Service Manual

DL1720/DL1740 Digital Oscilloscope

SM 701710-01E

YOKOGAWA

Yokogawa Electric Corporation

SM 701710-01E
4th Edition

Important Notice to the User

This manual contains information for servicing YOKOGAWA's DL1720 and DL1740 Digital Oscilloscopes, in particular the DL1740. Check the serial number to confirm that this is the correct service manual for the instrument to be serviced. *Do not use the wrong manual*.

Before any maintenance and servicing, *read all safety precautions carefully*.

Only properly trained personnel may carry out the maintenance and servicing described in this service manual.

Do not disassemble the instrument or its parts, unless otherwise clearly permitted by this service manual.

Do not replace any part or assembly, unless otherwise clearly permitted by this service manual.

In principle, Yokogawa Electric Corporation (YOKOGAWA) does not supply parts other than those listed in the customer maintenance parts list in this service manual (mainly *modules* and *assemblies*). Therefore if an assembly fails, the user should replace the whole assembly and *not* components within the assembly (see "Note"). If the user attempts to repair the instrument by replacing individual components within the assembly, YOKOGAWA assumes no responsibility for any consequences such as defects in instrument accuracy, functionality, reliability, or user safety hazards.

YOKOGAWA does not offer more detailed maintenance and service information than that contained in this service manual.

All reasonable efforts have been made to assure the accuracy of the content of this service manual. However, there may still be errors such as clerical errors or omissions. YOKOGAWA assumes no responsibility of any kind concerning the accuracy or contents of this service manual, nor for the consequences of any errors.

Note

YOKOGAWA instruments have been designed in a way that the replacement of electronic parts can be done on an assembly (module) basis by the user. YOKOGAWA instruments have also been designed in a way that troubleshooting and replacement of any faulty assembly can be done easily and quickly. Therefore, YOKOGAWA strongly recommends replacing the entire assembly over replacing parts or components within the assembly. The reasons are as follows:

- The instruments use high-performance microprocessors, large scale CMOS gate arrays, and surface-mount components to provide state-of-the-art performance and functions.
- Repair of components can only be performed by specially trained and qualified maintenance personnel with special highly-accurate tools, including costly ones.
- When taking the service life and cost of the instruments into consideration, the replacement of assemblies offers the user the possibility to use YOKOGAWA instruments more effectively and economically with a minimum in downtime.

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Disk No. SM12
4th Edition : July 2002 (YK)

Introduction

This manual contains information for servicing YOKOGAWA's DL1720 and DL1740 Digital Oscilloscopes.

Note

This is the fourth edition of the manual, dated July 2002.

WARNING

This service manual is to be used by properly trained personnel only. To avoid personal injury, do not perform any servicing unless you are qualified to do so. Refer to the safety precautions prior to performing any servicing. Even if servicing is carried out according to this service manual, or by qualified personnel, YOKOGAWA assumes no responsibility for any result occurring from that servicing.

Safety Precautions

The following general safety precautions must be taken during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings given elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument.
Yokogawa Electric Corporation assumes no liability for the customer's failure to comply with these requirements.

WARNING

Use the Correct Power Supply
Ensure the source voltage matches the voltage of the power supply before turning ON the power.

Use the Correct Power Cord and Plug
To prevent an electric shock or fire, be sure to use the power supply cord supplied by YOKOGAWA. The main power plug must be plugged in an outlet with a protective grounding terminal. Do not invalidate protection by using an extension cord without protective grounding.

Connect the Protective Grounding Terminal
The protective grounding terminal must be connected to ground to prevent an electric shock before turning ON the power.

Do Not Impair the Protective Grounding
Never cut off the internal or external protective grounding wire or disconnect the wiring of the protective grounding terminal. Doing so creates a potential shock hazard.

Do Not Operate with Defective Protective Grounding or Fuse
Do not operate the instrument if you suspect the protective grounding or fuse might be defective.

Use the Correct Fuse

To prevent fire, make sure to use a fuse of the specified rating for current, voltage, and type. Before replacing the fuses, turn OFF the power and disconnect the power source. Do not use a different fuse or short-circuit the fuse holder.

Do Not Operate Near Flammable Materials

Do not operate the instrument in the presence of flammable liquids or vapors. Operation of any electrical instrument in such an environment constitutes a safety hazard.

Do Not Remove Any Covers

There are some components inside the instrument containing high voltage. Do not remove any cover, if the power supply is connected. The cover should be removed by qualified personnel only.

Ground the Instrument before Making External Connections

Connect the protective grounding before connecting the instrument to a measurement or control unit.

Safety Symbols Used on Equipment and in Manuals

To avoid injury, death of personnel or damage to the instrument, the operator must refer to an explanation in the user’s manual.

This symbol represents a functional grounding terminal. Such terminals should not be used as a protective grounding terminal.

WARNING

A WARNING sign calls attention to a procedure, practice, or condition, that could result in the injury or death of personnel if not correctly performed or adhered to.

CAUTION

A CAUTION sign calls attention to a procedure, practice, or condition, that could result in damage to or the destruction of part of the instrument if not correctly performed or adhered to.

Overview of This Manual

This manual is meant to be used by qualified personnel only. Make sure to read the safety precautions at the beginning of this manual as well as the warnings and cautions contained in the chapters relevant to any servicing you may be carrying out.

This manual contains the following chapters.

1 General Information
Provides an introduction and safety considerations.

2 Performance Testing
Explains the tests for checking the performance of the instrument.

3 Adjustments
Explains the adjustments which can be performed by users.

4 Principles of Operation
Provides function block diagrams and explains the principles of operation.

5 Troubleshooting
Presents procedures for troubleshooting and how to proceed in case parts need to be replaced.

6 Schematic Diagram
Provides a system configuration diagram.

7 Customer Maintenance Parts List
Contains exploded views and a list of replaceable parts.

8 Procedures for Disassembly
Lists the steps required to remove parts from the instrument.

Specifications are not included in this manual. For specifications, refer to IM 701710-01E.

Contents

Chapter 1 General Information

1.1 Introduction

This manual describes servicing information for any YOKOGAWA DL1720 and DL1740 Digital Oscilloscope. This chapter contains information required for using this manual and information that must be read before starting servicing DL1720 and DL1740 instruments.

1.2 Safety Considerations

You must thoroughly read the safety precautions at the beginning of this manual. Also fully read the warnings and cautions contained in each chapter.

Chapter 2 Performance Testing

2.1 Introduction

The aim of the tests in this chapter is to check the basic performance of the instrument. The order of the test procedures is just for convenience and does not need to be adhered to strictly. Please use the recommended equipment or their equivalents.

2.2 Test Environment

Operating Conditions

- Ambient temperature: 23 ±2°C
- Humidity: 55 ±10% RH
- Voltage of power supply: Specified voltage ±1%
- Frequency of power supply: Specified frequency ±1%

Warm Up Time

- More than 30 minutes after turning ON the instrument.
- Confirm that self-calibration is correctly executed after the 30 minute warm up. (Be sure to pay attention to the warm up time of all equipment that will be used in the test.)

2.3 Equipment Required for the Performance Test

Equipment	Qty	Mandatory Specifications	Recommended
Calibrator	1	Accuracy ±0.05% Output voltage –40 V to 40 V Output resolution 1 mV Output frequency range 0.1 MHz to 500 MHz	WAVETEK 9500
Programmable head	1		WAVETEK 9520

2.4 Self Diagnosis

Equipment Required

None

Procedure

Follow the procedure described in section 15.3, “Self-Diagnostic Test (Self Test)” of the user’s manual (IM 701710-01E).

2.5 Vertical Axis DC Voltage Accuracy Test

Specifications

2 mV/div to 50 mV/div:	±(1.5% of 8 div. +0.2 mV)
100 mV/div to 500 mV/div:	±(1.5% of 8 div. +2 mV)
1 V/div to 10 V/div:	±(1.5% of 8 div. +20 mV)

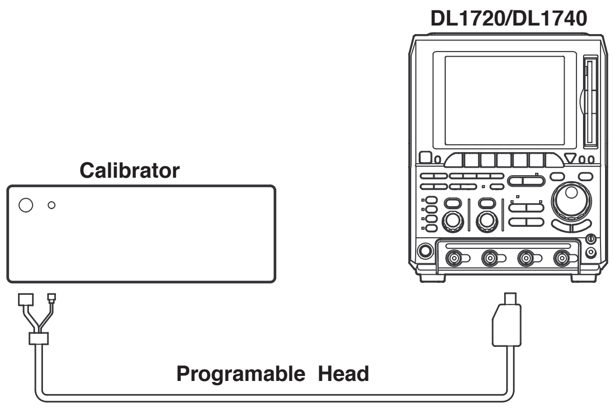
Permissible Range

Range	Tolerance
2 mV/div	±0.44 mV
5 mV/div	±0.8 mV
10 mV/div	±1.4 mV
20 mV/div	±2.6 mV
50 mV/div	±6.2 mV
100 mV/div	±14 mV
200 mV/div	±26 mV
500 mV/div	±62 mV
1 V/div	±140 mV
2 V/div	±260 mV
5 V/div	±620 mV
10 V/div	±1.22 V

Equipment Required

Equipment	Qty	Mandatory Specifications	Recommended
Calibrator	1	Accuracy ±0.05% Output voltage –40 V to 40 V Output resolution 1 mV	WAVETEK 9500
Programmable Head	1		WAVETEK 9520

Connection



Procedure

1. Turn on the power source to the DL1720/DL1740. After warm-up press the ***MISC*** key, followed by the **Calibration** soft key, then press the **Cal Exec** soft key to calibrate the instrument.
   Next, press the ***SETUP*** key, then press the **Initialize** soft key to initialize the settings.

2. Enter the settings on the DL1720/DL1740 oscilloscope as shown below.

VERTICAL (for all channels)

Coupling	DC1 MΩ
V/div	According to the inspection item below
Probe	1:1

HORIZONTAL

T/div	1 ms/div

TRIGGER

Mode	Auto

ACQ

Mode	Box Average
Count	Infinite

DISPLAY

Format	Single

MEASURE

Mode	ON
Item Set Up	▼ (Set to channel to be measured) Select Avg.
Time Range 1	–5 div
Time Range 2	+5 div

3. Input the following voltages from the voltage generator to the DL1720/DL1740 being tested, read the indication on the DL1720/DL1740 (value of Avg), and compare the reading with the tolerance.

Measurement Range	Test Input Voltage	Tolerance
2 mV/div	–8, 0, +8 mV	±0.44 mV
5 mV/div	–20, 0, +20 mV	±0.8 mV
10 mV/div	–40, 0, +40 mV	±1.4 mV
20 mV/div	–80, 0, +80 mV	±2.6 mV
50 mV/div	–200, 0, +200 mV	±6.2 mV
100 mV/div	–400, 0, +400 mV	±14 mV
200 mV/div	–800, 0, +800 mV	±26 mV
500 mV/div	–2, 0, +2 V	±62 mV
1 V/div	–4, 0, +4 V	±140 mV
2 V/div	–8, 0, +8 V	±260 mV
5 V/div	–20, 0, +20 V	±620 mV
10 V/div	–40, 0, +40 V	±1.22 V

4. Test all channels in the same manner.

2.6 Frequency Response Test

Specifications

DC50 Ω (1 V/div to 10 mV/div) DC to 500 MHz (–3 dB point)

DC50 Ω (2 mV/div and 5 mV/div) DC to 400 MHz (–3 dB point)

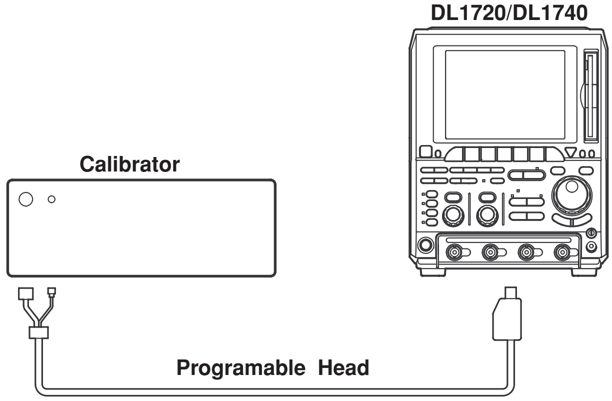
Permissible Range

Range	Input Amplitude (p-p)	Input Frequency	Permissible Range (Sdev)
1 V/div	5 V	500 MHz	1.26 V to 1.98 V
200 mV/div	1.2 V	500 MHz	301 mV to 476 mV
50 mV/div	0.3 V	500 MHz	75.1 mV to 119 mV
10 mV/div	60 mV	500 MHz	15.1 mV to 23.8 mV
5 mV/div	30 mV	400 MHz	7.51 mV to 11.9 mV
2 mV/div	12 mV	400 MHz	3.01 mV to 4.76 mV

Equipment Required

Equipment	Qty	Mandatory Specifications	Recommended
Calibrator	1	Output voltage 0 V to 10 V Output resolution 1 mV Output frequency range 0.1 MHz to 500 MHz	WAVETEK 9500
Programmable Head	1		WAVETEK 9520

Connection



Procedure

1. Turn on the power source to the DL1720/DL1740. After warm-up press the ***MISC*** key, followed by the **Calibration** soft key, then press the **Cal Exec** softkey to calibrate the instrument.
   Next, press the ***SETUP*** key, then press the **Initialize** soft key to initialize the settings.

2. Enter the settings on the DL1720/DL1740 as shown below.

VERTICAL (for all channel)

	Coupling	DC50 Ω
	V/div	Set this according to following measurement conditions
	Probe	1:1

HORIZONTAL

	T/div	2 ns/div

TRIGGER — SIMPLE

Mode		Normal
SIMPLE		
	Source	(Channel to be tested)
ACQ		
	Mode	Average
	Count	Infinite
	Weight	4
	Record Length	1 k
DISPLAY		
	Format	Single
MEASURE		
	Mode	ON
	Item Set up	▼ (Set to channel to be tested) Select Sdev
	Time Range 1	–5.00 div
	Time Range 2	+5.00 div

3. Input voltages as listed on the following table to the DL1720/DL1740 you are testing, and check if the automatically measured value of waveform parameters (Sdev) is within the permissible range.

Range	Input Amplitude (p-p)	Input Frequency	Permissible Range (Sdev)
1 V/div	5 V	500 MHz	1.26 V to 1.98 V
200 mV/div	1.2 V	500 MHz	301 mV to 476 mV
50 mV/div	0.3 V	500 MHz	75.1 mV to 119 mV
10 mV/div	60 mV	500 MHz	15.1 mV to 23.8 mV
5 mV/div	30 mV	400 MHz	7.51 mV to 11.9 mV
2 mV/div	12 mV	400 MHz	3.01 mV to 4.76 mV

4. Test all channels in the same manner.

2.7 Time-Base Accuracy Test

Specifications

±0.005%

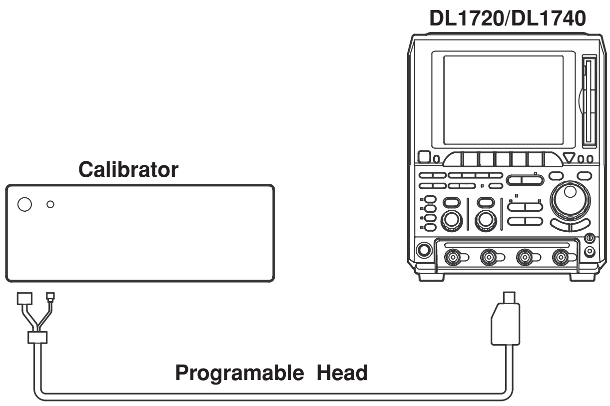
Permissible Range

Time Range	Input Frequency	Permissible Range
2 μs/div	500.2 MHz	200±25 kHz
5 μs/div	200.1 MHz	100±10 kHz

Equipment Required

Equipment	Qty	Mandatory Specifications	Recommended
Calibrator	1	300 mVp-p, sine wave 200.1 MHz and 500.2 MHz	WAVETEK 9500
Programmable Head	1		WAVETEK 9520

Connection



Procedure

1. Turn on the power source to the DL1720/DL1740. After warm-up press the ***MISC*** key, followed by the **Calibration** soft key, then press the **Cal Exec** softkey to calibrate the instrument.
   Next, press the ***SETUP*** key, then press the **Initialize** soft key to initialize the settings.

2. Enter the settings on the DL1720/DL1740 as shown below.

VERTICAL			
	CH1		
		V/div	50 mV/div
		Coupling	DC50 Ω
		Probe	1:1
HORIZONTAL			
		T/div	According to the inspection item below
	Display		
		Format	Single
	ACQ		
		Record Length	10k
	MEASURE		
		Mode	ON
		Item Set up	▼
		CH1	Select Freq

3. Input a 300 mVp-p sine wave signal with the input frequency listed in the table below to the DL1720/DL1740 you are testing, and check if the automatically measured waveform parameters (Freq) are within the permissible range.

Time Range	Input Frequency	Permissible Range (Freq)
2 μs/div	500.2 MHz	200±25 kHz
5 μs/div	200.1 MHz	100±10 kHz

2.8 Trigger Sensitivity Test

Specifications

DC to 500 MHz: 1 divp-p on the screen

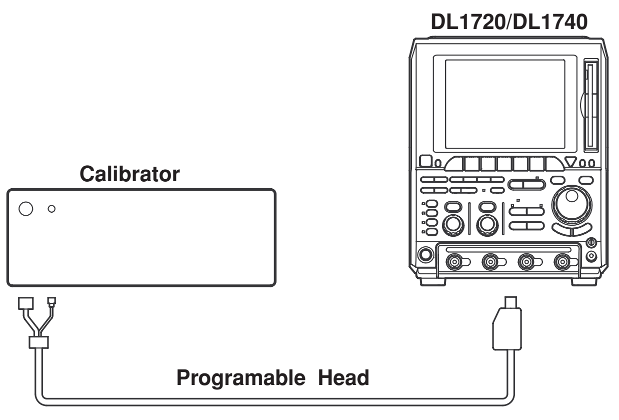
Permissible Range

500 mV/div 500 MHz 1 divp-p on the screen

Equipment Required

Equipment	Qty	Mandatory Specifications	Recommended
Calibrator	1	500 mVp-p, 500 MHz, sine wave	WAVETEK 9500
Programmable Head	1		WAVETEK 9520

Connection



Procedure

1. Turn on the power source to the DL1720/DL1740. After warm-up press the ***MISC*** key, followed by the **Calibration** soft key, then press the **Cal Exec** softkey to calibrate the instrument.
   Next, press the ***SETUP*** key, then press the **Initialize** soft key to initialize the settings.

