56

datron
ELECTRONICS LIMITED

OPERATING MANUAL
for
DATRON MODEL 1030
True RMS
DIGITAL VOLTMETER

METEOR CLOSE
NORWICH AIRPORT INDUSTRIAL ESTATE NORWICH NR6 6HQ ENGLAND

OPERATING MANUAL
for
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True RMS
DIGITAL VOLTMETER

Instrument Designed and Manufactured by:-

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CONTENTS

CONTENTS (continued)

CONTENTS (continued)

APPENDICES

ILLUSTRATIONS

SECTION 1

GENERAL INFORMATION

1.1 FEATURES

Model 1030 Digital RMS Voltmeter utilizes an entirely new type of True Root Mean Square sensing circuit for the accurate measurement of both sinusoidal and non-sinusoidal waveforms. The circuitry was developed to overcome the shortcomings of thermal r.m.s. to d.c. convertors, by directly computing the true r.m.s. value of an input waveform. It offers the user significant advantages over currently available instruments in several important areas of measurement. Among these is its accuracy at extremely low frequencies even with high crest factor signals, its exceptionally rapid response and its accuracy over a wide dynamic range of input signals.

The utilization of all-electronic circuitry enables the Model 1030 to operate over a frequency range of 0.01 Hz to 1 MHz, displaying either the Root Mean Square or the Mean Square value of the input waveform. It opens new fields of measurement capability, in control engineering, noise and vibration studies and in any application involving complex or distorted waveforms.

Reading indication is by means of an integrating analogue to digital convertor equipped with highly-efficient cold-cathode seven-segment displays. These are mounted behind a polarising filter to provide high visual contrast under all normal lighting conditions.

1.1.1 Options

A number of optional facilities may be specified at the time of ordering to extend the versatility of the Model 1030.

(A01)	Analogue Output gives a 1-volt d. c. full-range output for any full-range input.
(R01)	Rear input terminals may be specified as an alternative to the normal front-panel terminals.
(D01)	A fourth display digit may be specified to give improved resolution when operating at a low percentage of full-scale input.
(F01-F04)	A number of alternative integration response times are available, see SPECIFICATION, Section 1.4.
a) – j)	Combinations of normal mode and LF mode filters.
(BO1 and BO1a)	Electrically isolated BCD outputs give remote indication of reading, range and function in 1-2-4-8 TTL compatible code, from a 50-way rear-panel connector. External hold command and print facilities are provided for readings at up to 20 per second.
(BO2 and BO2a)	At small additional cost to Option (B01) the Systems user may include the added versatility of 3-state logic. In effect, this means that a single line on the 50-way connector may be grounded to disable the BCD output completely. When multiplexing is used on logic highways, the Model 1030 may be left permanently connected to the system bus-bars without interfering with other peripherals.
(P01)	Isolated remote programming enables all ranges and functions to be selected from a remote point using TTL logic levels.

1.2 MECHANICAL DESCRIPTION

Although Model 1030 quite legitimately claims its place amongst precision laboratory instruments, it is housed in a robust heavy-gauge aluminium case designed to withstand the rough knocks of industrial usage. The handle-pivots are fitted with latch mechanisms enabling the carrying handle to be used as a prop-stand to cater for a convenient viewing angle.

A rack-mounting conversion kit is available to permit the Model 1030 to be permanently installed as part of a system.

The detachable supply-lead provided, comprises two metres of 3-core P.V.C. sheathed cable in accordance with BS 6500, permanently moulded to a fully-shrouded 3-pin cable socket. The complete cable assembly complies with the requirements of CEE Publication 22 and IEC 320.

All components, including those of the power supply, are mounted on two rigidly-supported circuit boards. The components used are all of the nature and quality necessary to ensure long and trouble-free service despite arduous use.

1.3 ELECTRICAL DESCRIPTION

The instrument comprises a precision wideband preamplifier with a selectable low-pass bandlimit filter, an r.m.s. computation section, a two-speed selectable 3-pole integration filter and an analogue-to-digital convertor/display device. A simplified block diagram, Fig. 1, illustrates the functions of the various sections.

1.3.1 High Stability Preamplifier

The preamplifier combines excellent d.c. performance (2 $\mu V/^oC$, 2 $pA/^oC$) with low noise and a bandwidth in excess of 3 MHz. The very low offset drift overcomes the necessity for a.c. coupling after the preamplifier when measuring on low ranges, resulting in only one d.c. blocking capacitor at the input. This arrangement allows the measurement of a.c. voltages with up to 1 kV of d.c. bias .... even on the 10 mV range. All switching is by means of front panel push buttons or, when Option P01 is incorporated, by applying TTL levels to the appropriate isolated programming lines.

1.3.2 Bandlimit Filter

The preamplifier is followed by a low-pass filter which can be switched into circuit to reject high frequencies, a feature particularly useful in noise measurement. The filter has a single pole (-6 dB/octave) and is normally -3 dB at 10 kHz, giving an equivalent rectangular bandwidth for Gaussian noise of 15.7 kHz. Non-standard frequencies may be specified at the time of ordering.

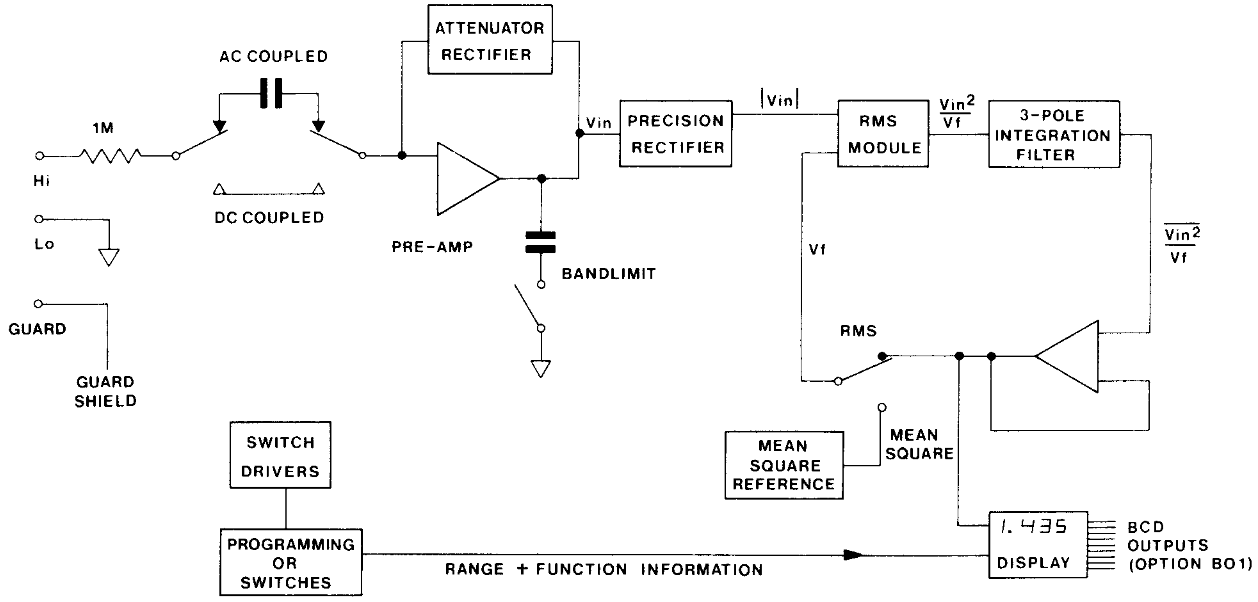

FIG.1

1.3.3 RMS to DC Conversion

The RMS Module utilizes all solid-state circuitry to overcome the shortcomings of thermal r.m.s. to d.c. convertors with their inherent limited dynamic range. The output waveform from the preamplifier is, first full-wave rectified by a precision rectifier circuit, and then applied as one input, Vin, of the RMS Module. In this unit the square of the input voltage Vin is computed relative to a second input Vf, to produce an output Vo.

Output voltage Vo takes the following form: $\mathrm{Vo} = \dfrac{\mathrm{Vin}^2}{\mathrm{Vf}}$

The output is averaged in the Integration Filter to give: $\overline{\mathrm{Vo}} = \dfrac{\overline{\mathrm{Vin}^2}}{\mathrm{Vf}}$

In the r.m.s. mode the feedback loop is closed so that: $\overline{\mathrm{Vo}} = \mathrm{Vf}$

The averaged output therefore comprises: $\overline{\mathrm{Vo}} = \dfrac{\overline{\mathrm{Vin}^2}}{\overline{\mathrm{Vo}}}$

This is the same as: $\overline{\mathrm{Vo}} = \sqrt{\overline{\mathrm{Vin}^2}}$ i.e. the r.m.s. of Vin.

From the foregoing explanation it will be appreciated that, in the r.m.s. mode, the second input Vf is the overall output voltage, thus scaling the square-law circuitry to the r.m.s. signal level, without explicitly generating the square of the input waveform either thermally or electronically. Herein lies the key to the wide dynamic range of Model 1030.

In the Mean Square mode the feedback loop is broken, and the second input Vf is derived from a separate mean square reference voltage.

1.3.4 Integration

The integration filter is a 3-pole active device having two switch-selectable (or programmable) response modes, for which various Options may be ordered allowing the user to choose the best low-frequency capability or response time for his own application. If, for example, accurate measurement of a signal with significant components at 0.1 Hz is required, then Option F02 is necessary and the D.C. COUPLED response time will be 150 seconds. Additionally, it may be desirable to select this low-frequency Option to take advantage of the longer effective integration time, thereby reducing statistical errors in noise measurement.

Model 1030 has an effective integration time for noise measurements, equal to its response time. An alternative requirement may be to select an integration-filter Option to minimize response time when a rapid read rate is required. The filter normally settles to ±0.1% within 15 cycles of its lowest-frequency capability.

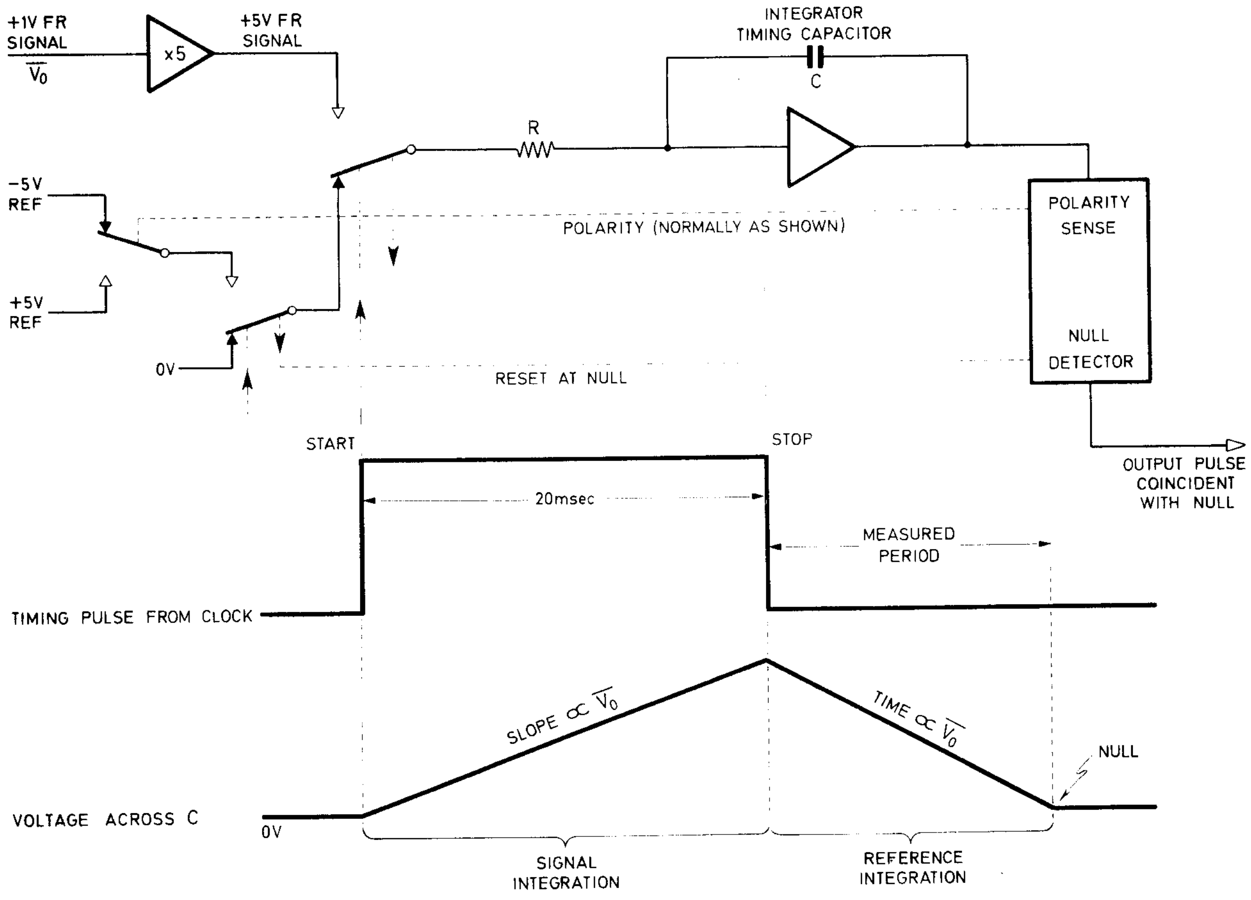

Fig. 2

1.3.5 Analogue to Digital Conversion

The choice of circuit used for conversion of the analogue output signal $\overline{Vo}$, obtained from the RMS Module, to digital form was governed, amongst other factors, by considerations of common-mode rejection. The phenomenon of common mode and the necessity for its rejection is a well understood fact of life in the field of low-level d.c. measurement. By using Guard Shield techniques, any common mode error voltages can be greatly reduced, and the remaining superimposed a.c.

waveform totally rejected by resorting to a technique similar to the commonly used dual-slope integration method of analogue-to-digital conversion.

Fig. 2 shows a simplified functional diagram of the convertor section. The purpose of this part of the circuit is to convert the input signal $\overline{Vo}$ into a time-period directly proportional to the input voltage. The 1-volt FR signal is first amplified to give a 5-volt FR signal. This is applied via electronic switching, controlled by timing pulses, to resistor R connected to the virtual-earth input of a very high-gain integration amplifier. Capacitor C always starts the integration period from a state of zero change, and now commences to charge up at a rate proportional to the input voltage. The signal integration period lasts for exactly 20 msec, during which time capacitor C acquires a charge proportional to $\overline{Vo}$.

At the end of 20 msec, resistor R is disconnected from the incoming signal and transferred to an accurate 5-volt reference source of opposite polarity to that of the input signal. The length of time it takes to discharge capacitor C to zero volts is directly proportional to the state of charge acquired during the signal integration period which, in turn, is proportional to the input voltage $\overline{Vo}$. The instant that the voltage across capacitor C reaches zero is signalled by a pulse from the Null Detector, and fed as a strobe pulse to the display circuitry. The same pulse is used to disconnect the reference voltage, and reset the circuit ready for the start of the next timing pulse.

In the unlikely event of capacitor C acquiring a reverse charge during the signal integration period, the Null Detector incorporates a polarity-sensing circuit; this ensures that the reference potential is always of the correct polarity to discharge capacitor C and eliminates all possibility of 'lock-up'.

1.4 SPECIFICATION

Ranges: 10.00 mV, 100.0 mV, 1.000 V, 10.00 V, 100.0 V, 1000 V.

Overrange: 100% (i.e. 1999 Full Scale on all ranges except 1000 V. (Maximum input 1000 V).

Accuracy: 90 days duration at 25°C ± 5°C, less than 90% RH.
Subject to frequency/voltage limitation:
Sinewave less than 10^8 Volt Hertz. e.g. 100 volt @ 1 MHz
add 1.5 ppm/volt above 300 volts

Ranges	Up to 5 kHz	5 kHz to 30 kHz
100 mV – 1000 V:	0.1%R ± 0.05% FS*	0.2%R ± 0.1% FS
10 mV (>100 μV):	0.2%R ± 0.1% FS	0.5%R ± 0.1% FS

Ranges	30 kHz to 100 kHz	100 kHz to 300 kHz
100 mV – 1000 V:	0.3%R ± 0.2% FS	2.0%R ± 0.3% FS
10 mV (>100 μV):	3.0%R ± 0.2% FS	(Typ. 5% to 500 kHz)

Ranges	300 kHz to 1 MHz
100 mV – 1000 V:	3.0%R ± 2% FS

*For option D01
read .02% FS

Temperature Coefficient: One tenth of accuracy rating per °C ± 3 μV/°C

Internal Noise: It is impossible to zero the lowest ranges on a 1030 due to internally generated noise. This noise is from two sources as follows:–

1. MAINS LINE FREQUENCY common mode noise generated in the mains transformer and coupled to guard. The effect of this noise is completely removed if Guard is referred to true earth through any impedance less than about 1 Megohm. The standoff error due to this source may be up to about 120 microvolts.

2. Wideband random noise in the input stage of about 80 microvolts reducing to less than 30 microvolts when bandlimit is depressed, which represents a noise level of

$$0.3\mu V / \sqrt{Hz}$$

The effect of both these noise sources is that it is impossible to reach zero on the lowest ranges. It should be noted however, that because the instrument is true RMS the noise does not normally upset the accuracy because considering a signal S and the noise level N, then the RMS is given by:

$$RMS = \sqrt{S^2 + N^2}$$

Suppose the signal is only 300 microvolts and the wideband internal noise is 80 microvolts

$$RMS = \sqrt{90000 + 6400}$$
$$= 310.5\mu \text{ volts}$$

The error being only 10.5μ volts or .05%FS.

Crest Factor: 5:1 at full range input.
2·5:1 at 100% overrange.
Holds over entire frequency range.

Common Mode Rejection: Greater than 90 dB from d.c. to 50 Hz.

Input Impedance: 1 MΩ shunted by 20 pF.
(50 pF, Option R01)

Maximum Input Voltage: Signal Hi to Signal Lo: 1000 volts peak.
A.C. Coupled: 1500 V pk, 20 Hz to 100 kHz.
D.C. Coupled: 1500 V pk, d.c. to 100 kHz.

Signal Lo to Guard: 250 volts.

Guard to Earth: 500 volts peak.

Integration Filter Response: Maintains full accuracy down to the lowest specified frequency provided D.C. COUPLED is selected below 30 Hz.

	Lowest* Specified Frequency	Settling Time to 0.1% of Final Value	Accuracy Degradation
NORMAL:	40 Hz	300 msec	—
LF MODE:	1 Hz	15 sec	—
Option F01:	10 Hz	1.50 sec	—
Option F02:	0.1 Hz	150 sec	±0.1% FS
Option F03:	0.01 Hz	1500 sec	±0.5% FS
Option F04:	**350.0** Hz	50 msec	—

Filter Combinations

FILTER COMBINATIONS

	Normal	LF Mode
A	40 Hz	1 Hz
B	40 Hz	10 Hz
C	10 Hz	1 Hz
D	10 Hz	0·1 Hz
E	1 Hz	0·1 Hz

	Normal	LF Mode
F	1 Hz	0·01 Hz
G	0·1 Hz	0·01 Hz
H	350 Hz	40 Hz
I	350 Hz	10 Hz
J	350 Hz	1 Hz

* Multiply Lowest Specified Frequency by 2 for grossly asymmetrical waveforms.

Bandlimit Filter: Limits upper frequency response to 10 kHz (-3 dB ±0.5 dB). (Single pole rectangular bandwidth, 15.7 kHz.)

Options: Other filter frequencies within the band 100 Hz to 100 kHz are available.

Mean Square: Displays the True Mean Square value of the input waveform. Error is less than twice the appropriate r.m.s. error.

D.C. Coupled: Button Depressed:

Responds to the true r.m.s. value of the d.c. and a.c. waveforms thus:

$$\sqrt{AC^2 + DC^2}$$

Button Not Depressed:
Responds to the true r.m.s. value of the a.c. coupled input waveform only.
L. F. Response: Normally -3 dB at 0.8 Hz (0.1% at 30 Hz)
Other Options available.
Note: The max. input voltage when a.c. coupled must be less than 1000 V pk (d.c. + a.c. pk) at frequencies below 20 Hz.

Reading Rate:	Internal: 3 readings/sec.
BCD Output:	Options (BO1, BO1a, BO2, BO2a): Reading, Range and Function. 1–2–4–8 +ve True, TTL compatible code. External hold command and print facilities are provided for readings at up to 20 per second.
Remote Programming:	Option (P01): Enables any range or function to be remotely programmed using +ve True, TTL compatible logic.
Power Supply:	**205-255** V, **105-127** V, 48 to 440 Hz. Specify line frequency and voltage when ordering. Consumption: Approximately 10 VA.
Operating Temperature:	0°C to +50°C.
Storage Temperature:	-25°C to +70°C.
Dimensions:	Height: 90 mm (3.5") Width: 224 mm (8.8") Depth: 330 mm (13")
Weight:	4 kg (8.8 lb) net
Shipping Weight:	4.6 kg (10 lb) gross.
Panel Mounting:	Additional hardware is available to enable the instrument to be panel mounted in a standard 19" rack.

1.4.1 Specification Verification

A checking routine to ensure that the instrument is working within its specified accuracy is given in Section 5, SPECIFICATION VERIFICATION. The checking procedures given are suitable for incoming inspection purposes, or for use as a periodic check of instrument calibration. Full calibration procedures are given in Section 6, MAINTENANCE.

SECTION 2

INSTALLATION AND OPERATION

2.1 UNPACKING AND INSPECTION

Every care is taken in the choice of packaging materials to ensure that your new instrument will reach you in an unblemished factory-fresh condition. There is, however, an economic limit to the degree of packaging/protection it is desirable to provide, and our level of protection is more than adequate to cater for all the normal hazards of road or rail transport. Special export packaging is provided for overseas orders.

Should your instrument have been subjected to excessive mishandling in transit the fact will probably be visible as external damage to the shipping carton.

Unpack the instrument and carefully examine the exterior for damage to case, panels, push buttons, terminals, etc. If any damage is found, notify the Carrier immediately.

2.2 INSTALLATION

Unless otherwise specified at the time of ordering, the instrument is normally despatched ready for immediate use with 205 to 255 V, 48 to 440 Hz supplies.

2.2.1 Voltage Tappings

To make the instrument suitable for operation from supplies in the range 105 to 127 V, 48 to 440 Hz, it is necessary to alter the connections to the primary windings of the mains transformer. Remove the top cover (See Section 6.2.) and note the tags mounted on the printed circuit board adjacent to the toroidally-wound mains transformer. To gain access to these tags it is desirable to remove the four screws securing the rear panel, and to ease the panel away from the instrument as far as the wiring will permit. For 240-volt operation the two primary windings are series-connected by linking the 'start' (Red) of one winding to the 'finish' (Brown) of the other.

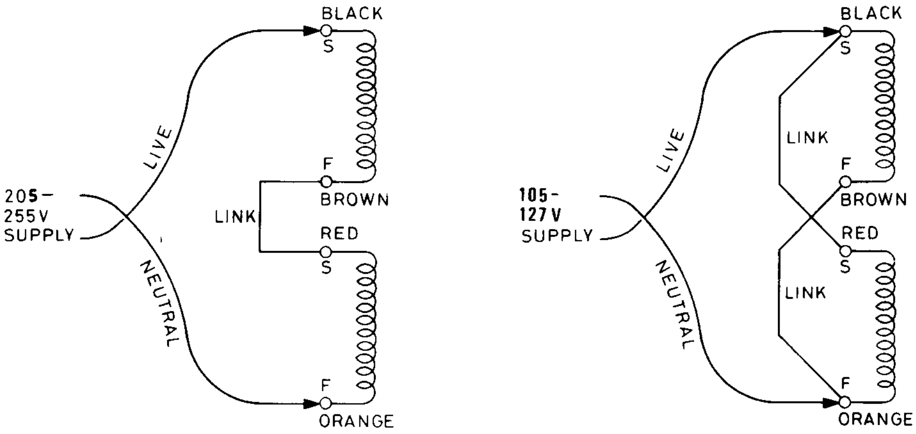

Fig. 3 Mains transformer tappings

Remove the link and reconnect the two windings in parallel so that the incoming supply is applied across the 'start' and 'finish' of both windings as shown in Fig. 3. i.e. Red should be joined to Black to form the Live input; Brown should be joined to Orange to form the Neutral input.

2.2.2 Supply Lead and Earthing

As already described in Section 1.2. the 2-metre supply lead is permanently fitted with a moulded-on 3-pin socket. This fits the receptacle at the rear of the instrument and should be pushed firmly home. The cable conforms to the colour code specified in BS 4410, viz.

Brown = Live
Blue = Neutral
Green/Yellow = Supply Earth

When connecting the supply lead to a suitable plug, it is strongly recommended that the instrument case should be earthed via the Yellow/Green earth wire; this should be connected to the supply-line earth by using a 3-pin plug. If the plug used incorporates a cartridge fuse, this should be replaced by one of low-current rating, say 1 or 2 amperes.

It should be noted that although it is recommended that the instrument case should be earthed, none of the front-panel terminals are connected to the case. This enables measurements to be made on circuitry floating at a considerable level above earth potential, (See Section 2.2.3).

In these circumstances it should be remembered that the internal guard shields can be elevated to dangerous potentials. For this reason it is safest to disconnect not only the supply mains, but also the signal input leads, before removing the instrument covers.

2.2.3 Input Connections

Three signal input terminals are located on the front panel marked respectively Hi, Lo and Guard. These terminals may be used as 'binding-posts', or connection may be made using 4 mm banana plugs. The terminals are mounted on standard $\frac{3}{4}$'' spacing between centres, enabling double or triple banana-plug adaptors to be used.

Note: The following input voltages must not be exceeded under any circumstances:-

Signal Hi to Signal Lo: 1000 volts peak.
D.C. Coupled: 1500 V pk, d.c. to 100 kHz.
A.C. Coupled: 1500 V pk, 20 Hz to 100 kHz.
Signal Lo to Guard: 200 volts peak.
Guard to Earth: 500 volts peak.

Full details of the recommended methods of making connection between the input terminals and the circuit under test are given in Section 2.4.1.

2.3 CONTROLS

ON/OFF

A push button switch with alternate ON/OFF action is mounted at the left of the display above the input terminals. It completely isolates the mains supply live from the instrument, with the exception of the mains fuse and socket, which remain live unless the supply-lead is disconnected.

Although no 'Supply On' pilot light is fitted, the circuit is so arranged that when the mains transformer is energized, at least one part of the display will always be glowing, even when no numerals are visible.

RANGE INDICATION LIGHTS

Immediately to the right of the numeric display, four indicator lights are fitted to illuminate one of the following legends:-

$$V \qquad mV \qquad \frac{V^2}{FR} \qquad \frac{mV^2}{FR}$$

The legends are necessary in order that the numeric display can be interpreted correctly as being either volts or millivolts.

$\frac{V^2}{FR}$ or $\frac{mV^2}{FR}$ are illuminated only when the instrument is operating in the Mean Square mode to enable the decimal point position to be established; it would otherwise be 'off the screen'.

PUSH BUTTONS

A row of eleven push buttons, each clearly marked as to its function, are the only operational controls. Lest there be any confusion regarding these markings, it should be understood that the labelled function or range becomes effective when the button is depressed. i.e. A TRUE RMS display is obtained when the MEAN SQUARE button is not depressed.

RANGE

The six push buttons at the left of the row are marked:-

1 kV	100 V	10 V	1V	100 mV	10 mV

corresponding to full-range displays of:-

1000.V	100.0 V	10.00 V	1.000 V	100.0 mV	10.00 mV

Overrange is signified by a 1 being illuminated at the left of the normal display. 100% overrange permits a maximum display of 1999 except on the 1 kV range which is 1000 max.

Overload. Above 100% overrange of 1999 the display blanks out (apart from the decimal point) until a less sensitive range is selected.

REMote PROGramme	This button is effective only when Option (P01) is fitted. With the button depressed, the Range and Function may be remotely programmed using +ve True TTL Compatible logic. See Section 3.2. The range-indication lights function normally showing whether volts or millivolts are being displayed.
DC COUPLED	When this push button is not depressed, the input to the instrument is a.c. coupled via a d.c. blocking capacitor. The instrument responds to the a.c. component of the input signal only, with a low-frequency response of -3dB at 0.8 Hz. See Section 2.4.2. Button Depressed: Shorts out the blocking capacitor so that the instrument responds to both the d.c. and a.c. components of the input signal thus:- $\sqrt{AC^2 + DC^2}$
BAND LIMIT	Depressing this button introduces a single-pole (-6 dB/Octave) low-pass filter to reject high frequencies. Normally, the filter is -3 dB at 10 kHz giving an equivalent rectangular noise bandwidth of 15.7 kHz. Note: An alternative filter frequency may have been fitted by request.
LF MODE	Under normal conditions, with this push button not depressed, the lowest measurement frequency for symmetrical waveforms* is 40 Hz, with a settling time of 300 msec. Button Depressed: Extends the lowest measurement frequency for symmetrical waveforms* to 1 Hz, with a settling time of 15 seconds. *Note: For details of asymmetric waveforms and alternative filter frequencies, see Section 1.4, Specification.
MEAN SQUARE	With the MEAN SQUARE button depressed the instrument responds to the True Mean Square of the input waveform instead of the True RMS value. To enable the decimal point to appear on the display, the numerical indication is, in fact either $\frac{V^2}{FR}$ or $\frac{mV^2}{FR}$ as indicated by the range indication lights.
mV NULL	This is a screwdriver-operated preset control to enable the instrument to be adjusted for minimum output indication with zero input signal applied to the most sensitive range. To adjust mV NULL, strap all three input terminals together and connect them to true earth. Select the 10 mV range and note the offset reading in the last window of the display due to internally-generated thermal noise. Select BAND LIMIT to exclude the high-frequency noise, and note the reduced readout. Then adjust mV NULL to obtain the lowest possible readout figure. It will not be possible to

mV NULL (continued)	reduce the readout to zero, and an indication of 2 to 3 in the last window is quite normal for a correctly adjusted instrument. (This becomes 20 - 30 when D01 is fitted.)
FUSE	The supply to the mains transformer primary windings is protected by a 20mm x 5mm glass cartridge, anti-surge type fuse; 160mA rating for 230V operation and 250mA rating for 115V operation.

2.4 OPERATION

Assuming that you are going to use the Model 1030 for the first time, it is strongly recommended that, before switching on, you should:-

1) Check that the instrument is correctly adjusted for the particular mains supply to which it is to be connected. Within each of the two major voltage ranges no fine tapping adjustments are required. See Section 2.2.1.

2) Connect the supply lead ..... if in doubt see Section 2.2.2.

3) Switch ON the supply and, while allowing a minute or so for the internal circuits to stabilize, read Section 2.2.3 and Section 2.3 to familiarize yourself with the maximum safe input voltages, and the functions of the various push buttons.

2.4.1 Using the GUARD Terminal

If you are not familiar with the use of GUARD terminal techniques, to minimize the unwanted effects of common-mode voltages, the following comments may prove helpful.

For a start it should be understood that there are many measurements on the laboratory bench, where the use of the GUARD terminal is not necessary. In instances where the connecting leads are short, the GUARD terminal is usually strapped to the Lo terminal as shown.

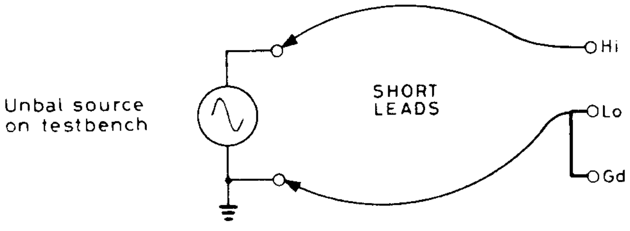

Fig. 4

The disadvantage of the simple arrangement in Fig. 4 is that the connecting leads form a loop. If a stray alternating magentic field from the mains transformer of a neighbouring instrument passes through the loop it will behave as a single turn secondary winding, and unwanted a.c. voltages will be induced into the measuring circuit.

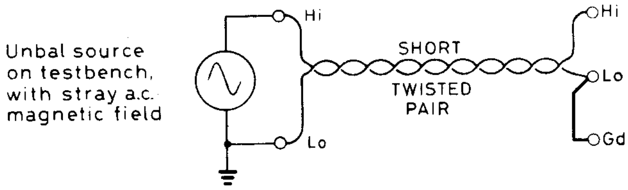

Fig. 5

Fig. 5 is a better arrangement, where the twisted pair reduces the loop area and adjacent twists of the wires produce cancellation of any induced voltages.

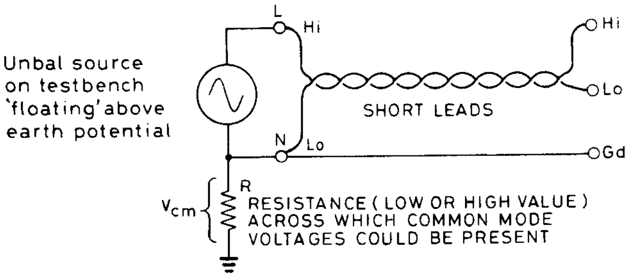

Fig. 6

When making measurements on an unbalanced source, (still using short leads) where the source is 'floating' above earth potential, as shown in Fig. 6, then the GUARD terminal may be connected to the Lo (N) terminal of the source. This applies whether the resistance R is very low (earth circuit impedance) or deliberately of a high value as in the case of floating sources. The advantage gained is small in this instance, because the resistance of the connecting leads is low.

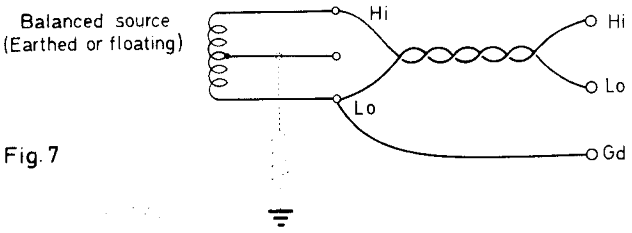

Fig. 7

The same comments apply with balanced sources on the testbench. The GUARD connection should, in most instances, be connected to the same point as the Lo terminal, whether the centre tap is earthed or floating.

The GUARD terminal is of greatest benefit when the source to be measured is some distance away from the measuring instrument. A screened twisted-pair cable (Duradio Type) with an insulated outer jacket should be used. At low frequencies a screened twin microphone cable is suitable, but it is important to choose a type with low capacitance per foot. Suitable types are listed below; the r.f. types are, in general, more expensive and less flexible, but they have merit for high-performance semi-permanent measuring lines.

MICROPHONE CABLE

Mfr.	Type	pF/ft	O/D"
Suhner	G03939	20	.197
Suhner	CB04730	59	.228
Transradio	MC 02-A	35	.187
Transradio	MC 02-D	40	.150
B.I.C.C.	9442Y	36	.244

R. F. CABLE

Mfr.	Type	pF/ft	O/D"
Suhner	G05730	16.2	.292
Suhner	G05770	16.2	.292
B.I.C.C.	T3121	18.0	.228
B.I.C.C.	T3249(DR68)	16.0	.265
B.I.C.C.	T3078	16.0	.265

Fig. 8 shows the recommended method of connecting to a remote unbalanced source. In the example illustrated, one side of the source is bonded to an earthed screen, and the bonding point would probably form the best place to connect the cable braid (guard).

If, however, the remote source is balanced, or is 'floating' above the potential of the surrounding earth screen (or chassis) then the GUARD connection should be made to the Lo side of the source and not to the earth screen, Fig. 9.

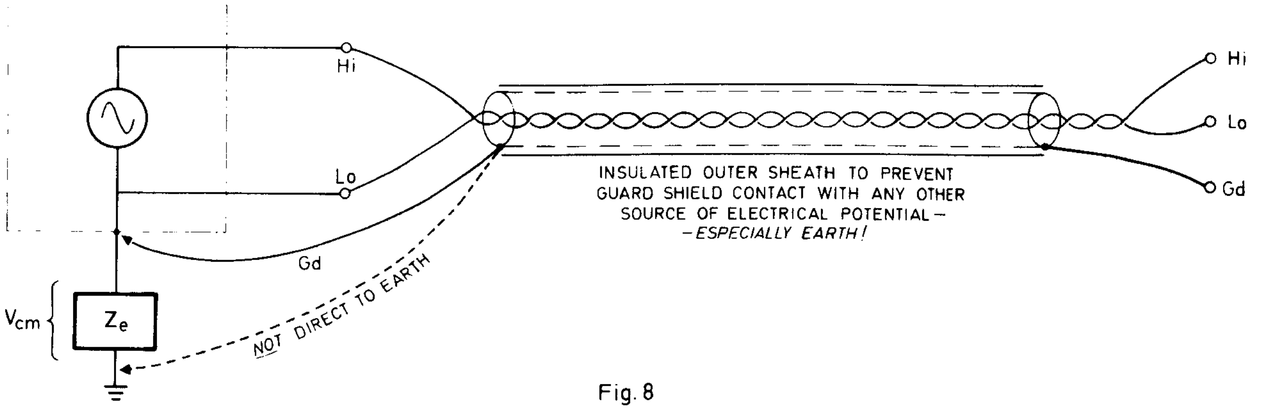

Fig. 8

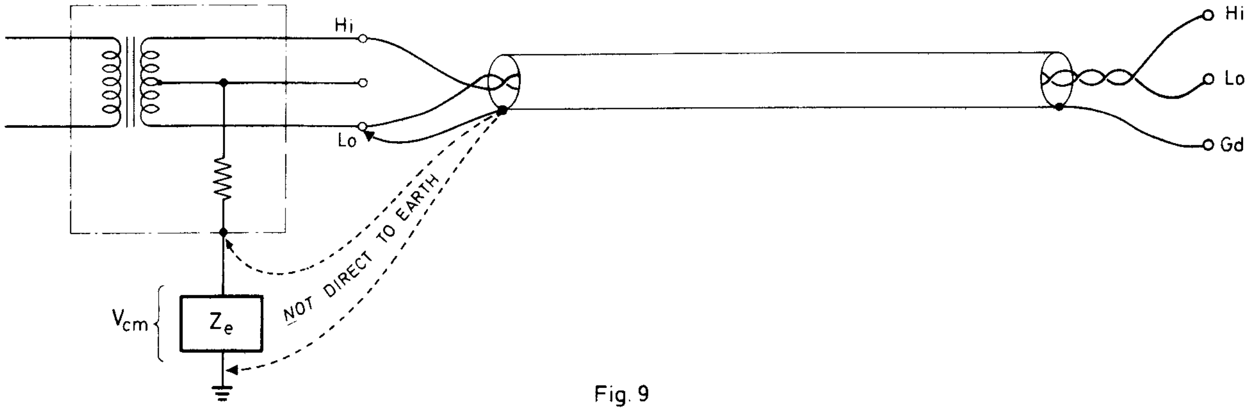

Fig. 9

Finally, having decided upon the most suitable method of connection for making a particular measurement, check that the proposed method does not involve exceeding the maximum input voltage ratings of the instrument.

Signal Hi to Signal Lo: 1000 volts peak.
D.C. Coupled: 1500 V pk, d.c. to 100 kHz.
A.C. Coupled: 1500 V pk, 20 Hz to 100 kHz.
Signal Lo to Guard: 200 volts peak.
Guard to Earth: 500 volts peak.

2.4.2 Special Notes: AC Coupling

When using the instrument in its a.c. coupled mode, the user should have an understanding of certain basic theoretical problems which are not shortcomings of the instrument but fundamental to any a.c. coupled circuit.

AC coupling in the Model 1030 is by means of a single 0.22 μF capacitor in series with the input resistance of 1 Mohm. This means that there is an input time constant of 0.22 seconds, giving a frequency response of -3 dB at 0.8 Hz, equivalent to -0.1% at 30 Hz.

This time constant also has a finite settling time, and if d.c. bias voltages are applied to the input of the instrument when it is switched to AC COUPLED, they may take up to 1.5 seconds to settle out regardless of integration filter mode.

If high-accuracy AC COUPLED measurements have got to be made at frequencies below 30 Hz, then it will be necessary to switch to DC COUPLED, and to a.c. couple externally with a value of capacitor greater than 0.22 μF. The working voltage and leakage of the external capacitor should be carefully checked for suitability. At high d.c. voltages the onset of Partial Discharge phenomena within the capacitor could cause erroneous readings, and the inception voltage for the capacitor (if quoted) should be considerably higher than the applied d.c. Partial Discharge noise occurs at a much lower voltage than corona discharge, and the possibility should not be ruled out if the d.c. exceeds about 800 volts.

SECTION 3

OPTIONAL REMOTE OPERATION

3.1 OPTIONS (BO1) and (BO1a) : 1–2–4–8 BCD OUTPUT

3.1.1 Description

Options (BO1) and (BO1a) enable full Binary Coded Decimal outputs describing Reading Range and Function to be obtained from a 50–way Amphenol 'MICRO-RIBBON' Connector (J5) mounted on the rear panel. The outputs are isolated from true earth and also from the signal input terminals.

Whilst it is recommended that the output digital common be referred to true earth, the input terminals may be floated as high as 500 volts relative to true earth and digital common.

The 50-way connector (J5) also provides various control lines and flags, enabling complete external control of the Analogue to Digital convertor. All levels are TTL compatible, with a fan-out of 4.

3.1.2 Connections

The table below (and on the following page) lists the various functions of the pins on connector J5. BCD output numbers are given magnitudes that assume operation on the 1 V Range. Bar notation indicates that a low level (less than 0.4 V) is 'active' or 'enables' the described state.

> e.g. $\overline{\text{mV}}$ means that pin 32 is low (less than 0.4 V) when the instrument is operating in either of its two permitted millivolt conditions: 10 mV or 100 mV

J5 Pin No.	Function	Description
1	2×10^{-4}	BCD Output No. (Option D01 only)
2	4×10^{-4}	" " " (" " ")
3	8×10^{-4}	" " " (" " ")
4	1×10^{-4}	" " " (" " ")
5	2×10^{-3}	" " "
6	4×10^{-3}	" " "
7	8×10^{-3}	" " "
8	1×10^{-3}	" " "
9	2×10^{-2}	" " "
10	4×10^{-2}	" " "
11	8×10^{-2}	" " "
12	1×10^{-2}	" " "
13	2×10^{-1}	" " "
14	4×10^{-1}	" " "
15	8×10^{-1}	" " "
16	1×10^{-1}	" " "
17	OVERLOAD	Indicates signal greater than 1 9 9 9(9)
18	1×10^{0}	BCD Output Number

J5 Pin No.	Function	Description
19	*	
20	*	
21	*	* Used for programming Ranges and Functions when Option (P01) is fitted.
22	*	
23	*	
24	*	
25	*	
26	Not used	Do not connect
27	Not used	Do not connect
28	$\overline{\text{MEAN SQUARE}}$	'0' indicates MEAN SQUARE: '1' = RMS
29	$\overline{\text{DC COUPLED}}$	'0' indicates DC COUPLED: '1' = AC COUPLED
30	$\overline{\text{BAND LIMIT}}$	'0' indicates BAND LIMIT: '1' = WIDEBAND
31	$\overline{\text{LF MODE}}$	'0' indicates LF MODE: '1' = NORMAL
32	$\overline{\text{mV}}$	'0' indicates mV: '1' indicates Volts
33	Not used	Do not connect
34	RANGE A	) Decimal Point Coding
35	RANGE B	) (Range). (See following
36	RANGE C	) tables)
37	RANGE D	) (Option BO1 and BO2 only)
38	Not used	Do not connect
39	Digital COMMON	'0' state reference
40	$\overline{\text{HOLD}}$	Input control line
41	$\overline{\text{COMMAND}}$	" " "
42	$\overline{\text{PRINT INHIBIT}}$	" " "
43	SIG. INTEGRATE	Output " flag
44	$\overline{\text{DELAY}}$	Input " line
45	$\overline{\text{PRINT COMMAND}}$	Output " flag
46	*	
47	*	* Used for programming Ranges and Functions when Option (P01) is fitted.
48	*	
49	*	
50	*	

1030 Range Coding for Options BO1a and BO2a

– BCD Output

Range	Pin 34 (A)	Pin 35 (B)	Pin 36 (C)
10mV	1	0	0
100mV	0	1	0
1V	1	1	0
10V	0	0	1
100V	1	0	1
1000V	0	1	1

1030 Range Coding for Options BO1 and BO2

Range	Pin 34 (A)	Pin 35 (B)	Pin 36 (C)	Pin 37 (D)
10mV	1	0	1	1
100mV	1	1	0	1
1V	0	1	1	1
10V	1	0	1	1
100V	1	1	0	1
1000V	1	1	1	0

3.1.3 Examples of BCD Coding

Suppose the following pins of J5 are in a '1' state (greater than 2.4 V):-

3 - 5 - 6 - 9 - 12 - 15 - 16

this gives a reading of:-

Pins		
3	8×10^{-4}	= .0008 (Option D01 only)
5 & 6	$+2 \times 10^{-3} + 4 \times 10^{-3}$	= .006
9 & 12	$+2 \times 10^{-2} + 1 \times 10^{-2}$	= .03
15 & 16	$+8 \times 10^{-1} + 1 \times 10^{-1}$	= .9
	TOTAL	= .9368

Now suppose that Option BO1a is fitted and that pins 32, 35 and 36 are in a low or 'O' state (less than 0.4V):

Pin 32 low, indicates that the instrument is measuring mV.
Pin 35 and 36 low, indicate that the decimal point is one place to the right ie. 10.00(0)
The reading is therefore 9.368 millivolts.

