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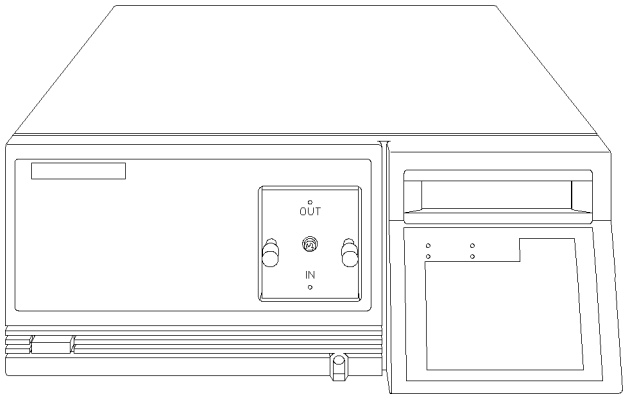
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1050 Series of HPLC Modules

Service Handbook - Variable Wavelength Detector (79853C)



Agilent Technologies

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Part No. NONE

11/2001

Printed in Germany

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IMPORTANT NOTE

This version of the 1050 service manual includes all sections from the 01050-90102 edition 4 (1995).

The series I opticals information (79854A MWD) and the 79853A VWD information has been removed (products went out of support during 2000).

Part numbers have been updated as of 11/2001. Contact your local Agilent support office in case of part number issues or upgrades.

The latest version of this manual is available as Adobe Acrobat Reader (PDF) version only and can be downloaded from the Agilent Technolgies web page www.agilent.com.

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1

VWD: General Information

This chapter provides general information about the 1050 Variable Wavelength Detectors

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VWD: General Information

This chapter gives general information on

- about this detector
- repair policy
- specifications

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About the Detector

The 1050 Variable Wavelength Detector (VWD) is a detector of the modular type liquid chromatograph 1050 Series. This is a standalone grating/photodiode type general purpose detector. The performance and features match the requirements of the routine analysis and QC/QA analysis. The 1050 VWD is a standard size detector of 1050 modular type LC series and can be build up with other LC modules, such as pump and automatic sampler. Since it is standalone type, it can be also used as an ordinary LC detector. It has a functional keyboard and 16-character fluorescent display which provides you easy operation.

Versions vs. Support Periods (EOS)

79853A

- The 79853A VWD was shipped between May 1988 and January 1992. The support with parts ended November 1, 2000.

79853C

- The 79853C VWD replaced the model 79853A VWD in January 1992. The end of support (EOS) will be August 1, 2006 with all 1050 series HPLC modules.
- The 79853C VWD got a redesigned optical unit (“D” enhanced optical, see “VWD: Enhanced Optical Unit Information” on page 705) that replaced the original “C” optical unit in June 1995. The end of support (EOS) for the “C” optical unit parts will be August 1, 2006 with all 1050 series HPLC modules.

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Repair Policy

The 1050 VWD is designed that you can access all components easily. You can recalibrate wavelength using control functions. Customers are able to maintain certain parts of the 1050 VWD see *Operator's Handbook*.

For details on repair policy refer to "Repair Policy" on page 38 in chapter *1050 Common Information*.

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Specifications

Table 1 **Specifications of 79853C VWD**

Detection Type	Double beam photometer.
Noise	< 1.5 x 10^{-5} AU peak-to-peak at 254 nm, flowing water at 1 ml/min, 1 second response time (10-90%), standard flow cell.
Drift	< 5 x 10^{-4} AU/hour at 254 nm after warm-up.
Wavelength Range	190 - 600 nm, settable in 1 nm increments.
Wavelength Accuracy	±2 nm.
Wavelength Reproducibility	±0.3 nm.
Bandwidth	6.5 nm.
Linear Absorbance Range	Better than 1% up to 1.2 AU using acetone at 265 nm.
Response Time	0.25, 1 or 4 seconds (10-90%); user-selectable.
Spectra	Storage of 1 spectrum during run; scan rate 10 nm/sec; range from 190 to 600 nm, selectable. Post-run plotting speed from 1 to 50 nm/sec selectable; plotting of background-corrected spectrum.
Light Source	Deuterium lamp from 1090/40/50 DAD.
Flow Cells	Standard 14 µl volume, 8 mm pathlength cell with 40 bar (588 psi) pressure maximum. Optional micro, preparative, high-pressure cells are available.
Display	Single line, 16 character fluorescent display with real time display of operating parameters and/or absorbance.
Control	Integrated keyboard with function keys; parameter editing during run possible; keyboard lock; optional control by computer or 3396 Series II integrator.

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Table 1 **Specifications of 79853C VWD**

Parameters	Wavelength, output range, response time, zero, offset, balance, spectrum acquisition.
Diagnostic Aids	Wavelength calibration check with Holmium oxide filter.
Time-programs	Time-programmable wavelength and output range; storage of up to 5 time-programs.
Analog Output	One output user-configurable as recorder or integrator. For recorder: 100 mV or 1 V output range from 0.001 to 4 AU, user-selectable; for integrator: 100 mV/2 AU full scale or 1 V/2 AU full scale, user-selectable.
Communications	START (input/output), STOP (input/output), READY (output), SHUTDOWN (output) for synchronization with other LC modules.
Safety Aids	Extensive diagnostics, error detection and display via front-panel LED's. Leak detection, safe leak handling, leak output signal for shutdown pumping system. Low voltages in major maintenance areas.
Environment	Temperature range: 5 to 55°C
	Humidity: < 95% (non-condensing)
Power Requirements	Line voltage: 100-120 or 220-240 VAC ±10%
	Line frequency: 48-66 Hz
	Power consumption: 150 VA max.
Dimensions	Height: 133 mm (5.2 inch)
	Width: 325 mm (12.8 inch)
	Depth: 545 mm (21.5 inch)
	Weight: 14 kg (31 lb)

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VWD: Hardware Information

This chapter provides hardware information about the 1050 Variable Wavelength Detectors

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VWD: Hardware Information

Overview

NOTE

The information in this chapter is based on the original optical unit (version "C"). In June 1995 this optical was replaced by the enhanced version "D" to overcome baseline stability problems in unstable environments.

For details on this "D" version refer to section Enhanced Optical Unit Information *"VWD: Enhanced Optical Unit Information" on page 705*.

Figure 206 on page 567 shows the block diagrams of the 1050 VWD 79853C.

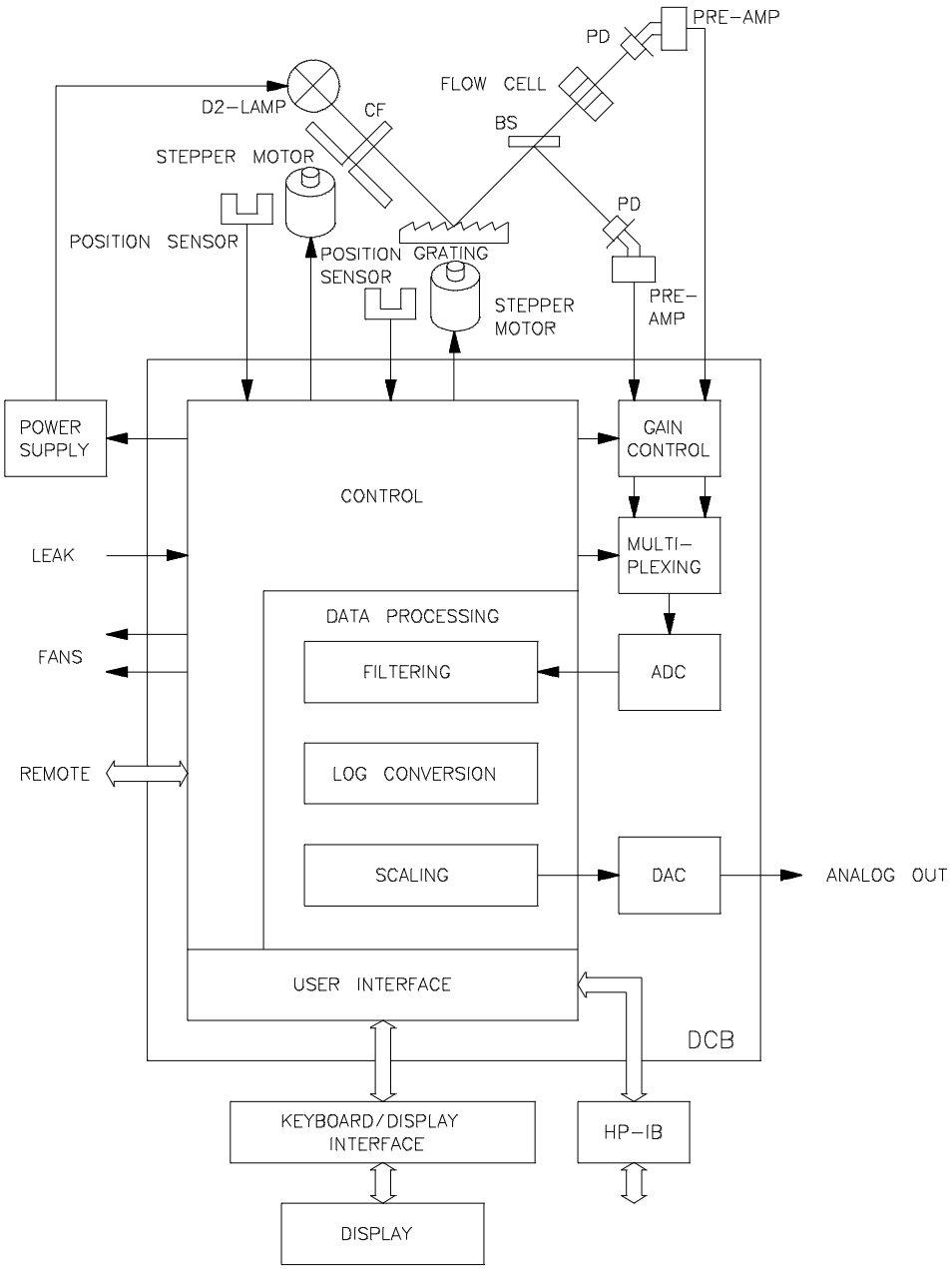
The main components are:

Table 1 **Main Components Overview**

Component	Purpose
Power Supply (DPS-A)	provides all voltages within the instruments
Detector Controller Board (DCB)	controls power supply, grating stepper motor, cutoff filter, keyboard, display and GPIB interface. It processes the signals coming from the pre-amplifier boards (sample and reference), the information from the grating and filter position sensor, leak sensor, remote control lines and the GPIB interface.
Optical Unit	contains all optical parts
Keyboard/Display	entry and display of parameter
GPIB Interface	communication with external controllers via GPIB

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Figure 1 **Block Diagram of VWD**

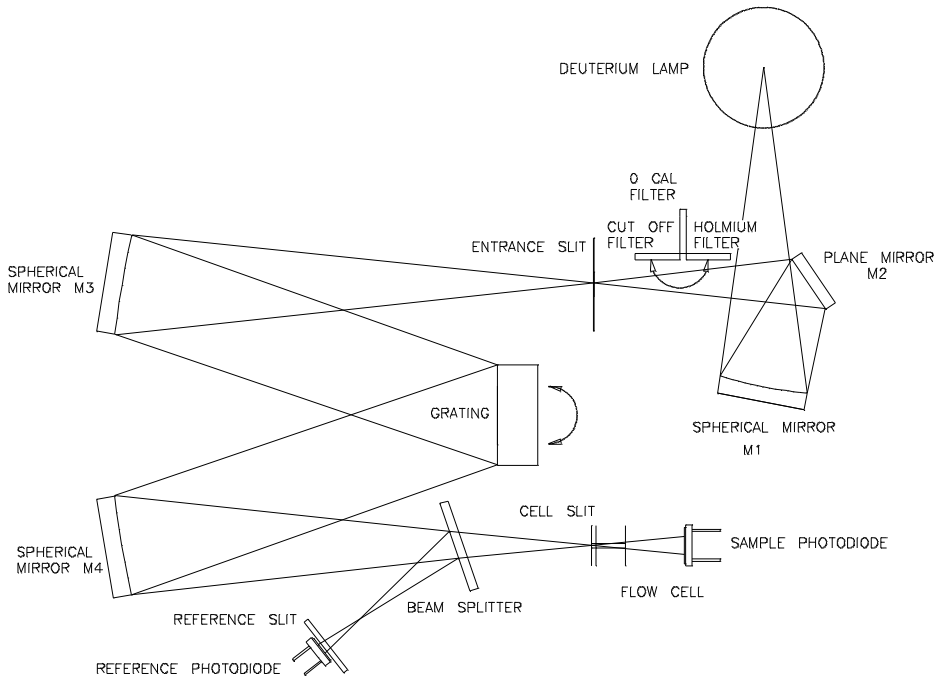


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Optical System Overview

Figure 207 shows the optical diagram of the 79853C VWD. The radiation from the deuterium lamp is focused on a spherical mirror (M1). The light beam passes then a plane mirror (M2) the cutoff filter, the entrance slit, a spherical mirror (M3), the grating, again a spherical mirror (M4), a beam splitter and the flow cell to the sample diode. The beam through the flow cell is absorbed depending on the solutions in the cell, where UV absorption takes place. The intensity is converted to an electrical signal by means of the sample photodiode. Part of the light is directed to the reference photodiode by the beam splitter to obtain reference signal for compensation of intensity fluctuation of the light source. A slit in front of the reference photodiode focusses the light. Wavelength selection is made by rotating the grating, which is driven directly by a stepper motor. This configuration allows fast change of the wavelength. The cutoff filter is moved into the lightpath above 370 nm to reduce higher order light.

Figure 2 **Light Path of Detector**

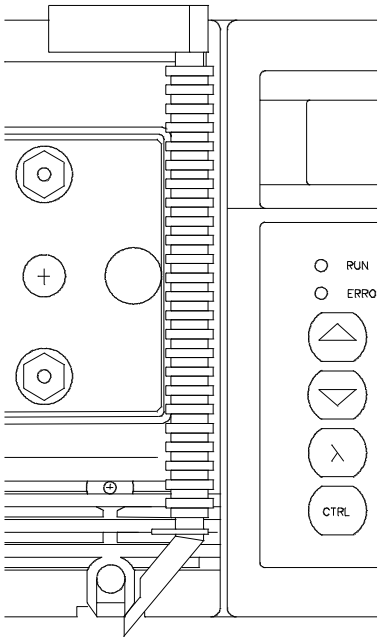


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Leak Interface Assembly

To route waste from a module standing above the 1050 VWD to a module below a leak interface can be installed at the detector. It is part of the accessory kit.

Figure 3 **Leak Interface**



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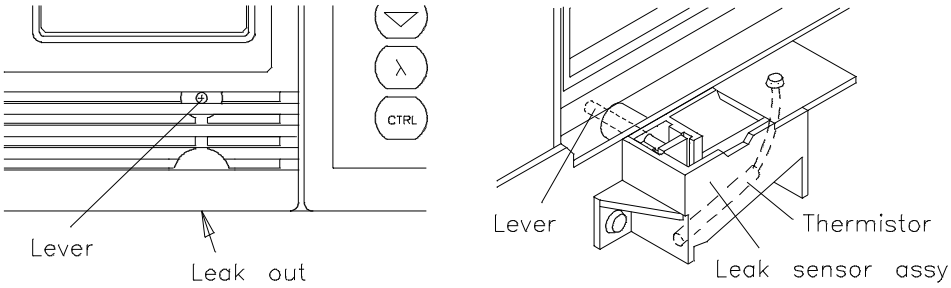
Leak Sensor Assembly

A drain is located at the bottom of the cell compartment and can be led to the waste container or the 1050 waste handling system (the VWD has to stand on top of another module when the leak interface is not used).

A leak sensor is located behind the front panel assembly (Figure 209). Solvent would cool the leak sensor (self heating thermistor). The resulting change in resistance, measured by comparators on the Detector Controller Board (DCB), would generate an error message and switch the deuterium lamp OFF.

NOTE In the 1050 System remote mode the leak message will turn off the pump.

Figure 4 **Leak Sensor Assembly**



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Fan Assemblies

The instrument is equipped with two fans.

On the 79853C VWD, the fans are of different type:

HIGH type	this fan is located close to the lamp housing and runs with a higher speed
LOW type	this fan is located at the rear under the GPIB interface and runs with a lower speed

The fans are connected to +24 VDC on the DCB Board.

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Optical Unit

NOTE

The information in this chapter is based on the original optical unit (version “C”). In June 1995 this optical was replaced by the enhanced version “D” to overcome baseline stability problems in unstable environments.

For details on this “D” version refer to section Enhanced Optical Unit Information *“VWD: Enhanced Optical Unit Information” on page 705*.

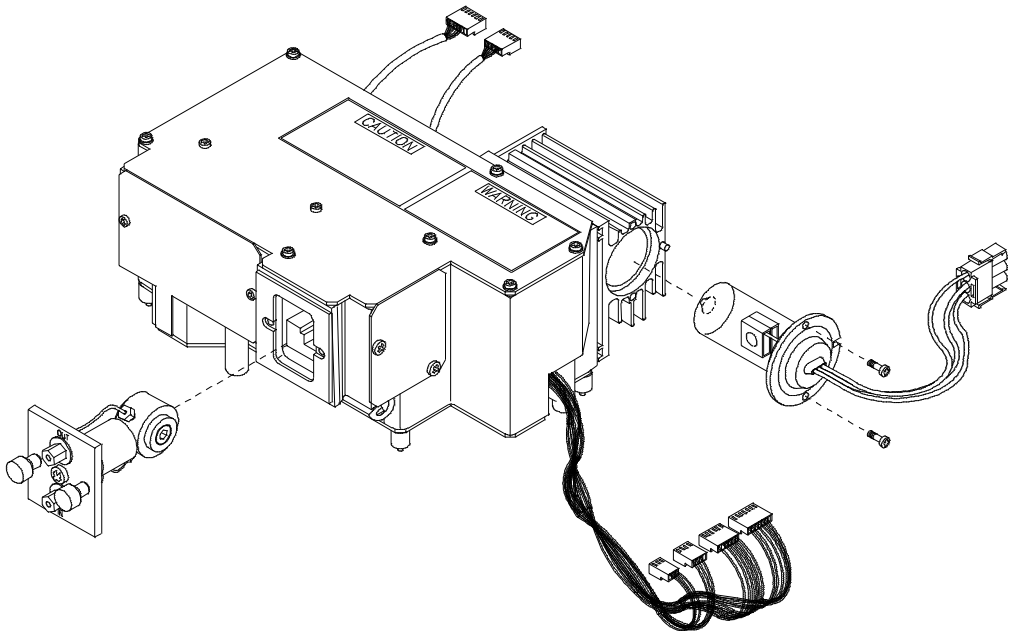
The Optical Unit houses all parts, from the deuterium lamp to the photodiode pre-amplifiers.

NOTE

The repair level is **component**.

The optical unit is also available as assembly.

Figure 5 **Optical Unit**



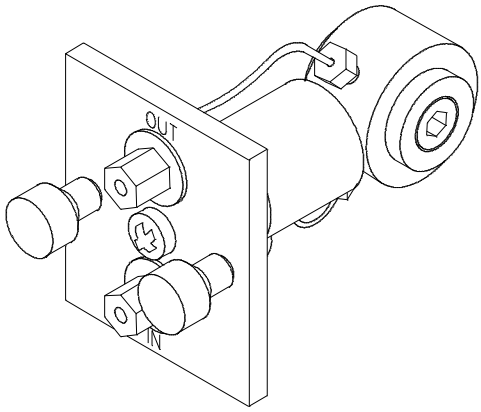
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Flow Cells

There are several flow cells available as stainless steel or as titanium version, see Table 138 on page 574. The flow cell (Figure 211) can be exchanged easily. No adjustments are necessary. After disassembling of the flow cell, gaskets and windows can be replaced (refer to section *"Flow Cell Maintenance" on page 655*).

There are several kits set up with replacement parts like gaskets and windows, see *"Standard Flow Cell "C" (SST/Ti)" on page 693* and the following pages.

Figure 6 **STD Flow Cell**



NOTE At the outlet of the flow cell a defined peek capillary (from the accessories must be connected to build up a certain back pressure (noise reduction). See *"Standard Flow Cell "C" (SST/Ti)" on page 693* and the following pages for parts.

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Table 2 **Flow Cell Data**

	STD (SST)	UHP (SST)	MICRO (SST)	STD (TI)	PREP (TI)	
Maximum Pressure	40	400	40	40	40	bar
Pathlength	8	8	5	8	VAR	mm
Volume	14	14	1	14	VAR	µl
Inlet i.d.	0.25	0.25	0.10	0.25	0.80	mm
Inlet length	555	555	555	555	67	mm
Outlet i.d.	0.25	0.25	0.25	0.25	0.80	mm
Outlet length	67	67	67	67	100	mm
Outer diameter	1/16	1/16	1/16	1/16	1/16	inch

Used materials for SST flow cells: SST, quartz and PTFE or Polyimide HP cell

Used materials for TI flow cells: TI, quartz and PTFE

STD	Standard Flow Cell
HP	High Pressure Flow Cell (replaced by UHP early 1993)
UHP	Ultra High-Pressure Flow Cell (replaces HP early 1993), see details on *"Ultra High-Pressure Flow Cell" on page 575*.
PREP	Variable Preparative Flow Cell with volume of 0.9, 1.8, 4.4 or 8.8 µl depending on which gasket is used.
MICRO	Semi Micro Flow Cell

NOTE

The gaskets, windows and rings **are not compatible** with the high pressure Cell (79853-60009 - OBSOLETE) that has been replaced by the ultra high pressure Cellflow cell (79853-60013). See *"Ultra High Pressure Flow Cell (SST)" on page 697* for details.

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Table 3 **Correction factors for 79853C flow cells**

Flow cell type	Cell volume	Part number	Path length (nominal)	Path length (actual)	Correction factor
Standard flow cell	14 µl	79853-60000	8 mm	8.00 ± 0.19 mm	8/8.05
Standard flow cell TI	14 µl	79853-60011	8 mm	8.00 ± 0.19 mm	8/8.00
Micro flow cell	1 µl	79853-60010	5 mm	5.00 ± 0.19 mm	5/5.00
Ultra High pressure flow cell	14 µl	79853-60013	8 mm	8.00 ± 0.19 mm	8/8.00

Ultra High-Pressure Flow Cell

Typical applications of the high-pressure flow cells are:

- Hyphenated systems (LC-MS)
- Supercritical Fluid Chromatography (SFC)
- Multidetector systems
- Narrow-bore column applications

The main difference between the standard and high-pressure flow cells is the design of the window assemblies. The high-pressure flow cells have different windows, seal ring and gaskets, see Figure 212. The seal rings support and hold the window and at the same time form the high-pressure seal.

NOTE

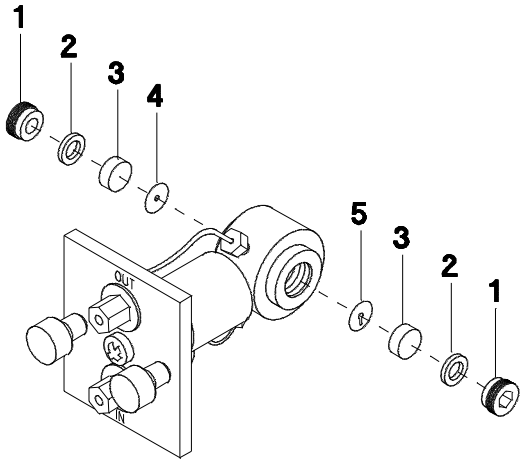
The gaskets, windows and rings **are not compatible** with the high pressure Cell (79853-60009 - OBSOLETE) that has been replaced by the ultra high pressure Cellflow cell (79853-60013). See *"Ultra High Pressure Flow Cell (SST)" on page 697* for details.

The following materials are in contact with solvents: Stainless steel (AISI 316), Quartz, Kapton® polyimide (Kapton is a registered trademark of DuPont).

Recommended pH range: 2.3 to 9.5

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Figure 7 **Exploded Diagram of High-Pressure Flow Cell**



Deuterium Lamp

On the 79853C VWD, the deuterium lamp (Figure 213) is the high intensity lamp (79883-60002), which is same as in the 1040/90/50 series Diode Array Detectors.

The reduction of energy emission of the lamp (Figure 214 on page 577) is time and wavelength dependent and is significantly higher within the first days and for wavelengths in the ultra violet range compared to the visible range (change in transmission of lamp glass).

Usually, the response maximum of the lamp is near 230 nm, but can be shifted to a higher wavelength for an aged lamp. It has no relevance for intensity degradation at other wavelengths.

The deuterium lamp filament is heated only during the ignition phase. The deuterium lamp can be exchanged easily. The lamp needs no adjustments.

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Figure 8 **Deuterium Lamp**

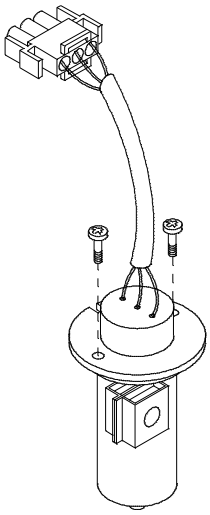
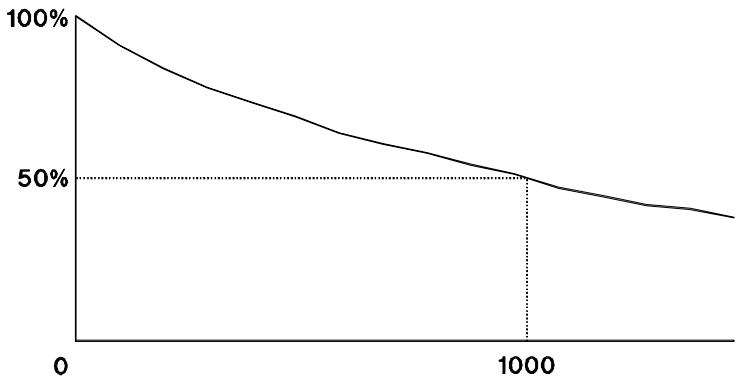


Figure 9 **Intensity Degradation of Lamp (79883-60002)**



- Measured wavelength is 230 nm
- initial intensity about 20% higer than 79880-60002
- decrease in intensity is less with use

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NOTE

The lamp should be replaced only if the following two criterias are both fulfilled:

Baseline Noise (with test cell) has increased significantly.

Amount of counts of the lamp (with test cell) has decreased to less than 50% of the count record of this same lamp when newly installed).

The decision to replace the lamp due to criterium 2 alone is not relevant, because the signal/noise may be still within instrument specifications.

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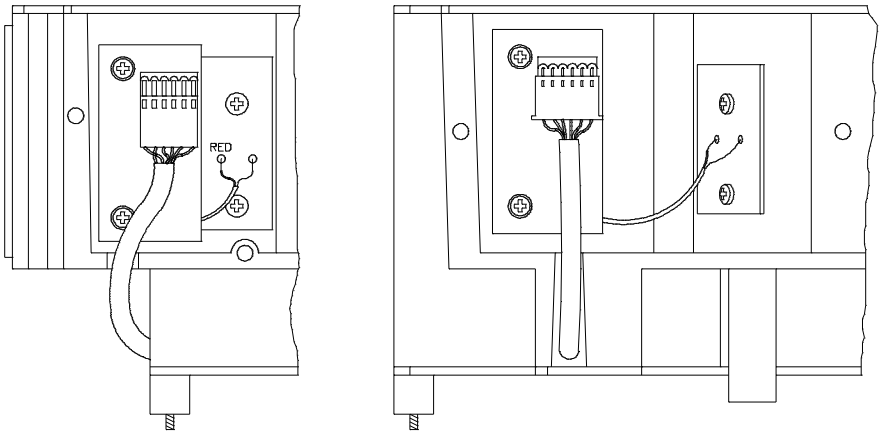
Photodiodes Assemblies

Two photodiode assemblies (Figure 215) are installed in the optical unit. The sample diode assembly is located at the right side of the optical unit. The reference diode assembly is located in the front of the optical unit.

NOTE Neither, the diodes nor the pre-amplifier boards are interchangeable.

NOTE Refer to *"Replacing Pre-amplifiers or Photodiodes" on page 667* for cleaning.

Figure 10 **Photodiode Assemblies**



sample diode reference diode

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Filter Assembly

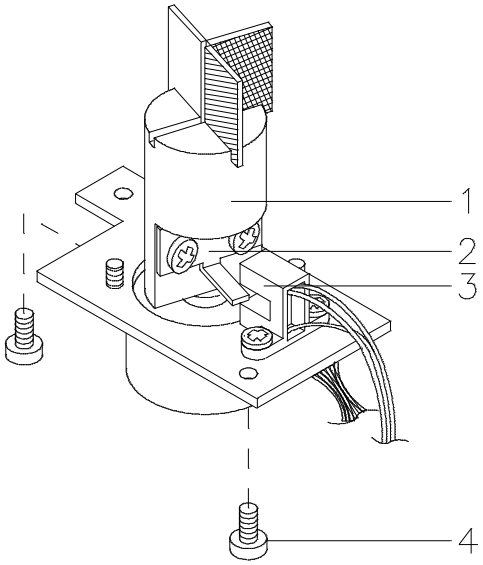
On the 79853C VWD (Figure 216), the Filter Assembly has a three filters [1] installed and is processor controlled. It can move into four positions:

OPEN	nothing in lightpath at wavelength < 370 nm
CUTOFF	cut off filter in lightpath at wavelength > 370 nm
DARK	0 order calibration filter to reduce the light throughput to the photodiode during grating calibration at 0 order light
HOLMIUM	holmium filter for grating motor alignment

A photo sensor [3] determines the correct position.

NOTE Refer to *"Replacing Filter Assembly Parts" on page 670* for cleaning.

