of intermittent fuse blowing was traced to poor joints on the commutating coil in the thyristor line output stage.
R.B.

Sony 21XMU (AE1 Chassis)

There was sound but no picture. When the first anode voltage was varied a faint picture was noticed at one point but it then disappeared. We found that the RGB signals were missing at the c.r.t. base panel. Lots of tests were then carried out on board B. The sandcastle and blanking pulse waveforms were both present and correct. When we checked the beam limiter circuit we found that transistor Q801 wasn't conducting, its collector being at 12V while its base was at -2.4V. Bias resistor R812 (68k Ω) turned out to be open-circuit.

You get a similar fault with the Ferguson TX90 chassis when R231 (150k Ω) goes open-circuit. The symptom is very low contrast however. On Sony sets diagnosis is more difficult as the fault tends to cut off the picture completely.
J.S.R.

JVC 7255UB

The symptom with this set was excessive brightness with flyback lines. The picture was very faint and dull. Turning the first anode voltage down made no difference. On checking the collector voltages of the RGB output transistors we found that they were all very low at 60V even with no signal. Feed resistor R831 (47 Ω) in the supply had gone very high in value, a replacement curing the fault.
J.S.R.

Bush 2521T

This set displayed a faint blank raster with flyback lines, noticeable only when the first anode supply was at maximum. Changing the TDA3561A colour decoder chip IC500 made no difference so the service manual was ordered. It was of little help as it gave only the supply voltages and alignment waveforms. The technical description was also poor. After spending considerable time elsewhere in the circuitry and contacting Bush Technical we replaced IC500 again. The blank raster was now much brighter. A check on the voltages at the output plug K501 then revealed that there was no connection to chassis at pin 5 – the reading here was 11.5V. We found that there was a dry-joint on an earthing link connected to this pin. As a result IC500 had been destroyed. Repair and replacement solved our headache.
S.R.D.

ITT Monoprint B Chassis

Having been left off overnight this set wouldn't power up without multiple pressings of the on/off switch. The TEA2165 chopper control chip IC701 (TEA2162 in some versions) was shutting down because of inadequate negative bias at pins 4 and 5. C704 (47 μ F) was the cause, being unsatisfactory at low temperatures. You could see the ripple across it change when freezer was applied.

Three months later the symptom reappeared. This time the mains bridge rectifier's reservoir capacitor C701 (4.7 μ F) was found to have 100V peak-to-peak across it when cold, a replacement curing the fault.
R.S.P.

Mitsubishi CT2146TX (Euro 6 Chassis)

We've sold a substantial number of these sets and have found them to be reliable. One came back recently however with a peculiar fault. The symptoms were intermittent shut-

down and a poor response or none at all to commands from the remote control handset. When we ran the set on the bench we found that it seemed to have two modes of operation. In one mode it would run normally, with everything functioning. It would then shut down and come on again, after which the remote control system didn't work. We noticed that the on-screen graphics were corrupted in this latter mode.

We made a start by carrying out checks around the microcontroller chip IC701. As the 5V supply at pin 52 had ripple on it we added a small decoupling electrolytic. This cleaned up the graphics and the remote control system now worked perfectly. So we went back to the 5V regulator chip IC951. After disconnecting our temporary electrolytic we heated and froze IC951. This enabled us to make the fault come and go at will. IC951 was therefore replaced and the set ran perfectly for a week. The symptoms then returned, exactly as before. Once again the regulated 5V supply was found to be low with ripple on it. On probing around the 5V standby supply we found that C960, the reservoir capacitor that provides the input for IC951, was dry-jointed. Fitting a replacement provided a complete cure. **A.F.**

Toshiba 285T8BZ

The symptoms with this set were reduced width and line foldover, accompanied by an arcing sound. The fault could be rectified by tapping the cabinet. A visual check on the power supply/deflection panel showed that there was noticeable discoloration beneath the line scan correction capacitor C363. So C363 was refitted in conveniently placed adjacent holes. This seemed to provide a complete cure – or did it? The set worked until text was selected, revealing severe raster distortion. We then found that the controls associated with the TEA2031A EW scan correction control chip IC361 had no effect. Scope checks showed that a field-rate sawtooth waveform entered this chip, but there was no EW drive output at pin 5. This output drives the EW modulator diodes via the loading coil L362.

Full of confidence we ordered and fitted a new TEA2031A chip. But the symptoms remained as before. There was one slight change however: a most peculiar line-rate waveform, with no field-rate component, could be seen at pin 5 of the chip. Remembering problems with the EW modulator in the ITT CVC30 chassis we decided to remove L362 and recheck the waveform. It was now correct. So L362 could well be responsible for the problem. As we didn't have a replacement we hooked in an ITT loading coil (L24 from the CVC30 chassis) to prove the point. Everything now worked correctly. Close examination of L362's winding showed that there was slight darkening, but it was not very obvious. Fitting the correct replacement completed the job. One can only surmise that if the two faults were linked then the arcing associated with C363 had probably caused the failure of L362. **A.F.**

ITT CVC1200 Chassis

It's common to get a dead set with the on-board fuse blown because C701 (4.7 μ F, 350V) is short-circuit. **J.E.**

Philips 2A Chassis

A dead set with no standby or channel indicators alight is becoming a common fault. You find that the mains fuse and the 1 Ω surge limiter resistor 3654 are open-circuit while two of the bridge rectifier diodes, also the BUT11A chopper transistor 7687 and the CNX62 optocoupler 7668, are short-

circuit. After replacing these components check for a short-circuit reading across the 280V reservoir capacitor 2659. If all seems to be well the set can be switched on with confidence. On one occasion I found that the 1N4148 diode 6689 was also short-circuit. **J.E.**

Philips K40 Chassis

This set appeared to be dead though the power supply, on a separate PCB beneath the tube, was working. In fact the line timebase wasn't working as there was no drive from pin 11 of the TDA3576B timebase generator chip IC7200. Fitting a new TDA3576B put matters right. We've had the identical symptoms due to the line driver transistor's collector feed resistor being open-circuit. It's on the previously mentioned power supply PCB. When it goes open-circuit there's no voltage on the BF819 line driver transistor's metal collector tab: I mention this because it's a quick, easy check to make before getting too involved. **J.E.**

Alba CTV2

This set's power supply had destroyed itself. The BUV46A chopper transistor TR3 was short-circuit while resistors R97 (4.7 Ω), R92 (1.5 Ω), R93 (1.5 Ω), R86 (4.7 Ω) and R79 (4.7 Ω) were charred and open-circuit. The circuit I was able to obtain from Alba was so poor that the above component values had to be obtained by phone – no charge was made for it however. We replaced the TEA2018A chopper control chip IC5, checked all the diodes in the power supply circuit and fitted new resistors as necessary. When we switched the set on it worked normally and we were able to adjust the h.t. for the correct reading of 102V at the cathode of D17. Alba told me that they supply a power supply modification kit for this model. It contains TR3, IC5, numerous resistors and details of how to modify the circuit board. We ordered the kit in case we should need it but don't know how successful we'll be in using it as the circuit is again unreadable. **J.E.**

Ferguson TX100 Chassis

When we switched this set on the relay clicked but the set remained dead, with no standby or channel indicators alight. A check was made on the voltage at the collector of the BU508A line output transistor TR10. It was low at only 80V. The cause of the trouble was the 119V supply reservoir capacitor C121 (47 μ F, 160V). **J.E.**

Hitachi CPT2050 (Salora J Chassis)

The fault symptom was intermittent green faces. This chassis uses a TDA3562A colour decoder chip, with the PAL switching controlled by the sandcastle pulses. As the pulses didn't change when the fault was present we suspected the TDA3562A, but a replacement made no difference. Neither did replacement of the components connected to pin 2. While we were studying the fault we noticed that the field height increased when the ident dropped out. This was the clue that led us to the cause of the fault.

The TDA2653A field timebase chip detects the frequency of the sync pulses, either 50Hz or 60Hz, putting out a voltage at pin 12 to adjust the height and switch the colour decoder chip to NTSC operation as appropriate. For PAL operation the voltage at this pin must be zero. When it rises above 12V the set changes to NTSC operation. In this particular set the voltage at pin 12 varied intermittently. Fitting a new chip restored correct operation. **M.Dr.**

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the initial models the mains transformer is energised even when the set is switched off – beware of this if the guards are not in place). In most models FS101 and FS102 are situated on the body of the transformer, FS102 being on the top side and FS101 underneath. In the 20in. models FS102 is on panel PC1183 with the extra scan circuit components.

T101's secondary winding feeds two full-wave rectifier circuits. D120 and D123 develop about 90V across their reservoir capacitor C183. This unregulated supply is fed via L120 to the line output stage which develops a regulated 95V boost voltage and also a 150V supply for the RGB output transistors and the field driver transistor. The fact that regulation is carried out within the line output stage means that the 150V rail is also stabilised. The over-voltage circuit senses the 150V line. Should the voltage on the 150V line be excessive trip transistors TR109/110 conduct, shorting out the line drive. The trip resets automatically when the excess voltage condition has cleared.

The other two rectifier diodes D121/122 develop 18V across C181. This supply is used by the audio output stage. It's also fed to the 12V regulator whose output powers the small-signal parts of the receiver.

The Line Output Stage

The line output stage incorporates a regulated boost voltage generator circuit to stabilise the width and the e.h.t. This 95V supply is also used by the field output stage, thus stabilising the height. As the main circuit is a bit complicated, for the purposes of explanation Fig. 4 shows a simplified circuit of the line output stage.

TR112 is the line output transistor, D113 the shunt efficiency diode, D114 the series boost diode and C189 the boost reservoir capacitor. At the end of the forward scan TR112 is switched off by the line drive waveform. Following the line flyback pulse D113 and D114 conduct to produce the initial part of the forward scan. During this period C189 is charged by D114 in the conventional boost supply manner.

The circuit is designed to hold the 95V boost voltage stable over an input voltage range of 70-95V and compensate for load variations. With an input above 95V D109 will be forward biased, charging C189 and C191 directly. The switching transistor TR107 will be cut off. At the other extreme, with an input voltage of 70V, TR107 will conduct continuously and D109 will remain cut off. With 70V fed to the boost circuit C189 will be charged to 25V, i.e. a boosted supply of 95V will be produced across C191.

Between these two conditions TR107 is switched on for a longer/shorter time at line frequency to provide the regulating action. When it is switched on it provides a feed to C189/D114. When it's switched off, the action of L120 produces a positive pulse at TR107's collector. As a result D109 conducts, charging C189/191. The energy stored in L120 while TR107 is on is proportional to the "excess" voltage above the 70V level and TR107's conduction time. Thus by controlling the mark-space ratio of the drive at TR107's base the boost voltage is stabilised.

The control circuit uses TR111 as an error detector. It samples the boost voltage at its base, in turn setting TR108's base voltage. TR108 also receives at its base a line-frequency sawtooth waveform which is produced by the integrating action of R222/C186 on the flyback pulses. Thus TR108 acts as a pulse-width modulator, conducting at a point during the sawtooth set by TR111. When TR108 switches on TR107 switches off and vice versa.

A variac is useful when fault finding in this area. It may be essential. Note that the voltages quoted above apply to 14in. models. With 16in. sets the boost voltage is quoted as 97.5V

while for 20in. sets the figure given is 115V. The corresponding RGB etc. supply voltages are given as 160V and 175V respectively.

DC Powering

There's a facility for a battery converter/PSU, Model TA127A, to be fitted to portable versions of the chassis.

Fault Finding

Because of the compact, single-board chassis design, print breaks and dry-joints are frequent causes of faults. Check for these very carefully, especially with portable models that tend to live a rougher life. As the aerial socket is an integral part of the tuner a lot of plugging and unplugging will have stressed not only the socket and the tuner but much of the board. Time now for our extended faults list. It's based mainly on the 14in. version of these sets, so a bit of double checking may be required with the larger screen models, i.e. compare circuit diagrams!

Faults List

- (1) Field distortion or collapse, quite possibly intermittent:** Check for dry-joints at the field output transistors TR104 and TR105. Also check for print breaks around them. Since the supplies come from the line output transformer, check for dry-joints here, specifically at pins 5, 3 and 10. I've had thermal as well as complete breakdown of the field output transistors TR104/5. TR105 is more likely to fail. Note that it's a Darlington device, type TIP112H. I've seen non-Darlington devices fitted in error: the result is field foldover. Other things to check are D106 and D107 (1N4001 – D106 is a zener diode in the larger screen models) and the field scan coupling capacitor C171 (47 μ F).
- (2) Dead set, quite possibly intermittent:** The mains switch is a weak point in these sets. It can go open-circuit or lose its latching action. Dry-joints often develop, particularly with 14in. sets in which the switch is soldered to the main board. With these sets you may find small charred areas of the PCB. The switch can overheat, melt and catch fire, especially when the owner has tried to jam it because it wouldn't latch – matches often seem to be used!
- (3) Low contrast, with the d.c. levels at pins 4 (brightness) and 7 (contrast) of IC103 low:** The cause is excessive beam-current limiter action, usually because R231 (143k Ω or 150k Ω , 100k Ω or 110k Ω in larger screen sets) is open-circuit or high-resistance. Also check R232 (9.1k Ω or 8.2k Ω), R233 (470k Ω), C196 (47 μ F) and TR114 (BC307B).
- (4) Vision smeary, ringy or luminance shading:** Check C138 (1 μ F) and C132 (10 μ F). They tend to dry up and go open-circuit/low in value.
- (5) No or distorted sound:** The speaker is often faulty. Note that different types have been fitted, a circular one and a 5 x 3in. oval one, mounted on different baffles. Their impedance is 16 Ω . Portable sets tend to be run hard, eventually ruining the speaker. 16/20in. sets have an 8 Ω loudspeaker.
- (6) Dead set, excessive load:** Check the T9064V line output transistor TR112. It often goes short-circuit. Dry-joints on its legs are sometimes the cause of no go. Depending on the nature of the transistor's failure the mains fuse(s) may or may not fail. In 16/20in. models the transistor is generally type

- (17) Field cramped in the centre and stretched at the top and bottom, 16/20in. sets:** Zener diode D137 (68V) in the field output stage faulty. This is often a thermal fault.
- (18) Rolling with horizontal rippling:** Check R236 and R241, both 33k Ω , which are connected in parallel in the feed to pin 5 of IC102. They tend to go open-circuit. Also check the core of the line driver transistor T103 – it tends to drop out.
- (19) Random fuse blowing:** Fit type BYD33G diodes in positions D120/1/2/3.
- (20) Line output transformer faults:** A defective line output transformer can produce the following symptoms: intermittent loss of sound and vision; loss of the c.r.t. heater supply; loss of the e.h.t. or focus supply; low collector voltage supply to the RGB output transistors. An open-circuit between pins 6-9 will remove the supply to the RGB output and field driver transistors. Interwinding shorts are a common failing. 20in. models use a different transformer.
- (21) No regulation with high h.t., resulting in blown line output transistors:** Check TR107 (BD839) and TR108 (BC338C) for shorts. If necessary check L120 for shorts.
- (22) Ripple on vision, h.t. low and RV224 (set-h.t. potentiometer) inoperative:** Check whether TR107 (BD839) is open- or short-circuit. Also check TR108 and L120 for shorts.
- (23) Intermittent loss of line lock:** Check for a break in the print to pin 5 of IC102.
- (24) Hum bar moves up the screen:** Boost reservoir capacitor C189 (22 μ F) open-circuit.
- (25) Pumping:** Check R225 (33k Ω) and R222 (10k Ω).
- (26) Field roll and buzz on sound:** C131 (0.22 μ F) faulty. Check by replacement.
- (27) Regulation problems:** Check the 47k Ω resistors R208/209/210/221 by replacement (14in. sets).
- (28) Hum bar:** Check the boost voltage smoothing capacitor C191 (22 μ F).
- (29) Mains fuse(s) blown:** Check that the c.r.t. fixing bolts/washers haven't trapped and pierced the degaussing coils, thus shorting them to the earthed c.r.t. Rimband.
- (30) Intermittent clicking from back of set:** Cause is c.r.t. flashovers.
- (31) Intermittent field roll:** Can be caused by c.r.t. flashovers.
- (32) Weak, distorted sound which goes completely when the volume is turned up:** C114 (0.01 μ F) faulty.
- (33) Intermittent no go:** Fuseholder for FS102 weak/dirty. This fuse was uprated from 1A to 1.6AT.
- (34) Intermittent colour:** C155 (47pF) faulty. In later production the value of this capacitor was changed to 100pF.
- (35) Line wobble:** C125 (68nF) faulty.
- (36) No go with the h.t. and 12V supplies present and correct:** Check the line driver transformer T103 for dry-joints, breaks or open-circuit windings.
- (37) Dark band down left-hand side of the picture, severe ringing:** C132 (10 μ F) which decouples pin 4 of IC103 open-circuit.
- (38) Pulsating h.t./picture:** TR107 and D109 leaky.
- (39) Loss of field sync and no sound:** R241 (33k Ω) open-circuit.
- (40) Low gain, grainy picture:** SL1432 SAWF driver chip IC101 faulty.
- (41) Dead set with faint line whistle:** Break in the print between the collector of TR112 and pin 10 of the line output transformer.
- (42) Set trips, h.t. o.k., no e.h.t.:** R225 (33k Ω , 47k Ω in 20in. models) high in value or open-circuit.
- (43) 20in. set trips with low brightness setting:** Ensure that R213 is 86k Ω , not 82k Ω .
- (44) Ripple on verticals:** Boost reservoir capacitor C189 (22 μ F) open-circuit.
- (45) Intermittent line collapse:** Check for breaks in the print around the line driver transformer T103.
- (46) Line output transistor failure:** In the event of failure of TR112 ensure that the efficiency diode D113 is not type 1N4007GP. It should be replaced with an OGF72 (selected BYV95) which is available under part no. 00V4-631. Ensure that a 47k Ω resistor (R246) is connected between the base of TR110 and chassis. With 20in. sets ensure that C211 which is connected between the base of TR113 and the 12V rail is 22nF, not 220nF. With 16 and 20in. sets TR112 may be type T6076V instead of the R4050 fitted in earlier production models: because of mechanical differences between the heatsinks required these transistors are not interchangeable.
- (47) Line jitter at low signal levels (20in. models):** Change the value of C194 from 5.6nF to 4.7nF with a 680pF capacitor (C209) in parallel.
- (48) Field collapse following field drift:** C112 (0.22 μ F) is open-circuit. It's connected to pin 1 of IC102.
- (49) Field collapse with the vertical white line modulated at mains rate:** Check for a dry-joint/print break at the chassis end of the field scan coils.
- (50) Bottom foldover:** R203 (33 Ω , 10 Ω in 16/20in. sets) open-circuit.
- (51) Overscan with no line sync:** D137 (68V zener diode) faulty (16 and 20in. models).
- (52) Intermittent height variation and field bounce:** D137 again (16/20in. models)!
- (53) Teletext lines with ITV and Ch 4 only:** Zener diode D102 (4.7V) at pin 2 of IC103 short-circuit.
- (54) Intermittent field slip:** Focus spark gap firing over.

(55) Top inch of picture blanked: R237 or R240 (both 47k Ω) open-circuit.

(56) No sync: R236, R241 (both 33k Ω) or C125 (68nF) open-circuit.

(57) Intermittent loss of sync: C129 (68nF) intermittently open-circuit or C124 (2.7nF) leaky when warm.

(58) Loss of field sync when brightness or contrast is adjusted: L103 open-circuit.

(59) Ripple on picture: C125 (68nF) faulty.

(60) Colour drops out when volume is increased/crackle on sound: C166 (0.1 μ F) open-circuit.

(61) Intermittent colour: C157 or C159 dry-jointed. If these are o.k. try adding a wire link on the print side of the board from the screen of L111 to pin 14 of IC103 to prevent static discharge.

(62) Cannot set up the colour a.p.c. circuit: C159 (22nF leaky).

(63) Blank raster with slight patterning: C121 (10nF) connected to pin 18 of IC102 short-circuit.

(64) White lines 3in. in from the left-hand side: Line driver transformer T103 faulty.

(65) Sound-on-vision: Dry-joint on C166.

(66) No sound, no voltage at pin 11 of IC102: C123 (10nF) short-circuit.

(67) Weak sound: C113 (390pF) open-circuit or C123 (10nF) leaky.

(68) Sound fades when volume is turned up: Quadrature coil L104 faulty.

(69) Expanded teletext lines and flyback lines over the picture: R194 (270k Ω or 200k Ω in 16in. and 20in. sets) faulty.

Remote Control Sets

(70) Dead set, no channel lights: TR902 faulty.

(71) Cracks then trips then goes off: TR916 short-circuit. Also check C915, D908, TR901/917.

(72) Set won't start from cold: Ensure that R947 is 56k Ω not 22k Ω .

(73) Intermittent problems with channel up/down and mute buttons: Check whether C908 (10nF) is leaky.

(74) Loses memory approximately every week: Try replacing the line output transformer, D115 and C190 on the main PCB.

(75) Tuning sweep up button doesn't work, down button and store o.k.: IC902 (M293B1) faulty.

(76) Will not go to standby: Check C179 or C180 (0.1 μ F) for being open-circuit.

(77) No sweep tuning plus hum bar: Check D908 for being short-circuit and R969 open-circuit, TR916/7 for short- and R966 for open-circuit.

(78) Skips programme numbers when stepping: Ensure that C908 is 0.1 μ F not 10nF or 22nF. Fit part no. C6120-WW263-17CG.

(79) Channels sequencing/no 12V rail: The 12V supply can disappear on its route across the remote control PCB. Check TR902/3/4.

(80) Won't store channel information: Replace IC902 (M293B1).

(81) Won't lock channels over about 30: Check the 33V zener diode D908 for correct operating point.

(82) Intermittent loss of memory: Can be due to IC902 (M293B1) or c.r.t. flashovers.

(83) Goes to standby intermittently: Check whether TR902 (ZTX750) is short-circuit.

(84) Failure to search, 20in. model: Check R986 (1k Ω). If open-circuit, also check the supply to the tuning voltage regulator. If high, check R56 (2.4k Ω) on the linearity PCB – it tends to go low in value.

(85) Continuous channel stepping when used with TA127 battery converter: Replace link 925 with a PH425 diode connected with its anode to the junction of C906/R919.

(86) Mains operation o.k. but won't go to standby when TA127 battery converter fitted: Ensure that D22 (1N4001) is fitted in series with R6 on TA127 panel. If not, add it as follows: remove R6 and connect the cathode of D22 to the junction of C2 and pin 10 of IC1; fit a replacement R6 (part no. R4220-GF02-01RG) with one end to the junction of LK2/R1 and the other end to the anode of D22 in a mid-air joint.

Monitors

(87) Dot pattern with TA127 fitted (MC01): Add a 10nF capacitor on the print side of panel PC1129 from the 85V output to chassis.

(88) 50Hz buzz on sound in RGB mode (MC01): Ensure that C823 is fitted. Fit a 10 μ F capacitor in place of R865, its positive side to the base of TR834. Then add R865 back on the print side of the panel – there's not room to fit the capacitor on the print side.

(89) Poor sync in the computer mode (MC05): Add a 150 Ω resistor between pins 1 and 3 of the composite video input plug.

(90) Display starts two columns to the left when used with a Sinclair QL: Fit width reducer kit (SP5611).

Spares

Spares are readily available from many sources. Virtually all spares wholesalers should be able to help, but for total support contact an approved distributor (CHS/CPC/HRS/Willow Vale). Sendz Components regularly list Ferguson spares and can supply certain PCBs at very good prices.

Teletopics

THE CHANNEL 5 BID

The ITC received just one bid for the Channel 5 licence. It came from the Thames Television led consortium Channel 5 Holdings and is reputed to have been for a nominal £1,000. Whether the ITC will accept the bid and award the licence should be known by November. It could withhold the licence on the grounds that Channel 5 Holdings has yet to arrange full funding.

Channel 5 Holdings plans to recruit a workforce of 2,000 retuners who will each be responsible for some 2,000 homes in their allocated area. Thorn UK Rentals will be responsible for recruitment and training (Thorn EMI owns Thames Television). The tuners will wear a uniform, carry a photo-identity card and in view of concern about security will be screened. Basic pay will be £1.50 a visit, with a bonus of 40p if 90 per cent of the work is done before transmissions begin. During a field trial in Harrow retuning took on average ten minutes from arriving at the doorstep. In ten working days 61 per cent of the 725 households involved had had their equipment retuned despite there being no publicity or prearranged appointments. Total cost of the operation is expected to be around £50m.

