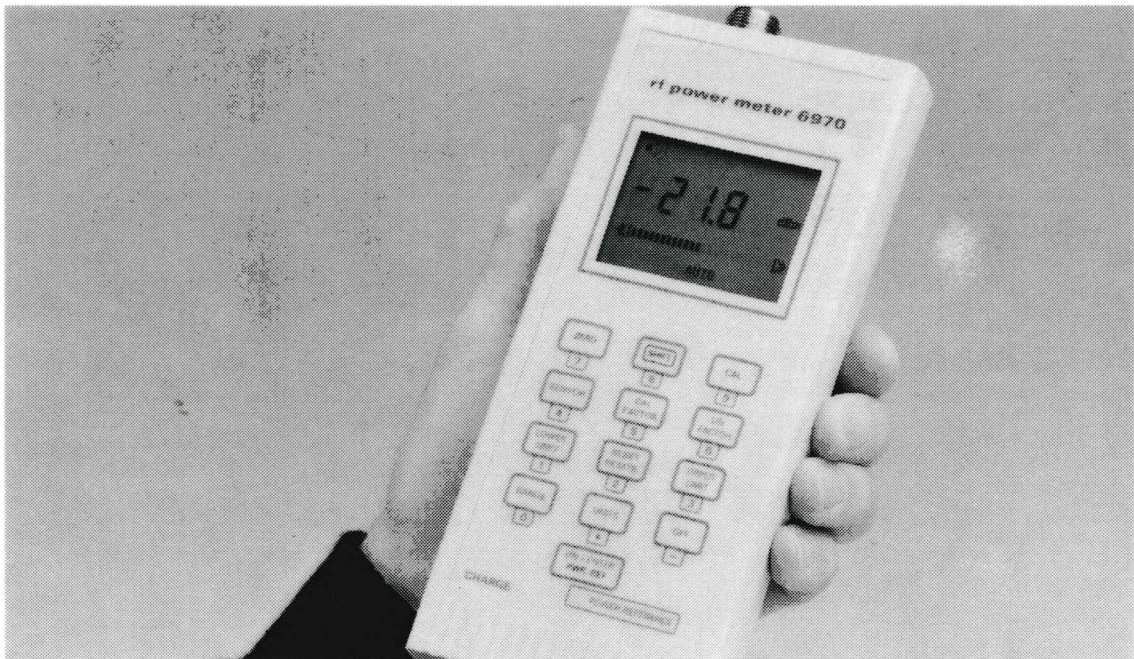




RF POWER METER

6970



Maintenance Manual

46882-207T

CUSTOMER QUESTIONNAIRE

Please spare a moment to detach, complete and return the Questionnaire on the next page. Your comments and suggestions will help us improve our products.

If you have had any problems with this product, please call 01438-742200 and ask for the Customer Support Help Desk if you are in the UK, or your Local Service Centre if outside the UK. The address and telephone number of your Local Service Centre is listed in this manual.

Please put the completed form in the addressed envelope provided and mail.

IFR EQUIPMENT DELIVERY REPORT

End User details

Name		
Company Name		
Company Address		
Country	Post Code	Fax no.
Telephone No		Ext.

Equipment details

Part nos	Serial nos	Software Issues
Name & Address of Purchaser (if different from above)		
Delivery Date	Do you have a Maintenance Contract? ☐ Yes ☐ No	

Equipment Condition

Was the equipment in perfect working order when delivered? ☐ Yes ☐ No	
If the answer to the above question was 'no', was the problem to do with	
mechanical condition (damaged case etc.) ☐ suspected hardware fault ☐ suspected software fault ☐ did not meet its specification. ☐	Severity Critical ☐ Major ☐ Minor ☐
Please tick the relevant item and describe below; (continue in blank space on previous page if necessary)	Repeatable? Yes ☐ No ☐ Occasionally ☐

Claim under Guarantee

If you have had problems,

have you already claimed under the Guarantee
or do you intend to claim under Guarantee?

☐ Yes ☐ No
☐ Yes ☐ No

Improvements

We should like to receive any suggestions for improvements or applications of this or other products that you may have. Please add them below or include them on an extra sheet.

(continue in blank space on previous page if necessary)

IFR Action

Initial/Date	Initial/Date	Initial/Date
Copy to Comm. Admin.	Distributor contacted	Problem established
Service Dept response	Follow through needed	Cleared

RF POWER METER

6970

Including Option 001

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PRECAUTIONS

WARNINGS, CAUTIONS and NOTES

These terms have specific meanings in this manual:

WARNINGS contain information to prevent personal injury.

CAUTIONS contain information to prevent damage to the equipment.

Notes contain important general information.

HAZARD SYMBOLS

The meaning of hazard symbols appearing on the equipment is as follows:

Symbol	Nature of hazard
	Toxic hazard
	Class II supply
	Static sensitive component

GENERAL CONDITIONS OF USE

This product is designed and tested to comply with the requirements of IEC/EN61010-1 'Safety requirements for electronic measuring apparatus', for Class III hand-held equipment and is for use in a pollution degree 2 environment. The equipment is designed to operate from an installation Category I supply.

Equipment should be protected from the ingress of liquids and precipitation such as rain, snow, etc. When moving the instrument from a cold to a hot environment, it is important to allow the temperature of the instrument to stabilise before it is connected to the supply to avoid condensation forming. The instrument must only be operated within the environmental conditions specified in Chapter 1, 'Performance Data'.

This product is not approved for use in hazardous atmospheres or medical applications. If the equipment is to be used in a safety-related application, e.g. avionics or military applications, the suitability of the product must be assessed and approved for use by a competent person.



WARNING - TOXIC HAZARDS

Some of the components used in this equipment may include resins and other materials which give off toxic fumes if incinerated. Take appropriate precautions, therefore, in the disposal of these items.



WARNING - NICKEL CADMIUM

A Nickel-cadmium battery is used in this equipment.

Do not crush or otherwise mutilate, as corrosive electrolyte can be released. Do not incinerate as they may explode or release toxic fumes.



WARNING - POWER ADAPTER

The supplied power adapter has been designed and tested in accordance with IEC 950 (BS EN 60950, UL 1950 and CAN/CSA C22.2 No. 234) 'Safety of information technology equipment, including electrical business equipment', and meets the SELV requirements of products with low voltage DC supply inputs. The adapter conforms with IEC Safety Class II incorporating double insulation in its construction, and does not require a protective ground connection; it is only suitable for indoor use.

No user serviceable parts are contained within the adapter and no attempt should be made to open the case. Should a replacement adapter be needed, please refer to your local IFR Ltd Sales Office.

Where the equipment carries a Third Party product safety approval (for example, UL3111-1), this approval will be invalidated if the equipment is used with a power adapter that does not have the same ratings and approvals as the adapter supplied by IFR Ltd or if the equipment is operated in conditions outside those specified in Chapter 1 in the Operating manual.

Where a supply lead is fitted to adapters incorporating an integrally fused plug ensure that the fuse rating is commensurate with the current requirements of the lead. See under 'Performance data' in Chapter 1 in the Operating/Instruction manual for power requirements.

CAUTION - LCD HANDLING

When using this equipment take care not to depress the front of the display module, as this may damage the liquid crystal elements.

CAUTION - STATIC SENSITIVE COMPONENTS

This equipment contains static sensitive components which may be damaged by handling - refer to the Maintenance part of the Service Manual for handling precautions.

CAUTION - PRECISION CONNECTOR

The precision Type N connector fitted to this instrument (Option 001 only) may be damaged by mating with a non-precision type. Damage to the connector may also occur if the connector interface parameters are not within specification. The connector should be checked with the appropriate gauging tool.

PRECAUTIONS

WARNINGS, CAUTIONS et NOTES

Les termes suivants ont, dans ce manuel, des significations particulières:

WARNINGS contient des informations pour éviter toute blessure au personnel.

CAUTIONS contient des informations pour éviter les dommages aux équipements.

Notes contient d'importantes informations d'ordre général.

SYMBOLES SIGNALANT UN RISQUE

La signification des symboles liés à cet équipement est la suivante:

Symbole	Nature du risque
	Danger produits toxiques
	Class II supply

CONDITIONS GENERALES D'UTILISATION

Ce produit a été conçu et testé pour être conforme aux exigences des normes CEI/EN61010-1 « Spécifications des conditions de sécurité pour instruments de mesure électronique », pour des équipements Classe III qui tiennent dans la main et pour une utilisation dans un environnement de pollution de niveau 2. Cet équipement est conçu pour fonctionner à partir d'une alimentation de catégorie I.

Cet équipement doit être protégé de l'introduction de liquides ainsi que des précipitations d'eau, de neige, etc... Lorsqu'on transporte cet instrument d'un environnement chaud vers un environnement froid, il est important de laisser l'instrument se stabiliser en température avant de le connecter à une alimentation afin d'éviter toute formation de condensation. L'instrument doit être utilisé uniquement dans les conditions d'environnement spécifiées dans le chapitre 1 « Performances » du manuel d'utilisation.

Ce produit n'est pas garanti pour fonctionner dans des atmosphères dangereuses ou pour un usage médical. Si l'équipement doit être utilisé pour des applications en relation avec la sécurité, par exemple des applications militaires ou aéronautiques, la compatibilité du produit doit être établie et approuvée par une personne compétente.



WARNING - DANGER PRODUITS TOXIQUES

Certains composants utilisés dans cet appareil peuvent contenir des résines et d'autres matières qui dégagent des fumées toxiques lors de leur incinération. Les précautions d'usages doivent donc être prises lorsqu'on se débarrasse de ce type de composant.



WARNING - NICKEL CADMIUM

Une batterie au cadmium nickel est utilisée dans cet équipement.

Ne pas l'écraser ou la broyer, l'électrolyte contenu est corrosif. Ne pas l'incinérer cela risque de provoquer l'explosion et le dégagement de fumées toxiques.



WARNING - ADAPTATEUR SECTEUR

L'adaptateur secteur fourni avec l'appareil a été conçu et testé en conformité avec la norme IEC 950 <BS EN 60950, UL 1950 et CAN/CSA C22.2 N°234> Sécurité d'équipements de technologie de l'information et équipements électriques industriels" et suit les recommandations "SELV" des produits comportant des entrées continues à faible voltage. L'adaptateur possède d'origine une double isolation conformément à la norme CEI "Sécurité Classe II", ne requière pas de retour à la masse ; il n'est utilisable que sous abri.

L'adaptateur ne contient pas de composants réparables et il faut absolument éviter de l'ouvrir. S'il y a besoin de le remplacer, renseignez vous auprès de votre agent local IFR.

Si l'équipement comporte un troisième niveau d'agrément (par exemple : UL3111-1), cet agrément peut être annulé en cas d'utilisation avec un adaptateur secteur qui n'aurait pas le même niveau d'agrément que l'adaptateur secteur fourni par IFR ou si l'équipement est utilisé dans des conditions non spécifiées au chapitre 1 du manuel d'utilisation.

Lorsque le câble d'alimentation connecté à l'adaptateur contient un fusible, il faut vérifier qu'il soit bien dimensionné. Voir "Installation" au chapitre 2 du manuel d'utilisation pour la valeur du fusible.

VORSICHTSMASSNAHMEN

WARNINGS, CAUTIONS und NOTES

Diese Hinweise haben eine bestimmte Bedeutung in diesem Handbuch:

WARNINGS dienen zur Vermeidung von Verletzungsrisiken.

CAUTIONS dienen dem Schutz der Geräte.

Notes enthalten wichtige Informationen.

GEFAHRENSYMBOL

Die Gefahrensymbole auf den Geräten sind wie folgt:

Symbol	Gefahrenart
	Warnung vor giftigen Substanzen
	Class II supply

ALLGEMEINE HINWEISE ZUR VERWENDUNG

Dieses Produkt wurde entsprechend den Anforderungen von IEC/EN61010-1 "Sicherheitsanforderungen für elektronische Meßgeräte", Klasse III, für Betrieb in der Hand zur Verwendung in einer Grad 2 verunreinigten Umgebung, entwickelt und getestet. Dieses Gerät ist für Netzversorgung Klasse I zugelassen.

Das Meßgerät sollte vor dem Eindringen von Flüssigkeiten sowie vor Regen, Schnee etc. geschützt werden. Bei Standortänderung von kalter in wärmere Umgebung sollte das Meßgerät wegen der Kondensation erst nach Anpassung an die wärmere Umgebung mit dem Netz verbunden werden. Das Meßgerät darf nur in Umgebungsbedingungen wie in Kapitel 1 "Leistungsdaten (Performance data)" der Bedienungsanleitung beschrieben, betrieben werden.

Dieses Produkt ist nicht für den Einsatz in gefährlicher Umgebung (z.B. Ex-Bereich) und für medizinische Anwendungen geprüft. Sollte das Gerät für den Einsatz in sicherheitsrelevanten Anwendungen wie z.B. im Flugverkehr oder bei militärischen Anwendungen vorgesehen sein, so ist dieser von einer für diesen Bereich zuständigen Person zu beurteilen und genehmigen.



WARNING - WARNUNG VOR GIFTIGEN SUBSTANZEN

In einigen Bauelementen dieses Geräts können Epoxyharze oder andere Materialien enthalten sein, die im Brandfall giftige Gase erzeugen. Bei der Entsorgung müssen deshalb entsprechende Vorsichtsmaßnahmen getroffen werden.



WARNING - NICKEL CADMIUM

Eine Nickel-Cadmium-Batterie ist in diesem Gerät eingebaut.

Das Gerät nicht beschädigen oder verbrennen, da ätzende Elektrolyte freigesetzt wird. Die Batterie kann dabei explodieren oder giftige Gase freisetzen.



WARNING - NETZADAPTER

Der mitgelieferte Netzadapter ist entsprechend der Norm IEC 950 BS EN 60950, UL 1950 und CAN/CSA C22.2 No. 234 für die Sicherheit datentechnischer Anlagen, inklusive elektrischer Büromaschinen, ausgelegt und getestet worden. Er entspricht den "SELV" Richtlinien für Geräte mit niedrigen Gleichspannungsversorgungen. Der Adapter entspricht mit doppelter Isolation der IEC Sicherheitsklasse II und benötigt keinen Masse-Schutzleiter; er darf nur innerhalb von Räumen verwendet werden. .

Der Adapter enthält keine reparier- oder austauschbaren Teile und darf nicht geöffnet werden. Sollte ein Ersatz erforderlich sein, setzen Sie sich bitte mit der nächstgelegenen Niederlassung von IFR in Verbindung.

Sollte ein Gerät ein Sicherheitsprüfzeichen von dritter Seite (z.B. UL3111-1) aufweisen, und wird dieses Gerät mit einem Netzadapter betrieben welcher nicht die gleichen elektrischen Werte und Prüfzeichen wie der von IFR gelieferte Netzadapter aufweist, so wird dieses von dritter Seite vergebene Prüfzeichen ungültig. Gleiches gilt für einen Betrieb welcher nicht die Bedingungen wie in Kapitel 1 der Bedienungsanleitung spezifiziert, erfüllt.

Falls ein Netzkabel und ein Stecker mit eingebauter Sicherung verwendet werden, beachten Sie bitte, daß die Sicherung den elektrischen Werten des Adapters entspricht. Weitere Information zur Leistungsaufnahme finden Sie unter "Installation" in Kapitel 2 der Bedienungsanleitung.

PRECAUZIONI

WARNINGS, CAUTIONS e NOTES

Questi termini vengono utilizzati in questo manuale con significati specifici:

WARNINGS riportano informazioni atte ad evitare possibili pericoli alla persona.

CAUTIONS riportano informazioni per evitare possibili pericoli all'apparecchiatura.

Notes riportano importanti informazioni di carattere generale.

SIMBOLI DI PERICOLO

Significato dei simboli di pericolo utilizzati nell'apparato:

Simbolo	Tipo di pericolo
	Pericolo sostanze tossiche
	Class II supply

CONDIZIONI GENERALI D'USO

Questo prodotto è stato progettato e collaudato per rispondere ai requisiti della direttiva IEC/EN61010-1 'Safety requirements for electronic measuring apparatus' per apparati di classe III palmari e per l'uso in un ambiente inquinato di grado 2. L'apparato è stato progettato per essere alimentato da un alimentatore di categoria I.

Lo strumento deve essere protetto dal possibile ingresso di liquidi quali, ad es., acqua, pioggia, neve, ecc. Qualora lo strumento venga portato da un ambiente freddo ad uno caldo, è importante lasciare che la temperatura all'interno dello strumento si stabilizzi prima di alimentarlo per evitare formazione di condense. Lo strumento deve essere utilizzato esclusivamente nelle condizioni ambientali descritte nel capitolo 1 'Performance Data' del manuale operativo.

Questo prodotto non è stato approvato per essere usato in ambienti pericolosi o applicazioni medicali. Se lo strumento deve essere usato per applicazioni particolari collegate alla sicurezza (per esempio applicazioni militari o avioniche), occorre che una persona o un istituto competente ne certifichi l'uso.



WARNING - PERICOLO SOSTANZE TOSSICHE

Alcuni dei componenti usati in questo strumento possono contenere resine o altri materiali che, se bruciati, possono emettere fumi tossici. Prendere quindi le opportune precauzioni nell'uso di tali parti.



WARNING - NICHEL CADMIO

Quest 'apparato incorpora una batteria al nichel cadmio.

Non tentare di rompere o comunque di manomettere la batteria in quanto essa contiene un elettrolito corrosivo. Non incenerire in quanto la batteria può esplodere o emettere dei fumi tossici.



WARNING - CARICA-BATTERIE

Il caricabatterie fornito è stato progettato e collaudato secondo le raccomandazioni IEC 950 <(BS EN 60950, UL 1950 y CAN/CSA C22.2 No. 234)> "Safety of information technology equipment, including electrical business equipment" e rispetta i requisiti "SELV" per prodotti alimentati a bassa tensione e a corrente continua. Il caricabatterie rispetta le norme IEC per apparati di classe di sicurezza II con doppio isolamento e non richiede collegamento di terra di protezione, esso può essere usato solo al coperto.

Il caricabatterie non contiene parti sostituibili per cui qualsiasi tentativo di apertura è da evitare. Nel caso sia richiesto un nuovo caricabatterie, si prega di contattare l'ufficio o il rappresentante IFR Ltd. locale.

Qualora l'apparato contenga prodotti di terzi con propria approvazione di sicurezza (vedi ad es. UL3111-1), questa sarà invalidata se l'apparato viene usato con un caricabatterie con caratteristiche ed approvazione diverse da quelle del caricabatterie fornito dalla IFR Ltd o se l'apparato viene utilizzato in modo non conforme a quanto riportato al capitolo 1 .

Qualora un cavo di alimentazione venga collegato ad un caricabatterie con presa protetta da fusibile, verificare il carretto amperaggio secondo quanto riportato al Capitolo 2 "Installation" del manuale operativo.

PRECAUCIONES

WARNINGS, CAUTIONS y NOTES

Estos términos tienen significados específicos en este manual:

WARNINGS contienen información referente a prevención de daños personales.

CAUTIONS contienen información referente a prevención de daños en equipos.

Notes contienen información general importante.

SÍMBOLOS DE PELIGRO

Los significados de los símbolos de peligro que aparecen en los equipos son los siguientes:

Símbolo	Naturaleza del peligro
	Aviso de toxicidad
	Class II supply

CONDICIONES GENERALES DE USO

Este producto ha sido diseñado y probado para cumplir los requerimientos de la normativa IEC/EN61010-1 "Especificaciones de los requisitos de seguridad para instrumentos electrónicos de medida", para equipos clase III de mano y para uso en un ambiente con un grado de contaminación 2. El equipo ha sido diseñado para funcionar sobre una instalación de alimentación de categorías I.

Debe protegerse el equipo de la entrada de líquidos y precipitaciones como nieve, lluvia, etc. Cuando se traslada el equipo de entorno frío a un entorno caliente, es importante aguardar la estabilización el equipo para evitar la condensación. Sólo debe utilizarse el aparato en las condiciones ambientales especificadas en el capítulo 1 "Especificaciones" o "Performance Data" del Manual de Instrucciones/Manual de Operación/Funcionamiento.

Este producto no ha sido aprobado para su utilización en entornos peligrosos o en aplicaciones médicas. Si se va a utilizar el equipo en una aplicación con implicaciones en cuanto a seguridad, como por ejemplo aplicaciones de aviónica o militares, es preciso que un experto competente en materia de seguridad apruebe su uso.



WARNING - AVISO DE TOXICIDAD

Alguno de los componentes utilizados en este equipo pudieran incluir resinas u otro tipo de materiales que al arder produjeran sustancias tóxicas, Por tanto, tome las debidas precauciones en la manipulación de esas piezas.



