Service Manual

Tektronix

DG2030
Data Generator

071-0058-50

Warning
The servicing instructions are for use by qualified personnel only. To avoid personal injury, do not perform any servicing unless you are qualified to do so. Refer to all safety summaries prior to performing service.

www.tektronix.com

Tektronix, Inc., P.O. Box 500, Beaverton, OR 97077

WARRANTY

Tektronix warrants that the products that it manufactures and sells will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If a product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; c) to repair any damage or malfunction caused by the use of non-Tektronix supplies; or d) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

THIS WARRANTY IS GIVEN BY TEKTRONIX IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED. TEKTRONIX AND ITS VENDORS DISCLAIM ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. TEKTRONIX' RESPONSIBILITY TO REPAIR OR REPLACE DEFECTIVE PRODUCTS IS THE SOLE AND EXCLUSIVE REMEDY PROVIDED TO THE CUSTOMER FOR BREACH OF THIS WARRANTY. TEKTRONIX AND ITS VENDORS WILL NOT BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES IRRESPECTIVE OF WHETHER TEKTRONIX OR THE VENDOR HAS ADVANCE NOTICE OF THE POSSIBILITY OF SUCH DAMAGES.

Table of Contents

List of Figures

List of Tables

General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

To Avoid Fire or Personal Injury

Use Proper Power Cord. Use only the power cord specified for this product and certified for the country of use.

Connect and Disconnect Properly. Do not connect or disconnect probes or test leads while they are connected to a voltage source.

Ground the Product. This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

Observe All Terminal Ratings. To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

Do Not Operate Without Covers. Do not operate this product with covers or panels removed.

Use Proper Fuse. Use only the fuse type and rating specified for this product.

Avoid Exposed Circuitry. Do not touch exposed connections and components when power is present.

Do Not Operate With Suspected Failures. If you suspect there is damage to this product, have it inspected by qualified service personnel.

Do Not Operate in Wet/Damp Conditions.

Do Not Operate in an Explosive Atmosphere.

Keep Product Surfaces Clean and Dry.

Provide Proper Ventilation. Refer to the manual's installation instructions for details on installing the product so it has proper ventilation.

Symbols and Terms

Terms in this Manual. These terms may appear in this manual:

WARNING. *Warning statements identify conditions or practices that could result in injury or loss of life.*

CAUTION. *Caution statements identify conditions or practices that could result in damage to this product or other property.*

Terms on the Product. These terms may appear on the product:

DANGER indicates an injury hazard immediately accessible as you read the marking.

WARNING indicates an injury hazard not immediately accessible as you read the marking.

CAUTION indicates a hazard to property including the product.

Symbols on the Product. The following symbols may appear on the product:

WARNING
High Voltage

Protective Ground
(Earth) Terminal

CAUTION
Refer to Manual

Double
Insulated

Service Safety Summary

Only qualified personnel should perform service procedures. Read this *Service Safety Summary* and the *General Safety Summary* before performing any service procedures.

Do Not Service Alone. Do not perform internal service or adjustments of this product unless another person capable of rendering first aid and resuscitation is present.

Disconnect Power. To avoid electric shock, disconnect the mains power by means of the power cord or, if provided, the power switch.

Use Caution When Servicing the CRT. To avoid electric shock or injury, use extreme caution when handling the CRT. Only qualified personnel familiar with CRT servicing procedures and precautions should remove or install the CRT.

CRTs retain hazardous voltages for long periods of time after power is turned off. Before attempting any servicing, discharge the CRT by shorting the anode to chassis ground. When discharging the CRT, connect the discharge path to ground and then the anode. Rough handling may cause the CRT to implode. Do not nick or scratch the glass or subject it to undue pressure when removing or installing it. When handling the CRT, wear safety goggles and heavy gloves for protection.

Use Care When Servicing With Power On. Dangerous voltages or currents may exist in this product. Disconnect power, remove battery (if applicable), and disconnect test leads before removing protective panels, soldering, or replacing components.

To avoid electric shock, do not touch exposed connections.

X-Radiation. To avoid x-radiation exposure, do not modify or otherwise alter the high-voltage circuitry or the CRT enclosure. X-ray emissions generated within this product have been sufficiently shielded.

Preface

This is the service manual for the DG2030 Data Generator. The manual contains information needed to service the DG2030 to the module level.

Manual Structure

This manual is divided into sections, such as *Specifications* and *Theory of Operation*. Further, some sections are divided into subsections, such as *Product Description* and *Removal and Installation Procedures*.

Sections containing procedures also contain introductions to those procedures. Be sure to read these introductions because they provide information needed to do the service correctly and efficiently. The following contains a brief description of each manual section.

- *Specifications* contains a description of the DG2030 and the characteristics that apply to it.
- *Operating Information* includes general information and operating instructions.
- *Theory of Operation* contains circuit descriptions that support service to the module level.
- *Performance Verification* contains procedures for confirming that the DG2030 functions properly and meets warranted limits.
- *Adjustment Procedures* contains a statement explaining that adjustment is unnecessary for the DG2030.
- *Maintenance* contains information and procedures for performing preventive and corrective maintenance of the DG2030. These instructions include cleaning, module removal and installation, and fault isolation to the module.
- *Options* contains information on servicing factory-installed options.
- *Electrical Parts List* contains a statement referring you to *Mechanical Parts List*, where both electrical and mechanical modules are listed.
- *Diagrams* contains block diagrams and an interconnection diagram.
- *Mechanical Parts List* includes a table of all replaceable modules, their descriptions, and their Tektronix part numbers.

Manual Conventions

This manual uses certain conventions that you should become familiar with.

Some sections of the manual contain procedures for you to perform. To keep those instructions clear and consistent, this manual uses the following conventions:

- Names of front panel controls and menus appear in the same case (initial capitals, all uppercase, etc.) in the manual as is used on the DG2030 front panel and menus. Front panel names are all upper-case letters; for example, SETUP MENU, HARDCOPY, etc.
- Instruction steps are numbered unless there is only one step.

Modules

Throughout this manual, any replaceable component, assembly, or part of the DG2030 is referred to generically as a module. In general, a module is an assembly (like a circuit board), rather than a component (like a resistor or an integrated circuit). Sometimes a single component is a module; for example, the chassis of the DG2030 is a module.

Safety

Symbols and terms related to safety appear in the *Safety Summary* near the beginning of this manual.

Finding Other Information

Other documentation for the DG2030 Data Generator includes:

- The *DG2030 User Manual* contains a tutorial to quickly describe how to operate the DG2030. It also includes an in-depth discussion on how to more completely use DG2030 features.
- The *DG2030 Programmer Manual* explains how to use a GPIB or RS-232 interface to remotely control the DG2030.

Contacting Tektronix

Phone	1-800-833-9200*
Address	Tektronix, Inc. Department or name (if known) 14200 SW Karl Braun Drive P.O. Box 500 Beaverton, OR 97077 USA
Web site	www.tektronix.com
Sales support	1-800-833-9200, select option 1*
Service support	1-800-833-9200, select option 2*
Technical support	Email: techsupport@tektronix.com 1-800-833-9200, select option 3* 6:00 a.m. – 5:00 p.m. Pacific time

*** This phone number is toll free in North America. After office hours, please leave a voice mail message.**
Outside North America, contact a Tektronix sales office or distributor; see the Tektronix web site for a list of offices.

Introduction

This manual contains information needed to properly service the DG2030 Data Generator, as well as general information critical to safe and effective servicing.

To prevent personal injury or damage to the DG2030, consider the following before attempting service:

- The procedures in this manual should be performed only by a qualified service person
- Read the *General Safety Summary* and the *Service Safety Summary*, beginning on page vii
- Read *Preparation for Use* in section 2, *Operating Information*

When using this manual for servicing, be sure to follow all warnings, cautions, and notes.

Performance Check Interval

Generally, the performance check described in section 4, *Performance Verification*, should be done every 12 months. In addition, performance check is recommended after module replacement.

If the DG2030 does not meet performance criteria, repair is necessary.

Strategy for Servicing

Throughout this manual, the term, module, refers to any field-replaceable component, assembly, or part of the DG2030.

This manual contains all the information needed for periodic maintenance of the DG2030. (Examples of such information are procedures for checking performance.)

Further, it contains all information for corrective maintenance down to the module level. To isolate a failure to a module, use the fault isolation procedures found in *Troubleshooting*, part of section 6, *Maintenance*. To remove and replace any failed module, follow the instructions in *Removal and Installation Procedures*, also part of section 6. After isolating a faulty module, replace it with a fully-tested module obtained from the factory. Section 10, *Mechanical Parts List*, contains part number and ordering information for all replaceable modules.

Tektronix Service Offerings

Tektronix provides service to cover repair under warranty as well as other services that may provide a cost-effective answer to your service needs.

Whether providing warranty repair service or any of the other services listed below, Tektronix service technicians are well equipped to service the DG2030. Tektronix technicians train on Tektronix products; they have access to the latest information on improvements to the DG2030 as well as the latest new options.

Warranty Repair Service

Tektronix warrants this product for one year from date of purchase. The warranty appears on the back of the title page in this manual. Tektronix technicians provide warranty service at most Tektronix service locations. The Tektronix product catalog lists all worldwide service locations.

Self Service

Tektronix supports repair to the module level by providing *Module Exchange*.

Module Exchange. This service reduces down-time for repair by allowing you to exchange most modules for remanufactured ones. Each module comes with a 90-day service warranty.

For More Information. Contact your local Tektronix service center or sales engineer for more information on any of the repair or adjustment services just described.

Product Description

The DG2030 is a digital data generator designed for high performance and ease of use. The DG2030 is easy to use for testing and evaluating semiconductors and logic circuits, which are continually becoming faster and more complex.

The DG2030 provides, in a compact package, high performance and a wide range of functions. Features include a maximum data rate of 400 MHz, a 256 K word pattern memory, 4 channels (with support for up to 8 channels by adding option), a ±1 ns timing skew adjustment function, and variable output levels (from –1.5 to +3.50 V).

Any memory size from 90 words to 256 K words can be used easily, with no restrictions within that range. The DG2030 also provides a 4K-step sequence controller, which enables the generation of not only a data pattern longer than the pattern memory but also the dynamic change of the pattern due to the external events.

The DG2030 provides flexible data editing functions, including word and line unit input and extended data creation functions. Furthermore, the DG2030 provides a rich set of functions required for system construction, such as a sequencing function, a jump function using external input, and an inhibit function.

Features

- The DG2030 supports smooth and rapid product development by simulating the digital signals from incomplete sections of a product.
- Logic function test systems can be constructed by combining this instrument with a logic analyzer.
- Margin tests can be easily performed by using this instrument to generate patterns that have a low probability of occurrence or are difficult to generate. This can increase end-product reliability.
- Interactive digital simulation systems can be constructed using the sequence output, external jump, and tristate control functions.
- Flexible data output functions make the DG2030 an ideal data generator for simulation of LCD display units, CCD line and area sensors, and all types of digital circuits.

Specifications

The DG2030 specifications are divided into three categories:

- Warranted characteristics. Warranted characteristics are described in terms of quantifiable performance limits which are guaranteed.
- Typical characteristics. Typical characteristics are described in terms of typical or average performance for the DG2030. The characteristics described herein are not absolutely guaranteed.
- Functionality. Functionality describes instrument capabilities.

Items marked with asterisk (*****) are tested in the *Performance Verification* (Appendix B).

The certification and compliances for the DG2030 are also found at the end of this appendix.

Warranted Characteristics

This section describes the warranted characteristics of the DG2030. These can be divided into two categories: electrical characteristics and environmental characteristics.

Items marked with asterisk (*) are tested in the Performance Verification (Appendix B).

Performance Conditions

The electrical characteristics are valid under the following conditions:

- The instrument must be in an environment with temperature, altitude, humidity, and vibration within the operating limits described in these specifications.
- The instrument must have had a warm-up period of at least 20 minutes.
- The instrument must have been calibrated/adjusted at an ambient temperature between +20° C and +30° C.
- The instrument must be operating at an ambient temperature between +10° C to +40° C, unless otherwise noted.

Table 1-1: Warranted electrical characteristics

Characteristics	Description	Performance test
Internal trigger generator		
Internal trigger rate		
Accuracy	±0.01 %	
Data and clock out		
*Output voltage		See page 4-28.
Accuracy		
DC (data out)	(±3 % of setting) ± 50 mV (into 50 Ω)	
Amplitude (clock out)	(±5 % of setting) ± 50 mV (into 50 Ω)	
Maximum Output Current	± 100 mA	
*Rise/fall time (20 % to 80 %)		See page 4-28.
Accuracy	(±10 % of setting) ±500 ps, within the variable range	
*Channel skew	< ±300 ps, reference to the clock out, at 10 MHz, 50 % duty and rise/fall times set to FAST.	See page 4-33.
*Delay function		See page 4-33.
Accuracy	(±3 % of setting) ±500 ps ±60 ps × | Ambient temperature (°C) − 25 |, At 10 MHz, 50 % duty, 1.5 V high, 0 V low, and rise/fall times set to FAST.	
Event input		
Minimum pulse width	≧ 100 ns	
Sensitivity	≧ 1.0 Vp-p	
Inhibit input		
Minimum pulse width	≧ 100 ns	
Sensitivity	≧ 1.0 Vp-p	
Trigger input		
Threshold		
Accuracy	±(5 % of setting) ±0.1 V	
Minimum pulse width	≧ 10 ns	
Sensitivity	≧ 1.0 Vp-p	
Impedance	50 Ω ±2 Ω 1 kΩ ±100 Ω	
Unacceptable time on resetting trigger	Minimum 100 ns	

Table 1-1: Warranted electrical characteristics (Cont.)