The consortium plans to issue vouchers for free aerials, though viewers will be expected to pay for the installation – estimated at around £25 a time. It's thought that the total cost of setting up the service will be around £150m. Channel 5 Holdings plans to phase in the service in stages, starting with the London area in July 1993. A Manchester-based service would start in 1994, followed by Birmingham in 2000 and Scotland in 2001.

SATELLITE TV

BSkyB has sold its back-up Marco Polo satellite to Norwegian Telecom (see note on page 000). Because of the legal position it cannot sell the other Marco Polo satellite until the end of 1994 – and then only if the ITC has not found another use for the satellite. It's understood that Norwegian Telecom paid around £30m.

The *Financial Times* satellite monitor suggests that there was a further fall in dish installations in June. It estimates that the figure was around 57,000. This is a decline compared with both previous months and the same month last year.

Northern Telecom, which produced the 38cm BSB Squarials, is supplying a modified 47cm version to the German market for Astra reception. In addition a 19cm version is being supplied for reception of the German TVSAT services.

CD-I LATEST

Philips plans to launch a portable, professional CD-I player in November, Model CDI360. Features will include a 6in. 756 x 556 pixel colour LCD screen, a built-in twin-button controller, remote control, Y/C, RGB and composite video outputs and built-in speakers. There's mains or battery powering, the latter providing a playing time of around one-two hours. The player sits on the full motion video (FMV) cartridge when this is in use, though Philips plans to launch a unit with an integrated FMV chipset by the end of 1993. The player is expected to sell for around £800. The FMC

cartridge will cost £100-£150 (our apologies for saying £10 last month – page 722). Philips gave the first public demonstration of a production-line CD-I player fitted with an FMV cartridge at the recent European CD-I launch in Paris.

MORE ON DISC SYSTEMS

Pioneer has launched a re-recordable PAL video disc system using magneto-optical technology. The player has a novel dual-head arrangement that allows playback from different parts of the disc and simultaneous erasure/recording. The 30cm discs have a playing time of 32 minutes and can be re-recorded over a million times. Access time is around 0.3 sec. More on the system next month.

Philips plans to launch a record/playback CD system next year, with the players selling for around £800. They will use the same write-once technology employed by professional CD-R machines that cost upwards of £3,000: the disc has a special dye layer that turns dark when struck by a laser beam with sufficient energy.

Kodak has revealed the price of its Photo CD hardware and photo transfer service. The first player, the mid-range PCD865, will become available on September 1st at a suggested price of £369. It will be followed by the basic PCD265 at £299 and the five-disc carousel PCD5865 at £429 a month later. The price for transferring a 24-exposure film to disc will be £8.75, a 36-exposure film costing £12.11. There will also be a variety of special transfer, disc duplication and Photo CD print services at prices from £3.95 to £24.99. Kodak reports that the first 5,000 Photo CD units are rolling off a production line at Hassault, Belgium.

THORN RENTALS PUSH WIDESCREEN TV

Radio Rentals has added a widescreen 16:9 TV set to its range, the first such model to be offered by rental outlets. It expects that this and other developments will increase the percentage of the market taken by the rental chains. Initially a 28in. Philips model will be available.

BBC ENGINEERING NEWS

Nicom stereo sound will be available from the following transmitters and their dependent relays by the end of 1993, bringing the BBC's coverage up to 87 per cent: Blaenplwyf (West Wales), Caradon Hill (Cornwall), Craigmilly (Edinburgh), Hannington (Central/Southern England), Llanddona (North Wales), Oxford (Central/Southern England), Rowridge (Southampton/Southern England), Sudbury (East Anglia) and Waltham (East Midlands). Tacolneston (East Anglia) will come into operation by the end of 1994 and Bilsdale (N.E. England) by the end of 1995.

BBC Engineering is also working with the British National Space Centre and other European organisations on speeding up the development and introduction of digital audio broadcasting (DAB).

EXHIBITIONS

European Cable Communications '92, the only exhibition and conference for the European cable TV and telecoms industry, is to be held at the Olympia Centre, London on October 19th-21st. It's being hosted by the Cable Television Association (Fifth Floor, Artillery House, Artillery Row, London SW1P 1RT – 071 222 2900).

A UK consumer electronics show, called LIVE '93, is planned for September 16-20th next year at the Grand Hall, Olympia. It's being organised by News International Exhi-

bitions and has received the backing of many major brown goods manufacturers.

FERGUSON NEWS

Ferguson products are to bear a new logo – "Ferguson, Thomson Technology". The company has been restructured, with a French management team now in place. Three new VCRs with built-in Video Plus timer systems are being launched, the FV61LV at £329, the four-head/LP FV62LV at £359 and the FV67HV which includes Nicam and hi-fi stereo sound at £449. They all have a one-year, eight-event timer, a mid-mount tape slot, a simplified remote control handset, a rapid-start tape mechanism, child lock and auto head cleaning. Ferguson says that it has developed a VCR that combines Startext and Video Plus but won't launch the machine until more broadcasters adopt Startext.

A 32in. 16:9 set, Model C76W, is to be launched this autumn. Features will include a Nicam decoder, digital signal processing to provide improved definition, digital picture effects and a five-speaker sound system. Price is expected to be around £1,600. Other sets in the pipeline include the 14in. B14C which, at about £230, will include a built-in clock radio alarm.

HARWOOD SPARES

Spares for Harwood brand products are no longer available from the source quoted in our Spares Guide (June issue). Some spares can be supplied by Lamda Electronics Ltd., Unit 59, Millmead Industrial Estate, Millmead Road, London N17 9QQ (081 885 2268, fax 081 801 3118).

NEW REMOTE CONTROL SYSTEM

Celtel Ltd., P.O. Box 135, Basingstoke, Hants RG25 2HZ (0256 64324) has introduced a remote control extender system called Powermid. It enables IR remote controlled equipment to be operated from more than one room in the home. Powermid is a simple to operate, DTI approved low-power radio transmission system. The range between the transmitter and receiver units is approximately 30m, which is more than adequate for most homes. Suggested price of the system is around £70.

IN BRIEF

Swedish Telecom has successfully transmitted digital HDTV (1,250-line) pictures using a standard 8MHz European terrestrial u.h.f. TV channel. The system employs a sophisticated hybrid coding technique that compresses a 900Mbit/s signal into a 24Mbit/s channel with very little loss of picture quality. It was demonstrated at the recent International Broadcasting Convention at Amsterdam. A report on the Convention will appear next month. . . Oki Electric has developed a 100in. flat-panel plasma display that can be used with the Japanese HDTV system. The panel is unlikely to be available commercially until later in the decade however. To date the largest plasma display shown has been a 60in. one produced by Fujitsu. Along with other Japanese companies Oki will be demonstrating a 25in. colour plasma panel at Electronica, Munich in November. . . Philips is selling to consumer electronics manufacturers a complete DCC package that includes a chip set, a thin-film head and all the other non-standard components required. There are nine i.c.s in the chip set. Philips has also designed a new fixed record/playback head for use in automobile DCC players.

next month in

TELEVISION

FREE CATALOGUE

Next month's issue comes with a free 32-page catalogue from East Cornwall Components.

● SERVICING B & O 31XX SERIES RECEIVERS

Though there were only two models, the M20 and MX2000, a lot of these 20in. monitor-style sets were sold. Some relatively uncommon circuitry is employed, such as the step-up chopper circuit and thyristor field output stage. Nick Beer describes the sets and provides fault notes.

● PALMCORDER SHAKE COMPENSATION

The main user problem with mini camcorders is that they are too light to hold still, particularly noticeable with a zoom to telephoto. Shake compensation was originally developed by Panasonic for the NVS1. It uses a fuzzy logic controlled electronic giro system. Now Sony and Canon have come up with a new system that relies on a novel device called a variangle lens or prism. Steve Beeching explains the operation of these systems.

● PROBLEMS WITH NICAM

Nicam has introduced a great improvement in TV sound. Most of the circuitry used is in chip form, so there's little to go wrong. Some problems have been experienced however. Steve Cannon summarises his experiences to date.

● IBC '92

The International Broadcasting Convention presents an opportunity to get acquainted with the latest developments in the broadcasting field. George Cole reports on this year's event at Amsterdam. Digital TV systems were much in evidence.

● EXPERIMENTS WITH VIDEO

David Woodnott describes his early efforts at producing video pictures in the pre-vidicon days.

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Satellite TV Polarisation Systems

Derek J. Stephenson, B.A., I.Eng.

The demand for increased satellite channel capacity has led to the adoption of frequency re-use. One of the more common techniques used is dual polarisation, which enables the channel capacity of a given bandwidth to be effectively doubled. There are two main polarisation systems, linear and circular. We'll discuss them both, describe common methods of resolving them at the receiver and conclude with quick, simple field service checks on the polariser circuit.

Geo-synchronous Satellite Basics

Geo-synchronous satellites, which are sometimes misleadingly referred to as geo-stationary, are parked in a narrow belt directly above the equator at a height of 35,734km (22,235 miles). At this altitude the orbital speed of the satellite coincides with the natural rotation of the earth. Thus to a ground-based observer the satellite appears to be stationary. It should be pointed out however that corrective action is required to maintain "station keeping accuracy" over the satellite's lifetime. Each satellite is allocated a particular orbital position which is referred to as the longitude at the equator. This point is called the "sub-satellite point".

It's traditional to refer to the longitudes of orbital positions as either east or west of the Greenwich meridian (0°) – the system used by conventional atlases. There are exceptions however: Intelsat for one often uses the degrees E terminology, with all longitudes specified in degrees east of the Greenwich meridian. Using this terminology 3°W becomes 357°E. The main reason for doing this is the unambiguousness of azimuthal computations.

Signals from any geo-synchronous satellite above the horizon at the receiving site can be received by aligning the aerial to specific azimuth and elevation angles. The signals from satellites lower than 10° elevation are likely to be swamped by diffracted ground noise however when a small aerial is used.

The geometric elevation angle E_l calculated by the usual equation (below) is not the strictly true elevation but is accurate enough for satellite reception purposes. At elevations lower than about 30° refraction of microwave signals in the atmosphere produces a very slight error.

$$E_l^\circ = \arctan [6.61 \times \cos A \times \cos B - 1/6.61 \sqrt{(1 - \cos^2 A \times \cos^2 B)}]$$

where A is the receiving site latitude (+ve northern hemisphere, -ve southern hemisphere) and B is the receiving site longitude minus the satellite's longitude (expressed in °E).

The azimuth angle Az of a geo-synchronous satellite is not

simply the longitudinal position as given by the satellite's operator. It also depends on the longitude of the receiving site. In other words it's the longitudinal difference between the satellite and the receiving site that needs to be taken into account in the calculation of azimuth angles.

$$Az^\circ = 180 + \arctan (\tan B / \tan A).$$

The term 180 is valid only for receiving sites in the northern hemisphere – neglect it in the southern hemisphere.

Polarisation Overview

An electromagnetic wave from a distant source is normally pictured as a plane wave whose electric and magnetic fields are at right angles. See Fig. 1. The electric field is represented by vector E and the magnetic field by vector H. To increase the use of the available bandwidth satellite telecommunication systems generally employ specific polarisation senses to effectively double the channel capacity. Two types of dual polarisation are in common use: (1) linear polarisation, which includes fixed vertical and horizontal polarisation senses, used by satellites such as Astra; (2) circular polarisation, which includes left-hand circular and right-hand circular senses where the E field rotates around the axis of propagation – the majority of high-power DBS satellites employ a single instance of this derived type. They are special cases of what's known as elliptical polarisation.

With linear polarisation the two senses are produced by transmitting the signal with the E field fixed, either vertically or horizontally. Obtaining the spin of circular polarisation is a little more complicated. It's produced by splitting a linearly polarised vector into two vectors at $\pm 45^\circ$ to the original then delaying or advancing the phase of one of the 45° vectors with respect to the other to set up the polarisation senses. In this discussion you can forget about the H field as it's always at 90° to the E field vector.

A perfectly polarised signal will have zero energy in the opposite polarisation sense. Unfortunately it's not possible in practice to obtain exactly pure polarisation: there will always be a residual component of the opposite polarisation sense. Fig. 2 shows how the resultant signal is resolved into vectors. The horizontal component EH is expressed as $EH = E \cos \Theta$ while the vertical component EV is $EV = E \sin \Theta$.

The ratio between the E field voltage amplitude of the wanted (co-polar) polarisation to that of the unwanted (cross-polar) polarisation, expressed in dB, is known as the cross-polar discrimination or XPD. It's given by

$$XPD = 20 \log (E1/E2) \text{ dB}$$

where E1 is the wanted polarisation (the co-polar component) and E2 is the unwanted polarisation (cross-polar component).

The XPD is thus a measure of the purity of the polarisation and the higher the figure the better. As an example, if the voltage amplitude of the unwanted polarisation sense is 20 times lower than that of the wanted polarisation the XPD is about 26dB. A decrease in the XPD reduces the carrier to interference (C/I) rather than the carrier to noise (C/N) ratio.

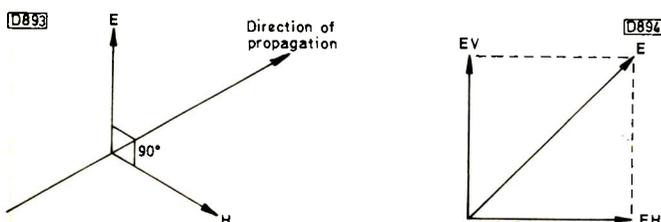


Fig. 1 (left): Electromagnetic wave propagation.
Fig. 2 (right): Resolving the signal vectors.

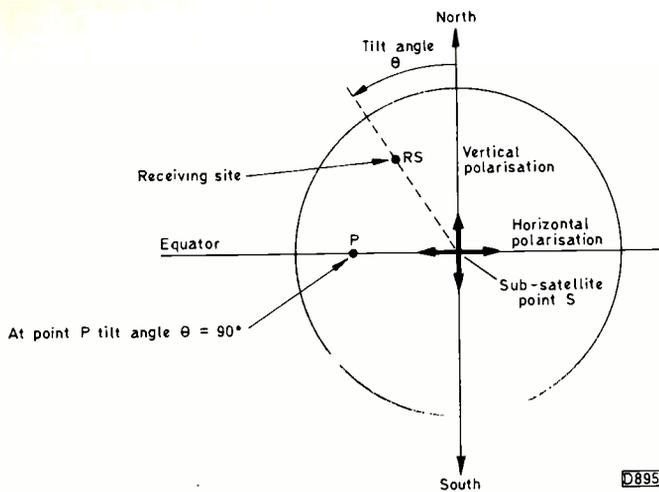


Fig. 3: Tilt angle and receiving site.

0895

to Fig. 3, the sub-satellite point S is the position on the earth's surface directly below the satellite and is always on the equator (0° latitude).

If the receiving site RS is on the same longitudinal meridian as the satellite, the tilt angle will be 0° and the vertical polarisation vector of the transmission will be in alignment with the local vertical. As RS moves away from this meridian the tilt angle increases until, when on the equator, at say point P, the tilt angle increases to 90°. In this case the local vertical is in alignment with the satellite transmission's horizontally polarised vector.

Further Complications

Depending on the amount of solar sunspot activity and the operating frequency, a Faraday rotation effect may become significant as the signal passes through the ionosphere. The degree of rotation is inversely proportional to the square of the frequency. Thus the effect is greater at lower frequencies. At 12GHz the rotation is so small that it has negligible effect, but at 4GHz and below a small correction, of the order of 1 or 2°, may be required. The result of neglecting this effect is that the cross-polar discrimination between the two polarisation senses is reduced, thus decreasing the carrier to interference ratio.

Precipitation can cause significant depolarisation of signals, lowering the XPD. Circular polarisation is most affected by this but, since aerial pointing errors are less critical, the disadvantage is not always significant. Signal depolarisation due to precipitation is a complex subject that's well outside the scope of the present article.

Resolving Linear Polarised Signals

Resolving a linearly polarised transmission is generally cheaper and easier than resolving a circularly polarised one. In addition the XPD is less influenced by atmospheric effects. Not surprisingly a device that resolves the two linear polarisation senses is called a linear polariser. In order to compensate for the previously mentioned tilt angle some form of fine adjustment is required so that the polariser can be aligned with the polarisation at the receiving site. There are three basic linear polariser designs, the solid-state probe selection type, the electromagnetic or ferrite type and the mechanical type. We'll deal with each in turn.

Solid-state Probe Selection Polarisers

The V/H switched polariser, often called a solid-state probe selection polariser, consists of a pair of probes at right-angles to each other (orthogonal). The probes project directly into the waveguide. One detects vertical polarisation and the other horizontal polarisation. A solid-state switching system is used, see Fig. 5, to select the required output. An LNB supply of 13V might for example select vertical polarisation and 17V horizontal.

These lower cost units tend to be relatively inefficient due to losses and noise and can be used only for single satellite or satellite cluster (e.g. the Astra system) reception. The reason for the inefficiency is that the probes are fixed and no provision for fine tuning of the tilt angle is provided. To align the probes with the polarisation sense of the received signal the LNB/polariser must be physically rotated in its holder by the required amount calculated from the previously given equation for EH. From a viewpoint behind the dish, rotate the LNB/polariser by the required amount anti-clockwise if the satellite is to the east of you or clockwise if the satellite is to the west. This will obviously be reversed if you're in the

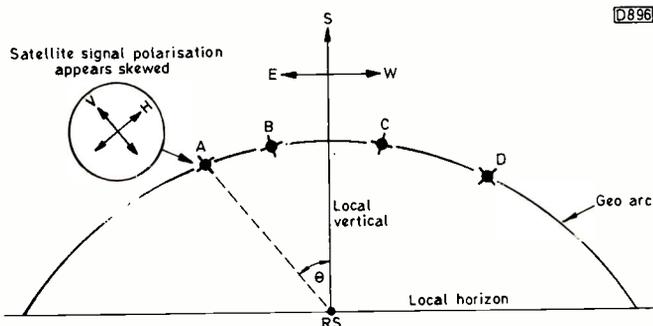


Fig. 4: Tilt angle/polarisation offset as seen from the receiving site.

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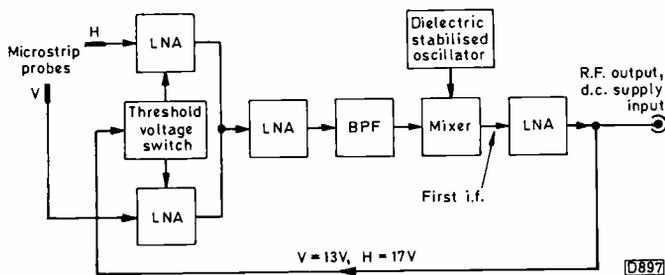


Fig. 5: Typical solid-state probe selection system.

0897

Factors that reduce the XPD are (1) poor aerial design, (2) pointing errors between the transmitter and receiver aerials and (3) precipitation in the intervening atmosphere (rain etc.).

Linear Polarisation

The reference vector for linear polarisation is the E field which, as far as a satellite transmission is concerned, is parallel to the equator for horizontal polarisation and at right-angles to the equator for vertical polarisation. As Fig. 3 shows, if the receiving site is not at exactly the same longitudinal meridian as the satellite, the orientation of the polarisation plane will appear to be twisted from the local vertical or horizontal. The amount of twist (rotation) is called the tilt angle, the polarisation offset or sometimes the skew. For any receiving site it's given by the formula:

$$\text{tilt } (\Theta^\circ) = \arctan(\sin B/\tan A).$$

Fig. 4 shows the same effect viewed from a position directly behind the aerial at the receiving site. With reference

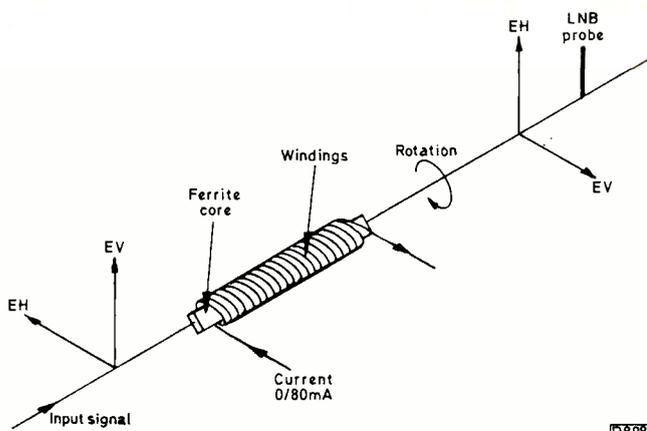


Fig. 6: Electromagnetic polariser action.

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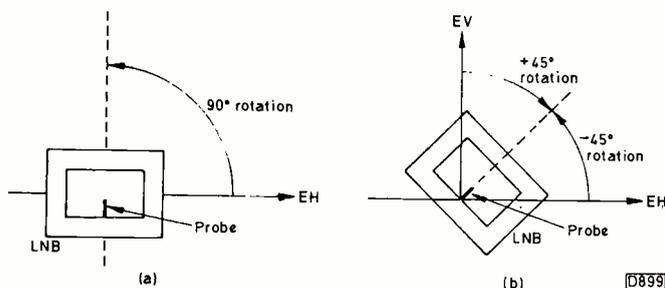


Fig. 7: Electromagnetic polariser orientation. (a) Square setting: 80mA rotates EH by 90°. (b) Diamond configuration: ± 40 mA rotates EV and EH by $\pm 45^\circ$.

D899

southern hemisphere.

Many low-cost Astra systems are installed with total neglect of the tilt angle since the setting may not appear to improve the picture quality significantly in "clear-sky" conditions.

Electromagnetic/ferrite Polarisers

This type is now the industry standard for multi-satellite reception and is also used with some of the more up-market single-satellite systems. Operation is based on the Faraday rotation principle, see Fig. 6, the idea being to rotate the electric vector of the signal to match the physical orientation of the LNB probe. Control is achieved by varying the magnitude or direction of the current flowing through the windings of the ferrite polariser. The loss with such a device is of the order of 0.3dB.

Satellite receivers designed for use with this type of polariser usually provide fine control of rotation over more than 90° to compensate for the tilt angle. A typical rotation range is 120° or more. Optimal polarisation settings for each channel are set up during installation and are stored in memory.

Current Control

The electromagnetic polariser is a current-operated device, commonly driven at 0/80mA or +45/-40mA to rotate the electric field of the required polarisation sense to suit the orientation of the LNB probe. For Ku band reception the 0/80mA type is mounted so that the major dimension of the rectangular WR75 waveguide is horizontal. Thus for vertical polarisation the incoming signal is not rotated at all while to select horizontal polarisation the signal is rotated through 90°. This is often called "square" orientation, see Fig. 7(a). Receivers that provide a single polarity drive current use this arrangement. There's often a single wire connection to the

polariser, the braid of the coaxial cable at 0V being used to complete the current path. The rather elderly Grundig STR20 Astra package is a typical example of this system.

With the "diamond" configuration shown in Fig. 7(b) the WR75 waveguide is set diagonally with respect to the ground. A +40/-40mA supply from the receiver is used. The incoming E field vector is rotated by either +45° or -45° depending on the required polarisation sense.

Receivers that supply a single polarity current can control this type of polariser when it's mounted in the square mode provided the maximum operating current rating is not exceeded. The diamond configuration seems to be more common with current models. If the correct orientation isn't known or the head unit is fully assembled on purchase of a packaged system a clue is provided by the fact that the polariser lead connections usually exit downwards. With kits and component-part assemblies rectangular waveguides must be matched dimension to dimension. Use appropriate adaptors for any transition from a circular waveguide (C120) to a rectangular one (WR75).

Mechanical Polarisers

With a mechanical polariser, which is often called a polarotor though this is a brand name, the probe is physically rotated to suit the required polarisation sense. This type of polariser, which operates under remote servo or pulse control, is becoming increasingly rare. Good cross-polar isolation is provided but there's the major disadvantage that the moving parts tend to wear out and may seize in cold weather. Fig. 8 gives a simplified idea of the internal workings. For tilt angle compensation it's easy to increase or decrease the angular orientation of the probe by electronic control, as with a ferrite polariser.

Circular Polarisation

With circular polarisation the E field is spun so that the radiation is propagated through space in a corkscrew or spiral fashion. The spinning may be clockwise (as viewed from the source) giving right-hand circular polarisation (RHCP) or anti-clockwise giving left-hand circular polarisation (LHCP), see Fig. 9.

There's a simple rule to picture the direction of spin, following the lines of the left- and right-hand rules that we all learnt at college for motors and generators. Fortunately the contortions are not quite so painful. For RHCP the thumb of the right hand points in the direction of propagation and the natural bend of the fingers shows the direction of spin. Use the left hand instead for LHCP.

The tilt angle for circular polarisation is always taken as 45° irrespective of the receiving site's location.

