

Jenway 6400/05

Spectrophotometer Service Manual

Section 1	Introduction
Section 2	Quick Reference
Section 3	System Description
Section 4	Optical Description
Section 5	Electronic Description
Section 6	Software Description
Section 7	Diagnostics
Section 8	Maintenance
Section 9	Circuit Diagrams
Section 10	Assembly Diagrams
Section 11	Spare Parts List

Section 1

Introduction

- 1.0 Index to Sections
- 1.1 About This Manual
- 1.2 Using This Manual
- 1.3 Warnings & Safe Practice
- 1.4 Standards & Certification
- 1.5 Ordering Spares
- 1.6 Returning Items
- 1.7 Contacting Jenway Limited

Introduction.

1.0 Index to Sections

Section 1 – Introduction

- 1.0 Index to Sections
- 1.1 About This Manual
- 1.2 Using This Manual
- 1.3 Warnings & Safe Practice
- 1.4 Standards & Certification
- 1.5 Ordering Spares
- 1.6 Returning Items
- 1.7 Contacting Jenway Limited

Section 2 - Quick Reference

- 2.0 About 'Quick Reference'
- 2.1 Specification
- 2.2 Main Sub-Assemblies
- 2.3 Power Supply Voltages
- 2.4 Signal Levels
- 2.5 Error Codes
- 2.6 Special Key Functions
- 2.7 Test Solutions

Section 3 - System Description

- 3.1 6400 & 6405 Comparison
- 3.2 Sub-Assemblies
- 3.3 Accessories
- 3.4 Outputs

Section 4 - Optical Description

- 4.1 Light sources
- 4.2 Stray Light Filters
- 4.3 Grating
- 4.4 Signal Detector

Section 5 - Electronic Description

- 5.1 Power Supplies
- 5.2 Deuterium Lamp Supplies
- 5.3 Detector Circuit
- 5.4 Microprocessor and Memory Functions
- 5.5 Accessory driver PCB

Section 6 - Software Description

- 6.0 Warning
- 6.1 Start Up Routine
- 6.2 Main Menu
- 6.3 Menu Options

Section 7 – Diagnostics

- 7.1 The Diagnostics Menu
- 7.2 Shutter and Filters
- 7.3 Lamp Control
- 7.4 Zero Order Cal.
- 7.5 Calibrate Functions
- 7.6 Wavelength Functions
- 7.7 Channel Outputs
- 7.8 Voltage Display
- 7.9 Motor Position sensor

Section 8 – Maintenance

- 8.1 Routine Maintenance
- 8.2 Dismantling
- 8.3 Energy Levels
- 8.4 Wavelength Calibration
- 8.5 A to D Calibration
- 8.6 D to A Calibration
- 8.7 Performance Verification

Section 9 - Circuit Diagrams

- 9.10 Power Supply Schematic 640 008
- 9.11 Power Supply Layout 640 008
- 9.20 Deuterium Lamp Supply Schematic 640 506
- 9.21 Deuterium Lamp Supply Layout 640 506
- 9.30 Detector PCB Schematic 640 009
- 9.31 Detector PCB Layout 640 009
- 9.32 Detector PCB Schematic 640 505
- 9.33 Detector PCB Layout 640 505
- 9.40 Microprocessor PCB Schematic 640 007
- 9.41 Microprocessor PCB Layout 640 007
- 9.50 Accessory Driver PCB Schematic 642 003
- 9.51 Accessory Driver PCB Layout 642 003

Section 10 - Assembly Diagrams

- 10.1 6400 Final Assembly 640 003
- 10.2 6405 Final Assembly 640 503
- 10.3 6400 Lower Case Assembly 640 505
- 10.4 6405 Lower Case Assembly 640 505
- 10.5 6400/05 Top Case Assembly 640 005
- 10.6 6400 Optics Assembly 640 017
- 10.7 6405 Optics Assembly 640 517
- 10.8 6400/05 Rear Panel Assembly 640 006
- 10.9 6400/05 Multi-cell Changer Assembly 644 002

Section 11 – Spare Parts List

- 11.01 Packed Instrument
- 11.02 Top Case Assembly
- 11.03 Microprocessor PCB
- 11.04 Lower Case Assembly
- 11.05 Lamp Housing Assembly
- 11.06 Monochromator Assembly
- 11.07 Detector PCB
- 11.08 Power Supply PCB
- 11.09 Deuterium Lamp Supply PCB
- 11.10 Rear Panel Assembly
- 11.11 Multi-Cell Changer PCB
- 11.12 Built-In Printer Option

1.1 About This Manual

This manual covers the service, maintenance, calibration and repair of the Jenway Ltd models 6400 and 6405 Spectrophotometers.

Throughout this manual all general statements and procedures should be considered to be relevant for both models. Where a statement or procedure is relevant to only one of the two models it will be clearly stated in *underlined italics*, to which model it relates, at the beginning of the relevant paragraph or section.

This manual must be used in conjunction with the Instruction Manual for these models, as many of the routine maintenance procedures detailed in the Instruction Manual are not repeated in this Service Manual.

1.2 Using This Manual

This manual is only for the use of Engineers and Technicians who have successfully completed a Jenway Ltd approved Service Training course on the 6400 and 6405 Spectrophotometers.

Updates to this manual will be circulated through the Jenway Ltd TSI (Technical Service Information) systems and to other registered users of this manual. Please complete the form at the rear of this manual to register your copy for future updates.

In practice Section 2 - Quick Reference and Section 8 – Maintenance, with the Diagrams in Section 9 and 10, will be most frequently used, however it is good practice to read the complete manual initially and review it again periodically.

To find the information required refer to the Main Index or Index to Sections to identify the relevant Section/page number required.

1.3 Warnings & Safe Practice

Disconnect the mains supply when any covers are removed as there are high voltages present inside the unit that pose the risk of electric shock at levels that are hazardous to life!

Do not look directly at the light sources or allow the light beam to fall directly on the eyes, switch off or dim the lamps (as described in the procedures) whenever possible and wear UV eye protection at ALL times.

Both the UV and visible lamps get very hot when in use, always allow time for them to cool down before removing them. Always wear cotton gloves when removing faulty lamps and replacing them with new ones.

Finger marks, dust and condensation can quickly destroy sensitive and expensive optical components, always wear cotton gloves when the optical bench is uncovered and handle any components by their edges only. Never touch optical surfaces. Do not remove optical covers unless the unit is in a clean, dust and condensation free environment.

Many of the reagents, solutions and standards used for maintenance and calibration are corrosive or hazardous, ensure all precautions supplied with them are followed, where there is any doubt request a MSDS (Material Safety Data Sheet) from the supplier.

These instruments can be used for analysing a broad range of samples, do not handle them unless you are qualified to do so. Ensure that the instrument has been correctly decontaminated before working on it, specifically in areas where the instrument may have been used for clinical, biological, corrosive or radioactive samples.

1.4 Standards & Certification

No adjustments should be made to these instruments unless the test and measurement equipment, signal source or filters to be used have a current calibration certificate that is traceable to national or international standards and that it is known that this test equipment

is currently performing to the certified standards. All solutions and reagents should be fresh and within any stated shelf life with a certificate of analysis.

1.5 Ordering Spares

When ordering spare parts as detailed in this manual please quote the Part Number and Description. These items should be ordered from the original supplier of the equipment or your local Jenway Limited Distributor.

1.6 Returning Items

Should it be necessary to return any item for any reason then this should be done through the original supplier of the equipment or your local Jenway Limited Distributor.

1.7 Contacting Jenway Limited

Before contacting Jenway Limited please check our web pages for any information or updates that may be helpful to you.

www.jenway.com

Emails should be sent to sales@jenway.com

Fax: +44 1371 821083

Phone: +44 1371 820122

Please note no items can be returned (or will be accepted by) Jenway Limited without a Returns Authorisation number (RA number) and a completed Safety Clearance and Decontamination certificate.

Section 2

Quick Reference

2.0 About ‘Quick Reference’

2.1 Specification

2.2 Main Sub-Assemblies

2.3 Power Supply Voltages

2.4 Signal Levels

2.5 Error Codes

2.6 Special Key Functions

2.7 Test Solutions

2.0 About 'Quick Reference'

This section contains a selection of the key information that is often forgotten or difficult to find when required. Use Quick Reference as a memory jogger, but for more information check out the references to the main sections on each point.

2.1 Specification

Also see Section 1.2 of the Instruction Manual.

Wavelength Range	<u>6400</u> 320nm to 1100nm <u>6505</u> 190nm to 1100nm
Wavelength Resolution	0.1nm
Wavelength Accuracy	1nm
Spectral Bandwidth	5.0nm
Light Source	Visible; Tungsten Halogen Ultra Violet; Deuterium
UV Lamp Auto Off	Selectable 320nm to 390nm
Optics	Single Beam
Transmittance	Range; 0 to 199.9% Resolution; 0.1% Accuracy; 0.1% at 10%T <0.5% at 340nm
Absorbance	Range; -0.300A to 3.000A Resolution; 0.001A Accuracy; 0.005A at 1.0A
Concentration	Range; -300 to 9999 Resolution; 0.001, 0.01, 0.1, 1 Units; ppb, ppm, $\mu\text{g l}^{-1}$, mg l^{-1} , g l^{-1} , M, %, blank.
Spectrum	Abs. %T or Conc. Against wavelength

Scan Interval	Scan Speed
5nm	1200nm/min
1nm	400nm/min
0.2	166nm/min

Stray Light	Less than 0.05% @340nm
-------------	------------------------

2.2 Main Sub-Assemblies

Also see Section 11 – Spare Parts

640 005 Top Case Assembly – includes the following...

640 058	Keypad
640 007	Microprocessor PCB
012 093	LCD Module

640 504 Lower case Assembly – includes the following...

640 510	Optics Assembly
640 025	Power Supply PCB
640 516	Deuterium Power supply PCB
640 505	6405 Detector PCB
640 009	6400 Detector PCB
644 001	Multi-cell Changer with PCB
060 342	Cooling Fan
010 039	Torroidal Transformer

640 510 Optics Assembly – includes the following...

012 075	Tungsten Halogen lamp
640 508	Deuterium Lamp
650 507	Monochromator assembly
032 005	12V Solenoid

Other Items – including...

016 058	1.6A Fuse for 220V supply
016 007	3.15A Fuse for 110V supply
017 050	Mains Switch
009 123	Mains Input Socket

2.3 Power Supply Voltages

Also see Section 9 - Circuit Diagrams

Before commencing more complex fault finding it is important to check all the internally generated supply voltages are correct. The following list is a useful guide to help quickly check these are functioning correctly. Not all the points where these voltages can be measured are given and where the voltage is stated as unregulated variations may occur. In general regulated supplies should vary by no more than $\pm 5\%$ from their nominal value.

Tungsten Lamp Supply, 12V dc regulated and set by VR1, measure at PL5 pin 3 with respect to PL5 pin 4 on the power supply PCB and at the terminals on the lamp base with the lamp fitted.

Solenoid, Relay and Fan Supplies, 12V dc regulated and pre-set, measure at PL5 pin 1 with respect to PL5 pin 2 on the power supply PCB and on the solenoid and fan terminals and at the cathode of D3 on the Deuterium Power supply PCB with respect to 0V.

Digital Supply, 5V dc regulated and pre-set, measure across C17 on the power supply PCB and across C62 on the microprocessor PCB.

Stepper Motor Drive, 30V dc unregulated, also acts as unregulated supply for all above, measure between Star3 and Star 2 on power supply PCB.

LCD Supply, -18V dc regulated and pre-set, measure across the outside pins of REG. 5 (7918) on the power supply PCB.

DAC Supply, 12V dc regulated and pre-set, measure across the top two pins of REG. 4 (7812) on the power supply PCB.

Deuterium PCB Supplies, 24V dc unregulated, measure across the top two pins of REG1 (7812) on the Deuterium Lamp Supply PCB. 12V dc regulated and pre-set, measure across the bottom two pins of REG. 1 (7812) on the Deuterium Lamp Supply PCB. 5V dc regulated and pre-set, measure across pins 4 and 8 of IC1 (LM311) on the Deuterium Lamp Supply PCB. 30V dc unregulated, measure

from the top of R120 (junction with R100) with respect to the top of R102 in the centre of the Deuterium Lamp Supply PCB. 14V dc regulated and pre-set, measure from the top of R101 with respect to the top of R102 on the Deuterium Lamp Supply PCB.

Deuterium Lamp Heater, 2.5V dc (1.0V when arc has struck) regulated and pre-set, measure across R9 on the Deuterium Lamp Supply PCB or between the two blue wires on pins 2 and 3 of the Deuterium Lamp Socket (SK1).

Deuterium Lamp Arc, 170V dc pulsed to strike, 300mA at 70V (Temperature Compensated) when arc has struck. Measure across R119 on the Deuterium Lamp Supply PCB and between pins 1 and 3 on the Deuterium Lamp Socket (SK1).

Detector PCB Supplies, 5Vdc regulated and pre-set, measure across D2 on the Detector PCB. -5V dc regulated and pre-set, measure across D3 on the Detector PCB.

Sampling Accessory PCB, 5Vdc regulated and pre-set, measure across C15. 15V dc regulated and pre-set, measure between R18 at junction with REG 2 and junction of D1 and C22.

2.4 Signal Levels

Also see Section 7.02 - Shutter and Filters and 8.3 – Energy Levels

All analogue signal processing is dealt with on the Detector PCB. Relevant signals from this PCB are shown in the Diagnostics Screen as a Voltage, in mV, and CH0, CH1 and CH2 in 'counts' directly from the A to D converter. For more detailed definitions of these terms see Section 5.3 - Detector Circuit and Section 7.01 – The Diagnostics Menu, Section 7.02 – Voltage Display and Section 7.03 Channel Outputs.

The Voltage Display can be used to check lamp energy (ageing), the correct functioning of the IR Stray Light filter and the UV Stray Light Filter as well as the Dark Shutter.

6405

U V Energy, Set wavelength to 190nm, Dark Shutter open, IR stray light filter closed, UV second order stray light filter open; Voltage Display must be greater than 20mV.

6400/6405

Visible Energy, Set wavelength to 805nm, Dark Shutter open, IR stray light filter open, UV second order stray light filter closed; Voltage Display must be greater than 1000mV and less than 3600mV.

Dark Current, Set wavelength to 320nm, Dark Shutter closed, IR stray light filter closed, UV second order stray light filter open; Voltage Display should be zero +/- 6mV.

320nm Output, Set wavelength to 320nm, UV lamp off, Dark Shutter open, IR stray light filter closed, UV second order stray light filter open; Voltage Display must be greater than 17mV.

2.5 Error Codes

See also Section 8 of the Instruction Manual

A number of dialogue boxes are generated with messages relating to fault conditions, these are detailed below with a brief description of some of the most common causes for these errors.

Self Test Failure, If any of the power-on self tests have been failed this message is displayed. The check box for the specific test that has failed will be marked with a cross (X).

Warning – Operating Parameters Corrupt Restoring To Default Settings, This warning message indicates that the contents of the non-volatile memory has been corrupted. This may be due to a failure of the battery back up, or that the battery has become discharge if the instrument has not been used for several months. It may also occur by switching off, or a power interruption, during a save or retrieve operation. Acceptance of the warning by pressing the enter key will enable normal operation to continue with the default settings loaded, all previously stored settings will be lost.

Dark Level Too High, Sample chamber cover left open during start up tests or a calibration, dark shutter stuck open, solenoid or solenoid drive/connections faulty, Detector PCB failure.

Light Level Too Low, Blank too optically dense, plastic or glass cuvettes used in the UV range, miss-alignment of cell carriage, wrong lamps fitted, lamps miss-aligned, dark shutter stuck closed. This may also be due to the contamination of optical surfaces.

Unable To Detect Peak Level, Cuvette left in sample chamber during start up tests, miss-aligned cell carriage, wrong lamps fitted, miss-aligned lamps or lamp carriage, contaminated optical component.

Error, Unable to Acquire Dark Level, This message will be shown if the dark level cannot be achieved during the start up tests, possible causes will be similar to those listed under 'Dark level too high' above.

Fatal Error, Calibration Failure, Grating position opto-coupler faulty or connections broken/intermittent, incorrect wavelength calibration carried out, check connections to stepper motor and check PL3 connections on Power Supply PCB.

Invalid Slope Range, The standard used to calibrate a concentration measurement cannot give the standard value entered, this can be because the standard is too optically dense or too similar to the blank. Alternatively the incorrect standard value may have been entered.

Warning Tungsten Lamp Failure, Tungsten lamp filament broken, wrong type of tungsten lamp fitted, no tungsten lamp fitted, cables to lamp base broken/damaged, check SK4 on power supply PCB.

Warning Deuterium Lamp Failure, Deuterium lamp faulty, cable disconnected, 6400 set up as 6405.

Fatal Error, System Calibration Data Failure, During the start up test sequence the microprocessor has been unable to detect the calibration data stored in the E²PROM on the Detector PCB. This may indicate a faulty Detector PCB or that the connections to the Detector PCB are not made or are intermittent.

2.6 Special Key Functions

There are a number of special key functions for use by trained engineers, do not use them unless you are fully conversant with all the procedures these invoke.

Power On Reset, Hold the <Enter> key depressed while turning on the power. This clears the operator set parameters held in non-volatile memory and is useful in correcting many software conflicts.

Skip Power On Tests, Hold the decimal point <.> key depressed while turning the power on, this function must only be used for fault finding procedures, taking readings on an instrument started in this way will produce unpredictable errors.

Diagnostics Mode, Hold the right arrow <>> key depressed while turning the power on, do not enter this mode unless you have the correct training and equipment, making adjustments here can permanently damage the instrument.

2.7 Test Solutions

1. Holmium Perchlorate – 5% w/v solution of Holmium Oxide in 1.4N Perchloric acid, this will give absorbance maxima at 241.0, 278.1, 287.0, 361.4, 416.1, 451.1, 485.3, 536.5 and 640.5nm.
2. Potassium Dichromate – 100.0mg/l in 0.005M Sulphuric Acid (use the Sulphuric Acid as the blank). This will give Absorbance values of 1.071 at 350nm, 0.484 at 313nm, 1.444 at 257nm, 1.242 at 235.
Potassium Dichromate – 50.0mg/l in 0.005M Sulphuric Acid (use the Sulphuric Acid as the blank). This will give Absorbance values of 0.536 at 350nm, 0.242 at 313nm, 0.722 at 257nm, 0.621 at 235.
3. Sodium Nitrate – 50g/l in deionised water, should give less than 0.1% transmittance at 340nm.
Sodium Iodide – 10g/l in deionised water, should give less than 0.1% transmittance at 220nm.

All these solutions are hazardous and the manufacturer/suppliers safety precautions should be carefully followed at all times in preparation, use and storage.

Section 3

System Description

3.1 6400 & 6405 Comparison

3.2 Sub-Assemblies

3.3 Accessories

3.4 Outputs

3.1 6400 & 6405 Comparison

The models 6400 and 6405 share the majority of common sub-assemblies. However the 6400 is not fitted with the Deuterium Lamp power Supply PCB and of course the Deuterium Lamp itself.

Because of this the optics and monochromator are slightly different, but in arrangement only.

The Detector, hence Detector PCB is specific to each model, 640 009 for the 6400 and 640 505 for the 6405. (See Section 5.3 Detector Circuit).

3.2 Sub-Assemblies

The 6400 and 6405 can easily be broken down into sub-assemblies for the purposes of repair or replacement. All the PCBs are easily removed, see Section 8.2 – Dismantling. The monochromator and lamp carriage, which together contain most of the optical components are both replaceable sub-assemblies. There are a number of sampling accessories that can be fitted into the sample compartment and removed with very little dismantling.

See Section 2.2 for details of the main sub-assemblies and Section 11 for details of other spare parts. The following paragraph lists the sampling accessories available.

3.3 Accessories

The following sampling and temperature control accessories are available, where necessary additional service information for these accessories is available on request. The development of other sampling accessories is continuous, please check current brochures or www.jenway.com for up-to-date information.

644 001	Motorised Eight Position Cell Holder
644 003	Rack to Hold 10mm Cells for Above
649 001	Water Jacketed Cell Holder as Above
648 001	Water Jacketed Single Cell Holder
642 001	Sipper Pump
647 001	Temperature Controlled Sipper Pump

645 001	Vacuum Pump
643 001	Peltier Temperature Control System
646 002	Universal Test Tube Holder
630 003	20 to 100mm Single Cell Holder

Other accessories include:

641 001	Internal 40 Column Printer
542 009	Interface Cable Kit
640 133	Dust Cover

3.4 Outputs

The 6400 and 6405 have both analogue and RS232 outputs.

Details of the level of the analogue output for the different ranges that may be selected on the instruments is given in Section 6.3 of the Instruction Manual.

Pin configuration for the RS232 socket is given in Section 6.2 of the Instruction Manual. Section 6.1 of the Instruction Manual gives details of the various ASCII codes that may be transmitted to the 6400 or 6405 to remotely control them.

Section 4

Optical Description

4.1 Light Sources

4.2 Stray Light Filters

4.3 Grating

4.4 Signal Detector

4.1 Light Sources

The model 6400 uses a single Tungsten Halogen lamp to cover its full wavelength range of 320nm to 1100nm.

The model 6405 uses the same Tungsten Halogen lamp with a 'see through' Deuterium lamp to cover its wavelength range of 190nm to 1100nm.

The use of the 'see through' Deuterium lamp enables both lamps to be on in the low energy area, found at high UV wavelengths, reducing the typical energy dip. It also eliminates the spikes created in systems that use a lamp changeover mirror.

It is still possible to switch off the Deuterium lamp to save lamp life when working only in the visible region and the 'switch off' point can be selected between 320nm and 390nm.

The lamps are both pre-aligned and can be simply replaced by removing the lamp carriage after the lamp access panel has been removed. See Sections 4.2 and 4.3 of the Instruction Manual.

4.2 Stray Light Filters

6405 The 6405 uses three stray light filters.

The first filter is located between the Tungsten and Deuterium lamps. This filter is solenoid actuated and is switched into the light path between 0nm and 390nm to eliminate unwanted Infra Red light. (Part number 035 105)

The second filter is located after the Deuterium lamp, inside the monochromator, is solenoid actuated and is switched into the light path between 390nm and 1100nm to eliminate unwanted UV light. (Part number 035 109)

The third filter is mechanically linked to the grating mount and is in the light path between 550nm and 1100nm to eliminate unwanted second order diffraction. (Part number 035 036)

6400 The 6400 uses two stray light filters

The first filter is located after the tungsten lamp inside the monochromator. This filter is solenoid actuated and is switched into the light path between 0nm and 390nm to eliminate unwanted Infra Red light. (Part number 035 106)

The second filter is mechanically linked to the grating mount and is in the light path between 550nm and 1100nm to eliminate unwanted second order diffraction. (Part number 035 036)

4.3 Grating

The 6400 and 6405 optics use the same grating, this is a concave holographic grating with 1200 lines per mm

The grating is directly coupled to the stepper motor, which is under microprocessor control, thus reducing backlash and mechanical errors.