Alternatively, mV may be interpreted as 'divided by 1000' giving:-

$$\frac{.9368 \times 10}{1000}$$
$$=.009368 \text{ volts}$$

If pin 28 had been held at '0', then the output would have been:-

$$9.368 \ \frac{(\text{mV})^2}{\text{FR}} \quad (\text{FR} = \text{Full Range})$$

Alternatively when pin 28 is held at '0' the weighting of pins 32, 34, 35, 36 and 37, may be regarded as squared, giving:-

$$\frac{.9368 \times (10)^2}{(1000)^2} \quad \text{volts}^2$$

$$\text{or} \quad 00009368 \ \text{V}^2$$

Pins 29, 30 and 31 are merely flags indicating a particular measurement mode, and do not affect interpretation of the BCD number. Pin 17, OVERLOAD, indicates when the input signal is too high for a particular range. BCD numbers may be present even when pin 17 is in a '1' state but they must not be taken as valid though they will be accurate for numbers only slightly in excess of 1999(9).

3.1.4 Control Lines

Pins 40 to 45 are control lines, enabling the user to control the instrument remotely when it is used in conjunction with other equipment as part of a test system. The control input lines float to a '1' or high state if open circuit, and can be held to a '0' or low state by connecting them to pin 39, digital COMMON.

3.1.4.1 Print Command: Pin 45, $\overline{\text{PRINT COMMAND}}$ falls from a '1' to '0' state at the end of each measurement cycle, when the new reading has been transferred to the storage registers and is available at the pins of J5 in the form of steady BCD output information.

The falling voltage step available at pin 45 can thus command an external reading device to take note of the BCD output or, alternatively, the '1' state can be used to inhibit scanning of the BCD information. Since the reading is stored, it is available at any time except when new information is being transferred. Pin 45 is in the '1' state for approximately 5mS during which time the update of data occurs.

A logic low on pin 42 $\overline{\text{PRINT INHIBIT}}$ prevents the $\overline{\text{PRINT COMMAND}}$ edge from occurring on pin 45, thus making it easy to stop external printers etc. Pin 45 is forced to a low state in this condition.

3.1.4.2 Signal Integrate: Pin 43 exhibits a high state flag while the analogue to digital convertor is acquiring its information. It is made available because its falling edge represents the earliest time at which new signal information may be applied to the input terminals without disturbing the reading in hand. It can thus be used to operate a signal scanner, for example, at the highest possible speed for fully accurate information. The falling edge can also be used to command the instrument, via its delayed command facility, at the same time. See Section 3.4.1.5.

3.1.4.3 Hold Reading: Pin 40, $\overline{\text{HOLD}}$, may be externally held in a low state if it is desired to the stop the instrument from reaching its normal free-run mode. When pin 40 is taken low the instrument will complete any reading in progress, followed by storing and displaying it until pin 40 is taken high or released, or until an external read command is applied.

3.1.4.4 Read Command: A falling edge on pin 41, $\overline{\text{COMMAND}}$, instructs the instrument to take one reading immediately if, and only if, pin 40 $\overline{\text{HOLD}}$ is already held low. The instrument inhibits commands that are applied before conversion in progress is complete. Fig. 10 shows the relationship of $\overline{\text{COMMAND}}$ and $\overline{\text{PRINT COMMAND}}$ to the integration cycle.

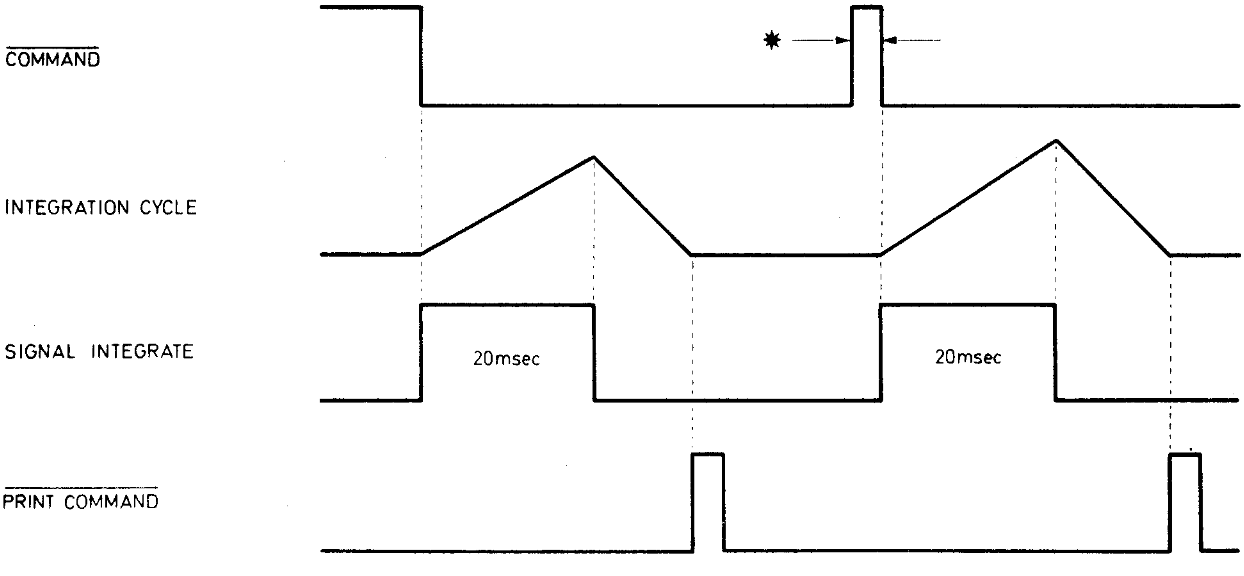

Fig 10

* Note: Minimum $\overline{\text{COMMAND}}$ pulse width is 2 microseconds.

3.1.4.5 Delayed Command: If pin 44, $\overline{\text{DELAY}}$ is held at logic '0' while an external command is applied, then the command will be automatically delayed by a period of time equal to the settling time of the integration filter. This delay is automatically adjusted depending on whether NORMAL or LF MODE is selected by the front panel push button, or by optional remote programming.

Provided pin 44 is held low, this means that the instrument can be commanded at the same instant that new signal information is applied to the front panel terminals. A particularly useful example of this is where the Model 1030 is used in conjunction with a signal scanner, the same command being used for stepping or switching the scanner, as for commanding a reading to be taken, Fig. 11.

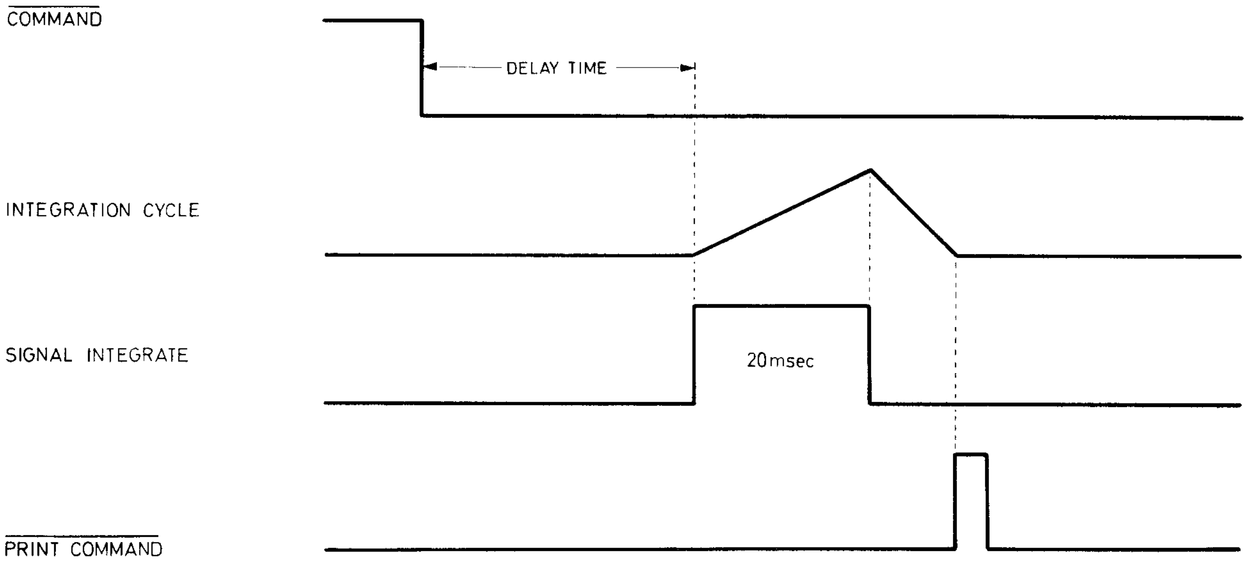

Fig. 11

For maximum read rate in a closed-loop system, the command could be the falling edge of pin 43, SIGNAL INTEGRATE, Fig. 12.

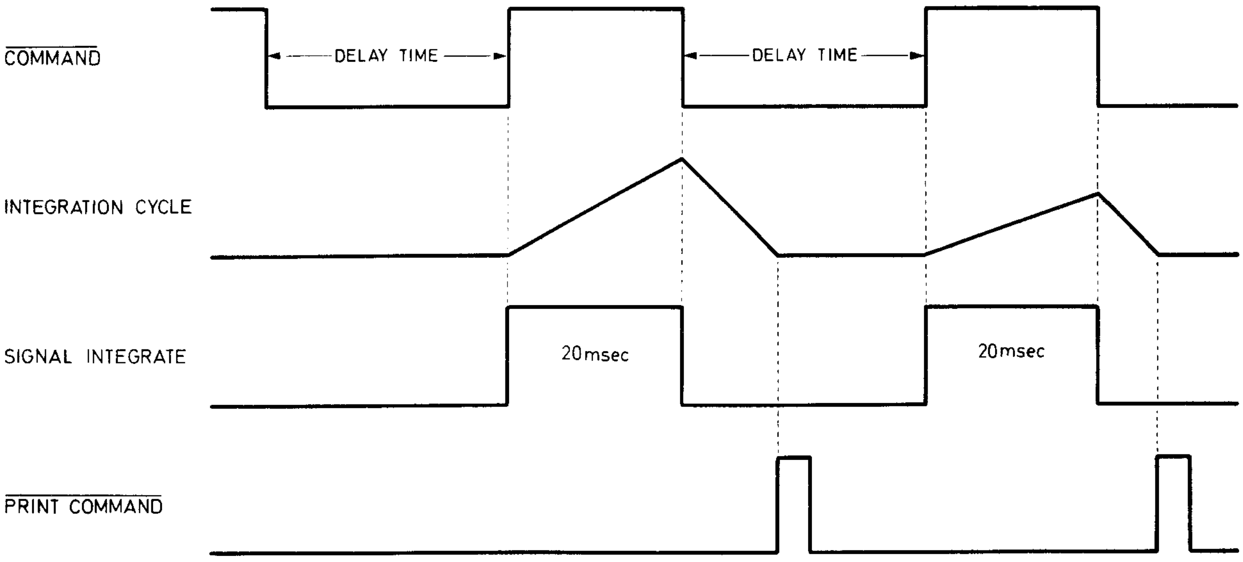

Fig. 12

3.1.4.6 <u>'0' State Reference:</u> All digital outputs and command lines are referred to digital COMMON on pin 39. Maximum fan-in is two TTL loads, minimum fan-out capability is 4 TTL loads.

3.2 OPTIONS (BO2) and (BO2a) : THREE STATE LOGIC OUTPUTS

Options (BO2) and (BO2a) are 3-state (or (Tri-state'*) versions of Options (BO1) and (BO1a) respectively. The basic difference is that upon application of a logic low to pin 42, PRINT INHIBIT, all active BCD and control lines are inhibited. The output lines are forced to a 'third' state which is a very high impedance OFF state.

The instrument can therefore be permanently connected to logic highways or bus-bars in a system and then, by the application of a single logic '0' to pin 42, electrically disconnected at will. Another example would be where the BCD outputs of several instruments are connected in parallel to a printer: a simple single-pole switch could be used to select the outputs from a particular instrument for printing.

3.3 OPTION (P01): REMOTE PROGRAMMING

3.3.1 <u>Description</u>

Option (P01) enables all Ranges and Functions of the Model 1030 to be remotely programmed via the 50-way Amphenol connector provided. All the programme lines are electrically isolated from both earth and signal input terminals by means of opto-electronic isolators. It is recommended that the programme common (digital COMMON) be referred to earth in the measurement system; the signal input terminals are then able to float ±500 volts peak relative to earth and digital COMMON.

3.3.2 <u>Method of Operation</u>

The optional Programme Board mounts on top of the front-panel bank of push-button switches, making connection to certain of the contact pins. In the basic instrument, signal switching is accomplished by the push buttons, which apply +15 volt levels to appropriate parts of the analogue circuitry to operate switches. These are either field-effect transistors or, where high signal voltages could be present, relays. See Drawing No. 439105, Sheets 1, 2 and 3.

Similarly, digital switching is accomplished by the push buttons which apply digital COMMON to appropriate parts of the circuitry to operate the decimal points and Function lights on the display.

Operation of the REM PROG push button disconnects both the +15 volt and digital COMMON lines from the rest of the switches, the lines being routed instead into the Programme Board mounted on top of the switches. See Drawing No. 409117. Remote programming is achieved by connecting the appropriate lines (output contacts of the push button switches), via connector J5, to digital COMMON. This lights up the selected Function lights and decimal point directly

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* Trade mark: National Semiconductor Inc.

and by-passes the push button switches. The digital signal is also responsible for signal switching using opto-electronic isolators.

Fig. 13 shows a simplified version of the circuit in which the digital signal excites a light-emitting diode. The diode is encapsulated with, and optically coupled to a photo-transistor. Light from the diode turns on the photo-transistor and pulls its emitter up to +15 volts to supply the signal switching voltage. It should be noted that since all lines are buffered there is a maximum fan-in of one per line.

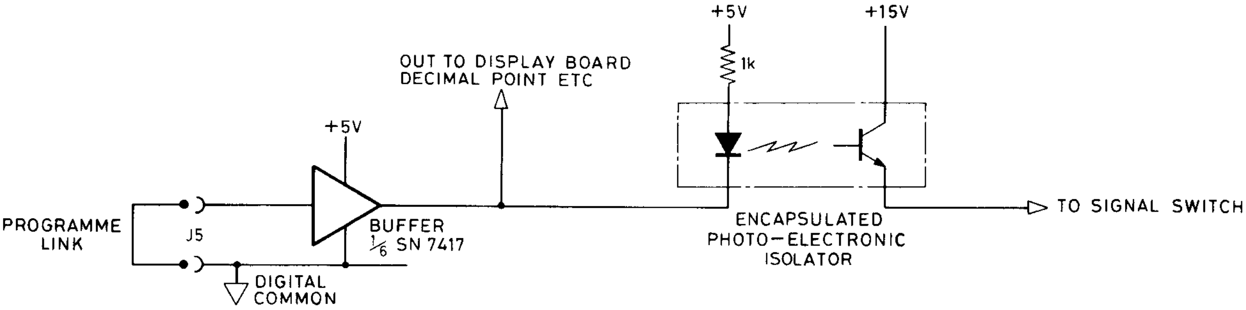


Fig. 13

3.3.3 Pin Connections

The following tables give the pin connections on connector J5 used for programming: the full listing of all pin connections is given in Section 3.1.2.

3.3.3.1 Range Connections: The table below shows the required states necessary to programme the six voltage ranges. Pins 46 - 47 - 48 - 49 position the decimal point and achieve the necessary signal switching, while pin 20 calls up mV. The table shows the only permitted states for each range.

Pin No	10 mV	100 mV	1 V	10 V	100 V	1 kV
20	O	O	1	1	1	1
48	1	1	O	1	1	1
47	O	1	1	O	1	1
46	1	O	1	1	O	1
49	1	1	1	1	1	O

3.3.3.2 Function Connections: In this table the '0' states select the required Function. X indicates that the pins may be in either state, depending upon other Functions selected for the same measurement.

Pin No	DC CPLD	BANDLIMIT	LF MODE	MEAN SQUARE
21	O	X	X	X
22	X	O	X	X
23	X	X	O	X
19	X	X	X	O

3.3.4 Characteristics of Use

As described in Section 3.2 a Range or Function is called up by connecting a logic low (less than 0.4 V relative to digital COMMON) to the appropriate line. If any line is not connected, it will float to a logic high or '1' state.

The table in Section 3.3.3.1 must be adhered to if sensible results are to be obtained. Damage is unlikely to occur if forbidden codes are programmed: for example, all lines high will place the instrument in its 1 volt analogue range, but no decimal point will be illuminated.

The table in Section 3.3.3.2 indicates Function programming, and since all Functions may usefully be employed simultaneously, any combination of codes is valid.

It should be noted that the codes for both programming and BCD output have been made identical to facilitate system checks.

3.3.5 Remote Indication

An output code appears on pin 24 of J5, to indicate whether or not the front panel REMOTE push button is depressed. A '1' on pin 24 indicates that the instrument is switched to REMOTE for programming via connector J5, a '0' that it is switched for local operation via the front panel push buttons.

This code can be usefully employed to provide a safety inhibit in systems use. If pin 24 is connected to pin 42 $\overline{\text{PRINT INHIBIT}}$, then it will inhibit print commands if the Model 1030 is inadvertently, or intentionally, switched for local operation. If Option (B02) is fitted, then all output lines as well as programme lines would be disabled under this condition.

SECTION 4

TECHNICAL DESCRIPTION

4.1 GENERAL

The internal circuits of Model 1030 are divided between two printed-circuit boards. The first printed board (Drawing No. 409106) is concerned with A.C. to D.C. Conversion and includes the preamplifier, scaling circuits, and the r.m.s. convertor. The second board (Drawing No. 409109) is concerned with Analogue to Digital Conversion and produces the BCD output together with drive for the 7-segment display devices. In the Model 1030, the regulated power supply components are mounted on the second board.

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

4.2. A.C. TO D.C. CONVERTOR
(Assembly Drawing No. 409106)

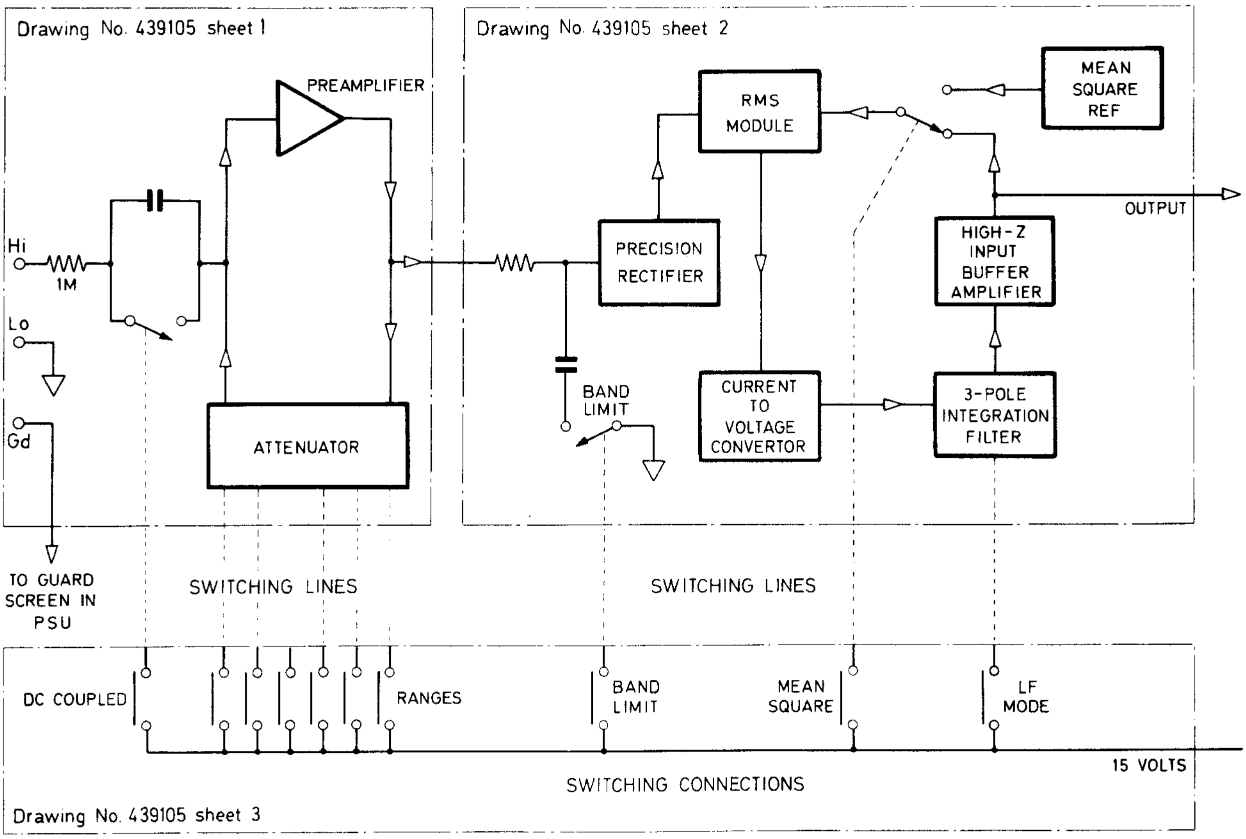


Fig. 14 Schematic diagram of A.C. to D.C. Convertor

4.2.1 Preamplifier & Scaling

(Circuit Diagram No. 439105 Sheet 1)

The simplified diagram, Fig. 15, 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 triangular contact normally 'open') regardless of whether the switching is accomplished electronically (f.e.t.) or by means of relay contacts. In Fig. 15 all switching is shown in the 1 V RANGE position.

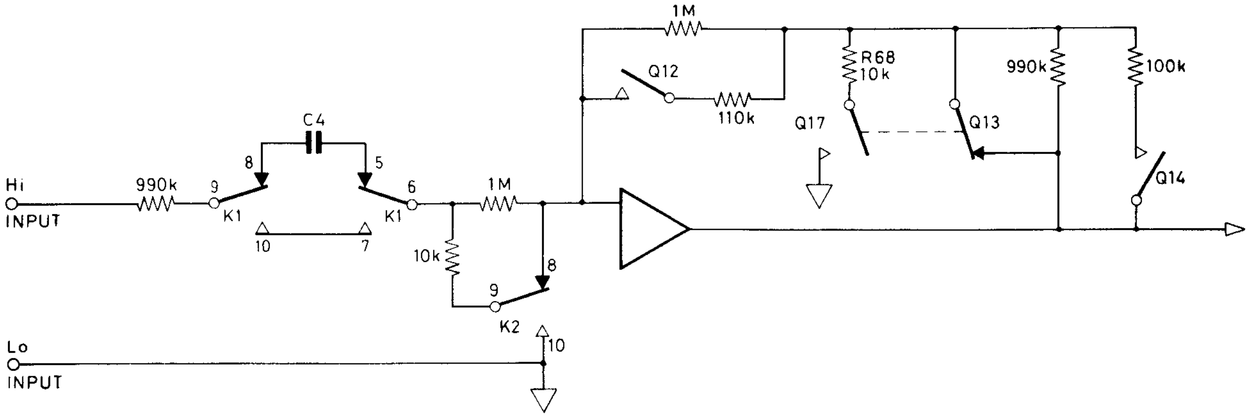


Fig. 15 Simplified diagram of preamplifier and scaling

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

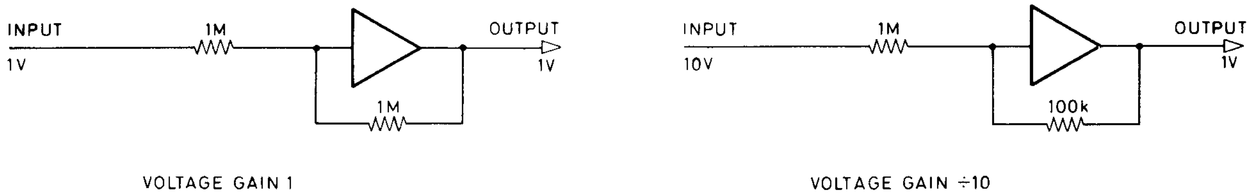
VOLTS RANGE	OVERALL VOLTS GAIN		RELAY K2	FET Q12	FET Q13	FET Q14	FET Q17
10 mV	100	(+40 dB)	9 - 8	OPEN	OPEN	OPEN	CLOSED
100 mV	10	(+20 dB)	9 - 8	OPEN	OPEN	CLOSED	CLOSED
1 V	1	(0 dB)	9 - 8	OPEN	CLOSED	OPEN	OPEN
10 V	0.1	(-20 dB)	9 - 8	CLOSED	CLOSED	OPEN	OPEN
100 V	0.01	(-40 dB)	9 - 10	OPEN	CLOSED	OPEN	OPEN
1 kV	0.001	(-60 dB)	9 - 10	CLOSED	CLOSED	OPEN	OPEN

Although the reader could, no doubt, puzzle out the different circuit configurations 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. 16.

Then, having grasped the basic essentials, reference should next be made to Circuit Diagram No. 439105, Sheet 1, for a more detailed explanation.

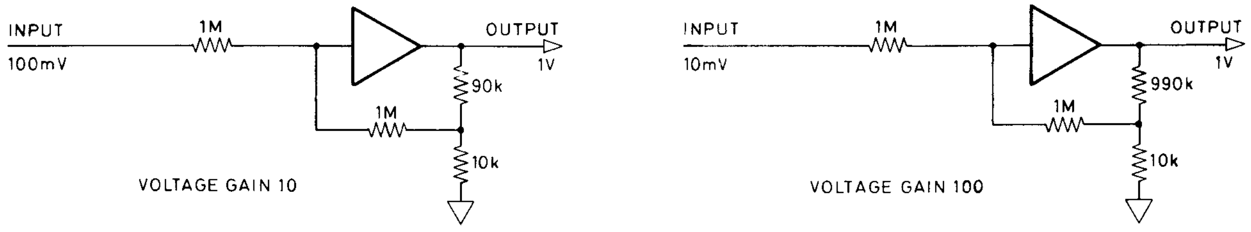
Resistors R1 - R4, in a series-connected chain, have a total value of 990 kohm, permanently connected to the Hi input terminal. Four separate resistors are used in order to provide the best possible voltage coefficient of resistance for optimum accuracy on the high-voltage ranges. The input resistor chain is frequency corrected by components C1, C2 and R115.

A 1 kV d.c. working polycarbonate capacitor is used for the d.c. blocking capacitor, C4. Relay K1 by-passes C4 via contacts 9 - 10, 6 - 7, when the



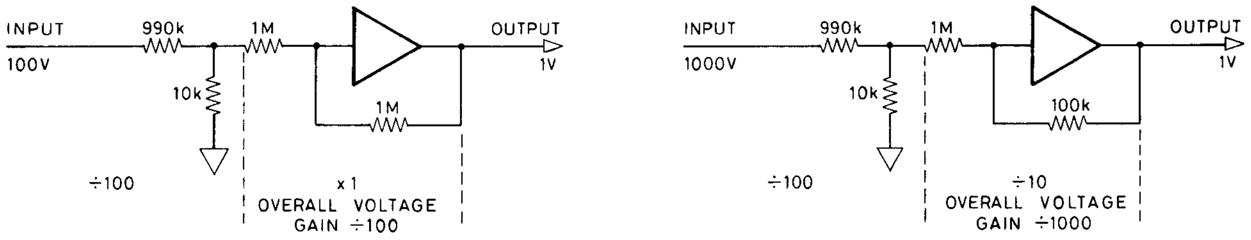
1 VOLT RANGE

10 VOLT RANGE



100mV RANGE

10mV RANGE



100V RANGE

1kV RANGE

Fig. 16

instrument is switched to the DC COUPLED mode. The relay is energized via switching-transistor Q1 which is, in turn, voltage controlled from the front-panel push button or by external command, Option (P01). Diode CR1 across the relay coil suppresses switching voltage surges due to the inductance of the coil.

The input signal is applied to the gate of dual field-effect transistor Q4A via 10 kohm resistor R8 and normally-closed relay contacts K2 9 - 8. Input resistors R1 - R4 (990 kohm) plus R8 (10 kohm) form the 1 Mohm input resistor shown on the 10 mV - 10 V simplified diagrams. A slight error, due to R9/11 (1 Mohm) in parallel with R8, is corrected by reducing the gain of the amplifier fractionally below unity. Frequency correction is applied across R8 by components C8, R7.

On the 100 V and 1 kV RANGE positions, relay K2 is energized via switching transistor Q2; contact 9 is connected to 0 V, converting R8 into the shunt arm of a 'divide by 100' input attenuator in which R1 - R4 forms the series arm.
With the circuit in this configuration, resistors R9/11 provide the 1 Mohm input resistor necessary to define the gain of the preamplifier. Components C5, C6 and R10 give frequency correction. In the event of gross over-voltage a protection network of four diodes, CR4 - CR7 provides a shunt path for the signal, and protects the gate of the input FET Q4A.

Dual FET Q4A/Q4B is connected as a balanced long-tailed pair, and is of a type specially chosen for its low noise and close matching of both electrical and thermal characteristics. The two halves are direct coupled to dual transistor Q5A/Q5B and the two halves of the circuit balanced by FSV (Factory Selected Value) resistors R21 and R30.

To correct for long-term slight changes in the balance of the preamplifier, resistors R152, R153 and the mV NULL control are connected across the drain resistors R16 and R26 of Q4A and Q4B.[1] FSV resistors R17 and R25 are chosen to give a balanced state with the mV NULL control in its mid-position. Cascaded balanced pairs of direct-coupled transistors Q6 - Q7, Q8 - Q9, Q32 - Q33 are driven from the collectors of Q5A and Q5B, the final output at TPI being produced by complementary pair Q10 and Q11. This part of the circuit is quite conventional and may be dismissed with relatively few comments. Transistors Q6 and Q7 are a selected matched pair, cemented together with cyanoacrylate adhesive so as to be in thermal contact with each other. Q32 and Q33, although not specially matched, are cemented together for the same reason. Forward voltage drop across the pair of series-connected diodes, CR14 and CR15, is used to forward-bias the complementary output transistors, Q10 and Q11 to prevent crossover distortion.

FSV resistor R154 is selected during manufacture for best flatness of response at 1 MHz on the 1 V RANGE, and resistor R22 serves a similar function on the 10 V RANGE when it is switched into circuit by transistor Q3.

The rest of the circuit is devoted entirely to switching the appropriate feedback networks into circuit, in accordance with the control voltages originating from the RANGE switches, or from remote TTL commands when Option (P01) is fitted. Field-effect transistors are used for the feedback switching, Q13 being connected so that it is permanently conducting on all ranges except 10 mV and 100 mV, when it is turned off by switching transistor Q15.

On the 1 V RANGE the feedback path is via FET Q13, through R40 - R38 (1 Mohm) to the gate of input FET Q4A. The feedback resistance of 1 Mohm in conjunction with the 1 Mohm input resistor chain, R1 - R4, R8, defines the gain of the preamplifier at unity. Capacitors C14, C15 and preset capacitor C16 provide frequency correction, and preset resistor R40 enables the overall gain to be adjusted to exactly unity.

On the 10 V and 1 kV RANGES, when the amplifier gain requires to be reduced to 'divide by 10', switching FET Q12 is turned on, either via logic diode CR11, or via CR10. Resistor network R36, R37, R39 is thus connected in parallel across the 1 Mohm feedback resistor, reducing the combined value to 100 kohm and defining the gain at 'divide by 10'. Capacitor C17 and preset capacitor C18 provide frequency correction, and preset resistor R39 permits precise gain adjustment.

Reference to the simplified diagrams shows that the difference between the 1 V and 100 V RANGES is effected by relay K2 operating on the 100 V RANGE and introducing a 'divide by 100' attenuator at the input of the preamplifier ... the latter having a gain of unity as already described. Relay K2 is also energized on the 1 kV RANGE when the preamplifier is switched to 'divide by 10', giving an overall gain of 'divide by 1000'.

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[1] Later versions connect to Q4B gate.

On the 10 mV and 100 mV RANGES Q12 is not conducting, so the basic feedback resistor is 1 Mohm. Q17 conducts and Q13 is turned off on both mV RANGES, and reference to Fig. 15 shows how this introduces a 10 kohm shunt resistor R68 into the feedback loop. When Q14 is not conducting on the 10 mV range, the feedback is attenuated due to a 990 kohm series resistor R59/R60 and the 10 kohm shunt resistor R68. This reduces the negative feedback, and the gain of the preamplifier increases to x 100. R60 provides fine-gain adjustment, and capacitors C22, C23 together with preset capacitor C24, frequency correction.

Q14 conducts only on the 100 mV RANGE, connecting a resistance of 100 kohm, R65/R66, in parallel with R59/R60. This gives an effective series-arm value of 90 kohm which, in conjunction with 10 kohm shunt arm, R68, reduces the feedback and increases the gain of the preamplifier from x 1 to x 10. R66 is a preset resistor for precise gain adjustment on the 100 mV range, and frequency correction is provided by C25, C27 and preset capacitor C26.

Field-effect switching transistors Q13 and Q14 are controlled by switching transistors Q15 and Q16 respectively. Q15 and Q16 are, in turn, controlled by three logic diodes CR17, CR18 and CR19. Switching FET Q17 is controlled directly via logic diodes CR17 and CR18. C21 is a frequency-correction feedback capacitor, connected in such a manner that the feedback signal through it depends upon the voltage gain selected.

4.2.2 True RMS Convertor
(Circuit Diagram No. 439105, Sheet 2)

The output signal from TP1 of the preamplifier divides into three routes immediately it enters the True RMS Convertor circuit .... shown on the extreme left-hand side of the circuit diagram. Each of the three paths has its own single-pole RC bandlimit filter comprising a permanently-connected series resistor and a transistor-switched shunt capacitor. The three transistors concerned are Q18, Q19 and Q20, and their respective filter components are R71/C29, R78/C30 and R86 - 87 - 91/C31. It will be noted that the time constants are all the same, producing a -3 dB roll off at 10 kHz in each of the three routes.

Precision Rectifier Reference to Fig. 14 shows that, following the bandlimit filter, the signal passes into a precision rectifier. The basic rectifying technique is shown in Fig. 17.

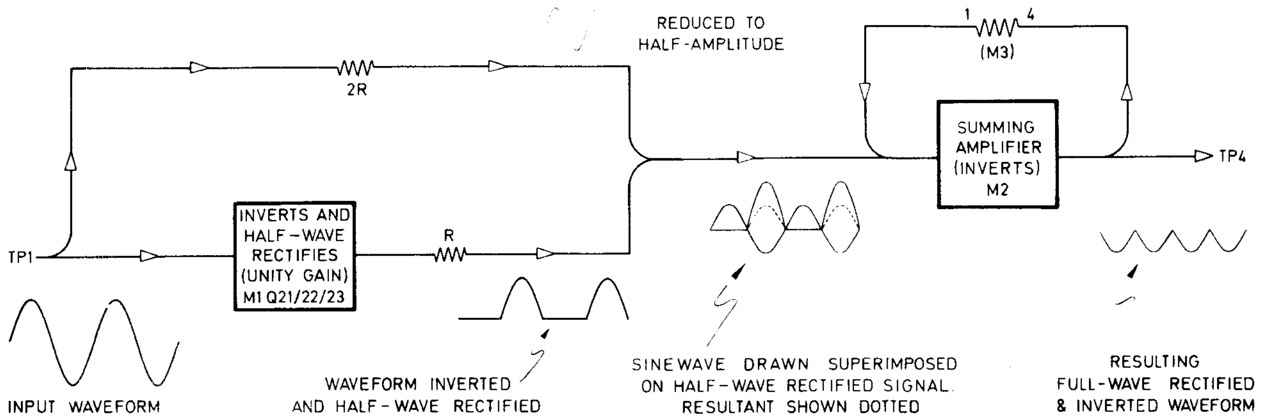


Fig.17

Conventional rectifier circuits using diodes, produce waveform distortion at low amplitudes due to the inherent non-linearity of diode forward conduction in the threshold region. The rectifier circuit used in the True RMS Convertor overcomes this problem, by incorporating the diodes within the feedback loop of amplifier M1. A simplified version of the circuit is shown in Fig. 18.

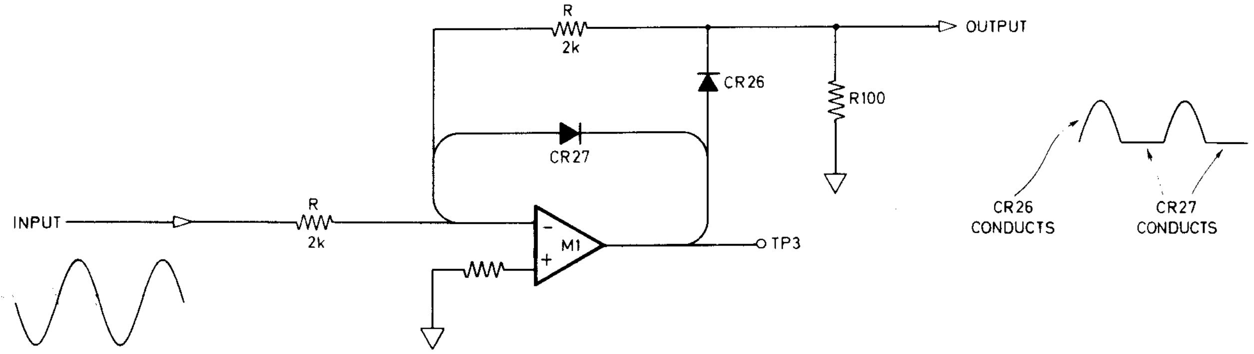


Fig. 18

Input is applied via a 2 kohm resistor R to the inverting input of M1. During a negative $\frac{1}{2}$-cycle of the input waveform, the positive output voltage at TP3 drives diode CR26 into conduction and the output waveform developed across load resistor R100, is fed back to the inverting input via a 2 kohm resistor, thus defining the gain of the amplifier at unity. CR26 is part of the feedback loop so that the diode offset voltage is effectively divided by the amplifier open-loop gain. Putting it even more simply, when the diode is reluctant to conduct (at the start and finish of the half-cycle) the amplifier gain rises in direct proportion, to provide a compensating effect.

During a positive $\frac{1}{2}$-cycle of the input waveform, the negative output voltage from M1 drives diode CR27 into conduction, by-passing the feedback resistor and reducing the gain to zero.

Referring back to the circuit diagram, it will be seen that the signal is applied to the inverting input (pin 2) of M1 via the network R86/R87/R91/R92. The first three resistors, forming part of the bandlimit filter, add up to 1 kohm and, together with R92 (1 kohm), form the 2 kohm series input resistor for M1. R91 provides a small range of adjustment to enable the amplitude of the half-wave rectified output to be set to the precise level required. Reverse-connected shunt diodes CR22/CR23 provide overload and lock-up protection at the input of M1, and normally do not conduct.

Transistor Q23, driven by the output of M1, is connected in the common-base configuration and provides a non-inverting current source for driving diodes CR26, CR27and TP3. The d.c. offset at TP3 due to Q23 is reduced to zero by preset resistor R94. R100 forms the load resistor for CR26 as already described, and R101 is the 2 kohm feedback resistor. The half-wave rectified output at the junction of R100/R101 passes through R81 (10 kohm) and combines with the original input signal at pin 2 of the Summing Amplifier, M2. The unrectified input signal passes through R78/R80 (20 kohm) so the peak amplitude is reduced to half that of the rectified waveform, see Fig. 17. The resultant full-wave rectified signal appears in inverted form (negative going) at TP4.

Mention has been deliberately omitted of the function of transistors Q21 and Q22, because their description was not essential to a basic understanding of the Precision Rectifier circuit. Their purpose is to speed up the turn-on time of CR26 and CR27 which, for the same reason, are Schottky hot-carrier types. High-frequency components of the input waveform are taken from the inverting input of M1 and routed via a 100 pF capacitor, C34, to the base of transistor Q21. The fast edges of the input waveform are amplified and inverted by Q21/Q22 and, appearing at TP3, are applied to diodes CR26 and CR27 to 'shock' them into the shortest possible switching times. When low frequencies only are present, the route through Q21/Q22 ceases to have any effect.

R.M.S. Module Before proceeding into a detailed description of the rest of the circuit, the reader is referred back to Section 1.3.3, so as to refresh his memory regarding the underlying principles of r.m.s. generation used in the instrument.

The RMS Module is a current-operated device containing an arrangement of closely-matched and thermally stable monolithic circuitry which exploits the logarithmic characteristics of diodes and transistors to perform the function:-

$$\frac{I_9^2}{I_7} = I_{14}$$ (Where the suffix numbers represent the pin numbers of the RMS Module.)

The negative-going full-wave rectified signal at TP4 is connected to pin 4 of the RMS Module, M3, and reference to the simplified diagram Fig. 17 shows that (via pin 9) M3 is included in the feedback loop of Summing Amplifier, M2, so that the feedback current I_9 is a function of the output voltage appearing at TP4. M2 therefore provides voltage-to-current conversion to drive pin 9 of the RMS Module. CR24 by-passes the feedback loop and reduces the gain of M2 to zero in the event of a positive-going signal appearing at TP4.

The current output from pin 14 of M3 (equal to $\frac{I_9{}^2}{I_7}$ flows into the inverting input of high-gain amplifier M4, arranged as a current-to-voltage convertor. Output voltage from M4 is passed through a 3-pole active filter, comprising M6 and its associated circuit, to obtain the Average Value rather than the true Integral. (This simplifies the circuitry whilst still enabling the instrument to achieve its full accuracy.)

L. F. Filter The active filter is basically a Bessel Function device giving an attenuation of -60 dB at the lowest specified frequency. The response settles to within 0.1% of its final value within a period corresponding to fifteen cycles of the lowest specified frequency. Switching of the three sets of time constants to provide NORMAL and LF MODE operation is achieved by field-effect transistors Q25, Q26 and Q27, controlled by switching transistor Q24.

With all FET switches conducting, the circuit is in the NORMAL mode and the lowest specified frequency is 40 Hz with a settling time of 300 msec. LF MODE opens all the switches and, for a standard instrument (See Options F01, F02, etc.), the lowest specified frequency becomes 1 Hz with a settling time of 15 seconds. For satisfactory operation of the active filter, it is essential that the circuit loading of its output should be minimal; it is therefore followed by a buffer stage, M7, arranged to have a very high input impedance.