WARNING - NIQUEL CADMIO

En este equipo se utiliza una batería de **NiquelCadmio**.

No las aplaste o rompa ya que podría liberar electrólito corrosivo.

No las queme ya que podría dar lugar a que la batería explote o libere humos tóxicos.



WARNING - ADAPTADOR DE ALIMENTACIÓN A RED AC

El adaptador de alimentación suministrado ha sido diseñado y probado según la normativa IEC 950 <(BS EN 60950, UL 1950 y CAN/CSA C22.2 No. 234)> “Seguridad en aparatos de tecnologías de la información, incluyendo equipamiento eléctrico de oficinas “ y cumple los requerimientos “SELV” de productos con baja tensión de entrada DC. El adaptador cumple la normativa de seguridad IEC clase II, e incorpora doble aislamiento en su construcción, no requiere conexión a tierra de protección; sólo es adecuado para uso en interiores.

En el interior del adaptador no existen partes reemplazables por el usuario y no debe hacerse ningún intento de abrir la carcasa.

Si el equipo lleva una aprobación de seguridad de un tercero (pro ejemplo UL 3111-1), esta aprobación quedará invalidada si el equipo se utiliza con un adaptador de red de distinto, valores o con distintas aprobaciones a las del adaptador suministrado por IFR, Ltd. o si se trabajan con el equipo en condiciones distintas a las especificadas en el capítulo 1 del Manual de Instrucciones/Manual de Operación/Funcionamiento.

Si el cable de alimentación tiene una clavija con fusible integrado, asegúrese que el valor del fusible concuerda con la necesidad de corriente del cable. Vea el capítulo 2 "Installation" del Manual de Instrucciones/Manual de Operación/Funcionamiento para el cosumo de corriente.

Chapter 1

TECHNICAL DESCRIPTION

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CONSTRUCTION

The 6970 Power Meter comprises a plastic case moulded in two sections. The electronic circuits are located on two multi-layer PCBs using surface mounted components.

The upper case section has the LCD PCB secured inside with the LCD visible through an aperture. The keypad assembly uses metal dome spring keys in a layered construction which is adhesively fixed to the case upper surface. Three NiCd rechargeable batteries are held in clips on the PCB.

The lower case section has the Main PCB secured inside. The SENSOR INPUT multi-pin connector, fitted to the aluminium/polycarbonate front panel, is located in a groove at the top end of the case assembly. The DC input connector is similarly located at the bottom end of the case, with a voltage regulator heat sink plate attached to it.

TECHNICAL DESCRIPTION

The Power Reference PCB is secured inside the upper section of the case, and is fixed to the LCD PCB. The power reference output N-type connector is located on the front panel of the case, next to the previously mentioned SENSOR INPUT connector.

SYSTEM DESCRIPTION

The heart of the 6970 Power Meter is an 8-bit microcontroller which provides control and timing for the unit and processes measurement data acquired through an analogue/digital converter (ADC), it also drives the liquid crystal display (LCD) and interfaces with the keypad. Program code is contained in internal ROM.

The 6970 uses a signal chopper to provide a pulsed DC voltage which is proportional to the incident RF power and thus allows AC coupled differential amplification. The tuned input amplifier is distributed between the selected sensor and the 6970 input amplifier, as shown in Fig. 1-1.

The second stage amplifier scales the signal as appropriate over four ranges before feeding the ADC, which converts the analogue signal to digital form suitable for the microcontroller to process and apply corrections.

A digital/analogue converter (DAC) is used as part of the sensor zero operation to minimize and account for system offsets when no RF signal is applied.

The internal power source comprises three rechargeable NiCd cells; two DC-DC converters are used to boost the NiCd power source to regulated +5 V and -5 V power rails required by the analogue and digital circuitry.

The optional power reference provides a 0 dBm (1mW) 50 MHz signal from a level controlled oscillator based on a dual gate FET. Thermal compensation techniques are used in the design of the oscillator such that long term drift of output power due to temperature variations are minimised.

Note...

In the subsequent circuit description and circuit diagrams, TTL signals shown in the form ADC_CONVST (L) signifies an 'active low' signal.

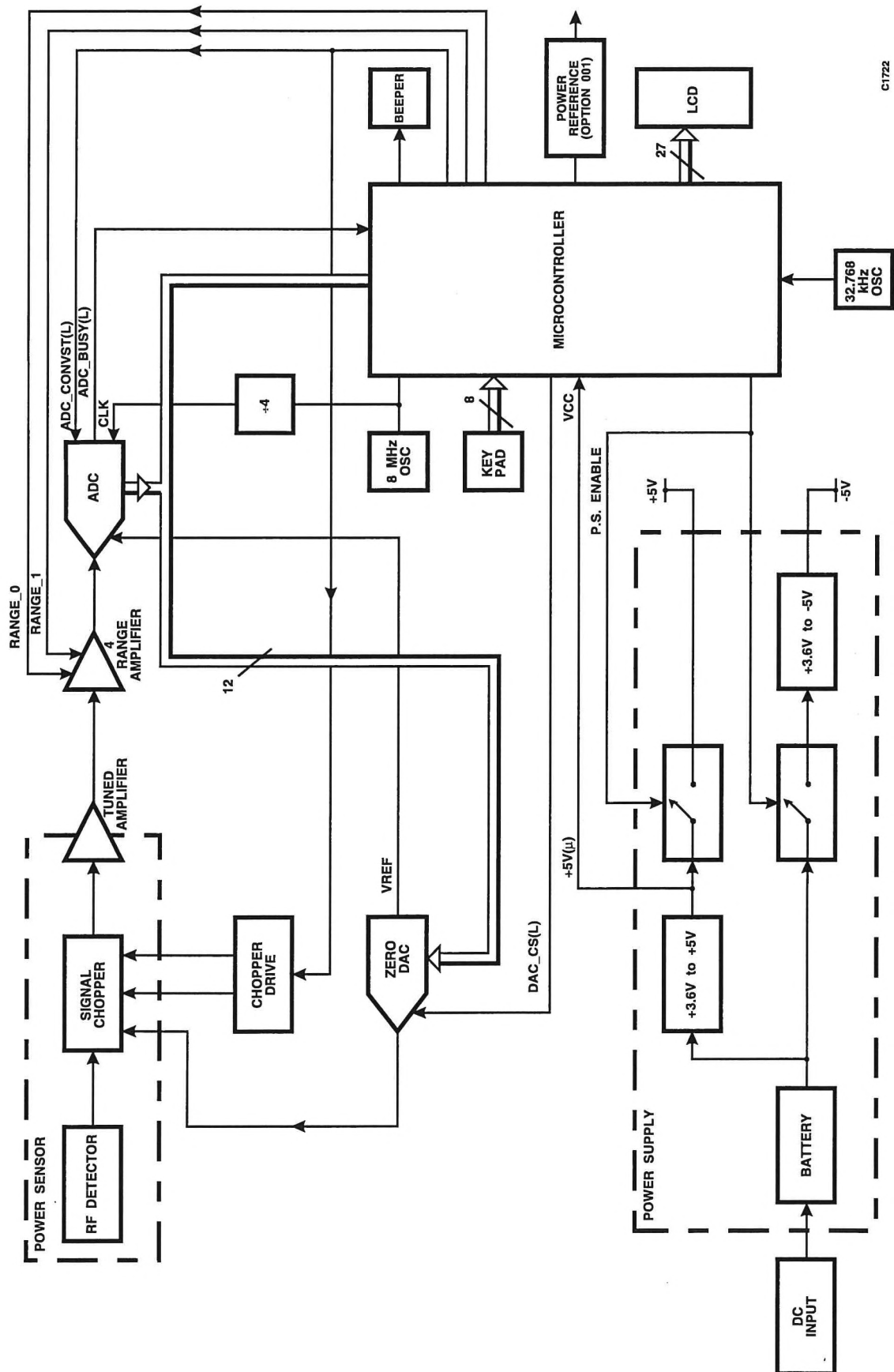


Fig. 1-1 6970 Power Meter block diagram

LCD PCB

The LCD PCB contains the power supply circuitry, the microcontroller and the LCD. The following technical description should be read in conjunction with the circuit diagram Fig. 7-4.

Power Supplies

The internal power source comprises three AA size NiCd rechargeable cells. The nominal fully charged voltage is 3.6 V and the 0.7 Ah capacity should typically provide 7 hours use.

A DC input in the range 9 V to 21 V, applied via the 2.1 mm connector to PLB, can be used to charge the batteries and power the unit for bench applications.

An LM317 regulator, on a separate heat sink, provides an 80 mA current source for charging the batteries. When the unit is switched on, the current source is increased to 120 mA (IC3 turned on) to allow for the current consumption of the 6970 circuitry. This condition reduces the battery charging current to approximately 20 mA. LED D2 is illuminated to indicate that the batteries are charging.

The +5 V DC supply is provided by a step-up switch-mode controller IC6, using the energy stored in the changing magnetic field of L1. IC6 also monitors the battery voltage (divided down by R4, R5). When this falls below the internal reference of 1.31 V, pin 2 goes low. The state of this pin is periodically read by the microcontroller, which then displays the 'battery low' symbol on the LCD if appropriate.

IC5 switches the +5 V supply to the rest of the circuitry, operated by the microcontroller when the unit is switched on. In standby mode, the microcontroller draws only 1 μ A, IC6 draws 140 μ A and 4 μ A flows through R4, R5.

IC7 is a similar converter, which is wired as a switching inverter to provide the -5 V supply. It is enabled by switch IC4.

The IC6 and IC7 circuits are enclosed by a metal box to guard against RF interference at the converters' switching frequencies.

Test points provided are TP1 for battery voltage, TP2 the +5 V(μ) standby supply for the microcontroller, and TP3 for the power supply enable signal (low for 'on').

Microcontroller

The microcontroller IC2 has an internal 12 kbit ROM which holds the 6970 program code. It has 40 I/O pins, 31 of which are used, and 27 of the available 28 LCD interface pins are used for the LCD drive. Port 0 and the lower 4 bits of Port 1 form a 12-bit data bus over which data is written to, and read from, the DAC and ADC, respectively.

The microcontroller operates in high speed mode, with the 8 MHz oscillator (XL1) divided by 4 internally to generate a 2 MHz system clock. For approximately 30% of its active time, the microcontroller is in a low power 'wait' mode, consuming <10% of maximum operating power.

The board provides ± 5 V supplies for the Power Reference PCB via PLC. The Power Reference PCB feeds back a signal to PLC pin 6 indicating the reference is turned on; this is used to drive LED D13.

Port 2 is used to scan the 4 rows and 4 columns of the keypad matrix, shown in Fig. 1-2. The ON key is arranged to map directly onto a single bit of Port 2 which is configured with the 'key on/wake-up' function.

This generates an interrupt, bringing the microcontroller out of its standby mode and into full operation.

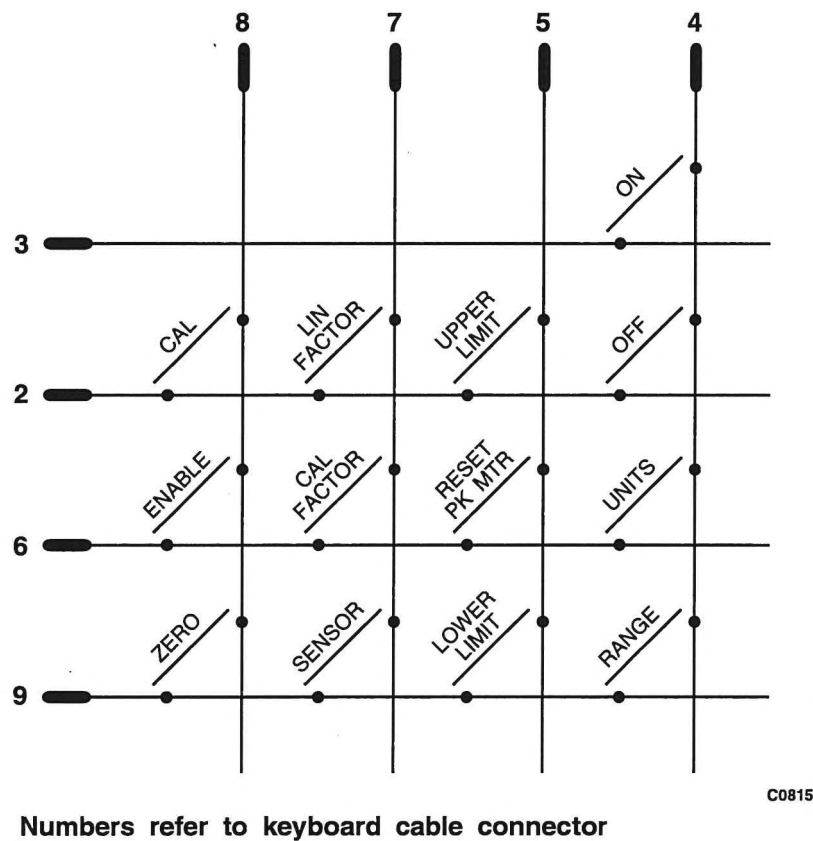


Fig. 1-2 Keyboard connections

Data Acquisition

The data acquisition sequence is controlled by timers within the microcontroller and external interrupts received from the ADC. Fig. 1-3 shows the control timing.

Internal timers determine the pulse width and duty cycle of the waveform output from P54, the ADC_CONVST (L) signal. The rising edge of this signal is used to trigger the ADC to begin a conversion, whereupon the ADC_BUSY (L) signal goes low. Conversion complete is indicated by this line returning high, which also generates an interrupt in the microcontroller (input INT1). Data is then read from the ADC by strobing the CS (L) line low.

The trigger point for the power sensor chopper drive cycle is derived from the falling edge of the ADC_CONVST (L) signal. The ADC_CONVST (L) pulse is set at 50 μ s so that the ADC will make its conversion as close as possible to the end of each half chop cycle.

Depending on the sensor type, the optimum chop rates differ slightly. For example, for the 6910 series sensors the optimum chop frequency is 925 Hz, i.e. ADC_CONVST (L) is high for 50 μ s, low for 490 μ s.

Test points provided are TP4 ADC_BUSY (L), TP5 chopper drive signal, TP6 ADC_CONVST (L), and TP8 ADC_CS (L).

IC8 divides the microcontroller clock by 4 to provide a 2 MHz clock for the ADC on the Main PCB, monitored at TP7.

The position of shorting link LK1 at PLC pulls P51 high or low; this function is intended for future use.

LCD

The LCD is a 40 pin device with 23 segment drives and 4 command lines. The operating frequency of 300 Hz is derived from XL2 source which is divided down by Timer 1 of the microcontroller.

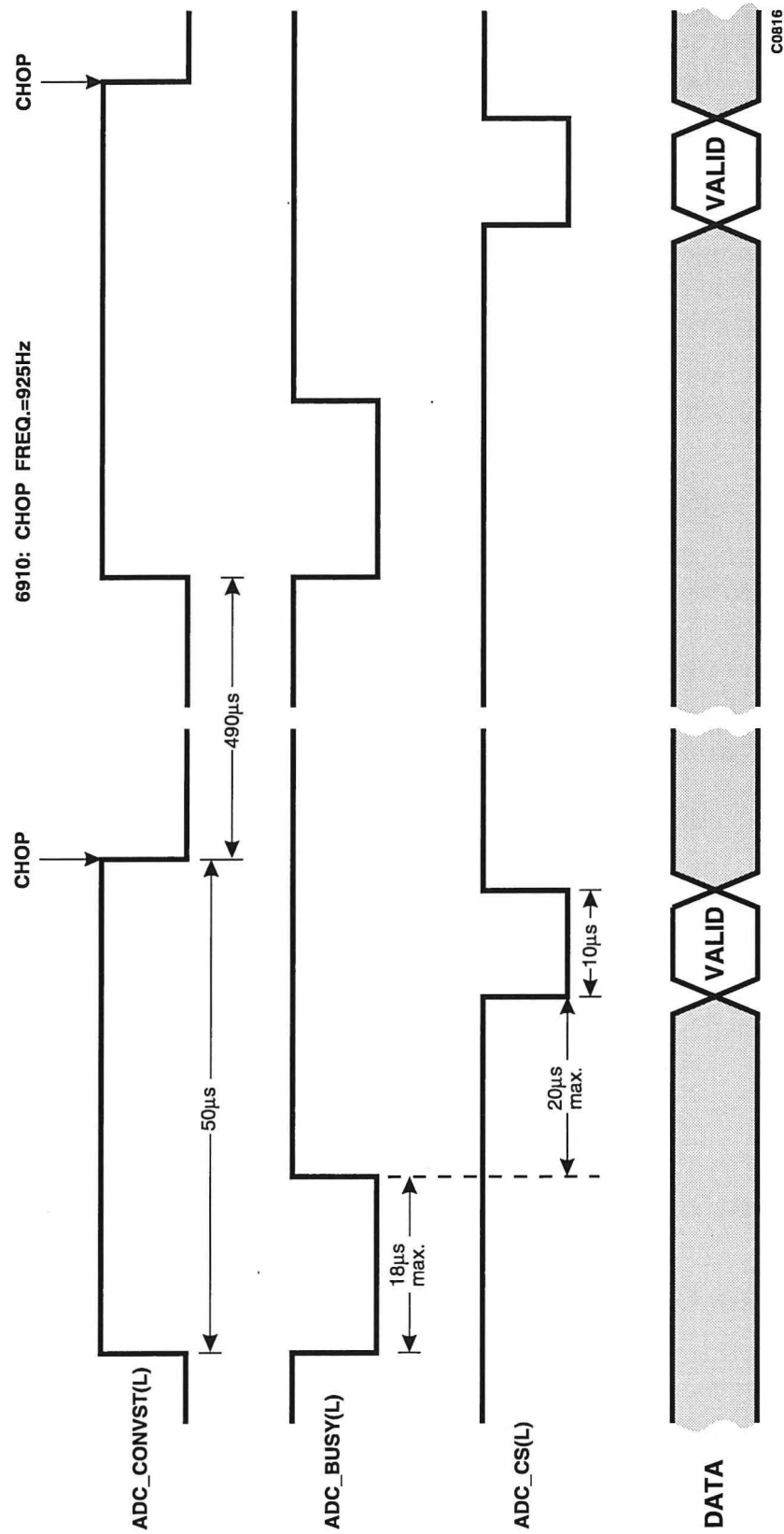


Fig. 1-3 ADC control timing diagram

MAIN PCB

The Main PCB contains the data acquisition circuitry, which comprises part of the distributed tuned input amplifier, the second stage amplifier, the ADC, the chopper drive and the sensor zero circuits. The following technical descriptions should be read in conjunction with the circuit diagram, Fig. 7-2.

Power Sensor Tuned Amplifier

The tuned front-end amplifier is distributed between the sensor head and the Main PCB. IC1a and its associated components comprise the 6970 part of the tuned amplifier, and have a pass band gain of approximately 1000.

The amplifier signal appears across R10. The amplified sensor output is available at test point TP1 and the driven ground at test point TP2.

Second Stage Amplifier

The second stage amplifier is formed by IC2 and IC3. IC3, R11 to R17 and R58 provide four differential gain settings of $\times 637$, $\times 89$, $\times 8$ and $\times 1$, the common mode gain being unity. IC2c is a differential-to-single-ended converter to ground reference the amplifier output to the ADC ground; it has a gain of $\times 1$.

The amplifier chain common-mode performance is that of a voltage-follower. This enables significant ground potentials at the sensor head to be tolerated without affecting the amplifier performance. Noise floor level shifts due to return currents in the sensor cable are also significantly reduced using this approach.

The two range control signals from the LCD board give the following stage gains:

RANGE_0	RANGE_1	GAIN
0	0	$\times 1$
0	1	$\times 8$
1	0	$\times 89$
1	1	$\times 637$

Test points TP9 and TP10 are provided for the range control signals Range_0 and Range_1, respectively, and TP11 for the amplifier output.

Analogue/Digital Converter

IC4 is a single supply 12-bit ADC with built-in track-hold amplifier; the control interface with the microcontroller on the LCD board has been described earlier.

The ADC operates from a 2 MHz clock, giving a total conversion time of 18 μ s maximum, and uses a 3 V reference supplied by the zero DAC IC7, via IC8b.

Chopper Drive

The chopper drive signal is generated by IC6a which is clocked on the falling edge of ADC_CONVST (L) from the microcontroller. IC9a and IC9b form a phase splitter, with the components at the inputs of IC9c and IC9d ensuring a constant dead time between the two phase-split signals.

