datron
ELECTRONICS LIMITED

SERVICING MANUAL
for
DATRON MODEL 1051
DIGITAL VOLTMETER

METEOR CLOSE
NORWICH AIRPORT INDUSTRIAL ESTATE NORWICH NR6 6HQ ENGLAND

www.g0rsq.co.uk

SERVICING MANUAL
for
DATRON MODEL 1051
DIGITAL VOLTMETER

(for general information and specification
refer to the Operating Manual)

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Instrument Designed and Manufactured by:–

DATRON ELECTRONICS LTD.
METEOR CLOSE,
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850016 Issue 3.

Due to our policy of continuously updating our products, this manual may contain minor differences in specification, components and circuit design to the instrument actually supplied. Amendment sheets precisely matched to your instrument serial number are available on request.

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SECTION 1

TECHNICAL DESCRIPTION

1.1 GENERAL

The internal circuits of the 1051 are divided between two printed circuit boards, in the basic machine. The first printed board (Schematic No. 430019) is the DC isolator board and includes the preamplifier, scaling circuits, bootstrapped supplies, and range logic. The second board (Schematic No. 430026) is concerned with Analogue to Digital conversion and produces the BCD output together with drive for the displays. The regulated power supply components are also mounted on this board. When AC and Ω are specified these are incorporated on two separate boards plugging into the main isolator board.

For the purpose of explanation boards will be described separately and each board further sub-divided according to the various functions involved.

1.2 DC ISOLATOR BOARD (Assembly Drawing No. 400087)

This is split in three distinct sections: isolator, range encoding/decoding, and range logic.

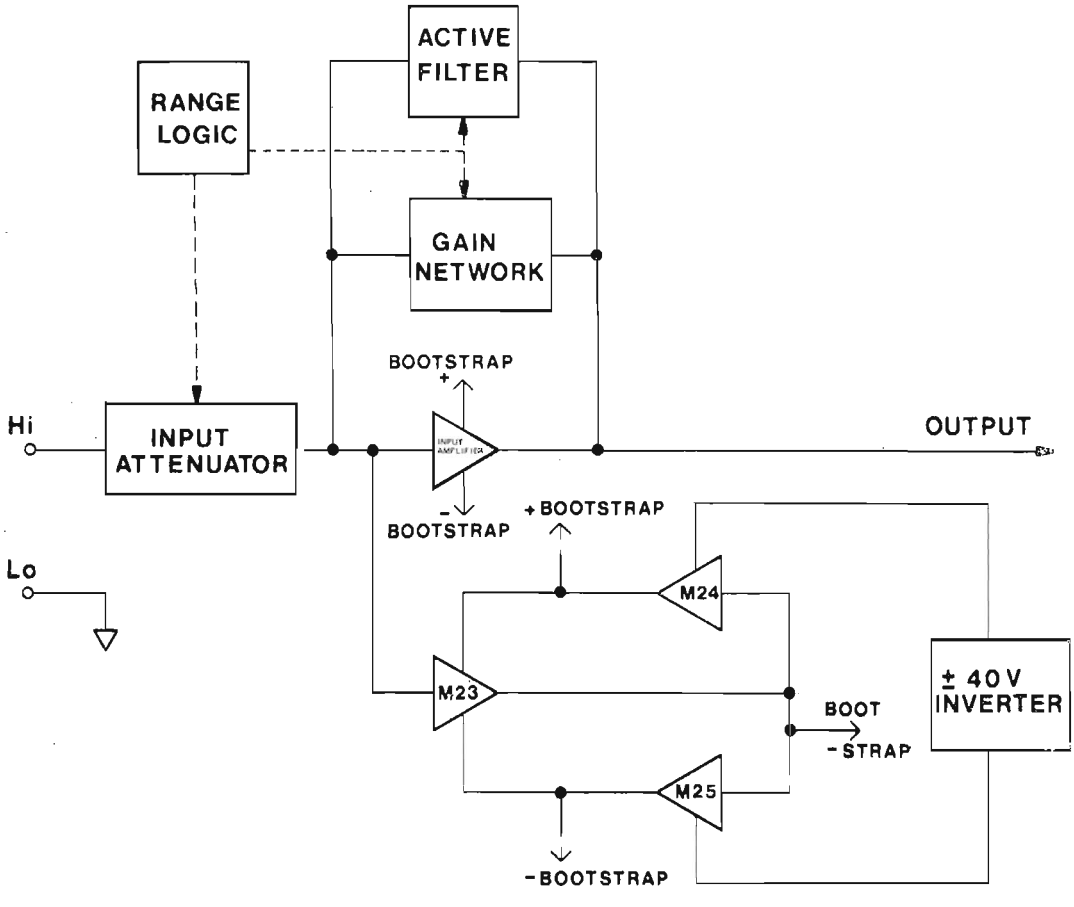


FIG. 1:1 SIMPLIFIED DIAGRAM OF DC ISOLATOR

1.2.1 Preamplifier Scaling

The simplified diagram, Fig. 1:2 shows the essential features of the isolator scaling circuit. For the purpose of explanation the same symbols are used (Black triangular contact normally 'made', white triangular contact normally 'open') regardless of whether the switching is accomplished electronically (F.E.T.) or by means of relay contacts. In Fig. 1:2 all switching is shown in the 1V RANGE position.

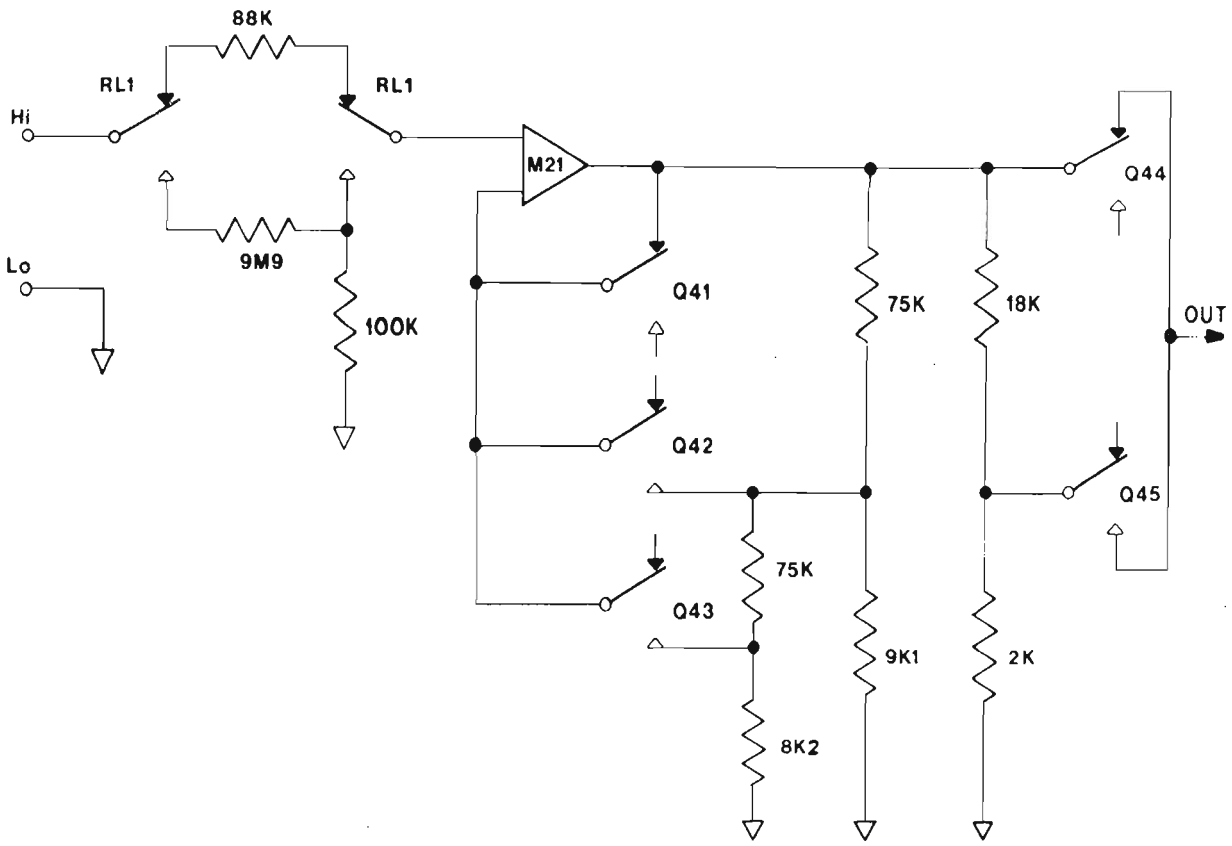


FIG. 1:2 SIMPLIFIED DIAGRAM OF ISOLATOR SWITCHING

The various switching combinations for the different ranges are as follows:-

RANGE	GAIN	Q41	Q42	Q43	Q44	Q45	RL1
10 mV	X100	OFF	OFF	ON	ON	OFF	OFF
100 mV	X10	OFF	ON	OFF	ON	OFF	OFF
1 V	X1	ON	OFF	OFF	ON	OFF	OFF
10 V	÷ 10	ON	OFF	OFF	OFF	ON	OFF
100 V	÷ 100	ON	OFF	OFF	ON	OFF	ON
1000 V	÷ 1000	ON	OFF	OFF	OFF	ON	ON

The different configuration circuits are shown in Fig. 1:3.

Having grasped the basic essentials, reference should be made to circuit diagram No. 430019, Sheet 2 for a more detailed explanation.

Resistor chain R1 – R4, 100 kΩ total, is in series with the Hi input on all ranges from 10 mV – 10 V. The amplifier end of R4 is clamped by zener diodes ZD5, ZD6 and Q49, Q50 to the bootstrap rail which is in turn clamped to Lo (0) by zener diodes, ZD7, ZD8. This means that the amplifier input can never exceed approximately ± 35V: the sum of the zener diode voltage drops. The 100 kΩ chain limits the current in overload. The power dissipation of the chain is such that 1000 V can be applied continuously.

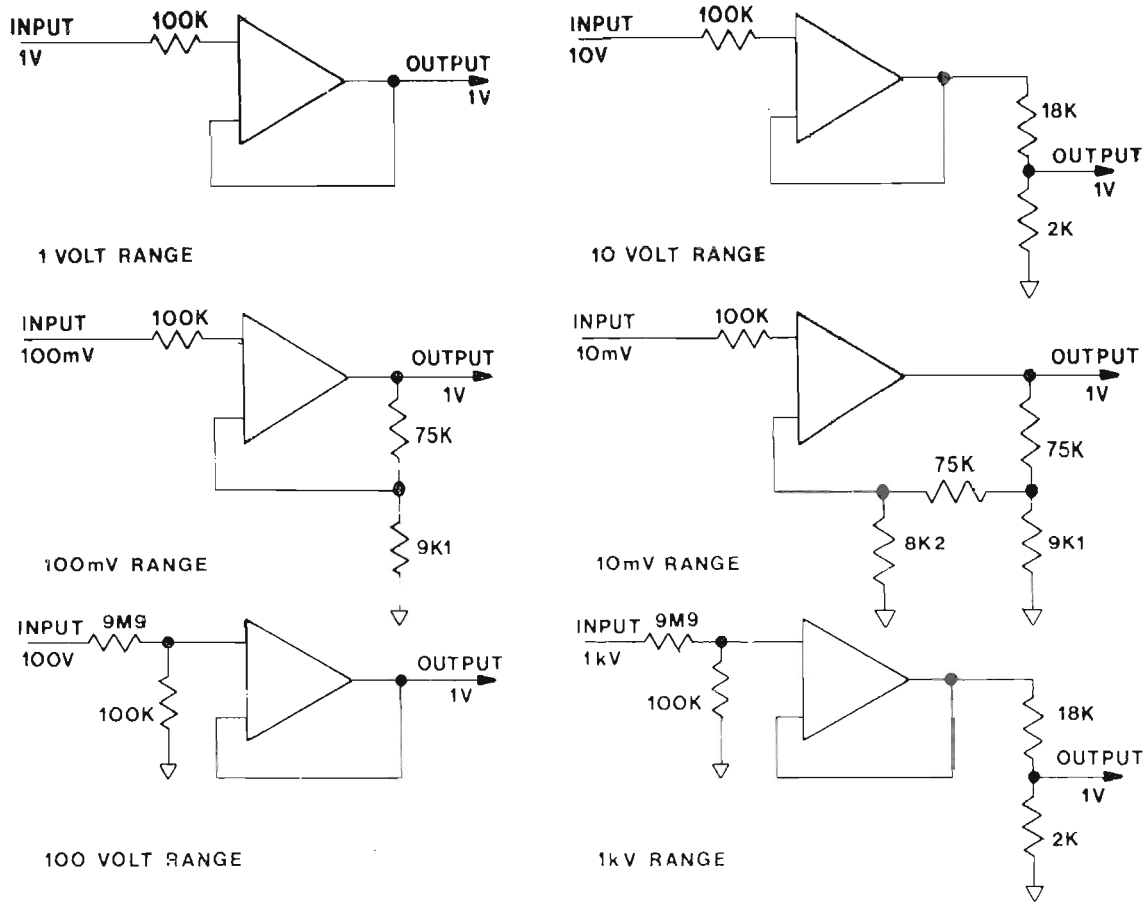


FIG. 1:3 SEPARATE RANGE SWITCHING

On the 100 V and 1 KV ranges a ÷ 100, 10M input attenuator is switched in. This is a matched set of resistors for low temperature coefficient.

On selecting 10 mV, Q43 and Q44 are turned on: all other F.E.T's are turned off. The output of the preamplifier is then connected to its inverting input via R 21, R22, R24, R25 an attenuator chain of ÷ 100 which gives the amplifier an overall gain of X100. Q44 connects the preamplifier directly to the output.

On selecting 100 Mv Q42 and Q44 are turned on: all other F.E.T's are turned off. The preamplifier is connected to its inverting input via R21, R22, but its output is attenuated by a ÷ 10 attenuator. The overall amp gain is X10. Q44 again connects the preamplifier directly to the output.

With 1V selected Q41 and Q44 are turned on. The preamplifier output is now connected directly to its inverting input giving a gain of unity.

For 10 V range Q41 is kept on, retaining a preamplifier gain of unity but the output of M21 is attenuated by 10 (R33 – R34) before being passed to the output via Q45 instead of Q44.

The 100 V range selects the 1 V range and inserts a ÷ 100 attenuator (R57, R60) between the Hi and the preamplifier input.

The 1 KV range selects the 10 V range and also inserts the same ÷ 100 attenuator at the front end.

1.2.2 Preamplifier

The preamplifier is designed to present an input impedance of greater than 10000 MΩ for signals up to ± 20 V.

Bootstrapping (tracking of both ground lines and supply voltage with input signal) is essential for correct operation of input bias compensation, input offset voltage compensation, temperature compensation, F.E.T. switching and common mode rejection.

M23 is a high impedance buffer which looks at the inverting input of the preamplifier. The offset of M23 is adjusted so that its input is within 100 μV of the input of the preamplifier. M23 thus functions as a low impedance rail following the signal precisely.

By means of zener diode level shifting M24 and M25 produce outputs tracking +10 V and –10 V respectively from the bootstrap rail. These rails power the preamplifier (schematic 430322) and the bootstrap-amp M23 as well as driving the switching to the F.E.T. gates. For example with +15 V on the high terminal the +ve supply of the preamplifier is +25 V and the –ve supply +5 V. This produces excellent common mode rejection.

It should be obvious that this immediately requires a higher supply voltage than the ± 15 V stabilized rails provide. With the maximum +20 V of signal this means a supply of +30 V stabilized is needed for the +BS rail and to provide this nearly 40 V is required. A capacitive inverter driven from M26 provides ± 38 V from the ± 15 V rails.

Zener diodes ZD3, ZD4 provide levels approximately fifteen volts above and below bootstrap. Emitter followers Q52 and Q53 provide a low output impedance for these rails which power M24 and M25.

1.2.3 Drift compensation

Q1 of the preamplifier is a well matched monolithic NPN transistor pair exhibiting minimal voltage drift and low noise characteristics.

To compensate for the current gain match of Q1 at different temperatures (approx 1% /^{o}C), the base emitter voltage is sensed by M2. Its output is linearised by Q2 which has a temperature coefficient similar to that of Q1. Hence the input bias current is kept constant.

M1 is the output buffer of the preamplifier.

1.2.4 Filtering

In the FILTER mode, a 2 pole active filter is switched in by Q46 and Q47. This provides 36 dB attenuation at 50 Hz increasing at 40 dB per decade, and settles to 0.001% in 350 mS. To allow for fast read rates, negligible filtering takes place in the DC Isolation circuitry in the FILTER mode, although an effective 70 dB attenuation at line frequency is still present in the A–D circuitry due to the line locking feature (see section 1.3.2.8).

On the 10 mV range only, a long time constant single pole filter is always switched in by Q40 providing 36 dB attenuation at 50 Hz and settling to .001% in approximately 10 secs.

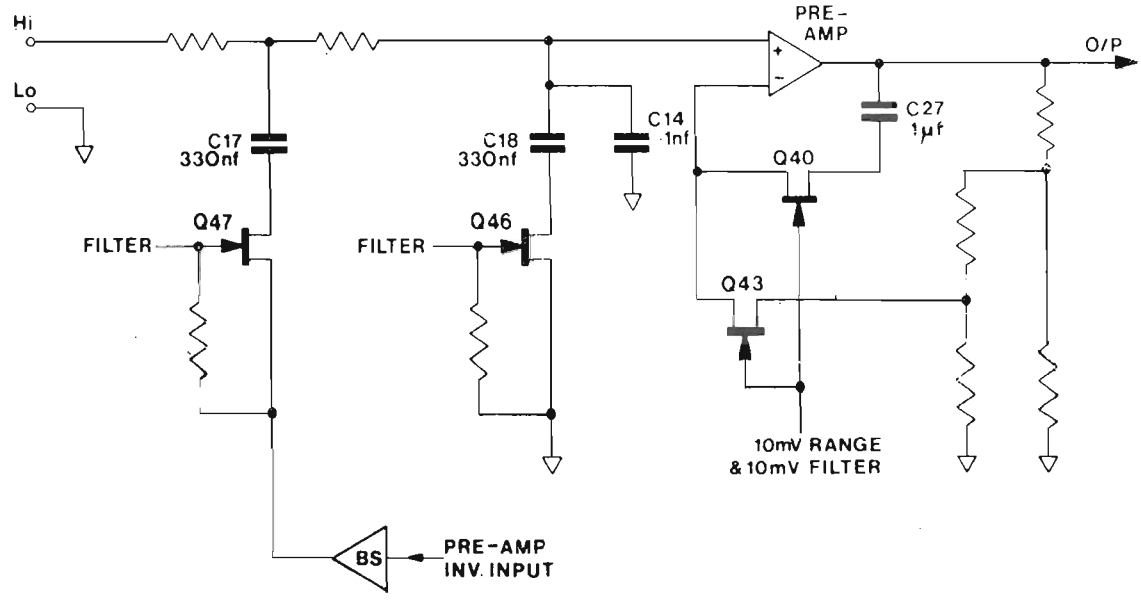


FIG. 1:4 FILTER NETWORK

1.2.5 Isolator range coding/decoding (Drawing 430019, sheet 1).

M9 – M14 are optical isolators separating the auto range digital circuits from the isolator circuit. The outputs of M9, M10, M11 form a range code in BCD format. M12 calls up the resistance converter card, M13 the AC card and M14 filter.

Q18 – Q23, Q27 and the resistor diode matrix R182, R189, D101 – D140 decode the BCD from M9 – M11 and recode it for the AC card and the resistance card. Q28 – Q30, Q33 – Q37 code the drive to the F.E.T's on the DC isolator.

Examining the BCD code more closely:

Range	M9	M10	M11	Q18	Q19	Q20	Q21	Q22	Q23
10 mV	0	0	1	1	1	0	0	0	1
100 mV	0	1	0	1	0	1	0	1	0
1 V	0	1	0	1	0	0	0	1	1
10 V	1	0	0	0	1	1	1	0	0
100 V	1	0	1	0	1	0	1	0	1
1 kV	1	1	0	0	0	1	1	1	0

In the case of Q18 – Q23 a '1' represents ≈+15 V and a '0' ≈ –15 V.

These codes remain the same whether DC, AC or Ω is selected. The outputs of the diode matrix following Q18, Q23 are modified by the selections of DC, AC or Ω.

1.2.5.1 DC coding

When 10 mV is selected the collectors of Q18, Q19, Q23 are at +15 V. Consequently the junction of D127 – D131/R188 is +ve and this turns F.E.T. Q43 on, which gives a preamp gain of X100.

Q21 is – ve, which turns Q28 on and in turn Q35. This turns Q37 off. The collector of Q37 is now +ve, turning F.E.T. Q44 on, connecting the preamp directly to the output.

When 100 mV is selected, the collectors of Q18, Q20, Q22 are at +15 V consequently the junction of D117 – D121/R186 is +ve. This turns Q29 off and in turn Q33 off. The collector of Q33 goes +ve and this turns F.E.T. Q42 on giving a preamp gain of X10. Q21 is still - ve, thus Q28 is on, Q35 off, Q37 off, and F.E.T. Q44 on, again connecting the preamp directly to the output.

When 1 V is selected neither of the two previous codes are present. Q33 and Q34 are both on; this turns Q36 off and F.E.T. Q41 on, giving a preamp gain of X1. Q21 is still - ve, so Q44 is still on.

When 10 V is selected Q20 and Q21 are high. The junction of D132 - D134, D140, R189 is +ve, turning Q28 off, turning F.E.T. Q45 on. Q36 is still off. This calls up a preamp of unity again but divides the output by ten before passing it to the output.

On both 100 V and 1 KV, RL1 is pulled in, connecting the 100:1 input attenuator in circuit. Q27 is at +15 when *either* Q19 is low and Q23 low *or* Q22 low and Q20 low. Thus on 100 V and 1 KV the junction of D114 – D116, D147, R197 is high, turning Q26 on, pulling in RL1.

If 10 MΩ is incorrectly selected in DC the 1 KV range will be called up by the range logic on the analogue side of the opto-isolators.

1.2.5.2 AC coding

When AC is selected M13 turns Q31/Q32 on. These pull RL1 in, turn Q35, Q37 on and F.E.T's Q44/Q45 off. The preamp on the DC isolator is thus totally disconnected from the output. This now receives its input via R38 from the AC converter. Note that these actions are effective on AC regardless of the range selected.

The AC converter receives 4 lines of coded range information via pins 1,3,5,7.

Range	Pin 1	Pin 3	Pin 5	Pin 7
10 mV	0	1	1	1
100 mV	0	1	0	1
1 V	0	0	0	1
10 V	1	0	0	1
100 V	0	0	0	0
1 KV	1	0	0	0

If 10 MΩ is incorrectly selected in AC the 1 KV range will be called up, by the range logic on the analogue side of the opto-isolators.

1.2.5.3 Resistance Converter Coding

The collectors of Q18 – Q23 are fed directly to the resistance converter without being modified in the diode matrix. However, before the opto-isolators in the range logic an extra range, 10 MΩ, is added. The BCD code for this is:-

M9	M10	M11	Q18	Q19	Q20	Q21	Q22	Q23	
1	1	1	0	0	0	1	1	1	10 MΩ

The DC isolator is used on the ohms ranges, with a gain of X1 on all except the 10Ω range, when it is X10. On selecting ohms, M12 turns Q24 on and Q25 off. This modifies the diode matrix outputs to the DC isolator, holding Q26 and RL1 off on the '100 V' (100 K) and 1 KV (1 MΩ) positions. Q28, Q35 and therefore F.E.T. Q44 are also turned on.

1.2.5.4 Filter

M14 passes the filter command to Q38, turning it on. F.E.T's Q46 and Q47 are both turned on via D1 and D2, switching in the 2 pole active filter of the DC isolator. A line is also taken from Q38 to the AC converter.

On the 10 mV range only, F.E.T. Q40 is switched on irrespective of the FILTER or $\overline{\text{FILTER}}$ mode being selected to switch in a single pole long time constant filter.

FILTER can be called up, and is effective on DC, AC and OHMS (where it is useful for resistances in the 10 MΩ region or where long unscreened leads are used).

1.2.6 Auto Range and Range Selection (Drawing No. 430019, Sheet 3).

Range selection can be made by front panel push button, by remote programming via the rear panel, or automatically by auto range. Function selection can be by either front panel or remote programming.

The basis of range selection is M2, a presettable up - down counter. If AUTO is not selected, the counter is prohibited from clocking up or down and the 3 output lines are similar to the three presettable input lines. These input lines come from M1 a 4 input - 2 way multiplexer. Selections of which 3 inputs are connected to the outputs is controlled by front panel or programme REMOTE function selection. The three outputs of the up - down counter drive opto-isolators M9 – M11 feeding a BCD range code to the DC isolator. (See 1.2.5). M6, a BCD – decimal decoder, together with M5 and Q8 – Q12 provide remote range indication for the BCD output option and range decimal point drives for the analogue to digital converter display.

When autorange is selected (AUTO) two modes are possible. If there is an overload on the range in use (i.e.$>$ 200,000 digits) an UP command will come from the digital board via J3 – 13 *and* the counter will clock up one range. After a fixed period ($\approx$10 mS in FILTER and $\approx$500 mS in FILTER) the counter will either remain in a fixed state if the reading is on scale or if still overloaded will clock UP again. This will continue until an on scale reading is achieved, or the highest range reached. Gating on M7 prevents clocking beyond the top range. Alternatively, if the reading is too small for reasonable accuracy on the range in use (i.e. $<$ 10,000 digits) a DOWN command will come from the digital board via J3 - 14 and the counter will clock down one range. Again, after a fixed period, the counter will either remain in a fixed state if the reading is between 10,000 and 200,000 digits or if still underscale, will clock DOWN again. This will continue until a reading of $>$10,000 digits is achieved or the bottom range reached. Gating on M4 prevents clocking beyond the bottom range.

The 10 mV DC range can only be selected by the front panel switch or remote programming and the bottom range in the AUTO mode is 100 mV or 100Ω.

An identical quad 2 way multiplexer M8 is used for function selections. Front panel or remote programming again selects which information to transfer.

M3, Q7, Q13, Q14, Q17 decode the multiplexer (M8) outputs into AC, DC, OHMS and FILTER which connect to the analogue-to-digital converter via J3 and to the DC isolator via opto-isolators M12 – M14 (only $\overline{\Omega}$ and $\overline{AC}$ are transmitted, DC is $\overline{\Omega}$ and $\overline{AC}$).

There are two methods of remote selection. A remote programme link is fitted at the factory and EITHER front panel OR programming can call up REMOTE. If this link is removed, then only the front panel button can call up REMOTE and the programme line pin 12 becomes an output flag indicating REMOTE.

1.2.7 Models 01 and 11 AC Converter

The Model 01 AC Converter is an electronic True RMS AC to DC converter operating over a bandwidth of 30 Hz to 1 MHz and incorporating 5 ranges from 100 mV full range to 1000 volts.

The Model 11 AC Converter covers 4 ranges from 1 V to 1000 V and operates up to 100 kHz.

The circuitry is on one printed circuit assembly which plugs into the underside of the DC isolator board assembly. There are two main circuit sections, the preamplifier (Drawing No. 430016, sheet 1) which buffers and ranges the signal in order to present .9 volts full range to the AC to DC converter section (Drawing No. 430016, sheet 2).

1.2.7.1 Preamplifier

The simplified diagram, Fig. 1:5 shows the essential features of the preamplifier and scaling circuit. For the purposes of explanation the same symbols are used (black triangular contact normally "made", white contact normally "open") regardless of whether the switching is accomplished electronically (F.E.T.) or by means of relay contacts. In Fig. 1:5 all switching is shown in the 1 V range position.

The various switching combinations for the different ranges are as follows:–

VOLTS RANGE	OVERALL VOLTS GAIN	RELAY K2	F.E.T. Q2	F.E.T. Q4	F.E.T. Q3	F.E.T. Q5
10 mV	90	6 – 5	OFF	OFF	ON	OFF
100 mV	9	6 – 5	OFF	OFF	ON	ON
1 V	.9	6 – 5	OFF	ON	OFF	ON
10 V	.09	6 – 5	ON	ON	OFF	ON
100 V	.009	6 – 7	OFF	ON	OFF	ON
1000 V	.0009	6 – 7	ON	ON	OFF	ON

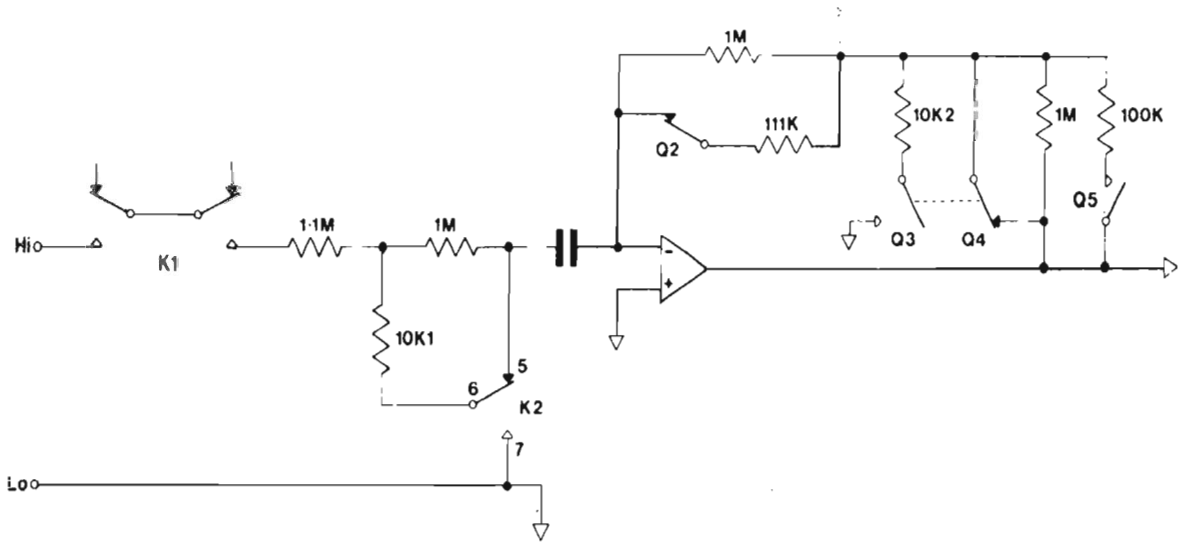


FIG. 1:5

Although the reader could, no doubt, puzzle out the different circuit configuration on each range, it will be quicker to simplify the circuit still further and to show separate drawings for each RANGE setting as shown in Fig. 1:6.

Note that in the model 11 AC converter the 100 mV range is omitted, but all other circuit descriptions are similar to the model 01.

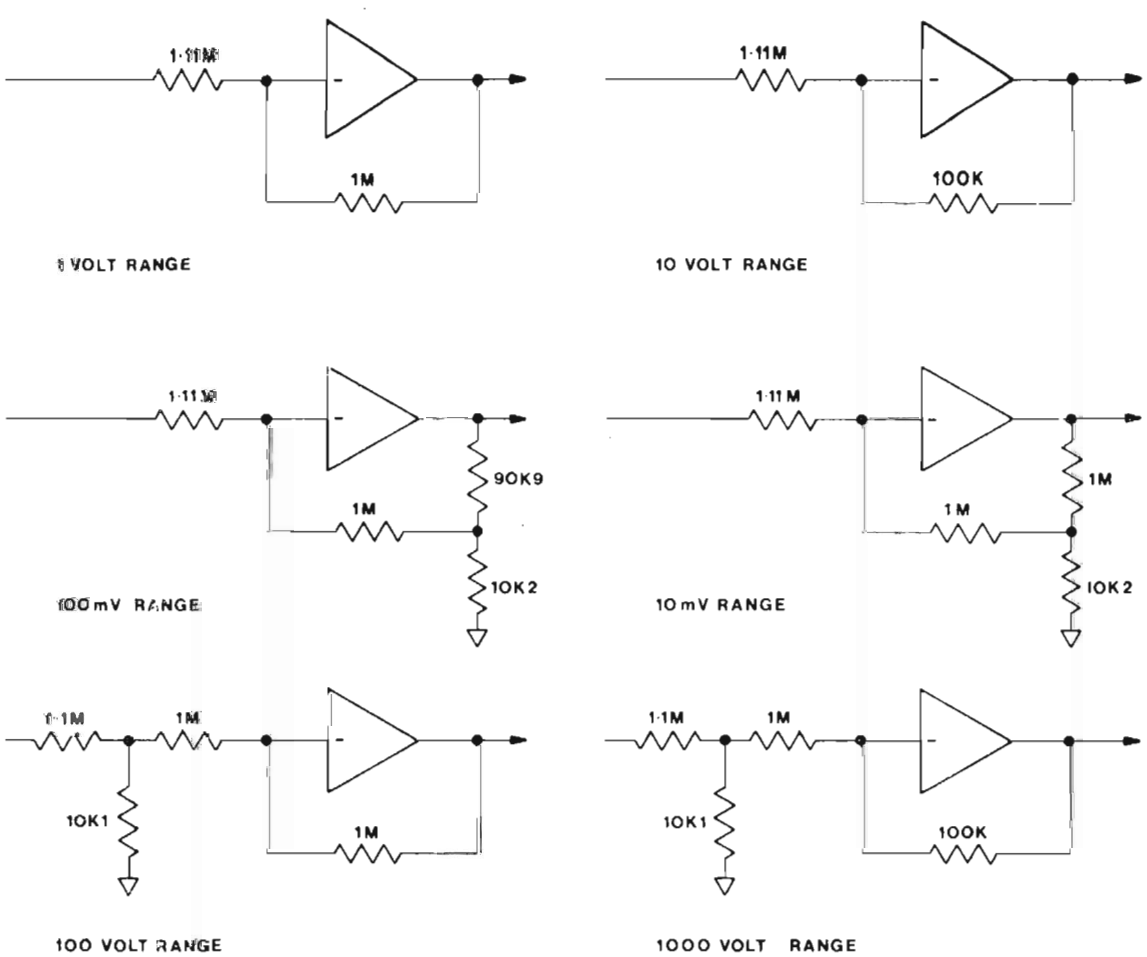


FIG. 1:6 AC PREAMPLIFIER GAIN CONFIGURATIONS

Having grasped the basic essentials, reference should be made to Circuit Diagram No. 430016, Sheet 1.

Relay K1 is energized when AC is selected and directly connects resistor chain R3 - R6 to the Hi input terminal. The four resistors total 1.11 MΩ and are capable of dissipating 2 Watts. Capacitors C2, C3, C4 and R7 provide frequency compensation to increase the accuracy at high frequencies. For the purposes of this description no further reference to frequency compensation will be made although, of course, every gain defining resistor is frequency compensated.

The signal current passing through R3 - R6 either flows into the virtual earth (TP1) of the preamplifier via R10 and C8 or, if K2 is energized 99% of the current is shunted to common providing the ÷ 100 condition required on the 100 and 1000 volt ranges.

The preamplifier itself is of the inverting type, is of high bandwidth and has remarkably low offset drift characteristics. Q6, Q7 and Q10 form a very high bandwidth unity gain buffer. Q6 is a dual F.E.T. operating in a unique differential mode such that each half tracks thermally. M1 is a fast operational amplifier. F.S.V. resistors R51 and R52 are selected to offset M1 such that its offset drift is very low, R41 and R42 such that the offset drift of Q6 is very low and R34 and R35 to provide zero output offset of the whole preamplifier. This is finely adjusted by R36.

The feedback network has been described previously (see Fig. 1:5 and 1:6). Note that the gain defining resistors are associated with trim adjust potentiometers and that where this is the case the compensating capacitor network is also adjustable. Two "twisted-wire" capacitors are also incorporated for very fine frequency flatness adjustments.

The preamplifier is AC coupled at its input with a 1000 volt capacitor allowing AC measurements in the presence of very high DC bias potentials. Although the AC gain is high on the millivolt ranges C22 and C23 limit the DC gain to unity.

1.2.7.2 RMS Converter (Circuit Diagram No. 430016, Sheet 2).

The RMS Converter takes the scaled AC signal from the preamplifier and converts it to an equivalent DC signal suitable for Analogue-to-Digital conversion. The conversion technique is electronic true RMS sensing as shown in the simplified block diagram Fig. 1:7.

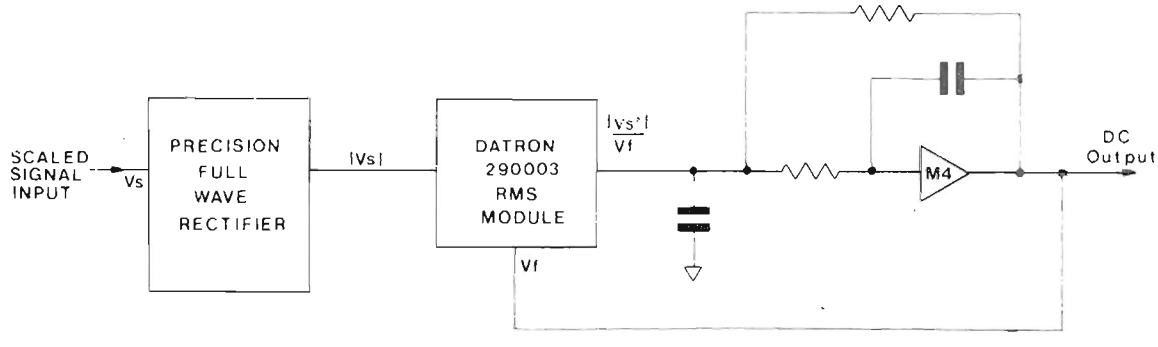


FIG. 1:7 TRUE RMS CONVERTER

With reference to Fig. 1:7 the sections are explained except for the circuitry around M4 which forms a 2-pole active filter with approximately 60 dB rejection at 40 Hz (referred to input).

Mathematically the description is as follows:-

$$\text{Output voltage, Vo} = \frac{\overline{|Vs|^2}}{Vf}$$

where bar notation indicates overrange.

$|Vs|$ is the rectified form of the input signal Vs.

Since the loop is closed:

$$Vo = Vf$$

$$\text{therefore} \quad Vo^2 = \overline{Vs^2} \quad (Vs^2 = |Vs|^2)$$

$$Vo = \sqrt{\overline{Vs^2}}$$

Thus Vo is the true RMS value of Vs.

With reference to drawing No. 430016, sheet 2, M2 and M3 form the full-wave rectifier which is of the summing type, that is, M2 is a precision half-wave rectifier inverter, the output of which is summed with the non-inverted signal, with a weighting of 2:1, at the input of M3. This forces a full-wave rectified current to flow in RMS module M6. Although the simplified block diagram of Fig. 1:7 implied that the RMS module operated with voltages, it in fact operates on currents both in and out. Trim resistor R61 balances the rectifier such that a non-symmetrical waveform provides the same output whether inverted or not.

The output current from the RMS module passes into filter-buffer M4 and is converted to the output voltage. Q15 and Q16 switch in additional capacitors for operating in the FILTER mode down to 40 Hz or lower. M5 is a voltage to current converter which provides a feedback current to the RMS module which is proportional to the output voltage. R98, R109, R115 are zero adjusts for M3, M4, M5 respectively, R67 is an overall gain adjust and R70 is a high crest factor gain adjust. All these components are coarsely adjusted with FSV resistors. Q23 is turned on in AC and off in the other functions and it switches the output of the AC converter into the output buffer M22 of the DC isolator.

1.2.8 Resistance Converter – OPTION 03 (Drawing No. 430027, Sheet 1).

This is a true 4-wire measurement and incorporates an active guard for in-circuit measurement. In many cases, 2-wire measurement is adequate and more convenient: a front panel switch is incorporated to provide for this.

The instrument functions by measuring the voltage across an unknown resistance with a known, constant, current flowing in it.

As can be seen in Section 5.4 of the Operating Manual, 4-wire measurement can eliminate the effects of lead resistance. However, for short leads of 24/0.2mm wire, the few tens of milliohms error when measuring greater than 100 ohms soon become negligible; from this point on, 2-wire measurement becomes more attractive. Referring to drawing No. 430027, the converter is in two parts: a constant current source covering 6 decades from 10 mA – 100 nA and a low drift voltage follower. It should be noted that when the resistance converter is fitted the DC isolator Lo is no longer directly connected to front panel Lo, but goes via RL1 on the resistance converter. On DC, isolator Lo connects to front panel Lo. On Ohms, the front panel Lo is connected to the –ve input of M3, the +ve input of which is referred to DC isolator Lo. (This remains reference common). M3 together with output follower Q9, will thus apply a voltage at I+ such that the voltage at front panel Lo is reference 0 + offset M3 (which is zeroed to $< 10\ \mu V$).