Figure 11 **Filter Assembly**



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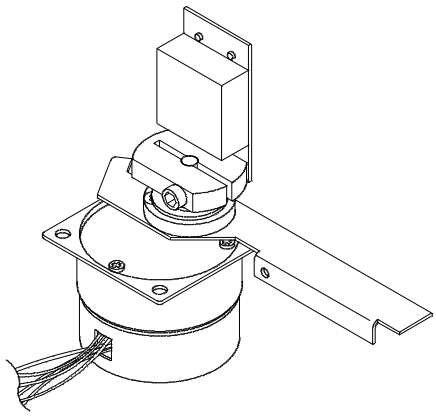
Grating Assembly and Motor

The Grating has 1200 lines/mm and is directly rotated by the Grating Drive Stepper Motor, depending on the wavelength entry. The whole range (190...600 nm) is equal to 1238 steps (15.5°). The step angle of the stepper motor rotation is 3.75° and is reduced to 1/300 by a gear mounted directly to the motor shaft. The stepper motor is controlled and driven by the Detector Controller Board (DCB). The stepper motor reference position is determined by a plate fitted on the motor shaft interrupting a beam of a photo sensor.

The wavelength calibration of the grating is done at the 0 order light position and at at 656 nm, which is the emission line of the deuterium lamp.

If the motor assembly has to be exchanged it is necessary to do a compensation of motor tolerances. Refer to *"Replacing Grating Assembly Parts" on page 668*.

Figure 12 **Grating Asembly**



NOTE

The grating is coated with magnesium fluoride. The grating surface should not be touched or cleaned (see also *"Replacing Grating Assembly Parts" on page 668)*. This will destroy the surface and reduce the light reflection.

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Mirrors

The instrument contains four mirrors (M1, M2, M3, M4). Three of them are spherical type, one plane. On M2, M3 and M4 the beam height is adjustable. Mirror M3 and M4 are identical.

NOTE

The mirrors are coated with magnesium fluoride. They should not be touched or cleaned (see also *"Replacing Mirrors, Beamsplitter and Slits" on page 670*). This will destroy the surface and reduce the light reflection.

Slit Assemblies

The instrument has two slit assemblies. The first slit is located at the light entry into the main optical compartment and focused the light on mirror M3. The second slit is in front of the reference diode.

Beam Splitter

The beam splitter splits the light beam. One part goes directly to the sample diode. The reference diode gets the other part. The height of the light beam is adjustable.

Refer to *"Replacing Mirrors, Beamsplitter and Slits" on page 670* for cleaning.

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Enhanced Optical Unit (“D”)

In June 1995 this original optical unit was replaced by the enhanced version “D” to overcome baseline stability problems in unstable environments.

For details on this “D” version refer to section Enhanced Optical Unit Information *“VWD: Enhanced Optical Unit Information” on page 705*.

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1

VWD: Electronic Information

This chapter provides electronic information about the 1050 Variable Wavelength Detectors

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VWD: Electronic Information

This chapter gives information about the electronic of the 1050 Variable Wavelength Detector:

- Overview
- Interconnection Diagram
- Detector Controller Board (DCB)
- Power Supply (DPS-A)
- Keyboard/-electronics
- Pre-amplifier Boards
- Power Supply Connection Board (PSC)
- GPIB Communication Interface

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Location of Electronic Assemblies

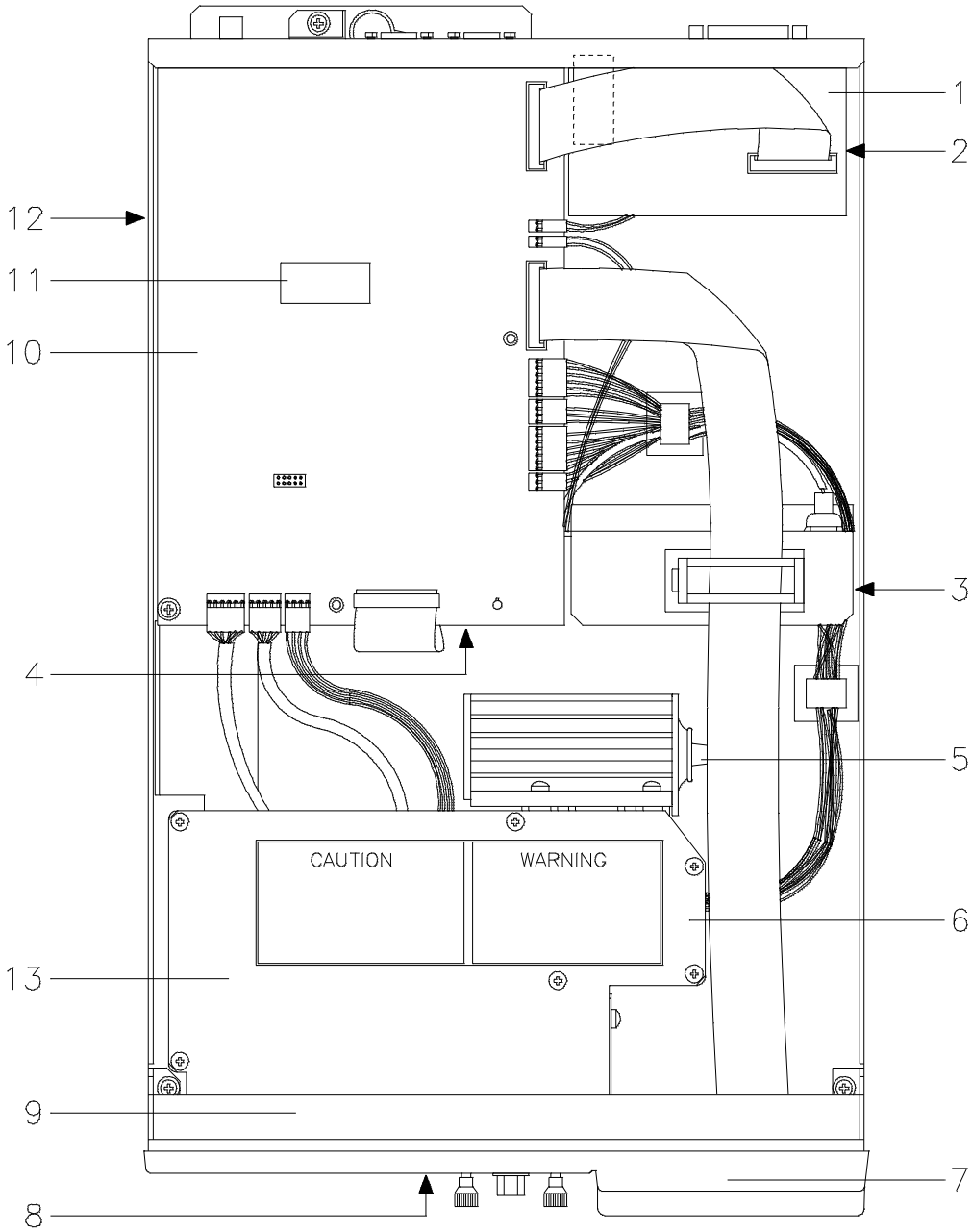
In the 1050 VWD, the following electronic assemblies are available (for item numbers refer to Figure 218 on page 588):

Table 1 **Electronic Assemblies**

Item	Description
1	GPIB Interface
	Firmware ROM GPIB
2	Fan Assembly (LOW)
3	Fan Assembly (HIGH)
4	Connection Board (PSC)
5	Deuterium Lamp Assembly
6	Sample Diode Assembly (SDA)
6	Pre-Amplifier Board SAMP
7	Display Interface Board (KDI)
7	Display Module (VFD)
8	Leak Sensor Assembly
9	Reference Diode Assembly (RDA)
9	Pre-Amplifier Board REF
10	Controller Board (DCB)
11	Firmware ROM DCB
12	Power Supply Assembly (DPS-A)

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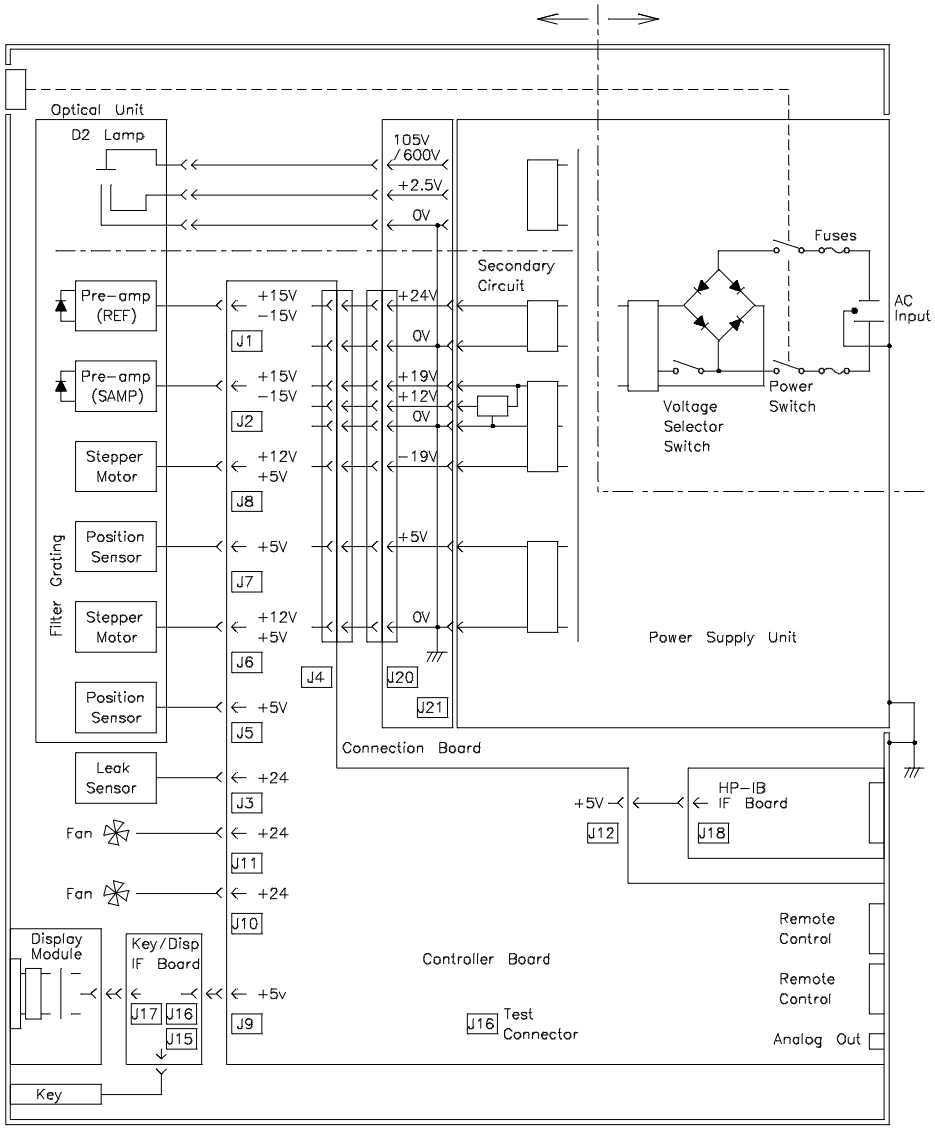
Figure 1 **Location of Electronic**



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Interconnection Diagram

Figure 2 **Interconnection Diagram**



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Detector Controller Board (DCB)

Repair Level: EPROM and Board

Table 2 **Part Numbers for DCB**

tem	Part Number	Comment
DCB (Exchange)	79853-69511	for use with PSC -66512
DCB	79853-66511	for use with PSC -66512
DCB	79853-66506 (OBSOLETE)	for use with PSC -66509 (OBSOLETE)
Firmware ROM DCB	79853-13005	

NOTE If the DCB board is replaced by 79853-66511 version, the PSC board MUST be changed to 79853-66512.

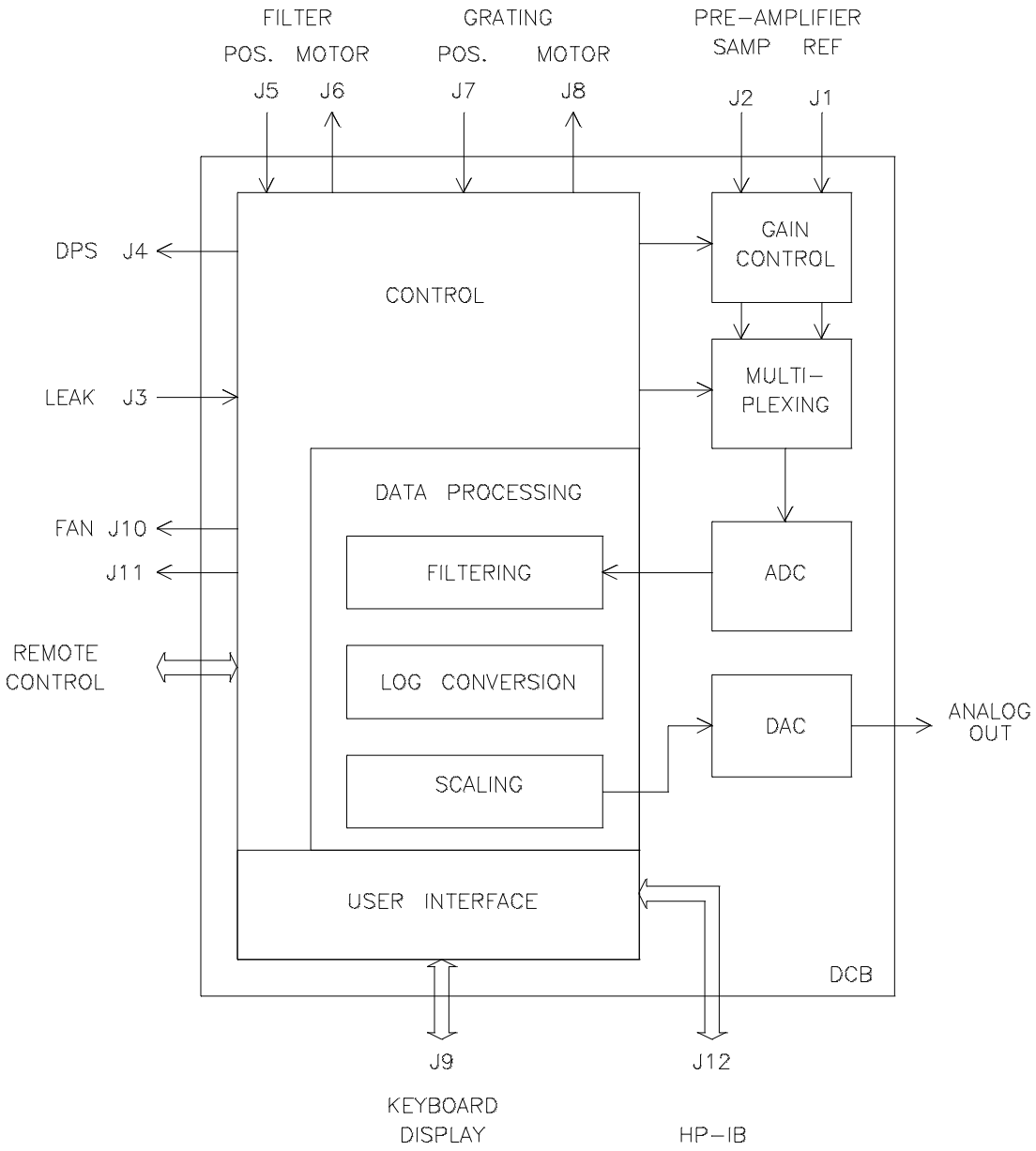
Main Functions

The main functions of the Detector Controller Board (DCB) are:

CPU	
signal processing	display
	analog output
	digital input/output
A/D conversion	
D/A conversion	
control of Optical Unit	deuterium lamp ignition
	grating movement
	filter movement
	leak detector
remote control	

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Figure 3 **Block Diagram DCB**



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Digital Section

CPU

A 8-bit 1-chip Microprocessor 7810 is used as CPU. The 7810 includes 256 byte-RAM, 8 channel 8-bit A/D Converter, 16-bit timer/event counter, 2-channel 8-bit timer and two 8-bit I/O Ports. The Data Bus is 8-bit multiplexed with the address.

ROM/RAM/EEPROM

The ROM contains the firmware of the the detector and can be exchanged separately. In addition to the built-in functions, the 7810 has 64 Kbytel of external memory address and 32 Kbyte-ROM, 8 Kbyte-SRAM and 2 Kbyte-EEPROM are added.

The EEPROM contains:

- the time program;
- the grating calibration constant;
- D/A converter calibration constant;
- parameters set by key input (wavelength, range, response time, mode).

Clock

The main clock (24 MHz) is divided and distributed to:

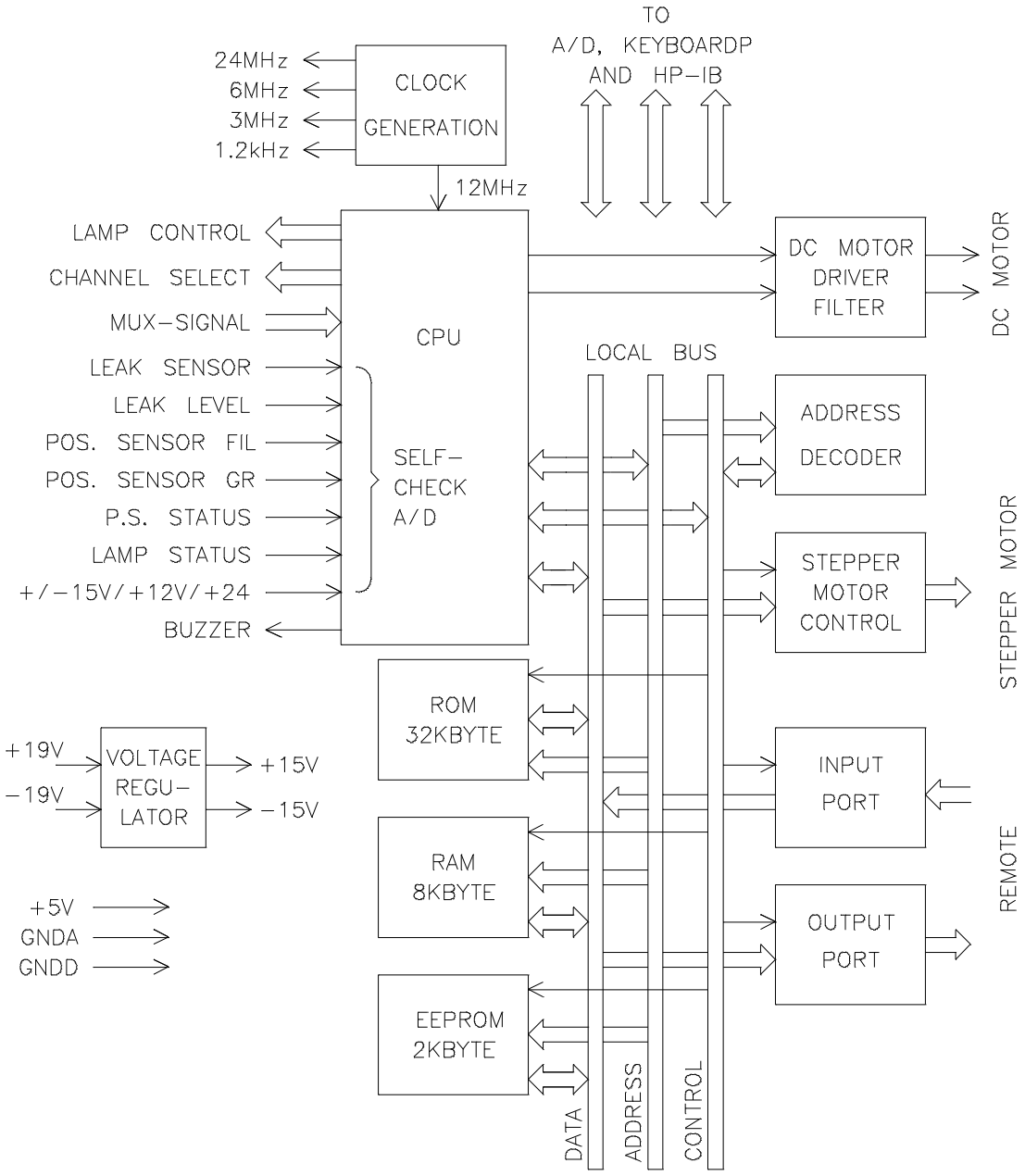
24 MHz	A/D Converter Count Pulse
12 MHz	CPU Clock
6 MHz	D/A Converter Count Pulse
3 MHz	GPIB Controller, Key/Display Controller Clock
1.2 KHz	A/D Converter Integration period

After the power turns on, for about 100 ms the RESET signal is supplied to CPU, GPIB Controller and Key/Display controller. Also, anytime when power voltage becomes less than 4.7 V, the RESET signal is generated. The CPU controls directly the Buzzer and the Stepper Motor Driver to move the filters on the filter assembly.

The stepper motor for the grating, the input and the output port are connected to the internal BUS (DATA ADDRESS and CONTROL) and are controlled by the CPU. The grating motor and the filter motor are driven by a motor controller IC and phase pattern are coming from CPU.

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Figure 4 **Block Diagram DCB - Digital**



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Analog Sections

Signal Processing

The light beam from the SAMPLE and REFERENCE enters the photodiode respectively. Its current output is converted into a voltage by pre-amplifier. The gain of the pre-amplifier can be changed into four stages with CPU control.

The voltage signal from the pre-amplifiers are multiplexed and converted into digital form by a 18-bit A/D Converter. The conversion time of A/D Converter is 25 ms and is performed cyclically in the order of

Zero Sample-Reference

(Zero=GNDA)

Electrically zero calibration is done while balancing.

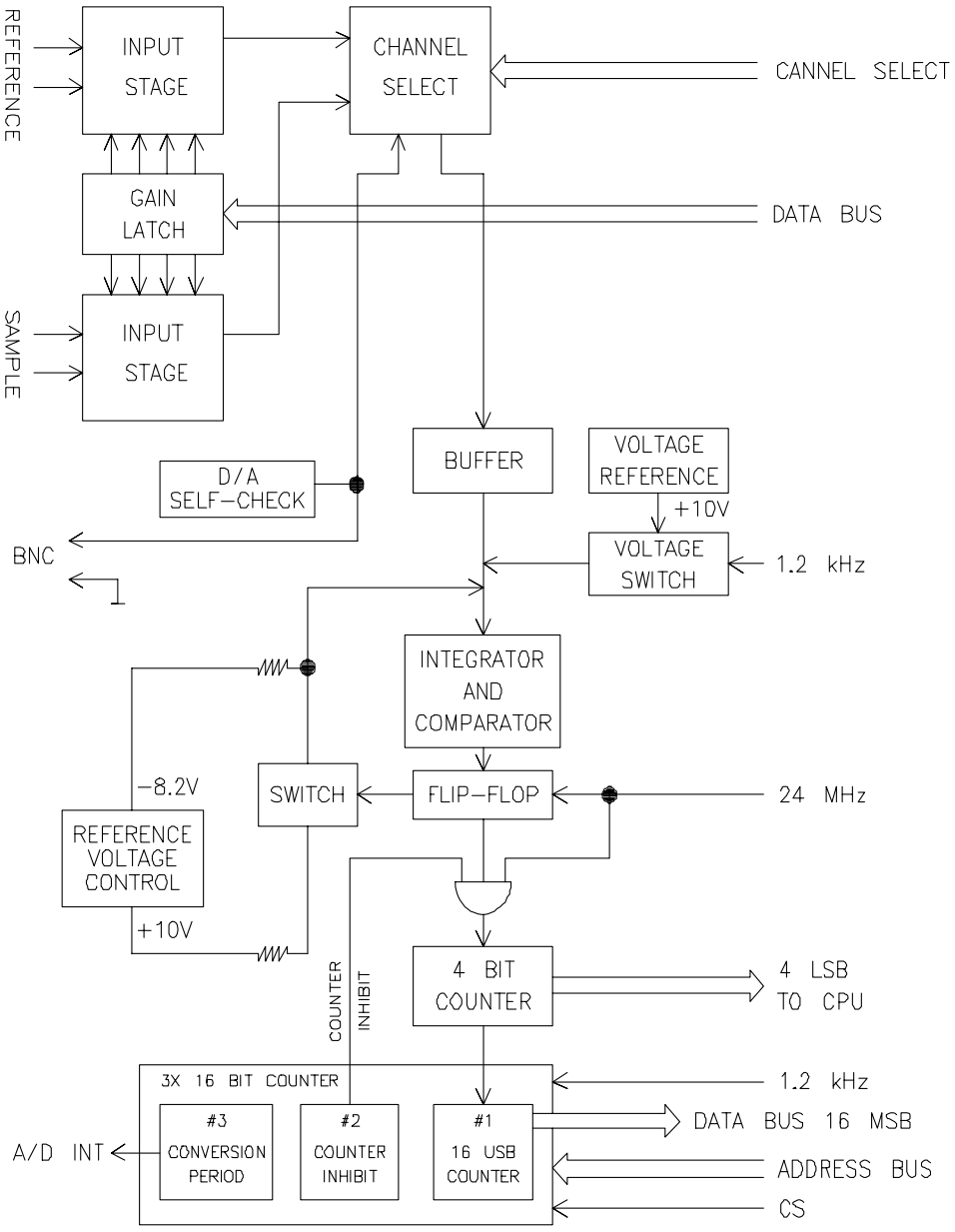
Digital data is transmitted to the CPU, digitally filtered based on response time and converted into the absorbance unit using the equation shown below:

$$AU = \log_{10}(REF) - \log_{10}(SAMP)$$

The input voltage range of the integrator is -0.5..+9.5 V.

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Figure 5 **Block Diagram DCB - A/D Conversion**

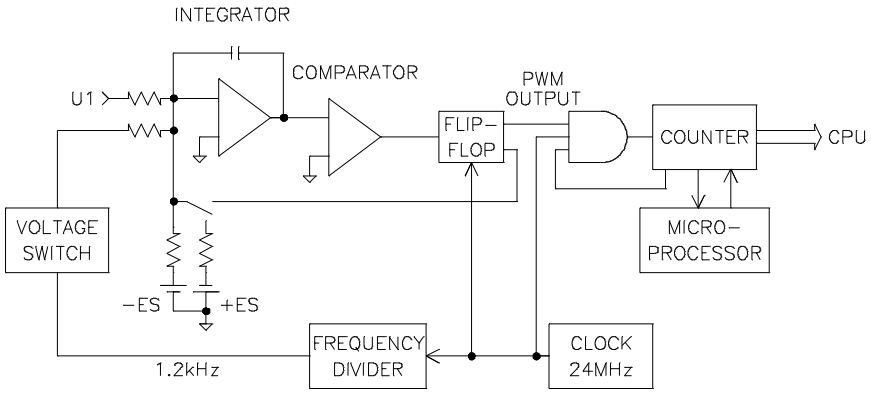


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A/D Converter

Method for the A/D conversion is feedback type Pulse Width Modulation (PWM).

Figure 6 **A/D Converter**



Positive or negative reference voltage is alternately added to the integrator. Duty cycles of each reference voltage is controlled by the output of a comparator connected to the output of integrator. Input voltage (U1) is converted to pulse width so that sum of both reference voltages is balanced with the U1. Clock voltage and ±ES control this system and determines the period. The sum of clock voltage in one cycle is set to zero.

Pulse width, which is proportional to input voltage U1, is counted and is converted into a digital output.

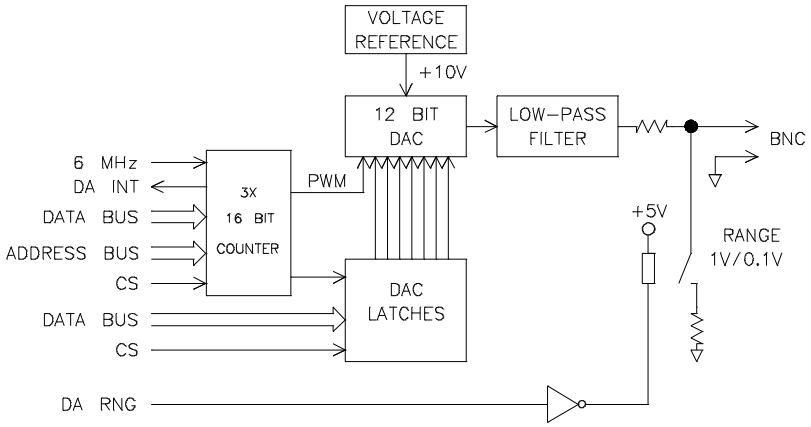
The A/D converter has 18 bits resolution with 25 ms conversion time.

D/A Converter

D/A converter combines a Pulse Width Modulator (PWM) and a 12-bit DAC. The lower 4 bits of the DAC pulse width modulated with 12 bit resolution is added to the upper 8 bits of the DAC. The upper 8 bits are also modulated by fixed pulse width so that the lower 4 bits balances to LSB of the upper 8 bits (pulse width is 15/16). The lower 4 bits are scaled to each bit of the upper 8 bits when using `44:DAC CALIBRATION`. The output of the 12-bit DAC is passed through a low-pass filter and 20-bit resolution analog signal is outputted to the BNC Connector. The cutoff frequency of a low-pass filter is set at 17 Hz while conversion frequency is 183 Hz.

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Figure 7 **D/A Conversion**



Signal Output

The signal output is classified into three types: Display Out, Analog Out, Digital In/Out.

Display Out

The display module receives ASCII codes via Keyboard Interface Board via the Data Bus. On the Display Module, the ASCII code is converted to display code and gives output on fluorescent display with 5 x 7 dots and 16 characters.