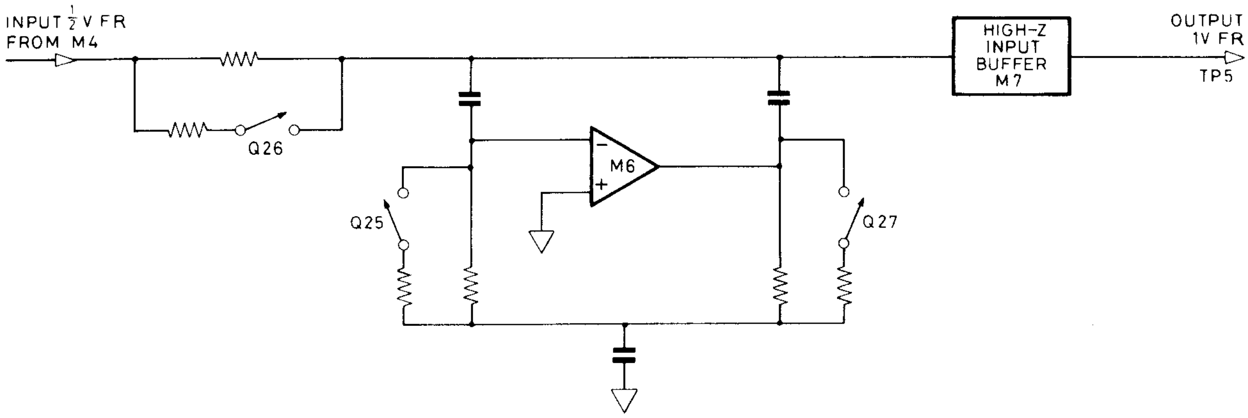


Fig. 19

Buffer Stage To achieve the desired order of buffering by M7, particularly at very low frequencies, an additional transistor, Q28, is fitted. Q28 acts as a compensator for the input offset and bias current of M7, which it tracks with temperature to a high degree of matching. FSV resistor R147 and preset resistor R148 in the emitter circuit of Q28 provide adjustment for correct setting-up of the compensation at very low frequencies, while preset resistor R144 provides the fast adjustment. Positive-going output from M7 is routed in two directions ... through switching-FET Q31, to complete the feedback path in the RMS mode .... and via TP5 and tags T6/T7 to drive the Analogue to Digital Convertor. 10-volt Zener diode CR34 is a protection device only, and prevents negative-going output or excessive positive excursions; the normal signal level at TP5 is +1 volt FR.

RMS/MEAN SQUARE Switching In the RMS mode, output from M7 passes through switching FET Q31, which is in its normally-on state. Operation of the MEAN SQUARE switch S11 (or the application of a control voltage when Option P01 is fitted) drives the base of switching transistor Q29 positive, and turns FET Q31 off. The same control voltage switches FET Q30 into conduction. When Q30 is turned on, an accurately-adjusted +1 volt d.c. reference, obtained from the slider of R138, is applied to the input of M5 instead of the normal +1 V FR feedback signal from M7 via Q31.

Voltage/Current Convertor, M5 Feedback voltages from M7 (or the MEAN SQUARE reference voltage) are applied to the input, pin 2, of M5 via resistors R116/R117. Output from M5 passes into the RMS Module via pins 8, 16 and 13, and feedback current flows back to the input of M5 via pin 7 of M3. Because the input of M5 is a virtual-earth point, the current I_7 is defined solely by the fixed value of R116/R117 and the signal voltage.

Knowing that the RMS Module performs the function:-

$$\frac{I_{9}^{2}}{I_7} = I_{14}$$

If the value of R116/117 is adjusted during manufacture so that $I_{14} = I_7$ then:-

$$I_{14} = \frac{I_{92}}{I_{14}} = \sqrt{I_{92}}$$

Looking at the voltage equivalents of these currents, the output voltage Vo at TP5 is proportional to the averaged value of I_{14} and the input current to M3, I_9 is proportional to Vin, therefore:-

$$\overline{Vo} = \sqrt{\overline{Vin}}$$

Considering the few remaining components yet to be described, preset resistor R113 adjusts the offset voltage of M5, and all the other components and signal paths are associated with the requirements of the RMS Module. It is unfortunate that, for reasons of commercial security, a detailed modus operandi of the RMS Module cannot at this stage be disclosed. Sufficient information has, however, been given to enable the reader to gain a general understanding of the workings of the RMS conversion circuit.

4.2.3 Switching and Optional Power Supply

(Circuit Diagram No. 439105, Sheet 3.)

The diagram shows the push button switch connections and is largely self explanatory. The top row of contacts carry the d.c. control signals for the various ranges and modes of operation. The lower rows of contacts, connected to J1 are concerned with remote readout of range and function, decimal point selection and, in the case of Option P01, remote control of range and function.

At the bottom-left of the diagram, the power-supply circuit shown is applicable to Model 1110 RMS Convertor only. Power supply components for Model 1030 True RMS Voltmeter are included on the Analogue to Digital Convertor board (Drawing No. 409109) which is not, of course, included in the former instrument.

Transformer T1-1 is of toroidal construction with a split primary, comprising two 115-volt windings intended for either series or parallel connection, depending on the supply voltage. An earth screen is interposed between primary and secondary windings to minimise electrostatic coupling and, completely separate from the earth screen and isolated from the windings, a further electrostatic screen is fitted to act as a Guard Shield.

Three secondary windings are provided, each with its separate full-wave bridge rectifier and solid-state regulator. Outputs from the regulators are: -15 V - 0 - +15 V and a separate +5 V supply. The solid-state regulators are worthy of special mention; they are Motorola Types MC7805 and MC7815, both being capable of delivering a 1-ampere fully-regulated output at their respective voltages. They are in the form of very compact units and feature foldback current limiting, and thermal shut-down protection; this makes them virtually short-circuit proof.

4.3 ANALOGUE-DIGITAL DISPLAY
(Assembly Drawing No. 409109)

4.3.1 Analogue Section:
(Circuit Diagram No. 439106, Sheet 2.)

Before proceeding into a detailed description of the circuit, the reader is referred back to Section 1.3.5 and Fig.2, to refresh his memory regarding the principles of dual-slope integration. The two-way switches shown in Fig.2 are, in fact, flip-flop circuits and diode-logic, used to switch field-effect transistors. A more realistic representation of the circuit is given below in Fig.20, which is shown in the RESET state, waiting for a SIG. pulse.

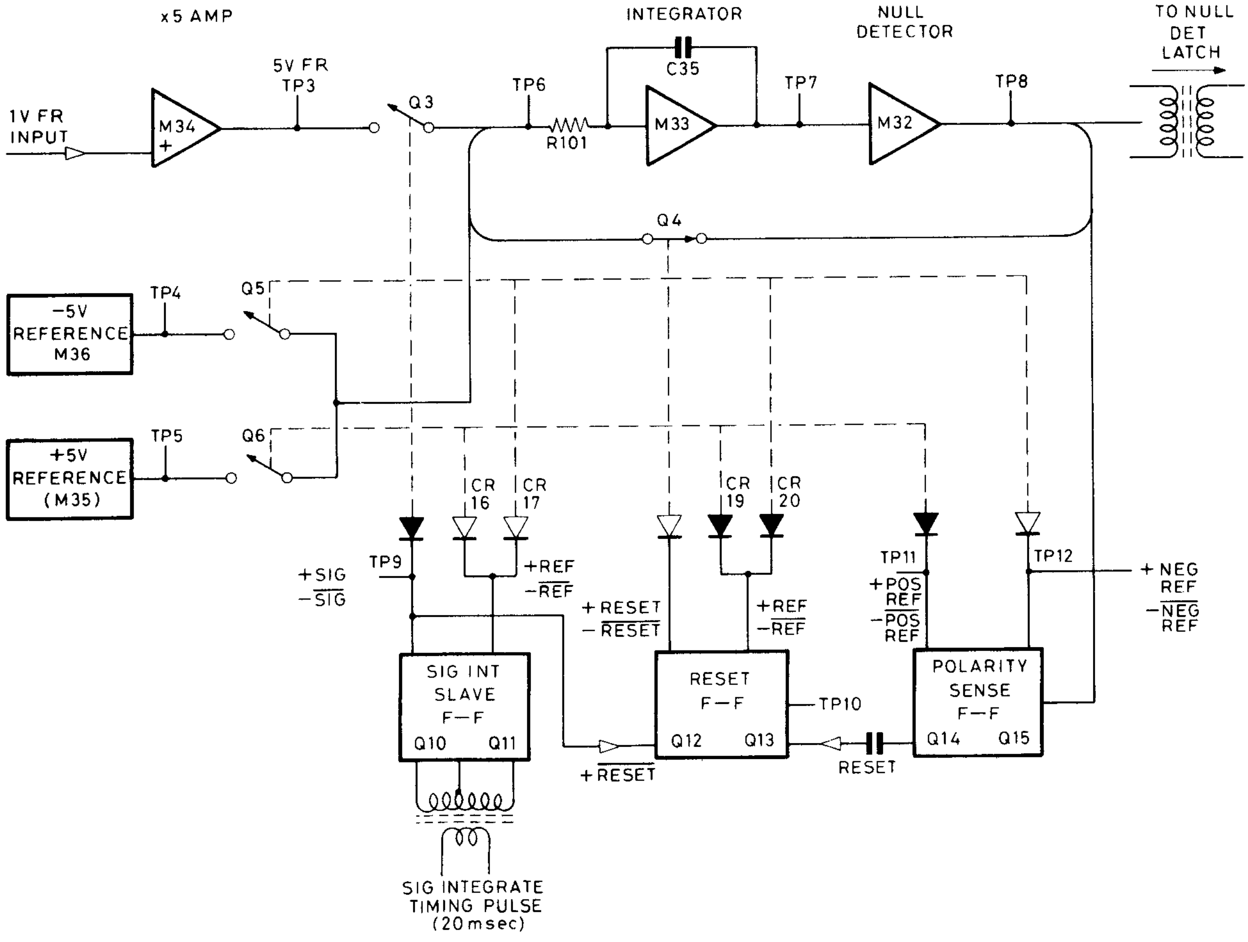


Fig.20 Dual-slope integrator switching

As explained in Section 1.3.5., the input signal is applied to an integrator for a set period of 20 msec, and the charge acquired by the integration capacitor during that time is proportional to the amplitude of the applied voltage. The capacitor is then discharged to zero volts by connecting the Integrator to a precise reference voltage; the length of time the reference voltage has to be applied in order to reach zero volts is measured by the digital circuitry, and is proportional to the amplitude of the input signal.

The sequence of operations is best explained with the aid of a timing diagram.

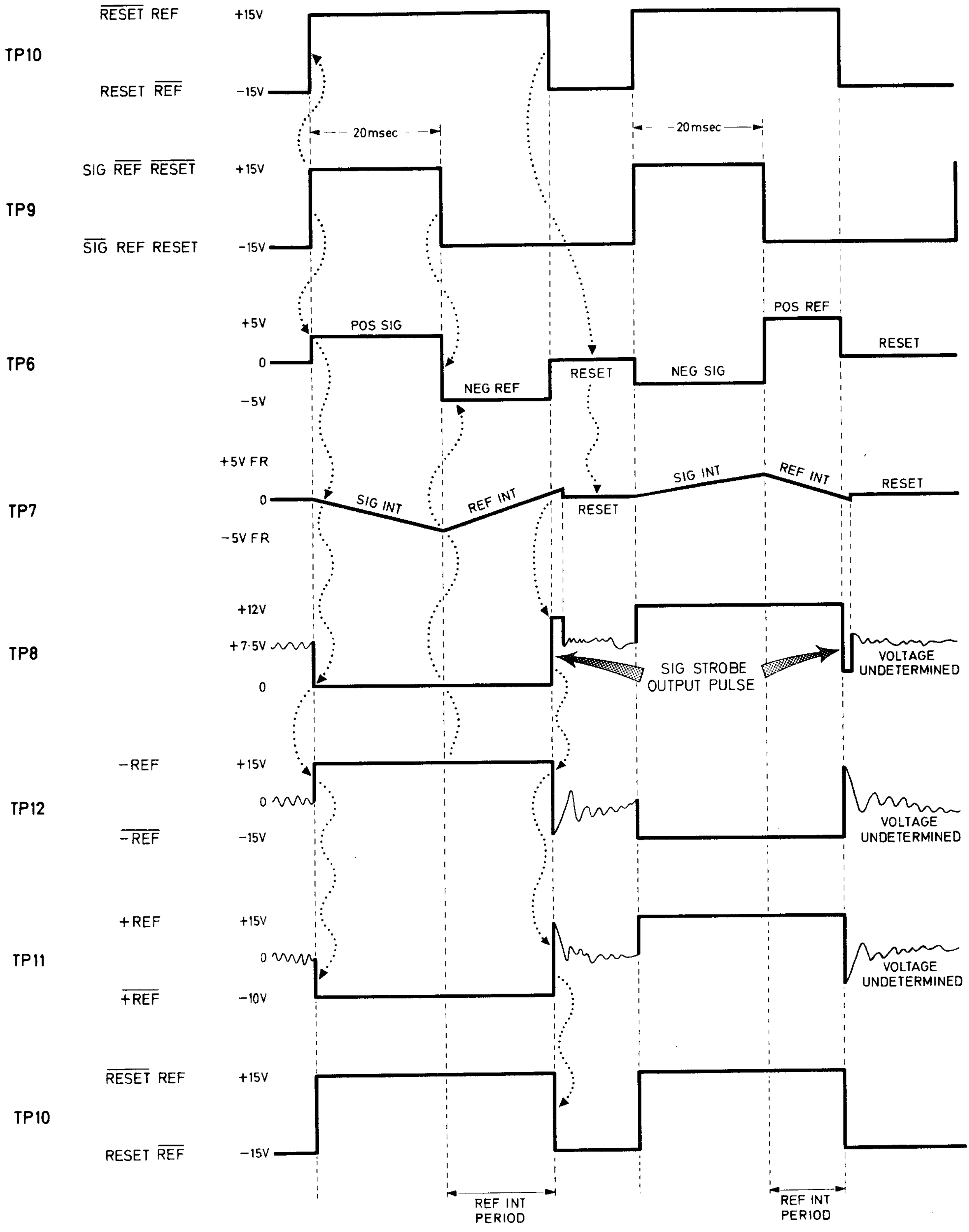


Fig. 21 Integrator timing diagram

Reference to the simplified switching diagram, Fig. 20 shows that the 1-volt FS input signal is amplified to 5-volts FS by M34 and appears in this form at TP3. A signal-integrate period is initiated by the positive-going edge of a timing pulse from the digital part of the circuit being applied to the Sig. Int. Slave F-F comprising Q10 and Q11 so that TP9 is driven positive into the SIG. state.

Apart from its primary function of closing signal-switching FET Q3, the positive SIG. voltage at TP9 changes over the Reset F-F into the $\overline{\text{RESET}}$ state and also inhibits the application of either positive or negative REF voltages by the action of logic diodes CR16/CR17 whose cathodes are taken negative.

When switching FET Q3 is turned on at the start of a signal integrate period, the signal (of some value less than 5 volts) appears at TP6 and is applied to the virtual-earth inverting input of M33 via a series resistor R101. The slope (rate of charging) applied to capacitor C35 is determined by the value of R101 (fixed) or by the voltage of the input signal. The polarity of the charging voltage at the output of M33 (TP7) is greatly amplified by the Null Detector, M32. The Null Detector circuit incorporates clamping diodes CR9/CR10 so that although a large output voltage swing occurs when TP7 departs from zero volts by only a small amount, the output voltage appearing at TP8 is clamped between fixed limits.

Null Detector output voltage at TP8 sets the polarity of the Polarity Sense F-F, attempting to apply a 5-volt reference potential by closure of Q5 or Q6 whose switching action is inhibited by the $\overline{\text{REF}}$ state of switching diodes CR16/CR17. At the end of the 20 msec timing pulse the Sig. Int. Slave F-F changes over. TP9 goes negative to the $\overline{\text{SIG}}$ state, opening Q3 and, at the same moment, switching diodes CR16/CR17 allow either Q5 or Q6 (as determined by the state of the Polarity Sense F-F) to close.

In the Model 1030, where the input signal is always positive, it is Q5 which closes. This applies a -5 volt reference to the Integrator to discharge the capacitor. The reference-integration period required for discharging the capacitor to zero volts will always be less than 20 msec (except with a FS input signal when it will equal 20 msec), and the instant of zero-crossing is sensed by the Null Detector. An output pulse of about 1 msec duration appears at TP8, and the pulse leading edge is fed as a SIG. STROBE OUTPUT, via pulse transformer TR3, to the Null Detect Latch in the digital part of the circuit. The pulse at TP8 changes over the Polarity Sense F-F and also drives the Reset F-F into its RESET state. Switching diodes CR19/CR20 inhibit further reference voltage being applied by opening Q5 (Q6), and the switching FET Q4 is turned on, closing the feedback loop so that C35 assumes a state of zero charge. The circuit is thus reset, ready for the next timing pulse.

A further look at the Timing Diagram Fig. 21 shows first a positive-going input signal, followed by a negative-going signal of smaller amplitude. Note the difference in the REF. INT. period. As used in the Model 1030, the +5-volt reference is only included as a safety precaution so that, in the event of a spurious negative signal, the Integrator would not lock up. For this reason the +5 V reference source is simplified for the Model 1030 and the regulation circuit comprising M35 is omitted.

Power Supply Unit The mains transformer and power supply components are mounted near the rear of the Analogue-Digital Display board. Transformer TR1 is of toroidal construction with a split primary comprising two 115-volt windings. These are intended for either series or parallel connection, depending on the supply voltage. An earth screen is interposed between the primary and secondary windings to minimize electrostatic coupling; this is grounded to supply-line earth. Completely separate from the earth screen, and isolated from all the windings, a further electrostatic screen is fitted to act as a Guard Shield.

Three secondary windings are provided, each with its separate full-wave bridge rectifier and solid-state regulator. Outputs from regulators M38 and M39 provide a -15 V - COMMON - +15 V d.c. supply, while an 8 volt r.m.s. winding is used with rectifier W1 and regulator M37 to give a separate +5 V line. The regulators used are Motorola Types MC7815 and MC7805. Apart from the difference in regulated output voltage, they are all capable of delivering a 1-ampere output, with foldback current limiting and thermal shut-down protection built in. No damage results to them even under short-circuit conditions.

4.3.2 Digital Section
(Drawing No. 439106 Sheet 1)

The simplified block diagram given below illustrates the general arrangement of the digital circuitry.

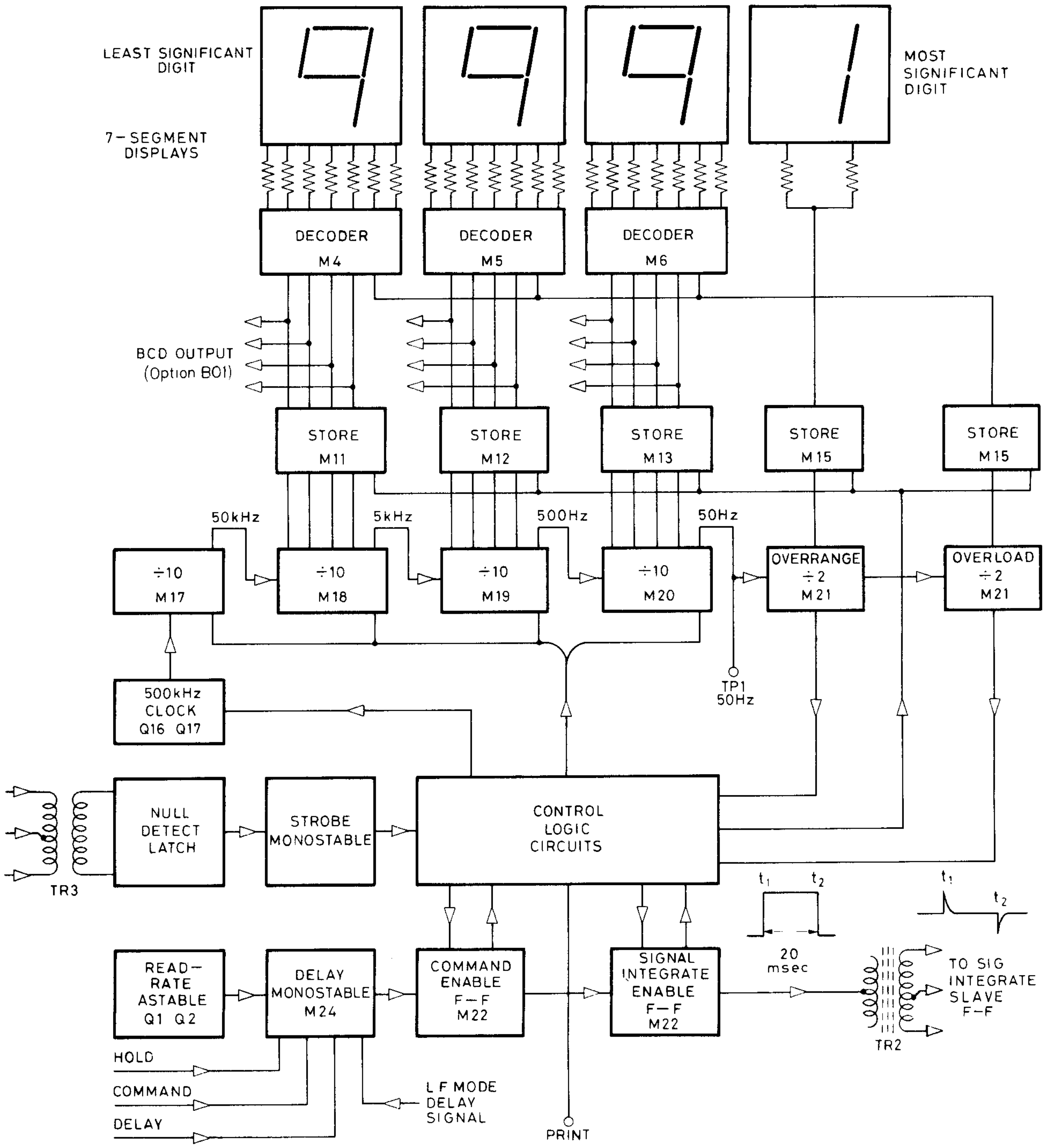


Fig.22 Simplified diagram of digital circuit

The repetition frequency with which digital measurements are made is determined by the Read Rate Astable. Its output is gated to allow HOLD, COMMAND or DELAY to be introduced by the Delay Monostable. DELAY applies to external command only and is only brought into operation by applying a zero to the Delay pin of the BCD connector (Option B01). The appropriate delay period is then automatically selected to allow a delay equal to the settling time of the analogue circuitry, depending upon whether it is switched to NORMAL or LF MODE.

At any time following a STROBE pulse from the Null Detector, the Command Enable F-F is in a state to permit a COMMAND to be fed into the Control Logic circuits. Upon receipt of a COMMAND pulse the Control Logic clears the Stores and sets all the decade counters to:-

999901

Note: In this, and all subsequent explanations, the least significant figure is shown on the left.

Output from the 500 kHz Clock is then admitted to the four cascaded decade counters M17 - M18 - M19 - M20 followed by two binary counters, Overrange and Overload. The first clock pulse admitted to the decade counters changes their state to:-

000011

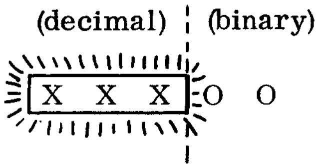
The change in state of the Overrange binary counter creates a pulse which is fed, via the Control Logic, to the Signal Integrate Enable F-F. This generates the leading edge of a flat-topped pulse at time t_1. After 10 000 clock pulses the Overrange binary counter changes state again when all the digits revert to zero, and:-

	(decimal)	(binary)
	0000	11
Plus:	0000	1
Equals:	0000	00

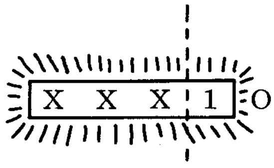
Signal Integrate Enable returns to its original state at time t_2, having generated a precise SIG. INTEGRATE pulse of exactly 20 msec duration. This pulse determines the signal integration period as explained in Section 4.3.1.

The count (standing at 000000 at time t_2) proceeds in an uninterrupted manner during the REF. INTEGRATE period until the Null Detect Latch operates and (via the Strobe Monostable and Logic Circuitry) stops further clock pulses from reaching the decade counters. At the same moment, the Strobe Monostable pulse is made available as a PRINT command. Depending upon the state of the count at the instant of STROBE, any one of three conditions can occur:-

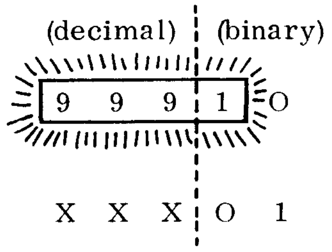
If less than full-range count:
The 7-segment displays fed from the decade counters will be illuminated.



If more than full-range count:
The 7-segment displays fed from the decade counters, plus the overrange figure 1 will be illuminated.



In the event of the count exceeding:



Then the instrument is in the OVERLOAD state and no digits are illuminated.

In the OVERLOAD condition the Control Logic circuits inhibit the Command Enable F-F and the Signal Integrate Enable F-F so that no further counts take place until the overload is removed.

On the following page the above sequence is summarized in tabular form for quick reference, see Fig. 23.

COUNTER SEQUENCE SUMMARY

(X = Undefined Digit)

	Least Significant					Most Significant
	DECADES				BINARY	
					Overrange	Overload
Initially	X	X	X	X	X	X
COMMAND sets to → (Then starts count)	9	9	9	9	0	1
TIME t_1 (COMMAND +1 clock pulse) Start of SIGNAL INTEGRATE	0	0	0	0	1	1
TIME t_2 (20 msec later) i.e. 10 000 clock pulses End of SIGNAL INTEGRATE Start of REF. INTEGRATE	0	0	0	0	0	0
Null Detects at end of REFERENCE INTEGRATE	Option (D01)					
<Full Range	X	X	ILLUMINATED X	X	0	0
>Full Range	X	X	ILLUMINATED X	X	1	0
Overload	X	X	X	X	0	1

Fig. 23

SECTION 5

SPECIFICATION VERIFICATION

5.1 DESCRIPTION

The following steps form a routine for checking that the instrument is working within its specified accuracy where the intention is not to re-calibrate internally. It is thus useful for incoming inspection or routine calibration checks. Full internal calibration is described in Section 6, MAINTENANCE.

It is recommended that due to the wide measurement capability of the instrument, only those aspects of the Specification relevant to normal use be verified. This saves considerably in both time and calibration equipment, particularly where high-frequency response up to 1 MHz is not required for the intended application. For general-purpose measurements, the whole procedure should be followed to verify the entire Specification. Space is provided to tick against each step checked.

5.2 INSTRUMENT REQUIREMENTS

For verifying the d.c. performance, a d.c. voltage source is required capable of producing approximately 1 volt.

For verifying the a.c. performance, a precision a.c. voltage source of high amplitude resolution and enough ranges to cover the user's requirements (10 mV to 1000 V for full performance check) and a wide enough frequency response to exceed the user's requirements (40 Hz to 1 MHz for full performance check) is needed. Accuracy should be three times better than the accuracy being verified. Alternatively, an a.c. voltage source of suitable capability but low accuracy may be used in conjunction with a thermal transfer standard of suitable range and accuracy (as above) with a precision d.c. voltage source for comparison purposes.

<u>Examples</u>: AC Calibrated Voltage Source: Fluke Model 5200A (5205A *)
‡Hewlett Packard Model 745A (746A *)

* The number in parenthesis above, represents a 1000 volt amplifier only, and thus can be dispensed with if voltages greater than 100 V are not to be measured.

‡ For tests up to 100 kHz only.

<u>Note</u>: If the performance of the 1, 10 and 100 volt ranges is found to be well within Specification it is extremely unlikely that the 1 kV range will be out of calibration. The 1 kV range uses only components previously checked for the above ranges, and cannot be calibrated separately.

Non-calibrated AC Voltage Source:	Optimation Model AC104
Thermal Transfer Standard:	Fluke Model 540B

5.3 PROCEDURE .... A.C. PERFORMANCE

5.3.1 Turn on the instrument to be checked and also the calibration instrument to be used, and allow at least 1 hour to warm up, preferably 2 hours.

5.3.2 Switch instrument to 1-volt range and ensure that all other push buttons are out. Connect Signal Lo to Guard with the link provided or with wire. (Signal Lo should always be connected to Guard via a low impedance, preferably at the signal source when very long leads are being used.) Always connect Signal Lo to the earthy side of the source.

5.3.3 To check the 1 V range, apply 1.0000 volts at about 420 Hz from the calibrated a.c. source and ensure that the instrument reads:

1.000(0) V ± .002 (.0014) V ....

(Brackets here and below indicated reading where fourth digit Option D01 is fitted.)

This check, if passed, indicates that most of the instrument is working correctly. If it is failed by more than about 1% then it is likely that there is a fault rather than a calibration error.

5.3.4 Switch to 10 V range. Apply 10.000 volts at about 420 Hz. Reading is:

10.00(0) ± .02 (.014) V ....

5.3.5 Switch to 100 V range. Apply 100.00 volts at about 420 Hz. Reading is:

100.0(0) ± .2 (.14) V ....

5.3.6 Switch to 1000 V range. Apply 1000 volts (if available *) at about 420 Hz.

Reading: 1000.(0) ± 3 (2.4) V ....

5.3.7 Switch to 10 mV range. Apply 10.000 mV at about 420 Hz. Reading is:

10.00(0) ± .04 mV ....

5.3.8 Switch to 100 mV range. Apply 100.00 mV at about 420 Hz. Reading is:

100.0(0) ± .2 '(.14) mV ....

5.3.9 Switch to 1 V range. Leave signal at 100.00 mV. Reading is:

.100(0) ± .001 (.0005) V ....

5.3.10 Leave on 1 V range. Apply 10.000 mV at about 420 Hz. Reading is:

.010(0) ± .001 (.0004) V ....

5.3.11 Switch to 10 V range. Leave signal at 10.000 mV. Reading is:

.01(0) ± .01 (.004) V ....

5.3.9, 5.3.10 and 5.3.11 check basic instrument linearity.

* See also Note, Section 5.2.

5.3.12 Switch to 1 V range. Apply 1.0000 volts at about 420 Hz. Switch to MEAN SQUARE. Reading is:

1.000(0) ± .004 (.0028) $\frac{V^2}{FR}$ ....

Leave on 1 V range. Apply 0.5000 volts at about 420 Hz. Reading is:

.250(0) ± .003 (.0018) $\frac{V^2}{FR}$ ....

These two measurements check the MEAN SQUARE capability and are also an indication that the square law circuitry (which defines RMS response) is working correctly.

5.3.13 Release MEAN SQUARE button. Repeat steps 5.3.3 to 5.3.8 inclusive at a frequency of about 30 kHz and check against readings below:-

1 V range, 1.0000 volts, 30 kHz input.

Reading: 1.000(0) ± .004(0) V ....

10 V range, 10.000 volts, 30 kHz input.

Reading: 10.00(0) ± .04/0) V ....

100 V range, 100.00 volts, 30 kHz input.

Reading: 100.0(0) ± .4(0) V ....

1 kV range, 1000.0 volts, 30 kHz input.

Reading: 1000.(0) ± 5.(0) V ....

10 mV range, 10.000 millivolts, 30 kHz input.

Reading: 10.00(0) ± .07(0) mV ....

100 mV range, 100.00 millivolts, 30 kHz input.

Reading: 100.0(0) ± .4(0) mV ....

5.3.14 Repeat steps 5.3.3 to 5.3.8 inclusive at a frequency of 100 kHz and check against the readings below:

1 V range, 1.000 volts, 100 kHz input.

Reading: 1.000(0) ± .007(0) V ....

10 V range, 10.00 volts, 100 kHz input.

Reading: 10.00(0) ± .07(0) V ....

100 V range, 100.0 volts, 100 kHz input.

Reading: 100.0(0) ± .7(0) V ....

1 kV range, 1000 volts, 100 kHz input.

Reading: 1000.(0) ± 8.(0) V ....

10 mV range, 10.00 millivolts, 100 kHz input.

Reading: 10.00(0) ± .34(0) mV ....

100 mV range, 100.0 millivolts, 100 kHz input.

Reading: 100.0(0) ± .7(0) mV ....

5.3.15 Repeat steps 5.3.3, 5.3.4, 5.3.5 and 5.3.8 with an input frequency of 1 MHz. Note that the calibration of the 1 kV range, is not specified at 1 MHz due to the maximum input limitation of 10^8 Volt-Hertz. THIS MUST NOT BE EXCEEDED. The calibration of the 10 mV range is not specified at 1 MHz

1 V range, 1.00 volts, 1 MHz input.

Reading: 1.000(0) ± .070(0) V ....

10 V range, 10.0 volts, 1 MHz input.

Reading: 10.00(0) ± .70(0) V ....

100 V range, 100 volts, 1 MHz input.

Reading: 100.0(0) ± 7.0(0) V ....

100 mV range, 100 millivolts, 1 MHz input.

Reading: 100.0(0) ± 7.0(0) mV ....

5.3.16 The above steps check the overall frequency response of the instrument and, as noted previously, can be curtailed when certain frequencies or ranges will never normally be used.

5.4 PROCEDURE .... D.C. PERFORMANCE

To check the d.c. performance of the instrument, after having checked the a.c. performance as described in Section 5.3, it is only necessary to check that it responds equally to positive and negative signals as follows:-

Switch to the 1 V range, DC CPLD (coupled). Apply approximately 1 volt d.c. with positive to Hi and negative to Lo, and note the reading.

Reverse the connections and check that the same reading, within ±.002 V, is obtained.

5.5 PROCEDURE .... L.F. PERFORMANCE

To check the low-frequency performance, a low-frequency function generator or oscillator is necessary. e.g. KDP Electronic Systems, Type 301. The Function Generator should be set to deliver a sinewave output, since this is the worst case for this test, and DC OFFSET should be switched out.

Maintain the Model 1030 settings as above. Apply approximately 1 volt 420 Hz sinewave from the Function Generator and set its output to approximately 1 volt. Change frequency to the Lowest Specified Frequency (depends on the Option fitted) for the NORMAL mode.

After settling check that the run-around is less than ±.001(0).

Switch to LF MODE and change the frequency to the Lowest Specified for LF MODE (again this depends on the Option ordered).

After settling check that the run-around is less than ±.001(0).

Notes: If non-standard integration filters are fitted, the details are recorded on the rear panel. The Specification section lists the relevant Lowest Specified Frequencies and additional %FS errors for each Option. Standard is as follows:-

NORMAL (button not depressed)	....	40 Hz.
LF MODE (button depressed)	....	1 Hz.

5.6 PROCEDURE .... BANDLIMIT FILTER

To check the BANDLIMIT filter, set the Model 1030 to its 1 V range ... all other buttons should be out. Set the Function Generator to give a 1.000 volt reading on the Model 1030 at 10 kHz....or alternate BANDLIMIT frequency, if specially ordered and supplied.

Switch to BANDLIMIT and check that the reading is .707(0) ±.042(0).

5.7 USING A TRANSFER STANDARD

Where a precision calibrated a.c. source is called for in the foregoing tests, and is not available, an uncalibrated source covering the required ranges can be used instead. It must be calibrated for each setting, using an alternative measuring device, which will almost certainly need to be a Thermal Transfer Standard together with a precision d.c. comparison source.

Care should be taken using such an instrument because its input impedance is likely to be low, whereas the Model 1030 is high. Shielded cables should therefore run from the signal source to the thermal transfer standard and then, from the same terminals of the thermal transfer standard, to the Model 1030. The Model 1030 reading should only be noted whilst the transfer standard is switched to the A.C. position; this ensures that the Model 1030 reading is taken with the transfer standard loading the signal source.

The transfer standard, in conjunction with a function generator, may also be used for further verification of the RMS response of the Model 1030. Measurements as above should be made on, say, the 1 V range using the function generator as the signal source. The conditions in Section 5.3.3 should be met for sine, square or triangle inputs, provided they have first been adjusted to exactly 1.0000 volts r.m.s. using the transfer standard.

If all the checks given in Sections 5.3 to 5.6 are made, and met by the Model 1030, this confirms that it is within its calibration specification.

SECTION 6

MAINTENANCE

6.1 GENERAL

It is strongly recommended that you should become familiar with the principles described in Section 4 . . . TECHNICAL DESCRIPTION . . . before commencing with the adjustment or replacement of component parts of the instrument. The Circuit Diagrams and Component Lists show all the electrical components contained in the instrument, together with their values and significant ratings.

The instrument uses solid-state devices which, despite their inherent long-term reliability and mechanical ruggedness, are susceptible to damage by overloading, reversed polarity, and excessive heat or radiation. Avoid hazards such as reversal of d.c. supply polarity, prolonged soldering, strong r.f. fields or other forms of radiation, the use of high voltage insulation testers or accidentally applied short circuits.

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 1.4.1 details a routine for checking the instrument is working within its specified accuracy and may be used as the first stage of an instrument maintenance procedure.

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 6.2.

Following repair or component replacement the procedures in Section 6.3.2 relevant to the repaired part should be carried out prior to performing a full routine calibration.

In case of difficulties, or for general advice on servicing your instrument, do not hesitate to write or telephone our Service Department. Always mention the type number and serial number of your instrument (For the address and telephone number, see the front of this handbook).

6.1.1 REMOVAL OF COVERS . . . ACCESS TO COMPONENTS

To gain access to the interior of the instrument, remove the four screws securing the top cover . . . two screws at each end. The cover may now be lifted clear of the instrument. Removal of the bottom cover is achieved in an identical manner.

It will be noted that, with both covers removed, the instrument is still fully capable of being operational; it may be inverted with no danger of component damage, and full mechanical rigidity is maintained during servicing operations.

When working on the instrument with its covers removed, it should be remembered that the supply-mains connections are not the only source of potential hazard; if the input terminals are still connected to an external circuit, the guard shields could be elevated to a dangerously high voltage.

6.2 ROUTINE CALIBRATION

6.2.1 General

The following section details a calibration procedure which should be carried out at the end of the Specification Validity period, or when the instrument is found to be out of specification.

After repair or replacement of components a full recalibration should be carried out consisting of the part of Section 6.3.2 applicable to the repaired circuitry followed by the routine calibration detailed here.

Before commencing calibration allow the instrument to stabilize for a minimum of 2 hours. Remove the covers but leave the guard shields in position for calibration.

6.2.2 Test Equipment

A.C. Calibrator
e.g. Hewlett Packard, Model 745A/746A.
Fluke, Model 5200/5205.

D.C. Digital Voltmeter: Accuracy 0.01% with 10μV resolution
e.g. Datron 1045, 1041, 1055, 1051.

20 MHz Oscilloscope: with Hi Z probe (10 Mohm, shunted by 10 pF or less).

D.C. Voltage Source: about 10 volts.

Function Generator: With good squarewave at 100 kHz, and calibrated sinewave output at 1 MHz. Accuracy 1.5%. (This last capability will not be required if already provided by the A.C. Calibrator.)

e.g. KDP Electronic Systems, Model 301
V-F Instruments, Model VFG 1500

Calibrated Source: Of about 5:1 crest-factor pulse train, at 1 volt r.m.s.

The last two items should be calibrated against a thermal transfer standard. If they are stable, this need not be done each time a 409106 is calibrated, but at periods frequent enough to overcome long-term drift.

6.2.3 Procedure

N.B. All inputs are A.C. sine waves unless otherwise stated.
All adjustments and test points are on the A.C. to D.C. converter board, 409106, unless otherwise stated.

Select 10V range, apply 0V input, 10mV 400Hz input and 100mV 400Hz input. If the instrument is within specification for these inputs Section 6.2.3.1 of this procedure may be omitted, otherwise complete all sections below.

6.2.3.1 Zero Adjustments

R23 i) Select 10mV range. Select D.C. coupled and Band Limit. Apply S/C (short circuit) input. Connect DVM to TP7 (Test Point) w.r.t. (with respect to) TP2. Adjust R23, front panel offset adjust, for minimum reading on DVM at TP7.

R94 ii) Switch to the 1 kV range and select MEAN SQUARE, all the other push buttons should be out. Short the input terminals and connect the oscilloscope to TP3, the current source of the half-wave recitfier, the oscilloscope timebase being set to 10 msec/div. and the Y sensitivity to 0.5 V/div. Adjust R94 for zero output, but note that the waveform will appear noisy due to the very high effective gain at this point.

R83 Move the oscilloscope probe to TP4 and adjust R83 to obtain –500 to –700 mV on TP4; once again the waveform will appear very noisy for the reason above.

Re-check and adjust R94/TP3 as above, then re-check and adjust R83/TP4. This process is repeated because the two adjustments are not totally independent of each other. Disconnect the oscilloscope. Turn R83 fully clockwise.

R144 R113 R83 Connect the DVM, switched to its 1 volt range, to output TP5; then adjust R144 to obtain a reading of –350μV ± 50μV. Release the MEAN SQUARE button and observe the DVM display. (If the 40 Hz NORMAL filter is fitted, connect the oscilloscope to TP5 as well.) On turning R113 clockwise, low-frequency oscillations may be observed at TP5. Adjust to obtain this condition and then turn R113 anti-clockwise until oscillations *just* cease. Depress the MEAN SQUARE button again, and adjust R144 for zero (± 40μV) at TP5; release MEAN SQUARE and check that the reading is very similar. Zero calibration is now complete. If oscillations do not appear, M5 Pin 6 (TP9) may be observed and adjusted for zero volts ± 100 mV using R113. Apply 1 mV @ 420 Hz and adjust R83 for 1.0 mV output.

6.2.3.2 D.C. Turnover Calibration

R91 Switch to the 10V range and select DC CPLD; all the other push buttons should be out. Check that, with the input short circuited, the DVM connected to TP5 reads zero ±200μV. Then connect a 10 volt d.c. source (approximate only), negative to Hi and positive to Lo, and note the DVM reading. Reverse the 10 volt source and adjust R91 for an identical reading on the DVM.

6.2.3.3 Full Scale Calibration

Set the instrument to its 1V range with all other buttons out. Apply 1.0000 volts r.m.s. at 420 Hz from the A.C. Calibrator. A reading very close to 1.000(0)V should be displayed on the DVM which is still connected to TP5. Note the reading.

Switch to DC CPLD and apply a calibrated 1.0000 volts high crest-factor signal
R74 to the input; then adjust R74 for an identical reading to that above. Remove the high crest factor and re-apply the sinewave and note the reading if different. Re-connect the high crest-factor signal and re-adjust R74 to agree with the new sinewave reading.

6.2.3.4 Analog to Digital Converter Calibration

i) Select 1KV range. No other buttons depressed. Apply S/C input. Adjust R75 on A–D converter board, 409109, to give a zero display. Set R75 to the mid-point of its adjustment which gives zero indication.

ii) Select 1V range. Apply 1V 400Hz. Adjust R86 on A–D converter board, 409109, until the display reads the same as the DVM which is still connected to TP5 on the AC–DC Board.

6.2.3.5 Full Range Adjustments

Place the upper and lower covers in position but not fastened in place, and allow the instrument to stabilise. Each adjustment should be made as quickly as possible and the covers replaced.
Readings given in brackets thus, 999(9) are applicable to Option D01.

Using the A.C. Calibrator apply the specified input voltages and adjust the associated component until the display is as stated.

1 V range: 420 Hz, 1.0000 volts input.
Adjust R40 for 1.000(0) ± .000(3) V.

10 V range: 420 Hz, 10.000 volts input.
Adjust R39 for 10.00(0) ± .00(3) V.

100 V range: 420 Hz, 100.00 volts input.
Adjust R11 for 100.0(0) ± .0(3) V.

10 mV range: 420 Hz, 10.000 millivolts input.
Adjust R60 for 10.00(0) ± .00(5) mV.