Consider 2-wire measurement for ease of explanation: I+ linked to Hi, I– linked to Lo, the unknown resistance between Hi and Lo. A constant current flows from Hi to Lo through the unknown resistance. The Lo terminal is maintained at $0 \pm < 10\ \mu V$. The Hi terminal (DVM isolator input) is, I constant x R unknown, above Lo. As long as the error on Lo is small referred to reference 0, the DVM will read the correct resistance. The voltage offset error is kept small (<1 digit) by compensating M3 in the same manner used for M21 on the isolator. (See Section 2, Maintenance).

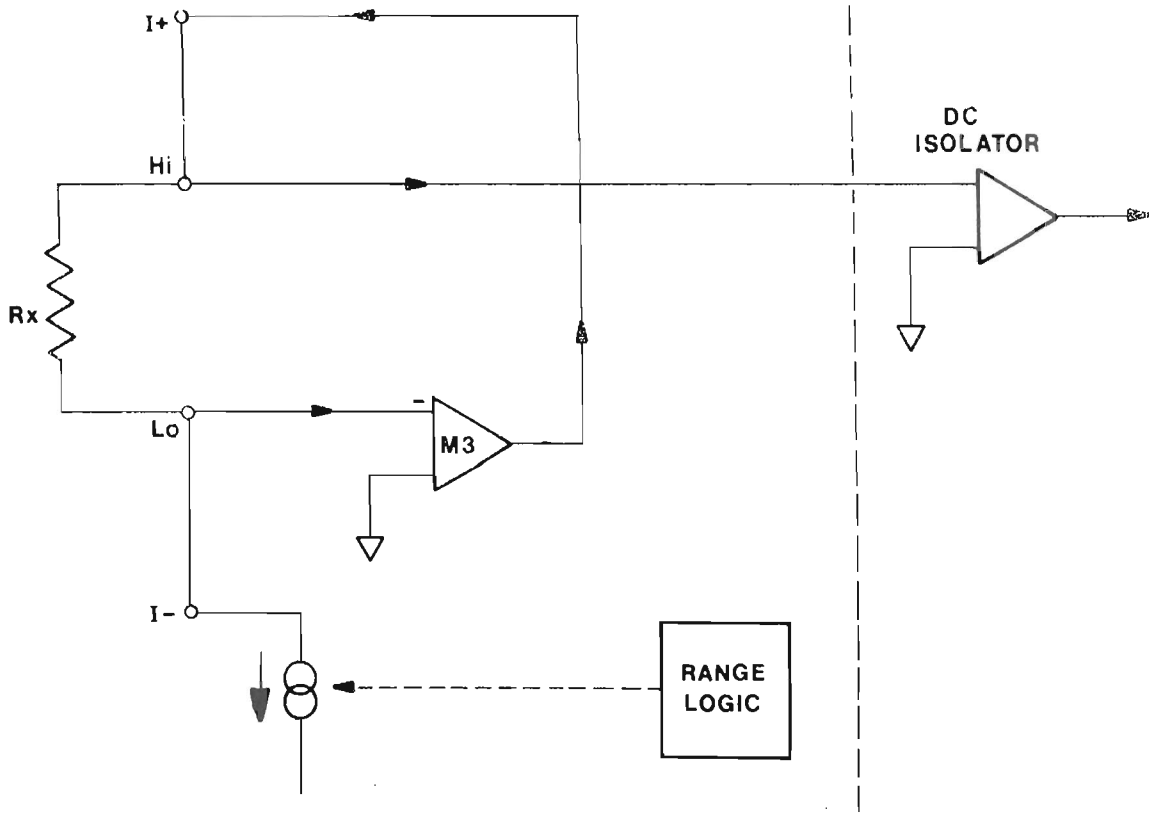


FIG. 1:8 SIMPLIFIED Ω SCHEMATIC

Seven decades of ohms ranges are provided by 6 ranges of current and 2 ranges of isolator voltage gain. The diode switch matrix on the isolator board provides 7 lines of information in BCD code. A small matrix on the Ω card provides gate drive for 6 current selector F.E.T's (Q2 – Q5, Q7, Q8) and for F.E.T. Q6, used for leakage reduction. M1 converts the −5 V reference voltage from the digital assembly into a current of 500 μA flowing in R5. R5, M2 and the switched resistor chain R6 R54 form a current mirror: the current flowing in the chain on the right of M3 is equal to the current flowing in R5 on the left of M3 multiplied by the ratio of the right hand resistor to R5. Put even more simply, the voltage across R5 must equal the voltage across the right hand chain + offset voltage of M2. Thus a fixed voltage difference appears across the resistance chain; by varying the value of resistor, the current is varied selecting tappings on the chain.

The various currents produced are:-

		F.E.T's ON
100 Ω	10 mA	Q2
1 kΩ	1 mA	Q3
10 kΩ	100 μA	Q4
100 kΩ	10 μA	Q5
1 MΩ	1 μA	Q6 Q7
10 MΩ	100 nA	Q6 Q8

4 basic currents are provided and a 1000:1 attenuator used with two of these currents provides two more ranges.

If difficulty is experienced in understanding how the 2M/2K functions as a current divider, remember that the point the 2M is connected to is I and this will be at most only a hundred ohms from Lo. Lo is maintained within a few μV of ref. 0 and the 2K is taken to the ref. 0. Thus the 2M is in effect shunting the 2K and the same voltage therefore exists across the 2M as across the 2K. Q6 is switched in when Q7 and Q8 are on, to sink gate leakage currents from Q2, Q5 to ground.

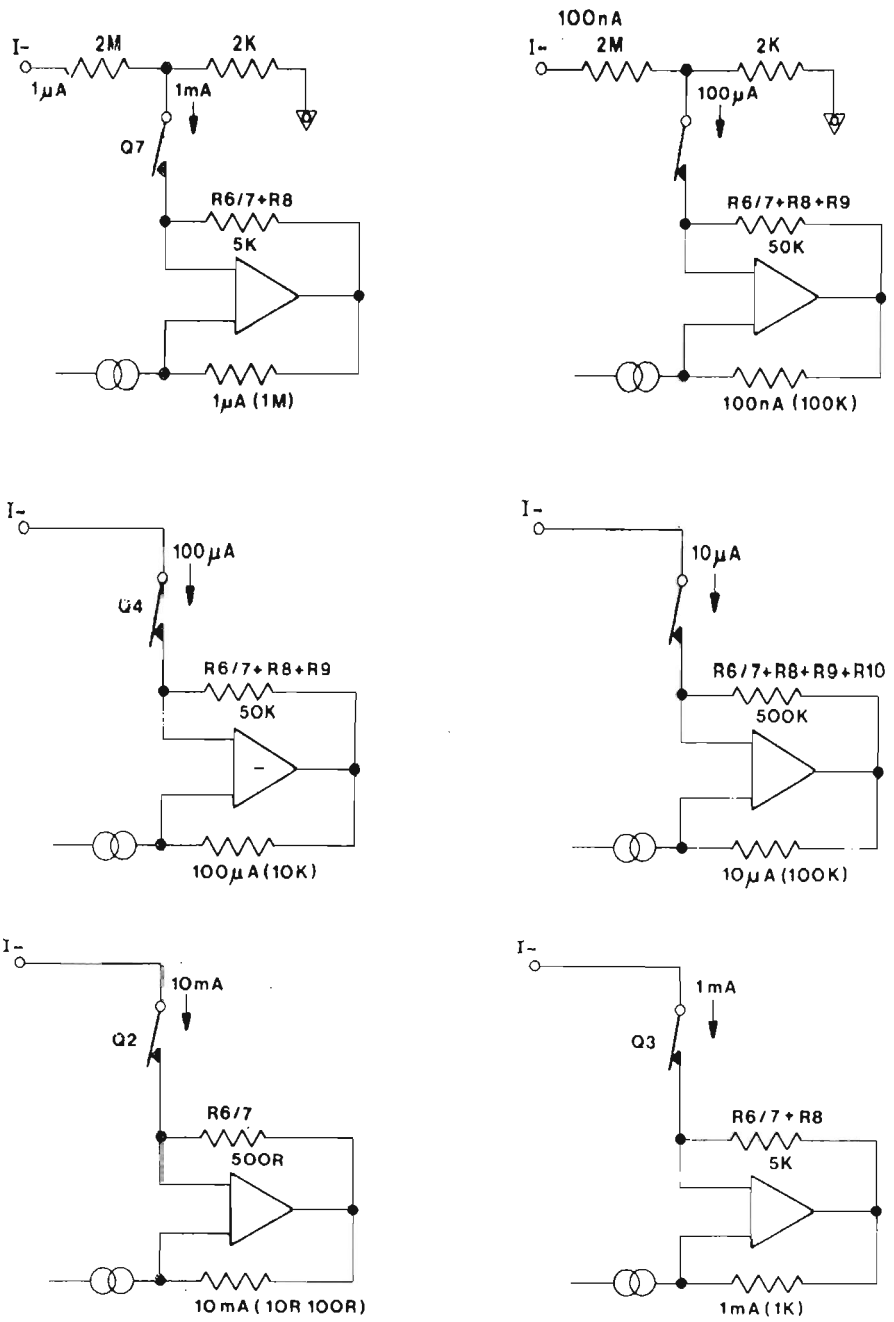


FIG. 1:9 SIMPLIFIED Ω CURRENT SWITCHING

Protection from overload in the current leads is achieved by positive temperature coefficient thermistors R47 (in the I+ lead) and R48 (in the I– lead). Diodes D31 -- D34 and zeners D36, D37 prevent excessive voltages from reaching the current generator or the voltage follower output. Protection is such that 240 V r.m.s. may be applied between I+ and I– or I+, I– to ohms guard or Lo to ohms guard. Following the application of such an accidental overload the PTC resistors R47, R48 have to cool down and this may take several minutes.

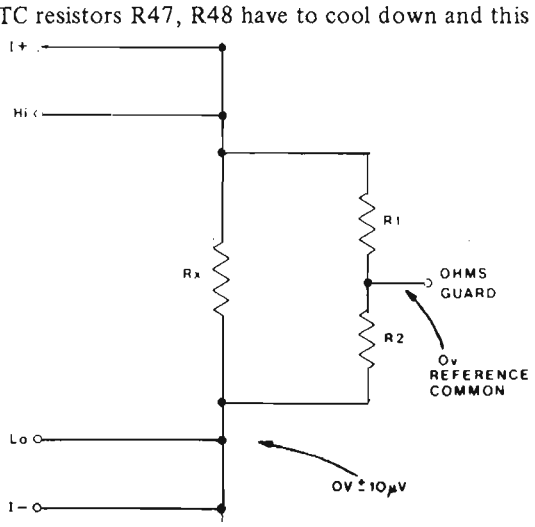


FIG. 1:10 Ω GUARD

The use of ohms guard permits in circuit measurement of resistors, provided shunt paths are greater than 250Ω and a suitable tapping point is available. Consider Fig. 1:10. Ω Guard is reference 0, Lo is, as previously explained, actively maintained within a few μV of ref. 0. Thus there is no voltage across R2 and consequently no current in it. R2 can cause no measurement error. Thus all the constant current because it cannot flow in R2, must flow in the unknown resistance. Voltage follower M3 will simply pass more current into R1 from the I+ terminal until the selected current for the particular range flows through Rx.

1.3 ANALOGUE TO DIGITAL CONVERTER

1.3.1 Analogue Section

1.3.1.1 General Principles

Section 1.3 and Fig. 1:3 of the Operating Manual gives a very basic description of the principles of integration involved. This paragraph covers in more detail those general principles. Fig. 1:11 is a block diagram showing the essentials of the analogue section of the analogue to digital converter. Fig. 1:12 is a timing diagram which should be referred to in conjunction with Fig. 1:11 for a full appreciation of the circuit operation.

As explained in Section 1.3 of the Operating Manual the analogue section is controlled by timing pulses generated in the digital section and transferred via pulse transformers T2 and T3 to the analogue side. These timing pulses control the sequence from RESET to SIG to REF and back to RESET. The sequence is effected by using the timing pulses to set and then clock a 2 bit binary counter M44. The 2 bit output $\overline{AB}$ and its complement, AB drive logic gates which in turn operate F.E.T. switches Q1 – Q4, Q6 – Q9.

1.3.1.2 RESET Period and Auto Zero

During this period any residual charge from the previous reading cycle is removed from the integrator capacitor C30, and the AUTO ZERO circuitry stores the cumulative zero errors of M35, M36 and M37.

The RESET state is dictated by LOW (–15 V) states at both A and B from M44, when this occurs a HIGH (–10 V) state appears at the input pins 5 and 6 of the M46 NAND gate producing a LOW (–15 V) at pin 4. This turns off Q18, which switches Q4 (FAST RESET) on momentarily (approx 1 mS) via C17 and R26, and after a short delay (approx. 1 mS) set by C38 and R22 allows Q3 (RESET and Auto Zero) to switch ON. When B went to a logic '1' at the end of the previous SIG period, it reset M45 F/F to give a LOW state at the Q output (pin 13) which turned off Q14 allowing Q2 to turn on and turning off Q1. These states of Q1 and Q2 are maintained from the end of SIG through to REF and RESET.

Also, at the commencement of RESET $\overline{B}$ changes to a HIGH (–10 V) state. This appears at pin 12 & 13 of M46 NAND gate causing the output pin 11 to go LOW and turn OFF Q23 allowing F.E.T. switch Q8 to turn ON.

Now, during RESET the F.E.T. switches are in the states shown in Fig. 1:11. Q8 connects the output of M35 to the input of the integrator. Q3 and Q4 close the feedback loop and C30 assumed a charge such that when C32 samples the cumulative errors of M35, M36 and M37, the stored error is transferred via M49 to the non-inverting input of M38, to produce zero volts at TP9. This auto zero output from M49 is maintained during the following SIG and REF periods until being adjusted again, if necessary, during the next RESET period.

1.3.1.3 SIGNAL INTEGRATE Period

Following the RESET period, a timing pulse arrives at T3 the SIG pulse transformer. This sets the binary counter, forcing A to a HIGH state (–10 V) and ensuring that B is a Low state. The SIG pulse also appears at the clock input (pin 11) of 'D' type flip-flop M45, the Q output (pin 13) thus adopts the signal at the D input (pin 9) –10 V, a high state. This switches ON Q14 which switches on F.E.T. Q1 and switches OFF F.E.T. Q2. Q1 connects the unknown signal to the X5 amplifier input. Q8 is already ON following the RESET period and X5 the input signal appears at TP5 and is fed to the integrator.

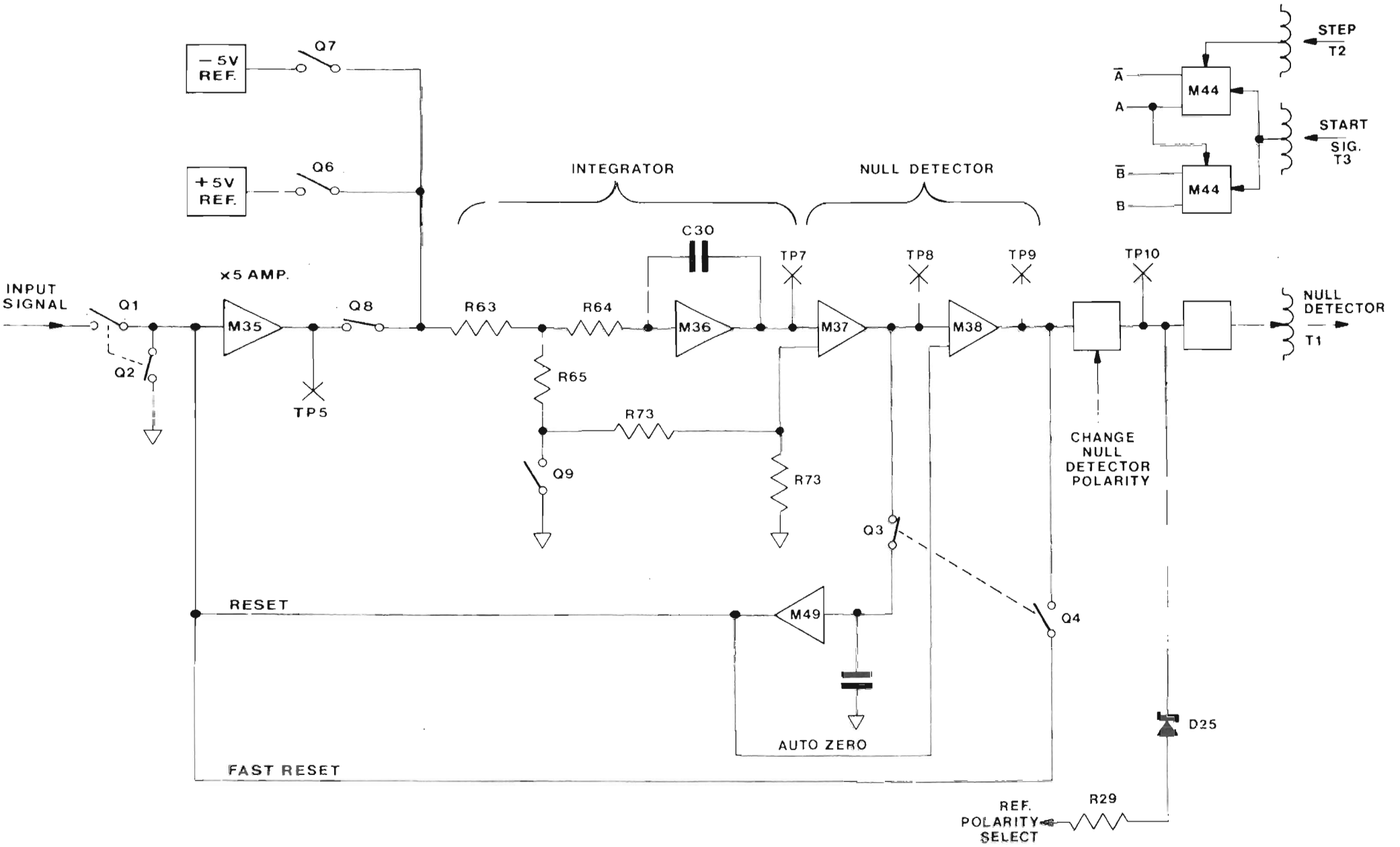


FIG. 1:11 SIMPLIFIED DIAGRAM OF ANALOGUE SECTION

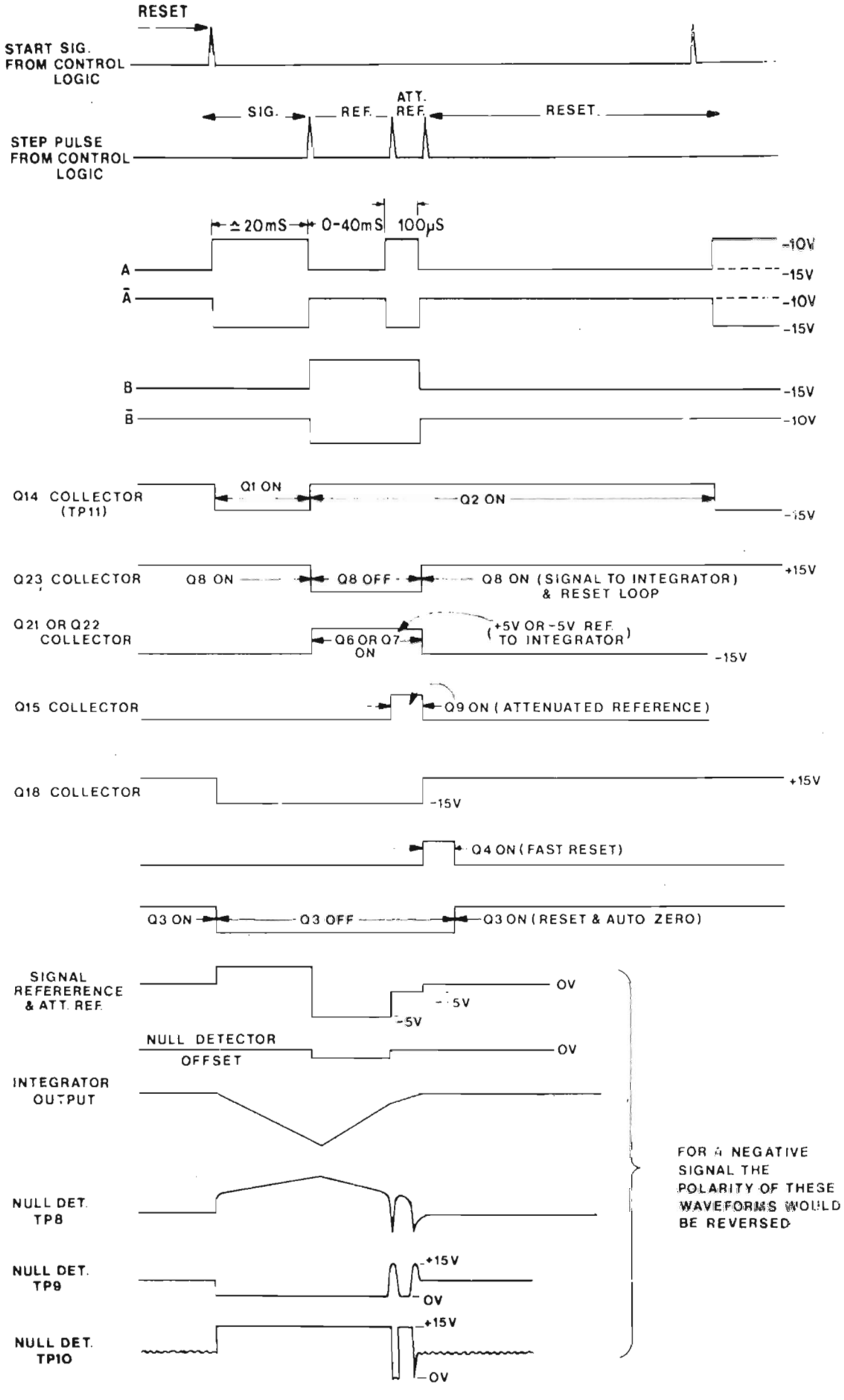


FIG. 1:12 A–D CONVERTER TIMING DIAGRAM

If the signal at TP5 is positive then the output of the integrator at TP7 will move off negatively as shown in Fig. 1:12. Meanwhile, the voltage at TP7 is much amplified by the first stage of the null detector M37. This stage incorporates clamping diodes D18 and D19 so that although a large output swing occurs when the voltage at TP7 departs from zero by only a small amount, the voltage at TP8 is clamped, again as shown in Fig. 1.12. Further null detector gain is introduced by M38 and through level shifting zener diode D23 to M42. At TP10, the null detector gain is such that the output is a logic level of either 0 V for a negative signal or +15 V for a positive signal as shown in Fig. 1:12. The logic voltage at TP10 is level shifted by zener diode D25 to provide either −9 V or −15 V via R29 at the D input (pin 5) of the 'D' type flip-flop M45. With a positive input signal the voltage at pin 5 is HIGH (−9 V).

1.3.1.4 REFERENCE INTEGRATE Period

After 20 mS of SIG a STEP pulse arrives at pin 3 of M44 to clock M44 and change A to a LOW (−15 V) and B to a HIGH (−10 V). $\overline{B}$ at NAND gate pin 13 changing to a LOW (- 15 V) produces a HIGH (−14.3 V) at the output pin 11 and turns ON Q23 which switches OFF the signal path through Q8.

As explained in paragraph 1.3.1.3, with a positive input signal a HIGH state (−9 V) is present at 'D' input (pin 5) of 'D' type flip-flop M45 at the end of the SIG period.

Therefore, when $\overline{A}$ changes to a HIGH on the clock (pin 3) input of M45 at the end of SIG, the HIGH at the 'D' input (pin 5) is transferred to the Q output (pin 1). At the same time a LOW (−15 V) appears at the $\overline{Q}$ output (pin 2), which turns OFF Q22 allowing F.E.T. Q7 to switch ON, thus connecting the −5 V reference to the input of the integrator. Consequently, a reference signal of opposite polarity to the measured signal is applied to the integrator to discharge the capacitor. The reference integrator period required for discharging the capacitor C30 to zero volts will always be less than 40 mS (except with an overload signal). To overcome the problem of uncertainty near zero a small proportion of the reference voltage is fed forward to bias the null detector. This means that even with zero input signal there is a small reference ramp lasting for a period of time determined by the amount of feed forward (set by R80 for positive signals and R81 for negative signals). This ensures that a false null detector pulse is not produced as a result of spurious noise generated at the end of the SIG period. For a zero input the display would read several digits, and thus is compensated for in the main digital counter by ignoring the first few clock counts.

During the first part of the reference period, F.E.T. switch Q9 is turned OFF. This allows the reference voltage, attenuated by R73 and R72 to feed a small offset into the null detector. The polarity of the offset is such that the reference ramp from the integrator (TP7) reaches null detector threshold before the integrator voltage has reached 0 V. When this threshold is crossed, the logic level at the null detector output changes state, in this case from HIGH, (+15 V) to LOW (0 V), which transfers a first null detector pulse via T1 to the control logic. Following an appropriate synchonization delay in the control logic another STEP pulse arrives at T2 to clock M44, this changes A to a HIGH state (−10 V). This means that both inputs (pins 1 and 2) of NAND gate M46 are HIGH, producing a LOW state (−15 V) at pin 3, turning Q15 OFF which allows Q9 to turn ON. When Q9 switches ON, the reference voltage is attenuated by R63 and R65 and is effectively −0.5 V, also the small offset fed to the null detector via R73 and R72 is removed. The removal of this offset immediately resets the null detector to its previous state with a HIGH (+15 V) at TP10. The reference to the integrator having been attenuated to 1/10 of its previous value, means that the integrator capacitor C30 now discharges at 1/10 of the previous rate and continues until zero charge is reached. At this point the threshold of the null detector, now 0 V, is again crossed and the logic level at the null detector output again changes to LOW (0 V) transferring a second null detector pulse via T1 to the control logic. The attenuated reference period lasts for approx 100 μS, whereas the full reference period varies from almost zero to 40 mS for a zero to full scale input signal respectively. Following the second null detector pulse another STEP pulse arrives at T2 which clocks M44, changing both A and B to a LOW (−15 V) and thus switching the analogue circuitry back into the RESET mode as described in paragraph 1.3.1.2.

1.3.1.5 References

Fig 1.13 shows the essentials of the circuitry for producing the stable +5V and –5V reference voltages.

The stability of the reference is dependent upon the inherent stability of device M39. This device produces an output voltage of +7V with very low temperature coefficient and extremely good long-term stability.

To obtain the 5V reference required, inverting amplifier M40 is used with the scaling resistors R66 and R67 being trimmed by R37, R38 and R70, R71 respectively. R76 is used as a fine adjustment to calibrate the output of M40 to –5V exactly. Similarly to produce the +5V reference, another inverting amplifier M41 is used, having unity gain and being finely trimmed by R78.

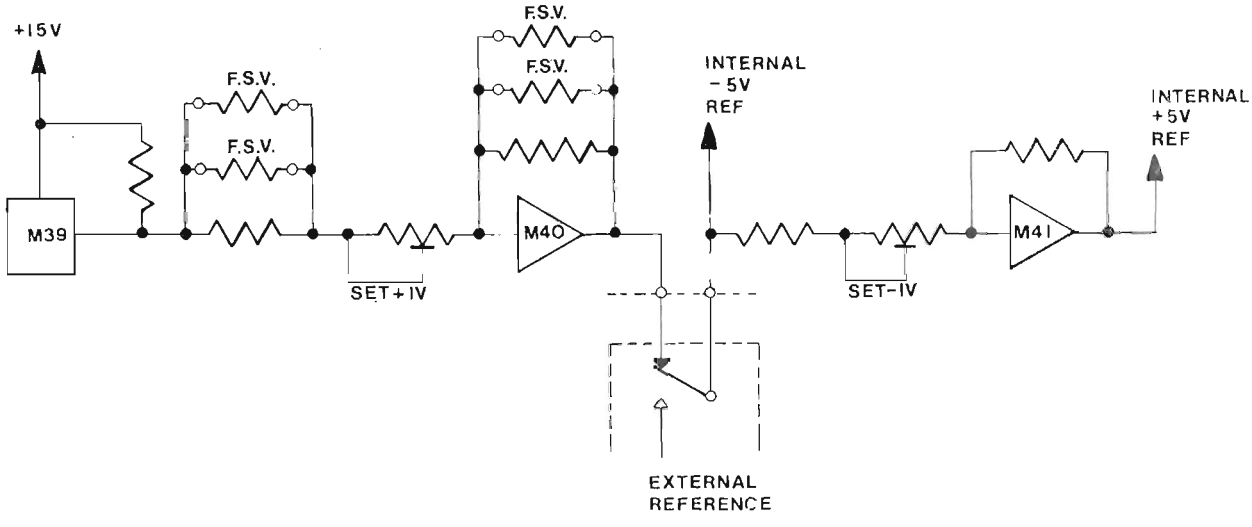


FIG. 1:13 REFERENCES

1.3.1.6 Using an External Reference

As explained in paragraph 1.3.5, provision is made for replacing the internal reference voltage by an externally generated voltage reference source. When using an internal reference, the polarity of that reference is selected opposite to that of the input signal to effect the charging and discharging action of the integrator as described in paragraph 1.3 of the Operating Manual.

Now, with an external reference, this polarity selection must still operate even though that external reference may be either polarity at the rear connector.

Block diagram 1:14 outlines the essentials to achieve this polarity selection. Firstly, considering the internal references, the relay K1 is in the normally closed position and the – 5 V from M40 is fed to the input of unity gain inverting amplifier M41 to produce the +5 V reference at the output. The +5 V reference via D15 allows

Q20 to switch on, this puts a LOW (0 V) at pin 9 of NAND gate M42 and a HIGH (+15 V) via INVERTOR M43 (pins 9 to 10) at pin 6 of second NAND GATE M42. The output of the first NAND gate M42 (pin 10) is thus held HIGH irrespective of the logic level at pin 8. Meanwhile, the HIGH at pin 6 of the second NAND gate M42 enables that gate to invert whatever logic level appears at pin 5. Similarly, the HIGH from pin 10 is fed to the input pin 12 of a NAND gate M42 which enables that gate to invert the logic level at its other input pin 13. Thus, overall from TP9 to TP10 three logic inversions occur, that being equivalent to a single inversion. As explained in paragraph 1.3.1.4, a HIGH (+15 V) at TP10 selects Q6, and a LOW (0 V) selects Q7 to switch the appropriate reference during the REF period.

If now external reference is selected, relay K1 connects to the normally open contact, and whatever voltage is present at the EXT REF socket passes via the X5 inverting buffer amplifier through the relay K1 to F.E.T. switch Q7 and via the unity gain inverting amplifier to Q6. If, for example, the external source is +1 V, then –5 V appears at Q7 and +5 V at Q6, just as if the circuitry were operating normally with an internal reference. Now if the polarity only of the external source is changed then +5 V is present at Q7 and –5 V at Q6. But the –5 V at Q6 now via D15, turns OFF Q20 which presents a HIGH to one input (pin 9) of the first NAND gate, this enables the gate to invert whatever logic level appears at the other input (pin 8). In addition the HIGH from Q20 collector via INVERTER M43 (pins 9 and 10) places a LOW at pin 6 of the second NAND gate M42 forcing a HIGH at its output (pin 4) irrespective of the level at pin 5. The HIGH now present at pin 13 of the third NAND gate M42 enables this gate to invert the level from pin 10 of the second NAND M42. Consequently, there are now from TP9 to TP10 four stages of inversion, being equivalent to non-inversion overall. Summarizing, the external reference having changed polarity means that whereas previously for a positive input signal, F.E.T. switch Q7 was selected, now for a positive input signal Q6 is selected. But, checking back, after the external reference polarity was reversed, –5 V was present at Q6. Therefore, the circuit has still selected the correct reference polarity to ensure satisfactory operation.

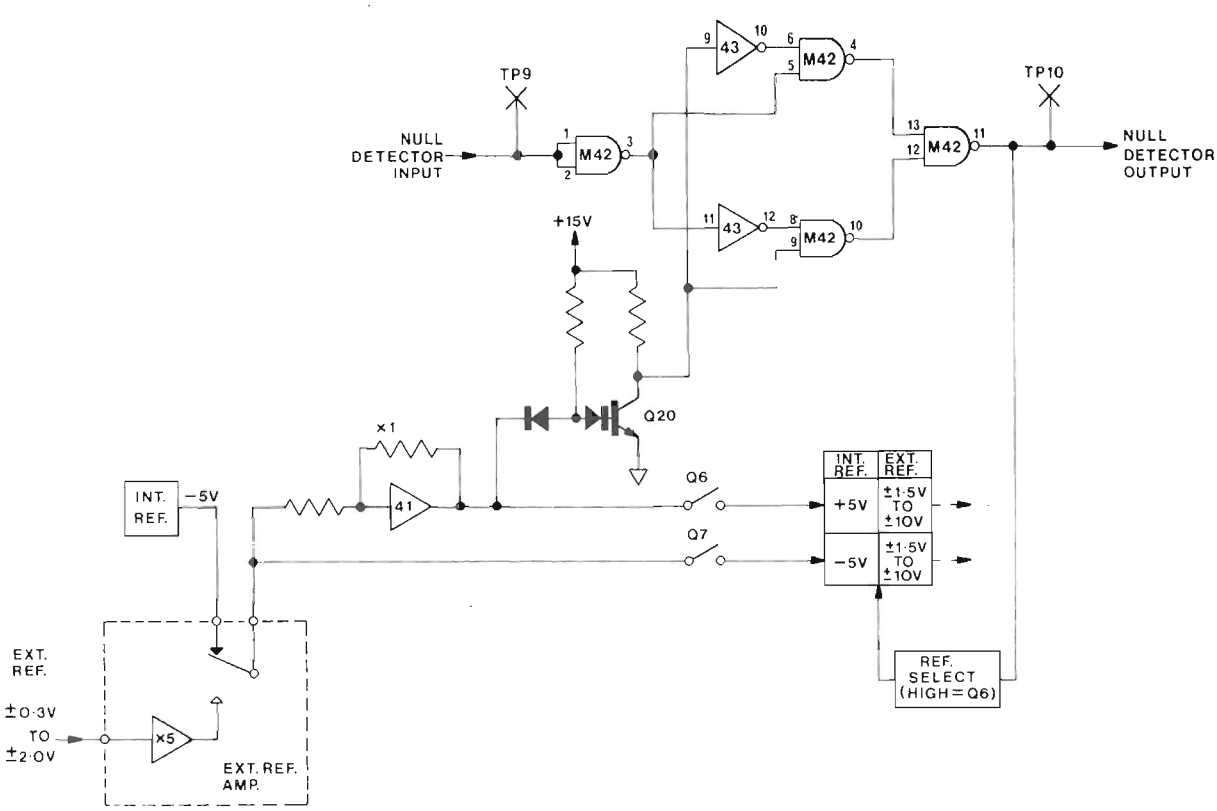


FIG. 1:14 EXTERNAL REFERENCE SWITCHING

1.3.2 DIGITAL SECTION

1.3.2.1 General Principles

Block diagram Fig. 1:15 outlines the essentials of the digital section and should be used with diagram 1:16 in order to follow the operation of this section.

The function of this section of the circuitry is to generate the timing pulses that when transferred to the analogue section , control the sequence from RESET to SIG to REF and back to RESET. Concurrent with this sequence, clock pulses are accumulated in a digital counter such that when the sequence is in the REF period, the number of clock pulses entering the counter is proportional to the length of that REF period, which is in turn proportional to the measured input signal. At the end of each reading cycle the count is stored and fed to the displays.

1.3.2.2 Command

To instruct the control logic to take a reading a COMMAND pulse is necessary ar the Command enable flip-flop M21. COMMAND can be generated either internally by the Read rate astable M27 providing for 3 readings/sec, or the front panel MANUAL switch (if HOLD is selected for single shot readings) or externally via the rear panel BCD socket for systems use. An extended command signal passes via the DELAY monostable and is delayed by a period appropriate to the function DC, AC or OHMS with or without FILTER, to allow adequate settling time of the analogue circuitry before taking a reading. When a COMMAND is received the Command enable flip-flop changes state which inhibits further Commands and admits 500 KHz clock pulses from the line locked clock to the least significant digit decade counter M9 and the cascaded decade counters M4.

1.3.2.3 Counter, Latches and Multiplexing

M4 is a large scale integrated circuit which contains the main counter and store (four full decades, one overrange latch and one overload latch) and also provides a multiplexed BCD output of the count stored in the four decade latches. The fifth decade counter M9 (least significant digit) is stored by M6 and its BCD output is introduced onto the multiplexing lines every fifth step pulse from the multiplex oscillator M19, by the logic 4 pole 2 way changeover switch M3. The multiplexed lines are decoded by M2 to produce data in seven segment format.

Before a COMMAND is received and until a subsequent TRANSFER pulse arrives, the stored count from the previous reading is multiplexed out to the display, the multiplexing frequency being approximately 1 KHz. The most significant digit (indicating a count of 100,000 or greater) is not multiplexed but is stored by M13 and fed directly to the most significant digit display.

1.3.2.4 Master Preset

Coincident with the first clock pulse after a COMMAND a MASTER PRESET pulse (approximately 2 μS) is generated and is fed to M4. This sets the 4 decade counters to all zero's and the binary overrange and overload latches to 1's (equivalent to a count of 30,000). The least significant decade M9 although receiving clock pulses is not allowed to count but is held preset at a count of 9.

1.3.2.5 Signal Integrate Period

A summary of the states of the counters during one reading cycle is shown in Fig. 1:17. As mentioned, following a MASTER PRESET pulse 1's appear at the overrange and overload latch outputs of M4 and remain in this state until a further 10,000 clock pulses have been counted when the clock resets to 00,000. At 500 kHz, 10,000 clock counts define a period of 20 mS and this period is used to determine the SIG period. At 30,000 a Start sig timing pulse is sent to the analogue section via T3 and after another 10,000 clock pulses a step pulse is sent via T2, this terminates the SIG period and starts the REF period.