Characteristics	Description	Performance test
External clock input		
Threshold level	+0.5 V	
Input low voltage range	–2 V to 0.3 V	
Input high voltage range	0.7 V to 2.0 V	
Input frequency	DC to 406.9 MHz	
Minimum pulse width	≧ 1.2 ns	
Sensitivity	≧ 0.5 Vp-p	
Maximum input level	≦ ±2 V	
AC line power		
Rating voltage	100-240 V AC	
Voltage range		
90-250 V AC	Input frequency range from 48.0 to 63.0 Hz	
90-127 V AC	Input frequency range from 48.0 to 440.0 Hz	
Maximum power	300 W	
Maximum current	4 A	

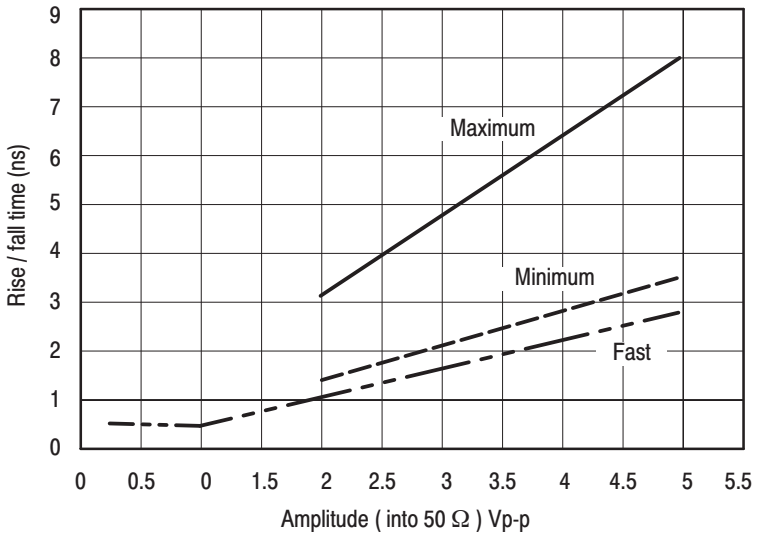


Figure 1-1: Range of rise/fall times

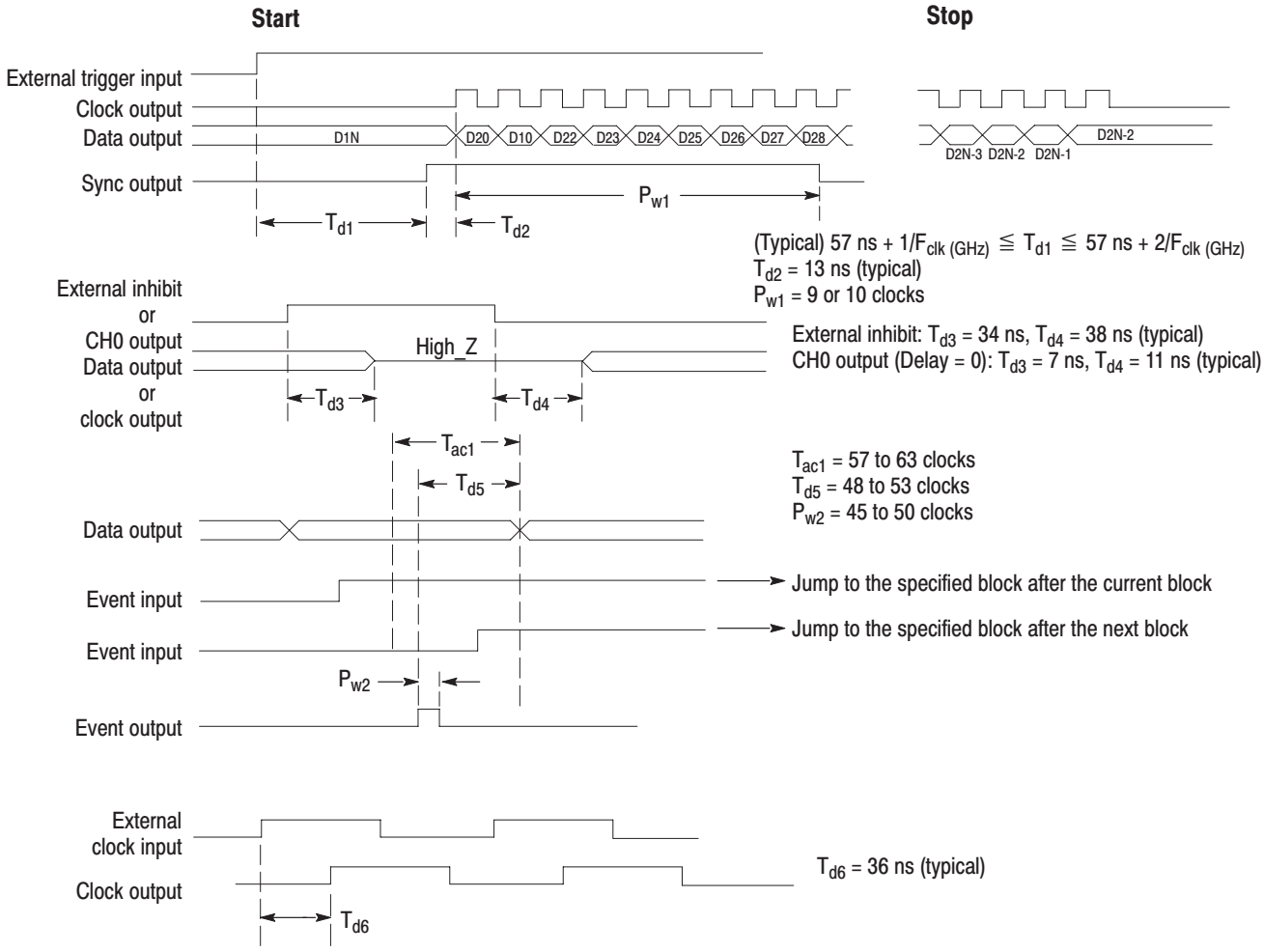


Figure 1-2: Signal timing

Table 1-2: Warranted environmental characteristics

Characteristics	Description
Temperature	
Operating	+10 °C to +40 °C
Non-operating	–20 °C to +60 °C
Relative humidity	
Operating	20% to 80% (No condensation) Maximum wet-bulb temperature 29.4 °C
Non-operating	5% to 90% (No condensation) Maximum wet-bulb temperature 40.0 °C
Altitude	
Operating	To 4.5 km (15000 ft). Maximum operating temperature decreases 1 °C each 300 m above 1.5 km.
Non-operating	To 15 km (50000 ft).
Dynamics	
Vibration	
Operating	0.27 Grms, 5 to 500 Hz
Non-operating	2.28 Grms, 5 to 500 Hz
Shock	
Non operating	294 m/s^2 (30 G), half-sine, 11 ms duration. Three shocks per axis in each direction (18 shocks total)
Installation requirements	
Power consumption	300 watts max. Maximum line current is 4 A rms at 50 Hz
Dissipation (fully loaded)	90 V libe, with 5 % clipping
Surge current	≦ 9 A peak for less than 5 line cycles, at 25 °C, after product has been off for at least 30 s.
Cooling clearance	
Top clearance	2.5 cm (1 inch)
Side clearance	15 cm (6 inches)
Rear clearance	7.5 cm (3 inches)

Typical Characteristics

This section will describe the typical characteristics for the DG2030. These values represent typical or average performance and are not absolutely guaranteed.

Table 1-3: Electrical characteristics (typical)

Characteristics	Description
Data and clock out	
Rise/fall time (20 % to 80 %)	
Value in FAST	500 ps, at 0.25 Vp-p to 1 Vp-p < Value represented by FAST line from 2 Vp-p to 5 Vp-p in Figure 1-2 on page 1-6, at 1 Vp-p to 2 Vp-p < 0.8 × Minimum value, at 2 Vp-p to 5 Vp-p
Aberration	
Overshoot	≦ 5 % at 3.5 Vp-p
Amplitude (clock out)	≦ 5 % at 3.5 Vp-p
Period jitter	Measured by TDS694C–1MHD with TDSJIT1 Refer to Table 1-4.
Cycle to cycle jitter	Measured by TDS694C–1MHD with TDSJIT1 Refer to Table 1-5.
Inhibit input	
Delay time to data to clock out	Refer to T_{d3} and T_{d4} in Figure 1-2 on page 1-6.
$\overline{\text{High Z}}$ to High Z	34 ns (typical)
High Z to $\overline{\text{High Z}}$	38 ns (typical)
Sync output	
Level	
V_{OH}	Approx. 5 V (into 1 MΩ) Approx. 2.5 V (into 50 Ω)
V_{OL}	Approx. 0 V (into both 1 MΩ and 50 Ω)
Delay time from external trigger input signal	Internal clock, PLL Off. Refer to T_{d1} in Figure 1-2 on page 1-6.
Trigger Input	$57\ ns + 1/F_{clk\ (GHz)} \leqq T_{d1} \leqq 57\ ns + 2/F_{clk\ (GHz)}$ (Typical)
Delay time to clock out and data out	13 ns, Refer to T_{d2} in Figure 1-2 on page 1-6.
External clock input	
Delay time to clock out	36 ns (typical). Refer to T_{d6} in Figure 1-2 on page 1-6.

Table 1-4: Period Jitter

Clock frequency	400 MHz (PLL ON)		200 MHz (PLL ON)	
Measurement	StdDev	Pk–Pk	StdDev	Pk–Pk
Clock output	6.0 ps	30 ps	6.0 ps	30 ps
CH0 output	50 ps	200 ps	15 ps	65 ps

Table 1-5: Cycle to Cycle Jitter

Clock frequency	400 MHz (PLL ON)		200 MHz (PLL ON)	
Measurement	StdDev	Pk–Pk	StdDev	Pk–Pk
Clock output	30 ps	200 ps	12 ps	60 ps
CH0 output	100 ps	340 ps	20 ps	90 ps

Nominal Traits

This section describes the general characteristics of the DG2030. These are divided into two main categories: Table 1-6 Electrical Characteristics and Table 1-7 Mechanical Characteristics.

Table 1-6: Nominal traits - electrical characteristics

Characteristics	Description
Operation mode	
Repeat	Pattern data is repeatedly output. When a sequence is specified, patterns are repeated according to the sequence order. The extended sequence functions such as trigger wait, event jump, etc. are ignored in this mode.
Single	Pattern data is output only once. When a sequence is specified, a trigger signal causes to perform output according to the sequence order.
Step	Pattern data are output based on the clock, not specified by clock source, but generated by pressing the **STEP/EVENT** button on the front panel. This mode is the same as Repeat mode except for the clock.
Enhanced	Pattern data is output completely according to a sequence. The all extended sequence functions such as trigger wait, event jump, etc. are valid in this mode. This mode is same as Repeat mode except for the extended sequence functions.
Output pattern	
Pattern length	90 to 262144 points
Number of channels	Up to 4 for standard and 8 for option 01
Sequence	Maximum 4000 steps
Number of blocks	Maximum 256
Clock generator	
Internal clock	
Frequency	0.1 Hz to 409.6 MHz
Resolution	
PLL on	7 digits
PLL off	4 digits
Accuracy	
PLL on	±0.0001 %, 1 year after shipment from factory
PLL off	±3 %, 1 day after self calibration
Internal trigger generator	
Internal trigger rate	
Range	1.0 µs to 10.0 s
Resolution	3 digits, 0.1 µs min.

Table 1-6: Nominal traits - electrical characteristics (Cont.)

Characteristics	Description
Data and clock out	
Connectors	CH0 to CH3, and clock out (BNC connectors at front panel) CH4 to CH7 (BNC connectors at rear panel)
Output impedance	50 Ω (typical)
Output voltage	
V_{OH}	–1.25 V to +3.50 V (into 50 Ω)
V_{OL}	–1.50 V to +3.25 V (into 50 Ω)
Resolution	5 mV (into 50 Ω)
Voltage swing ($V_{OH} - V_{OL}$)	0.25 V to 5.00 V (into 50 Ω) 0.5 V to 10 Vp-p (into 1 MΩ)
Rise/fall times	Rise and fall time can be varied when the amplitude is within the range from 2 Vp-p to 5 Vp-p into 50 Ω.
Variable range	The variable range varies depending on the amplitude. See Figure 1-1 on page 1-5. FAST can be set to rise and/or fall time in this instrument, which means output rising and/or falling edge(s) are/is the fastest.
De-skew	
Range	±1 ns
Resolution	10 ps
Delay function	
Delay channel	CH0, CH1, CH2, CH3, CH4, CH5, CH6, and CH7 (Referenced to clock out)
Delay time	–5 ns to +18 ns
Resolution	20 ps
Inhibit function	
Mode	
Off	Output is always enable.
Internal	Controlled by CH0 signal
External	Controlled by inhibit input signal
Both	Controlled by both CH0 signal and inhibit input signal

Table 1-6: Nominal traits - electrical characteristics (Cont.)