100 mV range: 420 Hz, 100.00 millivolts input.
Adjust R66 for 100.0(0) ± .0(3) mV.

1 V range: 25 kHz, 1.0000 volts input.
Adjust C16 for 1.000(0) ± .000(5) V.

10 V range: 25 kHz, 10.000 volts input.
Adjust C18 for 10.00(0) ± .00(5) V.

100 V range: 25 kHz, 100.00 volts input.
Adjust C6 for 100.0(0) ± .0(5) V.

10 mV range: 25 kHz, 10.000 millivolts input.
Adjust C24 for 10.00(0) ± .01(0) mV.

100 mV range: 25 kHz, 100.00 millivolts input.
Adjust C26 for 100.0(0) ± .0(5) mV.

1 V range, MEAN SQUARE: 420 Hz 1.0000 volts input.
Adjust R138 for 1.000(0) ± .000(5) $\frac{V^2}{FR}$

The instrument is now fully calibrated.

6.3 REPAIR AND COMPONENT REPLACEMENT

The necessity for integrated circuit or transistor replacement is unlikely and, should such an event occur, the semiconductor failure can often be attributed to component breakdown in the associated circuit.

Apart from the RMS Module (which is obtainable only from Datron Electronics Ltd.) and matched 2N3906 transistors, Q6 and Q7, which are available ready-matched from Datron, all the integrated circuits and other semiconductor devices are standard manufacturers' products, and special selection is unnecessary. The thermal tracking of the two halves of FET Q4A/B is particularly important, to ensure a low order of zero drift with variations of temperature. Thermal balancing of the two halves of the circuit is achieved by selecting associated component values, and is described in Section 6.3.2.2, Zero Drift Compensation. This rather time-consuming procedure is carried out initially during manufacture, and need only be repeated following replacement of Q4A/B.

In certain other cases, following semiconductor replacement, it may be necessary to readjust associated preset components, and full details of recalibration (based upon original factory calibration procedures) are given in this section.

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 to help with component removal.

The following Sections form part of the original factory setting-up procedures for the two printed-circuit boards. During manufacture certain resistors are selected in value (FSV = Factory Selected Value) to accommodate circuit component tolerances, or to bring the desired setting of a preset control to the middle of its adjustment range.

As the values of the FSV resistors have already been correctly chosen to suit your instrument, the methods used for their selection have, in most instances, been omitted. Full details are given for adjusting all the preset components.

Important: In some cases the factory setting-up procedure calls for an initial approximate setting of a preset control, and its final critical adjustment is more fully described in a later Section. The reader is therefore warned *not* to 'follow blindly' all the sequences described, but to read and understand the reason behind each procedure, before embarking upon any actual adjustments on his own account. This approach should minimize the amount of time you spend on recalibration and, in a number of instances, will save you from upsetting preset adjustments which are already correctly set.

Readings given in brackets thus, 999(9), are applicable to Option (D01).

N.B. A routine calibration as detailed in Section 6.2 should be carried out after completion of the following procedures.

6.3.1 A – D Board Procedures following repair or component replacement

Put the instrument into the HOLD mode. This is accomplished by connecting digital COMMON to the HOLD command line. (Link pins 39 and 40 of the BCD output connector J5 if either of the BCD output Options are provided.) Alternatively if BCD facilities are not included, turn the instrument OFF and solder a jumper lead between pin 7 LOWER and pin 6 LOWER of connector J4.

6.3.1.1 Integration Period Calibration: Sense the TTL pulse waveform on TP1, near M20, and adjust preset potentiometer R37 until the period of the waveform is 20.00 ± 0.01 milliseconds, i.e. 50 Hz.

In the U.S.A. and other counries where the supply-mains frequency is other than 50 Hz, the waveform period is set to the nominal mains period. Thus, in the U.S.A. set to 16.67 ± 0.01 milliseconds, i.e. 60 Hz.

A time interval counter may be used for this procedure or, alternatively, connect TP1 to the A Channel of the dual trace oscilloscope. Set the Y sensitivity to about 5 V/division, and trigger the timebase from this channel. Set the timebase to 10 msec/division. Connect a source of mains supply frequency (simple hum pick-up at a high sensitivity is adequate) to the B Channel, so that the 50 (or 60) Hz waveform is about 2 divisions p-p high on the screen. If the oscilloscope is dual-trace rather than double-beam, switch the time base to CHOP rather than ALTERNATE
R37 mode, and adjust R37 until both traces are the same frequency. (Both traces stationary with respect to each other, or less than one period drift in 20 seconds.) It is important, when using this procedure, that the supply-mains frequency is close to nominal and, for this reason, it should not be carried out at times of peak load, particularly in winter. Having adjusted R37, disconnect the oscilloscope probes, etc.

6.3.1.2 Zero Calibration: Remove the HOLD link and let the instrument free run. Short
R75 together Signal COMMON pin, Analogue COMMON pin and the Signal Input pin on the board. Adjust R75 for zero indication on the display.

6.3.1.3 Full-Scale Calibration: Remove the short between the Signal Input pin and COMMON (leaving Signal COMMON and Analogue COMMON shorted together). Adjust the D.C. Calibration Source to 1.0000 volts and connect it between the Signal Input pin and Signal
R86 COMMON . . . with the Lo side of the calibration source to COMMON. Adjust R86 until the display reads 1000(0). Reselect R87 if span of R86 insufficient.

6.3.1.4 Linearity and Display Check: Leaving the D.C. Calibrator connected, set it to the following output levels and observe the displayed readings: –

Set calibrator to .999 (.9999) volts
and observe reading 999(9)

Set calibrator to .888 (.8888) volts
and observe reading 888(8)

Repeat the above check for all digits down to 111(1) and continue through 11(1), 1(1) and (1). Linearity on all steps should be ± 1 least-significant digit.

6.3.1.5 Overload Check: Check that the display blanks out as soon as the input voltage exceeds 1.999(9) volts.

6.3.2 AC to DC Board – Procedures following repair or component replacement

6.3.2.1 General

Check as far as possible that the board is functioning correctly, by applying low frequency signals from the Function Generator and observing the output with the DVM on its 1 V range. Check that all ranges are functioning and that relay K1 operates when the DC COUPLED switch is depressed. Check that MEAN SQUARE is functioning, by applying about 0.5 volts and then switching to MEAN SQIARE; note that the output is approximately squared. Apply an input signal at BAND LIMIT frequency (Standard - 10 kHz) and note that there is a 3 dB fall in output when the BAND LIMIT switch is depressed.

Switch to the 100 V range with all other switches out, and disconnect the Function
R144 Generator. Switch to MEAN SQUARE and observe that the output is near zero. Adjust R144 for the smallest near-zero reading; note the output voltage and its polarity. Select LF MODE and adjust R148 for the same reading as noted above. (For the 0.01 Hz LF MODE, Option F04,
R148 this last adjustment should be amended to read +2.0 mV higher than the NORMAL mode reading; for 0.1 Hz LF MODE, Option F03, +0.4 mV higher.)

N.B. The settling time for this adjustment is dependant on the L.F. mode filter option fitted.

6.3.2.2 Zero Drift Compensation: This procedure should *only* be carried out following replacement of dual FET Q4A/B.

Switch to the 10 mV range, DC CPLD, short together Hi, Lo and GUARD terminals, and connect the DVM on its 1 volt d.c. range, positive to TP1 (Pre-amplifier output) and negative to TP2 (COMMON). Adjust the mV NULL to its approximate mechanical mid-position and observe the reading on the DVM.

Select FSV resistor (either R17 or R25) to reduce the DVM reading to less than 20 mV. Do *not* solder in.

Touch a soldering iron (isolated from mains and earth e.g. Weller TCP1/PU1D with TCP1 earth disconnected) to dual FET Q4A/B for a maximum of 2 seconds for thermal settling and observe the relatively steady offset voltage on the DVM. If it has changed by less than 3 mV, no further calibration is required.

If the output voltage has changed by more than 3 mV, note the direction (polarity) of the drift and select an FSV resistor, either R21 or R30, of about 270 ohms to offset the preamplifier output in the same direction as it drifted. After ensuring that Q4 has cooled to about room temperature (if necessary use a chemical freezer spray) re-select FSV resistor R17 or R25 to reduce the output to less than 20 mV as before.

Repeat the above heating process and select different values for R21 or R30. If the drift direction is still the same as previously and greater than 3 mV, reduce the value of the previously chosen FSV; if the drift direction has reversed, increase the value. Allow to cool and repeat the output nulling process by re-selecting R17 or R25.

Repeat the whole process as many times as is necessary, until the drift, when Q4A/B is heated with a soldering iron is less than 3 mV, giving an estimated 2 μV/°C or better. Solder the FSV resistors into position, and adjust the mV NULL control on the front panel until a zero reading is indicated on the DVM, thus zeroing the pre-amplifier. Disconnect the DVM.

Note 1: The dual FET must not be overheated during the above process. Excessive heating will cause gate current drift and affect the zeroing process by giving misleading results.

Note 2: For speed of setting up, preset potentiometers may be substituted for the FSV resistors during the above process. Having found the best settings for minimum thermal drift, their values should be measured and appropriate fixed resistors substituted.

6.3.2.3 Preamplifier H.F. Compensation: Release the DC CPLD switch and connect the Function Generator to the input, leaving the shorting link between Lo and GUARD. Select the 1 V range and adjust the Function Generator at 1 kHz to deliver 2 volts p-p as measured on the oscilloscope. Ensure that the oscilloscope probe compensation is correct and adjust if necessary, check the squarewave shape at 100 kHz and then return to 1 kHz.

Apply 1 V 1 MHz input. Connect DVM to TP7 w.r.t. TP2. Select R154 for reading of 1 V ± 5% on DVM.

Apply 100 mV 1 MHz input. Ensure DVM connected to TP7 w.r.t. TP2. Select R89 for reading of 100mV ± 5% on DVM.

SECTION 7

OTHER OPTIONS

7.1 ANALOGUE OUTPUT

The analogue output is presented from the rear panel via a 5-pin 'M' series connector and a fast-acting fuse in the Hi side. It is a 1 volt full range, output for any nominal full range input, with overrange capability to 2 volts. The output impedance is of the order of a few ohms and no more than 5 mA should be demanded.

Note:

Output Lo is connected via a PCB track to Input Lo. **DO NOT APPLY VOLTS BETWEEN OUTPUT Lo AND INPUT Lo OR DAMAGE MAY RESULT.**

Pin Connections as seen from rear.

A = Output Hi

B = Output Lo

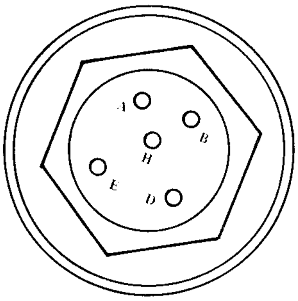


Fig. 24

7.2 Occasionally it may be more convenient for a user to apply his signal input via the rear rather than the front panel. The spare pins on the analogue output connector can be used for this as follows:-

E = INPUT Hi

D = INPUT Lo

H = GUARD

Note that since high voltage may be present on the input the connector must be wired with great care to prevent shorting or arcing.

If rear input is ordered then the front input terminals are omitted mainly for safety reasons, and a plate bearing the legend "Rear Input Only" mounted on the front panel.

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R1	050 003	249K, $\frac{1}{8}$W, 1% MF	Welwyn/Holco	4033D	3
R2	050 003	" " "	"	"	–
R3	050 003	" " "	"	"	–
R4	050 002	243K, $\frac{1}{8}$W, 1% MF	"	"	1
R5	000 104	100K, $\frac{1}{4}$W, 5% Carbon	Mullard	CR25	11
R6	000 332	3K3, 5%, $\frac{1}{4}$W Carbon	"	"	8
R7	000 330	33R, " "	"	"	1
R8	011 002	10K, 1%, $\frac{1}{8}$W MF	Welwyn	4033C	8
R9	019 763	976K, 1%, $\frac{1}{8}$W MF	"	"	3
R10	000 332	3K3, 5%, $\frac{1}{4}$W Carbon	Mullard	CR25	–
R11	063 503	50K, $\frac{3}{8}$" Cermet Pot	Beckman	72P	3
R12	000 104	100K, 5%, $\frac{1}{4}$W Carbon	Mullard	CR25	–
R13	000 332	3K3, " "	"	"	–
R14	000 224	220K, " "	"	"	4
R15	000 183	18K, " "	"	"	1
R16	070 080	6K8, 1%, $\frac{1}{4}$W WW	Mann	MX125B	2
R17		FSV (330K 5% $\frac{1}{4}$W Carbon)	Mullard	CR25	1 of Kit
R18	000 272	2K7, 5%, $\frac{1}{4}$W Carbon	"	"	3
R19	000 105	1M 5% ¼W CARBON	"	"	8
R20	014 708	47R, 1%, $\frac{1}{8}$W MF	WELWYN	"	2
R21		FSV (270R $\frac{1}{4}$W Carbon)	Mullard	CR25	1 of Kit
R22	000 470	47R, 5%, $\frac{1}{4}$W Carbon	"	"	3
R23	060 205	2 M, $\frac{3}{4}$" IOT Cer Pot	Beckman	79P	1

NOTES.

Do not load FSVs (Factory selected value)

ISS.	14	15	16	17	18	19	20	21	22C	23	24
ECO.	190	198	218	254	272	408	412	456	533	541	688

REV. 4	REV. 5	REV. 6	REV. 7	REV. 8	REV. 9	REV. 10	REV. 11	REV. 12	13
E.C.O. 29	E.C.O. 36	E.C.O. 57	E.C.O. 73	E.C.O. 80	E.C.O. 83	ECO 84	ECO. 124	ECO. 152	156

DATE 20.9.76

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NEXT DRAWING 2.2.77

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TITLE 1030 MAIN R.M.S. PCB ASSY.

DRAWING NUMBER 409106

SHEET 2 OF 15

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R24	000 272	2K7, $\frac{1}{4}$W, 5% Carbon	As Sheet 2	CR25	-
R25		FSV (330K) $\frac{1}{4}$W, 5% Carbon	"	"	1 of Kit
R26	070 080	6K8, $\frac{1}{4}$W, 1% W.W.	"	MX125B	-
R27	000 105	1M, $\frac{1}{4}$W, 5% CARBON	MULLARD	CR25	-
R28	000 332	3K3, $\frac{1}{4}$W, 5% Carbon	"	CR25	-
R29	014 708	47R, $\frac{1}{8}$W, 1% MF	WELWYN	4033C	-
R30		FSV (270R) 5% Carbon	MULLARD	CR25	1 of Kit
R31	018 201	8K2, $\frac{1}{8}$W, 1% MF	"	4033C	1
R32	000 224	220K, $\frac{1}{4}$W, 5% Carbon	"	CR25	-
R33	000 474	470K, " "	"	CR25	3
R34	000 152	1K5, " "	"	"	3
R35	000 152	1K5, " "	"	"	-
R36	000 825	8M2, " 10% "	"	"	1
R37	011 103	110K, $\frac{1}{8}$W, 1% MF	"	4033C	1
R38	019 763	976K, $\frac{1}{8}$W " "	"	"	-
R39	063 502	5K, $\frac{3}{8}$" Cerm Pot	"	72P	2
R40	063 503	50K, " "	"	72P	-
R41	000 391	390R, $\frac{1}{4}$W, 5% Carbon	"	CR25	1
R42	000 470	47R, " "	"	"	-
R43	000 222	2K2, " "	"	"	3
R44	000 102	1K, " "	"	"	2
R45	000 472	4K7, " "	"	"	2
R46	000 392	3K9, " "	"	"	1

NOTES.

REV. 4	REV. 5	REV.	
ECO. 29	ECO. 36	E.C.O.	

SEE SHEET 2 FOR LATEST ISSUE

DATE.

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CHECK

NEXT DRAWING

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TITLE

1030 MAIN R.M.S. PCB ASSY

DRAWING NUMBER 409106 - ~~4~~ 5

SHEET 3 OF 15

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R47	000 470	47R, $\frac{1}{4}$W, 5% Carbon	As Sheet 2	CR25	-
R48	000 102	1K, " "	"	"	-
R49	000 101	100R, " "	"	"	4
R50	000 101	100R, " "	"	"	-
R51	000 331	330R, " "	"	"	3
R52	000 100	10R, " "	"	"	2
R53	000 100	10R, " "	"	"	-
R54	000 331	330R, " "	"	"	-
R55	000 223	22K, " "	"	"	5
R56	000 104	100K, " "	"	"	-
R57	000 223	22K, " "	"	"	-
R58	000 122	1K2, " "	"	"	1
R59	019 763	976K, 1%, $\frac{1}{8}$W MF	"	4033C	-
R60	063 503	50K, $\frac{3}{8}$" Cerm Pot	"	72P	-
R61	000 104	100K, 5%, $\frac{1}{4}$W Carbon	"	CR25	-
R62	000 332	3K3, " "	"	"	-
R63	000 104	100K, " "	"	"	-
R64	000 223	22K, " "	"	"	-
R65	019 762	97K6, 1%, $\frac{1}{2}$W MF	"		1
R66	063 502	5K, $\frac{3}{8}$" Cerm Pot	"	72P	-
R67	000 104	100K, 5%, $\frac{1}{4}$W Carbon	"	CR25	-
R68	011 022	10K2, 1%, $\frac{1}{8}$W MF	"	4033C	1
R69	000 185	1M8, 10%, $\frac{1}{4}$W Carbon	"	CR25	1

NOTES.

REV. 4	REV. 5	REV.	
ECO. 29	ECO 36	ECO.	

SEE SHEET 2 FOR LATEST ISSUE

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REV ~~4~~ 5

datron ELECTRONICS LTD.

TITLE
1030 MAIN R.M.S. PCB ASSY

DRAWING NUMBER 409106

SHEET 4 OF 15

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R70		NOT USED	As Sheet 2		NOT USED
R71	000 103	10K, $\frac{1}{4}$W, 5% Carbon	"	CR25	17
R72	000 103	10K, " "	"	CR25	-
R73	290 025	FSV Part of RMS Kit	"		-
R74	063 101	100R, $\frac{3}{8}$" Cerm Pot	"	72P	1
R75	000 390	39R, $\frac{1}{4}$W, 5% Carbon	"	CR25	1
R76	000 103	10K, " "	"	"	-
R77	000 104	100K, " "	"	"	-
R78	011 002	10K, $\frac{1}{8}$W, 1% MF	"	4033C	-
R79	000 104	100K, $\frac{1}{4}$W, 5% Carbon	"	CR25	-
R80	011 002	10K, $\frac{1}{8}$W, 1% MF	"	4033C	-
R81	011 002	10K, " "	"	"	-
R82	000 682	6K8, $\frac{1}{4}$W, 5% Carbon	"	CR25	3
R83	063 205	2M, $\frac{3}{8}$" Cerm Pot	"	72P	3
R84	000 336	33M, $\frac{1}{4}$W, 10% Carbon	"	CR25	2
R85	000 221	220R, " "	"	"	2
R86	011 001	1K, $\frac{1}{8}$W, 1% MF	"	4033C	3
R87	000 473	47K, $\frac{1}{4}$W, 5% Carbon	"	CR25	1
R88	000 105	1M, " "	"	CR25	-
R89		FSV (100R,5% Carbon)	"	CR25	1
R90	000 223	22K, $\frac{1}{4}$W, 5% Carbon	"	"	-
R91	063 500	50R, $\frac{3}{8}$" Cerm Pot	"	72P	1
R92	011 001	1K, $\frac{1}{8}$W, 1% MF	"	4033C	-

NOTES.

REV. 4	REV. 5	REV.	
ECO. 29	ECO. 36	E.C.O.	

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NEXT DRAWING
REV ~~4~~5

datron ELECTRONICS LTD.
TITLE
1030 MAIN RMS PCB ASSY
DRAWING NUMBER 409106
SHEET 5 OF 15

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R93	000 152	1K5, $\frac{1}{4}$W, 5% Carbon	As Sheet 2	CR25	-
R94	063 205	2M, $\frac{3}{8}$" Cerm Pot	"	72P	-
R95	000 336	33 M, $\frac{1}{4}$W, 10% Carbon	"	CR25	-
R96	000 104	100K, $\frac{1}{4}$W, 5% Carbon	"	"	-
R97	000 124	120K, " "	"	"	1
R98	000 682	6K8, " "	"	"	-
R99	000 221	220R, " "	"	"	-
R100	000 222	2K2, " "	"	"	-
R101	012 001	2K, $\frac{1}{8}$W, 1% MF	"	4033C	1
R102	000 471	470R, $\frac{1}{4}$W, 5% Carbon	"	CR25	1
R103	000 103	10K, " "	"	"	-
R104	000 682	6K8, " "	"	"	-
R105	000 681	680R, " "	"	"	1
R106	000 101	100R, " "	"	"	-
R107	000 153	15K, " "	"	"	2
R108	000 272	2K7, " "	"	"	-
R109	000 108	1R, " "	"	"	1
R110	000 123	FSV (FIT 12k ON ASSY)	"		1
R111	000 222	2K2, $\frac{1}{4}$W, 5% Carbon	"	CR25	-
R112	000 106	10M, $\frac{1}{4}$W, 10% Carbon	"	"	2
R113	* 063 205	2M, $\frac{3}{8}$" Cermet Pot	"	72P	-
R114	000 223	22K, $\frac{1}{4}$W, 5% Carbon	"	CR25	-
R115	000 332	3K3, " "	"	"	-

NOTES.

* Is skeleton pot No. 062 205 on early models

REV. 4	REV. 5	REV.	
ECO.29	ECO.36	E.C.O.	

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REV ~~4~~ 5

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TITLE
1030 R.M.S. MAIN PCB ASSY

DRAWING NUMBER 409106

SHEET 6 OF 15

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R116	012 202	22K, $\frac{1}{8}$W, 1% MF	As Sheet 2	4033C	1
R117	440 028	FSV (150K,$\frac{1}{8}$W MF)	"	"	1
R118	000 331	330R, $\frac{1}{4}$W, 5% Carbon	"	"	–
R119	011 002	10K, $\frac{1}{8}$W, 1% MF	"	"	–
R120	000 103	10K, $\frac{1}{4}$W, 5% Carbon	"	CR25	–
R121	000 104	100K, " "	"	"	–
R122	000 332	3K3, " "	"	"	–
R123	000 224	220K, " "	"	"	–
R124	000 105	1M, " "	"	"	–
R125	000 105	1M, " "	"	"	–
R126	000 153	15K " "	"	"	–
R127	000 824	820K " "	"	"	1
R128	000 113	11K " "	"	"	1
R129	000 624	620K " "	"	"	1
R130	000 274	270K " "	"	"	1
R131	000 472	4K7 " "	"	"	–
R132	000 105	1M, $\frac{1}{4}$W, 5% Carbon	"	"	–
R133	000 104	100K, " "	"	"	–
R134	000 224	220K, " "	"	"	–
R135	000 332	3K3, " "	"	"	–
R136	000 105	1M, " "	"	"	–
R137	014 701	4K7, $\frac{1}{8}$W, 1% MF	"	4033C	1
R138	063 501	500R, $\frac{3}{8}$" Cermet Pot	"	72P	1

NOTES.

REV.4	REV. 5	REV.	
ECO. 29	ECO.36	E.C.O.	

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REV ~~4~~ 5

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TITLE
1030 MAIN R.M.S. PCB ASSY

DRAWING NUMBER 409106

SHEET 7 OF 15

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R139	011 002	10K, $\frac{1}{8}$W, 1% MF	See Sheet 2	4033C	-
R140	000 105	1M, $\frac{1}{4}$W, 5% Carbon	"	CR25	-
R141	000 106	10M, " "	"	"	-
R142	000 103	10K, " "	"	"	-
R143	011 002	10K, $\frac{1}{8}$W, 1% MF	"	4033C	-
R144	063 104	100K, $\frac{3}{8}$" Cermet Pot	"	72P	1
R145	000 103	10K, $\frac{1}{4}$W, 5% Carbon	"	CR25	-
R146	011 002	10K, $\frac{1}{8}$W, 1% MF	"	4033C	-
R147		FSV (680K,$\frac{1}{4}$W Carbon)	"	CR25	1 of Kit
R148	063 504	500K, $\frac{3}{8}$" Cermet Pot	"	72P	1
R149	000 476	47M, $\frac{1}{4}$W, 10% Carbon	Allan Bradley	C810	1
R150	000 103	10K, 5%, $\frac{1}{4}$W Carbon	Mullard	CR25	-
R151	000 101	100R, " "	"	"	-
R152	000 474	470k " "	"	"	-
R153	000 474	470k " "	"	"	-
R154		FSV (12K,$\frac{1}{4}$W Carbon)	"	"	1 of Kit
R155	011 001	1K, $\frac{1}{8}$W, 1% MF	Welwyn	4033C	-
R156	090 001	PTC Thermistor	Mullard	VA8650	1
R157-R165	000 103	10 K,¼W, 5% CARBON	MULLARD	CR25	—

NOTES.

REV. 4	REV. 5	REV.	
ECO. 29	ECO. 36	ECO.	

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REV ~~4~~ 5

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TITLE
1030 MAIN R.M.S. PCB ASSY
DRAWING NUMBER 409106
SHEET 8
OF 15

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
C1	104 014	27pF, 10%, 2KV NI50 Cer Disc	Erie	Standard Ceramicon 801	2
C2	104 014	" " "	"	" "	-
C3	102 221	220pF Cer Disc	"	801	1
C4	120 001	.22mF, 10%, 1Kv Polycarb	Facel	PC	1
C5	130 025	22pF, 5%, 160v, PS	Iskra/Suflex		3
C6	140 007 *	15pF Trimmer	Jackson	VPC 15	5
C7	130 002	15pF, 5%, 160v, PS	Iskra or Suflex		2
C8	130 012	1200pF±2½% 63v Ps.	Iskra or Suflex		2
C9	102 102	1KpF, 500v Cer Disc	Erie	Standard Ceramicon 801	6
C10	102 471	470pF, 500v Cer Disc	Erie	" " "	3
C11	102 102	1KpF, 500v Cer Disc	"	" " "	-
C12	110 015	.015mF Min Polyest	Wima	FKS 2 Min	2
C13	110 015	" " "	"	"	-
C14	130 025	22pF, 5%, 160v PS	Iskra Suflex		-
C15	130 002	15pF, " "	" "		-
C16	140 007 *	15pF Trimmer	Jackson	VPC 15	-
C17	130 004	100pF, 5%, 160v PS	Iskra Suflex		1
C18	140 007 *	15pF Trimmer	Jackson	VPC 15	-
C19	150 001	22mF, 16v Dipped Tant	Union Carbide	K22E16	2
C20	150 001	" " "	"	"	-
C21	102 220	22pF, 500v Cer Disc	Erie	Standard Ceramicon 831	2
C22	130 011	10pF, 5%, 160v PS	Iskra Suflex		2
C23	130 011	10pF, 5%, 160v PS	" "		-

NOTES.

Use Mullard 80909003 (140001) UNTIL STOCK EXHAUSTED

REV. 4	REV. 5	REV.	
ECO. 29	ECO. 36	E.C.O.	

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TITLE
1030 MAIN R.M.S. PCB ASSY
DRAWING NUMBER 409106
SHEET 9
OF 15

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
C24	140 007 *	15pF Trimmer	As Sheet 9	VPC 15	-
C25	130 006	82pF, 5%, 160v PS	"		1
C26	140 007 *	15pF Trimmer	"	VPC 15	-
C27	130 025	22pF, 5%, 160v PS	"		-
C28	130 012	1200pF±2½%63v PS	"		—
C29	130 007	3K3pF, " "	"		2
C30	130 007	3K3pF, " "	"		-
C31	110 006	.033mF, 10%, 250v PY	Mullard	C280AE/P33K	1
C32	102 228	2.2pF Cer Disc MPO	As Sheet 9	861 NPO	1
C33	102 102	1000pF Cer Disc	"	801	-
C34	102 471	470 pF " "	"	801	
C35	101 103	.01mF, " "	"	801	7
C36	101 103	.01mF, " "	"	"	-
C37	150 002	10mF, 16v	"	K10E16	1
C38	102 102	1000pF. Cer Disc	"	801	-
C39	102 330	33pF " "	"	801	2
C40	101 103	.01mF " "	"	801	-
C41	101 103	" " "	"	"	-
C42	101 103	" " "	"	"	-
C43	150 010	.33mF, 35v Dipped Tant	"	KR33E35	1
C44	102 101	100pF Cer Disc	"	801	2
C45	102 220	22pF " "	"	831	-
C46	110 005	.01mF, 10%, 250v PY	Mullard	0280AE P10K	1

NOTES. USE MULLARD 80909003 (140001) UNTIL STOCK EXHAUSTED.

REV. 4	REV. 5	REV.	
ECO. 29	ECO. 36	E.C.O.	

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REV ~~4~~5

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TITLE 1030 MAIN R.M.S. PCY ASSY

DRAWING NUMBER 409106

SHEET 10 OF 15

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
C47	110 004	.047mF, 10%, 250v PY	Mullard	C280AE P47K	1
C48	110 008	·68 mF, 10%, 100v PY	Wima	MKS	1
C49	102 101	100pF Cer Disc	Erie	801	–
C50	110 007	3·3mF, 10%, 100v PY	Wima	MKS	3
C51	110 007	3·3 mF " " "	"	"	–
C52	110 007	3·3 mF " " "	"	"	–
C53	102 330	33pF Cer Disc	Erie	801	–
C55, C56	101 103	.01mF " "	"	801	–
C57	110 013	0·1μF 10% 250V POLY.	MULLARD	C280AE/P100K	1
C58	102 471	470pF, 500v Cer Disc	Erie	801	–
C60, C61	102 102	1Kpf., 500v. CER DISC.	ERIE	801	–
C,54, C59		NOT USED			
D1-12	200 001	Diode Sil Gen Purp	Fairchild	IN4148	29
D14-25	200 001	" " "	"	"	–
D26-27	220 010	Diode Sil Hot Carrier	Hewlett Packard	HSCH1001/IN6263	2
D28-32	200 001	" " Gen Purp	Fairchild	IN4148	–
D13	210 056	5.6v, 400mW Zener		BZY 88C 5v6	1
D34	213 002	5.1v, 5W Surm Zener	Motorola	IN5338	1

NOTES.

REV. 4	REV. 5	REV.	
ECO. 29	ECO. 36	E.C.O.	

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NEXT DRAWING

REV ~~4~~5

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TITLE
1030 MAIN R.M.S. PCB ASSY

DRAWING NUMBER 409106

SHEET 11
OF 15

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
M1	260025	L IC LM101	National	LM101	5
M2	260025	LIC LM101	National	"	—
M3	290 025 *	RMS Module IC Kit	Datron	See drawing	1
M5, M6	260025	LIC LM101	National	LM101	—
M7	290 004	LIC LM312H	National	LM312H RED	1
M4	260025	L IC LM101	NATIONAL	LM101	—
Q1, Q2	240 001	Sil NPN GP		BC184K	10
Q3	240 001	Sil NPN GP		BC184K	-
Q4A, Q4B	239 024	Dual N-JUNCTION FET		U401 BLACK	1
Q5A, Q5B	249 004	Dual Hi Beta NPN		LM114H	1
Q6, Q7	259 005	Matched Pair 250 004	Datron	Pair 2N3906	1 Pair
Q8, Q9	250 004	Sil PNP HF GP		2N3906	5
Q10	240 006	Sil NPN HF GP		2N3904	4
Q11	250 004	Sil PNP HF GP		2N3906	-
Q12	230 003	Fet N. Junct Switch	Teledyne	U1899E/K4093-18	7
Q13	230 003	" " "	National	U1899E/K4093-18	-
Q14	230 003	Fet N. Junct Switch	Teledyne	U1899E/K4093-18	-
Q15, Q16	240 001	Sil NPN GP		BC184K	-
Q17	230 003	Fet N. Junct Switch		U1899E/K4093-18	-
Q18, Q19, Q20	240 001	Sil NPN GP		BC184K	-
Q21, Q22	250 004	Sil PNP HF GP		2N3906	-

NOTES.

* In 1110 R.M.S. MODULE KIT is tighter Spec 290 026
1 May use Rawstock No. 260 001 or Sel No. 290 009
2 May use Rawstock No. 260 008 or Sel No. 290 007
3 Also numbered 239 010

REV. 4	REV. 5	REV.
ECO. 29	ECO. 36	E.C.O.

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REV ~~4~~ 5

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TITLE
1030 MAIN R.M.S. PCY ASSY
DRAWING NUMBER 409106
SHEET 12 OF 15

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
Q23	240 006	Sil NPN HF GP		2N3904	-
Q24	240 001	Sil NPN GP		BC184K	-
Q25, Q26	230 002	Fet N. Junct GP		U1994E/K4416-18	2
Q27	230 003	Fet N. Junct Switch		U1899E/K4093-18	-
Q28	250 006	Sil PNP Gen Purp T092		BC322	1
Q29	240 001	Sil NPN GP		BC184K	-
Q30, Q31	230 003	Fet N. Junct Switch		U1899E/K4093-18	-
Q32, Q33	240 006	Sil NPN HF GP		2N3904	-
	620 002	PTFE Standoff Terminal	Sealectro	STSM1P47	6
	620 003	PCB Solder Terminal	Harwin	H2105A	9
	602 001	FSV Terminal	Molex	02-04-1875	20
J1	605 002	16 Pin DIL Socket	Antiferance		1
	614 001	4mm x 3.3mm Rivet Standoff	Harwin	CS2117B	6
	612 005	22 mm x M3 Rivet Standoff	Harwin	CS2116	6
	601 002	Connector Terminal	Amp	60803-1	9
S1 - S6	700 037	Switch Bank 6 x 6 Pole	LIPA * ISOSTAT	CD15	1 Bank
		Interlock		6 x 6 Pole Interlock	
	700 010	SWITCH BUTTON BLACK	LIPA * ISOSTAT		11
S7 - S11	700 038	Switch Push On/Off	LIPA * ISOSTAT	CD15	5
	613 011	NYLON WASHER			44

NOTES.

REV. 4	REV. 5	REV.
ECO. 29	ECO. 36	ECO.

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REV ~~4~~ 5

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TITLE 1030 MAIN RMS PCB ASSY
DRAWING NUMBER 409106
SHEET 13 OF 15

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
	611 004	Screw M3 x 6mm Pozipan			8
	615 002	Nut M3			2
	613 005	Int Shakeproof Washers M3			14
	900001	CYANOCRYLATE ADHESIVE		1512	A/R
	419 105-5	PCB	Datron		1
	540 001	24 Tinned CU Wire			A/R
	511 oo1	7/0.2 PVC 1KU Pink			A/R
	590 001	Hellerman Sleeves 1.5m x 15mm	Hellerman Electric	H15 x 15	10
	400 001	Input Cable Assy	Datron	400 001	1
	630 033	½"x 28 SWG BRASS STRIP			167 mm
	611006	SCREW POSIPAN M3 X 10			6
	459110	UPPER GUARD SHIELD			1
	459111	LOWER " "			1
	590011	BLACK SLEEVING	HELLARMAN	H15	A/R
	590004	SILICON RUBBER SLEEVE (1.5)			A/R

NOTES.

REV. 4	REV. 5	REV.	
ECO. 29	ECO. 36	E.C.O.	

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REV ~~4~~5

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TITLE
1030 MAIN R.M.S. PCB ASSY
DRAWING NUMBER 409106
SHEET 14
OF 15

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
K1	330003	RELAY 28V 3k2 2 POLE	POTTER & BROMFIELD	R10-E1-L2-53.2K	2
K2	330003	" " " "	"	"	
	459112	RELAY BRACKET			2
*	613 006	8BA SHAKEPROOF WASHER			2
*	615 001.	8BA FULL NUT			2

NOTES. * NUT & WASHER DEPEND ON TYPE OF RELAY MOUNTING STUD.

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TITLE 1030 MAIN RMS ASSY.
DRAWING NUMBER 409106
SHEET 15 OF 15

J. W. 1164

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R1 - R28		NOT USED			-
R29 - R31	000273	27K 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	4
R32	000104	100K 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	7
R33	000103	10K 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	16
R34	000471	470R 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	2
R35	000103	10K 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	-
R36	000471	470R 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	-
R37	063102	1K $\frac{3}{8}$" Cermet Pot	BECKMAN	72P	1
R38	018201	8k2 1% $\frac{1}{8}$W Metal Film	WELWYN / HOLCO	4033C / H4	2
R39	018201	8k2 1% $\frac{1}{8}$W Metal Film	WELWYN / HOLCO	4033C / H4	-
R40	000102	1K 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	3
R41	000103	10K 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	-
R42	000103	10K 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	-
R43	000222	2K2 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	7
R44	000102	1K 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	-
R45	000103	10K 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	-
R46	000103	10K 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	-
R47	000103	10K 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	-
R48	000331	330R 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	6
R49	000103	10K 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	-
R50	000154	150K 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	1
R51	000331	330R 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	-
R52	000104	100K 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	-

NOTES.

REV. 5	REV. 6	REV. 7	8	9	10	11	12	13	14	15	16	17	18^{c}	19	20
ECO. 73	ECO. 82	ECO. 85	148	185	283	398	426	387	517	525	548	610	625	642	670

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REV

datron ELECTRONICS LTD.
TITLE 1030 A.D PCB ASSY
DRAWING NUMBER 409109A
SHEET 2 OF 12

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R53	000103	10K 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	-
R54	000103	10K 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	-
R55		NOT USED			-
R56	000103	10K 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	-
R57	000223	22K 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	9
R58	000223	22K 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	-
R59	000223	22K 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	-
R60	000331	330R 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	-
R61	000331	330R 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	-
R62	000222	2K2 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	-
R63	000222	2K2 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	-
R64	000561	560R 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	1
R65	000331	330R 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	-
R66	000331	330R 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	-
R67	000223	22K 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	-
R68		NOT USED			-
R71	000223	22K 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	-
R72	000821	820R 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	1
R73	011001	1K0 1% $\frac{1}{8}$W MF	WELWYN / HOLCO	4033C / H4	1
R74	000272	2K7 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	2
R75	063103	10K $\frac{3}{8}$" Cermet Pot	BECKMAN	72P	1
R76	014021	4K02 1% $\frac{1}{8}$W MF	WELWYN / HOLCO	4033C / H4	1
R77 - R79	000563	56K 5% $\frac{1}{4}$W Carbon	MULLARD	CR25	4

NOTES.

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DATE.	datron ELECTRONICS LTD.
DRAWN BY. JRP	TITLE 1030 A.D. PCB
CHECK	
NEXT DRAWING	
REV 4	DRAWING NUMBER 409109A
	SHEET 3 OF 12

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R80	000563	56K 5% ¼W Carbon	MULLARD	CR25	-
R81	000332	3K3 5% ¼W Carbon	MULLARD	CR25	2
R82	000222	2K2 5% ¼W Carbon	MULLARD	CR25	-
R83	000562	5K6 5% ¼W Carbon	MULLARD	CR25	3
R84	000222	2K2 5% ¼W Carbon	MULLARD	CR25	-
R85	011302	13K0 1% ⅛W MF	WELWYN / HOLCO	4033C / H4	1
R86	063201	200R ⅛" Cermet Pot	BECKMAN	72P	1
R87	440022	FSV 220K ¼W Carbon	MULLARD	CR25	1 of kit
R88	011201	1K2 1% ⅛W MF	WELWYN / HOLCO	4033C / H4	1
R89	011002	10K0 1% ⅛W MF	WELWYN / HOLCO	4033C / H4	1
R90	000562	5K6 5% ¼W Carbon	MULLARD	CR25	-
R91	000272	2K7 5% ¼W Carbon	MULLARD	CR25	-
R92	000103	10K 5% ¼W Carbon	MULLARD	CR25	-
R93	NOT USED				
R94	NOT USED				
R95	NOT USED				
R96	NOT USED				
R97	NOT USED				
R98	NOT USED				
R99	000103	10K 5% ¼W Carbon	MULLARD	CR25	-
R100	000223	22K 5% ¼W Carbon	MULLARD	CR25	-
R101	014702	47K 1% ⅛W MF	WELWYN / HOLCO	4033C / H4	1
R102	000225	2M2 10% ¼W Carbon	MULLARD	CR25	1

NOTES.

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NEXT DRAWING
REV 4

datron ELECTRONICS LTD.
TITLE 1030 A.D. PCB
DRAWING NUMBER 409109A
SHEET 4 OF 12

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R103	000473	47K 5% ¼W Carbon	MULLARD	CR25	1
~~R104~~	NOT USED				
R105	NOT USED				
R106	063202	2K ⅛" Cermet Pot	BECKMAN	72P	1
R107	000472	4K7 5% ¼W Carbon	MULLARD	CR25	3
R108	000562	5K6 5% ¼W Carbon	MULLARD	CR25	-
R109	000107	100M 10% ¼W Carbon	MULLARD	CR25	1
R110	000222	2K2 5% ¼W Carbon	MULLARD	CR25	-
R111	000124	120K 5% ¼W Carbon	MULLARD	CR25	1
R112	000223	22K 5% ¼W Carbon	MULLARD	CR25	-
R113	000332	3K3 5% ¼W Carbon	MULLARD	CR25	-
R114	000102	1K 5% ¼W Carbon	MULLARD	CR25	-
R115	000470	47R 5% ¼W Carbon	MULLARD	CR25	1
R116	000152	1K5 5% ¼W Carbon	MULLARD	CR25	2
R117	000103	1oK 5% ¼W Carbon	MULLARD	CR25	-
R118	000273	27K 5% ¼W Carbon	MULLARD	CR25	-
R119	000101	100R 5% ¼W Carbon	MULLARD	CR25	1
R120, R124	000472	4K7 5% ¼W Carbon	MULLARD	CR25	-
R121 - R122	000104	100K 5% ¼W Carbon	MULLARD	CR25	-
R123	000222	2K2 5% ¼W Carbon	MULLARD	CR25	-
R125	000103	10K 5% ¼W Carbon	MULLARD	CR25	-
R126 - R128	000104	100K 5% ¼W Carbon	MULLARD	CR25	-
R129	000152	1K5 5% ¼W Carbon	MULLARD	CR25	-

NOTES.

R130	000103	10K 5% ¼W Carbon	MULLARD

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NEXT DRAWING
REV 4
TITLE 1030 A.D. PCB
DRAWING NUMBER 409109A
SHEET 5 OF 12

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R133	000684	680k 5% ¼ Carbon	Mullard	CR25	1
R131 – R132	000223	22K 5% ¼W Carbon	MULLARD	CR25	–
R134	000100	10R 5% ¼W Carbon	MULLARD	CR25	1
C1	180004	4700 MF / 16V Al Elect	WIMA	Printilyt 4700/16 NCW	1
C2	110013	.1MF 250V P7	MULLARD	C280AE P100K	1
C3	150003	47MF / 63V Dipped Tant	UNION CARBIDE	K47E6	1
C4 – C10	101103	.01MF 250V	UNION CARBIDE	801	11
C11	101222	2200pf 500V Cer Disc	ERIE	801	1
C12		NOT USED			
C13 – C14	150001	22MF /16V Dipped Tant	UNION CARBIDE	K22E16	5
C15	102221	220pf Cer Disc	ERIE	831	2
C16	110025	3300pF POLYESTER	MULLARD	347 61332	1
C17	102471	470pf Cer Disc	ERIE	831	1
C18	102221	220pf Cer Disc	ERIE	"	–
C19	102102	1Kpf Cer Disc	ERIE	"	5
C20	150009	3·3 µF 20% Bead Tant	UNION CARBIDE	K3R3E16	1
C21	150002	10 µF 20% Bead Tant	UNION CARBIDE	K10 E16	1
C22	110005	·01 µF 250v Dip Py	MULLARD	C280AE16	1
C23 C24	180005	1000MF /25V Al Elect	WIMA	PRINTILYT	2
C25	150001	22MF / 16V Tant Bead	UNION CARBIDE	K22E16	–
C26	150001	22MF / 16V Tant Bead	UNION CARBIDE	K22E16	–
C27 – C28	102470	47pf Cer Disc	ERIE	831	2

NOTES.