Signal (Analog) Out

The Signal (Analog) Out is available at a BNC connector at the rear of the instrument. It is generated by 20-bit D/A converter. The conversion cycle of the D/A converter is about 5.5 ms. The output of the D/A converter is filtered by a low-pass filter. The output can be switched to:

Full Scale	Output Impedance
1 V	1000 Ohm
0.1 V	100 Ohm

Digital In/Out

The digital signal is delivered to the GPIB Interface (option) via the Data Bus and is converted into an GPIB signal.

Control of Deuterium Lamp

The deuterium lamp is ignited using Anode Current, Trigger Voltage and Heater Voltage supplied from the Power Supply Unit. The ignition procedures are controlled by the CPU signal. The heater voltage is switched from 2.5 V during ignition to 0 V after ignition.

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Control of Grating Assembly

The wavelength is set by rotating the grating with a 2-phase stepper motor. The step angle of the stepper motor rotation (1 step angle 3.75°) and is reduced to 1/300 by a gear. The stepper motor is controlled and driven by DCB. The CPU contrls the motor controller IC that drives the motor. Stepper Motor reference position is determined by a plate fitted on the swing arm interrupting a beam of photo interrupter. The output signal of the photo interrupter is read by a 8-bit ADC of the CPU.

Control of Filter Assembly

The rotation of stepper motor controls the insertion of a diffterent filters into the light path (cutoff, holmium, light reduction).

The stepper motor is controlled and driven by DCB. The CPU controls the motor controller IC that drives the motor.

Remote Control

The REMOTE connectors communicate start or stop, error and not ready signal inputs and outputs.

For detailed description of remote control refer to the *1050 Service Handbook, chapter Common Information*.

NOTE

When the 79853C VWD is used in a system which is connected via remote, the VWD should be switched on as first module. Otherwise it may influence other modules at power on.

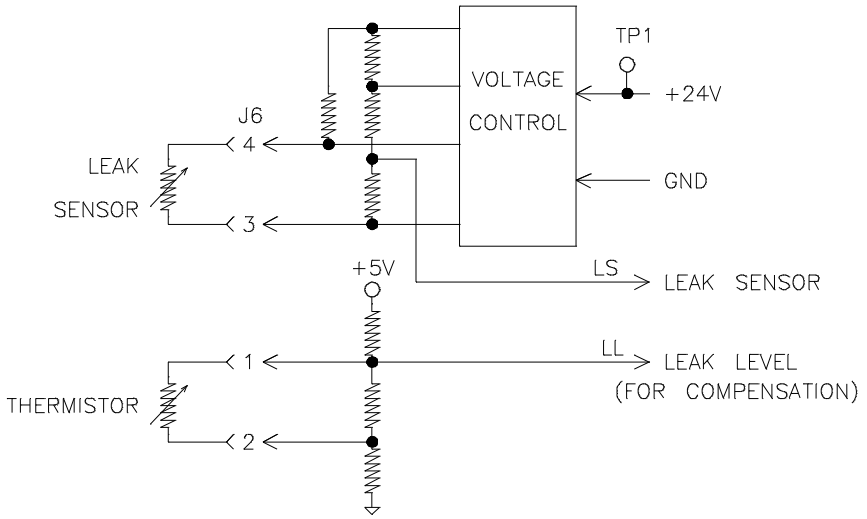
Leak Detection

The leakage from a flow cell is detected by change of Thermal Radiation Constant of NTC thermistor. Wheatstone bridge is constructed from NTC thermistor and resistors on the DCB. Its supply voltage is varied by controlling 24 V-power with Switching Regulator controller. The supply voltage is controlled to keep the thermistor at about 150 Ohm (150°C) constantly. If leakage occurs and the thermistor is soaked in the leaked liquid, the thermal radiation constant are changed and gives higher supply voltage at both ends of wheatstone bridge. This change is read by the CPU and compensated with ambient temperature.

Error condition is when LS > LL. The values are visable with `33:LEAK TEST`.

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Figure 8 **Block Diagram - Leak Detection**



Change in Thermal Radiation Constant with surrounding temperature change is compensated by second NTC thermistor having same characteristics.

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Figure 9 **Board Layout DCB**

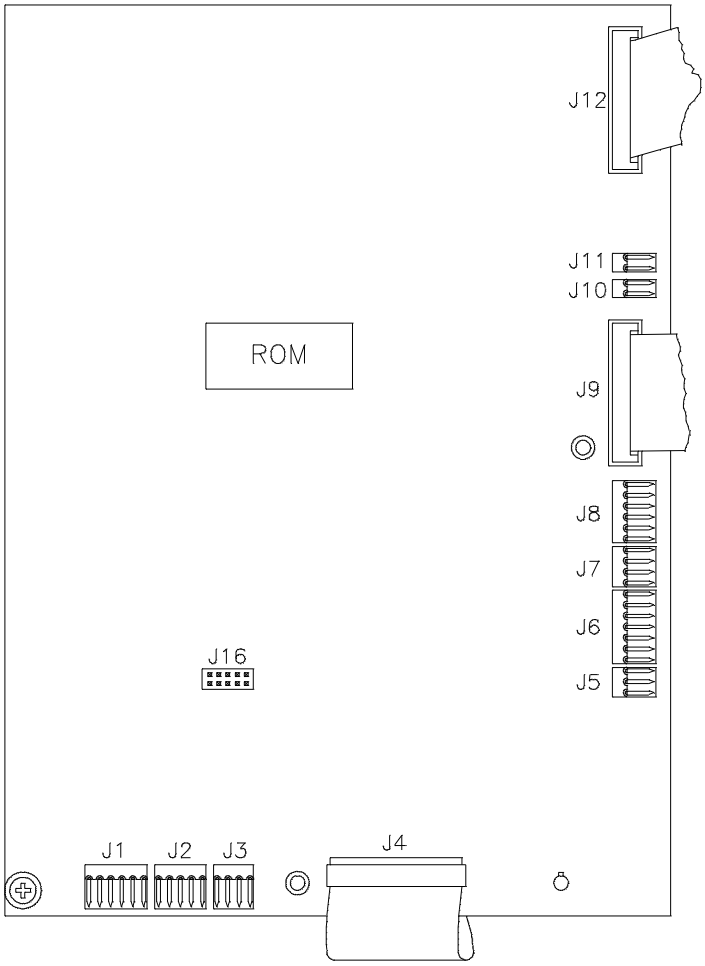


Table 3 **Test Connector J16**

Pin	Purpose	Pin	Purpose	Pin	Purpose	Pin	Purpose	Pin	Purpose
1	Photocurrent REF	2	Photocurrent SAMP	3	+15 V	4	-15 V	5	Digital GND
6	+5 V	7	A/D Clock 1.2 kHz	8	Ref Voltage +10 V	9	Analog GND	10	

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Power Supply (DPS-A)

Repair Level: Fuses and Exchange DPS-A

Table 4 **Part Numbers for DPS-A**

Item	Part Number
DPS-A (Exchange)	01050-69375
DPS-A (New)	5061-3375
Fuse for 110 V operation 3 A	2110-0003
Fuse for 220 V operation 2 A	2110-0002

For detailed information on the power supply refer the *1050 Service Handbook, chapter 1050 Common Information.*

Lamp Ignition

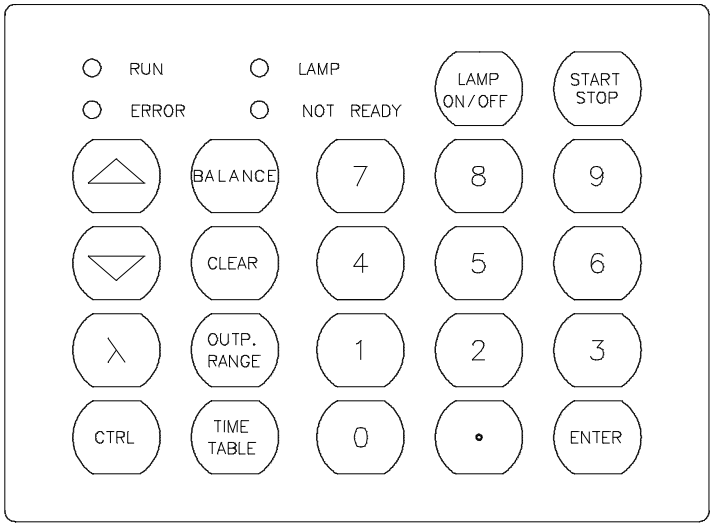
The heater output made by a series regulator is in the pre-heating status 2.5 V always. After ignition a different output voltage is selected depending on the lamp type used: In the 79853C VWD the heater is switched off after ignition.

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Keyboard

The flat keys at the front panel is composed of 6 x 4 matrix. Data is read by scanning at Key/Display Controller on the Keyboard Display Interface Board. Key entry is checked by reading the status of the controller by the CPU at every 10 ms. The Key/Display Controller also controls LED lamp lighting.

Figure 10 **Keyboard**



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Keyboard Electronics (KDI / VFD)

Repair Level: Board

Table 5 **Part Numbers for Keyboard Electronics**

Item	Part Number
Keyboard Display Interface (KDI)	79853-66502
Display Module Board (VFD)	79853-66503

Behind the frontpanel two electronic boards are located: Keyboard Interface Board (KDI) and the Display Module Board (VFD).

Keyboard Display Interface

The Keyboard Interface Board (KDI) is connected to the DCB board and contains:

- interface between key-matrix (6 x 4) and DATA bus
- LED driver for the status messages ERROR, NOT READY, LAMP and RUN
- buzzer.

Display Module

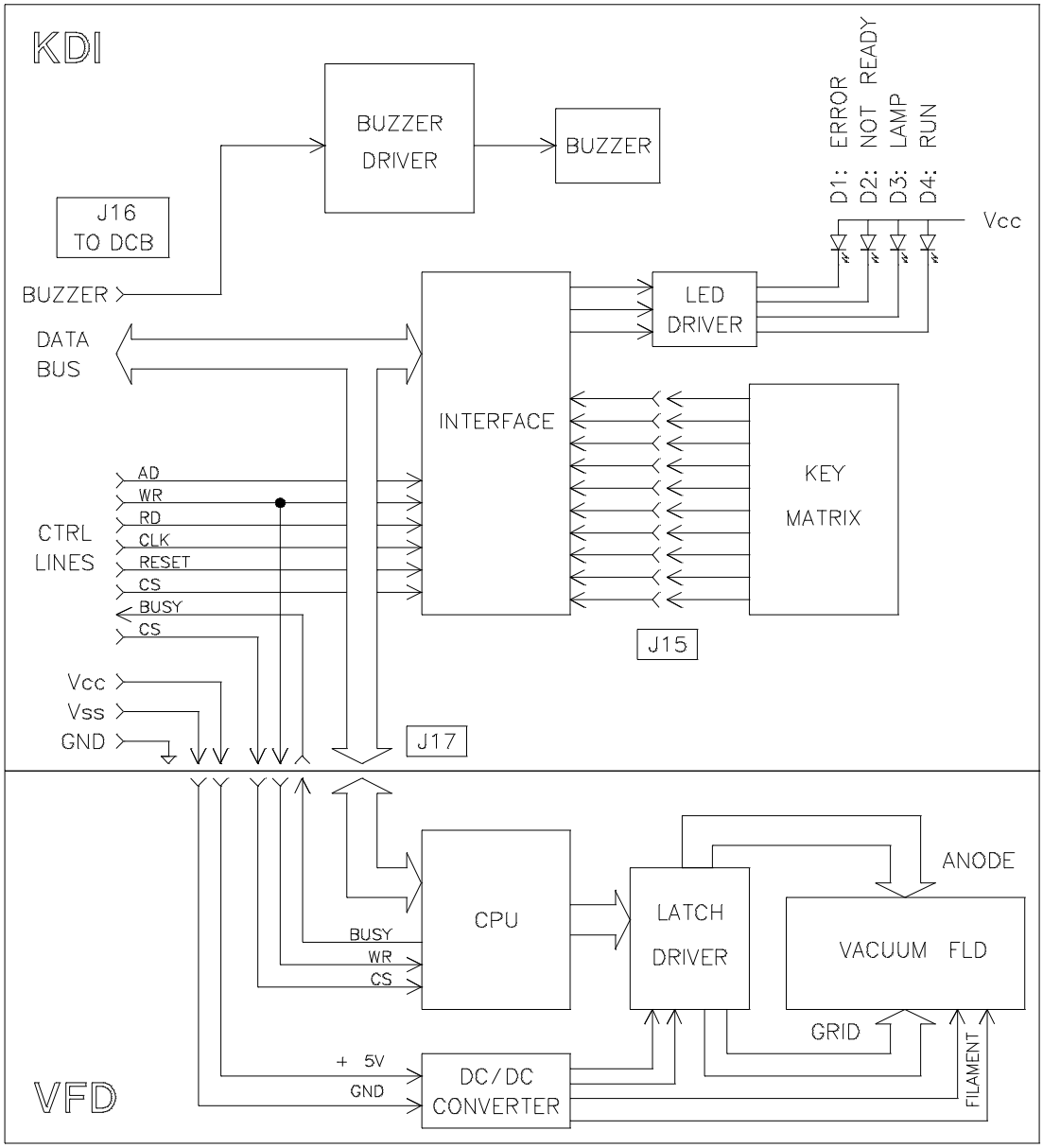
The Display Module Board (VFD) is connected to the KDI and contains:

- CPU for control of latch driver
- latch driver for the Vacuum Fluorescence Display (FLD)
- DC/DC converter to provide the voltages for the FLD.

Refer to *"Replacing Display Boards" on page 662*, when replacing this board.

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Figure 11 **Block Diagram of Keyboard Electronics**



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Pre-Amplifier Boards

Repair Level: Board

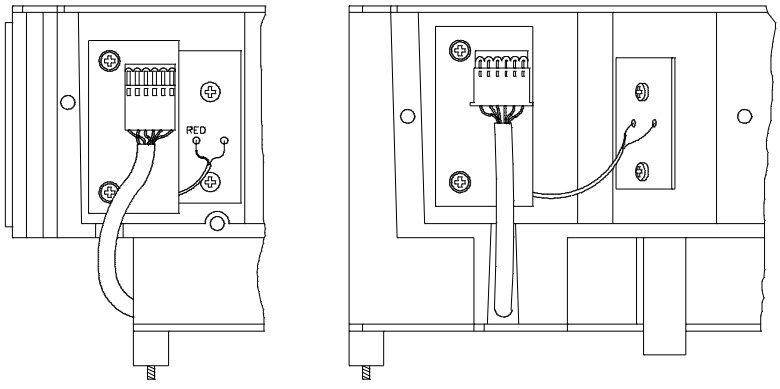
Table 6 **Part Numbers for Pre-Amplifiers**

Item	Part Number
Pre-Amplifier Board Sample	79853-66507
Pre-Amplifier Board Reference	79853-66508
Sensor Sample	79853-61109
Sensor Reference	79853-61110

The light (absorbtion) from the deuterium lamp (flow cell) is detected by the sample and the reference photodiode. Its current is then amplified by the pre-amplifiers. The signal then is routed to the DCB.

The wires from the photodiodes are soldered onto the board.

Figure 12 **Photodiode Assemblies**



Sample Reference

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Power Supply Connection Board (PSC)

Repair Level: Board

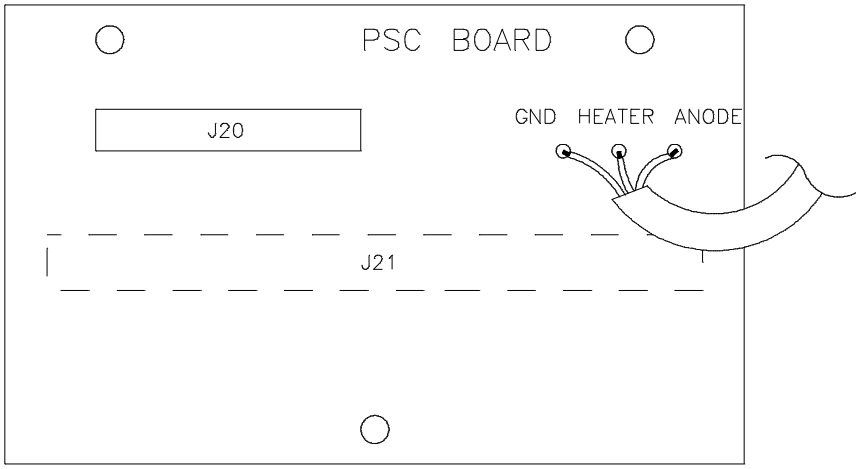
Table 7 **Part Numbers for PSC Board**

Item	Part Number
PSC Board (for DCB -66511)	79853-66512
PSC Board (for DCB -66506 OBSOLETE)	79853-66509 OBSOLETE

NOTE If the DCB board is replaced by 79853-66511 version, the PSC board MUST be changed to 79853-66512.

This board connects the Power Supply DPS-A with the DCB and the Deuterium Lamp Assembly. The wires of the lamp cable are soldered in.

Figure 13 **Board Layout PSC**



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GPIB Communication Interface

Repair Level: Board, Firmware

Table 8 **Part Numbers for GPIB Interface Board**

Item	Part Number
GPIB Board (with cable)	79853-68711
GPIB Cable to DCB Board	
Firmware ROM GPIB	79853-13004

Parallel Interface Dual direction transceiver for data bus between master and slave CPU's. 8 bit aux code from DCB to GPIB board. 3 bit control code from GPIB board to DCB

Microprocessor Single chip microprocessor with 1 Mbyte address capability, 512 byte internal RAM and 32 I/O ports.

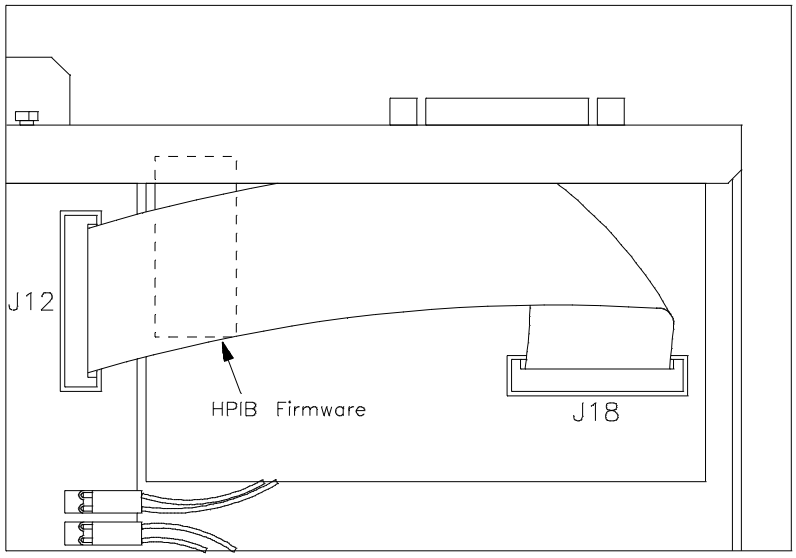
Memories 32 Kbyte of ROM for program memory and 128 Kbyte RAM for the run buffer.

Firmware Description The GPIB board performs all interruption processing from the GPIB controller. DCB and GPIB board communicate with hardware interrupts. Receiving GPIB commands the GPIB board passes them to the DCB with 3 bit control code. This control code shows the kind of bus data such as GPIB commands, error codes or requesting data code and whether the data ended or not. During run or monitor mode the DCB send chromatogram data immediately to the GPIB board with 8 bit aux code. This aux code shows the kind of bus data such as chromatogram data, parameters, time tables, remote line status or GPIB board control code and whether the data ended or not. The GPIB board writes the received data into the run buffer. The GPIB sends out the formatted data adding the start and the end record.

GPIB Address Setting The GPIB address setting is done with a switch (1) at the rear of the GPIB board. The factory setting is '10' (position A).

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Figure 14 **Location of GPIB board**



GPIB Firmware Revisions

Refer to *"GPIB ROM Firmware Revisions" on page 733* for information on firmware revisions.

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1

VWD: Diagnostic & Troubleshooting Information

This chapter provides information on error messages and diagnostic features of the 1050 Variable Wavelength Detectors

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VWD: Diagnostic & Troubleshooting Information

This section provides information on the

- diagnostic routines
- error messages
- user contol functions
- service control functions

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Self Diagnosis

At power on and after lamp ignition the instrument checks itself for correct operation. In case of malfunctions, error messages will inform the operator on the fault.

During Power On

The following tests are done automatically during power on. They are descibed on the next pages together with the error message:

- Vaccuum Fluorescent display
- ROM and RAM
- Display
- Leak sensor
- Voltages
- A/D Converter
- EEROM Data
- Grating Drive

During Normal Operation

The following tests are done automatically during normal operation:

- for light intensity
- for filter movement
- for leaks

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Error Messages Before Lamp Ignition

Error messages may come up during the power on state or the normal operation.

At Power ON

During power on the instrument run automatically through different selftest routines.

If all test are passed, the display shows `HP 1050 VWD`.

While initializing the CPU checks the response of the Vaccuum Fluorescent Display (VFD) module.

If there is no problem, `SELF DIAGNOSIS IN PROGRESS` is displayed.

If there is no response from the VFD, the ERROR lamp will light, the buzzer is heard for 2 seconds and is halted.

- ❏ Check connection DCB/KDI and KDI/VFD module.
- ❏ Replace VFD Module.
- ❏ Replace KDI Board.
- ❏ Replace DCB Board.
- ❏ Replace DPS.

ROM TEST FAILED

The ROM Test calculates the checksum and compares it with a stored value. If a difference is found, ERROR LED lights, `ROM TEST FAILED` is displayed and the CPU is halted. Otherwise `ROM TEST OK` is displayed.

- ❏ Replace EPROM.
- ❏ Replace DCB.

RAM TEST FAILED

During RAM Test, firstly every RAM address is uniformly written. Then in ascending order, each address is tested for contents and then the data is inverted and written. Then the same procedure is repeated in decending order with the inverted data. This cycle is repeated twice. If an error is found, `RAM TEST FAILED` is displayed and further operation is prohibited. Otherwise, `RAM TEST OK` is displayed.

- ❏ Replace DCB.

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Display Test

During Display Test every dot on the VFD module is set and you have to confirm it by yourself. If display is black or shows missing dots

- ❏ Check connection of flat ribbon cable DCB to KDI.
- ❏ Replace KDI.

L.SENSOR TROUBLE

The Leak Sensor Test checks the leak sensor and the leak sensor circuit, but not for a leak resulting from the cell. The voltage applied is measured using built-in 8 bit ADC (A/D Converter) of the CPU as well as temperature compensation voltage from a second thermistor.

If the LS > LL, `L.SENSOR TROUBLE` is displayed.

The range during turn on should be: LS:0.63..4.06 V and LL:2.82..4.00 V.

- ❏ Use `33:LEAK S.VOLT` to verify the values, (see message `LEAK DETECTED`.
- ❏ Check connection of leak sensor to DCB.
- ❏ Replace leak sensor.
- ❏ Replace DCB.

POWER FAILURE

During Voltage Test this message is displayed if the voltages exceeds the tolerance. If a voltage is not correct, it is displayed for a short moment, for example `+24V TROUBLE`.

- ❏ Check voltages using function `34:VOLTAGE TEST`:

Table 1 **DC Voltages**

Voltages	Used for
+ 12 V (±1 V)	filter and grating motor
- 15 V, + 15 V (±1 V)	analog circuits
+ 24 V (± 4.8V)	leak sensor, fans

- ❏ Replace DCB.
- ❏ Replace Power Supply.

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ADC TROUBLE

During the A/D Converter Test the 18 bit ADC for photocurrent acquisition is tested with multiplexer channel fixed at analog ground. Pulse count for ground input is measured 20 times and calculate the average and the fluctuations. If the value exceeds the pre-determined value `ADC TROUBLE` is displayed.

❏ Replace DCB.

EEROM DATA LOST

During EEROM Data Test various parameters such as monochrometer parameter and time table are stored in EEROM (Electrically Erasable Read Only Memory) in order to save the value in absence of power. At initializing those values are checked using checksum. If an error is found, `EEROM DATA LOST` is displayed and default values are set.

Different types of `EEROM DATA LOST` messages are possible:

EEROM DATA LOST0

The key settable parameters (wavelength, responsetime, and so on) or time time tables are lost. They are replaced by default values.

❏ Re-enter the values.

❏ Replace DCB.

EEROM DATA LOST1

Wavelength parameter (zero order) are lost. They are replaced by default values. The monochromater parameters are differrent for each instrument.

❏ Execute `20:0th CALIB.` or enter the 0th order parameter directly using `31:SET WL PARAM.`

❏ Execute `45:WL COMPENSATE`.

EEROM DATA LOST2

The DAC parameters are lost. The parameters are the scaling factors for each DAC bit and ZERO SPAN factors. The lost parameters are recoverable.

❏ Execute `44:DAC CALIB.`

EEROM DATA LOST3

The DAC parameters are lost. The parameters are the offset parameter of the ADC reading for the output of each DAC bit (used for DAC calibration).

NOTE

These parameters can be re-written at the factory only.

❏ Perform `41:DAC TEST`.

If OK, then leave it as it is.

If NOT OK, then continue.

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- ❏ Perform `44:DAC CALIB.` The default values of the offset parameters are taken now.
- ❏ Perform `41:DAC TEST`.

  If OK, then leave it as it is.

  If NOT OK, then replace DCB board.

WL SET TROUBLE

During the initialization of the grating motor position, the motor moves backward to the home position where position sensor detects the limit. If it is not able to detect the limit, `WL SET TROUBLE` is displayed.

- ❏ Check connection of position sensor and grating drive motor.
- ❏ Switch OFF lamp, remove top cover of optical unit to observe movement of grating mirror (changing wavelength).

  If grating will not rotate after changing the wavelength, replace DCB or the Grating Driver Assy.
- ❏ Using `36:GRATING P.S.` you can move the grating shaft automatically or stepwise by pressing the down/up key. Normally in the position of about -200 steps, the output voltage of the position sensor will change from LOW to HIGH, detecting the limit position. If the output voltage will never change, the position sensor is defective or the grating drive assembly has a problem and has to be replaced.

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Error Messages After Lamp Ignition

LAMP ERROR

❏ Check connections of lamp connector, PSC board and DPS to DCB.

❏ Replace lamp, DPS, DCB.

LOW ILLUMINATION

Light intensity of deuterium lamp is checked after lamp ignition at the wavelength of 250 nm. If the reference voltage at 250 nm is < 0.6 V, the detector will check the reference voltage at 500 nm and if < 0.12 V, `LOW ILLUMINATION` will be displayed. In this case the detector will never return to the original wavelength. It will remain at 500 nm.

This test is skipped if `WL SET TROUBLE` is displayed and unable to set the wavelength.

❏ Check the lamp image on the entrance slit.

If the image does not cover the slit properly, adjust mirror M1.

❏ Check connection to pre-amplifiers.

❏ Replace the lamp for deterioration of lamp.

❏ Replace the mirrors M1 and M2 for deterioration of mirrors.

FILTER ERROR

During Filter Test the second order light cutoff filter is tested by inserting it at the wavelength of > 370 nm and measuring the change of light intensity. If an error is found `FILTER ERROR` is displayed.

This message comes up if

- The reference current at 220 nm is more than 2.00 and at 500 nm more than 1/16 of the value at 220 nm. Then the filter is always off.
- The photocurrent at 220 nm is less than 2.00 and at 500 nm more than 0.04. Then the filter is always ON.
- The reference light beam is focussed far from the reference diode.

❏ Flow cell should be clean and bubble free.

❏ Check connection of filter motor.

❏ Check correct operation of filter with `39:FILTER TEST` and photo sensor of filter with `37:FILTER P.S.`

❏ Check beam splitter alignment.

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Error Messages During Normal Operation

LEAK DETECTED

❏ Enter service mode function `33:LEAK S. VOLT` and check leak sensor voltages.

Error condition is when LS > LL. The normal range should be:

Table 2 **Working Ranges for LS and LL**

LS signal	LL signal
2.35..2.85 V	2.95..3.45 V

❏ If there is no leakage, check the connection leak sensor to DCB.

❏ Replace Leak Detector board.

❏ Replace Leak Sensor.

DATA UNDERFLOW

This message may come up only during BALANCING when the sample or referrence voltage is lower than 1 mV.

❏ Check, whether the flow cell is in correct position and the screws are tightened.

❏ Check the connection of pre-amplifier sample to DCB.

❏ Clean cell windows.

❏ Replace photo diode assembly.

❏ Replace DCB.

DATA OVERFLOW

This message may come up only during BALANCING when the sample or referrence voltage exceeds 9.4 V.

Check, whether the flow cell is in correct position and the screws are tightened.

Replace DCB.

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ADC OVERFLOW

- ❏ Execute `BALANCE`, so that the proper pre-amplifier gain is selected.
- ❏ Check, whether the flow cell is in correct position and the screws are tightened.
- ❏ Is apature gasket installed in flow cell?
- ❏ Replace DCB.

No response for HPIB

- ❏ set address switch correct.
- ❏ check connection to DCB and GPIB cable.
- ❏ change GPIB board.

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Error Messages During Use of Control Functions

CALIB FAILURE

- When using `20:0th CALIB.` this message may come up because the lamp is turned OFF or to much light reaches the sample diode.

  ❏ Turn On the lamp.

  ❏ Reduce light to sample diode.