4.4 Signal Detector

Photo diode detectors are used on both models; an S1133 type on the 6400 and the UV enhanced version S1337 on the 6405.

The detector PCB carries out all the analogue signal processing and each one carries its own calibration data stored in an on-board E²PROM. The detector PCB also communicates with the microprocessor to set the instrument for UV/visible (6405) or visible (6400) operation. For more information see Section 5.3 – Detector Circuit.

Section 5

Electronic Description

5.1 Power Supplies

5.2 Deuterium Lamp Supplies

5.3 Detector Circuit

5.4 Microprocessor and Memory Functions

5.5 Accessory Driver PCB

5.1 Power Supplies

The ac mains supply is reduced by the torroidal transformer giving five low voltage outputs from the secondary windings. Each secondary is protected by a re-settable fuse which will go open circuit when excess current is drawn, when the current is reduced to normal the fuse will re-set. A 5A fuse is fitted for the 20V winding, 0.2A fuses for the 15V and 9V windings and 2.5A fuses for the 16V and 18V windings.

The 20V ac output from the transformer is rectified by D1; the 30V dc output from this rectifier is used as the input to three L4960 switch mode regulators. (REG1, REG 2 and REG 3).

Tungsten Lamp Supply, The output of the switch mode regulator REG 3 is set to 12V dc by VR1. The 10K NTC thermistor (R22) adds temperature compensation to this output voltage reducing warm up time and thermal drift. The 12V output can be reduced to 5.1V by a logic '1' on the gate of TR5 switching TR3. This happens during the start up tests to reduce the light level for accurate zero order detection, it can also be manually instigated by pressing key 5 when in the Diagnostics Menu. Increased current flow through the 0V return from the lamp is detected by TR1 to confirm that the lamp is functioning (i.e. the lamp filament is intact).

Solenoid, Relay and Fan Supply, The output of the switch mode regulator REG2 is pre-set to 12V. The output to the two fans is via PL12 pin 1 and 2 and PL5 pins 1 and 2.

The output to solenoid 1 (Dark Shutter) is via PL1 pin 1 and it is switched on when SK4 pin 27 goes high, this switches TR2 to make PL1 pin 4 low.

The output to solenoid 2 (IR Stray Light Filter) is via PL1 pin 2 and it is switched on when SK4 pin 22 goes high, this switches TR4 to make PL1 pin 5 low.

The output to solenoid 3 (UV (Second Order) Stray Light Filter) is via PL1 pin 3 and it is switched on when SK4 pin 14 goes high, this switches TR6 to make PL1 pin 6 low.

The 12V supply to the UV strike relay goes via SK9/PL9 pin 6 to the Deuterium Lamp supply PCB where it is tracked to the relay. The relay is switched when SK4 pin 23 goes high switching TR7 to make SK9/PL9 pin 7 low.

5V Digital Supply, The output of the switch mode regulator REG 1 is pre-set to 5V and the output is distributed via SK4 pin 1.

The 15V secondary winding of the transformer is half wave rectified by D5 and D6 to generate the following supplies:

LCD and DAC Supplies, The 7918, -18V regulator gives a -18V output on SK4 pin 28 this is then routed to the LCD supply. The 7812, 12V regulator gives a 12V output. This is tracked to IC200, and the associated circuitry that makes up the DAC. Calibration data for the DAC is stored in the E²PROM IC201.

5.2 Deuterium Lamp Supplies

In the Deuterium lamp the gas is initially heated by an element powered at 2.5V. An arc is struck between the Anode and cathode at around 750V, when the arc is established it is maintained at a constant current of 300mA at 70V while the heater voltage is reduced to 1V.

A local supply of 12V dc is generated from the 16V ac winding of the transformer. This 12V supply is then used to generate a regulated 5V supply.

The 20V ac winding of the transformer is used to generate an unregulated 30V supply.

The boost regulator circuit based around the pulse width modulator IC100 uses this 30V to generate a 170V supply. This supply is then switched across the auto-transformer L2 by relay RLY1a to increase this voltage to about 750V, sufficient to strike the arc.

When the arc has been struck IC101a and TR100 maintain the current at 300mA. Power is kept to a minimum at varying temperatures by R122, a 10K NTC Thermistor. TR101 detects the current flow and an output is sent to the microprocessor via PL9 pin 11.

The heater voltage is generated by the high side driver IC2, this will be 2.5V until a signal from the microprocessor, isolated by IC3 switches the comparator IC1a, which in turn reduces the heater voltage to 1V. The watchdog IC4 ensures that the comparator is continually updated.

5.3 Detector Circuit

Detectors and Amplifiers

The detector PCB's (640 009 for the 6400 and 640 505 for the 6405) are identical except for the photodiode detector and the pre-set programming that determines whether the unit is either a 6400 or 6405. The photodiodes fitted will be an S1133 for the Model 6400 or the UV enhanced version S1337 for the 6405.

The current through the detector is proportional to the incident light. IC3a acts as a current to voltage converter, the gain being set by the feedback resistors in the T network.

IC1 is a low pass filter that attenuates frequencies of 50Hz or greater from the signal. In normal operation pins 3 and 4 of SK2 are linked so the signal passes to the three remaining amplifiers of IC1. IC1b is set for unity gain, IC1c has a gain of 10 and IC1d a gain of 100.

A to D Conversion

Each of these amplified signals then pass into the first three channels (CH0 to CH2) of an 8 channel, 12 bit, serial, A to D converter.

All three channels are converted and the microprocessor selects the channel that gives the best resolution without reaching saturation (32767 counts). In effect this means CH2 will be selected for inputs up to 40mV, CH1 for inputs up to 400mV and CH0 for inputs up to 4.0V.

The A to d converter requires a reference voltage of 4.096V which is generated from the -5V rail by D4, this is inverted to a positive value by IC5d and fed to pin 14, Ref+, of the A to D converter, IC2.

The E²PROM, IC4, maintains calibration data for the PCB, see Section 8.6 - A to D Calibration as well as programming the unit for visible (6400) or UV/visible (6405) operation.

5.4 Microprocessor and Memory Functions

EPROM

IC3 is a 256K byte EPROM that contains the software code for the executable programme. Its label will show the software version number and date it was programmed.

RAM

User Variables that are input during operation are stored in battery backed RAM (IC1 supported by Bat 1). User variables are data generated from operator input for values such as wavelength limits for scanning, calibration data for concentration and quantitation measurements, run time for kinetics etc, etc. These values can be re-set to their factory set default values by the Reset Parameters function in the Instrument Setup Menu or by performing a power on re-set, see Section 2.6, Special Key Functions.

Peripherals

Active time and date information is generated and stored by the real time clock IC18, the data stored here can be re-set through the 'Clock Setup' function in the 'Instrument Setup' menu.

IC2 is the 'watchdog', which monitors the supplies and back up battery. It re-sets the instrument if these fall below critical levels.

The optional internal printer is driven directly from the microprocessor via PL3. Under no circumstances should this device be connected or disconnected with power supplied to the instrument.

Microcontroller

IC5 is the microcontroller, a Hitachi H8/3002 device running at 12MHz. This integrates system support functions together with an H8/300H CPU core with a 32 bit internal architecture. Of the system support functions the internal timer (ITU), serial communications interface (SCI), A to D converter and I/O ports are used to reduce the number of external components required.

Display Drive and Contrast

IC4 and IC6 are used to reduce the clock speed for running the LCD. The LCD contrast is pre-set in manufacture by VR1 and temperature compensated by TR1 at 10mV per degree C. Operator

adjustment of the contrast is through the software via the digital potentiometer IC13, this adjusts the output of IC11a to values around –10V at VLCD on PL1.

Keypad and RS232 Interface

The keypad interface uses the A to D converter built into the microcontroller. The eight resistors, R21 to R28 form a potential divider from the +5V to 0V levels. This gives 7 discrete voltage levels on pins 4 to 10 of PL4. These form a matrix with the 3 keypad input ports (KEYINP0, KEYINP1, KEYINP2) on PL4 pins 1,2 and 3. In this way up to 21 keys can be recognised by a specific voltage on its relevant port.

The RS232 output is generated by IC8 and routed via PL2 to the power supply PCB and hence to the rear panel socket.

5.5 Accessory Driver PCB

Both 6400 and 6405 models can be fitted with the optional Accessory Driver PCB. This is capable of driving all internal sampling accessories and makes available supplies and controls for driving external modules such as the peltier/sipper accessory.

Local supplies of 5V and 12V are generated from the 18V ac winding of the transformer.

The Accessory Driver PCB has its own on-board micro-controller which has a permanent master/slave relationship with the main microprocessor.

The Accessory Driver is on the Serial Peripheral Interface Bus (SPIBus) and is selected by the CSACC line.

The on-board E²PROM maintains calibration data for the fitted accessory. In the case of the multi-cell changer this includes the number of steps on the stepper motor from the sensor vane to the first sample position. This will vary from accessory to accessory, so the PCB and mechanical assembly must be treated as a matched pair in this instance.

Section 6

Software Description

6.0 Warning

6.1 Start Up Routine

6.2 Main Menu

6.3 Menu Options

6.0 Warning

This section gives an overview of the software modules, it is not meant to be a detailed analysis of the software routines or code. Also it must not be treated as a substitute Instruction Manual, its purpose is to enable basic navigation through the operational and set up modes sufficient to verify basic operation.

6.1 Start Up Routine

When the power to the unit is switched on a self-test routine is activated. This routine can be bypassed through the special key functions, see Section 2.6, this mode of operation must only be used for fault finding and repair as the unit will not have been through the necessary calibration and check routines to guarantee the accuracy of any readings. During the start-up tests the following parameters are checked and must pass before operation can continue:

System Test: - This test checks the status of the user variables stored in battery backed RAM and the calibration data stored in the E²PROM on the Detector PCB

This test will be failed following a power on re-set using the short cut keys. This is not a fatal error but a warning message will advise that 'Default operating parameters have now been loaded' and will require acceptance before continuing.

This test will also be failed if the calibration data has been corrupted, in this case a warning message 'FATAL ERROR. System Calibration data failure,' will be displayed. This failure will be due to a faulty Detector PCB or due to broken/damaged connections to the Detector PCB.

Tungsten Lamp Test: - This test checks for current flow through the tungsten (visible) lamp filament. This test will be failed if the lamp filament is broken (bulb blown), if the lamp is not fitted, if an incorrect lamp is fitted, if connections to the lamp base are faulty or broken or if the 12V supply to the lamp is faulty (power supply PCB).

Dark Level Test: - This test checks that the output of the detector is below a threshold level when there is no light falling on it. This test will be failed if the sample chamber lid is left open during the start up routine, if the dark shutter (solenoid 1) is faulty (electrical or mechanical) or if the Detector or Detector PCB is faulty.

Wavelength Calibration: - This test checks for the zero order (white) light that is reflected through the sample chamber when the grating is in a position where it acts as a mirror. Each time the unit is switched on this position is used as a physical reference point against which the stored wavelength calibration data is applied.

This test is carried out in the following manner; the microprocessor instructs the grating to drive anticlockwise by 1250nm. This should ensure that the vane attached to the grating mount breaks the light path of the optocoupler mounted on the monochromator base plate. If it does not receive a signal from the optocoupler then an error message 'Fatal Error, Calibration Failure' is returned when the motor stops.

In correct operation a signal is returned when the vane reaches the optocoupler. Then the microprocessor instructs the grating to rotate clockwise in 1nm steps for 200nm, or until a signal greater than 200mV is returned from the detector (this level, with the lamp dimmed can only be produced by the white zero order light). If this 200mV level can not be achieved then the grating stops after having rotated the 200nm and an error message 'Unable to Acquire Peak Level' is returned.

In correct operation when this 200mV level is detected the grating rotates in the same direction for a further 200nm but in 0.2nm steps. A wavelength/output table is generated as the output increases, and then decreases back to 200mv. If the grating rotates the full 200nm without the output falling back to 200mV then the error code 'Unable to Acquire Peak Level' is returned.

In correct operation when the 200mV level on the other side of the peak is reached, the actual peak wavelength level is picked from the table. This point is then set as the zero order level and the stored calibration data is referenced against this point.

This test will be failed if samples or cuvettes etc are left in the sample compartment during the start up routine, if the sample holder or sampling device in the sample chamber is incorrectly fitted/aligned such that it obscures the light beam. Also if the incorrect lamp is fitted, if the lamps or lamp carriage have not been fitted correctly, if the dark shutter is (stuck) in the closed position or through contamination, degradation or misalignment of other optical components.

Deuterium Lamp Test: - This test checks for the current flow that occurs when the arc in the Deuterium lamp has been struck. This test will be failed if the Deuterium lamp is faulty, if it is not fitted/connected or if the Deuterium lamp supply PCB is faulty.

Acquiring Baseline: - This test scans the full wavelength range of the instrument in 5nm increments and stores the data as a raw baseline. This baseline should not be used during operation when a new baseline should be run against the specific experimental data. Failure of this test is unlikely but errors may occur if cuvettes or samples are left in the sample chamber or the sample chamber cover is opened during the test.

6.2 Main Menu

When the Start Up Routine tests have been successfully completed the display defaults to the Main Menu screen. This details the four (five with the multi-cell changer accessory fitted) measurement types that can be carried out.

Photometrics: - This mode of operation will measure simple Absorbance, Transmission, and Concentration. The display will show the main value selected as well as the wavelength. See Section 3.3 of the Instruction Manual for more details.

Spectrum: - This mode of operation will measure changes of Absorbance, Transmission or Concentration over a selected wavelength range. The results are displayed in graphical form but tabular data is available. See Section 3.4 of the Instruction manual for more details.

Multi-Wavelength: - This mode of operation will measure the Absorbance or Transmission at 2 discrete wavelengths. The results are shown in tabular form and various calculations can be

performed on the data returned. See section 3.5 of the Instruction Manual for more details.

Kinetics: - This mode of operation will measure changes of Absorbance, Transmission or Concentration over selected time periods. The results are displayed in graphical form but tabular data can be accessed. See Section 3.6 of the Instruction Manual for more details.

Quantitation: - This mode of operation will only be available if the multi-cell changer accessory is fitted. It can be used to measure the Absorbance or Transmission of samples and convert the value to a Concentration against a complex calibration curve, plotted against up to 7 standards, with the ability to manipulate and correct the curve. See section 3.7 of the Instruction Manual for more details.

NOTE: - It is good practice to only turn the power off after having returned to the Main Menu screen, this will always ensure that all save/retrieve and other filing routines are complete. Turning power off while such functions are still being executed will lead to file corruption (which can only be recovered by reformatting the internal memory), invalid data and possible instrument failure.

6.3 Menu Options

There are a number of menu systems in the user interface that can be accessed once an initial selection has been made from the Main Menu.

In each mode of operation there is a horizontal menu bar at the bottom of the display that gives quick access to the most commonly required functions for the particular measurement being made.

In this menu bar will be a 'Set Up' option that invokes a drop down menu for the more detailed parameters to be set, such as wavelength limits for scans, time for Kinetic runs etc. These are the Operator Variables that are stored in the non-volatile memory (battery backed RAM).

In this set up menu will be links to the Instrument Set Up menu that allows the global parameters that affect all modes of operation, to be set. This includes such items as Language, time, date and contrast.

Links to other menus, such as Accessory Set Up, may also be present but these will depend on the specific configuration of the instrument.

See Section 3.2 - Instrument Set-Up Menu in the Instruction Manual for more information on setting global parameters.

The mode specific menus are detailed in the following sections of the Instruction Manual: -

Photometrics	Section 3.3
Spectrum	Section 3.4
Multi-Wavelength	Section 3.5
Kinetics	Section 3.6
Quantitation	Section 3.7 (Only available with multi-cell changer accessory fitted)

Section 7

Diagnostics

7.1 The Diagnostics Menu

7.2 Shutter and Filters

7.3 Lamp Control

7.4 Zero Order Cal.

7.5 Calibrate Functions

7.6 Wavelength Functions

7.7 Channel Outputs

7.8 Voltage Display

7.9 Motor Position Sensor

7.1 The Diagnostics Menu

The Diagnostics menu is accessed using the following Special Key function, hold down the right arrow key <> while turning the power on. Do not make any changes to the settings in this menu unless trained to the requirements set out in Section 1.2 of this manual. Similarly do not use any test or calibration equipment that does not meet the requirements set out in Section 1.4 of this manual.

7.2 Shutter and Filters

Pressing numeric keys in the Diagnostics menu will initiate specific functions. The first three of these affect the shutter and filter solenoids.

Pressing the number one <1> key toggles the dark shutter between its open and closed states. The 'open' state is when the shutter is out of the light path, the 'closed' state is when it is in the light path.

Pressing the number two <2> key toggles the IR Stray Light Filter between its open and closed states. The 'open' state is when the filter is out of the light path, the 'closed' state is when it is in the light path.

Pressing the number three <3> key toggles the UV Second Order Stray Light Filter between its open and closed states. The 'open' state is when the filter is out of the light path, the 'closed' state is when it is in the light path.

The shutter and filter controls can be used in conjunction with the Voltage Display and Channel Outputs to determine optical energy levels under various conditions, as described in Section 2.4 Signal Levels.

7.3 Lamp Control

The Diagnostics menu gives some control over both the visible and UV light sources.

Pressing the number four <4> key toggles the visible (tungsten) lamp between its normal 12V intensity and the dimmed 5V level. The selected voltage is shown against the menu option 'Lamp Voltage'.

Pressing the number five <5> key toggles the UV (Deuterium) lamp on and off. When on (enabled) 'yes' is shown against the menu option 'UV Lamp Enabled, when off 'no' is shown.

7.4 Zero Order Calibration

Pressing the Calibrate key in the Diagnostics Mode enables a manual zero order calibration to be set. Entering the Diagnostics Mode bypasses the Start Up Routine so no automatic zero order calibration has been carried out, although the settings from the previous operation will still be retained. However if a fault condition relating to wavelength accuracy exist it may be necessary to manually set the zero order point using this function before other settings are adjusted.

It should be possible to set this in most cases by pressing the GoTo key and then '0'. Then by using the up and down arrow keys while checking for the presence of white light passing through the sample compartment. Pressing the Calibrate key for a second time when the maximum white light is visible will set the zero order reference point. If it is impossible to find any white light within +/- 10nm of the 'GoTo 0' point then it will be necessary to open the monochromator and trace the light beam between the various components to check for any miss-alignment.

This procedure will not give the same accuracy as when the zero order point is set automatically during the start up routine. Any setting entered manually in this way will be overridden during the next completed Start Up Tests.

7.5 Calibrate Functions

Pressing the print key in the Diagnostics Mode will display a series of prompts for different input voltages to set and store calibration data for the A to D converter. This data is stored in the E²PROM on the Detector PCB. Do not enter this command without the correct, certified, equipment and leads available. Only personnel with specific training on these products should make this adjustment.

Pressing the number seven <7> key in the Diagnostics Mode will display a series of values for output voltages that enable the analogue output to be set. These settings are stored in the E²PROM on the Power Supply PCB.

7.6 Wavelength Functions

In the Diagnostics Mode pressing the 'GoTo' key causes exactly the same reaction as it would do in normal operation, that is a dialogue box is displayed for entering the wavelength that is required. Extra care must be taken however as the full range of values that will drive the grating from –50nm to 1250nm is now available.

Pressing the number six <6> key displays a dialogue box for entering a Wavelength (Zero)Offset. This value is in tenths of a nano-metre, (i.e. 25 = 2.5nm). The maximum range is +/- 30 (+/- 3.0nm). Careful adjustment of this value is the preferred method for adjusting wavelength accuracy in the field, see Section 8.3 Wavelength Calibration. NOTE: - Changes to this value are not effective until the instrument is Re-Booted and has successfully completed a Start Up Routine.

7.7 Channel Outputs

The signal is amplified to three different levels, with a factor of 10 between them (i.e. 1, 10 and 100 times gain). Each of these amplified signals then pass into the first three channels (CH0 to CH2) of an 8 channel, 12 bit, serial, A to D converter.

All three channels are converted and the microprocessor selects the channel that gives the best resolution without reaching saturation

(32767 counts) for manipulation and display in the operating mode. In the Diagnostics mode all three channels can be viewed enabling further judgement to be made on energy levels and calibration accuracy.

7.8 Voltage Display

This is the signal from the detector at SK2 pin 4 and is directly proportional to the level of light falling on the detector. This value is very useful in determining the light energy levels under different operating conditions. As there is no smoothing this value may be seen to vary at times.

7.9 Motor Position Sensor

The status of the opto-coupler that is triggered when the grating reaches the end of its travel is shown in the Diagnostics Menu as 'Motor Position Sensor'.

When this option shows 'clear' then the grating has not yet reached the end of its travel, when it shows 'blocked' then the grating has reached the end of its travel and the opto-coupler has been triggered by the sensor vane.

Section 8

Maintenance

8.1 Routine Maintenance

8.2 Dismantling

8.3 Energy Levels

8.4 Wavelength Calibration

8.5 A to D Calibration

8.6 D to A Calibration

8.7 Performance Verification

8.1 Routine Maintenance

The Jenway Limited, Model 6400 and 6405 have been designed to give optimum performance with minimal maintenance. It is only essential to keep the external surfaces clean and free from dust and to ensure that the area around and underneath the unit is also clean and dust free.

The sample area should be kept clean and accidental spillage should be wiped away immediately as some corrosive or solvent based samples or standards may attack the materials used in the sample chamber and cell holders.

To give added protection when not in use the unit should be disconnected from the mains supply and covered with the optional dust cover (640 133). For longer term storage or re-shipment, it is recommended that the unit be returned to the original packing case.

Details of all routine maintenance tasks, including changing the lamps can be found in Section 4 of the Instruction Manual.

8.2 Dismantling

Do not attempt to dismantle these units unless they are in a clean, dry and dust free environment.

Use a soft lint free cover on any benches that will have casework, displays or keypads placed on them.

Use approved and tested anti-static procedures when dismantling any electronic sub-assembly or PCB and store these items in anti-static containers where necessary.