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DATE.	datron ELECTRONICS LTD.	
DRAWN BY. JRP	TITLE 1030 A – D PCB ASSY	
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NEXT DRAWING		
REV 4	DRAWING NUMBER 409109A	SHEET 6 OF 12

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
C29	102102	1Kpf Cer Disc	ERIE	831	-
C30, C31	102101	100pf Cer Disc	ERIE	"	3
C32, C33	102102	1Kpf Cer Disc	ERIE	"	-
C34, C35	110011	.47MF / 100V PY	WIMA	MKS 100V	2
C36	102101	100pf Cer Disc	ERIE	831	-
C37	101103	.01MF Cer Disc	ERIE	801	-
C38	104013	100pf 20% Cer Disc	ERIE	861	1
C39	102478	4·7pF Cer Disc	ERIE	831	1
C40	101 103	·01mF CER DISC	ERIE	801	-
C41	150010	.33MF Dipped Tant Bead	UNION CARBIDE	KR33E35	1
C42	101 103	·01mF CER DISC	ERIE	801	-
C43	101103	.01MF Cer Disc 250V	ERIE	801	-
C44	NOT USED				
C45, C46	110012	150pf 10% +30ppm/°C AY	WIMA	Tropyfol F	2
C47	102102	1KpF Cer Disc	ERIE	801	-
C48	150001	22mF/16V Dipped tant	UNION CARBIDE	K22E16	-

NOTES.

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REV 4

datron ELECTRONICS LTD.
TITLE 1030 A-D PCB ASSY
DRAWING NUMBER 409109A
SHEET 7 OF 12

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
CR1 - CR3	200001	Sil Gen Purpose		IN4148	16
CR4 - CR6	NOT USED				
CR7	200001	Sil Gen Purpose			-
CR8	210100	10V 400MW Zener		BZY 88C10	1
CR9, CR10, CR11	200008	Sil Low Leakage		IN458A	3
CR12	214001	TC Ref. Zener 6V2		IN821	1
CR13 - CR24	200001	Sil Gen Purpose		IN4148	-
W1	209003	1.5 Amp 100V Rect Bridge	GI	WS01	1
W2	209004	1.0 Amp 100V Rect Bridge	GI	W01	2
W3	209004	1.0 Amp 100V Rect Bridge	GI	W01	-

NOTES.

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REV 4

datron ELECTRONICS LTD.
TITLE
1030 A-D PCB ASSY
DRAWING NUMBER 409109A
SHEET 8 OF 12

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
Q1 - Q2	240006	Sil NPN HF GP	FAIRCHILD	2N3904	5
Q3 - Q6	230002	Fet N Junct GP	TELEDYNE	U1994E/K4416-18	4
Q7 - Q8	240006	Sil NPN HF GP		2N3904	-
Q9	250004	Sil PNP HF GP		2N3906	3
Q10 - Q13	240001	Sil NPN Hi Gain GP		BC184K	4
Q14 - Q15	250004	Sil PNP HF GP		2N3906	-
Q16 - Q17	240007	Sil NPN HF Switch		2N3646	2
Q18	240 009	Sil NPN H.V. switch		MPSL01	3
Q19, Q20	240009	Sil NPN H.V. Switch		MPSL01	-
Q21	240006	Sil NPN HF GP	FAIRCHILD	2N3904	-

NOTES.

1 MAY BE NF 500 on EARLY MODELS

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REV 4

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TITLE
1030 A-D PCB ASSY
DRAWING NUMBER 409109A
SHEET 9 OF 12

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
M1	270001	DC 1C Quad Nand		7400NCommercial	6
M2	NOT USED				
M3	270024	DIG. IC. 7 SEG DECODE	SPERRY NATIONAL	DD700 DM8880	4
M4 - M6	270024	Dig 1C 7 Seg Decode	SPERRY NATIONAL	DD700 DM8880	–
M7 - M8	270001	Dig 1C Quad Nand		7400N Commercial	-
M9	270006	Dig 1C Hex Inv		7405N	1
M10	270026	DIG. IC. QUAD LATCH		74L75N COMMERCIAL	4
M11 - M13	270026	Dig 1C Quad Latch		74L75N Commercial	–
M14	270005	Dig 1C Hex Inv		7404N Commercial	1
M15	270027	Dig 1C Dual Dff		74L74N Commercial	1
M16	270008	Dig 1C Triple Nand		7410N Commercial	2
M17 - M20	270025	Dig 1C Delade Count		74L90N Commercial	4
M21 - M22	270013	Dig 1C Dual Dff		7474N Commercial	2
M23	270001	Dig 1C Quad Nand		7400N Commercial	-
M24	290003	Timer Monostable	SIGNETICS	NE 555V Commercial	1
M25	270002	Dig 1C Quad Nand		7401N Commercial	1
M26	270001	Dig 1C Quad Nand		7400N Commercial	-
M27	270008	Dig 1C Triple Nand		7410N Commercial	-
M28	270001	Dig 1C Quad Nand		7400N Commercial	-
M29	270023	DIG. IC QUAD NAND BUFFER		7437N COMMERCIAL	1
M30	NOT USED				
M31	NOT USED				
M32 - M33	290 010	Linear 1C 41301A or AMF	National	LM 301AH RED/ORANGE	2

NOTES.

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REV 4

datron ELECTRONICS LTD.

TITLE 1030 A-D PCB ASSY

DRAWING NUMBER 409109A

SHEET 10 OF 12

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
M34	290012	Linear 1C 741 OP AMP	FAIRCHILD	U5 B7741393 RED/ORANGE	2
M35	NOT USED				
M36	290012	Linear 1C 741 OP AMP	FAIRCHILD	U5 B7741393 RED/ORANGE	-
M37	260005	Linear 1C Power Receiver 5V	MOTOROLA	MC 7805	1
M38	260017	Linear 1C Power Receiver 15V	MOTOROLA	MC 78M15CP	2
M39	260017	Linear 1C Power Receiver 15V	MOTOROLA	MC 78M15CP	-
	613007	M3 PLAIN WASHER	GKN		2
	611019	M3x35 POZI PAN	GKN		1

NOTES.

1.

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REV 4

datron ELECTRONICS LTD.
TITLE
1030 A-D PCB ASSY
DRAWING NUMBER 409109A
SHEET 11 OF 12

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
TR1	300007	Toroidal Maine TX	PLESSEY WINDINGS	Issue 2	1
TR2, TR3	310001	Pulse Tx (Logic)	NEWPORT INSTRUMENTS	76616/4	2
	605059	8WAY D.I.L SOCKET	ASTRALUX	ICL-083-S6T	1
J3	605002	16 way D.IL Socket	ANTIFERENCE	ICN 163-53	1
J4	605058	42 WAY D.S. ·1" PCB Conn + Key in 21	PYE	MLD 21SN0101ML/M62-21	1
	620003	PCB Solder Terminal	HARWIN	H2105A	11
	602001	FSV Terminal	MOLEX	0204 1875	2
	601002	Connector Terminal	AMP	60803-1	8
	459138	Transistor Heat Dissipator	KDP ES	459138	2
	459139	Heat Dissipator	KDP ES	459139	1
	419108A-5A	P.C.B.			1
	618001	Transistor Mounting Kit			3
	611006	M3 x 10mm Pozipan	GKN		3
	611007	M3 x 6mm Pozipan	GKN		2
	615002	M3 Nut	GKN		4
	630033	½" x 28 SWG. BRASS STRIP			30mm
	615010	M3 NYLOCK NUT	GKN		1
	605028	16 Way D.I.L. Skt Str Bucket	Astralux	ICL 163-S6T	8
	605037	14 Way D.I.L. Skt Str Bucket	"	ICL 143-S3T	19
	613005	M3 SHAKEPROOF			5
	450139	GUARD SHIELD			1
	604017	MAINS CONNECTOR	MOLEX	10-08-1031	1
	612004	M3x4mm STANDOFF	HARWIN	CS2116-B	2

NOTES.

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REV 4

datron ELECTRONICS LTD.

TITLE 1030 A-D PCB ASSY

DRAWING NUMBER 409109A

SHEET 12 OF 12

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
M3	270024	DIG. I.C. 7SEG. DECODE	SPERRY / NATIONAL	DD700 / DM8880	1
M10	270026	DIG. I.C. QUAD. LATCH		74L75N COMMERCIAL	1

NOTES.

ISS.	1								
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DATE	24.2.77								

DATE 24. 2. 77
DRAWN BY M.J.D.
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datron ELECTRONICS LTD
TITLE 4½ DIGIT OPTION KIT – 1030
DRAWING NUMBER 440056
SHEET 1 OF 1

J. W. 1164

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
L1	370 001	10 micro H .8R Choke	PLESSEY	58/10/0011/10	1
R2	000 221	220R 5% ¼W Carbon	MULLARD	CR25	1
R3, R4	000 562	5K6 5% ¼W Carbon	MULLARD	CR25	3
R5	000 681	680R 5% ¼W Carbon	MULLARD	CR25	1
R6	000 272	2K7 5% ¼W Carbon	MULLARD	CR25	2
R7	000 102	1K 5% ¼W Carbon	MULLARD	CR25	3
R8	000 272	2K7 5% ¼W Carbon	MULLARD	CR25	-
R9	000 224	220K 5% ¼W Carbon	MULLARD	CR25	1
R10, R11	000 102	1K 5% ¼W Carbon	MULLARD	CR25	-
R12	-	NOT USED			
R13	-	NOT USED			
R14	000 562	5K6 5% ¼W Carbon	MULLARD	CR25	-
R15	000 273	27K 5% ¼W Carbon	MULLARD	CR25	1
R16	000 223	22K 5% ¼W Carbon	MULLARD	CR25	1
C1	150 003	47MF 20% 63V Dip Tant	UNION CARBIDE	K47E6	1
C2	110 013	.1MF 250V Dip PY	MULLARD	C280AEP100K	1
C3, C4	110 026	.0068mF 100V PY	WIMA	FKS-2-MIN	2
CR1, CR2	200 001	Sil Gen Purpose		IN 4148	2
CR3	200 002	Sil Rect		IN 4001	1
W1	209 007	1.0 Amp 400V Bridge		W04	1
Q1, Q2	240 001	Sil NPN Hi B Gen Purp		BC184K	2
Q3	240 011	Sil NPN 1 Watt Switch		BC338	1
Q4, Q5, Q6	-	NOT USED			

NOTES.

ISS	ISS 2	ISS 3
ECO 37	ECO 440	ECO 516

DATE. 26.11.73
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datron ELECTRONICS LTD.
TITLE Sperry Display PCB
Assy 1030
DRAWING NUMBER 400025
SHEET 2 OF 3

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
Q7, Q8	240 009	Silkon NPN Hi Volt Dr	MOTOROLA	MPSL01	2
M1	270 023	Quao Nand Buffer		7437N	1
FL1 - FL4	920 005	Filament Lamp 5V 60mA	GI	V683	4
DM1	800 004	Display .3" $\pm$ 18	BECKMAN	SP331	1
DM2	800 005	Display .3" .888	BECKMAN	SP333	1
T1	300 004	Toroidal Tx 5V - 190V			1
	630 045	Magnetic Shield Wrapping	TELCON METALS LTD	Telshield 'F'	A/R
	604 003	Connector Strip Pins 11	AMP	163740-9	4
	605 037	Dil Socket 14 Pin	Astralux	ICL143-S3T	1
	410 009 - 4	THP PCB			1
	450 006	TX Support Bracket			1
	450 003	Funct Block Inj Mould			1
	420 012	Funct Neg V,m,V V^{2}/FS $\frac{mV2}{FS}$			1
	611 004	Screw M3 x 6 Pozipan			3
	611 014	Screw Nº4 x 3/8" Self tapping			1
	800 007	2 Dig Display Socket	BECKMAN	CS332	1
	800 008	3 Dig Display Socket	BECKMAN	CS333	1

NOTES.

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E.C.O 37	

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TITLE
Sperry Display PCB
Assy 1030

DRAWING NUMBER 400 025

SHEET 3 OF 3

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
	605001	50 WAY AMP. SKT. (PANEL MNT)	AMPHENOL	57-40500	1
	604001	50 WAY AMP. SKT. (CABLE MNT)	AMPHENOL	57-30500	1
	410013-4	P.C.B.			1

NOTES.

SEE SHEET 2 FOR LATEST ISSUE

ISS.	1
E.C.O.	—
DATE	3.3.78
CHKD	MD

DATE 3.3.78
DRAWN K.S.S.
CHECKED MD
APPROVED
DATE

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TITLE 1030/41/45 BCD
BOARD ASSY. (B01)
DRAWING NUMBER 400348
SHEET 1 OF 2

J.W. 1164

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R1	000104	100k ¼W CARBON	MULLARD	CR25	1
R2	000103	10k ¼W CARBON	"	"	1
R3	000563	56k ¼W CARBON	"	"	1
C1	110005	0·01μF POLYESTER	MULLARD	C280AE/P10k	1
C2	102102	1000pF CER. DISC	ERIE		1
C3	102100	10pF CER. DISC	ERIE	801	1
C4	150002	10μF, 16v DIPPED TANT	UNION CARBIDE	K10E16	1
C5	110013	0·1μF POLYESTER	MULLARD	C280AE/P100k	1
Q1	240001	BC184 NPN G.P.		BC184k	1
D1, D2	200001	DIODE 1N4148		1N4148	2
M1	270017	QUAD 2 I/P NAND LP		74L00	1
M2	270021	QUAD 2WAY SELECT LP		74L157	1
M3	290003	TIMER/MONOSTABLE		NE555V	1
	604001	50 WAY AMPHENOL PLUG	AMPHENOL	57-30500	1
	410013-8	PCB			1
	605001	50 WAY AMPHENOL SKT.	AMPHENOL	57-40500	1
	605037	7 WAY DIL BUCKET	MOLEX	ICL 143-S3T	1
	605038	8 WAY DIL BUCKET	MOLEX	ICL 163-S6T	1
	605059	8 WAY DIL SOCKET	ASTRALUX	ICL·083-S6T	1
	620003	SOLDER TERMINAL	HARWIN	H2505A	1
	601002	CONNECTOR TERMINAL	AMP	60803-1	5

NOTES. * NOT TO BE FITTED ON 1041

J. W. 1164

ISS.	1	2	3	4	5	6	7		
ECO		158	354	380-1	380-2	ECO 586	ECO. 622		
	23.4.76	1.10.76	29.11.76	21.2.77	21.2.77	4-1-78	14.3.78		

DATE 21.2.77
DRAWN BY JBH
CHECK
NEXT DRAWING
AD 8.2.77

datron ELECTRONICS LTD

TITLE BCD BOARD B01a
1030,1041,1045

DRAWING NUMBER 400058

SHEET 2 OF 2

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R1	000222	2K2, 5%, 1/4W, CARBON	MULLARD	CR 25	1
R2–R4	000103	10K, " " "	"	"	3
C1	150003	47µF, 6.3V DIPPED TANT	UNION CARBIDE	K47E6	1
Q1	240001	SIL., NPN, HiB, G.P.		BC184K	1
M1–M6	270030	DIG.I.C., HEX TRI-STATE BUF.	SIGNETICS	DM80L95	6
	410004-3	P.C. BOARD			1
	605001	50 WAY SKT. (PANEL MTG)	AMPHENOL	57–40500	1
	604001	50 WAY SKT (CABLE MTG)	AMPHENOL	57-30500	1
	605038	16 WAY DIL SKT	ASTRALUX	ICL-163-S6T	6
	620003	SOLDER TERMINAL	HARWIN	H2505A	1

NOTES.

SEE SHEET 2 FOR LATEST ISSUE

ISS.	1										
E.C.O.	—										
DATE	3.3.78										
CHKD.											

DATE 3-3-78
DRAWN K.S.S.
CHECKED
APPROVED
DATE

datron ELECTRONICS LTD

TITLE 1030, 1041, 1045.
TRI-STATE BCD P.C.B. -
B02.

DRAWING NUMBER 400349
SHEET 2 OF 2

I.W. 1164

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R1	000104	100k 1/4W CARBON	MULLARD	CR25	2
R2	000103	10k 1/4W CARBON	MULLARD	CR25	6
R3	000103	10k 1/4W CARBON	MULLARD	CR25	–
R4	000103	10k 1/4W CARBON	MULLARD	CR25	–
R5	000104	100k 1/4W CARBON	MULLARD	CR25	–
R6	000103	10k 1/4W CARBON	MULLARD	CR25	–
R7	000563	56k 1/4W CARBON	MULLARD	CR25	1
R8, R9	000103	10k 1/4W CARBON	MULLARD	CR25	–
C1	150003	47µF, 6.3v DIPPED TANT	UNION CARBIDE	K47E6	1
C2	102100	10pF CER. DISC	ERIE	801	1
C3	102102	1000pF CER. DISC	ERIE		1
C4	150002	10µF, 16v DIPPED TANT	UNION CARBIDE	K10E16	1
C5	110013	0.1µF POLYESTER	MULLARD	C280AE/P100K	1
C6	110005	0.01µF POLYESTER	MULLARD	C280AE/P10K	1
Q1	240001	SIL NPN G.P. TRANSISTOR		BC184k	2
Q2	240001	SIL NPN G.P. TRANSISTOR		BC184k	–
D1, D2	200001	DIODE IN4148		IN4148	2
M1	270030	HEX TRI STATE BUFFER	SIGNETICS	DM80L95	6
M2	270030	HEX TRI STATE BUFFER	SIGNETICS	DM80L95	–
M3	270030	HEX TRI STATE BUFFER	SIGNETICS	DM80L95	–
M4	270030	HEX TRI STATE BUFFER	SIGNETICS	DM80L95	–

NOTES.

ISS. 2	3	4	5	6	7	8		
REDRAWN	193	355	380-1	380-2	ECO 584	ECO 643		
	12.3.76	16.12.76	21.2.77	21.2.77	1.11.77	6-4-78		

DATE 21.2.77
DRAWN BY PH
CHECK
NEXT DRAWING
22.2.77

datron ELECTRONICS LTD
TITLE TRI STATE BCD B02a
1030,1041,1045
DRAWING NUMBER 400023
SHEET 2 OF 3

J. W. 1164

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
M5	270030	HEX TRI STATE BUFFER	SIGNETICS	DM80L95	—
M6	270030	HEX TRI STATE BUFFER	SIGNETICS	DM80L95	—
M7	270017	QUAD 2 I/P NAND LP		74L00	1
M8	270021	QUAD 2WAY SELECT LP		74L157	1
M9	290003	TIMER / MONOSTABLE		NE555V	1
	410004-7A	PCB			1
	605001	50 WAY AMPHENOL SKT.	AMPHENOL	57-40500	1
	602005	8 WAY DIL BUCKET	MOLEX	2460-8	14
	602006	7 WAY DIL BUCKET	MOLEX	2460-7	2
	602004	DIL SOCKET STRIP	MOLEX	1938-4	156
	620003	SOLDER TERMINAL	HARWIN	H2505A	1
	601002	CONNECTOR TERMINAL	AMP	60803-1	5
	540001	TINNED COPPER WIRE			A/R
	590004	SILICON RUBBER SLEEVE			A/R
	604001	50 WAY AMPHENOL PLUG	AMPHENOL	57-30500	1
	605059	8WAY DIL SOCKET	ASTRALUX	ICL-083-S6T	1

NOTES.

ISS. SEE SHT. 2.

DATE 21.2.77

DRAWN BY JH

CHECK

NEXT DRAWING

datron ELECTRONICS LTD

TITLE TRI STATE BCD 802a
1030, 1041, 1045

DRAWING NUMBER 400023

SHEET 3 OF 3

J. W. 1164

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R1	000102	¼ W CARBON 5%	MULLARD	CR25 1K0	6
R2	000102	¼ W CARBON 5%	MULLARD	CR25 1K0	—
R3	000102	¼ W CARBON 5%	MULLARD	CR25 1K0	—
R4	000102	¼ W CARBON 5%	MULLARD	CR25 1K0	—
R5	000102	¼ W CARBON 5%	MULLARD	CR25 1K0	—
R6	000562	¼ W CARBON 5%	MULLARD	CR25 5K6	3
R7	000222	¼ W CARBON 5%	MULLARD	CR25 2K2	2
R8	000471	¼ W CARBON 5%	MULLARD	CR25 470R	5
R9	000471	¼ W CARBON 5%	MULLARD	CR25 470R	—
R10	000562	¼ W CARBON 5%	MULLARD	CR25 5K6	—
R11	000562	¼ W CARBON 5%	MULLARD	CR25 5K6	—
R12	000222	¼ W CARBON 5%	MULLARD	CR25 2K2	—
R13	000471	¼ W CARBON 5%	MULLARD	CR25 470R	—
R14	000102	¼ W CARBON 5%	MULLARD	CR25 1K0	—
R15	000471	¼ W CARBON 5%	MULLARD	CR25 470R	—
R16	000471	¼ W CARBON 5%	MULLARD	CR25 470R	—
Q1	250006	P.N.P GEN P. TRANSISTOR	FAIRCHILD	BC322	2
Q2	250006	" " " "	"	"	—

NOTES.

SEE SHEET 2 FOR LATEST ISSUE

ISS.	3
E.C.O	REDRAWN
DATE	11 JULY 78
CHKD.	

DATE	11 JULY 78
DRAWN	W.G.SMITH.
CHECKED	
APPROVED	
DATE	

datron ELECTRONICS LTD

TITLE REMOTE PROGRAMME
P.C.B. 1030

DRAWING NUMBER 409117

SHEET 2 OF 4

J.W. 1164

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
D1	200005	DIODE GERMANIUM G.P.	HUGHES	HG 5009	11
D2	200005	" " "	"	"	—
D3	200005	" " "	"	"	—
D4	200005	" " "	"	"	—
D5	200005	" " "	"	"	—
D6	200005	" " "	"	"	—
D7	200005	" " "	"	"	—
D8	200005	" " "	"	"	—
D9	200005	" " "	"	"	—
D10	200005	" " "	"	"	—
D11	200005	DIODE GERMANIUM G.P	HUGHES	HG 5009	—
M1	220005	OPTO ISOLATOR I	LITRONIX	FPLA 820	9
M2	220005	" "	"	"	—
M3	220005	" "	"	"	—
M4	220005	" "	"	"	—
M5	220005	" "	"	"	—
M6	220005	" "	"	"	—
M7	220005	" "	"	"	—
M8	220005	" "	"	"	—
M9	220005	" "	"	"	—

NOTES.

SEE SHEET 2 FOR LATEST ISSUE

ISS												
E.C.O												
DATE												
CHKD.												

DATE 11 JULY 78
DRAWN W.G. SMITH
CHECKED
APPROVED
DATE

datron ELECTRONICS LTD
TITLE REMOTE PROGRAMME
P.C.B 1030
DRAWING NUMBER 409117
SHEET 3 OF 4

J.W. 1164

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
M10	270016	HEX BUFFER OPEN C	NATIONAL	DM 7417 N	2
M 11	270016	HEX BUFFER OPEN C	NATIONAL	DM 7417 N	—
J6	605002	LO PROFILE 16WAY DIL	(ONE OFF FITTED TO BCD P.C.B)		2
	602004	DIL SOCKET STRIP (BREAKAWAY)	MOLEX	1938-4	28
	602006	DIL × 7 SOCKET STRIP (CARRIER)	MOLEX	2460-7	4
	410001-1	P.C. BOARD			1
	571535	RIBBON CABLE ASSY			1

NOTES.

SEE SHEET 2 FOR LATEST ISSUE

ISS.												
E.C.O.												
DATE												
CHKD												

DATE 11 JULY 78
DRAWN W.G. SMITH.
CHECKED
APPROVED
DATE

datron ELECTRONICS LTD
TITLE REMOTE PROGRAMME P.C.B 1030
DRAWING NUMBER 409117
SHEET 4 OF 4

J.W. 1164

FILTER OPTIONS - PART NUMBERS

R126-R131 are ¼W, 5% carbon resistors

Value	Datron Part No.
1K2	000122
2K2	000222
3K3	000332
3K9	000392
4K7	000472
5K1	000512
6K8	000682
8K2	000822
11K	000113
15K	000153
18K	000183
27K	000273
39K	000393
47K	000473
62K	000623
82K	000823
180K	000184
270K	000274
620K	000624
820K	000824
1M8	000185
2M	000205
2M7	000275

C48, 50 - 52 are as shown below

Value & Type	Datron Part No.
.22μF 10% 250V PY	110010
.68μF 10% 100V PY	110008
1.0μF 10% 100V PY	110009
3.3μF 10% 100V PY	110007
10μF 10% 63V PY	110001
100μF 10% 30V, WET TANT	170002

FILTER OPTIONS

The components shown in the table below are on the analog board, 409106, and are as detailed for the selected option. The corresponding part numbers are listed on the following page.

Option	Pt.No.	R126	R127	R128	R129	R130	R131	C48	C50,51,52
40Hz /1Hz	440004	15K	820K	11K	620K	270K	4K7	.68μF	3.3μF
40Hz /10Hz	440003	15K	82K	11K	62K	27K	4K7	.68μF	3.3μF
10Hz /1Hz	440005	82K	820K	62K	620K	270K	27K	.68μF	3.3μF
10Hz /.1Hz	440006	27K	2M7	18K	1M8	820K	8K2	1.0 μF	10.0μF
1Hz /.1Hz	440007	270K	2M7	180K	1M8	820K	82K	1.0 μF	10.0μF
1Hz /.01Hz	440008	27K	2M7	18K	1M8	820K	8K2	1.0 μF	100 μF
.1Hz /.01Hz	440009	270K	2M7	180K	1M8	820K	82K	1.0 μF	100 μF
350Hz/40Hz	440001	3K9	47K	3K3	39K	15K	1K2	.22μF	1.0μF
350Hz/10Hz	440002	3K9	270K	3K3	180K	82K	1K2	.22μF	1.0μF
50Hz /1Hz	440050	6K8	2M7	5K1	2M	820K	2K2	.22μF	1.0μF

DELAY TIME OPTIONS

The following components on the A-D Board 409109A are as shown below for the filter option selected:-

Option	Part No.	R50	C20	C21	C22
40Hz /1Hz	440013	150K	2.2μF	100μF	.01μF
40Hz /10Hz	440012	150K	2.2μF	6.8μF	.01μF
10Hz /1Hz	440014	150K	10 μF	100μF	.01μF
10Hz /.1Hz	440015	1M5	1.0μF	100μF	1KpF
1Hz /.1Hz	440016	1M5	10 μF	100μF	1KpF
1Hz /.01Hz	440017	15M	1μF	100μF	1KpF
.1Hz /.01Hz	440018	15M	10 μF	100μF	1KpF
350Hz/40Hz	440010	15K	3.3μF	22μF	.1μF
350Hz/10Hz	440011	150K	.33μF	10μF	.01μF
350Hz/1Hz	440051	150K	.33μF	100μF	.047μF

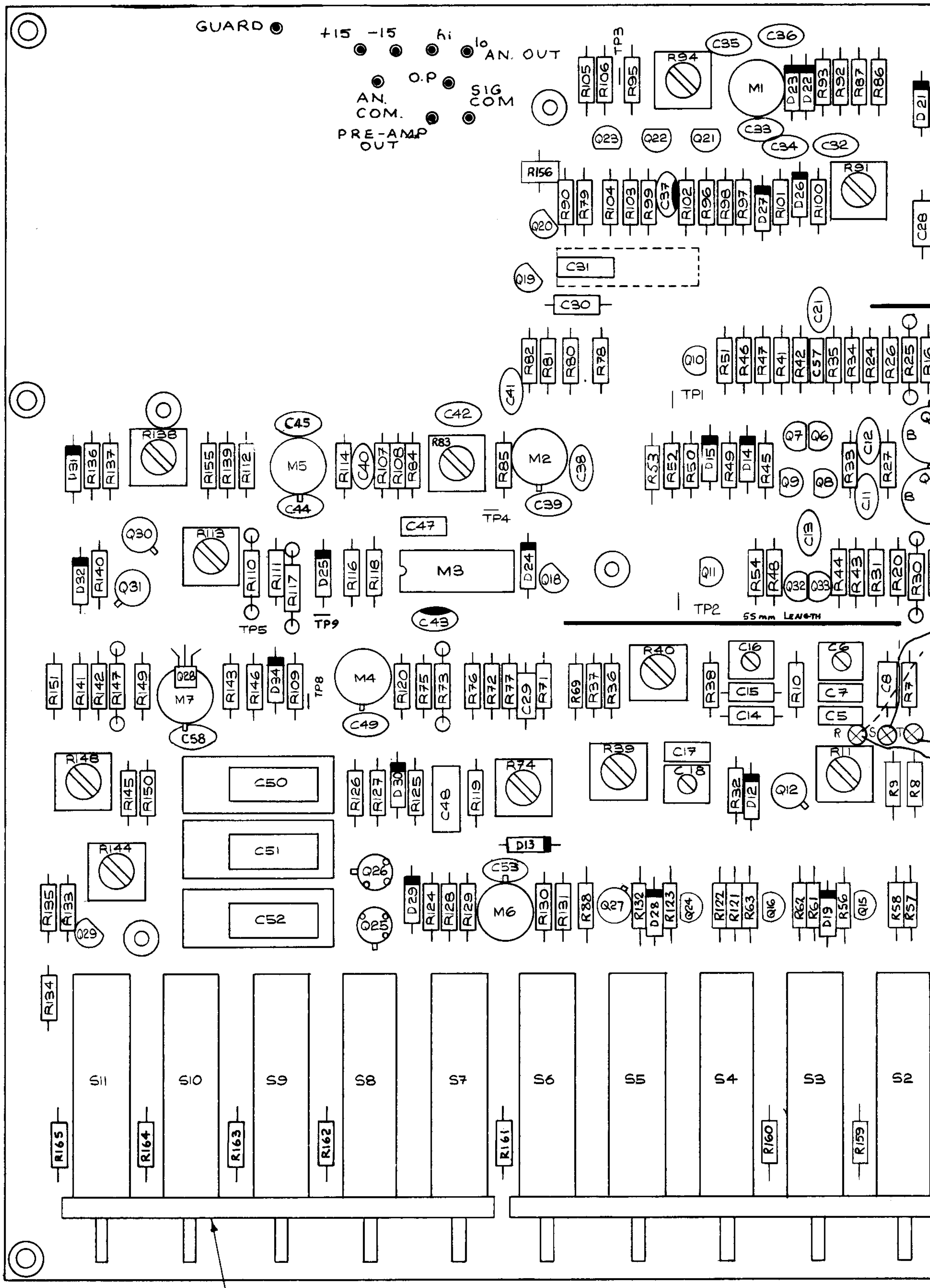
R50 is ¼W, 5%, carbon resistor

Value	Datron Part No.
15K	000153
150K	000154
1M5	000155
15M	000156

C20, 21 and 22 are as shown below:

Value & Type		Datron Part No.
1KpF	Cer Disc	102102
.01μF	10% 250V Dip PY	110005
.047μF	10% 250V Dip PY	110004
.1μF	10% 250V Dip PY	110013
.33μF	20% 35V Dipped Tant Bead	150010
1.0μF	20% 16V Dipped Tant Bead	150011
2.2μF	20% 16V Dipped Tant Bead	150005

Value & Type		Datron Part No.
3.3µF	20% 16V Dipped Tant Bead	150009
6.8µF	20% 16V Dipped Tant Bead	150007
10µF	20% 16V Dipped Tant Bead	150002
22µF	20% 16V Dipped Tant Bead	150001
100µF	20% 6.3V Dipped Tant Bead	150004

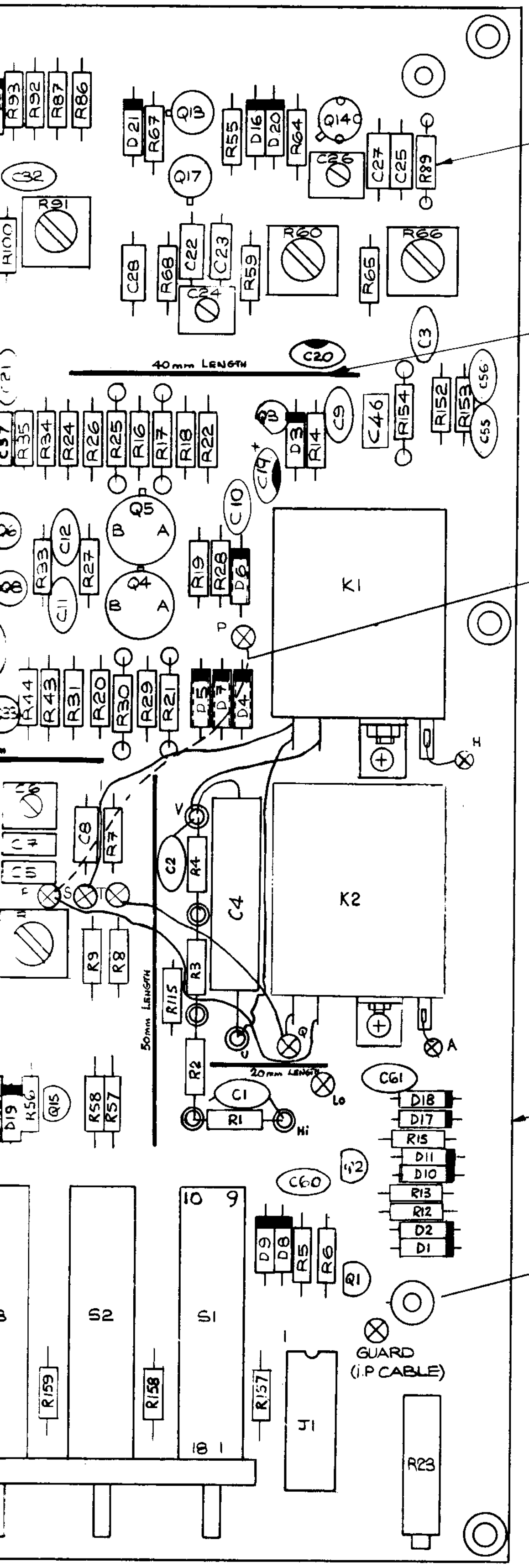


MOUNT LIPA & ISOSTAT SWITCHES ON
NYLON WASHERS (613011) 44 off

ISS.	CHANGES
22.	ECO 533. 26.9.77 K2 RE-POSITIONED. NEARBY COMPS. SHUFFLED ROUND. PARTS LIST MODS. IL
23	ECO 541 28.9.77 PT. LTS. CHANGE ONLY IL
24	ECO. 688. 25.5.78 PTS. LT. CHANGE ONLY IL

ISS.	CHANGES.
14	ECO 190 PT. LT. MOD. MJD. 10.3.76.
15	ECO.198. R141 WAS 22M R140 WAS 200K M.J.D. 13.4.76.
16	ECO 218 CR33 REPLACED BY LINK. R99 WAS 100R. M.J.D. 26.6.76
17	ECO 254 PT.LT. CONCH.
18	ECO 272 CR4-7 Sleeved PJH 8.9.76
19	ECO 408 PT.LT MODS PJH 17.3.77
20	ECO 412 PT. LT. MODS IL. 31.3.77
21	ECO 456 4-4-77 PARTS LIST MODS. IL.

ISS	CHANGES
4	ECO 36 VALUE OF R68 NOW 10K2 IL 21.4.75
5	E.C.O. 40 R89, R156 - R160. CR13, CR35, TP8, C3, C45, C57 & C58, T7, T8 ALL ADDITIONS. C4 WAS C3. IL 16.5.75
11	ECO 110 P/L CHANGE TO R23 IL 3/10/75
12	ECO 152 UPDATED M.J.D. 5.2.76
13	ECO 156 PT.LT. CHANGE M.J.D. 27.2.76



R89 FIT WIRE LINK ON ASSY. DO NOT SOLDER

¼" x 28 SWG BRASS STRIP (630033) SOLDERED TO PCB. IN 4 POSITIONS. 20. 40. 52 & 55 mm LENGTHS

MOUNT ON UNDERSIDE CUT PIN TO SUIT LINK P-R

PCB 419105-5

22mm TAPPED M3 STAND OFF MOUNTED ON TOP OF BOARD (6 OFF) 612005

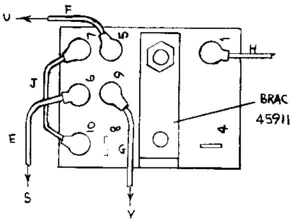
4mm CLEARANCE STANDOFF MOUNTED UNDER BOARD (6 OFF) 614001

NOTES: ASSEMBLE FROM MODEL IF POSSIBLE
Q6, Q7 STUCK WITH CYANOCRYLATE
Q32, Q33 " " "
◎ = TEFLON (PTFE) TERMINAL 620002
⊗ = SOLDER TERMINAL 620003
⊙ = STAKED SINGLE TERMINAL (SNAP-ON) 601002 (UNLESS WITH COMPONENT)
⊖ = (WITH COMPONENT) FSV TERMINAL) 602001

ALL PARTS WITH DASHED NUMBERS (e.g W1-1) ARE IN 1110 ONLY

MOUNT R156 WITH 5mm LENGTHS OF SLEEVE 590004

K1 RELAY WIRING (7/0.2 PVC 1kV)



UNSTRIPPED WIRE LENGTHS
E - 56
F - 43
G - 30
H - 25
J - 20

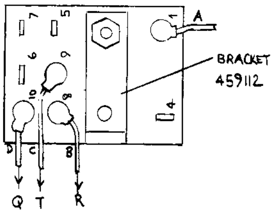
COIL CONNECTIONS TO ADJACENT PADS WITH SINGLE TINNED COPPER WIRE # 24 SLEEVED AS NECESSARY.
USE HELLERMAN SLEEVES ON RELAY PINS

GLUE Q32 TO Q33 AND Q28 TO M7 (DONE BY CHECKOUT), IN CLOSE CONTACT, WITH CYANOCRYLATE ADHESIVE (900001).

FIT UPPER GUARD SHIELD (459110) WITH 6 OFF SCREW POSIPAN M3 X 6 (611004) AND 6 OFF M3 SHAKEPROOF (613005)
FIT LOWER GUARD SHIELD (459111) WITH 6 OFF SCREW POSIPAN M3 X 10 (611006) AND 6 OFF M3 SHAKEPROOF (613005)

SLEEVE DIODES CR4-CR7 WITH SLEEVING 590011

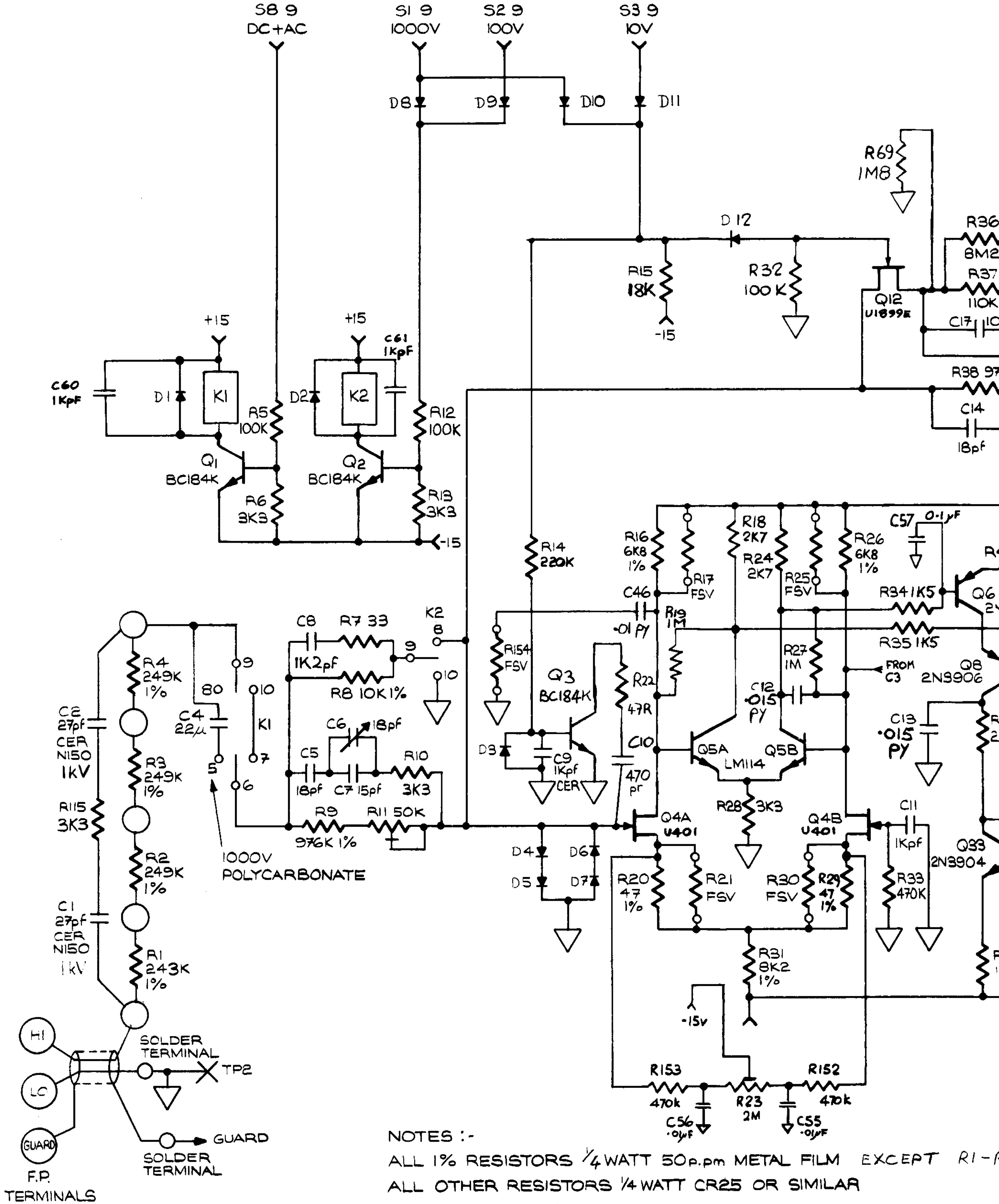
K2 RELAY WIRING (7/0.2mm PVC 1kV)



UNSTRIPPED WIRE LENGTHS
A — 25
B — 36
C — 25
D — 20

COIL CONNECTIONS AS K1 ABOVE

DATE 1-6-73	datron ELECTRONICS LTD.
DRAWN BY J P	TITLE ASSY. DRAWING RM6 PCB FOR 1030,
CHECK JKP	
NEXT DRAWING	
APP. L.A.D. 2.2.77	DRAWING NUMBER 409106 — SHEET 1 OF 15



NOTES :-

ALL 1% RESISTORS ¼ WATT 50p.pm METAL FILM EXCEPT R1-

ALL OTHER RESISTORS ¼ WATT CR25 OR SIMILAR

ALL DIODES IN4148

ALL CAPACITORS POLYSTYRENE 5% UNLESS MARKED

HIGHEST Q17, R70, C28, CR21. + Q31 + Q32

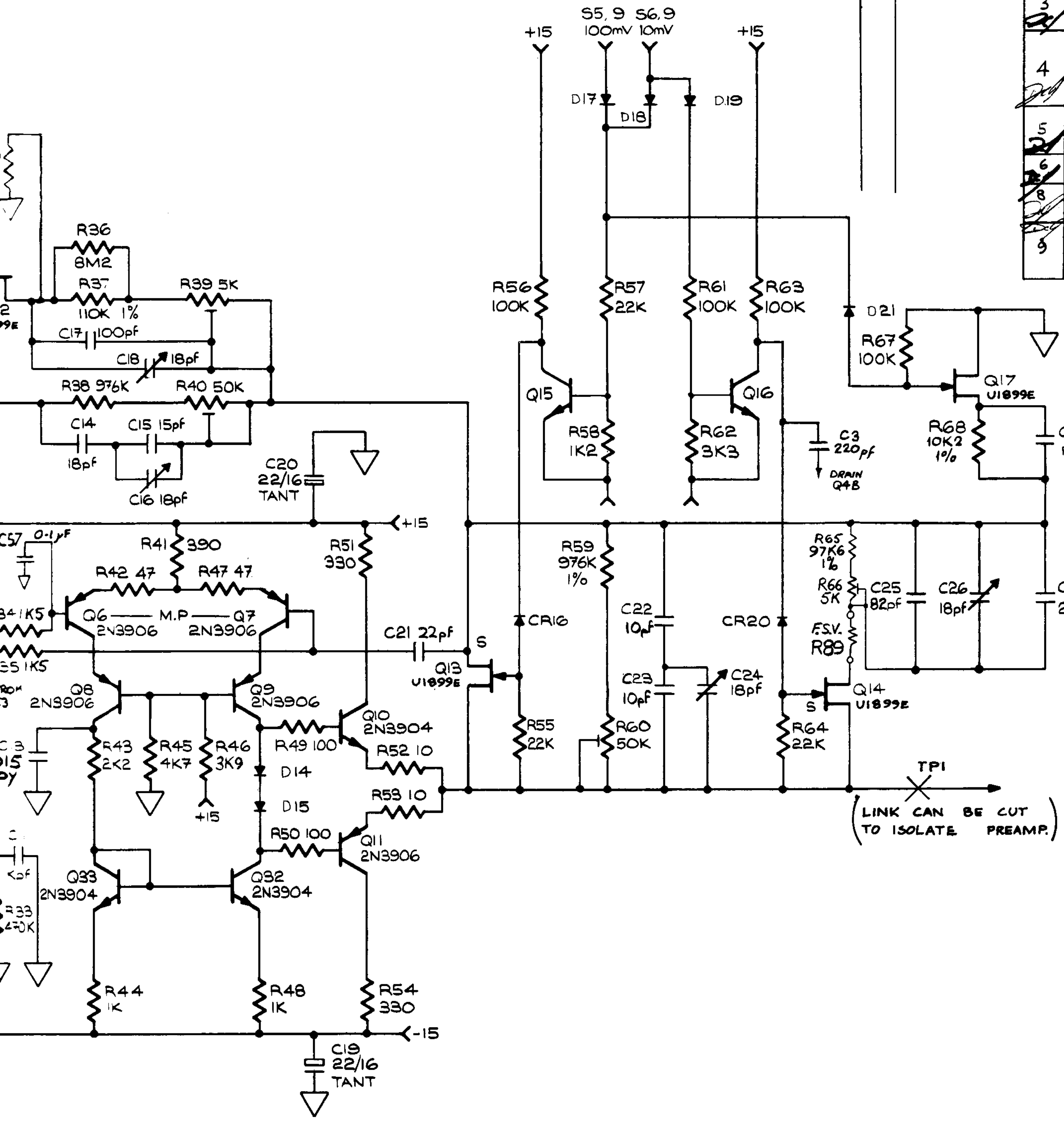
NOT USED CR13

MP = MATCHED PAIR PART No. 259005

Q6, Q7 IN THERMAL CONTACT

Q33, Q32 " "

ISS	CHANGES	ISS	CHANGES
10	ECO 456 4·4·77 Q4A/Q4B WAS 2N3956. IV	2	E.C.O. 29 COMPONENT VALUE & REF CHANGES & ADDITIONS. IV 10.4.75
11	ECO533. 26.9.77 R23 WAS 1M POT. R152. R153 WERE 1M. IL.	3	ECO 36 R68 WAS 10K5. NOW 10K2 IV 21.4.75
		4	ECO 83 CAP C60 AND RES R161 ADDED IN PARA- -LLEL WITH RES R19 IV 7.8.75
		5	E.C.O. 84 C10 WAS 220pf IV 18/8/75
		6	E.C.O. 152 UPDATED. M.J.D. 5.2.76
		8	ECO 408 17.3.77 C28 WAS 1000pF FBH
		9	ECO 412 31-3-77 R16 WAS 6K49 1% R26 WAS 6K49 1% IV.