- When using `21:WL CALIBRATION` this message may come up under the following reasons:

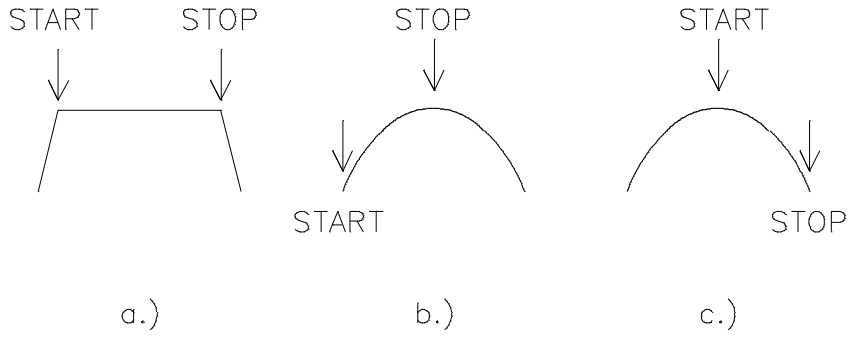
  If during scan the measured voltage of each step

  is the same (Figure 232-a), or
  is on an upslope (Figure 232-b) or
  is on a downslope (Figure 232-c).

  ❏ Use other wavelength setting to get a different range, `31:SET WL PARAM.`

  ❏ Recalibrate grating with `21:WL CALIBRATION`.

Figure 1 **Calibration Failure**



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User Control Functions

These functions are accessable for every instrument user. They are used for parameter settings and special operating functions during normal work.

Table 3 **User Control Functions**

#	Display	Used for
1	1:SAMPLE SCAN	takes a sample scan
2	2:REF. SCAN	takes a reference scan
3	3:SPECTRUM OUT	plots the spectrum
4	4:SCAN FROM	defines scan range from
5	5:SCAN TO	defines scan range to
6	6:ZERO OFFSET	zero offset in %
7	7:RESPONSETIME	choices 0.25, 1 and 4 s
8	8:AUTO LAMPOFF	automatic lamp off
9	9:AUTO LAMP ON	automatic lamp on
10	10:OUTP. DEVICE	integrator or recorder
11	11:OUTPUT VOLT	1 V or 100 mV
12	12:STATUS	FW revision, errors or status
13	13:START MODE	local, remote, hpsystem
14	14:OUTPUT CHECK	checks the output voltage
15	15:RESET	reset to default
16	16:PHOTOCURRENT	sample and reference diode's current
17	17:PARAM. LOCK	locks certain parameters
18	18:WL SHIFT	WL change on display
19	19:POLARITY	polarity of signal (analog/GPIB)
20	20:0th CALIB.	0th order calibration

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Table 3 **User Control Functions**

#	Display	Used for
21	21:WL CALIBRATION	656 nm calibration
22	22:HOLMIUMCHECK	WL Calibration check

Functions 1 to 21 are described in detail in the *User Documentation*.

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Service Control Functions

NOTE

These functions are secured by a PASSWORD, because they are normally used by trained Service Engineers. Misuse of certain function may result in a misalignment of the optical path or electronical values.

If the VWD is in service mode, the ERROR status lamp blinks.

If the instrument enters into this mode accidentally, the easiest way to abort from this mode is: TURN OFF the power off the instrument.

Entering the Service Mode

1 Press [CTRL] [3] [0] [ENTER]

2 {30:SERVICE MODE} [ENTER]

3 {Pass Word} [1] [0] [5] [0] [ENTER]

This control function is the entry point for all service control functions. You can enter service control function only through this control function. Select your desired control function using [DOWN] or [UP]. Once you abort from this mode, you have to execute this function again. However if power has not switched off since last entry, you can skip password by just pressing [ENTER].

It is adviced that you will turn-off the power, after you finished using service control functions to avoid the accidental entry to service control mode.

In Table 151 on page 623 all service related functions are listed. Due to different firmware versions and improvements on 79853C VWD, the order of the functions is different.

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The functions 20, 21 and 22 are part of the User Functions, but they are described in this section.

Table 4 **Service Control Functions**

#	Display	Used for
20	20:0th CALIB.	Zero Order calibration
21	21:WL CALIBRATION	656 nm calibration
22	22:HOLMIUMCHECK	Wavelength Calibration check
31	31:SET WL PARAM.	Parameter Set for Zero Order and 656 nm
32	32:FIX SIGNAL	Fixed voltage to sample or reference path
33	33:LEAK S. VOLT	Shows leak sensor voltages
34	34:VOLTAGE TEST	Shows DC Voltages
35	35:ADC NOISE	Check of ADC noise
36	36:GRATING P.S.	Check of Grating Sensor
37	37:FILTER P.S.	Check of Filter Sensor
38	38:REMOTE TEST	Check of Remote lines-
39	39:FILTER CHECK	Checks movement of Filter
40	40:0TH TEST OFF	Positions the Zero Order Beam
41	41:DAC TEST	Checks DAC
42	42:PREAMP GAIN	Checks linearity of gains
43	43:EEROM TEST	Checks EEROM data
44	44:DAC CALIB .	Calibrates the DAC
45	45:WL COMPENSATE	Compensates non-lineraties of grating

CAUTION

Important parameters might be lost. DO NOT use control functions 31 through 45 until you have read this paragraph and fully understand the functions and result of operation. Some functions may change the monochrometer parameters and misuse of these functions leads to inaccurate wavelength setting.

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Zero Order Calibration

20:0th CALIB.

This control function is used for the electrical calibration of the zero order beam of the monochrometer. The step number corresponds to the number in `31:SET WL PARAM.`

The grating is driven by the stepper motor through steps 150 to 250 searching for a maximum. The step number with the maximum voltage is displayed, and if accepted, written into the EEROM.

The intensity of the zero order light is reduced by inserting a filter in the calibration position automatically.

Prior to the use of this function, the grating assembly should be pre-aligned on the zero order light, using control function `40:0TH TEST OFF`.

Table 5 **Control Function: Zero Order Calibration**

Key Operation	Display	Description
	20:0th CALIB.	Select function.
ENTER	nn step CHANGE?	display current parameter or change to 200.
ENTER or		to continue calibration or
CLEAR		to abort.
		wait appr. 20 seconds.
	nn step x.xxxV	starts the calibration scan from 150 step to 250step
		No key entry is allowed here.
		Possible error message at this point may be:
	CALIB. FAILURE	Indicates that the lamp is OFF.
	DATA OVERFLOW	Indicates that too much light reaches the sample photo diode. Reduce light and insert paper between cell and sample diode

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Table 5 **Control Function: Zero Order Calibration**

Key Operation	Display	Description
	DATA UNDERFLOW	Indicates that not enough light reaches the sample photo diode. Check light path.
		The next line will be shown, if no error message occured.
	nn step y.yyyV	Displays the step that gave the maximum light intensity.
ENTER	nnn step OK ?	Promps for confirmation, to change the parameter.
ENTER		Takes the displayed step number.
CLEAR		Rejects the displayed step number.
ENTER	nnn step	New parameter is written in EEROM and monochrometer is reset with new parameter.
	20:0th CALIB.	End of Zero order beam calibration. You may repeat the procedure again.

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Wavelength Calibration

21:WL CALIBRATION

This control function is used for the calibration of the monochrometer using the 656 nm line emission from the deuterium lamp. The step number appeared in this control function is the number of steps of stepper motor from the 0 order beam to the 656 nm emission line. Maximum light intensity is searched between ±50 steps of 656 nm value. If the maximum peak is found, the step number is written into EEROM and corresponds to the value in `31:SET WL PARAM.`

Table 6 **Control Function: WL Calibration**

Key Operation	Display	Description
	21:WL CALIBRATION	Select function.
ENTER	656nm xxxx step	Displays the wavelength for calibration and steps based on present PARAM.WL 656.
ENTER or		To continue calibration or
CLEAR		to abort.
		Wait appr. 30 seconds.
	xxxxstep y.yyyV	Starts the calibration scan from 656 nm ±50 steps and seeks for maximum light intensity.
		No key entry is allowed here.
		Possible error message at this point may be:
	CALIB. FAILURE	Indicates that there was no maximum found (see *"CALIB FAILURE" on page 619*).
	DATA UNDERFLOW	Indicates that not enough light reaches the sample photodiode (<30 mV).
		The next line will be shown, if no error message occured.

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Table 6 **Control Function: WL Calibration**

Key Operation	Display	Description
	xxxxstep y.yyyV	Displays the step that gave the maximum light intensity.
ENTER	656nm xxxx step	Displays the wavelength and step that gave the maximum light intensity.
after 2 seconds	656nm xxxxstep	Displays the new parameter at 546 nm and prompts the confirmation.
ENTER		Takes the displayed step number.
CLEAR		Rejects the displayed step
ENTER	656 yyyystepOK	New parameter is written in EEROM and monochrometer is reset with new parameter.
after 2 seconds	21:WL CALIBRATION	End of calibration. You can repeat the procedure again.

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Wavelength Calibration Check

22:HOLMIUMCHECK

This control function is used for the automatic check of the instruments WL calibrations using the some specific lines on the Holmium oxide filter which is moved into the light path.

Table 7 **Control Function: HOLMIUMCHECK**

Key Operation	Display	Description
	22:HOLMIUMCHECK	Select function.
ENTER	CHECK?	
CLEAR		to leave function.
ENTER		to start the calibration check.
	360.8nm	automatic verification
	418.5nm	automatic verification
	536.4nm	automatic verification
	HOLMIUM CHECK OK	if within specification
CLEAR		to leave function.
DOWN	360.8nm 360.7nm	displays measured value
DOWN	418.5nm 418.4nm	displays measured value
DOWN	536.4nm 536.4nm	displays measured value
CLEAR	22:HOLMIUMCHECK	to leave function.

If this test was not successful, perform `20:0th CALIB.` and `21:WL CALIBRATION`.

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SET WL Parameter

31:SET WL PARAM.

This control function is used for the confirmation of monochrometer parameters or for changing them directly. `PARM.WL0` is the number of steps of stepper motor from the position sensor, while `PARM.WL656` is the number of steps from 0 order beam. As these values changes slightly from instrument to instrument, they are originally calibrated and written into EEROM.

The parameter 360.8 nm, 418.5 nm, 486 nm and 536.4 nm cannot be changed. These four parameters set with `45:COMPENSATE` are used to compensate non-linearity of the grating drive.

If `PARM.WL656` is changed, these four parameters are automatically shifted.

Table 8 **Control Function: SET WL PARAM.**

Key Operation	Display	Description
	31:SET WL PARAM.	Select function.
ENTER	Parm.WL0 200	Displays the 0 order light parameter (same
value found with 20:0th CALIB. .		
UP		Select the parameter WL656 nm.
	Parm. 656yyyy	Displays the step number at 656 nm (same value found with 21:WL CALIBRATION.
		Enter the parameter using numeric keys.
UP	Parm.360.8yyyy	Displays the step number at 360.8 nm.
UP	Parm.418.5yyyy	Displays the step number at 418.5 nm.
UP	Parm. 486 yyyy	Displays the step number at 486 nm.
UP	Parm.536.4yyyy	Displays the step number at 536.4 nm.

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Table 8 **Control Function: SET WL PARAM.**

Key Operation	Display	Description
ENTER	31:SET WL PARAM.	Control function is displayed again.
CLEAR		On WL0 or WL656 parameter, reenters the displyed value.

In order to change both parameters you have to repeat the above procedure for both wavelengths.

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Fix Signal

32:FIX SIGNAL

If the 1050 VWD shows noise or drift problems, this function can help to isolate the cause. The reference or the sample diode can be set to an fixed electrical value to remove influences from the light path.

This function can also be used to retrieve the instrument profile of the instrument.

Table 9 **Control Function: FIX SIGNAL**

Key Operation	Display	Description
	32:FIX SIGNAL	Select function.
ENTER	REF. CH. FIXED	The photocurrent of reference photo diode is a fixed electrical value.
DOWN or UP		Select the parameter.
	NORMAL-NOT FIXED	Return to normal condition (neither photocurrrent is fixed.)
	SMP. CH. FIXED	The photocurrent of sample photo diode is a fixed value.
ENTER	32:FIX SIGNAL	Control function is displayed again.

NOTE

If either channel is fixed, the ERROR status lamp is blinking even after returning to analysis mode from service control mode. This is an alarm to show that the instrument is abnormal condition. You can return to normal condition by executing NORMAL-NOT FIXED or switching off the power.

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Use of FIX SIGNAL

Use this function for

- checking the noise of both sides separately;
- taking the instrument profile of both sides separately.

With fixed signal, either the reference or the sample side is supplied with a constant current. So influences from the lamp effects only that side which is not fixed. Influence due to a drifting or defective photo diode effects both, a scan and the signal (noise). Small wavelength variations between fixed sample and reference scans are caused by the characteristics of the photo diodes.

Noise with Reference Signal Fixed: If the noise is large, the problem may be caused by light path, flow cell or sample diode/pre-amplifier.

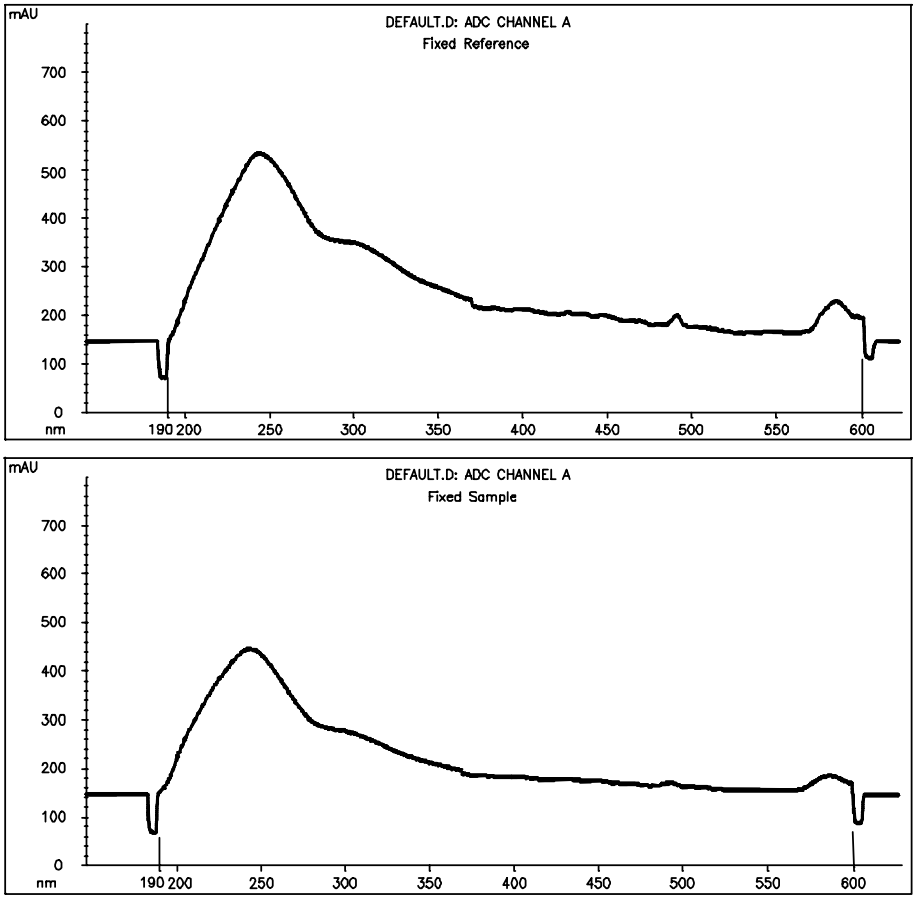
Noise with Sample Signal Fixed: If the noise is large, the problem may be caused by light path, lamp or reference diode/pre-amplifier.

To take an instrument profile proceed as follows:

- Enter `32:FIX SIGNAL` and set `SMP. CH. FIXED`.
- Press `[ENTER]` and leave function.
- Press `[BALANCE]`.
- Take a reference scan `2:REF SCAN`.
- Take a sample scan `1:SAMPLE SCAN`.
- Set integrator to ATTN9, CS10 and Zero10%.
- Press `[BALANCE]`.
- Enter `3:SPECTRUM OUT`, press `[ENTER] [ENTER]`.
- Start plot on integrator and press `[ENTER]`. The intensity profile is now plotted on the integrator.
- Perform above steps with `REF. CH. FIXED` to check the light through put of the cell. Figure 233 on page 633 shows both plots.

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Figure 2 **Example of Intensity Profiles**



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Leak Sensor Voltage

33:LEAK S.VOLT

You can check the leak sensor with this contol function in case of trouble.

Table 10 **Control Function: Leak Sensor Voltage**

Key Operation	Display	Description
	33:LEAK S.VOLT	Select function.
ENTER	LS:2.70 LL:3.30	Displays LS (Leak Sensor Voltage) and LL (Temperature compensation voltage). Error condition is when **LS > LL**. The normal ranges are: LS signal 2.35..2.85 V, LL signal 2.95..3.45 V
CLEAR	33:LEAK S.VOLT	Leaves function.

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Voltage Test

34:VOLTAGE TEST

You can check some (but not all) voltages with this contol function.

Table 11 **Control Function: Voltage Test**

Key Operation	Display	Description
	34:VOLTAGE TEST	Select function.
ENTER	15.0 22.9	Displays first set of voltages.
DOWN or UP	12.1 -15.0	Displays second set of voltages.
CLEAR	34:VOLTAGE TEST	Leaves function.

Table 12 **DC Voltages**

Voltages	Used for
+ 12 V (±1 V)	filter and grating motor
- 15 V, + 15 V (±1 V)	analog circuits
+ 24 V (± 4.8V)	leak sensor, fans

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ADC Noise

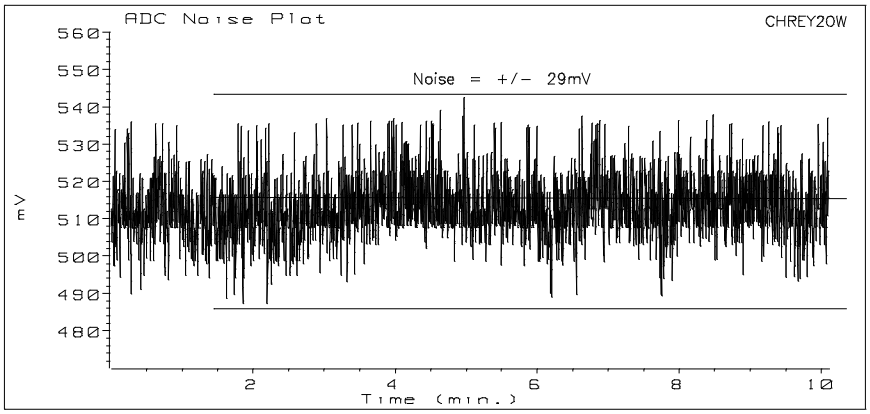
35:ADC NOISE

The output signal of the ADC noise corresponds to 196 AD counts at the Analog Output with 1 V full scale setting. The ADC noise must be within ±10 counts (±50 mV) over a time of 10 minutes (Figure 234).

Table 13 **Control Function: ADC Noise**

Key Operation	Display	Description
	35:ADC NOISE	Select function.
ENTER	TESTING ADC	ADC noise is outputted. Start plotter in ATTN 7, ZERO 50, Chartspeed 1 (on HP 339X)
CLEAR	35:ADC NOISE	Leaves function.

Figure 3 **ADC Noise**



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Grating Photo Sensor

36:GRATING P.S.

This control function can be used to check the function of the photo sensor and the drive mechanism of the grating. The movement of the grating can be done automatically or step for step. It will provide the step number and the voltage of photo sensor which detects the backward limit when the drive mechanism moves into the photo sensor. The photo sensor voltage exceeds 3 V when the photo sensor reaches at backward limit position.

A normal step value for change from LOW to HIGH is around -200 steps.

Table 14 **Control Function: Grating Photo Sensor**

Key Operation	Display	Description
	36:GRATING P.S.	Select function.
ENTER	STPxxx PS0.11	Present step of stepper motor and photo sensor voltage is displayed.
DOWN or UP	STPxxx PSy.yy	You can move the stepper motor and observe the voltage.
ENTER	STP-nnn PS3.90	Starts automatically the search for the home position and displays the step number (nnn) and the corresponding voltage.
CLEAR	36:GRATING P.S.	Leaves function.

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Filter Photo Sensor

37:FILTER P.S.

This control function can be used to check the function of the photosensor and the filter motor. The movement is done step for step. It will provide the step number and the voltage of photo sensor when the drive mechanism moves into the photo sensor.

Table 15 **Control Function: Filter Photo Sensor**

Key Operation	Display	Description
	37:FILTER P.S.	Select function.
ENTER	STP0 PS4.98	Move to home position and shows steps and photo sensor voltage.
DOWN or UP	STPxxx PSy.yy	You can move the stepper motor and observe the voltage. When the motor leaves the photo sensor, then PS changes to 0.01.
CLEAR	37:FILTER P.S.	Leaves function.

Pressing

UP once	rotates the filter 1 step (7.5°) to the left.
DOWN once	rotates the filter 1 step (7.5° to the right.

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Remote Test

38:REMOTE TEST

This control function is to test the remote control line. Disconnect the remote cables to avoid interferrence to and from other instruments.

Remote lines tested are: START, SHUT DOWN, POWER DOWN, READY and STOP. PREPARE and START REQUEST are not tested.

Table 16 **Control Function: REMOTE Test**

Key Operation	Display	Description
	38:REMOTE TEST	Select function.
ENTER	Disconnect REMOTE Cable and Press START	
START	REMOTE LINE TEST	The REMOTE LINE TEST starts.
	REMOTE LINE OK	When test is passed.
	REMOTE FAILURE	There's a trouble.
CLEAR	38:REMOTE TEST	Leaves function.

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Filter Check

39:FILTER CHECK

This control function is used to check the motion of second order cutoff filter. The cutoff filter returns to original position at the end of this control function.

Table 17 **Control Function: Filter Test**

Key Operation	Display	Description
	39:FILTER CHECK	Select function.
ENTER	CUT FILTER OFF	Displays present filter status.
DOWN or UP	CUT FILTER ON	Cutoff Filter moves in or out.
CLEAR	39:FILTER CHECK	Leaves function.

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Zero Order Test

40:0TH TEST OFF

This control function is used to move the stepper motor into the zero order position and has to be performed during the alignment of the grating.

Table 18 **Control Function: Zero Order Test**

Key Operation	Display	Description
	40:0TH TEST OFF	Select function. The test is still off and the grating is on set parameter wavelength.
ENTER	0th STEP NOnnn	Take the number of steps from 31:SET WL PARM. , (default) or use 200 steps.
ENTER	0TH TEST ON	The stepper motor is moved to zero order position.
CLEAR	40:0TH TEST OFF	Leaves function and grating is turned to set wavelength.

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DAC Test

41:DAC TEST

This control function is used to check the D/A converter by setting different bits. An AC voltage is added to the DC output and should be < 0.8 x 10^{-5} AU.

Table 19 **Control Function: DAC Test**

Key Operation	Display	Description
	41:DAC TEST	Select function.
ENTER	TESTING BIT 0	Bit 0 is tested.
UP	TESTING BIT 1	Bit 1 is tested.
UP	TESTING BIT 2	Bit 2 is tested.
UP	TESTING BIT 3	Bit 3 is tested.
UP	TESTING BIT 4	Bit 4 is tested.
UP	TESTING BIT 5	Bit 5 is tested.
UP	TESTING BIT 6	Bit 6 is tested.
UP	TESTING BIT 7	Bit 7 is tested.
CLEAR	41:DAC TEST	Leaves function.

Table 20 **DAC DC Values**

Bit	mV	Decription
0	27	
1	32	jump of 5 mV
2	42	jump of 10 mV
3	62	jump of 20 mV
4	104	jump of 40 mV
5	22	GND plus offset voltage
6	185	jump of 80 mV
7	511	about half of maximum output voltage

If you do not see a linear response, replace the DCB board.

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An AC voltage is added to the DC output and should be < 0.8 x 10^{-5} AU.

Figure 4 **DAC Test Bit 0 (AC)**

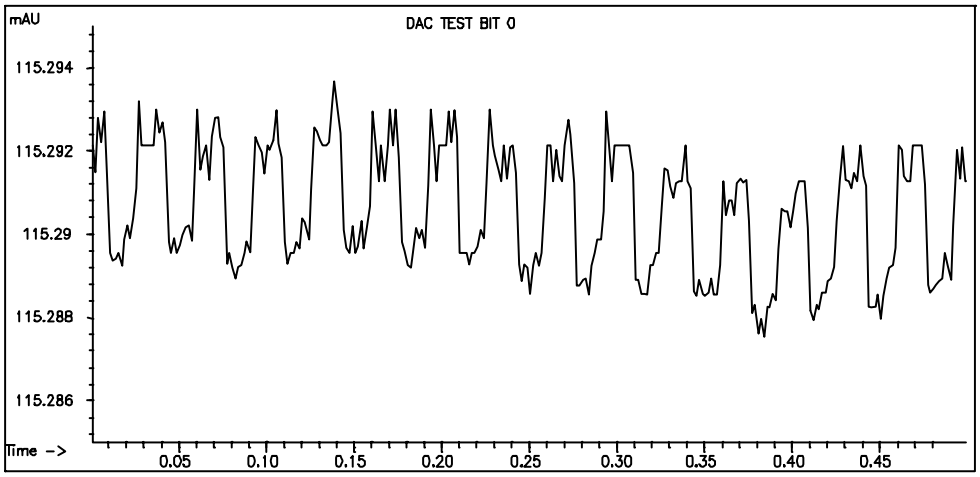
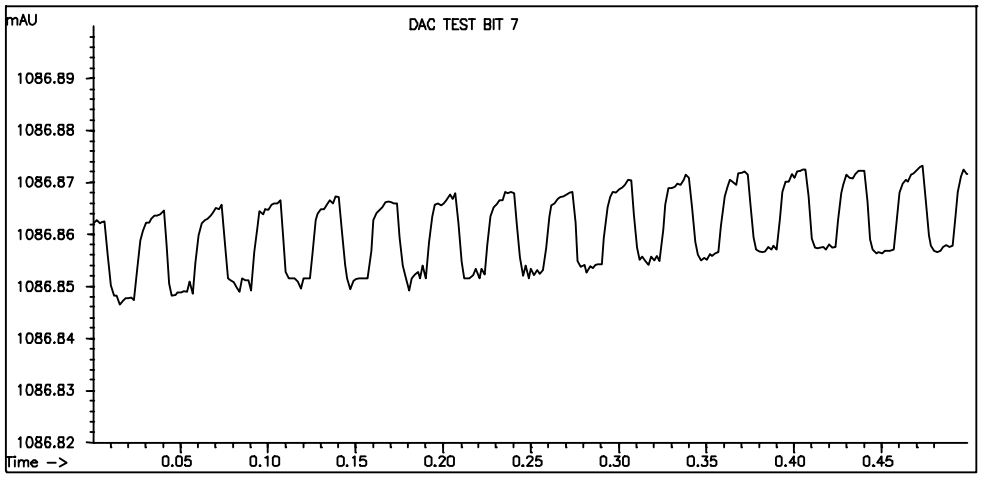


Figure 5 **DAC Test Bit 7 (AC)**



If one or more tested bits are out of limit, then perform `44:DAC CALIB`.

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Pre-amplifier Gain

42:PREAMP GAIN

This control function allows the check of gain switching on the DCB.

The gain can be switched to 1, 2, 4 and 8.

Table 21 **Control Function: Pre-Amplifier Gain**

Key Operation	Display	Description
		Change wavelength to 500 nm to reduce intensity of light.
	42:PREAMP GAIN	Select function.
ENTER	G1 R0.115 S0.045	Shows the photocurrent of reference and sample side with gain 1.
DOWN	G2 R0.227 S0.089	Shows the photocurrent of reference and sample side with gain 2.
DOWN	G4 R0.455 S0.179	Shows the photocurrent of reference and sample side with gain 4.
DOWN	G8 R0.914 S0.358	Shows the photocurrent of reference and sample side with gain 8. The displayed values should double each time. If not, change wavelength to 500 nm or change DCB.
CLEAR	42:PREAMP GAIN	Leaves function.

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EEROM Test

43:EEROM TEST

This control function checks the EEROM and is used as factory test.

Table 22 **Control Function: EEROM Test**

Key Operation	Display	Description
	43:EEROM TEST	Select function.
ENTER	EEROM TEST******	The blinking * indicates the checked section.
	EEROM TEST OK	Test was successful. If test failes, replace DCB.
CLEAR	43:EEROM TEST	Leaves function.

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DAC Calibration

44:DAC CALIB.

This control function does a scaling between lower 12 bits and upper 8 bits of DAC and an automatic recalibration of the DAC internal voltages. It should be performed when the noise is higher than expected and a DAC non-linearity is found. The test runs automatically.

The initial calibration is done at the factory.

The lamp can be off, but the instrument should be on for some time for stabilizing the instrument to reduce drift.

Table 23 **Control Function: DAC Calibration**

Key Operation	Display	Description
	44:DAC CALIB.	Select function.
ENTER	Disconnect SIGNAL Cable and Press START	
START	DAC SCALING	Scaling starts.
	SCALING 0	Step 0 of 7 is displayed.
	f0 yyyy	pre-scaling done for step 0.
		Now you steps 1 to 7 are done.
	DAC CALIB. OK	Calibration was successful.
ENTER	44:DAC CALIB.	Takes new factors and leaves function.
	DAC CALIB.FAILED	Calibration was not successful.
CLEAR	44:DAC CALIB.	Keeps previous factors when calibratio failed and leaves function.

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Wavelength Compensation

45:WL COMPENSATE

This control function is used to compensate non-lineratity of the grating drive.

NOTE

If the grating motor or the grating has been replaced or moved, this function MUST be executed.

During this test, the flow cell should be empty (no windows) or clean filled with water or methanol (no air bubbles). Absorption in the flow cell causes an error.

- First step is to search for the 656 nm line emission of the deuterium lamp within a window of ±50 steps.
- Then the processor sets the ideal (linear) steps for four interpolative points, 360.8 nm, 418.5 nm, 486 nm and 536.4 nm.