Resolving Circular Polarisation

The vast majority of direct broadcast services (DBS) operate in the 11.7-12.5GHz band. If only one circular polarisa-

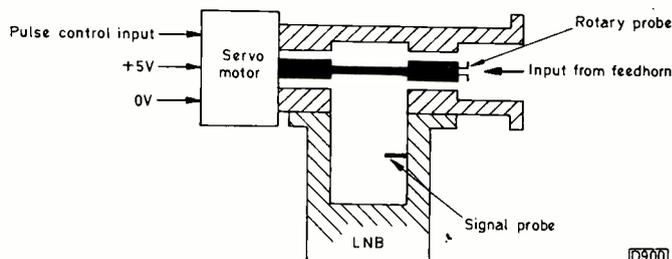


Fig. 8: Simplified mechanical polariser cross-section.

D900

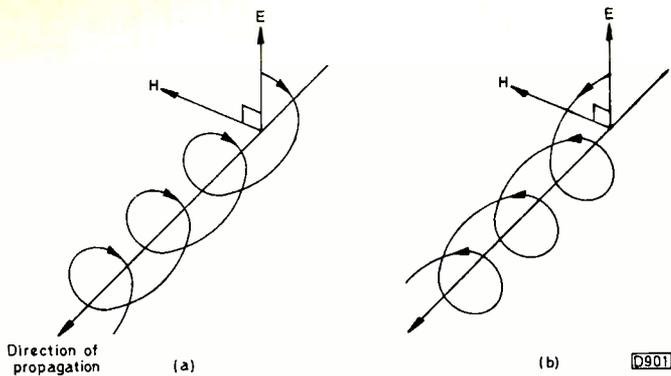


Fig. 9: Circular polarisation: (a) LHCP, (b) RHCP.

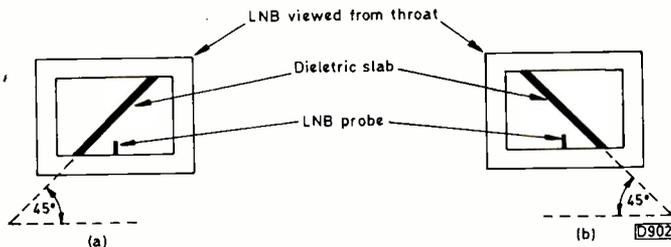


Fig. 10: Resolving RHCP (a) and LHCP (b).

tion sense is being received a linear polariser will, without modification, resolve the signals, introducing an attenuation of about 3dB. A more efficient method is to fit a dielectric slab at 45° in the throat of the feedhorn, see Fig. 10.

More elaborate methods of resolving RHCP and LHCP involve the use of a pair of orthogonal probes with the output from one being delayed by a quarter of a wavelength with respect to the other. Reversing the delay gives selection of either RHCP or LHCP.

Integrated Polariser Designs

The feedhorn, polariser and LNB are often integrated as a one-piece sealed unit called an LNP (low-noise polariser). Recently designed units of this type are a great improvement on the earlier efforts, which were prone to water seepage into the waveguides and electronics. The use of solid-state probe selection or a ferrite polariser is common.

Diagnosing Polariser Faults

Satellite system servicing seems to involve split responsibility nowadays. An initial call is made by a field TV/video technician to determine whether the head unit or the receiver is at fault. If the diagnosis is that the head unit is at fault an aerial rigger is called in, as with terrestrial aerial faults. If not the satellite receiver is repaired or collected.

The first problem is to determine which type of polariser is being used. As a general rule the following is true: (1) a solid-state probe selection polariser will have no extra wiring to the head end since the threshold switching voltage is sent up the coaxial cable; (2) an electromagnetic polariser will have one or more commonly two extra wires to supply the polarisation current; (3) a mechanical polariser will have three extra wires for a +5V supply, earth and pulses.

Quick Checks

A few simple checks are sufficient for diagnosing polariser faults. If signals are either weak or missing, or if signals of only one polarisation sense can be resolved, it's possible that there's a fault in the polarisation system. With

solid-state probe selection polarisers check that the LNB supply voltage switches between threshold levels. With the common Marconi units the levels are typically 13V for vertical polarisation and 17V for horizontal polarisation. It's very common for one polarisation to go down, resulting in loss of half the receivable channels. The cure is normally to replace the LNB.

Magnetic polariser currents can be checked by connecting a multimeter switched to the 100mA range in series with one of the polariser leads. The currents should be roughly +40mA or -40mA (or 0/80mA with a few designs) depending on the polarisation sense to be selected. Presence of these currents normally indicates that all is well. If no current is detected, check the d.c. resistance across the polariser's windings. For a good unit the reading should be about 70Ω. If this is the reading obtained, suspect the receiver's polarisation control circuitry. If a high resistance reading is obtained it's likely that the cause of the trouble is corroded or poor connections to the polariser at the head end. This is also the main cause of intermittent operation. Occasionally the polariser wires fracture a few centimetres from the connecting points, either at the receiver or the head end.

With the rarely encountered mechanical type of polariser check the 5V supply and that servo motor drive pulses are present during operation of the skew control. If these are present the polariser has probably seized up. If they aren't, suspect the control circuitry, particularly the output devices, or the power supply.

Simple Electrostatic Detector

S. Yousaf

The simple but very useful circuit shown in Fig. 1 can be used to "scan" for electrostatic fields – around a TV receiver for example. It's a highly-sensitive version of the gold-leaf electrostatic used in school science laboratories. The probe itself is an M2.5 x 30cm bolt. When an electrostatic field is present charge accumulates at the gate of the 2N3819 field-effect transistor. Current amplification produces a reading on the microammeter. Note that to obtain a reading you don't actually have to touch a point in a circuit with the probe, you merely have to bring the probe close to it. The reset switch enables the charge to be shorted to the negative side of the supply while the 10kΩ variable resistor adjusts the device's sensitivity.

The circuit can be used to check for the presence of mains electricity – simply bring the probe near to a mains-carrying cable. Note that it's not necessary for the cable to have a load connected to it for the meter to register the presence of the mains supply – it detects static electricity.

The detector consumes around 0.5mA, so with average use a single 1.5V AA cell will last for years. It can be built into a tiny "pocket-sized" probe. A suitable meter is available from Bull Electrical, 250 Portland Road, Hove, Sussex BN3 5QT.

The electrostatic detector is also a fascinating device for kids: rubbing feet on the floor, combing hair etc. all have an effect on the meter, even at considerable distances.

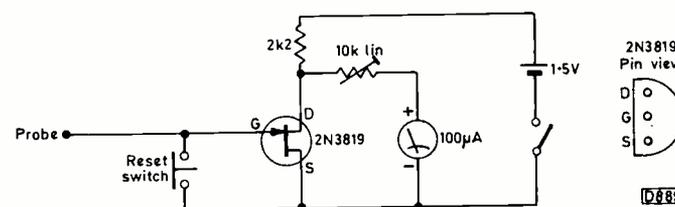


Fig. 1: The electrostatic detector circuit.

CD Player Casebook

Reports from Mike Leach,
Ronald Aranha, P.J. Roberts
and Jim littler

Akai ACMM370L

The complaint with this midi system was that some discs would skip and jump while others wouldn't play at all. We stripped the left-hand side cabinet section from the machine to gain access to the CD section. Close inspection of the laser lens then told us what we wanted to know – the lens was filthy. Cleaning it gave us an excellent r.f. waveform, so we put the machine back together.

Unfortunately it came back several days later with the same complaint. This time the condition was worse and the laser had to be changed. When it arrived (part no. BO728643K) a great deal of hassle was required to fit it. Why is it that these days so many manufacturers put the bits that go wrong in such inaccessible positions inside the cabinet?

M.L.

Kenwood DP710

I've had a couple of these machines in recently, both suffering from intermittent TOC reading. The cause of the trouble was a faulty laser unit of course, but the unit is not easy to replace. When a new one is ordered Kenwood send a complete mechanism assembly including the laser, tray, motors etc. A modification has to be carried out: this involves removal of the main PCB assembly followed by many component changes depending on which model you are servicing. Good luck if you get one of them in!

M.L.

Sony CFD770S

This portable was dead when it came in. After replacing the fuse we found that the tape and radio sections worked normally but the CD section didn't. We noticed that the laser unit wasn't in the home position. Checks showed that the sled motor drive chip wasn't getting the relevant command from the CXP5078063Q system control chip, which is a surface-mounted device. When a new system control chip had been fitted the laser unit would return to its home position but the display said "no disc". We then found that there was no laser glow, so a new KSS210B laser unit had to be fitted. This finally put the machine to rights: fortunately for the customer it was still under guarantee.

R.A.

Sony D99 Discman

The complaint was that this machine didn't work properly. We hooked it to a 9V adaptor, inserted a disc and pressed play. The disc played normally but we noticed that the LCD illuminating lights flickered in a periodic manner. We didn't pay much attention to this and kept the unit on test. Occasionally if it was stopped and play was then selected the display would show "no disc". So we put the machine in the service mode and pressed the play button. Focus search was activated but there was no spindle rotation. A slight tap on the spindle table started the motor. The fault cleared when a new spindle motor (part no. A3133372A) was fitted – and the display panel lamps no longer flickered!

R.A.

Sony CDPH3600

This unit is supplied with Sony's FHE737 portable music system. The problem was that ejection didn't occur when the eject button was pressed. If the tray was ejected manually how-

ever and the tray close button was then pressed the tray would go inside and the machine would read the TOC. A check on the voltage at pin 24 of the UPD75116GF system control chip showed that it stayed at 5V regardless of the open/close situation. A new system control chip put matters right.

R.A.

Sony D350 Discman

There was no TOC reading. A scope connected to the FE point showed that after pressing the play button the search curve was not symmetrical around the "zero" axis. As a result the FOK signal wasn't produced. The SF89 laser unit had to be replaced. Normal operation was restored after carrying out the relevant adjustments.

R.A.

Yamaha CDX510

The cause of failure of the drawer to open was traced to a worn drawer belt. After fitting a new one we gave the unit a short test and as everything seemed to be all right the machine was returned to the customer. Two months later it came back with the same fault. When I examined the new belt I'd fitted I found that it had worn out. A call was made to Yamaha to see what they had to say. We were told that the plastic type of motor pulley fitted does tend to wear the belt. They recommend fitting a new metal type, part no. VJ668800. We fitted one of these, plus a new belt (VE801800), and gave the machine another test. The change seems to have done the trick.

P.J.R.

Dual CD1030

This player would load a disc and read the TOC but wouldn't read any of the recordings – or if it did there would be bad skipping. The cause of this was traced to the worm gear on the sled motor spindle. What happens is that the gear slides along the spindle and jams the sled drive mechanism. Once the worm gear had been correctly positioned and fixed in place normal operation was restored.

Another fault I've had is a worn drawer belt. When I loaded a disc and pressed close or play the drawer closed but the disc didn't spin and the TOC wasn't read. On investigation I noticed that the drawer belt was slipping because it was slack. Drawer in/out sensing is done by monitoring the current drawn by the drawer motor. Thus when the belt slips the system control doesn't know whether the drawer is closed – the motor is still running but not drawing as much current as it would when stalled. With a new belt (part no. 282684) fitted the machine worked normally.

P.J.R.

Aiwa LX50

We had a linear tracking turntable fault on one of these machines. Failure of the 2SD150 Darlington regulator Q101 seems to have been the start of the trouble. A high voltage had been put on the 5V line with the result that the TLCS43 processor chip IC1 had died. No work could be done until IC1 and most of the power supply had been replaced. At this stage the arm moved right and the motor wouldn't stop. The position sensors and LED were found to be o.k. but the TC4069UBP inverter/amplifier chip IC2 had been damaged – its outputs at pins 10 and 6 sat at 3V no matter what you did

to the sensors. Replacing IC2 got the machine working, but the record size sensor had also been damaged. CP101 and a 2SC2001 transistor used as an amplifier had to be replaced – these items were not shown on our circuit diagram (issue 3, 1984).

Replacing all these parts plus a few belts restored the deck to full health. But all this mayhem had been caused by lack of over-voltage protection. Its omission may have kept the price competitive, but it made the repair long and costly.
J.L.

Test Report: Beckman DM71 and DM78 DMMs

David Botto

Two light-weight digital multimeters from Beckman Industrial make an interesting comparison. I've recently had them for test.

Model DM71

The DM71 is an autoranging, autopolarity probe-type instrument that uses dual-slope integration with a sampling rate of twice a second. According to the manufacturer it has been designed for easy carrying, simple use and convenient access to tight spots. It's certainly light to carry in your pocket. The body is grey, with an orange insulated section to secure the "hot" test probe. The other probe fits into a special slot at the top of the instrument when not in use. I found that the instrument fits comfortably in the hand. It comes in a sturdy, transparent carrying case that protects it from damage. Size is 165 x 28 x 19mm, weight 75g (105g with case and batteries).

A probe type instrument naturally doesn't provide the range of measurements that larger hand-held or bench-type meters do. This one does however provide all the voltage and resistance ranges the field service engineer is ever likely to need and most of the ranges required for day-to-day test bench servicing. The autoranging resistance ranges measure from 0.1Ω to 20MΩ for example. There's also an effective, fast-response diode check facility that gives both a visual and an audible tone indication.

The readout is a 3.5-digit LCD with 5/8in. high figures that are easy to see. Surprisingly for a meter at this price there's a full set of annunciators to indicate the type of measurement and range, the polarity in the case of a d.c. voltage check plus over-range and low-battery information. Power is provided by two LR44 1.5V alkaline-magnesium button-type batteries.

Range selection is by means of a five-position rotary switch. When a range is selected the DM71 emits a faint musical peep. Three little peeps are heard when a voltage is measured, indicating that the measurement has been made and registered in the readout. The input impedance is 11MΩ on all ranges except the 2V range where it's 12MΩ and the 200mV range where it's 1,000MΩ. Overload protection is provided on all ranges except for the diode check.

Table 1: Test measurement readings.

Precision standard	DM71	DM78
5V d.c.	5.01V	5.02V
12V d.c.	11.96V	11.97V
24V d.c.	23.8V	23.9V
240V a.c.	240V	240V
15Ω	15.33Ω	14.9Ω
39Ω	40Ω	38.9Ω
10kΩ	10.02kΩ	10.03kΩ
360kΩ	354kΩ	355kΩ
10MΩ	10.03MΩ	9.99MΩ

The autoranging has a fast response time, making the DM71 definitely user-friendly. A yellow hold button is placed on the top front edge of the meter so that it can be conveniently pressed without effort using your index finger. When you do this the words "data hold" appear in the display.

The following is a brief specification for the DM71: d.c. voltage ranges 200mV, 2V, 20V, 200V and 250V, accuracy 2 per cent in the 200mV range, 0.7 per cent in the 2V range, 1.3 per cent in the other ranges; a.c. voltage ranges 2V, 20V and 250V, accuracy 2.3 per cent; resistance ranges 200Ω, 2kΩ, 20kΩ, 2MΩ and 20MΩ, accuracy 2 per cent except for the 20MΩ range where it's 5-10 per cent.

Model DM78

The DM78 is a "credit card" DMM the size of a pocket calculator. It's easy to carry in a shirt or top pocket, making it immediately available for use at any moment. A neat vinyl carrying case is provided and the test leads/probes are permanently attached. This makes it very convenient for use by the field service engineer who doesn't want to be burdened down with heavy equipment. The DM78 measures 108 x 54 x 11mm and weighs 99g.

The 3/8in. high numbers are jet black and easy to see, the readout including a full set of annunciators. Power is provided by two LR44 batteries. The electrical specification is identical to the DM71 except that the input impedance on the a.c. ranges is 11MΩ instead of 12MΩ and there's no range-lock facility.

Accuracy

I checked the two meters against precision standards. Table 1 shows the results obtained.

Conclusions

The only criticism I have is that the test prod cables are wired into circuit directly. Should they break or go open-circuit after a long period of use it doesn't seem that it would be easy to replace them. It might have been worthwhile, even at extra cost, to have fitted the test leads with tiny jacks and the body of the meters with sub-miniature sockets.

The DM71 costs £42 plus VAT, the DM78 £25 plus VAT. Both meters are good value for money. The service engineer engaged mainly on outside work would find either of them a valuable addition to his kit. If I had to choose between them my own choice for outside work would be the DM71, because of its range-lock facility. If I needed a DMM to carry around permanently in my pocket however I'd choose the DM78.

The meters are available from Beckman Industrial Ltd., Astec Building, High Street, Wollaston, Stourbridge, West Midlands DY8 4PG (0384 442 394) My thanks to Sue Round for her help in supplying samples.

What a Life!

Donald Bullock

The workshop door flew open and a scruffy fellow entered. "Noggs" he said. I spun round, fearing the worst.

"Er grunts but don't go" he wheezed, producing a VCR and tapping its top. "How quickly can you get 'er done? Proper mind, but I can't spend much as I've a bill to pay for the old car. Three hundred quid."

"Perfection and cheapness, that's what we want isn't it? I'll start on it right now. Will that be soon enough?"

The Sharp VCA105HM

It turned out to be a Sharp VCA105HM, the first of its kind I'd seen. A clicking noise came from its main loading block, which is on the top of the deck to the right of the drum. Time to get a manual. A call to Dave Allen at Willow Vale to order one paid extra dividends. He knew the model and the fault well and told me that in addition to the main cam disc I'd almost certainly need a new loading block worm gear. A new mode switch would also probably be a good idea.

The package from Willow Vale arrived next morning. When I'd dismantled the mechanism I found that the cause of the trouble was as Dave had thought. The worm gear sits upright against the cam: its teeth were damaged. Thanks Dave for the manual, the spares and the instant advice. The job was completed in no time. Just like that!

Cars and a Panasonic TC2263

Later, whilst contemplating on the service I'd been able to provide for Noggs and the amount of my charge, I got to wondering where this trade is taking us. I wished I'd gone into car repairs instead. Then a huge Mercedes glided into the drive. Its driver was a brisk and mature gentleman I'd never seen before. He set about removing a 22in. Panasonic colour set from the back seat and soon got red-faced and breathless, as they do. I ran to his aid and as soon as he could speak he told me that the fault was no colour.

"The name's Fryer" he said. "Ring me at my fish and chip shop when it's done."

The set was a Panasonic TC2263. When I got around to looking into it I found that the TDA3562A colour decoder chip had been out recently and that the soldering was terrible. Some of the pins hadn't been resoldered at all. After tidying it up I tried the set again. As the fault was still there I replaced the chip. This time the colour came up.

When Mr. Fryer came back he expressed astonishment at the fact that the set was ready so soon and the charge. "I really thought it would cost much more" he said, pulling a little package of fish-and-chip wrapping paper from his pocket and unfolding it. Inside this he had a wad of greasy old banknotes. Those he gave me were spotted with oil. "Don't bother with the change" he said, "I didn't expect to have the set back so quickly."

He left me with two thoughts. First, there seemed to be a story with his set. Secondly, how could I get hold of a little chip shop?

Bertram's JVC 2151

While I was pondering over this Bertram Blowfly staggered in with a JVC Model 2151 in his arms. "My neighbour

told me that the tube's gone" he said. "Told me he'd change it for me only his meter thing doesn't work and he's under the doctor for his nerves."

"I'd have a mental breakdown myself if I had the time" I replied. Inside the set I found a Ferguson TX100 chassis. When I switched the set on the purity was awful. So I applied my degaussing wand, expecting at least a temporary improvement if the tube's shadowmask was in place. There was no improvement at all and I began to feel that Bertram's neighbour might be right. Then, casting aside my prejudices and adopting my usual rational approach, I replaced the posistor in the degaussing circuit. When I switched on again the picture was perfect. I shook the old posistor close to my ear: it sounded like a maraca.

Vibey's Panasonic Video

Just then Greeneyes called in at the workshop. She brought with her a strange-looking chap – he looked like a human toby jug. This is "Vibey" she announced. The toby jug grinned. "He's come to prune the vine. We'll pay him in grapes from the autumn crop. He's also brought you this video that needs adjusting."

It was a Panasonic NVL28HQ. On test it worked mechanically and split the aerial signal, but that was all. It wouldn't tune, record or produce a picture from a prerecorded tape. It seemed likely that the r.f. converter was in trouble. A meter check showed that the 12V supply was present at pin 4 while scope checks showed that there was a lush video input waveform at pin 2 and audio at pin 4. But there was no composite output at pin 1. So I took it out and gently opened it. The little i.c. was much the worse for wear, having baked. So I parcelled up the converter and sent it off to MCES of Manchester. It came back so quickly that I stopped and did some sums on my fingers to see whether it had been possible in the time. On fitting the repaired converter and switching the machine on I had excellent pictures. A saving factor in this difficult trade is that we are served by some excellent firms. MCES for one has proved to be consistently reasonable and quick.

Having reassembled the machine I called Greeneyes on the internal phone and asked her to return it to her friend Vibey. "You deal with him" I said. "Forty quid. Call him out of the vine and tell him I want cash, not kind."

The Doctor's Sharp Video

My next caller was old Dr. Hokum, who's as Irish as they come. I'd first met him forty years ago when we were both patients in a TB sanatorium. We'd both recovered rapidly, he because his patients wouldn't let him go, me because I'd a lot of living to do (I didn't know then that I was going to waste my life in this trade). He brought along his Sharp VCD801 VCR.

"I think it's got heart trouble Donald" he said, "give me your opinion."

I plugged it in, inserted a cassette and looked at my monitor. Nothing appeared. "Seems to need spare-part surgery" I said. When I removed the top I saw that the idler was slipping. So I took off the bottom cover, disengaged the idler drive belt, turned the machine the right way up, removed the two red Phillips screws – one at each side of the cassette carriage – and swung the carriage out. Then I undid the two screws that secure the idler, dropped in another, replaced the carriage, hooked up the belt, tried the machine out and finally boxed it up.

"The price of the idler will do, doctor, for old time's sake."

Dealing with Surface-mounted Chips

P.J. Roberts, G1VUV

The need to remove and replace surface-mounted components, especially i.c.s, is becoming more common. Those little flat, square chips with millions of legs are a particular problem. Getting them off the board is hard enough let alone putting them on. Unless, that is, you adopt the correct approach using the right tools – rework spray solder flux, 29 s.w.g. ECW, solder cream, a hot-air soldering iron such as the Jetmatic Station, and lots of patience.

Common Suggestions

Various ways of going about it have been suggested. I've tried them and found them wanting, eventually adopting my own approach. I'll start by reviewing a couple of methods I've rejected and give the reasons for doing so.

First there's the cut and bake method, as follows. Use a very sharp knife to cut off all the chip's legs. Then remove the legs and excess solder from the board. Place the new chip on the PCB and solder it by hand.

I don't recommend this because if you slip with the knife you may damage the print or cut yourself. In addition you cannot of course re-use an i.c. that's been removed in this way.

Secondly there's the cheese wire method. Take a length of 26 s.w.g. TCW and thread it through the gap between the body of the chip and its legs. Solder one end of the wire to a firm point then heat the chip's legs while pulling the free end of the wire upwards. If all goes well – though it won't – the legs should lift up one by one until they've all been lifted from the PCB.

Again, not recommended. I've tried this method and found it to be a good print lifter.

Recommended Method

The method I do recommend is as follows:

Take two lengths of copper wire, each about six inches long. Feed each one through the gap between the chip's body and its legs (on the sides of the chip with the most pins). Lift the wire ends at one end of the chip and twist them together. Repeat at the other end of the chip, then twist all the ends together.

Spray the area around the i.c. to be removed with rework flux. Apply light tension to the copper wire while using the hot-air iron, set to 360°C, air flow 5 with the small nozzle, to heat the chip's legs and the solder in an even manner. You will feel it when the chip starts to come away from the PCB. At this point reduce the tension on the wire. If you apply too much tension via the wire as the chip comes away you might lift the PCB print.

Having removed the chip, use desoldering braid to clean any excess solder from the print lands. When the PCB has cooled down, clean off any flux with a brass pencil (pencil RS 514-868, brass refill RS 514-880).

Spray the print lands with flux. Allow it to become tacky then place the new chip on to the lands. With the chip cor-

rectly positioned over the print, solder the two pins at opposite corners of one side of the i.c.

Apply the solder cream so that it fills the spaces between the pins, with the surface of the cream flush with the top of the i.c.'s legs.

Set the hot-air soldering iron to approximately 340°C with the air flow at about 3.5 on the scale. Hold the iron about 2.5in. away from the i.c.'s legs; move along progressively as the solder cream melts and flows into the joints. When you've done this turn the air flow to maximum and quickly run over the legs once more.

Repeat this operation on the remaining sides of the chip.

It's vital that you don't overheat the i.c. The chips can be very expensive, so the less you cook them the better. Now check for any dry-joints or solder bridges.