The outputs of IC9c and IC9d are level shifted by R35/D8, R36/D9 before going to line drivers IC5a/IC5c and IC5b/IC5d.

Test point TP3 is provided for the master chopper drive signal, TP4 is the series chopper drive and the TP5 the shunt chopper drive.

Sensor Zero

The power sensor zero voltage is generated by 14-bit DAC IC7. As the data bus input is 12 bits, the two least significant bits are tied low. Data is loaded by strobing the CS (L)/WR (L) line low for at least 50 ns. The zero voltage is derived by analysing the ADC output code during a sensor zero measurement and varying the code loaded to IC7 using a successive approximation algorithm, until the signal amplitude is minimized.

The DAC output is differentially buffered by IC8c and IC8d and then further attenuated by IC8a to a suitable level to be passed down to bias the front end chopper via PLA.

IC7's 3 V internal reference, also used for the ADC, sets the DAC LSB size to 1.46 mV; after being attenuated by IC8 this becomes 0.146 mV. Test point TP6 is provided for the control strobe CS (L) and TP7 for the DAC output.

POWER REFERENCE PCB

The Power Reference PCB provides a 0 dBm (1 mW) 50 MHz reference source for calibrating the 6970 Power Meter and sensors. The following technical descriptions should be read in conjunction with the circuit diagram, Fig. 7-6.

Oscillator and Level Detector

The 50 MHz sine wave source is provided by a Hartley-type LC oscillator formed by TR1 and associated circuitry. The amplitude of the sine wave output is controlled by the DC bias on gate g2 of TR1. The frequency of oscillation is determined by the resonant circuit of L2 and C14/C15, with C13 provided for fine tuning. Frequency stability is better than 1 Hz/°C temperature change.

C21, C22 and L3 form a tuned matching pad at the output of the oscillator, maximizing the available power to a 50 ohm load, whilst filtering unwanted harmonics.

Diode detector D1 provides a DC voltage which is proportional to the oscillator output level.

Levelling Loop

IC2a is configured as an integrator which has as its inputs the output of the RF output level detector and a reference voltage provided by IC2b and IC3. The output of IC2a biases g2 of TR1 to force the loop to a power level determined by the voltage reference at its non-inverting input as set at IC2b by R5.

Temperature changes at the level detector diode D1 will cause power level drift, so D2 is included in the feedback loop for thermal compensation.

Since the power reference behaves as a perfect voltage source when levelled (i.e. zero source impedance), the attenuator pad R16/R17/R18 is included to provide matching to a 50 ohm system.

The power reference is powered by ± 5 V from the LCD PCB, which is applied to analogue switch IC1. The switch is turned on when the REF_ENABLE line from the LCD PCB goes high. The -5 V output from the switch is fed back to the LCD PCB as the REF_ON signal, which turns on the power reference indicator LED.

Chapter 2

MAINTENANCE

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INTRODUCTION

This chapter gives instructions for gaining access to the various sub-assemblies in order that fault diagnosis, repair or replacement can be carried out, and also provides other relevant servicing support information.

PRECAUTIONS

In addition to the advice given under 'Precautions' at the front of this manual, special handling techniques are required for certain items, as described below.

Surface-mounted components. Numerous surface-mounted components are fitted in this instrument. When soldering these devices the following precautions should be observed.

- (a) Use a low melting point solder, and a soldering iron set to 315°C (600°F). The use of a high wattage soldering iron will minimize the time taken to solder the device.
- (b) Take care to avoid mechanical damage from flexing the PCB.

Static sensitive components. The CMOS integrated circuits used in the instrument have extremely high input resistance and can be damaged by accumulation of static charges (see preliminary pages, 'Precautions'). Boards that have such integrated circuits all carry labels warning against damage by static discharge. Take care also when using freezer sprays to aid fault finding; these can create a static discharge which can corrupt the data stored in programmed devices.

MAINTENANCE

Refer to Fig. 2-1

CAUTION

Avoid short circuiting the battery connections, particularly to the metallised case, as damaging current levels can be produced.

Access to internal components

The case assembly of the 6970 comprises two moulded plastic mating sections, with the SENSOR INPUT connector and POWER REFERENCE connector (if fitted), mounted on an aluminium/polycarbonate front panel. The panel is clamped in a groove between the two case sections, and a DC INPUT connector is located at the bottom of the upper section of the case. The LCD PCB and Power Reference PCB (if fitted) are fixed in the upper case section and the Main PCB in the lower one.

One end of a ribbon cable is permanently attached to the Main PCB the other connects to PLA on the LCD PCB. On early instruments, the cable was fixed to the Main PCB on the component side, but is connected to the solder side on later units.

It should also be noted that on earlier instruments the sensor input cable was connected to the Main PCB using a 12-way connector. On later units the cable is soldered directly to the board.

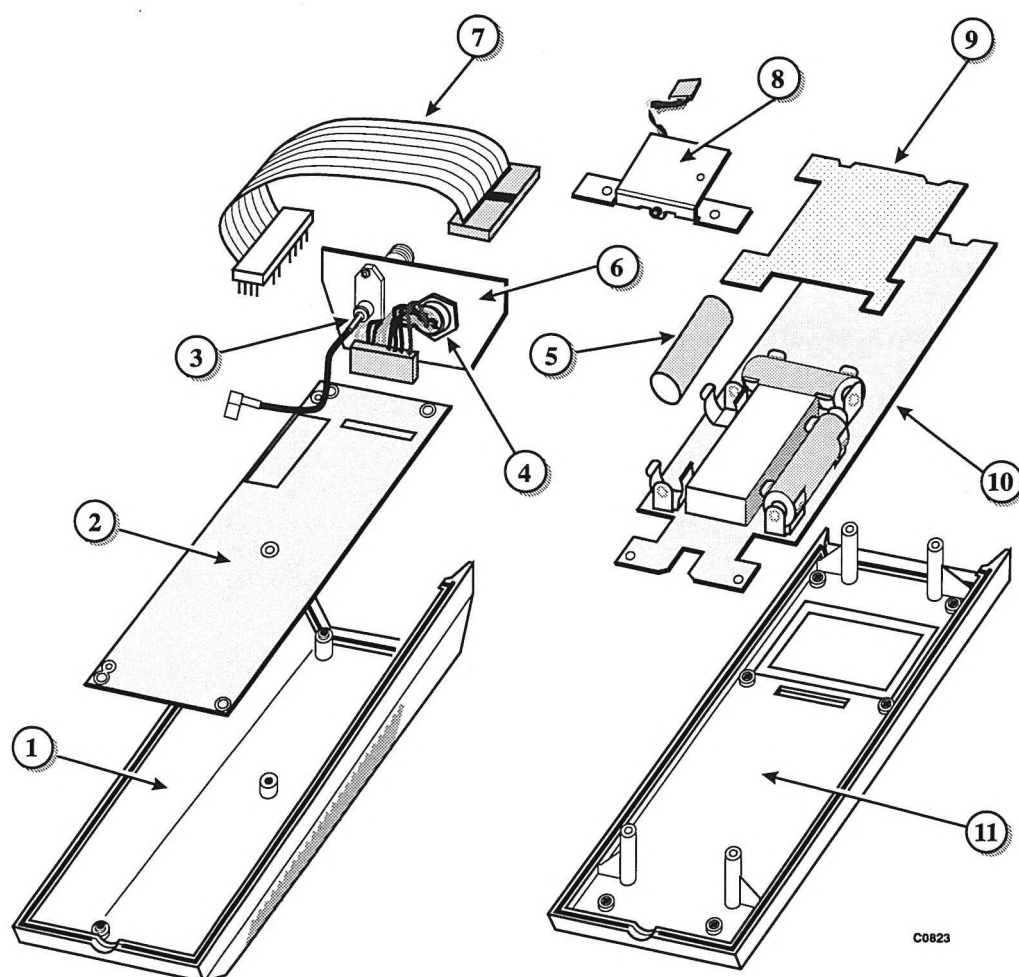
The two sections are secured by four screws accessed from the underside of the assembled case (see Fig. 2-1). The case may be disassembled as follows:

- (1) Remove the four screws in the case underside .
- (2) Carefully pull the two sections apart taking care to avoid straining the interconnecting ribbon cable, and the power reference and sensor input cable assemblies.
- (3) Carefully disconnect the ribbon cable from PLA on the LCD PCB, and the power reference RF cable assembly from the SMB connector on the power reference PCB.
- (4) To reassemble the unit, reverse the above procedure, ensuring that the front panel and DC Input connector are located correctly in the case sections. On units fitted with the power reference, also ensure that the power reference RF output cable does not become trapped as the two case sections are reassembled.

Replacement of Batteries

If a battery fails to hold a charge (voltage below 1 V) it may be replaced as follows:

- (1) Separate the two case sections as previously described.
- (2) Remove the cable ties from the battery clips (these were not fitted on earlier instruments). Prise the batteries out of their retaining clips on the LCD PCB in the upper section of the case. In order to remove the battery nearest the top of the unit, the ribbon cable must first be disconnected from PLD on the LCD PCB.
- (3) Fit the new batteries into the clips, observing the correct polarity orientation (see Fig. 2-2). Fit new cable ties to the clips.
- (4) Reassemble the case and put the batteries on charge for at least 14 hours, as they are supplied in a discharged state.



- | | |
|--|--|
| ① Case, bottom section | ⑦ 26 way ribbon cable |
| ② Main PCB | ⑧ DC input assy |
| ③ Power ref output connector assy (Option 001) | ⑨ Power Reference PCB (Option 001) |
| ④ Sensor input connector assy | ⑩ LCD PCB |
| ⑤ Nickel-cadmium battery (3 off) | ⑪ Case, top section (including keypad) |
| ⑥ Front panel | |

Fig. 2-1 Case assembly

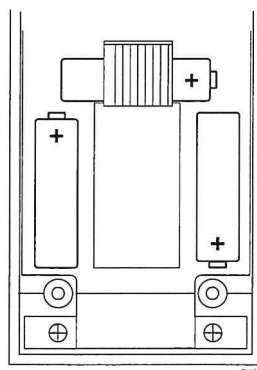


Fig. 2-2 Battery orientation

Replacement of DC Input Assembly

The DC Input Assembly comprises the DC input socket, a voltage regulator, cable assembly and a mounting plate/heat sink. Replace as follows:

- (1) Separate the two case sections as described previously.
- (2) Disconnect the DC Input Assembly lead by removing from PLB on the LCD PCB.
- (3) Remove the two screws that secure the assembly to the case.
- (4) Fit the replacement unit by reversing the above procedure.

Replacement of Power Reference PCB

The PCB is fitted in the case upper section. Replace the PCB as follows:

- (1) Separate the two case sections as previously described.
- (2) Disconnect the 5-wire lead to the LCD PCB by removing PLC.
- (3) Remove the four nuts and washers that secure the PCB to the hexagonal pillars then remove the PCB.
- (4) Fit the replacement PCB by reversing the above procedure.

Replacement of the LCD PCB

Replace the LCD PCB in the case upper section, as follows:

- (1) Separate the two case sections as previously described.
- (2) Remove the DC Input Assembly, as described previously.
- (3) Disconnect the lead from the keypad by removing PLD on the LCD PCB, then remove the centrally located battery from its clip.
- (4) If fitted, remove the Power Reference PCB as described previously.
- (5) Remove the four hexagonal pillars securing the PCB. Lift out the PCB and feed connector PLD through the slot in the PCB.
- (6) Fit the replacement PCB by reversing the above procedure.

Replacement of Keypad Membrane

The keypad membrane is self-adhesive and is fixed to the outside of the upper case section. Replace as follows:

- (1) Separate the two case sections and remove the LCD PCB, as previously described.
- (2) Remove the keypad membrane from the upper case section. This is done by using a sharp instrument to lift up one corner of the keypad membrane and then peeling it off.
- (3) Peel off the backing paper from the replacement keypad membrane. Pass the cable through the slot in the upper case section, carefully position the keypad over the recessed area in the case, then press down firmly. This must be done correctly the first time, since the keypad membrane can easily be damaged if an attempt is made to remove it once it has been stuck down.
- (4) Refit the LCD PCB and reassemble the case, as described previously.

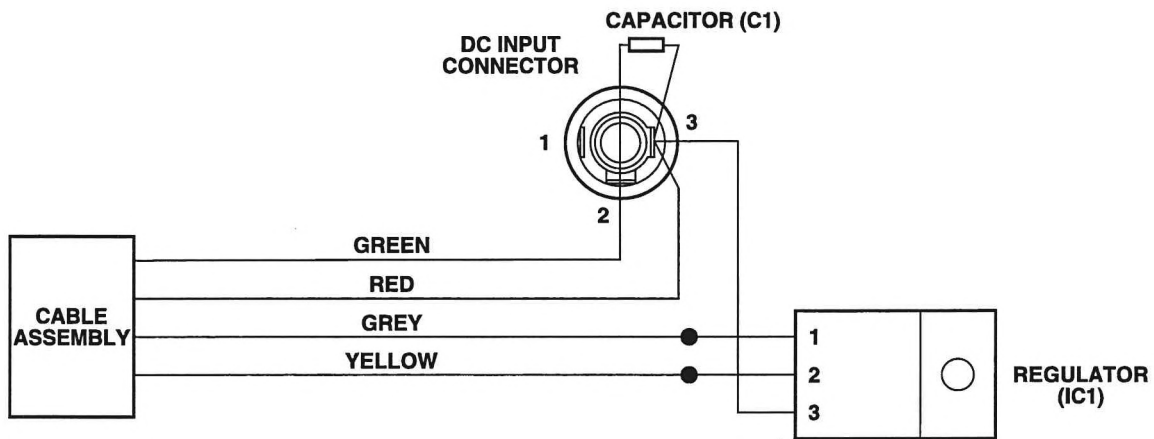
Replacement of Main PCB

Replace the Main PCB in the case lower section, as follows:

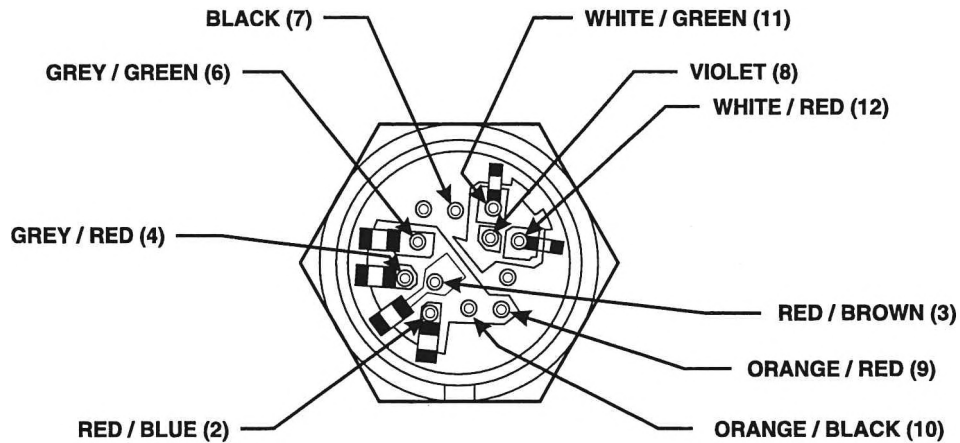
- (1) Separate the two case sections as described previously.
- (2) Disconnect the lead from the SENSOR INPUT connector by removing PLA (on later units the sensor input wires are soldered directly to the main PCB). Remove the connector and plate assembly from the case.
- (3) Remove the one central screw securing the PCB. Lift out the PCB.
- (4) Fit the replacement PCB by reversing the above procedure.

Cleaning of the LCD Window

If it should be necessary to clean the LCD window, the recommended cleaning agent is Industrial Optical Cleaner (98% IPA).



DC CONNECTOR/REGULATOR ASSEMBLY (44991/143)



SENSOR INPUT CONNECTOR (44991/047)

C2893

NOTE: Numbers in brackets refer to the connection points on the main PCB.

SENSOR INPUT CONNECTOR

Fig. 2-3 Wiring details for DC input and sensor input connectors

Chapter 3

ADJUSTMENT AND CALIBRATION

INTRODUCTION

This chapter describes the adjustments required to maintain the 6970 RF Power Meter in peak operating condition. These adjustments only apply to instruments fitted with the 0 dBm 50 MHz power reference (Option 001); there are no adjustments on the standard instrument. The adjustments should only be carried out if the instrument does not meet the performance specifications, as detailed in Chapter 1 of the Operating Manual

All adjustments are located on the Power Reference PCB; Refer to Chapter 2 for details of access to this board.

POWER REFERENCE FREQUENCY ADJUSTMENT

TEST EQUIPMENT

Description	Minimum Specification	Example
Frequency counter	Frequency: 50 MHz	Philips PM 6673

- (1) Connect the 6970 POWER REFERENCE output to the appropriate input on the frequency counter.
- (2) If necessary, press [ON/ENTER] to switch on the 6970.

Press [SHIFT] [ON/ENTER] to switch on the power reference.

- (3) Adjust C13 for a counter reading of 50 MHz $\pm$ 50 kHz.

POWER REFERENCE LEVEL ADJUSTMENT

TEST EQUIPMENT

Description	Minimum Specification	Example
50 MHz, 1 mW power reference standard	Calibrated to National Standards	Available in: 6200 Series MTS IFR 6960B and 6970 RF
Power sensor	1 mW, type-N connector	Power Meters IFR 6910

ADJUSTMENT & CALIBRATION

- (1) Connect the 6910 power sensor to the 6970 SENSOR INPUT using a sensor cable.
- (2) If necessary, press [ON/ENTER] to switch on the 6970.
- (3) Press [SENSOR]. If the display does not indicate 6910, press [SENSOR] repeatedly until it does, then press [ON/ENTER].
- (4) Enter the linearity factor of the 6910 into the 6970. this is shown on the sensor's label or, more precisely (to two decimal places), on the Calibration Data Chart supplied with the sensor. (For example, [LIN FACTOR] [8] [.] [6] [ON/ENTER].)

Set the CAL FACTOR to 100% for the 6910 sensor by pressing [CAL FACTOR] [1] [0] [0] [ON/ENTER].

- (5) Set the 6970 to read Watts by pressing [UNITS].
- (6) Ensure that the sensor is not connected to any RF source, then press [SHIFT] [ZERO] and wait for the zero to complete.
- (7) Connect the sensor to the 1 mW power reference standard. Press [SHIFT] [CAL] and wait for the calibration to complete.
- (8) Remove the sensor from the power reference standard and connect it to the 6970 POWER REFERENCE output. Press [SHIFT] [ON/ENTER] to switch on the power reference. Adjust R5 to give a reading on the 6970 display of 1.000 mW.
- (9) Reassemble the case, ensuring that the power reference RF output cable does not become trapped between the two case sections.