Characteristics	Description
Event input	
Connector	BNC at rear panel
Threshold level	–5.0 V to +5.0 V, +1.4 V at default
Resolution	0.1 V
Input impedance	1 kΩ (typical)
Turning point for event jump	57 to 63 clocks before the next block. Refer to T_{ac1} in Figure 1-2 on page 1-6.
Maximum input voltage	±5 V
Polarity	Positive (rising edge)
Event output	
Connector	BNC at rear panel
Level	
V_{hi}	Approx. 5 V into 1 MΩ Approx. 2.5 V into 50 Ω
V_{lo}	Approx. 0 V into both 1 MΩ and 50 Ω
Delay time	48 to 53 clocks before data output change. Refer to T_{d5} in Figure 1-2 on page 1-6.
Pulse width	45 to 50 clocks. Refer to P_{W2} in Figure 1-2 on page 1-6.
Impedance	50 Ω
Inhibit input	
Connector	BNC at rear panel
Threshold level	–5.0 V to +5.0 V, +1.4 V at default
Resolution	0.1 V
Input impedance	1 kΩ (typical)
Maximum input voltage	±5 V
Sync output	
Connector	BNC at rear panel
Pulse width	9 or 10 clocks. Refer to P_{W1} in Figure 1-2 on page 1-6.
Impedance	50 Ω (typical)
Trigger input	
Connector	BNC at front panel
Threshold level	–5.0 V to +5.0 V, +1.4 V at default
Resolution	0.1 V
Impedance	50 Ω or 1 kΩ
Polarity	Positive or Negative

Table 1-6: Nominal traits - electrical characteristics (Cont.)

Characteristics	Description
External clock input	
Connector	BNC at rear panel
Impedance	50 Ω terminated to 0.5 V
Display	
Display area	Width: 13.2 cm (5.2 inches) Height: 9.9 cm (3.9 inches)
Resolution	Horizontal: 640 pixels Vertical: 480 pixels
AC line power	
Fuse rating	6A FAST, 250 V, UL 198G (3AG) 5A (T), 250 V, IEC 127

Table 1-7: Nominal traits - mechanical characteristics

Characteristics	Description
Net weight	
Standard	10.3 kg (22.7 lb)
Dimensions	
Height	164 mm (6.4 inches) including feet
Width	362 mm (14.3 inches) including handle
Length	491 mm (19.25 inches) including front cover 576 mm (22.2 inches) with handle extended

Certification and Compliances

The certification and compliances for the DG2030 are listed in Table 1-8.

Table 1-8: Certifications and compliances

Category	Standards or description
EC Declaration of Conformity – EMC	Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities: EMC Directive 89/336/EEC: EN 55011 Class A Radiated and Conducted Emissions EN 50081-1 Emissions: EN61000-3-2 AC Power Line Harmonic Emissions EN 50082-1 Immunity: EN61000-4-2 Electrostatic Discharge Immunity EN61000-4-3 RF Electromagnetic Field Immunity EN61000-4-4 Electrical Fast Transient/Burst Immunity EN61000-4-11 Voltage Dips and Interruptions Immunity
Australian/New Zealand declaration of Conformity - EMC	Complies with EMC provision of Radio–communications Act per the following standard: AS/NZS 2064.1/2 Industrial, Scientific, and Medical Equipment: 1992
EC Declaration of Conformity – Low Voltage	Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities: Low Voltage Directive 73/23/EEC, amended by 93/68/EEC EN 61010-1/A1:1992 Safety requirements for electrical equipment for measurement, control and laboratory use.
Approvals	Complies with the following safety standards: UL3111–1, First Edition Standard for electrical measuring and test equipment. CAN/CSA C22.2 No.1010.1-92 Safety requirements for electrical equipment for measurement, control and laboratory use.
Installation Category	CAT II
	Terminals on this product may have different installation (over–voltage) category designations. The installation categories are: Category — Examples of products in this category CAT III — Distribution-level mains (usually permanently connected). Equipment at this level is typically in a fixed industrial location. CAT II — Local-level mains (wall sockets). Equipment at this level includes appliances, portable tools, and similar products. Equipment is usually cord-connected. CAT I — Secondary (signal level) or battery operated circuits of electronic equipment.

Table 1-8: Certifications and compliances (cont.)

Category	Standards or description
Pollution Degree	A measure of the contaminates that could occur in the environment around and within a product. Typically the internal environment inside a product is considered to be the same as the external. Products should be used only in the environment for which they are rated. Pollution Degree 2 — Normally only dry, nonconductive pollution occurs. Occasionally a temporary conductivity that is caused by condensation must be expected. This location is a typical office/home environment. Temporary condensation occurs only when the product is out of service.
Conditions of Approval	Safety Certifications/Compliances are made for the following conditions: Altitude (maximum operation): 2000 meters
IEC Characteristics	Equipment type: Test and Measuring Installation Category II (as defined in IEC 61010–1, Annex J) Pollution Degree 2 (as defined in IEC 61010–1) Safety Class I (as defined in IEC 61010–1, Annex H)

Preparation for Use

This section describes how to prepare the DG2030 Data Generator for use. The information describes these items:

- Proper operating environment
- Checking power cord and line voltage configurations
- Checking the fuse
- Power-on and power-off cycles

Supplying Power

Section 1, *Specifications*, lists the line voltage and frequency ranges over which the DG2030 operates. Before installing the DG2030, note these precautions:

WARNING. *To avoid equipment failure and potential fire or personal shock hazards, do not exceed the maximum rated operating voltage of 250 V between the voltage-to-ground (earth) and either pole of the power source. The DG2030 operates from a single-phase power source and has a three-wire power cord with a two-pole, three-terminal grounding plug. Also, before making connection to the power source, be sure the DG2030 has a suitable two-pole, three-terminal grounding-type plug.*

To avoid personal shock hazard, do not touch conductive parts. All accessible conductive parts are directly connected through the grounding conductor of the power cord to the grounded (earthing) contact of the power plug. The DG2030 is safety Class 1 equipment (IEC designation).

To avoid personal shock hazard, do not defeat the grounding connection. Insert the power input plug only in a mating receptacle with a grounding contact where earth ground has been verified by a qualified service person. Also, for electrical shock protection, make the grounding connection before making connection to the DG2030 input or output terminals.

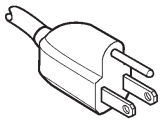
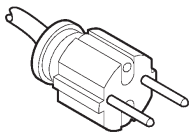
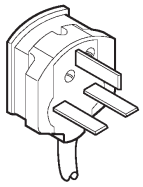
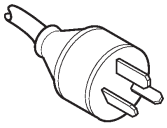
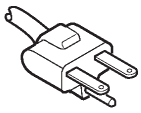
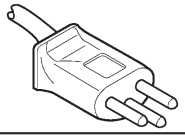
Power Cord Information

The DG2030 ships with the required power cord as ordered by the customer. Table 2-1 gives the color-coding of the conductors in the power cord. Table 2-2 shows information on the available power cords.

Table 2-1: Power-cord conductor identification

Conductor	Color	Alternate color
Ungrounded (Line)	Brown	Black
Grounded (Neutral)	Light Blue	White
Grounded (Earthing)	Green/Yellow	Green

Table 2-2: Power cord identification

Plug configuration	Normal usage	Option number
	North America 125 V	Standard
	Europe 230 V	A1
	United Kingdom 230 V	A2
	Australia 230 V	A3
	North America 230 V	A4
	Switzerland 230 V	A5

Operating Environment

To ensure proper DG2030 operation and long life, note the following environmental requirements.

Operating Temperature

The DG2030 operates in an environment with an ambient air temperature between +10° C and +40° C. The DG2030 storage temperature ranges from –20° C to +60° C. After storage at temperatures outside the operating limits, allow the DG2030 chassis to stabilize at a safe operating temperature before applying power.

Ventilation Requirements

Air drawn in and exhausted through the cabinet side and bottom panels cools DG2030 internal circuits. To ensure proper cooling, allow the following clearances:

Top	1 inch (2.5 cm)
Back	3 inches (7.5 cm)
Left and right	6 inches (15 cm)

The feet on the bottom of the DG2030 cabinet provide the required clearance when it is set on a flat surface. The top of the DG2030 does not require ventilation clearance.

CAUTION. *To prevent temporary shutdown of the DG2030, do not restrict air flow through the chassis. If the DG2030 shuts down unexpectedly, improve ventilation around the DG2030 and wait a few minutes to allow it to cool down; then switch the power on again.*

Rear Panel Controls

Figure 2-1 shows the rear panel controls for the DG2030.

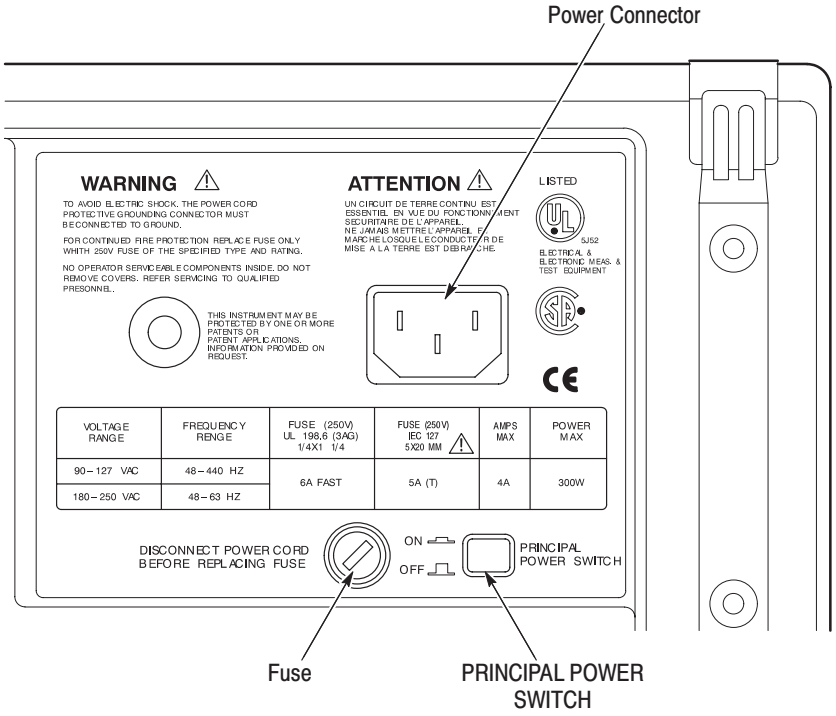


Figure 2-1: Rear panel controls

Fuse Type and Rating

The DG2030 uses the same fuse for all operating line voltage ranges. One of two fuse types is installed in the instrument, depending upon the power cord option. Table 2-3 provides the available types and ratings.

Table 2-3: Fuse type and rating

Power cord option	Fuse	Fuse part number	Fuse cap part number
Standard, Option A4	0.25 inch × 1.25 inch (UL 198G,3AG): 6A FAST, 250V	159-0239-00	200-2264-00
Option A1, A2, A3, A5	5 mm × 20 mm (IEC 127): 5A(T), 250V	159-0210-00	200-2265-00

WARNING. *To avoid electrical shock, always unplug the power cord from the socket before checking the line fuse.*

To check the fuse, remove the fuse holder on the rear panel. Refer to Figure 2-1 for the location of the fuse holder. To remove the fuse holder, turn it counter-clockwise with a screwdriver while pushing it in. Then remove the fuse from the fuse holder.

Applying and Interrupting Power

Consider the following information when you power on or power off the DG2030, or when external power loss occurs.

Power-on Cycle

At power-on, the start-up diagnostics check the DG2030 operation. If all diagnostic items complete without error, the DG2030 displays the **EDIT** menu.

If the diagnostics detect an error, the DG2030 displays the error code. To exit the diagnostics menu, press any key; then the system displays the **EDIT** menu. See section 6, *Maintenance*, for information on diagnostics and fault isolation.

***NOTE**. If the ambient temperature goes outside the specified operating temperature range, an error occurs during the diagnostics at power-on. If this happens, power off the DG2030 and wait until the chassis temperature is appropriate; then switch the power on again.*

Power-off Cycle

Wait for the DG2030 to finish the operation when saving data files. Improper power-off or unexpected loss of power to the DG2030 can result in the corruption of data stored in nonvolatile memory.

Memory Backup Power

A lithium battery maintains internal nonvolatile memory, allowing the DG2030 to retain data files if AC power is lost. This battery has a shelf life of about three years. Partial or total loss of stored information at power-on may indicate that the battery needs to be replaced.

***WARNING.** To avoid risk of fire or explosion, replace the DG2030 battery with a lithium battery having the part number listed in section 10,* Mechanical Parts List. *This battery is a safety-controlled part.*

To avoid risk of fire or explosion, do not recharge, rapidly discharge, or disassemble the battery; and do not incinerate the battery or heat it above 100° C. Also, dispose of used batteries promptly. Small quantities of used batteries can be disposed of in normal refuse. Keep lithium batteries away from children.