2. Enter the settings on the DL1720/DL1740 as shown below.

VERTICAL (for all channels)	
V/div	500 mV/div
Coupling	DC50 Ω
Probe	1:1
HORIZONTAL	
T/div	1ns/div
TRIGGER	
Mode	Normal
ENHANCED	
Type	Pattern
Set Pattern	▼
Clock CH	(Set to channel to be measured)
Slope	↑ (channel to be measured)
	X (the other channel)
Condition	True
Level / Coupling	▼
Level	0 mV
Coupling	DC
DISPLAY	
Format	Single
ACQ	
Record Length	1 k
Mode	Average
Count	Infinite
Weight	4

3. Input a sine wave signal of 500 mVp-p, 500 MHz to the DL1720/DL1740, and confirm that the waveform stabilizes.

Note

If the trigger is not activated, adjust the trigger lever within ±250 mV until the trigger is activated.

4. Test all channels in the same manner.

2.9 Trigger Accuracy Test

Specifications

±(1 div.+10% of the trigger level)

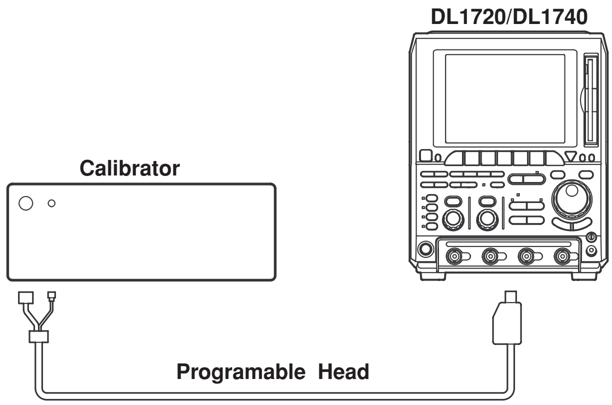
Permissible Range (at 200 mV/div)

Trigger level	Offset	Permissible Range
600 mV	600 mV	–260 mV ≤ (Vin + Vout) / 2 ≤ 260 mV
–600 mV	–600 mV	–260 mV ≤ (Vin + Vout) / 2 ≤ 260 mV

Equipment Required

Equipment	Qty	Mandatory Specifications	Recommended
Calibrator	1	400mVp-p, 2kHz, sine wave	WAVETEK 9500
Programmable Head	1		WAVETEK 9520

Connection



Procedure

1. Turn on the power source to the DL1720/DL1740. After warm-up press the ***MISC*** key, followed by the **Calibration** soft key, then press the **Cal Exec** softkey to calibrate the instrument.
   Next, press the ***SETUP*** key, then press the **Initialize** soft key to initialize the settings.

2. Enter the settings on the DL1720/DL1740 oscilloscope as follows.
   VERTICAL (for all channels)

V/div	200 mV/div
Probe	1:1
Band Width	20 MHz
Offset	–600 mV, 600 mV

   HORIZONTAL

T/div	100 μs/div

   TRIGGER
   ENHANCED

Type	OR
Window	ON
Set Pattern	▼
	IN, OUT (channel to be measured)
	– (the other channel)
Level / Coupling	▼
Center	–600 mV, 600 mV
Width	1.2 V

   DISPLAY

Format	Single

   CURSOR

Type	Marker
Position	0.0 div

3. Input a sine wave signal of 400 mVp-p, 2 kHz to the DL1720/DL1740 oscilloscope, and use cursors to read the voltage of the waveform at the trigger position. Set Vin for Polarity IN, Vout for Polarity out, and check if (Vin+Vout)/2 is within the permissible range.

Trigger level	Offset	Permissible Range
600 mV	600 mV	–260 mV ≤ (Vin + Vout) / 2 ≤ 260 mV
–600 mV	–600 mV	–260 mV ≤ (Vin + Vout) / 2 ≤ 260 mV

4. Test all channels in the same manner.

Chapter 3 Adjustments

3.1 Introduction

The top cover, printer cover, printer case, front bezel, and shield cover must be removed before adjusting the DL1720/DL1740. Read the warning and cautions below before doing so.

WARNING

Circuit patterns of the printed circuit board are exposed. Be careful when handling so that hands or fingers are not injured by the protruding pins.

CAUTION

- Circuit patterns of the printed circuit board are exposed. If these patterns touch other metallic materials, electrical shorting will occur, causing the circuit to be damaged or burnt.
- It is sometimes necessary to turn the DL1720/DL1740 upside down for adjustment. Do not drop the instrument, or allow it to fall over.
- When feeding power with the DL1740's cover open, apply a flow of air to the AD4 board (or the AD2 board for the DL1720) and Power Supply (B9989YA).

3.2 Test Environment

Operating Conditions

- Ambient temperature: 23 ±2˚C
- Humidity: 55 ±10 % RH
- Voltage of power supply: Specified voltage ±1 %
- Frequency of power supply: Specified frequency ±1 %

Warm Up Time

- More than 30 minutes after tuning ON the instrument.
- Confirm that self calibration is correctly executed after a 30 minute warm up.
  (Be sure to pay attention to the warm up time of all equipment that will be used in the test.)

3.3 Equipment Required

Table 3.1 Equipment required

Equipment	Critical Specification	Recommended
Calibrator Programmable Head	DC Output Level : 1 V Accuracy : < 0.02% Square wave Frequency : 10 kHz Output Level : > 60 Vp-p	WAVETEK 9500 WAVETEK 9520

Note

The values shown in the specification column are those set in this service manual. These values do not indicate the performances of the recommended equipment and tools. Therefore, non-designated equipment and tools which satisfy the specifications are permitted.

3.4 DC Gain Adjustment on the AD Board

Procedure

1. Remove the top cover and shield cover.
2. Allow the unit to warm up for 10 minutes or more.
3. Connect each instrument as shown in figure 3.1, "Connection Method."

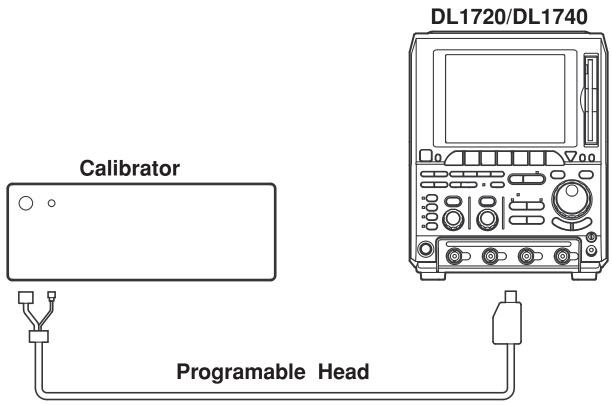


Figure 3.1 Connection Method

4. Press the ***SETUP*** key and select the **Initialize** soft key to execute initialization.
5. Press the ***MISC*** key and select the **Calibration** soft key.
6. Press the **Cal Exec** soft key to perform calibration.

7. Enter the settings on the DL1720/DL1740 and calibrator as follows.

DL1720/DL1740

VERTICAL (for all channels)

V/div	2 mV/div
Position	0 div
Probe	1:1
Offset	+1.000 V
Bandwidth	20 MHz

HORIZONTAL

T/div	1 ms/div

TRIGGER

Mode	Auto

ACQ

Mode	Box Average
Count	Infinite

DISPLAY

Format	Single

MEASURE

Mode	ON
Item Set Up	▼ (Set to channel to be measured) Select Avg.
Time Range 1	–5 div
Time Range 2	+5 div

Calibrator

DC Output Level	+1.0000 V

8. Adjust the variable resistor (refer to table 3.2, “Adjustment Point” and figure 3.2, 3.3, “Adjustment Point Location Diagram”) corresponding to each channel so that the DC waveform fits within 1 V±1 mV as shown in figure 3.4, “Observed Waveform.”
9. Perform the adjustment in step 7) for all channels.

Table 3.2 Adjustment Point

Channel	Adjustment Point
CH1	R707
CH2	R714
CH3*	R721
CH4*	R728

* The DL1720 is not equipped with CH3 and CH4

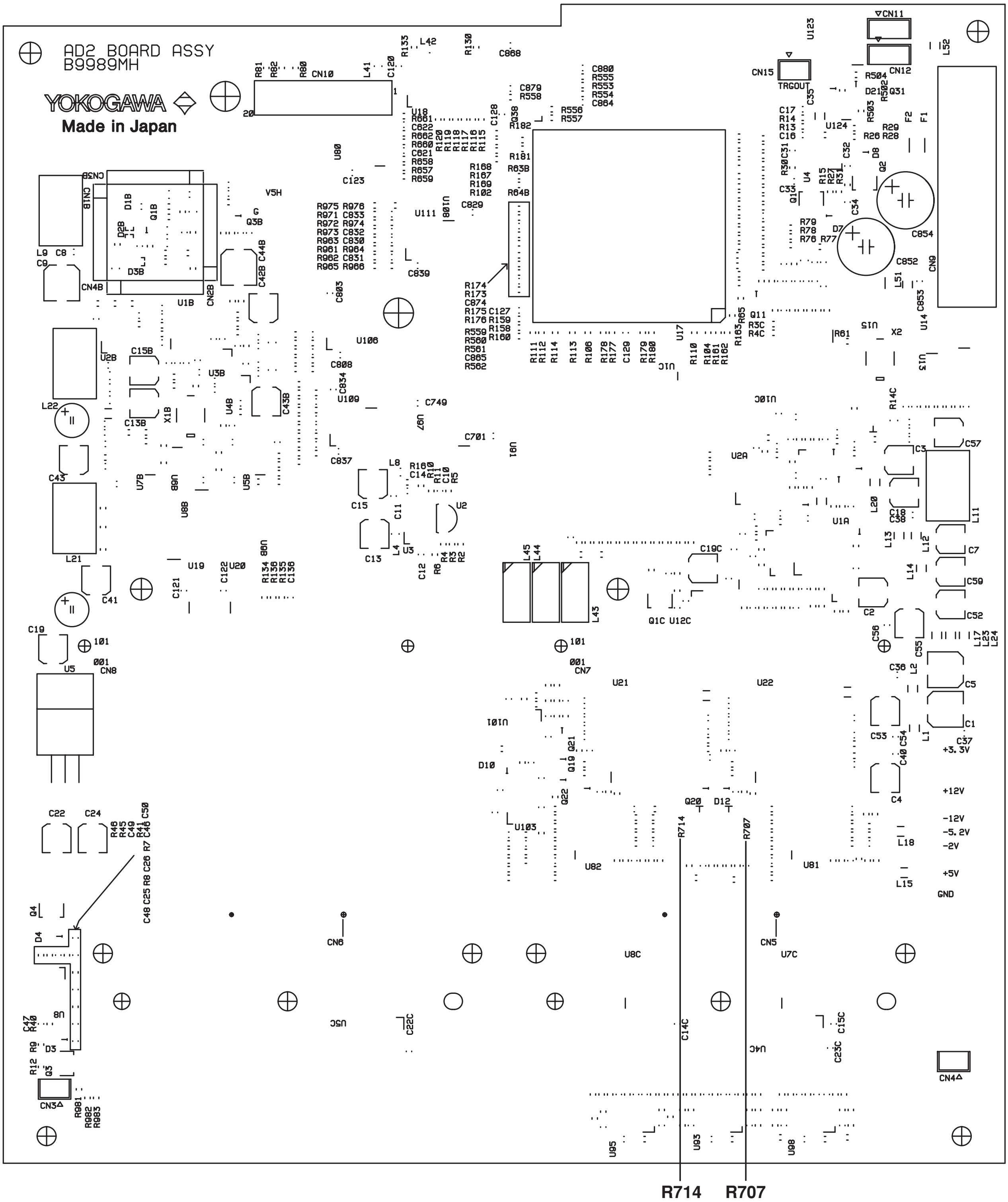


Figure 3.2 Adjustment Point Location Diagram (DL1720)

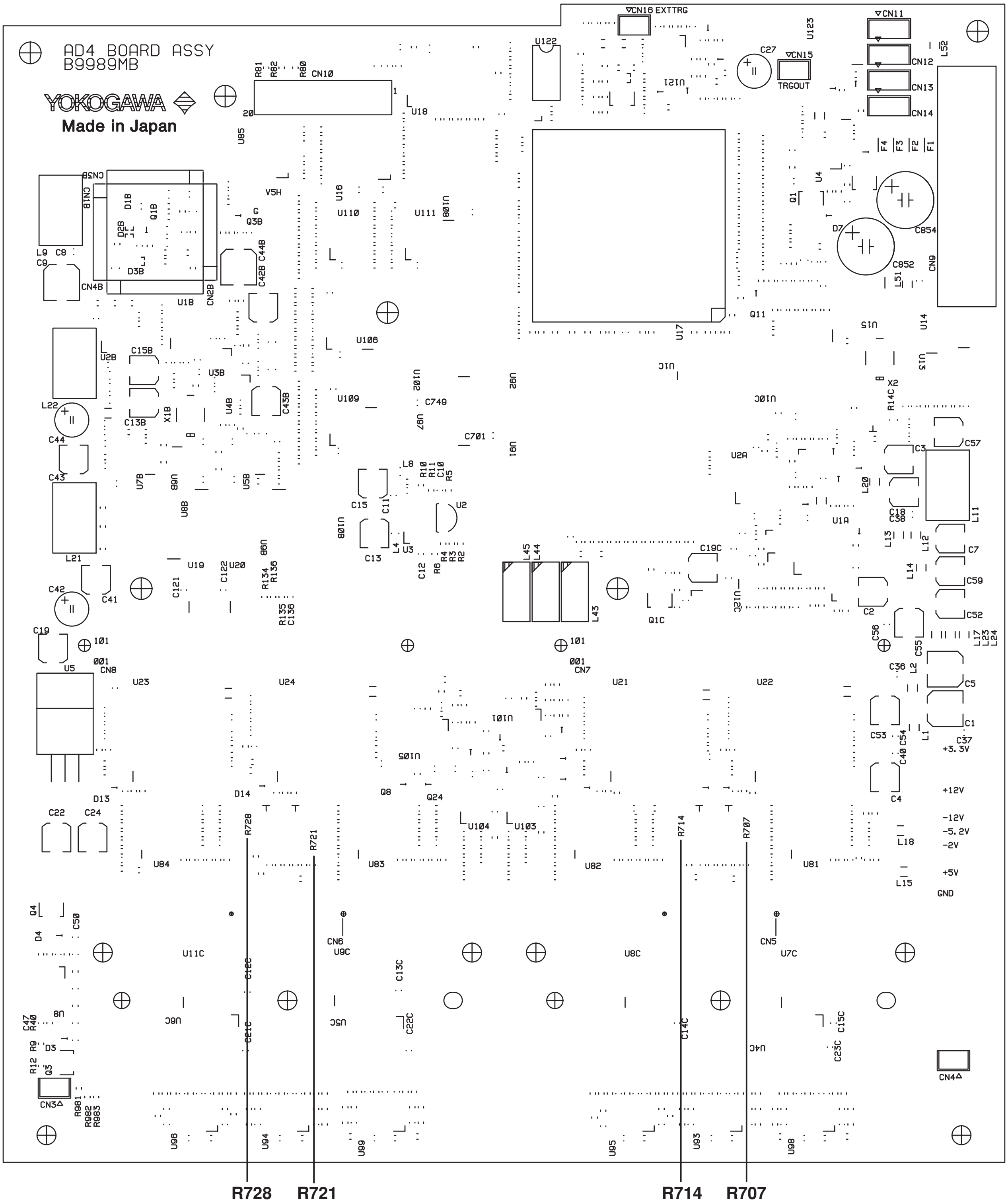


Figure 3.3 Adjustment Point Location Diagram (DL1740)

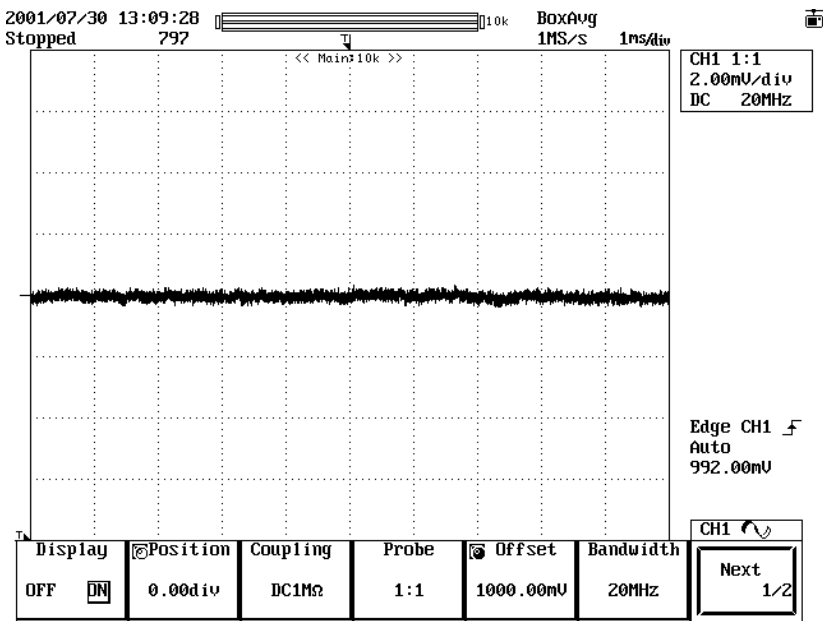


Figure 3.4 Observed Waveform

3.5 Flatness Adjustment on the Analog Board

Note

Before performing this flatness adjustment, the DC gain adjustment on the AD board must have been completed.

Procedure

1. Remove the top cover, printer cover, printer case, front bezel, and shield cover.
2. Turn on the power and allow the unit to warm up for 10 minuets or more.
3. Connect each instrument as shown in figure 3.5, "Connection Method."

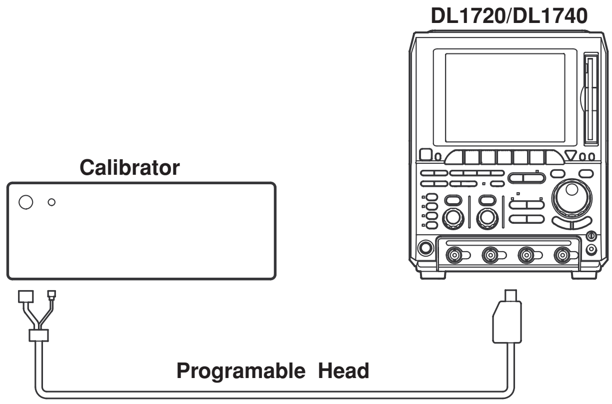


Figure 3.5 Connection Method

4. Press the ***SETUP*** key and select the **Initialize** soft key to execute initialization.
5. Press the ***MISC*** key and select the **Calibration** soft key.
6. Select the **Cal Exec** soft key to perform calibration.