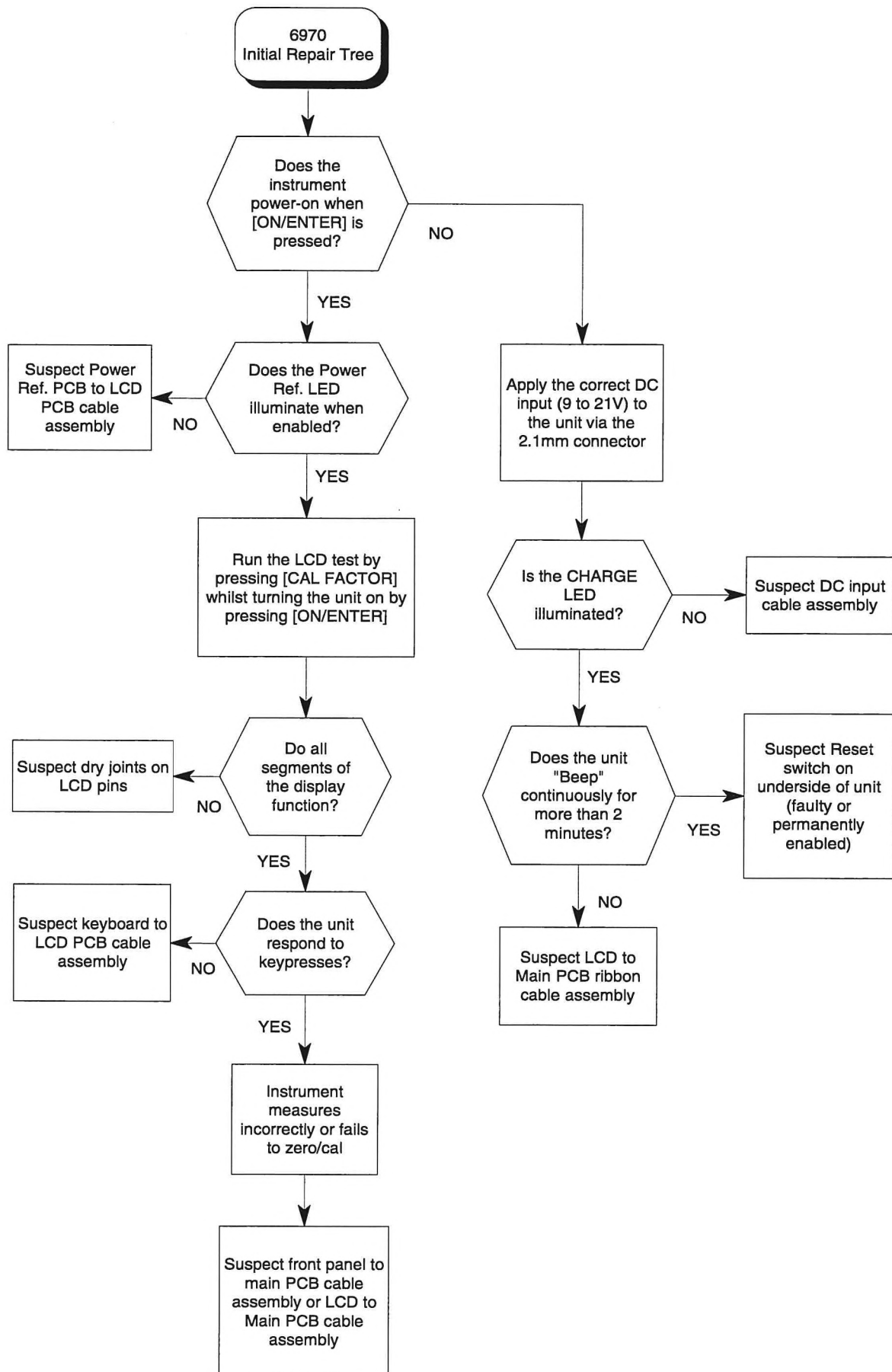
Chapter 4

INITIAL REPAIR

INTRODUCTION

The following flow chart describes the action that should be taken if the instrument fails to function correctly following delivery or during the normal course of operation. Only a screwdriver is required, and no test equipment is necessary.

INITIAL REPAIR



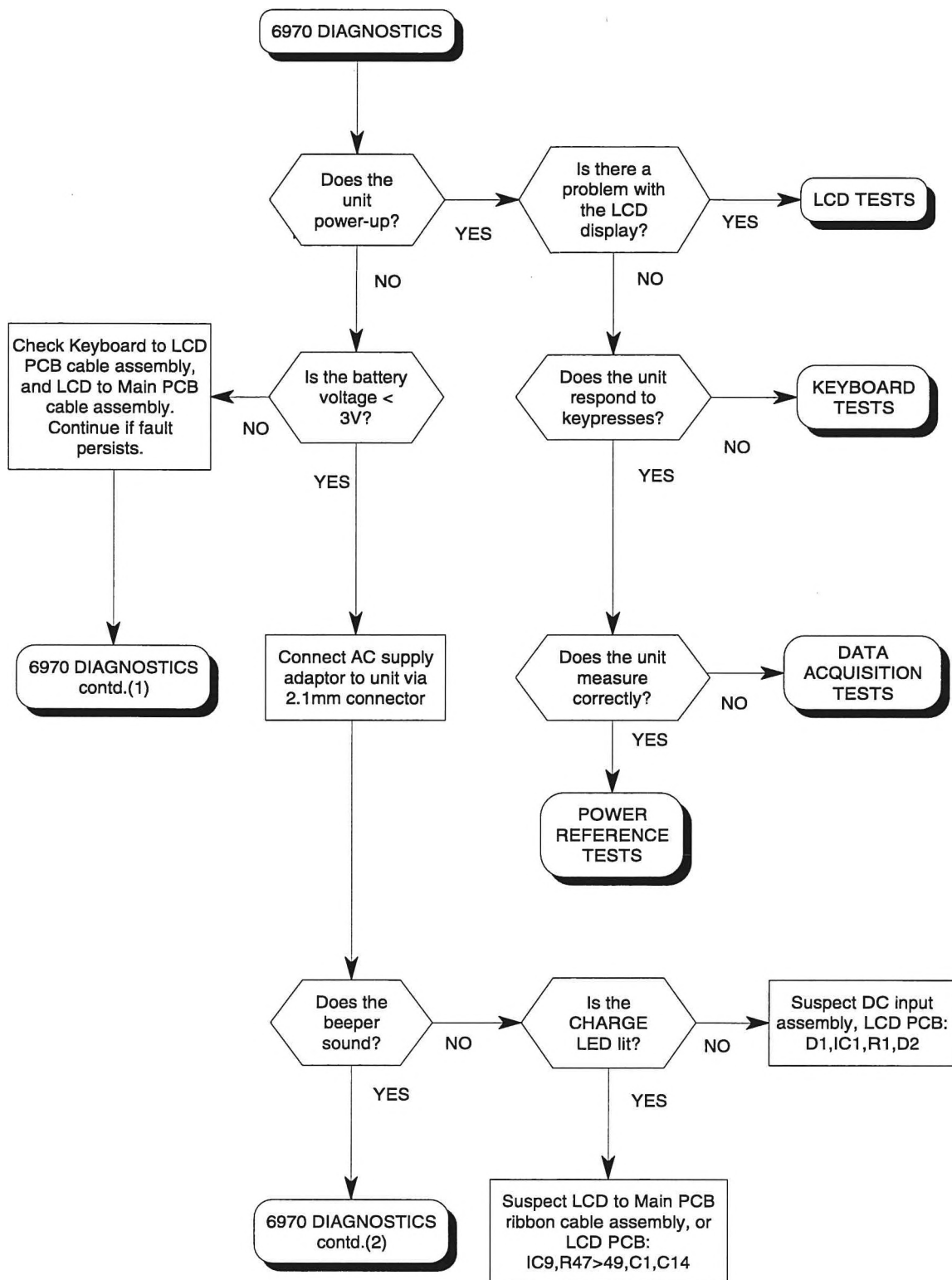
Chapter 5

FAULT DIAGNOSIS

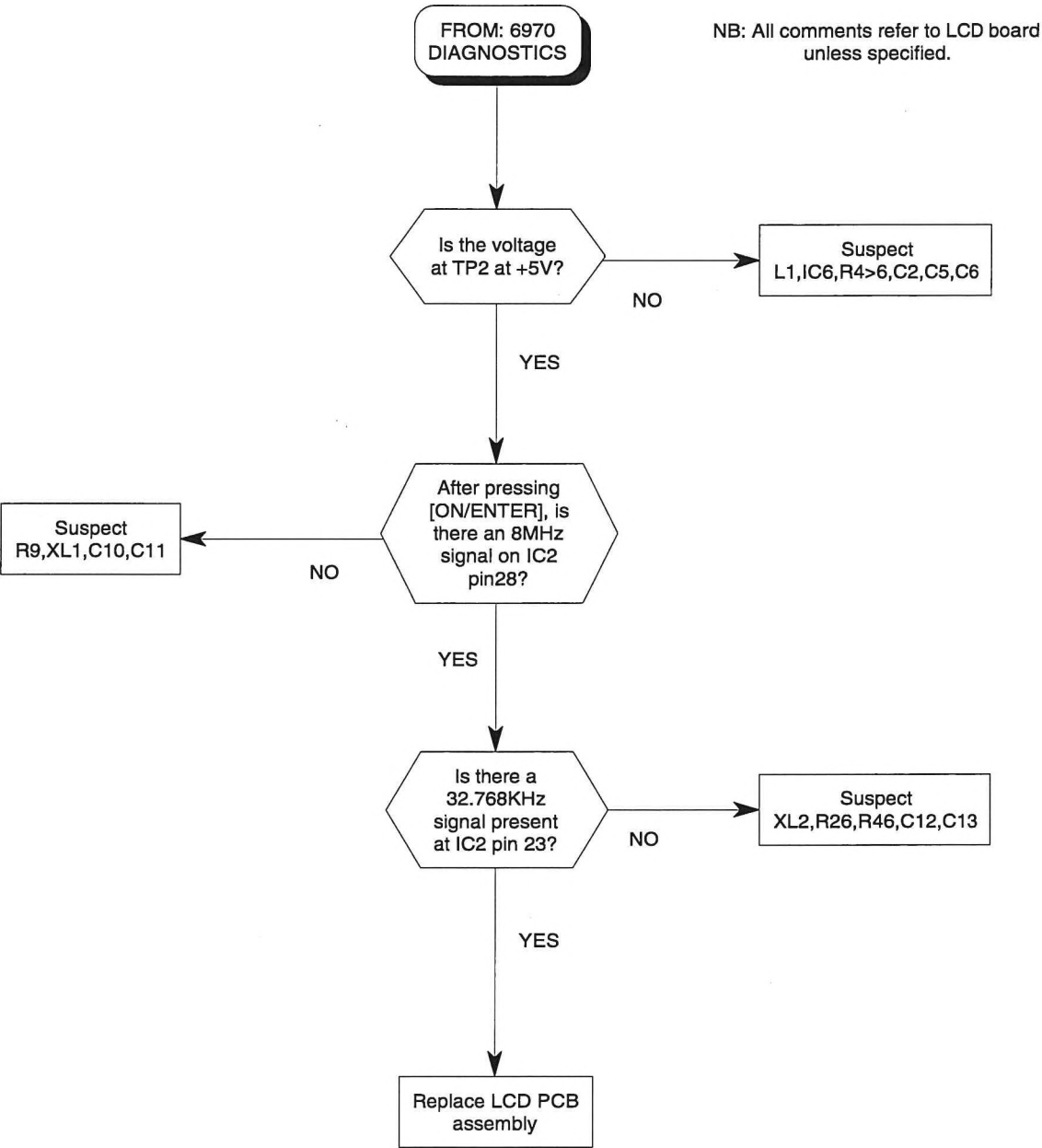
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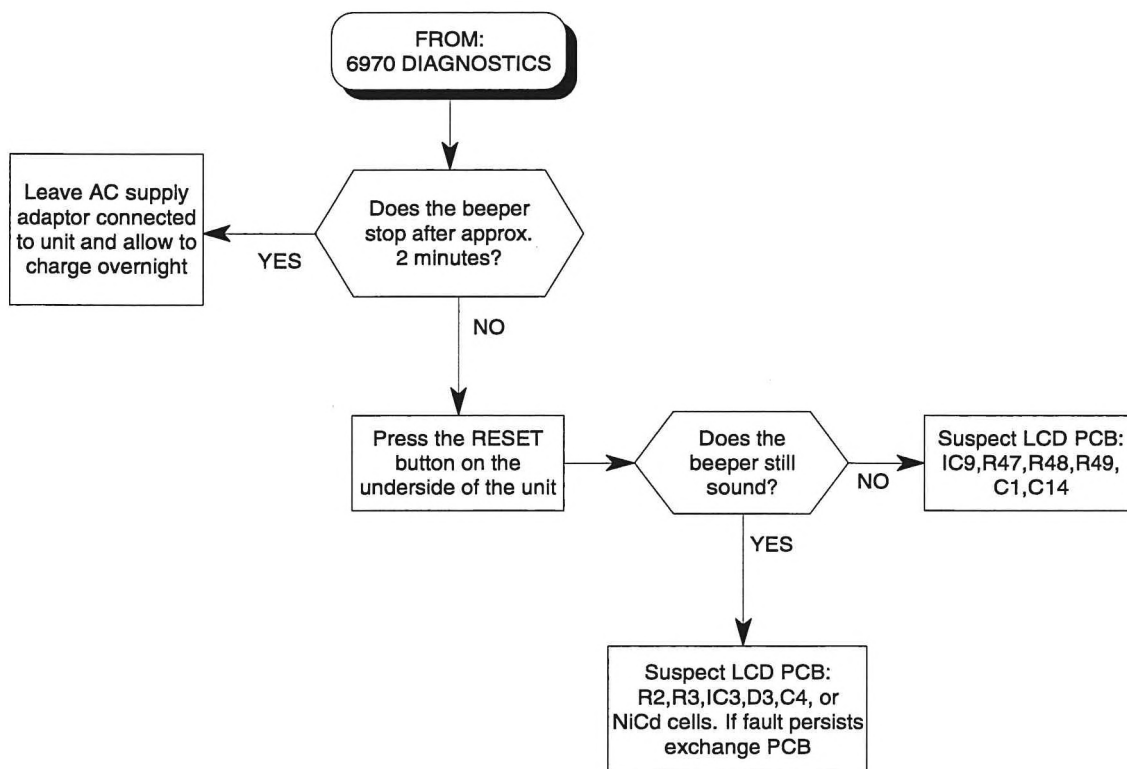
6970 DIAGNOSTICS



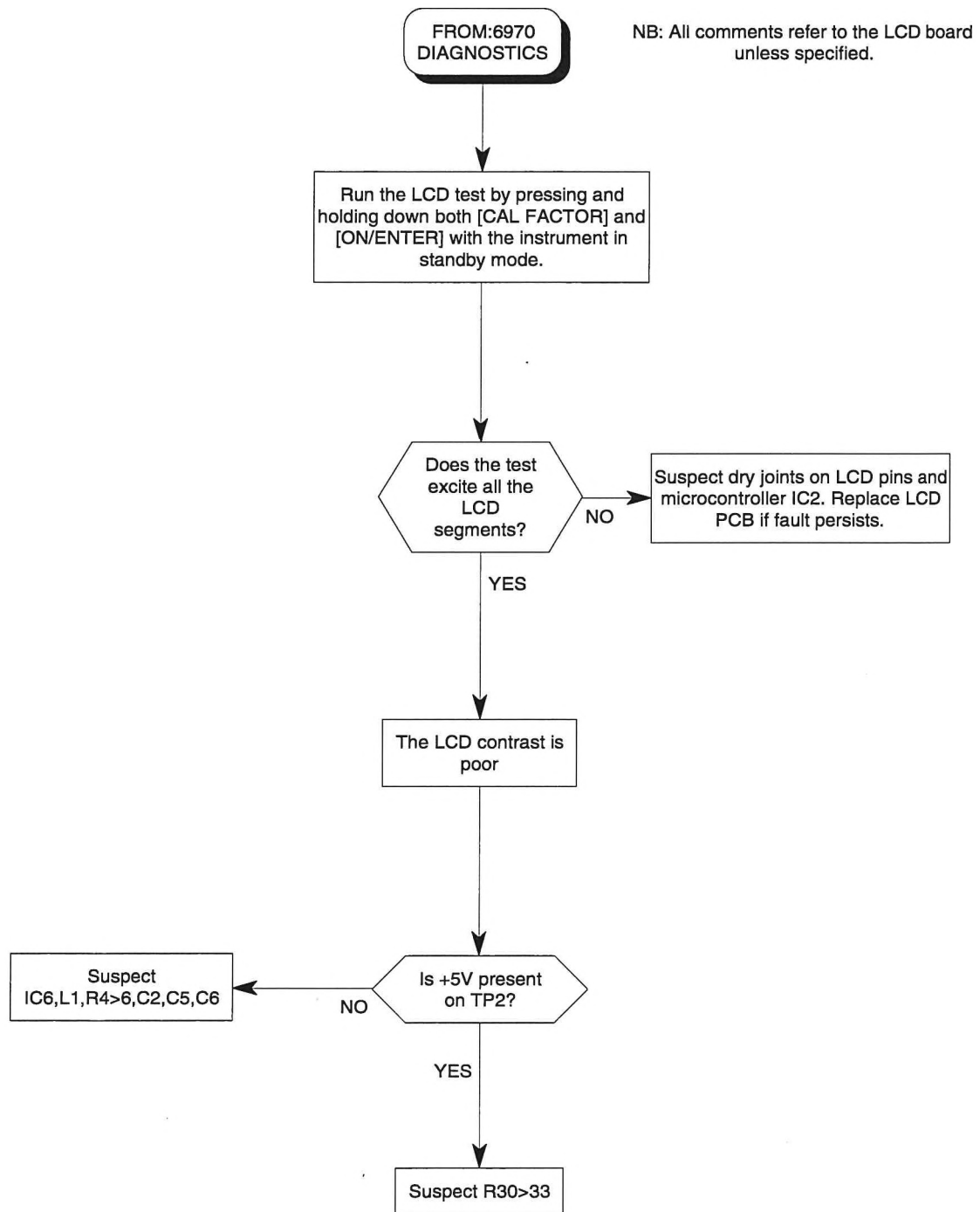
6970 DIAGNOSTICS contd. (1)



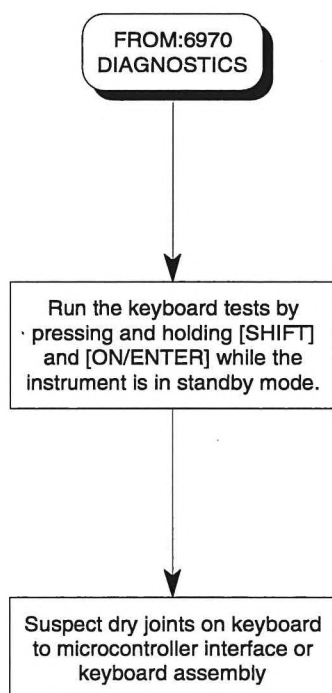
6970 DIAGNOSTICS contd. (2)