EPT R1-R4 = 25ppm.

DATE
1-5-73

datron ELECTRONICS LTD.

DRAWN BY

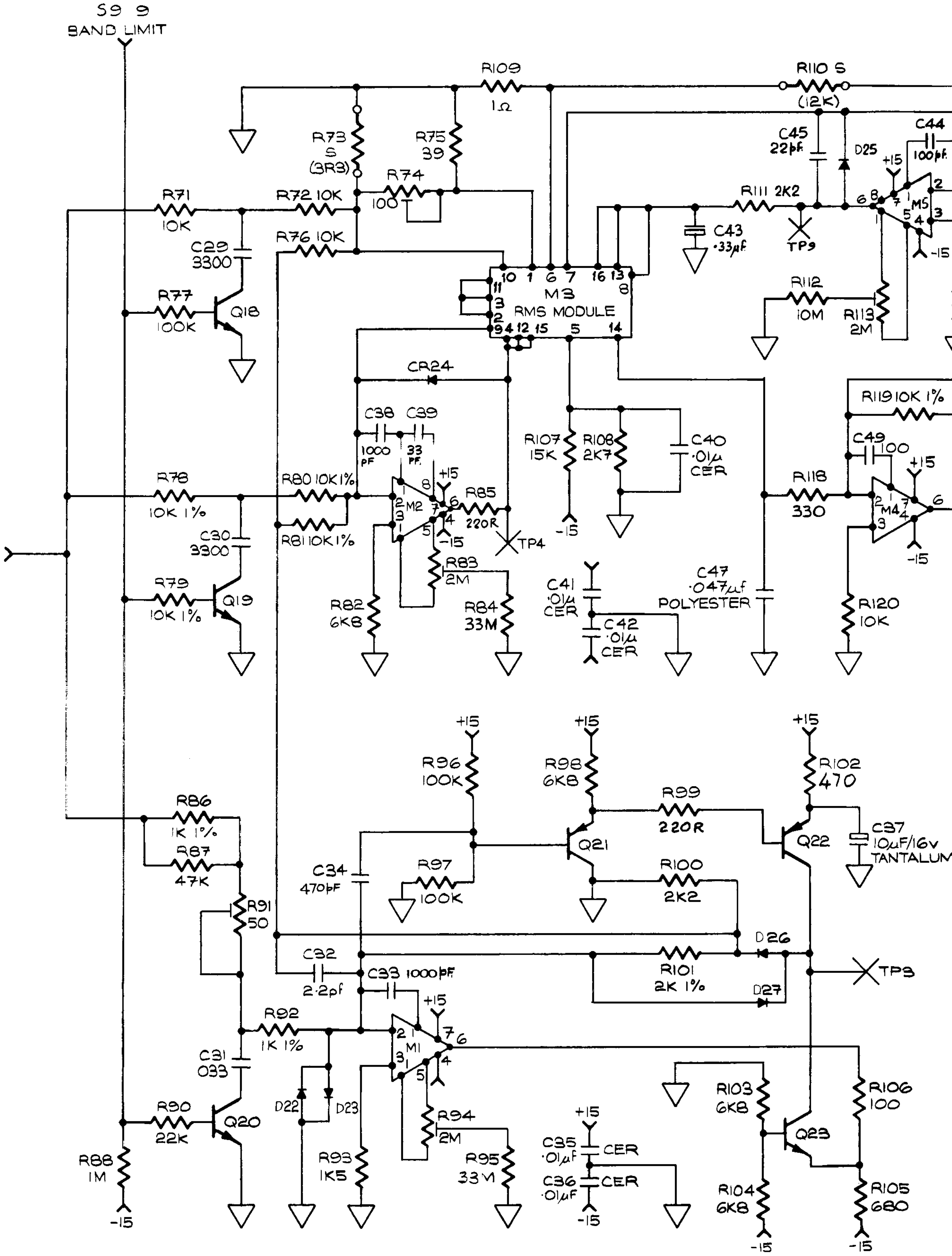
CHECK

NEXT DRAWING (ASSY) 409106

TITLE
PREAMP & SCALING FOR MODELS
1030

DRAWING NUMBER 439105

SHEET 1
OF 3


S9 9
BAND LIMIT
R109
1Ω
R110 S
(12K)
C45
22pF
D25
C44
100pF
+15
R73
S
(3R3)
R75
39
R74
100
R71
10K
R72 10K
R76 10K
R111 2K2
C43
·33μF
TP9
M5
-15
C29
3300
R77
100K
Q18
M3
RMS MODULE
10 1 6 7 16 13
11
3
2
9 4 12 15 5 14
8
R112
10M
R113
2M
CR24
R119 10K 1%
C38
1000
PF
C39
33
PF
C49
100
R107
15K
R108
2K7
C40
·01μ
CER
R78
10K 1%
R80 10K1%
R81 10K1%
M2
+15
R85
220R
-15
TP4
R118
330
M4
C30
3300
R79
10K 1%
Q19
R83
2M
R82
6K8
R84
33M
C41
·01μ
CER
C42
·01μ
CER
C47
·047μf
POLYESTER
R120
10K
R96
100K
R98
6K8
R102
470
R99
220R
Q21
Q22
C37
10μF/16v
TANTALUM
C34
470pF
R97
100K
R100
2K2
R86
1K 1%
R87
47K
R91
50
D26
C32
2·2pf
C33 1000pF
R101
2K 1%
D27
TP3
R92
1K 1%
M1
C31
033
R90
22K
Q20
D22
D23
R93
1K5
R94
2M
R95
33M
C35
·01μF
CER
C36
·01μF
CER
R103
6K8
R104
6K8
Q23
R106
100
R105
680
R88
1M
-15

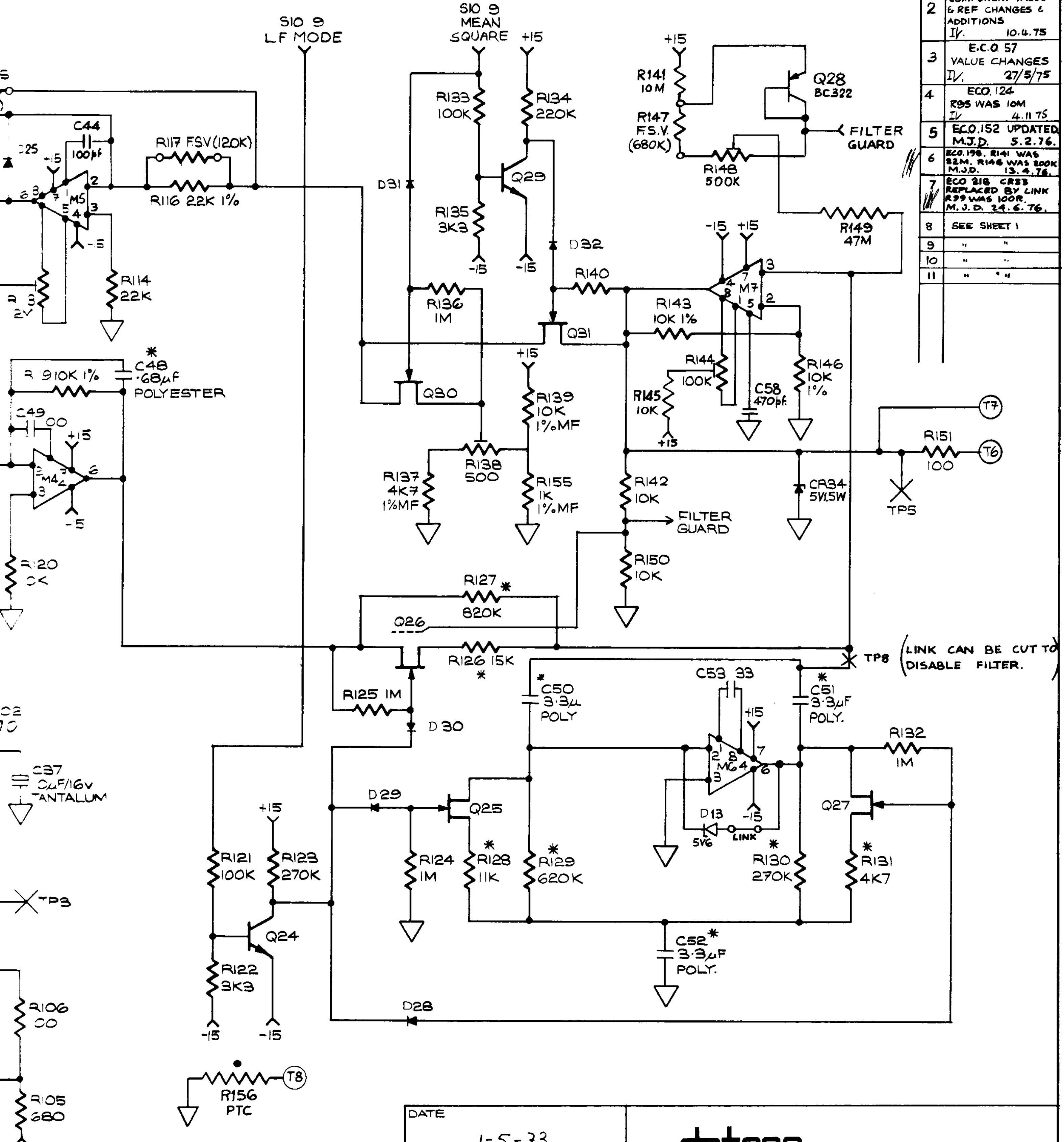
NOTES: Q

C

* D

IN

ISS	CHANGES
2	E.C.O. 29 COMPONENT VALUE & REF CHANGES & ADDITIONS IV. 10.4.75
3	E.C.O 57 VALUE CHANGES IV. 27/5/75
4	ECO. 124 R95 WAS 10M IV 4.11 75
5	ECO.152 UPDATED M.J.D. 5.2.76.
6	ECO.198. R141 WAS 82M. R148 WAS 200K M.J.D. 13.4.76.
7	ECO 216 CR33 REPLACED BY LINK R99 WAS 100R. M.J.D. 24.6.76.
8	SEE SHEET 1
9	" "
10	" "
11	" "



NOTES: Q28 IN THERMAL CONTACT WITH M7

CR26-27 HOT CARRIER DIODES

* DEPENDS ON OPTIONS - 1Hz AND 50Hz INTEGRATION FILTERS SHOWN

DATE	1-5-73
DRAWN BY	
CHECK	
NEXT DRAWING	(ASSY) 409106

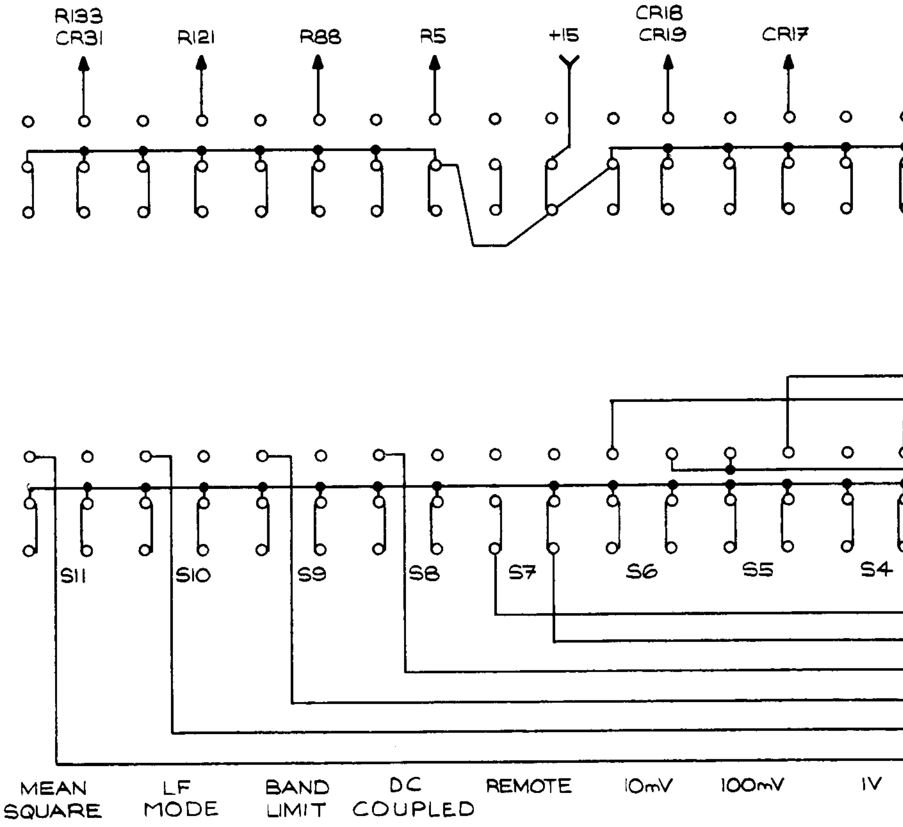
datron ELECTRONICS LTD.

TITLE

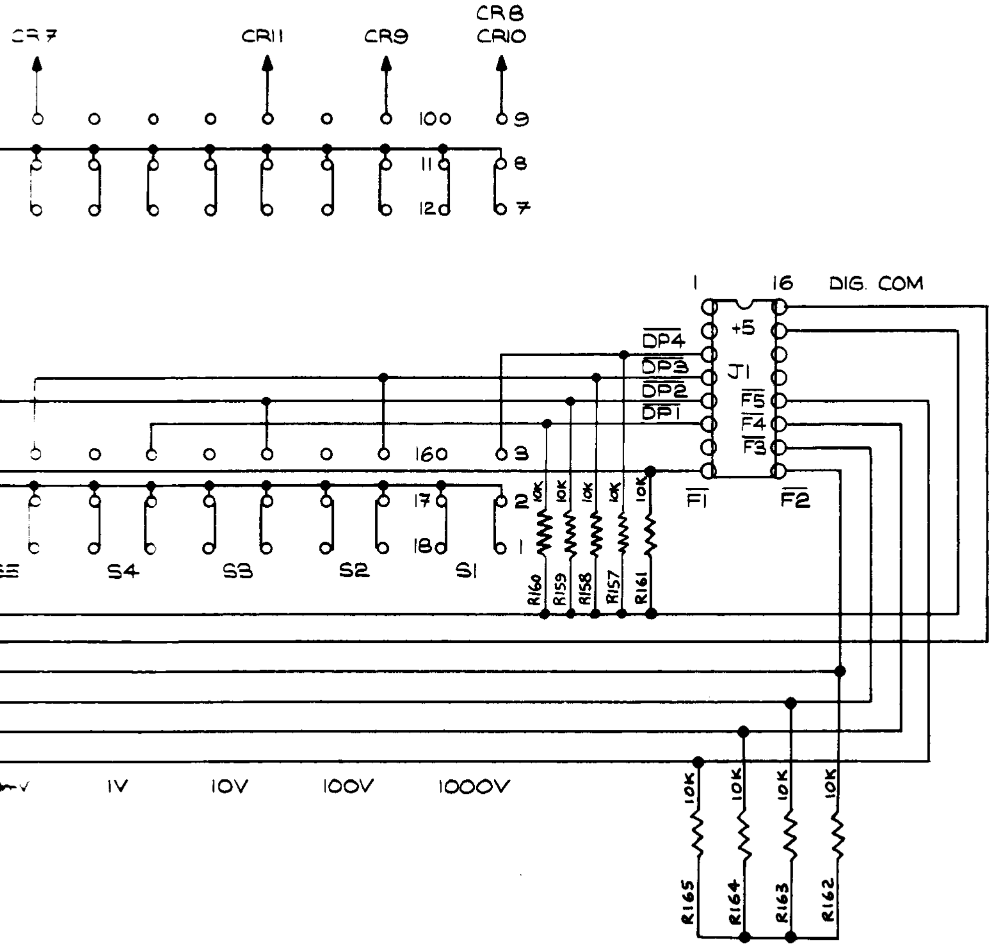
TRUE RMS CONVERTER FOR MODELS
1030

DRAWING NUMBER 439105

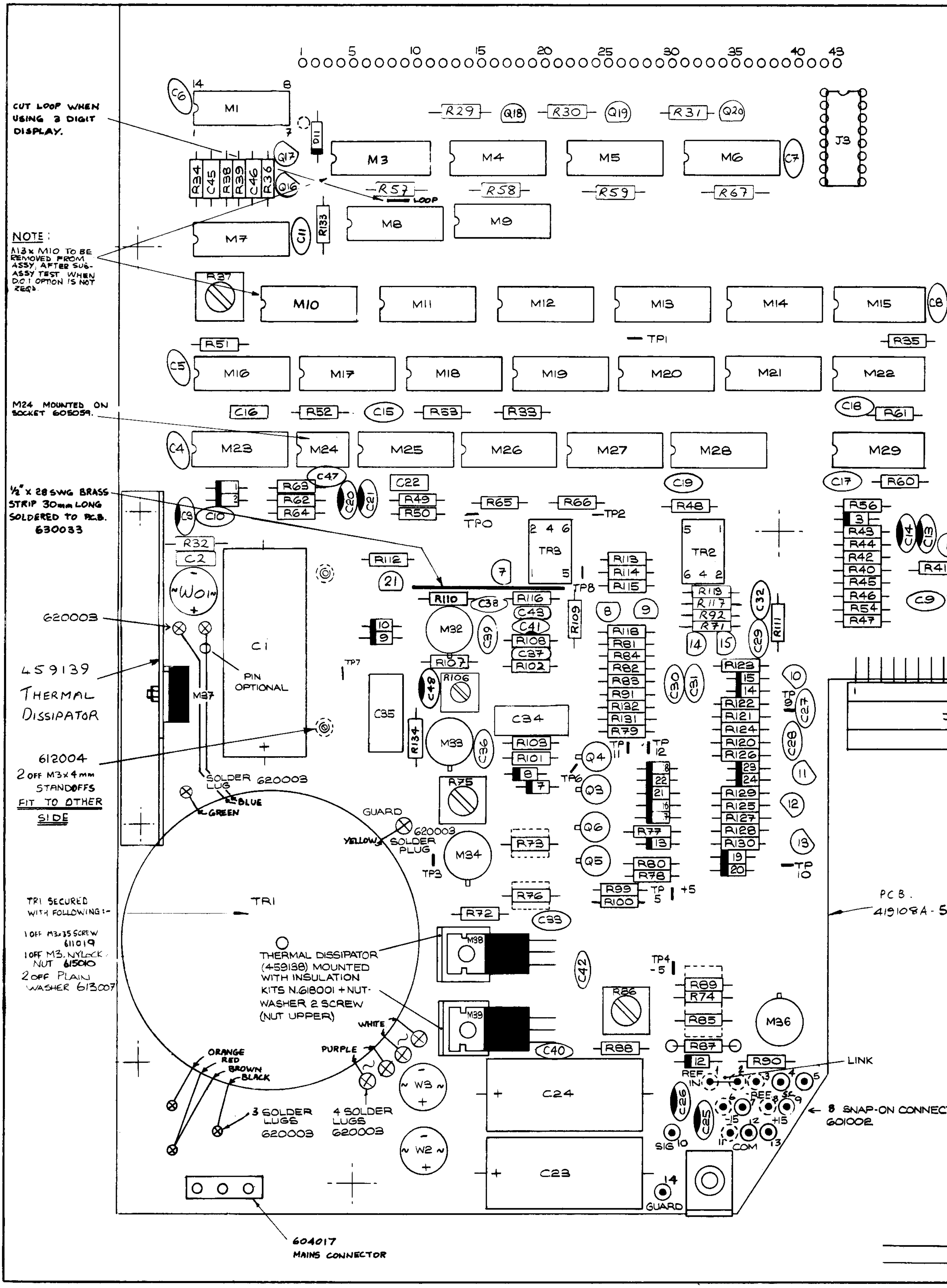
SHEET 2
OF 3


R133
CR31
R121
R88
R5
+15
CR18
CR19
CR17
S11
S10
S9
S8
S7
S6
S5
S4
MEAN
SQUARE
LF
MODE
BAND
LIMIT
DC
COUPLED
REMOTE
10mV
100mV
1V

ISS	CHANGE
2	E.C.O.40 R157-R160 ADDED IV. 16.5.75
3.	ECO 152 R161-165 ADDED. SUPPLY DELETED M.J.D. 5.2.76
8	SEE SHEET 1
9	" "
10	" "
11	" "



DATE 1-5-73	datron ELECTRONICS LTD
DRAWN BY.	TITLE SWITCHING AND OPTIONAL POWER SUPPLY FOR MODELS 1030
CHECK	
NEXT DRAWING 409106 (ASSY. PCB)	DRAWING NUMBER 439105 — SHEET 3 OF 3



CUT LOOP WHEN USING 2 DIGIT DISPLAY.

NOTE :
M13 x M10 TO BE REMOVED FROM ASSY, AFTER SUB-ASSY TEST WHEN D.O.1 OPTION IS NOT REQD.

M24 MOUNTED ON SOCKET 605059.

½" x 28 SWG BRASS STRIP 30mm LONG SOLDERED TO P.C.B. 630033

620003

459139
THERMAL DISSIPATOR

612004
2 OFF M3 x 4mm STANDOFFS
FIT TO OTHER SIDE

TR1 SECURED WITH FOLLOWING :-

1 OFF M3x35 SCREW 611019
1 OFF M3. NYLOCK NUT 615010
2 OFF PLAIN WASHER 613007

THERMAL DISSIPATOR (459138) MOUNTED WITH INSULATION KITS N.618001 + NUT-WASHER 2 SCREW (NUT UPPER)

PIN OPTIONAL

SOLDER LUG 620003

GUARD 620003 SOLDER PLUG

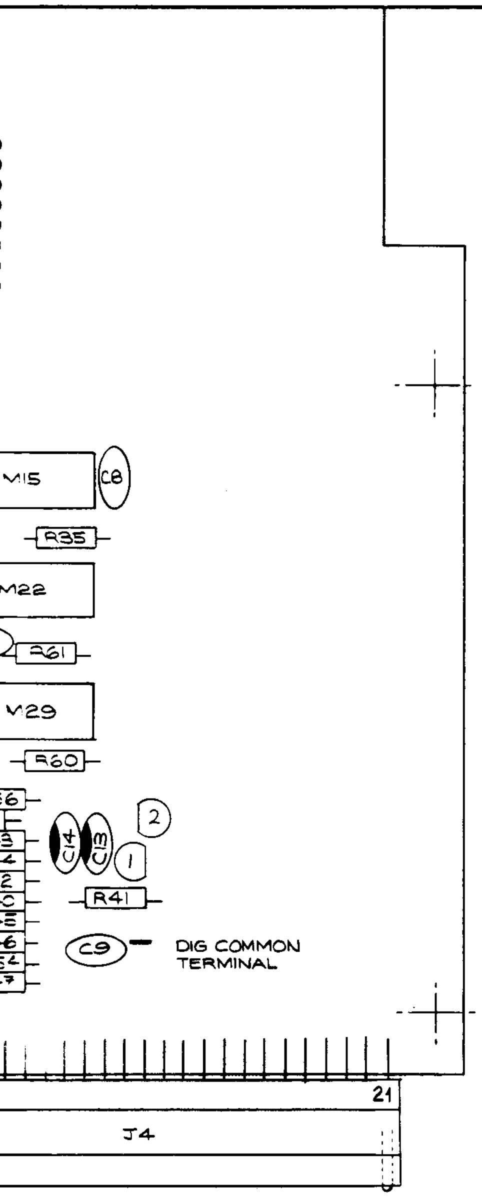
3 SOLDER LUGS 620003

4 SOLDER LUGS 620003

8 SNAP-ON CONNEC
601002

PCB.
419108A-5

604017
MAINS CONNECTOR



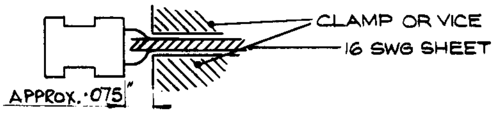
4908A-5A

K

P-ON CONNECTIONS
E

NOTES:

1 J4 CONNECTOR TERMINALS MUST BE PREFORMED AS BELOW BEFORE SOLDERING.



2 DIL PACKAGES FITTED WITH FOLLOWING:-

16 PIN DIL SOCKET 605038
14 PIN DIL SOCKET 605037

3 TERMINALS SHOWN ON RESISTOR LEGS (E.G. R87) ARE COMPONENT MOUNTING FSV

4 TERMINALS MARKED AS SOLDER LUGS ARE FOR SOLDERED WIRE CONNECTIONS

5 ALL OTHER TERMINALS ARE FOR SNAP-ON WIRE CONNECTIONS

6 TP'S ARE BENT LOOPS OF WIRE AS BELOW

7 ⊗ DENOTES SOLDER LUG CONNECTION TO TRANSFORMER

8 FIT GUARD SHIELD 450/139 WITH
SCREW POSIPAN M3 X 6 (611007) 2 OFF
NUT M3 (615002) 2 OFF
SHAKEPROOF M3 (613005) 2 OFF
FIT NUTS ON TOP SIDE.

9 FIT INSULATING BUSH TO M37, M38 & M39 & SMEAR WITH HEATSINK COMPOUND 900003 ALSO FIT MICA WASHER TO M37.

PROD APP L.A.D. 2.3.77

DATE 28-2-73

DRAWN BY J P

CHECK

NEXT DRAWING 409115

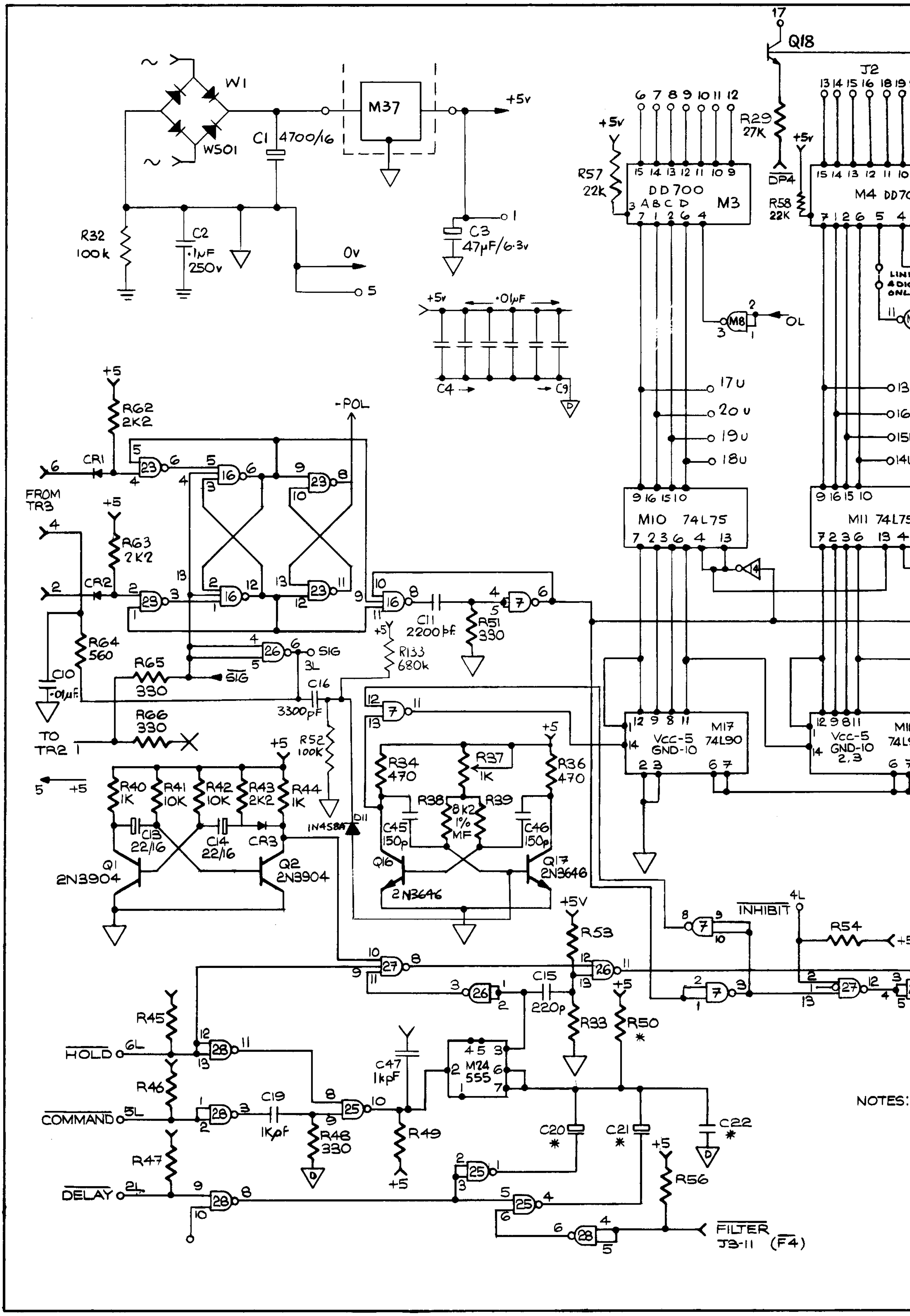
datron ELECTRONICS LTD.

TITLE
ANALOG TO DIGITAL CONVERTER
1030

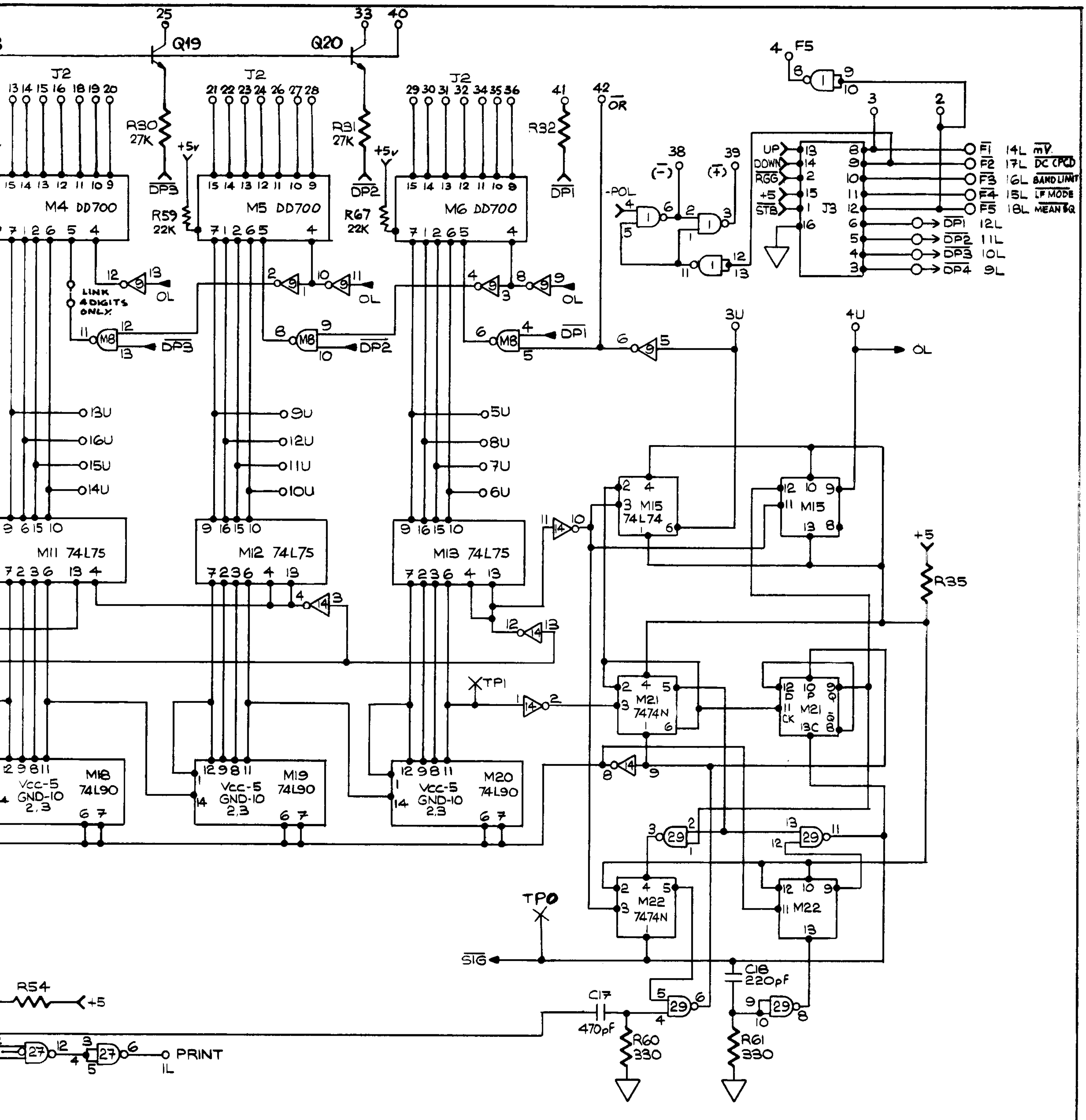
DRAWING NUMBER 409109

SHEET 1 OF 12

20	19	18	17	16	15	14	13	12	11	10	ISS. 2	ISS 8	ISS. 9
670	642	625	610	548	525	517	387	426	398	293	ECO. 85	ECO. 148	ECO. 185



W1
WS01
C1 4700/16
M37
+5v
R32 100k
C2 ·1μF 250v
0v
5
1
C3 47μF/6·3v
+5v
·01μF
C4
C9
17
Q18
J2
13 14 15 16 18 19
6 7 8 9 10 11 12
R29 27K
DP4
+5v
R57 22k
DD700
A B C D
M3
R58 22K
M4 DD70
LIN
4 DIG
ONL
M8
OL
17u
20u
19u
18u
M10 74L75
M11 74L75
+5
R62 2K2
CR1
FROM TR3
R63 2K2
CR2
-POL
R64 560
C10 ·01μF
R65 330
SIG
3L
R66 330
TO TR2
C11 2200pF
R51 330
R133 680k
C16 3300pF
R52 100k
M17 74L90
Vcc-5
GND-10
2, 3
R34 470
R37 1K
R36 470
R38
R39
8K2 1% MF
C45 150p
C46 150p
Q16
2N3646
Q17 2N3646
1N4584
D11
R40 1K
R41 10K
R42 10K
R43 2K2
R44 1K
C13 22/16
C14 22/16
CR3
Q1 2N3904
Q2 2N3904
5 +5
+5V
R53
INHIBIT
4L
R54
C15 220p
R33
R50 *
R45
HOLD
6L
R46
COMMAND
5L
C19 1KpF
R48 330
R49
C47 1KpF
M24 555
C20 *
C21 *
C22 *
R47
DELAY
2L
R56
FILTER
J3-11 (F4)
NOTES:



NOTES: 1. R1-R32 270Ω ALL OTHER UNMARKED R - 10K

2 ALL UNMARKED CR IN4148

3 HIGHEST R66, C22, CR2, Q2
NOT USED R1-8, R57 (D.01 OPTION ONLY)
58, 59, 68, 69

✱ VALUES DEPEND ON OPTIONS

4 M3 & M10 FORM 4TH DIGIT OPTION D.0.1 & ARE REMOVED FROM PCB AFTER TESTING UNLESS OPTION IS REQUIRED BY ORDER

DATE 1-5-73

DRAWN BY

CHECK

NEXT DRAWING (PCB ASSY) 409109

ISS. 2	3	4	5	6	7
ECO.82	283	398	426	387	670

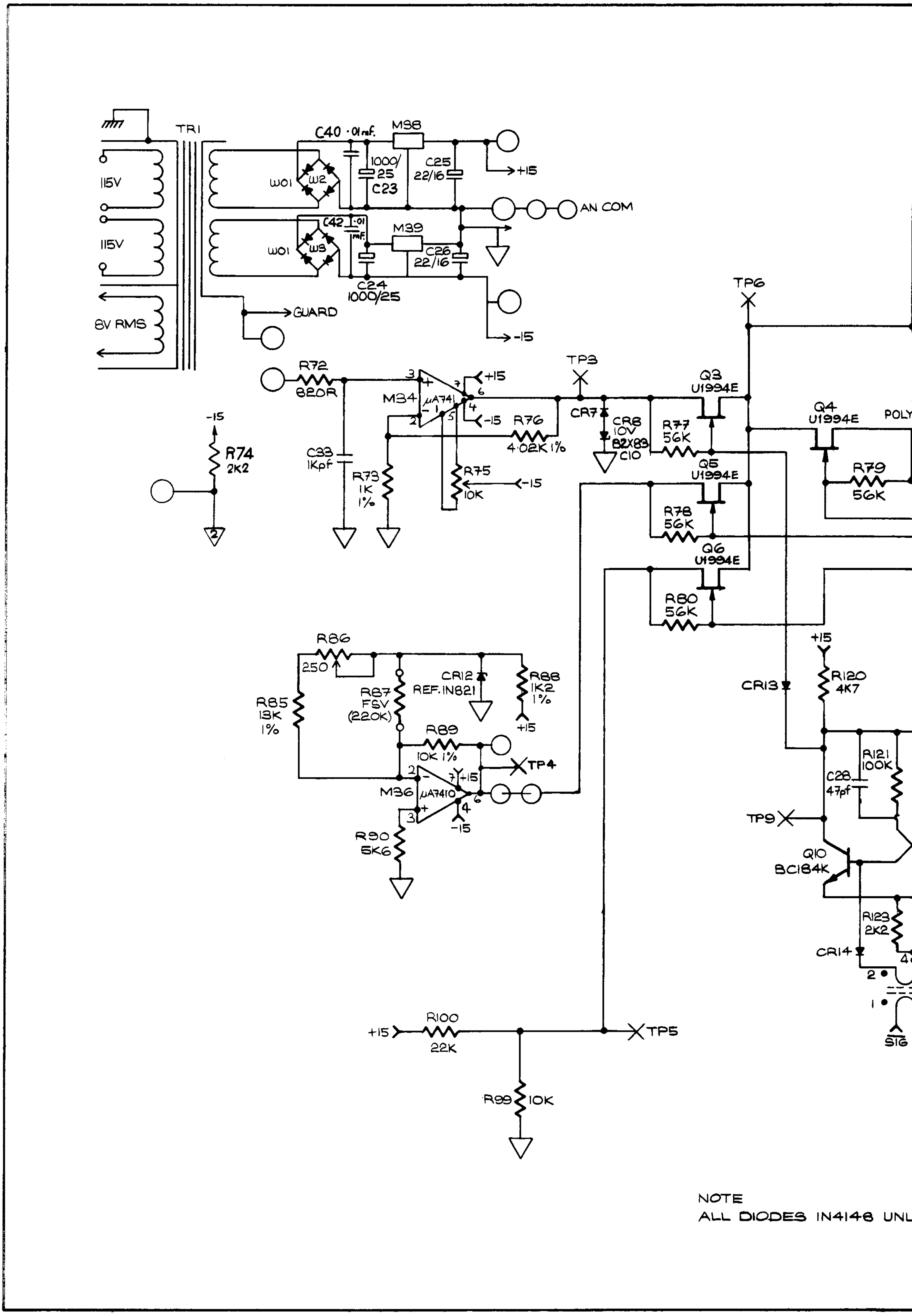
datron ELECTRONICS LTD.