Repackaging Instructions

Use a corrugated cardboard shipping carton having a test strength of at least 275 pounds and with an inside dimension at least six inches greater than the DG2030 dimensions. (If available, use the original shipping carton, which meets these requirements.)

If the DG2030 is shipped to a Tektronix Service Center, enclose the following information:

- The owner's address
- Name and phone number of a contact person
- Type and serial number of the DG2030
- Reason for returning
- A complete description of the service required

Seal the shipping carton with an industrial stapler or strapping tape.

Mark the address of the Tektronix Service Center and your own return address on the shipping carton in two prominent locations.

Installed Options

Your DG2030 may include one or more options. To determine which options are installed, look at the instrument option configuration listed on the rear panel.

Table 2-2 on page 2-2 gives information about line cord options. Section 7, *Options*, lists other options and optional accessories. For further information and prices of options, see your Tektronix Products catalog or contact a Tektronix Field Office.

Operating Instructions

Before servicing the DG2030, read the following operating instructions. These instructions are at the level appropriate for servicing the DG2030. The user manual contains complete operator instructions.

In addition, Section 4, *Performance Verification*, includes instructions for making the front-panel settings required to check DG2030 characteristics.

How to Power On

To power-on the DG2030, follow these steps:

1. Set the **PRINCIPAL POWER SWITCH** (on the rear of the DG2030) to the ON position. This switch is the main power switch; it routes power to the standby circuit in the DG2030.
2. Then, press the **ON/STBY** (standby) switch on the front (lower-left corner) of the DG2030. This switch applies power to the remaining circuits of the DG2030. Allow at least 20 minutes for the DG2030 to warm up.

WARNING. *To avoid personal shock hazard, turn off both the* ***ON/STBY*** *switch and the* ***PRINCIPAL POWER SWITCH*** *before servicing. The* ***PRINCIPAL POWER SWITCH*** *on the rear panel is the true power disconnect switch. The ON/STBY (standby) switch simply toggles operation on and off. When connected to a power source and when the* ***PRINCIPAL POWER SWITCH*** *is on, the internal power supplies and much of the other circuitry of the DG2030 remain energized regardless of the setting of the ON/STBY switch.*

To avoid personal shock hazard, set the ***PRINCIPAL POWER SWITCH*** *off before connecting or disconnecting the line cord to or from the power source.*

Internal Diagnostics Routines

At power-on, the DG2030 performs internal start-up diagnostics. These diagnostics check internal circuit function and report any failures. In addition, you can initiate internal diagnostics using the **Diag** item in the UTILITY menu; these diagnostics differ from the start-up diagnostics in that they do more extensive memory checking.

User Interface

The DG2030 uses a combination of front-panel buttons, keys, a knob, and on-screen menus to control generator functions. Some front-panel controls select menus and manipulate menu items. Others enter values and units, allow manual triggering, start/stop DG2030 output, advance the pattern data, generate an event pulse, and make a hard copy. On-screen graphics show various aspects of the current DG2030 configuration.

On-screen menus set most DG2030 functions. Main menus provide access to lower-level nested submenus. Buttons in the center of the front panel select the main menus.

When you select a menu, the display shows the items controlled by that menu and numeric values currently in effect. Buttons around the display select lower-level menus, change menu selections, modify numeric values and units, and execute functions.

Display Elements

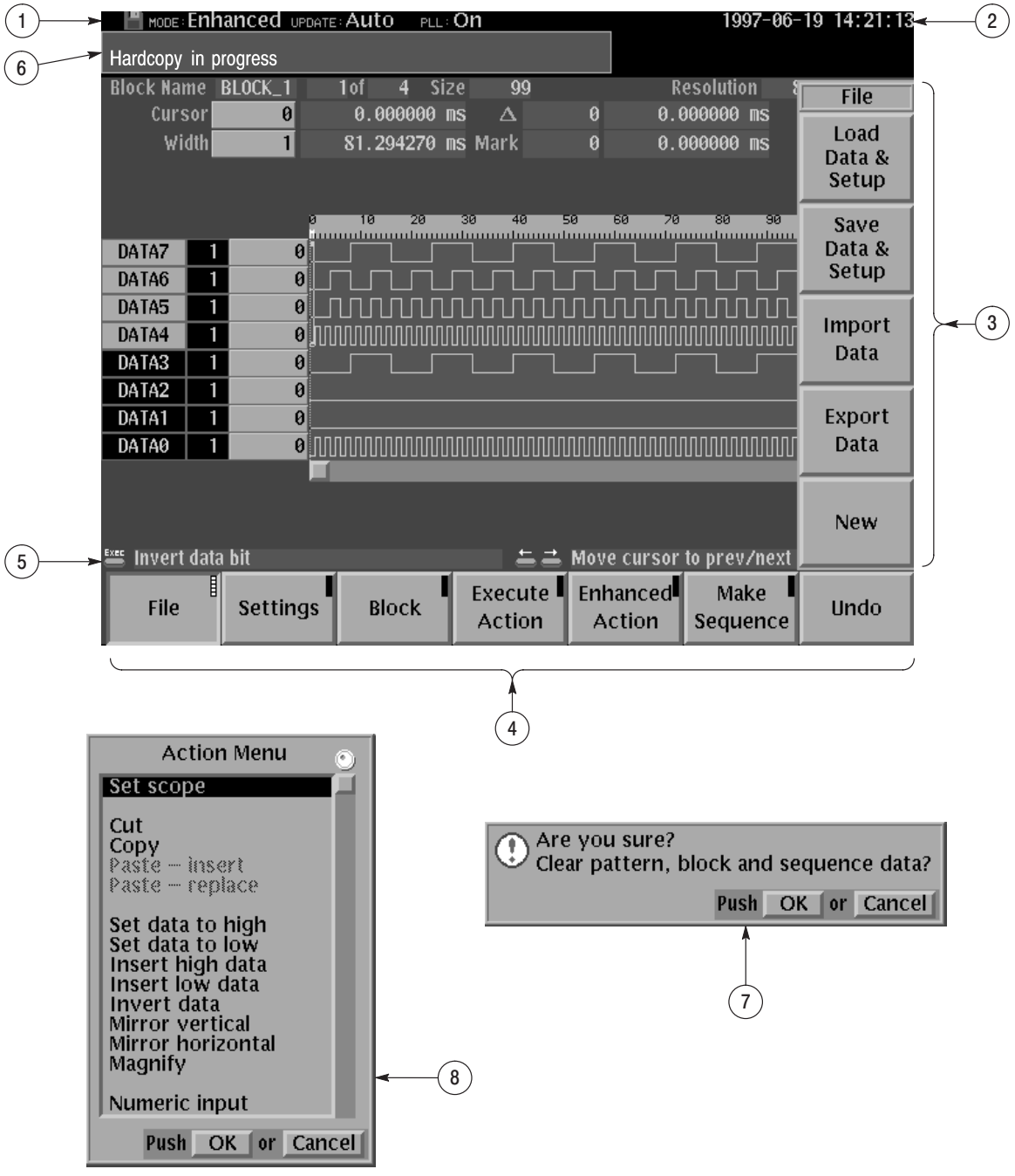


Figure 2-2: DG2030 display elements

Table 2-4: DG2030 display elements

Figure number	Label	Description
1	Status area	Displays the current status of the instrument. This status line is always displayed, whichever menu is displayed. The status line displays the following four items. **MODE**: Displays the run mode in which pattern data will be output. **UPDATE**: Displays the update method for pattern data output when data is updated. **PLL**: Displays whether or not the PLL circuit is used as the internal oscillator circuit. In addition, there is also a disk icon that indicates whether or not a floppy disk is inserted in the disk drive. A clock icon may also be displayed at the left end of the status line. When this icon is displayed, the instrument is busy with internal processing and cannot accept other inputs.
2	Date and Time display area	The date and time display can be turned on or off using the UTILITY menu.
3	Side menu	Related side menu items are displayed here when a bottom menu item is selected. The topmost entry in the side menu displays either a label representing the side menu or the operation name for the confirmed item.
4	Bottom menu	When one of the buttons in the menu section is pressed, the corresponding bottom menu is displayed. When a bottom menu item is selected the corresponding side menu is displayed. Selecting the same bottom menu item again closes the side menu.
5	Button function description area	Displays descriptions of the functions of the front panel buttons.
6	Message display area	Displays messages that report on the current processing state. This area can be also used by remote commands to display user messages.
7	Popup message box	When required, the instrument temporarily displays a window at the center of the screen to display a warning or question for the user.
8	Popup menu	The instrument sometimes displays a pop-up menu when a bottom menu or side menu item is selected. Enter a numeric value or select an item using either the general purpose knob or the front panel buttons.

Menus

The DG2030 operation is primarily controlled by means of menus that correspond to the SETUP, EDIT, APPLICATION and UTILITY buttons in the MENU column. To display one of these main menus on the screen, push the corresponding button. The button LED indicates which menu is currently selected. Refer to the User Manual for more details concerning these menus.

- EDIT Menu

  Provides functions for editing pattern data and creating sequences.

- SETUP Menu

  Provides functions for defining groups, setting up channels, and setting output channel voltages, the operating mode, and triggers.

- APPLICATION Menu

  The current version of the firmware does not provide any functions under the APPLICATION menu.

- UTILITY Menu

  This menu provides functions for manipulating the basic instrument settings.

Clock Calibration

After the 20-minute warm-up period has been passed, the clock calibration must be made. Also when the ambient temperature has been changed by ±5 °C from the previous calibration, the clock calibration must be performed.

To calibrate the clock, do the following steps:

1. Press the **UTILITY** button on the front panel.
2. Press the **Cal** bottom button, and then press the **Execute** side button.

Pattern Storage and I/O

The DG2030 has internal nonvolatile memory (NVRAM) for pattern file storage. The DG2030 generates patterns from file residing in internal nonvolatile memory.

The DG2030 also has a floppy-disk drive for loading files from floppy disk into internal nonvolatile memory, and for saving files from memory to floppy disk. The disk drive accepts 3.5-inch floppy disks in the MS-DOS format.

Loading Files

The following steps explain how to load files from a floppy disk into internal memory.

1. Turn the disk so the side with the arrow is on top; insert the disk into the DG2030 floppy disk drive.
2. Press the **EDIT** button on the front panel.
3. Select **File** from the bottom menu.
4. Select **Load Data & Setup** from the side menu. The menu in Figure 2-3 appears.
5. Turn the general purpose knob to highlight the file you want to load and select **OK** from the sub menu.
6. Push the floppy drive button and remove the disk from the floppy drive.

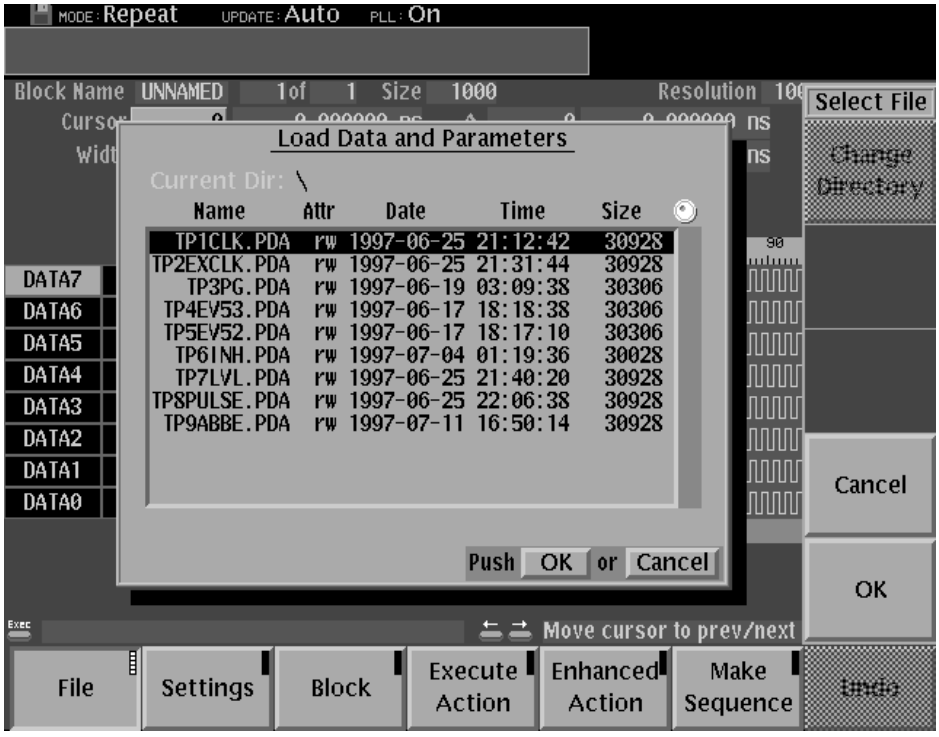


Figure 2-3: Load Data and Parameters menu

Signal Output

The procedure assumes that data has already been loaded as explained in the previous section.

The following example first groups the data bits from the pattern data already created and allocates each data bit to output channels. Next, this procedure sets all the settings required for signal output and actually outputs the signals.