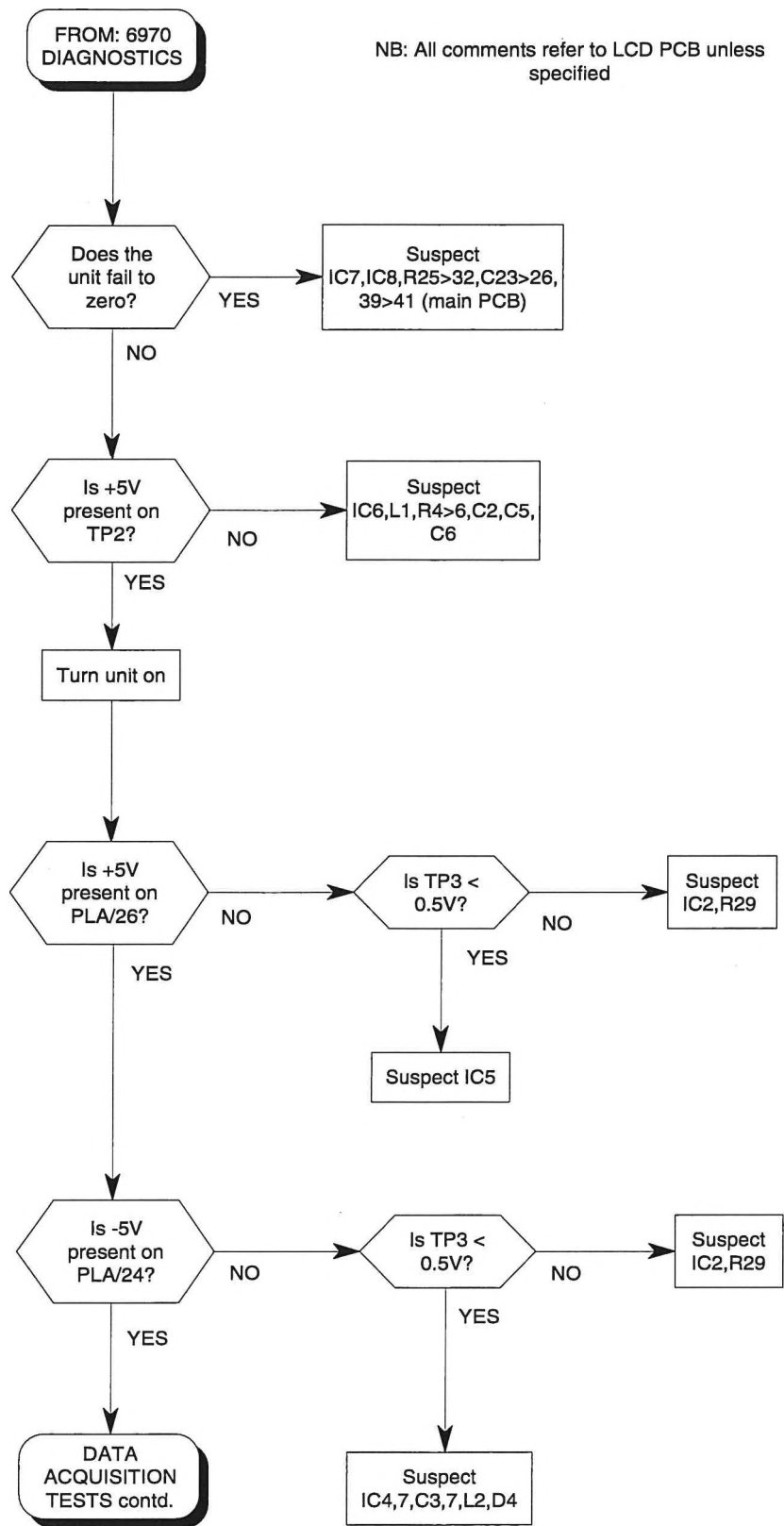
LCD TESTS



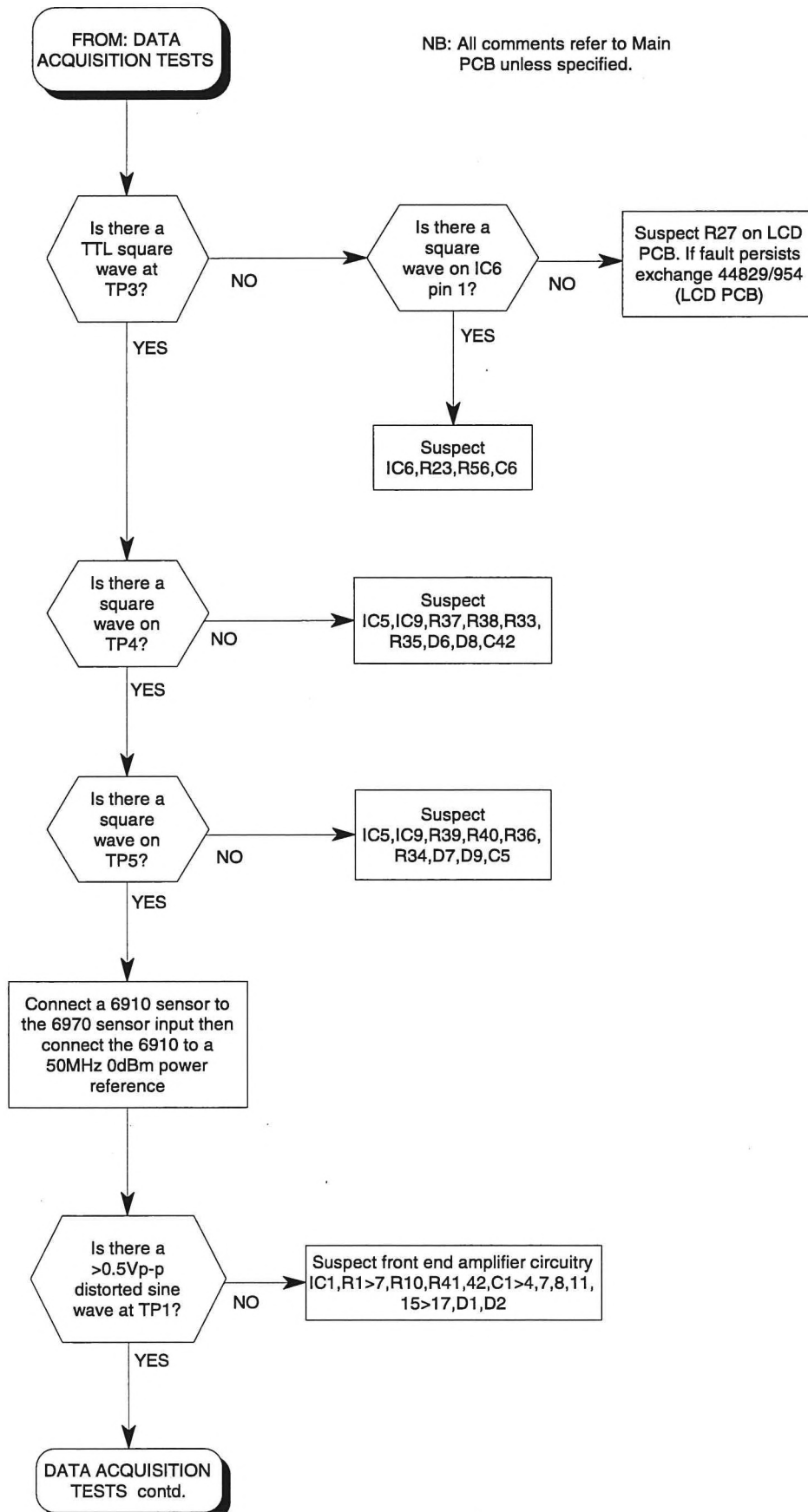
KEYBOARD TESTS



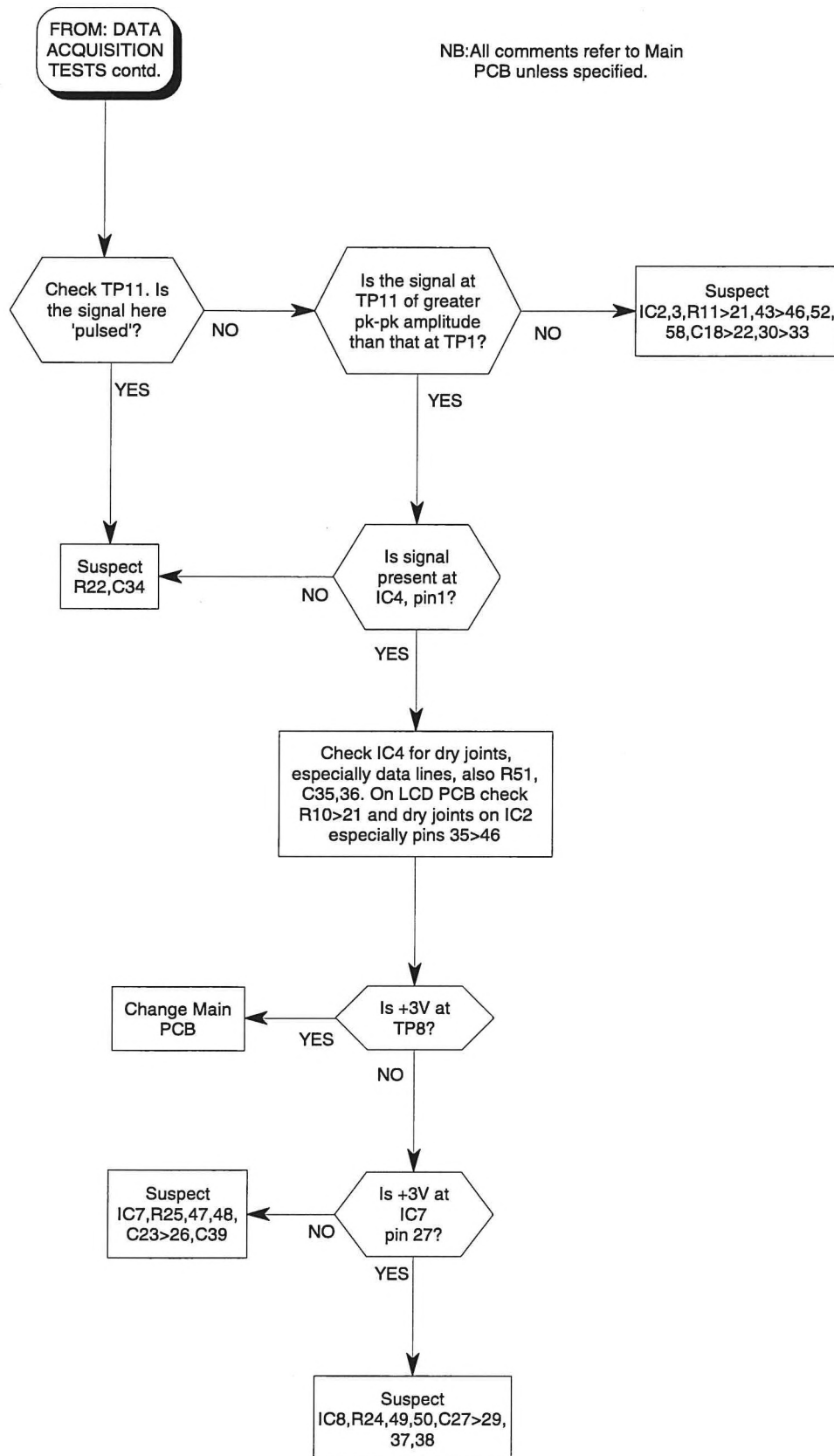
DATA ACQUISITION TESTS



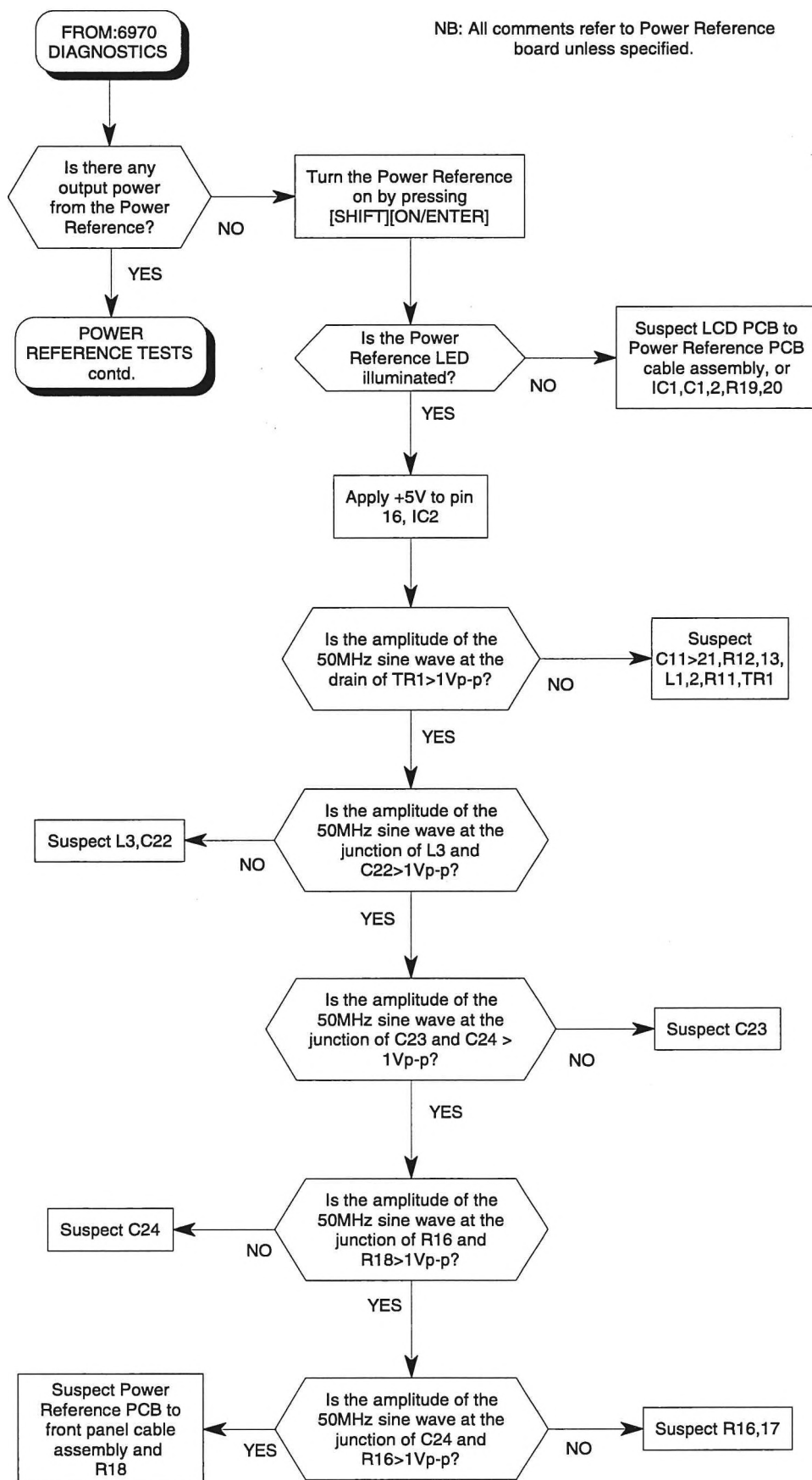
DATA ACQUISITION TESTS contd.



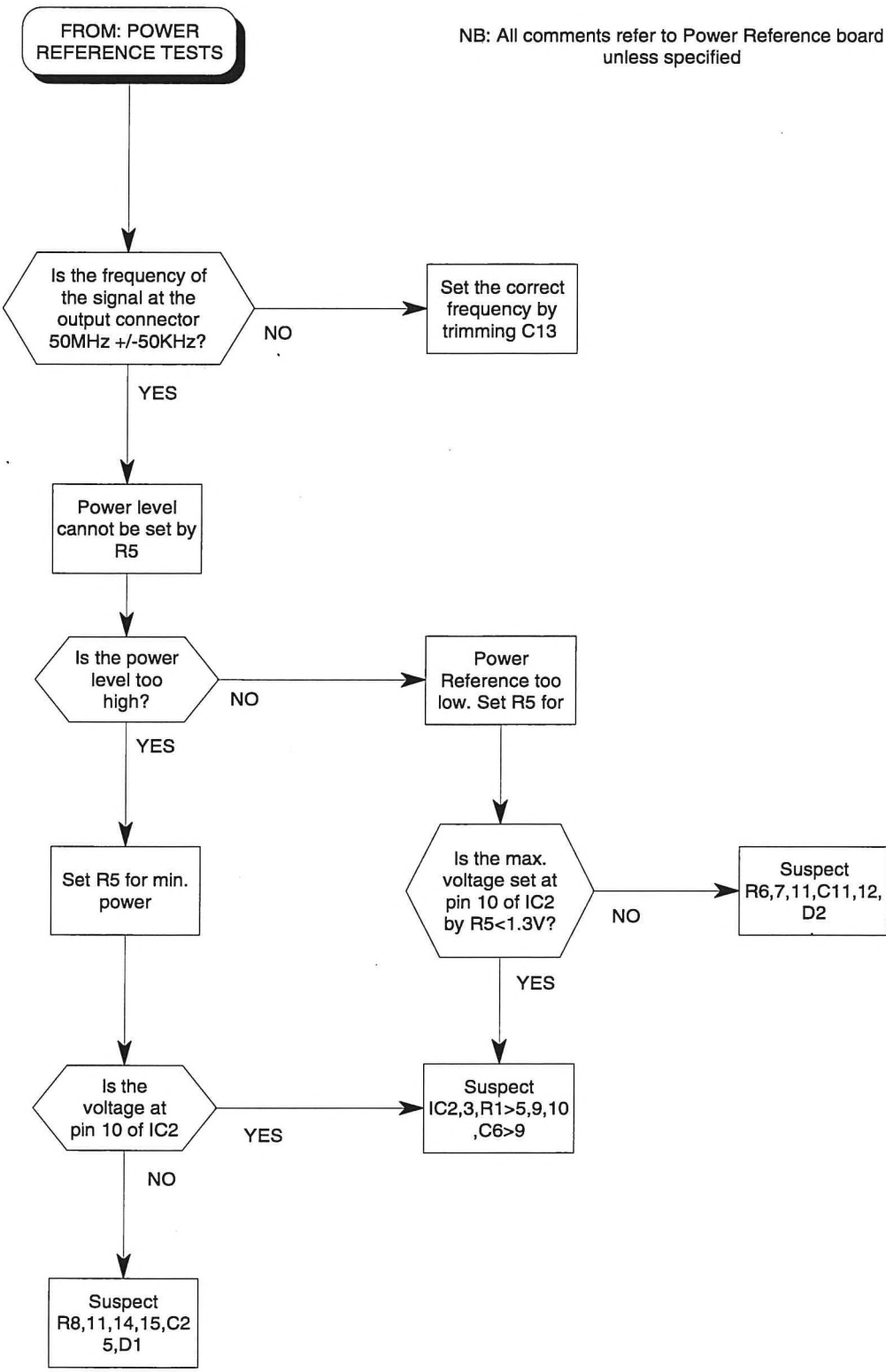
DATA ACQUISITION TESTS contd.



POWER REFERENCE TESTS



POWER REFERENCE TESTS contd.



Chapter 6

REPLACEABLE PARTS

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INTRODUCTION

Each sub-assembly or printed circuit board in this equipment has been allocated a reference designator code, e.g. A0, A1, A2 etc.

The complete component reference includes its reference designator as a prefix, e.g. A2C1 (capacitor C1 on sub-assembly A2, but, for convenience in the text and diagrams, the prefix is omitted unless it is needed to avoid confusion. However, when ordering replacements or in correspondence, the complete component reference should be quoted.

COMPONENT VALUES

One or more of the components fitted in the equipment may differ from those listed in this chapter (see *Supply statement* below).

Components indicated by an * (or SIC) have their values selected during test to achieve particular performance limits. This may mean that in some instances no component is fitted.

When there is a difference between the component fitted and the one listed, always use as a replacement the same type and value of component as that found in the equipment.

COMPONENT SPARES AND ASSEMBLIES

Supply statement

- (a) IFR satisfies its material requirements by purchasing components from leading suppliers, who may manufacture in many countries. In most instances, components with different identities and slightly different specifications will be acceptable to us and will be identified under a single IFR part number regardless of manufacturer.

The IFR part number is the definitive reference. Service manuals and recommended service parts lists will give an example of one of the manufacturer's devices that meets our specification requirement.

We reserve the right to supply in manufactured equipment or for service spares any item that meets the requirements of our part number.

- (b) It may be necessary (due for example to obsolescence) to supply an item with a different IFR Ltd part number from that identified in our published documentation. Supply of such an alternative item is deemed to satisfy, in full, the requirements of any order or contract.

IFR Ltd warrants that the device supplied under our part number will function correctly when placed in the correctly identified circuit location for such a device in the relevant product.

ORDERING

When ordering replacements, address the order to our Service Division (address at rear of manual) or nearest agent and specify the following for each component required:-

- Type and serial number of equipment, as given on the serial number label at the rear of the equipment. If this is superseded by a model number label, quote the model number instead of the type number.
- Complete circuit reference.
- Description.
- IFR part number.