Remember: practice on scrap panels, not on customers' units!

Hot-air Soldering Problems

Here are some of the problems you might experience while learning how to use a hot-air soldering iron.

Symptom: PCB charred.

Cause: Iron held in one place for too long.

Remedy: Keep the hot-air iron moving – don't hold it in one place for more than two seconds.

Symptom: Dry-jointed legs.

Cause: Not enough solder cream.

Remedy: Use more solder cream.

Symptom: Solder bridges between i.c. legs.

Cause: Too much solder cream.

Remedy: Use less solder cream on the i.c.'s legs. If you are careful you can remove a solder bridge using braid. Then go over the legs with the hot-air iron.

Symptom: Lifted print.

Cause: Too much tension applied to the wire whilst removing the chip.

Remedy: Apply less tension to the wire.

The comments above should enable you to adopt this successful method of dealing with SM chips. Practise on scrap panels, progressing to customers' units when you find that you can replace these i.c.s with consistent results.

Letters

STEREO SOUND FROM ASTRA?

Having purchased a Luxor Mk. II satellite TV receiver on the surplus market I set it up for Astra reception – no doubt a trivial task since the unit was designed for use with low-power satellites such as Gorizont. It came with a different LNB from the original one, but adapting the receiver to work with a magnetic polariser instead of a mechanical one was a relatively easy matter.

Most of the Astra channels offer stereo sound and the Luxor receiver has two f.m. channels. They work by using a local oscillator to change the i.f. to 10.7MHz, which is then fed to a conventional f.m. radio type i.f. strip. Provision is made for expanding the audio, but this is not required for Astra and Dolby sound decoding. There's a wide/narrow switch, and I found that the results were best in the narrow position. Some potentiometers are provided to adjust what the manual refers to as "volume", but they appear to be more than simple gain controls. They are in front of the long vertical panel on the main board, to the left of the mains transformer. The rear two affect the narrow-band volume.

Feeding the two signals to an audio vectorscope (an oscilloscope with the signals fed to the two axes) provided a surprise. My vectorscope's tube is arranged so that a mono signal produces a horizontal line while a stereo signal produces a "ball" of squiggles depending on the channel separation. But the Luxor receiver's outputs produced a vertical line, indicating a mono signal with the two channels out of phase. On some broadcasts there was a degree of separation between the channels, but this is very seldom seen. I tried adding a matrix, partially combining the two signals, to see if a stereo signal appeared. Doing this reduced the overall sound level and produced a pseudo-stereo effect that's similar to the once popular "electronically reprocessed stereo". This simply placed a capacitively-induced phase shift in one channel. Another thing I've noticed is that there seems to be excessive bass, i.e. the time-constant in the f.m. demodulator circuit is not correct for Astra's pre-emphasis.

I can see nothing in the Luxor receiver's circuit that would produce anti-phasing of the two signals and can only conclude that this, rather than proper stereo, is what Astra is transmitting.

John de Rivaz, B.Sc. (Eng.), AMIEE,
Truro, Cornwall.

LUXOR 9570/AMSTRAD FAULT

With reference to K.D. Bunting's letter (August) I too obtained a Luxor 9570 satellite TV receiver from Sendz Components. The intention was to use it with a Connexions polariser that's attached to the LNB. On the face of it this should have worked all right, as the three-terminal output (5V, pulse and earth) is identical to that on the back of the original Connexions receiver. In practice the system worked for twenty minutes or so after which it started to hunt back and forth with the polariser emitting a constant snarling noise. If left like this a fuse would eventually blow.

Obviously the Connexions polariser needs more current than the Luxor receiver can supply. My solution was twofold. First to install a second 7805 regulator to supply the polariser only (to avoid possibly overloading the existing regulator). And secondly to feed the pulse output to

the polariser via an emitter-follower. As shown in Fig. 1, my emitter-follower is mounted outside the case. This was done so that I could see if it overheated or blew up! Obviously it would be better to mount it inside the receiver. The extra 7805 is within the receiver, bolted upside-down on the heatsink using the same bolt that secures the other 5V regulator.

The arrangement described has now been in use for some days, with the receiver switched on permanently, and has worked without mishap. Fine polarisation adjustment is also satisfactory. I'm indebted to K.D. Bunting for giving me the original idea. Not having a circuit diagram I'd previously suspected that there was a faulty component rather than excessive current drain.

I recently read an article by Donald Bullock in another publication describing a battle with an Amstrad combined video/TV set. Two of these came in for repair not long ago, in quick succession. In each unit the STK7348 switch-mode chip was inoperative and ran hot, but replacement of the chip didn't cure the fault. In both cases a disc ceramic capacitor, different each time, was short-circuit. The cause of the failure was unduly close proximity of the capacitor to an adjacent heavy-duty cement resistor. Both capacitors had surface cracking. Unfortunately I didn't make a note of the circuit reference numbers, but if you do come across the problem visual inspection of the power supply area should lead you to the faulty component. Mount the replacement on longer wires and dress it away from the resistor.

Philip Lane,
Aberqeron, Dyfed.

CHANNEL 5 PROBLEMS

I must congratulate Harold Peters for his lucid article (July) on Channel 5 reception problems. It's not a subject to which I'd given much thought. Harold's article came as a bit of a shock, so I decided to look back at previous comments in the magazine on this subject.

Gareth Foster pointed out that the use of traditional high- and low-pass filters in the combining units seems to be out of the question. The gap between Bands IV and V, where nearly all the Channel 5 transmissions will lie, is only 32MHz wide however, i.e. it occupies just 8.5 per cent of the total u.h.f. TV spectrum. Thus a combination of band-pass and bandstop filters as shown in Fig. 2 would probably suffice to isolate the inputs from the two aerials and prevent

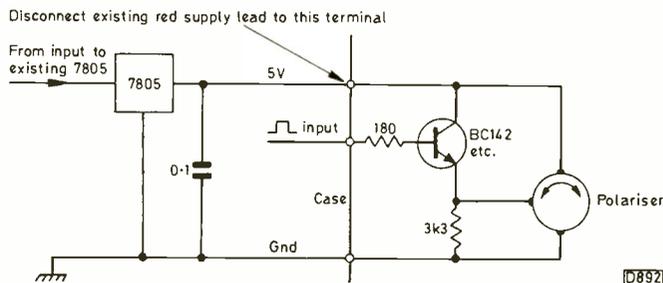


Fig. 1: Connexions polariser drive circuit for use with the Luxor 9570 satellite TV receiver.

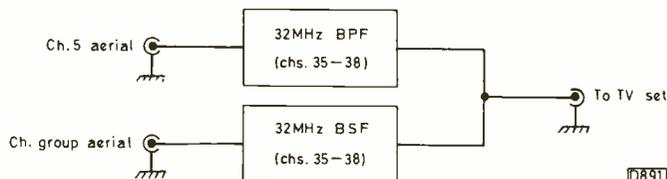


Fig. 2: Possible aerial filter arrangement for Channel 5 reception.

oscillator associated with the MC1377 RGB to composite video converter can beat with another oscillator within the unit. This can cause colour intensity flashing on the News Channel from the composite video and modulator outputs, though it doesn't affect the RGB outputs. Trimmer 2004 can be very slightly adjusted to speed up the beating to a point where it's less objectionable. This can be done via the ventilation slots, so you don't have to remove the case.

Colin McCormick,
Plymouth, Devon.

SERVICING COMMENTS

A few years ago I took redundancy after working for a national TV rental company for fifteen years but found it difficult making a living as a self-employed TV engineer.

PHOTOSTATS SERVICE

Newer readers may have missed important servicing features that have appeared in *Television* over the past few years. We have therefore in operation a photostat service to make this information readily available. Photostats of the following servicing features, listed in alphabetical order, can be supplied at the prices shown. Please send requests to: Television Editorial Department, Room L323, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Cheques/POs should be made payable to Reed Business Publishing Ltd. There are two standard prices, see below.

Feature	Price
B and O L/LX2500/2800 chassis	A
Decca 80/100 chassis	A
Decca 120/130 chassis	A
Ferguson FV31R VCR	A
Ferguson TX10 chassis	A
Ferguson TX100 chassis	A
Finlux 1000 series chassis	A
Fisher FVH-P520 VCR	A
Mitsubishi CT2227	A
Mitsubishi Euro-4 chassis	A
Mitsubishi HS304 VCR	A
Panasonic D1 VCR deck	A
Panasonic G VCR deck	B
Panasonic NV333/366 VCRs	A
Panasonic NV370/830/850 VCRs	A
Panasonic NV730 VCR	A
Panasonic NV777/780 VCRs	A
Panasonic NV2000/2010/3000 VCRs	A
Panasonic U3 chassis	A
Panasonic U4 chassis	A
Panasonic U5 chassis	A
Salora F chassis	A
Salora G and H chassis	B
Salora J chassis	A
Salora K and L chassis	B
Sanyo CTP7130/1/2	A
Sony KV2252/2256/2752/2762	B

Prices, A = £2.50, B = £3.50
Please allow 14 days for delivery.

So I took a technician's job at a local school and am self-employed on only a part-time basis now. This way I get the best of both worlds – a hassle-free day job plus a satisfying part-time job to supplement my wages.

I note with interest mention in the July issue of problems with different versions of the TDA3562 colour decoder chip. I've just had similar problems with the TDA3654 field output chip when I tried fitting one as a replacement for a TDA3652 in a Ferguson TX10 chassis (PC1560/61 version) that suffered from field collapse. The fault persisted when the replacement had been fitted. After spending a considerable time changing most of the components in the output stage and trying another TDA3654 chip I resorted to fitting a replacement panel which had a TDA3652 chip. This restored the picture. As a matter of interest I tried fitting the TDA3654 chips from the other panel, also two others, but the field collapse remained. Have I got a duff batch of TDA3654 chips or is some change necessary in addition to reducing the value of R771 in the drive feed from 6.8kΩ to 3.3kΩ?

After some consideration I decided to buy a line output transformer tester advertised in *Television* and have since found it to be invaluable. Admittedly it can't show up every fault, in particular high-voltage breakdowns (though these are often obvious), but it does give me greater confidence in ordering a new transformer when necessary. So to anyone thinking of buying such a tester I'd say go ahead.

I read about someone who snipped off the last coil of spring on the take-up clutch modification for the Amstrad 4600 series VCR. I've been doing this for some time as I regularly found that the modification was not fully effective, the machine still tending to crease tapes. This "bodge" certainly seems to work.

E.S. Branch,
Northallerton, N. Yorks.

SATELLITE NOTEBOOK

With reference to the VideoCrypt decoder problem mentioned by Nick Beer in the August Satellite Notebook, he could have saved himself some time if he had used the de-emphasis switch at the rear of the SVA1 decoder.

T. Giddings,
Harlow, Essex.

In the July Satellite Notebook there was reference to the fact that the Cambridge Computer made remote control unit used with the Finlux SR5100 IRD can interact with the Ferguson Model 51P7 CTV receiver (TX98 chassis), causing the TV set to enter the AV or tuning mode when certain functions are selected. I would like to assure readers that the problem is not caused by the Cambridge remote control unit but is related to the TX98 chassis. According to our sources, Ferguson has now cured the problem.

Ian Radley, Managing Director,
Cambridge Computer Ltd.,
Irvine, Ayrshire.

FAIR CHARGES

I read with interest and sympathy Donald Bullock's story (June) about the customer – for want of a better word – who doesn't pay call out charges. That's up to him, but people of his sort are the last to do anything for anyone for free themselves!

Look through any local paper and you will see numerous ads offering free call outs, free estimates, no VAT etc. How

do such operators survive? The truth is that they don't. If only they realised that there's no need to give free service. No other trade compares with ours in this respect. Our trade must really get a grip on itself and stop providing free this and that. The public don't appreciate it and are very quick to complain about the slightest thing that's wrong with their equipment after a repair. Whether you've charged £5 or £100 makes no difference to them when it comes to calling you back, even months later.

Every business should and is entitled to charge for estimates and call outs, whether you're a free-lance working from home (I know many excellent ones) or a company with higher overheads. You can always knock the fee off the final bill if you get the job, but make sure before you visit a customer or before the item is left with your staff that the customer is aware of the charge. If we really want our efforts and, just as important, our true status to be recognised then we must get up to date with reality. I know that times are hard and that people haven't much money. But

that's not our fault and we won't do them any favours by going bust ourselves.

Manufacturers and retailers who sell ever increasing quantities of budget, low-price equipment will also loose out since every repair estimate refused "because it isn't worth it" will lead to the customer buying a different brand the next time round, something he believes will last longer and be worth repairing. This doesn't affect the repair trade of course provided we're paid for estimates.

So come on chaps, realise your worth. Call a plumber or white goods engineer out and see what free service he offers – not a lot! We must all without exception charge for estimates and call outs. Only then will the public be educated into expecting to have to pay. Do a good job, be pleasant and they'll come back regardless. Our policy must be that money in the till for doing estimates/call outs is better than money out of the till for doing free ones.

*John Edwards,
Bromley, Kent.*

HELP WANTED

Can anyone supply a circuit diagram or service manual for the Goldstar VR700 monochrome portable? L.E. Swain, 53 Park Road, Buckden, Huntingdon PE18 9SL (0480 811 058).

Wanted: circuit diagram or in particular the mains transformer secondary voltages for the Unaohm EP684R colour bar generator. A.R. Cooper, 8 Greenhead Lane, Chapeltown, Sheffield S30 4TP (0742 463 640).

Wanted: Sinclair Microvision Model MTV1B, one tube or a scrap set. Leon Electronics, 11 Woodend Close, Three Bridges, Crawley, West Sussex RH10 1RS (0293 520 536).

Can anyone supply a field timebase panel for the Ferguson 3787/NordMende 8180? Keith Docura, DTV Service, 38 Kent Road, Margate, Kent CT9 3SN (0843 226 773).

Can anyone supply any information on a Radiotelephone Type 25 made by Ajax Electronics - also *Television* issues for May 1985, June 1986, November 1987 and March 1990? V.E. Buffin, 2 Southern Terrace, Mutley, Plymouth PL4 7LS.

Could anyone out there supply an r.f. modulator for the Sanyo VTCNX100 Betamax VCR? One from a faulty machine would do fine. R. Baker, 17 Chapel Lane, Upwey, Weymouth, Dorset DT3 5NA (0305 208 815)

Portable 3 in One



The VX 600S TV Measurements Receiver covers three essential

functions in one portable unit: Spectrum display scanning a whole band – expandable to a single channel with frequency read-out; signal strength meter – plus audible alignment tone; and picture/sound monitor – to confirm reception. It covers TV (UHF/VFH), Satellite, Cable and FM bands. Operating from an internal battery (with built-in charger) or mains supply and complete with carrying case, the VX 600S is equipped for all your professional applications.

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Electricity at Work Act

Nick Beer

Despite the fact that the Electricity at Work Act was introduced back in 1989 many people seem to be unaware of it and its requirements. The name might suggest that it applies to only the electrical industry, in particular to the electrical installation side of the industry. In fact the act is aimed at every company and employer, whatever the nature of his business. Its aim is simple: to ensure that every workplace and employee is protected from electrical danger.

Every employer must have his entire electrical installation(s) checked "regularly" by a "competent person" (electrician or electrical engineer) who has been given a contract to carry out the task, and have every electrical appliance, both fixed and portable, tested for electrical safety. Records must be kept of all these inspections and tests. Every appliance, from a multi-million piece of machinery to the kettle in the tea room, must be tested – it applies to any appliance that any employee might use or be in contact with.

This means that every item on display in your shop, if it's at any time connected to the power supply and working, must be tested. This may seem to be ridiculous, especially as appliances are tested by their manufacturers. But one should appreciate that defects can occur, especially during transit, and that you are protected by being able to say that you've tested a unit instead of simply relying on the manufacturer. I asked a Health and Safety Executive a direct question on testing equipment that's on display. He gave a less than direct reply but what it amounted to was that yes you must test everything.

The act has further implications when it comes to service technicians and engineers. Anyone who carries out repair or maintenance of an electrical appliance must test it for electrical safety and record the results.

Appliance Testing

The testing requirements are as follows. A physical examination must be carried out – are plugs, connectors and leads intact, undamaged, correct and safe? Is the unit's case undamaged and safe? Is the correct plug and fuse fitted? Engineers should of course check such things anyway regardless of the requirements of an act. Where applicable (not class II appliances) the insulation resistance between live and neutral and earth/any exposed metal part must be checked.

There is no requirement that appliances should be flash tested. I have spoken to a number of brown goods manufacturers about this. They are against flash testing because of the damage that can be caused by incorrect test methods or too frequent testing.

Portable Appliance Testers

To facilitate safe, correct and efficient portable appliance testing a number of manufacturers in the electrical test equipment business have developed units that carry out all the required tests. The appliance's mains plug is plugged into the portable appliance tester (PAT). Where required an external earth return connection is made.

Some very basic units simply have pass and fail indicators, but this doesn't allow you to record actual values for earth and insulation resistance. This is relevant because gradual insulation breakdown, due maybe to a humid atmosphere,

and increasing earth resistance, due possibly to corrosion of case parts in a microwave oven for example, can be detected and monitored. The more sophisticated PATs have a meter that shows values in addition to the relevant pass bands. An example is the Megger PAT 3, which sells for £381 plus VAT and is available from RS Components and electrical wholesalers such as Newey and Eyre. It doesn't have a flash test facility but is ideal for the average brown goods workshop.

More advanced models that include flash testing may enable test routines to be customised. This ensures thorough testing and helps to prevent mistakes, something that's a possibility when someone may be testing hundreds of appliances one after another, by prompting the user. Other features that one may find include result data logging in an on-board memory and connections to a PC for data storage and manipulation. Various software packages are available for this operation. A PAT that incorporates these features is the Seeward PAT1000S, which is available from RS Components at £590 plus VAT under order code 203-704 (240V version). A 110V version of this PAT is available, also at extra cost the option of calibration.

The Megger PAT 3

The Megger PAT 3 offers the required tests in a convenient and easy to use package at a reasonable cost. It's housed in a very tough yellow plastic case and operates as follows. The initial appliance test is for fuse check/continuity. Full or no meter deflection indicates continuity/open-circuit. With some equipment however the results may not be as straightforward as this. You get less than full-scale deflection and decaying readings when certain types of circuit are present across the mains input. This is especially the case where a switch-mode power supply is used. An open-circuit 100V d.c. voltage is applied during this test: the short-circuit current is 0.5mA.

Earth Continuity

For the earth bond test a meter deflection reads 0-0.5Ω. The pass limit is 0.1Ω. An open-circuit 6V a.c. voltage is applied at a nominal 38A, which at 0.1Ω equates to 26A and at 0.5Ω equates to 10A. More sophisticated PATs offer a choice of two test currents, with typically a lower one of 6A for appliances with lighter leads such as earthed soldering irons or lamps.

Why carry out high-current earth tests? Suppose that the earth connection in a microwave oven's plug top, or where it bolts to the case, is damaged and that only a couple of wire strands beyond the PVC sheath are actually connected. In the event of a heavy earth-current fault these strands could fuse. The earthing would then be inoperative, with a potentially fatal live oven case. The earth continuity test shows up such deficiencies.

Insulation Resistance

The test that is most often associated with electrical safety testing is of the resistance between the live and neutral connections and the exposed metal parts of an appliance. With non-earthed (Class II) appliances an earth return lead is for

test purposes connected to any exposed metal parts such as the case, aerial socket or scart socket chassis connection. A 600V nominal, 500V at 2M Ω test supply is then applied between the live and neutral connections and the test earth return lead. This is one of the benefits of using a PAT. As the mains plug of the unit being tested is plugged into the PAT a good connection to both the live and neutral pins is ensured. Many pieces of equipment have in the past been damaged because a poor connection has resulted in the voltage being applied between live and neutral! With the PAT 3 the pass limit is 2M Ω . For new units there's a standard of 4M Ω .

Tests have to be made when the repair has been carried out and the unit has been reassembled. Any test failures must be corrected or the unit removed from use. The test results must be recorded and the appliance should be marked. Labels are available from RS Components. "Tested for electrical safety" is supplemented by the date and initials. Such labels and a great deal of other health and safety material is available from Seton Ltd. (see addresses at the end of this article).

Electrical Installation Inspections

There should be no difficulty in obtaining an inspection certificate for a dealer's showroom – it will differ little from any other such installation. When it comes to workshops however the situation is different. Many electricians are unfamiliar with isolated areas used for servicing live chassis equipment and don't know how the IEE regulations apply to them. I've spent much time investigating the requirements and how they they should be satisfied in order to obtain an inspection certificate.

Let's consider one or two practical points. Beside your bench there may be a metal filing cabinet that's used to store service manuals. Your workbench feed is naturally via an isolation transformer with no earth connection. Since the filing cabinet is a metal mass it should be earthed – but do so and your work area becomes very dangerous.

There's reference to isolated areas in the IEE regulations—under "protection by non-conducting location". The following is a summary of the requirements:

- Exposed conductive parts must be arranged so that under normal circumstances no one will come into simultaneous contact with two exposed conductive parts or with an exposed conductive part and any extraneous conductive part if these parts could be at different potentials through failure of the insulation of live parts.
- In a non-conducting location there must be no protective conductors and socket outlets must not have an earthing contact.
- At every point of measurement under the conditions specified elsewhere in the Regulations the resistance of insulating floors and walls must be not less than 50k Ω where the supply voltage does not exceed 500V and not less than 100k Ω where the supply voltage exceeds 500V but does not exceed low voltage. If the resistance is less than the specified value at any point the floors and walls are extraneous conductive parts for the purposes of protection against shock. Steps may need to be taken to ensure that humidity does not affect these requirements.
- The arrangements must be permanent and also afford protection where the use of mobile or portable equipment is envisaged. Attention is drawn to the risk that where electrical installations are not under effective supervision further conductive parts may be introduced at a later date, e.g. mobile or

portable Class I equipment or metallic water pipes, invalidating this requirement.

- Precautions must be taken to ensure that a potential on extraneous conductive parts in the location isn't transmitted outside the location.
- The first regulation mentioned above is fulfilled when the location has an insulating floor and walls and one or more of the following arrangements applies:

(1) The relative spacing of exposed conductive parts and of extraneous conductive parts as well as the spacing of exposed conductive parts is sufficient if the distance between two parts is not less than 2m. This distance can be reduced to 1.25m out of the zone of arm's reach.

(2) Effective obstacles interpositioned between exposed conductive parts and extraneous conductive parts are sufficiently effective when they extend the distances to be surmounted to the values stated in (1) above. They must not be connected to earth or to exposed conductive parts and as far as possible they should be of insulating material.

(3) The insulation of extraneous conductive parts must be of adequate electrical and mechanical strength.

Apart from the obvious electrical requirements the main point is that the installation must be supervised by a competent person. My approach is to earth as much of the workshop area as possible to the standard regulations. Isolated areas as required should be as per the regulations outlined above to maintain suitable physical isolation between the two. With dedicated soak test and audio service areas the isolation requirement is nil. Soak testing in an isolated area followed by failure to test the appliance for insulation resistance could be nasty, as a short-circuit aerial isolator for example would not show up until the customer's earthed aerial was connected at home – then bang!

One needs to ensure that there are no dangerous earthed areas present in the isolated area – the most likely is a non-isolated aerial socket.

In Conclusion

If your arrangements don't comply with the requirements more detailed thought is needed. Failure to comply is serious – in fact a criminal offence – but above all compliance will ensure that you are working in a safe environment in a safe manner. We all have our opinions about such legislation and its seemingly excessive zealotry, but we have to comply. It's possible with thought and some expense.

My research into all this has been carried out over two years or so as the act is typically non-specific, using terms like "regular" and being generalised, overlooking our rather special requirements in the workshop. Thus I do hope that the points made in this article will save you time and effort.

I have to thank the Health and Safety Executive, the National Inspection Council for Electrical Installations and Contracting, the Electrical Contractors' Association and the IEEIE. You may find the following addresses useful.

RS Components, PO. Box 99, Corby, Northants NN17 9RS.

Seton Ltd., PO Box 77, Banbury, Oxon OX16 7LS.

Avo International (Megger), Archcliffe Road, Dover, Kent CT17 9EN.

Consult local directories for the addresses of Newey and Eyre branches and Health and Safety Executive offices.