- Tables such as the one below show in the operating procedure. Execute the action in left end of the top row first. Then execute actions from left to right along the row. When one row has been completed, move to the left end of the next row down, and repeat. For popup menus, use the general purpose knob to select items from the menu list. Operations such as operation 6 (below) do not involve pressing the buttons shown in the row above, but rather are descriptions of operations to be performed. Figure 2-4 shows the buttons used and the menu layout.

Menu button	Bottom button	Popup menu	Side button	Front panel button
Operation 1	Operation 2	Operation 3	Operation 4	Operation 5
Operation 6 (For example, set to xx with general purpose knob.)				
			Operation 7	

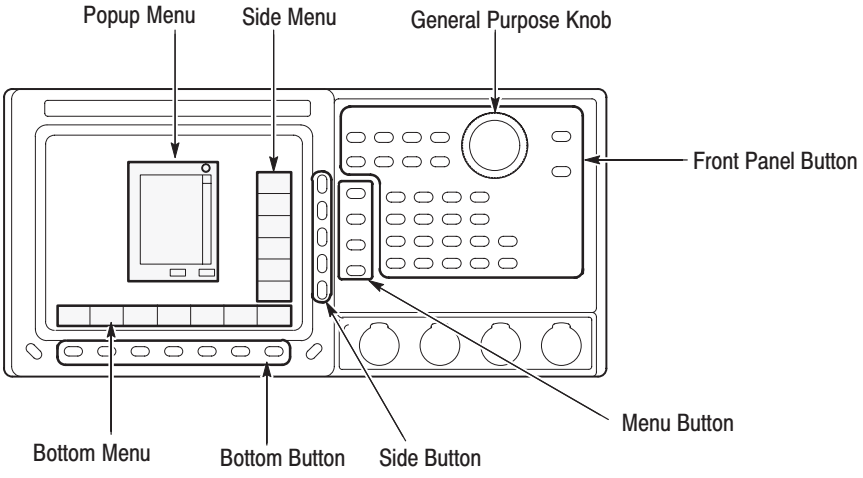


Figure 2-4: Operating buttons and menu layout

Grouping the data bits

1. Assign DATA0 to DATA3 to a group called IC1.

a. Reset all bit allocations.

Menu button	Bottom button	Popup menu	Side button	Front panel button
SETUP	Group Assign		Reset All bits Assign	
			OK	

b. Set the MSB and LSB to D3 and D0, respectively.

Menu button	Bottom button	Popup menu	Side button	Front panel button
		Select 4 DATA03	Group Bit(s) Config	
			MSB (Set D3)	
			LSB (Set D0)	
			OK	

***NOTE**. The MSB setting may change depending on the direction the general purpose knob is turned. If that happens, the MSB setting must be set again.*

c. Attach the name IC1 to the newly created group.

Menu button	Bottom button	Popup menu	Side button	Front panel button
			Rename	
			Clear String	
		IC1	OK	

2. Assign DATA4 to DATA7 to a group called IC2.

a. Set the MSB and LSB.

Menu button	Bottom button	Popup menu	Side button	Front panel button
		Select 0 DATA07	Group Bit(s) Config	
			MSB (Set D7)	
			LSB (Set D4)	
			OK	

***NOTE**. The MSB setting may change depending on the direction the general purpose knob is turned. If that happens, the MSB setting must be set again.*

b. Attach the name IC2 to the group.

Menu button	Bottom button	Popup menu	Side button	Front panel button
			Rename	
			Clear String	
		IC2	OK	

Allocating Data Bits to Output Channels

3. Allocate data bits to output channels **CH0** to **CH7**.

a. Clear the output channels for channels **CH0** to **CH7**.

Menu button	Bottom button	Popup menu	Side button	Front panel button
	Output Condition		Assign Condition	
Press the front panel up and down arrow buttons to select channel CH0 from the Output assign list.				
			Release	
Clear the CH1 and CH7 allocations in the same manner.				
			OK	

b. Turn off the output impedance control for each channel.

Menu button	Bottom button	Popup menu	Side button	Front panel button
			Control Condition	
Select CH0 from the list displayed in the screen using the general purpose knob.				
			Change Inhibit Control	
		Select OFF	OK	
Using the same procedure to turn off the output impedance control for channels CH1 to CH7.				
			Go Back	

c. Allocate the IC1 group data to the output channels **CH0** to **CH3** and turn off the output impedance control for each channel.

Menu button	Bottom button	Popup menu	Side button	Front panel button
			Assign Condition	
Press the front panel up and down arrow buttons to select channel CH0 from the Output assign list.				
Select data D3 (IC1:3) from the Data bits list using the general purpose knob.				
			Assign	
Allocate D2 to D0 to CH1 to CH3 using the same procedure and turn off the output impedance control for each channel.				

d. Allocate the **IC2** group data to the output channels **CH4** to **CH7**.

Menu button	Bottom button	Popup menu	Side button	Front panel button
Press the front panel up and down arrow buttons to select channel CH4 from the Output assign list.				
Select data D7 (IC2:3) from the Data bits list using the general purpose knob.				
			Assign	
Allocate D6 to D4 to CH5 to CH7 using the same procedure and turn off the output impedance control for each channel.				
			OK	

***NOTE**. Press the **OK** button when done to activate the allocations. Note that the allocations will not become valid unless the **OK** button is pressed.*

To summarize, the above has allocated data bits to the output channels as shown in Figure 2-5.

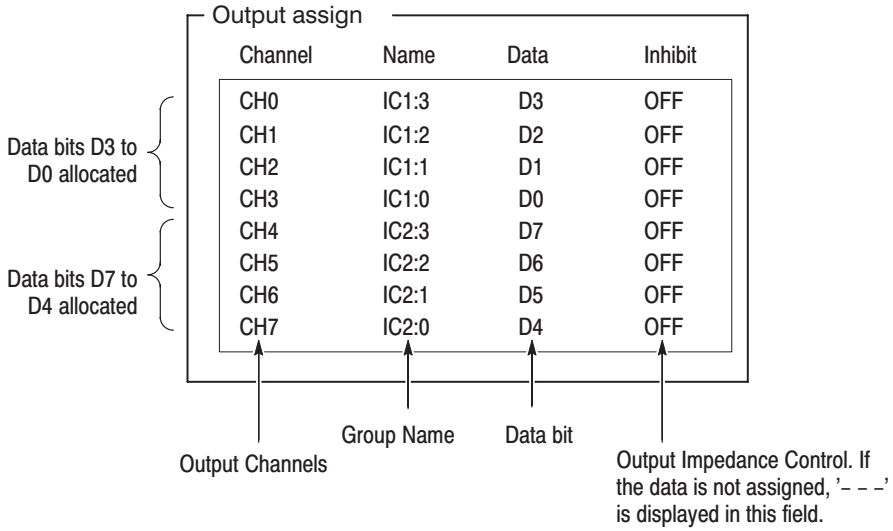


Figure 2-5: Output channel data bit allocation

Setting Sampling Clock Frequency

4. Set the sampling clock frequency to 50 MHz.

Menu button	Bottom button	Popup menu	Side button	Front panel button
	Clock		Source (Select Int)	
			Int FREQ	50 MHz
			PLL (Select On)	

Setting Signal Generation Mode

5. Set the signal generation mode to continuous mode.

Menu button	Bottom button	Popup menu	Side button	Front panel button
	Run Mode		Repeat	

Setting Output Level

The output level is always at the TTL level.

6. Set the output channel **CH0** to **CH7** output levels to 3 V for the high level and –1 V for the low level.

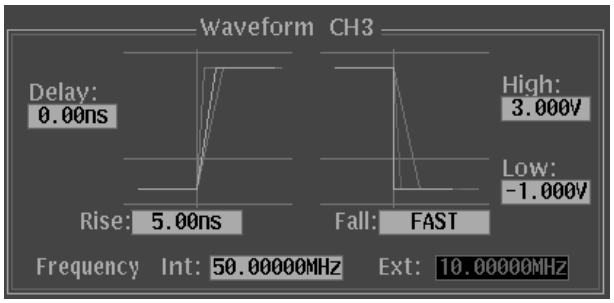
Menu button	Bottom button	Popup menu	Side button	Front panel button
	Level Condition			
Select channel CH0 using the front panel up and down arrow buttons.				
			High Level	3 ENTER
			Low Level	–1 ENTER
Set the output levels for channels CH1 to CH7 in the same manner.				

Setting Rise/Fall Timing

The rise time and fall time of each output signal can be varied within a certain range.

7. Set the rise time for the output channel **CH0** to **CH3** to 5 ns and fall time for those channels to FAST. See Figure 2-6.

Menu button	Bottom button	Popup menu	Side button	Front panel button
	Timing Condition			
Select channel CH0 using the front panel up and down arrow buttons.				
			Rise	5 ENTER
			Fall	0 ENTER
Set the rise and fall times for channels CH1 to CH3 in the same manner.				



Slopes for the rising and falling periods can be set within the ranges indicated by the non-highlighted lines. As a slope, FAST or a value from the range can be selected.

Figure 2-6: Rise / fall time settings

Setting Delay Timing

The delay time for each channel can be set.

8. Set the delays for the output channels **CH4** to **CH7** to 10 ns.

Menu button	Bottom button	Popup menu	Side button	Front panel button
Select channel CH4 by pressing the front panel up and down arrow buttons.				
			Delay	10 ENTER
Set the delays for channels CH5 to CH7 in the same manner.				

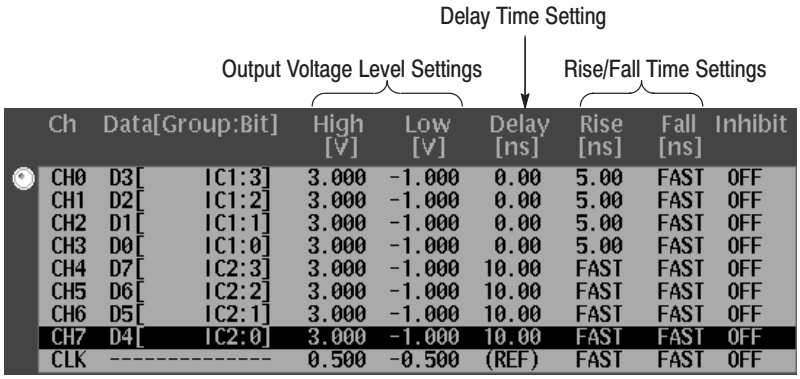


Figure 2-7: Output voltage level and delay time display

Signal Output

This step actually outputs the signals.

9. Press the **START/STOP** button on the front panel.

Theory of Operation

This section describes the basic operation of the major circuit blocks or modules in the DG2030. Section 9, *Diagrams*, includes a block diagram and an interconnect diagram. Figure 9-1 shows the modules and functional blocks of the DG2030 with Option 01 installed. Figure 9-2 shows how the modules interconnect.

Module Overview

The module overview describes the basic operation of each functional circuit block.

The DG2030 Data Generator consists of two major electrical sections; the **Main Frame section** and the **PG & Output section**. The Main Frame section consists of Clock Board, CPU Board, Back Plane, Bezel Switch, Display Monitor, Power Supply, Aux Power Supply, FDD, and Fan. The PG&Output section consists of PG circuitry and Output circuitry.

Main Frame Section

The Main Frame section consists of the following modules and components.

Clock Board (A30). The clock board contains the clock generator, trigger circuit, and miscellaneous control circuit for the PG and Output board. This trigger signal is provided from the connector on the front panel.

CPU Board (A6). The CPU board receives commands from the front panel or the GPIB/RS-232-C interface and controls the PG section through the Back Plane board. It also sends the video signal to the display monitor for displaying various graphical menus, data pattern figures, message texts, etc. The CPU board contains MPU, ROM, RAM, video display, bus timing circuitry, and the interfaces to GPIB, RS-232-C, FDD, and the front panel.

CAUTION. *To avoid losing pattern data files stored in NVRam, save the files to a floppy disk before removing the A6 CPU board or A16 Backplane board. Then restore the files from floppy disk to DG2030 nonvolatile memory after reinstalling the board(s).*

Back Plane Board (A17). The DG2030 back plane has five slots which accommodate the CPU board and Clock board. This board receives the power from the

Power Supply module and distributes the power to the boards in the slots. This board also interconnects various lines such as the CPU buses and other control signals.

Power Supply. The power supply module receives the filtered line power from Aux Power board and sends regulated voltages to the Back Plane board. The module supplies the following voltages: +5 V, –4.6 V, –2 V, +15 V, and –15 V.

This module features a remote control with the ON/STBY switch on the bezel. The remote switching signal which is generated on the bezel is sent to the CPU board by the Back Plane board. The signal is transformed by the CPU board and sent to the Power Supply via the Back Plane.

Front Panel (A6, CPU Board). The front panel contains a scanned rubber button matrix, LEDs, a rotary encoder and so on, for entering selections. User selections from the front panel are sent to the processor. This interface is compatible with TDS series oscilloscope. Commands from the processor control the LED in the buttons.

Display Monitor (A6, CPU Board). The Display Monitor consists of a raster scan CRT and its driver circuitry. It receives the sync and video signals from the CPU board and +15 V DC power from the Power Supply. The Display Monitor is serviced as a module; no adjustment procedure or circuit description is provided.

Bezel Switch. The buttons at the bottom and side of the display are bezel switches. This is a flexible circuit which is sealed on the chassis.