7. For adjustment of the /10 range, enter the settings on the DL1720/DL1740 oscilloscope and calibrator as follows.
   DL1720/DL1740
   VERTICAL (for all channels)
   V/div 100 mV/div
   Position 0 div
   Probe 1:1
   HORIZONTAL
   T/div 10 μ s/div
   TRIGGER
   Mode Auto
   ACQ
   Mode Box Average
   Count Infinite
   DISPLAY
   Format Single
   Calibrator
   Wave Form Square wave
   Frequency 10 kHz
   Amplitude 600 mVp-p
8. Adjust the variable capacitors CV101 and CV201, (refer to figure 3.6, “Adjustment Point Location Diagram”) so that the top of the waveform becomes flat as shown in figure 3.7, “Observed Waveform.” The flatness of the waveform must be fitted within ±0.1 div.
9. For adjustment of the /100 range, enter the settings on the DL1720/DL1740 oscilloscope and calibrator as follows.
   DL1720/DL1740
   VERTICAL (for all channels)
   V/div 1 V/div
   Position 0 div
   Probe 1:1
   HORIZONTAL
   T/div 10 μ s/div
   TRIGGER
   Mode Auto
   ACQ
   Mode Box Average
   Count Infinite
   DISPLAY
   Format Single
   Calibrator
   Wave Form Square wave
   Frequency 10 kHz
   Amplitude 6 Vp-p
10. Adjust the variable capacitors CV102 and CV202 (refer to figure 3.6, “Adjustment Point Location Diagram”) so that the top of the waveform becomes flat as shown in figure 3.7, “Observed Waveform.” The flatness of the waveform must be fitted within ±0.1 div.

11. For adjustment of the /200 range, enter the settings on the DL1720/DL1740 oscilloscope and calibrator as follows.
    DL1720/DL1740
    VERTICAL (for all channels)
    - V/div 10 V/div
    - Position 0 div
    - Probe 1:1

    HORIZONTAL
    - T/div 10 μs/div

    TRIGGER
    - Mode Auto

    ACQ
    - Mode Box Average
    - Count Infinite

    DISPLAY
    - Format Single

    Calibrator
    - Wave Form Square wave
    - Frequency 10 kHz
    - Amplitude 60 Vp-p
12. Adjust the variable capacitors CV103 and CV203 (refer to figure 3.6, "Adjustment Point Location Diagram") so that the top of the waveform becomes flat as shown in figure 3.7, "Observed Waveform." The flatness of the waveform must be come within ±0.1 div.

The assembly number differs depending on the date of manufacture as follows:
During or before December, 2001: B9989MA
After December 2001: B9989ML

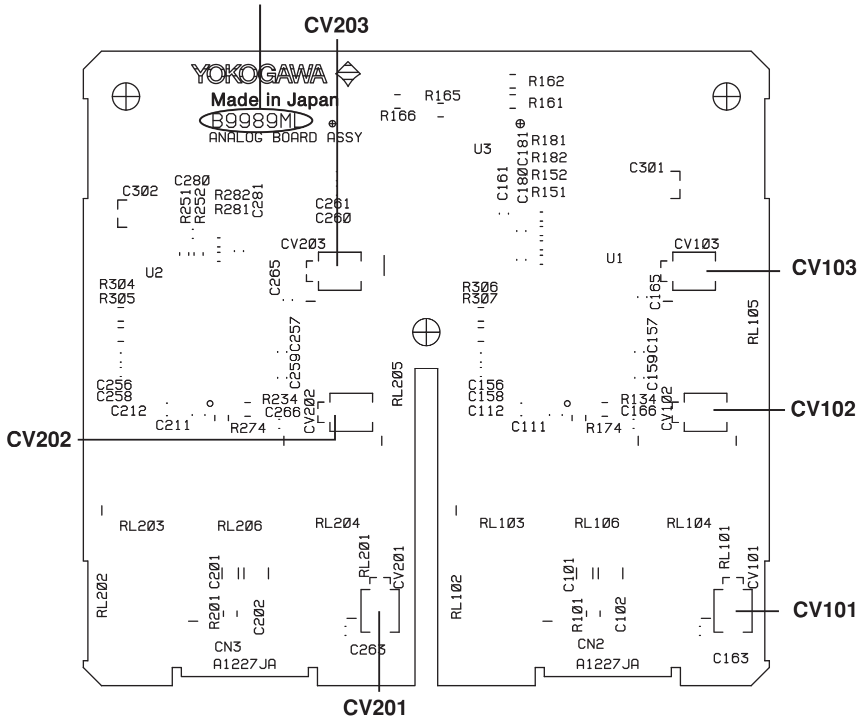


Figure 3.6 Adjustment Point Location Diagram

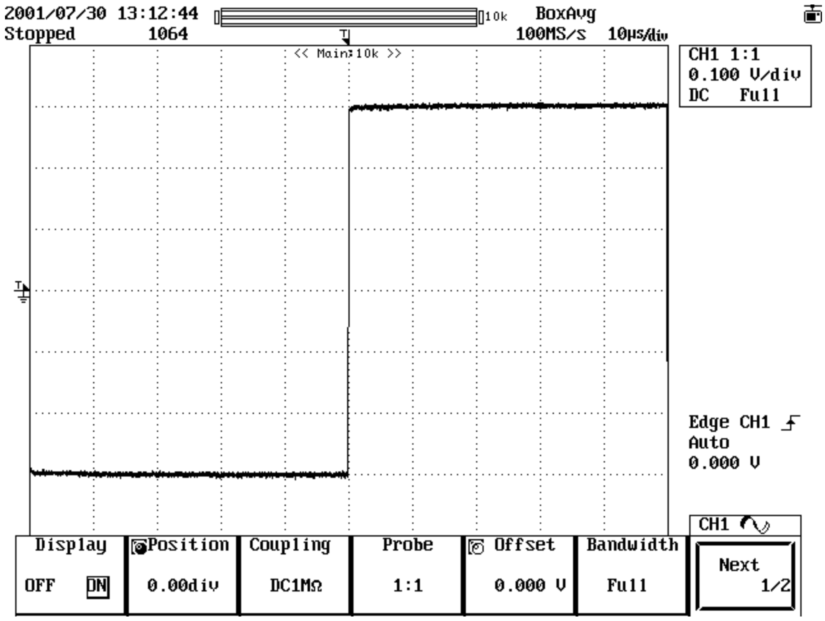


Figure 3.7 Observed Waveform

Chapter 4 Principles of Operation

4.1 Introduction

The block diagrams of the DL1720 are shown in figure 4.1 and figure 4.2.
The block diagrams of the DL1740 are shown in figure 4.3 and figure 4.4.
Figure 4.1 and figure 4.3 are block diagrams of the circuit from the analog input to the data acquisition circuit including the attenuator, one-chip amplifier, analog multiplexer, A/D converter, trigger comparator, trigger circuit, and the ring buffer memory and its controller.
Figure 4.2 and figure 4.4 are block diagrams of (1) the data processing section which processes the acquired data and displays the waveform, (2) the CPU, and (3) the peripheral circuitry.

4.2 Function of Each Assembly

Analog Board Assembly

The analog board assembly has a coupling switch for AC/DC, 1 MΩ/50 Ω, and GND/Measure and a switch circuit for the attenuator (1:1, 10:1, 100:1, 200:1). Relays are used to make the switch. In addition, a one-chip amplifier IC and an analog multiplexer IC are onboard.

The one-chip amplifier IC has a gain switch circuit, a low-pass filter circuit (external capacitor), a trigger coupling circuit (external capacitor), and a trigger bandwidth limiting circuit (external capacitor). In addition, the input offset voltage and the trigger level are varied using an external DC voltage input. The frequency bandwidth of the IC is approximately 600 MHz.

As indicated in figure 4.1 or figure 4.3, the vertical sensitivity from 10 V/div to 2 mV/div is achieved by switching the gain on the attenuator and the one-chip amplifier IC.

The analog multiplexer IC is used to achieve the interleave operation. During the interleave operation, the input signal of CH1 (CH3) is supplied to the A/D converter of CH2 (CH4). The frequency bandwidth of the IC is approximately 2 GHz.

The above-mentioned control signal, offset, and DC voltage for the trigger level are supplied by the analog front-end controller (AFC) IC on the AD4 board (or the AD2 board for the DL1720) assembly.

Table 4.1 Setting Range and Amplifying Level

Setting Range	Attenuator Division Ratio	Amplifying Rate
2 mV/div	1/1	x25
5 mV/div	1/1	x10
10 mV/div	1/1	x5
20 mV/div	1/1	x2.5
50 mV/div	1/1	x1
100 mV/div	1/10	x5
200 mV/div	1/10	x2.5
500 mV/div	1/10	x1
1 V/div	1/100	x5
2 V/div	1/100	x2.5
5 V/div	1/100	x1
10 V/div	1/200	x1

The setting range here is for the 1:1 probe setting.

AD4 Board (or AD2 Board for the DL1720) Assembly

The AD4 board (or AD2 board for the DL1720) assembly has the time base, trigger, A/D converter, and analog control circuits onboard.

The time base is of a PLL configuration. 1 GHz and 800 MHz can be switched. On the DL1720/DL1740, the frequency of the clock is converted to 500 MHz or 400 MHz using high-speed ECL logic and distributed to each channel. When in interleave mode, the clock for CH2 and CH4 is delayed by 1 ns with respect to the clock for CH1 and CH3, respectively (the DL1720 is not equipped with CH3 and CH4). For making minute time measurements of phase difference between the trigger and sampling clock (needed during repetitive sampling mode, for example), the T-V converter (TVC) is used.

The trigger section consists of a comparator, fast trigger logic (FTL), and pulse width detector (PWD). It also has a TV trigger circuit used only on CH1. The comparator has a window comparator function that allows window triggering. The window width is controlled by an external DC voltage input. The frequency bandwidth of the comparator IC is approximately 1 GHz.

The A/D converter operates at 500 MHz only when the sampling rate is 500 MS/s or when in 1 GS/s interleave mode. In all other cases, the A/D converter operates at 400 MHz. Sampling rates of 200 MS/s or lower are attained by extracting a portion of the data sampled at 400 MHz using the RBC on the ACQ4 board (or the ACQ2 board for the DL1720) assembly.

The analog control circuit consists of an analog front-end controller (AFC), a PWM D/A converter, and a serial/parallel converter. This circuit controls the analog section of the analog board assembly and the AD board assembly. There are also EXT CLOCK IN, EXT TRG IN, and TRG GATE IN functions, as well as an active probe power supply (/P4 or /P2 for the DL1720) circuit.

ACQ4 Board (or ACQ2 Board for the DL1720) Assembly

The ACQ4 board (or the ACQ2 board for the DL1720) assembly has a primary data processing section, a secondary data processing section, and a display section (for displaying waveforms and other information).

The primary data processing section consists of the ring buffer memory (PBSRAM) and controller (RBC). The RBC receives the data that is transferred from the A/D converter on the ACQ4 board (or the ACQ2 board for the DL1720) assembly and performs the primary data processing such as the above-mentioned data extraction of sampled data, envelope, and box averaging, then stores the data in the ring buffer memory. The written data are transferred to the acquisition memory interface (AMI) in the secondary data processing section according to the trigger address.

The secondary data processing section consists of the AMI, work memory (PBSRAM), and the acquisition memory (synchronous DRAM). The AMI processes the data (averaging, for example) that is transferred from the RBC and stores the result in the acquisition memory. Then, the AMI converts the stored data to display data by performing additional processing such as compression and interpolation. The resultant data are transferred to the graphic control process (GCP) according to the display update interval. The AMI also has computation functions (addition, subtraction, multiplication, division, differentiation, integration, etc.) and auxiliary functions such as automated measurement of waveform parameters.

The display section consists of a GCP, graphic memory (synchronous GRAM), character memory (fast SRAM), and VGA VIDEO OUT circuits. The GCP writes the waveform data that are transferred from the AMI to the graphic memory. It synthesizes the contents of the graphic memory and the character memory and displays them on the TFT color LCD. The GCP also controls the built-in printer.

CPU Board Assembly

The CPU board consists of each circuit block’s control circuit, an I/O circuit, and other peripheral circuits.

A Hitachi HD6417709A is used for the CPU. The actions of each circuit block connected to the CPU bus are controlled by the CPU.

The main memory (synchronous DRAM) and Flash memory are included in the CPU’s peripheral circuits.

In the I/O circuit, the following circuits carry out control through the CIO (CPU I/O interface IC). They are the backup memory, keyboard, floppy disk drive controller (Zip drive circuit), GP-IB controller, USB I/F circuit, and SCSI controller (option:/C7). On the CPU bus, they are the Ethernet I/F (option:/C10)circuit, and the serial I/F circuit.

Key Board Assembly

Key switches, LEDs, the rotary encoder, and the jog shuttle are installed on the key board assembly.

ADP Board Assembly

The ADP board assembly distributes the power supply output from the ACQ4 board (or the ACQ2 board for the DL1720) to the AD4 board assembly.

BUS Board Assembly

Controls the exchange of signals between the CPU, KEY, ACQ4 (or the ACQ2 for the DL1720), and AD board assemblies and a printer assembly. Supplies output from the power supply unit to the CPU, KEY, ADP and ACQ4 board (or the ACQ2 board for the DL1720) assemblies and a printer assembly. +12 V generation takes place on this board.

LCD Board Assembly

The LCD board assembly converts the connector of the LCD signal cable.

LCD Assembly

6.4-inch color TFT LC display
Full display resolution: 640 x 480
Waveform display resolution: 500 x 384

Printer Assembly (Optional)

The printer is of a thermal sensitivity type that prints 8 dots per mm and 832 dots per line. A hardcopy of the display is printed in approximately 12 seconds.

FDD Assembly (-J1)

The FDD assembly supports 3.5-inch floppy disks (720 KB and 1.44 MB formats).

Zip Assembly (-J2)

The Zip assembly supports both 100 MB and 250 MB capacity media.

Zip Board Assembly (-J2)
The Zip board assembly is an adapter which connects the Zip drive to the CPU board.

I/F Board Assembly (Optional)
The I/F board assembly supports both SCSI I/F and serial I/F, and is controlled by the CPU and CPU I/O interface (CIO) on the CPU board.

Ethernet Board Assembly (Optional)
Option /C10 consists of an Ethernet interface section. The Ethernet interface section has an Ethernet connector and a LAN (local area network) controller. These interfaces are controlled by the CPU and CPU I/O interface (CIO) that are on the CPU board assembly.

OPT TRIG Board Assembly (Optional)
Option /F5 consists of I2C BUS trigger section. The OPT TRIG board assembly provide I2C BUS trigger signal.

4.3 Function of Each ASIC

The following items describe the IC and the gate array function used in each assembly.

Analog Front-End Controller (AFC)
The AFC is a Bi-CMOS gate array. Its main functions are controlling the analog front-end circuit and assisting the trigger circuit. It includes a PWM signal output circuit used for D/A conversion, a parallel port, a serial port, a trigger hold-off circuit, an auto trigger circuit, a TV trigger generator, a fast counter, and a slow counter.

Fast Trigger Logic (FTL)
The FTL is an ECL gate array. Its main functions include generation of trigger signals according to the trigger functions, trigger hold-off function, and control of the time-to-voltage converter (TVC).

Pulse Width Detector (PWD)
The PWD is an analog IC. Using an internally-startable oscillator and an external counter (AFC), it detects the pulse width for width triggering.

Time-to-Voltage Converter (TVC)
This is the analog IC that measures the internal sampling clock and trigger time, and converts time to voltage.

Ring Buffer Memory Controller (RBC)
The RBC is a Bi-CMOS gate array. It performs primary processing of the data such as the extraction of the sampled data, envelope, and box averaging. It also provides functions for controlling the ring buffer memory and the interface to the acquisition memory interface (AMI).

Acquisition Memory Interface (AMI)
The AMI is a CMOS gate array. Its functions include interfacing to the ring buffer memory controller (RBC), interfaceing to the graphic control processor (GCP), averaging, history control, waveform computation, and auxiliary functions for the automated measurement of waveform parameters.

Graphic Control Processor (GCP)
The GCP is a CMOS gate array. Its functions include interfacing to the acquisition memory interface (AMI), graphic memory and character memory control, a waveform drawing function (accumulated display, for example), built-in printer control, and display data generation for the LCD.

CPU I/O Interface (CIO)
The CIO is a CMOS gate array. Its functions include interfacing to the CPU (HD6417709A) and the peripheral ICs, keyboard control, LED control, interrupt control, and DMA selection.

I2C BUS Trigger Logic 2 (ITL2)
The ITL2 is field programmable gate array. Its function is generation of I2C BUS trigger signal.