General – Access to all major sub-assemblies can easily be gained by removing the top half of the case. Access to the lamp housing can be made through the lamp access panel on the rear of the unit. The sampling accessory and its relevant driver PCB can be accessed by removing the sample chamber lid assembly.

Top/Bottom Case Assemblies – The top and bottom case assemblies can easily be separated by unscrewing the four recessed screws in each corner of the base. This should be done without

inverting the unit, by moving it forward over the front edge of the bench to unscrew the front two screws, and then turning it around to do the same with the back two. While it is turned round the top two screws that hold the lamp access panel in place should be removed. Turn it back round and then the top half of the case can be lifted off the bottom half, take care that the sample chamber rear wall and back panel are not lifted out of their slots as the top is raised. Turn the top through 90 degrees and rest it on its back edge to the left-hand-side of the unit. Take care not to strain any cables between the top and bottom sections.

Should it be necessary to work on the top case assembly by itself it is simply a matter of disconnecting the plug from SK4 on the power supply PCB then the top can be completely removed.

Microprocessor/Display PCB The microprocessor/display PCB is mounted in the top case assembly. To remove it disconnect PL3 to the internal printer, PL2 to the power supply PCB, and PL4 to the membrane keypad. Unscrew the four outer screws and the two boards can be removed. The display module can be separated from the microprocessor PCB by unplugging PL6 and unscrewing the other four screws that pass through the pillars and are fixed with nuts and washers. When reassembling ensure that the membrane keypad strip connector passes through the slot in the PCB.

Deuterium Lamp Supply PCB The Deuterium Lamp Supply PCB is mounted in the lower case assembly and plugs (at 90 degrees) into the Power Supply PCB. To remove it unscrew the two screws that hold the right hand bracket into the base. Lift the bracket clear of the two earth wires and put to one side with the screws. Carefully unplug the Deuterium Lamp Supply PCB from the Power Supply PCB. To completely remove it from the instrument, unplug the Deuterium lamp and pull the connector through the moulded channel. When replacing make sure the pins on the connector to the Power Supply PCB are correctly aligned and that the PCB is correctly located in the grove in the case.

Power Supply

Disconnect the large multi-pin connector to the transformer, PL6, then the four smaller connectors on the lower front side of the PCB, PL1, PL3, PL12 and PL5, then remove PL7 from the top of the PCB. Remove the two screws from the lower case moulding

that secure the bracket at the front edge of the PCB, remove the bracket and screws and place to one side. Remove the two screws that hold the bracket to the rear panel and lift out the PCB.

When replacing the PCB ensure that it fits correctly into the groove in the chassis moulding and if re-connecting the Deuterium Lamp Supply PCB ensure that the pins on the right angle connectors are correctly aligned.

Detector PCB The detector PCB is mounted vertically at the far right hand side of the lower chassis. It is easily removed by unscrewing the two screws recessed in the top of the metal mounting block, the plugs in SK1 and SK2 should also be removed. Remove the two screws and spacers that hold the lens block, take care not to rotate it as the detector is mounted in a recess inside the block and can easily be broken off. Remove the last screw with its nut and washer to enable the electrostatic screen to be removed from the PCB.

The Detector PCB stores detailed calibration data relating to the optics of the unit it is fitted in, replacing the detector PCB without a full re-calibration will invalidate the quoted specification.

Monochromator The monochromator is located in the centre of the lower case. It is a sealed unit and breaking the seals will invalidate the warranty. Before proceeding with replacement ensure the unit is in a clean, dust and humidity free area.

First remove the top cover by unscrewing the two screws in the top, remove the top cover and place to one side. Do not touch any optical components. Then remove the four screws from the base plate, two at the front, two at the rear. Lift the monochromator assembly by the pillars only, unplug the connectors PL5, PL1, and PL3. Remove the Yellow/Black and Yellow wires from PL1 to free the monochromator from the lamp assembly.

Replacement is the reverse of dismantling, but ensure a full calibration is run so that the new calibration data is stored on the Detector PCB.

Sampling Accessory/Driver PCB The sampling accessory and its driver PCB can be accessed without removing the top half of the case. The mechanical part of the accessory can often be fitted by simply opening the sample cover, however for more complex arrangements or where a replacement driver PCB has to be fitted access can be gained by removing the complete sample chamber cover. To do this turn the instrument around and remove the two countersunk screws in the back of the grey moulding that is the fixed part of the sample chamber cover. Lift the sample chamber lid and remove the single screw at the front of the same moulding, do not touch the two screws in the black hinge block. This will enable the complete sample chamber cover to be removed.

Multi-Cell Changer Assembly This accessory is required for the Quantitation mode of operation to become active. It is easily fitted in the following manner: - (See Section 10.9 Assembly Diagrams)

Remove the complete sample chamber cover assembly as detailed above. Then remove the cuvette holder assembly by loosening the large thumb-screw at the front of the sample chamber. The cuvette holder fixing plate should then be removed by unscrewing the four small countersunk screws. Finally the sample chamber base plate should be removed by unscrewing the four pan head screws that hold it in place. Slide the sample chamber back plate up and out of its retaining groove. Note the cut out in its lower right corner.

Place the multi-cell changer assembly in the sample compartment so that the four cut outs pass over the four moulded pillars in the case. Ensure that the cable and connector pass freely from the rear of the assembly before screwing into place with the four pan head screws, two at the front, two at the rear. It is acceptable to slide the cuvette rack forward to uncover the rear fixing holes if required, the position will be correctly re-set on power up.

Fit the Accessory PCB in the rear chamber with the four screws supplied and plug the motor connector into PL2 and the 10 pin IDC connector into PL1. This PCB holds the calibration data for the multi-cell changer positioning stepper motor so the mechanical assembly and this PCB must be treated as a matched pair.

Replace the sample chamber rear wall in its retaining groove and ensure that the cable passes under the cut out in the lower right corner and is not trapped or damaged by the plate.

Replace the sample chamber lid assembly and check that it opens and closes correctly. Verify the instrument performance as necessary

8.3 Energy Levels

Equipment Required; - None, checked against internal settings.

Before proceeding with any calibration it is essential to ensure the correct functioning of the optical system, this can be done very easily in the Diagnostics Menu (see Section 7) where the following performance should be obtained.

6405 only

U V Energy, Set wavelength to 190nm, Dark Shutter open, IR stray light filter closed, UV, second order stray light filter open; Voltage Display must be greater than 20mV.

Visible Energy, Set wavelength to 805nm, Dark Shutter open, IR stray light filter open, UV second order stray light filter closed; Voltage Display must be greater than 1000mV and less than 3600mV.

Dark Current, Set wavelength to 320nm, Dark Shutter closed, IR stray light filter closed, UV second order stray light filter open; Voltage Display should be zero +/- 6mV.

320nm Output, Set wavelength to 320nm, UV lamp off, Dark Shutter open, IR stray light filter closed, UV second order stray light filter open; Voltage Display must be greater than 17mV.

8.4 Wavelength Calibration

Equipment Required; - A certified wavelength standard, i.e. Holmium Oxide Filter, Holmium Perchlorate Solution etc. (See Section 8.7.1)

Wavelength calibration can be carried out in the Diagnostics Mode using the wavelength (zero order) offset function. Do not carry out

the following procedure without a suitable, certified wavelength calibration standard.

Turn the unit on and allow the Start Up tests to complete.

Select the Spectrum Mode from the Main Menu.

Set up a scan of the certified wavelength calibration standard using a resolution of 0.2nm over the minimum wavelength range needed to isolate the peak of interest. Carry out a Baseline scan using these settings, and then scan the wavelength calibration standard.

Use the Peak and Valley table or the cursor to identify and record the wavelength of the peak of interest.

Repeat the above and check that the same value is reported.

Calculate the adjustment required to correctly align the reported figure with the certified value.

Certified Value – Reported Value = Correction factor (can be negative or positive, maximum correction permissible is 3.0nm)

Switch the unit off and re-start it in the Diagnostics Mode by holding down the right hand arrow key <>> while turning power on.

Make a note of the value in the Wavelength (zero order) Offset option, including whether negative or positive.

Press the number six <6> key to clear the Wavelength (zero order) Offset entry.

Enter a new number calculated from; (Correction Factor x 10) + existing value. If this is negative press the sign (+/-) key first to bring up the negative sign. Then press enter to confirm the value.

Switch the unit off and then on again, allowing the Start Up tests to be completed, re-scan the certified wavelength calibration standard and check that the reported value is now correct.

8.5 A to D Calibration

The A to D converter should only be calibrated by engineers who have been trained on this aspect of servicing by Jenway Limited.

Equipment Required; - A certified voltage calibrator with a resolution of 0.1mV and a range up to at least $\pm 4.0000V$.
A lead for connecting the calibrator to pins 1 (negative) and pin 3 (positive) of SK2 on the detector PCB. (8 pin Molex type connector)

Access the Detector PCB by removing the top case assembly as described in Section 8.2 - Dismantling.

Remove the plug from SK2 on the Detector PCB and replace with the one connected to the calibrator.

Switch the calibrator on and select a negative output (or reverse the contacts)

Select the Diagnostics menu by turning the unit on with the right hand $\langle \rangle$ arrow key depressed.

Press the Print Key to activate the Calibrate ADC menu option.

The menu line will change to prompt for specific input levels and show the relevant channel output counts.

First is $-1mV$, set the calibrator to give an input signal of $-1mV$ and then press the enter key.

Then the prompt changes to $-20mV$, set the calibrator to $-20mV$ and then press the enter key.

Continue responding to the prompts in this way for $-39mV$, $-200mV$, $-390mV$, $-2000mV$ and $-3900mV$. Note that the $-39mV$ and $-390mV$ levels are repeated as these are the cross over points from one channel to the next.

When all the levels have been correctly entered and stored the menu option returns to its original state.

8.6 D to A Calibration

Equipment required; - Voltmeter capable of reading 2.0V with a resolution of 1mV.

The D to A calibration sets the levels of the analogue output. This is carried out with the on-board voltage reference at zero and +/- 2000mV.

Select the Diagnostics menu by turning the unit on with the right hand <>> arrow key depressed.

Press the Seven <7> Key to activate the Calibrate DAC menu option.

The menu line will change to prompt for specific input levels and show the relevant channel output counts.

Connect a voltmeter to the analogue output on the rear panel. Select a range that will display 2000mv to 0.1mV resolution.

The first prompt indicates an output level of -2000mV, use the up and down and left and right arrow keys to adjust the actual reading on the voltmeter to -2000mV.

The left and right arrow keys change the output in 5mV steps, the up and down arrow keys in 0.5mV steps.

When the correct level is reached press the enter key and the prompt moves on to 0mV, repeat the above for this and the 2000mV levels.

When successfully completed the Calibrate DAC menu option returns to its original state.

8.7 Performance Verification

Equipment Required; - 1. Certified Wavelength Standard, 2. Certified Absorbance Standards, 3. Certified Stray Light Standard.

Items 1 and 2 above can be supplied as Calibration Filter Sets, order part numbers 035 088 for the 6400 or 035 091 for the 6405.

Where filters are not available the following reagents may be used:

- 8.7.1 Holmium Perchlorate – 5% w/v solution of Holmium Oxide in 1.4N Perchloric acid, this will give absorbance maxima at 241.0, 278.1, 287.0, 361.4, 416.1, 451.1, 485.3, 536.5 and 640.5.
- 8.7.2 Potassium Dichromate – 100.0mg/l in 0.005M Sulphuric Acid (use the Sulphuric Acid as the blank). This will give Absorbance values of 1.071 at 350nm, 0.484 at 313nm, 1.444 at 257nm, 1.242 at 235. Potassium Dichromate – 50.0mg/l in 0.005M Sulphuric Acid (use the Sulphuric Acid as the blank). This will give Absorbance values of 0.536 at 350nm, 0.242 at 313nm, 0.722 at 257nm, 0.621 at 235.
- 8.7.3 Sodium Nitrate – 50g/l in deionised water, should give less than 0.1% transmittance at 340nm.
Sodium Iodide – 10g/l in deionised water, should give less than 0.1% transmittance at 220nm.

All these solutions are hazardous and the manufacturer/suppliers safety precautions should be carefully followed at all times in preparation, use and storage.

8.7.4 Wavelength Verification

Equipment Required; - A certified wavelength standard, i.e. Holmium Oxide Filter, Holmium Perchlorate Solution etc. (See Section 8.7.1)

Turn the unit on and allow the Start Up tests to complete then allow 15 minutes for the instrument to warm up.

Select the Spectrum Mode from the Main Menu.

Set up a scan of the certified wavelength calibration standard or Holmium Perchlorate solution using a resolution of 0.2nm over the minimum wavelength range needed to isolate the peaks of interest. Adjust the Noise Filter or Smoothing and the resolution to give clean peaks without any interfering spikes.

Carry out a Baseline scan using these settings, and then scan the wavelength calibration standard or Holmium Perchlorate solution.

Use the table of peaks or the cursor to check that the wavelengths of the peaks of interest fall within the specified tolerance of the instrument PLUS the tolerance of the filter/reagent used.

8.7.5 Absorbance Verification

Equipment Required; - Certified Standard Absorbance Filters or Potassium Dichromate solution. (See Section 8.7.2)

Turn the unit on and allow the Start Up tests to complete then allow 15 minutes for the instrument to warm up.

Select the Photometrics Mode from the Main Menu.

Select a wavelength at which the filter or solution is certified.

For the Potassium Dichromate solution use the Sulphuric Acid solution as a blank, (See Section 8.7.2) if the filter set includes a zero filter use this as the blank, if not set the blank (zero absorbance or 100% transmittance) with an empty sample chamber.

Insert the certified filter or Potassium Dichromate solution and check that the reading is within the specified tolerance of the instrument PLUS the tolerance of the filter/solution used.

Repeat this for other filters or solutions and at other specified wavelengths as necessary.

8.7.6 Stray Light Verification

Equipment Required; - Certified Stray Light Filters or Sodium Nitrate Solution or Sodium Iodide Solution. (See Section 8.7.3)

Turn the unit on and allow the Start Up tests to complete then allow 15 minutes for the instrument to warm up.

Select the Photometrics Mode from the Main Menu.

Select a wavelength at which the filter or solution is certified (340nm for Sodium Nitrate or 220nm for Sodium Iodide).

Set 100% transmittance with a quartz cuvette filled with the deionised water used to make up the solutions or with the blank filter supplied by the manufacturer.

Insert the stray light filter or solutions, as above, and ensure that the reading is within the specified tolerance of the instrument PLUS the tolerance of the filter/solution used.

Section 9

Circuit Diagrams

- 9.10 Power Supply Schematic 640 008 (3pgs)
- 9.11 Power Supply Layout 640 008 (1pg)

- 9.20 Deuterium Lamp Supply Schematic 640 506 (2pgs)
- 9.21 Deuterium Lamp Supply Layout 640 506 (1pg)

- 9.30 Detector PCB Schematic 640 009 (1pg)
- 9.31 Detector PCB Layout 640 009 (1pg)
- 9.32 Detector PCB Schematic 640 505 (1pg)
- 9.33 Detector PCB Layout 640 505 (1pg)

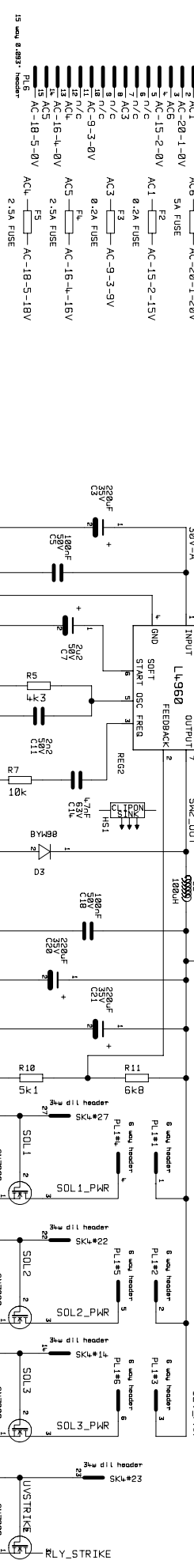
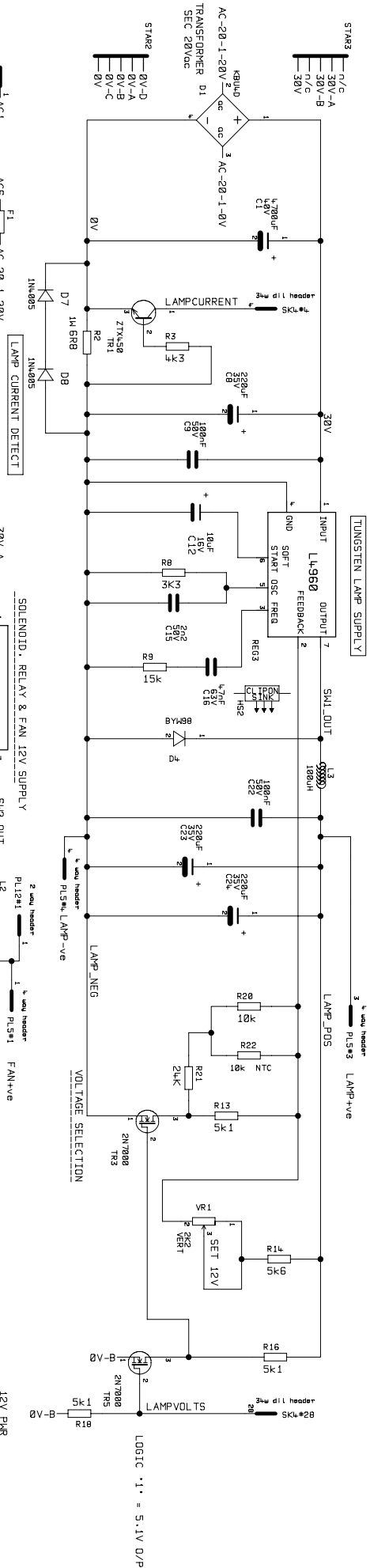
- 9.40 Microprocessor PCB Schematic 640 007 (2pgs)
- 9.41 Microprocessor PCB Layout 640 007 (1pg)

- 9.50 Accessory Driver PCB Schematic 642 003 (1pg)
- 9.51 Accessory driver PCB Layout 642 003 (1pg)

Section 9

Circuit Diagrams

- 9.10 Power Supply Schematic - 640 008 – 3 pages
- 9.11 Power Supply Layout – 640 008 – 1 page

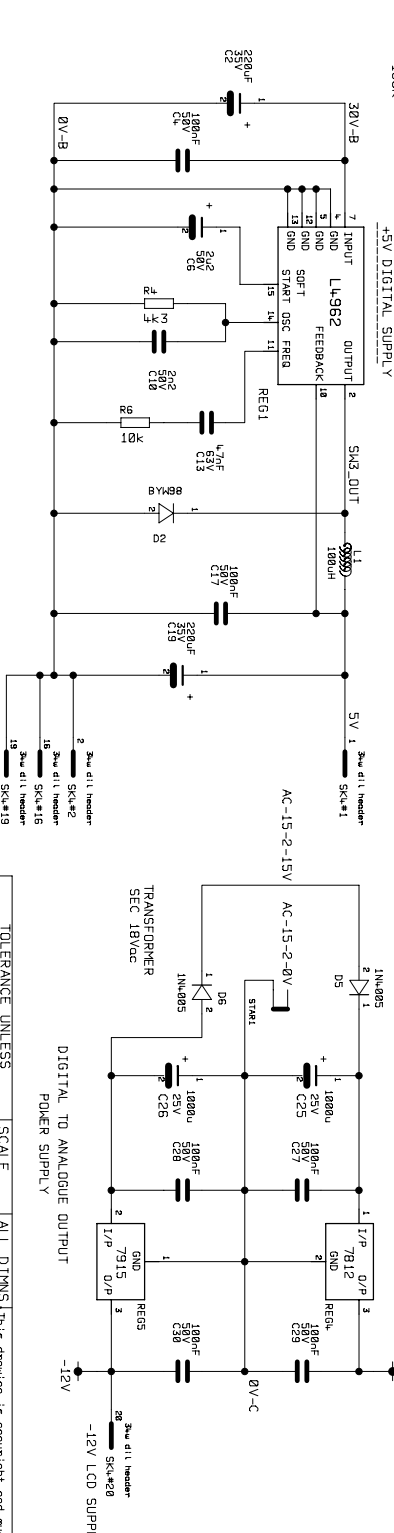
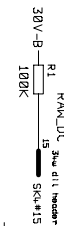


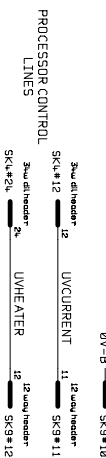
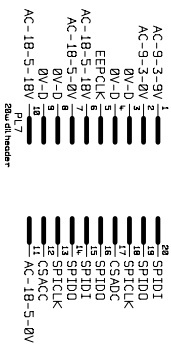
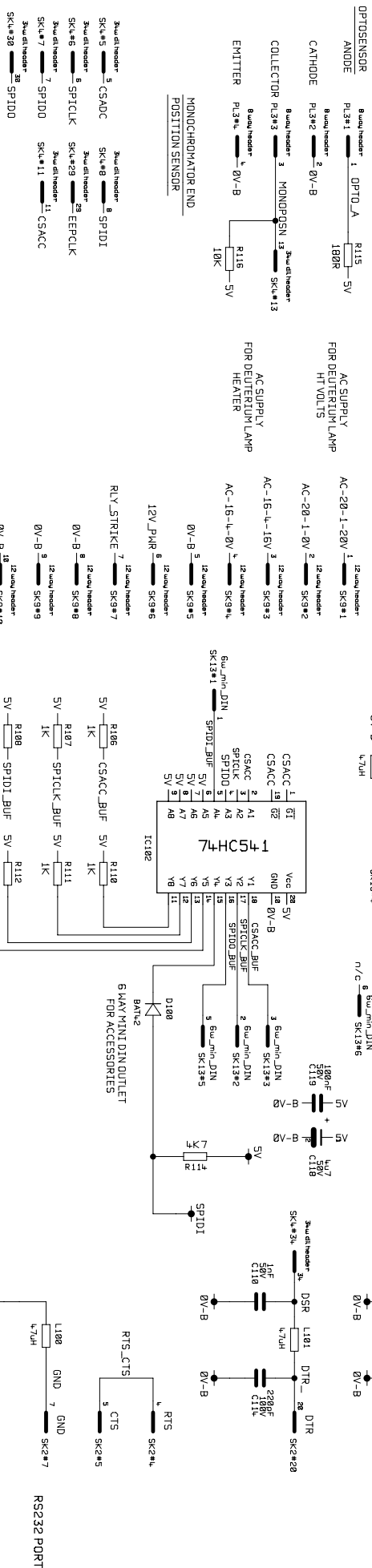
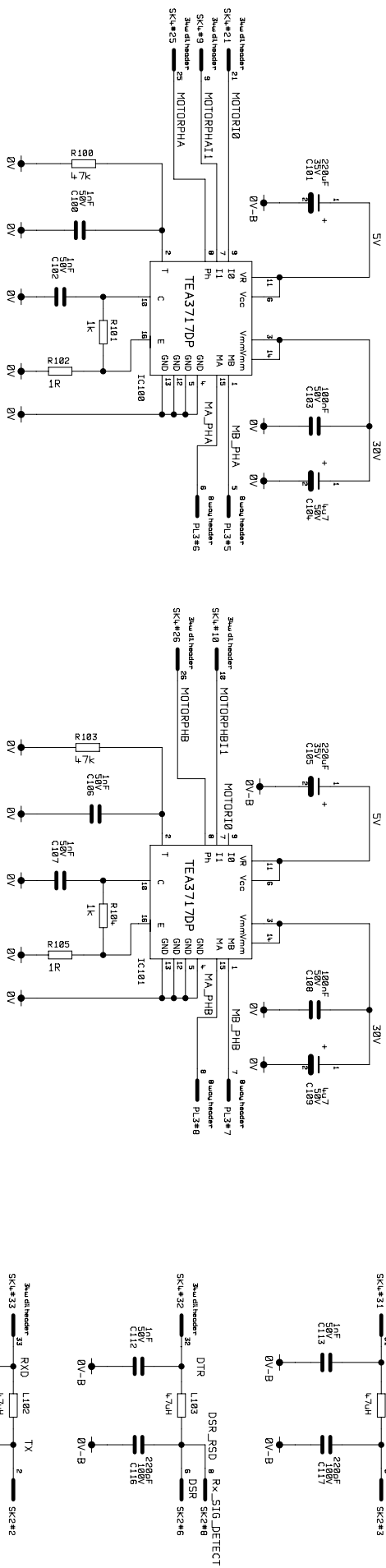
SECONDARY #1 TUNGSTEN LAMP, +5V, FAN/SOLENOID
SECONDARY #2 +/- 12V SUPPLY FOR DAC & LCD SUPPLY
SECONDARY #3 +/- 5V SUPPLY FOR DETECTOR PCB
SECONDARY #4 SUPPLY FOR DEUTERIUM HEATER
SECONDARY #5 SUPPLY FOR ACCESSORIES
SECONDARY #5 SUPPLY FOR PRINTER ACCESSORY



MAINS TRANSFORMER

SECONDARIES

© 1997 by The American Nuclear Society
All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or by any information storage and retrieval system, without permission in writing from The American Nuclear Society.