Aux Power Supply (A100). The Aux Power Supply consists of a main power switch, a fuse, and an AC power.

GPIB (A6, CPU Board). This functional block is the General Purpose Interface Bus (GPIB) interface drive, which controls communication with external devices over the parallel interface. The GPIB connector is on the rear panel.

RS-232C (A6, CPU Board). This functional block is the RS-232-C interface circuit which controls serial communication with external devices over the RS-232-C interface. The RS-232-C interface connector is on the rear panel.

Floppy Disk Drive. The 3.5-inch floppy disk drive supports both 2DD and 2HD MS-DOS formats.

Fan. This is a brushless DC fan which draws approximately 0.5 A from +12 V. The fan prevents heat build-up inside the cabinet; it pulls air into the right (floppy-disk) side of the DG2030 and exhausts it out the left side.

PG&Output Section

The PG&Output Section consists of the following circuit blocks.

PG Circuitry (A50, PG & Output Board). The PG circuitry is the core of the DG2030 and consists of the pattern memory, shift register, and address generator. The sequence of the output pattern is controlled by the address generator. This block receives the system clock from the Clock board and sends the digital pattern data to the Output circuit.

Output Circuit (A50, PG & Output Board). The output circuitry contains the Pin Driver and the delay control circuit. The Pin Driver outputs the digital pattern and converts the signal levels for various types of logics such as TTL, CMOS, LVCOMS, ECL, and PECL. It also has the ability of changing the output signal edge slew rate. This block has the data latch clock signal. This signal generated by the Pin Driver is the same as data outputs, the signal levels can be converted like data outputs.

Options

The following option are available on the DG2030:

- **Option 01: 8-Channel Output**
  This option adds another 4 channels to allow the instrument to output a total of 8 channels.

For more information about this and other options, see Section 7, *Options*.

Performance Verification

This section describes the operation tests for the DG2030 data generator, and the procedures for those tests. The operation tests can be divided into two categories.

- Self Tests.

  The DG2030 incorporates a diagnostic system that performs comprehensive instrument testing. This system confirms that the DG2030 is operating correctly. The self tests execute quickly and require no special equipment during execution.

- Performance Tests.

  These tests confirm the operation of the items that are marked with an asterisk (*) in the guaranteed items in the operating specifications listed in Appendix A, *Performance Characteristics*. The equipment listed in Table 4-2 is required to perform these performance tests.

Before Running the Operation Tests

Perform the following before running the Operation Tests.

Warm up

A 20 minute warm up period is required prior to running the operation tests.

Calibration

The clock calibration must be performed after the warm up period has been passed. The calibration must be made during operations at least when the ambient temperature has been changed by ±5 °C from previous calibration.

To perform the clock calibration:

1. Select **UTILITY → Cal → Execute**.
2. Verify whether error have occurred or not in the screen.

File Loading

The performance check disk provided with the DG2030 includes the files listed in Table 4-1. The specified file must be loaded into the DG2030 for each operation test item. These files include pattern data and setup information.

Table 4-1: Performance check disk's file list

File name	Operation test
TP1CLK.PDA	Internal clock frequency
TP2EXCLK.PDA	External clock input
TP3PG.PDA	Sequence and digital output
TP5EV52.PDA	Event input
TP6INH.PDA	Inhibit function
TP7LVL.PDA	Data output voltage level
TP8PULSE.PDA	Clock output amplitude and delay time
TP9ABBE.PDA	Aberration

Use the following procedure to load the file required by a performance test into the instrument.

1. Insert the performance check disk into the DG2030's floppy disk drive.
2. Select **EDIT → File → Load Data & Setup**.
3. Select the required file using the general purpose knob.
4. Select **OK** from the sub menu.

Required Equipment

Table 4-2 lists the equipment required for the performance tests.

Table 4-2: Required equipment

Item	No.	Required precision	Recommended equipment
Frequency counter	1	Frequency range: 0.1 Hz to 400 MHz Precision: 7 digits or higher	ANRITSU MF 1603A
Digital multi–meter	1	DC voltage range: ±10 V Precision: 0.01 V	Tektronix DM2510
Performance check disk	1		Tektronix part no. 063-2922-XX (provided with the DG2030)
Oscilloscope	1	Bandwidth: 1 GHz or higher	Tektronix TDS784A
Function generator	1	Amplitude: 4 V, offset: 2 V (50 Ω termination), Frequency: 1 MHz or higher	Tektronix AFG2020
BNC cable	5	Impedance: 50 Ω Length: 24 inches	Tektronix part no. 012-1342-00
Precision 50 Ω termination	1	Impedance: 50 Ω (0.1 %)	Tektronix part no. 011-0129-00
BNC T dual input adapter	1		Tektronix part no. 103-0030-00
N-to-BNC adapter	1		Tektronix part no. 103-0045-00
BNC-dual-banana adapter	1		Tektronix part no. 103-0090-00

Test Procedure Notes

The following conventions are used in this section for describing the self tests and performance tests.

- The test items are described in the following order.
  - Characteristic tested
  - Required equipment
  - Connections
  - Test procedure
- The test procedure is presented in order starting with step 1, and progresses through the end of the procedure. Tables such as the one shown below appear in these steps. For these steps, press the buttons in the order shown in the table, either from left to right or from top to bottom, to select the required menu item. For pop up menus, use the general purpose knob to select items from the menu list. Operations such as operation 6 do not involve pressing the buttons shown in the row above, but rather are descriptions of operations to be performed. Figure 4-1 shows the buttons used and the menu layout.

Menu button	Bottom button	Pop up menu	Side button	Front panel button
Operation 1	Operation 2	Operation 3	Operation 4	Operation 5
Operation 6 (e.g., insert a disk in the disk drive.)				
			Operation 7	

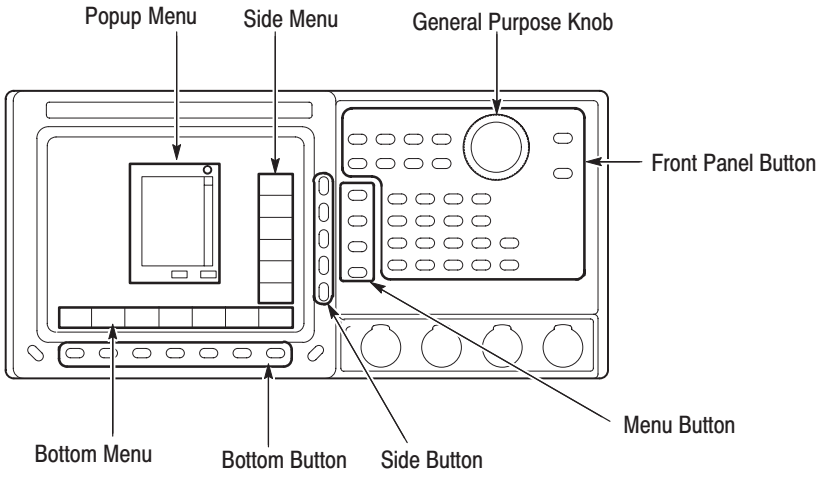


Figure 4-1: Operating buttons and menu layout

Self Tests

Execute the DG2030 self tests and confirm that no errors occurred.

1. Press the required buttons in the following order. Selecting **All** from the **Type** side button causes the instrument to run the self-test on all test items.

Menu button	Bottom button	Pop up menu	Side button	Front panel button
UTILITY	Diag		Type (Select All)	
			Execute	

2. Confirm that all self tests passed by checking the **Status** display area shown in Figure 4-2.

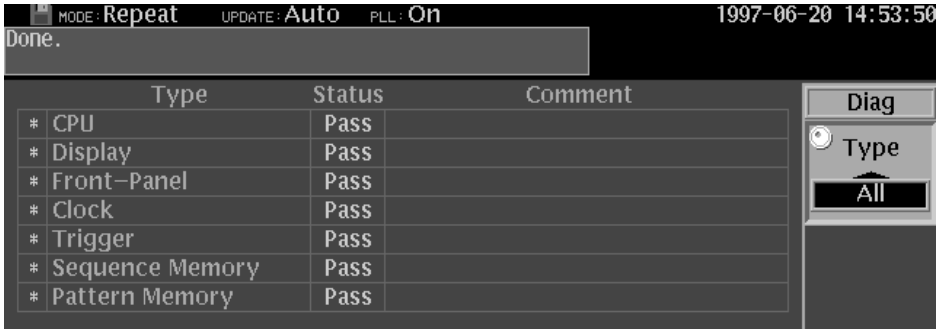


Figure 4-2: Diagnostics menu

If **Fail** is listed in the **Status** display area, an error code will be displayed in the **Comment** column. See Table 4-3 for the meanings of the error codes.

***NOTE**. Contact your Tektronix sales representative if an error occurs.*

Table 4-3: Error codes

Error code	Error meaning	Failed component
1XX	CPU diagnostics error	A6 CPU board
2XX	Display diagnostics error	A6 CPU board
3XX	Front panel diagnostics error	A12 Key board
4XX	Clock diagnostics / calibration error	A30 Clock board
5XX	Trigger diagnostics / calibration error	A30 Clock board
6XX	Sequence memory error	A50 PG&Output board
7XX	Pattern memory diagnostics error	A50 PG&Output board

Performance Tests

The performance test for the DG2030 must be performed in the following order.

- Internal clock frequency
- External clock input
- Sequence & digital output
- Inhibit function
- Output level, amplitude, rise time and fall time accuracies
- Delay time accuracy

Internal Clock Frequency

This test confirms the frequency accuracy of the DG2030 internal clock.

With the PLL circuit on: Clock frequency ±0.0001 %

With the PLL circuit off: Clock frequency ±3 %

Equipment Required	Frequency counter
	BNC cable
	50 Ω termination
	N-to-BNC adapter
	Performance check disk

Connections. Connect the clock output from the DG2030 front panel to the frequency counter input (INPUT B) through the N-to-BNC adapter with the BNC cable.

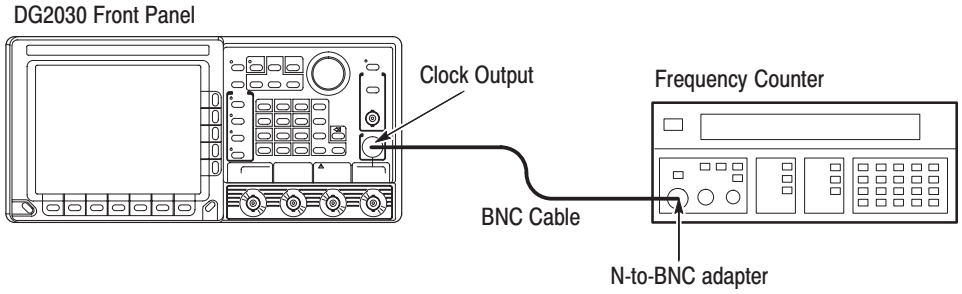


Figure 4-3: Frequency measurement connections

Setup. Set the frequency counter to frequency measurement mode.

Characteristics Confirmation Procedure.

1. Load the **TP1CLK.PDA** test pattern file from the performance check disk. When the file is loaded, the DG2030 clock frequency will be set to 400 MHz internally and the PLL circuit will be turned on.

The following steps check the clock frequency accuracy with the PLL circuit on and the internal clock frequency set to 400 MHz.

2. Press the **START/STOP** button on the front panel so that the button's LED indicator lights.

3. Set the counter trigger to an appropriate value and confirm that the counter displays a frequency in the range 399.9996 to 400.0004 MHz.

The following steps check the clock frequency precision with the PLL circuit on and the internal clock frequency set to 200.1 MHz, 200 kHz and 100.0 mHz.

4. Press the following buttons to set the DG2030 clock frequency to 200.1 MHz.

Menu button	Bottom button	Pop up menu	Side button	Front panel button
SETUP	Clock		Int FREQ	200.1 MHz/μs

5. Set the counter trigger to an appropriate value, and confirm that the counter displays a frequency in the range 200.0998 MHz to 200.1002 MHz.

6. Change the frequency counter input to INPUT A through the 50 Ω termination with the BNC cable.

7. Set the DG2030 clock frequency to 200 kHz.

8. Set the counter trigger to an appropriate value, and confirm that counter displays a frequency in the range 199.9998 kHz to 200.0002 kHz.

9. Set the DG2030 clock frequency to 100 mHz.

10. Set the frequency counter to period measurement mode.

11. Set the counter trigger to an appropriate value, and confirm that the counter displays a frequency in the range 99.9999 mHz to 100.0001 mHz.

The following steps check the clock frequency accuracy with the PLL circuit off and the internal clock frequency set to 400 MHz, 200 kHz and 100.0 mHz.

12. Press the following buttons to turn the PLL circuit off.

Menu button	Bottom button	Pop up menu	Side button	Front panel button
SETUP	Clock		PLL (Set to Off)	

13. Set the internal clock frequency to 400 MHz, 200 kHz, and 100.0 mHz, and confirm that the frequencies and periods measured by the frequency counter fall within the ranges shown in Table 4-4.