ECONOMIC DEVICES 32 TEMPLE STREET, WOLVERHAMPTON, WV2 4AN

1580H	3.63	25C15730	0.25	25D716	1.39	BC148	0.05	BD232	0.27	BFR90A	0.59	CD4069	0.17	M5218L	0.36	SGSF344	5.04	TA7122BP	0.61	TDA1151	0.49	TD4405	2.92
1586R	3.72	25C1675	0.08	25D718	1.14	BC148A	0.05	BD234	0.24	BFR91	0.58	CD4070	0.13	M5231L	0.53	SKE2G202	0.63	TA7146P	5.44	TDA1170	0.96	TD4460	1.17
17052	2.31	25C1586	0.13	25D734	0.23	BC148B	0.03	BD237	0.29	BFR96	0.47	CXK62A	0.84	M5432P	1.28	SKE4F104	0.23	TA7176P	1.25	TDA1170N	1.19	TD4270A	1.48
17053	2.31	25C1740	0.11	25D762	0.62	BC149	0.03	BD238	0.10	BFW92A	0.84	CRCM2	2.54	M5453Z	1.24	SKE4F210	0.89	TA7193AP	3.26	TDA1170S	0.85	TD4270S	6.60
17088	2.31	25C1741	0.16	25D774	0.23	BC149C	0.03	BD239	0.28	BFX85	0.31	CR02AM	1.69	M54543L	1.21	SKE5F310	1.63	TA7193P	3.26	TDA1180	1.24	TD48140	2.31
17089	3.28	25C1815	0.13	25D787E	0.25	BC157	0.12	BD241	0.39	BFY50	0.31	CV12E	2.44	M54544L	1.46	SL1430	1.36	TA7205	1.06	TDA11902	3.96	TD48153	4.95
17127	1.71	25C1826	0.69	25D837	0.90	BC159	0.05	BD243	0.37	BFY51	0.33	CA109	6.84	M54548L	1.46	SL1431	1.65	TA7205AP	0.91	TDA1200	0.88	TD48170	2.55
1M4001	0.03	25C1827	0.74	25D841	1.24	BC160	0.40	BD243A	0.41	BR100	0.13	DTA124EF	0.12	M54644L	2.95	SL1432	1.53	TA7205P	0.91	TDA1270	1.73	TD48180	5.19
1M4002	0.06	25C1845	0.20	25D856	0.64	BC161	0.26	BD243C	0.31	BR101	0.95	DTA144EF	0.41	M54648L	5.04	SL471	1.65	TA7207P	1.63	TDA1412	0.74	TD48190	2.78
1M4003	0.03	25C1846	0.28	25D869	2.47	BC162	0.40	BD244	0.33	BR103	0.37	ET1400	2.08	M54898AP		SL490	2.31	TA7210P	1.45	TDA1470	0.00	TD48903	1.56
1M4004	0.06	25C1923	0.13	25D870	2.60	BC171B	0.13	BD244C	0.20	BR303	1.20	HA11235	1.73		14.69	SN29764AN	1.77	TA7214P	3.63	TDA1470P	0.00	TEA1002	5.14
1M4005	0.05	25C1942	2.31	25D871	4.95	BC177	0.13	BD245C	0.68	BRX44	0.99	HA11244	3.71	M58485P	5.78	SN7474N	0.36	TA7217AP	1.40	TDA1506	4.45	TEA1009	1.20
1M4006	0.05	25C1959	0.10	25D880	0.33	BC178	0.10	BD246C	0.75	BRV56	0.47	HA1124A	0.70	MB3730	1.89	SN75013ND	7.75	TA7222	1.24	TDA1510	1.38	TEA1014	1.81
1M4007	0.05	25C1969	1.80	25D882	0.29	BC182	0.05	BD247A	0.54	BSS38	0.11	HA11423	1.96	MB3731	1.98	SN76227N	1.03	TA7222AP	1.23	TDA1512	2.29	TEA1039	1.88
1M4148	0.03	25C1983	0.99	25D888B	2.39	BC182A	0.12	BD247B	1.40	BT120	1.24	HA11440	2.83	MB3732	2.22	SN76666N	1.20	TA7227P	1.50	TDA1515A	2.47	TEA2018A	1.46
1M4448	0.05	25C2001	0.13	25D904	6.07	BC182L	0.05	BD248	1.12	BT129	3.16	HA1166X	6.73	MC13002	3.71	SN76705AN	1.65	TA7230P	1.30	TDA15160	3.23	TEA2164	2.40
1M5001	0.25	25C2029	0.33	25D973	0.36	BC182LB	0.05	BD248C	0.39	BT139600	1.01	HA11713	1.31	MC13002P	4.65	SR2M	0.66	TA7233P	1.72	TDA15180	3.05	TEA2165	4.66
1M5002	0.05	25C2073	0.49	74L500	0.20	BC183	0.05	BD249	0.26	BT151500R	0.78	HA11741	6.86	MC1310P	0.82	STA341M	2.31	TA7240AP	0.00	TDA1670A	2.02	TEC106D	0.53
1N5404	0.07	25C2078	0.56	7805	0.23	BC184	0.08	BD434	0.28	BT151800	1.11	HA11745	5.25	MC1327AP	1.57	STA401	2.23	TA7240P	2.15	TDA1701	4.71	TEC106M	0.67
1N5406	0.11	25C2141	1.43	7805T022	0.23	BC184L	0.03	BD435	0.36	BU205	1.03	HA13001	1.30	MC1330AIP	1.22	STA441C	2.39	TA7241	2.23	TDA1770	2.49	TEC106S	0.57
1N5408	0.10	25C2166	0.92	7808	0.24	BC184LC	0.09	BD436	0.31	BU208A	0.92	HA13108	2.67	MC1350P	1.76	STK0029	5.70	TA7243P	2.71	TDA1870	2.64	TIL100	0.50
1N5414	0.03	25C2168	0.87	7812	0.35	BC204	0.35	BD437	0.31	BU208D	0.85	HA13116	1.85	MC1352P	1.40	STK0039	5.50	TA7250	3.28	TDA1904	1.17	TP110	0.33
1S1555	0.21	25C2236	0.25	7815	0.24	BC207B	0.22	BD438	0.16	BU208A	0.50	HA13119	1.63	MC1358P	1.23	STK0040	9.18	TA7267P	1.96	TDA1905	0.91	TP112	0.00
1S2076	0.28	25C2271	0.21	7818	0.39	BC212	0.04	BD441	0.69	BU406	0.43	HA13403	3.96	MC14393	3.79	STK0059	4.46	TA7270	1.56	TDA1908A	1.10	TP112H	0.00
2N2219A	0.26	25C2274	0.21	7905	0.41	BC212B	0.05	BD442	0.40	BU406D	0.33	HA1374A	2.89	MC14528BCP		STK025	9.30	TA7270P	1.50	TDA1940	3.89	TP120	0.55
2N2222	0.16	25C2274K	0.13	7912	0.33	BC212L	0.05	BD443	1.30	BU407	0.57	HA1377	1.36		2.15	STK043	0.37	TA7270P	1.90	TDA1950	2.01	TP121	0.40
2N2905	0.20	25C2314	0.28	AA119	0.34	BC213	0.10	BD529	0.93	BU407D	0.94	HA1388	1.87	MDA2062	2.14	STK3042	4.82	TA7273	3.43	TDA2002	0.82	TP126	0.51
2N2926G	0.35	25C2335	1.07	AA143	0.12	BC214	0.05	BD530	1.01	BU426A	0.64	HA1389	2.44	MJ2955	0.94	STK3062	8.62	TA7274P	2.15	TDA2003V	0.63	TP132	0.44
2N3053	0.34	25C2456	0.08	AC127	0.10	BC214L	0.08	BD535	0.41	BU426E	2.06	HA1392	1.56	MJ802	2.60	STK4131	7.56	TA7280	2.11	TDA2004	1.23	TP137	0.46
2N3054	0.95	25C2482	0.25	AC141K	0.44	BC237	0.04	BD536	0.46	BU500	1.06	HA1397	2.56	MJE13005	0.79	STK4141	8.00	TA7281	2.09	TDA2005	1.24	TP2955	0.79
2N3055	0.42	25C2547E	0.23	AC176K	0.29	BC237A	0.07	BD675	0.29	BU509A	0.90	HA1398	2.56	MJE2955	0.66	STK4142	7.97	TA7299	1.93	TDA2006	1.02	TP299C	0.29
2N3442	1.12	25C2565	3.67	AC187	0.15	BC237B	0.04	BD677	0.29	BU509AF	1.10	HA1452	0.95	MJE3055	0.49	STK4162M	9.22	TA7313P	0.60	TDA2009	2.23	TP299E	0.39
2N3702	0.10	25C270A	1.28	AC187K	0.31	BC238	0.10	BD707	0.49	BU509D	0.85	HM6232	5.77	MJE3059	1.38	STK4171		TA7317P	0.77	TDA2020	2.29	TP3055	0.69
2N3704	0.13	25C2577	0.20	AC188	0.29	BC238B	0.05	BD839	0.49	BU509DF	1.36	HM6251	5.69	ML2370	0.23		10.56	TA7325P	1.63	TDA2030	0.00	TP300C	0.16
2N3773	1.23	25C2581	2.38	AC188K	0.65	BC239	0.03	BD901	0.45	BU509V	1.13	HM7103		ML923	3.82	STK4181H		TA7343AP	0.69	TDA2030H	0.71	TP301	0.00
2N3819	0.33	25C2632	0.28	AD149	0.58	BC252B	0.16	BD902	0.58	BU526	1.36		13.66	MN1405VKF			12.47	TA7358P	0.75	TDA2030V	0.66	TP31A	0.25
2N3904	0.10	25C2655	0.24	AD161	0.99	BC300	0.28	BD911	0.63	BU536	1.59	ICH281	1.20		11.41	STK4181A		TA7358P	0.66	TDA2040	1.63	TP31B	0.29
2N4444	2.60	25C2671	0.19	AD162	0.92	BC301	0.33	BD912	0.68	BU536	1.54	KA2101	0.58	MN1435VX			12.09	TA7607AP	1.89	TDA2170	2.47	TP31C	0.28
2N6292	0.60	25C2688	0.29	AF124	0.74	BC302	0.35	BDV658	1.12	BU705	1.56	KB108	0.45		12.75	STK4332		TA7609P	1.90	TDA2270	3.91	TP32A	0.35
2N6195	0.08	25C2945	0.16	AF127	0.58	BC303	0.26	BDW84C	0.94	BU806	0.95	KS91004	0.08	MN14355VX	9.98	STK4352	1.68	TA7630P	7.00	TDA2525	3.54	TP32C	0.36
2SA1016	0.17	25C2791	1.25	AF139	0.28	BC307	0.05	BDW93C	1.06	BU806A	0.78	L200CV	1.09	MN650	2.27	STK437	7.96	TA7630P	1.04	TDA2530	0.41	TP33	0.57
2SA1020	0.30	25C3150	4.06	AF239	0.41	BC307A	0.05	BDW94C	0.45	BU807	0.49	LA1201	0.54	MPS442	0.22	STK4392	5.26	TA7640P	1.81	TDA2540	0.36	TP33A	0.89
2SA1020Y	0.30	25C3153	2.21	AF279	0.33	BC307B	0.05	BDX32	1.65	BU826A	1.53	LA1230	1.86	MPSA56	0.11	STK441	9.73	TA7676P	4.13	TDA2541	1.46	TP33C	0.95
2SA1085	5.71	25C3156	3.61	AL102	2.48	BC308	0.05	BDY20	2.06	BU908	1.13	LA1385	1.40	MPSA93	0.08	STK459	7.73	TA7684P	4.39	TDA2560	2.47	TP34	1.15
2SA1102	1.73	25C3182	3.13	AN245	5.78	BC308A	0.11	BF115	0.39	BU9444	2.04	LA3161	0.37	MPSU10	2.54	STK461	8.99	TA7698AP	5.77	TDA2576A	4.65	TP34C	0.86
2SA1143	0.17	25C3225	0.33	AN381K	7.01	BC308C	0.05	BF179	0.30	BU111	0.87	LA1410	0.35	MR854	0.13	STK4843		TA7705P	1.38	TDA2577	4.71	TP41A	0.29
2SA1175	0.49	25C3796	1.27	AN535	1.30	BC327	0.09	BF184	0.40	BU111A	0.69	LA1482	0.75	MSM5840H			11.19	TA7769P	1.39	TDA2577A	2.76	TP41B	0.30
2SA1186	3.42	25C3800	0.12	AN543	1.24	BC327B	0.17	BF185	0.28	BU111AF	0.82	LA1912	1.10		14.91	STK5211		TA8205	3.18	TDA2578A	2.47	TP41C	0.35

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BU 208A	0.82	TDA 2579A	2.50
BU 508AF	1.00	TDA 3653B	1.56
CO AXIAL AERIAL PLUG X25	3.75	TEA 1014	1.32
LM 317T	0.21	TIP 110	0.25
TDA 4503	3.70	TV FAULT FINDING GUIDE	8.99
SEMICONDUCTOR DATA BOOK	8.50	2M2222	0.08

25X°F CONNECTOR (SCREWTYPE) £3.00

2SA1208	0.25	25C388A	0.57	AN6512	1.82	BC328	0.06	BF194	0.14	BU112A	0.82	LA4220	1.25	MMS240	0.51	12.63	TAR210H	3.96	TDA2579	2.85	TP42A	0.29
2SA1265	1.89	25C458	0.08	AN5515	2.06	BC337	0.09	BF196	0.14	BU1T56A	0.55	LA4261	1.60									

VCR Clinic

*Reports from Philip Blundell, AMIEIE
Eugene Trundle, Michael Dranfield,
Alfred Damp, Nick Beer, Brian Storm
and Joe Cieszynski.*

Philips VR703/713/813

For intermittently ejecting the tape while in play or record, especially in the LP mode, and E4 or E5 in the error memory, check the amplitude of the reel tacho pulses. If they are low change the value of the opto pull-up resistors R3318/9 from 100k Ω to 47k Ω . **P.B.**

Philips VR6585/Granada VHSGP7

There is usually, but not always, a mechanical cause for mechanical misalignment of the Panasonic G deck. In this case the cause was electrical. After replacing the stripped gears and checking the operation of the mechanism by rotating the drive by hand I connected the power. The mechanism took the cassette in but didn't find the half-load position. After four or five attempts the cassette would be ejected. Sometimes the capstan would run at full speed when the power was connected: as the motor didn't stop at the fully threaded position you would have to repair the gears again if you weren't quick to disconnect the power! We fitted a new mode switch and a new tray position switch, but the fault was still present. Fortunately we had a new stock machine of the same type, so we were able to do some panel swapping to localise the cause of the fault. This proved that the cause of the trouble was in the power supply. The output voltages were correct, but they dropped when the deck was in operation. A new CNX83A optocoupler put matters right. **P.B.**

Sony SLV373

Sony machines are not given to tape chewing. This one would damage the tape at the end of high-speed rewind however, especially if you went straight to eject. The cause of the trouble was that the take-up reel was being inadequately braked. This was because the felt pad on the brake shoe was skew-whiff. As a result it failed to contact the turntable rim. We restuck it with Superglue. **E.T.**

Logik VR955/Samsung VI710

If the problem is no erasure (the old sound left on the tape and floating colour blobs on playback of the machine's own recordings) look no farther than L0504, which is a little oscillator module in a screening can. It's prone to staging a mini bonfire inside. Willow Vale can supply replacements under part number 79710CB. **E.T.**

Sharp VCA140HM

When this machine had been running for about twenty minutes the capstan motor would start to stop for about half a second every few seconds, giving a momentary freeze-frame effect twice a minute. We found that the i.c. incorporated in the capstan motor was too hot to touch, so a new motor was fitted. This cured the problem. Note that a different capstan motor (part no. RM0TN2020GEZZ) is used in machines whose serial number is above 628200, as this one was. **E.T.**

Hitachi VTM820E

Sometimes – not often! – this machine would record and play with severe mistracking. Playback of a good recording would

give no sound and multiple narrow noise bars across the screen – rather like the effect of cue-mode operation, but at normal speed. If by chance the fault was present during both recording and playback of the same programme the picture and sound came through quite well. Close examination of the deck when the fault was present showed that the tongue of the exit guide pole assembly failed to locate properly in its V block. The cause of this was that the plate assembly's inner slide bar (no. 216 in the exploded diagram in the manual) was bent upwards slightly. We judiciously bent it back downwards slightly. **E.T.**

Ferguson FV11R

The complaint with this VCR was that it kept stopping after about an hour's use. On test we found that the tape counter stopped counting. The cause of this turned out to be the famous loose deck earthing screw that provides the earth return for the take-up optosensor and the mode switch. What puzzled us was that in every previous case we've dealt with this screw has caused a loading fault when loose. Presumably a high-resistance connection was enough to upset the optosensor but not the input to the microcomputer chip from the mode switch. Incidentally the official cure is to fit a small shake-proof washer beneath the screw, not just tighten it. **M.Dr.**

Saisho VR3400

The problem was that the take-up reel wasn't being braked when stop was pressed during rewind, causing tape to be spilled into the machine. We've had this fault often enough with the Sharp VC8300, but in this case we were unable to find the brake. On the underside of the deck the take-up reel is obscured by the master cam: it looked like a fair old job stripping the lot down. A check on the supply spool however suggested that the brake was on the inside of the spool. After removing the take-up and supply reel discs the cause of the problem was clear. A small spring was missing. We assumed that it had never been fitted. When we'd found and fitted a suitable spring the machine functioned normally. **M.Dr.**

Sharp VC9300

This machine came in from another dealer with the suggestion that the 12V supply was missing. Sound was o.k. but there was no E-E or playback vision. Scope checks showed that the video signal was o.k. up to the HA11703 chip IC402 but didn't emerge at pin 16 of this chip. An incorrect d.c. voltage reading (12V) at this pin led us to check Q406 (2SC945) which was short-circuit collector to base. Hence the 12V at pin 16 of IC402. A new transistor put matters right – fortunately the chip hadn't been damaged. **M.Dr.**

Ferguson FV26D

This machine came from another dealer with the complaint of no playback video. On test we found that the E-E picture seemed to be slightly over-modulated. There was a good f.m. envelope at pin 39 of the PB20166G chip IC101. Further checks on this i.c. showed that the output at pin 10 wasn't passing via LPF102 to reach pin 21. As we didn't have this

filter in stock we had to order one from CPC. It arrived next day. When we'd fitted it the machine was back in good working order.

M.Dr.

Hitachi VT220

This machine was dead with no switched 5V or 12V supplies. The display lit up and the operate LED was on continuously. We found that IC901's reset pin 49 was high at 5V instead of being at 0V. The reset pulse is generated within IC802 on the VS tuning PCB. A check at pin 9 of this chip showed that everything was in order. The collector and base of transistor QR804 were both at 5V however – the collector should have been at 0V. Replacing QR804 restored normal operation. **A.D.**

Hitachi VT63

The problem with this machine was overloaded video. A quick scope check revealed that the cause of the fault was at the front end, on the tuner/i.f. board. C832 (470µF) was short-circuit. **A.D.**

Panasonic NV333

The reported problem was faulty audio. We found that the VCR also refused to work mechanically. The audio fault was in the E-to-E mode: approximately one second of audio was heard about every five seconds. The audio mute line was high most of the time but dipped low to allow sound to be heard intermittently. The audio mute command comes from the syson chip IC6001. A check at its reset pin 27 showed that a continuous line of pulses were present here. The reason for this was traced to D6038 which was leaky. **A.D.**

Panasonic NVMC20

There was a problem with this camcorder's electronic viewfinder. I replaced the c.r.t. as it had been cracked when the unit had been dropped. On soak test the new c.r.t. fired over and I was left with an overbright raster with flyback lines – vision was discernible. The d.c. conditions around the video output from the chip were low while they were high at the collector of the 2SA1532 video output transistor Q803, a tiny surface-mounted device. There should have been -11.9V here but there was over 1V. As there was -23V at pin 9 of the line output transformer we checked Q803 which turned out to be short-circuit collector-to-base. **N.B.**

Samsung VI710

The carriage was out of sync with the rest of the mechanism – there's no separate front-loading motor in these machines, the drive coming from the main mechanism loading motor. Retiming got the machine working but it would snap intermittently as teeth slipped. There was too much lateral play in the front-loading mechanism because of a crack in the right-hand black plastic sidepiece where the cogs mount. **N.B.**

Panasonic NVL20

This G mechanism machine refused to load a tape because it had damaged gears. So out came the main cam gears (VDG0343 and VDG0346) which both had damaged teeth. The subloading cam gear (VDG0448) and arm (VXL1857) were also broken. Replacements were fitted, along with a new deck mode switch (VSS0175A) in case this was the source of the problem. In the test mode with the carriage out everything worked correctly. After refitting the carriage how-

ever I managed to jam the cassette across it. Instead of the machine stalling and ejecting the tape there was a raucous clattering of disintegrating nylon teeth, after which the machine sullenly powered down. Once more to the gear drawer.

In these machines the mechanism is driven by the capstan motor via a simple gearing system that's engaged by a solenoid. To prevent the full capstan torque damaging the nylon gears there's a friction clutch on the bottom of the capstan rotor: it's designed to slip before the gears are damaged. In this case the clutch was the cause of the problem – it was too tight. A replacement rotor and another set of gears restored normal operation. **B.S.**

Panasonic NVJ30

This machine suffered from very intermittent capstan servo problems. After about three hours' operation the sound would start to wow and tracking bars would flash and flicker across the picture. Unfortunately the symptoms were erratic and couldn't be relied upon, so fault-finding of any sort was fruitless. Convinced that the cause of the fault was in the main systems and servo circuit we changed many i.c.s and capacitors in this area, but the fault continued to recur. After the machine had spent many weeks on the soak test bench the cause proved to be C1122 (330µF, 10V) in the power supply module. It was apparently going open-circuit when hot. **B.S.**

Panasonic NVF55

The complaint was of monochrome recordings and an unstable picture. On test however all that this modern Nicam machine would do was to display E9 in the self-diagnosis list. According to the service manual this means no serial data. The MN67431VREH systems and servo flat-pack chip IC6001 was totally inactive. A replacement got the machine working and we were then able to attend to the original complaint. This was dealt with by switching off the NTSC 4-43 switch which is meant for copying NTSC tapes only. **B.S.**

Ferguson 3V35

When switched on this machine was mechanically dead – it wouldn't even accept a cassette, though E-E came up. After ruling out such things as the cassette lift and the power supply we turned our attention to the system control section. A cassette was manually loaded and left in the unlaced position. The relevant logic conditions around IC201 were then checked. This showed that when any function was selected the microcomputer control chip would attempt to energise the relevant motors though nothing happened. At this point we discovered that circuit protector CP1 was open-circuit. It's on the servo/mechacon panel and is in series with the 13V supply to all the motors apart from the drum motor. With CP1 replaced the machine would load a cassette and fast wind was restored, but it still wouldn't thread the tape when play was selected. Further tests showed that the mode/lacing motor was open-circuit. A replacement restored full operation. **J.C.**

Ferguson 3V36

Sound problems are rare with these machines. One that had no E-E or playback sound came along recently however. We soon found that there was no d.c. supply to any of the sound chips on the main sound panel, which is mounted at the back of the chassis. The cause of the trouble was that the regulator transistor Q4 on the sound panel was short-circuit base-to-collector. **J.C.**

Long-distance Television

Roger Bunney

The 1992 Sporadic E season has well and truly arrived. A look at the June loggings shows that there were prolonged openings on several days while one day in particular, the 22nd, produced some quite remarkable DX-TV results. Before listing the cumulative SpE log we'll briefly run through the other events of the month.

Iain Menzies noted an intense aurora during the early evening on the 8th: the v.h.f. reflection included some heavily distorted Band I TV pictures. A high-pressure weather system centred over the UK for much of the month produced some remarkably hot weather, reaching into the mid-80s (°F), and enhanced tropospheric propagation. There were two main phases. The 11-14th produced signals from the Benelux countries, France and Scandinavia. The peak day was the 14th, with signals from Denmark, Sweden, Norway, the Benelux countries – even Ireland. These Band III/u.h.f. signals were at high levels. Towards the end of this period signals also started to arrive from Spain in the south west. The first Spanish u.h.f. channels seen are usually E34, E37 and E42: it's worth keeping an eye on these channels when propagation from a southerly direction occurs. There was more tropospheric propagation on the 17th, which produced an even more intense opening with good reception from Scandinavia – even Danish Band I signals were received. Well done David Oliver (Birmingham) who received numerous Swedish second chain transmitters. Towards the end of the month, on the 27th, a very slight tropospheric lift brought signals on the usual Spanish u.h.f. channels to the south-west UK.