TITLE

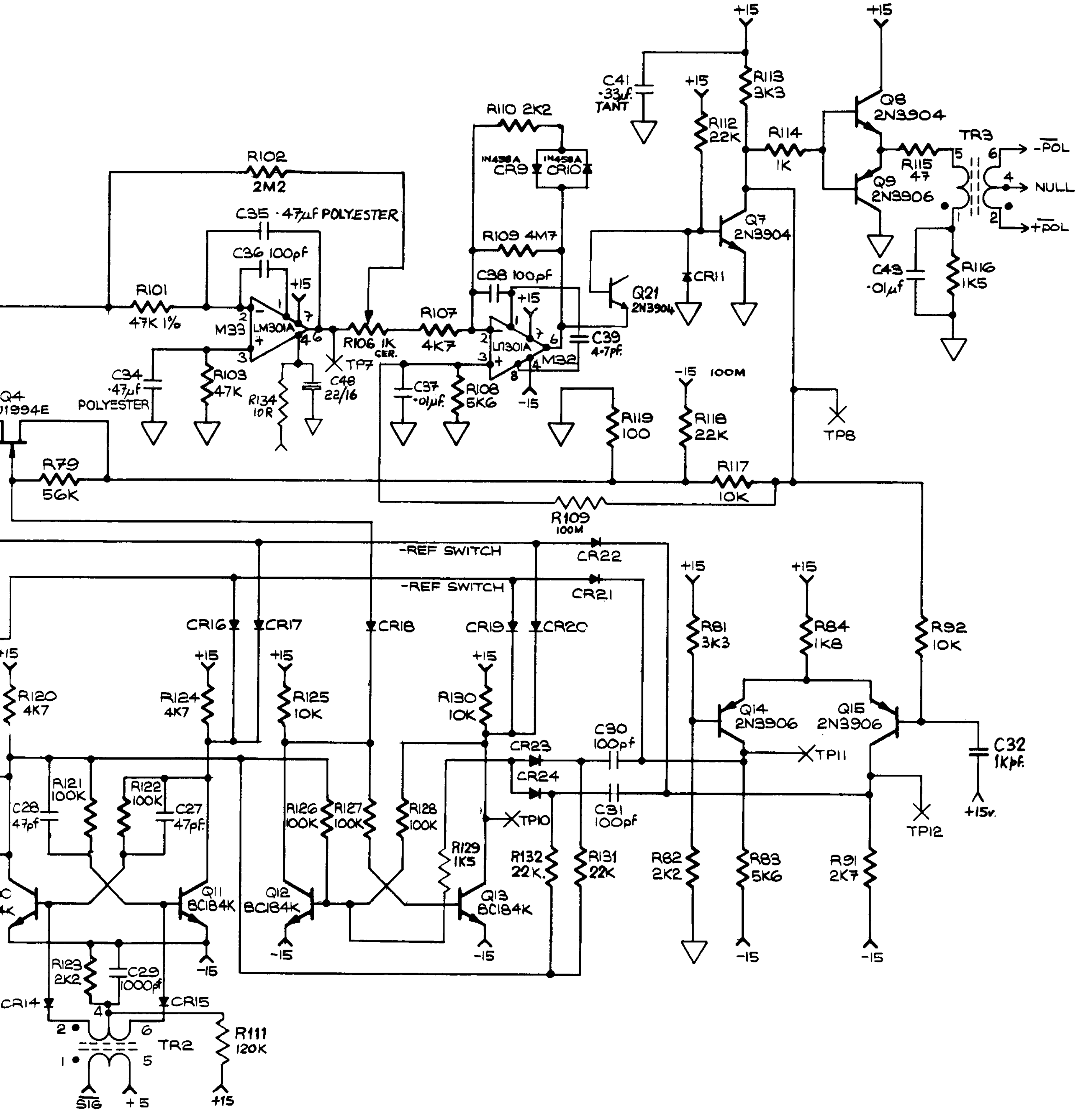
A-D DISPLAY DIGITAL SECTION
1030

DRAWING NUMBER 439106

SHEET 1 OF 2



NOTE
ALL DIODES IN4148 UNL



IN4148 UNLESS NOTED OTHERWISE

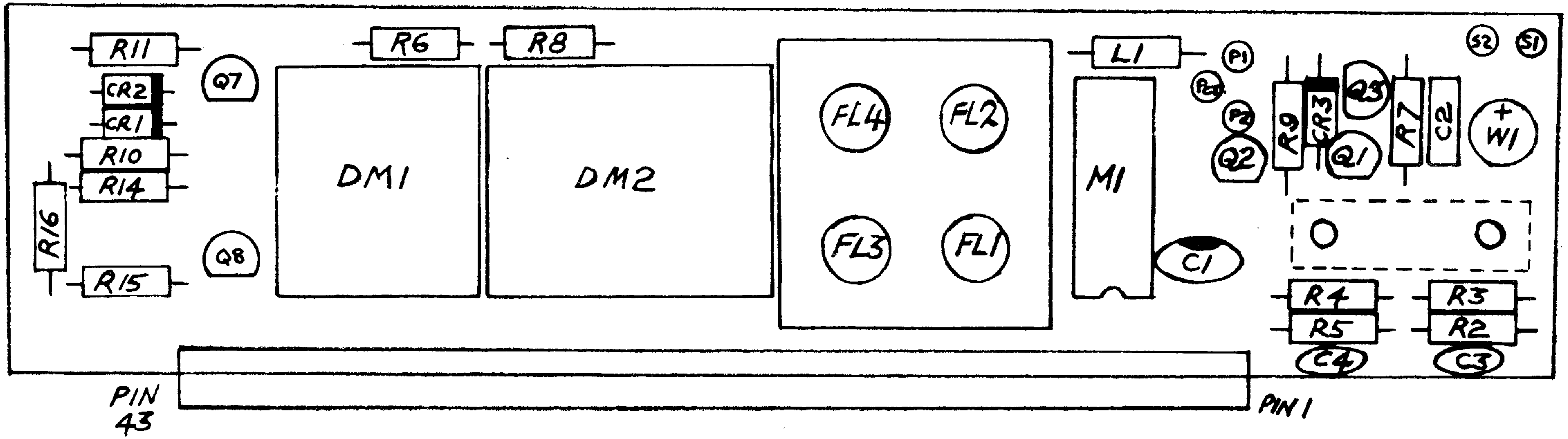
DATE 1-5-73	**datron** ELECTRONICS LTD.
DRAWN BY	TITLE
CHECK	A-D DISPLAY ANALOG SECTION 1030
NEXT DRAWING (PCB ASSY.) 409109	
	DRAWING NUMBER 439106
	SHEET 2 OF 2

ISS. 2	3	4	5	6	7
ECO. 85	283	398	426	387	670

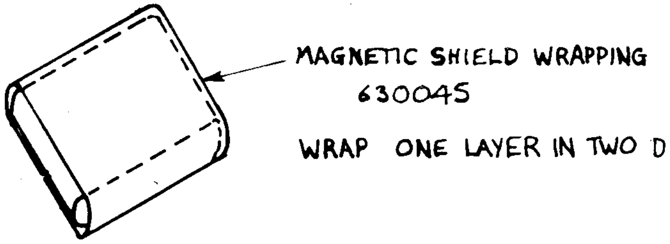
THIRD ANGLE PROJECTION
DRAWN IN ACCORDANCE WITH B.S. 308

ALL BURRS TO BE REMOVED

ISS	CHANGES
2	PARTS LIST CHANGES ECO 440 IV 1.4.77
3	DIL SOCKET CHANGE 7.7.77. ECO 516 PJH



TRANSFORMER WIRING
P1 GREEN
PCT YELLOW
P2 ORANGE
S1 BROWN
S2 RED


MAGNETIC SHIELD WRAPPING
630045

WRAP ONE LAYER IN TWO DIRECTIONS

TRANSFORMER SHIELDING

DRAWN IV.
CHECKED
TRACED
APPROVED
DATE 22.8.75
DATE

DIMENSIONS IN MILLIMETRES
SCALE NOT TO BE SCALED

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

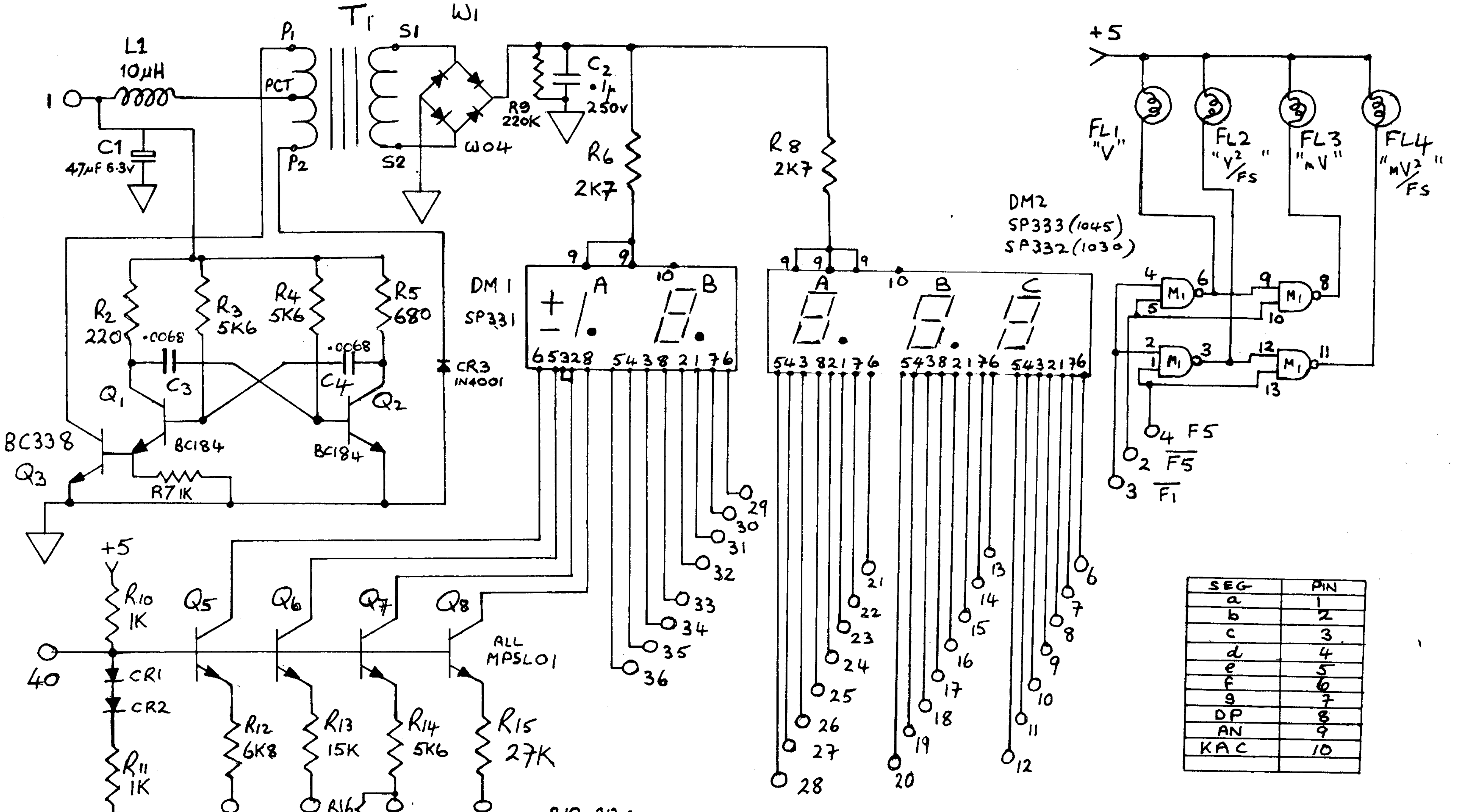
MATERIAL

FINISH

datron ELECTRONICS LTD. NORWICH

TITLE 1030 SPERRY DISPLAY
DRAWING No. 400025/29
DRAWING SIZE A4
SHEET 1 OF 3

JW 1163



SEG	PIN
a	1
b	2
c	3
d	4
e	5
f	6
g	7
DP	8
AN	9
KAC	10

R12, R13 &
Q5, Q6 } NOT USED IN 1030 (400025/29)

FL2, FL4 " " " 1045 (400028)

ISSUE 3 23-4-75
ISSUE 4 ECO 440 1.4.77

DATE. 23-11-73

DRAWN BY.

CHECK

NEXT DRAWING 400025
400 028

datron ELECTRONICS LTD.

TITLE 1030/1045 DISPLAY SCHEMATIC (SPERRY)

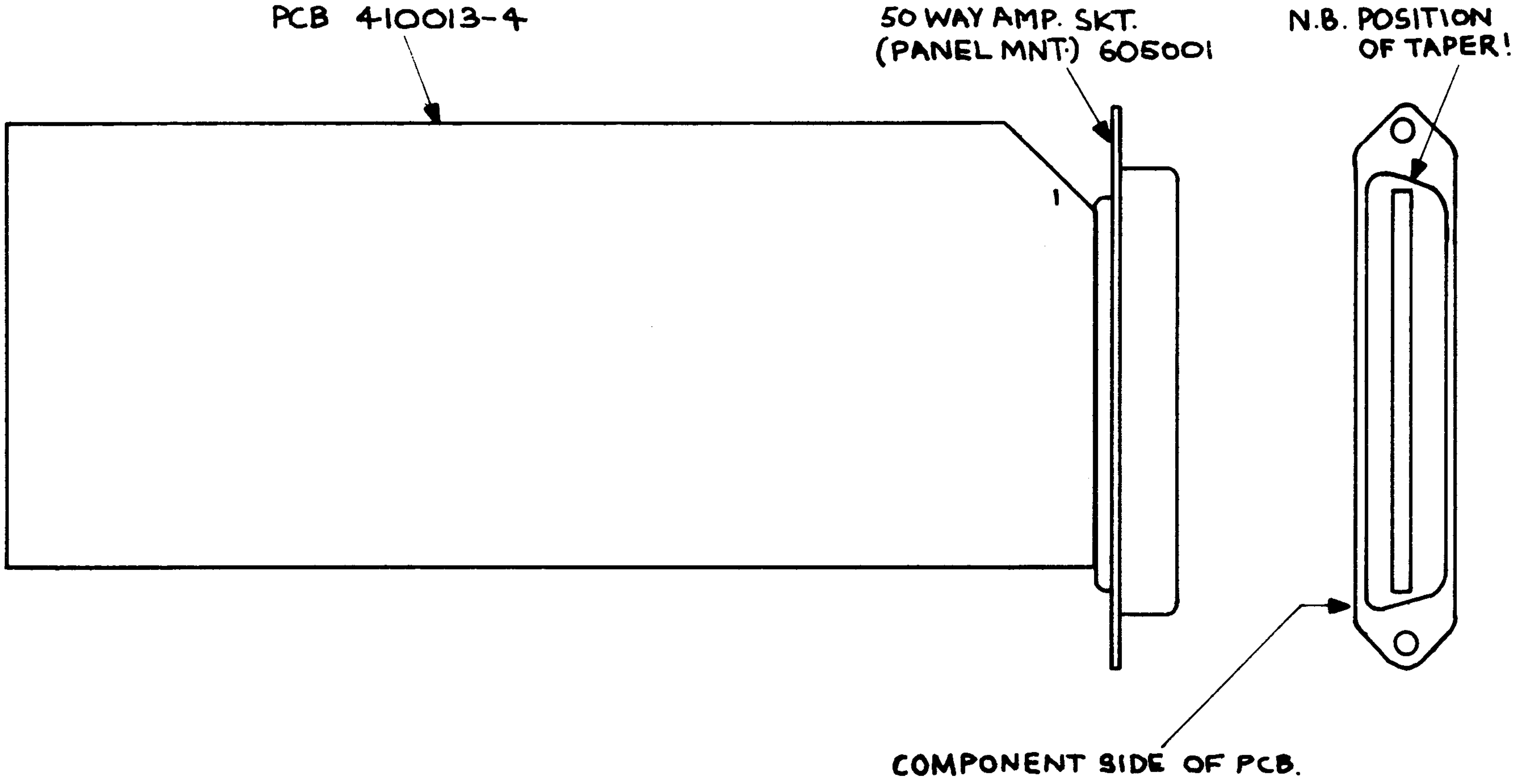
DRAWING NUMBER 430006

SHEET 1 OF 1

THIRD ANGLE PROJECTION
DRAWN IN ACCORDANCE WITH B.S. 308

ALL BURRS TO BE REMOVED

ISS	CHANGES
1	



DRAWN K.J.S.	CHECKED MD	DIMENSIONS IN MILLIMETRES	TOLERANCES 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 ANGULAR ± ½°	MATERIAL	datron ELECTRONICS LTD. NORWICH	DRAWING SIZE A4
TRACED	APPROVED	SCALE				
DATE 2.3.79	DATE	NOT TO BE SCALED		FINISH	TITLE B01 BCD ASSEMBLY 1030/41/4.5	DRAWING No. 400348	SHEET 1 OF 2

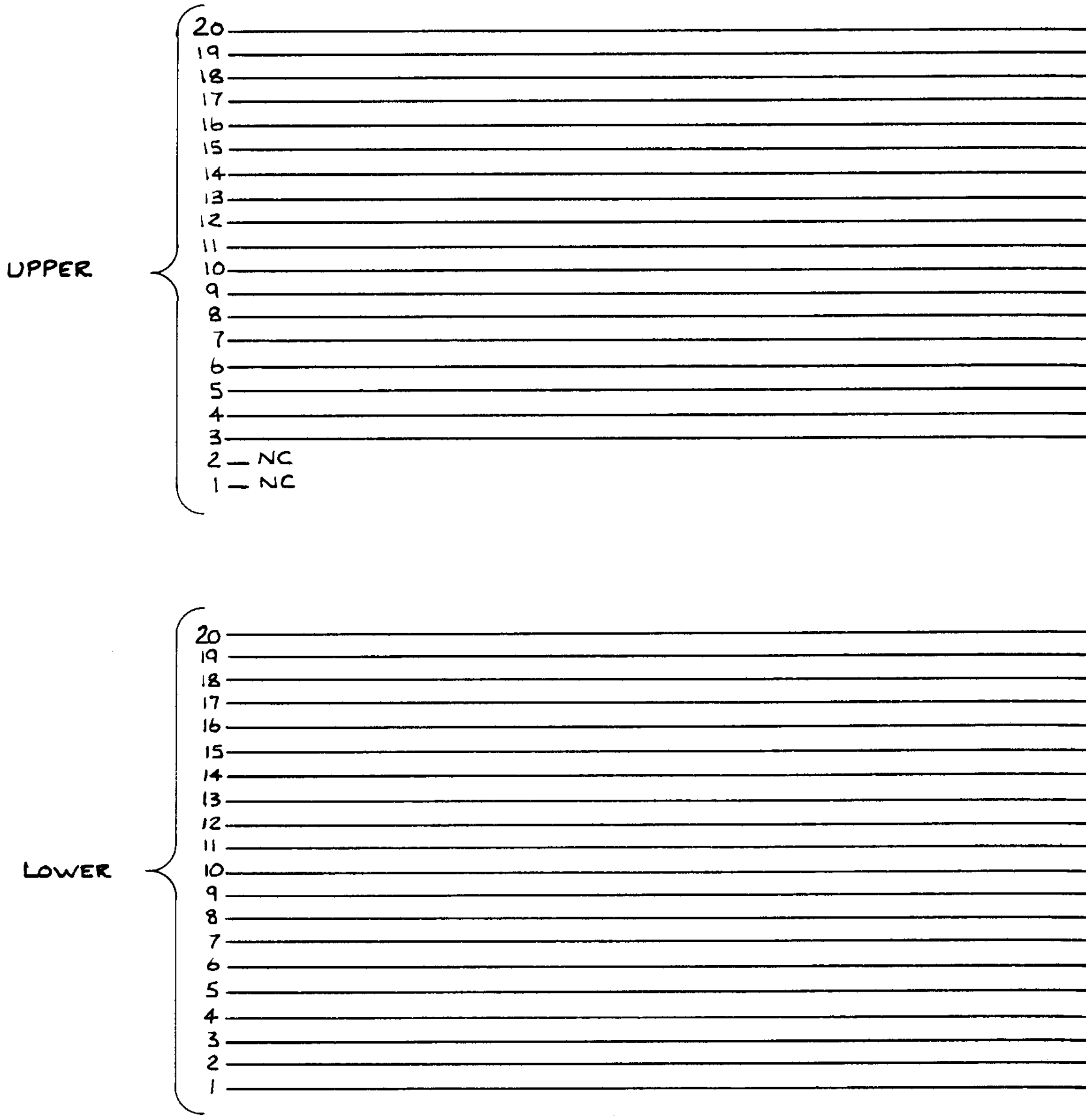
1163

DRAWING No.
430348.

FIRST USED ON
1030

THIRD ANGLE PROJECTION

DRAWN IN ACCORDANCE WITH BS 308

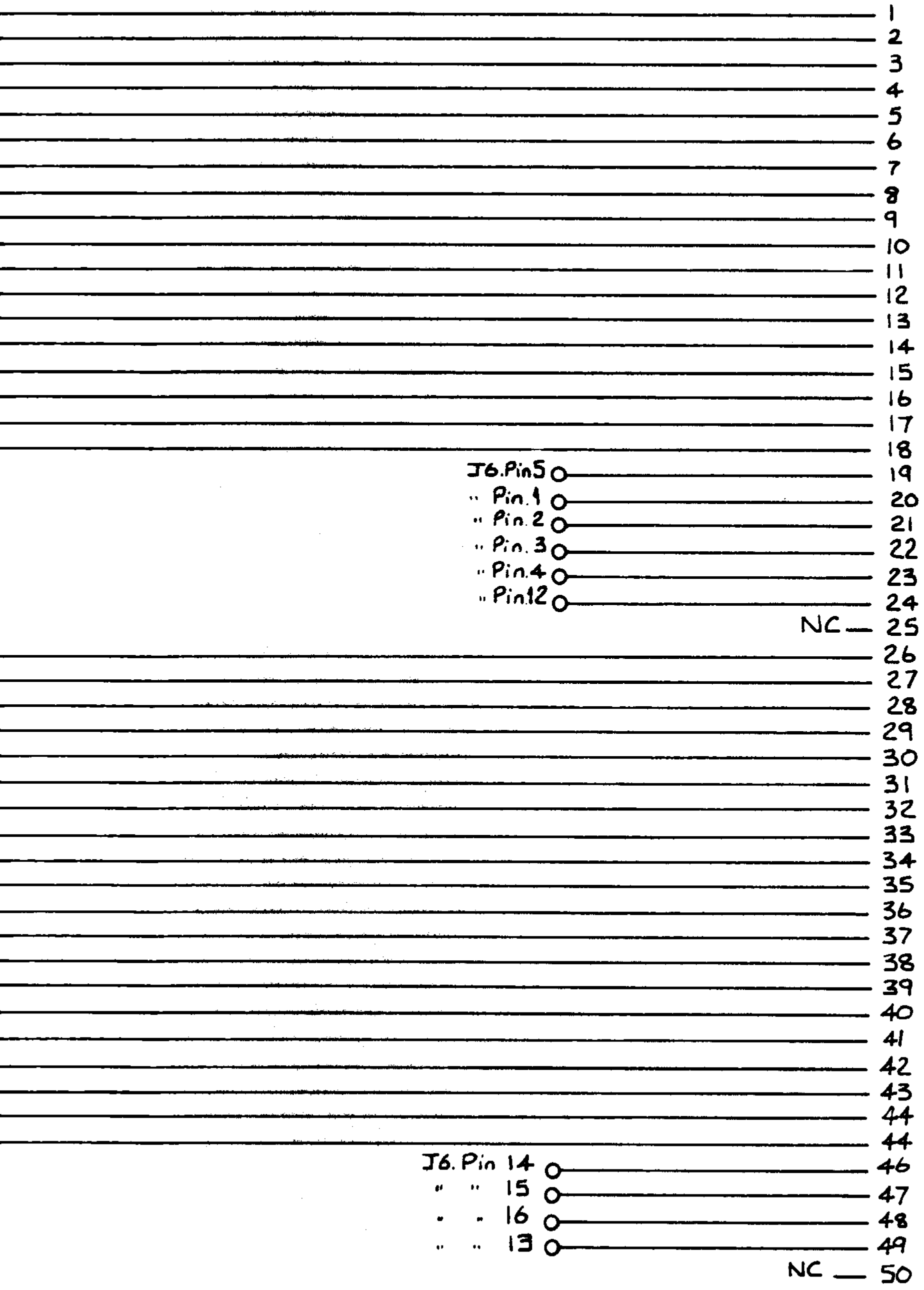


DRAWN B.J.	CHECKED MD	DIMENSIONS IN MILLIMETRES	TOLERANCES ANGULAR ± ½° INCH DIMENSIONS DECIMAL TO 3 PLACES ± .005 DECIMAL TO 2 PLACES ± .010 FRACTIONAL ± 1/64	MATERIAL ———
TRACED	APPROVED	SCALE NOT TO BE SCALED	METRIC DIMENSIONS DECIMAL TO 2 PLACES ± 1mm DECIMAL TO 1 PLACE ± 2mm WHOLE DIMENSIONS ± 4mm UNLESS OTHERWISE STATED	FINISH ———
DATE 7-3-78	DATE			

4	5	6	ISS.	CHANGES
ALL BURRS TO BE REMOVED		NOTES	1	

NOTES

NC = NOT CONNECTED.



datron ELECTRONICS LTD. NORWICH.

DRAWING SIZE A2

TITLE B.O.1 B.C.D SCHEMATIC

DRAWING No. 430348

SHEET 1 OF 1

1
2
3

DRAWING No.
400058

FIRST USED ON
1041

THIRD ANGLE PROJECTION

DRAWN IN ACCORDANCE WITH BS 308

ALL

A

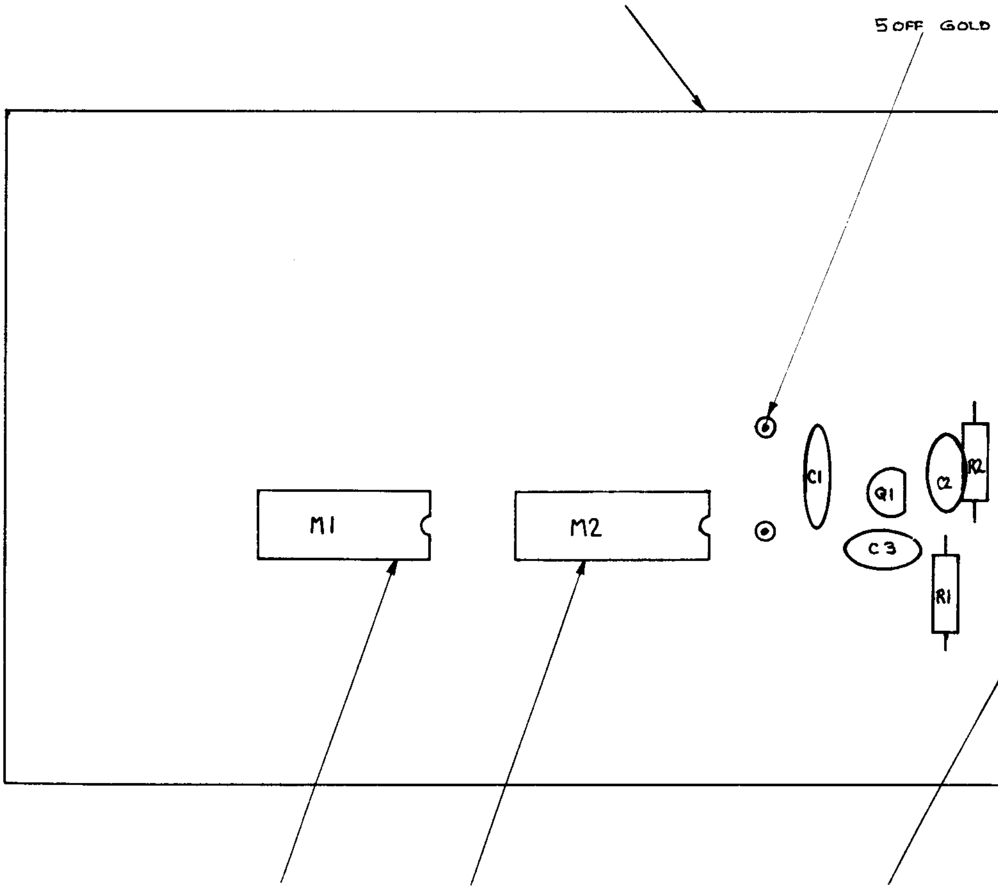
B

C

D

PCB 410013-8

5 OFF GOLD



MOUNT M1 ON 14 PIN SOCKET
605037.

MOUNT M2 ON 16 PIN SOCKET
605038

MOUNT M3 ON 8
SOCKET 605059

DRAWN
FSH

CHECKED
GC.M

TRACED

APPROVED
L.A.D.

DATE
29.11.76

DATE
2.2.77

DIMENSIONS IN

MILLIMETRES

SCALE

NOT TO BE SCALED

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
/

FINISH
/

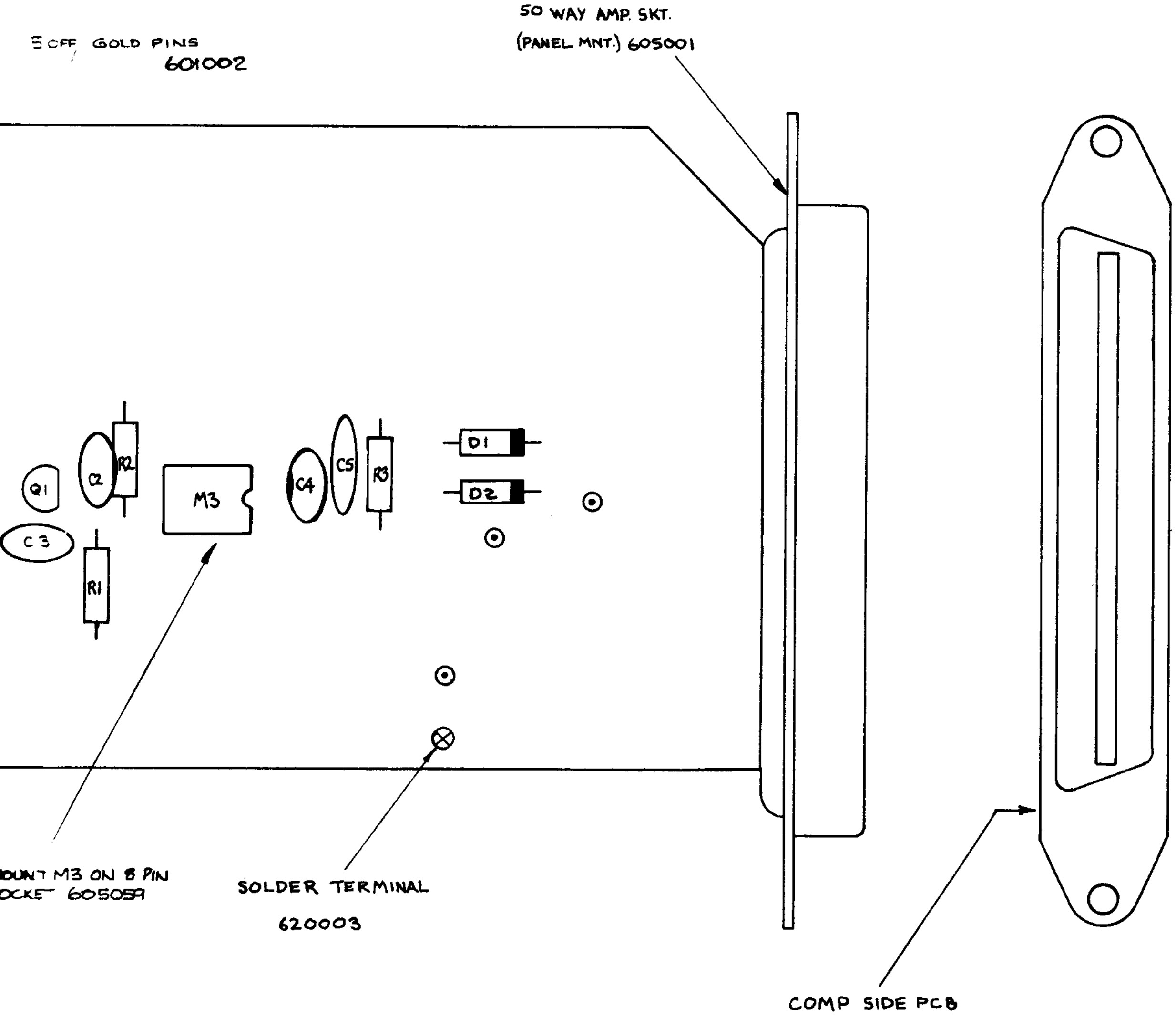
J.W.1162

4 5 6

ALL BURRS TO BE REMOVED

NOTES

ISS.	CHANGES
3	Redrawn 2:1, M1 M2 added ECO354 29.11.76 PJH
4	ECO 381 -1 M3 etc. added. PJH
5	ECO 381 -2 LINK REMOVED. PJH C3 moved. 21.2.77
6	ECO 586 ADD D1 D2 5 gold pins 4-1-78 BJ.
7	ECO. 622. IC. MOUNTING SKTS INDICATED. IL. 14.3.78



datron ELECTRONICS LTD. NORWICH.

DRAWING SIZE
A2

TITLE
1030, 1041, 1045 BCD BOARD ASSY B01a

DRAWING No.
400058

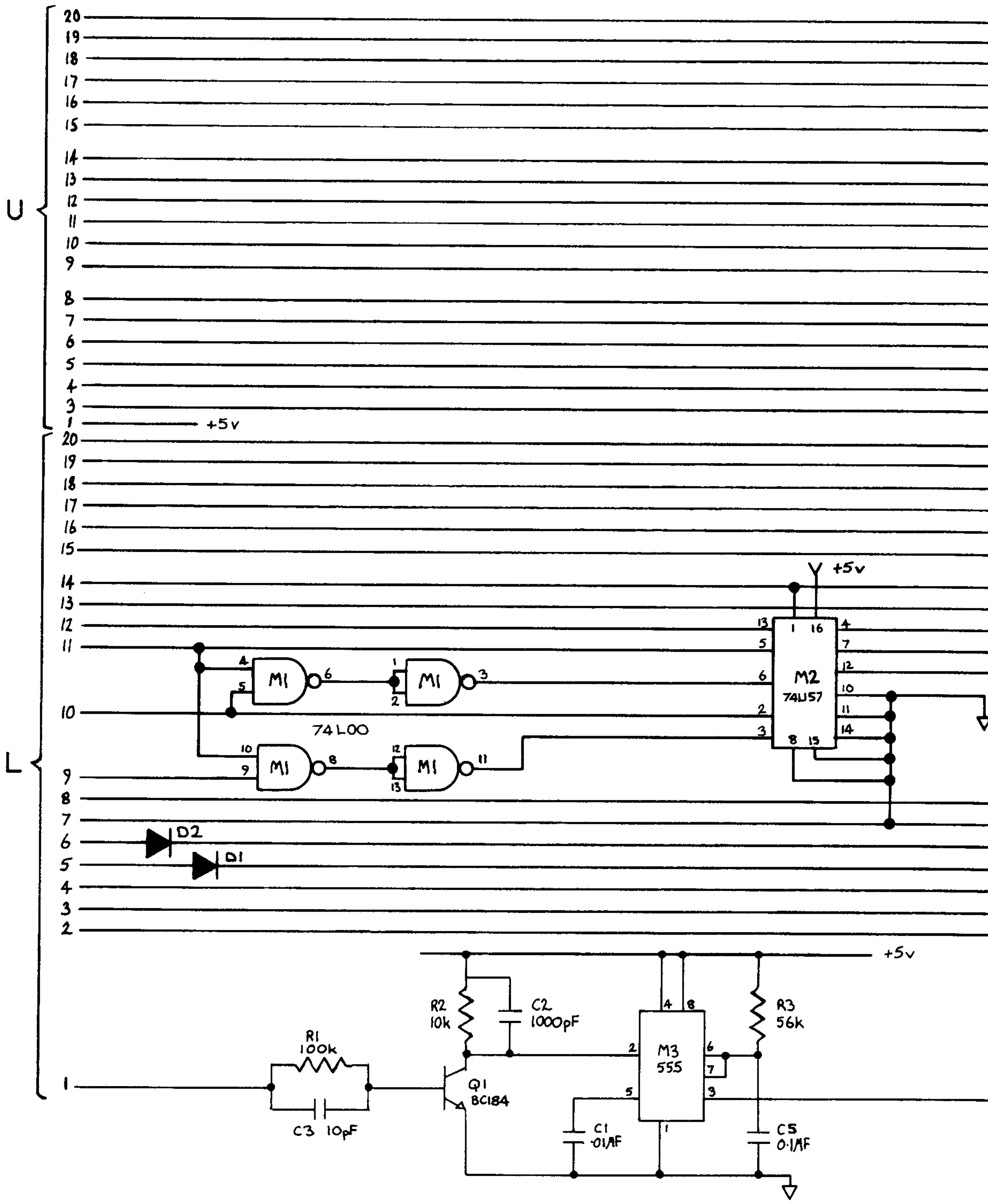
SHEET
1 OF 2

DRAWING No.
430042

FIRST USED ON

THIRD ANGLE PROJECTION

DRAWN IN ACCORDANCE WITH BS 308



DRAWN PJH

CHECKED

TRACED

APPROVED L.A.D.

DATE 22.2.77

DATE 22.2.77

DIMENSIONS IN MILLIMETRES

SCALE

NOT TO BE SCALED

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

FINISH

J.W.1162

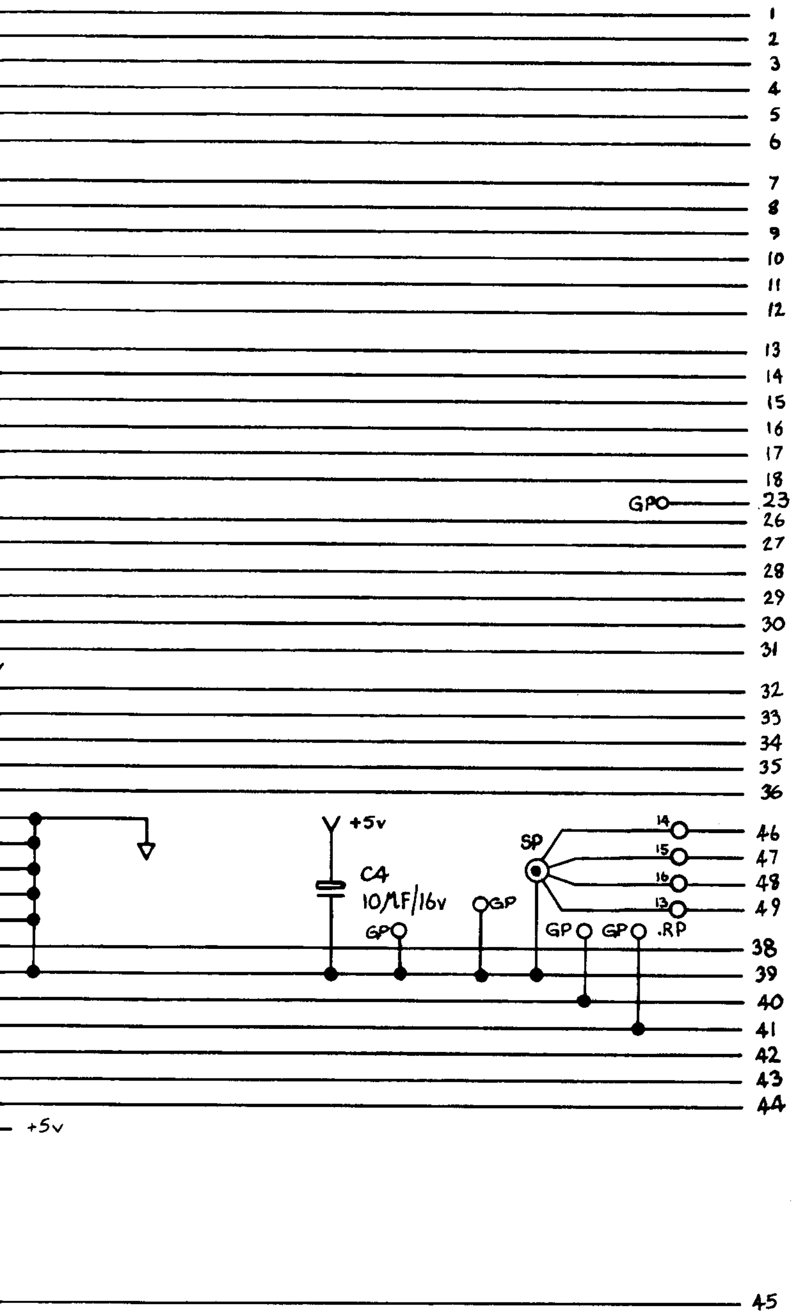
4 | 5 | 6

ALL BURRS TO BE REMOVED

NOTES

1. RP = REMOTE PROG. SOCKET (1030 OPTION)
2. SP = SHORTING PAD
(REMOVED WITH ABOVE OPTION IN.)
3. GP = GOLD PIN

ISS.	CHANGES
4	Redrawn. PJH 14-3-77
5	ECO 586 BJ. 4-1-77.



datron ELECTRONICS LTD. NORWICH.