[illegible]



P1								IF IN DOUBT ASK	
DPH	15/4/97	A	CN2139	1/9/97				DO NOT SCALE	
		B	CN2146	6/8/1997				THIRD ANGLE	
		C	CN2154	12/12/97				PROTECTION	


TOLERANCE UNLESS OTHERWISE STATED		SCALE	ALL DIMMS.		
GENERAL	±	NIS	IN		
HOLE CRS.	±				
DIAMETERS	±				
ANGLES	±				
DRN. DATE	DATE 08/FEB/97	APPD.	DATE	DRG. REF.	640 008
JENWAY LTD Gannock-Croft Estate, Dumfries, Dumfries & Galloway, Scotland, Galloway, KA6 3LJ Tel 01371 8200125 Fax 01371 823846			6400/5 MAIN PUMPER SCHEMATIC		

FIG. 3.

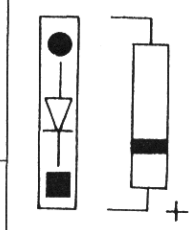


FIG. 1.

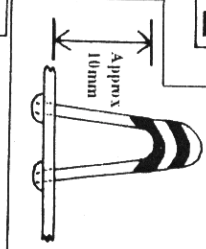


FIG. 11.

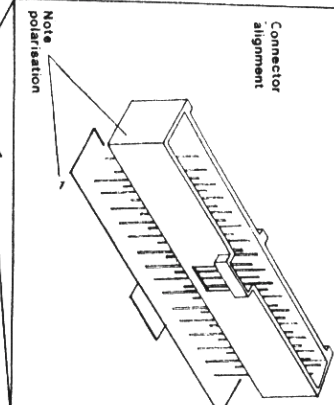


FIG. 7.

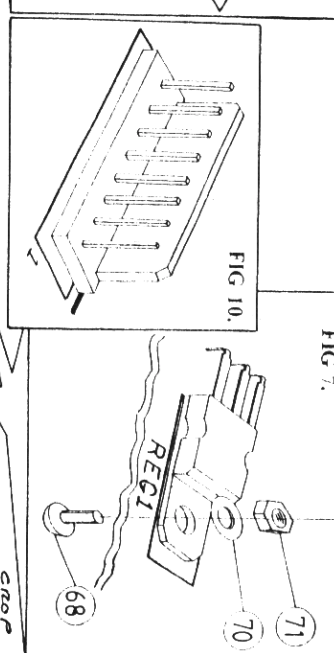


FIG. 6.

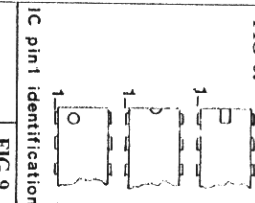


FIG. 9.

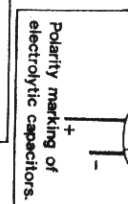


FIG. 4.

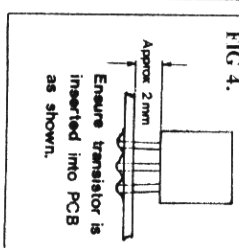


FIG. 2.

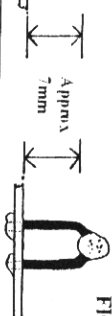


FIG. 8.

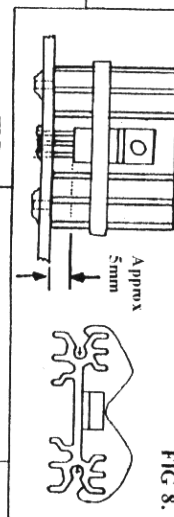


FIG. 5.

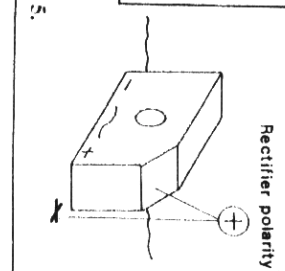
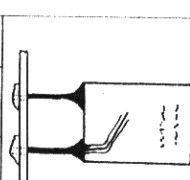
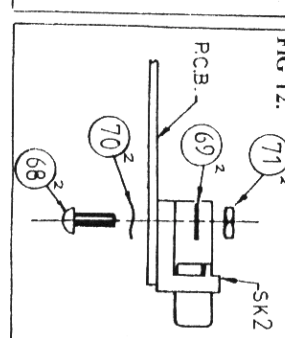


FIG. 12.



P1

P2

P3

P4

A

B

C

D

E

F

G

H

CN2139

CN2146

CN2232

H

DATE 25/9/97

APP'D

DATE 25/9/97

DRN. SRL

DRG. REF. 640 008

SHT. 1 OF 1

TITLE

6400/5 MAIN PSU

Grossmore Green, Felsted,

Dunmow, Essex, CM6 3LB

JENWAY LTD.

Tel: 01371 820122

CAUTION. Assemble using static precautions. Place completed PCB into bag provided. These devices are static sensitive.

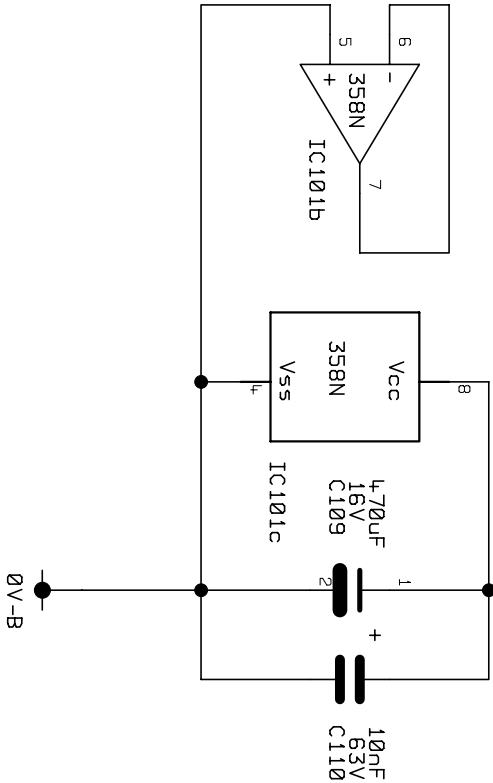
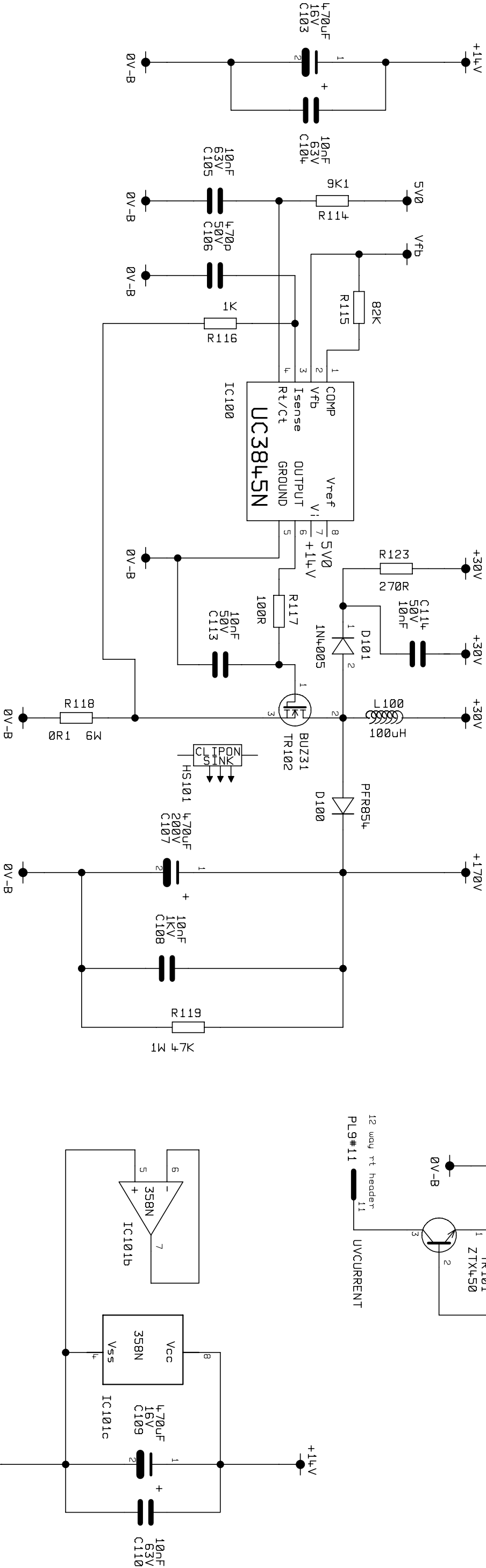
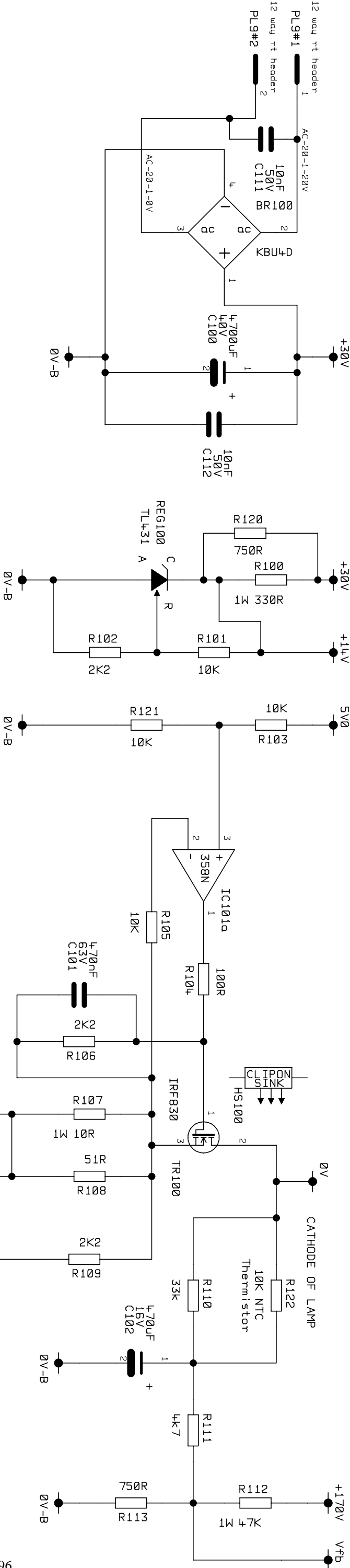
ASSEMBLY NOTES

- 1) Fit Resistors R1 through R21, R100 through R116 and R200 through R211 in positions shown. Trim leads to length and solder.
- 2) Fit Inductors L100 through L105, L200 and L201. Trim leads to length and solder.
- 3) Referring to FIG 1, fit R22. Trim leads to length and solder.
- 4) Referring to FIG 2, fit Resettable fuses F1 through F5. Trim leads to length and solder.
- 5) Referring to FIG 3, fit Diodes D2 through D8 and D100 in positions shown. Trim leads to length and solder. **Ensure polarity is observed.**
- 6) Referring to FIG 4, fit Diode D200. Trim leads to length and solder.
- 7) Referring to FIG 5, fit Bridge Rectifier D1 in position shown. Trim leads to length and solder. **Ensure polarity is observed.**
- 8) Referring to FIG 6, fit integrated circuits (ICs) IC100, IC101, IC102, IC200, IC201 and REG1. Solder all pins.
- 9) Referring to FIG 7, fit Regulators REG 4, 5. Trim leads to length, solder and secure regulator to PCB as shown.
- 10) Referring to FIG 8, fit Regulators REG 2, 3. Apply a smear of heat sink compound (item 65) to mating surface of each regulator. Fit heat sink (item 34) and solder both legs. Push heat sink retaining clip (item 35) in to place.
- 11) Referring FIG 4, fit TR1 through TR7 and TR200. Trim leads to length and solder.
- 12) Fit Capacitors C4, C5, C9, C10, C11, C13, C14, C15, C16, C17, C18, C22, C27, C28, C29, C30, C100, C102, C103, C106, C107, C108, C110 through C117, C119, C200, C201, C202, C203, C205, C206, C208, C209. Trim leads to length and solder.
- 13) Referring FIG 9, fit Capacitors C1, C2, C3, C6, C7, C8, C12, C19, C20, C21, C23, C24, C25, C26, C101, C104, C105, C109, C118, C204, C207. Trim leads to length and solder. **Ensure polarity is observed.**
- 14) Fit Inductors L1, L2 and L3. Trim leads to length and solder.
- 15) Fit Variable Resistor VR1. Trim leads to length and solder.
- 16) Referring to FIG 10, fit molex connectors PL1, PL3, PL5, PL12 and socket SK9. **Ensure polarity is observed.**
- 17) Referring to FIG 11, fit DIL connectors PL7 and SK4.
- 18) Referring to FIG 12, fit 25 way 'D' type Connector SK2 as shown and secure with fixings provided. Solder all pins.
- 19) Fit Red socket in position SK10 and Black socket in position SK11. **Check LEDs.**
- 20) Fit Mini Din connector in position SK13. Solder all pins.
- 21) Fit 15 Terminals (item 42) in Plug Housing (item 41) and fit complete assembly to PCB in position SK3. Solder all pins. **Ensure polarity is observed.**
- 22) Inspect PCB to ensure all components have been correctly and neatly fitted. Ensure all joints are soldered neatly without shorts and that all fixings are tight. Place completed PCB in static safe bag and seal with standard label.

Section 9

Circuit Diagrams

- 9.20 Deuterium Lamp Supply Schematic – 640 506
– 2 pages
- 9.21 Deuterium Lamp Supply Layout - 640 506
– 1 page

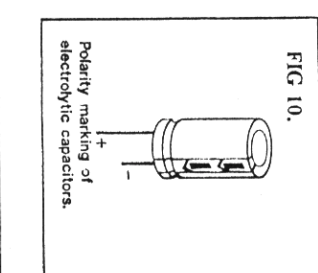
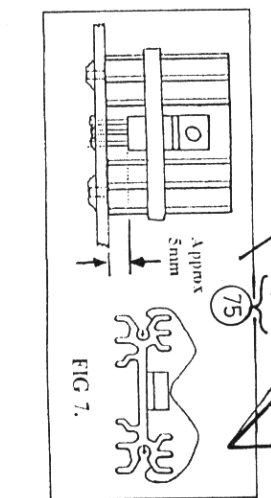
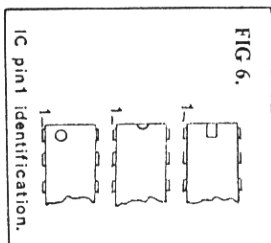
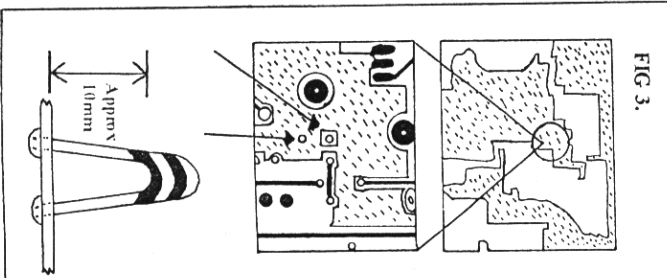
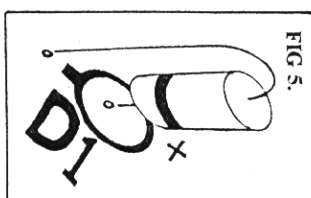
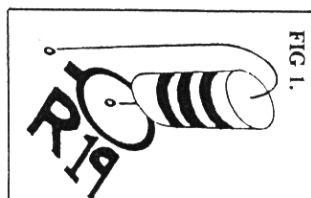
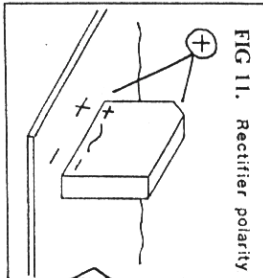
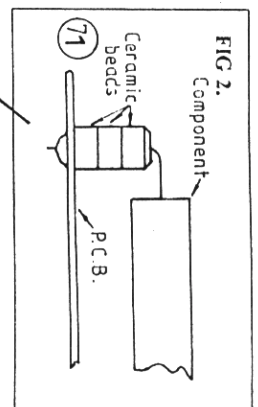
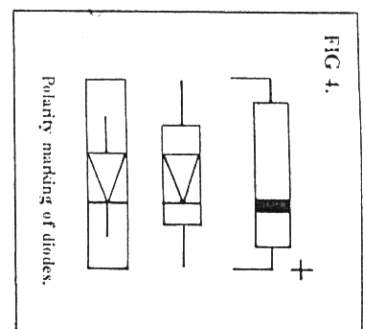
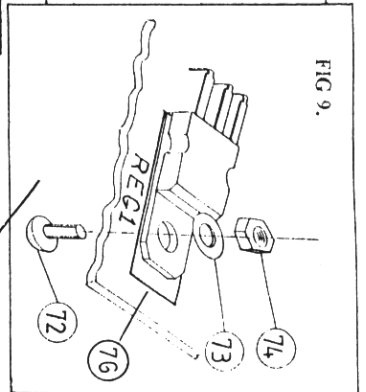
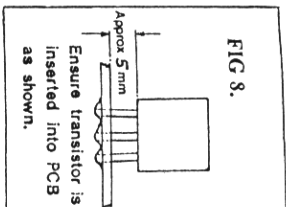


P1	15/05/97	DPH	A	14/8/97	CN2139	E	DATE	APP'D	DATE	15/05/97	DRN.	DPH	DRG. REF.	640-506	SHT.	2 OF 2
P2	21/7/97	DPH	B			F							TITLE	6405 DEUTERIUM LAMP SUPPLY		
P3			C			G										
P4			D			H										

This drawing is copyright and must not be reproduced or otherwise made use of without written permission.

JENWAY LTD.

Dunmow, Essex, CM6 3LB
Tel: 01371 820122



P1	A	17/9/97	02139	E	10/11/99	01224	DATE	SEPT 97	APP'D	MF	DATE	17/9/97	DRN.	SRL	DRG. REF.	640 506	SHT.	1 OF 1
P2	B	5/10/97	02139	F	11/12/00	02139	DATE	SEPT 97	APP'D	MF	DATE	17/9/97	DRN.	SRL	DRG. REF.	640 506	SHT.	1 OF 1
P3	C	17/9/98	02139	G	17/9/98	02139	DATE	SEPT 97	APP'D	MF	DATE	17/9/97	DRN.	SRL	DRG. REF.	640 506	SHT.	1 OF 1
P4	D	17/9/98	02139	H	17/9/98	02139	DATE	SEPT 97	APP'D	MF	DATE	17/9/97	DRN.	SRL	DRG. REF.	640 506	SHT.	1 OF 1

CAUTION . Assemble using static precautions.
Place completed PCB into bag provided.
These devices are static sensitive.