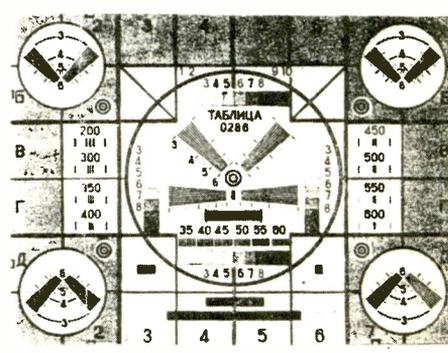
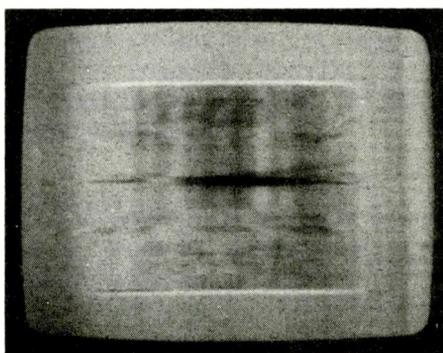
Now for the SpE log:

- 4/6/92 TVE (Spain) chs. E2, 3, 4; TDF (Canal Plus, France)ch.L3; RAI (Italy) ch. IA; +PTT (Switzerland) E2; plus Arabic signals - see later.
- 5/6/92 TVE E2, 3, 4; RTP (Portugal) E2, 3; RAI IA, B;+PTT E2, 3; TDF L2; HTV (Yugoslavia) E4; RTM (Morocco) E4.
- 6/6/92 TVE E2, 3, 4; RAI IA, B; TVA (Italy) E3; TDF L2,4; ARD(Germany) E2; HTV E3; TVR (Rumania) R1, 3; CSI R1, 2,3; SVT (Sweden) E2, 3, 4.
- 7/6/92 ORF (Austria) E4; CST (Czechoslovakia) R1; +PTT E2, 4;TVP (Poland) R2; DR (Denmark) E3, 4; CSI R1-5; SVT E2,3, 4; NRK (Norway) E2, 3, 4; MTV(Hungary)

- R1; RUV(Iceland) E4; TDF L2, 3; RAI IA, B; TVA E3; ARD E4.
- 8/6/92 DR E3; TVE E3; +PTT E2.
- 9/6/92 TVE E2, 3, 4; RAI IA; DR E3; ARD E2; CSI R1.
- 10/6/92 CSI R1, 2.
- 11/6/92 DR E3.
- 12/6/92 DR E3; +PTT E4.
- 13/6/92 TVE E2, 3.
- 14/6/92 TVE E2, 4; DR E3.
- 15/6/92 TVE E2, 4; +PTT E2, 3; ARD E2, 3; DR E3.
- 16/6/92 +PTT E2, 3; DR E3.
- 17/6/92 TVE E2, 3, 4; RTP E2, 3; RAI IA; CSI R1.
- 18/6/92 ARD E2; +PTT E2, 3; TVE E3.
- 19/6/92 RAI IA; TVE E2, 3, 4.
- 20/6/92 TVE E2, 3, 4; TVE-2 E2; RAI IA, B; RTP E3;+PTT E2, 3;ARD E3, 4; SVT E2, 3; NRK E2; DR E3; HTV E3, CST R1,2.
- 21/6/92 TVE E2, 3, 4; TVE-2 E2; RAI IB; RTP E3; TDF L2.
- 22/6/92 TVE E2, 3, 4; TVE-2 E2; RTP E2, 3; RAI IA, B; TDF L2;CSI R2; NRK E3, 4; SVT E4; CST R2. Plus various Canadian signals, see later.
- 23/6/92 SVT E2, 3, 4; NRK E2, 3; RUV E4; HTV E4; TVE E2; RAI IA;CSI R1-5. Very weak ch. A2 signal at 0545.
- 24/6/92 DR E3; SVT E3; +PTT E2, 3; TVE E3.
- 27/6/92 SVT E2, 3; DR E3; ARD E3; +PTT E2, 3; RAI IA, B; HTV E3.
- 28/6/92 RAI IA, B.
- 29/6/92 TVE E2, 3; HTV E3.
- 3/7/92 HTV E3, 4.

From 1930-2100 BST on the 4th there was notable reception of Arabic signals on ch. E3. Italian ch. IA signals were present at this time, which suggests that the Arabic reception was possibly via double-hop propagation. While a single Arabic station was predominant during this period at 2044 a second Arabic signal with captions was seen as a floater. The predominant signal consisted of an American movie with white Arabic subtitles: one of these signals was undoubtedly JTV Amman.

Monday the 22nd was another dramatic day, for Cyril Willis at any rate. At 1452 he noted a smeary, rolling ch. E2 picture: it was the Astra TCC channel but unlike the official transmission this one had subtitles. At 1500 he saw the same signal on ch. E2, without subtitles. Are Italian private stations maybe lifting the Astra downlink? At 2115 he found signals on ch. A3 (525 lines). Later, at 2235 onwards, he received 525-line signals on chs. A2, 3 and 4, with floaters. A check on the audio showed that these signals consisted of both English and French language programming. The signals were still present at 0100, but were very weak. A check on station lists led Cyril to the following possible source identifications: ch. A2 CBFT Montreal or CJBR Rimoushi (both in Quebec



Left: End of transmission logo from the Ekran satellite, received at 714MHz in Sri Lanka by Bandula Gunasekera. Centre: Egyptian second network clock received by Garry Smith (Derby) via F2 from Dumyaç ch. E2 (900W) in mid-February. Right: The 0286 CIS test card, designed in 1986.

with French language); ch. A3 CBHT Halifax, Nova Scotia (English – the ads mentioned St. Johns); ch. A3 CBWFT Winnipeg (rather far but no other French language station listed on this channel); ch. A4 CBOT Ottawa (English). A remarkable evening!

In all a fairly active month, especially so near to the cycle 22 sunspot maximum.

Our thanks to Cyril Willis (King's Lynn), David Oliver (Birmingham), Simon Hamer (Powys), Peter Schubert (Rainham), Roger Fussell (Torpoint), Garry Smith (Derby) and Iain Menzies (Aberdeen) for sending in reception reports..

News Items

Czechoslovakia: By the end of the year some sections of the Czech (CTV) and Slovak (STV) networks will have switched to full-time PAL transmissions using system D/K (6.5MHz sound-vision spacing). Regular test transmissions two days a week are being carried out during the summer. The main CST channel will continue to use SECAM to serve the half million or so SECAM only receivers in use. The new Bratislava transmitter will use PAL system B/G from the start. It's expected that the whole network will switch to PAL at some date in 1995.

Greece: It's expected that the new "Nea Tileorasis" channel will be providing a countrywide service by the end of the year.

France: The French/German ARTE channel is due to start transmissions shortly using the former La Cinq network.

Estonia: Estonian TV has formed a commercial offshoot called Reklaami TV (RTV).

Norway: The new TV2 network comes into operation on September 5th, covering 75 per cent of the population. Break-even for this commercial service is expected to be in late 1995. Headquarters for the service is at Bergen.

Finland: A new channel called MTV is to come into operation next January. This commercial channel has leased transmission time over the YLE-2 network.

The Netherlands: The American Forces u.h.f. transmitter at Soesterberg is to close at the end of the year. A new identification, "Nozema", is in use on the Dutch test pattern. The initials stand for Nederlandse Omroep Zender Maatschappij.

Radio Microphones: Early radio microphones used in the broadcasting industry operated on specifically allocated spot frequencies around 170-180MHz and 200MHz. U.H.F. types operate in the low 470MHz band with a further allocation in ch. 35. Apparently many visiting pop groups from overseas find that their radio microphone kits are non-DTI approved and clash with local cellphone transmissions. The DTI has now approved a radio microphone band in ch. 69, with freedom to operate on any frequency within this spectrum. It seems that there are no standard international radio microphone frequency allocations.

Satellite TV

The BBC used HDTV equipment at the Centre Court, Wimbledon for internal demonstrations and HD-MAC transmissions via the Olympus satellite to Expo '92 in Seville. HDTV uplinks from Seville were transmitted via France Telecom to the IBC, Amsterdam, to the Eureka 95 HDTV conference in Rome and to Philips, Eindhoven for technical evaluation.

The Intelsat K satellite is now in orbit at 21.5°W. It has 16 Ku band transponders that can operate in the half-transponder mode to offer 32 links between North/South America and Western Europe. Brightstar and RAI have each leased two transponders, Brightstar for news feeds and RAI for direct-to-

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Aerial Techniques

home transmissions to the Americas, probably scrambled.

The back-up Marco Polo satellite has been sold to Norwegian Telecom. It has been repositioned at 1°W where the other may join it once BSkyB services have ceased.

Intelsat has announced further orbital allocations: a parking slot for inclined orbit type V and VA craft at 40.5°W, re-siting of the V F6 craft at 50°W and a slot at 91.5°E for the V F1 craft to provide improved Asian links. During the autumn of 1994 the Eutelsat II F6 craft will be co-located with the II F1 craft at 13°E, offering another 16 TV channels to bring the total to 39 channels from 32 transponders. The transponders run at 70W, providing an e.i.r.p. of 49dBW across Europe. Coverage in the widebeam mode will be from the Ukraine/Turkey to Morocco, Iceland and the far reaches of Scandinavia.

Star TV (Hutchvision) has started a multilingual channel via the Asiasat 1 craft, offering programmes in Hindi, Japanese, Bengali, Urdu and Arabic.

Strong rumours suggest that Filmnet will soon adopt D2-MAC with Eurocrypt via transponder 11 on Astra 1A. VisEurope is using Videocrypt via its Telecom Band news feed transponder.

The EBU's Euronews Editorial news service is to start on January 1st 1993.

Iran TV plans to start a two-channel service to Azerbaijan and Tajikistan. Turkey is already transmitting its Avrasya (Euro-Asia) service to Turkmenistan and neighbouring republics.

Broadcasting Technology

US firms Scientific-Atlanta and Mediatech are developing the first operational digital compression TV service. It will be

used by Mediatech to distribute commercials direct to broadcasters via satellite and should prove the feasibility of using SA's VQ (vector quantisation) video compression technique. The VQ technique carries out compression on a frame-by-frame basis and is said to be more accurate than DCT (direct cosine transform) compression. It can carry additional information such as invoicing, timings etc. At its present stage of development the VQ technique enables up to four compressed TV channels to be carried in the space of a single standard analogue TV channel along with twenty high-quality audio signals. SA considers that VQ will eventually enable up to ten TV channels to be carried by a single transponder. Meanwhile the Comsat Corporation has filed with the FCC details of an offer to clients of satellite links using digital compression.

In the UK National Transcommunications is testing a digital compression system called SPECTRE. This is an ongoing programme that could lead to HDTV, possibly transmitted in parallel with the present PAL services.

Test Case 357

High summer is Victor-the-Vid's busiest time. He's in the business of recording weddings, parties, sports events and so on for posterity – at a price. With his little camcorder, his enhancer and title generator, his copyright-free music and his jog-and-shuttle home deck he'll turn the happy day into an epic. Extra copies £20 each.

Now Victor is given to tinkering with the miscellany of equipment he uses in his enterprises, and much of the gear is of uncertain age and origin. So when he pays a visit to the workshop, festooned with AV leads and with lenses, batteries and adaptors bulging from his pockets and soft carry-case, the technicians tend to become scarce.

As is usually the case with Victor and his wondrous works, there was on this occasion nothing simple about the fault symptom. Not for him a blocked head or blown fuse! The story went something like this. A recording had been made using his full-size VHS camcorder. Then, using a posh Panasonic edit deck, one of the very best available on the domestic/enthusiast market, parts of the sound track were over-dubbed. This process consisted of wiping out the 1mm wide longitudinal sound track on the original recording and replacing it with some locally-generated signal of Victor's own concoction.

The new sound track was fine when played back in the Panasonic wonder-machine. When it was played back in the camcorder that had been used to make the original recording however the sound track was marred by remnants of the original sound – the picture was fine. Weak and muffled the remnants may have been, and audible during only the quiet bits of the new sound track, but they were certainly there and that was no good to Victor. Why did he want to play the dubbed tape in the camcorder anyway? Because he'd found that there was less timing jitter (and thus less picture wobble) when a copy was taken from playback using the machine that made the original recording.

He played the tape once again in the Panasonic home

deck. There were no signs of audio crosstalk. He next selected a JVC HRD860 from his battery of VCRs. A test run showed that reproduction of the dubbed sound track was excellent, with no incursion of noise from the original track. When he fed the tape into a rather ancient GEC top-loader however our videographer's twitching ear once more detected a very slight double-track effect as he wound the TV set's volume control up and down. So he loaded the camcorder and the Panasonic edit/dub machine into his car and brought them to us, along with the offending tape, the inevitable hook-up leads and four closely-written pages of fault description on his Victor Video headed notepaper. Our man read through it, threw up his hands in horror and made his way down to the Nag's Head for lunch.

He thought about the problem over his pint and ploughman's in the pub's sunny garden. Could it be that the erase or record bias level in the Panasonic machine was incorrect? If the machine hadn't erased the original sound completely in the dub mode how was it that some VCRs were able to play back a pure sound signal? Maybe the bias/erase oscillator's frequency was wrong.

While our technician considered all the symptoms, aware of the fact that V-the-V may have been in the old GEC machine (and even maybe the camcorder!) at some time, an idea dawned upon him. It was something that would be easy to check in the workshop. When he returned he got busy and found that he was right. The fault was soon cleared, without the need for any replacement components. What had been the cause of the trouble? For the answer and another item in the test case series see next month's issue of *Television*.

ANSWER TO TEST CASE 356

—page 740 last month—

The symptom described last month used to be called ringing. And ringing it usually was: an inductive component associated with the line scan coils, or even the coils themselves, would produce a little oscillation initiated by the line flyback pulse. This damped oscillation would alternately accelerate and slow down the progress of the electron beam(s) at the start of their forward scan(s). As the brightness of the spot is proportional to its speed, the result would be alternate light and dark areas. A slow beam is bright, a fast one dim. Velocity modulation is the posh term for this effect, which is nowadays used in some sets to sharpen the vertical edges in the picture – but we digress.

If Roger had closely examined the line scan current in the set under investigation – maybe compared it with the current flowing in another set of the same type – he would have found that it was quite normal. The fault was in fact due to intensity modulation of the electron beams. Not at the cathodes or grid, which had already been checked, but at the tube's first anode where Television Ted's oscilloscope showed a line-rate waveform at about 50V peak-to-peak. Much of it took the form of a sinusoidal wiggle just after the line flyback pulse. It came from the line output transformer's overwinding and was modulating the first anode voltage because the 10nF, 2kV decoupling capacitor C901 had failed – it was virtually open-circuit in fact.

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Satellite Notebook

Nick Beer

A visit to Pace at Shipley has enabled me to get clarification on the spares position – you may recall the problems I mentioned last month. The visit itself will be the subject of a forthcoming article.

Pace Spares

Pace will deal on a pro-forma basis with dealers/service centres where this is required. As I discovered during my visit, the company's spares stocks are incredible. Pace has appointed CPC of Preston as its main spares supplier for the UK however. The arrangement with HRS dates from an earlier time, before this company was taken over by the Ring Group. HRS can still supply spares, but on more of an "as required" basis. CPC on the other hand hold Pace supplied stocks at a minimum agreed level as models reach certain ages or production points. In fact CPC is able to offer a "total spares support" service.

On my return to Devon I was greeted by a fax from CPC and subsequently received copies of the company's catalogue along with various newsletters and supplements. It looks as if the service provided is good. CPC can be contacted on 0772 555 034, fax 0772 201 905.

Satellite Servicing Book

For several years now U-View has been publishing servicing data books on TV chassis and VCRs. They provide circuit diagrams and, where available, layouts, board interconnection diagrams, alignment details and so on. Mick Dutton has reviewed them in the past in these pages. I'd say that they are essential if you service all brands and don't hold all the official manuals. The latest addition to U-View's servicing series is *Satellite Servicing 1987-90*. It provides circuit diagrams and other data and information from the majority of firms active in this field. An index doubles as a cross-reference guide to similar models.

Each section contains, in varying degree, a specification, block/interconnection diagrams, a parts list, an exploded diagram of the mechanics and details of the dish hardware supplied and plug-socket connections for special decoder plugs etc. – all this is addition to the circuit diagram. Remote control handsets are not overlooked where the information is available from the manufacturer.

I was surprised at the scope of the publication's coverage. IRDs such as the Ferguson SRV1/Pace SS9000 and the Ferguson SRD4 are included despite being of recent introduction. I couldn't help but smile when I turned the pages and found the Ferguson SRB1 BSB unit. Ironic that probably the most advanced and complex piece of electronics featured in the book is now virtually redundant. The "traditional" satellite receiver manufacturers such as Echostar, Connexions, Channel Master and Triax are well represented alongside the more familiar setmakers such as Ferguson, Grundig, Panasonic, Sony and Amstrad. The inclusion of Panasonic intrigued me. This company's policy on providing technical data seems to change with the wind. The firm has maintained that it will supply information only to its own dealers and doesn't encourage third-party servicing, yet we find details of the TUS100. Good going, U-View!

The book is reassuringly strongly made and the binding is

such that wherever you open it the book lays flat – you don't have to continually flick the page back and the need to have the meter on one corner to keep the book in place is nil! A new volume covering subsequent models will be published later this year. I'm told that even more manufacturers will be represented – almost one hundred per cent in fact.

At £55 plus £4 post and packing (there's no VAT on publications) this manual represents extremely good value for money. If you service only one brand however you won't save much, if anything – you could purchase all the Ferguson manuals for far less for example. But think about this. If you have the equipment to be able to work on almost any type of receiver why not take on other makes? Many satellite TV installers, especially of the aerial rigger type, have no means of repairing receivers other than to return them to the distributor or manufacturer. Thus in many areas there's a need for a local repair service. You might find that there's an opportunity to do good business.

My thanks to Roger Yaxley of U-View for sending me the book for review. It can be obtained, along with the various TV and VCR servicing volumes, from U-View, 29 Warmsworth Road, Doncaster, South Yorkshire DN4 0RP – telephone 0302 855 017, fax 0302 855 267.

Marco Polo

The news that BSKyB has sold its back-up Marco Polo satellite to Norwegian Telecom means that services from the satellite should continue. A subsidiary of Norwegian Telecom, Tele-TV, plans to start a five-channel service in the autumn. As to whether you'll be able to use those BSB receivers, this depends of course on the transmission standard, though apparently the receivers can be changed from D-MAC to D2-MAC operation if required. It also depends on how much English language programming will be featured – or whether you can cope with Norwegian. In preparation for the Tele-TV service the Marco Polo satellite has been moved to a new orbital position at 1°W. Changing to D2-MAC and reorientating the aerial, whether dish or Squarial, enables French signals from the TDF-1 satellite at 19°W to be received. A dish would be required for the German signals from this satellite since these are transmitted with left-hand circular polarisation – the BSB Squarials will receive only right-hand circularly polarised signals (in fact the rejection of LHCP signals is typically -25dB).

The Squarial

Little has been published on the construction of the Squarial apart from a chapter in John Breeds' *Satellite Book*. Briefly, the BSB Squarial consists of an array of 256 circular aerial elements laid down on a PCB in the form of a 16 x 16 matrix. Each element acts as a tiny slot aerial, with two probes mounted 90° apart to pickup the signal energy. It follows that there has to be a 90° phase shift in the connections to the two probes. Each pair of probes is linked to all the others so that the signals add to provide an adequate output to feed to the LNB. The difficulty with this arrangement is that there must be no phase differences between the signals from the 256 elements otherwise signal cancellation will occur. Thus the Squarial was tricky to design and expensive to manufacture. The spacing between the circular element centres is 2.25cm, which is about 0.9 times the wavelength (this gives maximum gain). For LHCP the 90° shift networks between the probes have to be laid down differently. For linear polarisation the slots should be rectangular.

Mounting the Squarial "diamond" fashion minimises the sidelobes in the polar response.