ELECTRICAL COMPONENTS**Standard 6970**

Cir. Ref.	IFR part number	Description	Manufacturer	Manufacturer's part no.
	44829/947	MAIN PCB	IFR LTD.	
	44829/954	LCD PCB	IFR LTD.	
	44991/143	DC INPUT ASSY	IFR LTD.	
	43138/292	26-WAY RIBBON CABLE	IFR LTD.	
	44991/047	SENSOR INPUT CONNECTOR	IFR LTD.	
	23725/107	NICKEL-CADMIUM BATTERY, SIZE AA 1.2V, 0.7 AMP-HRS	SAFT (UK) LTD	VE AA 700 CFG

6970 with Option 001

As for the standard 6970 but with the following additional items:

44829/981	POWER REFERENCE PCB (includes lead to LCD PCB)	IFR LTD.
23448/899	RF CABLE ASSY (POWER REF output)	ROSENBERGER GERMANY LO2-185-95

REPLACEABLE PARTS

Cir. Ref.	IFR part number	Description	Manufacturer	Manufacturer's part no.
Main PCB				
	44829/947	Complete unit	Issue 010	
C1	26451/009	CAPACITOR-FIXED ALUMINIUM 47µF +/-20% 16V ELECTROLYTIC, SURFACE-MOUNTED, SIZE 6.6 x 6.6mm,	PANASONIC INDUSTRIAL	ECE-V-1CA-470P
C2	26386/824	CAPACITOR-FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805-5A-101-JAT-00-J
C3	26386/828	CAPACITOR-FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805-5A-221-JAT-00-J
C4	26451/009	CAPACITOR-FIXED ALUMINIUM 47µF +/-20% 16V ELECTROLYTIC, SURFACE-MOUNTED, SIZE 6.6 x 6.6mm,	PANASONIC INDUSTRIAL	ECE-V-1CA-470P
C5	26386/828	CAPACITOR-FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805-5A-221-JAT-00-J
C6	26386/899	CAPACITOR-FIXED CERAMIC 100nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206-5C-104-KAT-00-J
C7	26386/871	CAPACITOR-FIXED CERAMIC 4.7nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805-5C-472-KAT-00-J
C8	26386/823	CAPACITOR-FIXED CERAMIC 82pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805-5A-820-JAT-00-J
C9	26386/899	CAPACITOR-FIXED CERAMIC 100nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206-5C-104-KAT-00-J
C10	26386/899	CAPACITOR-FIXED CERAMIC 100nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206-5C-104-KAT-00-J
C11	26386/899	CAPACITOR-FIXED CERAMIC 100nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206-5C-104-KAT-00-J
C13	26451/003	CAPACITOR-FIXED ALUMINIUM 10µF +/-20% 16V ELECTROLYTIC, SURFACE-MOUNTED, SIZE 4.3 x 4.3mm,	PANASONIC INDUSTRIAL	ECE-V-1CA-100R
C14	26451/003	CAPACITOR-FIXED ALUMINIUM 10µF +/-20% 16V ELECTROLYTIC, SURFACE-MOUNTED, SIZE 4.3 x 4.3mm,	PANASONIC INDUSTRIAL	ECE-V-1CA-100R
C15	26451/003	CAPACITOR-FIXED ALUMINIUM 10µF +/-20% 16V ELECTROLYTIC, SURFACE-MOUNTED, SIZE 4.3 x 4.3mm,	PANASONIC INDUSTRIAL	ECE-V-1CA-100R
C16	26386/899	CAPACITOR-FIXED CERAMIC 100nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206-5C-104-KAT-00-J
C17	26451/003	CAPACITOR-FIXED ALUMINIUM 10µF +/-20% 16V ELECTROLYTIC, SURFACE-MOUNTED, SIZE 4.3 x 4.3mm,	PANASONIC INDUSTRIAL	ECE-V-1CA-100R
C18	26451/003	CAPACITOR-FIXED ALUMINIUM 10µF +/-20% 16V ELECTROLYTIC, SURFACE-MOUNTED, SIZE 4.3 x 4.3mm,	PANASONIC INDUSTRIAL	ECE-V-1CA-100R
C19	26386/899	CAPACITOR-FIXED CERAMIC 100nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206-5C-104-KAT-00-J
C20	26451/003	CAPACITOR-FIXED ALUMINIUM 10µF +/-20% 16V ELECTROLYTIC, SURFACE-MOUNTED, SIZE 4.3 x 4.3mm,	PANASONIC INDUSTRIAL	ECE-V-1CA-100R
C21	26386/899	CAPACITOR-FIXED CERAMIC 100nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206-5C-104-KAT-00-J
C22	26386/899	CAPACITOR-FIXED CERAMIC 100nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206-5C-104-KAT-00-J
C23	26386/899	CAPACITOR-FIXED CERAMIC 100nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206-5C-104-KAT-00-J
C24	26451/003	CAPACITOR-FIXED ALUMINIUM 10µF +/-20% 16V ELECTROLYTIC, SURFACE-MOUNTED, SIZE 4.3 x 4.3mm,	PANASONIC INDUSTRIAL	ECE-V-1CA-100R
C25	26451/003	CAPACITOR-FIXED ALUMINIUM 10µF +/-20% 16V ELECTROLYTIC, SURFACE-MOUNTED, SIZE 4.3 x 4.3mm,	PANASONIC INDUSTRIAL	ECE-V-1CA-100R
C26	26386/899	CAPACITOR-FIXED CERAMIC 100nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206-5C-104-KAT-00-J

REPLACEABLE PARTS

Cir. Ref.	IFR part number	Description	Manufacturer	Manufacturer's part no.
MAIN PCB (contd.)				
C27	26451/003	CAPACITOR-FIXED ALUMINIUM 10uF +/-20% 16V ELECTROLYTIC, SURFACE-MOUNTED, SIZE 4.3 x 4.3mm,	PANASONIC INDUSTRIAL	ECE-V-1CA-100R
C28	26386/899	CAPACITOR-FIXED CERAMIC 100nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206-5C-104-KAT-00-J
C29	26451/003	CAPACITOR-FIXED ALUMINIUM 10uF +/-20% 16V ELECTROLYTIC, SURFACE-MOUNTED, SIZE 4.3 x 4.3mm,	PANASONIC INDUSTRIAL	ECE-V-1CA-100R
C30	26386/818	CAPACITOR-FIXED CERAMIC 33pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805-5A-330-JAT-00-J
C31	26386/818	CAPACITOR-FIXED CERAMIC 33pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805-5A-330-JAT-00-J
C32	26386/871	CAPACITOR-FIXED CERAMIC 4.7nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805-5C-472-KAT-00-J
C33	26386/871	CAPACITOR-FIXED CERAMIC 4.7nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805-5C-472-KAT-00-J
C34	26386/759	CAPACITOR-FIXED CERAMIC 22nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	PHILIPS	1206-2R-223-K9-BB
C35	26451/003	CAPACITOR-FIXED ALUMINIUM 10uF +/-20% 16V ELECTROLYTIC, SURFACE-MOUNTED, SIZE 4.3 x 4.3mm,	PANASONIC INDUSTRIAL	ECE-V-1CA-100R
C36	26386/899	CAPACITOR-FIXED CERAMIC 100nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206-5C-104-KAT-00-J
C37	26386/899	CAPACITOR-FIXED CERAMIC 100nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206-5C-104-KAT-00-J
C38	26451/003	CAPACITOR-FIXED ALUMINIUM 10uF +/-20% 16V ELECTROLYTIC, SURFACE-MOUNTED, SIZE 4.3 x 4.3mm,	PANASONIC INDUSTRIAL	ECE-V-1CA-100R
C39	26451/001	CAPACITOR-FIXED ALUMINIUM 1uF +/-20% 50V ELECTROLYTIC, SURFACE-MOUNTED, SIZE 4.3 x 4.3mm,	PANASONIC INDUSTRIAL	ECE-V-1HA-010R
C40	26386/759	CAPACITOR-FIXED CERAMIC 22nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	PHILIPS	1206-2R-223-K9-BB
C41	26386/759	CAPACITOR-FIXED CERAMIC 22nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	PHILIPS	1206-2R-223-K9-BB
C42	26386/828	CAPACITOR-FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805-5A-221-JAT-00-J
D1	28357/028	DIODE RECTIFIER, 1N4004... 400V 1A 1.1Vf @ 1A, AXIAL, SOD-81, (TAPED).	PHILIPS	1N4004
D2	28357/028	DIODE RECTIFIER, 1N4004... 400V 1A 1.1Vf @ 1A, AXIAL, SOD-81, (TAPED).	PHILIPS	1N4004
D6	28383/901	DIODE SMALL-SIGNAL, BAV70... DUAL, 70V 100mA 1.1Vf @ 50mA, COMMON CATHODE, MARKING CODE A4, SURFACE	PHILIPS	BAV70
D7	28383/901	DIODE SMALL-SIGNAL, BAV70... DUAL, 70V 100mA 1.1Vf @ 50mA, COMMON CATHODE, MARKING CODE A4, SURFACE	PHILIPS	BAV70
D8	28371/412	DIODE ZENER, BZX84-C5V1... 350mW 5.1V 5% 250mA MARKING CODE Z2, SURFACE MOUNTED, SOT-23, (TAPED).	PHILIPS	BZX84-C5V1
D9	28371/412	DIODE ZENER, BZX84-C5V1... 350mW 5.1V 5% 250mA MARKING CODE Z2, SURFACE MOUNTED, SOT-23, (TAPED).	PHILIPS	BZX84-C5V1
IC1	28461/511	IC-ANALOGUE OPERATIONAL AMP OP275... DUAL, 15V BANDWIDTH PROD 9MHz, OFFSET 1.0mV, DRIFT 5uV/DEG.C,	ANALOG DEVICES LTD	OP275GS

REPLACEABLE PARTS

Cir. Ref.	IFR part number	Description	Manufacturer	Manufacturer's part no.
MAIN PCB (contd.)				
IC2	28461/505	IC-ANALOGUE OPERATIONAL AMP OP482... QUAD, JFET INPUT, LOW SUPPLY CURRENT, SLEW RATE 7V/ μ S MIN,	ANALOG DEVICES LTD	OP-482GS
IC3	28469/762	IC-ANALOGUE MULTIPLEXER DG409... 8 INPUT, DUAL, 15V 35 μ A DIFFERENTIAL 4 CHANNEL, RDS<100R, CMOS,	SILICONIX LTD	DG409DY
IC4	28461/839	IC-ANALOGUE A/D CONVERTER AD7880B... 5V 10 μ A 12 BIT, WITH TRACK/HOLD AMP, PARALLEL O/P, FULL POWER	ANALOG DEVICES LTD	AD7880BR
IC5	28466/414	IC-DIGITAL EXCLUSIVE-OR 74HC86... 2 INPUT, QUAD, CMOS-H/SPEED, 14 PIN, SMALL-OUTLINE.	PHILIPS	74HC86D
IC6	28462/148	IC-DIGITAL FLIP-FLOP/J-K 74HC112... 2 INPUT, DUAL, SET/RESET, NEG EDGE TRIGGER, CMOS-H/SPEED, 16 PIN,	PHILIPS	74HC112D
IC7	28461/001	IC-ANALOGUE D/A-CONVERTER AD7840... 5V 14mA 14 BIT, PARALLEL/SERIAL INTERFACE, 3V ZENER	ANALOG DEVICES LTD	AD7840KP
IC8	28461/388	IC-ANALOGUE OPERATIONAL AMP LM324D... QUAD, GEN-PURPOSE, SLEW RATE 0.2V/ μ S MIN, GAIN BANDWIDTH	PHILIPS	LM324D
IC9	28466/414	IC-DIGITAL EXCLUSIVE-OR 74HC86... 2 INPUT, QUAD, CMOS-H/SPEED, 14 PIN, SMALL-OUTLINE.	PHILIPS	74HC86D
L1	23642/535	INDUCTOR-FIXED 1 μ H +/- 5% MOULDED-EPOXY, 400mA 0R7 MAX, 30 Q @ 7.96 MHz, 120 MHz SRF, SURFACE	MEGGITT ELECTRONICS	3612-T-1R0-J
LS1	23646/153	BUZZER PCB-MOUNTING, 2 - 15V, 7mA TYP, 75 dBA, 4K Hz, 14mm DIA, 7.5mm HIGH, 2 PIN, 7.6mm PWP.	ROXBURGH ELECTRONICS	M3CPM121A0AWP-T
PLA	23435/188	TERMINAL CONNECTOR-PIN, 0.64mm SQUARE, 5.97mm HIGH, PCB-MOUNTING, SINGLE-ENDED, PHOSPHOR BRONZE,	DU PONT (UK) LTD	75401-001
R1	24811/213	RESISTOR-FIXED METAL-FILM 47K5 +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-47K5-1%50ppm
R2	24811/197	RESISTOR-FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF, (8mm	VISHAY COMPONENTS	SMM0204-10K-1%50ppm
R3	24811/211	RESISTOR-FIXED METAL-FILM 39K2 +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-39K2-1%50ppm
R4	24811/205	RESISTOR-FIXED METAL-FILM 22K1 +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-22K1-1%50ppm
R5	24811/189	RESISTOR-FIXED METAL-FILM 4K75 +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-4K75-1%50ppm
R6	24811/215	RESISTOR-FIXED METAL-FILM 56K2 +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-56K2-1%50ppm
R7	24811/245	RESISTOR-FIXED METAL-FILM 1M +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF, (8mm	VISHAY COMPONENTS	SMM0204-1M0-1%50ppm
R10	24811/197	RESISTOR-FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF, (8mm	VISHAY COMPONENTS	SMM0204-10K-1%50ppm
R11	24811/628	RESISTOR-FIXED METAL-FILM 90K9 +/- 0.1% 250mW 200V 15 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-90K9-0.1%-15
R12	24811/628	RESISTOR-FIXED METAL-FILM 90K9 +/- 0.1% 250mW 200V 15 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-90K9-0.1%-15
R13	24811/621	RESISTOR-FIXED METAL-FILM 11K +/- 0.1% 250mW 200V 15 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-11K0-0.1%-15
R14	24811/621	RESISTOR-FIXED METAL-FILM 11K +/- 0.1% 250mW 200V 15 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-11K0-0.1%-15

REPLACEABLE PARTS

Cir. Ref.	IFR part number	Description	Manufacturer	Manufacturer's part no.
MAIN PCB (contd.)				
R15	24811/606	RESISTOR-FIXED METAL-FILM 1K +/- 0.1% 250mW 200V 15 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-1K0-0.1%-15
R16	24811/606	RESISTOR-FIXED METAL-FILM 1K +/- 0.1% 250mW 200V 15 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-1K0-0.1%-15
R17	24811/616	RESISTOR-FIXED METAL-FILM 324R +/- 0.1% 250mW 200V 15 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-324R-0.1%-15
R18	24811/602	RESISTOR-FIXED METAL-FILM 10K +/- 0.1% 250mW 200V 15 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-10K0-0.1%-15
R19	24811/602	RESISTOR-FIXED METAL-FILM 10K +/- 0.1% 250mW 200V 15 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-10K0-0.1%-15
R20	24811/602	RESISTOR-FIXED METAL-FILM 10K +/- 0.1% 250mW 200V 15 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-10K0-0.1%-15
R21	24811/602	RESISTOR-FIXED METAL-FILM 10K +/- 0.1% 250mW 200V 15 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-10K0-0.1%-15
R22	24811/125	RESISTOR-FIXED METAL-FILM 10R +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF, (8mm	VISHAY COMPONENTS	SMM0204-10R-1%-50ppm
R23	24811/197	RESISTOR-FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF, (8mm	VISHAY COMPONENTS	SMM0204-10K-1%50ppm
R24	24811/197	RESISTOR-FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF, (8mm	VISHAY COMPONENTS	SMM0204-10K-1%50ppm
R25	24811/221	RESISTOR-FIXED METAL-FILM 100K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-100K-1%50ppm
R26	24811/197	RESISTOR-FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF, (8mm	VISHAY COMPONENTS	SMM0204-10K-1%50ppm
R27	24811/189	RESISTOR-FIXED METAL-FILM 4K75 +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-4K75-1%50ppm
R28	24811/189	RESISTOR-FIXED METAL-FILM 4K75 +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-4K75-1%50ppm
R29	24811/211	RESISTOR-FIXED METAL-FILM 39K2 +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-39K2-1%50ppm
R30	24811/211	RESISTOR-FIXED METAL-FILM 39K2 +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-39K2-1%50ppm
R31	24811/180	RESISTOR-FIXED METAL-FILM 2K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF, (8mm	VISHAY COMPONENTS	SMM0204-2K0-1%50ppm
R32	24811/180	RESISTOR-FIXED METAL-FILM 2K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF, (8mm	VISHAY COMPONENTS	SMM0204-2K0-1%50ppm
R33	24811/161	RESISTOR-FIXED METAL-FILM 332R +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-332R-1%50ppm
R34	24811/161	RESISTOR-FIXED METAL-FILM 332R +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-332R-1%50ppm
R35	24811/180	RESISTOR-FIXED METAL-FILM 2K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF, (8mm	VISHAY COMPONENTS	SMM0204-2K0-1%50ppm
R36	24811/180	RESISTOR-FIXED METAL-FILM 2K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF, (8mm	VISHAY COMPONENTS	SMM0204-2K0-1%50ppm
R37	24811/149	RESISTOR-FIXED METAL-FILM 100R +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-100R-1%50ppm
R38	24811/149	RESISTOR-FIXED METAL-FILM 100R +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-100R-1%50ppm
R39	24811/149	RESISTOR-FIXED METAL-FILM 100R +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-100R-1%50ppm
R40	24811/149	RESISTOR-FIXED METAL-FILM 100R +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-100R-1%50ppm

REPLACEABLE PARTS

Cir. Ref.	IFR part number	Description	Manufacturer	Manufacturer's part no.
MAIN PCB (contd.)				
R41	24811/141	RESISTOR-FIXED METAL-FILM 47R5 +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-47R5-1%50ppm
R42	24811/141	RESISTOR-FIXED METAL-FILM 47R5 +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-47R5-1%50ppm
R43	24811/141	RESISTOR-FIXED METAL-FILM 47R5 +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-47R5-1%50ppm
R44	24811/141	RESISTOR-FIXED METAL-FILM 47R5 +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-47R5-1%50ppm
R45	24811/141	RESISTOR-FIXED METAL-FILM 47R5 +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-47R5-1%50ppm
R46	24811/141	RESISTOR-FIXED METAL-FILM 47R5 +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-47R5-1%50ppm
R47	24811/141	RESISTOR-FIXED METAL-FILM 47R5 +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-47R5-1%50ppm
R48	24811/141	RESISTOR-FIXED METAL-FILM 47R5 +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-47R5-1%50ppm
R49	24811/141	RESISTOR-FIXED METAL-FILM 47R5 +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-47R5-1%50ppm
R50	24811/141	RESISTOR-FIXED METAL-FILM 47R5 +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-47R5-1%50ppm
R51	24811/197	RESISTOR-FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF, (8mm	VISHAY COMPONENTS	SMM0204-10K-1%50ppm
R52	24811/197	RESISTOR-FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF, (8mm	VISHAY COMPONENTS	SMM0204-10K-1%50ppm
R53	24811/197	RESISTOR-FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF, (8mm	VISHAY COMPONENTS	SMM0204-10K-1%50ppm
R54	24811/197	RESISTOR-FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF, (8mm	VISHAY COMPONENTS	SMM0204-10K-1%50ppm
R55	24811/197	RESISTOR-FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF, (8mm	VISHAY COMPONENTS	SMM0204-10K-1%50ppm
R56	24811/197	RESISTOR-FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF, (8mm	VISHAY COMPONENTS	SMM0204-10K-1%50ppm
R57	24811/173	RESISTOR-FIXED METAL-FILM 1K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF, (8mm	VISHAY COMPONENTS	SMM0204-1K0-1%-50ppm
R58	24811/228	RESISTOR-FIXED METAL-FILM 200K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	VISHAY COMPONENTS	SMM0204-200K-1%50ppm
TR2	28453/829	TRANSISTOR NPN BIPOLAR BC848B... 30V 200MHz 200mW 100mA 520hFE @ 2mA, NOISE 2dB @ 1KHz, MARKING CODE	PHILIPS	BC848B

REPLACEABLE PARTS

Cir. Ref.	IFR part number	Description	Manufacturer	Manufacturer's part no.
LCD PCB				
	44829/954	Complete unit	Issue 007	
C1	26451/001	CAPACITOR FIXED ALUMINIUM 1uF +/-20% 50V ELECTROLYTIC, SURFACE-MOUNTED, SIZE 4.3 x 4.3mm,	PANASONIC INDUSTRIAL	ECEV1HA010R
C2	26451/001	CAPACITOR FIXED ALUMINIUM 1uF +/-20% 50V ELECTROLYTIC, SURFACE-MOUNTED, SIZE 4.3 x 4.3mm,	PANASONIC INDUSTRIAL	ECEV1HA010R
C3	26422/347	CAPACITOR FIXED ALUMINIUM 470uF +/-20% 10V ELECTROLYTIC, RADIAL, 5mm PWP, 10mm DIA, 14mm	PANASONIC INDUSTRIAL	ECA1AFQ471
C4	26421/118	CAPACITOR FIXED ALUMINIUM 100uF +/-20% 6.3V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	PANASONIC INDUSTRIAL	ECE-A-0J-K-101-B
C5	26422/347	CAPACITOR FIXED ALUMINIUM 470uF +/-20% 10V ELECTROLYTIC, RADIAL, 5mm PWP, 10mm DIA, 14mm	PANASONIC INDUSTRIAL	ECA1AFQ471
C6	26386/899	CAPACITOR FIXED CERAMIC 100nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5C 104 KAT 00 J
C7	26386/899	CAPACITOR FIXED CERAMIC 100nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5C 104 KAT 00 J
C8	26386/899	CAPACITOR FIXED CERAMIC 100nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5C 104 KAT 00 J
C9	26386/899	CAPACITOR FIXED CERAMIC 100nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5C 104 KAT 00 J
C10	26386/818	CAPACITOR FIXED CERAMIC 33pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 330 JAT 00 J
C11	26386/818	CAPACITOR FIXED CERAMIC 33pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 330 JAT 00 J
C12	26386/818	CAPACITOR FIXED CERAMIC 33pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 330 JAT 00 J
C13	26386/820	CAPACITOR FIXED CERAMIC 47pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 470 JAT 00 J
C14	26386/899	CAPACITOR FIXED CERAMIC 100nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5C 104 KAT 00 J
D1	28373/275	DIODE ZENER, IN5359B 5W 24 V 5%, AXIAL, CASE-17	MOTOROLA INC.	IN5359B
D2	28624/136	LED RED, SIZE T1, 3mm DIA, HLMP-1301... 2.4 Vf TYP, 90 mA If MAX, 2.5 mcd @ 10mA - 60 DEG,	HEWLETT-PACKARD	HLMP-1301
D3	28383/901	DIODE SMALL-SIGNAL, BAV70... DUAL, 70V 100mA 1.1Vf @ 50mA, COMMON CATHODE, MARKING CODE A4, SURFACE	PHILIPS	BAV70
D4	28355/197	DIODE RECTIFIER, SCHOTTKY, 1N5817... 20V 1A 0.45Vf @ 1A, AXIAL, DO-41, (TAPED OR LOOSE).	MOTOROLA INC.	1N5817
D5	28383/903	DIODE SMALL-SIGNAL, BAV99... DUAL, 70V 100mA 1.1Vf @ 50mA, IN SERIES, MARKING CODE A7, SURFACE	PHILIPS	BAV99 (A7)
D6	28383/903	DIODE SMALL-SIGNAL, BAV99... DUAL, 70V 100mA 1.1Vf @ 50mA, IN SERIES, MARKING CODE A7, SURFACE	PHILIPS	BAV99 (A7)
D7	28383/903	DIODE SMALL-SIGNAL, BAV99... DUAL, 70V 100mA 1.1Vf @ 50mA, IN SERIES, MARKING CODE A7, SURFACE	PHILIPS	BAV99 (A7)
D8	28383/903	DIODE SMALL-SIGNAL, BAV99... DUAL, 70V 100mA 1.1Vf @ 50mA, IN SERIES, MARKING CODE A7, SURFACE	PHILIPS	BAV99 (A7)
D9	28383/903	DIODE SMALL-SIGNAL, BAV99... DUAL, 70V 100mA 1.1Vf @ 50mA, IN SERIES, MARKING CODE A7, SURFACE	PHILIPS	BAV99 (A7)