  360.8 nm and 418.5 nm are absorption points of the holmium oxide spectra. 536.4 nm is a line emission from the deuterium lamp.
- Next, it scans each ideal interpolative point (±25 steps) as reference.
- Then the holmium oxide filter is inserted and it scans again for the three absorption points of holmium oxide spectra (±25 steps).
- If all found values are in limit, then the parameters are written into EEROM (visable with `31:SET WL PARAM.`).

Table 24 **Control Function: WL Compenstation**

Key Operation	Display	Description
	45:WL COMPENSATE	Select function.
ENTER	PARAM. CHANGE ?	
ENTER		to continue calibration
CLEAR		to abort calibration
	XXXstep y.yyyV	displays steps and voltage during calibration
	CALIB. FINISHED	new parameter, written into EEROM.

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Table 24 **Control Function: WL Compenstation**

Key Operation	Display	Description
ENTER	45:WL COMPENSATE	Takes new factors and leaves function.
	WL CALIB. FAILURE	one or more peaks could not be found with ±25 steps. Parameters are set to previous values.
CLEAR	45:WL COMPENSATE	Keeps previous factors when calibration failed and leaves function.

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1

VWD: Maintenance Information

This chapter provides provide procedures for service and maintenance of the 1050 Variable Wavelength Detectors

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VWD: Maintenance Information

NOTE

The information in this chapter is based on the original optical unit (version “C”). In June 1995 this optical was replaced by the enhanced version “D” to overcome baseline stability problems in unstable environments.

For details on this “D” version refer to section Enhanced Optical Unit Information *“VWD: Enhanced Optical Unit Information” on page 705*.

Warnings

WARNING

Dangerous voltage is present in the cabinet, though it is covered and insulated. DO NOT TOUCH PARTS unless they are specified in the procedure.

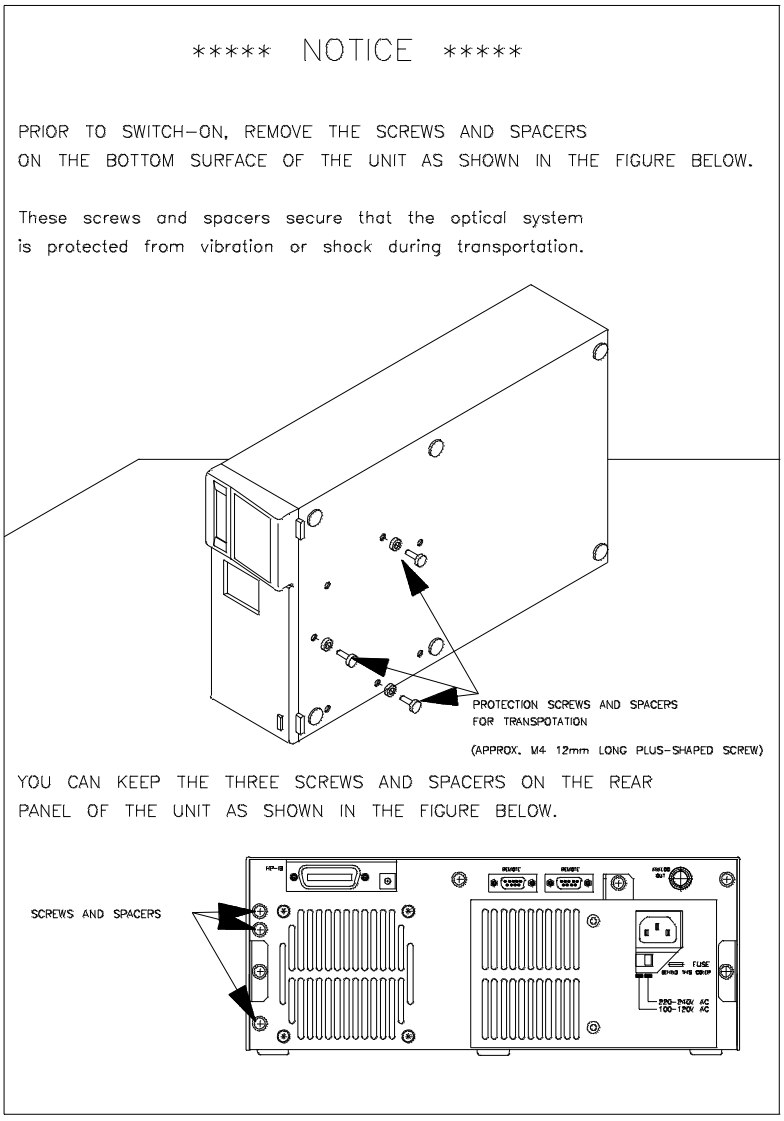
Be careful when you have to work in the optical unit. The lamp housing is hot.

Be sure to wear a pair of safety or sun glasses. Since the deuterium lamp emits intensive ultraviolet light, it is dangerous to perform optical alignment without eye protection. Be careful not to expose your eyes directly to the light coming from the lamp.

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Securing for Transport

Figure 1 **Securing for Transport**



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Replacement of Deuterium Lamp

If the Deuterium lamp no longer ignites or the lamp emission has become too low **and** noisy, the lamp has to be replaced.

The deuterium lamp is exchangeable by the user. No adjustment is necessary. For accurate wavelength setting excute user control function `20:0th CALIB.` and `21:WLCalibration` after exchanging the lamp.

Step 1: Replacement

- ❏ Turn the lamp off.
- ❏ Loosen the two screws at the rear of the instrument which fix the cover and remove them.
- ❏ Remove top cover.
- ❏ Unplug the lamp and remove it.
- ❏ Exchange the lamp (no adjustment is required).
- ❏ Reconnect the lamp.
- ❏ Replace top cover.
- ❏ Turn the lamp on.

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Step 2: 0th Order Calibration

The instrument scans for the maximum of the zero-order light.

During 0th order calibration a filter for reducing light intensity to prevent ADC data overflow will be inserted automatically.

Select control function `20:0th CALIB`.

[ENTER]	enters function
200step CHANGE?	displays the current parameter
[ENTER] or [CLEAR]	to continue or to abort
150step 0.000V	instrument scans now for maximum from step 150 to 250
201step X.XXXV	maximum when calibration successfully finished, press [ENTER]
201 step OK ?	press [ENTER] to keep the new value and to leave function

If `CALIB. FAILURE` occurs, press `[CLEAR]` to keep the old value and to leave function.

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Step 3: WL CALIBRATION

The instrument scans for maximum light intensity of 656 nm line spectrum of deuterium lamp.

Enter control function `21:WL CALIBRATION`.

[ENTER]	enters function
656nm 1900step	displays the current parameter.
[ENTER] or [CLEAR]	to continue or to abort
1875step 0.000V	the instrument scans now for for maximum for 100 steps
1902step X.XXXV	maximum when calibration successfully finished, press [ENTER]
656 1902stepOK?	press [ENTER] to keep the new value and to leave function.

If `CALIB. FAILURE` occurs, press `[CLEAR]` to keep the old value and to leave function.

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Flow Cell Maintenance

To replace or clean certain parts of the flow cell you should have a clean working area.

Refer to *"Standard Flow Cell "C" (SST/Ti)" on page 693* and the following pages for detailed flow cell schematics.

Flow Cell Maintenance Kits

There are several maintenance kits available with replacement parts for the flow cells.

For details see*"Standard Flow Cell "C" (SST/Ti)" on page 693* and the following pages.

Replacing Cell Parts

For the detailed procedures refer to the Operating Manual.

- ❏ Remove flow cell.
- ❏ Unscrew the cell screw using a 6 mm hexagon wrench, see Figure 238 on page 656, item 1.
- ❏ Remove inner parts carefully and place them in the correct order in front of you.
- ❏ Replace window, gaskets or other parts as needed.

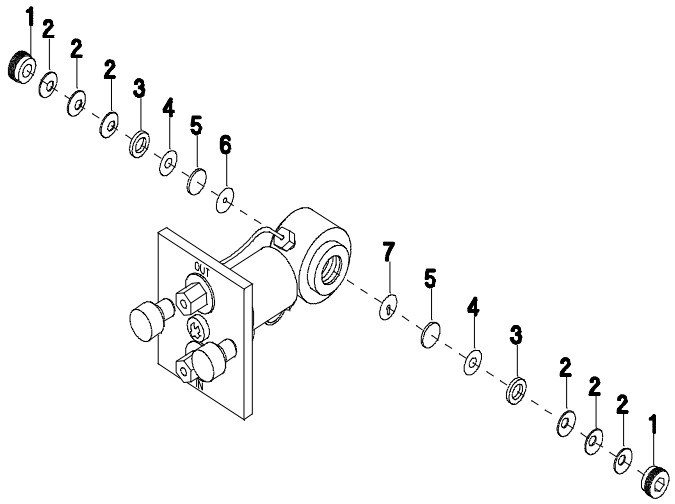
NOTE

Once a gasket has been compressed or spoiled on the surface, DO NOT use it again. A used gasket may cause leakage.

- ❏ Insert all parts in the correct order.
- ❏ Tighten the cell screw.
- ❏ Perform a "Leak Test" on page 657.

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Figure 2 **Standard Flow Cell**



Flushing Procedure

Cleaning the cell (by using a glass syringe!)

- ❏ Flush with iso-Propanol.
- ❏ Flush with bidistilled water.
- ❏ Flush with nitric acid : water (5 : 95).
- ❏ Flush with bidistilled water.
- ❏ Flush with iso-Propanol

CAUTION

This concentration of nitric acide is dangerous and proper attention to safety should be given. Also, the nitric acid flushing procedure is not a certain cure for a dirty cell. It is to be used as a last attempt to salvage the cell before certain cell parts have to be replaced.

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Leak Test

Remove the flow cell and connect the outlet tubing of the flow cell directly to the pump. Then flow an appropriate solvent (for example Isopropanol) at 10 ml/min. After several minutes check the cell visually. If it is necessary to check it for higher pressure, put an appropriate stainless steel tubing which can build up a back-pressure.

CAUTION

DO NOT apply higher back pressure to the flow cell than maximum pressure of the flow cell.

Table 1 **Pressure Rating on Flow Cells**

Type	Pressure
Standard Flow Cell	40 bar
Ultra High-Pressure Cell	400 bar
Preparative Flow Cell	40 bar
Semi-Micro Flow Cell	40 bar

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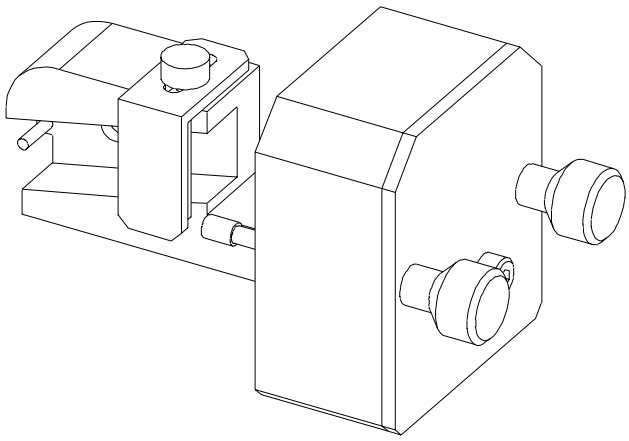
Using the Cuvette Holder

When required:	If your own standard should be used to checkout the instrument.
Tools required:	None
Parts required:	Cuvette Holder 79853-60016 Cuvette with the “standard”, e.g. NIST certified holmium oxide sample

This cuvette holder can be placed instead of a flow cell in the variable wavelength detector. Standard cuvettes with standards in it, for example, National Institute of Standards & Technology (NIST) holmium oxide solution standard, can be fixed in it.

This can be used for wavelength verifications.

Figure 3 **Cuvette Holder**



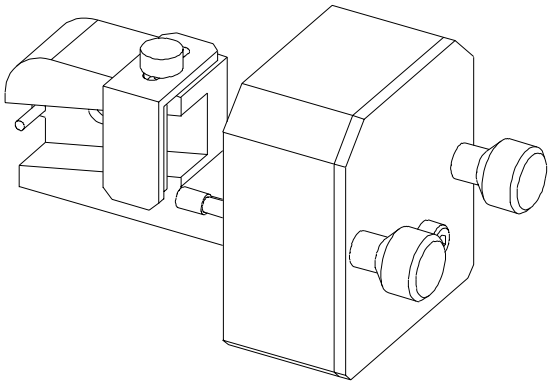
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Using the Cuvette Holder

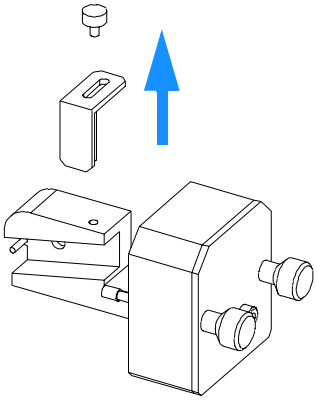
Preparation for this procedure are:

- ❏ Remove the normal flow cell.
- ❏ Install the cuvette holder in the instrument and perform a wavelength calibration.
- ❏ Have cuvette with standard available.

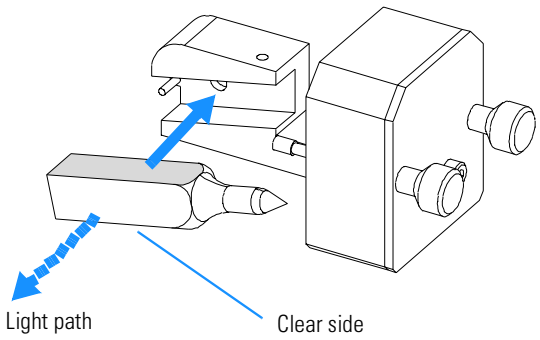
1 Locate the cuvette holder on the desk.



2 Unscrew the bracket.

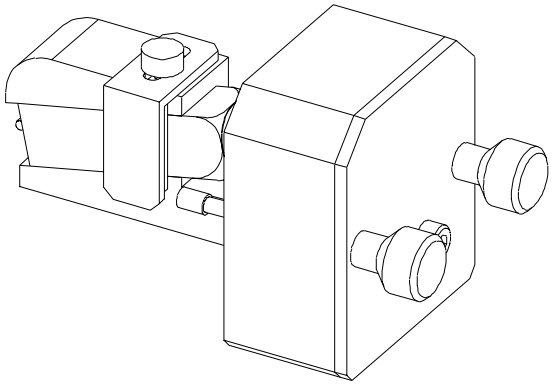


3 Insert the cuvette with the sample into the holder.



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4 Replace the bracket and fix the cuvette.



5 Install the cuvette holder in the instrument.

6 Perform your verification.

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Replacing DCB Board and Firmware

When performing one of these tasks, take care for electrostatic discharge protection to keep the electronics alive.

DCB Board

- ❏ Note the parameters from `31:SET WL PARAM.`
- ❏ Disconnect the power from the instrument.
- ❏ Remove main cover and disconnect all connectors from DCB.
- ❏ Replace DCB after loosening the 3 fixing screws.
- ❏ Fix all screws and reconnect all connectors to the DCB.
- ❏ Carefully remove the firmware ROM from removed DCB and insert it on new DCB.
- ❏ Replace main cover and turn the instrument ON.
- ❏ Turn lamp on and wait some minutes to stabilize the lamp.
- ❏ Perform functions `20:0th CALIB.`, `21:WL CALIBRATION`, `44:DAC CALIB.` and `45:COMPENSATE` to input the detector specific parameters into the EEROM.

DCB Firmware

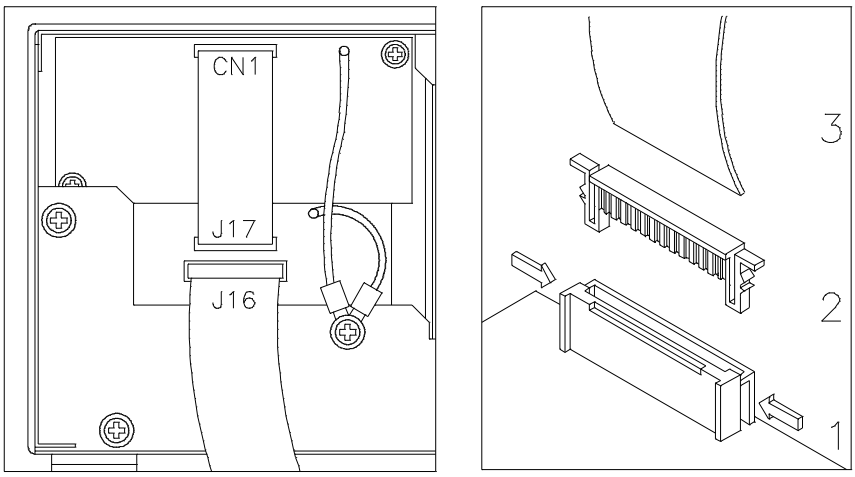
- ❏ Disconnect the power from the instrument.
- ❏ Remove main cover.
- ❏ Carefully replace the firmware ROM.
- ❏ Replace main cover and turn the instrument ON.
- ❏ Turn lamp on and wait some minutes to stabilize the lamp.

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Replacing Display Boards

- ❏ Remove front panel assembly and disconnect cables between front panel and DCB.
- ❏ Unscrew the six screws which hold the plastic part at the metal frame (except the two screws that fix the leak assembly).
- ❏ Disconnect the grounding cable and the cable between the two display boards.
- ❏ Replace the defective board.
- ❏ To loosen the flat cable [3] from the keyboard, press a flat screwdriver onto the two noses on each side of the connector [1] to release the upper part [2] of the connector.

Figure 4 **Release of connector**



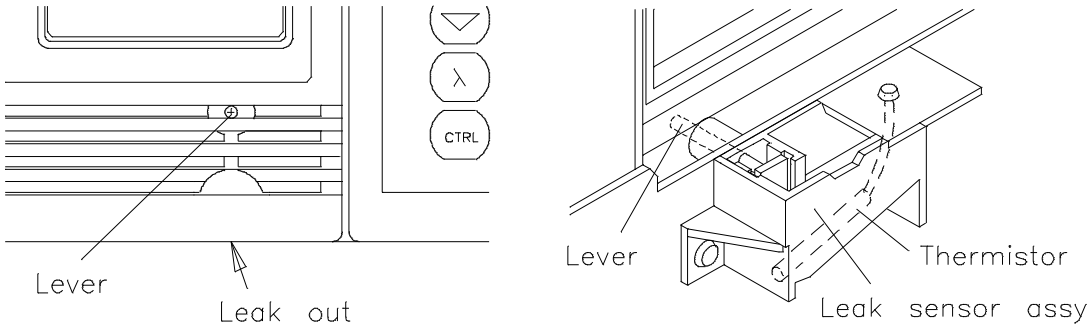
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Replacing the Leak Interface

Leak Sensor Assembly

- ❏ Remove the flow cell.
- ❏ Remove top cover.
- ❏ Disconnect leak cable from DCB and the flat ribbon cable from DCB to keyboard at the KDI board.
- ❏ Unscrew the screws that fix the front panel.
- ❏ Remove front panel.
- ❏ Replace sensor board or complete assembly.

Figure 5 **Leak Sensor Assembly**

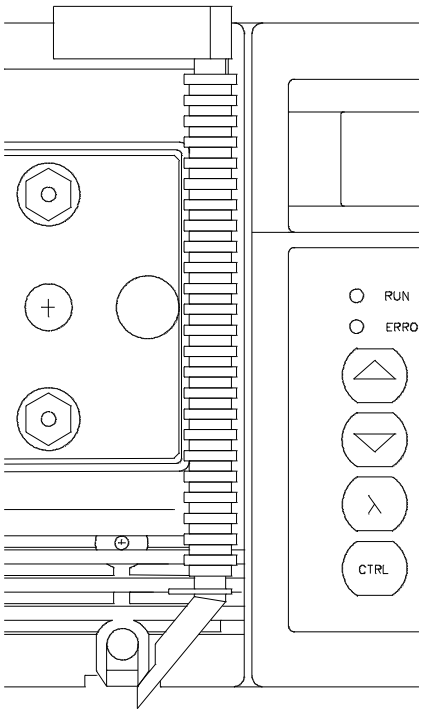


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Leak Interface

- ❏ Carefully remove the leak interface.
- ❏ Replace the defective item. All three parts (top, bottom and tubing are coming together as kit).
- ❏ Install the leak interface.

Figure 6 **Leak Interface**



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Replacements in the Optical Unit

The repair level of optical unit parts is component level.

Refer to section *"Optical Unit "C"" on page 688* for additional parts.

NOTE

The information in this chapter is based on the original optical unit (version "C"). In June 1995 this optical was replaced by the enhanced version "D" to overcome baseline stability problems in unstable environments.

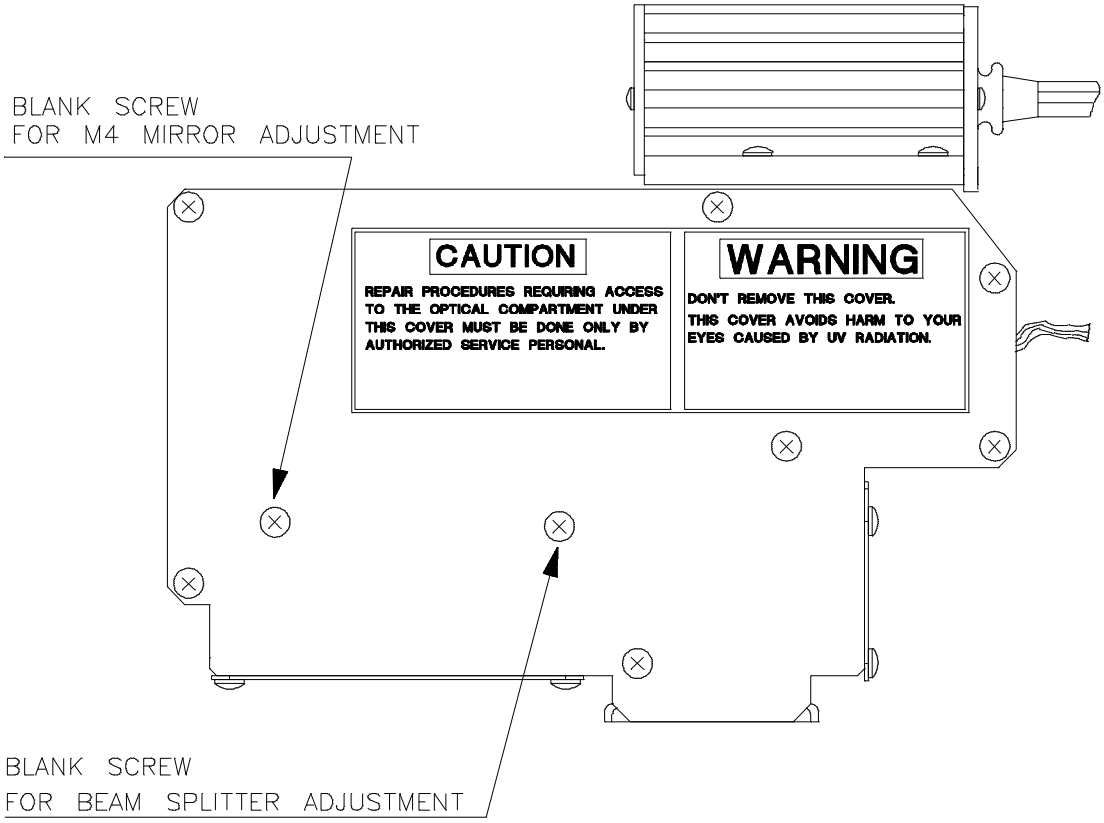
For details on this "D" version refer to section Enhanced Optical Unit Information *"VWD: Enhanced Optical Unit Information" on page 705*.

WARNING

Be sure to wear a pair of safety or sun glasses. Since the deuterium lamp emits intensive ultraviolet light, it is dangerous to perform optical alignment without eye protection. Be careful not to expose your eyes directly to the light coming from the lamp.

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Figure 7 **Optical Unit**



Removing the Optical Unit

- ❏ Disconnect power from instrument.
- ❏ Remove flow cell.
- ❏ Remove top cover.
- ❏ Disconnect all cables that go from the optical to the Detector Controller Board (DCB).
- ❏ Place the instrument on its left or right side.
- ❏ Remove all nuts that fix the optical unit.
- ❏ Take out the optical unit.

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Replacing the PSC Board

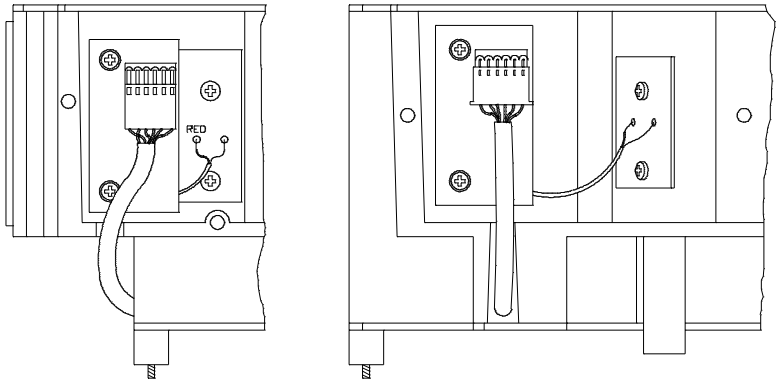
- ❏ Refer to “Removing the Optical Unit” on page 666.
- ❏ Remove the PSC protection cover (2 screws).
- ❏ Loosen the PSC board (3 screws).
- ❏ Remove the lamp supply connector from the fan assembly.
- ❏ Fed the wire carefully between fan cover and power supply cabinet. If not possible, loosen the fan cover.
- ❏ Replace the PSC board and reuse the old cable to the DCB board.
- ❏ When replacing the PSC protection cover, take care for correct routing of the wire at the right side.

Replacing Pre-amplifiers or Photodiodes

- ❏ Remove the top cover and the front panel assembly.
- ❏ Refer to Figure 244 for next steps.
- ❏ Remove the cover that protects the pre-amplifier.
- ❏ To replace the pre-amplifier boards
  - ❏ disconnect cable from pre-amplifier board
  - ❏ unscrew the board
  - ❏ unsolder the wire from the photodiode
  - ❏ replace the board.
- ❏ To replace the photodiode
  - ❏ remove cover plate of photodiode
  - ❏ unsolder photodiode
  - ❏ unscrew photodiode
  - ❏ replace photodiode.

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Figure 8 **Location of Photodiodes**



Replacing Grating Assembly Parts

Photo Sensor

❏ Refer to “Removing the Optical Unit” on page 666.

❏ Remove the bottom plate of the optical unit.

❏ Unscrew the photo sensor and replace it.

Grating

For [ ] items refer to Figure 245 on page 669.

❏ Remove the top cover of the optical unit.

❏ Use a hex key (2.5 mm) to loosen the grating screw [2].

❏ Replace the grating [1].

❏ Refer to “Optical Alignment Procedures” on page 671.

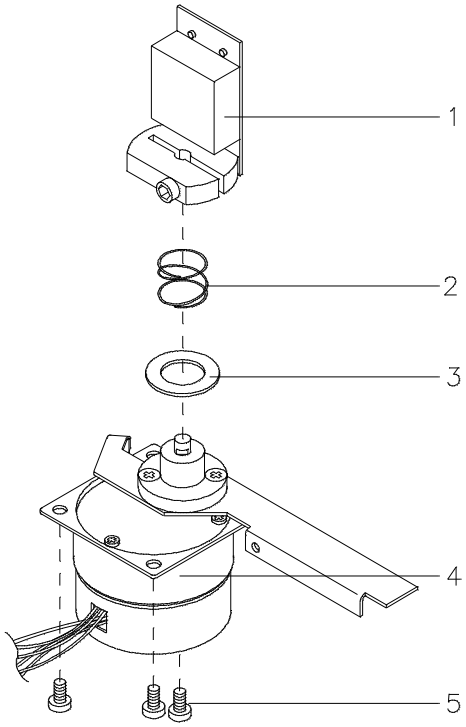
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Grating Motor

For [ ] items refer to Figure 245 on page 669.

- ❏ Refer to “Removing the Optical Unit” on page 666.
- ❏ Refer to “Replacing Grating Assembly Parts” on page 668 and take grating out.
- ❏ Remove the bottom plate of the optical unit.
- ❏ Remove the two springs.
- ❏ Unscrew the three screws [6] that fix the motor assembly [5] and take it out. Keep spring [3] and gasket [4].
- ❏ Replace the spring [3], gasket [4] and complete motor assembly [5].
- ❏ Reinstall the grating [1].
- ❏ Refer to “Optical Alignment Procedures” on page 671.

Figure 9 **Grating Assembly**

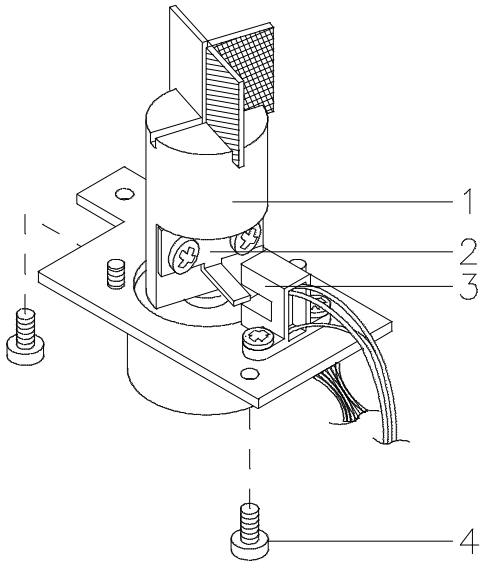


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Replacing Filter Assembly Parts

- ❏ Refer to Refer to “Removing the Optical Unit” on page 666.
- ❏ Remove the bottom plate of the optical unit.
- ❏ Unscrew the 2 screws that fix the filter assembly.
- ❏ Take out the complete assembly.
- ❏ Replace the complete filter assembly, sensor lever or the sensor.