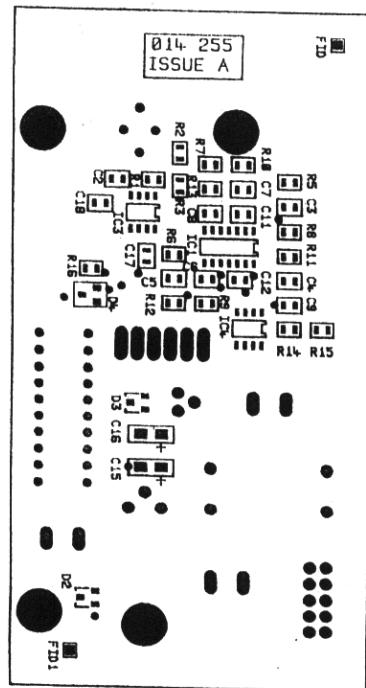
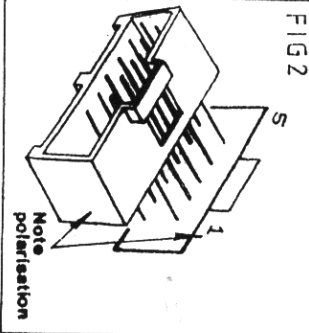
ASSEMBLY NOTES

- 1) Fit Resistors R1 through R13, R15, R17, R18, R100 through R117, R119 through R121 and R123 in positions shown. Trim leads to length and solder.
- 2) Referring to FIG 1, fit Resistors R19 and R123 in position shown. Trim leads to length and solder.
- 3) Referring to FIG 2, fit R118 in position shown using ceramic beads at each end. Trim leads to length and solder.
- 4) Referring to FIG 3, fit R122 to the other side of PCB. Trim leads to length and solder.
- 5) Ensure R122 is not damaged by subsequent assembly operations.
- 6) Referring to FIG 4, fit Diodes D4, D5 and D100 in positions shown. Trim leads to length and solder. Ensure polarity is observed.
- 7) Referring to FIG 5, fit Diodes D1, D3, D6 and D101 in positions shown. Trim leads to length and solder. Ensure polarity is observed.
- 8) Referring to FIG 6, fit integrated circuits (IC's) IC1 through IC4, IC100 and IC101. Solder all pins.
- 9) Fit IC101. Trim leads to length and solder.
- 10) Fit TR100, TR2 and D2 in that order. All three are fitted in the same fashion as TR102 (note 9).
- 11) Referring to FIG 8, fit TR1, TR3, TR101, REG2 and REG100. Trim leads to length and solder.
- 12) Referring to FIG 9, fit REG1. Trim leads to length, solder and secure regulator to PCB as shown.
- 13) Fit Capacitors C2, C4, C6, C7, C12, C13, C15, C16, C17, C18, C104, C105, C106, C108, C110, C111, C112, C113, C114. Trim leads to length and solder.
- 14) Referring to FIG 10, fit Capacitors C3, C5, C10, C14, C102, C103, 107, C109. Trim leads to length and solder.
- 15) Ensure polarity is observed.
- 16) Fit L2, L100 and L1 in that order. Trim leads to length and solder.
- 17) Referring to FIG11, fit Capacitors C1, C8, C9, C11, C100. Trim leads to length and solder. Ensure polarity is observed.
- 18) Referring to FIG 12, fit Bridge Rectifiers BR1 and BR100 in positions shown. Trim leads to length and solder.
- 19) Ensure polarity is observed.
- 20) Fit RL1.
- 21) Fit PL9.
- 22) Fit cable assembly (item 75) to SK1 as shown. Red to 'ANODE' Blue to 'HEATER' & 'COMMON'.
- 23) Inspect PCB to ensure all components have been correctly and neatly fitted. Ensure all joints are soldered neatly without shorts and that all fixings are tight. Place completed PCB in static safe bag and seal with standard label.

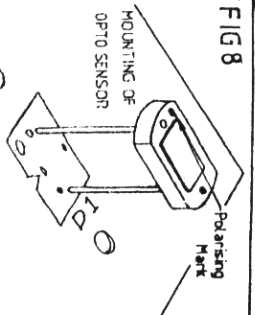
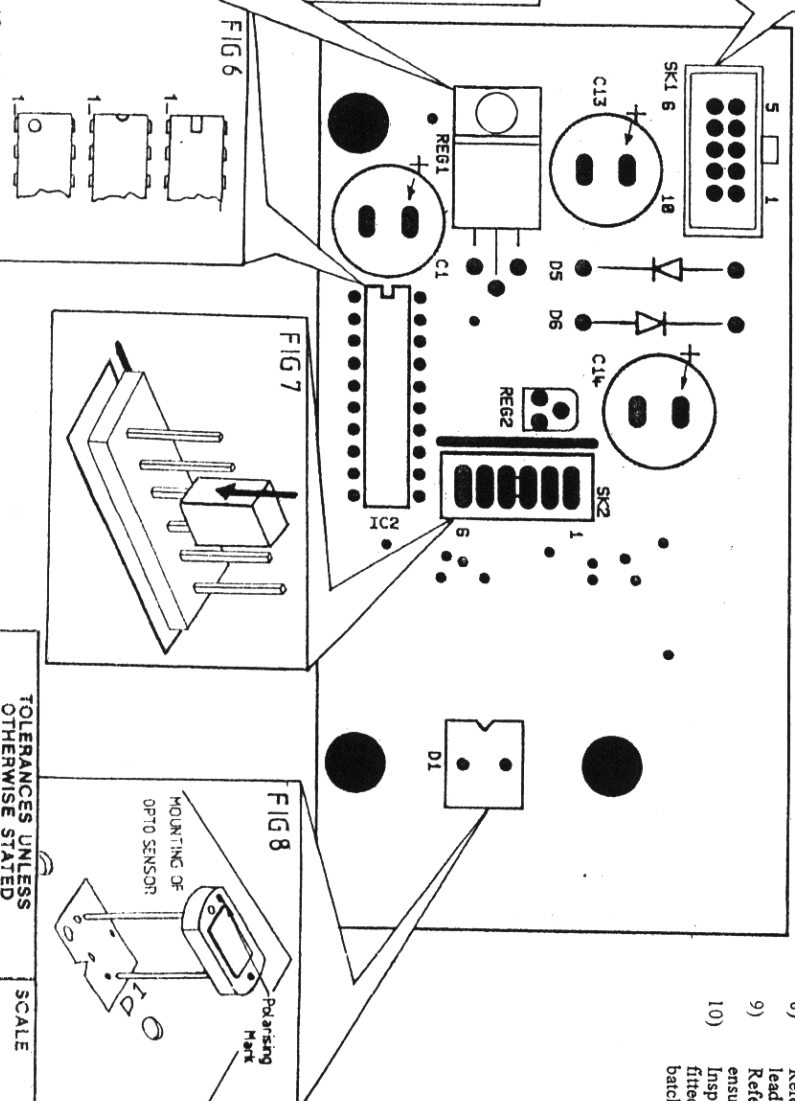
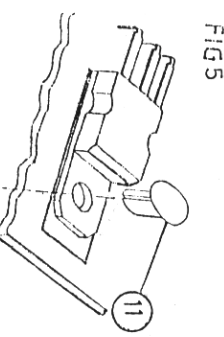
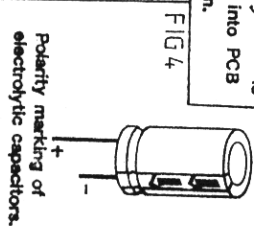
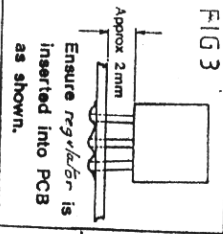
Section 9

Circuit Diagrams

- 9.30 Detector PCB Schematic - 640-009 - 1 page
- 9.31 Detector PCB Layout - 640-009 - 1 page
- 9.32 Detector PCB Schematic – 640 505 – 1 page
- 9.33 Detector PCB Layout – 640 505 – 1 page



△ SURFACE MOUNT
SIDE OF PCB.
(Ref 540-021)



CAUTION. Assemble using static precautions. Place completed PCB into bag provided. These devices are static sensitive.

ASSEMBLY NOTES:

6400 Detector PCB Assembly:- 640-009

- 1) Referring to Feeder List, adjacent drawing, screening and reflow information, complete all surface mount aspects of this assembly (Job/Feet Ref 640-021).
- NOTE: All leaded components are fitted on the opposite side of the board to the Surface Mount Components.**
- 2) Referring to FIG 1, fit Diodes D5 & D6 as shown. Trim leads to length and solder.
- 3) Referring to FIG 3, fit Regulator REG 2 as shown. Trim leads to length and solder.
- 4) Referring to FIG 6, fit Integrated Circuit in position IC2. Solder all pins.
- 4) Referring to FIG 2, fit connector in position SK1. Solder all pins.
- 6) Referring to FIG 5, fit Regulator in position REG 1 and secure with fixing specified. Trim leads to length and solder.
- 7) If necessary, reduce Header to six ways and referring to FIG 7, fit in position SK2 and solder in place. Push Low Profile Shunt over pins 3 & 4 as shown.
- 8) Referring to FIG 4, fit Electrolytic Capacitors in positions C1, C13 & C14. Trim leads to length and solder.
- 9) Referring to FIG 8, fit Photo-Cell (CD) as shown. Trim leads and solder in place ensuring that the photo-cell is flat against PCB.
- 10) Inspect PCB to ensure all components (including Surface Mount) are correctly

FEEDER LIST

A	B	E	
Unit not configured	Unit not configured	Unit not configured	
C00	001-380 47K	F00	Not assigned
C01	001-388 100K	F01	Not assigned 100PF
C02 & C03	Not assigned	F02	002-094 1Hf
C04	001-412 1M	F03 thro F05	Not assigned
C05	Not assigned	F06	001-364 10K
C06	002-089 100Hf	F07	001-348 2K2
C07	002-090 1uF	F08	Not assigned
C08	Not assigned	F09	001-316 100R
C09	002-087 10pF		
D00	Not assigned	G00	Not assigned
D01	004-065	G01	020-029
D02 thro D05	Not assigned	G02 & G03	Not assigned
D06 & D07	019-063	G04	002-099 100pF
D08	004-056	G05	Not assigned
D09	Not assigned	G06	005-033 B,R 43
		G07 thro G09	Not assigned
		H	Unit not configured


Screening:

Use Stencil 077-255

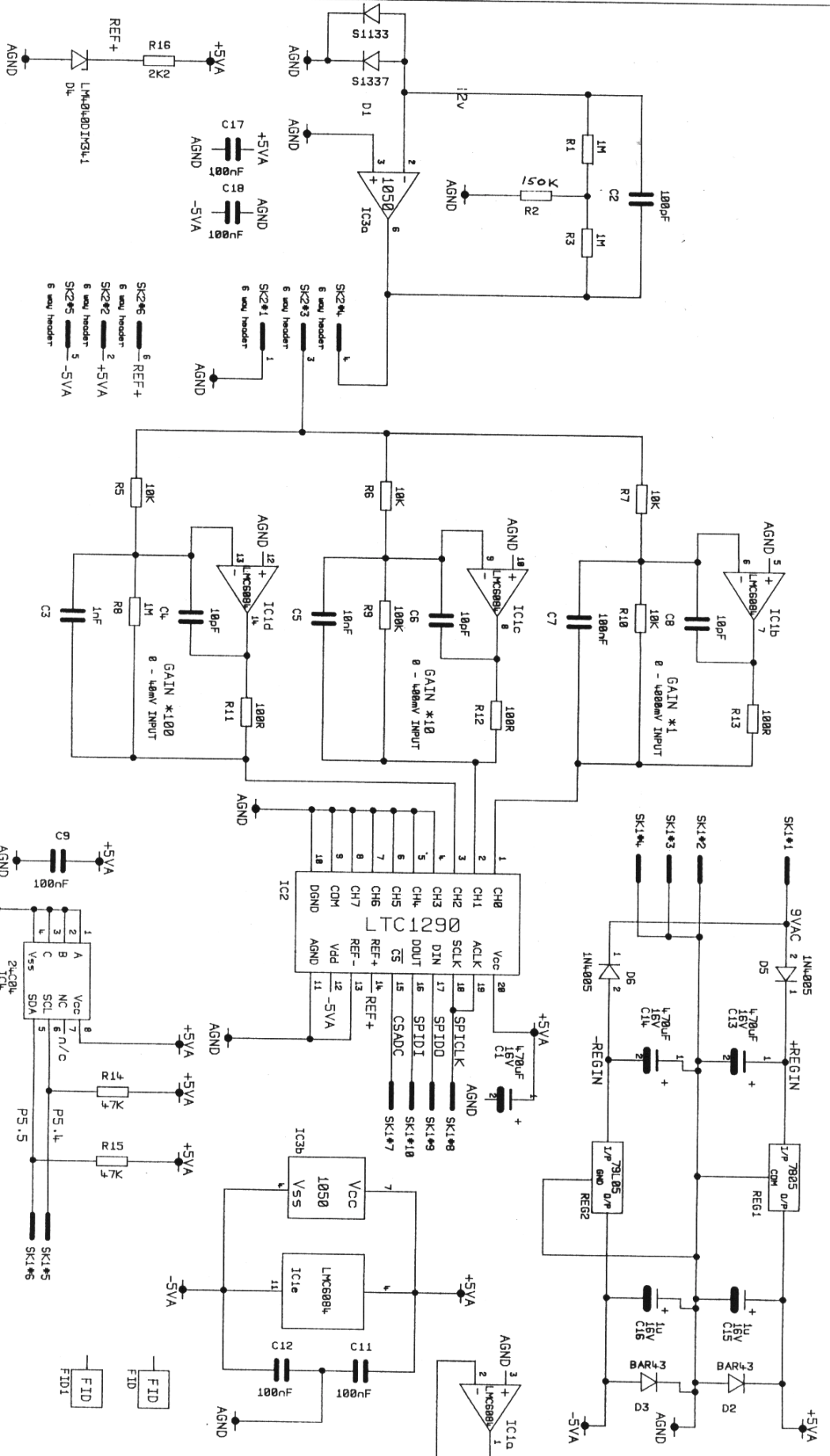
Use Solder Paste RMLAA590 (060-280)

Ref: 10

Use Profile 002

A	ON2159	14/10/98	E	I	IF IN DOUBT ASK	
B	ON2165	23/3/98	F	J	DO NOT SCALE	
C	ON2174	21/12/98	G	K	THIRD ANGLE PROJECTION	
D			H	L		

TOLERANCES UNLESS OTHERWISE STATED		SCALE	ALL DIMS	This drawing is copyright and must not be reproduced or otherwise made use of without written permission (c)
GENERAL	±	NTS	IN mm	
HOLE CRS.	±	FINISH	~	MATERIAL
DIAMETERS	±			
ANGLES	±			
DRN. S. P. C.	DATE 14/10/97	APPD. ME	DATE OCT 97	DWG. REF. 640-009
JENWAY LTD			6400 DETECTOR PCB ASSY	



P1		5		9	DATE 007 97	APP'D MF	DATE 7 AUG 97	DRN. DPH	DRG. REF. 640-505	SHT. 1 OF 1
A	CN2165	24/5/97	6	10	This drawing is copyright and must not be reproduced or otherwise made use of without written permission.					
B	CN23/7	08/2/00	7	11						
C			8	12						

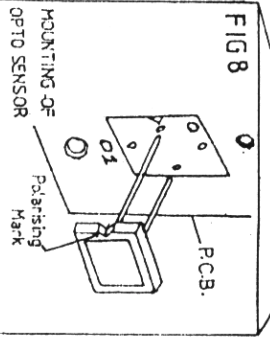
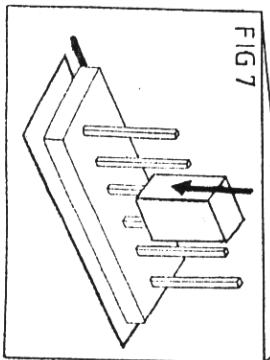
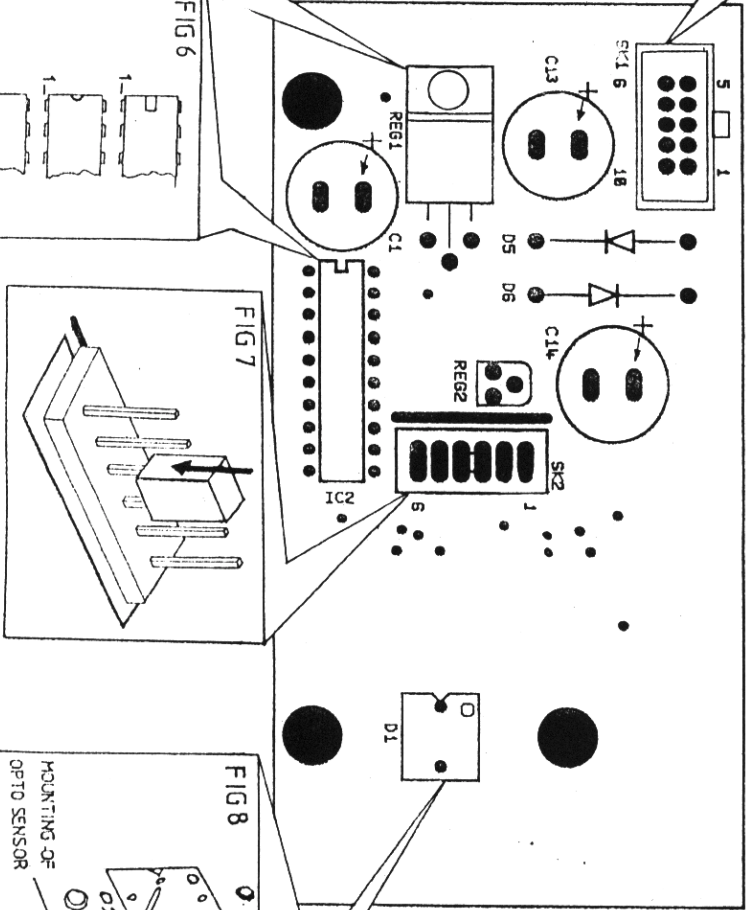
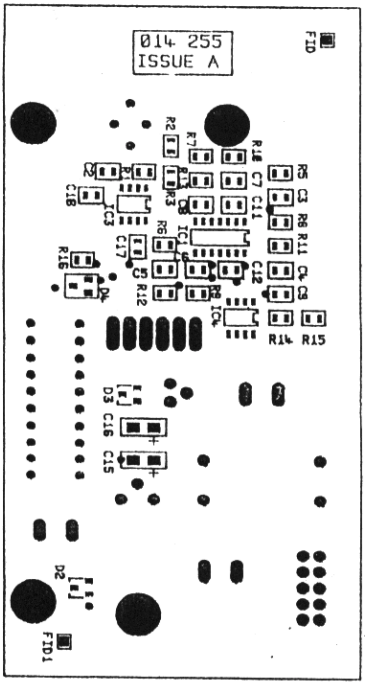
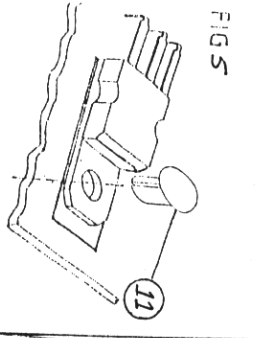
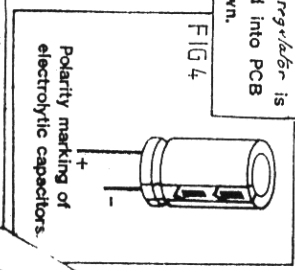
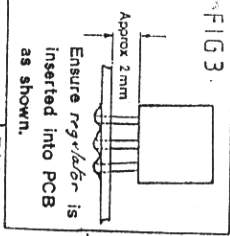
©



JENWAY LTD.

Gransmore Green, Felsted,
Dunmow, Essex, CM8 3LB
Tel: 01371 820122

CM8 3LB

DETECTOR BOARD SCHEMATIC



A	CN2159	14/12/67	E		I		IF IN DOUBT ASK	
B	CN2165	23/3/68	F		J		DO NOT SCALE	
C	CN2174	21/12/67	G		K		THIRD ANGLE	
D	CN2312	11/12/60	H		L		PROJECTION	

TOLERANCES UNLESS OTHERWISE STATED		SCALE	ALL DIMS	This drawing is copyright and must not be reproduced or otherwise made use of without written permission.
GENERAL	±	N/TS	IN mm	
HOLE CRS.	±	FINISH	~	MATERIAL
DIAMETERS	±			
ANGLES	±			
DRAWN BY	DATE	APPROVED BY	DATE	DWG. REF.
JENWAY LTD	14/10/92	ME	07/92	640-505
Gransmore Green, Feistick, Dunmow, Essex, CM6 3LB Tel: 0371 820122		6405 DETECTOR PCB ASSY		

- 1) Referring to Feeder List, adjacent drawing, screening and reflow information, complete all surface mount aspects of this assembly (Job/File Ref 640-509).

NOTE: All leaded components are fitted on the opposite side of the board to the Surface Mount Components.

- 2) Referring to FIG 1, fit Diodes D5 & D6 as shown. Trim leads to length and solder.
- 3) Referring to FIG 3, fit Regulator REG 2 as shown. Trim leads to length and solder.
- 4) Referring to FIG 6, fit Integrated Circuit in position IC2. Solder all pins.
- 5) Referring to FIG 2, fit connector in position SK1. Solder all pins.
- 6) Referring to FIG 5, fit Regulator in position REG 1 and secure with fixing specified. Trim leads to length and solder.
- 7) If necessary, reduce Header to six ways and referring to FIG 7, fit in position SK2 and solder in place. Push Low Profile Shunt over pins 3 & 4 as shown.
- 8) Referring to FIG 4, fit Electrolytic Capacitors in positions C1, C13 & C14. Trim leads to length and solder.
- 9) Referring to FIG 8, fit Photo-Cell (D1) as shown. Trim leads and solder in place ensuring that the photo-cell is flat against PCB.
- 10) Inspect PCB to ensure all components (including Surface Mount) are correctly fitted and that polarities are correct. Test in accordance with 640-505 and adhere batch code label. Place completed PCB in static safe bag.