Table 4-4: Internal clock frequency precision (PLL off)

Internal clock frequencies	Clock frequency ranges
400.0 MHz	388 MHz ~ 412 MHz
200.0 kHz	194 kHz ~ 206 kHz
100.0 mHz (10.0 s)	97 mHz ~ 103 mHz

14. Press the **START/STOP** button on the front panel to stop output (the button's LED goes off).

External Clock Input

This test confirms external clock input operation. Confirm that the clock signal is output from the CLOCK OUT connector when a square wave signal with a frequency of 1 MHz and an amplitude of 1 V (V_{IH} > 0.7 V, V_{IL} < 0.3 V) is input as an external clock signal.

Equipment Required	Oscilloscope
	Function generator
	Two BNC cables
	Performance check disk

Connections. Connect the clock output from the DG2030 front panel to the oscilloscope CH1 input with an BNC cable. Connect the function generator output to the DG2030 rear panel clock input with the other BNC cable.

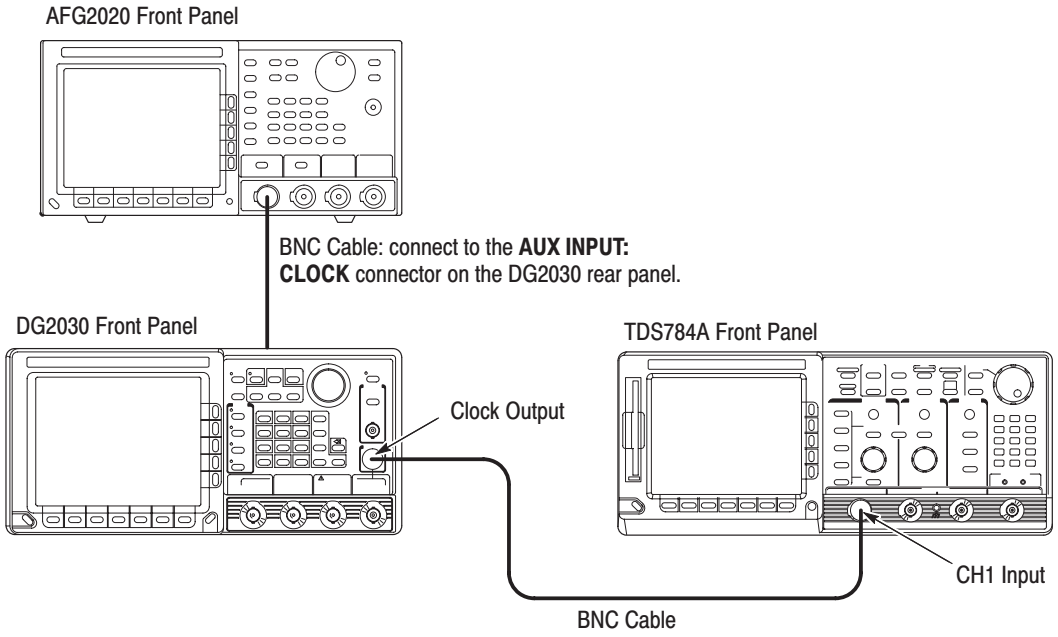


Figure 4-4: External clock input connections

Setup.

- Oscilloscope

  Displayed channel CH1
  Vertical axis . 500 mV/div
  Horizontal axis 1 µs/div
  Trigger mode Auto
  Trigger level . 500 mV
  Input coupling DC
  Input impedance . . . . . 50 Ω

- Function generator

  Waveform . . . Square wave
  Frequency . . . 1 MHz
  Amplitude . . . 1 V (50 Ω termination)
  Offset . . . . . 500 mV (50 Ω termination)

Characteristics Confirmation Procedure.

1. Load the **TP2EXCLK.PDA** test pattern file from the performance check disk.
2. Press the **START/STOP** button on the front panel so that the button's LED indicator lights.
3. Confirm that the clock pulse waveform can be observed on the oscilloscope.
4. Press the **START/STOP** button on the front panel to stop output (the button's LED goes off).

Sequence & Digital Output

This test confirms that pattern data is output from the DG2030 output channel ports (CH0 through CH7) in various run modes.

Equipment Required	Oscilloscope
	Function generator
	Five BNC cables
	BNC T adapter
	Performance check disk

Connections. Connect the clock output from the DG2030 front panel to the oscilloscope CH1 input with an BNC cable. Connect the function generator output to the DG2030 rear panel event input with the other BNC cable.

Next, using the BNC cables, connect the CH0 signal output from the DG2030 to the oscilloscope CH2 input, the event output from the DG2030 rear panel to the oscilloscope CH3 input, and the sync output from the DG2030 rear panel to the oscilloscope CH4 input. See Figure 4-5 for those connection

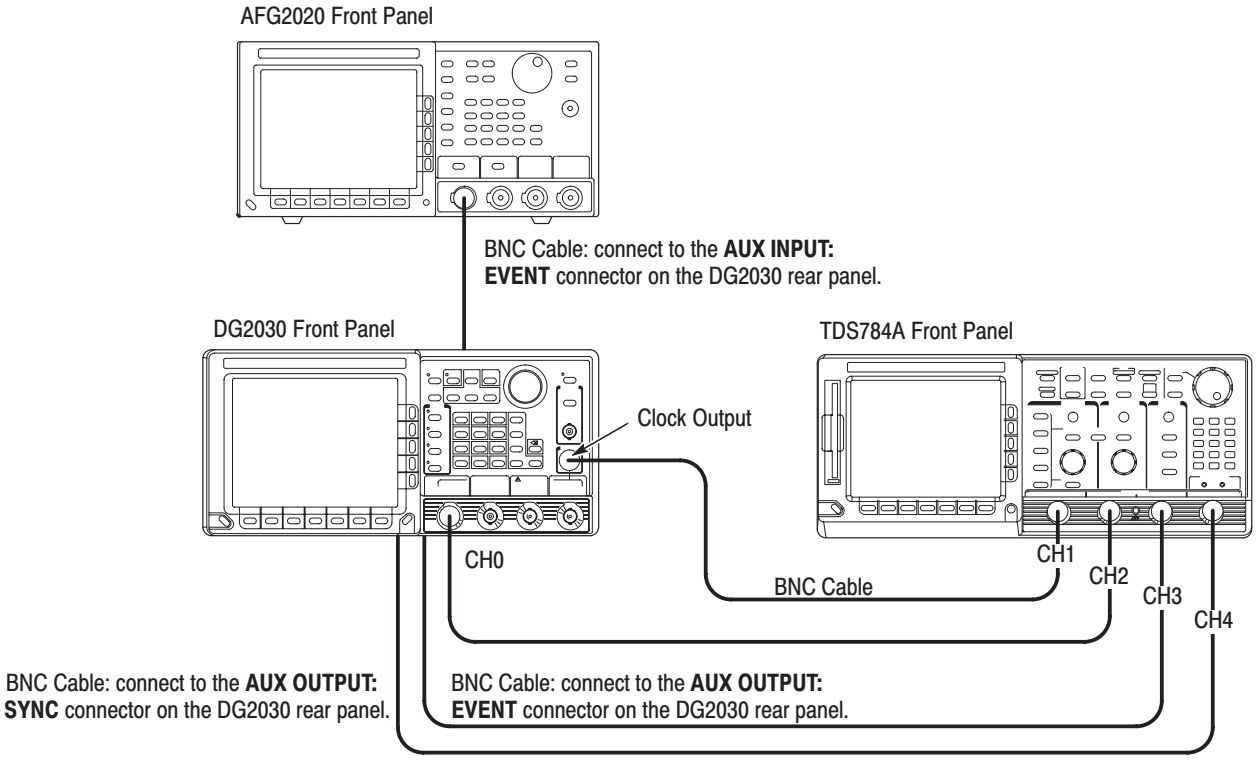


Figure 4-5: Sequence & digital output connections #1

Setup.

- Oscilloscope

  Displayed channel . . . . . CH1, CH2, CH3 and CH4
  Vertical axis . 1 V/div for CH1 and CH2
  5 V/div for CH3 and CH4
  Horizontal axis 400 ns/div
  Record length 5000
  Acquire mode Peak Detect
  Single acquisition sequence (Stop After menu)
  Trigger mode Auto
  Trigger level . 2 V
  Trigger source CH4
  Trigger position 3 %
  Input coupling DC
  Input impedance . . . . . 50 Ω for CH1 and CH2
  1 MΩ for CH3 and CH4

- Function generator

  Waveform . . . Square wave
  Frequency . . . 500 kHz
  Amplitude . . . 1 V (50 Ω termination))
  Offset . . . . . 500 mV

Characteristics Confirmation Procedure.

1. Load the **TP3PG.PDA** test pattern file from the performance check disk.

The following steps check the pattern data output operation in Repeat run mode.

2. Press the following buttons to set the DG2030 run mode to **Repeat**.

Menu button	Bottom button	Pop up menu	Side button	Front panel button
SETUP	Run Mode		Repeat	

3. Run the oscilloscope for acquisition.

4. Press the **START/STOP** button on the front panel so that the button's LED indicator lights.

5. Confirm that the data pattern shown in Figure 4-6 appears on the oscilloscope.

6. Press the **START/STOP** button on the front panel to stop output (the button's LED goes off).

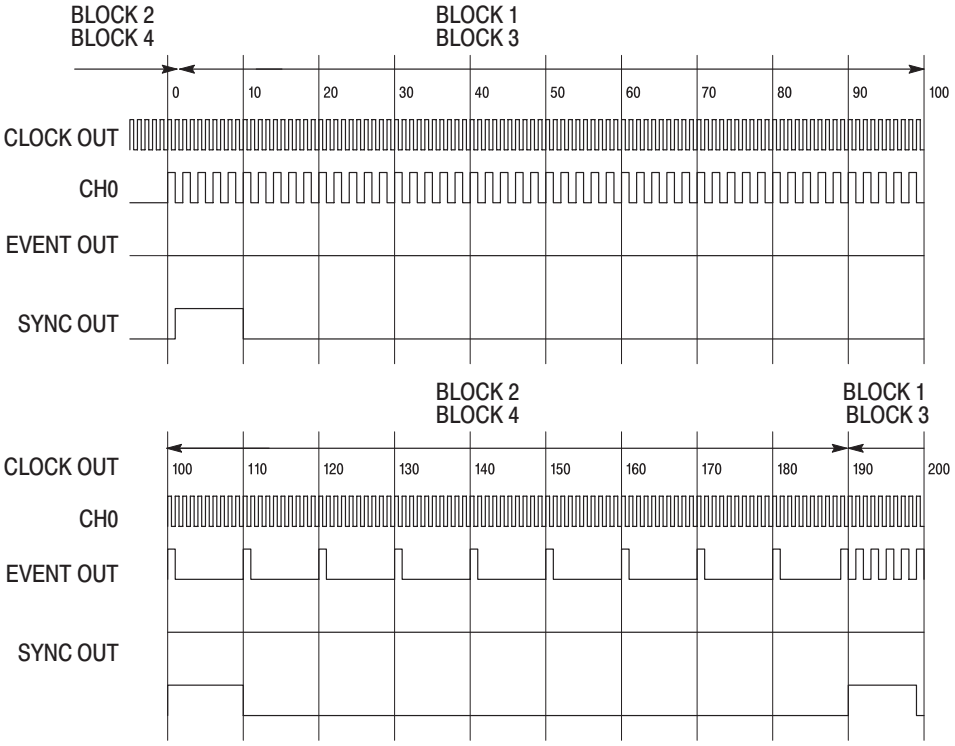


Figure 4-6: Repeat mode timing chart

The following steps check the pattern data output operation in Single run mode.

7. Press the following buttons to set the DG2030 run mode to **Single**.

Menu button	Bottom button	Pop up menu	Side button	Front panel button
SETUP	Run Mode		Single	

8. Run the oscilloscope so that the oscilloscope is waiting for a trigger event.

9. Press the **START/STOP** button on the front panel so that the button's LED indicator lights.

10. Confirm that the CH0 output data pattern as shown in Figure 4-7 appears on the oscilloscope screen once every time the **FORCE TRIGGER** button on the DG2030 front panel is pressed.

11. Press the **START/STOP** button on the front panel to stop output (the button's LED goes off).

The following steps check the pattern data output operation in Step run mode.

12. Press the following buttons to set the DG2030 run mode to **Step**.

Menu button	Bottom button	Pop up menu	Side button	Front panel button
SETUP	Run Mode		Step	

13. Cancel the single acquisition mode setting in the oscilloscope, and then start acquisition.

This can be made by selecting **SHIFT + ACQUIRE (front panel → Stop After (bottom) → Run/Stop button only (side)** for the TDS784A, and then by pressing the **RUN/STOP** button.

14. Press the **START/STOP** button on the front panel so that the button's LED indicator lights.

15. One bit appears in the CH0 output each time the **STEP/EVENT** button on the DG2030 front panel is pressed. Press the **STEP/EVENT** button six times and confirm that the bit pattern: 0 1 0 1 0 1, one bit for every pressing that button, appears.