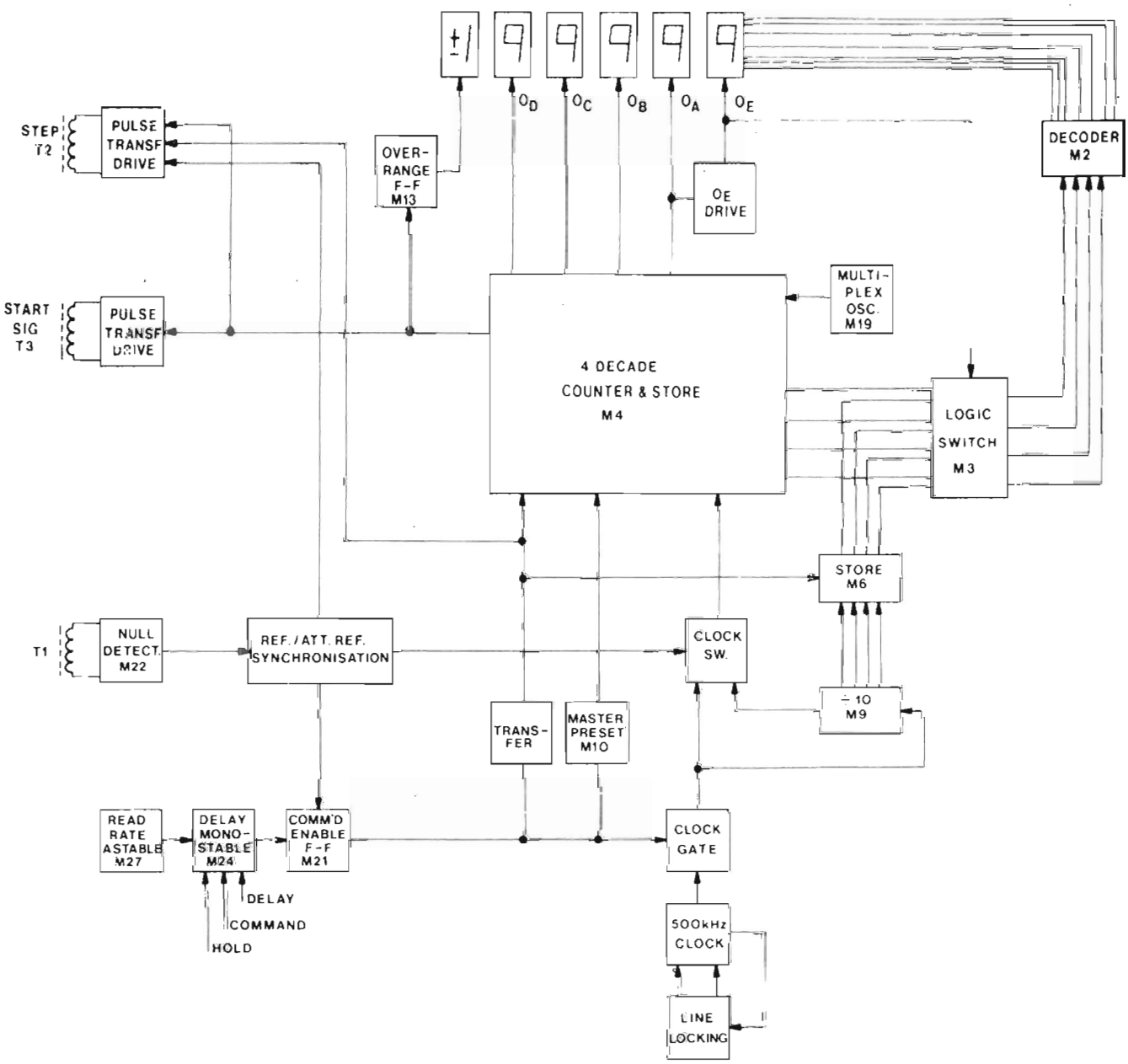


FIG. 1:15 SIMPLIFIED DIAGRAM OF DIGITAL SECTION

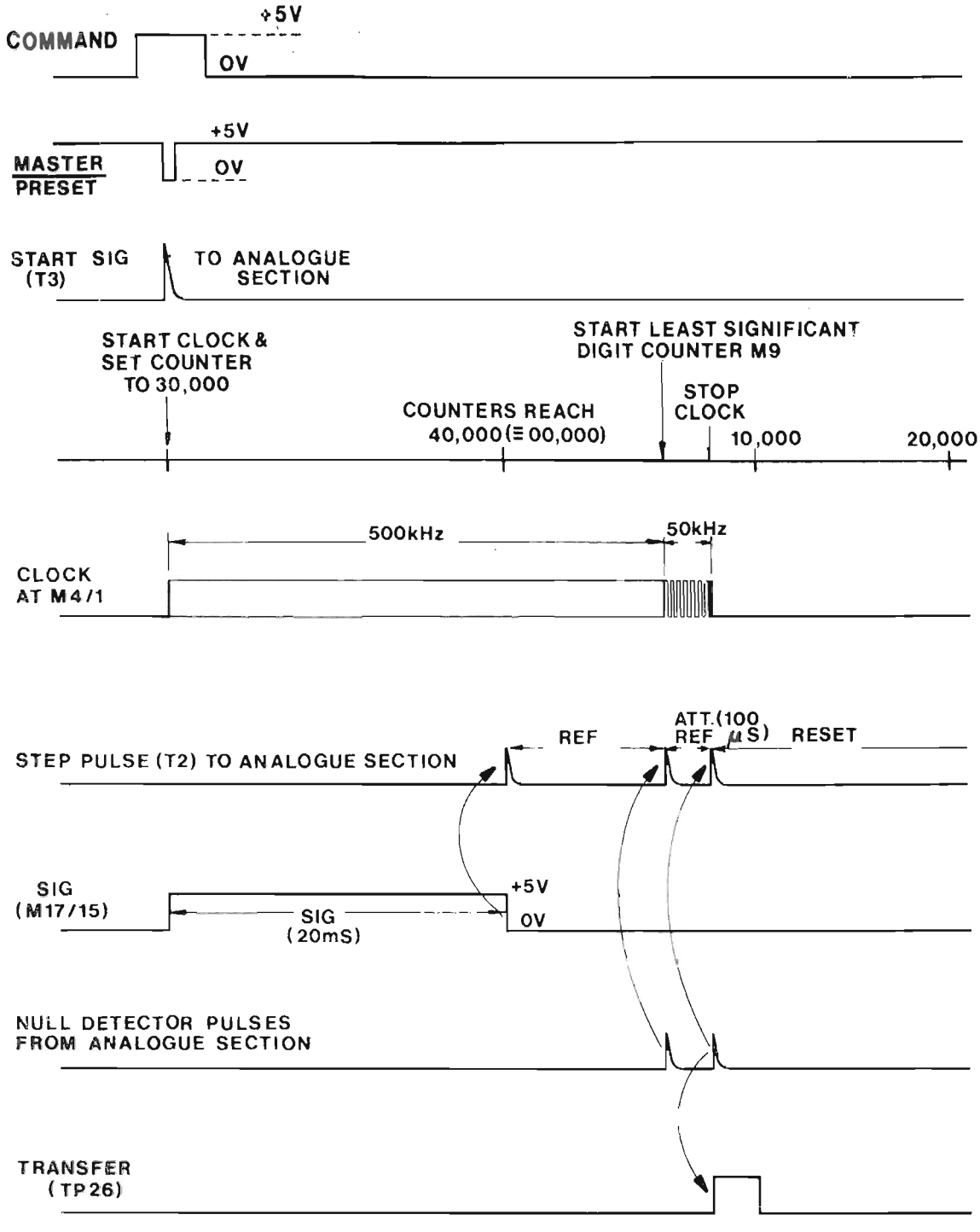


FIG. 1:16 DIGITAL SECTION TIMING DIAGRAM

1.3.2.6 Reference Integrate Period

During the REF period the clock pulses continue to accumulate in the M4 counters, M9 still being held at 9, until a null detector pulse is received from the analogue section via T1. This pulse is stored by M16 flip-flop which removes the hold on the least significant digit counter M9. In synchronism with the next clock pulse the clock input to M4 is switched from the 500 kHz clock to the output of M9 (50 kHz) and a step pulse is sent via T2 to the analogue section to start the attenuated REF period.

Clock pulses now feed the five cascaded decade counters M9 and M4 until the second null detector pulse appears at T1. This pulse is used to reset the state of the Command flip-flop M21 enabling further commands to be accepted, and the 500 KHz clock to the counters is gated out preventing further accumulation of clock pulses.

	SUMMARY OF COUNTER SEQUENCE	MOST SIGNIF. DIGIT (BINARY)	DECADES	CLOCK TO M4	LEAST SIGNIF. DIGIT	CLOCK
READING FROM PREVIOUS CYCLE		01 01	4573		6 0	CLOCK STOPPED
START SIG.	COMMAND PRODUCES MASTER PRESET WHICH SETS 30,000 AND HOLDS LEAST SIGNIFICANT DIGIT AT 9	1 1 1 1	00000 00000	500kHz	9 9	START CLOCK 500kHz
END SIG.	AFTER 10,000 CLOCK PULSES (≙ 20mS) COUNTER AT 00,000 (≡ 40,000) LEAST SIGNIF. DIGIT STILL HELD AT 9	00 00	00000 00000	500kHz	9 9	500kHz
START REF.	1 CLOCK PULSE LATER	00 00	00001 00001	500kHz	9 9	500kHz
FIRST NULL DETECTOR PULSE	COUNTER HAS REACHED, FOR EXAMPLE:	01 01	4562 4562	500kHz	9 9	500kHz
START ATT. REF.	1 CLOCK PULSE LATER	01 01	4563 4563	50 kHz	0 0	500kHz
FINAL READING	SECOND NULL DETECTOR PULSE STOPS CLOCK & PRODUCES TRANSFER	01 01	4568 4568		2 2	STOP CLOCK

FIG. 1:17

1.3.2.7 Transfer

When the COMMAND enable flip-flop is reset by the second null detector pulse, a TRANSFER pulse is generated by M21 to instruct the counter latches M4 and M6 to store the new count, which is then multiplexed out to the displays. Coincident with the TRANSFER pulse a third step pulse is passed via T2 to the analogue sector to start the RESET period. Both the analogue and digital sections remain in this state until the next COMMAND pulse arrives.

1.3.2.8 The Line Locked Clock

For optimum rejection of mains borne interference in the analogue circuitry it is important that the SIG period is an exact multiple of the line period (normally 20 mS). As the line frequency (nominally 50 Hz) is subject to small variations, the high rejection obtained is only preserved by changing the SIG period accordingly. To achieve this, the 500 KHz clock frequency is changed in sympathy with line frequency variations, commonly called 'line locking'.

Block diagram Fig. 1:18 shows the line locking network. A sample of the line frequency is shaped into a line frequency square wave by M29.

This square wave is passed to ÷ 2 flip-flop M30 to produce an approximately 25 Hz output.

The clock used to feed the counters in the digital section consists of an astable oscillator Q44 and Q45 with a nominal frequency of 500 KHz. It is provided with additional circuitry such that a logic level at one of two inputs (TP20 or TP21) can increase or decrease this frequency by about 1%. The application of either of these FAST/SLOW signals turns on either Q48 or Q49, thus charging or discharging capacitor C112 via R119. The voltage

on C112 is buffered by Q46 and Q47 and appears on capacitor C111 (TP22). The longer the fast or slow signals are applied, then the further the control voltage at TP 22 will drift and this change varies the discharge rate of timing capacitors C109 and C110 and thus effects the required change in frequency.

The nominal 500 KHz from the clock oscillator is fed to a ÷ 10,000 counter. This counter is held in reset by the high state of the 25 Hz square wave mentioned before. When the 25 KHz changes to a low the ÷ 10,000 divider starts counting. After 10,000 clock pulses an output appears from the counter and is stored by M30, this is fed to the logic changeover switch M32. This switch is changed over when the 25 Hz square wave returns to a high state. This means that depending upon the frequency of the clock being high or low, the output of the ÷ 10,000 counter arrives at the changeover switch early or late respectively. If the output of M30 is produced early, then a logic high state appears at TP21 and remains until the switch changes over. If the switch changes over before the output of M30 has changed then a FAST logic level appears at TP20 and remains until the output of M30 does change.

In this way, the frequency of the clock is changed up or down to correspond with line frequency changes. It should be noted that although the maximum duration of the SLOW/FAST signals is 20 mS, in practice once the clock has 'line locked' after switch on (approximately 3 mins) the SLOW/FAST signal duration is typically 5 μS. This means that any change in clock frequency taking place whilst a reading cycle is in progress introduces a negligible error in the displayed reading.

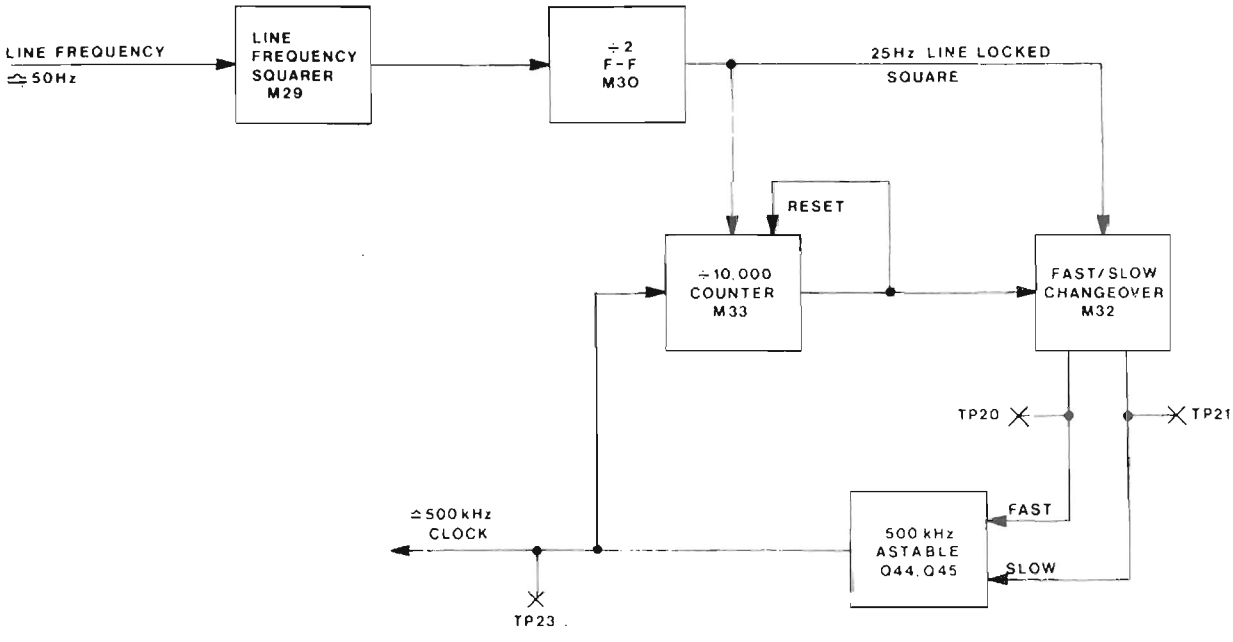


FIG. 1:18 LINE LOCKING BLOCK DIAGRAM

1.3.2.9 External Control

The internal commands from the read/rate astable may be inhibited by the $\overline{\text{HOLD}}$ external signal (via the BCD connector or front panel switch). A reading is then initiated by generating a command via the $\overline{\text{COMMAND}}$ BCD control line of the front panel MANUAL switch. This is routed via the Delay Monostable, M24. A logic '0' on the $\overline{\text{DELAY}}$ control line will automatically insert a delay equal to the settling time of the analog circuitry.

1.3.3 Power Supplies

1.3.3.1 General

The mains transformer and power supply components are situated along the right hand side of the Analogue–Digital board when viewed from the front. Transformer T4 is of toroidal construction with a split primary comprising two 115 V windings. These are intended for either series or parallel connection, depending on the line voltage. An earth screen is interposed between primary and secondary windings to minimise electrostatic coupling, this is grounded to line earth. Entirely isolated from the earth screen and all windings is a further electrostatic screen fitted to act as a Guard Screen.

1.3.3.2 +15V, –15V and +5V Supplies

Mains Transformer T4 has three secondary windings each with its separate bridge rectifier and solid-state regulator. Outputs from M47 and M48 are connected in series to provide DC supplies required for the entire analogue circuitry throughout the instrument. These regulators are capable of 500 mA output.

The third regulator M50 produces the +5 V DC supply, which is used to power all the logic circuitry in the instrument and the DC inverter for the +180 V Sperry supply. This regulator is capable of 1 ampere output and all regulators include foldback current limiting and thermal shut-down, to provide short circuit protection.

1.3.3.3 +180V and –8V Supplies

The +180 V supply is required for the seven segment cold cathode (Beckman) displays, and the –8 V for the VGG supply to PMOS integrated circuit M4, and the line locking circuitry.

The +180 V is produced by a DC to DC converter stepping up from the +5 V supply. Transistors Q40, Q41 form an astable multivibrator driving Q42 which switches the centre tap of the primary of the step-up transformer T5 to 0 V at approximately 12 KHz. One side of the primary is connected via L1 to +5 V and the other half of the primary acts as an auto-transformer to produce a voltage switching from +5 V to –5 V.

When this voltage is +5 V capacitor C106 charges through R107 and D32, when the transformer voltage switches to –5 V, C106 being already charged to 5 V produces –10 V as its negative terminal. Capacitor C107 then charges through D31 from C106. After several switching cycles the negative voltage at C107 builds up and is limited to –8.2 V by Zener Diode D33. The secondary produces a high voltage square wave which is rectified and smoothed by W4 and C108.

1.3.4 Display

The Display comprises seven segment cold cathode (Beckman) digits operating from a 180 V DC supply line. The complete assembly is mounted on the front of the A–D assembly and at right angles to it. The segment drive lines from the decoder driver on the A – D pass via the soldered right angle connector directly to the pins on the displays. The five decade displays are multiplexed by the anode switches Q1 to Q5, the seven segments of each decade being connected in parallel and taken to the decoder driver M2 on the A – D assembly. The decimal points DP2 to DP4 are driven by Q10 and multiplexed by Q1 to Q3 with the decade displays. The decimal point DP1, the overrange digit and the + and – indicators are multiplexed in parallel with the two least significant decades by Q4 and Q5. The inputs to the anode switches Q1 - Q5 are AC coupled from M1 buffer which is fed from M4 on the A – D assembly. The function indicators V, mV, MΩ, kΩ, Ω and EXT REF are incandescent long life lamps again driven by signals from A – D assembly.

1.3.5 External Reference (Ratio)

Under normal operation the references for the analogue to digital converter are provided internally on the A – D P.C.B, and an option is available for using an external reference when required. The external reference may be in the voltage range 0.3 V to 2.0 V and be of either polarity, as internal circuitry senses the polarity of both signal and reference inputs and enables 4 quadrant ratio measurements to be made.

The use of an external reference enables ratio measurements of VDC/V EXT REF, AC/EXT REF and OHMS/V EXT REF to be made.

Provision is made for switching to an external reference by operating the 'EXT REF' switch on the rear panel, or with remote programming pin 7, when the rear panel switch is in the 'INT REF' position. When an external reference has been selected either by the rear panel switch or remote programming, a logic signal EXT REF is available at the BCD output socket, pin 25 and EXT REF shows in the front panel display.

The external reference voltage should be connected to the 'EXT REF INPUT' socket.

For valid ratio measurements a X5 voltage gain is required between the external voltage reference and the voltage presented to the converter integrator (to match the X5 gain in the signal path provided by M34 on the A - D P.C.B.).

The external reference amplifier, the essential features of which are shown in Fig. 1:19, provides X5 gain and presents a high impedance to the external voltage.

Amplifier M1 and M2 are used in the non-inverting configuration producing a high input impedance. Amplifier M3 produces a differential input to single ended output conversion and gives an overall gain of X5.

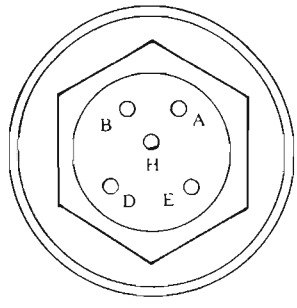
The switching of internal to external reference is achieved using relay K1.

Pin Connections as seen from rear.

E = Input Hi

D = Input Lo

H = Analogue Common



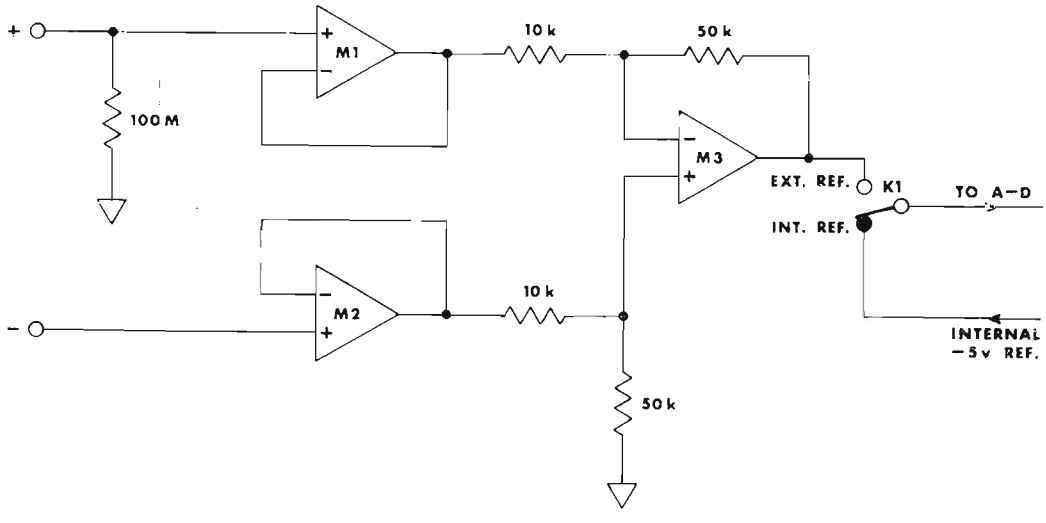
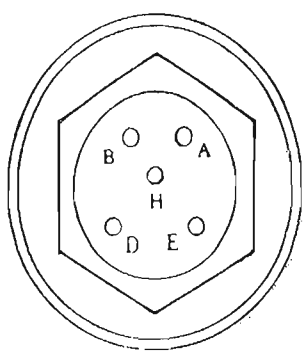


FIG. 1:19 EXTERNAL REFERENCE AMPLIFIER

An alternative ratio option is available for a 3V to 20V and 30V to 200V external reference. In this case the overall gain to that external reference is x.5 and x.05 respectively, as opposed to x5 for the 0.3V to 2.0V version. Otherwise operation is as for the low voltage reference version.

Pin connections seen from rear.

10V/100V
external reference range



A – Input Hi 10V
B – Input Lo 10V
D – Input Lo 100V
E – Input Hi 100V
H – Signal input Lo

SECTION 2

MAINTENANCE

2.1 INTRODUCTION

2.1.1 General

Regular maintenance of the instrument will enable the user to have confidence in measurements made as well as ensuring the highest accuracy possible.

Normally this will consist of checking the calibration at, or before, the end of the guaranteed specification validity period and adjusting where necessary.

Section 4.2 of the Operating Manual gives a routine for checking the instrument is working within its specified accuracy and may be used as the first stage of an instrument check.

Any readings found to be grossly out of specification should be treated with suspicion as they may indicate a fault.

A routine calibration procedure is given in Section 2.2 of this manual.

Before attempting any calibration it must be ensured that the test equipment is of sufficiently high accuracy. The test equipment required is specified in Section 2.2.2. It is also recommended that Section 1, Technical Description, be read before commencing, in order that some idea may be gained of the purpose and possible interaction of the various adjustments.

The circuit diagrams and printed circuit board layouts are contained in Section 4 of this manual.

In case of difficulties or for general advice in servicing your instrument, do not hesitate to contact our Customer Service Department. (For the address and telephone number, see the front of this manual).

2.1.2 Removal of Covers – Access for Calibration or Repair

Access to the interior of the instrument for routine calibration, or repair, is achieved by removing the four screws securing the top cover, two screws at each side, and lifting the cover clear of the instrument. Removal of the bottom cover is achieved in an identical manner. The top cover provides access to the Analogue to Digital Converter, the DC Isolator and the External Reference option. The bottom cover provides access to the AC and Resistance Options and BCD Output option. With both covers removed the instrument is still operational, may be inverted without component damage and full mechanical rigidity is maintained during servicing operations.

NOTE: The front panel terminals are insulated from the instrument case, enabling the internal circuitry to float at potentials greater than earth, so the potential of the internal Guard Shields can also reach dangerous levels. In addition, mains supplies appear on exposed conductors in the instrument. Therefore great care should be taken when handling an instrument with covers removed if the input terminals are connected to an external source or the mains supply is connected.

Access to the Display Board is achieved by removing the front panel. Disconnect the mains supply to the instrument and any connections to the input terminals. Remove the top and bottom covers as described in previous paragraph. Disconnect all internal leads from the input terminals. Remove the four screws fastening the front panel to the side panels, two screws each side, and the nuts from the studs on the front panel which pass through the centre screen. Draw the front panel forward until it clears the switches and remove the front panel to gain access to the Display Board (it should not be necessary to disconnect the 'power' switch).

2.2 ROUTINE CALIBRATION

2.2.1 General

The following section contains a calibration procedure which should be carried out at the end of the Specification Validity period, as stated in Section 4.1.1 of the Operating Manual, or when the instrument is found to be out of specification.

Routine calibration should be completed at an ambient temperature of $23^{o}C \pm 1^{o}C$ if the instrument is to meet its specification over the given operating range. Before commencing calibration allow 2 hours 'warm up' at this temperature with the upper and lower covers fitted in position but not fastened in place. The guard screens covering the boards should be left undisturbed throughout calibration.

For the greatest accuracy and for the minimum time spent calibrating, it is necessary for the boards to remain at their correct working temperature throughout a recalibration. Allow at least two hours warm up before commencing calibration. The top and bottom covers should be left in position whenever possible except when the actual adjustments are being made. AC, Voltage and Ohms options are initially calibrated with the instrument turned over. After the calibration procedures have been followed through, the instrument should be left the correct way up with the covers on for at least an hour for the internal temperature to stabilise again. If the calibration procedure is now repeated, it will be possible with relatively few adjustments to bring the instrument to optimum calibration.

Calibration of functions should always be in the sequence given.

2.2.2 Test Equipment Required

Test equipment specifications for fault finding, calibration and performance verification are given below. Generally, calibration sources should only be used where the accuracy specification exceeds that of the instrument by a factor of at least 4.

2.2.2.1 DC Calibrator

DC Calibration Source: Accuracy .001% or better,

e.g., Julie Research DVS 106.

Precision 100:1 attenuator, ratio accuracy better than 10 ppm, nominal impedance 10 kΩ 100 kΩ. (This is needed where the calibration source does have the required accuracy at 100 mV and 10 mV).

2.2.2.2 DC Voltmeter

High sensitivity, fully floating DVM or null detector capable of resolving 10 μV.

NOTE: (This is only required when Analogue Output option A01 is fitted).

Otherwise a meter capable of measuring 1 Volt ± ½ Volt.

2.2.2.3 AC Calibrator

Precision AC source capable of 0.02% accuracy at L.F. and 0.05% at 100 KHz. Ranges 10 mV to 1000 V.

NOTE: This is only required if option 01 or 11 is fitted.

2.2.2.4 Crest Factor Signal

A calibrated assymetric crest factor signal of magnitude approximately one volt to an accuracy of 0.02%.

NOTE: This is only required if option 01 or 11 is fitted. If it is not available the relevant steps in the calibration procedure may be omitted, the effect being a possible loss in accuracy for high crest factor signals.

2.2.2.5 Precision Resistors

A set of resistance standards 100Ω to 10MΩ in decades, the 100Ω and 1 kΩ to be 4 terminal resistors. Calibrated accuracy better than .001% up to 1 MΩ, .01% at 100 MΩ.

NOTE: These are only required if option 03 is fitted.

2.2.3 Procedure

2.2.3.1 General

Read Section 2.2.1 before proceeding.

Abbreviations:	TP	-	Test Point.
	w.r.t.	–	with respect to.

2.2.3.2 DC Voltage Calibration

A – D Converter Board Assembly – Drawing No. 400094.
DC Isolator Board Assembly – Drawing No. 400087.

If the instrument is fitted with an analogue output (option A01), it is necessary to calibrate the DC isolator for correct analogue output and then calibrate the A – D converter for correct displayed readings. If an analogue output is not fitted and the instrument is undergoing routine recalibration, steps 4, 5 may be omitted, these adjustments being made on the digital board instead (steps 6, 9).

DC Voltage calibration involves adjustments on both boards referred to above. The following procedure is divided into sub sections, the titles of which indicate to which board the component designators contained within that section refer.

For all the following adjustments – DC Mode and Filter should be selected.

1. Line-locking adjustment. Connect an external DVM between logic 0 V (located between integrated circuits M14 and M15) and TP22, both on the digital board. Adjust R112 for a voltage of - 1 Volt ± ½ Volt at this point. Note there is a long settling time associated with this adjustment.

Preliminary DC Isolator board adjustments.

2. Select 100mV range and connect a 10 megohm resistor between Hi and Lo. Note the reading is noisy and takes time to settle. Adjust R65 for less than 200 μV displayed (= 20 pA input current).

3. Leave on 100mV range, and short input. Adjust R75 (Front Panel mV offset adjust) for zero displayed.

Steps 4 and 5 apply only if an analogue output option is fitted.

4. Switch to 10 V range and connect null detector or DVM between analogue output Hi (or TP3) and input Hi. Adjust R75 for null or zero (± 30 μV).

5. With the null detector or DVM connected as before (step 4), switch to 1 V range and apply +1 Volt. Adjust R69 for null or zero ± 30 μV. Check with -1 Volt applied. The null detector may now be removed as the analogue output is calibrated.

Analogue to Digital Board scale adjustments.

6. With instrument on 10 V range and input shorted, adjust R82 for zero (bouncing polarity) on display.

7. Select 10 V range and apply +10 mV. Adjust R46 (100 dig. pot) for +100 digits displayed.
NOTE: Earlier instruments do not have R46 fitted. Here adjustment for both 10 and 100 digits is effected by potentiometers R80 and R81.

8. Apply +1 mV. Adjust R80 for 9 bouncing to 10 digits displayed. Apply -1 mV and adjust R81 for a similar display.

9. With +1 Volt applied on the 1 Volt range, adjust R76 for +1.00000 Volt (± 1 digit) displayed. Apply 1 Volt and adjust R78 for a 1.00000 Volt (± 1 digit).

DC Isolator board full range adjustments.

10. Select 10 V range. Apply +10 Volts and adjust R70 for +10.0000 (± 1 digit) displayed. Check -10 Volts reads correctly.

11. Check inputs of +19 Volts and –19 Volts are displayed correctly (± 4 digits).

12 Select 100 V range. Apply +100 Volts. Adjust R71 for 100.000 (± 1 digit) displayed. Check for -100 Volts applied.

13. Select 1000 V range. Apply +1000 Volts. Adjust R72 for +1000.00 (± 1 digit) displayed. Check for -1000 Volts applied.
(Note: Take care that>500 V pk is not applied between signal Lo and earth).

14. Select 100 mV range. Apply +100 mV and adjust R67 for +100.000 (± 1 digit) displayed. Check for –100 mV applied.

15. Select 10 mV range. Apply plus and minus 10 mV and adjust R68 for a total span of 20.0000 mV (± 1 μV) e.g. +9.9990 and -10.0010 mV. Repeat until span is correct. This procedure is necessary due to thermal E.M.F.'s which can be nulled out with the front panel mV offset control if desired.
Note: There is a long settling time associated with this adjustment.

The DC isolator board and digital board are now calibrated.

2.2.3.3 AC Voltage Calibration (Options 01 and 11)

AC Converter Board Assembly – Drawing No. 400037.

In general it will be necessary to proceed through all the steps below. However, if the instrument is within specification for applied inputs of zero, 1 mV, 10 mV, 100 mV on the 10 V range, steps 1 - 8 may be omitted.

On the AC Converter options in particular various controls interact and the adjustments must be carried out in sequence.

Important
An AC calibration is normally done after the basic DC instrument has been calibrated. If it is intended to calibrate the AC option without first fully calibrating the DC, steps 1 - 9 in the DC Calibration procedure at least must be followed.

Before proceeding, ensure the introductory notes on the calibration procedures have been read.

For all the following adjustments AC Volts and Filter should be selected.

1. Select 10 V range and short input. Turn R98 and R115 fully clockwise and R109 fully anticlockwise.

2. Gradually turn R109 clockwise until between 30 and 40 digits are displayed. Do not pass through zero.

3. Turn R115 anti-clockwise until display starts to oscillate, and then rotate slowly clockwise until oscillations just stop. On some instruments a 'catching diode' has been fitted to inhibit the oscillation. If there is no oscillation sense TP9 with an oscilloscope and adjust R115 until TP9 is zero ± 200 mV. (TP9 is located immediately below R70).

4. Turn R109 slowly clockwise until display shows .0000 (± 5 digits).

5. Apply 10 mV 500 Hz, and adjust R98 for a display of .0095 ± 4 digits.

6. Adjust R36 for minimum reading (if zero, re-adjust R98 and repeat adjustment of R36).

7. Re-adjust R98 for .0095 (± 4 digits).

8. If the input is now shorted again the display should indicate between 0 and 15 digits for an 01 option, or up to 25 digits for a 11 option. (If not, steps 1 7 should be repeated).

Full Range Adjustments.

Each range on the converter is adjustable in gain by a variable resistor and a parallel trimming capacitor. The ranges are calibrated for a full range input signal at the two nominal frequencies 500 Hz and 50 kHz. By noting the readings at other frequencies, i.e. 50 Hz, 5 kHz, 20 kHz and 100 kHz, and by checking the accuracy specifications for the instrument at these frequencies an improved frequency response may be obtained for further minor adjustments.

Note there is a single gain control, R67, for the converter which adjusts full range on all ranges equally. This can be used whenever all ranges are found to be either high or low. Otherwise ranges should be adjusted individually and in sequence as detailed below. R67 should be approximately in the centre of its travel before proceeding.

Adjustments below should be made until the reading is within 10 digits of nominal.

9. Switch to 1 Volt range and apply 1 Volt at 500 Hz. Adjust R16 for correct reading.

   NOTE: If a high crest factor signal is not available, Steps 10 and 11 may be omitted, the effect being a possible loss of accuracy for high crest factor signals.

10. Apply crest factor signal as previously described.
    Note output when pulses are –VE going at input. Reverse the input and adjust R61 for a similar reading with +VE going pulses (± 10 digits).

11. Calibrate the high crest factor signal using R70. Re-check step 9 and repeat calibration of R70 until both are correct.

12. Apply 10 V 500 Hz, 10 V range. Calibrate using R18.

13. Apply 10 V 50 kHz. Calibrate using C15.

14. Reduce frequency to 5 kHz and check that the reading is within ± 20 digits of nominal. If not it will be necessary to move the wire joining R4 and R5; making it more 'earthy' will bring down the reading at 5 kHz. Repeat step 13 and re-check. This should only be necessary after component replacement.

15. Apply 1 V 50 kHz, 1 V range. Calibrate using C13.

16. Reduce the frequency to 5 kHz and adjust twisted pair capacitor C55 to bring output to within 20 digits of nominal (closer coupling will increase the reading). This can be adjusted without removing the guard shield by varying the capacitance of the coupled wire capacitor, accessible with a screwdriver through the guard shield holes. Repeat step 15 and re-check. This should only be necessary after component replacement.

17. Apply 100 V 500 Hz, 100 V range. Adjust R9 for correct reading.

18. Apply 100 V 50 kHz. Adjust C6 for correct reading.

The following steps apply to 01 options only:

19. Apply 100 mV 500 Hz, 100 mV range. Adjust R26 for correct reading.

20. Apply 100 mV 50 kHz. Adjust C20 for correct reading.

21. At this point the 1000 V range can be checked for full range signals. There are no adjustments but both the 10 V and 100 V adjustments have some effect.
    N.B. Take care that ≥500 V pk is not applied between Lo, guard and earth. Also ensure that the maximum gain bandwidth product is not exceeded, e.g. 20 kHz at 1000 Volts.

The AC Converter is now calibrated.

2.2.3.4 Ohms Converter Calibration (Option 03)

Converter Board Assembly -- Drawing No. 400089.

Important
An ohms board calibration is normally done after the basic DC instrument has been calibrated. If it is intended to calibrate the ohms option without first fully calibrating the DC, steps 1 – 9 in the DC calibration procedure at least must be followed.

Before proceeding ensure the introductory notes on the calibration procedures have been read.

Throughout the following adjustments OHMS and FILTER should be selected unless otherwise stated.

The lower ohmic value resistance standards (100Ω, 1kΩ) should be connected in the normal manner for 4 wire measurements whereas the higher values may be connected for 2 wire measurement. Ensure the 2 wire - 4 wire switch on the instrument is in the relevant position.

Before proceeding re-check step 3 in the DC voltage calibration procedure.

1. Select 4 wire on the 2 wire – 4 wire switch and apply a 4 wire short to the input terminals. This may most simply be done by connecting together I+, Hi, and Lo.
   Select 100Ω range. Adjust R55 on the ohms board for .0000 displayed.

2. Select 100Ω range and connect 100Ω resistance standard. Adjust R50 for 100.000 (± 2 digits) displayed.

3. Leave the 100Ω resistance standard connected and insert a 100Ω resistor (± 5%) in series with the I-lead. Adjust R49 for 100.000 (± 3 digits) displayed.

Repeat steps 2 and 3 until the displayed reading is correct in both cases.

4. Select 1kΩ range and connect the 1kΩ standard. Adjust R52 for 1.00000 (± 2 digits) displayed.

5. Select 10kΩ range and connect the 10kΩ standard. Adjust R53 for 10.0000 (± 2 digits) displayed.

6. Select 100kΩ range and connect the 100kΩ standard. Adjust R54 for 100.000 (± 2 digits) displayed.

7. Select 1MΩ range and connect the 1MΩ standard. Adjust R51 for 1000.00 (± 4 digits) displayed.

8. Select 10MΩ range and connect the 10MΩ standard. Note the reading will appear noisy and may take time to settle. Adjust R59 for 10.0000 (± 30 digits) displayed.

9. Repeat steps 7 and 8 until both are correctly adjusted.

The Ohms converter is now calibrated.

2.2.3.5 External Reference (Ratio) Calibration (Option R03)

Ratio amplifier (1V I/P) board assembly - Drawing No. 400091.
A – D Converter board assembly – Drawing No. 400094.

Polarity Quadrant definitions:-

Quadrant 1 - positive signal, positive external reference
2 - positive signal, negative external reference
3 - negative signal, positive external reference
4 - negative signal, negative external reference

1. Select External Reference on the rear panel slide switch. Select 1, DCV, Connect the DC Calibrator to the voltage input terminals on the front panel of the instrument and the external reference 'Signal Inputs' to obtain a voltage ratio as defined by quadrant 1 when positive signal is applied.

2. Apply +0.3 V and -0.3 V alternately (i.e. from quadrant 1 to 4) and adjust R24 (on the External Reference Board) to obtain the same reading on the display ± 2 digits for both quadrants (allow adequate settle time when changing quadrants).

3. Apply +2 V and adjust R14 (on the External Reference Board) for a reading on the display of 1.00000.

4. Connect the external reference 'Signal Inputs' to obtain a voltage ratio as defined by quadrant 2 when a positive signal is applied. Select External Reference.

   Apply +0.3 V and -0.3 V alternately (i.e. from quadrant 2 to quadrant 3) and adjust R79 ('Ref Zero' on the A D Converter Board) to obtain the same reading on the display ± 2 digits for both quadrants.

5. Select Internal Reference. Apply -1 V. Adjust R78 ('-1 V' on the A – D Converter Board) for a reading of 1.00000 ± ½ digit.

6. Select External Reference. Apply - 2 V (i.e. in quadrant 3) and adjust R19 (on the External Reference Board) for a reading on the display of 1.00000.

7. Repeat steps 4 to 5 until the readings are correct without any further adjustment.

8. Repeat steps 1 to 6 until the readings are correct without any further adjustment.

This completes the calibration procedure.

2.2.3.6 External Reference (Ratio) Calibration (Option RO6)

Ratio amplifier ($\frac{10}{100}$ V I/P) board assembly Drawing No. 400125

A - D Converter board assembly – Drawing No. 400094.

Polarity Quadrant definitions:-

Quadrant 1 – positive signal, positive external reference
2 – positive signal, negative external reference
3 – negative signal, positive external reference
4 – negative signal, negative external reference

1. Select External Reference on the rear panel slide switch. Select 10, DCV. Connect the DC Calibrator to the voltage input terminals on the front panel of the instrument and the external reference 'Signal Inputs' to obtain a voltage ratio as defined by quadrant 1 when positive signal is applied.
2. Apply +3.0V and -3.0V alternately (i.e. from quadrant 1 to 4) and adjust R15 (on the External Reference Board) to obtain the same reading on the display ± 2 digits for both quadrants (allow adequate settle time when changing quadrants).
3. Apply +20V and adjust R5 (on the External Reference Board) for a reading on the display of 10.0000.
4. Connect the external reference 'Signal Inputs' to obtain a voltage ratio as defined by quadrant 2 when a positive signal is applied. Select External Reference.

   Apply +3V and –3V alternately (i.e. from quadrant 2 to quadrant 3) and adjust R79 ('Ref Zero' on the A - D Converter Board) to obtain the same reading on the display ± 2 digits for both quadrants.
5. Select Internal Reference & 1V range. Apply –1V. Adjust R78 ('–1V' on the A – D Converter Board) for a reading of –1.00000 ± ½ digit.
6. Select External Reference & 10V range. Apply –20V (i.e. in quadrant 3) and adjust R5 (on the External Reference Board) for a reading on the display of -10.0000.
7. Repeat steps 4 to 5 until the readings are correct without any further adjustment.
8. Repeat steps 1 to 6 until the readings are correct without any further adjustment.
9. Select quadrant 1 and apply +200V. Adjust R2 (on the External Reference Board) for a reading on the display of 100.000.
10. Select quadrant 3 and adjust R1 for a display of 100.000.
11. Repeat steps 9 and 10 until no further adjustments are necessary.

2.3 REPAIR AND COMPONENT REPLACEMENT

IT IS RECOMMENDED THAT THIS SECTION BE NOTED BEFORE UNDERTAKING ANY REPAIR.

A fault in the analogue circuitry will require the internal Guard Shields removing for access to the components and subsequent recalibration. Digital integrated circuits are fitted in sockets and can be replaced without disturbing the calibration of the instrument (although it is advisable to verify the performance after any component change).

The method of manufacture evolved by DATRON to ensure high reliability and stability involves elevated temperature 'burn-in' at both component and instrument level. In addition, operational amplifiers and other devices are selected for certain parameters. Hence many of the components used, although originally of a standard type, have a performance which can only be identified by a DATRON part number. These devices are held as stock items by DATRON who should be contacted if replacement is necessary.

Replacement of certain active devices and precision resistors also necessitates the re-selection of their associated F.S.V. [Factory Selected Value] resistors to accommodate component tolerances. These resistors, often high stability, metal film types are used to preset an offset or reference setting, usually with fine adjustment provided by an associated potentiometer. For information concerning the re-selection of F.S.V. resistors, the relevant sheets are available from DATRON.