REPLACEABLE PARTS

Cir. Ref.	IFR part number	Description	Manufacturer	Manufacturer's part no.
LCD PCB (contd.)				
D10	28383/903	DIODE SMALL-SIGNAL, BAV99... DUAL, 70V 100mA 1.1Vf @ 50mA, IN SERIES, MARKING CODE A7, SURFACE	PHILIPS	BAV99 (A7)
D11	28383/903	DIODE SMALL-SIGNAL, BAV99... DUAL, 70V 100mA 1.1Vf @ 50mA, IN SERIES, MARKING CODE A7, SURFACE	PHILIPS	BAV99 (A7)
D12	28383/903	DIODE SMALL-SIGNAL, BAV99... DUAL, 70V 100mA 1.1Vf @ 50mA, IN SERIES, MARKING CODE A7, SURFACE	PHILIPS	BAV99 (A7)
D13	28624/136	LED RED, SIZE T1, 3mm DIA, HLMP-1301... 2.4 Vf TYP, 90 mA If MAX, 2.5 mcd @ 10mA - 60 DEG,	HEWLETT-PACKARD	HLMP-1301
IC1	28461/734	IC ANALOGUE VOLTAGE-REGULATOR 78L05AC... 5V 100mA POSITIVE, LINEAR, MONOLITHIC, 3 PIN, TO-92.	NAT. SEMICONDUCTOR	LM78L05ACZ
IC3	28459/083	TRANSISTOR P-CHANNEL-ENHANCE MOSFET SI9405DY... 20V 2W 3.7A 0R12 GATE THRESHOLD < 3V, SURFACE	SILICONIX LTD	SI9405DY
IC4	28459/083	TRANSISTOR P-CHANNEL-ENHANCE MOSFET SI9405DY... 20V 2W 3.7A 0R12 GATE THRESHOLD < 3V, SURFACE	SILICONIX LTD	SI9405DY
IC5	28459/083	TRANSISTOR P-CHANNEL-ENHANCE MOSFET SI9405DY... 20V 2W 3.7A 0R12 GATE THRESHOLD < 3V, SURFACE	SILICONIX LTD	SI9405DY
IC6	28461/778	IC ANALOGUE VOLTAGE-REGULATOR MAX631... 18V 135uA TYP, SWITCHING, STEP UP, 5V +/-5% OR ADJUSTABLE	MAXIM INTEG PRODUCTS	MAX631ACSA
IC7	28461/779	IC ANALOGUE VOLTAGE-REGULATOR MAX638... 18V 135uA TYP, SWITCHING, STEP DOWN, 5V OR ADJUSTABLE O/P,	MAXIM INTEG PRODUCTS	MAX638ACSA
IC8	28462/148	IC DIGITAL FLIP-FLOP/J-K 74HC112... 2 INPUT, DUAL, SET/RESET, NEG EDGE TRIGGER, CMOS-H/SPEED, 16 PIN,	PHILIPS	PC74HC112T
IC9	28461/676	IC ANALOGUE COMPARATOR LM311... 2 INPUT, SINGLE, 15V 500mW, LINEAR, MONOLITHIC, 8 PIN,	NAT. SEMICONDUCTOR	LM311M
L1	44291/054	WOUND-PART INDUCTOR, 300uH, RING-CORE, 55 TURNS, UNMOUNTED.	AMETHYST DESIGNS LTD	AD5357
L2	44291/055	WOUND-PART INDUCTOR, 116uH, RING-CORE, 34 TURNS, UNMOUNTED.	AMETHYST DESIGNS LTD	AD5357
LP1	44991/103	DISPLAY LIQUID CRYSTAL, 6970, 7 SEGMENT, 4 CHARACTER, 1 LINE, 10 ANNUNCIATORS & BAR DISPLAY,	HAMLIN ELECTRONICS EUROPE LTD	7858-313-400
PLA	23435/188	TERMINAL CONNECTOR-PIN, 0.64mm SQUARE, 5.97mm HIGH, PCB-MOUNTING, SINGLE-ENDED, PHOSPHOR BRONZE,	DU PONT (UK) LTD	75401-001
PLB	23435/188	TERMINAL CONNECTOR-PIN, 0.64mm SQUARE, 5.97mm HIGH, PCB-MOUNTING, SINGLE-ENDED, PHOSPHOR BRONZE,	DU PONT (UK) LTD	75401-001
PLC	23435/188	TERMINAL CONNECTOR-PIN, 0.64mm SQUARE, 5.97mm HIGH, PCB-MOUNTING, SINGLE-ENDED, PHOSPHOR BRONZE,	DU PONT (UK) LTD	75401-001
PLD	23435/188	TERMINAL CONNECTOR-PIN, 0.64mm SQUARE, 5.97mm HIGH, PCB-MOUNTING, SINGLE-ENDED, PHOSPHOR BRONZE,	DU PONT (UK) LTD	75401-001

REPLACEABLE PARTS

Cir. Ref.	IFR part number	Description	Manufacturer	Manufacturer's part no.
LCD PCB (contd.)				
R1	24811/159	RESISTOR FIXED METAL-FILM 274R +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-274R-1%50ppm
R2	24811/130	RESISTOR FIXED METAL-FILM 16R2 +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-16R2-1%50ppm
R3	24811/129	RESISTOR FIXED METAL-FILM 15R +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-157-1%50ppm
R4	24811/241	RESISTOR FIXED METAL-FILM 681K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-681K-1%50ppm
R5	24811/235	RESISTOR FIXED METAL-FILM 392K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-392K-1%50ppm
R6	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R7	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R8	24811/221	RESISTOR FIXED METAL-FILM 100K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R9	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R10	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R11	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R12	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R13	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R14	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R15	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R16	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R17	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R18	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R19	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R20	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R21	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R22	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R23	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R24	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R25	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R26	24811/270	RESISTOR FIXED METAL-FILM 10M +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10M-1% 50ppm

REPLACEABLE PARTS

Cir. Ref.	IFR part number	Description	Manufacturer	Manufacturer's part no.
LCD PCB (contd.)				
R27	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R28	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R29	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R30	24811/219	RESISTOR FIXED METAL-FILM 82K5 +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-82K5-1%50ppm
R31	24811/219	RESISTOR FIXED METAL-FILM 82K5 +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-82K5-1%50ppm
R32	24811/219	RESISTOR FIXED METAL-FILM 82K5 +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-82K5-1%50ppm
R33	24811/226	RESISTOR FIXED METAL-FILM 162K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-121K-1%50ppm
R34	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R35	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R36	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R37	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R38	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R39	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R40	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R41	24811/197	RESISTOR FIXED METAL-FILM 100K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R42	24811/211	RESISTOR FIXED METAL-FILM 100K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R43	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R44	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R45	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R46	24811/228	RESISTOR FIXED METAL-FILM 200K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-200-1%50ppm
R47	24811/215	RESISTOR FIXED METAL-FILM 56K2 +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-56K2-1%50ppm
R48	24811/221	RESISTOR FIXED METAL-FILM 100K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-100K-1%50ppm
R49	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R50	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R51	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R52	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm

REPLACEABLE PARTS

Cir. Ref.	IFR part number	Description	Manufacturer	Manufacturer's part no.
LCD PCB (contd.)				
R53	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R54	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
XL1	28312/143	CRYSTAL 8 MHz +/- 20 ppm, FUNDAMENTAL, 30pF PARALLEL RESONANCE, HC-49/U, WIRE LEADS.	SALFORD ELECTRICAL	8MHz.20/30/10/30
XL2	28312/050	CRYSTAL 0.032768 MHz +/- 15 ppm, 12pF PARALLEL RESONANCE, 35K ESR MAX, MAX DIMS - 3mm DIA, 8.2mm	MOTOROLA INC.	MTF32 CL12 32.768KHZ

DC Input Assembly

	44991/143	Complete unit	Issue 003	
C1	26386/987	CAPACITOR FIXED CERAMIC 10uF +/-10% 50V X7R MULTILAYER, AXIAL, GLASS COATED BODY	PHILIPS	C41C103K-DRM
IC1	28461/726	IC-ANALOGUE VOLTAGE - REGULATOR LM317T 37V 1.5 A POSITIVE ADJUSTABLE, LINEAR MONOLITHIC, 3 PIN	TEXAS INSTRUMENTS	LM317KC
IC2	23421/750	CONNECTOR JACK, SOCKET, 2 WAY, 12 VDC, 1A, PANEL MOUNTING, SOLDER TAG TERMS, BREAK SWITCH	CLIFF ELECTRONIC LTD	FC681445
IC3	43138/293	WIRE-LEAD-CRIMPED 4-WIRE, 16/0.2MM, CRIMP HOUSING 5-WAY, KEY POS 5, FREE END	IFR	

REPLACEABLE PARTS

Cir. Ref.	IFR part number	Description	Manufacturer	Manufacturer's part no.
Power Reference PCB				
	44829/981	Complete unit	Issue 007	
C1	26451/003	CAPACITOR FIXED ALUMINIUM 10uF +/-20% 16V ELECTROLYTIC, SURFACE-MOUNTED, SIZE 4.3 x 4.3mm,	PANASONIC INDUSTRIAL	ECEV1CA100R
C2	26451/003	CAPACITOR FIXED ALUMINIUM 10uF +/-20% 16V ELECTROLYTIC, SURFACE-MOUNTED, SIZE 4.3 x 4.3mm,	PANASONIC INDUSTRIAL	ECEV1CA100R
C3	26386/899	CAPACITOR FIXED CERAMIC 100nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5C 104 KAT 00 J
C4	26386/899	CAPACITOR FIXED CERAMIC 100nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5C 104 KAT 00 J
C5	26386/899	CAPACITOR FIXED CERAMIC 100nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5C 104 KAT 00 J
C6	26451/003	CAPACITOR FIXED ALUMINIUM 10uF +/-20% 16V ELECTROLYTIC, SURFACE-MOUNTED, SIZE 4.3 x 4.3mm,	PANASONIC INDUSTRIAL	ECEV1CA100R
C7	26386/875	CAPACITOR FIXED CERAMIC 10nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5C 103 KA6 CV J
C8	26451/003	CAPACITOR FIXED ALUMINIUM 10uF +/-20% 16V ELECTROLYTIC, SURFACE-MOUNTED, SIZE 4.3 x 4.3mm,	PANASONIC INDUSTRIAL	ECEV1CA100R
C9	26386/875	CAPACITOR FIXED CERAMIC 10nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5C 103 KA6 CV J
C10	26386/877	CAPACITOR FIXED CERAMIC 15nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5C 153 KAT 00 J
C11	26386/899	CAPACITOR FIXED CERAMIC 100nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5C 104 KAT 00 J
C12	26386/863	CAPACITOR FIXED CERAMIC 1nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5C 102 KAT 00 J
C13	26878/402	CAPACITOR VARIABLE PTFE 2pF to 15pF 200 ppm/DEG.C VERTICAL-PCB MOUNT, 5mm DIA, 5mm PWP, 2 PIN,	DAU COMPONENTS LTD	105-3901-015
C14	26386/819	CAPACITOR FIXED CERAMIC 39pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 390 JAT 00 J
C15	26386/820	CAPACITOR FIXED CERAMIC 47pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 470 JAT 00 J
C16	26343/784	CAPACITOR FIXED CERAMIC 68pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 680 JAT 00 J
C17	26386/816	CAPACITOR FIXED CERAMIC 22pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 220 JAT 00 J
C18	26343/784	CAPACITOR FIXED CERAMIC 68pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 680 JAT 00 J
C19	26386/875	CAPACITOR FIXED CERAMIC 10nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5C 103 KA6 CV J
C20	26386/875	CAPACITOR FIXED CERAMIC 10nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5C 103 KA6 CV J
C21	26386/827	CAPACITOR FIXED CERAMIC 180pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 181 JAT 00 J
C22	26386/829	CAPACITOR FIXED CERAMIC 270pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 271 JAT 00 J
C23	26386/875	CAPACITOR FIXED CERAMIC 10nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5C 103 KA6 CV J
C24	26386/875	CAPACITOR FIXED CERAMIC 10nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5C 103 KA6 CV J
C25	26386/863	CAPACITOR FIXED CERAMIC 1nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5C 102 KAT 00 J

REPLACEABLE PARTS

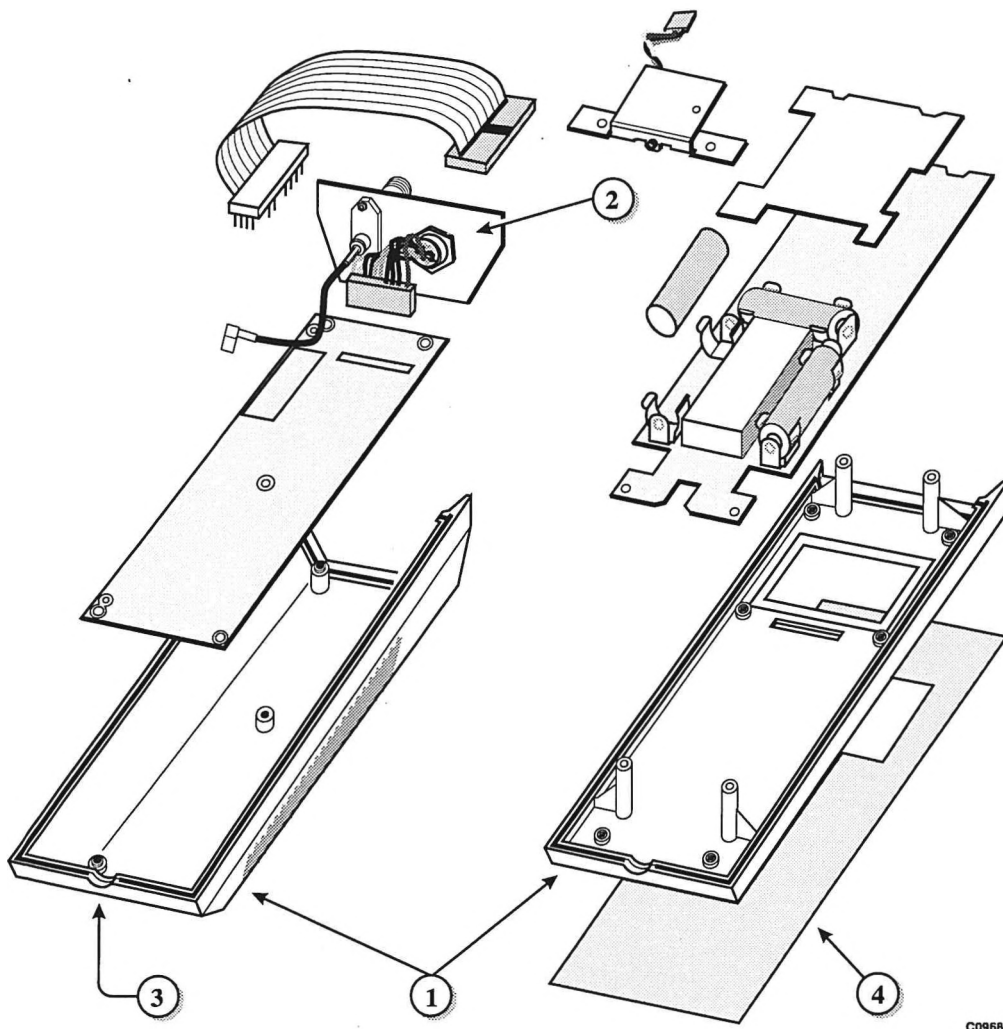
Cir. Ref.	IFR part number	Description	Manufacturer	Manufacturer's part no.
Power Reference PCB (contd.)				
D1	28349/007	DIODE SMALL-SIGNAL, SCHOTTKY, 1N5711... 250mW 70V 1Vf @ 15mA, AXIAL, HP-OUTLINE-15, (TAPED).	HEWLETT-PACKARD	1N5711
D2	28349/007	DIODE SMALL-SIGNAL, SCHOTTKY, 1N5711... 250mW 70V 1Vf @ 15mA, AXIAL, HP-OUTLINE-15, (TAPED).	HEWLETT-PACKARD	1N5711
IC1	28461/030	IC ANALOGUE SWITCH DG412... QUAD, 15V SPST, ON-RESISTANCE<35R, 4 x N/C @ LOGIC 1, TTL	SILICONIX LTD	DG412DY
IC2	28461/462	IC ANALOGUE OPERATIONAL AMP OP-290... DUAL, 36V 60uA SINGLE SUPPLY, LOW POWER, LOW OFFSET < 200uV,	ANALOG DEVICES LTD	OP-290GS
IC3	28461/791	IC ANALOGUE VOLTAGE-REFERENCE LT1019... 2.5V PRECISION, OUTPUT VOLTAGE DRIFT 20ppm/DEG.C MAX,	ANALOG DEVICES LTD	REF43GS
L1	23642/559	INDUCTOR FIXED 47uH +/- 10% COATED-LACQUER, MINIATURE, 140mA 9R6 MAX, 55 Q @ 2.5 MHz, 15 MHz	BICC-CITEC LTD	C11-406/8/27520/014
L2	23642/543	INDUCTOR FIXED 0.1uH +/- 20% COATED-LACQUER, MINIATURE, 2.8A 0R03 MAX, 50 Q @ 25 MHz, 500 MHz	SIGMA PRODUCTS LTD	10-10-0501-10
L3	23642/712	INDUCTOR FIXED 0.082uH +/- 5% MOULDED-EPOXY, 450mA 0R4 MAX, 27 Q @ 100 MHz, 900 MHz SRF, SURFACE	BICC-CITEC LTD	3612T-082-J
PLA	23444/334	CONNECTOR-RF SMB-TYPE MALE, RECEPTACLE, 50 OHMS, PCB-MOUNTING, NICKEL PLATED BODY.	ITT CANNON (UK)	051-051-0000-C90
PLB	23233/270	TERMINAL CONNECTOR-PIN, LOOP ASSEMBLY, 2 mm DIA, PCB-MOUNTING, WITH BORO-SILICATE GLASS INSULATOR,	BICC-VERO ELECTRONIC	20-2136J
PLC	23233/270	TERMINAL CONNECTOR-PIN, LOOP ASSEMBLY, 2 mm DIA, PCB-MOUNTING, WITH BORO-SILICATE GLASS INSULATOR,	BICC-VERO ELECTRONIC	20-2136J
PLD	23233/270	TERMINAL CONNECTOR-PIN, LOOP ASSEMBLY, 2 mm DIA, PCB-MOUNTING, WITH BORO-SILICATE GLASS INSULATOR,	BICC-VERO ELECTRONIC	20-2136J
PLE	23233/270	TERMINAL CONNECTOR-PIN, LOOP ASSEMBLY, 2 mm DIA, PCB-MOUNTING, WITH BORO-SILICATE GLASS INSULATOR,	BICC-VERO ELECTRONIC	20-2136J
PLF	23233/270	TERMINAL CONNECTOR-PIN, LOOP ASSEMBLY, 2 mm DIA, PCB-MOUNTING, WITH BORO-SILICATE GLASS INSULATOR,	BICC-VERO ELECTRONIC	20-2136J
R1	24811/642	RESISTOR FIXED METAL-FILM 7K5 +/- 0.1% 250mW 200V 15 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-7K5-0.1%-15
R2	24811/614	RESISTOR FIXED METAL-FILM 1K62 +/- 0.1% 250mW 200V 15 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-1K0-0.1%-15
R3	24811/611	RESISTOR FIXED METAL-FILM 9K09 +/- 0.1% 250mW 200V 15 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-9K09-0.1%-15
R4	24811/602	RESISTOR FIXED METAL-FILM 10K +/- 0.1% 250mW 200V 15 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K0-0.1%-15
R5	25748/507	RESISTOR VARIABLE CERMET LINEAR, 10K 10% 300mW 200V 100 ppm/DEG.C, MULTI-TURN, HORIZONTAL-PCB,	DALE ELECTROSIL LTD	784I-10K-10%

REPLACEABLE PARTS

Cir. Ref.	IFR part number	Description	Manufacturer	Manufacturer's part no.
Power Reference PCB (contd.)				
R6	24811/194	RESISTOR FIXED METAL-FILM 7K5 +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-7K5-1%50ppm
R7	24811/229	RESISTOR FIXED METAL-FILM 221K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-221K-1%50ppm
R8	24811/221	RESISTOR FIXED METAL-FILM 100K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-100K-1%50ppm
R9	24811/141	RESISTOR FIXED METAL-FILM 47R5 +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-47R5-1%50ppm
R10	24811/141	RESISTOR FIXED METAL-FILM 47R5 +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-47R5-1%50ppm
R11	24811/204	RESISTOR FIXED METAL-FILM 20K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-20K-1%50ppm
R12	24811/229	RESISTOR FIXED METAL-FILM 221K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-221K-1%50ppm
R13	24811/161	RESISTOR FIXED METAL-FILM 332R +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-332R-1%50ppm
R14	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
R15	24811/229	RESISTOR FIXED METAL-FILM 221K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-221K-1%50ppm
R16	24811/144	RESISTOR FIXED METAL-FILM 61R9 +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-61R9-1%50ppm
R17	24811/618	RESISTOR FIXED METAL-FILM 100R +/- 0.1% 250mW 200V 15 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204 100R 0.1%-15
R18	24811/127	RESISTOR FIXED METAL-FILM 12R1 +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-12R1-1%50ppm
R19	24811/159	RESISTOR FIXED METAL-FILM 274R +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-274R-1%50ppm
R20	24811/197	RESISTOR FIXED METAL-FILM 10K +/- 1% 250mW 200V 50 ppm/DEG.C, SURFACE MOUNTED, SIZE MINI-MELF,	DALE ELECTROSIL LTD	SMM0204-10K-1%50ppm
TR1	28459/210	TRANSISTOR N-CHANNEL-DEPLETION MOSFET BFR84... DUAL-GATE, 20V 200MHz 300mW 50mA TO-72.	PHILIPS	BFR84
	43138/387	CABLE ASSY (to LCD PCB, PLC)	IFR LTD.	