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AN5033 £2.10	BA4281 £2.40	HA4394 £4.00	LM1366N £1.50	MH27316 £3.00	SL9327 £1.25	STR454 £4.85	TAT7629P £2.75	TD1770A £3.00	TD4440 £2.40	
AN5132 £3.90	BA4286 £2.75	HD4539 £0.70	LM1894N £1.50	MH27316 £3.00	SL9327 £1.25	STR5020 £7.90	TAT7630P £2.00	TD18170A £2.60	TD4442 £2.95	
AN5265 £1.50	BA4402 £1.90	KQ2210 £2.30	LM3177 £1.00	ML232B £4.50	SSA1250 £3.50	STR5030A £5.50	TAT7640 £2.00	TD1965 £1.40	TD4450 £3.00	
AN5510 £4.50	BA4403 £2.75	L7805 £0.80	LM321 £0.80	ML232B (BTP6018) £3.50	ST082 £12.00	STR5412 £9.50	TAT7658 £2.00	TD1908A £1.75	TD4450 £3.80	
AN5512 £1.95	BA5102 £2.45	L7806 £0.80	LM339 £0.80	ML2388 £7.50	ST1195 £5.50	STR58041 £6.75	TAT7668 £2.00	TD19490 £1.80	TD4451 £4.00	
AN5527 £5.50	BA5204 £2.75	L7808 £0.80	LM339N £0.75	ML2388 £7.50	ST1401A £3.75	STR6020 £4.90	TAT7680 £4.80	TD1950 £2.50	TD4450 £4.50	
AN5730 £3.20	BA524 £3.00	L7812 £1.00	LM364 £1.20	ML923 £4.50	ST4441C £3.00	STR8050 £14.15	TAT7681AP £5.75	TD2002 £1.40	TD4450 £6.75	
AN5750 £1.50	BA5402 £2.40	L7815 £0.60	LM366N £0.80	ML923DP £4.50	STK40090 £3.00	STR893C £2.00	TAT7687 £2.00	TD2003 £1.30	TD4450 £4.40	
AN5760 £2.00	BA5406 £2.50	L7818 £0.80	LM556CN £2.50	ML926 £4.20	STK2029 £12.00	TA4180 £3.00	TAT7688A £3.80	TD2004 £1.70	TD4450 £4.70	
AN5900 £1.50	BA6104 £2.50	L7824 £0.95	LM6402G-2003 £10.00	ML926 £4.20	STK2029 £8.50	TA4193 £5.00	TAT7688AP £7.50	TD2005 £1.70	TD4460 £2.60	
AN6326 £4.00	BA6109 £1.80	L7905 £0.80	LM641 £1.80	MM314AP £1.75	STK2125 £10.00	TA4194 £5.50	TAT7705P £1.50	TD2005S £2.95	TD4601 £2.10	
AN6332 £4.40	BA6124 £2.75	L7912 £0.80	LM641 £1.80	MM3108N £1.25	STK2250 £9.20	TA4301 £4.50	TAT7709 £2.50	TD2006V £1.95	TD4610 £4.50	
AN6341 £2.75	BA6154 £2.50	L7915 £0.80	LM748CN 8 PIN £1.25	MMS387 £2.90	STK3041 £5.70	TA4345 £4.40	TAT7738 £2.50	TD2020 £3.50	TD4610 £2.00	
AN6344 £5.50	BA6208 £3.75	L7918 £0.80	LM748CN 8 PIN £1.25	MMS402 £1.50	STK40090 £3.00	TA4350 £9.00	TAT7810P £1.75	TD2030 £1.10	TD4610 £2.40	
AN6346 £4.50	BA6209 £3.20	L7924 £0.60	LM748N £2.00	MMS405N £3.00	STK4029 £8.75	TA4350 £9.00	TAT7811 £4.25	TD2030H £2.00	TD4610 £2.60	
AN6346 £4.50	BA6219 £1.95	LA1180 £2.60	M104 £0.70	MMS456 £2.25	STK4141 I £0.90	TA4350 £9.00	TAT7812 £1.25	TD2030V £1.75	TD4610 £2.60	
AN6359 £5.50	BA6222 £3.10	LA1185 £2.60	M29381 £1.00	MMS457N £2.50	STK4142 I £1.00	TA4350 £9.00	TAT7816 £2.50	TD2040 £2.00	TD4610 £2.60	
AN6360 £3.75	BA6229 £1.85	LA1201 £0.95	M4909B1 £1.50	MMS458N £2.50	STK4151 I £1.50	TA4350 £9.00	TAT7817 £2.40	TD2040A £2.00	TD4610 £2.60	
AN6362 £4.25	BA6238A £1.95	LA1235 £2.50	M4918BB1 £1.50	MMS5108 £2.65	STK4171 II £0.90	TA4350 £9.00	TAT7819AP £4.00	TD2040S £2.00	TD4610 £2.60	
AN6387 £5.50	BA6239 £3.75	LA1260 £1.75	M50127AP £5.00	MMS5108 £2.65	STK4300 £6.00	TA4350 £9.00	TAT7819P £6.00	TD2040S £2.00	TD4610 £2.60	
AN6512 £2.20	BA6259 £3.00	LA1403 £3.75	M50431-101SP £5.00	MM7317 £3.75	STK4311 I £1.20	TA4350 £9.00	TAT7820 £1.75	TD2040S £2.00	TD4610 £2.60	
AN6551 £0.60	BA6301 £2.00	LA3160 £1.90	MPD4091C £1.10	MM74C901 £1.10	STK433 £7.50	TA4350 £9.00	TAT7820AP £1.25	TD2040S £2.00	TD4610 £2.60	
AN6671K £5.50	BA6302A £1.80	LA3210 £1.90	MPD4091C £1.10	MPD4091C £1.10	STK435 £8.00	TA4350 £9.00	TAT7822 £2.25	TD2040S £2.00	TD4610 £2.60	
AN6677 £5.25	BA6304 £1.70	LA3220 £1.00	MPD4091C £1.10	MPD4091C £1.10	STK4352 £5.80	TA4350 £9.00	TAT7822P £2.30	TD2040S £2.00	TD4610 £2.60	
AN6894 £2.75	BA6305 £1.75	LA3350 £1.50	MPD4091C £1.10	MPD4091C £1.10	STK437 £10.00	TA4350 £9.00	TAT7822P £2.30	TD2040S £2.00	TD4610 £2.60	
AN6912 £2.00	BA6311 £1.50	LA3360 £1.50	MPD4091C £1.10	MPD4091C £1.10	STK4392 £7.00	TA4350 £9.00	TAT7823P £1.65	TD2040S £2.00	TD4610 £2.60	
AN7111 £1.50	BA7001 £1.80	LA3600 £1.50	MS1356P £5.00	MSL9378RS £5.00	STK499 £10.50	TA4350 £9.00	TA6440 £6.50	TD2530 £3.00	TD4610 £2.60	
AN7112 £3.00	BA718 £1.90	LA3700 £2.50	MS1381P £5.00	MSL9378RS £5.00	STK499 £11.00	TA4350 £9.00	TA6440 £6.50	TD2530 £3.00	TD4610 £2.60	
AN7116 £1.20	BA728 £1.10	LA4100 £1.90	MS1593 £4.25	MSL9378RS £5.00	STK461 £10.50	TA4350 £9.00	TA6440 £6.50	TD2530 £3.00	TD4610 £2.60	
AN7143 £1.65	BA7767S £5.00	LA4102 £1.20	MS1513 £10.00	MSL9378RS £5.00	STK463 £14.50	TA4350 £9.00	TA6440 £6.50	TD2530 £3.00	TD4610 £2.60	
AN7148 £1.70	BT7601B £3.50	LA4125 £2.00	MS1515L £3.10	MSL9378RS £5.00	STK465 £12.00	TA4350 £9.00	TA6440 £6.50	TD2530 £3.00	TD4610 £2.60	
AN7158 £1.40	ONK524 £4.50	LA4140 £0.70	MS1516 £4.00	MSL9378RS £5.00	STK465 £12.00	TA4350 £9.00	TA6440 £6.50	TD2530 £3.00	TD4610 £2.60	
AN7180 £3.80	HA11215A £3.50	LA4160 £1.25	MS1903L £3.50	MSL9378RS £5.00	STK465 £12.00	TA4350 £9.00	TA6440 £6.50	TD2530 £3.00	TD4610 £2.60	
AN7169 £3.50	HA11223 £3.75	LA4182 £2.10	MS213L £3.10	MSL9378RS £5.00	STK465 £12.00	TA4350 £9.00	TA6440 £6.50	TD2530 £3.00	TD4610 £2.60	
AN7173 £4.50	HA11225 £2.10	LA4183 £2.75	MS2184 £3.10	MSL9378RS £5.00	STK465 £12.00	TA4350 £9.00	TA6440 £6.50	TD2530 £3.00	TD4610 £2.60	
AN7205 £1.95	HA11226 £3.75	LA4192 £1.70	MS2314 £1.10	MSL9378RS £5.00	STK465 £12.00	TA4350 £9.00	TA6440 £6.50	TD2530 £3.00	TD4610 £2.60	
AN7213 £1.10	HA11235 £3.10	LA4422 £1.30	MS4519P £1.00	MSL9378RS £5.00	STK465 £12.00	TA4350 £9.00	TA6440 £6.50	TD2530 £3.00	TD4610 £2.60	
AN7218 £1.20	HA11244 £1.75	LA4440 £2.70	MS4543 £1.75	MSL9378RS £5.00	STK465 £12.00	TA4350 £9.00	TA6440 £6.50	TD2530 £3.00	TD4610 £2.60	
AN7220 £1.60	HA11434 £2.50	LA4445 £2.50	MS4544L £1.85	MSL9378RS £5.00	STK465 £12.00	TA4350 £9.00	TA6440 £6.50	TD2530 £3.00	TD4610 £2.60	
AN7222 £2.10	HA11701 £3.10	LA4460 £1.70	MS4548L £4.50	MSL9378RS £5.00	STK465 £12.00	TA4350 £9.00	TA6440 £6.50	TD2530 £3.00	TD4610 £2.60	
AN7223 £7.60	HA11713 £8.90	LA4461 £1.80	MS4787P £4.75	MSL9378RS £5.00	STK465 £12.00	TA4350 £9.00	TA6440 £6.50	TD2530 £3.00	TD4610 £2.60	
AN7224 £1.40	HA11714 £3.50	LA4550 £2.70	MS48555P £6.50	MSL9378RS £5.00	STK465 £12.00	TA4350 £9.00	TA6440 £6.50	TD2530 £3.00	TD4610 £2.60	
AN7225 £1.90	HA11715 £3.20	LA4570 £2.20	MS4859P £8.00	MSL9378RS £5.00	STK465 £12.00	TA4350 £9.00	TA6440 £6.50	TD2530 £3.00	TD4610 £2.60	
AN7273 £2.00	HA11745 £1.75	LA4572 £2.20	M708 £9.50	MSL9378RS £5.00	STK465 £12.00	TA4350 £9.00	TA6440 £6.50	TD2530 £3.00	TD4610 £2.60	
AN7310 £1.10	HA11749 £7.00	LA4577 £1.90	M709 £4.75	MSL9378RS £5.00	STK465 £12.00	TA4350 £9.00	TA6440 £6.50	TD2530 £3.00	TD4610 £2.60	
AN7311 £1.75	HA11750 £3.50	LA4588 £5.00	MA150 £2.20	MSL9378RS £5.00	STK465 £12.00	TA4350 £9.00	TA6440 £6.50	TD2530 £3.00	TD4610 £2.60	
AN7315 £1.75	HA12005 £3.80	LA47016 £2.50	MB3106 £1.00	MSL9378RS £5.00	STK465 £12.00	TA4350 £9.00	TA6440 £6.50	TD2530 £3.00	TD4610 £2.60	
AN7324 £4.50	HA12017 £2.00	LA47096 £4.00	MB3730 £2.75	MSL9378RS £5.00	STK465 £12.00	TA4350 £9.00	TA6440 £6.50	TD2530 £3.00	TD4610 £2.60	
AN7410 £2.10	HA12026 £2.00	LA47210 £3.10	MB3731 £3.25	MSL9378RS £5.00	STK465 £12.00	TA4350 £9.00	TA6440 £6.50	TD2530 £3.00	TD4610 £2.60	
AN7415 £1.40	HA2413 £1.20	LA47305 £6.90	MC13002P £5.00	MSL9378RS £5.00	STK465 £12.00	TA4350 £9.00	TA6440 £6.50	TD2530 £3.00	TD4610 £2.60	
AN7420 £3.20	HA13001 £1.60	LA47309 £3.75	MC1310 £1.25	MSL9378RS £5.00	STK465 £12.00	TA4350 £9.00	TA6440 £6.50	TD2530 £3.00	TD4610 £2.60	
AN7818F £1.40	HA13402 £5.50	LA47520 £4.00	MC1330P £2.95	MSL9378RS £5.00	STK465 £12.00	TA4350 £9.00	TA6440 £6.50	TD2530 £3.00	TD4610 £2.60	
B1403 £1.00	HA13403 £4.00	LA47520 £4.00	MC14001BCP £1.10	MSL9378RS £5.00	STK465 £12.00	TA4350 £9.00	TA6440 £6.50	TD2530 £3.00	TD4610 £2.60	
BA1320 £1.50	HA1350 £4.00	LA47800 £2.50	MC14093B £1.50	MSL9378RS £5.00	STK465 £12.00	TA4350 £9.00	TA6440 £6.50	TD2530 £3.00	TD4610 £2.60	
BA1332 £1.00	HA1368R £2.55	LA47801 £1.25	MC1426P £2.20	MSL9378RS £5.00	STK465 £12.00	TA4350 £9.00	TA6440 £6.50	TD2530 £3.00	TD4610 £2.60	
BA3018 £1.50	HA1374 £5.00	LA47820 £1.90	MC14429P £2.20	MSL9378RS £5.00	STK465 £12.00	TA4350 £9.00	TA6440 £6.50	TD2530 £3.00	TD4610 £2.60	

TRANSISTORS

2N3773 £1.90	2N5109 £1.90	2N5112 £0.95	2N5124 £0.35	2N5122 £1.10	2N5136 £4.70	2N5147 £0.40	2N5154 £0.20	2N5165 £0.20	2N5175 £0.20	2N5183 £0.20	2N5195 £0.20	2N5200 £0.20	2N5205 £0.20	2N5206 £0.20	2N5207 £0.20	2N5208 £0.20	2N5209 £0.20	2N5210 £0.20	2N5211 £0.20	2N5212 £0.20	2N5213 £0.20	2N5214 £0.20	2N5215 £0.20	2N5216 £0.20	2N5217 £0.20	2N5218 £0.20	2N5219 £0.20	2N5220 £0.20	2N5221 £0.20	2N5222 £0.20	2N5223 £0.20	2N5224 £0.20	2N5225 £0.20	2N5226 £0.20	2N5227 £0.20	2N5228 £0.20	2N5229 £0.20	2N5230 £0.20	2N5231 £0.20	2N5232 £0.20	2N5233 £0.20	2N5234 £0.20	2N5235 £0.20	2N5236 £0.20	2N5237 £0.20	2N5238 £0.20	2N5239 £0.20	2N5240 £0.20	2N5241 £0.20	2N5242 £0.20	2N5243 £0.20	2N5244 £0.20</
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18 BROOKWOOD ROAD, SOUTHFIELDS, LONDON SW18 5BP.

TEL: 081-877 3492/877 3518 FAX: 081-877 3518

TRANSISTORS Cont.

2SD1391	£4.20	2SD868	£3.50
SDC1397	£3.75	2SD869	£3.00
2SD1398	£2.25	2SD870	£3.50
2SD1426	£4.50	2SD871	£4.50
2SD1432	£5.00	2SD872	£5.00
2SD1453	£1.60	2SD888	£2.25
2SD1455/2SD1730	£3.10	2SD888B	£2.75
2SD1496	£4.00	2SD9008	£4.00
2SD1497	£2.60	8C107B	£0.10
2SD1497-02	£5.95	8C108	£0.10
2SD1497-06	£5.95	8C108B	£0.10
2SD1650	£3.50	8C115	£0.16
2SD1877	£2.30	8C118	£0.12
2SD639	£0.35	8C147A	£0.07
2SD667	£1.00	8C159	£0.09
2SD725	£3.70	8C171	£0.09
2SD787E	£0.50	8C172	£0.09
2SD811	£2.95	8C172C	£0.07
2SD836	£1.10	8C182L	£0.09
2SD837	£0.80	8C183	£0.09

TDA180 ORIGINAL £9.50

TRANSISTORS

BC184	£0.09	BF422	£0.15
BC212	£0.09	BF458	£0.22
BC213	£0.09	BF459	£0.22
BC214	£0.07	BF469/BF471	£0.25
BC214B	£0.07	BF471	£0.25
BC214L	£0.09	BF472	£0.25
BC237	£0.07	BF870/BF472	£0.25
BC238	£0.07		
BC307	£0.12	BU108	£0.25
BC308B	£0.07	BU126	£0.70
BC327-25	£0.07	BU208	£1.00
BC328-40	£0.05	BU208A	£1.00
BC337	£0.05	BU208D	£1.15
BC372	£0.95	BU208T	£1.00
BC392	£1.50	BU326A	£1.00
BC441	£0.25	BU406	£0.90
BC461	£0.25	BU406D	£1.50
BC547	£0.07	BU406G	£0.50
BC548	£0.07	BU426A	£1.00
BC549	£0.07	BU500	£1.00
BC557	£0.30	BU508A	£1.00
BC559B	£0.07	BU508AF	£1.70
BC639	£0.18	BU508D	£1.00
BC640	£0.30	BU606	£0.75
BD131	£0.50	BU807	£0.75
BD132	£0.40	BU111	£0.95
BD137	£0.35	BU111AF	£1.95
BD237	£0.22	BUW84	£1.65
BD238	£0.22	BUX84	£0.60
BD243B	£0.40	SD12659	£0.75
BD243C	£0.40	TS648	£2.28
BD244	£0.30	TIP110	£0.45
BD244C	£0.30	TIP112	£0.45
BD278A	£0.80	TIP29	£0.30
BD434	£0.80	TIP30	£0.45
BD508	£0.90	TIP31	£0.30
BF195	£0.07	TIP42	£0.30
BF196	£0.15	TIP43	£0.27
BF197	£0.15	TIP42C	£0.40
BF198	£0.07	TIP47	£0.98
BF199	£0.14	TIP1791A	£1.20
BF244	£0.40	ZTR604	£0.55
BF259	£0.22	ZTR650	£0.70

DIODES AND THYRISTORS

BA157	£0.07	FB2506	£1.50
BR100	£0.20	IN4001	£0.06
BR101	£0.40	IN4002	£0.06
BR103	£0.75	IN4004	£0.10
BR303	£1.50	IN4005	£0.10
BR556	£0.75	IN4006	£0.08
BT116	£2.50	IN4007	£0.08
BT128P	£4.50	IN4148	£0.10
BT129P	£4.50	IN4149	£0.10
BT151/800R	£1.75	KBLO8	£1.95
BY126	£0.20	OA91	£0.20
BY127	£0.08	OT112	£2.20
BY133	£0.20	RGPI15G	£0.45
BY184	£0.90	RP15J	£0.55
BY184/SKB2/02	£1.10	RP15K	£0.30
BY179	£1.10	RP30K	£0.70
BY179/SK2/08	£1.10	RH1	£1.30
BY184	£0.65	RM11C	£0.45
BY189	£2.00	SG26A	£8.50
BY190	£2.00	SG13	£12.00
BY223	£1.15	SKB102	£0.75
BY206 (BY96R)	£0.55	SKB 08	£1.20
BY210/800/BV96	£0.55	SKB2/02	£0.90
	£0.55	SKB2/08	£1.10
	£0.20	SKE102	£0.60
BY228	£0.50	SKE1M15	£0.65
BY229	£1.15	SKE2G2/02	£0.75
BY299	£0.50	SKE2G3/04	£1.30
BY96D	£0.30	SKE4F1/04	£0.45
BY96D	£0.55	SKE4F1/06	£0.45
BYW56	£0.50	SKE5F3/10	£2.20
BYW96E	£0.50	SR2M	£0.75
BYX10	£0.50	T9653V	£1.40
BYX55-600	£0.55	T964V	£2.28

ASK FOR SEMICONDUCTORS NOT LISTED

VIDEO HEADS

AMSTRAD

3HSSR-VCR7000 (Saisho/Orion)	£16.00
PSF1-VCR4500.5200.9000	£15.00
PSF2-VCR4600.4700	£14.00
PSF3-VCR6000	£17.00

FERGUSON

3HSSV-2 Head universal	£7.50
3HSSVA-3V42.44.45.46 etc.	£20.00
3HSS4V3-3V32/HR7655	£25.00
3HSS4V3-3V48/HRD565	£26.00
3V48.58.59.65.FV10.11.12.13.14.20.21.26	
And most other Fergusons	POA

HITACHI

3HSSHA-VT8000.9000 series	£15.00
3HSSHB-VT11.33 etc	£15.00
10082-VT120.220	£22.00
10081-VT130.135	£25.00

PANASONIC

3HSSN-2 Head universal	£7.50
3HSSU1N-NV100.370.380/Philips VR6460	£9.00
3HSSU2N-NV230.470.480.G9.10.11.15PX	£17.80

VIDEO HEADS Continued

3HSSU3N-NV430.460	£14.70
3HSS3N-NV777.330	£18.50
3HSS4NB-NV730	£19.00
3HSS4NA-NV366	£24.00
NVG30.33.40.45.46.130. & most other Panasonics	POA

SANYO

3HSSSY-VHR1100.1110.1300	£18.00
3HSS3SY-VHR1500	£32.00

SHARP

3HSSSP-VC9300.9500.9700.381.481.482.483.486 etc	£15.50
3HSSSPB-VC581.583.651.670 etc	£14.50
VC7000.8000 series (Brass)	£42.00

OTHER MAKES

Alba 4000. Goldstar 8000. Sentra 8000 Solavox 1000	£16.50
Fisher FVHP510.520.530.615.710 etc	£18.00
Fisher VBS7000.9000 etc	£25.00
Hinari VXL2.4.3.20.25	£16.00
Hinari VXL5.6.20H	£15.00
Mitsubishi HS306.710	£23.90
Orion VC150.180.VH1.2.3 etc	£16.00
Saisho VR100.605.705.805.905	£16.00
Samsung Universal 2 Head	£18.50

T o s h i b a

V71.73.74.75.81.82.83.84.85.87	£20.00
Toshiba V93	£19.00

ASK FOR VIDEO HEADS NOT LISTED
The above heads are new.

BELT KITS

A range of belt kits in stock from 60p to £2.40. Makes for most models available including: Alba, Akai, Amstrad, Ferguson/JVC, Fisher, Funai, GEC, Goldstar, Granada, Grundig, Hinari, Hitachi, Mitsubishi, NEC, Orion, Panasonic, Philips, Saisho, Samsung, Sanyo, Schneider, Sharp, Sony, Tensai, etc - Please state model and make.



LINE OUTPUT TRANSFORMERS

LOPT Hitachi CPT1476	£18.00
LOPT Hitachi CPT2276 etc	£19.00
LOPT Matsui 1440	£18.00
Trip Grundig CUC2401 etc	£17.00

OTHER GRUNDIG TRIPPLERS IN STOCK

Decca 100D	9.50
ITT CVC20	12.50
ITT CVC25/30/32	9.50
ITT Compact 80 Series 110	16.75
ITT Compact 80 Series 90	19.75
ITT CVC45	18.00
ITT 1109F	14.00
ITT CVC1204	11.00
ITT CVC800/1/3	21.50
ITT CVC1100	16.50
ITT CVC1150/1175	20.00
ITT 6325	18.50
ITT 3546	18.50
ITT 1200/1	20.00

Other IIT transformers available

Fidelity all models up to 20" ZX3000	15.50
Fidelity Panel for ZX2000	1.00
Fidelity 22" ZX3000	18.50
Hinari CT4/5 & TVA1	14.75
Philips KT3	12.95
Thorn TX100 Green Spot 110	16.75
Ferguson TX90 LOPT specify size/screen	17.75
Ferguson 3V35/36 Mains Transformer	23.00
Ferguson 3V44/44/45 Mains Transformer	18.85
Sony - Please state model for price	
Universal Tripler	4.75
Universal Tripler with focus unit	9.50
Decca 120/130 series tripler	8.50
Thorn TX10 Focus Unit Kit	10.00

Hitachi and Matsui LOPTs in stock

VIDEO MOTORS

A range of Reel Motors made by Ferguson, Hitachi, Sanyo, Sharp & Panasonic are available, please state model and make. We stock capston motors, makes include Ferguson/JVC, Hitachi and Sharp.

Also available are Ferguson Mode Control Motors, please state make.

Sharp Reel Motor Pulley only £1.20

Replacement of plastic pulley on a number of Sharp Reel Motors with the above metal pulley gives better rewind/F performance.

IDLER ASSEMBLIES

FERGUSON

Take up Clutch (Mechanical models)	£5.00
3V29/30 Take up Idler	£2.00
3V29/30 Take up Clutch	£2.85
3V29/30 Reel Idler	£3.00
3V35 Reel Idler	£3.00
3V35.36.38.39 Take up Clutch	£2.85
3V58.59.64.65.FV10.11.12.13.14 Idler Arm	£1.80
Clutch Assembly 3V44.45.48.49.52.53.54.55	£14.00
Clutch Assembly 3V42.43	£14.00

FISHER

FVHP615.905.910. Idler Assembly Original	£5.00
FVHP615 Gear Idler Assembly	£4.35
FVHP905.910 Gear Idler Assembly	£5.00
FVHP520.530 Idler	£3.00
FVHP520.530 Pulley	£0.70

HITACHI

VT11.33 etc. Original Idler Arm	£2.50
VT11.33 etc. Idler Replacement	£1.75
VT9300.9500 etc. Play Idler	£3.65
VT9300.9500 etc. F/F Idler	£2.95
VT9300.9500 etc. Idler	£2.95
VT8000.8500 etc. F/F Rew Idler	£2.95
VT8000.8500 etc. Play Idler Assembly	£3.00
VT8000.8500 etc. FF/Rew Pulley	£0.70
VT11.33 etc. Clutch Assembly	£8.00
VT400.500. series clutch/base complete	£3.50

PHILIPS

VR6460.6920 Idler Arm (Original)	£3.00
VD464.6462.6463.650 etc. Idler Mod. Kit (Original)	£6.75
VR6542.6843 Reel Idler	£6.50
VR6542 Reel Drive Pulley	£7.75
VR6843 Reel Drive Pulley	£9.00

PANASONIC (All Original)

NV370 Idler Arm Unit VXP0521 Gen.	£3.00
NV8600.8610 Play Idler VXP0243	£0.95
NV332.777.788 Idler Unit VXP0463	£3.00
NV600.688 Idler VXP0515	£3.00
NV333.366 Idler Arm 2 Unit VXL0997	£10.50
NV4800.8600.8610 etc. VXP0245	£0.95
NV333.366 etc. Idler VXP0401-NV700.7200.7800 Idler VXP0344	£0.90
NV2000.3000 Play Idler VXP0331	£1.10
NV2000.3000 Idler Unit VXP0329	£1.10
G Mech. Play Gear VXL1490	£1.90
Back Tension Bands	From £1.50
All Panasonic Maintenance Kits	POA

QUOTE PANASONIC PART No. FOR PARTS NOT LISTED

SANYO

Idler VHR1100.1300.1500	£5.50
Idler VHR2100.2300.2500.2700	£5.50
Reel Drive Pulley Unit	
VTC5000.5150.6500	£5.00
Idler Roller Assembly	
VTC5000.5150.6500	£2.25

SHARP

Idler VC9300.9500 etc.	£1.75
Idler VC481.581 etc.	£1.95
Idler (original) VC9300.481.581 etc.	£3.50
Idler Assembly (original)	
VC651.681.685	£6.50
Idler Assembly (original) VC780.781.785.787.793.VCT72	£6.50

AMSTRAD

4500.4600 MOD KIT INCLUDES PINCH ROLLER AND IDLER CLUTCH	£5.00
Limiter Post Assembly	£1.75

Makes & Models: Hinari VXL4, Matsui VX730.735.735A.755.770.800A.810.820.880.990. Saisho VR1100.1200.1200HQ.1600.2500.3200.3300.3300X.3500.3600.3700

IDLERS FOR AKAI, SAMSUNG, MITSUBISHI, NEC, ETC. IN STOCK

REMOTE CONTROLS

Bush, Ferguson, Grundig, I.T.T. Philips, Pye, Sony, Hitachi, Matsui, Logik, Panasonic, Saisho, Salora, Samsung, Tashiko, Tatung, Toshiba. Various models TV & Video From £10.00; MANY HITACHI TV REMOTE CONTROLS; NOW IN STOCK.

SONY REMOTE CONTROL RUBBER PADS. STATE MODEL FOR PRICE.

Universal Remote Control £25.00

Sony type RC670. RM670. RM673	
from £15.50	
Sony type RC661. RM652. RM654. RM657. RM663. RM664. RM651	from £15.50
Panasonic Models TC2110. 2255. 2655. 2680. TX1752. 2251. 2656. 5500	from £14.50
Panasonic Models TC1632. 1642. 2232. TX2034. 2044. 2200. 2234. 2244. 2636. 3300	from £14.50

TV ON/OFF SWITCHES

ITT, Philips, Decca, Thorn, Fidelity, Grundig, Sony and Hitachi. State model for price. Sony Push Switch £0.70 each

PINCH ROLLERS

A range of Pinch Rollers is in stock, most of them @ £2.80. Makes include Akai, Amstrad, Ferguson, Fisher, Funai, GEC, Goldstar, Grundig, Hinari, Hitachi, I.T.T., JVC, Marantz, Mitsubishi, NEC, Nordmende, Orion, Panasonic, Philips, Samsung, Sanyo, Schneider, Sharp, Sony, Tensai, Thomson, Toshiba etc. Please state model and make.