Replacement of analogue components should be followed by recalibration of the relevant part of the circuit and details of these procedures are available from DATRON. Full routine calibration should then be carried out to ensure the instrument is within specification - if in any doubt consult our Customer Service Department.

When replacing semiconductor devices take great care to avoid overheating them during soldering. . . each joint being made as rapidly as possible. Although the use of a thermal shunt between semiconductor device and the soldered joint is strongly recommended, it is realised that it is impractical to use one in many instances. . .particularly when unsoldering a multi-lead device from a high density circuit board, a suction de-soldering tool is recommended.

When working on the isolator board, special consideration should be given to the effects of board leakage. Although active guarding is used extensively to reduce these effects, it should be borne in mind because of the high input impedance and sensitivity involved.

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R1 - R4	003223	22K 5% 2W Carbon			4
R5	000823	82K 5% ¼W Carbon	Mullard	CR25	2
R6	000103	10K 5% ¼W CARBON	"	"	48
R7	000105	1M 5% ¼W CARBON	"	"	4
R8	000103	10K 5% ¼W Carbon	Mullard	CR25	—
R9	011001	1K 1% ⅛W MF	Welwyn	4033C	1
R10 - R11	440024	F.S.V. 1 - 10M 1% MF	Welwyn	4033C	2 of Kit
R12		NOT USED			—
R13	011622	16k2 1% ⅛W M.F.	ERG	EE-0-10	1
R14		NOT USED			—
R15		NOT USED			—
R16, R17		NOT USED			—
R18 - R19	000106	10M 10% ¼W Carbon	Mullard	CR25	8
R20	000562	5K6 5% ¼W Carbon	Mullard	CR25	2
R21, R22	090009	75K/9K1 .02% W/W - MATCHED/Pr.	MANN	3C-B	1 MATCHED PAIR
R23	011540	154R 1% ⅛W MF	Welwyn	4033C	1
R24, R25	090008	8K2/75K .02% W/W - MATCHED/Pr.	MANN	3C-B	1 MATCHED PAIR
R26	000823	82K 5% ¼W Carbon	Mullard	CR25	—
R27	000912	9K1 "	Mullard	CR25	1
R28	050017	7k5 .1% 25ppm. ⅛W M/F	WELWYN	4033D	1
R29	000106	10M 5% ¼W. CARBON	Mullard	CR25	—

NOTES.

ISS.	23	24	25	26	27	28	29	30	31	32	33
ECO.	242	281	325-2	397	471	510	518	547	651	652	661

ISS.22	ISS.21	ISS.20	ISS.19	ISS.18	ISS.17	ISS.16	ISS.15	ISS.14	ISS.13	ISS.12
ECO 199	ECO 184	ECO. 131	ECO. 129	ECO. 127	ECO. 119	ECO. 112	ECO. 98	ECO. 89	ECO. 88	ECO. 81

ISS 1	ISS 2	ISS 3	ISS 4	ISS 5	ISS 6	ISS 7	ISS 8	ISS 9	ISS. 10	ISS. 11
ECO. 15	ECO 28	ECO 31	ECO 33	ECO 42	ECO 45	ECO 50	ECO. 51	ECO 64	ECO. 76	ECO. 78

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TITLE
1051 D.C. ISOLATOR

DRAWING NUMBER 400087

SHEET 2 OF 12

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R30, R32	000106	10M 10% ¼W Carbon	MULLARD	CR25	-
R31	000105	1M 5% "	MULLARD	CR25	-
R33, R34	090 010	18K/2K ·02% W/W - MATCHED PAIR	MANN	3C-B	1 MATCHED PAIR
R35	011801	1K8 1% ⅛W MF	WELWYN	4033C	1
R36, (R39)	000106	10M 10% ¼W Carbon	MULLARD	CR25	-
R37	000100	10R 5% ¼W Carbon	MULLARD	CR25	1
R38	000103	10K 5% ¼W Carbon	MULLARD	CR25	-
R40	000473	47k 5% ¼W Carbon	MULLARD	CR25	43
R41	000223	22K 5% ⅛W CARBON	MULLARD	CR25	2
R42, R45	011002	10K 1% ⅛W MF	WELWYN	4033C	2
R43, R44	011302	13K 1% "	WELWYN	4033C	2
R46 - R47	000103	10K 5% ¼W Carbon	MULLARD	CR25	-
R48 - R49	000683	68K 5% "	MULLARD	CR25	7
R50 - R51	000273	27K 5% "	MULLARD	CR25	2
R52 - R53	008 007	10R 5% ·2W CARBON FILM	MULLARD	CR16	2
R54 - R55	000104	100K 5% "	MULLARD	CR25	34
R56	000102	1K 5% "	MULLARD	CR25	5
R57 A - D	090005	2.475M Matched Set WW	MANN		1 MATCHED PAIR
R60	090005	99.95K " " WW	MANN		
R61	000476	47M 10% ¼W Carbon	ALLEN - BRADLEY	CB 4761	1
R62 R 63	000105	1M 5% "	MULLARD	CR25	-
R64	000363	36k 5% "	"	"	1

NOTES.

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	SHEET 3 OF 12

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R65	063502	5k POT Cermet	BECKMAN	72P	1
R66					
R67	063100	10R POT Cermet	BECKMAN	72P	1
R68 - R70	063200	20R POT Cermet	BECKMAN	72P	3
R71 - R72	063201	200R POT Cermet	BECKMAN	72P	2
R73	063104	100k " "	"	"	2
R74	063104	100K POT Cermet	BECKMAN	72P	-
R75	064105	1M POT 10 turn Cermet	BECKMAN	89P	1
R76 - R77	000102	1K 5% ¼W Carbon	MULLARD	CR25	-
R78	000123	12k 5% " "	"	"	2
R79	000123	12k 5% " "	"	"	
R80	000562	5K6 5% ¼W Carbon	MULLARD	CR25	-
R81	000107	100M 10% ¼ Carbon	ALLEN - BRADLEY	CB 1071	2
R82	000107	" "	ALLEN - BRADLEY	CB 1071	-
R83	011270	127R 1% 1/8W M.F	WELWYN	4033C	1
R84					
R85					
R86	000101	100R 5% ¼W Carbon	MULLARD	CR25	1
R87	000106	10M 10% ¼W CARBON	MULLARD	CR25	-
R88 - R89	000270	27R 5% ¼W CARBON	"	CR25	2
R90	000222	2k2 5% ¼W CARBON	"	CR25	1

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SHEET 4 OF 12

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R101 - R108	000473	47K 5% ¼W Carbon	MULLARD	CR25	-
R109 - R111	000152	1K5 5% "	MULLARD	CR25	6
R112	000473	47K 5% "	MULLARD	CR25	-
R113	000103	10K 5% "	MULLARD	CR25	-
R114	000473	47K 5% "	MULLARD	CR25	-
R115	000103	10K 5% "	MULLARD	CR25	-
R116	000473	47K 5% "	MULLARD	CR25	-
R117	000103	10K 5% "	MULLARD	CR25	-
R118 - R120	000473	47K 5% "	MULLARD	CR25	-
R121 - R122	000103	10K 5% "	MULLARD	CR25	-
R123	000473	47K 5% "	MULLARD	CR25	-
R124	000103	10K 5% "	MULLARD	CR25	-
R125	000473	47K 5% "	MULLARD	CR25	-
R126 - R128	000152	1K5 5% "	MULLARD	CR25	-
R129	000103	10K 5% "	MULLARD	CR25	-
R130 - R131	000473	47K 5% "	MULLARD	CR25	-
R132	000103	10K 5% "	MULLARD	CR25	-
R133	000473	47K 5% "	MULLARD	CR25	-
R134	000103	10K 5% "	MULLARD	CR25	-
R135 - R136	000473	47K 5% "	MULLARD	CR25	-
R137	000103	10K 5% "	MULLARD	CR25	-
R138 - R139	000473	47K 5% "	MULLARD	CR25	-
R140	000103	10K 5% "	MULLARD	CR25	-

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R141	000473	47K 5% ¼W Carbon	MULLARD	CR25	-
R142	000103	10K 5% "	MULLARD	CR25	-
R143 - R146	000473	47K 5% "	MULLARD	CR25	-
R147 - R148	000103	10K 5% "	MULLARD	CR25	-
R149 - R157	000473	47K 5% "	MULLARD	CR25	-
R158	000103	10K 5% "	MULLARD	CR25	-
R159 - R160	000473	47K 5% "	MULLARD	CR25	-
R161 - R171	000103	10K 5% "	MULLARD	CR25	-
R172 - R177	000104	100K 5% "	MULLARD	CR25	-
R178 - R179	000103	10K 5% "	MULLARD	CR25	-
R180 - R184	000104	100K 5% "	MULLARD	CR25	-
R185	000103	10K 5% "	MULLARD	CR25	-
R186 - R189	000683	68K 5% "	MULLARD	CR25	-
R190 - R192	000104	100K 5% "	MULLARD	CR25	-
R193	000103	10K 5% "	MULLARD	CR25	-
R194 - R196	000104	100K 5% "	MULLARD	CR25	-
R197 - R199	000103	10K 5% "	MULLARD	CR25	-
R200	000683	68K 5% "	MULLARD	CR25	-
R201	000103	10K 5% "	MULLARD	CR25	-
R202	000104	100K 5% "	MULLARD	CR25	-
R203	000103	10K 5% "	MULLARD	CR25	-
R204	000104	100K 5% "	MULLARD	CR25	-
R205	000103	10K 5% "	MULLARD	CR25	-

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R206	000473	47K 5% ¼W Carbon	MULLARD	CR25	–
R207	000103	10K 5% "	MULLARD	CR25	–
R208	000104	100K 5% "	MULLARD	CR25	–
R209	000103	10K 5% "	MULLARD	CR25	–
R210	000473	47K 5% "	MULLARD	CR25	–
R211	000104	100K 5% "	MULLARD	CR25	–
R212	000104	100K 5% "	MULLARD	CR25	–
R213	000224	220K 5% "	MULLARD	CR25	1
R214	000103	10K 5% "	MULLARD	CR25	–
R215	000104	100K 5% "	MULLARD	CR25	–
R216	000104	100K 5% "	MULLARD	CR25	–
R217 – R222	000104	100K 5% "	MULLARD	CR25	–
R223 – R224	000102	1K 5% "	MULLARD	CR25	–
R226	000336	33M 10% "	ALLEN BRADLEY	CB3361	1
R227 – R229	000474	470K 5% "	MULLARD	CR25	3
R230 – R231	000103	10K 5% "	MULLARD	CR25	–
R232	000156	15M 10% "	ALLEN BRADLEY	CR25	1
R233	000223	22K 5% "	MULLARD	CR25	–
R234	000473	47K 5% "	MULLARD	CR25	–
R235 – R236	000104	100K 5% "	MULLARD	CR25	–
R237	000103	10K 5% "	MULLARD	CR25	–
R238	000103	10K 5% "	MULLARD	CR25	–

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SHEET 7 OF 12

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
C1 - C2	150001	22u 16V TANT	UNION CARBIDE		2
C3 - C4	180006	47u 25V AL. ELECT	MULLARD	016 - 16479	2
C5 - C6	180 021	3·3 µF 63V " "	MULLARD	015 - 18338	2
C7 - C8	180 022	33 µF 40V " "	MULLARD	016 - 17339	2
C9	150007	6.8µf 16V TANT	UNION CARBIDE		1
C12		NOT USED			-
C13		NOT USED			-
C14	130003	1000p 160V POLYSTYRENE	SUFLEX	HS	1
C15	102471	470p CER DISC	ERIE	8 1	4
C16	120 002	2µ2. 160v. 10% POLYCARB	ADVANCE	MR30A	1
C17 (see note 1 below)	140006	0.33u 10% POLYPROP	WIMA	MKP10	2
C18	140006	0.33u 10% "	WIMA	MKP10	-
C19					
C20, C10	101103	0.01u CER DISC	ERIE	801	13
C21	110002	0.15u 10% POLYESTER	MULLARD	C280AEP150K	1
C22 - C23, C11	102471	470p CER DISC	ERIE	801	-
C24					
C25	110004	·047µf 10% 250v. POLYESTER	MULLARD	C280AEP47K	2
C26	102102	1000pF CER DISC	ERIE	801	4
C27	120012	1u 160V POLYCARBONATE	ADVANCE	CMR20A	1
C28					
C29					
C30 - C33	101103	0.01u CER DISC	ERIE	801	-

NOTES. 1/ " USE 1400k IN PLACE OF 1400G UNTIL STOCK IS EXHAUSTED".

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
C34 - C35	180010	33u 6V3 AL ELECT	MULLARD	015 - 13339	2
C37	110004	0.047u 10% POLYESTER	MULLARD	C280 AE P47K	-
C38-C43	101103	0.01u CER DISC	ERIE	801	-
C44, C45, C46	102102	1Kpf CER DISC	ERIE	801	-
C47	101103	0.01μF CER DISC	ERIE	801	-
D1- D6.	200001	DIODE S1 GP	FAIRCHILD / MULLARD	IN4148	63
D7 -D11	200008	DIODE Low Leakage	FAIRCHILD	IN458A	9
D16-D19	200001	DIODE S1 GP	FAIRCHILD / MULLARD	IN4148	-
D20, D21	200008	DIODE Low Leakage	FAIRCHILD	IN458A	-
D22 - D25	200001	DIODE S1 GP	FAIRCHILD / MULLARD	IN4148	-
D26, D27	200008	DIODE LOW LEAKAGE	FAIRCHILD	IN458A	-
D101-D137, D140-D151	200001	DIODE S1 GP	FAIRCHILD / MULLARD	IN4148	-
ZD1 - ZD2	210056	ZENER DIODE 5V6 400mW	MULLARD	BZY88 - C5V6	4
ZD3 - ZD4	210150	ZENER DIODE 15V 250mW	MULLARD	BZX83 -C15	2
ZD5 - ZD6	210056	ZENER DIODE 5V6 400mW	MULLARD	BZY88-C5V6	-
ZD7 -ZD8	210220	ZENER DIODE 22V 400mW	MULLARD	BZY88C22	2

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
Q6	240007	TRANSISTOR NPN GP	FAIRCHILD	2N3646	1
Q1-Q5, Q7-Q27	240001	TRANSISTOR N.P.N. GP	FAIRCHILD / WAYCOM	BC184K	33
Q28 - Q30	250001	TRANSISTOR P.N.P. GP	FAIRCHILD / WAYCOM	BC214K	5
Q31	240001	TRANSISTOR N.P.N GP	FAIRCHILD / WAYCOM	BC184K	-
Q32	250001	TRANSISTOR P.N.P. GP	FAIRCHILD / WAYCOM	BC214K	-
Q33 - Q37	240001	TRANSISTOR N.P.N. GP	FAIRCHILD / WAYCOM	BC184K	-
Q38	250001	TRANSISTOR P.N.P. GP	FAIRCHILD / WAYCOM	BC214K	-
Q39	240001	TRANSISTOR N.P.N. GP	FAIRCHILD / WAYCOM	BC184K	-
Q40	230012	N - FET SWITCH Low LEAKAGE	TELEDYNE	2N3824	3
Q41, Q42, Q43	239021	MATCHED SET ($\Delta R_{ON} < 30\Omega$) OF		237017, OR 239016 or 230012	1 MATCHED SET
Q44	239016	N - FET SWITCH Low Leakage	TELEDYNE	2N3824 BLACK	1
Q45	230002	N - FET SWITCH GP	TELEDYNE / NATIONAL	U1994E / NF500/K4416-18	3
Q46 -Q47	230012	N - FET SWITCH Low Leakage	TELEDYNE	2N3824	-
Q48	230 003	N - FET SWITCH GP	TELEDYNE / NATIONAL	U1899E/NF510/K4093-18	2
Q49 - Q50	230002	N - FET SWITCH GP	TELEDYNE / NATIONAL	U1994E /NF500/K4416-18	-
Q51		NOT USED			-
Q52	240006	TRANSISTOR N.P.N.	FAIRCHILD	2N3904	1
Q53	250004	TRANSISTOR P.N.P.	FAIRCHILD	2N3906	1
Q54	240 014	TRANSISTOR N.P.N.	FAIRCHILD	BC337	1
Q55	250 011	TRANSISTOR P.N.P.	FAIRCHILD	BC327	1
Q56 - Q57	239020	N - FET SWITCH GP WHITE SEL. $< 50\Omega$	TELEDYNE / NATIONAL	U1899E / NF510/K4093-18	2
Q58	230003	N - FET SWITCH GP	TELEDYNE / NATIONAL	U1899E / NF510/K4093-18	-

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
M1	280001	QUAD 2 INPUT MULTIPLEXER	TEXAS / NATIONAL	74C157N	2
M2	280026	4 Bit UP /DOWN DECADE COUNTER	TEXAS / NATIONAL	74C193	1
M3, M4	280016	QUAD 2 INPUT NAND	TEXAS / NATIONAL	74C00	2
M5	280017	HEX INVERTOR	TEXAS / NATIONAL	14069	1
M6	280019	BCD TO DECIMAL DECODER	TEXAS / NATIONAL	74C42	1
M7	280018	TRIPLE 3 INPUT NAND	TEXAS / NATIONAL	74C10	1
M8	280001	QUAD 2 INPUT MULTIPLEXER	TEXAS / NATIONAL	74C157N	-
M9 - M14	220015	OPTO - ISOLATOR	SPECTRONICS	SPX33	6
M21		NOT USED			-
M22	290007 or 290014	LINEAR LM312H OP AMP	"	LM312H (BLACK OR GREEN/ORANGE)	1
M23	290014	LINEAR LM312H OP AMP	NATIONAL	LM312H (GREEN/ORANGE)	1
M24 - M26	290012	LINEAR LM 741 OP AMP	FAIRCHILD	741HC (RED/ORANGE)	3
	605059	8WAY D.I.L SOCKET	ASTRALUX	1CL-083-56T	6
	630024	INSULATING BEAD-STEATITE	PARK ROYAL PORCELAINS	TYPE Nº 2	3
	400064	INPUT CABLE ASSY			1
RL1	330003	RELAY 28V D.P. D.T.	POTTER & BRUMFIELD	R10 - E1 - L2 - S3.2K	1
	450009	UPPER GUARD SHIELD			1
	450010	LOWER " "			1
S1 - S7	700011	SWITCH 7 x 2 POLE INTERLOCK	LIPA & ISOSTAT		1
S8 - S10	700013	SWITCH 3 x 2 POLE PUSH ON/OFF	LIPA & ISOSTAT		1
S11 - S13	700012	SWITCH 3 x 2 POLE INTERLOCK	LIPA & ISOSTAT		1
	700020	BUTTON CHROME	LIPA & ISOSTAT		13
	630036	INSULATING BEAD STEATITE		TYPE Nº 1	5

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
	410003 - 9A	P.C.B.			1
	611007	SCREW POSICSK. M3 X 6			6
J1 - J2	605005	CONNECTOR 13 WAY	AMP	1 -163680-2	2
J3 - J4	605002	SOCKET D.I.L. 16 PIN	ANTIFERENCE	1CN-163-S3	2
	611006	SCREW POSIPAN M3 X 10			6
	601002	CONNECTOR SNAP	AMP	60803-1	11
	602001	TERMINAL F.S.V.	MOLEX	02-04-1875	4
	605038	16 WAY DIL SOCKET	ASTRALUX	ICL 163-S6T	4
	605037	14 WAY DIL SOCKET		ICL 143-S3T	4
	400322	INPUT AMP PCB. ASSY.	DATRON		1
	613005	M3 SHAKEPROOF			7
	620001	P.T.F.E. CLOVERLEAF	SEALECTRO	FT - E - 12	5
	620002	P.T.F.E. STANDOFF	SEALECTRO	STSM1P51	5
	620003	TERMINAL RIVET	HARWIN	H2105A	10
	510222	7/.2 PVC WIRE RED			A/R
	611004	SCREW ST. ZINC PASS		M3 x 6MM	1
	612005	STANDOFF M3 x 23MM	HARWIN		6
	615002	NUT M3 HEX		M3	1
	630026	MULTI-TURN POT SHROUD	BECKMAN	89B	1
	450004	ENVIRONMENTAL SHIELD	TIMPAK		1
	459112	RELAY BRACKET	KDP		1
	540001	B.T.C. WIRE 24 SWG			
	530004	SLEEVING			

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R1	090049	18M } MATCHED PAIR - SEE DRG.			1
R2		18M }			
R3	041005	10M 1% ½W M.F	A.B.	CC	1
R4	011003	100k 1% ⅛W M.F.	HOLCO	H8	1
R5	013921	3k92 1% ⅛W M.F.	HOLCO	H8	1
R6	000185	1M8 5% ¼W CARBON	MULLARD	CR25	1
R7	043904	3M9 1% ½W M.F.	A.B.	CC	3
R8	043904	3M9 1% ½W M.F.	A.B.	CC	–
R9	000224	220k 5% ¼W CARBON	MULLARD	CR25	1
R10	043904	3M9 1% ½W M.F.	A.B.	CC	–
R11	000475	4M7 5% ¼W CARBON	MULLARD	CR25	1
R12		FSV 1% MF	HOLCO	H8	1
R13	042205	22M 1% ½W MF	AB	CC	3
R14	042205	22M 1% ½W MF	AB	CC	–
R15	042205	22M 1% ½W MF	AB	CC	–
R16	063104	100k POT CERMET	BECKMAN	72P	1
R17	063205	2M POT CERMET	BECKMAN	72P	1
R18		NOT USED			
R19	000223	22k 5% ¼W CARBON	MULLARD	CR25	1
C1	102101	100pF 500v CER DISC	ERIE	801	2
C2	102101	100pF 500V CER DISC	ERIE	801	–
C3	102102	1nF 500v CER DISC	ERIE	801	1

NOTES.

J. W. 1164

ISS.	A	B	C	D	E				
	—	—	—	ECO. 629	—				
	23.11.77	15.3.78	16.3.78	30.3.78.	12.6.78				

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NEXT DRAWING

datron ELECTRONICS LTD

TITLE 1055 - INPUT AMP PCB. ASSY.

DRAWING NUMBER 400322

SHEET 2 OF 3

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
D1	200008	Si. LOW LEAKAGE	FAIRCHILD	IN458A	1
Q1	249017	Si NPN SUPERMATCH PAIR	NATIONAL	LM394	1
Q2	230001	N-CHAN CURRENT LIM.	SILICONIX	E506	1
M1	260022	J FET INPUT OP. AMP	NATIONAL	LF355	1
M2	260026	LINEAR I.C. LM212 OP. AMP	NATIONAL	LM212	1
	410110-2	PCB			1
	602001	F.S.V. TERMINAL PIN	MOLEX	02-04-1875	2
LK1. LK2.	540001	22 SWG BTC WIRE			A/R

NOTES.

ISS.								

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TITLE
1055 - INPUT AMP
PCB. ASSY.

DRAWING NUMBER 400322

SHEET 3 OF 3

J. W. 1164

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R2	000 102	1K 5% ¼W Carbon	Mullard	CR25	5
R3 - R6	050 005	275K .25% ⅛W MF	Erg	EE 0.25 - C-C4	4
R7	000 332	3K3 5% ¼W Carbon	Mullard	CR25	3
R8	050 004	995K .25% ¼W MF	Erg	EE 0.25 - C-C4	3
R9	063 103	10K ⅜" Cer Pot	Beckman	72P	3
R10	050 006	10K1 .25% ⅛W MF	Erg	EE 0.125 - C-C4	2
R11	000 330	33R 5% ¼W Carbon	Mullard	CR25	1
R12	000 222	2K2 5% ¼W Carbon	Mullard	CR25	2
R13	000 825	8M2 10% ¼W Carbon	Mullard	CR25	1
R14	000 105	1M 5% ¼W Carbon	Mullard	CR25	6
R15	050 004	995K .25% ¼W MF	Erg	EE 0.25 - C-C4	-
R16	063 103	10K ⅜" Cer Pot	Beckman	72P	-
R17	050 007	110.5K .25% ⅛W MF	Erg	EE 0.125 - C-C4	1
R18	063 102	1K ⅜" Cer Pot	Beckman	72P	2
R19	000 473	47K 5% ¼W Carbon	Mullard	CR25	3
R20	000 332	3K3 5% ¼W Carbon	Mullard	CR25	-
R21	050 004	995K .25% ¼W MF	Erg	EE 0.25 - C-C4	-
R22	063 103	10K ⅜" Cer Pot	Beckman	72P	-
R23	000 473	47K 5% ¼W Carbon	Mullard	CR25	-
R24	000 181	180R 5% ¼W Carbon	Mullard	CR25	1
R25	050 014	99K5 .25% ⅛W MF	Erg	EE 0.125 - C-C4	1
R26	063 102	1K ⅜" Cermet Pot	Beckman	72P	-
R27					

NOTES.

PROD APP. 2.2.77

ISS 15	ISS. 16	ISS 17	ISS. 18	ISS 19 C	ISS. 20	ISS. 21	ISS. 22				
ECO 271	ECO. 357	ECO 392	ECO 415	ECO 423	ECO 542	ECO. 695	669				
REV 3	REV 4	REV 5	REV. 6	REV. 7	REV. 8	REV. 9	10	11	12	13	14
ECO. 25	ECO. 39	ECO. 43	ECO. 54	ECO. 75	ECO. 123	ECO. 143	160	200	205	220	240

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Rev X 7 8 0

datron ELECTRONICS LTD.

TITLE 1041 1051 AC CONVERTOR

DRAWING NUMBER 400 037

SHEET 2 OF 13

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R28	050 006	10K1 .25% ⅛W MF	Erg	EE .125 - C-C4	-
R29	000 105	1M 5% ¼W Carbon	Mullard	CR25	-
R30	000 104	100K 5% ¼W Carbon	Mullard	CR25	10
R31	000 103	10K 5% ¼W Carbon	Mullard	CR25	8
R32	000 101	100R 5% ¼W Carbon	Mullard	CR25	6
R33	000 820	82R 5% ¼W Carbon	Mullard	CR25	2
R34		FSV (68K - 1M)	Welwyn/Mullard	)4033C up to 330K	)1 of Pair
R35		FSV (68K - 1M)	Welwyn/Mullard	)CR25 over 330K	)
R36	063 205	2M ⅜" Cer Pot	Beckman	72P	4
R37	070 088	2K2 1% Wirewound	Mann	MX125B	2
R38	070 088	2K2 1% Wirewound	Mann	MX125B	-
R39	000 820	82R 5% ¼W Carbon	Mullard	CR25	-
R40	000 272	2K7 5% ¼W Carbon	Mullard	CR25	2
R41		FSV (470K - 4M7)	Mullard	CR25	)1 of Pair
R42		FSV (470K - 4M7)	Mullard	CR25	)
R43	000 102	1K0 5% ¼W Carbon	Mullard	CR25	-
R44	000 683	68K 5% ¼W Carbon	Mullard	CR25	4
R45	000 154	150K 5% ¼W Carbon	Mullard	CR25	2
R46	000 154	150K 5% ¼W Carbon	Mullard	CR25	-
R47	000 682	6K8 5% ¼W Carbon	Mullard	CR25	3
R48	000 101	100R 5% ¼W Carbon	Mullard	CR25	-
R49	000 272	2K7 5% ¼W Carbon	Mullard	CR25	-
R50	000 221	220R 5% ⅛W Carbon	Mullard	CR25	1

NOTES.

REV. 3	REV. 4	REV. 5	REV. 6
ECO. 25	ECO. 39	ECO. 43	ECO. 54

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DATE. 15/08/74

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NEXT DRAWING Rev 16

datron ELECTRONICS LTD.

TITLE 1041 AC CONVERTOR 1051

DRAWING NUMBER 400 037

SHEET 3 OF 13

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R51		FSV (220K - 2M2)	Mullard	CR25	1 of Pair
R52		FSV (220K - 2M2)	Mullard	CR25	
R53	000 102	1K 5% ¼W Carbon	Mullard	CR25	-
R54	000 102	1K 5% ¼W Carbon	Mullard	CR25	-
R55	000 103	10K 5% ¼W Carbon	Mullard	CR25	-
R56	000 104	100K 5% ¼W Carbon	Mullard	CR25	-
R57					
R58	050 011	3K3 .25% ⅛W MF	Erg	Ee 0.125 - C-C4	2
R59	050 011	3K3 .25% ⅛W MF	Erg	EE 0.125 - C-C4	-
R60	050 010	8K95 .25% ⅛W MF	Erg	EE 0.125 - C-C4	1
R61	063 101	100R ⅜" Cer Pot	Beckman	72P	1
R62	050 009	18K .25% ⅛W MF	Erg	EE 0.125 - C-C4	1
R63	050 015	100K .25% ⅛W MF	Erg	EE 0.125 - C-C4	2
R64	000 332	3K3 5% ¼W Carbon	Mullard	CR25	-
R65	050 015	100K .25% ⅛W MF	Erg	EE 0.125 - C-C4	-
R66		FSV (150K - 470K)	Welwyn	4033C	1 of Kit
R67	063 500	50R ⅜" Cer Pot	Beckman	72P	2
R68	000 183	18K 5% ¼W Carbon	Mullard	CR25	2
R69	290 026	Part of RMS Kit	Datron		-
R70	063 500	50R ⅜" Cer Pot	Beckman	72P	-
R71	000 270	27R 5% ¼W Carbon	Mullard	CR25	1
R72	000683	FSV (~~68K~~) FIT 68K ON ASSY	"	"	-
R73	000 108	1R0 5% ¼W Carbon	Mullard	CR25	1

NOTES.

REV. 3	REV. 4	REV. 5	REV. 6
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NEXT DRAWING

Rev 6 1345

datron ELECTRONICS LTD.

TITLE 1041 AC CONVERTOR 1051

DRAWING NUMBER 400 037

SHEET 4 OF 13

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R74	000 912	9K1 5% ¼W Carbon	Mullard	CR25	1
R75	000 152	1K5 5% ¼W Carbon	Mullard	CR25	1
R76	000 473	47K 5% ¼W Carbon	Mullard	CR25	-
R77	000 104	100K 5% ¼W Carbon	Mullard	CR25	-
R78	000 682	6K8 5% ¼W Carbon	Mullard	CR25	-
R79	000 101	100R 5% ¼W Carbon	Mullard	CR25	-
R80	000 821	820R 5% ¼W Carbon	Mullard	CR25	1
R81	000 101	100R 5% ¼W Carbon	Mullard	CR25	-
R82	000 182	1K8 5% ¼W Carbon	Mullard	CR25	2
R83-R84	000 103	10K 5% ¼W Carbon	Mullard	CR25	-
R85	000 103	10K 5% ¼W Carbon	Mullard	CR25	-
R86	000 183	18K 5% ¼W Carbon	Mullard	CR25	-
R87	000 472	4K7 5% ¼W Carbon	Mullard	CR25	1
R88	000 104	100K 5% ¼W Carbon	Mullard	CR25	-
R89	000 474	470K 5% ¼W Carbon	Mullard	CR25	1
R90	000 682	6K8 5% ¼W Carbon	Mullard	CR25	-
R91	000 101	100R 5% ¼W Carbon	Mullard	CR25	-
R92	000 102	1K 5% ¼W Carbon	Mullard	CR25	-
R93	000 122	1K2 5% ¼W Carbon	Mullard	CR25	1
R94	000 101	100R 5% ¼W Carbon	Mullard	CR25	-
R95	000 103	10K 5% ¼W Carbon	Mullard	CR25	-
R96	000 103	10K 5% ¼W Carbon	Mullard	CR25	-
R97	000 182	1K8 5% ¼W Carbon	Mullard	CR25	-

NOTES.

REV. 3	REV. 4	REV. 5	REV. 6
ECO. 25	ECO. 39	ECO. 43	ECO. 54

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NEXT DRAWING Rev 6 2347

datron ELECTRONICS LTD.

TITLE 1041 AC CONVERTOR 1051

DRAWING NUMBER 400 037

SHEET 5 OF 13

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R98	063 205	2M $\frac{3}{8}$" Cer Pot	Beckman	72P	-
R99	000 476	47M 10% $\frac{1}{4}$W Carbon	Allan Bradley (Morganite)	CB10	1
R100		FSV (4M7 - 10M)	Mullard	CR25	1 of Pair
R101		FSV (4M7 - 10M)	Mullard	CR25	}
R102	000 103	10K 5% $\frac{1}{4}$W Carbon	Mullard	CR25	-
R103	000 104	100K 5% $\frac{1}{4}$W Carbon	Mullard	CR25	-
R104	000 105	1M 5% $\frac{1}{4}$W Carbon	Mullard	CR25	-
R105	000 104	100K 5% $\frac{1}{4}$W Carbon	Mullard	CR25	-
R106	000 104	100K 5% $\frac{1}{4}$W Carbon	Mullard	CR25	-
R107	000 106	10M 10% $\frac{1}{4}$W Carbon	Mullard	CR25	6
R108	000 104	100K 5% $\frac{1}{4}$W Carbon	Mullard	CR25	-
R109	063 205	2M $\frac{3}{8}$" Cer Pot	Beckman	72P	-
R110	000 106	10M 10% $\frac{1}{4}$W Carbon	Allan Bradley (Morganite)	CB10	-
R111	050 012	21K .25% $\frac{1}{8}$W M/F	ERG	EE 0.125 -C-C4	1
R112	050016	5K " " "	"	"	1
R113	000 104	100K 5% $\frac{1}{4}$W Carbon	Mullard	CR25	-
R114	000 222	2K2 5% $\frac{1}{4}$W Carbon	Mullard	CR25	-
R115	063 205	2M $\frac{3}{8}$" Cer Pot	Beckman	72P	-
R116	000 106	10M 10% $\frac{1}{4}$W Carbon	Allan Bradley	CB10	-
R117		FSV (1M5 - 10M)	Mullard	CR25	1
R118					
R119	000 104	100K 5% $\frac{1}{4}$W Carbon	Mullard	CR25	-
R120	000 334	330K 5% $\frac{1}{4}$W Carbon	Mullard	CR25	1

NOTES.

REV. 3	REV. 4	REV. 5	REV. 6.
ECO. 25	ECO. 39	ECO. 43	ECO. 54

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NEXT DRAWING

Rev 23456

datron ELECTRONICS LTD.

TITLE 1041 AC CONVERTOR 1051

DRAWING NUMBER 400 037

SHEET 6 OF 13

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R121	000 683	68K 5% ¼W Carbon	Mullard	CR25	-
R122	000 105	1M 5% ¼W Carbon	Mullard	CR25	-
R123	000 105	1M 5% ¼W Carbon	Mullard	CR25	-
R124	000 685	6M8 10% ¼W Carbon	Allan Bradley	CB10	1
R125		FSV (0 - 47K) Carbon	Mullard	CR25	
R126	000 106	10M 10% ¼W Carbon	Allan Bradley	CB10	-
R127	000 683	68K 5% ¼W Carbon	Mullard	CR25	-
R128		FSV (1M - 1M8)	Mullard	CR25	
R129	000 226	22 M 10% ¼W Carbon	Allan Bradley	CB10	1
R130		FSV (4R7)			
R131	000106	10M 10% ¼W Carbon	Allan Bradley	CB10	-
R132	000105	1 M 5% ¼W Carbon	Mullard	CR25	-
R133	000106	10M 10% ¼W Carbon	Allan Bradley	CB10	-

NOTES.

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NEXT DRAWING

Rev 6 2345

datron ELECTRONICS LTD.

TITLE

1041 AC CONVERTOR (01)
1051

DRAWING NUMBER 400 037

SHEET 1 OF 13

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
C1	130 006	82pF 5% 160V PS	Suflex		1
C2	104019	27pF ±1pF 750V	ERIE	N150/BD	1
C3	104020	22pF ±1pF 750V	ERIE	N150/AD	1
C4	170003	100MF 10% 15v WET TANT		69F245	2
C5	130 025	22pF ±1pF 160V PS	Suflex		3
C6	140 008	10pF PTFE Trimmer	Jackson	VPC Tetfer	3
C7	130 013	18pF ±1pF 160V PS	Suflex		2
C8	120 001	.22mF 10% 1KV Polycarb	Facel		1
C9	130 056	1300pF 2.5% 63V PS	Suflex		1
C10	170003	100MF 10% 15v WET TANT		69F245	
C11	130 025	22pF ±1pF 160V PS	Suflex		-
C12	130 013	18pF ±1pF 160V PS	Suflex		-
C13	140 008	10pF PTFE Trimmer	Jackson	VPC Tetfer	-
C14	130 024	110pF 2.5% 160V PS	Suflex		1
C15	140 007	15pF PTFE Trimmer	Jackson	VPC Tetfer	2
C16	130 025	22pF ±1pF 160V PS	Suflex		-
C17	130 002	15pF ±1pF 160V PS	Suflex		1
C18	140 008	10pF PTFE Trimmer	Jackson	VPC Tetfer	-
C19	130 040	115 pF 2% 160V PS	Suflex		1
C20	140 007	15pF PTFE Trimmer	Jackson	VPC Tetfer	-
C21	130 012	1200pF 2.5% 63V PS	Suflex		1
C22	150 001	22MF 16v Tant Bead	Union Carbide	K22E16	6
C23	150 001	22MF 16v Tant Bead	Union Carbide	K22E16	-

NOTES.

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NEXT DRAWING

Rev 6 2345

datron ELECTRONICS LTD.

TITLE 1041 AC CONVERTOR 1051

DRAWING NUMBER 400 037

SHEET 8 OF 13

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
C24					
C25	102228	2·2pF 500V Cer Disc	Erie		1
C26					
C27	102 221	220pF 500V Cer Disc	Erie	831	1
C28	102 471	470pF 500V Cer Disc	Erie	801	4
C29	150 002	10mF 16V Tant Bead	Union Carbide	K10E16	4
C30		NOT USED			
C31	102 102	1000pF 500V Cer Disc	Erie	801	4
C32	102 101	100pF 500V Cer Disc	Erie	801	3
C33	102 102	1000pF 500V Cer Disc	Erie	801	-
C34	102 471	470 pF 500V Cer Disc	Erie	801	-
C35	102 471	470 pF 500V Cer Disc	Erie	801	-
C36	102 102	1000pF 500V Cer Disc	Erie	801	-
C37	150 002	10mF 16V Tant Bead	Union Carbide	K10E16	-
C38	150 002	10mF 16V Tant Bead	Union Carbide	K10E16	-
C39					
C40	101 103	.01mF 250V Cer Disc	Erie	801	1
C41	120 010	1.5mF 10% 160V PC	Advance Filmcap	CMR25A	1
C42	* 110 018	6.8mF 10% 63V PY	Advance Filmcap	MD45A	1
C43	110 009	1·0 mF 10% 100V PC	WIMA	MKS	1
C44	110 010	·22 mF 10% 250V PY	MULLARD	C280	1
C45	102 101	100pF 500V Cer Disc	Erie	801	-
C46	102 101	100pF 500V Cer Disc	Erie	801	-

NOTES.

* Issue 2 PCB uses 10mF (110 001) and 6.8mF (110 018) respectively.

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ECO. 25	ECO. 39	ECO. 43	ECO. 54

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Rev 6 2345

datron ELECTRONICS LTD.

TITLE

1041 AC CONVERTOR
1051

DRAWING NUMBER 400 037

SHEET 9 OF 13

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
C47	102 220	22pF 500V Cer Disc	Erie	831	1
C48	102 470	47 pF 500V Cer Disc	"	"	1
C49	150 010	.33mF 35V Tant Bead	Union Carbide	KR33E35	1
C50	150 005	2.2mF 16V Tant Bead	Union Carbide	K2R2E16	1
C51	150 002	10mF 16V Tant Bead	Union Carbide	K10E16	-
C52	150 001	22mF 16V Tant Bead	Union Carbide	K22E16	-
C53	150 001	22mF 16V Tant Bead	Union Carbide	K22E16	-
C54	102 471	470pF 500V Cer Disc	Erie	801	-
C55-C56- C59	*	Twisted Wire Pair			*
C57-C58	150 001	22mF/16V Tant Bead	Union Carbide	K22E16	-
C60	102 102	1000pf 500R Cer Disc	ERIE	801	-
D1	Not Used				
D2-6, D6+9, D12+13	200 001	Diode Sil GP Switch		IN4148	18
D7, D14, D15	210 056	Diode Zener 5.6V		BZY88C5V6	4
D16	210 100	Diode Zener 10V		BZY88C10V	1
D17	200 001	Diode Sil GP Switch		IN4148	
D18- D21	200 001	Diode Sil GP Switch		IN4148	-
D22- D24	220 010	Diode Sil Hot Carrier	HP	HSCH1001/IN6263	3
D25- D28	200 001	Diode Sil GP Switch		IN4148	-
D29- D32, D10, D11	200 008	Diode Sil Low Leak		IN458A	6
D33	210 056	Diode Zener 5.6V		BZY88C5V6	-

NOTES.