A	Unit not configured	E	Unit not configured
B	Unit not configured	F00	Not assigned
C00	001-380 47K	F01	002-095 10mF
C01	001-388 100K	F02	002-094 1nF
C02 & C03	Not assigned	F03	Not assigned
C04	001-412 1M	F04	001-392 150K
C05	Not assigned	F05	Not assigned
C06	002-089 100nF	F06	001-364 10K
C07	002-090 1uF	F07	001-348 1K2
C08	Not assigned	F08	Not assigned
C09	002-087 10pF	F09	001-316 100R
D00	Not assigned		
D01	004-065	G00	Not assigned
D02 thru D05	Not assigned	G01	020-029
D06 & D07	019-063	G02 & G03	Not assigned
D08	004-076	G04	002-099 100pF
D09	Not assigned	G05	Not assigned

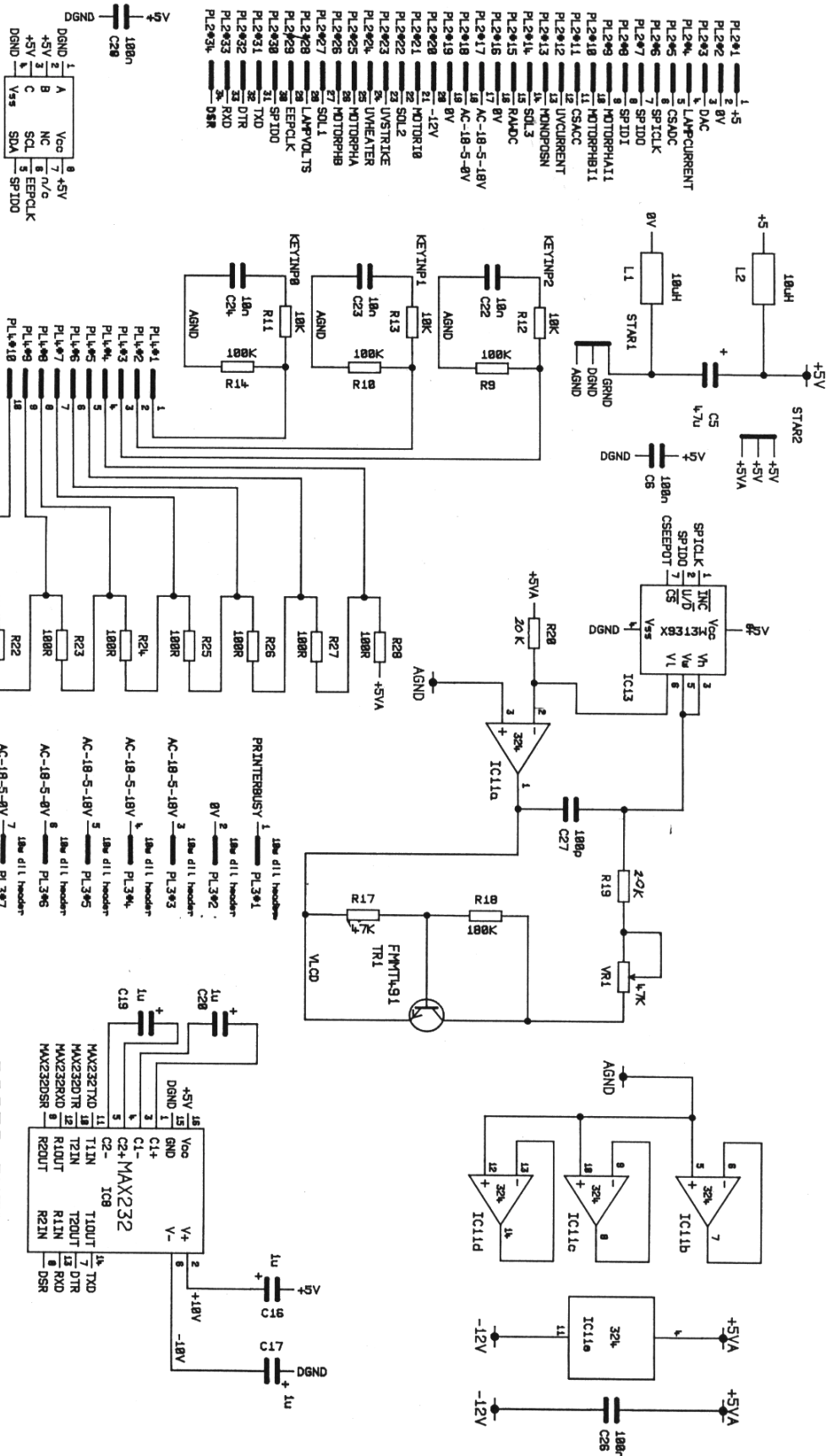
Redon:

Section 9

Circuit Diagrams

- 9.40 Microprocessor PCB Schematic – 640 007
 – 2 pages

- 9.41 Microprocessor PCB Layout - 640 007
 - 1 page



P1	23/4/97	DPH	A	11/8/97	CN2139	E		DATE	Nov 97	APP'D	M	DATE	23/4/97	DRN.	DPH	DRG.	REF.	640 007	SHT.	2	OF	2
P2	18/7/97	DPH	B	06/11/97	CN2146	F																
P3			C	10/06/99	CN2207	G																
P4			D	14/07/99	CN2240	H																

This drawing is copyright and must not be reproduced or otherwise made use of without written permission.

©

JENWAY LTD. Dunmow, Essex, CM6 3LB
 Tel: 01371 820122

PRINTER INTERFACE

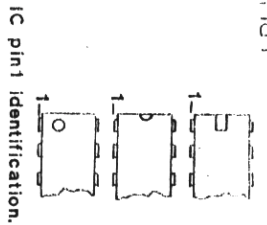
RS232C INTERFACE

Section 9

Circuit Diagrams

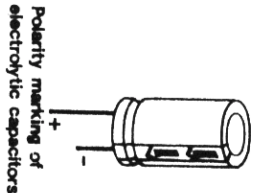
- 9.50 Accessory Driver PCB Schematic – 642 003 –
 1 page
- 9.51 Accessory Driver PCB Layout – 642 003 –
 1 page

FIG 1



IC pin identification.

FIG 2



Polarity marking of electrolytic capacitors.

FIG 3

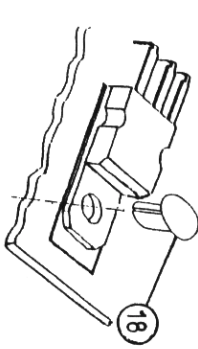
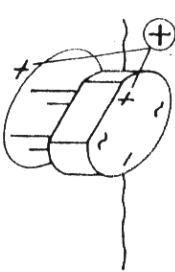
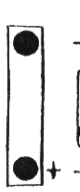


FIG 4



Rectifier polarity

FIG 5



Polarity marking of diode

FIG 6

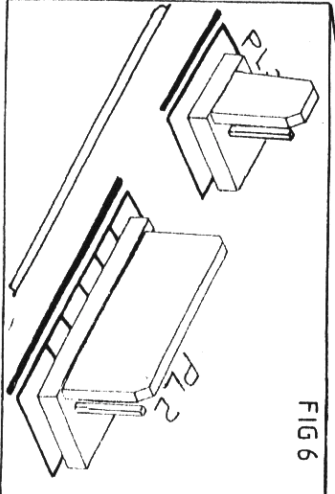
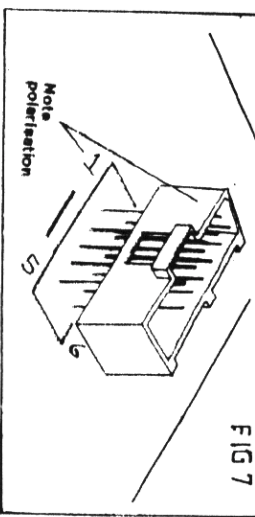


FIG 7

Note
Polarisation

CAUTION. Assemble using static precautions.
Place completed PCB into bag provided.
These devices are static sensitive.

ASSEMBLY NOTES:

6400/5 Accessory PCB Assembly: 642-003

- 1) Referring to Feeder List & Screening and Reflow information, complete all surface mount aspects of this assembly (Job/File Ref 642-004).
- 2) Fit Terminal Pin in position TP1 such that it protrudes from Component side of PCB. Solder in place.
- 3) Fit Resistors in positions R14, R17 & R18. Cut leads to length and solder.
- 4) Referring to FIG 5, fit Diode D1 in position indicated. Cut leads to length and solder.
- 5) Referring to FIG 1, fit Integrated Circuits IC5 & IC6. Fit IC Socket in position IC4. Solder all pins.
- 6) Referring to FIG 4, fit Bridge Rectifier BR1 in position indicated. Cut leads to length and solder.
- 7) Fit Capacitors C19 & C24 in positions indicated. Cut leads to length and solder.
- 8) Referring to FIG 6, fit Connectors PL2 & PL3 as indicated. Solder all pins.
- 9) Referring to FIG 7, fit Connector PL1 as indicated. Solder all pins.
- 10) Referring to FIG 2, fit Capacitors C11, C16, C20, C21 & C25 in positions indicated. Cut leads to length and solder.
- 11) Referring to FIG 3, fit Regulators REG1 & REG2 and retain with fixings indicated. Tighten fixings, trim leads to length and solder.
- 12) Inspect PCB to ensure that all components (including Surface Mount) are correctly fitted and that polarities are correct. Test in accordance with 642-003 and adhere batch code label. Place completed PCB in Static Safe bag.

FEEDER LIST

A	Unit not configured	F00	Not assigned
B00	010-023 10uH	F01	002-095 10uF
B01 thro B03	Not assigned	F02	002-024 1uF
B04	002-098 4u7	F03 thro F05	Not assigned
B05	034-006 12M	F06	001-364 10K
B06	Not assigned	F07	Not assigned
		F08	001-340 1K
		F09	001-350 2K7
C00	001-380 47K	G00 thro G07	Not assigned
C01 thro C06	Not assigned	G08	002-101 15uF
C07	002-090 1uF	G09	003-034
C08 & C09	Not assigned		
D00 thro D05	Not assigned	H00 thro H03	Not assigned
D06 & D07	019-063	H04	019-068
D08 & D09	Not assigned	H05 thro H09	Not assigned
E00 thro E24	019-055		
E25 thro E49	Not assigned		

Screening:

Use Stencil 077-256

Use Solder Paste RMCA/AS90 (060-280)

Reflow:

Use Profile 005

TOLERANCES UNLESS OTHERWISE STATED

GENERAL =

HOLE CRS. =

DIAMETERS =

ANGLES =

SCALE

ALL DIMS

IN

WITHOUT WRITTEN PERMISSION

FINISH

MATERIAL

~

This drawing is copyright and must not be reproduced or otherwise made use of

©

DRN. S.P.L. DATE 6/11/92 APPD MF DATE NOV 92 DRG. REF. 642-003
JENWAY LTD 3 years. Revised. 6400/5 ACCESSORY PCB ASSY
Barnstaple, Essex. CM6 3LB
Tel. 0377 820122

Section 10

Assembly Diagrams

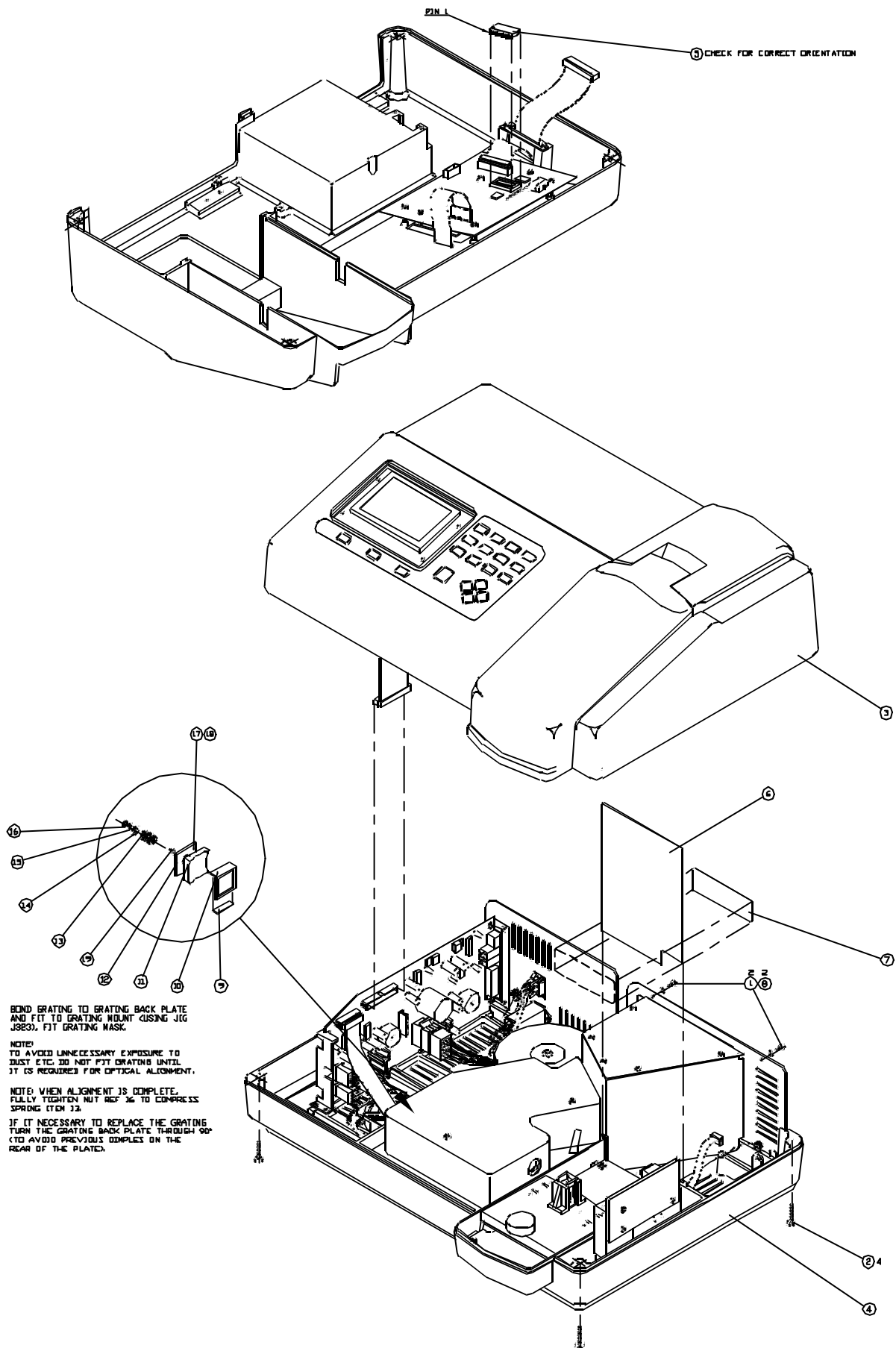
- 10.1 6400 Final Assembly 640 003
- 10.2 6405 Final Assembly 640 503
- 10.3 6400 Lower Case Assembly 640 005 (2 pgs)
- 10.4 6405 Lower Case Assembly 640 504 (2 pgs)
- 10.5 6400/05 Top Case Assembly 640 004
- 10.6 6400 Optics Assembly 640 017
- 10.7 6405 Optics Assembly 640 510
- 10.8 6400/05 Rear Panel Assembly 640 006
- 10.9 6400/05 Multi-Cell Changer 644 002

Section 10

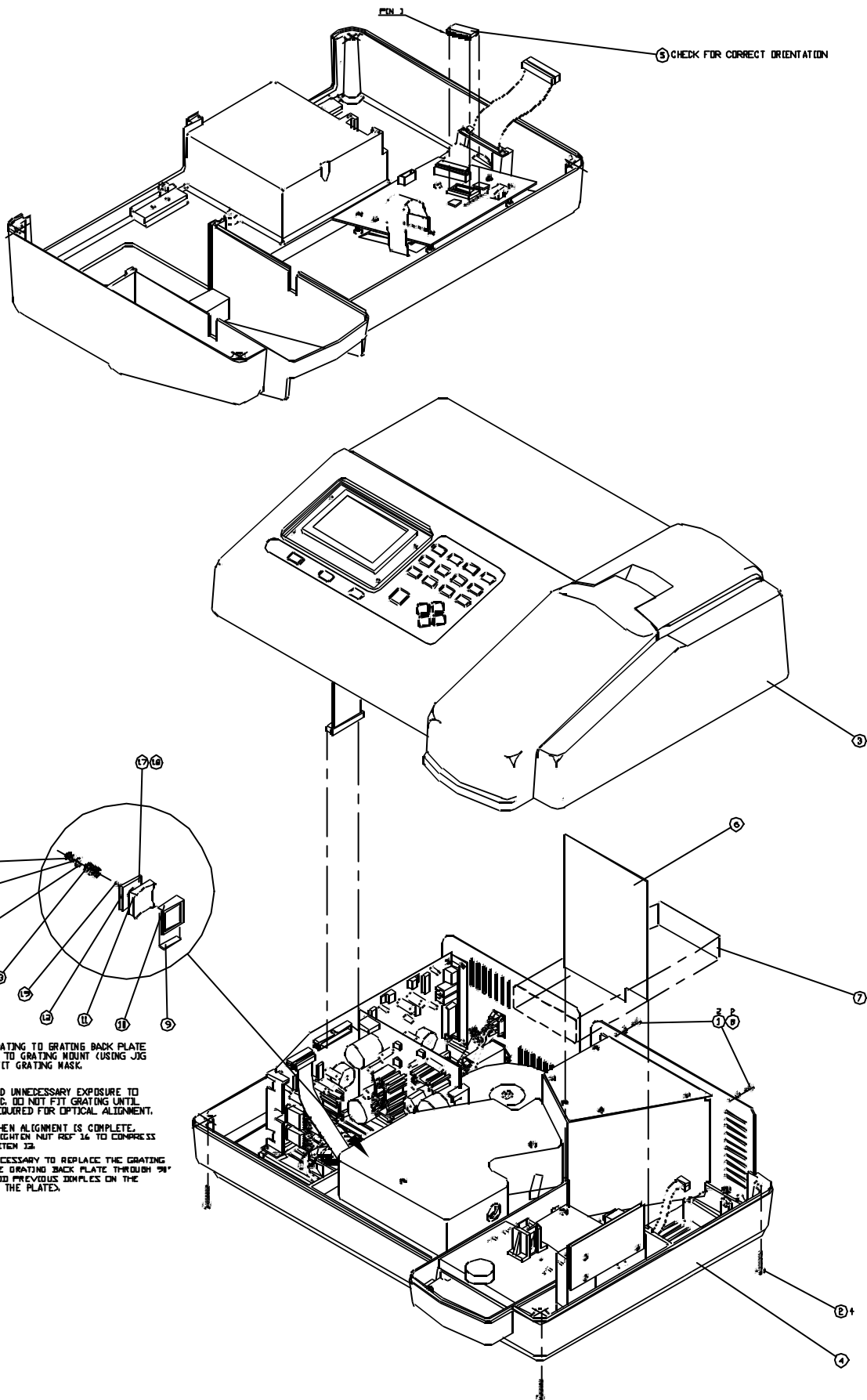
Assembly Diagrams

10.1 6400 Final Assembly – 640 003

10.2 6405 Final Assembly – 640 503



TOLERANCE UNLESS OTHERWISE STATED				SCALE		ALL DIMS IN MM		THIS DRAWING IS TO BE USED FOR THE PURPOSE OF THE PROJECT ONLY. IT IS NOT TO BE USED FOR ANY OTHER PURPOSE WITHOUT THE WRITTEN PERMISSION OF JENWAY LTD.	
GENERAL				3/B		FINISH		MATERIAL	
HOLE CRS									
DIAMETERS									
ANGLES									
A	2154	101297	E			I		IF IN DOUBT ASK	
B	2186	110998	F			J		DO NOT SCALE	
C	2194	191198	G			K		THIRD ANGLE	
D	2175	220399	H			L		PROJECTION	
DRN: Z. M. H. DATE: 101297 APPR: DATE: DEC REF: 640-003				JENWAY LTD		TITLE: FINAL ASSEMBLY		6400 SPECTROPHOTOMETER	



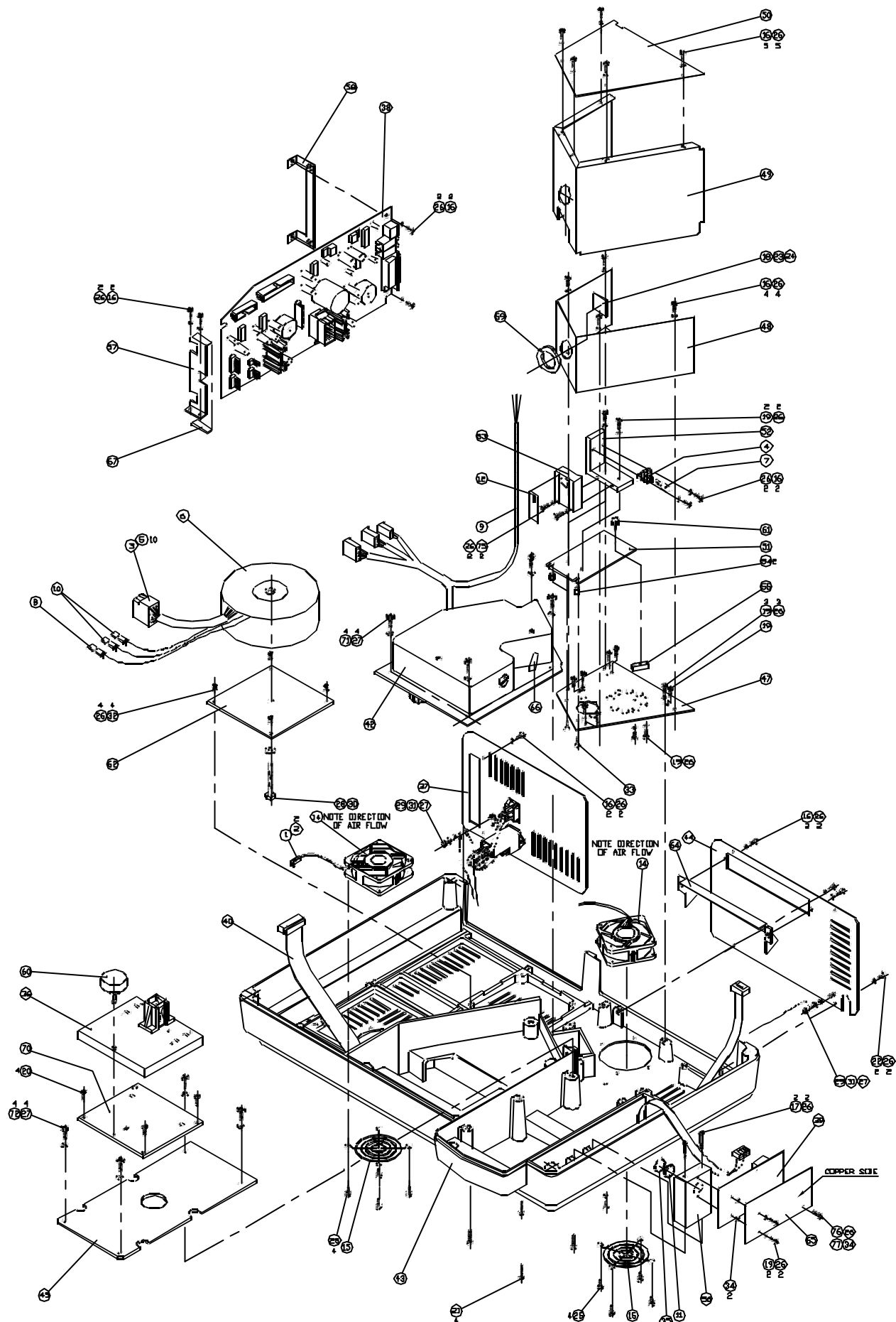
TOLERANCE UNLESS OTHERWISE STATED										SCALE		ALL DIMS		This drawing is copyright and must not be reproduced or information given out without written permission			
GENERAL										3/8		IN MM		C			
HOLE CIRC.										FINISH		-		MATERIAL			
DIAMETERS																	
ANGLES																	
A	B154	081297	E			I			IF IN DOUBT ASK								
B	B186	110998	F			J			DO NOT SCALE								
C	B194	191198	G			K			THIRD ANGLE								
D	B175	220399	H			L			PROJECTION								
DRN: Zee Wende										DATE: 081297		APP: [Signature]		DATE		DEC REF: 640-503	
JENWAY LTD										6405 SPECTROPHOTOMETER		TITLE: FINAL ASSEMBLY		6405 SPECTROPHOTOMETER			