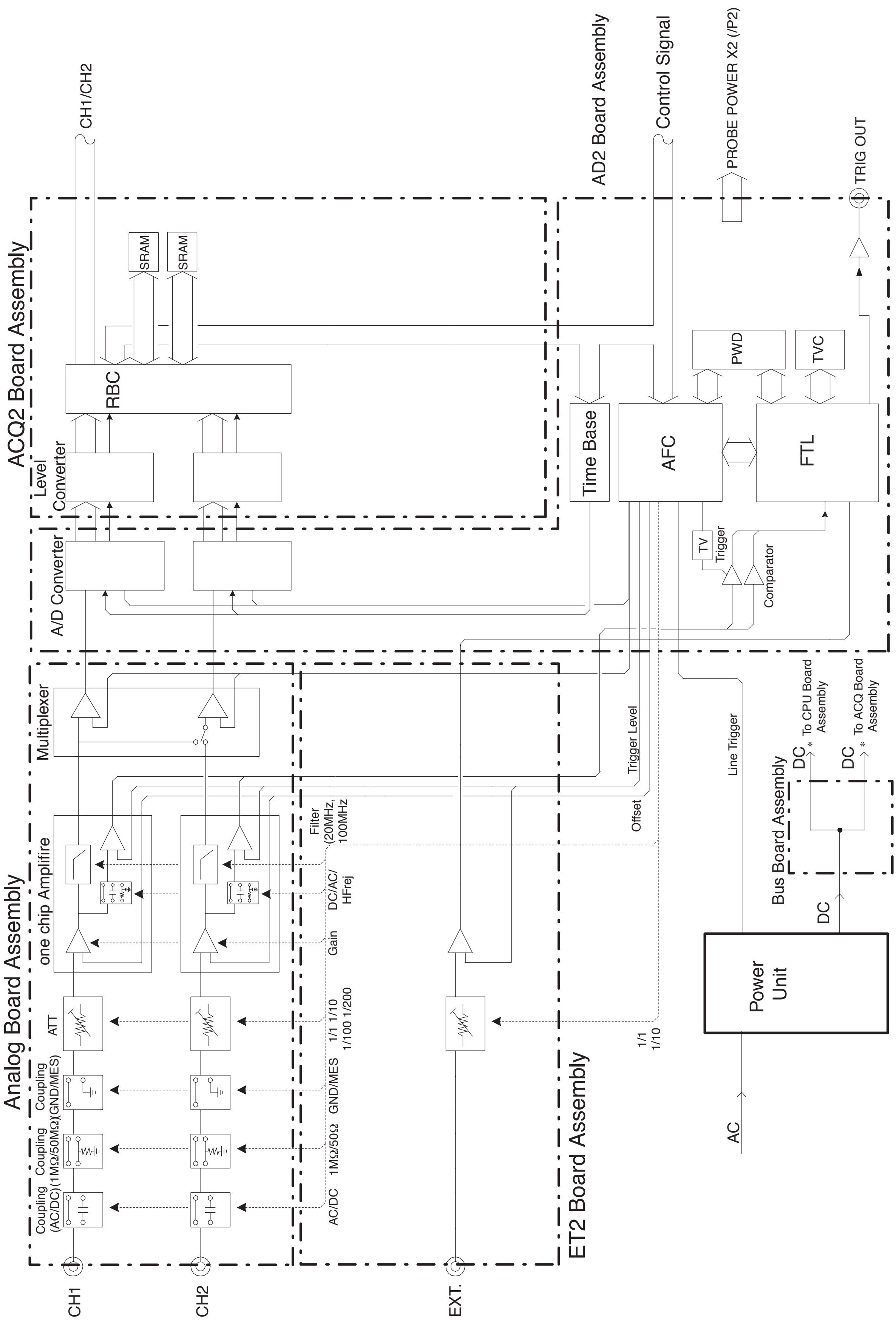


Figure 4.1 Block Diagram (Analog Section) of the DL1720

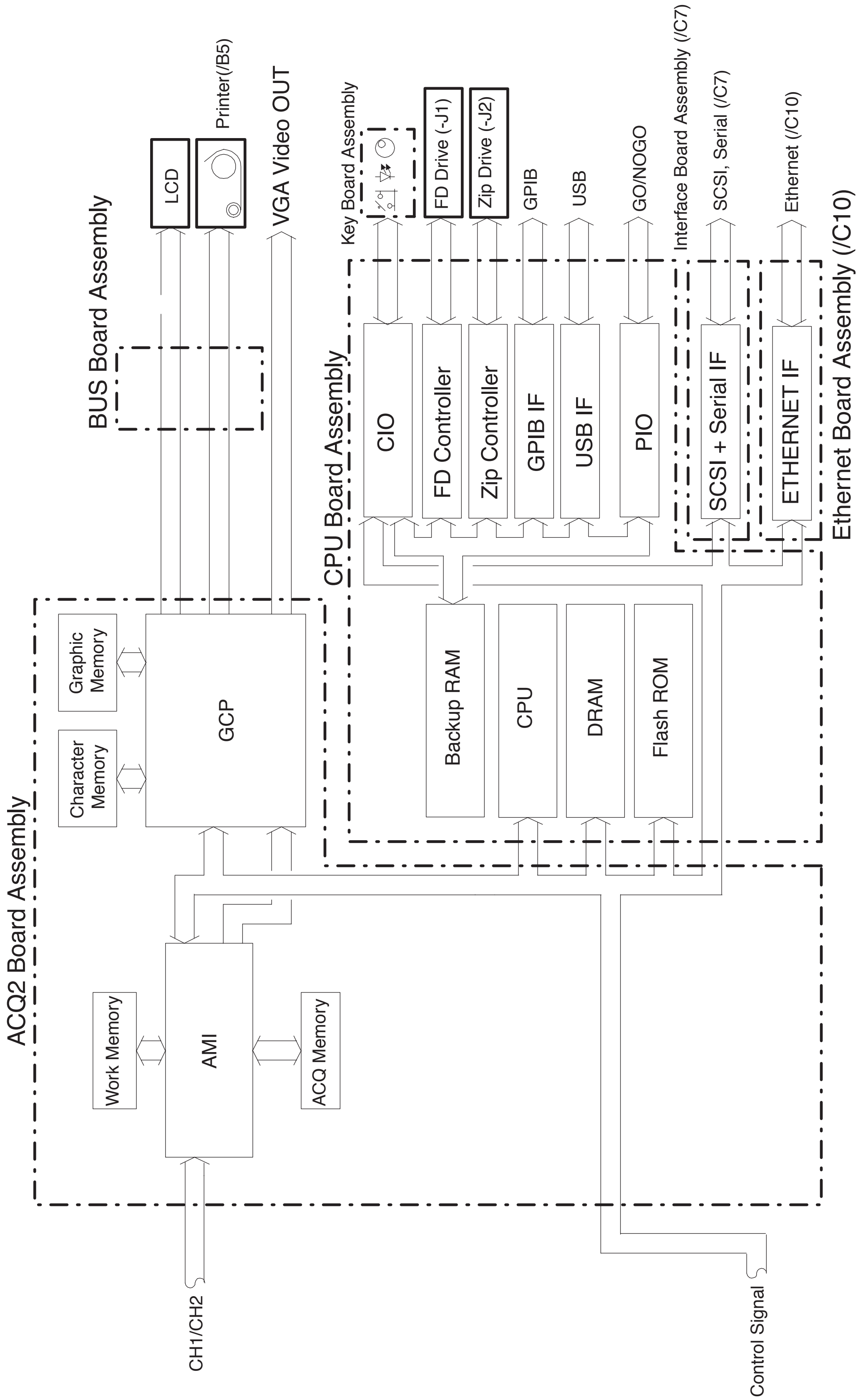


Figure 4.2 Block Diagram (Digital Section) of the DL1720

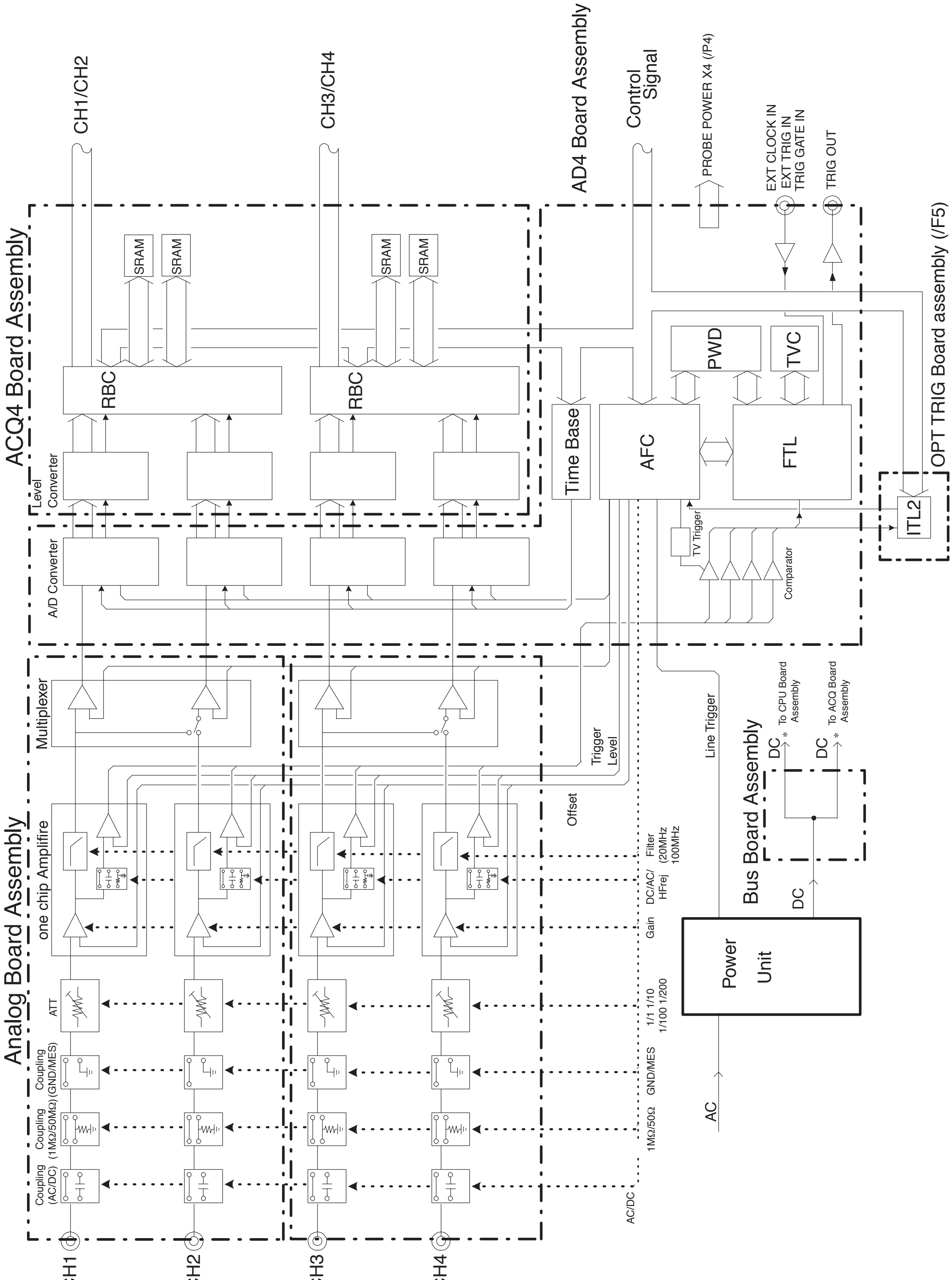


Figure 4.3 Block Diagram (Analog Section) of the DL1740

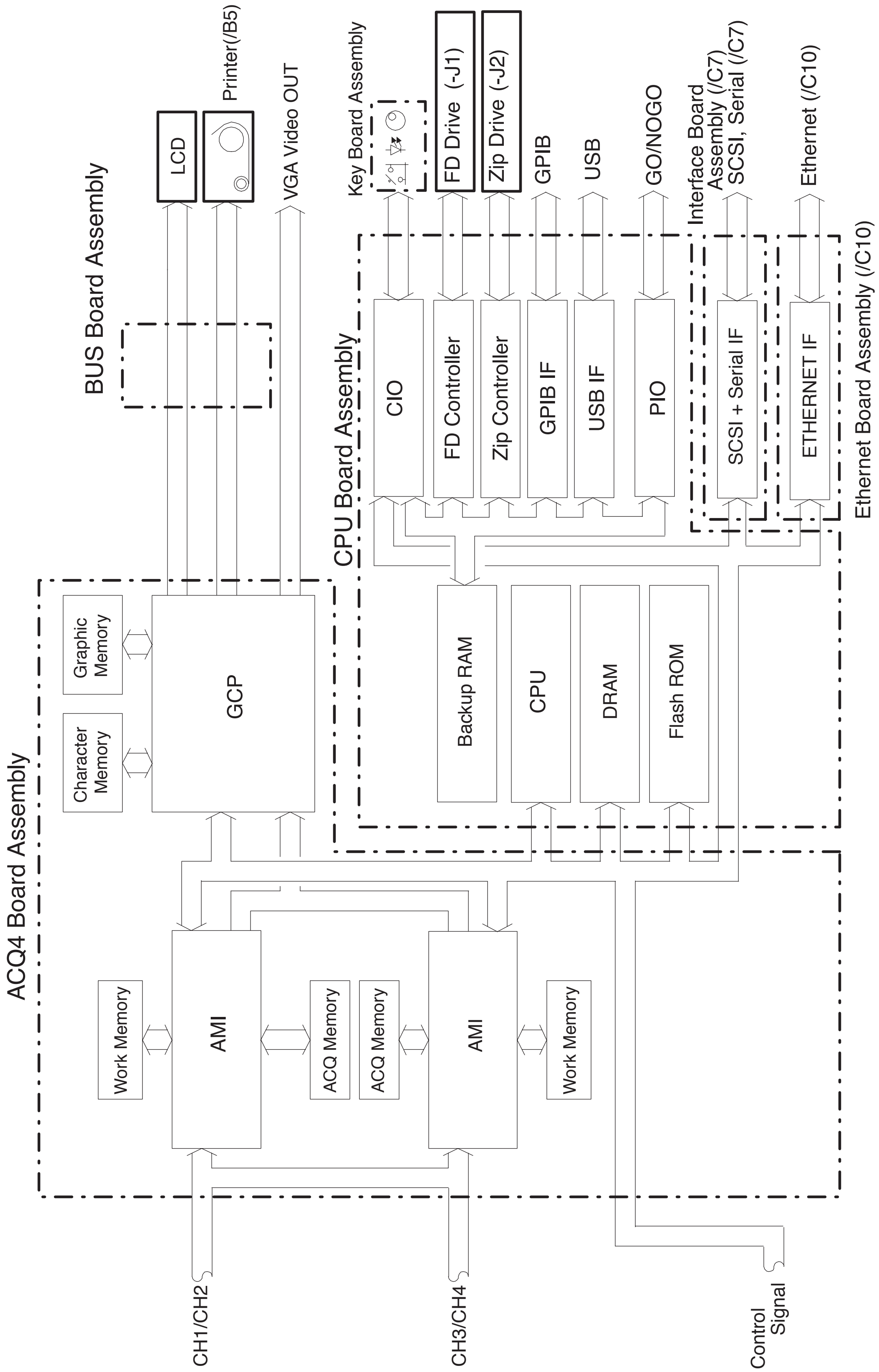


Figure 4.3 Block Diagram (Digital Section) of the DL1740

Chapter 5 Troubleshooting

5.1 Introduction

This chapter describes possible solutions for rectifying errors. In such cases, assembly removal may be required.
Please heed the following warning.

WARNING

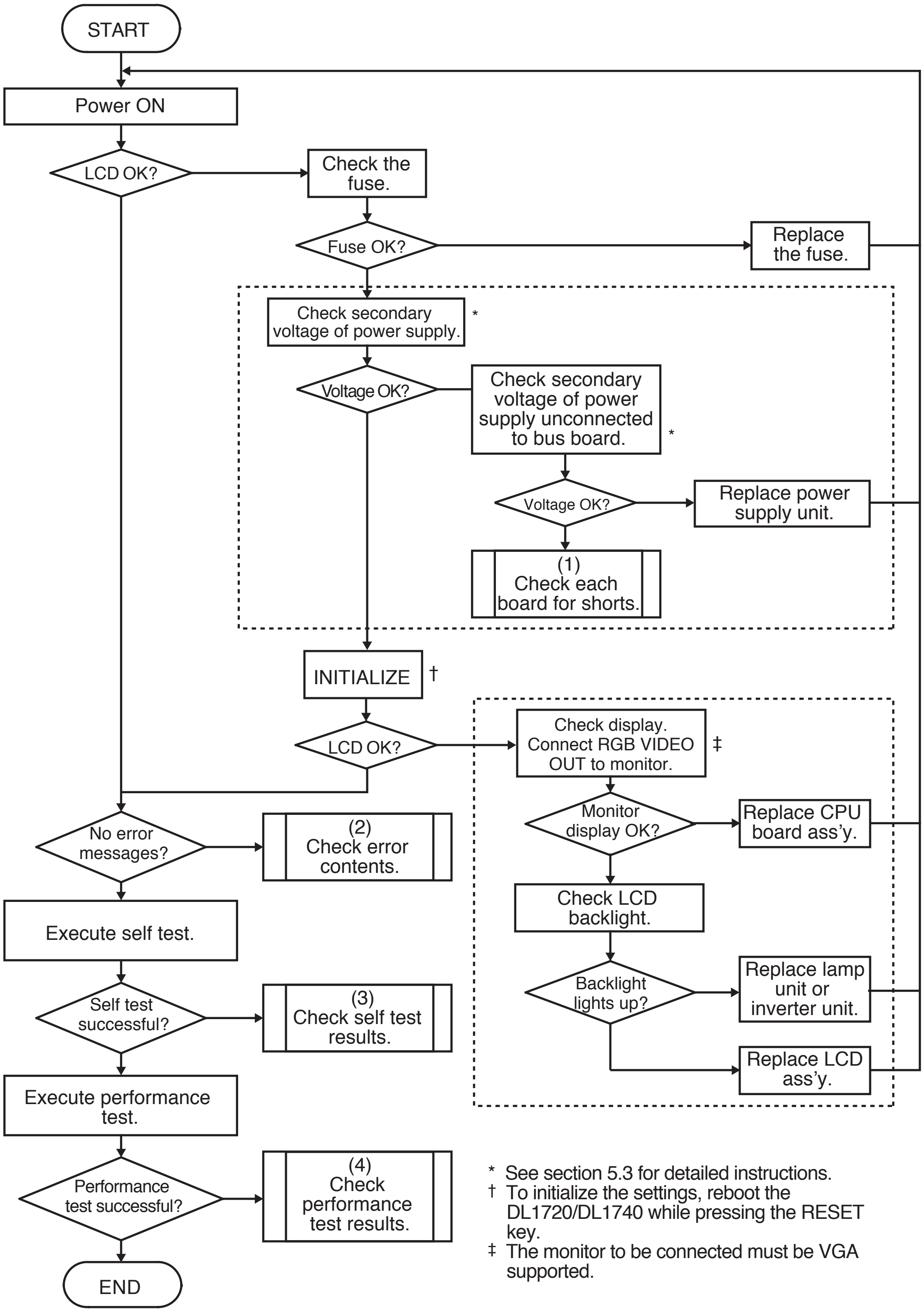
Assembly replacement is to be performed only by qualified service technicians who have experience working with the hazards involved (such as fire and electrical shock).

Note

If an error message is displayed, the error may have been caused by incorrectly operating the unit. Refer to the user's manual, and perform the correct operation.

5.2 Flowchart

Figure 5.1, "Troubleshooting Flowchart" shows an analytical method for handling malfunctions.



* See section 5.3 for detailed instructions.
† To initialize the settings, reboot the DL1720/DL1740 while pressing the RESET key.
‡ The monitor to be connected must be VGA supported.

Maintenance Service is Required
Contact your nearest YOKOGAWA representative as listed on the back cover of this manual.