Figure 10 **Filter Assembly**



Replacing Mirrors, Beamsplitter and Slits

- ❏ Open the optical untit's top cover.
- ❏ Replace the item that need to be replaced.
- ❏ Refer to “Optical Alignment Procedures” on page 671.

NOTE DO NOT touch the surface of the mirrors, beam splitter and the grating.

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Optical Alignment Procedures

Procedure 1:	alignment after exchange of a specific part
Procedure 2:	alignment of complete optical (sample path)
Procedure 3:	alignment of complete optical (reference path)

WARNING **Be sure to wear a pair of safety or sun glasses. Since the deuterium lamp emits intensive ultraviolet light, it is dangerous to perform optical alignment without eye protection. Be careful not to expose your eyes directly to the light coming from the lamp.**

Procedure 1: Simple Alignment

When replacing just a single part in the light path other than grating parts, M4 and beam splitter, this procedure can be performed.

- ❏ Execute `40:0th TEST` which shows the step number from `31: SET WL PARM.` and watch the location of the images on the slit assemblies (entrance and reference slit) and the cell center.
- ❏ Exchange the part Refer to *Replacing ...* for more information.
- ❏ Position the part so that the image centers on entrance and reference slit.
- ❏ Fix the part.
- ❏ If image on exit slit is too high or low, follow procedure “Procedure 2: Sample Beam Alignment” on page 672.
- ❏ If image on reference slit is too high or low, follow procedure “Procedure 3: Reference Beam Alignment” on page 674.
- ❏ Excute the `20:0th CALIB.` and `21:WL CALIBRATION`.
- ❏ Refer to “Replacement of Deuterium Lamp” on page 652, Step 2 and 3.

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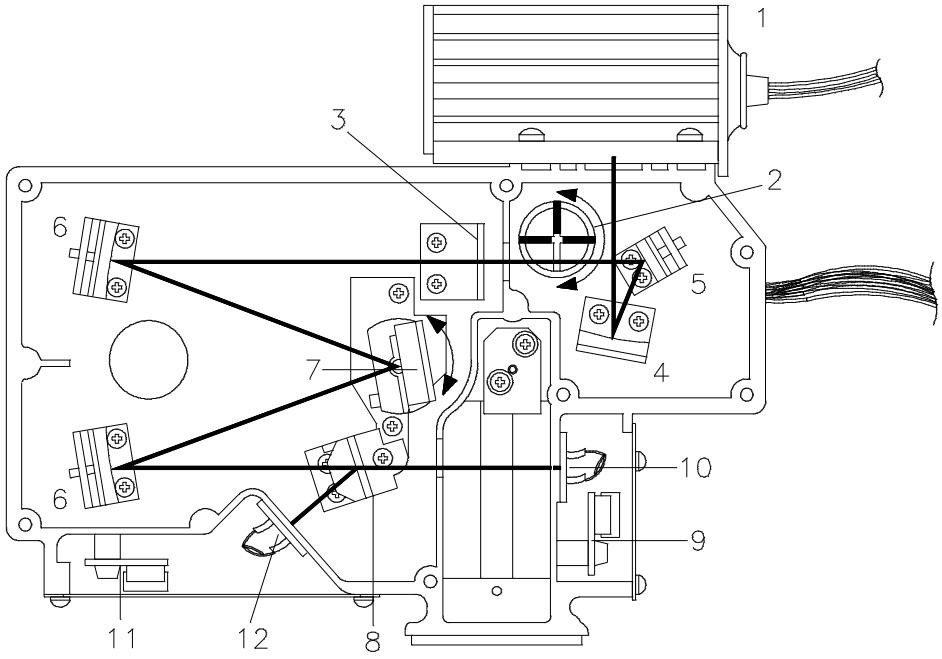
Procedure 2: Sample Beam Alignment

For [ ] items refer to Figure 247.

M1, M2, Entrance Slit, M3

- ❏ Remove the entrance slit [3].
- ❏ Turn the deuterium lamp [1] on.
- ❏ Make sure the light spot covers over mirror M1 [4].
- ❏ Adjust the direction of mirror M1 [4] so that the light beam covers over mirror M2 [5].
- ❏ Adjust the angle and direction of mirror M2 [5] so that the light beam covers over mirror M3 [6].
- ❏ Install the entrance slit [3] where the light beam illuminates the center of the slit.
- ❏ Adjust the angle and direction of the mirror M3 [6] so that the light beam covers over the grating mirror [7].

Figure 11 **Optical Unit Parts**



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Grating, M4, Beam Splitter

- ❏ Excute control function `40:0TH TEST OFF` to set the grating motor position to 200 steps (center step number).
- ❏ Adjust the direction of the grating mirror [7] so that the light beam covers over the mirror M4 [6].
- ❏ Remove the beam splitter [8] now so that you can see the center of the flow cell.
- ❏ Adjust the angle and direction of the mirror M4 [6] so that the light beam illuminates the center of the flow cell.
- ❏ Leave control function `40:0TH TEST OFF` and return to normal display.
- ❏ Excute the `20:0th CALIB.` and `21:WL CALIBRATION`. Refer to “Replacement of Deuterium Lamp” on page 652, Step 2 and 3.
- ❏ If grating has been moved, use `45:COMPENSATE` to compensate non-linearity of the grating motor.
- ❏ Set wavelength to 254nm.
- ❏ Place cover on optical unit (do not fix the screws at this time).

M4 fine tuning

- ❏ Excute control function `16:PHOTOCURRENT`.
- ❏ Remove the blank screw for mirror M4 adjustment (Figure 243 on page 666) on the top cover (leave the blank screw for beam splitter adjustment in).
- ❏ Adjust the angle of the mirror M4 with inserting a hexagon wrench (1.5 mm) through the top cover screw hole to get maximum photocurrent for the sample. Turn right to move image down and left for up.
- ❏ Replace the blank screw in the top cover.
- ❏ Excute the `20:0th CALIB.` and `21:WL CALIBRATION`. Refer to “Replacement of Deuterium Lamp” on page 652, Step 2 and 3.
- ❏ Install the beam splitter [8].

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Procedure 3: Reference Beam Alignment

For [ ] items refer to Figure 247 on page 672.

- ❏ Excute `40:0TH TEST ON` with calibrated step value displayed.
- ❏ Open the top cover and adjust the angle and direction of the beam splitter [8], so that the light beam illuminates the center of the reference slit [12].
- ❏ Place the cover on the optical unit.
- ❏ Leave `40:0TH TEST ON` and set wavelength to 254 nm.-
- ❏ Remove the blank screw for beam splitter adjustment (Figure 243 on page 666) in the top cover.
- ❏ Excute `16:PHOTOCURRENT`.
- ❏ Adjust the angle of the beam splitter inserting a hexagon wrench through the top cover screw hole to get maximum photocurrent for the reference. Turn right to move image down and left for up.
- ❏ Replace the blank screw in the top cover.
- ❏ Repeat the `20:0TH CALIB.` and `21:WL CALIBRATION`. Refer to “Replacement of Deuterium Lamp” on page 652, Step 2 and 3.
- ❏ Use `45:COMPENSATE` to compensate non-linearity of the grating motor.

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Cleaning of Optical Unit Parts

There are only a few parts within the optical unit that can be cleaned.

Table 2 **Cleanable Optical Parts**

NOT CLEANABLE	grating and all mirrors
	Touching or cleaning will result in decrease of reflaction/intensity
CLEANABLE	filters (holmium, cutoff and 0 order calibration), beam splitter, photo diodes
	You can wipe the surface with ethanol. In case you cannot remove stains, the part has to be replaced.

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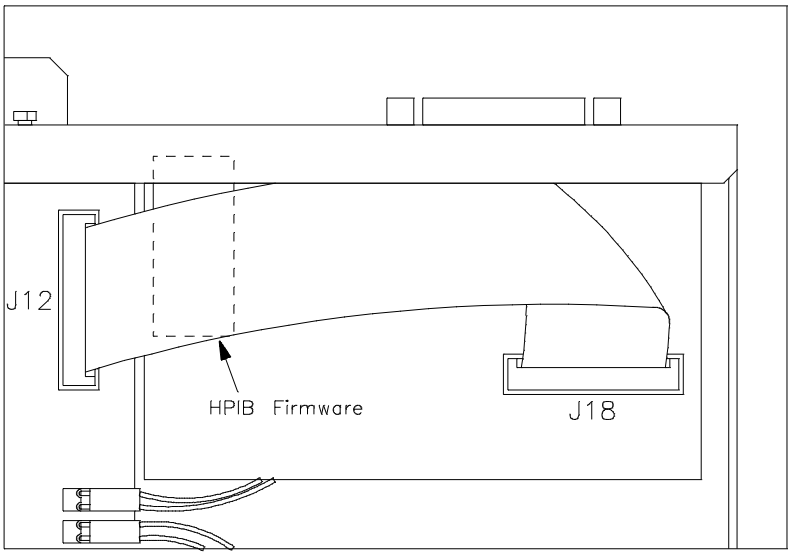
Upgrade to GPIB

- ❏ Note the values for WL, 0 and 656 nm using `31:SET WL PARAM.`, just in case the EEROM looses the values.
- ❏ Turn off the instrument.
- ❏ Remove top cover of the instrument.
- ❏ Remove plate at the rear panel above the fan.
- ❏ Install the GPIB board in that location using the screws that hold the plate.
- ❏ Connect the GPIB cable to J12 of the DCB board.

GPIB Address Setting

The GPIB address setting is done with a switch (1) at the rear of the GPIB board. The factory setting is '10' (position A).

Figure 12 **Location of GPIB board**



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Performance Verification

Table 3 **Noise and Drift Specifications**

Noise	1.5×10^{-5} AU
Drift	5.0×10^{-4} AU/h

What you need

- ❏ a pump that can deliver bidistilled water, at a rate of up to 1 ml/min against a back-pressure of about 200 bar.
- ❏ a column: we recommend our 100 x 4.6 mm i.d., 5 µm Hypersil ODS column.
- ❏ a recording device that can accept the output signal from your detector and that has attenuation set to about 35 cm/mV.

Preparations

- ❏ Prime the pump and ensure there are no air bubbles in the system.
- ❏ Thoroughly degas about 300 ml of bidistilled water.
- ❏ Set pump to deliver bidstilled water at a flow rate of 1 ml/min.
- ❏ Set the attenuation to about 35 cm/mV.
- ❏ Set run time on recorder to 6.0 min.
- ❏ Turn-ON line power and deuterium lamp.
- ❏ Set wavelength to 254 nm, response time to 1 second and output voltage to 1 V.

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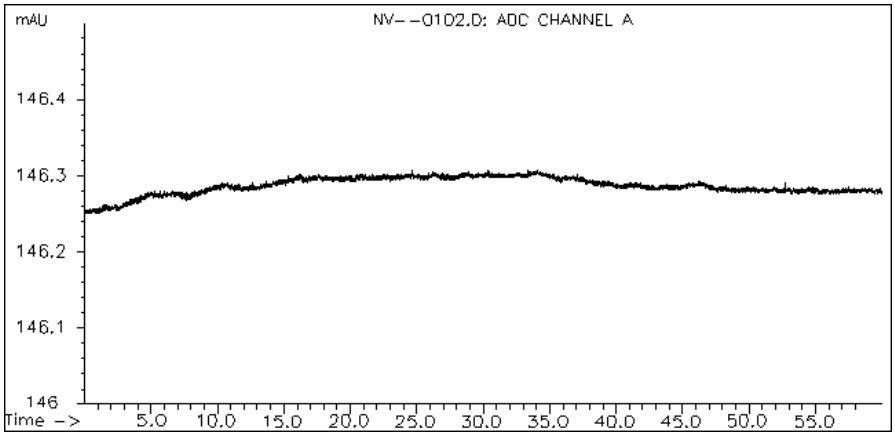
Starting a run

❏ Give the optical unit time to warm-up and stabilize.

❏ Start a run.

The baseline noise should not exceed 7.5 µV (1.5 x 10^{-5} AU) equivalent to 4.5 mm at attenuation - 3 on a 3390/2/3 integrator and equivalent to 9 mm at attenuation - 3 on a 3394/6 integrator.

Figure 13 **Example of Noise Plot**



This plot was taken with

- a 79853C VWD
- an 35900C A/D converter
- a LC DOS workstation
- flow cell windows removed, but gasket #2 installed.

It shows, that the drift on this example is < 1 x 10^{-4} AU/hr and the noise at about < 1 x 10^{-5} AU.

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Scaling Factors

The table below shows the scaling factors for the 339XA family of integrators. The 3390A, 3392A and 3393A have a full scale deflection of 75 mm. The 3394A and the 3396A have a full scale deflection of 150 mm, they also have an attenuation range between -8 and 36.

Table 4 **Scaling Factors on 339X integrators**

ATTN	mV full scale	mAU full scale
-3	0.125	0.25
-2	0.25	0.5
-1	0.5	1
0	1	2
1	2	4
2	4	8
3	8	16
4	16	32
5	32	64
6	64	128
7	128	256
8	256	512
9	512	1024
10	1024	2048

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1

VWD: Parts Information

This chapter provides information on parts of the 1050 Variable Wavelength Detectors

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VWD: Parts Information

This chapter gives diagrams for parts identification and the complete parts listings respectively.

- Overall Diagram
- Optical Unit
- Flowcell
- Flow Cell Kits
- Accessory Kit

NOTE

The information in this chapter is based on the original optical unit (version “C”). In June 1995 this optical was replaced by the enhanced version “D” to overcome baseline stability problems in unstable environments.

For details on this “D” version refer to section Enhanced Optical Unit Information *“VWD: Enhanced Optical Unit Information” on page 705*.

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Overall Diagram

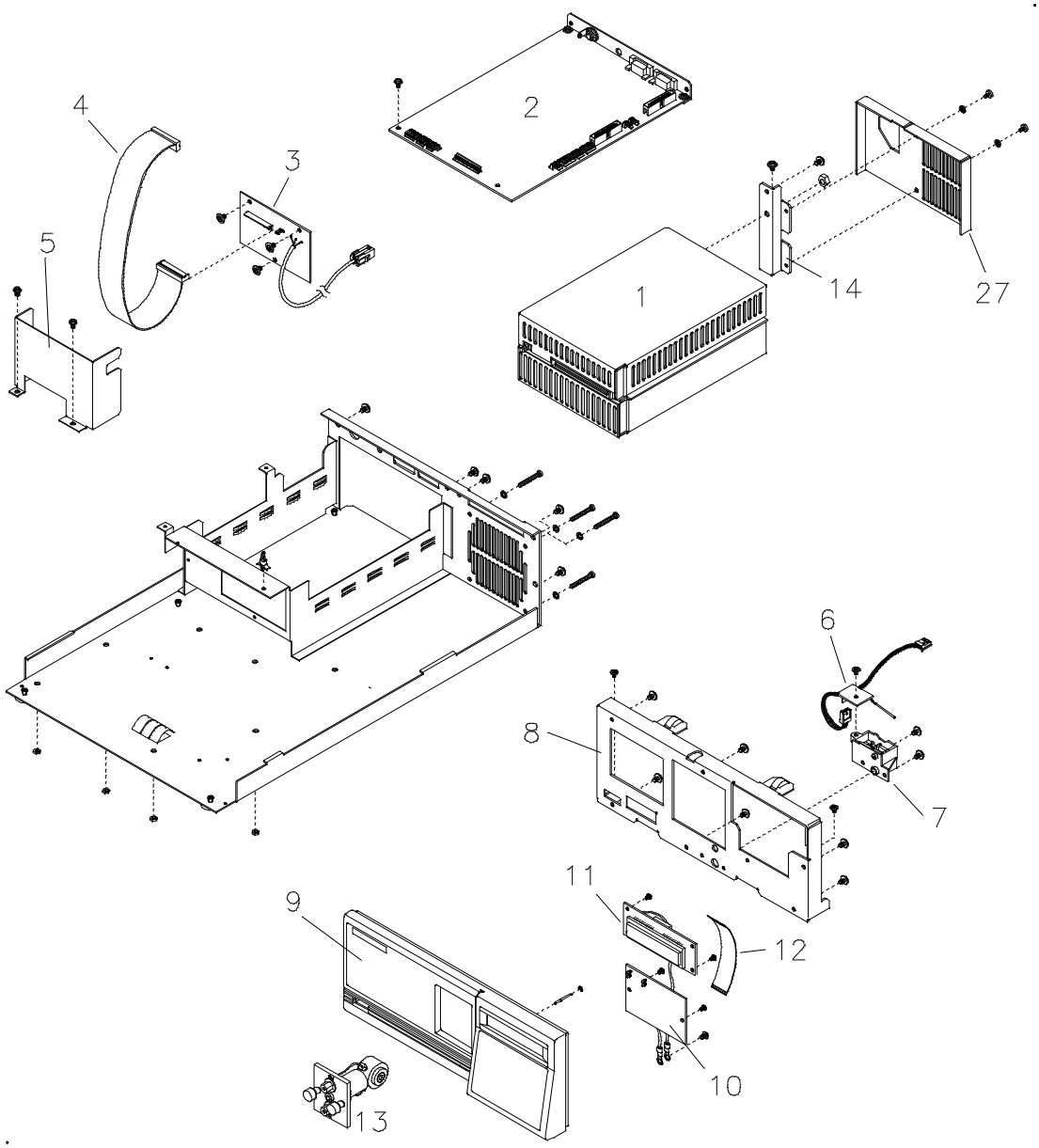
Table 1 Overall Diagram

Item	Description	Part Nmber	Item	Description	Part Nmber
1	Power Supply (5061-3375)	01050-69375	15	Cover Assembly	79853-64101
2	DCB Board Assembly, see *	79853-69511	16	GPIB Board Assembly	79853-68711
2	ROM DCB Firmware **"C" only**	79853-13005	16	ROM GPIB Firmware	79853-13004
2	ROM DCB Firmware **"D" only**	79853-13000		Cable DCB-GPIB	79853-61610
3	PSC Board for DCB 79853-66511	79853-66512	17	Fan Assembly (LOW)	79853-68503
4	Cable PSC-DCB	79853-61605	18	Cover Fan	79853-04102
5	Cover PSC	N.A.	19	Sheet Fan	N.A.
6	Leak Sensor Board	see page 687	20	Fan Assembly (HIGH)	79853-68502
7	Leak Sensor Assembly	see page 687	21	Switch Bearing	79853-61903
8	Sheet Front Panel	see page 687	22	Switch Bracket	N.A.
9	Front Panel Assembly	see page 687	23	Switch Shaft	79853-61901
10	Display Interface (KDI)	79853-66502	24	Switch Top	79853-61902
11	Display Module (VFD)	79853-66503	25	Cable DCB-KDI	79853-61609
12	Cable KDI-VFD	79853-61602	26	Optical Unit	see page 688
13	STD Flow Cell Assembly	see page 693			
13	Semi-micro Flow Cell Assembly	see page 695		Transport Screw Kit, contains 3 screws with washer and spacer	79853-68700
13	Ultra High Pressure Flow Cell Assembly	see page 697		PEEK Inlet Tubing Kit	5062-8522
13	Prep Flow Cell Assembly TI	see page 698		PEEK Waste Tubing Kit	5062-8535
14	Bracket DPS	N.A.			

* If installed in instruments with PSC -66509, then PSC must be updated to 79853-66512.

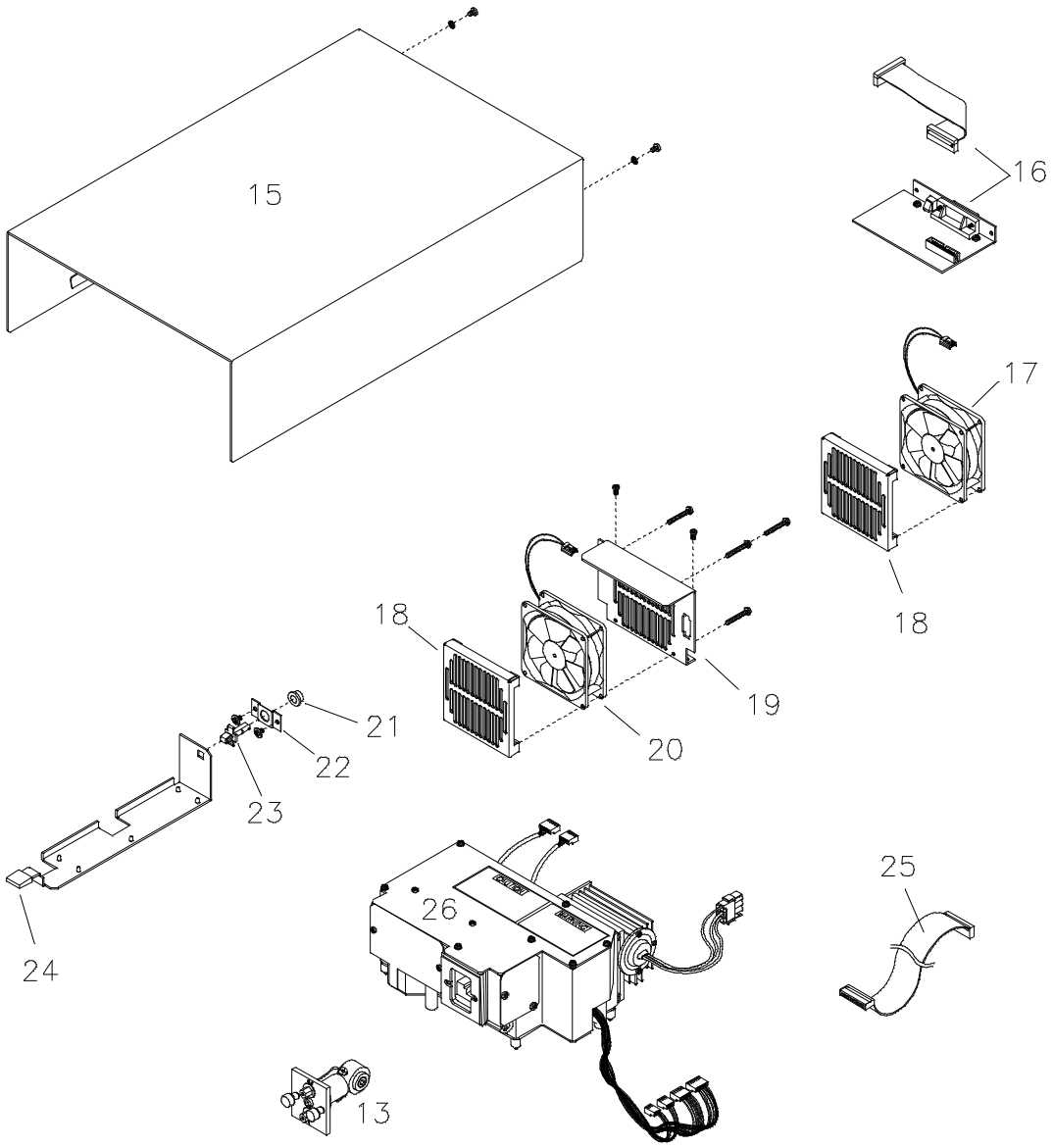
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Figure 1 **Overall Diagram Part 1**



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Figure 2 **Overall Diagram Part 2**



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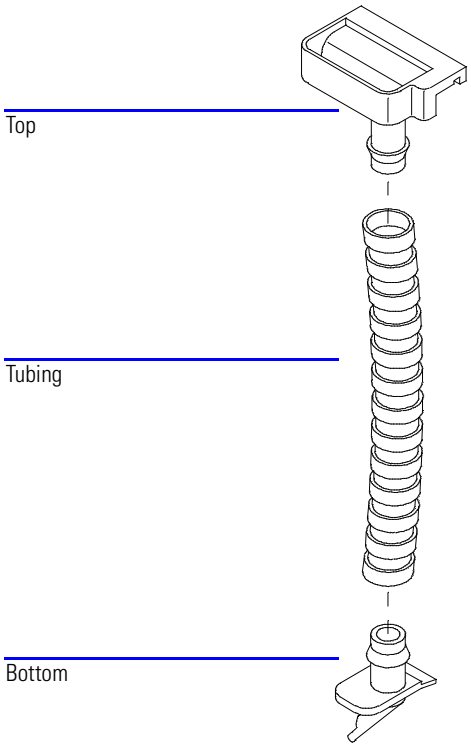
Front Panel Parts

Leak Interface

Table 2 **Leak Interface**

Description	Part number
Leak Interface Kit, contains	79853-68731
Top, Bottom and Tubing	

Figure 3 **Leak Interface**



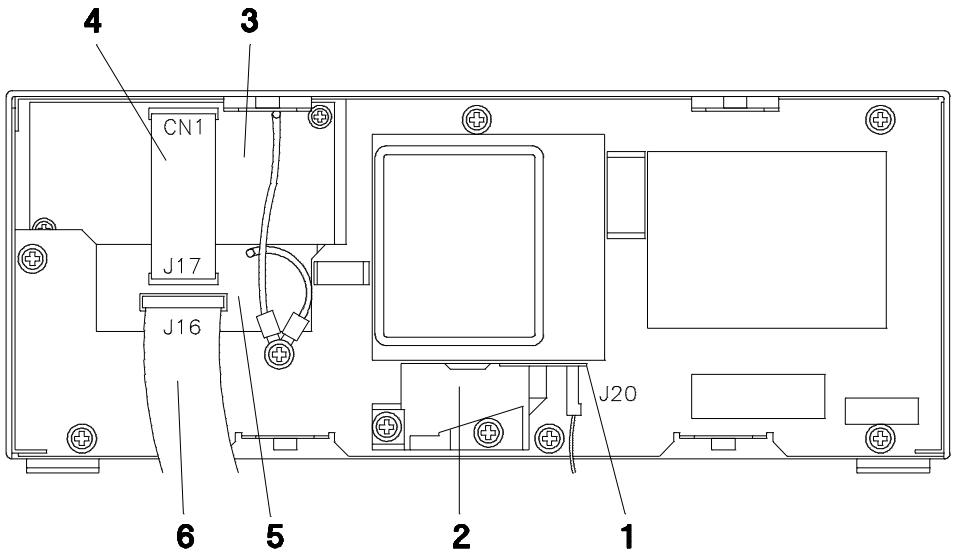
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Font Panel

Table 3 **Front Panel**

#	Description	Part number
	Front Panel Complete	79853-60203
	Front Panel	79853-60202
1	Leak Sensor Board	79853-66510
2	Leak Sensor Assembly	79853-66111
3	Display Module Board (VFD)	79853-66503
4	Cable KDI-VFD	79853-61602
5	Display Interface (KDI)	79853-66502
6	Cable DCB-KDI	79853-61609
	O-ring, Leak Assembly	79853-82501

Figure 4 **Front Panel**



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Optical Unit “C”

The parts identification of the optical unit is splitted into four sections:

- Optical Unit Inner Parts (Top)
- Optical Unit Inner Parts (Bottom)
- Grating Assembly
- Filter Assembly
- Flow Cell Assemblies

NOTE

The information in this chapter is based on the original optical unit (version “C”). In June 1995 this optical was replaced by the enhanced version “D” to overcome baseline stability problems in unstable environments.

For details on this “D” version refer to section Enhanced Optical Unit Information *“VWD: Enhanced Optical Unit Information” on page 705*.