* Use very stiff insulated wire about ½" long - guage approx. .8mm.
May use bare wire with insulating sleeving.

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ECO. 25	ECO. 39	Eco. 43	ECO. 54

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Rev 6 23/4/5

datron ELECTRONICS LTD.

TITLE 1041 AC CONVERTOR 1051

DRAWING NUMBER 400 037

SHEET 10 OF 13

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
Q1	240 001	Sil N.P.N. Hi HFE GP		BC184K	4
Q2	230 003	N Fet GP Switch	Teledyne	U1899E/K4093-18	5
Q3	230 003	N Fet GP Switch		U1899E/K4093-18	-
Q4	230 003	N Fet GP Switch		U1899E/K4093-18	-
Q5	230 003	N Fet GP Switch		U1899E/K4093-18	-
Q6a, Q6b	239 014	Sil Monolithic Dual Fet		2N3956	1
Q7	240 013	Sil N.P.N. Hi HFE GP		BC184KC	1
Q8	240 011	Sil N.P.N. GP		BC338	1
Q9	230 003	N Fet GP Switch	Teledyne	U1899E/K4093-18	-
Q10	250 004	Sil P.N.P. HF GP		2N3906	6
Q11	240 001	Sil N.P.N. GP		BC184K	-
Q12	250 004	Sil P.N.P. HF GP		2N3906	-
Q13	250 004	Sil P.N.P. HF GP		2N3906	-
Q14	240 006	Sil N.P.N. HG GP		2N3904	2
Q15	240 001	Sil N.P.N. Hi HFE GP		BC184K	-
Q16	230 002	N Fet GP	Teledyne	U1994E/K4416-18	2
Q17	250 004	Sil P.N.P. HF GP		2N3906	-
Q18	250 004	Sil P.N.P. HF GP		2N3906	-
Q19	240 006	Sil N.P.N. HF GP		2N3904	-
Q20	250 004	Sil P.N.P. HF GP		2N3906	-
Q21	230 002	N Fet GP	Teledyne	U1994E/K4416-18	-
Q22	240 001	Sil N.P.N. Hi HFE GP		BC184K	-
Q23, Q24, Q25	230022	N Fet Switch		E106/2N5434	3

NOTES.

REV. 3	REV. 4	REV. 5	REV. 6
ECO 25	ECO. 39	ECO. 43	ECO 54

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NEXT DRAWING Rev 6 2345

datron ELECTRONICS LTD.

TITLE 1041 AC CONVERTOR 1051

DRAWING NUMBER 400 037

SHEET 11 OF 13

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
M1	260 009	Wide Band Op Amp	National	LM318H	1
M2	260025	Precision GP Op Amp	National	LM101	4
M3	260025	Precision GP Op Amp	National	"	-
M4	260025	Precision GP Op Amp	National	"	-
M5	260025	Precision GP Op Amp	National	"	-
M6	290 026	RMS Module Kit	Datron		1
	510999	WIRE 7/0-2 WHITE			A/R
K1 , K2	330003	Relay	A.M.F.	R10-E1-L2-Q5·8K	2
	459112	RELAY BRACKET			2
	410 006 - 8	Printed Circuit Board			1
	400084	AC. INPUT LEAD ASSY.			1
	604 004	Pin Plugs	Amp	1 - 163749 - 2 (1)	1
	450 012	GUARD SHIELD			1
	612 005	Stand-Off Rivet M3	Harwin		4
	620 001	Cloverleaft Bush	Sealectro		8
	620 003	Rivet Solder Terminal	Harwin	H2105A	7
	602 001	FSV Terminals	Molex	02 - 04 - 1875	26
	630 003	P Clip $\frac{1}{4}$"			1
	611 016	M3 x 8 Pozipan	GKN		7
	590 011	BLACK SLEEVE	HELLARMAN	H15	A/R
	615 002	M3 Hex Nut			3
	613 005	M3 Shkprf Washer			7

NOTES.

(1) Strip of 13 pins

REV. 3	REV. 4	REV. 5	REV. 6
ECO. 25	ECO. 38	ECO. 43	ECO. 54

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TITLE 1041 AC CONVERTOR 1051

DRAWING NUMBER 400 037

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
	540002	22 SWG TINNED CU WIRE			A/R
	590004	SILICON RUBBER SLEEVE			A/R

NOTES.

J. W. 1164

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TITLE AC OPTION 01

DRAWING NUMBER 400037

SHEET 13 OF 13

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
(R1, R2) & (R3, R4)	090012	9K1/9K1 0·02% MATCHED PAIR.	MANN	3C-BT	2
R5.	070046	9K1 0·02%	"	3C-C	1
R6.	070060	500R 0·02%	"	3C-SPECIAL	1
R8.	070033.	4K53 0·02%	"	3C-C	1
R9.	070040	44K975 0·02%	MANN	3C-C	1
R10.	070043	449K75 0·02%	"	3D-C	1
R11.	015603	560K 1% ¼W MF	WELWYN	4033C	1
R12 - R13	011002	10K 1% ¼W MF	WELWYN	4033C	2
R14.	090 003	MATCHED PAIR MF 2M2	ERG.		1 SET.
R15.		2K2/2M2 0.2% 2K2			
R16 - R17.	440026	FSV (150K - 3M3)			1 OF KIT.
R18 - R19.	440027	FSV (560K - 4M7)			1 OF KIT.
R20.	014708	47R 1% ¼W MF	WELWYN	4033C	1
R21.	000224	220K 5% ¼W CARBON	MULLARD	CR25	1
R22.	004681	680R 5% ½W MET-Ox	ELECTROSIL	TR5	1
R23.	000824	820K 5% ¼W CARBON	MULLARD	CR 25	1
R24.	000476	47M 10% ¼W CARBON	ALLEN BRADLEY	CB10	1
R25.	000473	47K 5% ¼W CARBON	MULLARD	CR25	3
R26 - R32.	000104	100K 5% ¼W CARBON	MULLARD	CR25	7
R33 - R39.	000106	10M 10% ¼W CARBON	MULLARD	CR25	8
R40 - R41.	000473	47K 5% ¼W CARBON	MULLARD	CR25	—
R42.	000106	10M 10% ¼W CARBON	MULLARD	CR25	—
R43	000562	5K6 5% ¼W CARBON	MULLARD	CR25	1

NOTES.

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ISS	10	11	12	13	14 C	15	16
E.C.O	206	274	425	520	602	658	696
DATE	—	—	—	—	14-3-78	15.3.78	30.5.78
CHKD.	—	—	—	—	MD	MD	MD

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TITLE 1051 RESISTANCE CONVERTER (0.3.)

DRAWING NUMBER 400089

SHEET 2 OF 5

J.W. 1164

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R44.	000474	470K 5% 1/4W CARBON	MULLARD	CR25	1
R45.	000103	10K 5% 1/4W CARBON	MULLARD	CR25	1
R46.	000225	2M2 10% 1/4W CARBON	MULLARD	CR25	1
R47 - R48.	090001	PTC THERMISTOR	MULLARD	VA 8650	2
R49 - R50.	063100	10R 3/8" CERMET POT	BECKMAN	72P	3.
R51.	063100	10R 3/8" CERMET POT	BECKMAN	72P	—
R52.	063204	200K 3/8" CERMET POT	BECKMAN	72P	2
R53.	063500	50R 3/8" CERMET POT	BECKMAN	72P	1
R54.	063501	500R 3/8" CERMET POT	BECKMAN	72P	1
R55.	063205	2M 3/8" CERMET POT	BECKMAN	72P	1
R56.	000105	1M 5% 1/4W CARBON	MULLARD	CR25	1
R57 & R58.	000222	2K2 5% 1/4W CARBON	MULLARD	CR25	2
R59.	063204	200K 3/8" CERMET POT	BECKMAN	72P	—
R60.	000123	12K 5% 1/4W CARBON	MULLARD	CR25	1
C1 & C5	102102	1KpF 500V CER DISC	ERIE	801	2
C2 & C3.	102471	470pF 500V CER DISC	ERIE	801	2
C4.	102221	220pF 500V CER DISC	ERIE	801	1
C6	102330	33pF 500V CER DISC	ERIE	801	1
D1-D7 & D27	200008	LOW LEAKAGE DIODE	FAIRCHILD	IN458A	10
D8 - D26 & D28	200001	GP SIL. DIODE	FAIRCHILD	IN4148	20
D31.	213001	10V 5W ZENER		IN5347	3
D32 - D34	200006	SIL RECT HI VOLT		IN4005	3
D35 * D40	200008	LOW LEAKAGE DIODE	FAIRCHILD	IN458A	—

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TITLE 1051 RESISTANCE CONVERTER (0.3.)

DRAWING NUMBER 400089

SHEET 3 OF 5

J.W. 1164

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
D36 & D37	213001	10V 5w ZENER		IN5347	–
D39	210033	3V3 400MW ZENER		BZY88C 3V3	1
Q1	250001	TRANSISTOR SIL. P.N.P. GP	WAYCOM	BC214K	1
Q2	239020	N FET SIL GP SWITCH.	TELEDYNE / DATRON SELECT	U1899E (WHITE)	1
Q3 – Q8.	230002	N FET SIL GP	TELEDYNE	U1994E / K4416-18.	6
Q9	240012	TRANSISTOR SIL N.P.N. 1 WATT	MOTOROLA	2N3053	1
Q10	250006	TRANSISTOR SIL P.N.P. GP	FAIRCHILD	BC322	1
	450011	GUARD SHIELD			1
M1	260025	LINEAR I.C. 101		LM101	1
M2	290007	LINEAR I.C. LM312 SEL	NATIONAL	LM312H SEL (BLK)	1
M3.	290014	LINEAR I.C. LM312 SEL	NATIONAL	LM312H SEL (GREEN/ORANGE)	1
RL1	330001	RELAY B1F 4P2W 28V.	POTTER & BRUMFIELD	R10-E1-L4-Q2-5K	1
	540001	B.T.C WIRE 24SWG			A/R
	459112	RELAY BRACKET	KDP ES	459112	1
	590001	SLEEVE			20
J1	604004	13 WAY AMP MALE CNCTR	AMP	1-163749-2	1 SET
	410007 – 5A	PCB			
	602001	FSV TERMINAL	MOLEX	02-04-1875	8
	612005	23MM x M3 RIVET SNDF	HARWIN	CS	3
	620003	RIVET SOLDER TERMINAL	HARWIN	HZ105A	8
	630003	P-CLIP	PLEX.1		2
	611004	M3 x 6MM POZIPAN	GKN		6
	615002	M3 NUT	GKN		3

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TITLE 1051 RESISTANCE CONVERTER (03)

DRAWING NUMBER 400089

SHEET 4 OF 5

J.W. 1164

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
	613005	M3 SHAKEPROOF WASHER	GKN		6
	590011	BLACK SLEEVE REEL	HELLARMAN	HIS	A/R
	400065/A	INPUT CABLE ASSY			1
	400065/B	INPUT CABLE ASSY			1

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TITLE 1051 RESISTANCE CONVERTER (03)

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SHEET 5 OF 5

J.W. 1164

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R1	000 102	1K 5% ¼W CARBON	MULLARD	CR25	10
R2	000 272	2K7 "	"	"	3
R3	063 203	20K POT CERMET	BECKMAN	72P	1
R4	000 221	220R 5% ¼W CARBON	MULLARD	CR25	3
R5	000 221	220R "	"	"	—
R6	090 013	36K07 .02% MATCHED	MANN	3C-43T	1
R7		9K1 .02% PAIR			—
R8	000 103	10K 5% ¼W CARBON	MULLARD	CR25	17
R9	000 102	1K "	"	"	—
R10	000 103	10K "	"	"	—
R11	000 103	10K "	"	"	—
R12	000 103	10K "	"	"	—
R13	000 103	10K "	"	"	—
R14	000 103	10K "	"	"	—
R15	000 103	10K "	"	"	—
R16	000 103	10K "	"	"	—
R17	000 103	10K "	"	"	—
R18	011 004	1M 1% ½W MF	WELWYN	4033C	1
R19	000 185	1M8 5% ¼W CARBON	MULLARD	CR25	1
R20	000 105	1M "	"	"	8
R21	000 105	1M "	"	"	-
R22	000 105	1M "	"	"	-
R23	000 105	1M "	"	"	—

NOTES.

ISS. 29 ECO 537	30 ECO 558	31 ECO 573	32. ECO 595	33. ECO 610	34 ECO 649	35. ECO 684	36. ECO 682	
ISS. 2 ECO 58	3 ECO 63	4 ECO 62	5 ECO 70	6 ECO 76	7 ECO 72	8 ECO 93	9 ECO 111	10 ECO 120
11 ECO 137	12 ECO 141	13 ECO 146	14 ECO 157	15 ECO 173	16 ECO 202	17 ECO 212	18 ECO 217	19 ECO 228
20 ECO 286	21 ECO 244	22 ECO 364	23 ECO 446	24 ECO 451	25 ECO 382	26 ECO 467	27 ECO 509	28 ECO 540

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TITLE 1051 A-D

DRAWING NUMBER 400094

SHEET 2 OF 22

J. W. 1164

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R24	000 153	15K 5% 1/4W CARBON	MULLARD	CR 25	2
R25	000 102	1K "	"	"	—
R26	000 104	100K "	"	"	17
R27	000 104	100K "	"	"	—
R28	000 104	100K "	"	"	—
R29	000 104	100K "	"	"	—
R30	000 104	100K "	"	"	—
R31	000 562	5K6 "	"	"	3
R32	000 106	10M 10% 1/4W CARBON	"	"	3
R33	000 225	2M2 "	"	"	1
R34	000 106	10M "	"	"	—
R35	000 106	10M "	"	"	—
R36		NOT USED			
R37		FSV			
R38		FSV			
R39	014021	4k02 1% 1/8W MF	WELWYN		1
R40	000 912	9k1 5% 1/4W CARBON	MULLARD	CR25	1
R41	000 682	6K8 "	"	"	4
R42	000 472	4K7 "	"	"	4
R43	000 156	15M 10% 1/4W CARBON	ALLEN BRADLEY	CB 1561	1
R44	NOT USED				
R45	000 226	22M 10% 1/4W CARBON	ALLEN BRADLEY	CB 10	1
R46	063 101	100R POT CERMET	BECKMAN	72P	1

NOTES.

J. W. 1164

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TITLE 1051 A-D

DRAWING NUMBER 400094

SHEET 3 OF 22

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R47	000 221	220 5% ¼W CARBON	MULLARD	CR25	—
R48		FSV 5% ¼W CARBON	"	"	1
R49		FSV 5% ¼W CARBON	"	"	1
R50	000 102	1K "	"	"	—
R51	000 472	4K7 "	"	"	—
R52	000 222	2K2 "	"	"	1
R53	000 224	220K "	"	"	2
R54	000 103	10K "	"	"	—
R55	000 103	10K "	"	"	—
R56	NOT USED				
R57	000 472	4K7 5% ¼W CARBON	MULLARD	CR25	—
R58	000 101	100R "	"	"	9
R59	000 101	100R "	"	"	—
R60	000 101	100R "	"	"	—
R61	000 473	47K "	"	"	7
R62	000 184	180K "	"	"	1
R63	011 002	10K 1% ⅛W MF	WELWYN	4033C	1
R64	013 902	39K "	"	"	1
R65	017 870	787R "	"	"	1
R66	090 029	9K1 ·1% MATCHED	MANN	3C-BT	1
R67		6K55 ·1% PAIR			
R68	090 012	9K1 .02% MATCHED	"	3C-BT	1
R69		9K1 .02% PAIR			

NOTES.

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TITLE 1051 A-D

DRAWING NUMBER 400094

SHEET 4 OF 22

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R70		FSV 1% 1/8W MF	WELWYN	4033C	1
R71		FSV			
R72	000 272	2K7 5% 1/4W CARBON	MULLARD	CR 25	—
R73	000 155	1M5 10% 1/4W CARBON	"	"	1
R74	000 682	6K8 5% 1/4W CARBON	"	"	—
R75	000 682	6K8 "	"	"	—
R76	063 100	10R POT CERMET	BECKMAN	72P	2
R77	000 101	100R 5% 1/4W CARBON	MULLARD	CR25	—
R78	063 100	10R POT CERMET	BECKMAN	72P	—
R79	063 205	2M " "	"	"	2
R80	063 504	500K " "	"	"	2
R81	063 504	500K " "	"	"	—
R82	063 205	2M " "	"	"	—
R83	000 563	56K 5% 1/4W CARBON	MULLARD	CR25	2
R84	000 104	100K "	"	"	—
R85	000 102	1K "	"	"	—
R86	000 105	1M "	"	"	—
R87	000 105	1M "	"	"	—
R88	000 107	100M 10% 1/4W CARBON	ALLEN BRADLEY	CB 1071	2
R89		FSV 10% 1/4W CARBON (1M)	MULLARD	CR25	1
R90	000 101	100R 5% 1/4W CARBON	"	"	—
R91	000 101	100R "	"	"	—
R92	000 101	100R "	"	"	—

NOTES.

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SHEET 5 OF 22

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R93	000 182	1K8 5% ¼W CARBON	MULLARD	CR 25	2
R94		FSV 10% ¼W CARBON (15M)			1
R95	000 223	22K 5% ¼W CARBON	MULLARD	CR 25	6
R96	000 107	100M 10% ¼W. CARBON	ALLEN BRADLEY	CB 1071	—
R97	NOT USED				
R98	"				
R99	"				
R100	000 101	100R 5% ¼W CARBON	MULLARD	CR25	—
R101	000 104	100k 5% ¼W CARBON	"	CR25	—
R102	000 125	1M2 5% ¼W CARBON	"	CR 25	1
R103	000 151	150R "	"	"	1
R104	000 562	5k6 "	"	"	—
R105	000 562	5k6 "	"	"	—
R106	000 331	330R "	"	"	1
R107	000 390	39R "	"	"	1
R108	000 105	1M "	"	"	—
R109	000 102	1K "	"	"	—
R110	000 103	10K "	"	"	—
R111	000 102	1K "	"	"	—
R112	063 102	1K POT CERMET	BECKMAN	72P	1
R113	015 231	5K23 1% ⅛W MF	WELWYN	4033C	2
R114	015 231	5K23 1% ⅛W MF	WELWYN	4033C	—
R115	000 823	82K 5% ¼W CARBON	MULLARD	CR25	3

NOTES.

J. W. 1164

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TITLE 1051 A-D

DRAWING NUMBER 400094

SHEET 6 OF 22

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R116	000 823	82K 5% ¼W CARBON	MULLARD	CR25	—
R117	000 102	1K "	"	"	—
R118	000 686	68M 10% ¼W CARBON	"	"	1
R119	NOT USED				
R120	000 104	100K 5% ¼W CARBON	MULLARD	CR25	—
R121	000 153	15K "	"	"	—
R122	000 224	220K "	"	"	—
R123	000 473	47K "	"	"	—
R124	000 223	22K "	"	"	—
R125	000 270	27R "	"	"	1
R126	000 103	10K "	"	"	—
R127	000 104	100K "	"	"	—
R128	000 332	3K3 "	"	"	2
R129	000 104	100K "	"	"	—
R130	000 104	100K "	"	"	—
R131	000 104	100K "	"	"	—
R132	000 473	47K "	"	"	—
R133	000 563	56K "	"	"	—
R134	000 104	100K "	"	"	—
R135	000 823	82K "	"	"	—
R136	000 103	10K "	"	"	—
R137	000 103	10K "	"	"	—
R138	000 223	22K "	"	"	—

NOTES.

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SHEET 7 OF 22

J. W. 1164

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R139	000 123	12K 5% ¼W CARBON	MULLARD	CR25	1
R140	000 104	100K "	"	"	—
R141	000 223	22K "	"	"	—
R142	000 223	22K "	"	"	—
R143	000 104	100K "	"	"	—
R144	000 104	100K "	"	"	—
R145	000 333	33K "	"	"	2
R146	000 393	39K "	"	"	1
R147	000 333	33K "	"	"	—
R148	000 104	100K "	"	"	—
R149	000 182	1K8 "	"	"	—
R150	000 103	10K "	"	"	—
R151	000 683	68K "	"	"	1
R152	000 472	4K7 "	"	"	—
R153	000 682	6K8 "	"	"	—
R154	000 332	3K3 "	"	"	—
R155	000 223	22k "	"	"	—
R156	000 272	2K7 "	"	"	—
R157	000 473	47K "	"	"	—
R158	000 102	1K "	"	"	—
R159	000 102	1K "	"	"	—
R160	000 473	47K "	"	"	—
R161	000 473	47K "	"	"	—

NOTES.

J. W. 1164

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TITLE 1051 A-D

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SHEET 8 OF 22

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R162	000 473	47K 5% 1/4W CARBON	MULLARD	CR25	—
R163	000 103	10K "	"	"	—
R164	000 105	1M "	"	"	—
R165	000 101	100R 5% " "	"	"	—
T1	310 002	PULSE Tx	NEWPORT INST.	76616/4HV	3
T2	310 002	"	"	"	—
T3	310 002	"	"	"	—
T4	300 007	TOROIDAL MAINS Tx			1
T5	300 006	STEP-UP Tx	NEWPORT INST.	B79399	1

NOTES.

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J. W. 1164

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
L1	370 001	RF CHOKE 10μH	PLESSEY	58/10/0011/10	1
W1	209 003	BRIDGE RECTIFIER 100V 1.5A	GI	WS01	1
W2	209 004	" 100V 1A	"	W01	2
W3	209 004	" 100V 1A	"	W01	—
W4	209 007	" 400V 1A	"	W04	1
C1	180 020	1000μF 25V Al ELECT	WIMA	PRINTILYT 3	5
C2	180 020	1000μF "	"	"	—
C3	150 001	22μF 16V TANT	UNION CARBIDE	K22E16	12
C4	150 001	22μF "	"	"	—
C5	150 001	22μF "	"	"	—
C6	150 001	22μF "	"	"	—
C7	150 001	22μF "	"	"	—
C8	150 001	22μF "	"	"	—
C9	150 001	22μF "	"	"	—
C10	101 103	.01μF 250V CER DISC	ERIE	801	11
C11	101 103	.01μF "	"	"	—
C12	101 103	.01μF "	"	"	—
C13	101 103	.01μF "	"	"	—

NOTES.

J. W. 1164

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SHEET 10 OF 22

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
C14	101 103	.01μF 250v Cer Disc	ERIE	801	—
C15	150 008	.47μF 35v Tant	UNION CARBIDE	KR47E35	1
C16	101 103	.01μF 250v Cer Disc	ERIE	801	—
C17	110 017	22nF 250v Polyester	MULLARD	C280AE/P22K	1
C18	101 103	.01μF 250v Cer Disc	ERIE	801	—
C19	102 102	1nF 500v Cer Disc	"	"	7
C20	102 100	10pF 500v Cer Disc	"	"	3
C21	102 330	33pF 500v Cer Disc	"	"	3
C22	102 330	33pF "	"	"	—
C23	102 330	33pF "	"	"	—
C24	102 100	10pF 500v Cer Disc	"	"	—
C25	102 102	1nF 500v Cer Disc	"	"	—
C26	110 013	0.1MF 250v Polyester	MULLARD	C280AE/P100K	3
C27	150 001	22μF 16v Tant	Union Carbide	KR22E16	—
C28	110 012	150pF 400v Polyester	WIMA	Tropyfol F	1
C29	110 002	.15μF 250v Polyester	MULLARD	C280AE/P150K	1
C30	140 002	.47μF 10% Polyprop.	WIMA	MKP10	1
C31	102 102	1nF 500v Cer Disc	ERIE	801	—
C32	110 008	.68μF 100v	WIMA	MKS	1
C33	102 101	100pF 500v Cer Disc	ERIE	801	3
C34	102 101	100pF "	"	"	—
C35	102 101	100pF "	"	"	—
C36	NOT USED				

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
C37	150 001	22µF 16V TANT	UNION CARBIDE	K22E16	—
C38	102102	1nF 500V CER DISC	ERIE	801	—
C100	180 020	1000µF 25V AL ELECT.	WIMA	PRINTILYT 3	—
C101	180 020	1000µF "	"	"	—
C102	101 103	.01µF 250V CER DISC	ERIE	801	—
C103	150 018	220µF 6V3 TANT	UNION CARBIDE	K220E6V3	1
C104	110 026	6800pF 100V POLYESTER	WIMA	FKS2	2
C105	110 026	6800pF "	"	"	—
C106	150 001	22µF 16V TANT	UNION CARBIDE	K22E16	—
C107	180 020	1000µF 25V AL. ELECT	WIMA	PRINTILYT 3	—
C108	180 019	10µF 250V AL. ELECT	ERIE	21101-100	1
C109	110 016	220pF 400V TROPYFOL F	WIMA	TROPYFOL F	2
C110	110 016	220pF "	"	"	-
C111	150 001	22µF 16V TANT	UNION CARBIDE	K22E16	—
C112	110 022	2.2µF 63V P.E.T.P FILM	ADVANCE	MD30A	1
C113	150 001	22µF 16V 20% TANT	UNION CARBIDE	K22E16	—
C114	102 102	1nF 500V CER DISC	ERIE	801	—
C115	110 005	.01µF 250V POLYESTER	MULLARD	C280AE/P10K	4
C116	110 005	.01µF "	"	"	—

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
C117	150 010	.33µF 35V TANT.	UNION CARBIDE	KR33E35	1
C118	150 007	6.8µF 16V TANT	"	KR8E16	1
C119	101 103	.01µF 250V CER DISC	ERIE	801	—
C120	101 103	.01µF "	"	"	—
C121	150 012	0.1µF 35V TANT	UNION CARBIDE	KR1E35	1
C122	102 221	220pF 500V CER DISC	ERIE	801	1
C123	110 005	0.01µF 250V POLYESTER	MULLARD	C280AE/P10K	—
C124	101 103	.01µF 250V CER DISC	ERIE	801	—
C125	102 102	1nF 500V CER DISC	"	"	—
C126	102 471	470pF 500V CER DISC	"	"	1
C127	110 005	0.01µF 250V POLYESTER	MULLARD	C280AE/P10K	—
C128	102 100	10pF 500V CER DISC	ERIE	801	—
C129	102 102	1nF "	"	801	—
C130	150 005	2.2µF 16V TANT	UNION CARBIDE	K2R2E16	2
C131	150 002	10µF 16V TANT	"	K10E16	1
C132	150 003	47µF 6V3 TANT	"	K47E6	1
C133	110 013	.1µF 250V POLYESTER	MULLARD	C280AE/P100K	—
C134	150 005	2.2µF 16V TANT	UNION CARBIDE	K2R2E16	—
C135	110 013	.1µF 250V POLYESTER	MULLARD	C280AE/P100K	—
C136	150 009	3.3µF 16V TANT	UNION CARBIDE	K3R3E16	1

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SHEET 13 OF 22

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
D1	200 008	LOW LEAKAGE	FAIRCHILD	IN 458A	11
D2	200 008	"	"	"	—
D3	NOT USED				
D4	200 008	LOW LEAKAGE	FAIRCHILD	IN 458A	—
D5	NOT USED				
D6	200 008	LOW LEAKAGE	FAIRCHILD	IN 458A	—
D7	200 008	"	"	"	—
D8	200 008	"	"	"	—
D9	200 008	"	"	"	—
D10	200 008	"	"	"	—
D11	200 001	Si, GP		IN4148	27
D12	200 001	"		"	—
D13	200 001	"		"	—
D14	200 008	LOW LEAKAGE	FAIRCHILD	IN458A	—
D15	200 001	Si, GP		IN4148	—
D16	200 001	"		"	—
D17	200 001	"		"	—
D18	200 008	LOW LEAKAGE	FAIRCHILD	IN458A	—
D19	200 008	"	"	"	—

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SHEET 14 OF 22

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
D20	210 100	ZENER 10v 400mW	MULLARD	BZY88-C10	2
D21		NOT USED			
D22	210 056	" 5V6 "	"	BZY88-C5V6	1
D23	210 075	" 7V5 "	"	BZY88-C7V5	2
D24	210 075	" 7V5 "	"	BZY88-C7V5	—
D25	210 240	" 24V "	"	BZY88-C24	1
D26	200 001	Si, GP	"	IN4148	—
D27	200 001	Si, GP		IN4148	—
D28	NOT USED				
D29	NOT USED				
D30	210 043	ZENER 4V3 400mW	MULLARD	BZY88-C4V3	1
D31	200 001	Si, GP		IN4148	—
D32	200 001	"		"	—
D33	210 082	ZENER 8V2 400mW	MULLARD	BZY88-C8V2	1
D34	200 001	Si, GP		IN4148	—
D35	200 001	"		"	—
D36	210 100	ZENER 10V 400mW	MULLARD	BZY88-C10	—
D37	200 001	Si, GP		IN4148	—
D38	200 005	Ge, GP	HUGHES	HG 5009	2
D39	200 005	"	"	"	—
D40	200 001	Si, GP		IN4148	—
D41	200 001	"		"	—
D42	200 001	"		"	—

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
D43	200 001	Si, GP		IN4148	—
D44	200 001	"		"	—
D45	200 001	"		"	—
D46	200 001	"		"	—
D47	200 001	"		"	—
D48	200 001	"		"	—
D49	200 001	"		"	—
D50	210 150	ZENER 15V 400mW	MULLARD	BZY88-C15	1
D51	200 001	Si, GP		IN4148	—
D52	200 001	"		"	—
D53	200 001	"		"	—
D54	200 001	"		"	—

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
M1	280 008	QUAD NAND	MOTOROLA	MC14011CP	10
M2	270 024	7 SEG. DECODER/DRIVER	SPERRY	DD700	1
M3	280 001	4 POLE 2 WAY MULTIPLEXER	NATIONAL	MM74C157N	1
M4	290 016	DIGITAL VOLTMETER LOGIC ARRAY	FAIRCHILD	3814DC	1
M5	280 009	HEX BUFFER	MOTOROLA	MC14049CP	5
M6	280 003	QUAD LATCH	"	MC14042CP	1
M7	280 012	DECADE COUNTER	NATIONAL	MM74C163N	1
M8	280 007	TRIPLE NAND	MOTOROLA	MC 14023CP	3
M9	280 010	DECADE COUNTER	NATIONAL	MM74C160N	1
M10	280 008	QUAD NAND	MOTOROLA	MC 14011CP	—
M11	280 009	HEX BUFFER	"	MC 14049CP	—
M12	280008	QUAD NAND	"	MC 14011CP	—
M13	280 011	DUAL D FLIP-FLOP	"	MC 14013CP	3
M14	280008	QUAD NAND	"	MC 14011CP	—
M15	280 008	"	"	"	—
M16	280 011	DUAL D FLIP-FLOP	"	MC 14013CP	—
M17	280 009	HEX BUFFER	"	MC 14049CP	—
M18	280 007	TRIPLE NAND	"	MC 14023CP	—
M19	290 003	TIMER - ASTABLE	SIGNETICS	NE 555V	4
M20	280 006	DUAL J-K FLIP-FLOP	MOTOROLA	MC 14027CP	4
M21	280 006	"	"	"	—
M22	280 008	QUAD NAND	"	MC 14011CP	—
M23	280 008	"	"	"	—

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SHEET 17 OF 22

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
M24	290 003	TIMER - MONOSTABLE	SIGNETICS	NE555V	—
M25	270 028	QUAD NAND	NATIONAL	DM 74L03N	1
M26	280 009	HEX BUFFER	MOTOROLA	MC 14049CP	—
M27	290 003	TIMER - ASTABLE	SIGNETICS	NE 555V	—
M28	280 007	TRIPLE NAND	MOTOROLA	MC 14023CP	—
M29	290 003	TIMER - MONOSTABLE	SIGNETICS	NE 555V	—
M30	280 006	DUAL JK FLIP FLOP	MOTOROLA	MC 14027CP	—
M31	280 005	TRIPLE GATE	"	MC 14501CP	1
M32	280 008	QUAD NAND	"	MC 14011CP	1
M33	280 004	14 BIT BINARY COUNTER	"	MC 14020CP	1
M34	NOT USED				
M35	260 013	LINEAR I.C LF 356	NATIONAL	LF 356	1
M36	260025	LINEAR I.C 101 OP AMP	"	LM101	5
M37	260025	"	"	"	—
M38	260025	"	"	"	—
M39	260018	PRECISION REGULATOR		LM399H	1
M40	260025	LINEAR I.C. 101 OP. AMP	NATIONAL	LM101	—
M41	260025	" " "	"	"	—
M42	280008	QUAD NAND	MOTOROLA	MC 14011CP	—
M43	280009	HEX BUFFER	"	MC 14049CP	—
M44	280006	DUAL JK FLIP-FLOP	"	MC 14027CP	—
M45	280011	DUAL D FLIP-FLOP	"	MC 14013CP	—
M46	280008	QUAD NAND	"	MC 14011CP	—

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
M47	260 017	LINEAR I.C 15V REGULATOR	MOTOROLA	MC78M15	2
M48	260 017	"	"	"	—
M49	290 004	LINEAR I.C 312 OP AMP	NATIONAL	LM312H (RED)	1
M50	260 005	LINEAR I.C 5V REGULATOR	MOTOROLA	MC7805	1
Q1	230 019	P MOSFET ENHANCEMENT	G.I	MEM 806	1
Q2	230 002	N FET SWITCH GP	TELEDYNE	U1994E/K4416-18	3
Q3	230 002	"	"	"	—
Q4	230 002	"	"	"	—
Q5	NOT USED				
Q6	239 018	MATCHED SET OF 3 FETS	DATRON SEL. TELEDYNE	U1899E $\Delta R_{ON} < 10\Omega$	1 SET
Q7					
Q8					
Q9	230 003	N FET SWITCH GP	NATIONAL	U1899E/K4093-18	1
Q10	230 001	JUNCTION FET CURRENT LIMIT DIODE		E506	3
Q11	230 001	"		"	—
Q12	230 001	"		"	—
Q13	NOT USED				
Q14	240 001	SIL NPN GP		BC 184K	11

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SHEET 19 OF 22

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
Q15	240 001	SIL NPN GP		BC 184K	—
Q16	240 001	"		"	—
Q17		NOT USED			
Q18	240 001	"		"	—
Q19	NOT USED				
Q20	240001	SIL NPN GP		BC 184K	—
Q21	240007	SIL NPN GP	FAIRCHILD	2N 3646	6
Q22	240007	"	"	"	—
Q23	240007	"	"	"	—
Q24	250001	SIL PNP GP		BC 214K	5
Q25	240001	SIL NPN GP		BC 184K	—
Q40	240001	SIL NPN GP		BC 184K	—
Q41	240001	"		"	—
Q42	240011	SIL NPN MED. POWER	FAIRCHILD	BC 338	1
Q43	240 007	SIL NPN GP	"	2N 3646	—
Q44	240 007	"	"	"	—
Q45	240007	"	"	"	—
Q46	240013	SIL NPN GP		BC 184KC	2
Q47	240013	"		"	—
Q48	250001	SIL PNP GP		BC 214K	—
Q49	240001	SIL NPN GP		BC 184K	—

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SHEET 20 OF 22

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
Q50	250 001	SIL PNP GP		BC 214K	—
Q51	240 001	SIL NPN GP		BC 184 K	—
Q52	250001	SIL PNP GP		BC 214K	—
Q53	250001	"		"	—
Q54	NOT USED				
Q55	240 001	SIL NPN GP		BC 184K	—
	450039	UPPER GUARD SHIELD			1
	450 040	LOWER GUARD SHIELD			1
	700 020	SWITCH BUTTON CHROME			3
S1	700 005	SWITCH PCB PUSH ON/OFF	LIPA + ISOSTAT	CD 15 2 POLE	2
S2	700 039	SWITCH PCB MOMENTARY	"	CD 15 2 POLE	1
S3	700 005	SWITCH PCB PUSH ON/OFF	"	CD 15 2 POLE	—
	612 005	STANDOFF M3 x 23 mm	HARWIN		3
	612009	STANDOFF M3x12mm	CAMBION	350-5138-12-07	1
J3	605 002	16 WAY D.I.L SOCKET	ANTIFERENCE	ICN-163-53	1
J7	605 011	16 WAY SOCKET	AMP	H63680-5	2
J8	605 011	"	"	"	—

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
	620 003	PCB SOLDER TERMINAL	HARWIN	H2105A	11
	602 001	F.S.V TERMINAL	MOLEX	0204 1875	18
	601 002	CONNECTOR TERMINAL	AMP	60803-1	17
	459 138	TRANSISTOR HEAT DISSIPATOR	KDP ES	459138	2
	459 139	HEAT DISSIPATOR	"	459139	1
	410019-10	PCB			1
	618 001	TRANSISTOR MOUNTING KIT			.
	611 006	M3 x 10MM POZIPAN	GKN		9
	613 005	M3 SHAKEPROOF	GKN		9
	615 002	M3 NUT	GKN		3
	590 001	SLEEVE			11
	605059	8 WAY D.I.L SOCKET	ASTRALUX	ICL-083-S6T.	4
	605038	16-WAY D.I.L SOCKET	ASTRALUX	ICL163-S6T	16
	605037	14-WAY D.I.L SOCKET	"	ICL143-S3T	17
	605012	24WAY D.I.L SOCKET	JERMYN	A23-2023Y	1
	613011	6BA NYLON WASHER	NYLONIC ENG Co Ltd	7801	4
	604017	MAINS CONNECTOR	MOLEX	AE 3003	1
	613007	PLAIN WASHER M3			2
	611019	POZIPAN M3 x 35mm			1
	615010	M3 NYLOCK NUT	GKN		1

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R1	000 222	2K2 5% 1/4W CARBON	MULLARD	CR25	6
R2	000 222	2K2 "	"	"	—
R3	000 222	2K2 "	"	"	—
R4	000 222	2K2 "	"	"	—
R5	000 222	2K2 "	"	"	—
R6	000 222	2K2 "	"	"	—
R7	000 104	100K 5% 1/4W CARBON	"	"	5
R8	000 104	100K "	"	"	—
R9	000 104	100K "	"	"	—
R10	000 104	100K "	"	"	—
R11	000 104	100K "	"	"	—
R12	000 153	15K 5% 1/4W CARBON	"	"	5
R13	000153	15K "	"	"	—
R14	000153	15K "	"	"	—
R15	000153	15K "	"	"	—
R16	000153	15K "	"	"	—
R17	000472	4K7 5% 1/4W CARBON	"	"	2
R18	000472	4K7 "	"	"	—
R19	000224	220K 5% 1/4W CARBON	"	"	6
R20	000224	220K "	"	"	—
R21	000224	220K "	"	"	—
R22	000224	220K "	"	"	—
R23	000224	220K "	"	"	—

NOTES.

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	ECO 319	ECO 508							
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TITLE 1051 .5" SPERRY DISPLAY ASSY.

DRAWING NUMBER 400088

SHEET 2 OF 5

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R24	000224	220K 5% ¼W CARBON	MULLARD	CR25	—
R25	000225	2M2 10% ¼W CARBON	"	"	5
R26	000225	2M2 "	"	"	—
R27	000225	2M2 "	"	"	—
R28	000225	2M2 "	"	"	—
R29	000225	2M2 "	"	"	—
C1	110 013	0.1μF 250V POLYESTER	MULLARD	C280AE/P100K	5
C2	110 013	"	"	"	—
C3	110 013	"	"	"	—
C4	110 013	"	"	"	—
C5	110 013	"	"	"	—
D1	200 001	Si GP		IN4148	7
D2	200 001	"		"	—
D3	200 001	"		"	—
D4	200001	"		"	—
D5	200001	"		"	—

NOTES.

J. W. 1164

ISS. SEE	SHEET 2							

DATE 8/76
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datron ELECTRONICS LTD

TITLE 1051 .5" SPERRY DISPLAY ASSY.

DRAWING NUMBER 400088

SHEET 3 OF 5

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
D6	200 001	Si GP		IN4148	—
D7	200 001	"		"	—
Q1	250 009	PNP Si Hi VOLT		2N5401	5
Q2	250 009	"		"	—
Q3	250 009	"		"	—
Q4	250 009	"		"	—
Q5	250 009	"		"	—
Q6	240 009	NPN Si Hi VOLT GP	MOTOROLA	MPSL01	5
Q7	240 009	"	"	"	—
Q8	240 009	"	"	"	—
Q9	240 009	"	"	"	—
Q10	240 009	"	"	"	—
Q11	250 001	PNP Si GP		BC214K	3
Q12	250 001	"		"	—
Q13	250 001	"		"	—
M1	280 009	HEX. INVERTER	MOTOROLA	MC14049CP	1

NOTES.