Figure 5.1 Troubleshooting Flowchart

(1)

A short may occur in an assembly other than the power supply unit. To check in which voltage line a short has occurred, investigate each assembly to which voltage is supplied, using a circuit tester. Table 5.1 “Correspondence of Assembly to Voltage” shows the relationship between assemblies and voltages supplied to them.

Table 5.1 Correspondence of Assembly to Voltage

Voltage Series	Assembly No.	Assembly
+24 V	B9989MJ	ACQ2 Board Assembly (MODEL: 701705)
	B9989MD	ACQ4 Board Assembly (MODEL: 701710)
	B9989ME	BUS Board Assembly
	B9989GP	PRINTER Assembly (Option: /B5)
	B9989SA	FAN Assembly
+12 V	B9989MG	ET2 Board Assembly (MODEL: 701705)
	B9989MB	AD4 Board Assembly (MODEL: 701710)
	B9989MB	AD4 Board Assembly (MODEL: 701710)
	B9989MJ	ACQ2 Board Assembly (MODEL: 701705)
	B9989MD	ACQ4 Board Assembly (MODEL: 701710)
	B9989ME	BUS Board Assembly
	B9989MF	ADP Board Assembly
	A1468UP	Inverter Unit
+5 V	B9989MG	ET2 Board Assembly (MODEL: 701705)
	B9989ML*	ANALOG Board Assembly (MODEL: 701705, 701710)
	B9989MH	AD2 Board Assembly (MODEL: 701705)
	B9989MB	AD4 Board Assembly (MODEL: 701710)
	B9989MC	CPU Board Assembly
	B9989MJ	ACQ2 Board Assembly (MODEL: 701705)
	B9989MD	ACQ4 Board Assembly (MODEL: 701710)
	B9989ME	BUS Board Assembly
	B9989MF	ADP Board Assembly
	B9989MK	KEY Board Assembly
	B9989MS	I/F Board Assembly (Option: /C7)
	B9989MT	ETHERNET Board Assembly (Option: /C10)
	B9989MM	OPT TRIG Board Assembly (Option: /F5)
	A1092UN	FDD Unit (Model: -J1)
	A1152UN	Zip Drive Unit (Model: -J2)
+3.3 V	B9989MH	AD2 Board Assembly (MODEL: 701705)
	B9989MB	AD4 Board Assembly (MODEL: 701710)
	B9989MC	CPU Board Assembly
	B9989MJ	ACQ2 Board Assembly (MODEL: 701705)
	B9989MD	ACQ4 Board Assembly (MODEL: 701710)
	B9989ME	BUS Board Assembly
	B9989MF	ADP Board Assembly
	B9989MS	I/F Board Assembly (Option: /C7)
	B9989MT	ETHERNET Board Assembly (Option: /C10)
	B9989MM	OPT TRIG Board Assembly (Option: /F5)
–2 V	B9989ML*	ANALOG Board Assembly (MODEL: 701705, 701710)
	B9989MH	AD2 Board Assembly (MODEL: 701705)
	B9989MB	AD4 Board Assembly (MODEL: 701710)
	B9989MJ	ACQ2 Board Assembly (MODEL: 701705)
	B9989MD	ACQ4 Board Assembly (MODEL: 701710)
	B9989ME	BUS Board Assembly
	B9989MF	ADP Board Assembly
–5.2 V	B9989MG	ET2 Board Assembly (MODEL: 701705)
	B9989ML*	ANALOG Board Assembly (MODEL: 701705, 701710)
	B9989MH	AD2 Board Assembly (MODEL: 701705)
	B9989MB	AD4 Board Assembly (MODEL: 701710)
	B9989MJ	ACQ2 Board Assembly (MODEL: 701705)
	B9989MD	ACQ4 Board Assembly (MODEL: 701710)
	B9989ME	BUS Board Assembly
	B9989MF	ADP Board Assembly
–12 V	B9989MG	ET2 Board Assembly (MODEL: 701705)
	B9989MH	AD2 Board Assembly (MODEL: 701705)
	B9989MB	AD4 Board Assembly (MODEL: 701710)
	B9989MJ	ACQ2 Board Assembly (MODEL: 701705)
	B9989MD	ACQ4 Board Assembly (MODEL: 701710)
	B9989MF	ADP Board Assembly

* The assembly number differs depending on the date of manufacture as follows:
During or before December, 2001: B9989MA
After December, 2001 : B9989ML

(2)

When trouble occurs, refer to the user's manual to determine whether the trouble was caused by erroneous operation or by a hardware defect. Table 5.2, "Correspondence of Messages to Defective Assemblies," shows which kind of trouble may be due to a hardware failure.

Table 5.2 Correspondence of Messages to Defective Assemblies

Code	Message	Assembly No.	Assembly
713	Calibration failure. •••	B9989MG	ET2 Board Assembly (MODEL: 701705)
		B9989ML*	ANALOG Board Assembly (MODEL: 701705, 701710)
		B9989MH	AD2 Board Assembly (MODEL: 701705)
		B9989MB	AD4 Board Assembly (MODEL: 701710)
		B9989MC	CPU Board Assembly
		B9989MJ	ACQ2 Board Assembly (MODEL: 701705)
		B9989MD	ACQ4 Board Assembly (MODEL: 701710)
		B9989ME	BUS Board Assembly
		B9989MF	ADP Board Assembly
901	Failed to backup setup data. •••	B9989MC	CPU Board Assembly
906	Fan stopped •••	B9989SA	FAN Assembly
907	Backup battery is flat.	B9989MC	CPU Board Assembly

* The assembly number differs depending on the date of manufacture as follows:
During or before December, 2001: B9989MA
After December, 2001 : B9989ML

(3)

When trouble occurs, check the test item displaying FAIL and select the relevant defective item from table 5.3, "Correspondence of Test Items to Defective Assemblies." If necessary, replace the relevant assembly.

Table 5.3 Correspondence of Test Item to Defective Assemblies

Test item	Assembly No.	Assembly
Key Board	B9989MC	CPU Board Assembly
	B9989ME	Bus Board Assembly
	B9989MK	KEY Board Assembly
Memory	B9989MC	CPU Board Assembly
FDD	B9989MC	CPU Board Assembly
	A1092UN	FDD Unit (Model: -J1)
Zip	B9989MC	CPU Board Board Assembly
	B9989MU	Zip Board Assembly
	A1152UN	Zip Drive Unit (Model: -J2)
SCSI	B9989MC	CPU Board Assembly
	B9989MS	I/F Board Assembly (Option: /C7)
Printer	B9989MC	CPU Board Assembly
	B9989MJ	ACQ2 Board Assembly (MODEL: 701705)
	B9989MD	ACQ4 Board Assembly (MODEL: 701710)
	B9989ME	Bus Board Assembly
	B9989GP	Printer Assembly (Option: /B5)
Accuracy	B9989MG	ET2 Board Assembly (MODEL: 701705)
	B9989ML*	ANALOG Board Assembly (MODEL: 701705, 701710)
	B9989MH	AD2 Board Assembly (MODEL: 701705)
	B9989MB	AD4 Board Assembly (MODEL: 701710)
	B9989MC	CPU Board Assembly
	B9989MJ	ACQ2 Board Assembly (MODEL: 701705)
	B9989MD	ACQ4 Board Assembly (MODEL: 701710)
	B9989ME	BUS Board Assembly
	B9989MF	ADP Board Assembly

* The assembly number differs depending on the date of manufacture as follows:
During or before December, 2001: B9989MA
After December, 2001 : B9989ML

(4)

When trouble occurs, check the non-conforming test and select the relevant defective assembly from table 5.4, “Correspondence of Test Items to Defective Assemblies.” If necessary, replace the relevant assembly.

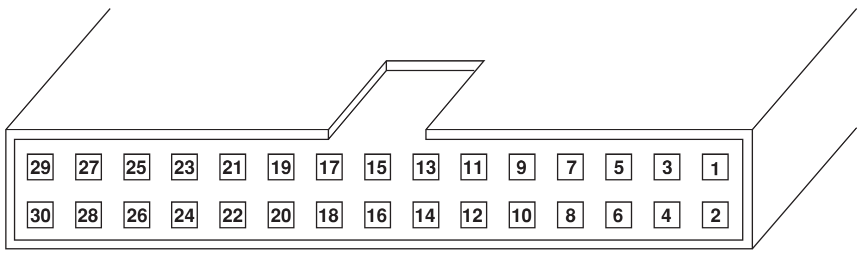
Table 5.4 Correspondence of Test Item to Defective Assemblies

Test item	Assembly No.	Assembly
2.5 Vertical Axis DC Voltage Accuracy Test	B9989ML*	ANALOG Board Assembly (MODEL: 701705, 701710)
	B9989MH	AD2 Board Assembly (MODEL: 701705)
	B9989MB	AD4 Board Assembly (MODEL: 701710)
2.6 Frequency Response Test	B9989ML*	ANALOG Board Assembly (MODEL: 701705, 701710)
	B9989MH	AD2 Board Assembly (MODEL: 701705)
	B9989MB	AD4 Board Assembly (MODEL: 701710)
2.7 Time-base Accuracy Test	B9989ML*	ANALOG Board Assembly (MODEL: 701705, 701710)
	B9989MH	AD2 Board Assembly (MODEL: 701705)
	B9989MB	AD4 Board Assembly (MODEL: 701710)
2.8 Trigger Sensitivity Test	B9989ML*	ANALOG Board Assembly (MODEL: 701705, 701710)
	B9989MH	AD2 Board Assembly (MODEL: 701705)
	B9989MB	AD4 Board Assembly (MODEL: 701710)
2.9 Trigger Accutracy Test	B9989ML*	ANALOG Board Assembly (MODEL: 701705, 701710)
	B9989MH	AD2 Board Assembly (MODEL: 701705)
	B9989MB	AD4 Board Assembly (MODEL: 701710)

* The assembly number differs depending on the date of manufacture as follows:
During or before December, 2001: B9989MA
After December, 2001 : B9989ML

5.3 Power Supply Secondary Voltage

Check whether the power supply secondary voltage fits the values listed on figure 5.2, “Power Supply Secondary Terminals” and Table 5.5, “Power Supply Secondary Terminal’s Name.”



Figuer 5.2 Power Supply Secondary Terminals

Table 5.5 Power Supply Secondary Terminal’s Name

Pin No.	Name
1	Sense
2, 4	+24 V
5	Remote
6	AC5 V
8	–12 V
10	–5.2 V
13, 14	–2 V
17, 18	+5 V
25-30	+3.3 V
3, 7, 9, 11, 12, 15, 16, 19—24	GND

When checking the secondary voltage of the power supply unit apart from the main unit, short the remote pin to ground and turn ON the main switch of the power supply unit located on the rear panel.

5.4 Self Test

After turning the power ON, first press the ***MISC*** key and then the **Next 1/2** soft key. Press the **Self Test** soft key and then the **Test Item** soft key to display the **Self Test** menu screen (figure 5.3).

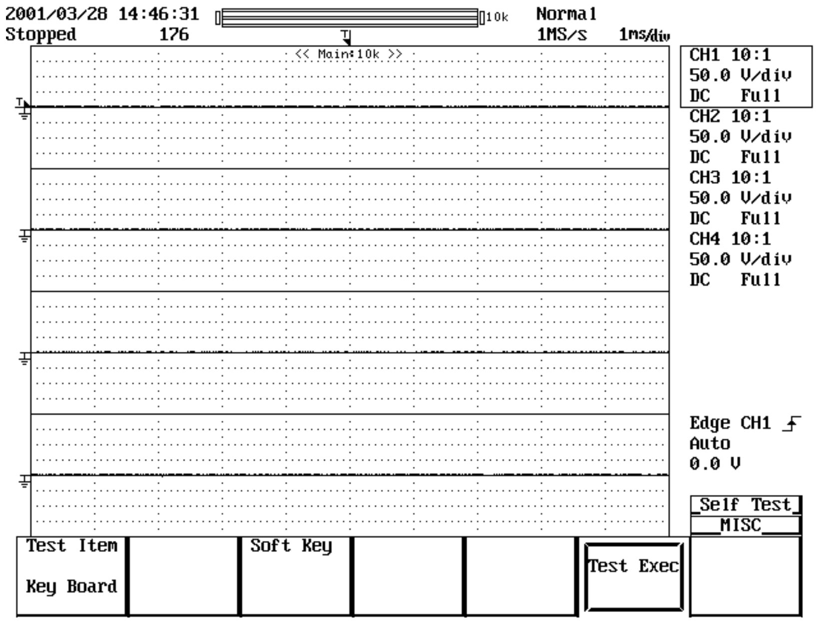


Figure 5.3 Self Test Menu

Press the soft key of the desired self test object.

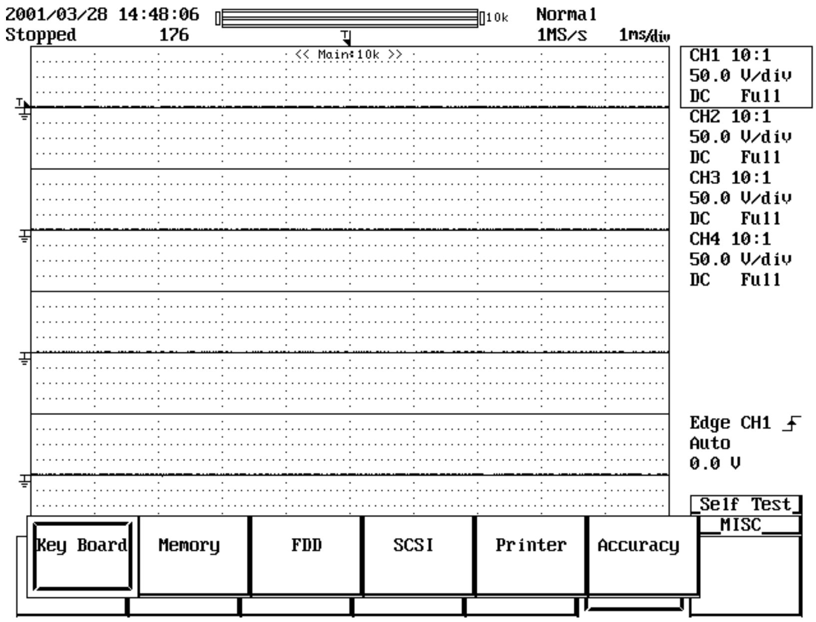


Figure 5.4 Self Test Item

5.4.1 Key Board Test

Check the operations of all keys, rotary knobs, and the jog-shuttle on the front panel.

1. Press the **Test Item** soft key in the **Self Test** menu, and select **Key Board**. Press the **Exec** soft key to start the key test.
2. The names of each key you press should be inversely displayed on a white background. To complete the key test, press all the keys at the front panel one by one. To abort the key test, press the ***ESC*** key twice.

5.4.2 Memory Test

After the memory test is performed, the results are displayed. When the test has been completed and no problems were detected, *Pass* is displayed on the screen (refer to figure 5.5). If a problem was detected, *Failed* is displayed on the screen. Refer to table 5.3 to select the relevant defective assembly.

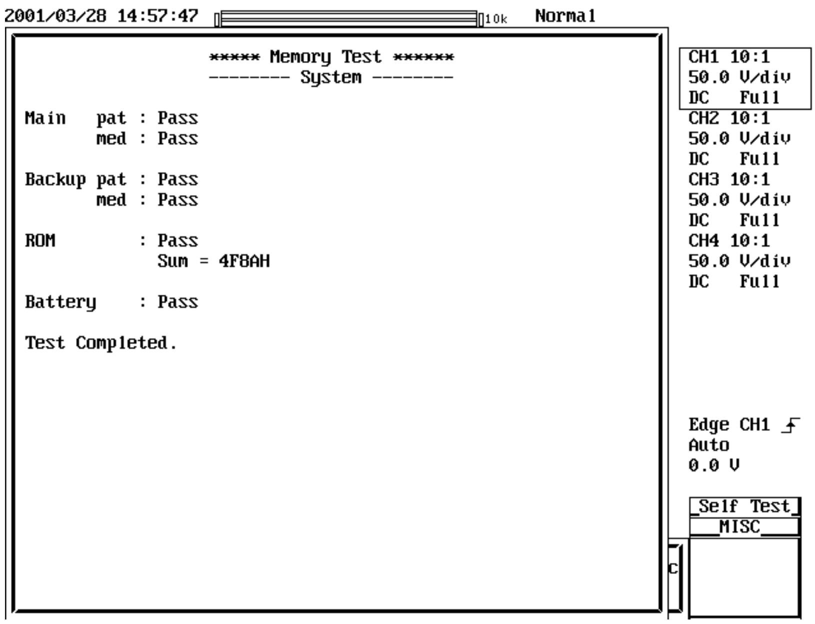


Figure 5.5 Execution Results of the Memory Test

5.4.3 FDD Test

After the FDD test is performed, the results are displayed. Insert a floppy disk into the drive before executing the test. If the test has been completed and no problems were detected, *Pass* is displayed on the screen (refer to figure 5.6). If a problem was detected, *Failed* is displayed on the screen. Refer to table 5.3 to select the relevant defective assembly.

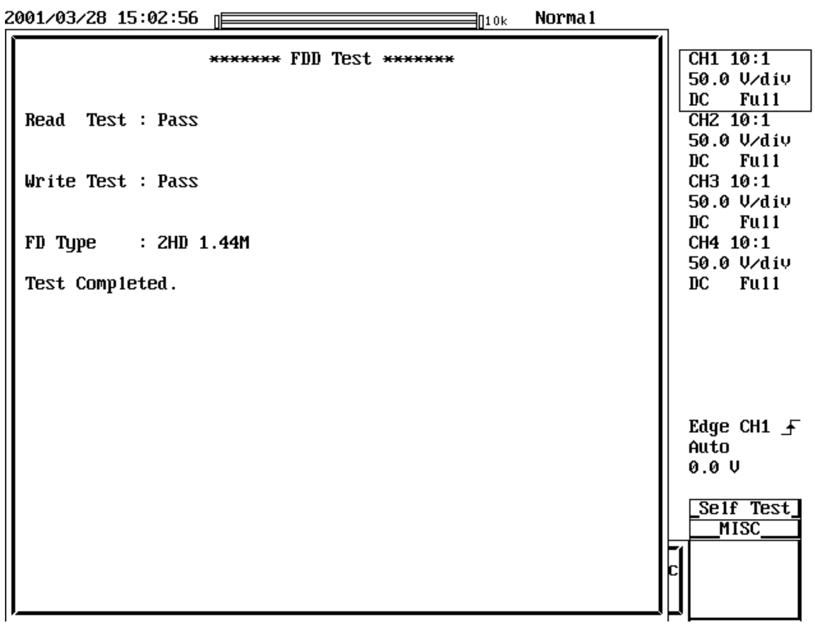


Figure 5.6 Execution Results of the FDD Test

5.4.4 Zip Test

After the Zip test is performed, the results are displayed. Insert a Zip disk into the drive before excuting the test. If the test has been completed and no problems were detected, *Pass* is displayed on the screen (refer to figure5.7). If a problem was detected, *Failed* is displayed on the screen. Refer to table 5.3 to select the relevant defective assembly.