For complete optical unit “C” replacements use part number 79853-60015. This upgrades to “D” version, see *“Part Numbers for Enhanced “D” Optical Unit” on page 709*

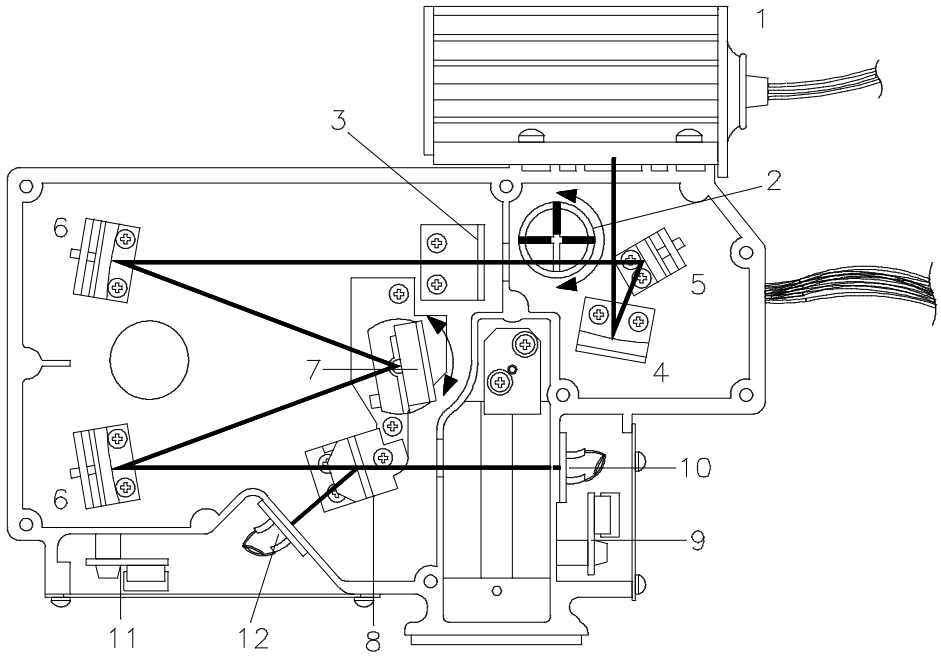
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Optical Unit “C” Inner Parts Top

Table 4 **Optical Unit “C” Inner Parts TOP**

Item	Description	Part Nmber	Item	Description	Part Nmber
	Optical Unit (complete assembly)	79853-69015	7	Grating Assembly	see page 691
	Plate Optical Top	79853-04108	8	Beam Splitter	79853-20402
1	Deuterium Lamp Assembly	79883-60002	9	Pre-Amplifier Board, SAMPLE	79853-66507
	Lamp housing	79853-22006	10	Sensor, Sample	79853-61109
2	Filter Assembly	see page 692	11	Pre-Amplifier Board, REF	79853-66508
3	Entrance Slit Assembly	79853-23103	12	Sensor, Reference	79853-61110
4	Mirror #1	79853-68107		Reference Slit	79853-23104
5	Mirror #2	79853-68108		Spacer Reference Sensor	79853-24702
6	Mirror #3 or #4	79853-68109		PTFE Ring 53C	79853-24500

Figure 5 **Optical Unit “C” Inner Parts TOP**



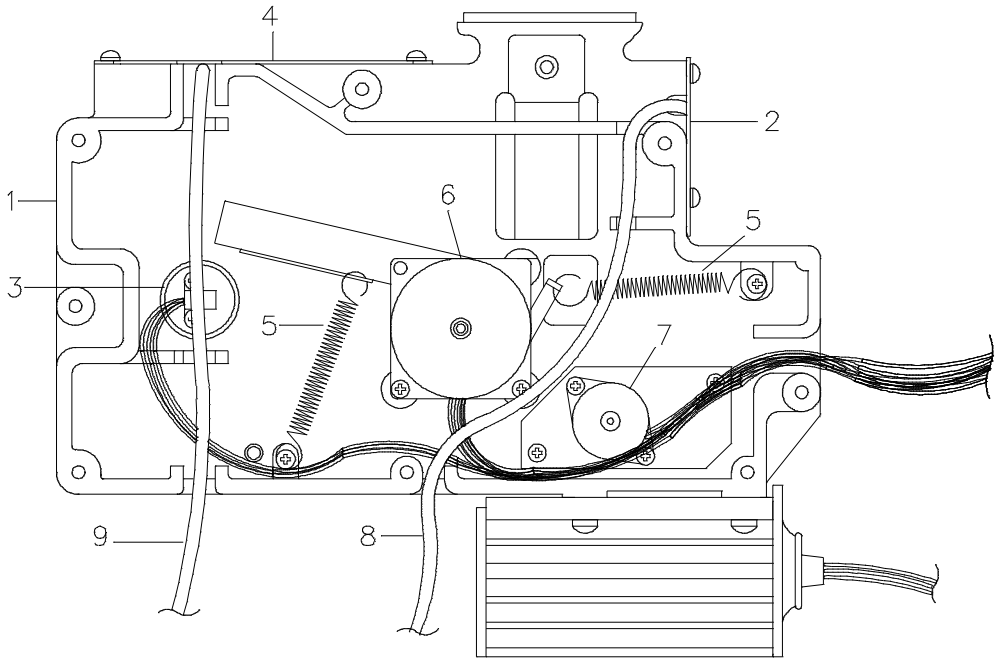
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Optical Unit “C” Inner Parts Bottom

Table 5 **Optical Unit “C” Inner Parts Bottom**

Item	Description	Part Nmber	Item	Description	Part Nmber
	Optical Unit (comple assembly)	79853-60015	7	Filter Assembly	see page 692
	Plate Optical Base	79853-04109	7	Position Sensor Assembly, Filter	79853-61107
1	Optical Body	N/A	8	Cable Assembly, Sample	79853-61607
2	Plate Sample Sensor	79853-04110	9	Cable Assembly, Reference	79853-61608
3	Position Sensor Assembly, Grating	79853-61106		Spacer, Optical (metal foot)	79853-24701
4	Plate Reference Sensor	79853-04111		Insulator, Optical (rubber foot)	79853-85401
5	Spring #1, Grating	79853-29102		Foot Kit Optical	79853-22005
6	Grating Assembly	see page 691			

Figure 6 **Optical Unit “C” Inner Parts Bottom**



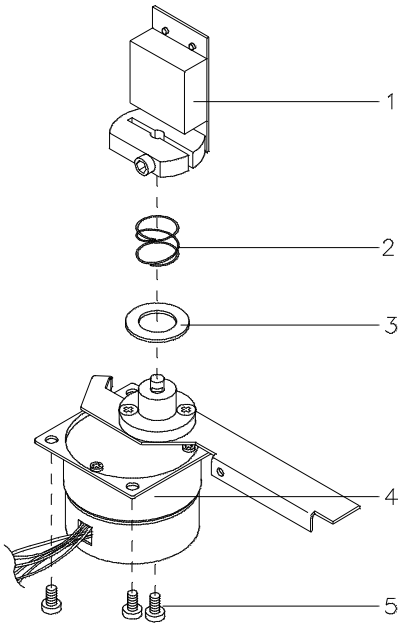
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Grating Assembly

Table 6 **Grating Assembly**

#	Description	Part number
1	Grating	79853-64605
	Hex Screw M3 14 mm lg	
2	Spring #2, Grating	79853-29103
3	Gasket	
4	Grating Motor Assembly	79853-64606
5	Screws M3 6 mm long	
	Photo Sensor	79853-61106

Figure 7 **Grating Assembly**



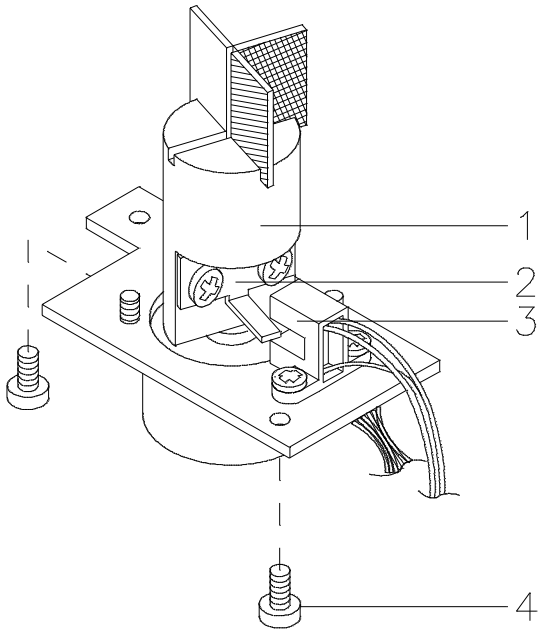
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Filter Assembly

Table 7 **Filter Assembly**

#	Description	Part number
1	Filter Assembly	79853-67903
2	Lever Position Sensor	
3	Position Sensor Filter	79853-61107
4	Screws M3 6 mm long	

Figure 8 **Filter Assembly**



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Standard Flow Cell “C” (SST/Ti)

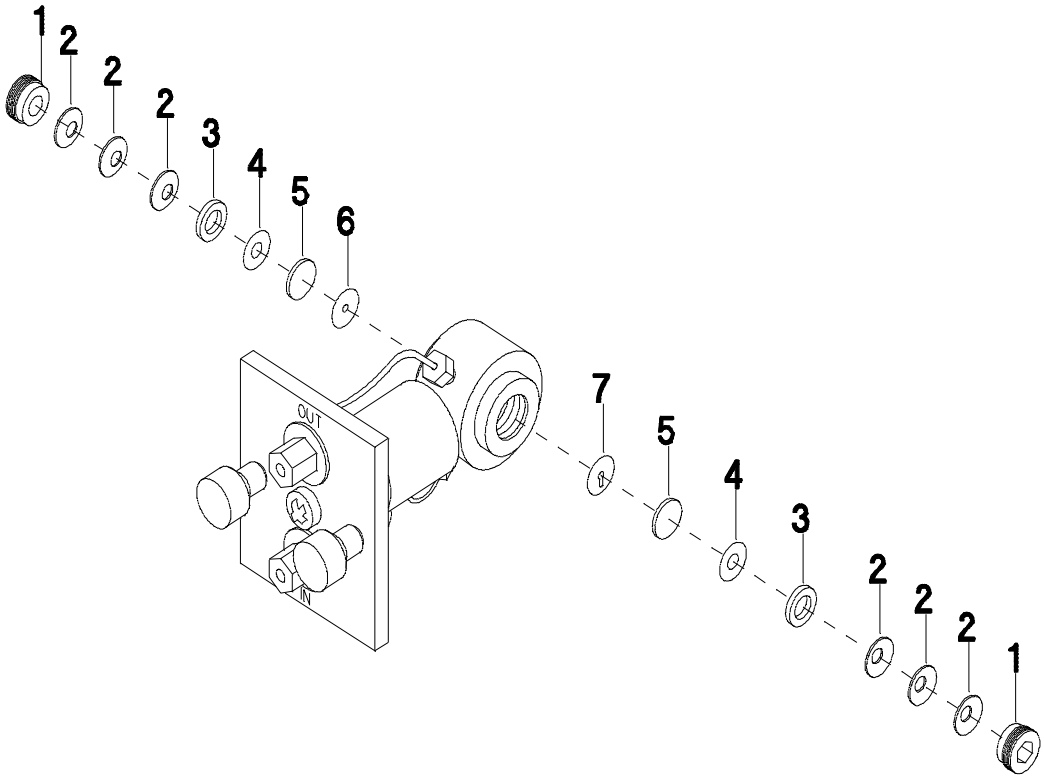
Table 8 **Standard Flow Cell “C” (SST/Ti)**

Item	Description	Part Nmber	Qty
1	Cell Screw	79853-27201	
2	Conical Spring 10/pk	79853-27203	10
3	Ring 2/pk	79853-27202	2
4	Gasket #1 PTFE		
5	Window Quartz		
6	Gasket #2 PTFE		
7	Gasket #3 PTFE		
	STD Flow Cell 8 mm SST	see Note below	
	STD Flow Cell 8 mm Ti	79853-60011	
	PEEK Inlet Tubing Kit	5062-8522	
	Cell Kit STD, includes items 4 (2x), 5 (2x), 6 (1x) and 7 (1x)	79853-68718	
5	Window Quartz Kit	79853-68719	2
4	Gasket #1 PTFE Kit STD 10/pk	79853-68720	10
6	Gasket #2 PTFE Kit STD 5/pk	79853-68721	5
7	Gasket #3 PTFE Kit STD 5/pk	79853-68722	5

NOTE The original STD flow cell 79853-60008 was replaced in June 1995 by the “D” version 79853-60000. For parts ID refer to *“Standard Flow Cell “D” Repair Parts” on page 710*.

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Figure 9 **Standard Flow Cell “C” (SST/Ti)**



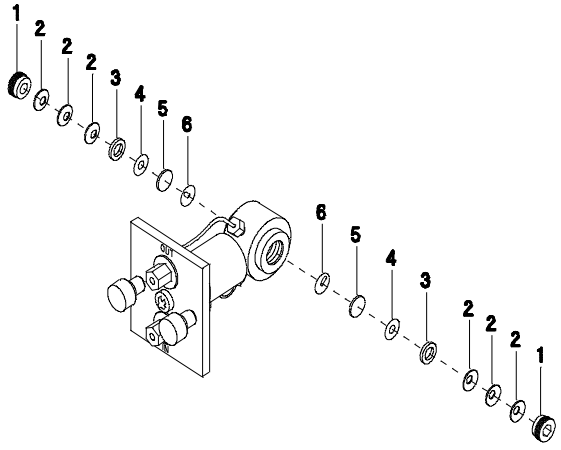
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Semi-Micro Flow Cell (SST)

Table 9 **Semi-Micro Flow Cell (SST/Ti)**

Item	Description	Part Nmber	Qty
1	Cell Screw (same as STD)	79853-27201	
2	Conical Spring (same as STD)	79853-27203	10/pk
3	Ring (same as STD)	79853-27202	2/pk
4	Gasket #1 PTFE (same as STD) 10/pk	79853-68720	10/pk
5	Window Quartz (same as STD)	79853-68719	2/pk
6	Gasket #2 PTFE Micro	79853-68724	10/pk
	Semi-Micro Flow Cell (complete)	79853-60010	
	PEEK Capillary 400 mm lg ID 0.12 mm	5021-1823	
	Fitting for PEEK capillary	0100-1516	2/pk
	Cell Kit Micro, includes items 4 (2x), 5 (2x) and 6 (2x)	79853-68723	

Figure 10 **Semi-Micro Flow Cell (SST)**



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High Pressure Flow Cell (SST)

Table 10 **High Pressure Flow Cell (SST)**

Item	Description	Part Nmber	Qty
1	Cell Screw (same as STD)	79853-27201	
2	Ring POLYIMIDE		
3	Window Quartz	79853-68740	2/pk
4	Gasket #1 POLYIMIDE	79853-68729	10/pk
5	Gasket #2 POLYIMIDE	79853-68730	5/pk
	High Pressure Flow Cell SST	replaced by UHP Cell, see *"Ultra High Pressure Flow Cell (SST)" on page 697*	
	PEEK Tubing Assembly	5062-8522	
	Cell Kit HP, includes items 2 (2x), 3 (2x), 4 (2x) and 5 (1x)	79853-68728	

NOTE

The gaskets, windows and rings are not compatible with the Ultra High Pressure Cell (79853-600013) that replaced the high pressure flow cell (79853-60009). For parts identification refer to *"Ultra High Pressure Flow Cell (SST)" on page 697*.

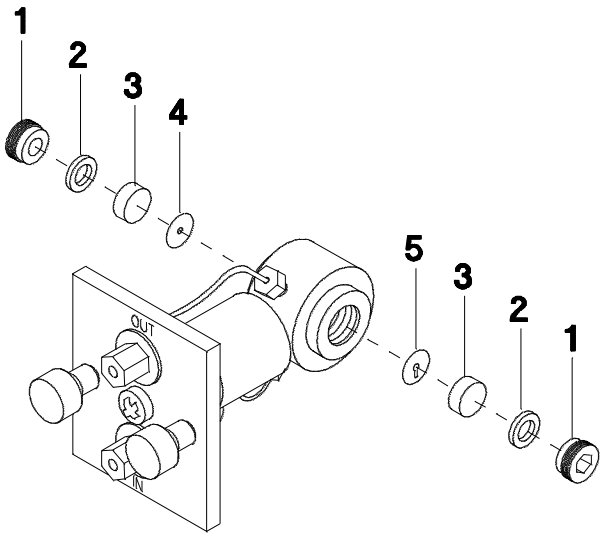
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Ultra High Pressure Flow Cell (SST)

Table 11 **Ultra High Pressure Flow Cell (SST)**

Item	Description	Part Nmber	Qty
1	Cell Screw	79853-27200	
2	Ring PEEK UHP		
3	Window Quartz Kit, UHP	79853-68734	2/pk
4	Gasket #1 POLYIMIDE Kit UHP	79853-68737	2/pk
5	Gasket #2 POLYIMIDE Kit UHP	79853-68738	2/pk
	Ultra High Pressure Flow Cell SST	79853-60013	
	PEEK Tubing Assembly	5062-8522	
	Cell Kit UHP, includes items 2 (1x), 3 (2x), 4 (2x) and 5 (2x)	79853-68733	

Figure 11 **Ultra High Pressure Flow Cell (SST)**



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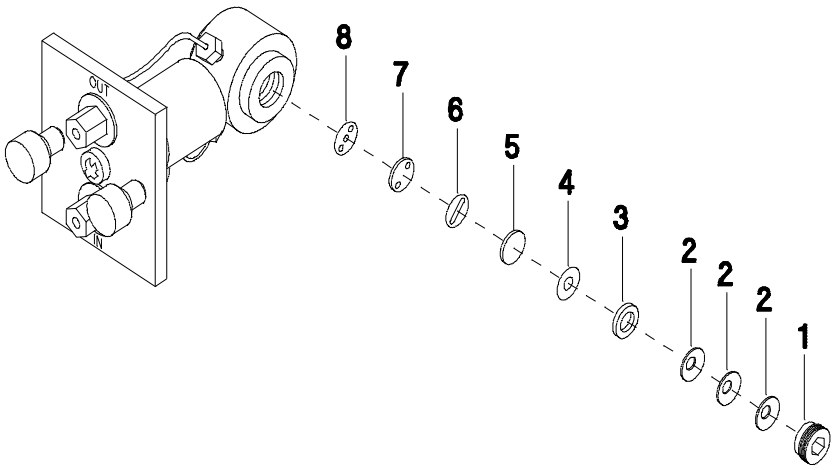
Preparative Flow Cell (Ti)

Table 12 **Preparative Flow Cell (Titanium)**

Item	Description	Part Nmber	Qty
1	Cell Screw (same as STD)	79853-27201	
2	Conical Spring (same as STD)	79853-27203	10/pk
3	Ring (same as STD)	79853-27202	2/pk
4	Gasket #1 PTFE (same as STD)	79853-68720	10/pk
5	Window #1 Quartz (same as STD)	79853-68719	2/pk
6	Gasket #2 PTFE (0.1) for 0.9 µl		
6	Gasket #2 PTFE (0.2) for 1.8 µl		
6	Gasket #2 PTFE (0.5) for 4.4 µl		
6	Gasket #2 PTFE (1.0) for 8.8 µl		
7	Window #2 Quartz		
8	Gasket #3 PTFE		
	Preparative Flow Cell (complete)	79853-60012	
	PEEK Tubing Assembly	5062-8522	
	Cell Kit PREP, includes items 4 (1x), 5 (1x), 6 (1 of each size), 7 (1x) and 8 (1x)	79853-68725	
	Window Quartz Kit PREP includes items 5 (1x), 7 (1x)	79853-68726	
	Gasket Kit PREP includes one of each size of gasket #2	79853-68727	

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Figure 12 **Preparative Flow Cell (Ti)**



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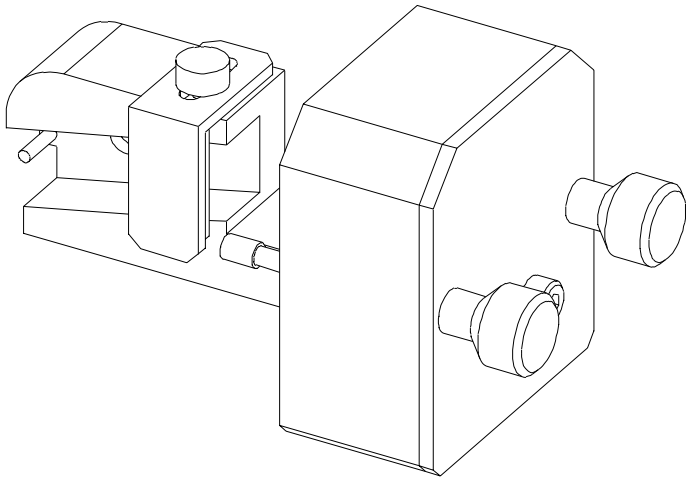
Cuvette Holder

Table 13 **Control Module Parts**

Item	Description	Part Number
	Cuvette Holder	79853-60016

For informationon the use of the cuvette holder, refer to *"Using the Cuvette Holder" on page 658*.

Figure 13 **Cuvette Holder**



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Accessories

These parts are shipped with the 79853C VWD

Table 14 **Accessories**

Description	Part number	QTY
Manual Getting Ready	01050-90211	1
Cable Remote	5061-3378	1
PEEK Waste Accessory Kit	5062-8535	1
Standard Accessory Kit	79853-68701	1
includes		
Fitting	0100-1516	1
Fuse 250 V 2A	2110-0002	3
Fuse 250 V 3A	2110-0003	3
Wrench 1/4-5/16 inch	8710-0510	1
Screwdriver POZI 1 PT 3	8710-0899	1
Leak Interface Kit	79853-68731	1
Manual SOP	79853-90009	1

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Screws

Below table lists all screws within the instrument. They can be bought locally, if needed.

Table 15 **Screws**

Location	Size	Length	Type
filter motor	M 2.3	4 mm lg	hexagon socket set screw with cup point
grating motor	M 3	3 mm lg	hexagon socket set screw with cup point
mirror adjustment	M 3	8 mm lg	hexagon socket set screw with dog point
grating adjustment	M 3	14 mm lg	hexagon socket cap screw
grating motor	M 3	4 mm lg	countersink screw
to fix assemblies on the optical body; cover on the DCB board; plate of lamp house; KDI and VFD board; mirrors, filter and grating;	M 3	6 mm lg	screw
position sensor	M 3	6 mm lg	screw with smaller head
REF sensor plate	M 3	10 mm lg	screw
SAMP and REF amplifier boards	M 3	18 mm lg	screw
cover assembly; optical unit top cover; DCB and GPIB boards from rear panel;	M 4	6 mm lg	screw with lock washer
to fix assemblies on the base; DCB abd GPIB board; leak detector assembly; front panel bracket; SAMP and REF covers; optical unit bottom cover; blank screws of optical unit top cover; plate for cell on the optical body;	M 4	5 mm lg	screw
blank plate of cell; lock screws	M 4	12 mm lg	screw

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Table 15 **Screws**

Location	Size	Length	Type
lamp house	M 4	14 mm lg	screw
fan assemblies	M 4	35 mm lg	screw
cell	M 5	10 mm lg	screw

All screws are plus-shaped type.

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Screws

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VWD: Enhanced Optical Unit Information

This chapter provides information about the enhanced optical unit “D”

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VWD: Enhanced Optical Unit Information

Since June 1995, the design of the optical unit for the 79853C Variable Wavelength Detector (VWD) was changed to improve its performance under unstable temperature conditions.

Together with the enhanced optical unit (“D”), the standard flow cell was changed (79853-60000).

NOTE

In this document the term “D” is used for the new enhanced optical design and “C” for the original optical design.

Compatibility

This new enhanced optical unit (“D”) is fully backward compatible with all 79853C VWDs shipped since January 1992.

The new standard flow cell (79853-60000) is backward compatible with the “C” optical unit.

Some of the parts for the enhanced optical unit (“D”) are not usable in the “C” version.

In case of replacing a “C” optical unit with an enhanced “D” optical unit, the new standard flow cell is required.

Support of Previous Optical Units

The parts for the “C” optical unit will continue to be available as a repair part as long as the 79853C is supported (08/2006). In case the complete “C” optical must be replaced, use the “D” upgrade mentioned on *“Part Numbers for Enhanced “D” Optical Unit” on page 709.*

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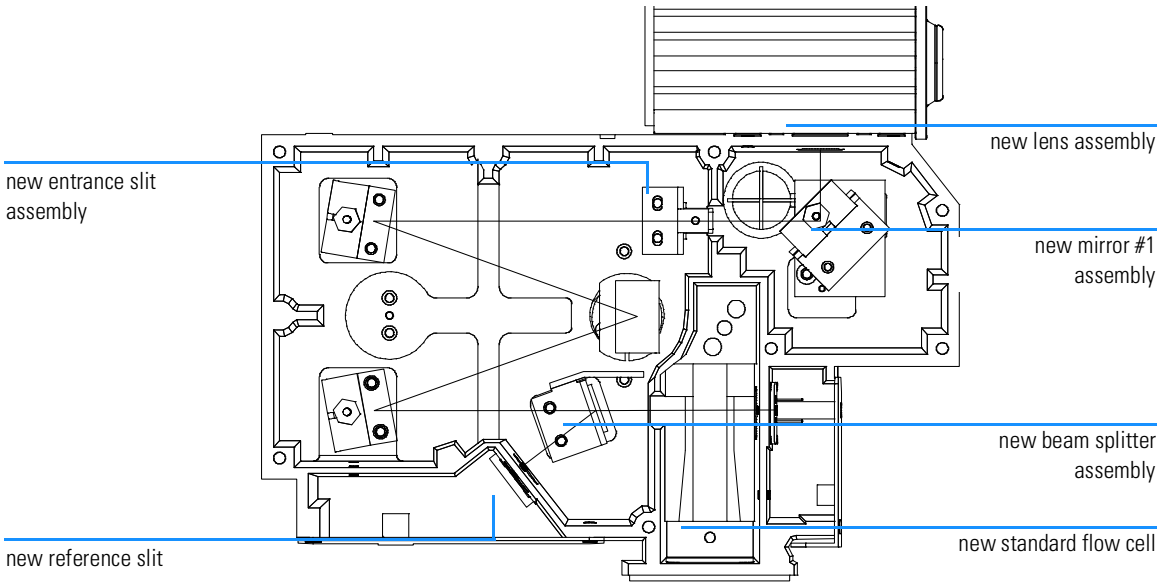
Introduction

To overcome wander problems due to temperature variations of the lab environment, the optical unit of the 79853C Variable Wavelength Detector (VWD) has been modified.

Following hardware modifications were implemented in June 1995:

- different coupling of the lamp housing (lens between lamp housing and optical casting).
- area around mirror M1 and M2 has been redesigned to eliminate one mirror - result is a mirror #1 assembly with a plane mirror.
- redesigned entrance slit holder. Slits are changeable (standard/test).
- beam splitter assembly no longer vertically adjustable.
- reference slit assembly redesigned for better optimization.
- new standard flow cell with different aperture material and different inlet capillary.

Figure 1 **Optical Path of Enhanced Optical Unit**



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Support Considerations

Prefix Change

The enhanced Optical Unit (“D” version) was introduced in production units in June 1995. Since the detector appears to look the same as before, a prefix change was made. All units with prefix **3522 J 04305** and above have the new optical installed.

NOTE Some units with a prefix lower than 3522 J 04305 have been installed on customer sites prior to the official shipments.

Identification

Following identifications for the enhanced “D” version are available:

- Prefix and serial number **3522 J 04305** and above (rear of instrument)
- firmware revision **4.31** (press CTRL 12 ENTER ENTER DOWN)
- label on the optical unit “**ENHANCED ILLUMINATION SYSTEM**”
- handle of new reference slit looking out of the optical’s cover plate (see Figure 266 on page 715).

Compatibility Matrix

Due to a redesign, several components are usable in the enhanced “D” version only. Refer to Table 191 on page 709 for details.

NOTE Both optical unit versions (“C” and “D”) can be operated with firmware revision 4.24 (79853-13005). Due to the modifications, the photocurrent readings are about 50% of those of the original “C” opticals. To make them comparable the firmware for the enhanced “D” version got a new revision and part number.

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Part Numbers for Enhanced “D” Optical Unit

Table 1 **Enhanced “D” Version Part Numbers**

Part Number	Description	Comments
79853-60000	Standard Flow Cell	backward compatible*, for details see Table 192 on page 710.
79853-69014	Exchange “D” Optical **includes** firmware 79853-13000	when “D” optical should be replaced, needs Standard Flow Cell 79853-60000
79853-69015	Exchange “D” Optical **includes** a Standard Flow Cell 79853-60000 and firmware 79853-13000	when “C” optical should be replaced
79853-68110	“D” Mirror 1 Assembly	for “D” only, includes test slit
79853-68111	“D” Mirror 3/4 Assembly	backward compatible**, includes test slit
79853-68112	“D” Beam Splitter	for “D” only, includes test slit
79853-68113	“D” Lens Assembly	for “D” only, includes test slit
79853-66508	Pre-amplifier Board REF	from “C” used for SAMPLE and REFERENCE on “D”
79853-61109	Diode Sample	from “C” used for SAMPLE and REFERENCE on “D”
79853-64605	Grating Assembly	same part number as before, but test slit added
79853-13000	Firmware “D” rev 4.31	for “D” only, added also to 79853-69014/15 and 79853-69511 (DCB)
79853-68746	Slit Kit “D”	Test slit plus STD slit

* with “C” version optical units
** with “C” version optical units; part number 79853-68109 should only be used for 79853C optical until stock has expired.

NOTE The part numbers 79853-68110, -68111, -68112, -68113 and -64605 include beside the test slit in addition a seal to close the hole for Mirror 4 adjustment setscrew. Close the hole with this seal during replacements (see Figure 266 on page 715 for the location).

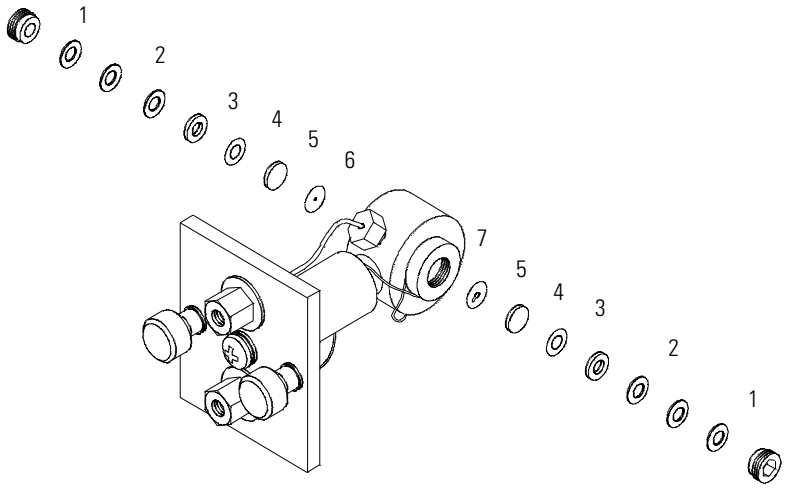
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Standard Flow Cell “D” Repair Parts

Table 2 **Standard Flow Cell “D” Repair Parts**

Item	Description	Part Number
	STD Flow Cell “D”, complete assembly	79853-60000
1	Cell Screw	79853-27200
	Kits:	
	Cell Kit STD “D”, consists of: two windows, two gaskets #1, one gasket #2 and one gasket #3.	79853-68741
2	Conical Spring “D”, Qty=10	79853-29100
3	Ring SST “D”, Qty=2	79853-22500
5	Window Quartz “D”, Qty=2	79853-68742
4	Gasket #1 “D”, PTFE, Qty=10	79853-68743
6	Gasket #2 “D”, Aperture, gold, Qty=5	79853-68744
7	Gasket #3 “D”, PTFE, Qty=5	79853-68745

Figure 2 **Standard Flow Cell “D” Repair Parts**



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Repair and Mainenance

WARNING

These procedures need special knowledge on servicing the 79853C VWD and should be done by trained Service Engineers only.