Section 10

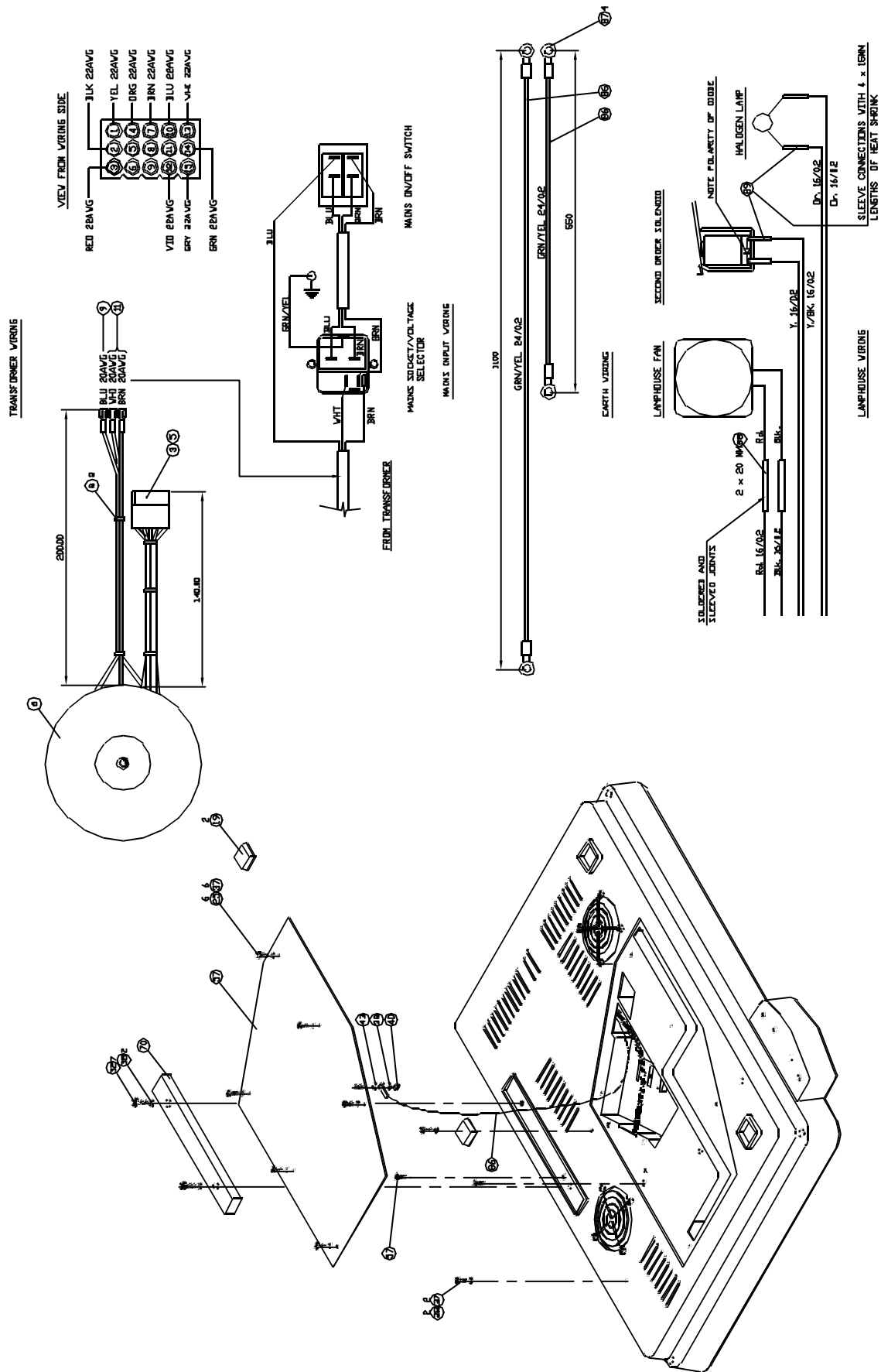
Assembly Diagrams

10.3 6400 Lower Case Assembly – 640 005

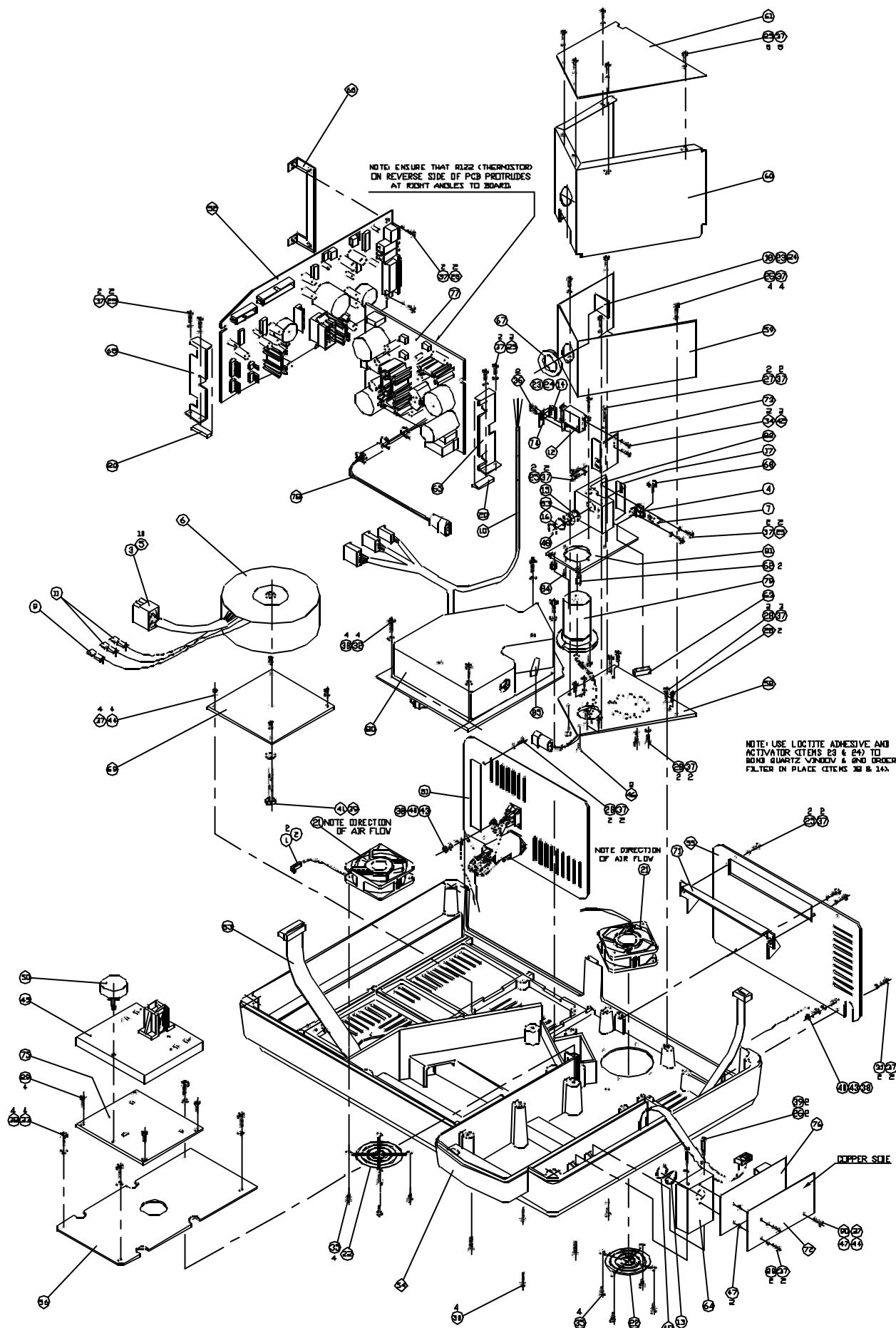
10.4 6405 Lower Case Assembly – 640 504



							TOLERANCE UNLESS OTHERWISE STATED		SCALE		ALL DIMS		THIS DRAWING IS COPYRIGHT © 1997 BY JENWAY LTD. ALL RIGHTS RESERVED. NO PART OF THIS DRAWING MAY BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, WITHOUT PERMISSION IN WRITING FROM JENWAY LTD. ©	
							GENERAL		3/B		IN MM			
							HOLE CRS		FINISH		-		MATERIAL	
							DIAMETERS							
							ANGLES							
A	B154	111297	E		I		IF IN DOUBT ASK							
B	B186	131198	F		J		DO NOT SCALE							
C			G		K		THIRD ANGLE							
D			H		L		PROJECTION							
							DIMS $\frac{1}{2}$ Scale		DATE 11/29/97		APPD		DATE	
							JENWAY LTD		12-13, The Quadrant, Bournemouth, Dorset, BH1 1AB, UK. Tel: 01202 551111 Fax: 01202 551112		TITLE		LOWER CASE ASSEMBLY 6400 SPECTROPHOTOMETER	



TOLERANCE UNLESS OTHERWISE STATED				SCALE		ALL DIMS		THIS DRAWING IS COPYRIGHT © 1978 BY JENWAY LTD. ALL RIGHTS RESERVED. NO PART OF THIS DRAWING MAY BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, WITHOUT PERMISSION IN WRITING FROM JENWAY LTD.	
GENERAL				3/8		IN MM		MATERIAL	
HOLE CRS				FINISH		-		-	
DIMANCERS				DATE 281197		APPD		DATE	
ANGLES				JENWAY LTD		DEC REC 640-504 SHT.1		TITLE LOWER CASE ASSEMBLY	
IF IN DOUBT ASK				DO NOT SCALE		THIRD ANGLE		PROJECTION	
DO NOT SCALE				THIRD ANGLE		PROJECTION		6405 SPECTROPHOTOMETER	
THIRD ANGLE				PROJECTION		6405 SPECTROPHOTOMETER			
PROJECTION									

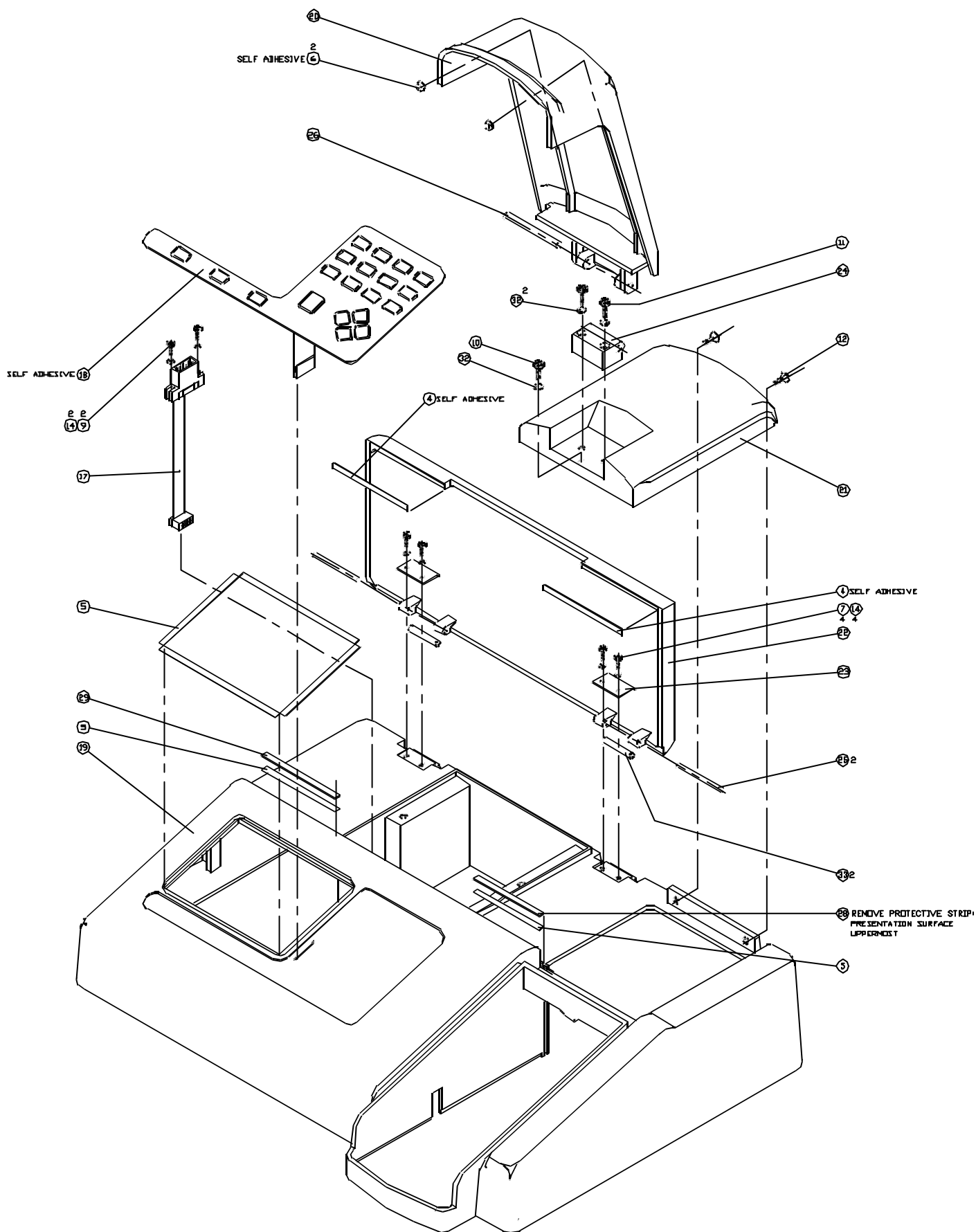


TOLERANCE UNLESS OTHERWISE STATED						SCALE	ALL DIMS	THIS DRAWING IS THE PROPERTY OF JENWAY LTD. IT IS TO BE USED FOR THE MANUFACTURE OF THE EQUIPMENT SPECIFIED HEREIN ONLY. IT IS NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, WITHOUT PERMISSION IN WRITING FROM JENWAY LTD.	
A	2154	281197	E		I	IF IN DOUBT ASK	3/8	IN MM	
E	2186	131198	F		J	DO NOT SCALE	FINISH		MATERIAL
C	2175	030399	G		K	THIRD ANGLE			
H	2175	240399	H		L	PROJECTION			
JENWAY LTD						DATE 281197	APPD	DATE	DEC REC 640-504 SHT.2
6405 SPECTROPHOTOMETER									

Section 10

Assembly Diagrams

10.5 6400/05 Top Case Assembly – 640 004



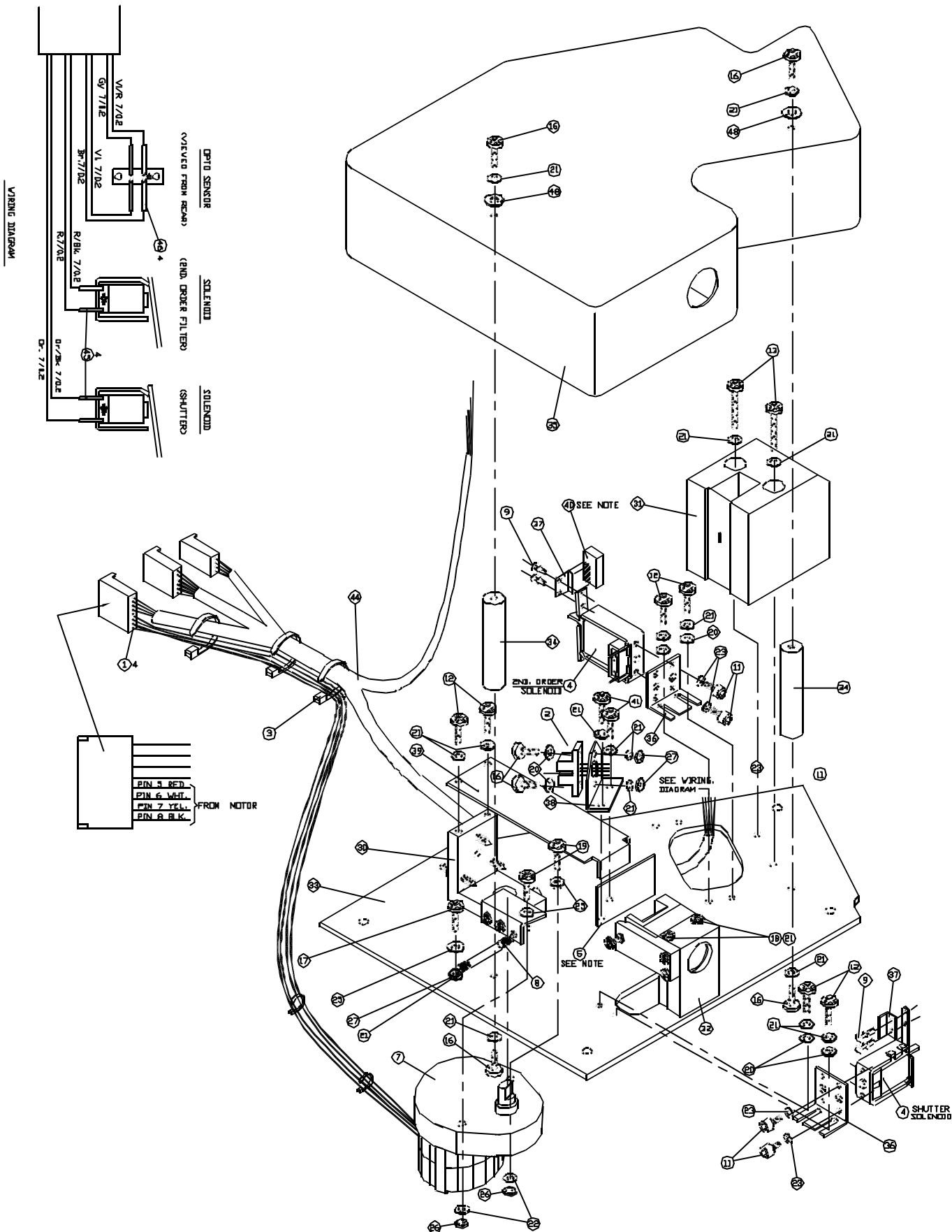
								TOLERANCE UNLESS OTHERWISE STATED		SCALE	ALL DIMS IN MM	This drawing is Copyright © 2004 Jenway Ltd. All rights reserved. No part of this drawing may be reproduced without written permission.
								GENERAL		FINISH	MATERIAL	
A	B154	021297	E		I		IF IN DOUBT ASK	HOLE PHS				
B			F		J		DO NOT SCALE	DIMANCORS				
C			G		K		THIRD ANGLE	ANGLES				
D			H		L		PROJECTION	DATE 011297		APPD	DATE	
								JENWAY LTD		DEC REQ 640-004 SHT.1		
								FINISH		TITLE TOP CASE ASSEMBLY		
								APPD		6405/6400 SPECTROPHOTOMETER		

Section 10

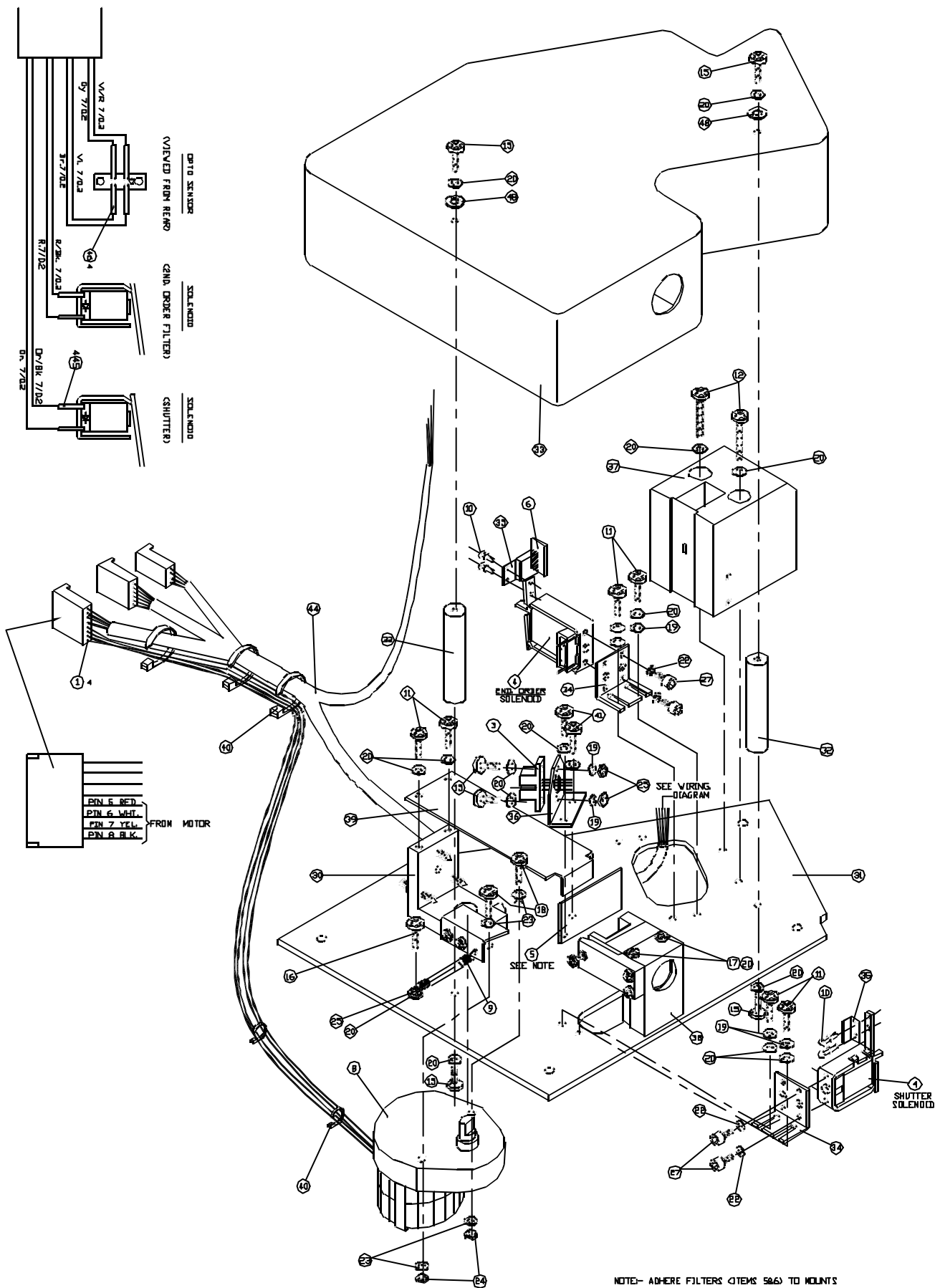
Assembly Diagrams

10.6 6400 Optics Assembly – 640 017

10.7 6405 Optics Assembly – 640 510



TOLERANCE UNLESS OTHERWISE STATED						SCALE	ALL DIMS	THIS DRAWING IS THE PROPERTY OF JENWAY LTD. IT IS TO BE USED FOR THE PURPOSES SPECIFIED AND IS NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, WITHOUT PERMISSION IN WRITING FROM JENWAY LTD.	
GENERAL						1:1	IN MM	MATERIAL	
HOLE (RS)						FINISH			
DIAMETERS									
ANGLES									
A	2139	101097	E	2175	231298	I		DATE	DEC 10 1997
B	2172	190698	F	2175	200199	I		APPD	DEC 10 1997
C	2186	170998	G	2173	220399	K		DATE	DEC 10 1997
D	2194	191198	H			L		TITLE	6400 OPTICS ASSEMBLY



NOTE- ADHERE FILTERS (ITEMS 586) TO MOUNTS USING ACTIVATOR (ITEM 43) & ADHESIVE (ITEM 42).
 NOTE IT IS IMPORTANT THAT ALL COMPONENTS (PARTICULARLY OPTICAL COMPONENTS) ARE KEPT AS CLEAN AS POSSIBLE.