DRAWING SIZE
A2

TITLE
BCD - BO1a 1030 1041 1045

DRAWING No.
430042

SHEET
1 OF 1

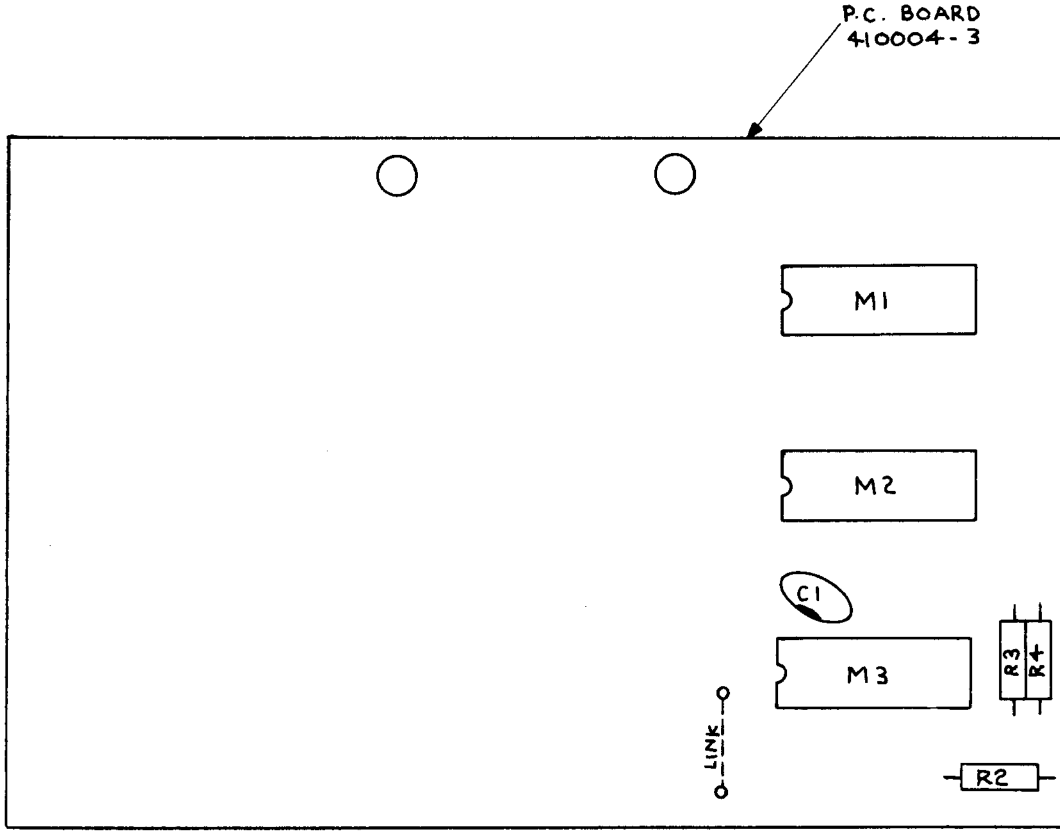
DRAWING No.
400349

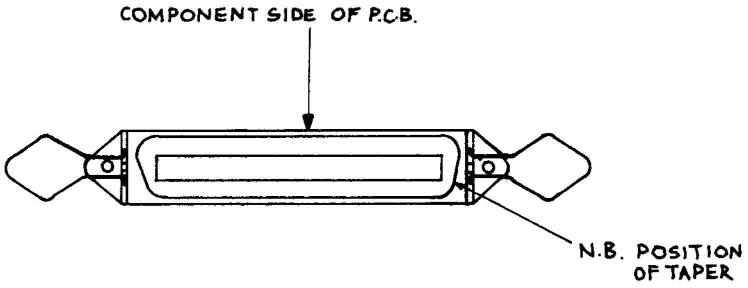
FIRST USED ON 1030

THIRD ANGLE PROJECTION

DRAWN IN ACCORDANCE WITH BS 308

ALL





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

DRAWN K.S.S.	CHECKED MD	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
TRACED	APPROVED	SCALE		FINISH
DATE 3·3·78	DATE	NOT TO BE SCALED		

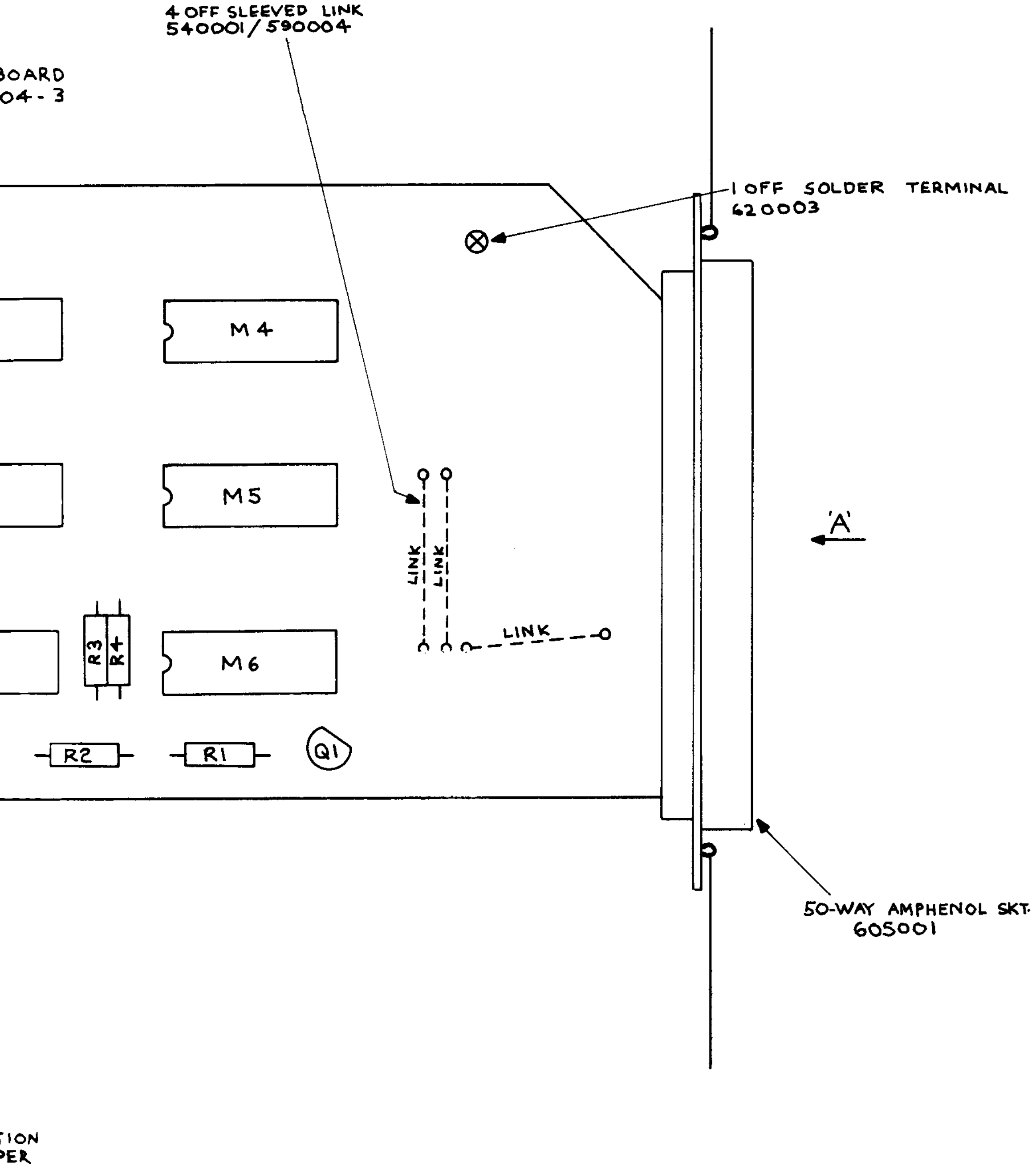
J.W.1162

4	5	6	ISS.	CHANGES
			1	

ALL BURRS TO BE REMOVED

NOTES

1. FIT M1 – M6 IN DIL SOCKETS 605038



datron ELECTRONICS LTD. NORWICH.

DRAWING SIZE A2

TITLE TRI- STATE B.C.D. ASSY. B.O.2.
1030, 1041, 1045

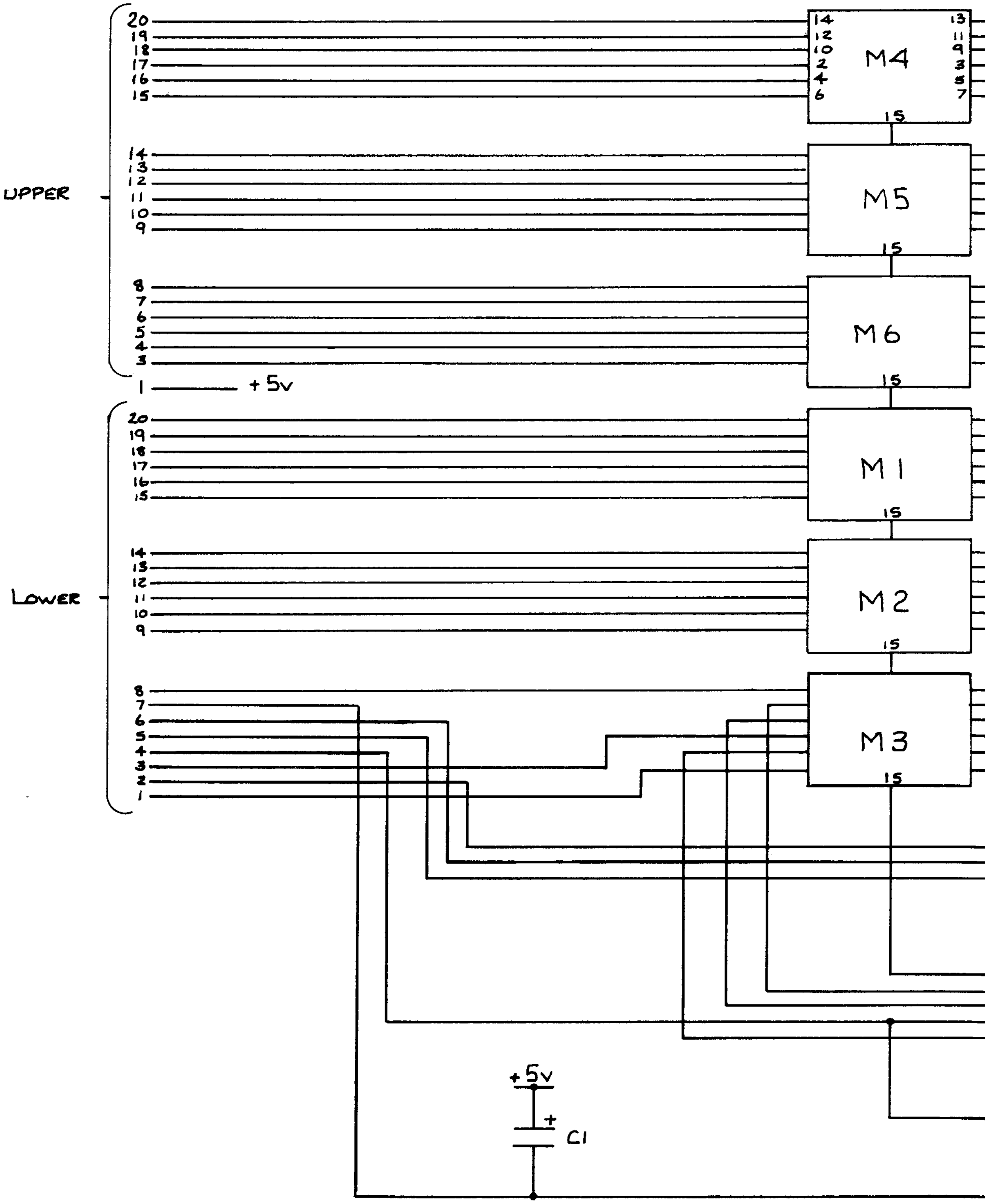
DRAWING No. 400349

SHEET 1 OF 2

DRAWING No.
430349
FIRST USED ON
1030

THIRD ANGLE PROJECTION

DRAWN IN ACCORDANCE WITH BS 308



DRAWN
KSS.
CHECKED
MD
TRACED
APPROVED
DATE
3-3-78
DATE

DIMENSIONS IN
MILLIMETRES
SCALE
NOT TO BE SCALED

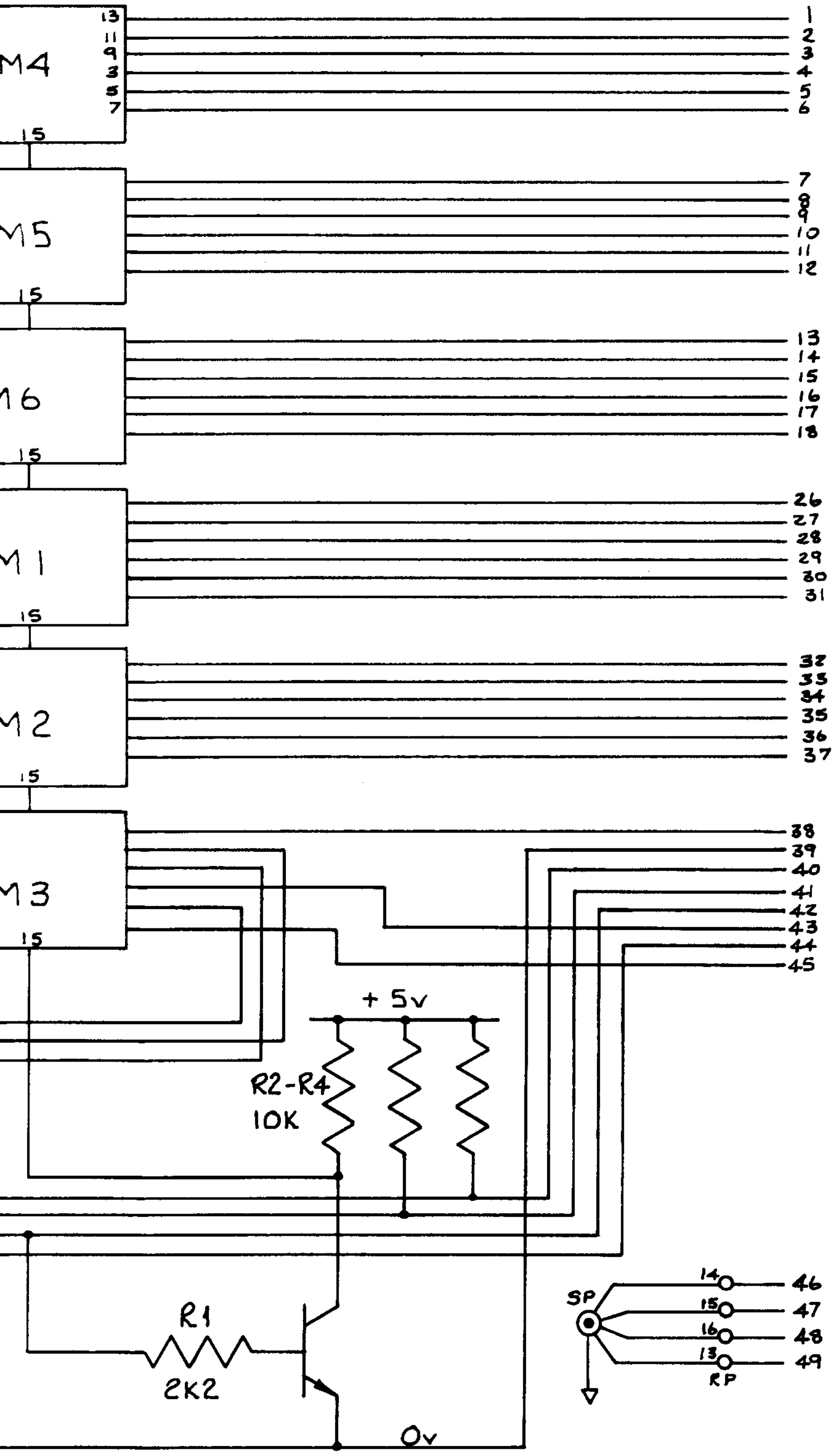
TOLERANCES ANGULAR ± ½°
INCH DIMENSIONS
DECIMAL TO 3 PLACES ± ·005
DECIMAL TO 2 PLACES ± ·010
FRACTIONAL ± 1/64
METRIC DIMENSIONS
DECIMAL TO 2 PLACES ± 1mm
DECIMAL TO 1 PLACE ± 2mm
WHOLE DIMENSIONS ± 4mm
UNLESS OTHERWISE STATED

MATERIAL

FINISH

J.W.1162

4	5	6	ISS.	CHANGES
ALL BURRS TO BE REMOVED		NOTES	1	



datron ELECTRONICS LTD. NORWICH.

DRAWING SIZE A2

TITLE TRI - STATE B.C.D B.O.2

DRAWING No. 430349

SHEET 1 OF 1

DRAWING No. 4-00023

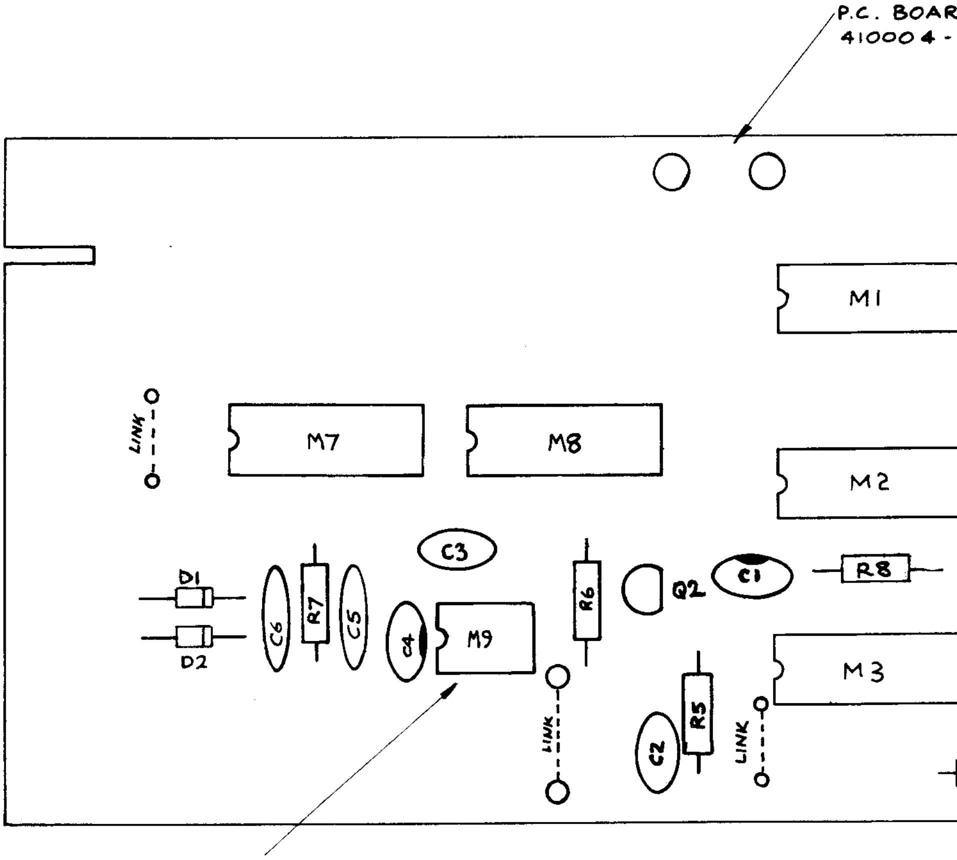
FIRST USED ON 1030

THIRD ANGLE PROJECTION

DRAWN IN ACCORDANCE WITH BS 308

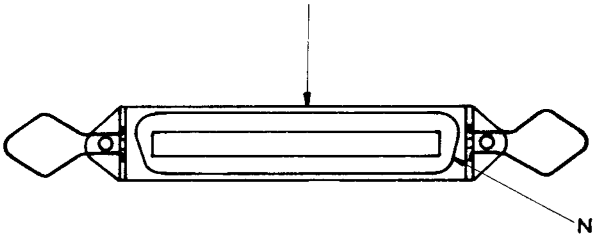
ALL

P.C. BOAR
41000 4 -



M9 MOUNTED IN SOCKET 605059.

COMPONENT SIDE OF P.C.B.



N.B. POSITION
OF TAPER

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

DRAWN M.J.D.	CHECKED IM	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 ~
TRACED	APPROVED L.A.D.	SCALE 2:1		FINISH ~
DATE 18.2.76	DATE 2.2.77	NOT TO BE SCALED		

J.W.1162

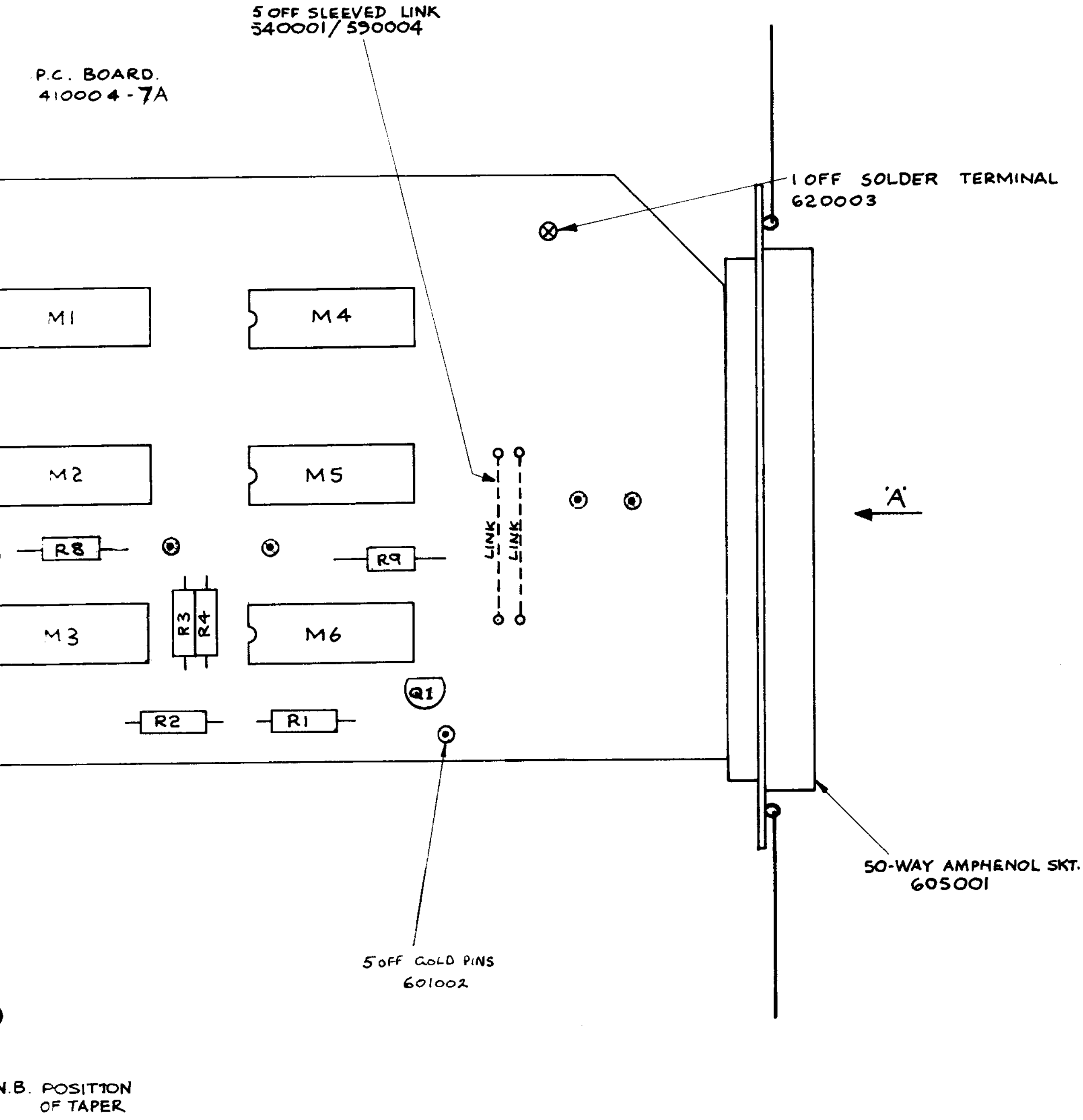
4 5 6

ALL BURRS TO BE REMOVED

NOTES

1. FIT M1 – M8 IN DIL SOCKETS 602004 AND BUCKETS 602005

ISS.	CHANGES
2	REDRAWN. TO ISS. 2 ARTWK M.J.D. 18.2.76
3	ECO 193 FIXING HOLE MOVED. M.J.D. 12.3.76
4	ECO 365 PCB ISS WAS 4. M7 & M8 Added. 15.12.76
5	ECO 380-1 17.2.77. PJH
6	ECO 380-2 17.2.77 PCB ISS 6
7	ECO 584 1.11.77 PCB ISS 7
8	ECO 643 B.J. 29-3-78 PCB 7A.



datron ELECTRONICS LTD. NORWICH.

DRAWING SIZE
A2

TITLE TRI-STATE B.C.D. ASSY. B.0.2 a
1030, 1041, 1045

DRAWING No.
400023

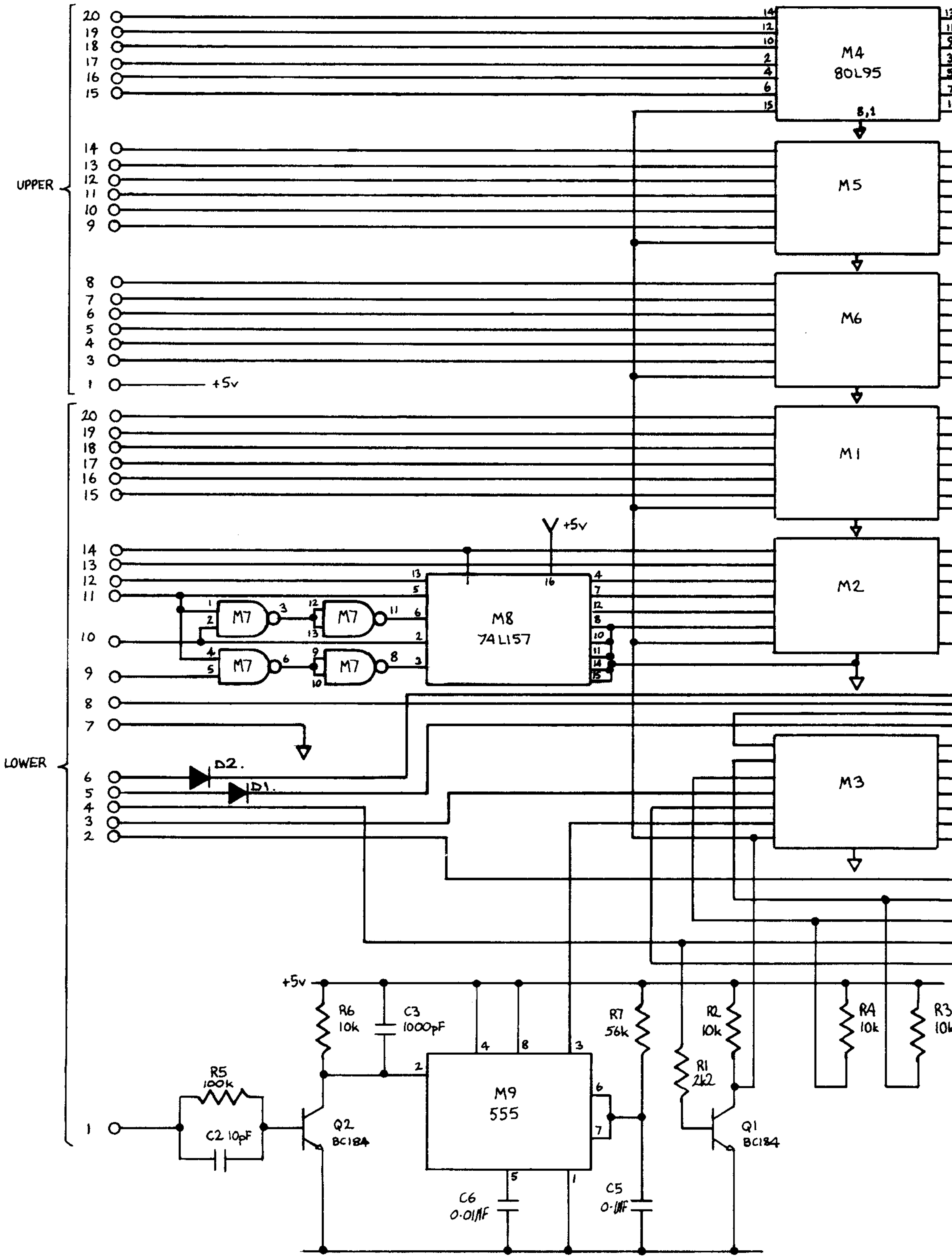
SHEET
1 OF 2

DRAWING No.
430002

FIRST USED ON

THIRD ANGLE PROJECTION

DRAWN IN ACCORDANCE WITH BS 308



DRAWN TJW	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
TRACED	APPROVED L.A.D.	SCALE NOT TO BE SCALED		FINISH
DATE 14.3.77	DATE 2.2.77			

J.W.1162

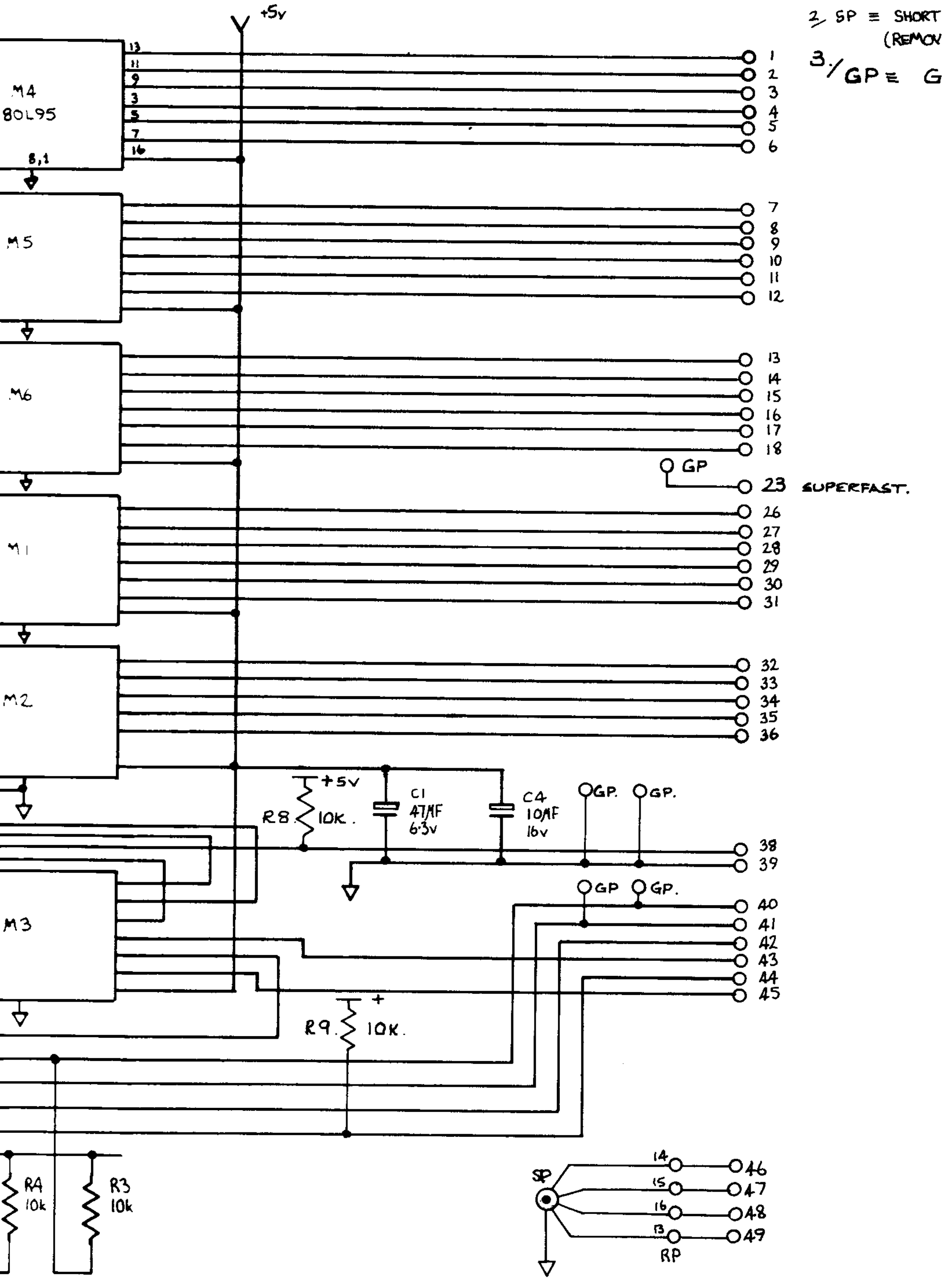
4	5	6

ALL BURRS TO BE REMOVED

NOTES

1. RP ≡ REMOTE PROG SOCKET (1030 OPTION)
2. SP ≡ SHORTING PAD
   (REMOVED WITH ABOVE OPTION IN)
3. GP ≡ GOLD PIN.

ISS.	CHANGES
4	REDRAWN 14-3-77
5.	ECO 584. S. 20-12-77 B.J.



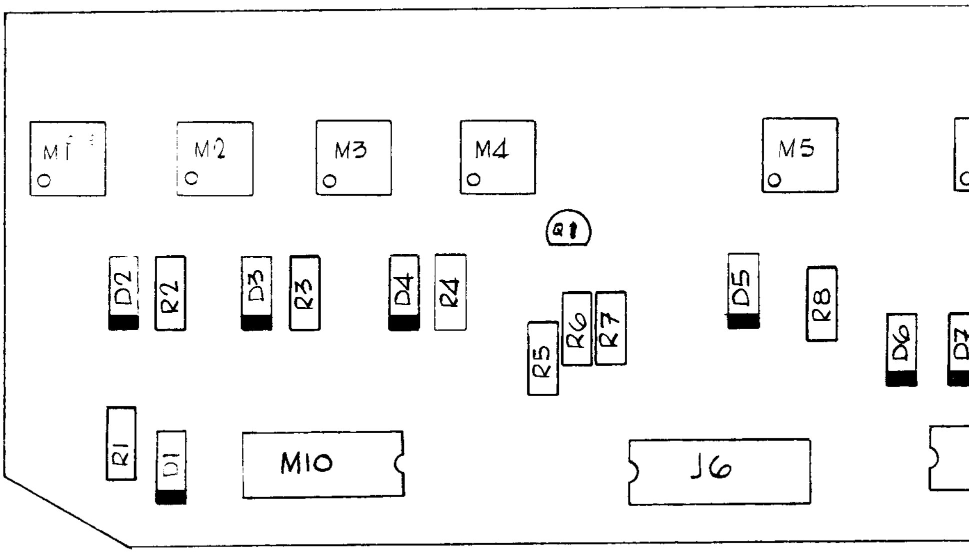
datron ELECTRONICS LTD. NORWICH.

DRAWING SIZE
A2

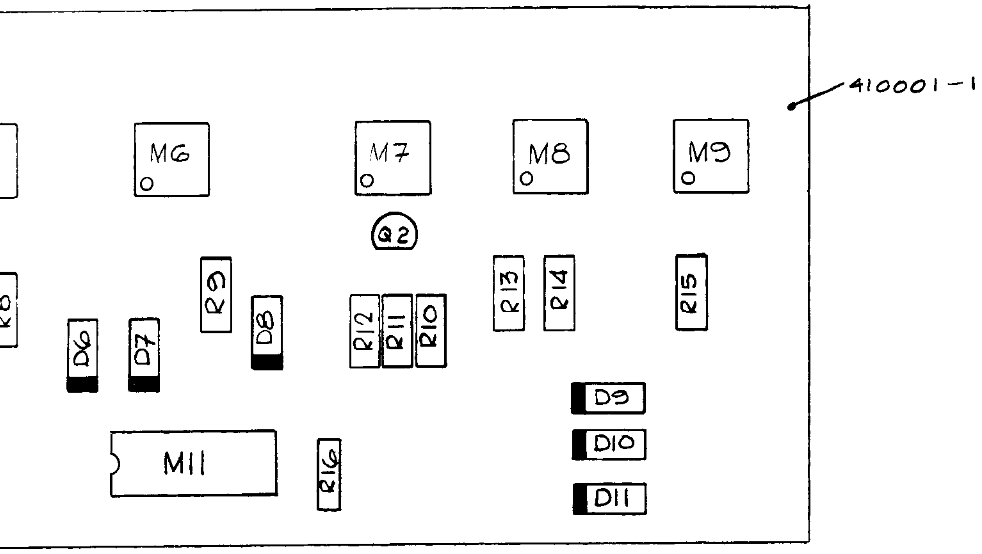
TITLE
TRI STATE B C D BO2a 1030 1041 1045

DRAWING No.
430002

SHEET
1 OF 1



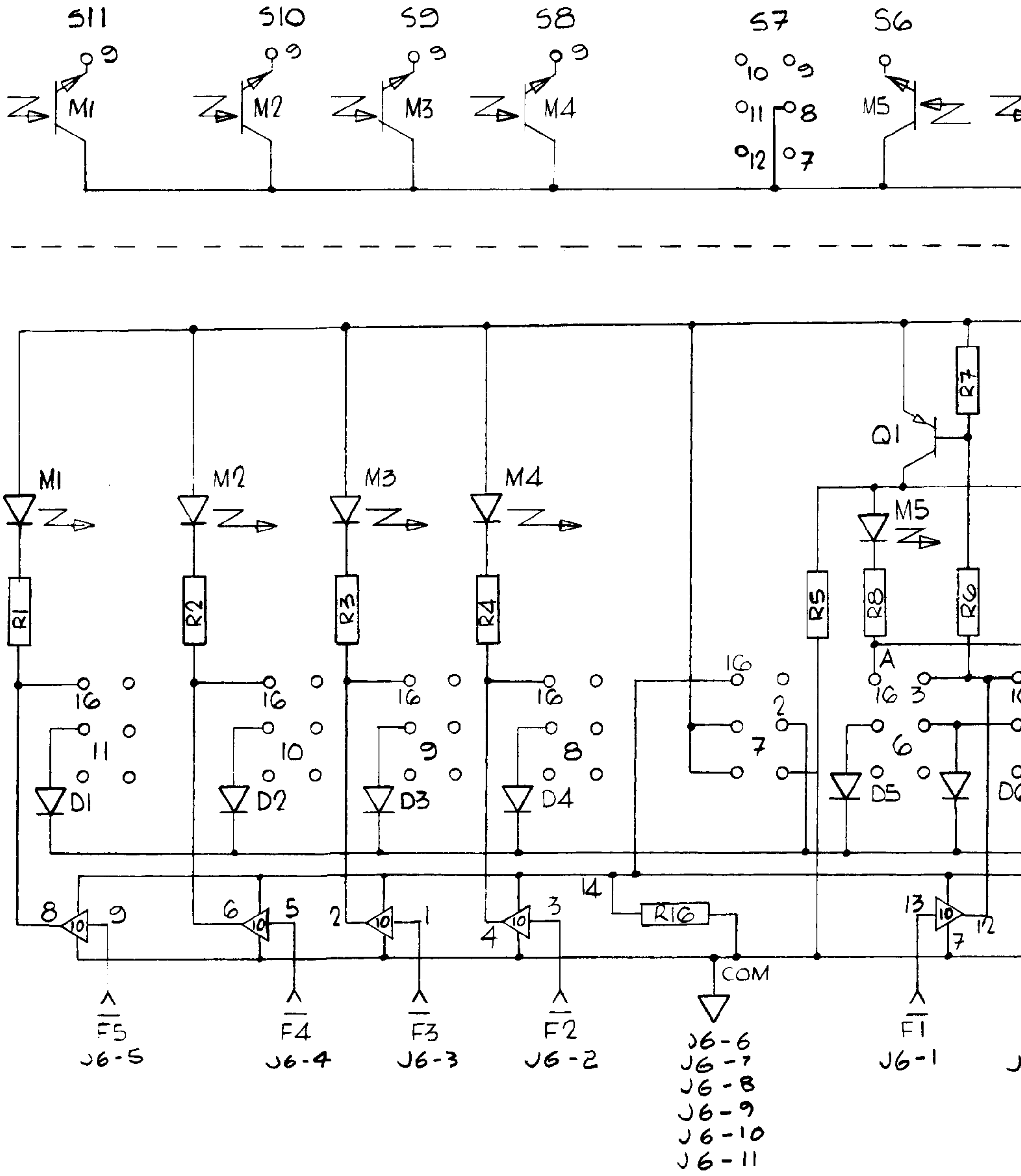
FIT 7 WAY BUCKETS AND DIL.
SOCKET STRIP TO M10 & M11



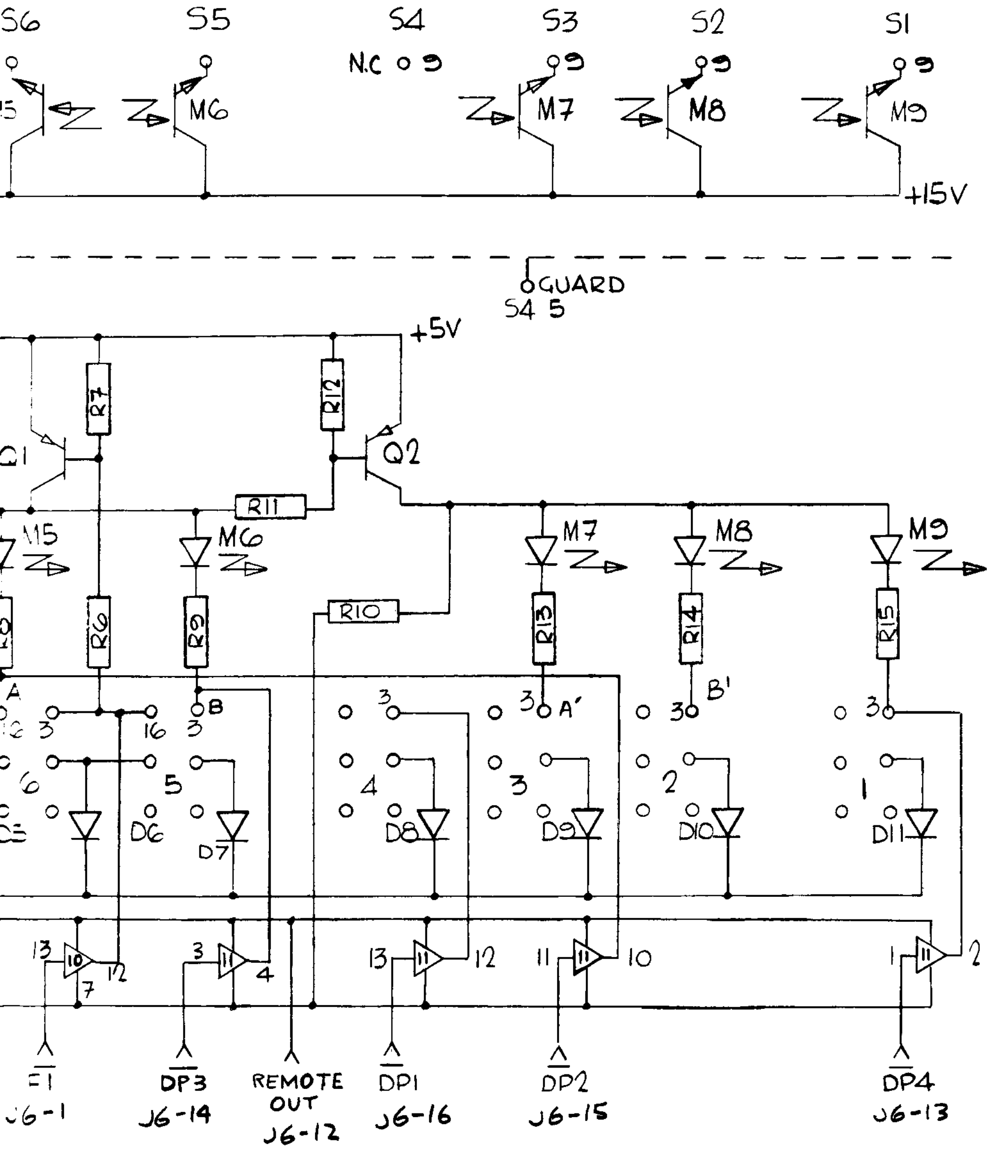
REVISION	DATE	
.2	18-8-76 ECO 255	REMOTE PROGRAMMING PCB FOR 1110-1030
		R&D JP
		CHECK
		PROD. L.A.D. 2.2.77
		NEXT DRG

DRG Nº 409117

SHEET 1 OF 4 SHEETS.



S11
S10
S9
S8
S7
S6
M1
M2
M3
M4
M5
Q1
R1
R2
R3
R4
R5
R6
R7
R8
R16
D1
D2
D3
D4
D5
A
COM
F5
J6-5
F4
J6-4
F3
J6-3
F2
J6-2
J6-6
J6-7
J6-8
J6-9
J6-10
J6-11
F1
J6-1



A-A' } CONNECTED
B-B' } ON ANALOG BOARD.

MODIFICATIONS TO ANALOG BOARD.

LINK 8 + 10 OF S7
CUT TRACK FROM 2 OF S7 TO 17 OF S6
CUT TRACK FROM 2 OF S7 TO 2 OF S8
CUT TRACK FROM 2 OF [illegible] L.A. Dunn
[illegible]

CUT 15V COMMON TRACK. (ANALOGUE SIDE)
EG. S1 PIN 8 TO S1 PIN 11 (~~ALL~~ LINKS) L.A. Dunn

REVISION 2
DATE 18-8-76 ECO 255

REMOTE PROGRAMMING P.C.B FOR 1110-1030

R&D JP
CHECK
PROD. L.A.D. 2.2.77
NEXT DRG.
DRG No 430001

ADDENDUM AND ERRATA SHEETS INDEX

INSTRUMENT:

SERIAL NO:

Component Parts and Serial Nos.	Associated Update Sheets

Errata sheets:

datron

TO: THE USER

Every effort has been made to ensure that the information supplied with the instrument is accurate and up to date. If, however, you find any errors or have any suggestions for improving this Manual, please return the reply card completed as appropriate.

Full information is available on the complete range of Datron products and we will be pleased to forward these to you on request by return of the reply card completed as appropriate.

Name:	Instrument:
Dept:	Serial No:
Company:	Manual Ref. No.:
Address	

Correction / Suggestion:

Please send information on the following products:--

Model 1030	True RMS Digital Voltmeter	☐
Model 1041	4½ digit Multifunction Digital Voltmeter	☐
Model 1045	4½ digit DC Digital Voltmeter	☐
Model 1051	5½ digit Precision Multifunction Digital Voltmeter	☐
Model 1055	5½ digit DC Digital Voltmeter	☐
Model 1057	5½ digit Digital Multimeter.	☐
Model 1059	5½ digit Digital Multimeter.	☐
Data Logging Equipment		☐