Philips Pinch Roller for models VR6180. 6185. 6285. 6362. 6367. 6467. 6468. 6470. 6561. 6670. 6760. 6761. 6870 £5.00

Panasonic G Mech. ass complete £9.00

BACK-UP BATTERIES

Philips 1.2V Back up Battery	£1.75
Philips 2.4V Back up Battery	£2.80
Ferguson TX10	£2.00

Wider Range Available

OTHER SPARES

Universal Video Copying Kit	£4.25
Universal Copying Kit (Scart)	£5.20
Universal Camcorder Kit	£6.90
Video Cassette Lamps from CRT Anode Caps	£0.50
Video Tape Splicing Kit	£6.95
Hitachi TV Frame Module HM6251	£5.90
Hitachi TV Frame Module HM6232	£5.50
Cassette Housing Assembly Ferguson 3V35.36.38.39.42.43.44	£25.25
Cassette Loading Roller Assembly 3V23. 3V31. 3V32	£3.50
5.5V Back up Cap	£1.85
Degaussing Positor Blue	£3.00
Degaussing Positor White	£1.30
Cassette Housing Assembly Hitachi VT11	£19.50
End Sensor for Hitachi VT63.64.65 (Pair)	£2.75
Cassette LED Sensor for Panasonic etc	£1.60
I.C. Circuit Protectors	£0.60
Clear Service Cassette	£5.90
M	

AMSTRAD PORTABLE PC'S FROM £149 (PPC1512SD). £179 (PPC1512DD). £179 (PPC1640SD). £209 (PPC1640DD). MODEMS £30 EXTRA. NO MANUALS OR PSU.

HIGH POWER CAR SPEAKERS. Stereo pair output 100w each. 4ohm impedance and consisting of 6 1/2" woofer 2" mid range and 1" tweeter. Ideal to work with the amplifier described above. Price per pair £30.00 Order ref 30P7R.

2KV 500 WATT TRANSFORMERS Suitable for high voltage experiments or as a spare for a microwave oven etc. 250v AC input. Now only £4.00 ref 4P157

MICROWAVE CONTROL PANEL. Mains operated, with touch switches. Complete with 4 digit display, digital clock, and 2 relay outputs one for power and one for pulsed power (programmable). Ideal for all sorts of precision timer applications etc. Now only £4.00 ref 4P151.

FIBRE OPTIC CABLE. Stranded optical fibres sheathed in black PVC. Five metre length £7.00 ref 7P29R

12V SOLAR CELL. 200mA output ideal for trickle charging etc. 300 mm square. Our price £15.00 ref 15P42R

PASSIVE INFRA-RED MOTION SENSOR. Complete with daylight sensor, adjustable lights on timer (8 secs -15 mins), 50' range with a 90 deg coverage. Manual override facility. Complete with wall brackets, bulb holders etc. Brand new and guaranteed. Now only £19.00 ref 19P29

PACK OF TWO PAR38 BULBS for above unit £12.00 ref 12P43R

VIDEO SENDER UNIT Transmits both audio and video signals from either a video camera, video recorder or computer to any standard TV set within a 100' range! (tune TV to a spare channel) 12v DC op. £15.00 ref 15P39R Suitable mains adaptor £5.00 ref 5P191R

FM TRANSMITTER housed in a standard working 13A adapter (bug is mains driven). £26.00 ref 26P2R

MINATURE RADIO TRANSCIEVERS A pair of walkie talkies with a range of up to 2 kilometres. Units measure 22x52x155mm. Complete with cases. £30.00 ref 30P12R

FM CORDLESS MICROPHONE. Small hand held unit with a 500' range! 2 transmit power levels reqs PP3 battery. Tunable to any FM receiver. Our price £15 ref 15P42AR

12 BAND COMMUNICATIONS RECEIVER. 9 short bands, FM, AM and LW DX/focal switch, tuning 'eye' mains or battery. Complete with shoulder strap and mains lead. Now only £19.00!! REF 19P14R.

CAR STEREO AND FM RADIO. Low cost stereo system giving 5 watts per channel. Signal to noise ratio better than wow and flutter less than 35%. Neg earth £19.00 ref 19P30

LOW COST WALKIE TALKIES. Pair of battery operated units with a range of about 200'. Our price £8.00 a pair ref 8P50R

7 CHANNEL GRAPHIC EQUALIZER plus a 60 watt power amp! 20-21KHZ 4-8R 12-14v DC negative earth. Cased £25 ref 25P14R

NICAD BATTERIES. Brand new top quality 4 x AA's £4.00 ref 4P44R 2 x C's £4.00 ref 4P73R, 4 x D's £9.00 ref 9P12R, 1 x PP3 £6.00 ref 6P35R

TOWERS INTERNATIONAL TRANSISTOR SELECTOR GUIDE. The ultimate equivalents book. Latest edition £20.00 ref 20P32R

CABLE TIES. 142mm x 3.2mm white nylon pack of 100 £3.00 ref 3P104R Bumper pack of 1,000 ties £14.00 ref 14P6R

GOT A CARAVAN OR BOAT?
NEW 80 PAGE FULL COLOUR LEISURE CATALOGUE
2,500 NEW LINES FREE WITH ORDER ON REQUEST

OR SEND £1.00
GEIGER COUNTER KIT. Complete with tube, PCB and all components to build a battery operated geiger counter. £39.00 ref 39P1R

FM BUG KIT. New design with PCB embedded coil. Transmits to any FM radio. 9v battery req'd. £5.00 ref 5P158R

FM BUG Built and tested superior 9v operation £14.00 ref 14P3R

COMPOSITE VIDEO KITS. These convert composite video into separate H sync, V sync and video. 12v DC £8.00 ref 8P39R

SINCLAIR C5 MOTORS 12v 29A (full load) 3300 rpm 6"x4" 1/4" O/P shaft. New. £20.00 ref 20P22R.

As above but with fitted 4 to 1 in line reduction box (800rpm) and toothed nylon belt drive cog £40.00 ref 40P8R.

SINCLAIR C5 WHEELS 13" or 16" dia including treaded tyre and inner tube. Wheels are black, spoked one piece poly carbonate. 13" wheel £6.00 ref 6P20R, 16" wheel £6.00 ref 6P21R.

ELECTRONIC SPEED CONTROL KIT for C5 motor. PCB and all components to build a speed controller (0-95% of speed). Pulse width modulation. £17.00 ref 17P3R.

SOLAR POWERED NICAD CHARGER. Charges 4 AA nicads in 8 hours. Brand new and cased £6.00 ref 6P3R

12 VOLT BRUSHLESS FAN 1/2" square brand new ideal for boat, car, caravan etc. £5.00 ref 5P206

ACORN DATA RECORDER ALF503 Made for BBC computer but suitable for others. Includes mains adapter, leads and book. £15.00 ref 15P43R

VIDEO TAPES. Three hour superior quality tapes made under licence from the famous JVC company. Pack of 5 tapes New low price £8.00 ref 8P161

PHILIPS LASER. 2MW HELIUM NEON LASER TUBE. BRAND NEW FULL SPEC £40.00 REF 40P10R. MAINS POWER SUPPLY KIT £20.00 REF 20P39R READY BUILT AND TESTED LASER IN ONE CASE £75.00 REF 75P4R.

12 TO 220V INVERTER KITs supplied it will handle up to about 15 w at 220v but with a larger transformer it will handle 80 watts. Basic kit £12.00 ref 12P17R. Larger transformer £12.00 ref 12P41R

VERO EASI WIRE PROTOTYPING SYSTEM Ideal for designing projects on etc. Complete with tools, wire and reusable board. New low bargain price only £2.00 ref 8P21R

HIGH RESOLUTION 12" AMBER MONITOR 2v 1.5A Hercules compatible (TTL input) new and cased £22.00 ref 22P2R

VGA PAPER WHITE MONO monitors new and cased 240v AC. £59.00 ref 59P4R

25 WATT STEREO AMPLIFIER. c. STK043. With the addition of a handful of components you can build a 25 watt amplifier. £4.00 ref 4P68R (Circuit dia included).

BARGAIN NICADS AAA SIZE 200MAH 1.2V PACK OF 10 £4.00 REF 4P92R, PACK OF 100 £30.00 REF 30P16R

FRESNEL MAGNIFYING LENS 83 x 52mm £1.00 ref BD827R. **ALARM TRANSMITTERS.** No data available but nicely made complex radio transmitters 9v operation. £4.00 each ref 4P81R

12V 19A TRANSFORMER. Ex equipment but otherwise ok. Our price £20.00

GX4000 COMPUTERS. Customer returned games machines complete with plug in game, joysticks and power supply. Retail price is almost £100. Ours is £12.00 ref B12P1

ULTRASONIC ALARM SYSTEM. Once again in stock these units consist of a detector that plugs into a 13A socket in the area to protect. The receiver plugs into a 13A socket anywhere else on the same supply. Ideal for projecting garages, sheds etc. Complete system £25.00 ref B25P1 additional detectors £11.00 ref B11P1

IBM XT KEYBOARDS. Brand new 86 key keyboards £5.00 ref 5P612

IBM AT KEYBOARDS Brand new 86 key keyboards £15.00 ref 15P612

386 MOTHER BOARDS. Customer returned units without a cpu fitted. £22.00 ref A22P1

BSB SATELLITE SYSTEMS

BRAND NEW

REMOTE CONTROL

£49.00 REF F49P1

286 MOTHER BOARDS. Brand new but customer returns so may need attention. Complete with technical manual £20.00 ref A20P2

286 MOTHER BOARDS. Brand new and tested complete with technical manual. £49.00 ref A49P1

UNIVERSAL BATTERY CHARGER. Takes AA's, C's, D's and PP3 nicads. Holds up to 5 batteries at once. New and cased, mains operated. £6.00 ref 6P36R.

IN CAR POWER SUPPLY. Plugs into cigar socket and gives 3,4,5,6,7,5,9, and 12v outputs at 800mA. Complete with universal spider plug. £5.00 ref 5P167R

RESISTOR PACK. 10 x 50 values (500 resistors) all 1/4 watt 2% metal film. £5.00 ref 5P170R

CAPACITOR PACK. £5.00 ref 5P170R

MIRACOM WS4000 MODEMS

V21/23

AT COMAND SET

AUTODIAL/AUTOANSWER

FULL SOFTWARE CONTROL

PHONE AND PULSE DIALLING

£29

IBM PRINTER LEAD. (D25 to centronics plug) 2 metre parallel. £5.00 ref 5P186R

COPPER CLAD STRIP BOARD 17" x 4" of 1" pitch "vero" board. £4.00 a sheet ref 4P62R or 2 sheets for £7.00 ref 7P22R

STRIP BOARD CUTTING TOOL £2.00 ref 2P352R

50 METRES OF MAINS CABLE £3.00 2 core black precut in convenient 2 m lengths. Ideal for repairs and projects. ref 3P91R

4 CORE SCREENED AUDIO CABLE 24 METRES £2.00. Precut into convenient 1.2 m lengths. Ref 2P365R

TWEETERS 2 1/4" DIA 8 ohm mounted on a smart metal plate for easy fixing £2.00 ref 2P366R

COMPUTER MICE Originally made for Future PC's but can be adapted for other machines. Swiss made £8.00 ref 8P57R. Atan ST conversion kit £2.00 ref 2P362R

6 1/2" 20 WATT SPEAKER Built in tweeter 4 ohm £5.00 ref 5P205R

WINDUP SOLAR POWERED RADIO! FM/AM radio takes rechargeable batteries complete with hand charger and solar panel 14P200R

PC STYLE POWER SUPPLY Made by AZTEC 110v or 240v input +5@15A,+12@5A,-12@5A,-5@3A. Fully cased with fan, on/off switch, IEC inlet and standard PC flyleads. £15.00 ref F15P4

ALARM PIR SENSORS Standard 12v alarm type sensor will interface to most alarm panels. £16.00 ref 16P200

ALARM PANELS 2 zone cased keypad entry, entry exit time delay

BULL ELECTRICAL
250 PORTLAND ROAD HOVE SUSSEX
BN3 5QT TELEPHONE 0273 203500
MAIL ORDER TERMS: CASH PO OR CHEQUE
WITH ORDER PLUS £3.00 POST PLUS VAT.
PLEASE ALLOW 7 - 10 DAYS FOR DELIVERY
NEXT DAY DELIVERY £8.00
FAX 0273 23077

etc. £18.00 ref 18P200
MODEMS FOR THREE POUNDS!!!

Fully cased UK modems designed for dial up system (PSTN) no data or info but only £3.00 ref 3P145R

TELEPHONE HANDSETS
Bargain pack of 10 brand new handsets with mic and speaker only £3.00 ref 3P146R

BARGAIN STRIPPERS
Computer keyboards. Loads of switches and components excellent value at £1.00 ref CD40R

DATA RECORDERS
Customer returned mains battery units built in mic ideal for Computer or general purpose audio use. Price is £4.00 ref 4P100R

SPECTRUM JOYSTICK INTERFACE
Plugs into 48K Spectrum to provide a standard Atan type joystick port. Our price £4.00 ref 4P101R

ATARI JOYSTICKS
Ok for use with the above interface, our price £4.00 ref 4P102R

BENCH POWER SUPPLIES
Superbly made fully cased (metal) giving 12v at 2A plus a 6V supply. Fused and short circuit protected. For sale at less than the cost of the case! Our price is £4.00 ref 4P103R

SPEAKER WIRE
Brown twin core insulated cable 100 feet for £2.00 REF 2P79R

MAINS FANS
Brand new 5" x 3" complete with mounting plate quite powerful and quiet. Our price £1.00 ref CD41R

DISC DRIVES
Customer returned units mixed capacities (up to 1.44M) We have not sorted these so you just get the next one on the shelf. Price is only £7.00 ref 7P1R (tune it even as a stripper)

HEX KEYBOARDS
Brand new units approx 5" x 3" only £1.00 each ref CD42R

PROJECT BOX
5 1/2" x 3 1/2" x 1" black ABS with screw on lid. £1.00 ref CD43R

SCART TO SCART LEADS
Bargain price leads at 2 for £3.00 ref 3P147R

SCART TO D TYPE LEADS
Standard Scart on one end, Hi density D type on the other. Pack of ten leads only £7.00 ref 7P2R

OZONE FRIENDLY LATEX
250ml bottle of liquid rubber sets in 2 hours. Ideal for mounting PCB's fixing wires etc. £2.00 each ref 2P379R

QUICK SHOTS
Standard Atari compatible hand controller (same as joysticks) our price is 2 for £2.00 ref 2P380R

VIEWDATA SYSTEMS
Brand new units made by TANDATA complete with 1200/75 built in modem infra red remote controlled qwerty keyboard BT approved Prestel compatible, Centronics printer port RGB colour and composite output (works with ordinary television) complete with power supply and fully cased. Our price is only £20.00 ref 20P1R

AC STEPDOWN CONVERTOR
Cased units that convert 240v to 110v 3" x 2" with mains input lead and 2 pin American output socket (suitable for resistive loads only) our price £2.00 ref 2P381R

SPECTRUM +2 LIGHT GUN PACK
complete with software and instructions £8.00 ref 8P58R/2

CURLY CABLE
Extends from 8" to 6 feet! D connector on one end, spade connectors on the other ideal for joysticks etc (6 core) £1.00 each ref CD44R

COMPUTER JOYSTICK BARGAIN
Pack of 2 joysticks only £2.00 ref 2P382R

BUGGING TAPE RECORDER
Small hand held cassette recorders that only operate when there is sound then turn off 6 seconds after so you could leave it in a room all day and just record anything that was said. Price is £20.00 ref 20P3R

IEC MAINS LEADS
Complete with 13A plug our price is only £3.00 for TWO! ref 3P148R

NEW SOLAR ENERGY KIT
Contains 8 solar cells, motor, tools, fan etc plus educational booklet. Ideal for the budding enthusiasts! Price is £12.00 ref 12P2R

286 AT PC
286 MOTHER BOARD WITH 640K RAM FULL SIZE METAL CASE, TECHNICAL MANUAL, KEYBOARD AND POWER SUPPLY £139 REF 139P1 (no i/o cards or drives included) Some metal work req'd phone for details.

35MM CAMERAS Customer returned units with built in flash and 28mm lens 2 for £8.00 ref 8P200

STEAM ENGINE Standard Mamod 1332 engine complete with boiler piston etc £30 ref 30P200

TALKING CLOCK
LCD display, alarm, battery operated. Clock will announce the time at the push of a button and when the alarm is due. The alarm is switchable from voice to a cock crowing! £14.00 ref 14P200R

HANDHELD TONE DIALLERS
Small units that are designed to hold over the mouth piece of a telephone to send MF dialling tones. Ideal for the remote control of answer machines. £5.00 ref 5P209R

COMMODORE 64 MICRODRIVE SYSTEM
Complete cased brand new drives with cartridge and software 10 times faster than tape machines works with any Commodore 64 setup. The original price for these was £49.00 but we can offer them to you at only £25.00! Ref 25P1R

ATARI 2600 GAMES COMPUTER Brand new with joystick and 32 game cartridge (plugs into TV) £29.00 ref F29P1 also some with 1 game at £19.00 ref F19P2

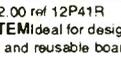
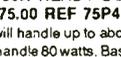
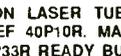
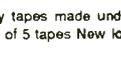
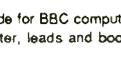
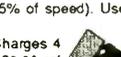
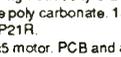
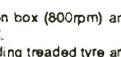
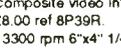
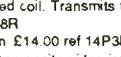
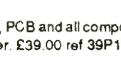
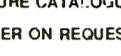
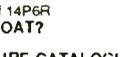
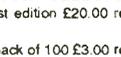
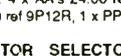
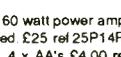
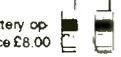
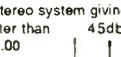
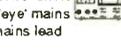
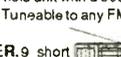
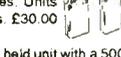
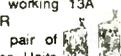
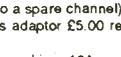
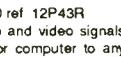
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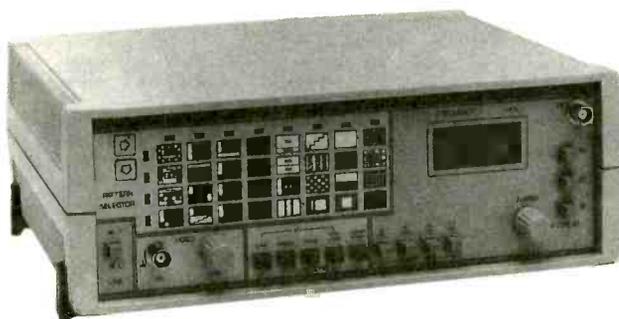
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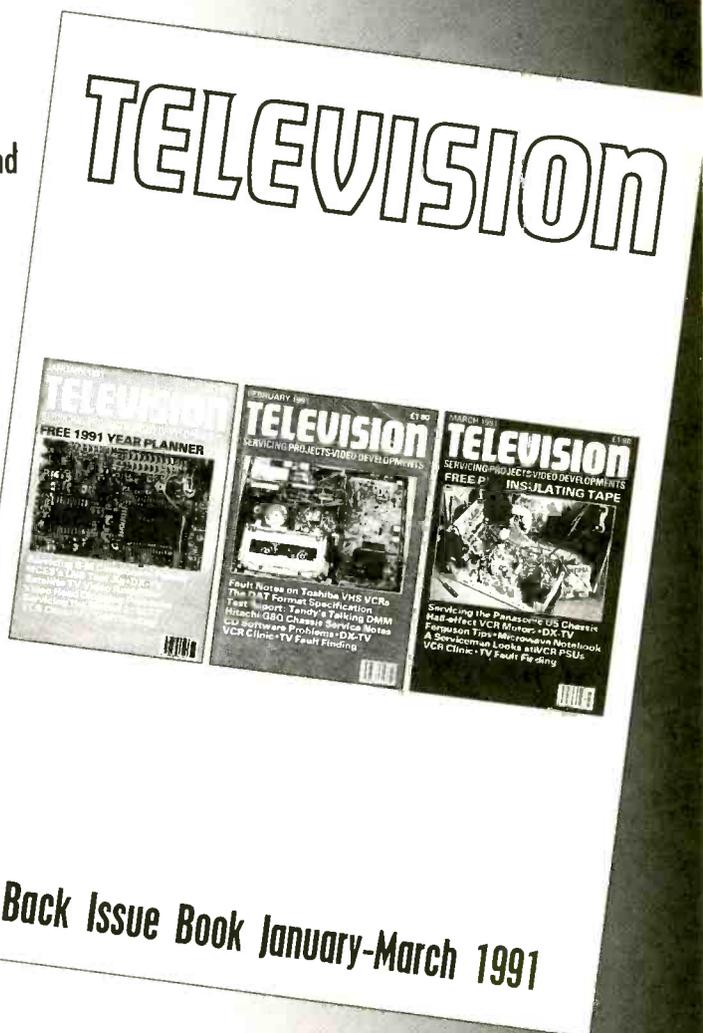
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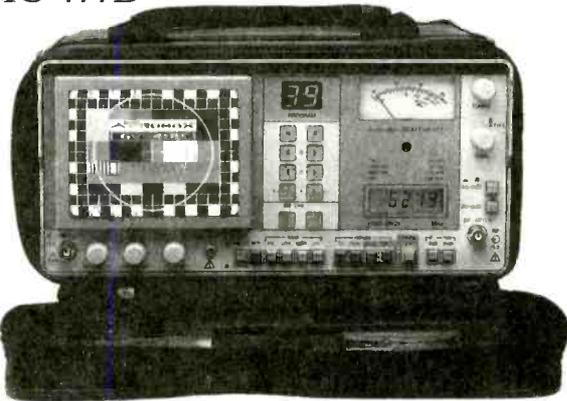
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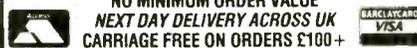
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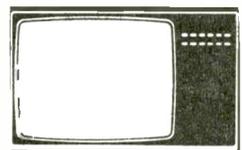
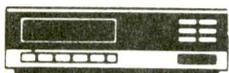
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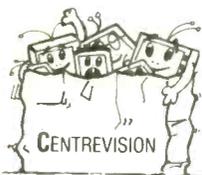
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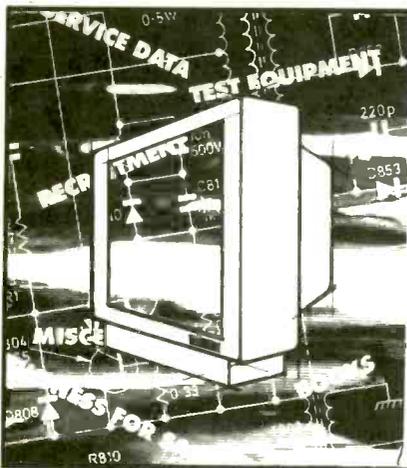
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VIDEO LEADS 4 for £1		PHILIPS RC5 EASY CONTROL £10		NEW 12" 90% MONO TUBES £10	
SEL ITT 1FB254/2 Front Panel £15.00		TRV3 Amstrad Cassette Mechanisms. New with 2 motors and sound head. £15. TVR3 Power Supply. £5. Amstrad Television Tuner UHF. Small. Fits most Amstrads. £6.		4600 TO 3600 AMSTRAD VIDEO HANDSET WITH LCD £10	
DECCA — GEC — ITT 6 push button £5.00		SENDZ SEE BACK PAGE		PHILIPS SBC 522 RGBI GENERATOR £90 PHILIPS SBC 850 ANALOG MULTIMETER £11.50 PHILIPS SBC 520 L.F. FUNCTION £75.00	
DECCA — GEC — ITT 6 push button £5.00		PHILIPS SBC 522 RGBI GENERATOR £90 PHILIPS SBC 850 ANALOG MULTIMETER £11.50 PHILIPS SBC 520 L.F. FUNCTION £75.00		FERGUSON ICCS5 STEREO O.P. PANEL IC'S TDA8405 TDA8421 TBA1204 £10	
DECCA — GEC — ITT 6 push button £5.00		PHILIPS SBC 522 RGBI GENERATOR £90 PHILIPS SBC 850 ANALOG MULTIMETER £11.50 PHILIPS SBC 520 L.F. FUNCTION £75.00		Burglar Alarm Has time delay to set £2 Mains Transformer 240v In 110v to 120v out 1 amp post £3 £4.00	