J. W. 1164

ISS.	SEE	SHEET	2						

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datron ELECTRONICS LTD

TITLE 1051 .5" SPERRY DISPLAY ASSY

DRAWING NUMBER 400088

SHEET 4 OF 5

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
LP1	920 005	FILAMENT LAMP 5V 60mA	G.I.	V683	6
LP2	920 005	"	"	"	—
LP3	920 005	"	"	"	—
LP4	920 005	"	"	"	—
LP5	920 005	"	"	"	—
LP6	920 005	"	"	"	—
	450 003	FUNCTION BLANK	NORWICH PLASTICS		2
	420 013	Ω, KΩ NEGATIVE			1
	420 030	MΩ NEGATIVE			1
	611 014	SCREW N°4 x 3/8" SELF TAPPING			2
	410018-3	PCB			1
	605038	D.I.L SOCKET 16 PIN	ASTRALUX	ICL 163-56T	1
	604 003	CONNECTOR STRIP 11 WAY	AMP		3
	800 010	SPERRY SOCKET	SPERRY	CS 353	2
	800 003	SPERRY .5" DISPLAY (888)	"	SP 353	1
	800 012	SPERRY .5" DISPLAY (185)	"	SP 354	1
	630 030	CREPE PAPER TAPE .200"	BRADY	CSR 200	80mm

NOTES.

J. W. 1164

ISS. SEE	SHEET	2							

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TITLE 1051 .5" SPERRY DISPLAY ASSY.

DRAWING NUMBER 400088

SHEET 5 OF 5

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R1	000107	100M 10% ¼W CARBON	ALLEN BRADLEY	CB 1071	1
R2	008006	56K THICK FILM	DUBILIER	RB07	4
R3	008006	"	"	"	—
R4	008006	"	"	"	—
R5	008006	"	"	"	—
R6	000124	120K 5% ¼W CARBON	MULLARD	CR25	2
R7	000124	120K "	"	"	—
R8		FSV			1
R9		FSV			1
R10	063205	2M 3/8" CERMET POT.	BECKMAN	72P	2
R11		FSV			1
R12		FSV			1
R13	063205	2M 3/8" CERMET POT.	BECKMAN	72P	—
R14	063100	10R "	"	"	1
R15	090014	9K995 .02% MATCHED	MANN	3C-B	2
R16		50K .02% PAIR			
R17		FSV			1
R18	000102	1K 5% ¼W CARBON	MULLARD	CR25	1
R19	063500	50R 3/8" CERMET POT	BECKMAN	72P	1
R20	090014	9K995 .02% MATCHED	MANN	3C-B	—
R21		50K .02% PAIR			
R22	000220	22R 5% ¼W CARBON	MULLARD	CR25	1
R23	000154	150K "	"	"	1

NOTES.

ISS. 2	3	4 C	5	6
ECO 125	ECO 203	ECO 203	ECO 276	ECO. 693
5.11.75	10.3.76	10.3.76	9.9.76	30.5.78

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PROD/AD 2.2.77

datron ELECTRONICS LTD

TITLE 1051 1059 — RATIO AMPL 1V I/P

DRAWING NUMBER 400091

SHEET 3 OF 3

J. W. 1164

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R24	063203	20K 3/8" CERMET POT	BECKMAN	72P	1
R25		FSV			1
R26		FSV			1
R27	NOT USED				
R28	000 103	10K 5% ¼W CARBON	MULLARD	CR25	3
R29	000 103	10K "	"	"	—
R30	000 272	2K7 "	"	"	1
R31	000 182	1K8 "	"	"	1
R32	000103	10K "	"	"	—
C1	120004	.68μF 10% POLYCARB.	ADVANCE	CMD 15A	2
C2	120004	"	"	"	—
C3	102102	1000pF CER. DISC	ERIE	801	2
C4	102102	"	"	"	—
C5	120013	.15μF 10% 63V POLYCARB.	ADVANCE	CMD 4	2
C6	120013	"	"	"	—
C7	102330	33pF CER DISC	ERIE	801	1
C8	101103	.01μF "	"	"	3
C9	101103	"	"	"	—
C10	101103	"	"	"	—

NOTES.

J. W. 1164

ISS.	SEE	SHEET	2

DATE 8/76
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NEXT DRAWING

datron ELECTRONICS LTD

TITLE 1051 1059 RATIO AMP² 1V I/P

DRAWING NUMBER 400091

SHEET 3 OF 6

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
D1	200008	LOW LEAKAGE	FAIRCHILD	IN458A	4
D2	200008	"	"	"	—
D3	200008	"	"	"	—
D4	200008	"	"	"	—
D5	200001	Si GP		IN4148	4
D6	200001	"		"	—
D7	200001	"		"	—
D8	200001	"		"	—
M1	290014	LINEAR LM312H OP AMP.	NATIONAL	LM312H (GREEN/ORANGE)	2
M2	290014	"	"	"	—
M3	260025	LM101	"	LM101	1
M4	220005	OPTO-ISOLATOR FCD820	FAIRCHILD	FCD 820	1
Q1	240001	Si NPN GP		BC 184K	3
Q2	240001	"		"	—
Q3	240001	"		"	—

NOTES.

J. W. 1164

ISS.	SHEET							
SEE	SHEET	2						

DATE 8/76
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TITLE 1051 1059 RATIO AMPL. IV I/P

DRAWING NUMBER 400091

SHEET 4 OF 6

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
K1	330003	RELAY 28v 3.2K BIF.	POTTER & BRUMFIELD	R10-E1-L2-S3.2K	1
	602007	RELAY SOCKET	POTTER & BRUMFIELD	A11-1	1
	630005	CLIP	" "	P28-1	1
S1	700019	SLIDE SWITCH	SIEMENS	C42315-A60-A1	1
	410015-6	P.C.B	DATRON		1
	602001	F.S.V. TERMINAL	MOLEX	02-04-1875	15
	612006	M3 STANDOFF x9.5mm LG.	HARWIN		4
	611004	SCREW M3x6mm POZI PAN	G.K.N		4
	601002	CONNECTOR TERMINAL	AMP	60803-1	5
	620003	SOLDER TERMINAL	HARWIN	H-2105A	11
	510333	7/.2 P.V.C. INSUL. WIRE-ORANGE			A/R
	510222	7/.2 P.V.C INSUL. WIRE-RED			A/R
	510666	" -BLUE			A/R
	510555	" -GREEN			A/R
	510111	" -BROWN			A/R
	510999	" -WHITE			A/R
	510000	" -BLACK			A/R
	510888	" -GREY			A/R
	510001	" -PINK			A/R

NOTES.

J. W. 1164

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TITLE 1051 1059 - RATIO AMPL 1v i/p

DRAWING NUMBER 400091

SHEET 5 OF 6

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
	521002	16/.2 P.V.C INSUL. WIRE - WHITE/RED			A/R
	521003	" - ORANGE/BLK			A/R
	521004	" - RED/BLK			A/R
	510777	7/.2 " - VIOLET			A/R
	602003	SNAP CONNECTOR	AMP	60983-1	16
	590001	SLEEVE	HELLERMAN	HIS-15	12
	590011	SLEEVE	"	HIS	A/R
	604006	5 WAY PLUG	PYE	M5P	1
	605007	5 WAY SOCKET	"	M5S	1
	606001/A	LOCKING HOOD (PANEL MT.)	"	MHN	1
	606001/B	LOCKING HOOD (CABLE MT.)	"	MHN	1
	606002	NUT	"	MN	1
	606003	WASHER	"	MLW	1
	605059	8 WAY D.I.L SOCKET	ASTRALUX	ICL-083-56T	1

NOTES.

J. W. 1164

ISS.	SHEET	
SEE	SHEET	2

DATE 8/76
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TITLE 1051 1059 RATIO AMPL 1v i/p

DRAWING NUMBER 400091

SHEET 6 OF 6

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R1	063203	20K POT CERMET	BECKMAN	72P	3
R2	063203	20K " "	"	"	—
R3	011003	100K 1% 1/8W M/F	WELWYN	4033C	2
R4	011003	100K 1% 1/8W M/F	"	"	—
R5	063202	2K POT CERMET	BECKMAN	72P	2
R6	063202	2K " "	"	"	—
R7	050015	100K .25% 1/8W M/F	ERG	EE125	2
R8	050015	100K " " "	"	"	—
R9		FSV			1
R10		FSV			1
R11	063205	2M POT CERMET	BECKMAN	72P	1
R12, R13	090014	9K995/50K .02%	MANN	3C-B	1 MATCHED PAIR
R14	000102	1K 5% 1/4W CARBON	MULLARD	CR25	1
R15	063203	20K POT CERMET	BECKMAN	72P	—
R16	000394	390K 5% 1/4W CARBON	MULLARD	CR25	1
R17	000100	10R 5% 1/4W CARBON	"	"	1
R18	000822	8K2 " " "		"	1
R19		FSV			1
R20		FSV			1
R21	000103	10K 5% 1/4W CARBON	MULLARD	CR25	3
R22	000103	10K " " "	"	"	—
R23	000272	2K7 " " "	"	"	1

NOTES.

J. W. 1164

ISS. 2 C	3	4
ECO 269	ECO 277	ECO. 694
26.8.76	14-9-76	30.5.78

DATE 25.8.76

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datron ELECTRONICS LTD

TITLE 10V/100V RATIO AMP 1051

DRAWING NUMBER 400125

SHEET 2 OF 6

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R24	000182	1K8 5% ¼W CARBON	MULLARD	CR25	1
R25	000103	10K " " "	"	"	—
R26	000226	22M 10% " "	ALLEN BRADLEY	CB10	1
R27		FSV			1
AN1	090018	THIN FILM NETWORK	ALLEN BRADLEY	FN207	2
AN2	090018	" " "	" "	"	—
C1	120004	.68μF 10% 63V POLYCARB.	ADVANCE	CMD15A	2
C2	120004	.68μF " " "	"	"	—
C3	102102	1nF 500V CER. DISC	ERIE	801	1
C4	120013	.15μF 10% 63V POLYCARB.	ADVANCE	CMD4	1
C5	102330	33pF 500V CER DISC	ERIE	801	1
C6	101103	10nF 250V " "	"	"	3
C7	101103	10nF " " "	"	"	—
C8	101103	10nF " " "	"	"	—
D1	200008	Si. LOW LEAKAGE	FAIRCHILD	IN458A	4
D2	200008	Si. " "	"	"	—

NOTES.

ISS.								
SEE SHT 2.								

DATE 25-8-76

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TITLE 10V/100V RATIO AMP. 1051

DRAWING NUMBER 400125

SHEET 3 OF 6

J. W. 1164

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
D3	200008	Si. LOW LEAKAGE	FAIRCHILD	IN458A	–
D4	200008	Si. " "	"	"	–
D5	200001	Si. G.P.		IN4148	4
D6	200001	Si. "		"	–
D7	200001	Si. "		"	–
D8	200001	Si. "		"	–
Q1	240001	Si NPN GP		BC184K	3
Q2	240001	Si " "		"	–
Q3	240001	Si " "		"	–
M1	290014	312 OP. AMP.	NATIONAL	LM312H (GREEN/ORANGE)	1
M2	260025	101 " "	"	LM101	1
M3	220005	OPTO ISOLATOR	FAIRCHILD	FCD 820	1
S1	700019	SLIDE SWITCH	SIEMENS	C42315-A60-A1	1
RL1	330003	RELAY 28V 3K2 BIF.	POTTER & BRUMFIELD	R10-E1-L2-S3.2K	1
	602007	RELAY SOCKET	"	A11-1	1
	630005	CLIP	"	P28-1	1
	410037-2	P.C.B.			1

NOTES.

J. W. 1164

ISS.								
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TITLE 10V/100V RATIO AMP. 1051

DRAWING NUMBER 400125

SHEET 4 OF 6

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
	601002	SNAP CONNECTOR	AMP	60803-1	7
	602001	FSV TERMINAL	MOLEX	02-04-1875	11
	620003	SOLDER TERMINAL	HARWIN	H210SA	11
	612006	STANDOFF M3 X 9·5 LG.	"		4
	540002	22SWG. TINNED Cu. WIRE			A/R
	590001	SLEEVE,	HELLERMAN	H15-15	A/R
	590002	SLEEVE	HELLERMAN	H30-20	1
	510222	7/·2 P.V.C. INSUL. WIRE - RED			A/R
	510666	" " " " - BLUE			A/R
	510555	" " " " - GREEN			A/R
	510111	" " " " - BROWN			A/R
	510999	" " " " - WHITE			A/R
	510000	" " " " - BLACK			A/R
	510888	" " " " - GREY			A/R
	511001	" " " " - PINK			A/R
	521002	16/·2 " " " WHT./RED			A/R
	521003	" " " " OR/BK			A/R
	521004	" " " " RED/BK			A/R
	602003	SNAP RECEPTACLE	AMP	60983-1	18
	590011	BLACK SLEEVING	HELLERMAN	H15	A/R
	510333	7/·2 P.V.C. INSUL. WIRE - ORANGE			A/R
	510777	" " " " - VIOLET			A/R

NOTES.

J. W. 1164

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TITLE 10V/100V RATIO AMP 1051

DRAWING NUMBER 400125

SHEET 6 OF 6

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
	604006	5 WAY PLUG	PYE	MSP	1
	605007	5 WAY SOCKET	"	MSS	1
	606001/A	LOCKING HOOD (PANEL MT.)	"	MHN	1
	606001/B	LOCKING HOOD (CABLE MT.)	"		1
	606002	NUT	"	MN	1
	606003	WASHER	"	MLW	1
	605059	8WAY D.I.L SOCKET	ASTRALUX	ICL-083-S6T	1

NOTES.

J. W. 1164

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TITLE 10V/100V RATIO AMP 1051

DRAWING NUMBER 400125

SHEET 6 OF 6

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R1	000104	100K 5% ¼W CARBON	MULLARD	CR25	6
R2	000104	100K "	"	"	–
R3	000104	100K "	"	"	–
R4	000563	56K "	"	"	1
R5	000104	100K "	"	"	–
R6	000104	100K "	"	"	–
R7	000104	100K "	"	"	–
D1	200001	Si G.P.		IN4148	2
D2	200001	Si G.P.		IN4148	–
C1	150012	0.1μF 35V 20% DIPPED TANT.	UNION CARBIDE	KRIE35	1
C2	102102	1kpF 500V CER DISC	ERIE	801	1
	601002	CONNECTOR TERMINAL	AMP	60803-1	4
M1	280014 *	TRI-STATE HEX BUFFER		80C95, COMMERCIAL	7
M2	290003	TIMER MONOSTABLE	SIGNETICS	NE555V, "	1
M3	280001	QUAD 2 I/P MULTIPLEXER		74C157, "	1
M4	280008	QUAD NAND		14011 "	2
M5	280014 *	TRI-STATE HEX BUFFER		80C95 "	–
M6	280014 *	"		" "	–
M7	280008	QUAD NAND		14011 "	–
M8	280009	HEX INVERTER		14049 "	1

NOTES.

J. W. 1164

ISS.	2	3	4	5	6	7	8	9
	ECO 122	ECO 207	234	310	507	559	558	645
				16-12-76	5.7.77	23.9.77	23.9.77	30-3-78

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datron ELECTRONICS LTD

TITLE 1051 1059 BCD OUTPUT OPTION B04

DRAWING NUMBER 400095

SHEET 2 OF 3

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
M9	280015	TRI-STATE QUAD LATCH		74C173, COMMERCIAL	5
M10	280015	"		" "	—
M11	280015	"		" "	—
M12	280015	"		" "	—
M13	280015	"		" "	—
M14	280014 *	TRI-STATE HEX BUFFER		80C95 "	—
M15	280014 *	"		" "	—
M16	280014 *	"		" "	—
M17	280014 *	"		" "	—
	590004	SILICON RUBBER SLEEVING	1.5 ID		A/R
	540002	22 SWG TINNED CU WIRE			A/R
	410027-6	PRINTED CIRCUIT BOARD			1
	604001	50 WAY PLUG (CABLE MTG.)	AMPHENOL	57-30500	1
	605001	50 WAY AMP. SKT. (PANEL MNT)	AMPHENOL	57-40500	1
	605037	14 WAY D.I.L. SKT.	ASTRALUX	ICL 163-56T	2
	605038	16 WAY D.I.L. SKT	"	ICL 143-53T	14
	605059	8 WAY D.I.L SOCKET	"	ICL 083-56T	1
J7	604010	16 WAY AMP MALE CON.	AMP	1-163749-5	2 SETS
J8	604010	"	"	"	—

NOTES. * ALTERNATIVE 280024 TRI STATE HEX BUFFER MOTOROLA MC14503

J. W. 1164

ISS.	SHEET							
SEE	2							

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TITLE 1051 1059 BCD OUTPUT OPTION B04

DRAWING NUMBER 400095

SHEET 3 OF 3

P.C. BOARD 410003-9A

M9 TO M14 MOUNTED ON SOCKETS PART No 605038

INPUT AMP PCB. ASSY. 400328 TO BE MOUNTED ON STEATITE BEADS AT POINTS A, C & E (630024 - 3 OFF) BY THREADING BEADS OVER WIRE LEADS.

N.B. COMPONENTS MARKED THUS * ARE MOUNTED ON INPUT AMP PCB. SOLDER WIRE LEADS FROM INPUT AMP PCB INTO CORRESPONDING POINTS (A-G) ON ANALOGUE PCB MARKED B

S1 10MΩ
S2 1KV
S3 100V
S4 10V
S5 1V
S6 100mV
S7 10mV
S8 AUTO
S9 REM
S10 FILTER
S11 AC
S12 DC
S13

M1 M2 M3 M4 M5 M6 M7 M8 M9 M10 M11 M12 M13 M14 M22 M23 M24 M25 M26

RL1

J1 J2,3 J2,1 J2,5 J3 J4

R1 R2 R3 R4 R57 A R57 B R57 C R57 D R60 R70 R68 R69 R67 R71 R72

C1 C2 C3 C4 C5 C6 C7 C8 C11 C15 C16 C17 C18 C25 C27 C31 C32 C33 C34 C35 C37 C41 C42 C43 C46 C47

Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10 Q11 Q12 Q13 Q14 Q15 Q16 Q17 Q18 Q19 Q20 Q21 Q22 Q23 Q24 Q25 Q26 Q27 Q28 Q29 Q30 Q31 Q32 Q33 Q34 Q35 Q36 Q37 Q38 Q39 Q40 Q41 Q42 Q43 Q44 Q45 Q46 Q47 Q48 Q49 Q50 Q51 Q52 Q53 Q54 Q55 Q56 Q57 Q58

D1 D2 D3 D4 D5 D6 D7 D8 D9 D10 D11 D17 D18 D19 D20 D21 D22 D23 D25 D26 D27 D28 D29 D30 D31 D32 D33 D34 D35 D36 D37 D38 D39 D40 D41 D42 D43 D44 D45 D46 D47 D48 D49 D50 D51 D52 D53 D54 D55 D56 D57 D58 D59 D60 D61 D62 D63 D64 D65 D66 D67 D68 D69 D70 D71 D72 D73 D74 D75 D76 D77 D78 D79 D80 D81 D82 D83 D84 D85 D86 D87 D88 D89 D90 D91 D92 D93 D94 D95 D96 D97 D98 D99 D100 D101 D102 D103 D104 D105 D106 D107 D108 D109 D110 D111 D112 D113 D114 D115 D116 D117 D118 D119 D120 D121 D122 D123 D124 D125 D126 D127 D128 D129 D130 D131 D132 D133 D134 D135 D136 D137 D138 D139 D140 D141 D142 D143 D144 D145 D146 D147 D148 D149 D150 D151

R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14 R15 R16 R17 R18 R19 R20 R21 R22 R23 R24 R25 R26 R27 R28 R29 R30 R31 R32 R33 R34 R35 R36 R37 R38 R39 R40 R41 R42 R43 R44 R45 R46 R47 R48 R49 R50 R51 R52 R53 R54 R55 R56 R57 R58 R59 R60 R61 R62 R63 R64 R65 R66 R67 R68 R69 R70 R71 R72 R73 R74 R75 R76 R77 R78 R79 R80 R81 R82 R83 R84 R85 R86 R87 R88 R89 R90 R91 R92 R93 R94 R95 R96 R97 R98 R99 R100 R101 R102 R103 R104 R105 R106 R107 R108 R109 R110 R111 R112 R113 R114 R115 R116 R117 R118 R119 R120 R121 R122 R123 R124 R125 R126 R127 R128 R129 R130 R131 R132 R133 R134 R135 R136 R137 R138 R139 R140 R141 R142 R143 R144 R145 R146 R147 R148 R149 R150 R151 R152 R153 R154 R155 R156 R157 R158 R159 R160 R161 R162 R163 R164 R165 R166 R167 R168 R169 R170 R171 R172 R173 R174 R175 R176 R177 R178 R179 R180 R181 R182 R183 R184 R185 R186 R187 R188 R189 R190 R191 R192 R193 R194 R195 R196 R197 R198 R199 R200 R201 R202 R203 R204 R205 R206 R207 R208 R209 R210 R211 R212 R213 R214 R215 R216 R217 R218 R219 R220 R221 R222 R223 R224 R225 R226 R227 R228 R229 R230 R231 R232 R233 R234 R235 R236 R237 R238

Z1 Z2 Z3 Z4 Z5 Z6 Z7 Z8

TP1 TP2 TP3 TP4

SIG COM DIG COM RATIO COM GUARD

+15V 0V -15V +5V AN O/P HI AN O/P LO

11 OFF CONNECTOR 601002

ENVIRONMENTAL SHIELD 450006 HELD ON BY 4 LINKS (10 mm HIGH) SOLDERED INTO PCB. 540002

4 OFF INSULATING BEAD 630036

13 OFF BUTTON 700020

SHROUD 630026 (NUT & WASHER NOT FITTED)

WIRE LINK TO P.C.B 540002

TO PIN B (RED)
TO R4 (C) (RED)
TO PIN D (RED)
TO PIN 'A' (RED)

RELAY WIRING

ALL UNSTRIPPED WIRE LENGTHS = 2" (50223 REQD)
ALL WIRE TERMINATIONS TO BE SLEEVED (5

6 OFF M3 STANDOFF 612003

1/P CABLE ASSY 400064

5 OFF CLOVERLEAF 620001

5 OFF PTFE STANDOFF 620002

10 OFF TERMINAL RIVET 620003

INSULATING BEAD 630036 THREADED ONTO PIN 6 OF M23 BEFORE CONNECTING R90

4 OFF F.S.V. TERMINAL 602001

NOTES:

1. OTHER ITEMS REQD TO ASSEMBLE P.C.B:
   1 OFF RELAY BRACKET 459112, SECURED BY SCREW (611004) & NUT (615002) & SHAKEPROOF (613008)
   1 OFF 16-WAY D.I.L. SOCKET 605038
   4 OFF 14-WAY D.I.L. SOCKET 605037
2. TEST POINT LOOPS (TP1 ETC) MADE FROM 24 SWG. B.T.C. WIRE (540001). CUT AS REQD
3. ALL WIRE LINKS TO BE SLEEVED (540001/590004)
4. J1 AND J2 TO BE SOLDERED TO UNDERSIDE OF BOARD
5. FIT UPPER GUARD SHIELD (450009) WITH 8 OFF POSICSK SCREWS M3X6 (611007) FIT LOWER GUARD SHIELD (450010) WITH 6 OFF POSIPAN SCREWS M3X10 (611006) AND 6 OFF M3 SHAKEPROOF (613006)

REVISION	DATE	REVISION	DATE	REVISION	DATE	REVISION	DATE
31	28.3.76 ECO 681	2	12-10-76 ECO 139	17	29/10/75 ECO 117	2	18/5/75 ECO 81
32	10.3.76 ECO 682	2	16.2.76 ECO 354	18	10/11/75 ECO 127	3	29/8/75 ECO 64
33	8.6.76 ECO 881	2	30.3.77 ECO 447	19	18/12/75 ECO 129	4	3/7/75 ECO 78
		2	8.3.77 ECO 471	20	2/1/76 ECO 181	5	29/8/75 ECO 88
		2	6.7.77 ECO	21	5.8.76 ECO 189	14	5/8/75 ECO 89
		29	18.7. ECO	22	14.4.76 ECO 129	15	5/8/75 ECO 98
		30	8.9.77 ECO 647	23	6.4.76 ECO 216	16	3/10/75 ECO 116

REVISION	DATE
	23-10-74

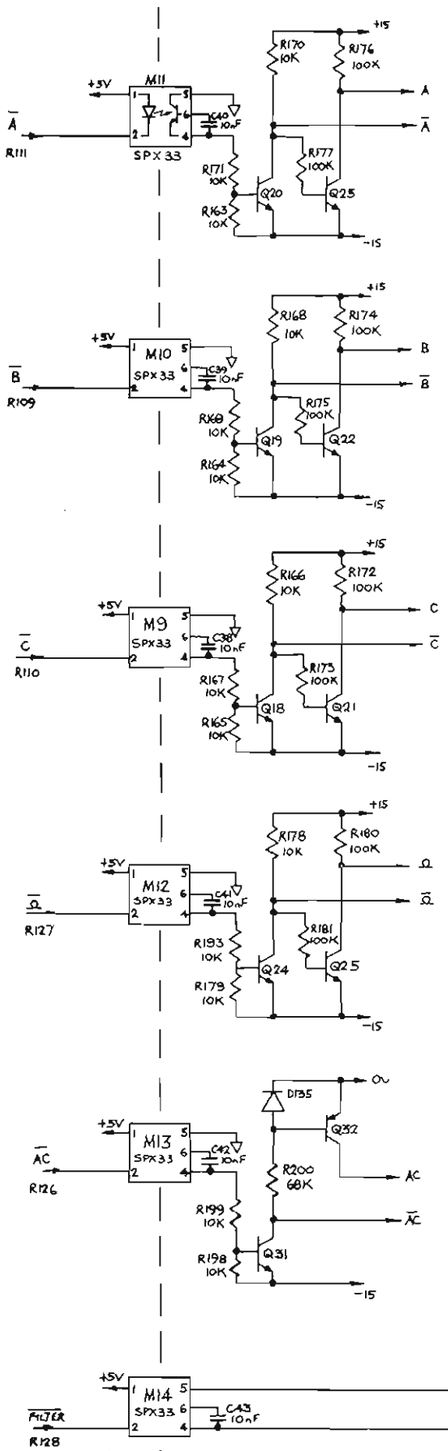
datron ELECTRONICS LTD

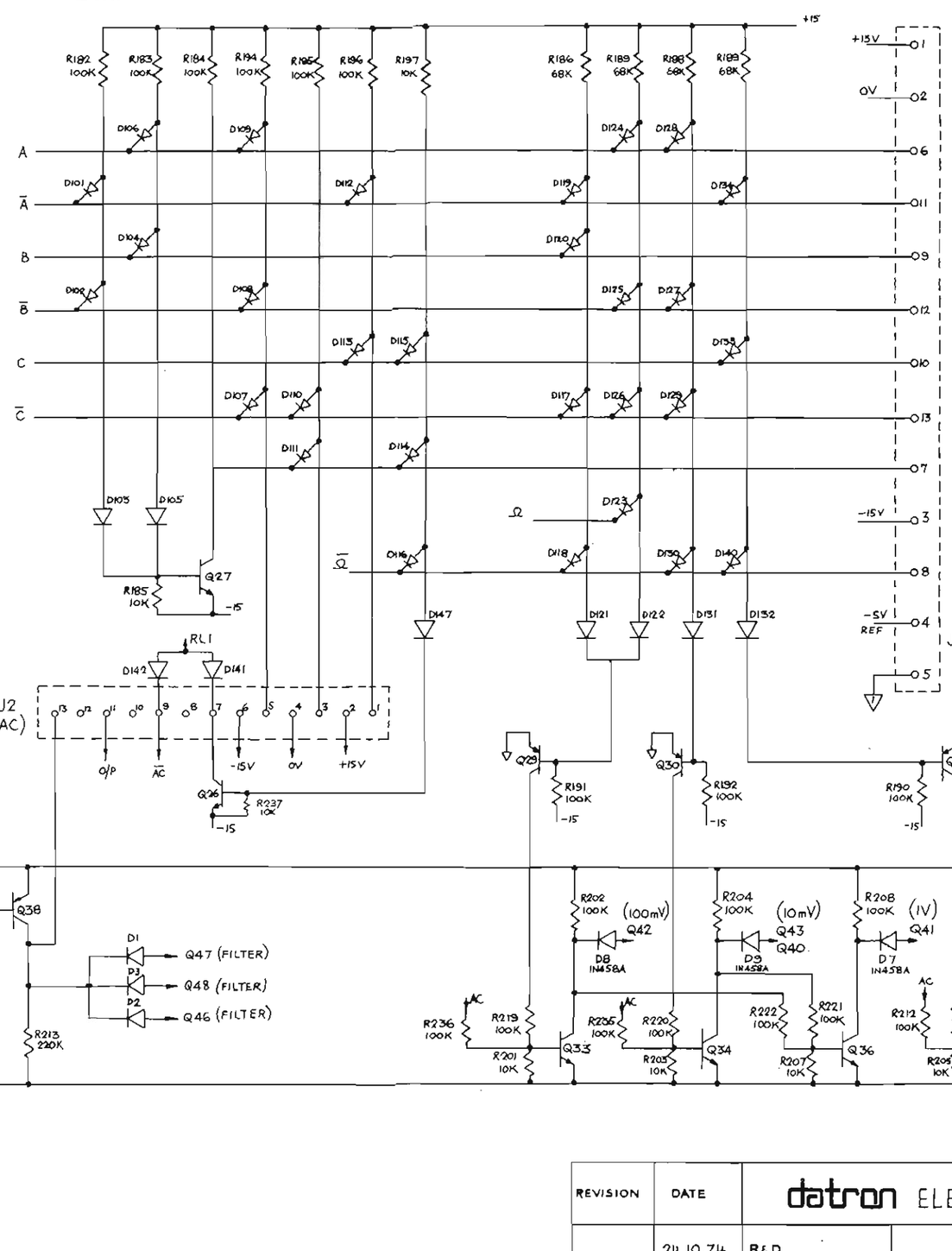
R&D
CHECK
PROD L.A.D. 2.2.77

1051 DC ISOLATOR

400087

SHEET 1 OF 12





ISS	CHANGE
12	ECO 525-2. R87, R88 Add. SHT 2. 16.3.77 PSH
13.	SHT. 3. ECO 547
14	ECO. G51 Jo. 3.78 M9 - M14 WERE FCD820 OPTO's.
15	ECO G52 24.5.78 SHT. 2.

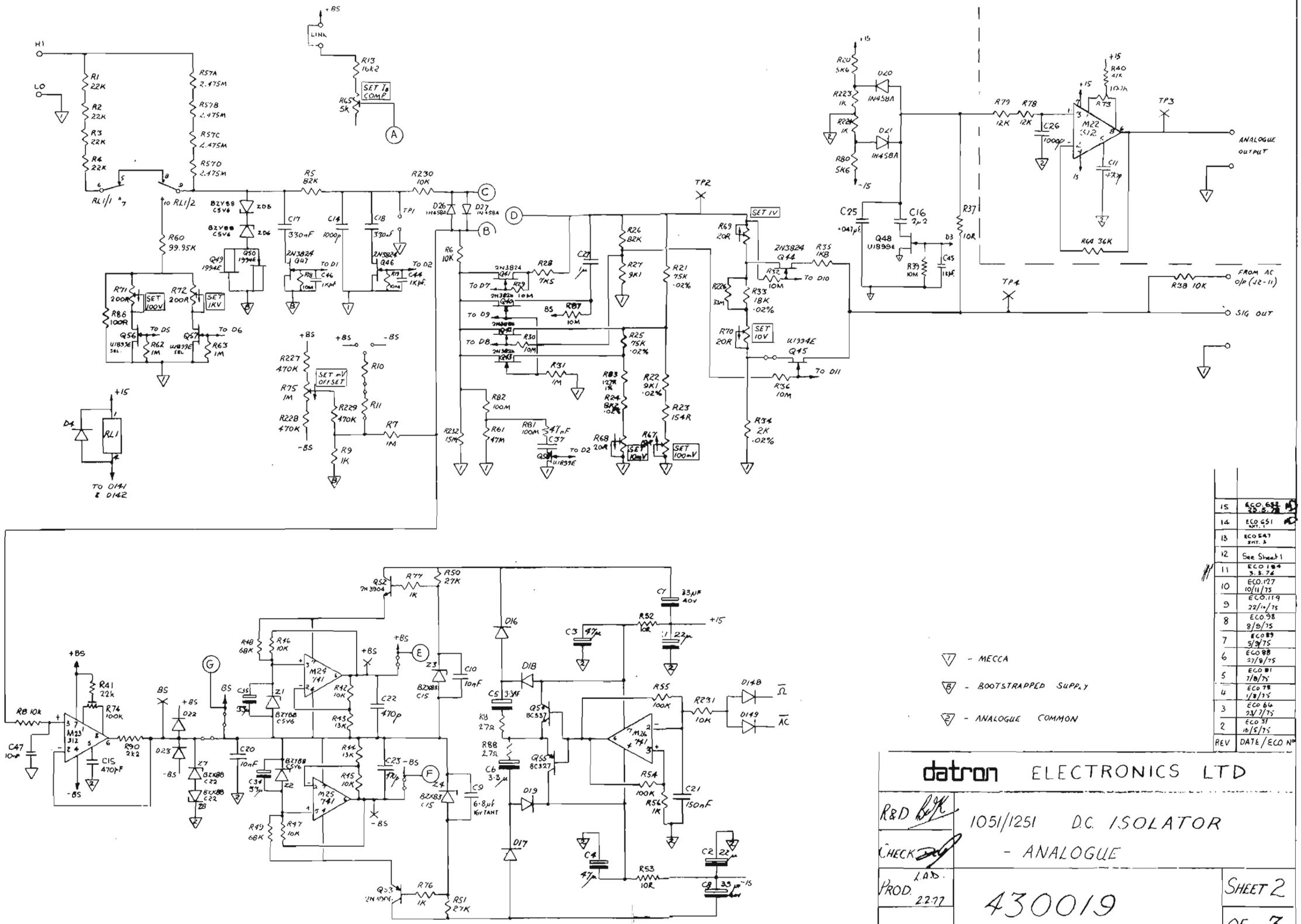
NOTES:

1. SOCKETS J1 & J2 NOT FITTED TO 1251 ASSYS.

2. UNMARKED DIODES IN4148

BC184K BC214K

REVISION	DATE	datron ELECTRONICS LTD.		
	24.10.74	R&D	1051 / 1251 D.C. ISOLATOR RANGE DECODING.	
1 SEE E.C.O.	11.4.75.	CHECKED		
2 E.C.O. 78	1/8/75	PROD. L.A. Dunn. 2.2.77	430019	SHEET 1
3 E.C.O. 119				OF 3



REV	DATE / ECO No
15	ECO 652 29.5.78
14	ECO 651 amt. 1
13	ECO 647 amt. 3
12	See Sheet 1
11	ECO 184 3.3.76
10	ECO 127 10/11/75
9	ECO 119 22/10/75
8	ECO 98 8/9/75
7	ECO 89 5/9/75
6	ECO 88 27/8/75
5	ECO 81 7/8/75
4	ECO 78 1/8/75
3	ECO 64 23/7/75
2	ECO 31 16/5/75

datron ELECTRONICS LTD

R&D	1051/1251 D.C. ISOLATOR - ANALOGUE
CHECK	
PROD. L.A.D. 2.2.77	430019
	SHEET 2 OF 3

J4	FUNCTION
PIN 1	FILTER
2	+5V
3	NOT USED
4	$\overline{AC}$
5	$\overline{\Omega}$
6	NOT USED
7	RATIO
8	NOT USED
9	0V
10	NOT USED
11	NOT USED
12	$\overline{REM}$
13	AUTO
14	RANGE CODE
15	RANGE CODE
16	RANGE CODE

S1-S7 INTERLOCKED

S1 10M
S2 1KV
S3 100V
S4 10V
S5 1V
S6 100mV
S7 10mV

AUTO S8
S9 REM
S10 FILTER

S11-S13 INTERLOCKED

S11 AC
S12 DC
S13 Ω

M1 74C157
M2 74C193
M8 74C157
M6 74C42

STROBE J3-1
UP J3-15
DOWN J3-14
RANGING J3-2
AUTO J3-7
REM J4-12
J4-16
J4-15
J4-14
J4-13
J4-11
J4-5
J4-4
J4-1
J3-15
J3-16
J4-9
J3-8 FI
J3-6 DP1
J3-5 DP2
J3-4 DP3
J3-3 DP4
J3-9 DC
J3-12 Ω
J3-10 AC
J3-11 FILTER

1 ALL UNMARKED TRANSISTORS BC184K.
2 SWITCHES S11, S12 & S13 REMOVED FROM ASSY FOR 1251

ISS	REVISION	DATE	datron ELECTRONICS LTD.	
12 SHT 1			R&D	1051 / 1251 D.C. ISOLATOR RANGE LOGIC.
13 ECO 547 27.9.77				
14 ECO 631 SHT. 1				
15 ECO 631 SHT. 2	1 E.C.O. 42	1/5/75	CHECK	
	2 E.C.O. 88	27/8/75	PROD. L.A.B. 2.2.77	430019 SHEET 3
	3 ECO 131	2/1/76		OF 3

DRAWING No. 400322

FIRST USED ON

THIRD ANGLE PROJECTION

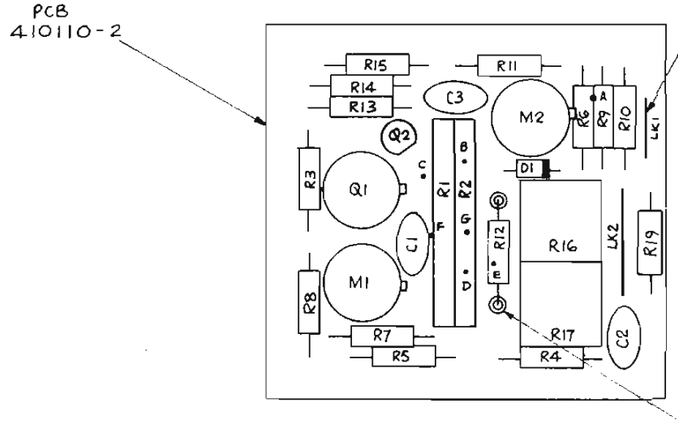
DRAWN IN ACCORDANCE WITH BS 308

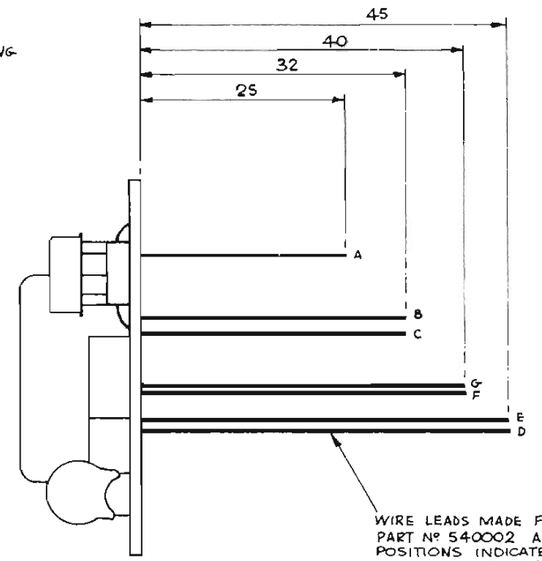
ALL BURRS TO BE REMOVED

NOTES

1. RESISTORS R1 & R2 MUST BE BONDED TOGETHER (IS.12) TO GIVE GOOD THERMAL CONTACT BETWEEN BODIES.

ISS.	CHANGES
A	1ST DRAWN IL. 11. 77
B	R19 ADDED. R13 & R15 REVERSED R1 R2 WERE 10M MATCHED PAIR NOW 18M M/PAIR. IL. 15.3.78
C	VIEW SHOWING WIRE LEAD LENGTHS ADDED. LK2 ADDED. R18 DELETED. IL. 17.3.78
D	ISSUE 2 PCB ECO 629 BJ 30-3-78
E	PARTS LIST MODS - M1. M2. PART Nº WAS 290007 IL. 12.6.78





WIRE LEADS MADE FROM 22 SWG BTC WIRE PART Nº S40002 AND SOLDERED INTO POSITIONS INDICATED A-G ON UNDERSIDE OF PCB. CUT APPROX TO LENGTHS SHOWN

DRAWN IL.	CHECKED	DIMENSIONS IN MILLIMETRES	TOLERANCES ANGULAR ± ½° INCH DIMENSIONS DECIMAL TO 3 PLACES ± .005; DECIMAL TO 2 PLACES ± .010; FRACTIONAL ∓ 1/64. METRIC DIMENSIONS DECIMAL TO 2 PLACES ± .1mm; DECIMAL TO 1 PLACE ± .2mm; WHOLE DIMENSIONS ∓ .4mm. UNLESS OTHERWISE STATED	MATERIAL ———	datron ELECTRONICS LTD. NORWICH.	DRAWING SIZE A2
TRACED	APPROVED	SCALE 2:1 NOT TO BE SCALED		FINISH ———	TITLE 1051 & 1055 – INPUT AMP PCB. ASSY.	DRAWING No. 400322
DATE 23.11.77	DATE					SHEET 1 OF

J.W.1982

DRAWING No. 430322

FIRST USED ON

THIRD ANGLE PROJECTION

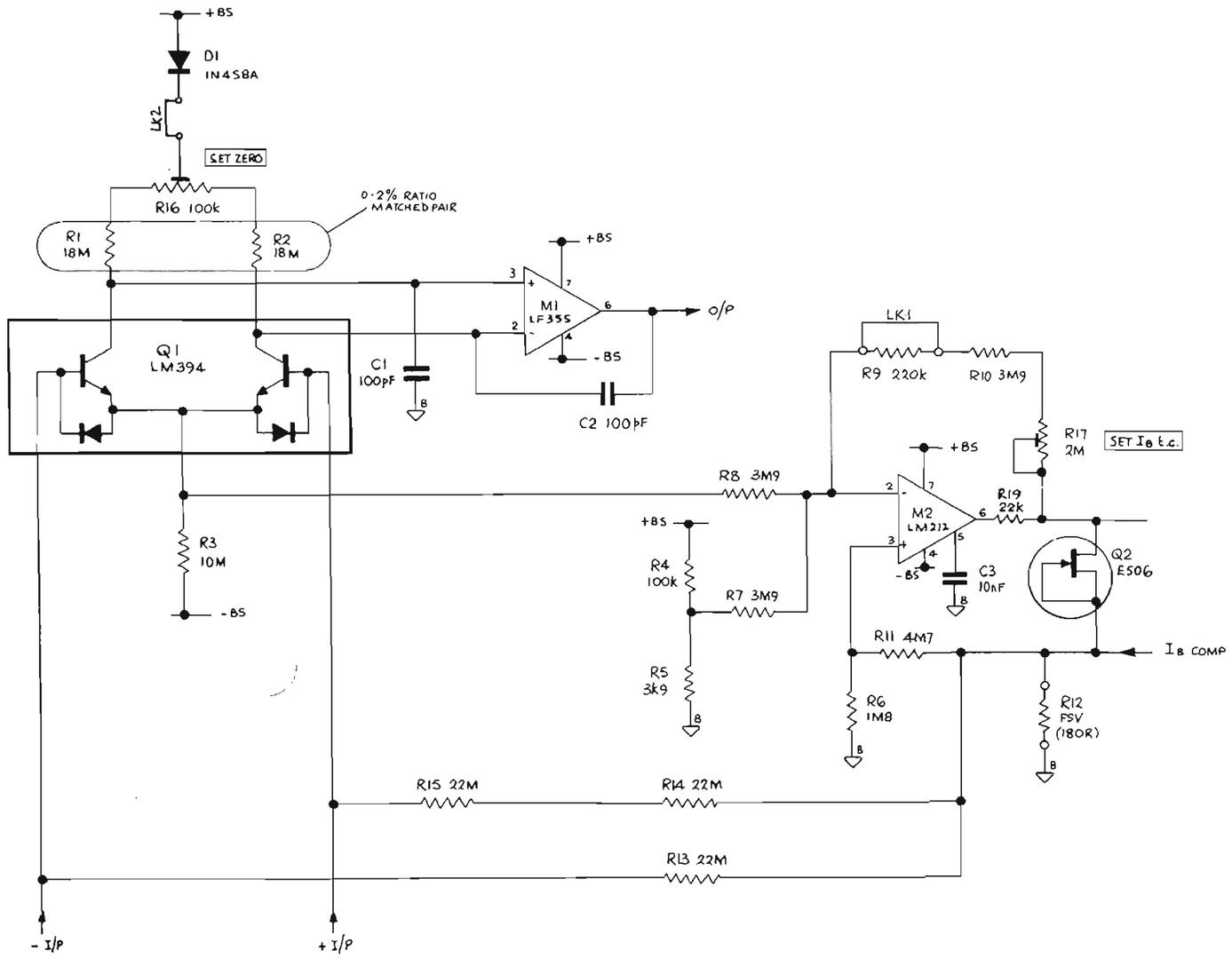
DRAWN IN ACCORDANCE WITH BS 308

ALL BURRS TO BE REMOVED

NOTES

1. (A) DENOTES POSITION OF SLEEVED LINK TO ANALOGUE PCB. - SEE SCHEMATIC 430030/S22.
2. ↓B = BOOTSTRAPPED COMMON

ISS	CHANGES
A	24.11.77
B	R1 R1 WERE 10M MATCHED PAIR R19 ADDED GEN. NOTATION MODS SHOWN. IL 15.3.78
C	M1.M2 WERE LM312N. IL. 12.6.78.