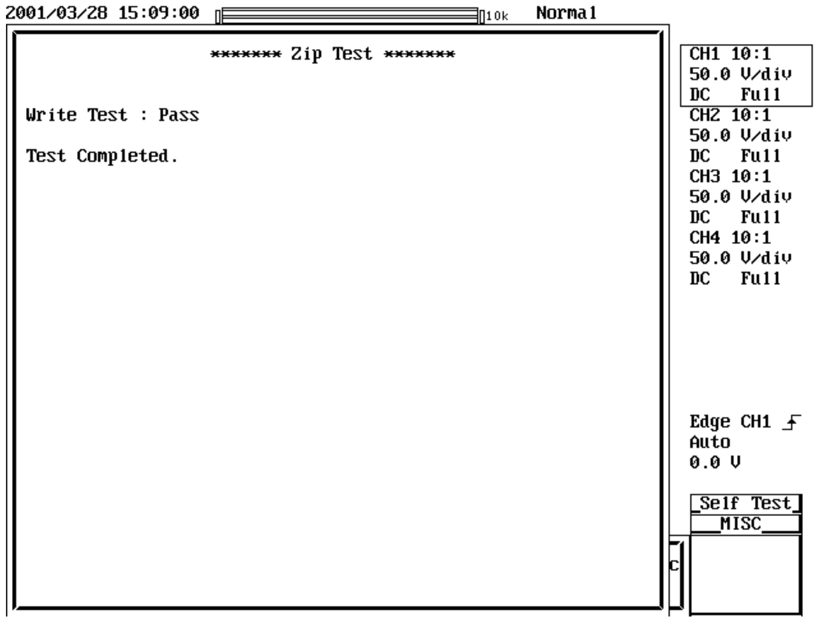


Figure 5.7 Execution Results of the Zip Test

5.4.5 SCSI Test

After the SCSI test is performed, the results are displayed. When the test has been completed and no problems were detected, *Pass* is displayed on the screen (refer to figure 5.8). If a problem was detected, *Failed* is displayed on the screen. Refer to the table 5.3 to select the relevant defective assembly.

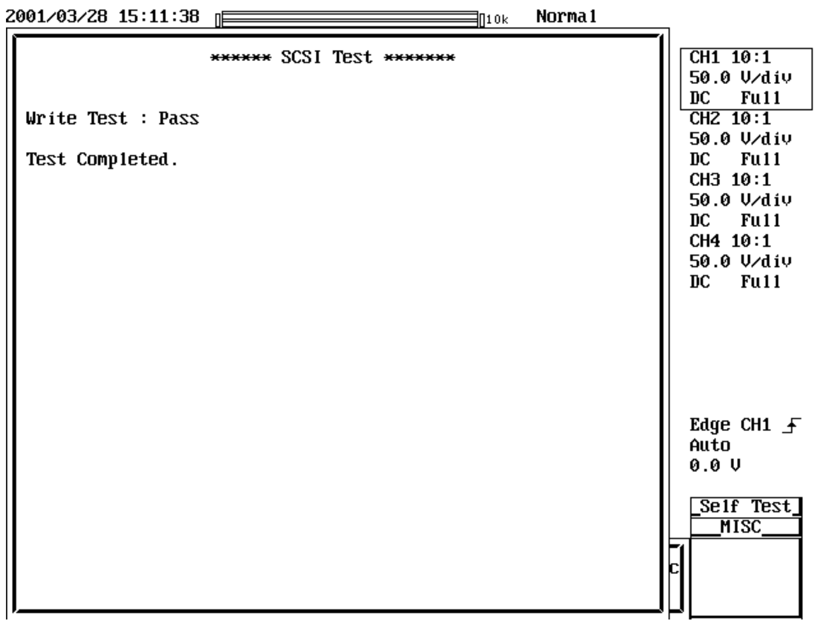


Figure 5.8 Execution Results of the Accuracy Test

5.4.6 Printer Test

If the DL1720/DL1740 is equipped with the optional printer (/B5), print out the patterns shown in figure 5.9, “Printer Print Patterns” on the printing paper.

1: Vertically printed lines on alternate dots
2: Checkered pattern every other dot
3: Checkered pattern every other 2 dots
4: Checkered pattern every other 4 dots
5: Checkered pattern every other 8 dots
6: Checkered pattern every other 16 dots
7: Checkered pattern every other 32 dots
8: Checkered pattern every other 64 dots
9: Horizontally printed lines on alternate line

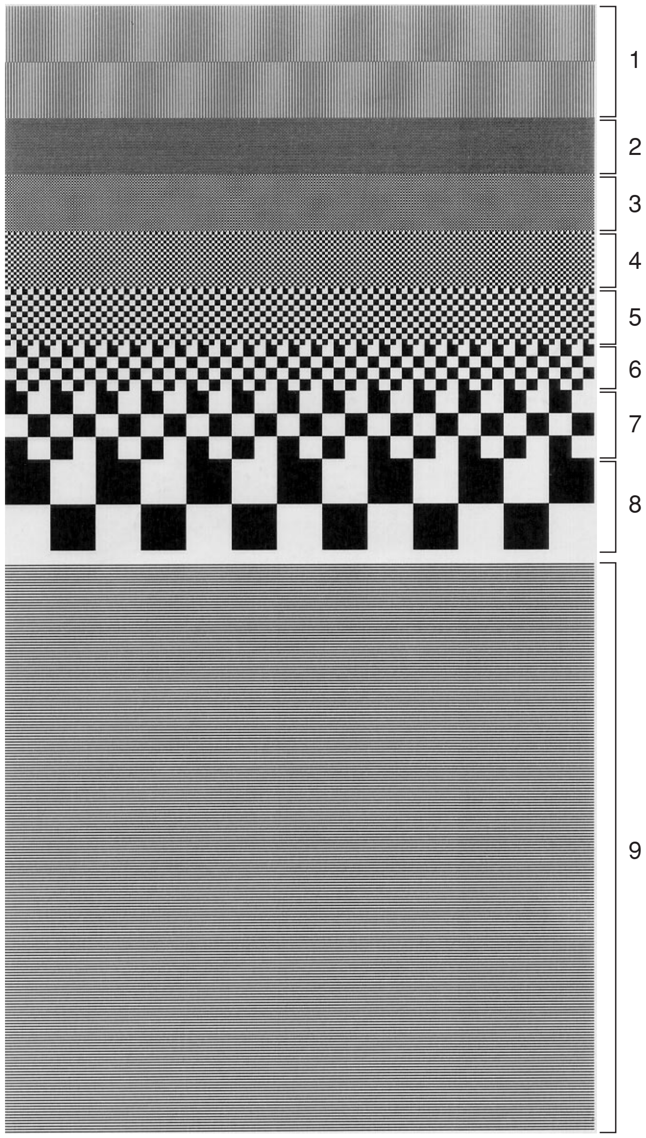


Figure 5.9 Printer Print Patterns

5.4.7 Accuracy Test

After the accuracy test is performed, the results are displayed. When the test has been completed and no problems were detected, *Pass* is displayed on the screen (refer to figure 5.10). If a problem was detected, *Failed* is displayed on the screen. Refer to the table 5.3 to select the relevant defective assembly.

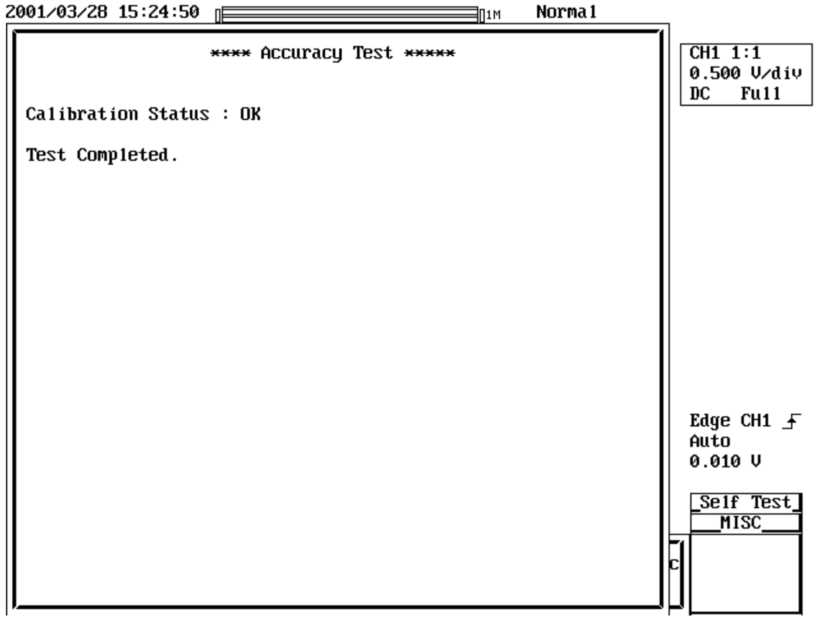
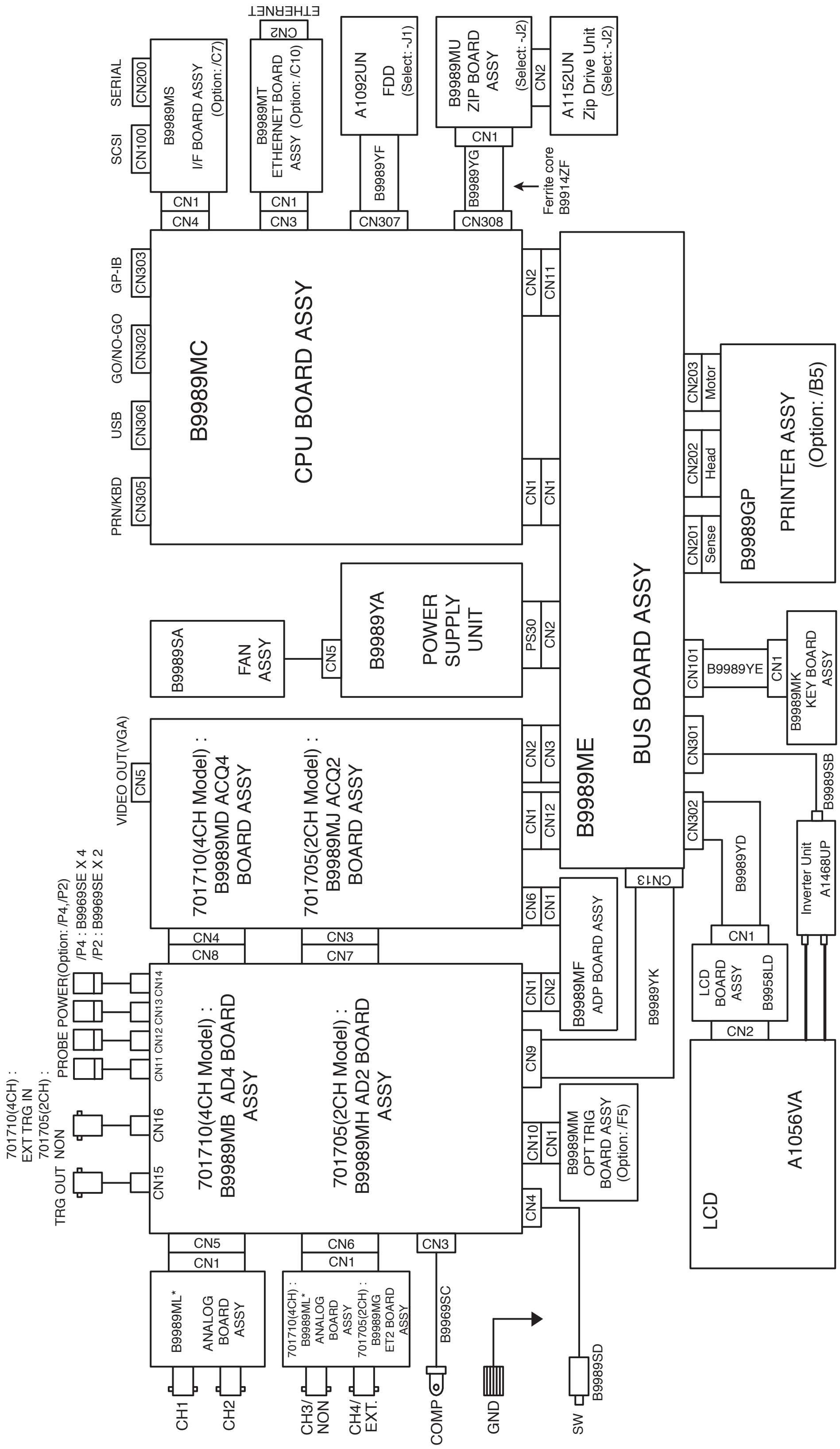


Figure 5.10 Execution Results of the Accuracy Test

Chapter 6 Schematic Diagram

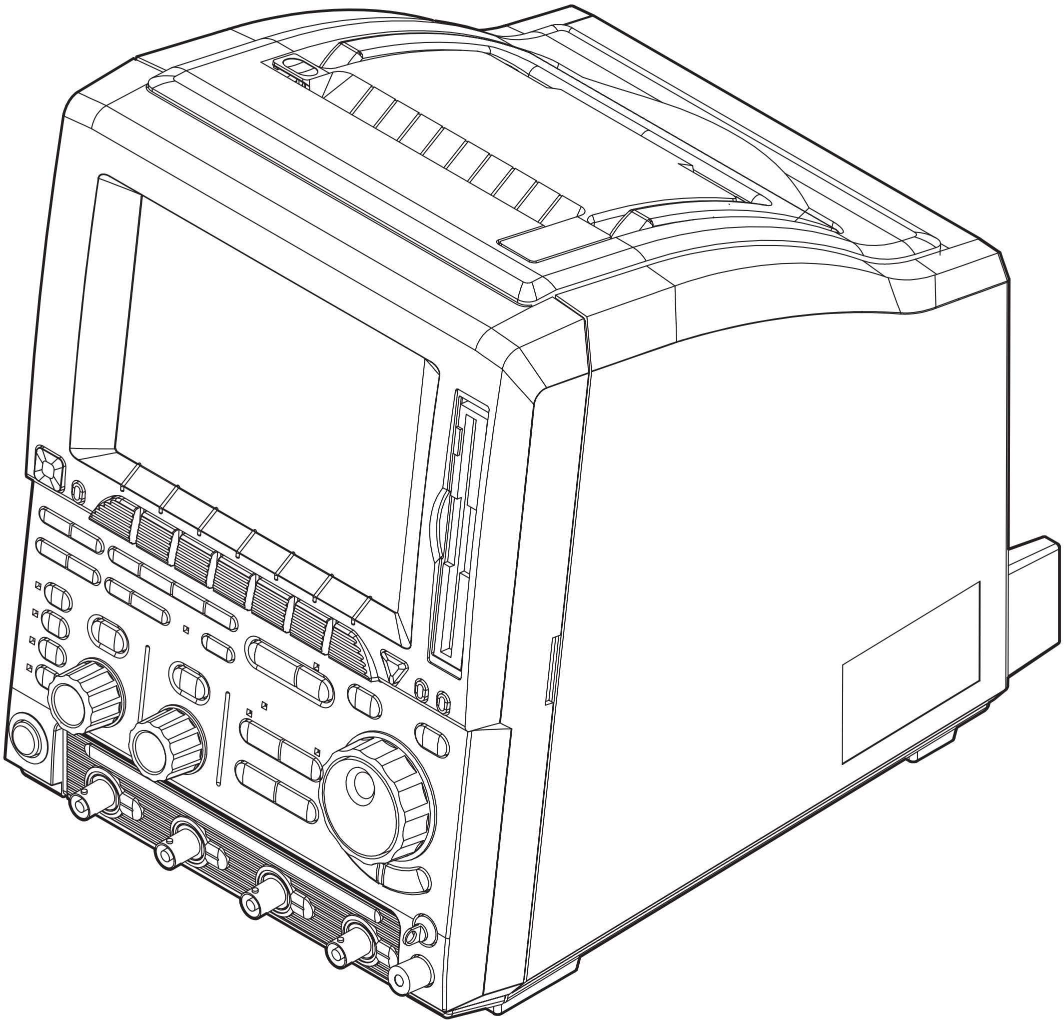


* The assembly number differs depending on the date of manufacture as follows:
During or before December, 2001: B9989MA
After December, 2001 : B9989ML

Figure 6.1 Schematic Diagram of the DL1720/DL1740

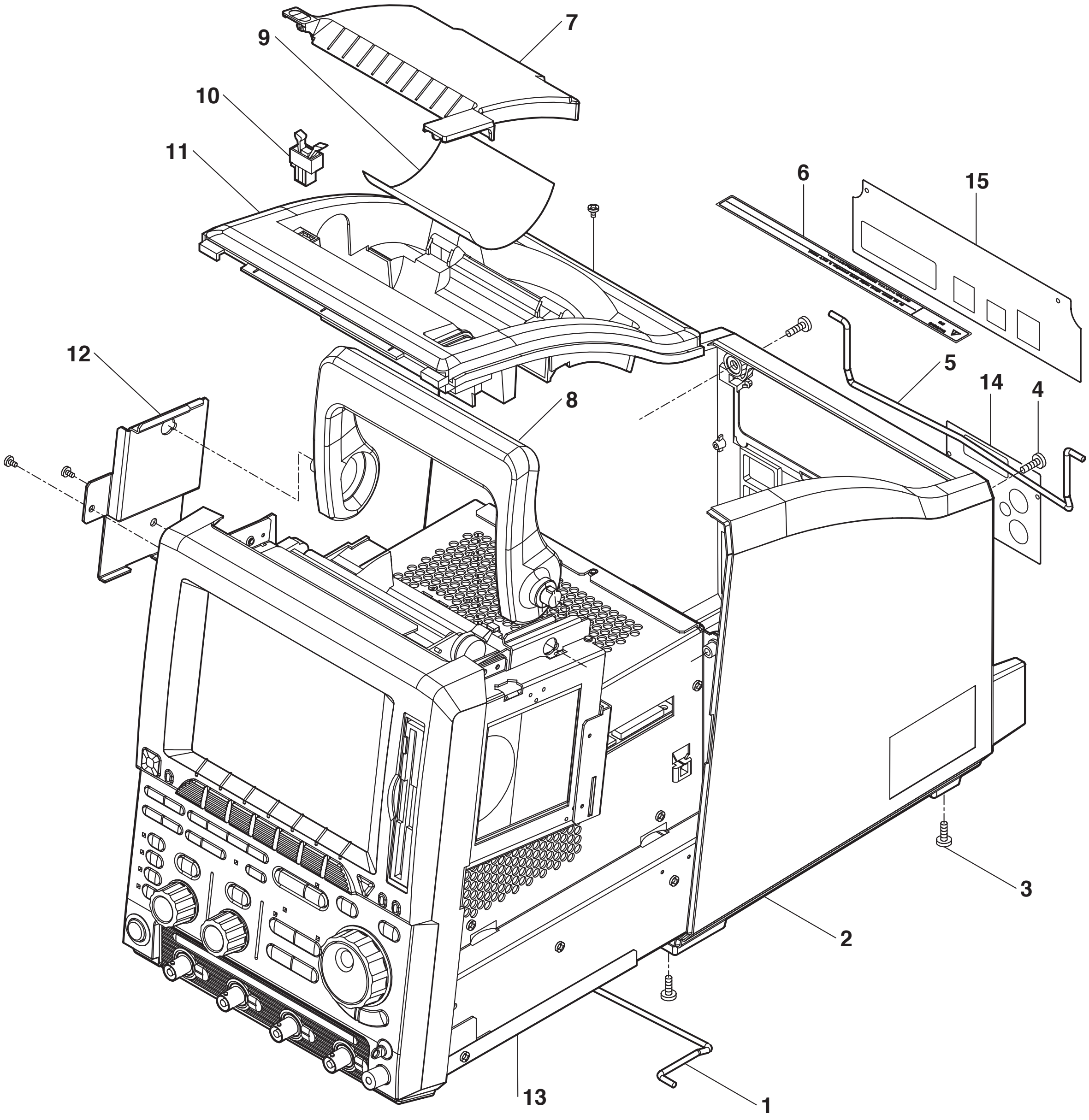
Chapter 7 Customer Maintenance Parts List

7.1 Customer Maintenance Parts List



Note: Parts marked with a ◎ symbol are CMPL (Customer Maintenance Parts List) parts.