MISCELLANEOUS MECHANICAL PARTS

Item No.	Description	Part Number
Item numbers as shown in Fig. 6-1.		
1	Case, complete assembly	37591/647
2	Front panel	
	Standard 6970	41590/285
	6970 with Option 001	41590/286
3	Self-adhesive foot (4 off)	22315/794
4	Keypad membrane	44338/167



C0966

Fig. 6-1 Miscellaneous mechanical parts

Chapter 7

SERVICING DIAGRAMS

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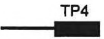
CIRCUIT NOTES

Component values

Resistors : R = ohms, k = kilohms, M = megohms.
Capacitor : μ = microfarads, n = nanofarads, p = picofarads.
Inductors : μ = microhenries, m = millihenries.
SIC : = value selected during test, nominal value shown.

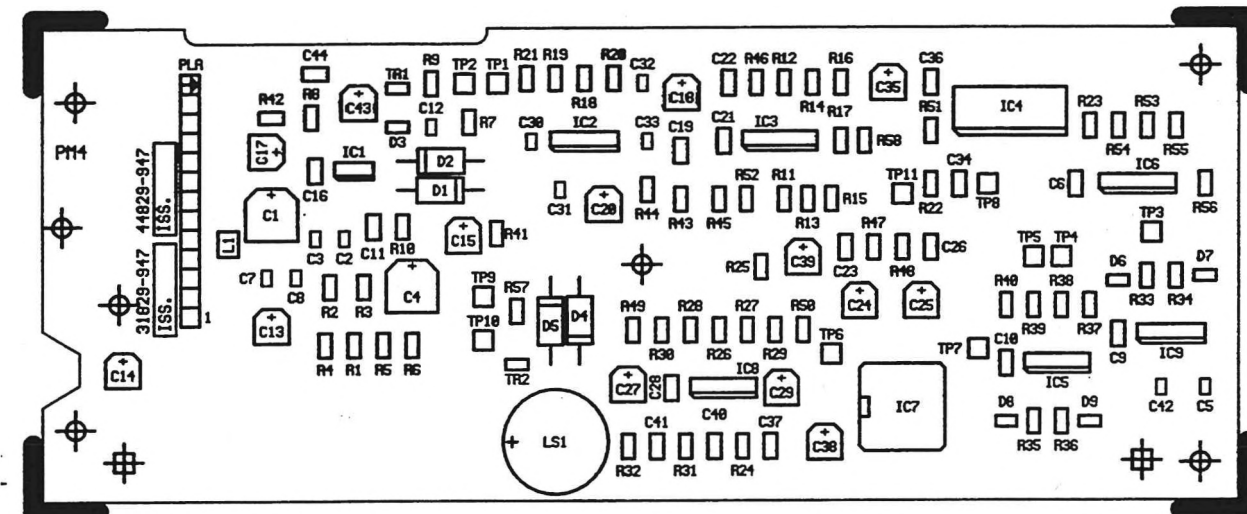
Symbols

Symbols are to BS 3939 with the following additions :

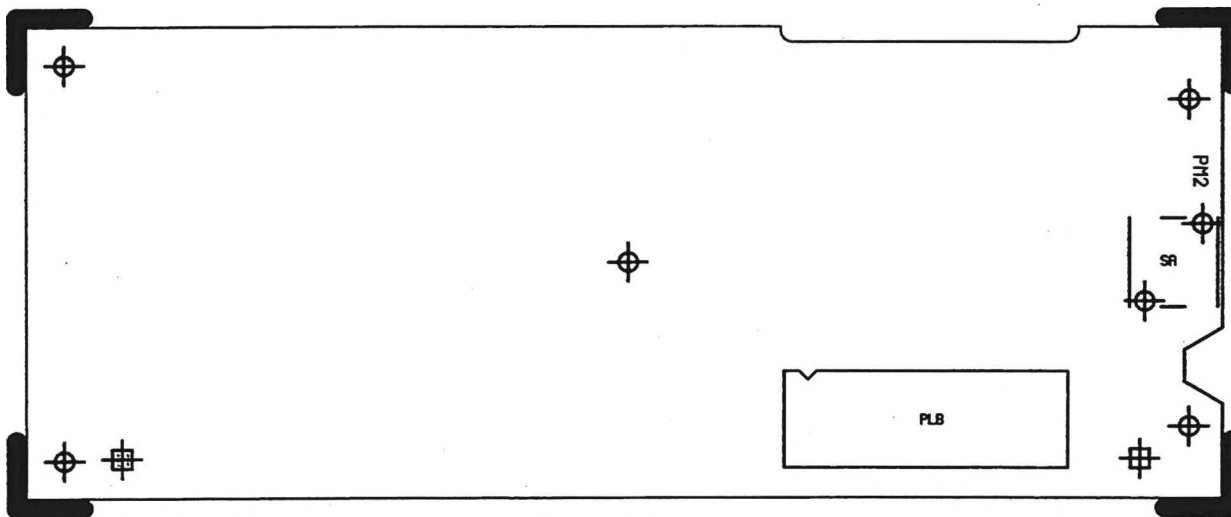
 Edge connector
 Test point
 Analogue ground

PCB layouts

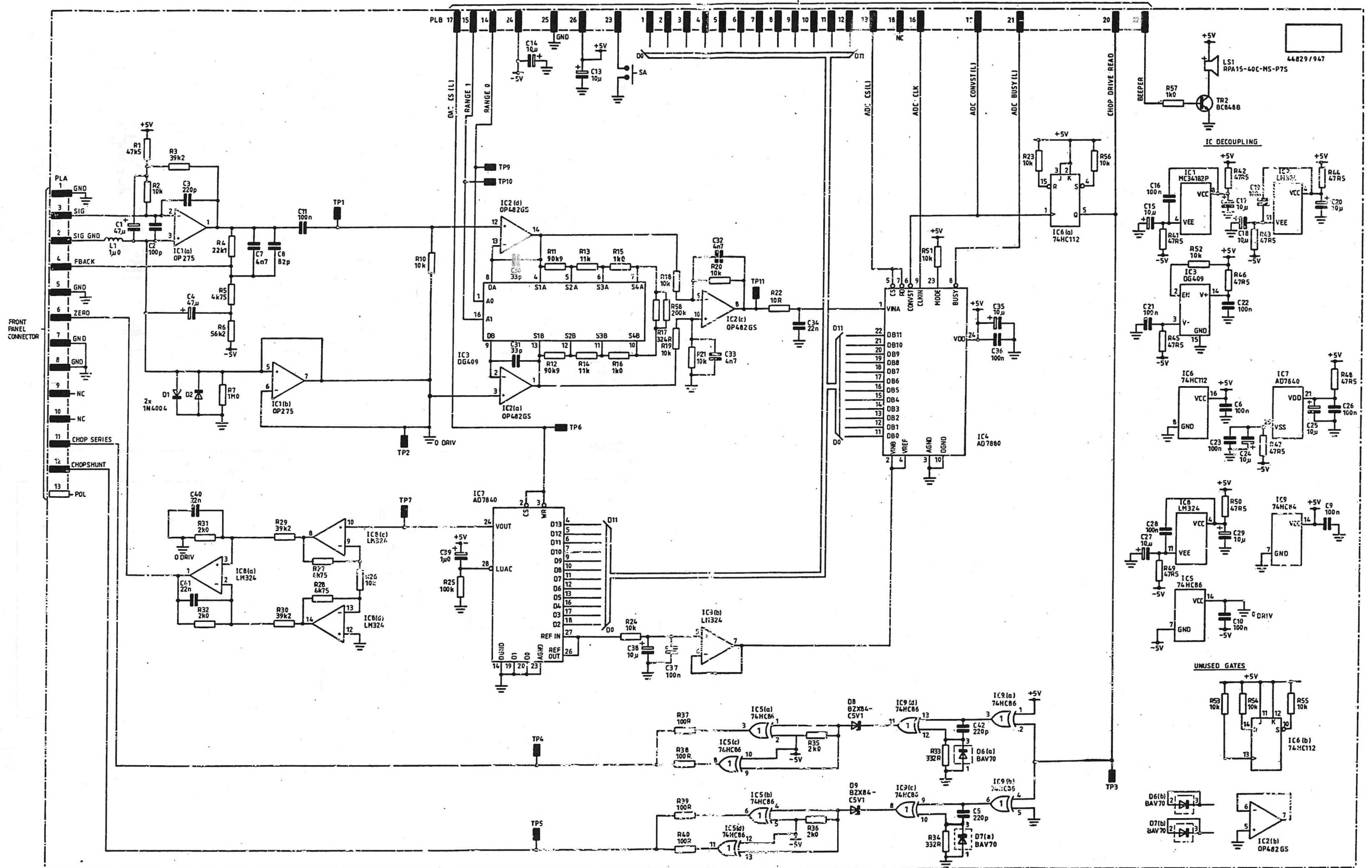
PCB layouts are shown as viewed from the component side.



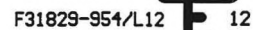
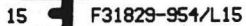
15 F31829-947/L15

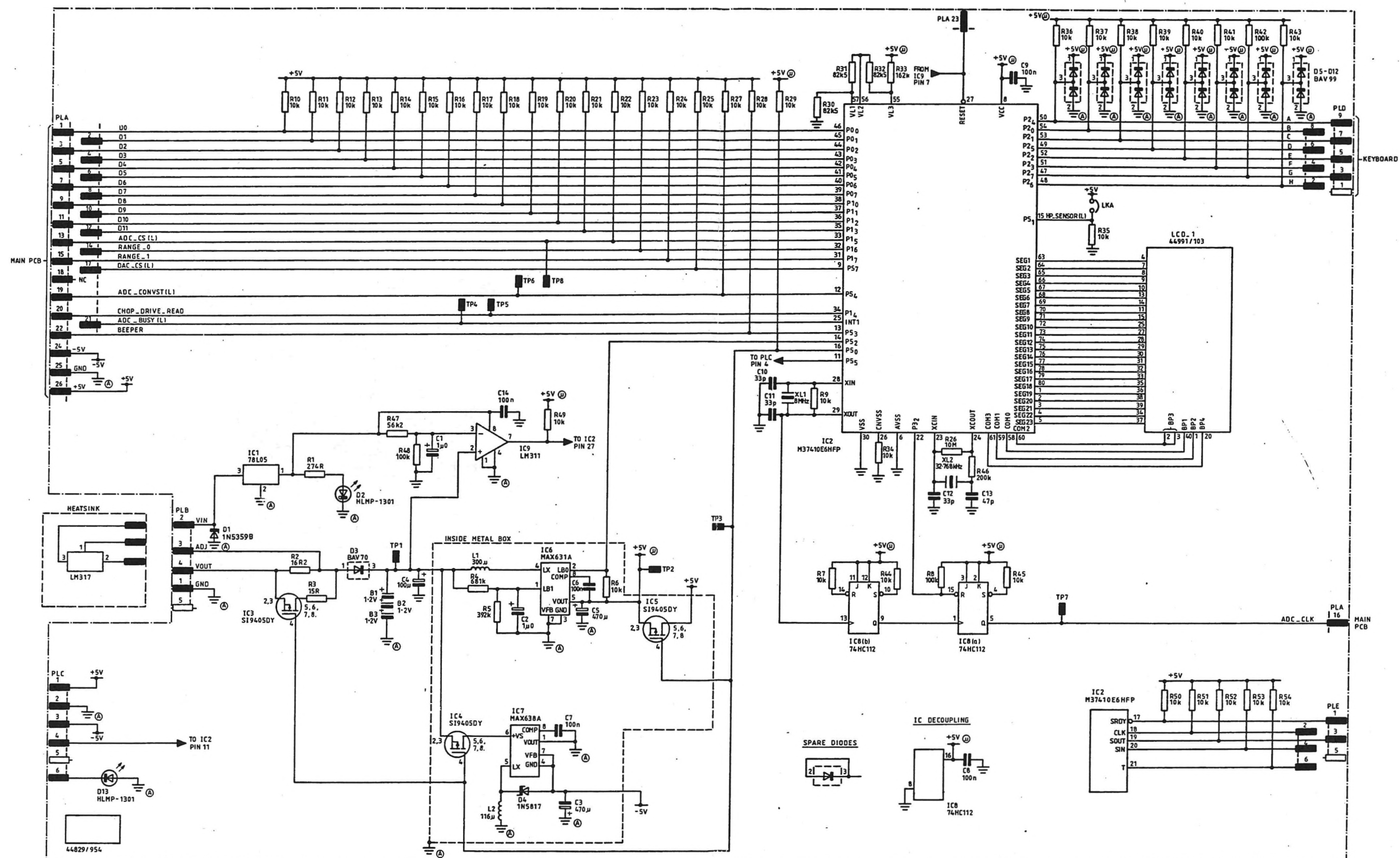


F31829-947/L12 12



Main PCB







Drg. No. 44829/981

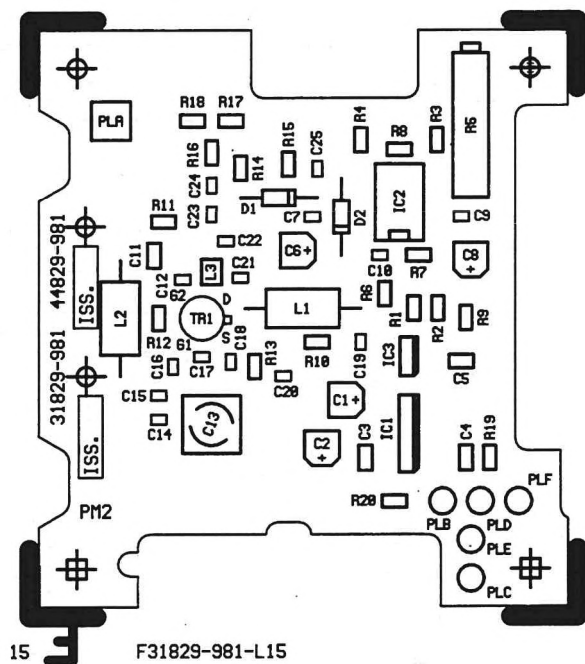


Fig. 7-5 Power Reference PCB: Component layout

Drg. No. ZZ44829/981 (Issue 2)

46882-207T

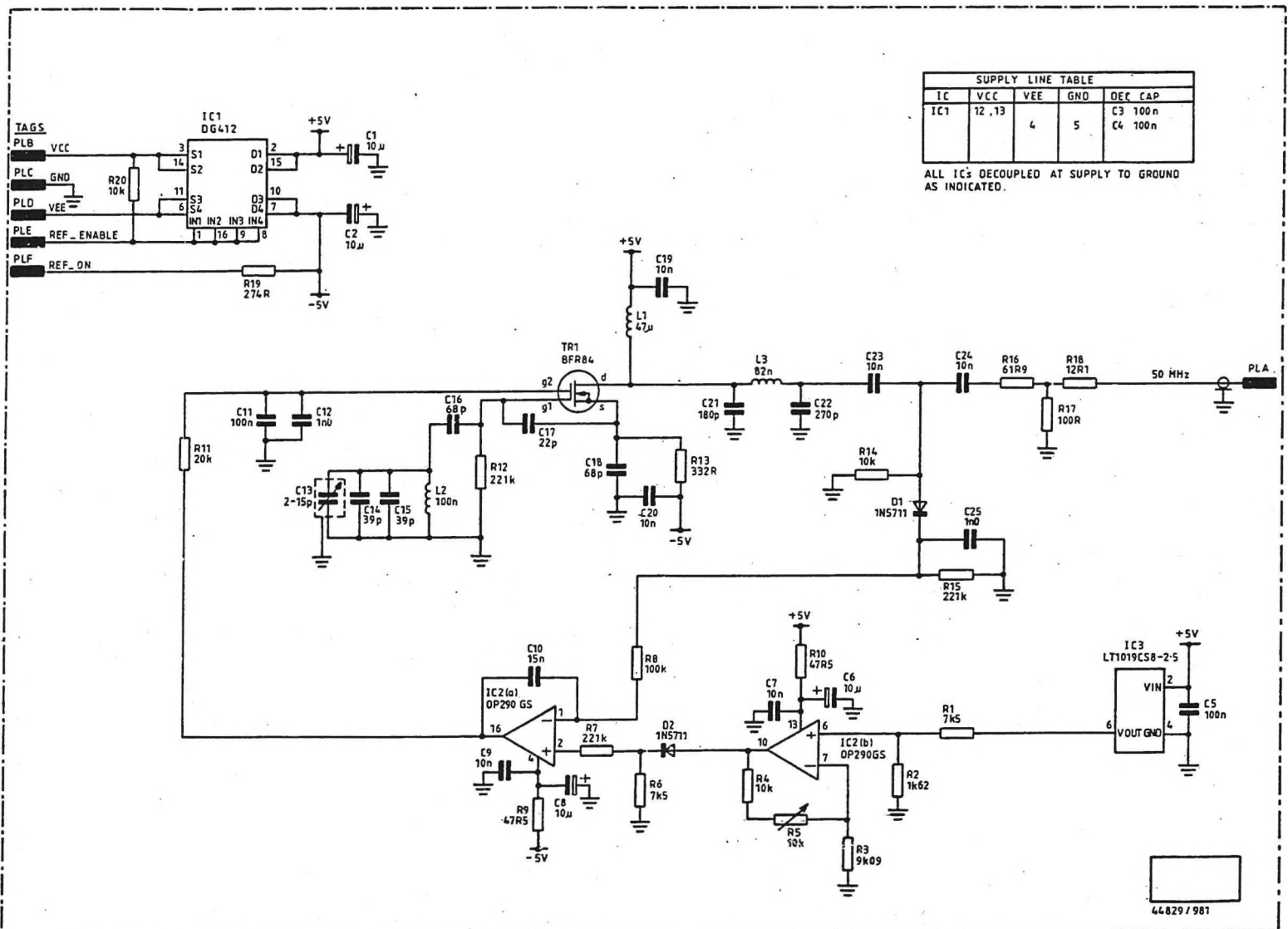


Fig. 7-6 Power Reference PCB: Circuit Diagram

Power Reference PCB