These procedures should be carried out in a room where the light can be reduced.

Since the deuterium lamp emits intensive ultraviolet light, it is dangerous to perform optical alignment without eye protection.

Tools required:

- ❏ Test Slit (supplied with mirror or grating assembly)
- ❏ Pozi Driv PT1
- ❏ hexagonal wrench (1.5 mm)
- ❏ hexagonal wrench (2.5 mm)
- ❏ pair of tweezers (not too sharp points)

Pre-requisites:

- ❏ Assure that the flow cell is clean, flushed with water and bubble free.
- ❏ Remove detector from system.
- ❏ Place the detector on a bench.
- ❏ Remove the main cover.

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Additional Information

For additional information about replacements and the use of the Service control Functions refer to *"VWD: Maintenance Information" on page 649* and *"Service Control Functions" on page 622*.

Replacements and Calibrations

The following procedures describe the replacements of parts separately.

NOTE It is important that only one assembly (mirror, grating, beam splitter, ...) is changed and calibrated at a time. Otherwise you will lose correct optical assembly alignment during the calibration process.

WARNING **Do not remove the Entrance Slit Holder nor loosen it. Otherwise the optical unit has to be exchanged completely.**

NOTE The photocurrent readings with test slit installed are much lower than with the standard slit.

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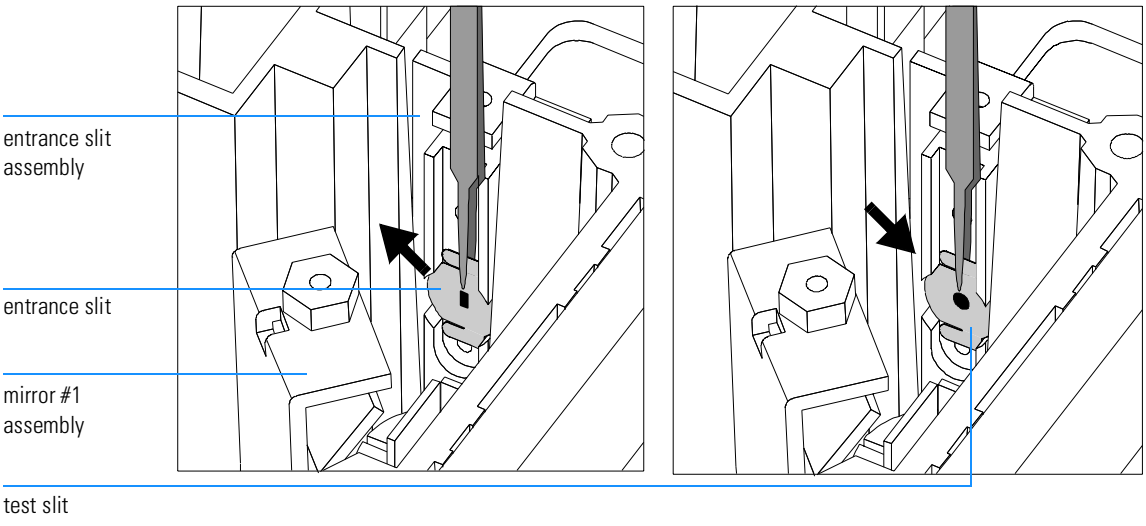
Installing the Test Slit

The small diameter of the test slit allows a straight forward alignment of the optical path. It enables the lamp image to be positioned optimally. This ensures correct illumination of the Entrance Slit and the Reference Slit.

NOTE This procedure has to be carried out at the beginning of all replacement procedures.

1. Turn on the detector and the lamp.
2. Set the wavelength to 250 nm.
3. Carefully remove the cover of the optical unit. Take care for the reference aperture handle, see Figure 266 on page 715.
4. Remove the standard slit from the entrance slit holder using a pair of tweezers and place it safe.

Figure 3 **Replacing the Entrance Slit**



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5 Carefully insert the test slit (with round hole) into the entrance slit holder. The slit must sit flat on the holder with the white side towards the incoming light.

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Replacing Mirror #1 Assembly

1 Install the Test Slit, see “Installing the Test Slit” on page 713.

2 Remove mirror #1 assembly.

3 Install new Mirror #1 assembly.

NOTE DO NOT remove or change its position of adapter plate underneath the mirror #1 assembly.

4 Position the lamp image onto the test slit hole:
- horizontally by rotating the mirror,
- vertically using the setscrew on the mirror.

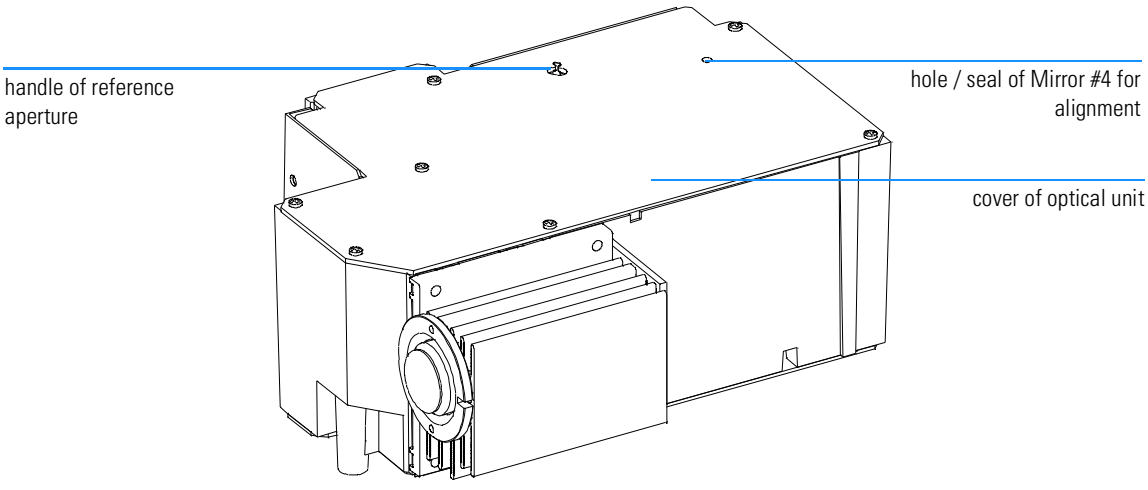
5 Fix the mirror.

6 Install the Standard Slit and perform grating calibrations, see “Installing the Standard Slit” on page 726.

7 Carefully replace the cover of the optical unit. Take care for the reference aperture handle.

8 Reassemble the detector.

Figure 4 **Handle of the Reference Aperture**



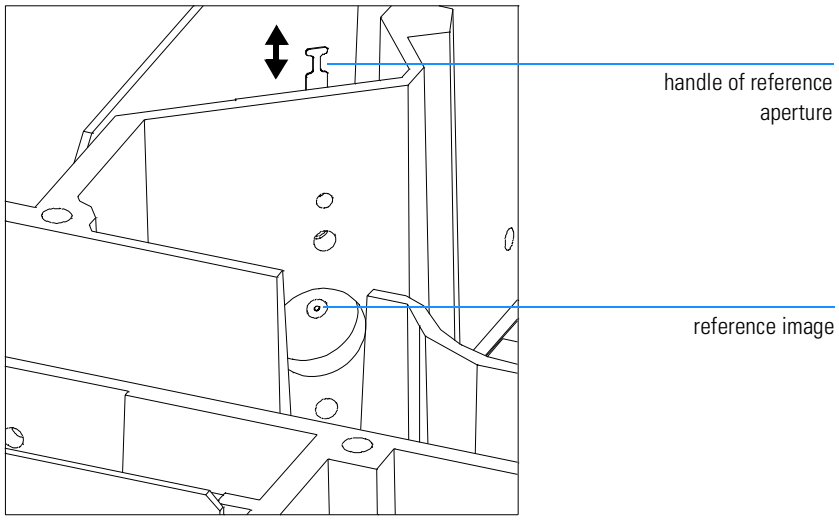
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Replacing Mirror #3 or #4 Assembly

NOTE Replace and calibrate one mirror at a time.

1. Install the test slit, see “Installing the Test Slit” on page 713.
2. Carefully replace the cover of the optical unit. Take care for the reference aperture handle, see Figure 266 on page 715.
3. Execute CTRL 20: 0th CALIB.
4. Activate service function CTRL 40: 0TH TEST ON.
5. Carefully remove the cover of the optical unit. Take care for the reference aperture handle, see Figure 266 on page 715.
6. Unlock the reference aperture, “Unlocking the Reference Aperture” on page 723.
7. Center the reference slit on the white image by moving the aperture up or down, see Figure 267. The image diameter is nearly equal to the reference slit diameter.

Figure 5 **Algning the Reference Slit**



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8 Install new mirror #3 or #4 assembly.

9 Position the white image precisely onto the reference slit:
- horizontally by rotating the mirror,
- vertically using the setscrew of the mirror

10 Carefully replace the cover of the optical unit. Take care for the reference aperture handle.

11 De-activate CTRL 40: 0TH TEST OFF, press CLEAR, CLEAR and BALANCE.

12 Set λ=250 nm.

13 Activate CTRL 16: PHOTOCURRENT.

14 Optimize the sample readings using the setscrew of mirror #4 through the hole in the optical unit cover, see Figure 266 on page 715.

15 Optimize the reference readings with the reference aperture, see “Optimizing the Reference Readings” on page 725.

16 Install the standard slit and perform electronic calibrations, see “Installing the Standard Slit” on page 726.

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Replacing the Grating or Grating Motor

NOTE To replace the Grating and/or the Grating Motor refer to *"Replacing Grating Assembly Parts" on page 668* and continue with the Alignment Procedure below.

1. Install the test slit, see "Installing the Test Slit" on page 713.
2. Carefully replace the cover of the optical unit. Take care for the reference aperture handle, see Figure 266 on page 715.
3. Execute `CTRL 20: 0th CALIB`.
4. Activate service function `CTRL 40: 0TH TEST ON`.
5. Carefully remove the cover of the optical unit. Take care for the reference aperture handle, see Figure 266 on page 715.
6. Unlock the reference aperture, see "Unlocking the Reference Aperture" on page 723.
7. De-activate `CTRL 40: 0TH TEST OFF`.
8. Center the reference slit on the white image by moving the aperture up or down. The image diameter is nearly equal to the reference slit diameter.
9. Remove the grating and reassemble new grating.

NOTE Assure that the grating is not fixed on the shaft with the setscrew.

10. Set the `Param. λ=200`, using service function `CTRL 31: SET λ PARAM`.
11. Activate service function `CTRL 40: 0TH TEST ON`.
12. Turn the grating so that the center of the image is on the reference slit (a small horizontal and vertical deviation can be accepted).
13. Fix the grating with the setscrew.
14. De-activate and re-activate `CTRL 40: 0TH TEST` and check the position of the image on the reference slit.

    If not correct, loosen the grating and repeat steps 12 to 14.

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15 Do a vertical adjustment with Mirror #4 for precise vertical fit of image on reference slit, using the setscrew of mirror #4 through the hole in the optical unit cover, see Figure 266 on page 715.

16 Carefully replace the cover of the optical unit. Take care for the reference aperture handle.

17 De-activate `CTRL 40: 0TH TEST OFF`, press [CLEAR], [CLEAR] and [BALANCE].

18 Execute `CTRL 20: 0th CALIB`.

19 Activate `CTRL 40: 0TH TEST ON` and readjust the Beam Splitter for ideal horizontal fit.

20 De-activate `CTRL 40: 0TH TEST OFF`.

21 Set λ=250 nm.

22 Activate `CTRL 16: PHOTOCURRENT`.

23 Optimize the sample readings, using the setscrew of mirror #4 through the hole in the optical unit cover, see Figure 266 on page 715.

24 Unlock the reference aperture, see “Unlocking the Reference Aperture” on page 723.

25 Optimize the reference readings with the reference slit, see “Optimizing the Reference Readings” on page 725.

26 Install the standard slit and perform electronic calibrations, see “Installing the Standard Slit” on page 726.

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Replacing the Beam Splitter

1. Install the test slit, see “Installing the Test Slit” on page 713.
2. Execute `CTRL 20: 0th CALIB`.
3. Carefully remove the cover of the optical unit. Take care for the reference aperture handle, see Figure 266 on page 715.
4. Activate service function `CTRL 40: 0TH TEST ON`.
5. Unlock the reference aperture, see “Unlocking the Reference Aperture” on page 723.
6. Center the reference slit on the white image by moving the aperture up or down. The image diameter is nearly equal to the reference slit diameter.
7. Install the new beam splitter assembly.
8. Position horizontally the white image center of the beam splitter onto the reference slit.
9. Fix the beam splitter after precise image fit.
10. Correct new vertical position with reference slit.
11. Carefully replace the cover of the optical unit. Take care for the reference aperture handle.
12. De-activate `CTRL 40: 0TH TEST OFF`, press [CLEAR], [CLEAR] and [BALANCE].
13. Set λ=250 nm.
14. Activate `CTRL 16: PHOTOCURRENT`.
15. Optimize the sample readings using the setscrew of mirror #4, using the setscrew of mirror #4 through the hole in the optical unit cover, see Figure 266 on page 715.
16. Optimize the reference readings, see “Optimizing the Reference Readings” on page 725.
17. Install the standard slit and perform electronic calibrations, see “Installing the Standard Slit” on page 726.

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Cleaning or Replacing the Lens

The lens is located between lamp housing and casting and can be cleaned or replaced.

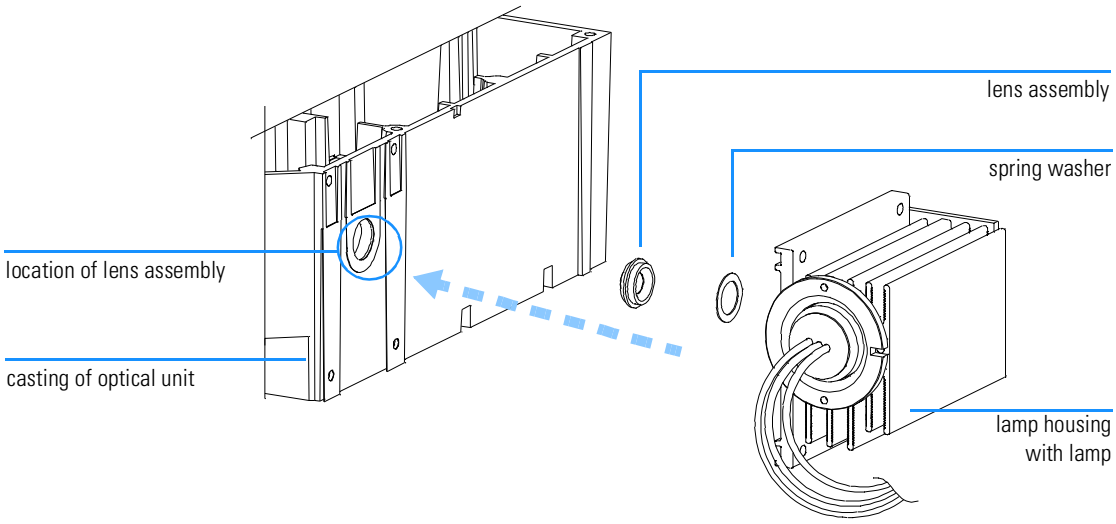
1 Turn the detector off.

2 Disconnect the lamp connector and all other connectors to the DCB board.

3 Remove the optical unit completely from the instrument.

4 Unscrew the four screws of the lamp housing and remove lamp housing.

Figure 6 **Lens Assembly Location**

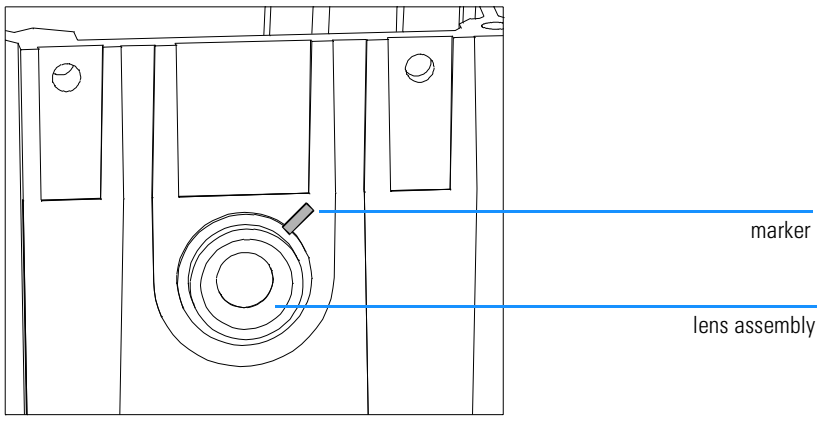


NOTE For easier repositioning the lens ring is marked with color paint, see Figure 269 on page 722. The position of the marker could differ from instrument to instrument and may be different to the position shown in the figure.

5 Remove, clean or replace the lens. If reusing old lens use markings for repositioning.

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Figure 7 **Lens Position**



NOTE The more plane lens side with smaller aperture faces towards the lamp.

NOTE If a new lens is installed, mirror #1 assembly has to be realigned after this procedure, see “Replacing Mirror #1 Assembly” on page 715.

6 Reassemble the flat spring.

7 Replace the Lamp housing and tighten it.

8 Reassemble the detector.

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Unlocking the Reference Aperture

NOTE Only necessary, if required during a replacement procedure.

For performance reasons, the reference aperture is fixed by one screw only and has to be unlocked prior to any replacement/calibration within the optical unit.

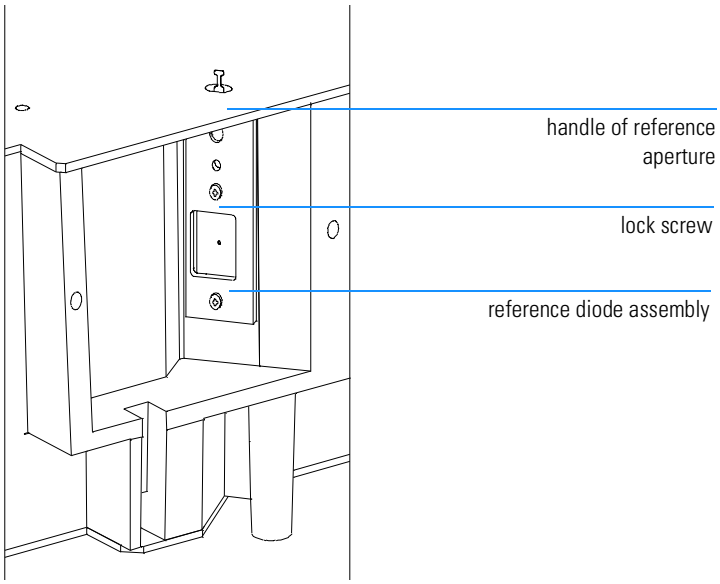
1 Unscrew the front panel and place it in front of the detector to have access to the reference pre-amplifier area.

NOTE When moving the front panel, assure that the keyboard cable is not partially disconnected - damage to the electronics is possible.

2 Unscrew the right screw of the reference pre-amplifier cover and loosen the left screw.

3 Turn the cover counter-clockwise until you can loosen the top screw of the photo diode holder sheet.

Figure 8 **Unlocking the Reference Slit**



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4 Replace the reference pre-amplifier cover (to prevent stray light).

5 Fit the front panel with one screw at the right of the mainframe.

6 Turn on the detector and the lamp

7 Set wavelength to 250 nm.

8 Return to your replacement procedure.

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Optimizing the Reference Readings

1 Carefully replace the cover of the optical unit. Take care for the reference aperture handle.

2 Activate `CTRL 16: PHOTOCURRENT`.

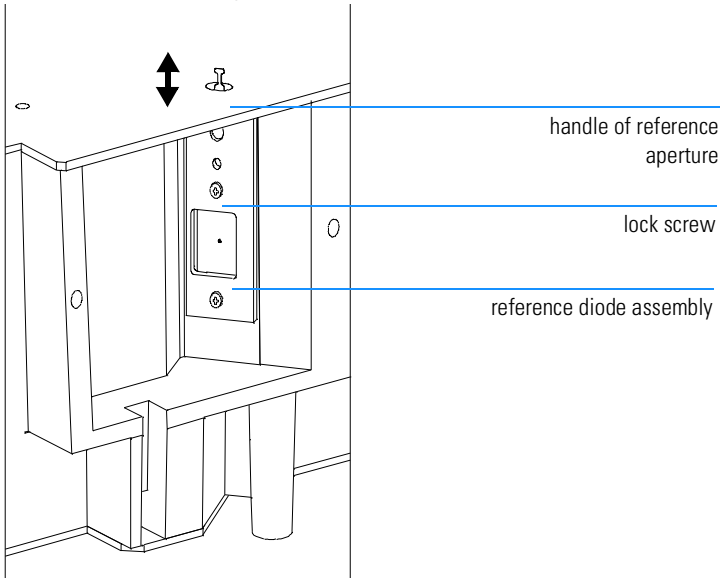
3 Shift reference aperture vertically for maximum reference readings.

4 Fix the reference slit with the top lock screw of the photo diode assembly.

5 Replace the reference photodiode cover.

6 Continue with the next step of the procedure of the assembly you are replacing.

Figure 9 **Optimizing the Reference Readings**



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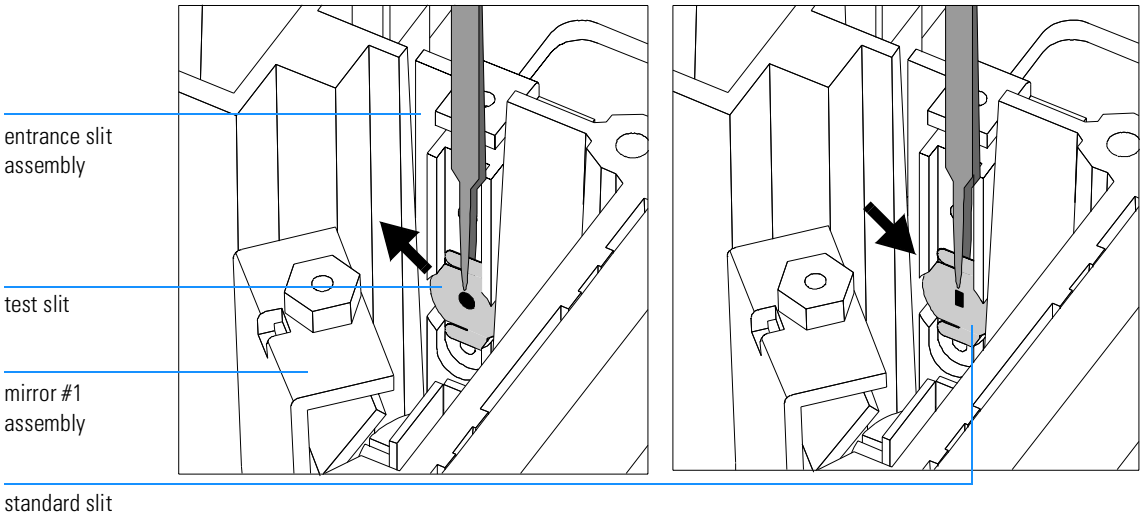
Installing the Standard Slit

NOTE This procedure has to be carried out at the end of all replacement procedures.

1 Carefully remove the cover of the optical unit. Take care for the reference aperture handle, see Figure 266 on page 715.

2 Remove the test slit from the entrance slit holder using a pair of tweezers and place it safe.

Figure 10 **Replacing the Entrance Slit**



3 Carefully insert the standard slit into the entrance slit holder. The slit must sit plane on the holder.

4 Carefully replace the cover of the optical unit. Take care for the reference aperture handle, see Figure 266 on page 715.

5 Execute `CTRL 20: 0th CALIB`.

6 Execute `CTRL 21: 1 CALIBRATION`.

7 Reassemble the detector.

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VWD: Additional Information

This chapter provides additional information about the 1050 Variable Wavelength Detectors

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VWD: Additional Information

Since the introduction of the 79853C Variable Wavelength Detector in 1991, the following hardware and firmware changes have been implemented.

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Product History

Since introduction of the 79853C Variable Wavelength Detector in January 1992 following changes have been implemented.

Prefix Changes

Table 1 **Prefix Changes**

Serial Number	Changes	Additional Information
3145 J 00101	Start of customer shipments	∅
3152 J 00263	New amplification factor of reference side due to high output of new DAD lamps.	See “Modified Pre-Amplifier Gain” on page 734.
3152 J 00489	Introduction of DCB firmware revision 4.22	See “SN 01050-055” on page 734.
3217 J 00603	Introduction of DCB firmware revision 4.23	See “SN 01050-055” on page 734.
3225 J 00773	Introduction of DCB firmware revision 4.24	See “SN 01050-055” on page 734.
3225 J 01801	Introduction of PTFE ring in optical unit	See “SN 01050-068” on page 734.
	Volume changes on Preparative Flow Cell in September 1992	See Table 138 on page 574 and Table 187 on page 698.
3225 J 02011	Introduction of new DCB/PSC boards	See “SN 01050-072” on page 734.
3323 J 03117	Introduction of new lamp housing	
3334 J 03255	Change of manufacturing process for photo diodes mounting	to improve stability against humidity
	Ultra High Pressure cell replaced High Pressure Cell in 1993	

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Table 1 **Prefix Changes**

Serial Number	Changes	Additional Information
3522 J 04305	Enhanced optical unit “D” with STD flow cell “D” in June 1995	to improve temperature stability, see “VWD: Enhanced Optical Unit Information” on page 705

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DCB ROM Firmware Revisions

Table 2 **DCB ROM Firmware Revisions**

Revision	Major Changes	Comments
4.08		Used for first internal Waldbronn/Avondale units and some demo units.
4.09	PHOENIX problem: won't stop when running with A/D Concerter (for example ABORT).	Not released.Used for internal Waldbronn/Avondale tests.
4.21	CTRL 45 COMPENSATE bug fix, calibrated wavelength deviation might exceed the specification. CTRL 22 HOLMIUMCHECK for GLP reasons added.	Released for 79853C in January 1992. For replacements use part number 79853-13005 (4.24). NEEDS GPIB ROM version 0.20 or above (79853-13004)
4.22	New algorithm for CTRL 45 COMPENSATE and CTRL 22 HOLMIUMCHECK.	Released for 79853C in March 1992. Started with serial number 3152J00489. For replacements use part number 79853-13005 (4.24). NEEDS GPIB ROM version 0.20 or above (79853-13004)
4.23	Removed bug: Incorrect wavelength setting during stepper motor intialisation bewteen 536.4 nm and 600 nm.	Released for 79853C in April 1992. Started with serial number 3217J00603. For replacements use part number 79853-13005 (4.24). NEEDS GPIB ROM version 0.20 or above (79853-13004)

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Table 2 **DCB ROM Firmware Revisions**

Revision	Major Changes	Comments
4.24	Removed bug : EEROM DATA LOST1 Removed bug : Wavelength accuracy between 360 nm and 486 nm	Released for 79853C in June 1992. Started with serial number 3225J00773. For replacements use part number 79853-13005 (4.24). NEEDS GPIB ROM version 0.20 or above (79853-13004)
4.31	For Enhanced Optical Unit "D" **only**	Released for 79853C in June 1995. Started with serial number 3522J04305. For replacements use part number 79853-13000 (4.31). NEEDS GPIB ROM version 0.20 or above (79853-13004)

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GPIB ROM Firmware Revisions

The table below lists all GPIB ROM firmware revisions for the 79853A/C.

Table 3 **GPIB ROM Revisions**

Revision	Major Changes	Comments
0.04		First official realease for 79853A.
0.05	LC APPACK problem: BUFFER OVERFLOW message preventing run buffer overflow.	Released for 79853A.
0.08	Also useable for 79853C. PHOENIX problem: prevents hang-ups at power on (if VWD is switched on after PHOENIX has been switched on).	Released for 79853A and 79853C. For replacements use part number 79853-13004 (0.2X)
0.09	PHOENIX problem: prevents VECTRA 486 hang-ups.	NOT officially released.
0.20	additional changes for future PHOENIX enhancements.	Released for 79853A and 79853C in January 1992. Required for 79853C firmware revision 4.21 and above. For replacements use part number 79853-13004 (0.2X)

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Hardware Changes and Service Notes

Modified Pre-Amplifier Gain

First instruments where shipped with a pre-amplifier gain of 100% on the reference side. The new deuterium lamps (79883-60002) showed sometimes very high energies which gave very high numbers on the reference side `16:PHOTOCURRENT`. To prevent an overload the amplification factor was changed to 75%. The feedback resistors on the reference side changed from 200 MOhm to 150 MOhm and on the sample side from 100 MOhm to 75 MOhm.

NOTE

No revision change was made. The modified pre-amplifiers started with serial number 3145J00263.

Important Service Note

SN 01050-055 Service Note 1050-055 describes the introduction of the DCB firmware revision 4.24 and the problems with previous revisions in more detail.

SN 01050-068 This note describes problems with POM ring between lamp housing and optical casting. Exchange POM ring against PTFE Ring 53C (79853-24500).

SN 01050-072 This note describes problems with negative baseline jumps on analog output signal. New DCB (79853-66511) and PSC (79853-66512) Boards have been introduced.

SN 01050-085 This note describes the optimization for drift problems.

SN 01050-104 Introduction of Enhanced Optical Unit, see *"VWD: Enhanced Optical Unit Information" on page 705*.

SN 01050-107 Cuvette Holder for Wavelength Verification with Certified Standard Solutions available see *"Cuvette Holder" on page 700*.

SN 01050-112 Check of photometric accuracy - information on path lengths of flow cells, see *"Correction factors for 79853C flow cells" on page 575*.

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In This Book

This manual contains technical information about the Agilent 1050 liquid chromatographs.

This manual is available as electronic version (Adobe Acrobat Reader file) only.

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