REF. TO 430019

- (A) — I_B COMP
- (B) — INV. I/P
- (C) — NON INV. I/P
- (D) — O/P
- (E) — + BS
- (F) — - BS
- (G) — BS

DRAWN I.	CHECKED	DIMENSIONS IN MILLIMETRES	TOLERANCES ANGULAR ± ½° INCH DIMENSIONS DECIMAL TO 1 PLACES ± .005; DECIMAL TO 2 PLACES ± .010; FRACTIONAL ± 1/64 METRIC DIMENSIONS DECIMAL TO 2 PLACES ± 1mm; DECIMAL TO 1 PLACE ± 2mm; WHOLE DIMENSIONS ± 4mm UNLESS OTHERWISE STATED	MATERIAL —	datron ELECTRONICS LTD. NORWICH.
TRACED	APPROVED	SCALE — NOT TO BE SCALED		FINISH —	TITLE 1051 & 1055. INPUT AMP SCHEMATIC
DATE 24.11.77	DATE				DRAWING No. 430322

DRAWING SIZE A2

SHEET 1 OF 1

J.W 1962

DRAWING No. 400037

FIRST USED ON 1041

THIRD ANGLE PROJECTION

DRAWN IN ACCORDANCE WITH BS 308

ALL BURRS TO BE REMOVED

NOTES

1. FIT GUARD SHIELD (450012) WITH
   4 OFF M3x8 POZIPAN SCREW (611016)
   4 OFF SHAKE PROOF M3 (613005)
2. RELAY WIRING:
   ALL UNSTRIPPED WIRE LENGTHS ± 50mm (510999)
   ALL WIRE TERMINATIONS TO BE SLEEVED (590001)
3. C55, 56 & 59 SLEEVED WIRE 13·0mm LONG
   HOOK ENDS TO RETAIN SLEEVE (590002/590004)

ISS.	CHANGES
19	REDRAWN TO INCLUDE ECO 423 5-4-77 PJH
20	ECO. 542 26.9.77 PT. LTS CHANGES. IL
21	ECO. 695. 30.5.78 PARTS LIST MODS IL
22	ECO. 865. 16.7.78 SUPPR GUARD SHIELD 450152 DELETED IL.

½" 28 SWG BRASS STRIP (630033) SOLDER TO PCB

TEST POINT WIRE LOOP 12 OFF (540002)

STANDOFF 4OFF 612005

PINS 604004 FIT OTHER SIDE

8 OFF CLOVERLEAF 620001

SOLDER PINS 7 OFF 620003

AC INPUT LEAD 400084

'P' CLIP 630003

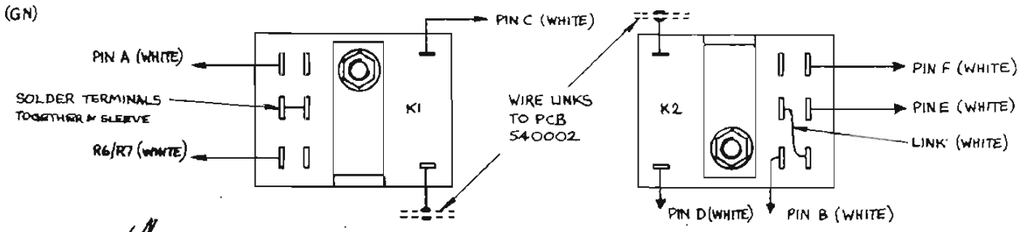
FIT WITH :-
M3x8 POZIPAN (611016)
M3 SHAKEPROOF (613005)
M3 NUT (615002)

SINGLE STRAND (GN)

PCB 410006-- .

FIT SOCKET STRIP 602004 16 OFF
DO NOT FIT DIL BUCKET

FIT ON ASSY DO NOT SOLDER



4 OFF DIODES SLEEVED BLACK SLEEVING 590011

FIT RELAYS K1, K2 WITH :-

RELAY BRACKET	(459112)	2 OFF
M3x8 POZIPAN	(611016)	2 OFF
M3 SHAKEPROOF	(613005)	2 OFF
M3 NUT	(615002)	2 OFF

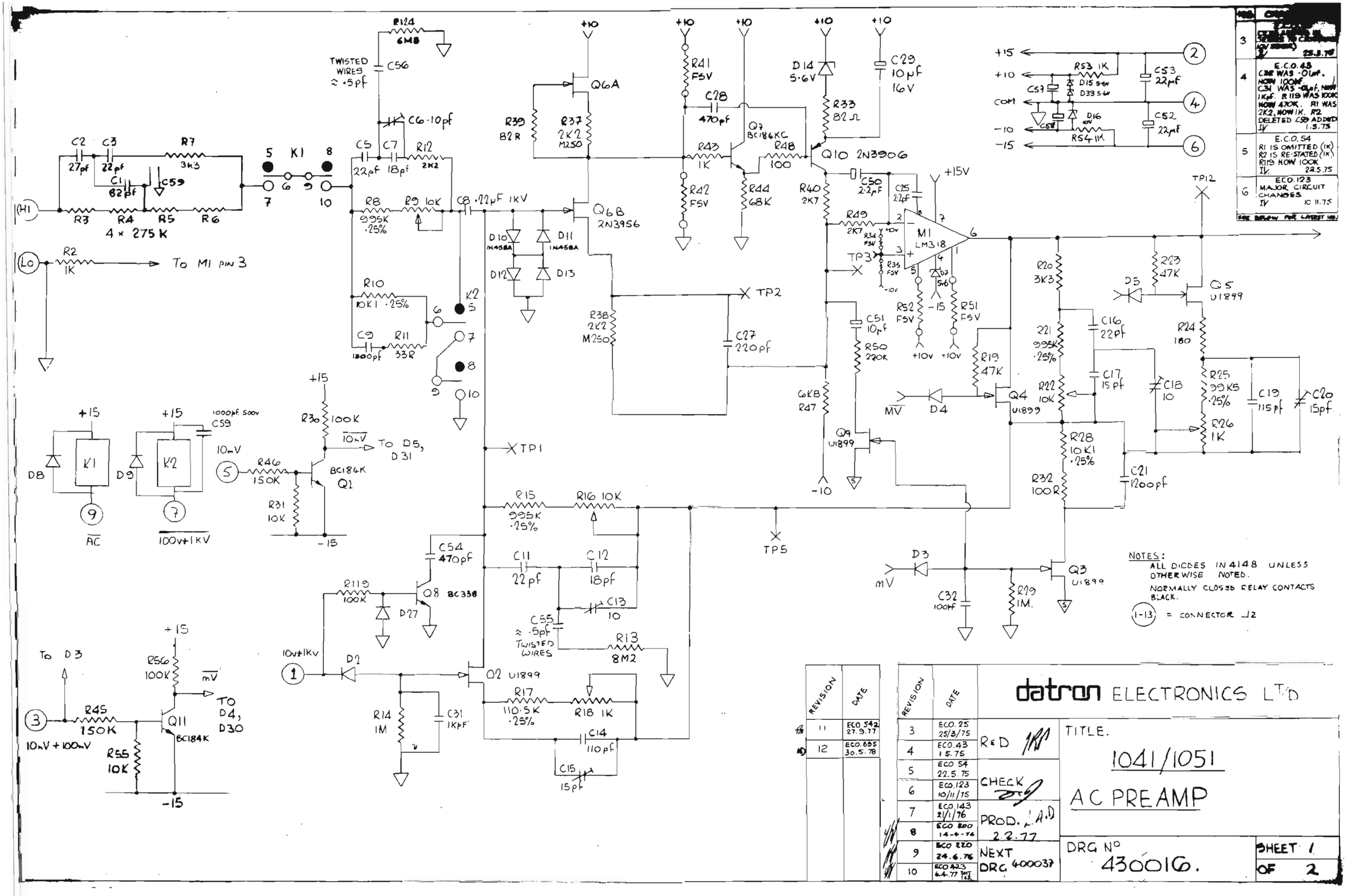
DRAWN PJH	CHECKED.	DIMENSIONS IN MILLIMETRES	TOLERANCES ANGULAR ± ½° INCH DIMENSIONS: DECIMAL TO 3 PLACES ± .005; DECIMAL TO 2 PLACES ± .010; FRACTIONAL ± 1/64. METRIC DIMENSIONS: DECIMAL TO 2 PLACES ± 1mm; DECIMAL TO 1 PLACE ± 2mm; WHOLE DIMENSIONS ± 4mm. UNLESS OTHERWISE STATED	MATERIAL ——	DRAWING SIZE A2
TRACED	APPROVED				
DATE 5.4.77	DATE 7.4.77	SCALE NOT TO BE SCALED		FINISH ——	

datron ELECTRONICS LTD. NORWICH.

TITLE A C OPTION 01 ASSEMBLY

DRAWING No. 400037

SHEET 1 OF 13



3	[illegible] 23.8.75
4	E.C.O. 43. C38 WAS ·01mf. NOW 100MF. C34 WAS ·01mf, NOW 1Kpf. R119 WAS 100K NOW 470K. R1 WAS 2K2, NOW 1K. R12 DELETED C59 ADDED IV 1.5.75
5	E.C.O. 54. R1 IS OMITTED (1K) R2 IS RE-STATED (1K) R119 NOW 100K IV. 22.5.75
6	ECO.123 MAJOR CIRCUIT CHANGES. IV 10.11.75

SEE BELOW FOR LATEST NO.

NOTES:
ALL DIODES IN4148 UNLESS OTHERWISE NOTED.
NORMALLY CLOSED RELAY CONTACTS BLACK.
(1-13) = CONNECTOR J2

REVISION	DATE
11	ECO 542 27.9.77
12	ECO.695 30.5.78

REVISION	DATE
3	ECO. 25 25/3/75
4	ECO.43 1.5.75
5	ECO 54 22.5.75
6	ECO.123 10/11/75
7	ECO 143 21/1/76
8	ECO 800 14-4-76
9	ECO 220 24.6.76
10	ECO 423 6.4.77 SMT

datron ELECTRONICS LTD

R&D IRP
CHECK
PROD. J.A.D 2.2.77
NEXT DRG 400037

TITLE.
1041/1051
AC PREAMP

DRG Nº 430016.

SHEET 1 OF 2

ISS	
4	ECO. [illegible] R108 WAS 100K NOW 470K. 1.5.75
5	ECO. 54 R105 CHANGED BACK TO 100K 29.5.75
	SEE BELOW FOR LATEST ISSUE No.

FROM PRE-AMP (TP2)

R131 10M · E106 · Q23 Q24 Q25 · R132 1M · C22 22µF/16V · C23 22µF/16V · C10 100pF/63V · C4 100pF/16V · R133 · R36 2M · 45V · -PA

C34 470pF · R76 47K · R77 100K · +15

R78 6K8 · R79 100R · Q12 · Q13 · 2N3906 · Q20 · C37 10nF 16V · R80 820R · R85 10K · R86 18K · TP6

C33 1000pF · R58 3K3 ·25% · D18 · D19 · 3K3 R75 · R81 100R · M2 101 · R83 10K · Q14 2N3906 · R82 1K8 · R84 10K · -15

TP8 · C41 1.5µF · R73 1R · R72 FSV (68K) · R102 10K · C40 .01 · R103 100K · -15

D23 HSCH1001/1N6263 · D24 HSCH1001/1N6263 · R59 3K3 ·25% · R74 9K1

D22 HSCH1001/1N6263 · R61 100 · R60 8K95 ·25% · R87 4K7

D29 · R127 68K · R126 10M · R128 FSV (1M2) · R125 FSV (10K) · R129 2.2M · D30 · D31 · D32 · -V · 10mV

+15 · R88 100K · R90 6K8 · C35 470pF · Q17 · R91 100R · Q18 · 2N3906 · R89 470K · -15V · C38 10pF 16V · C48 47PF · R93 1K2 · TP7 · C36 100pF

R92 1K · R70 30 · R69 FSV (3R3) · R71 27 · 290002

R95 10K · R96 10K · R97 1K8 · Q19 2N3906 · R94 100R · M3 101 · R68 18K

D20 · D21 · 12K ·1% · R98 2M · FSV R100 · FSV R101 · R99 47M · -15

M6 240002

FILTER (13) · D25 · R104 1M · R105 100K · Q15 BC184K · C42 6·8µ · D26 · R106 100K · R107 10M · Q16 U1994 · C43 1·0µF · C44 ·22µF.

R63 100K ·25% · C45 100pF · R64 3K3 · M4 101 · R108 100K · REF · R109 2M · R110 10M

TP9 · C46 100pF · D17 · C47 22pF · 2K14 2K2 · M5 101 · R115 2M · R116 10M · C49 ·33µF 35V · R113 100K · REF

TP10 · TP11 · R111 21K · R66 FSV · R65 100K ·25% · R67 50R · R112 5K · Q21. U1994 · OUTPUT (11) · R123 1M. · D28 · +15V · R120 330K · R121 68K · R122 1M · Q22 BC184K. · (9) AC · -15V

(12) OUTPUT COMMON · REF

ALL OP. AMPS TO ± 15V SUPPLY.

		REVISION	DATE
10	SEE SHT 1	2	27.10.74
11	27.9.77 ECO 542	3	—
12	30.5.78 ECO.695	4	1.5.75 ECO.43
		5	22.5.75 ECO.54
		6	10.11.75 ECO 123
		7	21.1.76 ECO.143
		8	14.4.76 ECO 200
		9	24.6.76 ECO 220

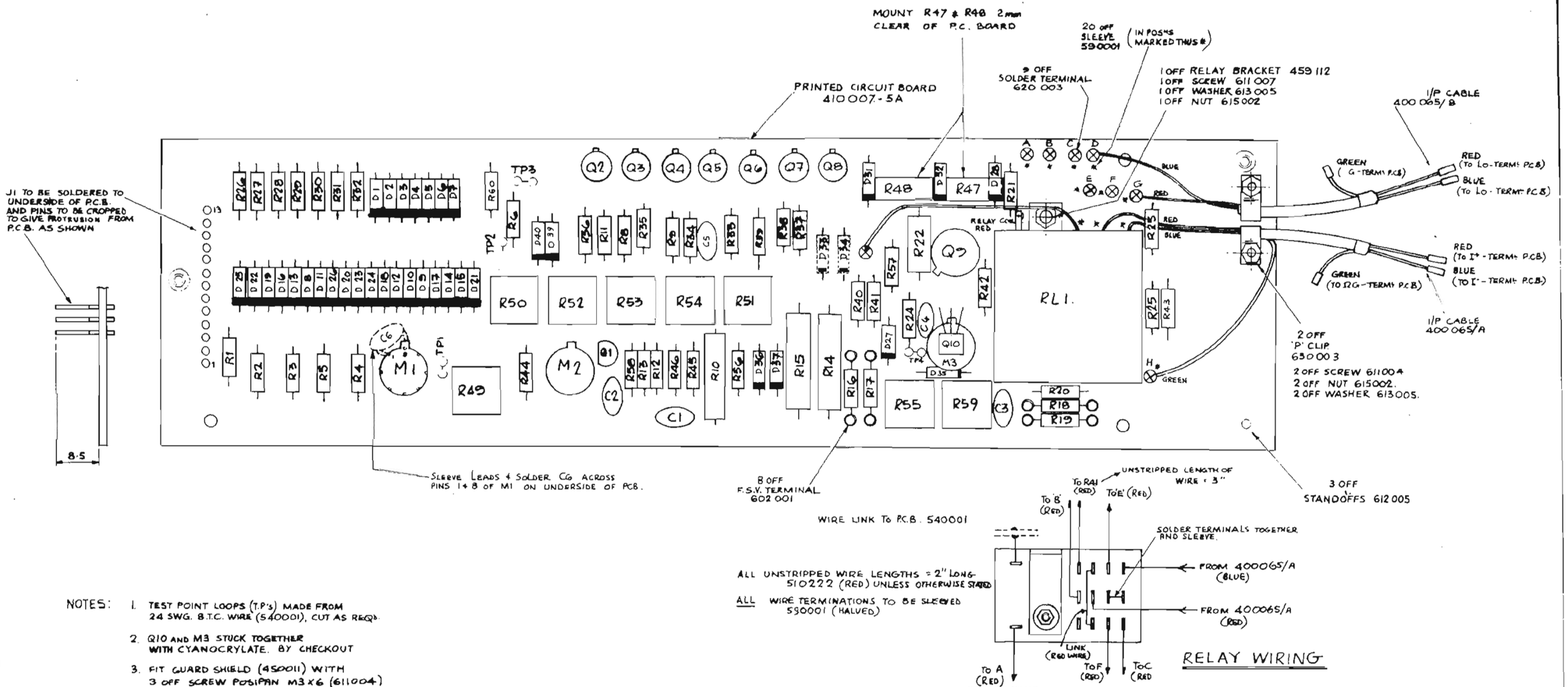
datron ELECTRONICS LTD.

RED · CHECK · PROD L.A.D. 2.2.77 · NEXT DRG 400037

TITLE. AC RMS 1041/1051

DRAWING Nº 430016

SHEET 2 OF 2



RELAY WIRING

ALL UNSTRIPPED WIRE LENGTHS = 2" LONG 510222 (RED) UNLESS OTHERWISE STATED

ALL WIRE TERMINATIONS TO BE SLEEVED 590001 (HALVED)

NOTES:

1. TEST POINT LOOPS (T.P's) MADE FROM 24 SWG. B.T.C. WIRE (540001), CUT AS REQ'D.
2. Q10 AND M3 STUCK TOGETHER WITH CYANOCRYLATE. BY CHECKOUT
3. FIT GUARD SHIELD (450011) WITH 3 OFF SCREW POSIPAN M3x6 (611004) AND 3 OFF M3 SHAKPROOF (613005)
4. SLEEVE D33, D34 WITH BLACK SLEEVING (590011)

PIN REF	LEAD DESTINATION	WIRE COLOUR	
A	RELAY COIL. PIN 1	RED	
B (I+)	" COMMON. " 12	RED	
C (I-)	" N/O " 10	RED	
D	Lo (TERM. P.C.B)	BLUE	
E	RELAY N/C. PIN 14	RED	
F	" N/C " 8	RED	
G	Lo (TERM. P.C.B.)	RED	
H	ΩG (" ")	GREEN	
R41	RELAY N/C PIN 11	RED	

L.A.D.

REVISION	DATE		REVISION	DATE
11	9-9-76 ECO 274			19/5/75
12	31.3.77 ECO. 425		4	10/9/75 ECO. 101
13	24.9.77 ECO 520		5	3/10/75 ECO. 113
14	14-3-78 ECO 602		6	2/1/76 ECO. 138
15	15.3.78 ECO. 658		7	27.2.76 ECO. 169
16	30.5.78 ECO. 696		8	3.3.76 ECO. 181
			9	6.8.76. ECO 195
			10	6.8.76. ECO 204

datron ELECTRONICS LTD

DRD

CHECK

PROD L.A.D. 2.3.77

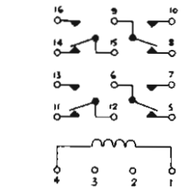
NEXT DRG.

TITLE

1051 Ω CARD: PCB ASSEMBLY

DRAWING N° 400089

SHEET 1 OF 5



VIEW ON RELAY BASE.

NOTE: D8 - D26 = IN4148 DEVICES
D1 - D7 = IN458A DEVICES.

REVISION	DATE	REVISION	DATE	datron ELECTRONICS LTD	
5	6.5.76 ECO 195		23.5.75	R&D IL	TITLE: 1051 Ω CARD SCHEMATIC.
6	21.9.77 ECO. 520				
7	14-3-78 ECO 602	2	10/9/75 E.C.O. 101	CHECK	
8	30.5.78 ECO. 696				
		3	27.2.76 E.C.O. 168	PROD. I.A.D. 2.2.77	DRAWING Nº. 430027
		4	2.3.76 E.C.O. 181	NEXT DRG	SHEET 1 OF 1

IMPORTANT:

WHEN FITTING T4 TO BOARD, ALL FLYING LEADS SHOULD BE CUT TO SUFFICIENT LENGTH (ALLOW FOR ½" LOOP TO FORM) TO ALLOW TRANSFORMER RADIAL FREEDOM DURING CALIBRATION PROCEDURE

T4 SECURED WITH FOLLOWING:-
1 OFF SCREW (M3×35mm LG) 611019
1 OFF NUT 615010
2 OFF WASHER 618007

11 OFF SLEEVE (IN POS'NS MARKED 'M3 ø') 590001

1 OFF TRANSISTOR MOUNTING KIT 618001

4 OFF 6BA NYLON WASHERS (BETWEEN PCB AND TS) 613011

1 OFF HEAT DISSIPATOR 459139

THE FOLLOWING ITEMS ARE USED TO SECURE M47, M48 & M50:
3 OFF SCREW (M3×10mm LG) 611006
3 OFF NUT 615009
3 OFF SHAKEPROOF M3 (613005)
AL30 SMEAR WITH HEATSINK COMPOUND (900003)

MAINS CONNECTOR 604017

ORANGE
RED
BROWN
BLACK

11 OFF SOLDER TERMINAL 620003

2 OFF TRANSISTOR HEAT DISSIPATOR (M47) (M48) 459138

PURPLE
WHITE
YELLOW
GUARD SCREEN
EARTH SCREEN
BLACK
BLUE
BROWN

18 OFF P.C.V TERMINAL 602001

17 OFF CONNECTOR TERMINAL 601002

3 OFF SLEEVED LINK (340001/380004)

7 OFF SLEEVED LINKS (340001/590004)

3 OFF WIRE LINKS (340001) MARKED '1051'

NOTE: J7 AND J8 TO BE SOLDERED TO UNDERSIDE OF BOARD

M18, M24, M27 & M29 MOUNTED ON SOCKETS (PART No 605039)

STANDOFF M3×12mm 612009 MOUNT UNDERSIDE OF BOARD

3 OFF M3 STANDOFF 612005

POSITION OF DISPLAY PCB ASSY 400088

PRINTED CIRCUIT BOARD 310019-40

ISS	CHANGES.
13	ECO 146. R68 ADDED: M.J.D. 9.2.76.
15	ECO 173 PT. LY. CHANGE PSH. 20.4.76
16	ECO 202 PT.LY CHANGE M.J.D. 12.4.76
17	ECO. 218 PT. LY CHANGE M.J.D. 23.6.76.
18	ECO 217 PT. LY. CHANGE M. J. D. 24.6.76
19	ECO 228 6BA NYLON WASHERS ADDED PSH 19.8.76
20	ECO 286 M47,M48 were 340004 (1A rtg.) PSH 19.10.76
21	PCB Updated to issue 8 BOARD C31, C36, mains connector added 23.11.76 PSH.
22	PTS LY CHANGES. ECO 344 14.12.76. PSH
23	PTS LY CHANGES ECO 446 25.4.77 PSH
24	ECO 451 PSH 19.5.77 C103 was 47µF
25	ECO 382. PCB Updated to change M39 etc 10.5.77 PSH
26	ECO 467 C108, C105 were 0.68µF 19.5.77 PSH
27	ECO 509 DIL SOCKETS changed to ADTRONIX 5.7.77 PSH
28	ECO 540 R104, R106 were 2k7. PSH. 19.7.77
29	ECO 537. PARTS LIST MODS ONLY JL 6.9.77
30	ECO 558 23.9.77 JL STANDOFF M3×12 ADDED
31	ECO 573 6.12.77 5.5µF (for T4/T5) ADDED TO 52 GJ
32	ECO 585 27.1.78 PARTS LIST MOD #5
33	ECO 610 10.4.78 NETWORK NO 7 ON DRAWING FOR MFR. GJ.
34	ECO 649 30.3.78 PARTS LIST MOD JL.
35	ECO 684 24.5.78 PARTS LIST MOD JL.
36	ECO 682 21.7.78 R94 / DOR ADDED & C104 DESIGNATION WAS R94 & C105 WDS

PIN No	PIN FUNCTION	LEAD COLOUR
1	ANAL COMM	GREEN
2	ANAL COMM	GREEN R
3	-15v	BLUE
4	-15v	BLUE R
5	+15v	RED
6	+15v	RED R
7	GUARD	YELLOW
8	SIG. COMM	BLACK
9	SIG. INPUT	ORANGE
10	-5v REF. (10 OHMS)	PURPLE
11	-5v REF-SENSE OUT	BROWN R
12	EXT. REF + IN	WHITE R
13	-5v REF. DRIVE OUT	WHITE/RED R
14	EXT REF. DRIVE	ORANGE/BLK R
15	RATIO LAMP DRIVE	GREY R
16	+5v POWER	RED/BLK R
17	DIGITAL COMMON	PINK R

← R = RATIO ONLY

OTHER ITEMS REQD TO ASSEMBLE P.C.B:
1 16-WAY DIL SOCKET 605038 16 OFF
2 14-WAY DIL SOCKET 605037 17 OFF
3 28 WAY DIL SOCKET 605012 1 OFF

4 TEST POINT LOOPS (TP1 etc) MADE FROM 24 SWG BTC WIRE. (340001) CUT AS REQD

5 UPPER GUARD SHIELD 450058 AND LOWER GUARD SHIELD 450040 SECURED WITH SCREW M3×10 (611006) 6 OFF AND SHAKEPROOF M3 (613005) 6 OFF

REVISION	DATE		
	8/5/75	datron ELECTRONICS LTD	
2 ECO 33	30/5/75	R&D	1051 A-D P.C.B ASSEMBLY
3 ECO 72	5/8/75	CHECK	
8 ECO 22	9/9/75	PROD	400094
9 ECO 111	3/10/75		SHEET 1 OF 22
10 ECO 20	23/10/75		
11 ECO 137	8/1/76		
12 ECO 141	29/1/76		

	A	B	$\bar{A}$	$\bar{B}$
RESET	0	0	1	1
SIG	1	0	0	1
REF 1	0	1	1	0
REF 2	1	1	0	0

* ONE OR OTHER 100Ω RESISTORS MAY BE REMOVED IN TEST

M42, M46 - MC14011CP
M43 - MC14049CP

REV.	DATE	REVISION	DATE
10	ECO 812 23.6.76	2 R&D DRAWN	1/5/75
11	ECO 884 11.11.76	3 ECO 55	23/5/75
12	ECO 946 23.11.76	4 ECO 63	16/6/75
13 (SHT 1)	ECO 946 15.6.77	5 ECO 72	31/7/75
14 (SHT 1)	ECO 451 9.5.77	6 ECO 93	9/9/75
15 (SHT 1)	ECO 482 10.5.77	7 ECO 120	28/10/75
16 (SHT 1)	ECO 827 19.5.77	8 ECO 141	28/1/76
17 (SHT 1)	ECO 833 16.5.77	9 ECO 146	3/2/76

datron ELECTRONICS LTD.

R&D Ir'

CHECK

PROD A.A.D. 7.7.77

1051 / 1251 A-D ANALOGUE SECTION

430026

SHEET 1 OF 4

J3		J7	J8
1	TRANSFER	-	-
2	RANGING	-	-
3	$\overline{DP2}$	-	11
4	$\overline{DP3}$	-	12
5	$\overline{DP2}$	-	13
6	$\overline{DP1}$	-	14
7	AUTO	5	-
8	$\overline{F1}$	-	15
9	$\overline{DC}$	7	-
10	$\overline{AC}$	2	-
11	FILTER	13	-
12	$\overline{S2}$	-	16
13	UP	-	-
14	DOWN	-	-
15	+5V	10	-
16	0V	9	-

J7		J3
1	O_A	-
2	$\overline{AC}$	10
3	$\overline{SIG}$	-
4	$\overline{DELAY}$	-
5	$\overline{AUTO}$	7
6	- VE	-
7	$\overline{DC}$	9
8	+ VE	-
9	0V	16
10	+5V	15
11	$\overline{HOLD}$	-
12	$\overline{COMMAND}$	-
13	FILTER	11
14	$\overline{FP\ OVERRIDE}$	-
15	$\overline{PRINT\ INHIBIT}$	-
16	DATA VALID	-

J8		J3
1	OVERRANGE	-
2	OVERLOAD	-
3	B	-
4	A	-
5	D	-
6	C	-
7	O_C	-
8	O_B	-
9	O_D	-
10	O_E	-
11	$\overline{DP4}$	3
12	$\overline{DP3}$	4
13	$\overline{DP2}$	5
14	$\overline{DP1}$	6
15	$\overline{F1}$	8
16	$\overline{S2}$	12

* R135 IS REPLACED BY CIRCUIT SHOWN THUS, ON 1251 ONLY :

ASST 400238
R2 82K
R1 2M

$\overline{DP1}$ 12 — MΩ 27 — $\overline{S2}$ + $\overline{SC}$ + $\overline{mV}$ 10 — KΩ 28 — V 30

O_B → M4-7
O_C → M4-17
BLANK DP → M4-12
O_D → M4-22

19K R139
22K R138

$\overline{DP4}$ J3-30, J8-11
$\overline{DP3}$ J3-4, J8-12
$\overline{DP1}$ J3-6, J8-14
$\overline{DP2}$ J3-5, J8-13
$\overline{F1}$ J3-8, J8-15
$\overline{\Omega}$ J3-12, J8-16

COMMAND J7-12
HOLD J7-11
PRINT INHIBIT J7-15
RANGING J3-2
FRONT PANEL OVERRIDE J7-14
1051 AUTO J3-7, J7-5
$\overline{AC}$ J3-10, J7-2
DELAY J7-4
1051 FILTER J3-11, J7-13

R140 100K
R127 100K
R129 100K
R130 100K
R131 100K
R134 100K
R135 82K
R128 3K3
C129 1μF
C131 1μF
R157 47K
C130 2.2μF
R132 47K
R133 56K
C134 2.2μF
C117 .33μF
C118 6.8μF
C121 1μF
C132 47μF
R136 10K
C119 10nF
R137 10K
C120 10nF
D42 IN4148
D43 IN4148
D41 IN4148
D44 IN4148
D40 IN4148
D38 HG5009
D39 HG5009
S1 S2 S3
C136 3.3μF
Q55 BC184K
Q52 BC214
Q53 BC214
M27
M24

TRANSFER → M17/10
COMMAND → M21/6
DATA VALID → J1-16

O_D	O_C	O_B	O_A	O_E
1.	0.	0.	0.	0 0

DP1 DP2 DP3 INH

N.B SWITCH S3 NOT FITTED TO 1251 ASSYS.

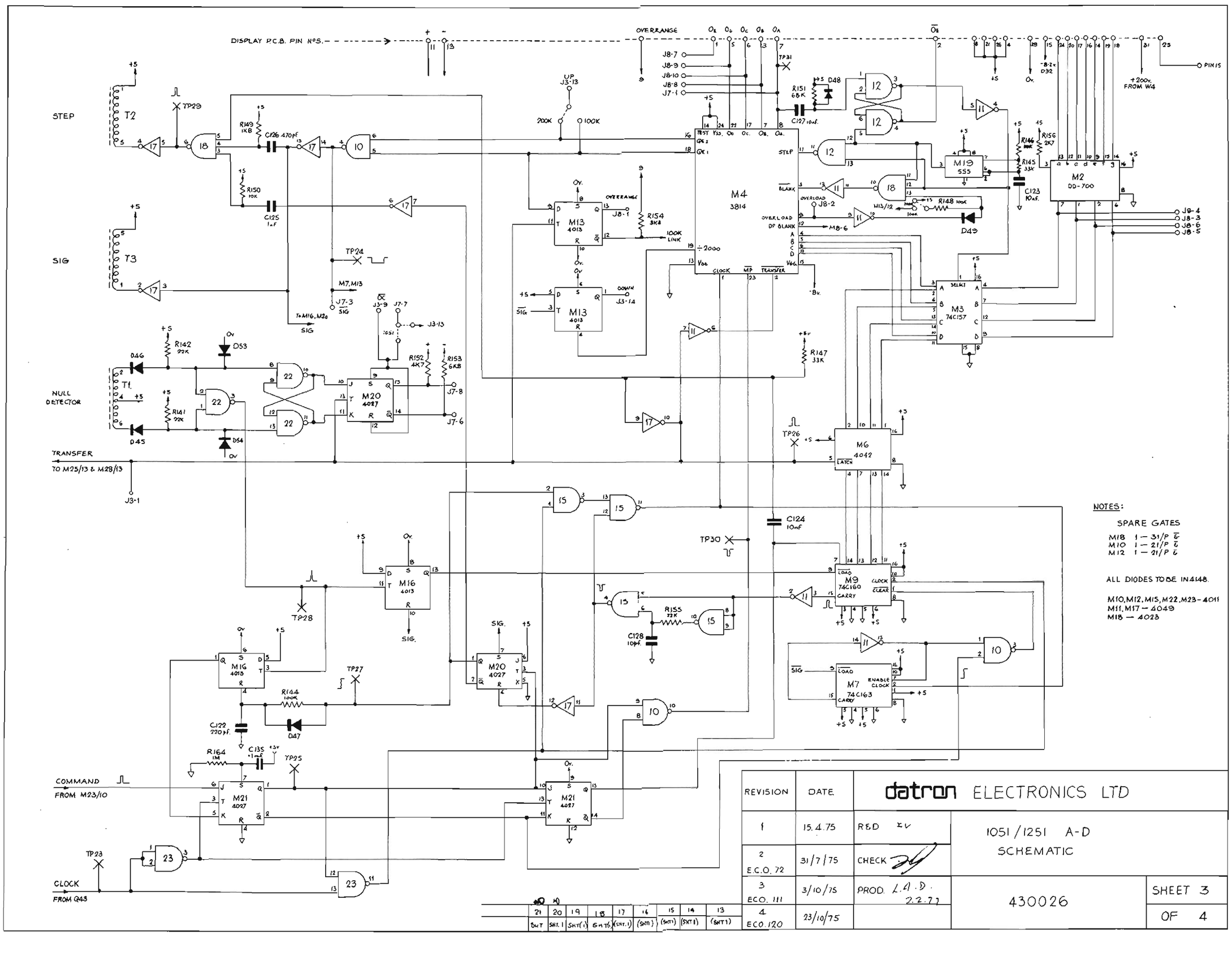
ISSUE	DATE	REVISION	DATE	
15	(SHT 1)		19-2-75	R&D
16	(SHT 1)			
17	(SHT 1)			
18	(SHT 1)	1 ECO 72	23.7.75	CHECK
19	(SHT 1)			
20	(SHT. 1)			
21	(SHT 1)	2 ECO 244	23 11 76	PROD. L.A.D. 2.2.77
		13	(SHT 1)	
		14	(SHT 1)	

datron ELECTRONICS LTD

1051/1251 A-D (DIGITAL)

430026

SHEET 2 OF 4



NOTES:

SPARE GATES

M18 1 — 31/P $\overline{G}$
M10 1 — 21/P G
M12 1 — 21/P G

ALL DIODES TO BE IN4148.