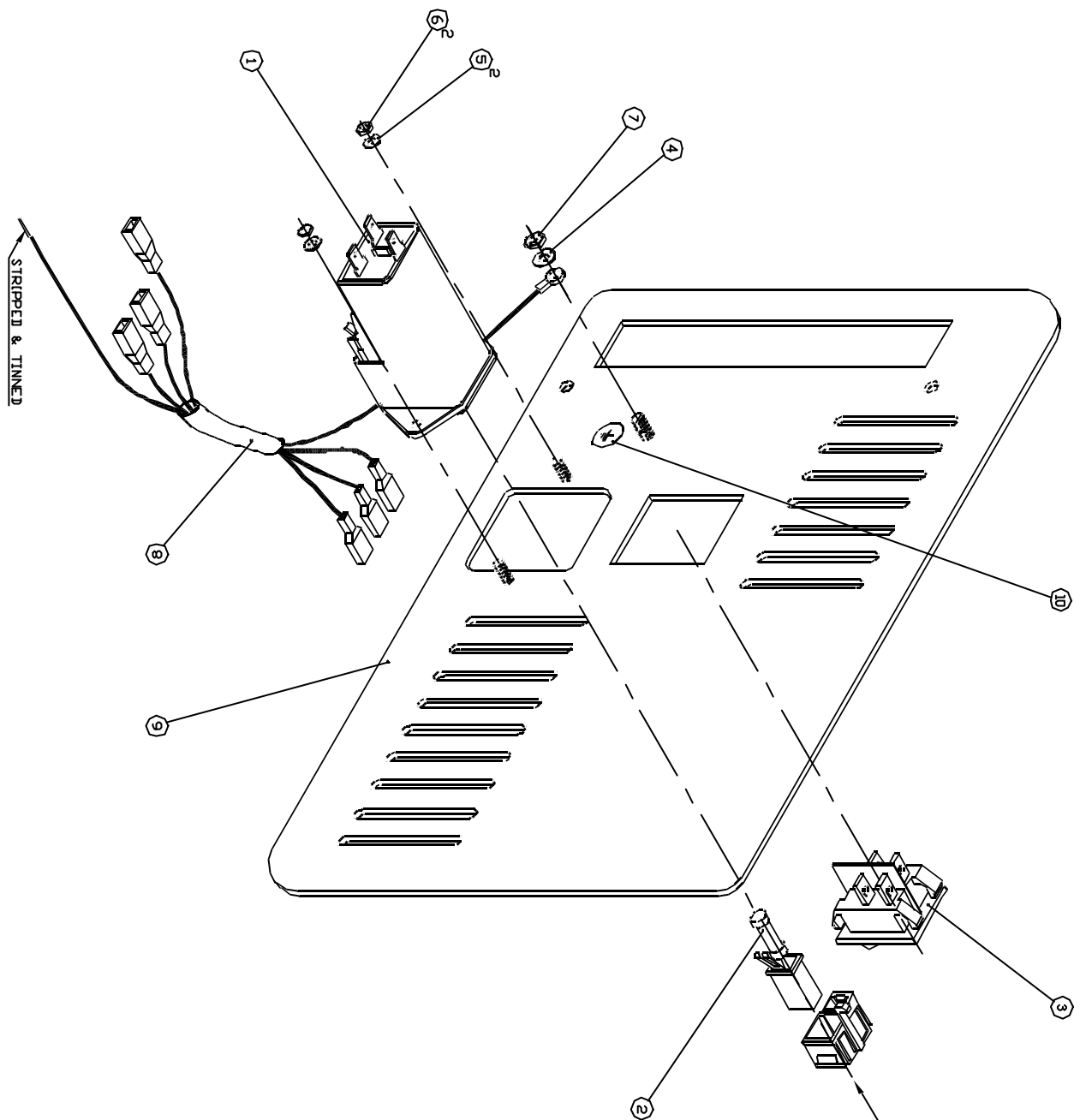
TOLERANCE UNLESS OTHERWISE STATED										SCALE		ALL DIMS		THIS DRAWING IS THE PROPERTY OF JENWAY LTD. AND IS NOT TO BE REPRODUCED OR USED IN ANY MANNER WITHOUT WRITTEN PERMISSION	
GENERAL										1:1		IN MM		C	
HOLE CIRC.										FINISH		MATERIAL			
DIAMETERS															
ANGLES															
IF IN DOUBT ASK										DATE		APPD		TITLE	
DO NOT SCALE										101097				6405-510	
THIRD ANGLE														6405 OPTICS ASSEMBLY	
PROJECTION															

Section 10

Assembly Diagrams

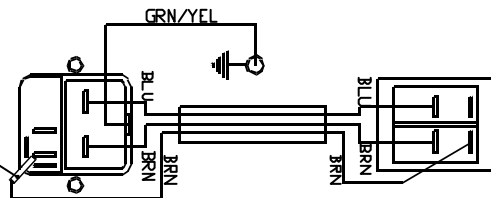
10.8 6400/05 Rear Panel Assembly – 640 006

10.9 6400/05 Multi-Cell Changer – 644 002



MAINS SOCKET/VOLTAGE
SELECTOR
(REAR VIEW)

⑨ SOLDER WIRE TO TAG & SLEEVE
WITH 10MM OF HEAT SHRINK

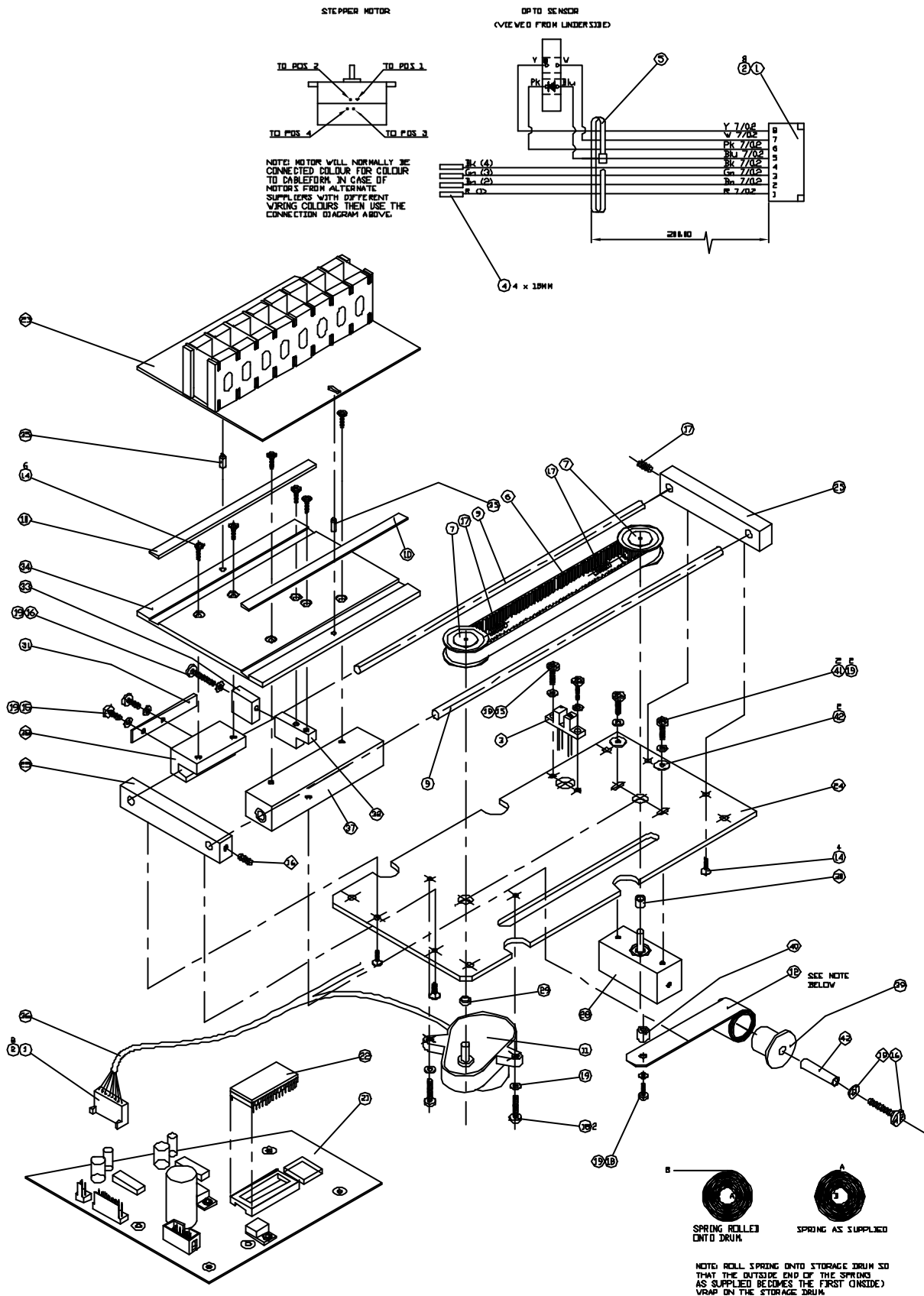


MAINS ON/OFF SWITCH
(REAR VIEW)

ENSURE '230V' SETTING
IS SELECTED

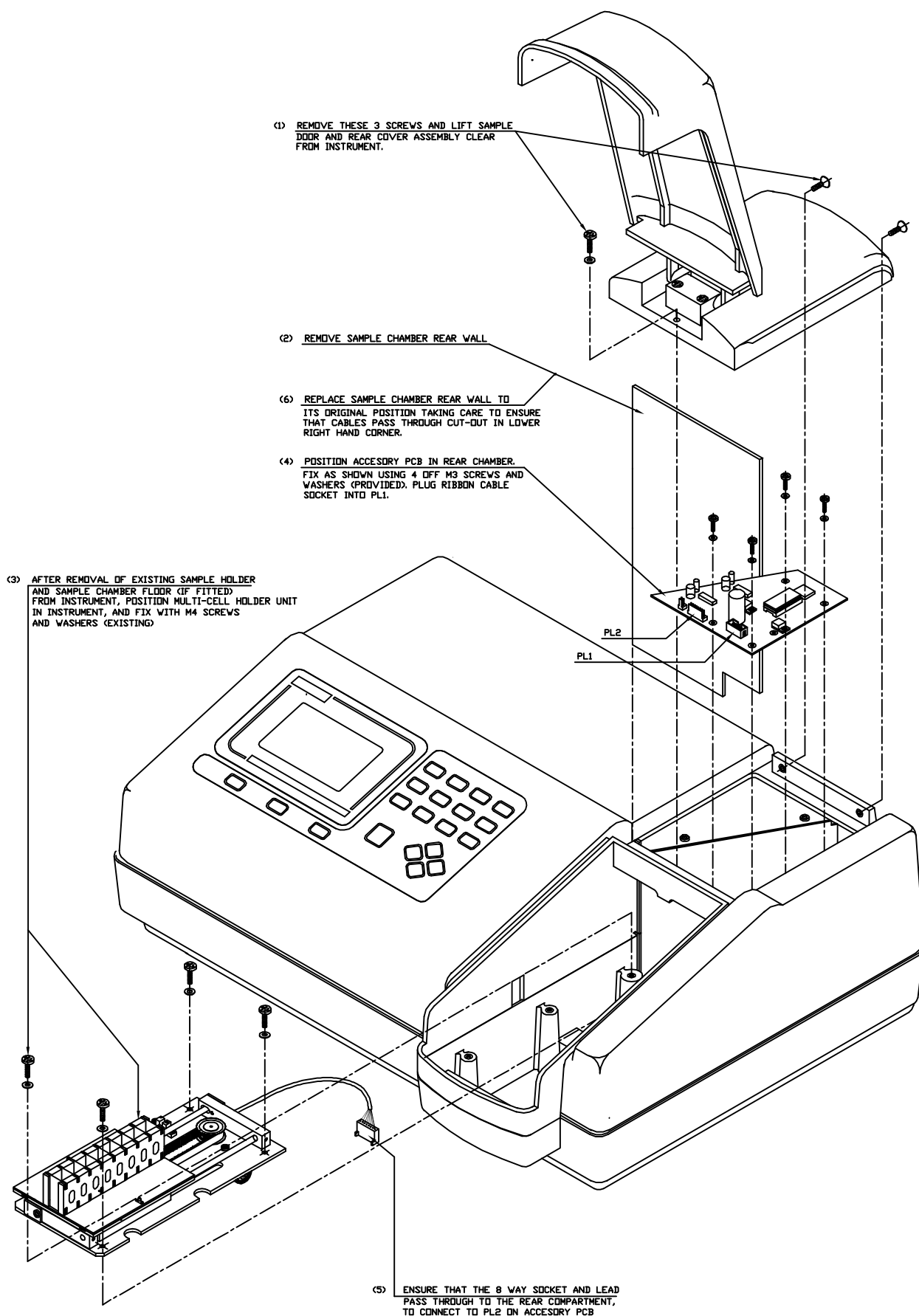
A	2146	001097	E		I		IF IN DOUBT ASK
E	2134	090198	F		I		DO NOT SCALE
C			G		K		THIRD ANGLE
D			H		L		PROJECTION

TOLERANCE UNLESS OTHERWISE STATED				SCALE	ALL DIMS	Rear Panel Assembly Spectrophotometer Average Color and Hue Difference from Color Reproduction Chart within 10% reflectance per channel.		C
GENERAL				NTS	IN MM			
HOLE PRS				FINISH			MATERIAL	
DIMANCERS								
ANGLES								
DRN Lm Shale				DATE 201097	APPD	DATE		DRG REF. 640-006
JENWAY LTD				TITLE		REAR PANEL ASSEMBLY 6400/6405 SPECTROPHOTOMETER		



TOLERANCE UNLESS OTHERWISE STATED								SCALE	ALL DIMNS IN	This drawing is copyright and must not be reproduced or otherwise made use of without written permission.	
GENERAL * HOLE CRS. * DIAMETERS * ANGLES *								FINISH	-	MATERIAL	
A	2154	070198	E	2172	220698	J	2326	020101	IF IN DOUBT ASK	DRN/Rev	070198
B	2165	030398	F	2184	010998	J			DO NOT SCALE	APPD.	
C	2165	200398	G	2205	290399	K			THIRD ANGLE	DATE	
D	2172	080698	H	2218	190599	L			PROJECTION	DRG REF.	644-002
JENWAY LTD								TITLE MULTI-CELL CHANGER F/ASSY			

ASSEMBLY OF MULTI-CELL CHANGER UNIT WITH 6400/6405 INSTRUMENT.



Section 11

Spare Parts

- 11.01 Packed Instrument
- 11.02 Top Case Assembly
- 11.03 Microprocessor PCB
- 11.04 Lower Case Assembly
- 11.05 Lamp Housing Assembly
- 11.06 Optics Assembly
- 11.07 Detector PCB
- 11.08 Power Supply PCB
- 11.09 Deuterium Lamp Supply PCB
- 11.10 Rear Panel Assembly
- 11.11 Multi-Cell Changer PCB
- 11.12 Built-In Printer Option

6400/05 SPARE PARTS LIST

Part Number	Drwg/Cct Ref	Description
-------------	-----------------	-------------

Section 11.01

640 501 Packed Instrument.

033 243		Packing case complete with inserts
060 084		Disposable cuvettes (4ml) pack of 100
640 050		Instruction manual
013 046		Mains cable without plug
013 083		Mains Cable U.S.A. plug
013 123		Mains Cable European plug
013 181		Mains Cable U.K. plug
TBA		Service Manual
640 133		Dust Cover

Section 11.02

640 004 Top Case Assembly.

640 058		6400 / 6400 Series membrane keypad
640 057		Display Window (Jenway Version)

Section 11.03

640 007 Microprocessor PCB.

640 007		Micro-processor PCB
TBA		Service Exchange 6400 / 05 microprocessor PCB
021 018		Battery PCB Mount 3.6V
640 056		EPROM (Programmed)

Section 11.04

640 504 Lower Case Assembly.

010 039		Torroidal transformer assembly
060 040		Large rubber feet
060 342		Cooling fan 12V 60mm
640 137		Rear Foot

Section 11.05

Lamp Housing Assembly.

009 063		Tungsten halogen lamp base
012 075		Tungsten halogen lamp
640 508		Deuterium lamp assembly
032 005		Solenoid 12V dc
035 105		IR Filter 6405

Section 11.06

640 017 / 640 510 Optics Assembly.

TBA		Monochromator assembly
TBA		Service exchange monochromator assembly
012 089		Chassis mount optocoupler
032 005		Solenoid 12V dc
012 055		Photodetector
035 106		IR Filter 6400

Section 11.07

640 009		<u>640 009 / 640 505 Detector PCB.</u>
640 505		Detector PCB assembly 6400
TBA		Detector PCB assembly 6405
002 054	C1, 13, 14	Service exchange detector PCB assembly
012 055	D1	470uF 16V radial electrolytic capacitor
012 085	D1	Photodetector 6405
020 002	Reg2	Photodetector 6400
020 006	Reg1	Voltage regulator 79L05
		Voltage regulator 7805

Section 11.08

640 025		<u>640 025 Main Power Supply PCB.</u>
TBA		Main power supply PCB
002 070	C25, 26	Service exchange main power supply PCB
005 024	D1	1000uF 25V radial electrolytic capacitor
002 112	C1	Bridge rectifier
016 054	F4, 5	4700uF 40V radial electrolytic capacitor
016 057	F2, 3	2.5A resettable fuse
016 061	F1	0.2A resettable fuse
020 019	Reg4	7.0A resettable fuse
020 027	Reg2, 3	Voltage regulator 7812
020 028	Reg1	L4960 voltage regulator
020 035	Reg5	L4962 voltage regulator
006 115	SK2	L7918CV voltage regulator
006 154	SK13	25 way D socket
009 124	SK10	6 way miniature DIN socket
009 125	SK11	4mm socket red
		4mm socket black

Section 11.09

640 516		<u>640 516 Deuterium Lamp Power Supply</u>
TBA		Deuterium lamp power supply
005 024	BR1, 100	Service exchange deuterium lamp power supp.
032 006	RLY1	Bridge rectifier 4A
020 004	Reg2	Relay single pole changeover 12V
020 016	Reg100	Voltage regulator 78L05
020 019	Reg1	Voltage regulator TL431
002 038	C14	Voltage regulator 7812
002 054	C102, 103	100uF 25V radial electrolytic capacitor
002 112	C1,100	470uF 16V radial electrolytic capacitor
002 114	C8, 9	4700uF 40V radial electrolytic capacitor
002 115	C11	220uF 35V radial capacitor low ESR
002 116	C107	2200uF 16V radial capacitor low ESR
		470uF 200V radial capacitor low ESR

Section 11.10

009 123		<u>640 006 Rear Panel Assembly.</u>
016 058		Mains input socket
017 050		1.6A fuse 20mm (T) (for 220V supply)
016 007		Switch rocker 2p
		3.15A Fuse 20mm (T) (for 110V supply)

Section 11.11

644 001		644 002 Multi-cell Changer with PCB
TBA		Multi-cell changer complete with PCB
012 089		Service exchange multi-cell changer with PCB
036 023		IR Chassis mount opto-coupler
060 344		Timing belt 2.5x330x6
060 345		Stepper motor
002 018	C16, C21	Constant force spring
002 073	C20, C25	220uF 25V radial electrolytic capacitor
002 082	C11	4.7uF 35V radial electrolytic capacitor
005 014	BR1	2200uF 35V radial electrolytic capacitor
020 006	Reg1	Bridge rectifier WO2
020 019	Reg2	+5V regulator 7805
644 003		12V regulator 7812
644 026		8 position cell holder
644 027		Cell retaining spring clip
		Cell wall

Section 11.12

		641 002 Built In Printer Option
641 001		Built-in printer option
TBA		Service exchange built-in printer module
060 287		Paper roll for 40 column printer
060 338		40 column printer mechanism
060 339		40 column printer module
641 010		Printer PCB
TBA		Service exchange printer PCB
002 054		470uF 16V radial electrolytic capacitor
002 112	C9	4700uF 40V radial electrolytic capacitor
002 114	C2, 6	220uF 35V radial electrolytic capacitor
002 115	C5	2200uF 16V radial electrolytic capacitor
005 024	BR1	Bridge rectifier 4A
016 054	F1	2.5A resettable fuse
020 006	Reg1	Voltage regulator 7805
020 019	Reg2	Voltage regulator 7812
005 040	D1	High speed diode BYW80-200