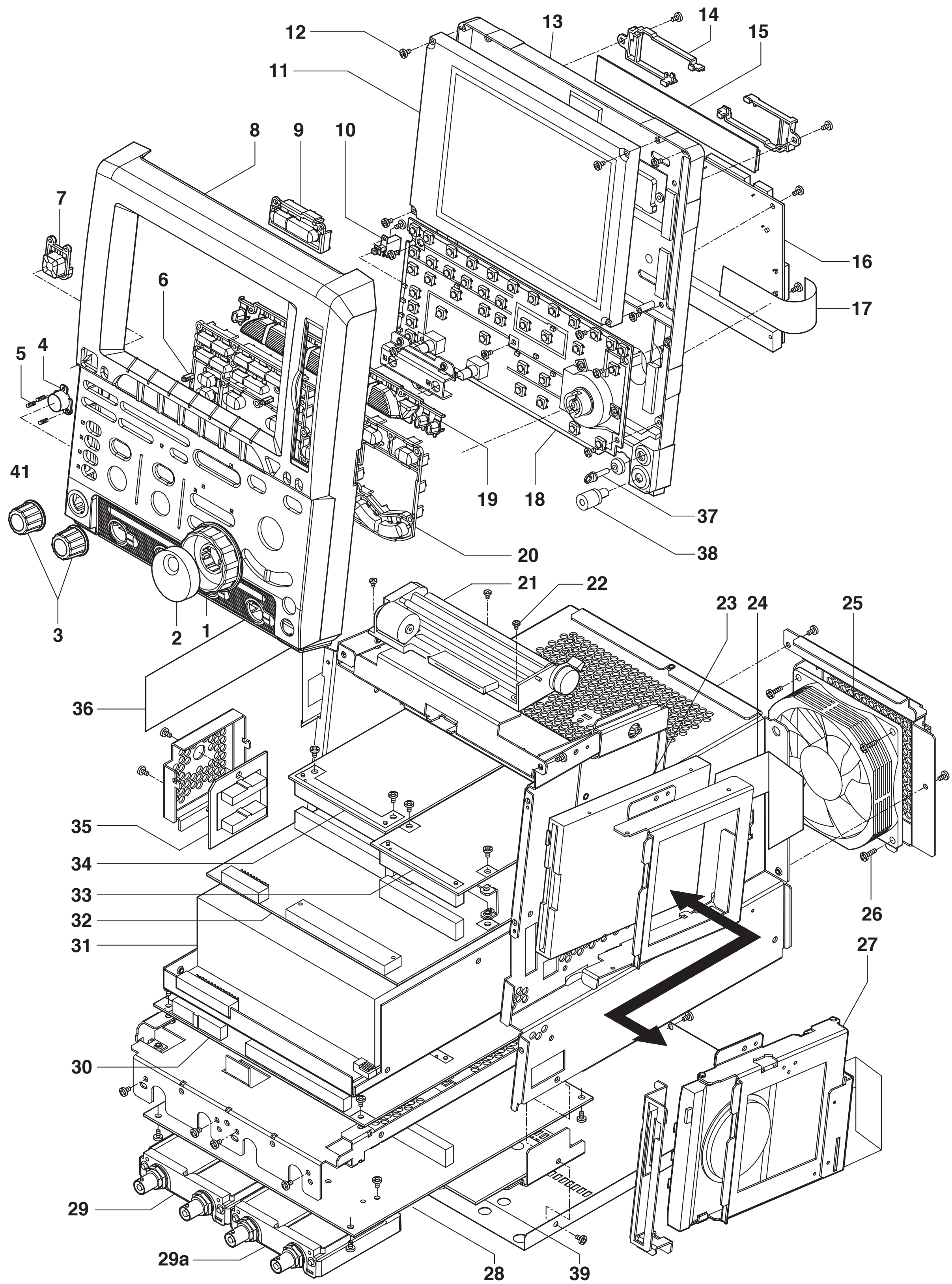
Complete Set



Item	Part No.	Qty	Description
◎ 1	B9989EC	1	Support
2	B9989DA	1	Top Cover
3	Y9408LB	4	B.H. Screw, M4x8
4	Y9408LB	2	B.H. Screw, M4x8
◎ 5	B9989EC	1	Support
◎ 6	B9989EU	1	Sheet
◎ 7	B9989DT	1	Printer Cover
8	B9989DU	1	Handle
9	B9946BQ	1	Sheet
10	B9858GB	1	Clamp
11	B9989DR	1	Printer Case
12	B9989CJ	1	Frame
13	-	1	Main Assembly

Item	Part No.	Qty	Description	
◎14	B9989ER	1	Sheet (701710)	(select)
	B9989EY	1	Sheet (701705)	
	B9989ES	1	Sheet (/P2)	
	B9989ET	1	Sheet (/P4)	
◎15	B9989FM	1	Sheet	(select)
	B9989FQ	1	Sheet (/C7 /C10)	
	B9989FN	1	Sheet (/C7)	
	B9989FP	1	Sheet (/C10)	

Note : ◎ CMPL parts


12
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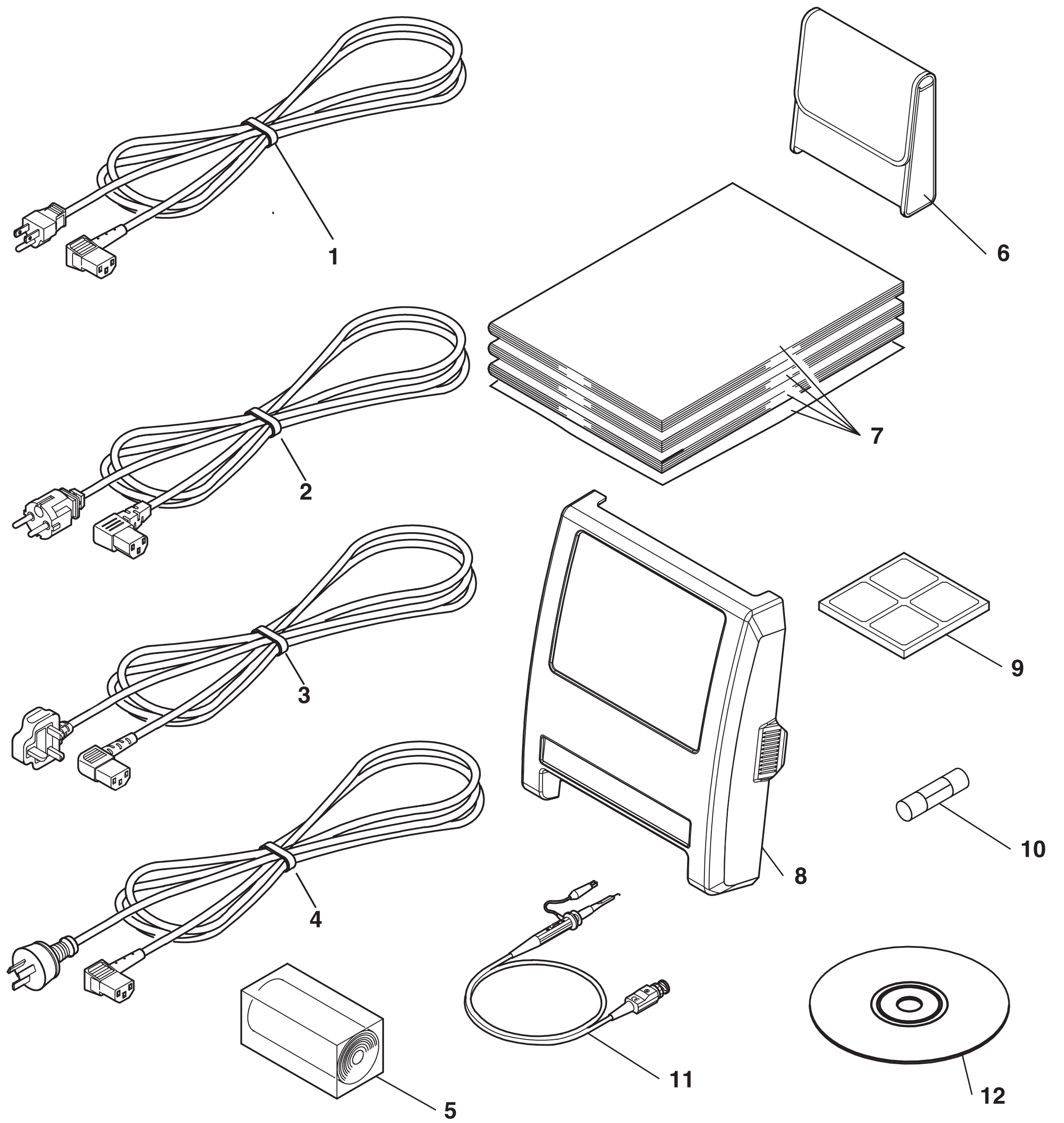
29a
28
39

Item	Part No.	Qty	Description
◎ 1	B9989DY	1	Knob
◎ 2	B9989DX	1	Knob
◎ 3	B9989DK	2	Knob
4	B9989DL	1	Knob
5	B9989EL	3	Spring
6	B9969DK	9	Lens
7	B9989DM	1	Knob
8	B9989DD	1	Front Bezel (701710) (select)
	B9989DF	1	Front Bezel (701705) (select)
	B9989DP	1	Front Bezel (701710 /F5) (select)
9	B9969DE	1	Knob
10	B9989SD	1	Switch and Cable Assembly (AD-Switch)
11	A1056VA	1	LCD
12	Y9205LB	4	Screw
13	B9989CA	1	Front Frame
14	A9135ZM	2	Spacer
15	A1468UP	1	Power Supply
16	B9989ME	1	BUS Board Assembly
17	B9989YE	1	SUMI-Card, BUS-KBD
18	B9989MK	1	Key Board Assembly
19	B9989DJ	1	Knob
20	B9989DH	1	Knob (701710) (select)
	B9989DG	1	Knob (701705) (select)
21	A1207UD	1	Printer (/B5)
22	Y9205LB	3	Screw (/B5)
23	A1092UN	1	FDD Memory System (-J1)
24	B9989YF	1	SUMI Card (-J1) (CPU-Floppy)
25	B9989SA	1	Fan Assembly
26	Y9308LB	4	B.H. Screw, M3x8
27	B9989GM	1	Zip Kit Assembly (-J2)
28	B9989MB	1	AD4 Board Assembly (701710) (select)
	B9989MH	1	AD2 Board Assembly (701705) (select)
29	B9989QA	1	Analog Assembly
29a	B9989QA	1	Analog Assembly (701710) (select)
	B9989QG	1	ET2 Assembly (701705) (select)
30	B9989MD	1	ACQ4 Board Assembly (701710) (select)
	B9989MJ	1	ACQ2 Board Assembly (701705) (select)
31	B9989YA	1	Power Supply
32	B9989MC	1	CPU Board Assembly
33	B9989MS	1	SCSI Serial Assembly (/C7)
34	B9989MT	1	Ether Assembly (/C10)
35	B9989MF	1	ADP Board Assembly
36	B9989YK	1	Shield SUMI-Card
37	B9850EG	1	TIP
38	B9850EF	1	ROD
39	B9989MM	1	OPT Trig Board Assembly (701710 /F5)

Note: ◎ CMPL parts

7.2 Standard Accessories



Item	Part No.	Qty	Description	
◎ 1	A1006WD	1	Power Supply Cord (UL/CSA Standard) *	(select)
◎ 2	A1009WD	1	Power Supply Cord (VDE Standard) †	(select)
◎ 3	A1054WD	1	Power Supply Cord (BS Standard) ‡	(select)
◎ 4	A1024WD	1	Power Supply Cord (AS Standard) §	(select)
◎ 5	B9850NX	1	Roll Chart (/B5) ‖	(select)
◎ 6	B9918EZ	1	Soft Case	
7	IM701710-01E	1	DL1720/DL1740 Digital Oscilloscope User's Manual	
	IM701710-02E	1	DL1720/DL1740 Digital Oscilloscope Operation Guide	
	IM701710-51E	1	DL1740 Digital Oscilloscope I2C Bus Analysis Function (Includes the SPI Bus Analysis Function)#	
	IM701710-71E	1	Regarding the DL1720/DL1740 Digital Oscilloscope Communications Interface User's Manual CD-ROM	
◎ 8	B9989FA	1	Front Cover	
◎ 9	B9989EX	1	Stopper (x4)	
◎ 10	A1352EF	1	Fuse (250V/4A)	
11	700988	2	Probe	
	700988	2	Probe (/E2)	
◎ 12	B9989YZ	1	CD for Manual for DL1720/DL1740	

Note:

*	701705/701710 -□-D
†	701705/701710 -□-F
‡	701705/701710 -□-Q
§	701705/701710 -□-R
‖	A roll chart will be supplied only when the instrument is equipped with a built-in printer
#	701705 /F5

◎ CMPL parts

Chapter 8 Procedures for Disassembly

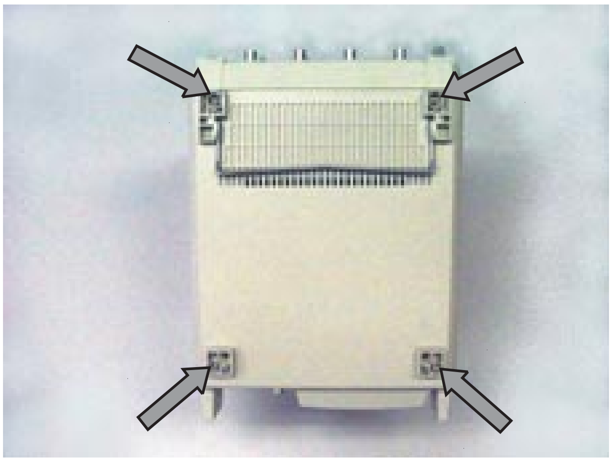
WARNING

This service manual is to be used by properly trained personnel only. To avoid personal injury, do not perform any servicing unless you are qualified to do so. Refer to the safety precautions prior to performing any servicing. Even if servicing is carried out according to this service manual, or by qualified personnel, YOKOGAWA assumes no responsibility for any result occurring from that servicing.

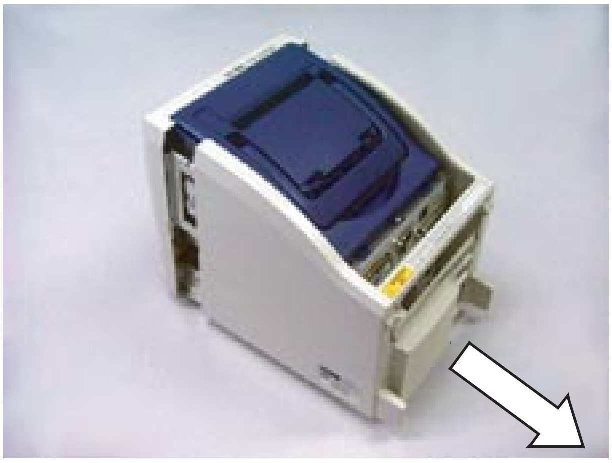
8.1 Removing the Top Cover

1. Remove the 2 screws from the rear panel.

2. Remove the 4 screws from the bottom of the instrument.



3. The top cover fits into the back of the front bezel. Remove the top cover by slowly pulling it away from the front bezel in the direction of the arrows as shown in the figure below.



The DL with the top cover removed

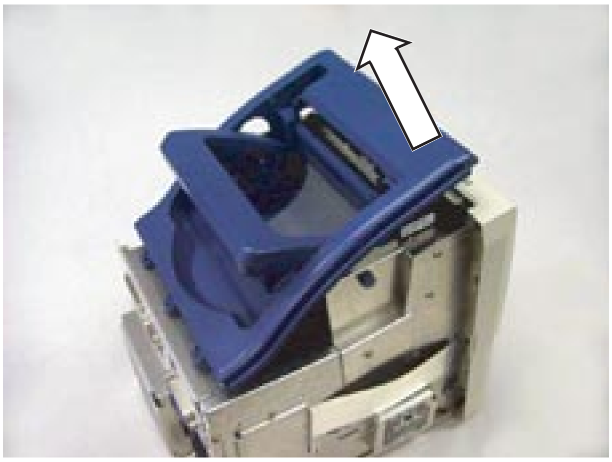
8.2 Removing the Printer Case

1. Remove the top cover. See section 8.1, “Removing the Top Cover.”
2. Remove the printer cover by raising it in the direction of the arrow as shown below, then forcing it back until it pops out.