M10, M12, M15, M22, M23 - 4011
M11, M17 — 4049
M18 — 4023

REVISION	DATE		
1	15.4.75	R&D KV	datron ELECTRONICS LTD
2 E.C.O. 72	31/7/75	CHECK	1051/1251 A-D SCHEMATIC
3 ECO. 111	3/10/75	PROD. L.A.D. 2.2.77	430026
4 ECO.120	23/10/75		SHEET 3 OF 4

21	20	19	18	17	16	15	14	13
SHT	SHT. 1	SHT(1)	SHT6	SHT.1	(SHT)	(SHT1)	(SHT1)	(SHT1)

T4
AV
W1
WS02
TP40
M50
MC7805
C102
10nF
C100
33µ
C101
1000µ
C103
+5V
PIN 16
10 RATIO
PIN 17
5 RATIO
TP39
0.1µ
C133
100K
R143
+5V
R100
100K
C131
100µ
R102
1M2
M29
555
C116
10nF
C115
10nF
C24
0.1µF
+5V
R106
330R
R104
5K6
C114
6800pF
R105
5K6
C105
6800pF
R103
150R
L1
T5
Q40
BC184A
Q41
BC184A
Q42
BC339
D39
BY148
CAT
W4
W104
C104
10µ
R108
1M
1200V
DISPLAY PC 8
PIN 31
D38
BC148
REV2
C107
100µH
D34
R107
39K
C106
22µ
-8.2V
TP32
D31
IN4148
M33
Q14
Q11
Q10
Q9
Q5
CLOCK
M23/1
+5
M30
R126
10K
C114
10nF
TP21
TP20
SLOW
FAST
TP33
+5V
R160
47K
R120
100K
R162
47K
R121
15K
Q48
BC214
Q50
BC214
R122
220K
R161
47K
R123
47K
-5V
TP34
R109
1K
R110
10K
R111
1K
R112
1K
SET LINE LOCK
R113
5K73
R114
5K73
220p
C110
R117
1K
220p
C109
Q44
BC184XC
Q47
BC184XC
R118
68K
C112
2.2µF
C111
22µ
D27
IN4148
D37
IN4148
Q43
2N3646
R163
10K
D51
IN4148
Q46
2N3646
Q45
2N3646
R115
82K
R116
82K
R158
1K
R159
1K
TP22
Q49
BC184
D36
BZY88
C10
C113
22µ
R124
22K
Q51
BC184
D34
IN4148
D35
IN4148
R125
27R
-8.2V (033)

REV	DATE	REVISION	TITLE	datron LLLCTRONICS LTD
4	23.11.76		2/75	R&D
13	(SHT1)			1051/1251 A-D
14	(SHT1)	1	14/7/75	(SUPPLIES & LINE LOCKING)
15	(SHT1)	E.C.O. 70		
16	(SHT1)			
17	(SHT.1)	2	31/7/75	L.A.D. 2.3.77
18	(SHT 1)	E.C.O. 72		430026 SHT 4
19	(SHT 1)			OF 4
20	(SHT 1)	3	23/10/75	
21	(SHT 1)	E.C.O. 120		

DRAWING No.	FIRST USED ON
400088	1051

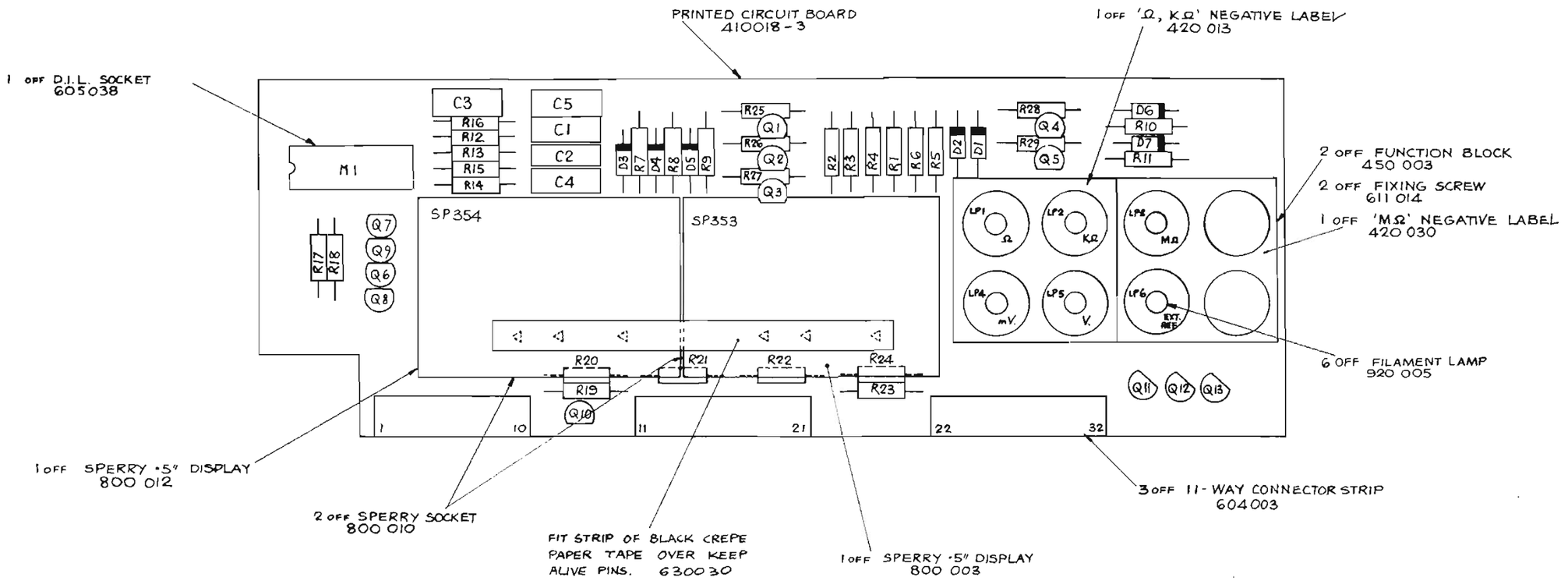
THIRD ANGLE PROJECTION

DRAWN IN ACCORDANCE WITH BS 308

ALL BURRS TO BE REMOVED

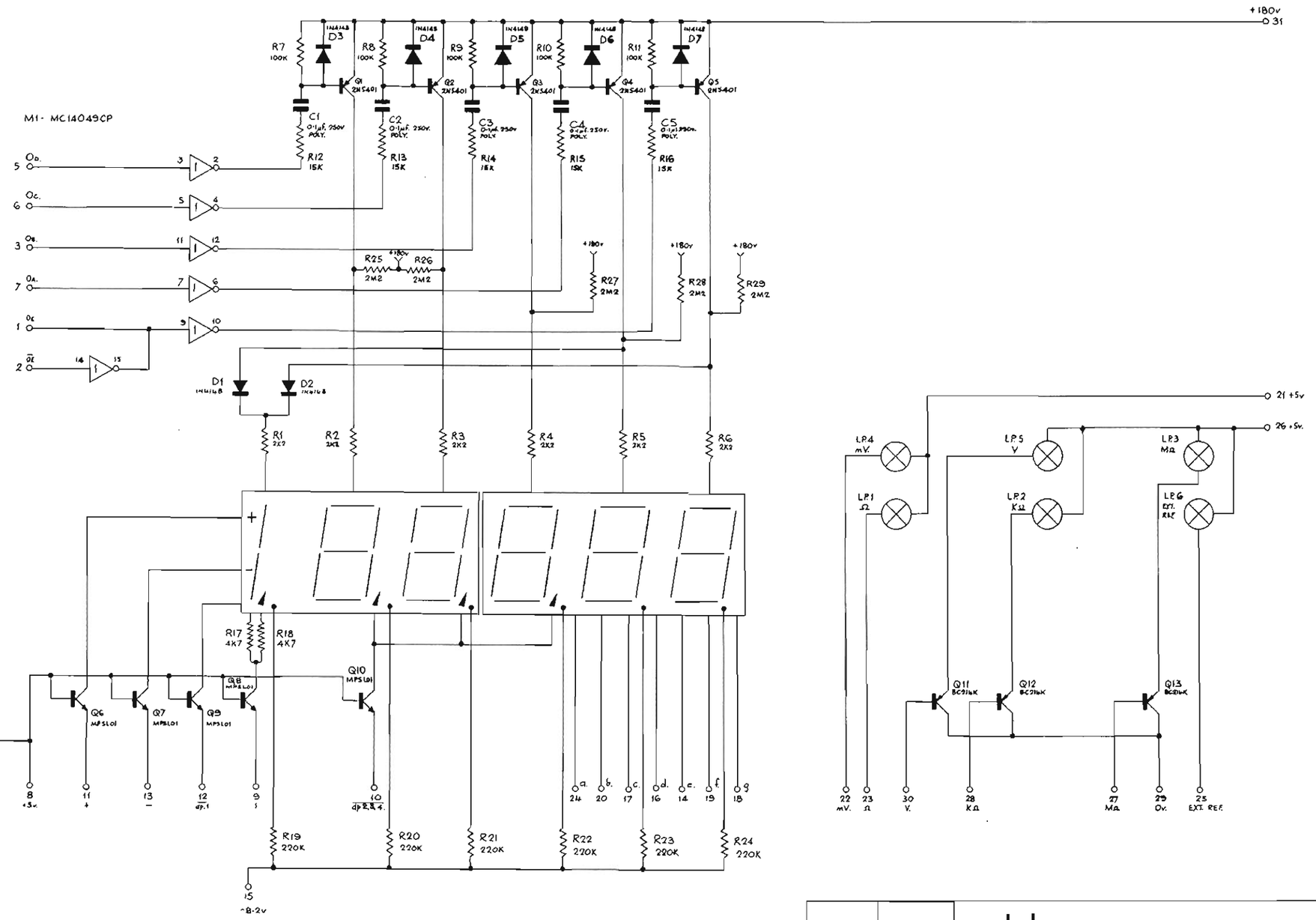
NOTES

ISS.	CHANGES
2	ECO.117 REDRAWN TO REVISED TRACK LAYOUT. IV 7.10.75
3	ECO 319 25.11.76 PCB NOW ISS 3 PJH.
4	ECO 508 5.7.77 DIL SOCKET CHANGE PJH



DRAWN	CHECKED	DIMENSIONS IN	TOLERANCES ANGULAR ± ½°	MATERIAL	datron ELECTRONICS LTD. NORWICH.	DRAWING SIZE
IV	D.J.	MILLIMETRES	INCH DIMENSIONS DECIMAL TO 3 PLACES ± .005 DECIMAL TO 2 PLACES ± .010 FRACTIONAL ± 1/64			A2
TRACED	APPROVED K.A.D.	SCALE 2:1	METRIC DIMENSIONS DECIMAL TO 2 PLACES ± 1mm DECIMAL TO 1 PLACE ± 2mm WHOLE DIMENSIONS ∓ 4mm	FINISH	TITLE 1051 – ·5" SPERRY DISPLAY P.C.B. ASSY	DRAWING No. 400088
DATE	DATE 2.2.77	NOT TO BE SCALED	UNLESS OTHERWISE STATED			SHEET 1 OF 5

J.W.1163



REVISION	DATE	datron ELECTRONICS LTD		
2 REDRAWN	8.4.75.	R&D. I V	1051 ·5" SPERRY DISPLAY SCHEMATIC.	
3 E.C.O. 71	23.7.75	CHECK DCG		
4 E.C.O. 117	21.10.75	PROD. L.A.Dunn 2.2.77	430020	SHEET 1 OF 1

DRAWING No. 400091

FIRST USED ON 1051

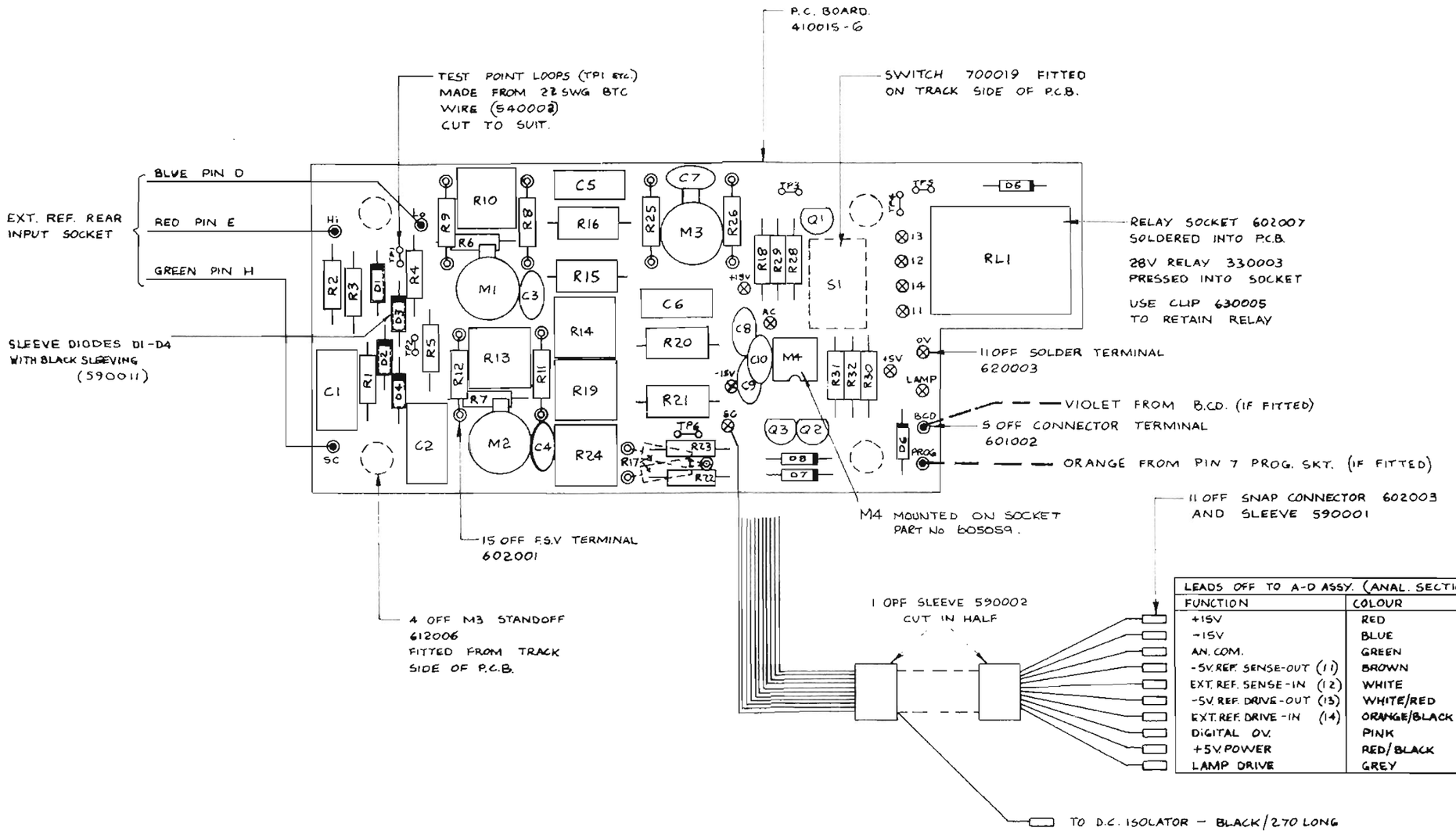
THIRD ANGLE PROJECTION

DRAWN IN ACCORDANCE WITH BS 308

ALL BURRS TO BE REMOVED

NOTES

ISS.	CHANGES
3	REDRAWN NEW LAYOUT M.J.D. 6.2.76
4	REVISED TO ISS.6 NETWORK 10.3.76.
5	D1-D4 SLEEVED ECO 276 DJH
6	ECO. 693. 30.5.78 PARTS LIST (MOD. L.



LEADS OFF TO A-D ASSY. (ANAL. SECTION).

FUNCTION	COLOUR	LENGTH
+15V	RED	100 mm
−15V	BLUE	"
AN. COM.	GREEN	"
−5V. REF. SENSE-OUT (11)	BROWN	"
EXT. REF. SENSE-IN (12)	WHITE	"
−5V. REF. DRIVE-OUT (13)	WHITE/RED	"
EXT. REF. DRIVE-IN (14)	ORANGE/BLACK	"
DIGITAL 0V.	PINK	"
+5V. POWER	RED/BLACK	"
LAMP DRIVE	GREY	"

DRAWN M.J.D.	CHECKED	DIMENSIONS IN MILLIMETRES	TOLERANCES ANGULAR ± ½° INCH DIMENSIONS: DECIMAL TO 3 PLACES ± .005; DECIMAL TO 2 PLACES ± .010; FRACTIONAL ± 1/64. METRIC DIMENSIONS: DECIMAL TO 2 PLACES ± .1mm; DECIMAL TO 1 PLACE ± .2mm; WHOLE DIMENSIONS ± .4mm. UNLESS OTHERWISE STATED	MATERIAL ~	datron ELECTRONICS LTD. NORWICH.	DRAWING SIZE A2
TRACED	APPROVED L.A.D.			FINISH ~	TITLE RATIO AMP (1V I/P) ASSY. 1059/1051	DRAWING No. 400091
DATE 6.2.76	DATE 6/76	SCALE 2:1 NOT TO BE SCALED				SHEET 1

DRAWING No. 430028

FIRST USED ON 1051

THIRD ANGLE PROJECTION

DRAWN IN ACCORDANCE WITH BS 308

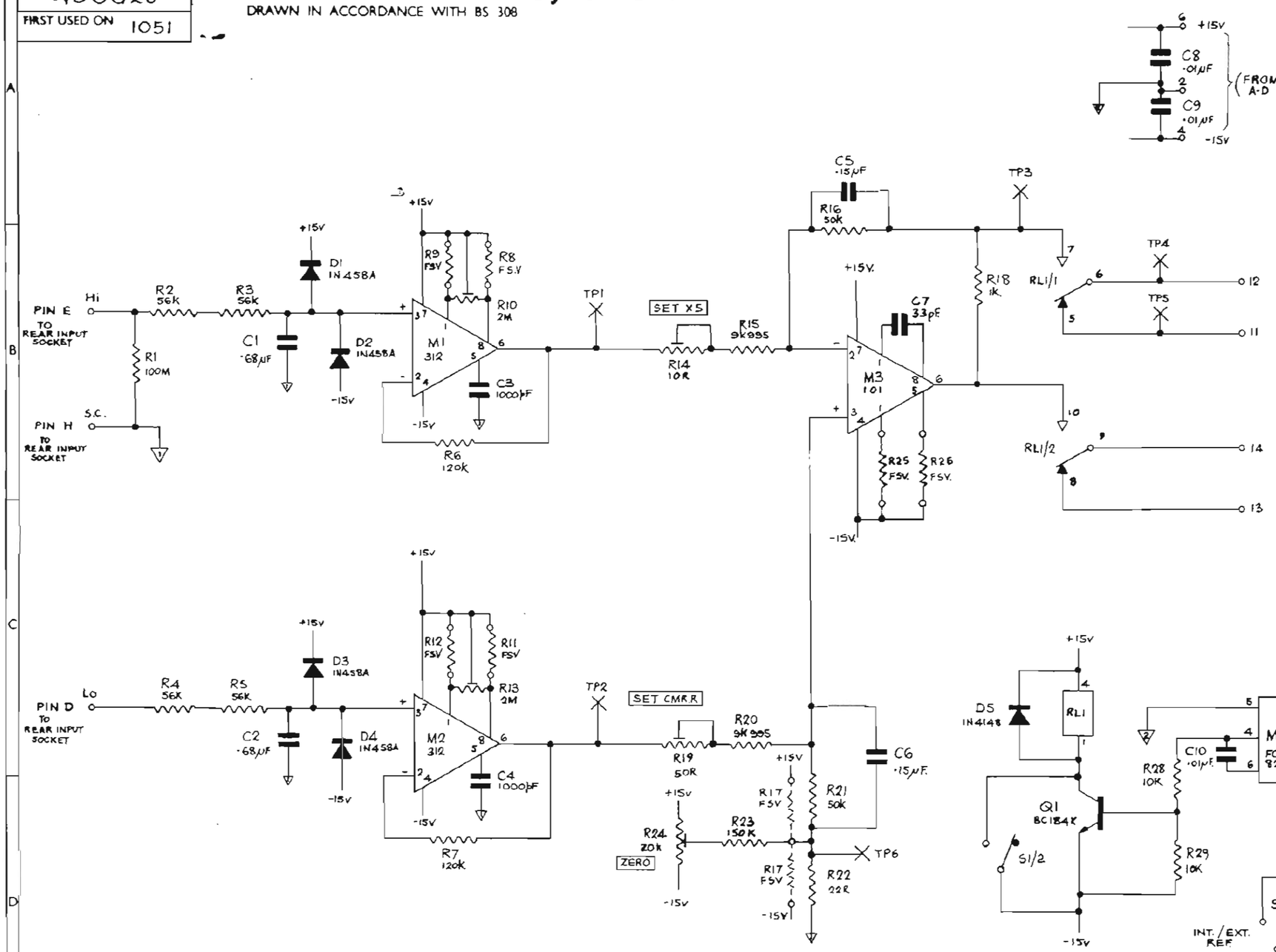
ALL BURRS TO BE REMOVED

NOTES

1 – SIG. COM.

2 – ANAL. COM.

ISS.	CHANGES
2	BC6 TO F. RED/BLUE
3 ECO 508	D9; R27, 28, 29 DELETED. C1/2 ADDED. R19 WAS 200R M.J.D. 19.2.76
4	ECO. 693. 30.5.78 M3 WAS LM301 DEVICE. I.



DRAWN IV	CHECKED	DIMENSIONS IN MILLIMETRES	TOLERANCES ANGULAR ± ½° INCH DIMENSIONS DECIMAL TO 3 PLACES ± .005; DECIMAL TO 2 PLACES ± .010; FRACTIONAL ± 1/64 METRIC DIMENSIONS DECIMAL TO 2 PLACES ± 1mm; DECIMAL TO 1 PLACE ± 2mm; WHOLE DIMENSIONS ± 4mm UNLESS OTHERWISE STATED	MATERIAL	DRAWING SIZE A2
TRACED	APPROVED J.A.B.	SCALE NOT TO BE SCALED		FINISH	
DATE 5.11.75	DATE 6/76				

datron ELECTRONICS LTD. NORWICH.

TITLE 1059/1051 - RATIO AMPL & SWITCHING (1v. I/P)

DRAWING No. 430028

SHEET 1 OF 1

DRAWING No. 400125

FIRST USED ON 1051

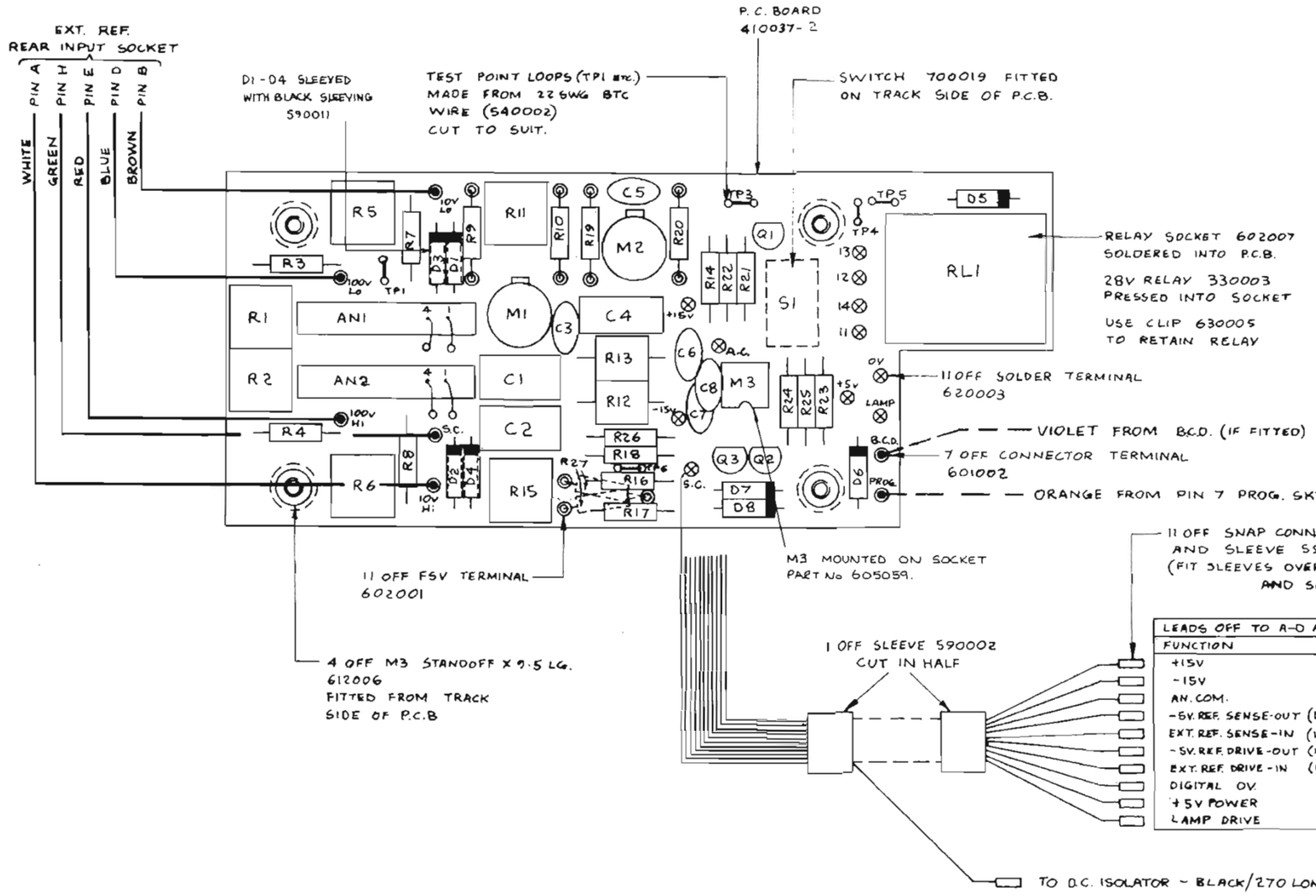
THIRD ANGLE PROJECTION

DRAWN IN ACCORDANCE WITH BS 308

ALL BURRS TO BE REMOVED

NOTES

ISS.	CHANGES
2	ECO 889 REDESIGNED M.J.D. 27/8/76
3	ECO 2778 M.J.D. 1.9.76 PARTS LIST MOD. M.J.D.
4	ECO 684. 28.5.78 PARTS LIST MOD. L.



LEADS OFF TO A-D ASSY. (ANAL. SECTION).		
FUNCTION	COLOUR	LENGTH
+15V	RED	100 mm
-15V	BLUE	"
AN. COM.	GREEN	"
-5V. REF. SENSE-OUT (11)	BROWN	"
EXT. REF. SENSE-IN (12)	WHITE	"
-5V. REF. DRIVE-OUT (13)	WHITE/RED	"
EXT. REF. DRIVE-IN (14)	ORANGE/BLACK	"
DIGITAL 0V.	PINK	"
+5V POWER	RED/BLACK	"
LAMP DRIVE	GREY	"

DRAWN M.J.D.	CHECKED	DIMENSIONS IN MILLIMETRES	TOLERANCES ANGULAR ± ½° INCH DIMENSIONS DECIMAL TO 3 PLACES ± .005; DECIMAL TO 2 PLACES ± .010; FRACTIONAL ± 1/64; METRIC DIMENSIONS DECIMAL TO 2 PLACES ± 1mm; DECIMAL TO 1 PLACE ± 2mm; WHOLE DIMENSIONS ± 4mm; UNLESS OTHERWISE STATED	MATERIAL	datron ELECTRONICS LTD. NORWICH.
TRACED	APPROVED L.A.D.	SCALE 2:1 NOT TO BE SCALED		FINISH	TITLE RATIO AMP (10/100 V I/P) ASSY, 1051
DATE 27-8-76	DATE 1-9-76				DRAWING No. 400125

DRAWING SIZE A2

SHEET 1 OF 5

DRAWING No. 430032

FIRST USED ON 1051

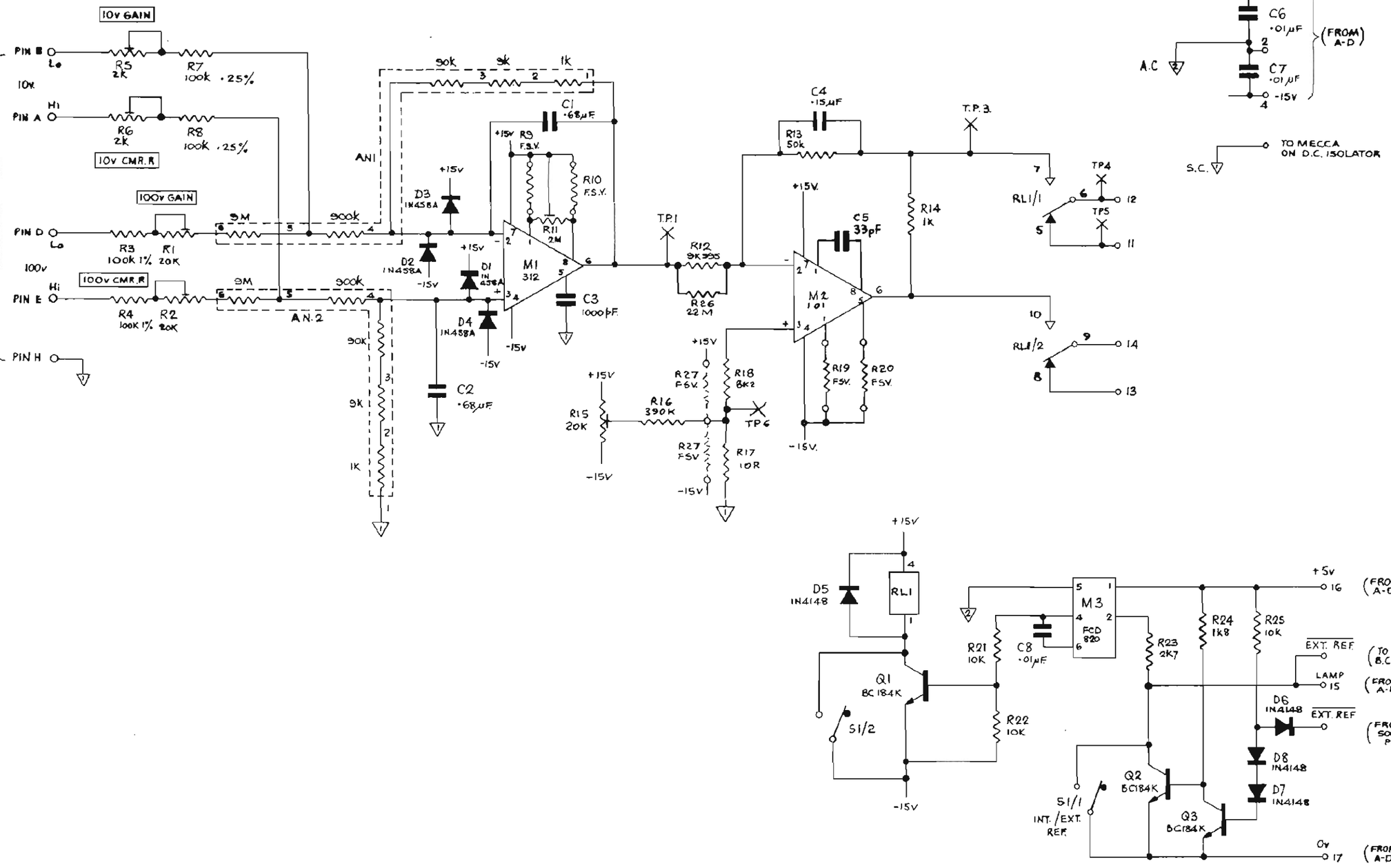
THIRD ANGLE PROJECTION

DRAWN IN ACCORDANCE WITH BS 308

ALL BURRS TO BE REMOVED

NOTES

ISS.	CHANGE
1	[illegible] 7.8.75
2	ECO 789 [illegible]
3	ECO 694. 20.5.75 M2 WAS LM301 DEVICE. L.



DRAWN	CHECKED	DIMENSIONS IN	TOLERANCES ANGULAR ± .°	MATERIAL
IV		MILLIMETRES	INCH DIMENSIONS DECIMAL TO 3 PLACES ± .005 DECIMAL TO 2 PLACES ± .010 FRACTIONAL ± 1/64 METRIC DIMENSIONS DECIMAL TO 2 PLACES ± 1mm DECIMAL TO 1 PLACE ± 2mm WHOLE DIMENSIONS ± 4mm UNLESS OTHERWISE STATED	
TRACED	APPROVED L.A.B.	SCALE /		FINISH /
DATE 3.11.75	DATE 2.8.77	NOT TO BE SCALED		

datron ELECTRONICS LTD. NORWICH.

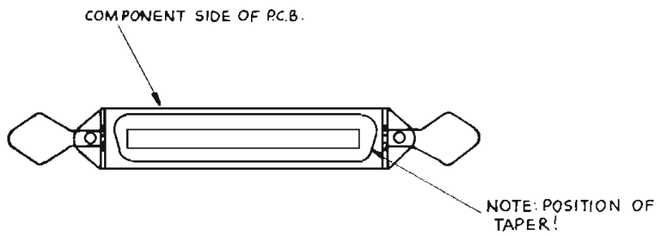
TITLE 1051 – RATIO AMPL & SWITCHING (10v/100v I/P)

DRAWING No. 430032

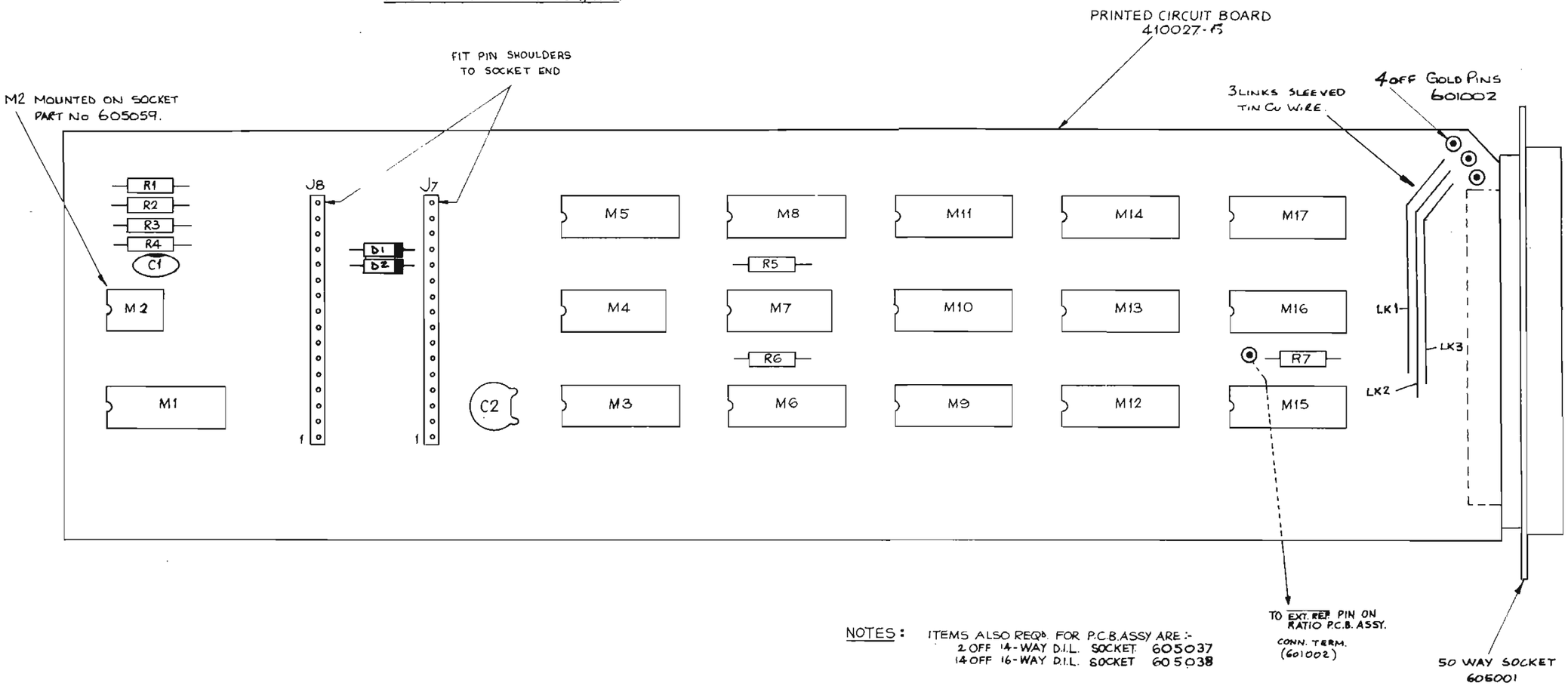
DRAWING SIZE A2

SHEET 1 OF 1

NO	CHANGES
2	ECO 122 GOLD TIN FOR INTERF LEAD ADDED. CORNER OF BOARD SHOWN CROPPED OFF IV 30/10/75
3	ECO 207 PCB WAS -2 M.J.D. 6.5.76.
4	ECO 234 7.9.76 PT. LT. CHANGE PJH
5	ECO 310 5.11.76 PCB WAS -4 PJH
6	ECO 507 change to Astralux dil added 5.7.77 PJH
7	ECO. 559 23.9.77 PARTS LIST MOD. ONLY
8	ECO. 558 23.9.77 M3 STANDOFF DELETED. IL
9	ECO 645 30-3-78 GOLD PINS B.J. LINKS & DIODES ADDED.



1:1 VIEW ON ARROW 'A' TO SHOW ORIENTATION OF CONNECTOR/P.C.B



NOTES: ITEMS ALSO REQD. FOR P.C.B. ASSY ARE :-
2 OFF 14-WAY D.I.L. SOCKET 605037
14 OFF 16-WAY D.I.L. SOCKET 605038

1 OFF 50-WAY. AMP SOCKET 605 001

DRAWN IV.	CHECKED	DIMENSIONS IN MILLIMETRES	TOLERANCES	MATERIAL	datron ELECTRONICS LTD., NORWICH	DRAWING SIZE A2
TRACED	APPROVED L.A.B.	SCALE 2:1 NOT TO BE SCALED	METRIC DIMENSIONS DECIMAL TO 2 PLACES ±·1mm. DECIMAL TO 1 PLACE ±·2mm WHOLE DIMENSIONS ±·4mm UNLESS OTHERWISE STATED.	FINISH	TITLE 1059/1051 B.C.D. OUTPUT P.C. BOARD ASSY.	DRAWING No 400095. SHEET 1 OF 3
DATE 14.4.75	DATE 2.2.77					

ISS	CHANGES
2	ECO.360 23.5.77 R4 WAS 39k
3	ECO 645 B.J 30-8-78

IH

J8-3 BCD.2
J8-6 BCD.4
J8-5 BCD.8
J8-4 BCD.1
J7-1 0A
J8-8 0B
J8-10 0C
J8-9 0D
J8-2 OVERLOAD
J8-1 1X10°
J8-7 0E
J7-16 DATA VALID

M11 74C173
M10 74C173
M13 74C173
M9 74C173
M12 74C173

M14 J5-1
M14 J5-2
M14 J5-3
M14 J5-4
M14 J5-5
M14 J5-6
M17 J5-7
M17 J5-8
M17 J5-9
M17 J5-10
M17 J5-11
M17 J5-12
M16 J5-13
M16 J5-14
M16 J5-15
M16 J5-16
M16 J5-17
M16 J5-18
M15 J5-19
M15 J5-20
M15 J5-21
M15 J5-22
J5-23
J5-24
J5-25

+5v
R7 100K
EXT REF

J7-6 −
J7-8 +
J8-16 OHMS
J7-7 D.C.
J7-2 A.C.
J7-13 FILTER
J8-15 mV
J7-5 AUTO
J8-14 dp1
J8-13 dp2
J8-12 dp3
J8-11 dp4
J7-14 F.P. OVERRIDE
J7-11 HOLD
J7-12 COMMAND
J7-15 PRINT INHIBIT
J7-3 SIG. INT.
J7-4 DELAY
J7-10 +5v
J7-9

M3 74C157
M4
M7
M2 NE555V
R4 56K
C2 1KpF 500V. CER
C1 0.1µF 25V.
D2
D1

M5 J5-26
M5 J5-27
M5 J5-28
M5 J5-29
M5 J5-30
M5 J5-31
M6 J5-32
M6 J5-33
M6 J5-34
M6 J5-35
M6 J5-36
J5-37
M6 J5-38
J5-39
M1 J5-40
M1 J5-41
J5-42
M1 J5-43
M1 J5-44
M1 J5-45
J5-46
J5-47
J5-48
J5-49

GP1
GP3
LK1
0v.
LK3
G.P.2.
LK2
+5v.
R3 100K
R5 100K
R2 100K
R1 100K
R6 100K

M1, M5, M6, M14–M17 = 80C95
M4, M7 = 14011
M8 = 14049
G.P. = GOLD PIN
L.K. = LINK

DRAWN IV	CHECKED I.M.	DIMENSIONS IN MILLIMETRES	TOLERANCES METRIC DIMENSIONS DECIMAL TO 2 PLACES ±·1mm DECIMAL TO 1 PLACE ±·2mm WHOLE DIMENSIONS ±·4mm UNLESS OTHERWISE STATED	MATERIAL /	datron ELECTRONICS LTD. NORWICH.	DRAWING SIZE A2
TRACED	APPROVED L.A.D	SCALE / NOT TO BE SCALED		FINISH /	TITLE 1051/1055/1059 B.C.D OUTPUT SCHEMATIC.	DRAWING No 430022 / SHEET 1 OF 1
DATE 11.4.75	DATE 2.8.77					