3. Remove the screw from the printer case located toward the rear of the instrument.

4. Raise the handle, then slide the printer case away from the bezel by pulling it back slightly in the direction of the arrow.

5. Lift the printer case to remove it, allowing the handle to slide through the opening in the case.



DL with the printer case removed

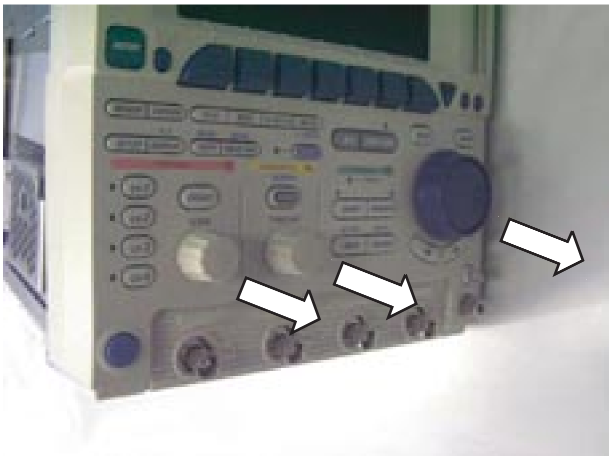
8.3 Removing the Front Bezel

Removing the Knobs

1. Remove the knobs by pulling them outward in the direction of arrows.

Note

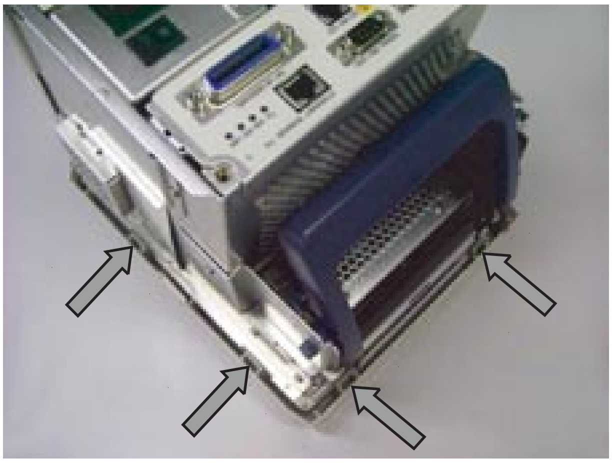
When the TIME/DIV and V/DIV knobs are removed, the “rib“ holding the knob to its shaft becomes worn down causing the knob to become loose. Therefore, you should replace the removed knobs with new ones.



DL with the knobs removed

Removing the Front Bezel

2. Remove the top cover. See section 8.1, “Removing the Top Cover.”
3. Remove the printer case. See section 8.2, “Removing the Printer Case.”
4. The front bezel is fastened to the frame by eight tabs. Identify the location of all tabs, then pry each tab away from the metal frame one-by-one until the bezel comes free of the frame.



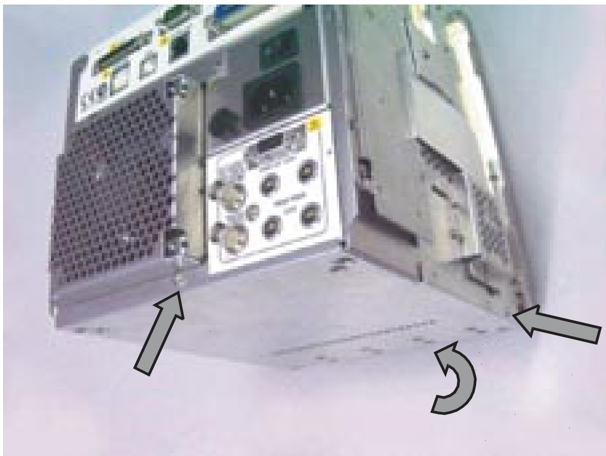
5. Remove the bezel, taking care not to damage the BNC connectors.

DL with the front bezel removed

8.4 Removing the AD Board Assembly and the Analog Assembly

Removing the Bottom Brackets

1. Remove the top cover. See section 8.1, “Removing the Top Cover.”
2. Remove the front bezel. See section 8.3, “Removing the Front Bezel.”
3. Remove the screws from the left, right, and rear sides (3 screws total), then remove the bottom brackets.



DL with the bottom brackets removed

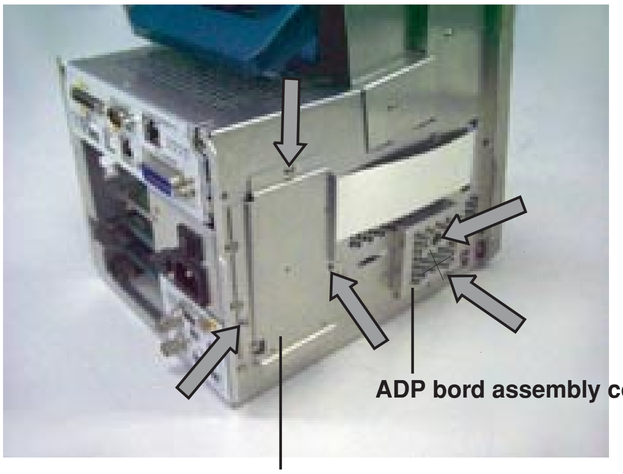
Removing the Fan Assembly

4. Holding the fan assembly cable by its connector (not the cable itself), disconnect the fan assembly cable. Unhook the cable from the plastic restraining tab.
5. Remove the 2 screws as shown, then lift the fan assembly upwards and remove it. Be careful not to pull out the wires as you do so.

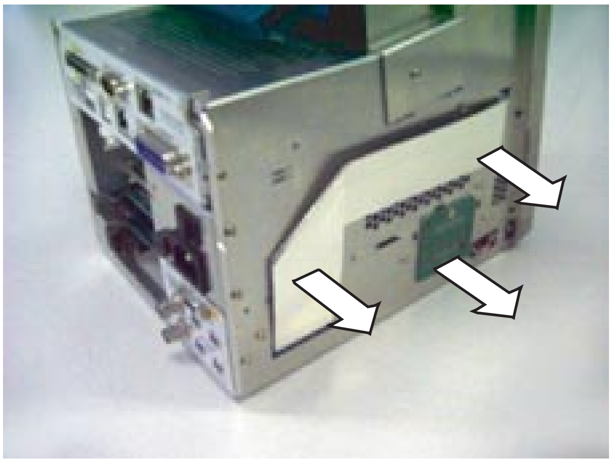
DL fan assembly removal

Removing the ADP Board Assembly and SUMI-Card

6. Remove the screw from the ADP board assembly cover, then remove the cover.
7. Remove the remaing screw from the ADP board assembly.
8. The ADP board assembly is fastened to the AD board assembly and the ACQ board assembly from the inside by a connector. Pull out the ADP board assembly.
9. Remove the 3 screws from the SUMI-Card bracket as shown in the figure below, then remove the bracket.



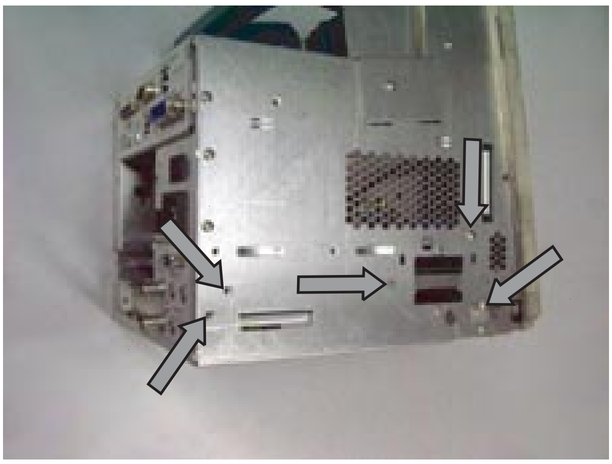
10. Grasp the SUMI-card near the connector with both hands, then slowly pull it out. Be careful not to bend the card as you do so.



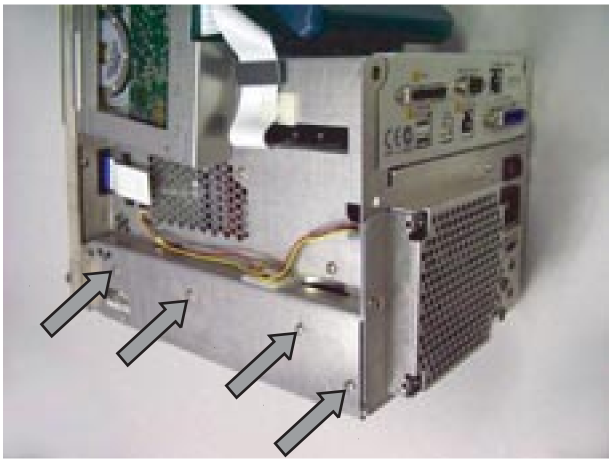
DL with the ADP board assembly and the SUMI-card removed

Removing the AD Board Assembly and the Analog Assembly

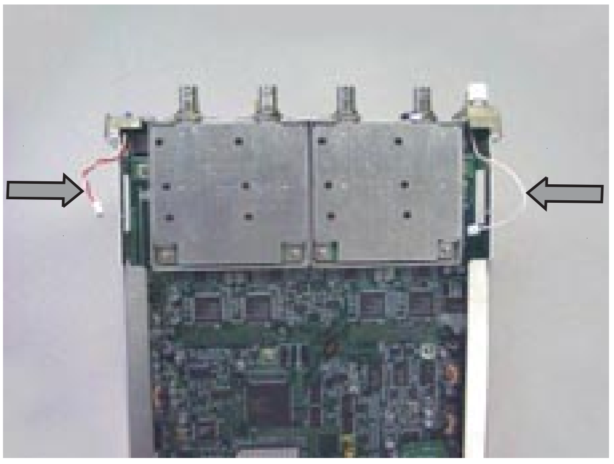
11 Remove the 5 screws from the left side of the instrument as shown in the figure below.



12. Remove the 4 screws from the right side of the instrument as shown in the figure below.



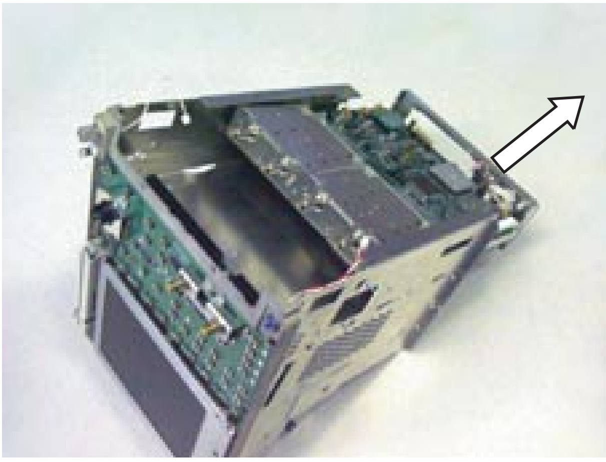
13. Turn the unit upside down.
14. Remove the cables from the left and right sides as shown in the figure below.



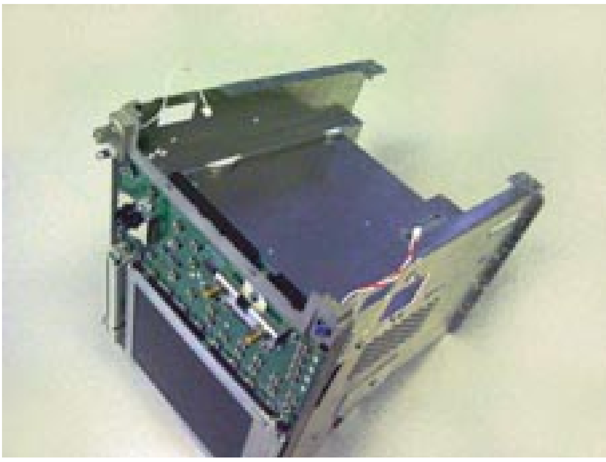
15. Remove the 2 screws from the front panel as shown.

16. The ACQ board assembly is fastened to the bus board assembly underneath by several connectors. The AD board assembly and the analog assembly cannot be removed until you disconnect these connectors. Pull the front side (the side with the BNC connectors) of the AD board assembly upwards to disconnect it from the bus board assembly.

17. Pull the AD board assembly out towards the rear of the instrument. The analog assembly pulls out with it.

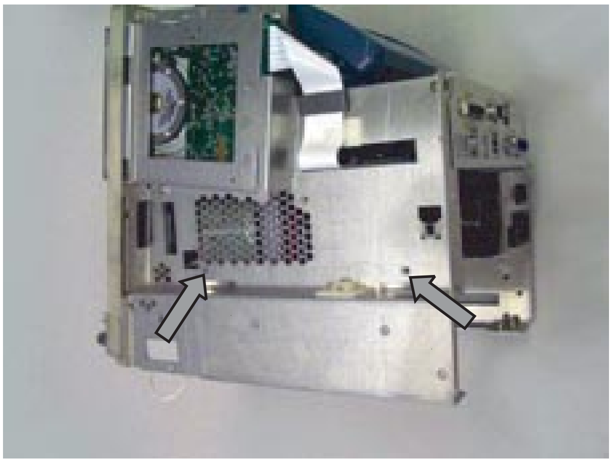


DL with the AD board and analog assemblies removed

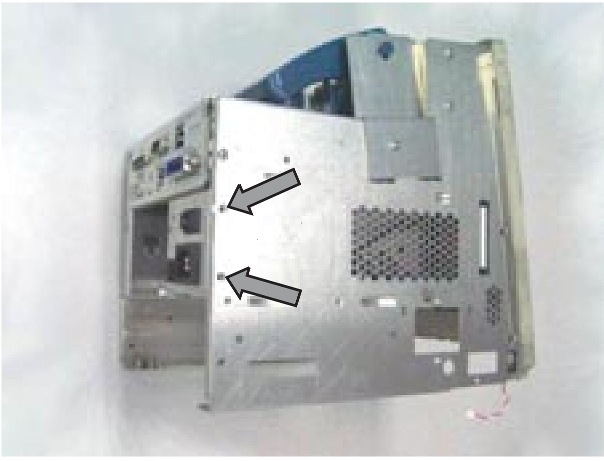


8.5 Removing the Power Supply

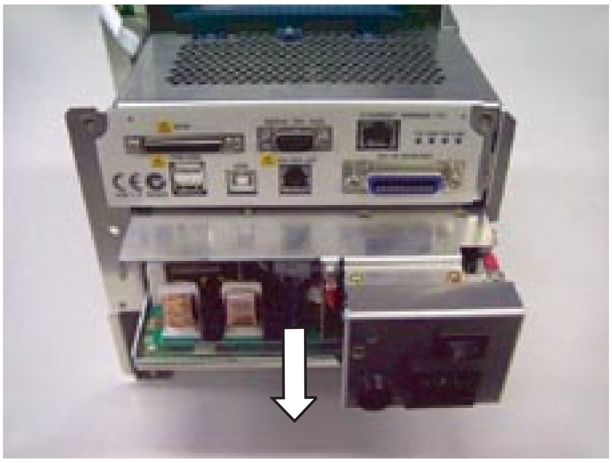
1. Perform the steps in sections 8.3 and 8.4.
2. Remove the 2 screws as shown.



3. Remove the 2 screws as shown.



4. Pull out the power supply in the direction of the arrow as shown below.



DL with the power supply removed.

8.6 Removing the CPU Board Assembly, SCSI Board Assembly, and the Ether Assembly

1. Remove the SUMI-card connected to either the floppy drive or the ZIP drive. Unhook the connector then remove the SUMI-Card. The SUMI-card is thin and fragile, so take care not to bend it when removing it.

2. In the same manner, unhook the connector on the board side, then remove the SUMI-Card.

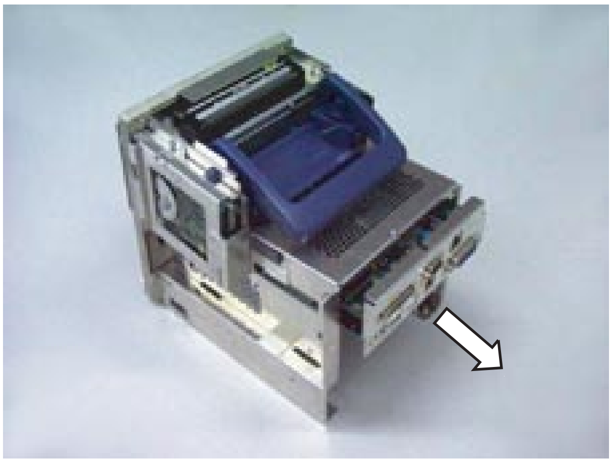
Note

When reinstalling the SUMI-Card, be sure to insert the cable all the way into the connector, then hook the sliders to fasten the card in place.

3. Remove the screw as shown in the figure below.

4. Remove the screw as shown in the figure below.

5. Pull out the CPU board assembly.
   The SCSI board assembly and Ether assembly are attached to the CPU board assembly, so they come out all together.

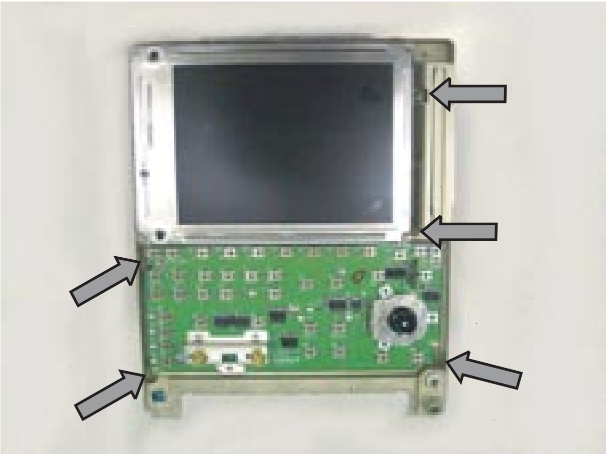


DL with the CPU Board Assembly, SCSI Board Assembly, and Ether Assembly removed

8.7 Removing the Front Frame

1. Peform the steps in section 8.1 to 8.6.
2. Remove the 2 screws that fasten the front frame to the rear panel.

3. Remove the SUMI-Card on the right side of the frame.
4. Remove the 5 screws that fasten the front frame to the front panel. Remove the front frame.



DL with the front frame removed