16. Press the **START/STOP** button on the front panel to stop output (the button's LED goes off).

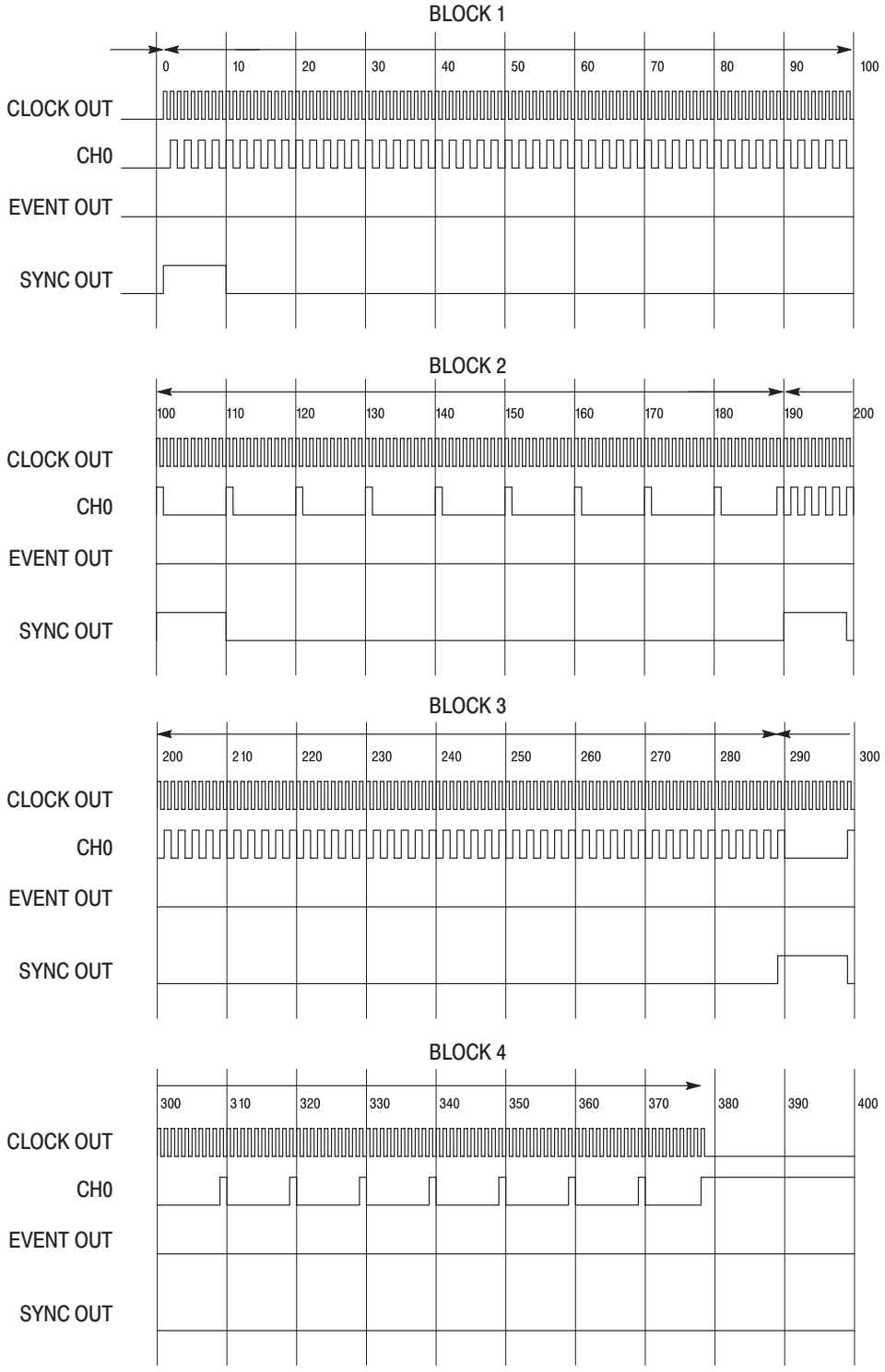


Figure 4-7: Single and step mode timing chart

The following steps check the digital pattern output, event output and sync output in Enhanced run mode.

17. Press the following buttons to set the DG2030 run mode to **Enhanced**.

Menu button	Bottom button	Pop up menu	Side button	Front panel button
SETUP	Run Mode		Enhanced	

18. Change the oscilloscope trigger source to CH3 and trigger position to 50 %.

19. Press the following buttons to set the trigger parameters.

Menu button	Bottom button	Pop up menu	Side button	Front panel button
SETUP	Trigger		Source (Set to Int)	
			Interval	
			State (Set to On)	
			Time	10 kHz/ms/mV

20. Press the **START/STOP** button on the front panel so that the button's LED indicator lights.

21. Confirm the following points from the oscilloscope screen:

- The output patterns in the CH0 to CH3 correctly appear as shown in Figure 4-8.

  Change the CH0 cable connection to, in turn, from CH1 to CH3 cable connection when you observe the outputs from CH1 to CH3.

- The output patterns in the CH4 to CH7 correctly appear as shown in Figure 4-8 if the option 01 has been installed.

  Change the CH3 cable connection to, in turn, from CH4 to CH7 cable connection on the rear panel when you observe the outputs from CH4 to CH7.

- The event signal pattern in the AUX OUTPUT: EVENT outputs correctly, and the event high and low levels are nearly 5 V and 0 V, respectively.
- The sync signal pattern in the AUX OUTPUT: SYNC outputs correctly, and the sync high and low levels are nearly 5 V and 0 V, respectively.
- Change the oscilloscope horizontal setting to 2 ms/div, and confirm that the trigger wait function operates correctly.

  Trigger event is generated in every 10 ms. Confirm that the block pattern (BLOCK 1) waits for the trigger event and then outputs.

22. Press the following buttons to set the DG2030 clock frequency to 409.6 MHz.

Menu button	Bottom button	Pop up menu	Side button	Front panel button
SETUP	Clock		Int FREQ	409.6 MHz/μs

23. Change the oscilloscope horizontal axis setting to 10 ns/div.

24. Confirm that the data pattern in the CH0 to CH3 (also CH4 to CH7 if the option 01 has been installed), EVENT OUT and SYNC OUT can be observed as shown in Figure 4-8 on the oscilloscope. Change the channel output connection as needed.

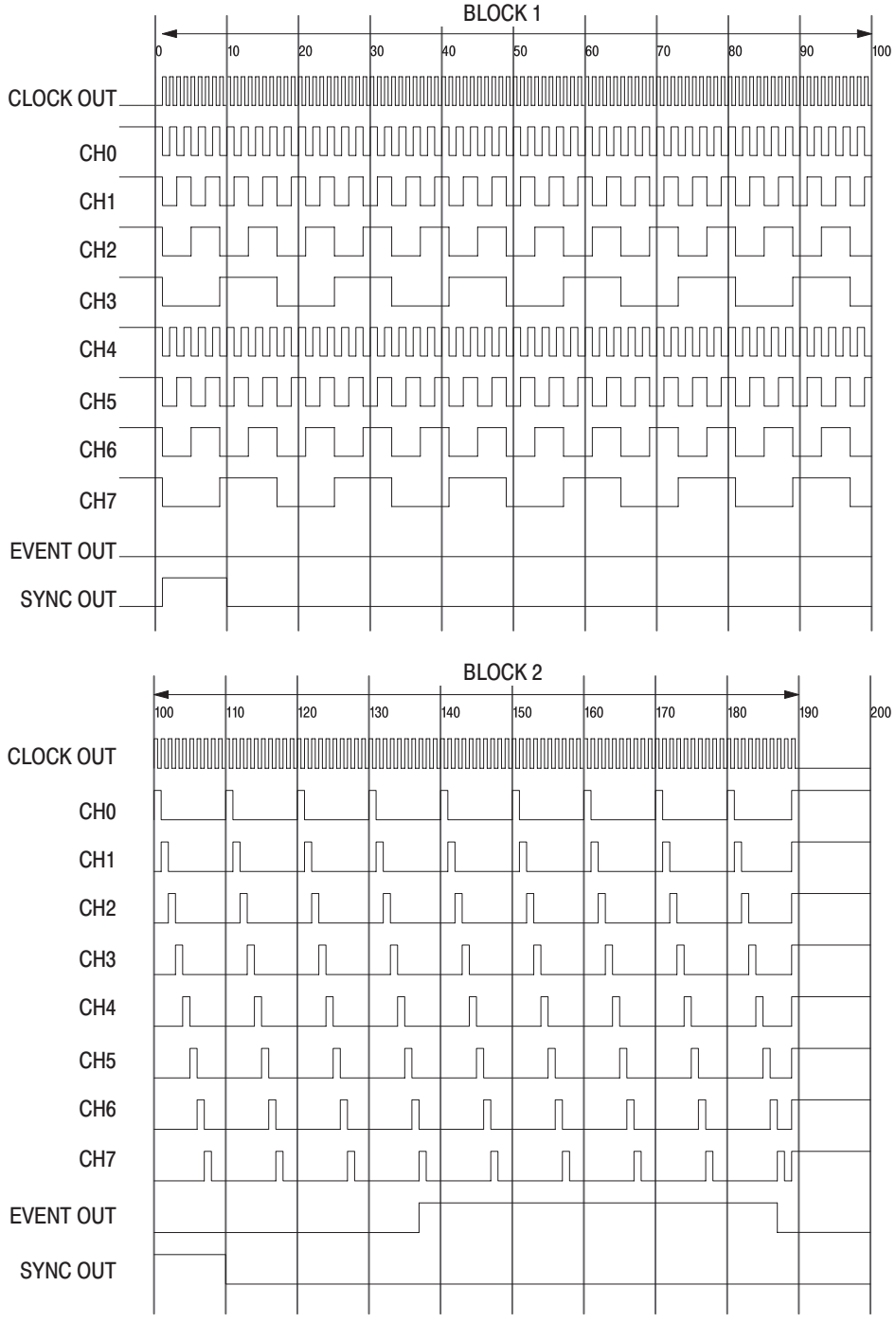


Figure 4-8: Enhanced timing chart

The following steps check that the DG2030 internal trigger source generates a 1 μs trigger event every 10 seconds.

25. Press the following buttons to set the DG2030 trigger interval to 1 μs.

Menu button	Bottom button	Pop up menu	Side button	Front panel button
SETUP	Trigger		Interval	
			State (Set to On)	
			Time	1 MHz/μs

26. Change the frequency settings in the function generator to 1 MHz.

27. Change the oscilloscope horizontal setting to 200 ns/div.

28. Confirm that trigger event is generated in every 1 μs with the oscilloscope screen.

This can be made by confirming that output signal appears on the oscilloscope CH2 in every 1 μs.

29. Press the following buttons to set the DG2030 trigger interval to 10 s.

Menu button	Bottom button	Pop up menu	Side button	Front panel button
SETUP	Trigger		Interval	
			State (Set to On)	
			Time	10 Hz/s/V

30. Stop acquisition in the oscilloscope, and then change the oscilloscope settings to:

Horizontal axis 5 s/div
Record length 500
Acquisition mode . . . . . Single Acquisition Sequence (Stop After menu)
Trigger source CH3

31. Press the **START/STOP** button on the front panel so that the button's LED indicator lights.

32. Confirm that there is a 1 μs trigger event every 10 seconds on the oscilloscope channel 2 display.

33. Press the following buttons to set the DG2030 trigger interval to 10 ms.

Menu button	Bottom button	Pop up menu	Side button	Front panel button
SETUP	Trigger		Interval	
			State (Set to On)	
			Time	10 kHz/ms/mV

34. Press the **START/STOP** button on the front panel to stop output (the button's LED goes off).

The following steps check that the DG2030 turns off the external trigger signal.

35. Load the **TP5EV52.PDA** test pattern file from the performance check disk.

36. Press the following buttons to set the DG2030 clock frequency to 400 MHz.

Menu button	Bottom button	Pop up menu	Side button	Front panel button
SETUP	Clock		Int FREQ	4,0,0,MHz/μs

37. Press the following buttons to turn off the DG2030 trigger interval.

Menu button	Bottom button	Pop up menu	Side button	Front panel button
SETUP	Trigger		Interval	
			State (Set to Off)	

38. Press the **START/STOP** button on the front panel so that the button's LED indicator lights.

39. Make sure that the message *Waiting for Trigger* is displayed at the upper right part of the DG2030 screen and the trigger event no longer occurs.

The following steps check the external trigger signal.

40. Press the following buttons to set the DG2030 trigger source to **Ext**.

Menu button	Bottom button	Pop up menu	Side button	Front panel button
SETUP	Trigger		Source (Set to Ext)	

41. Change the connection as follows.

a. Disconnect the BNC cable connecting between the DG2030 rear panel EVENT OUTPUT connector and the oscilloscope CH3 input connector.

b. Disconnect the BNC cable connecting between the DG2030 rear panel EVENT INPUT connector and the function generator output connector.

c. Connect a BNC T adaptor to the function generator output connector. And using two BNC cables, connect from the BNC T adaptor to the DG2030 front panel TRIGGER INPUT connector, other side BNC T adaptor to the oscilloscope CH3 input connector.

d. Disconnect the BNC cable from the DG2030 front panel CH3 connector and re–connect it to CH2 connector. (Disconnect the BNC cable from the DG2030 front panel CH7 connector and re–connect it to CH2 connector if the option 01 has been installed.)

e. Disconnect the BNC cable from the DG2030 front panel CLOCK OUT connector and re–connect it to CH0 connector.

See Figure 4-9.

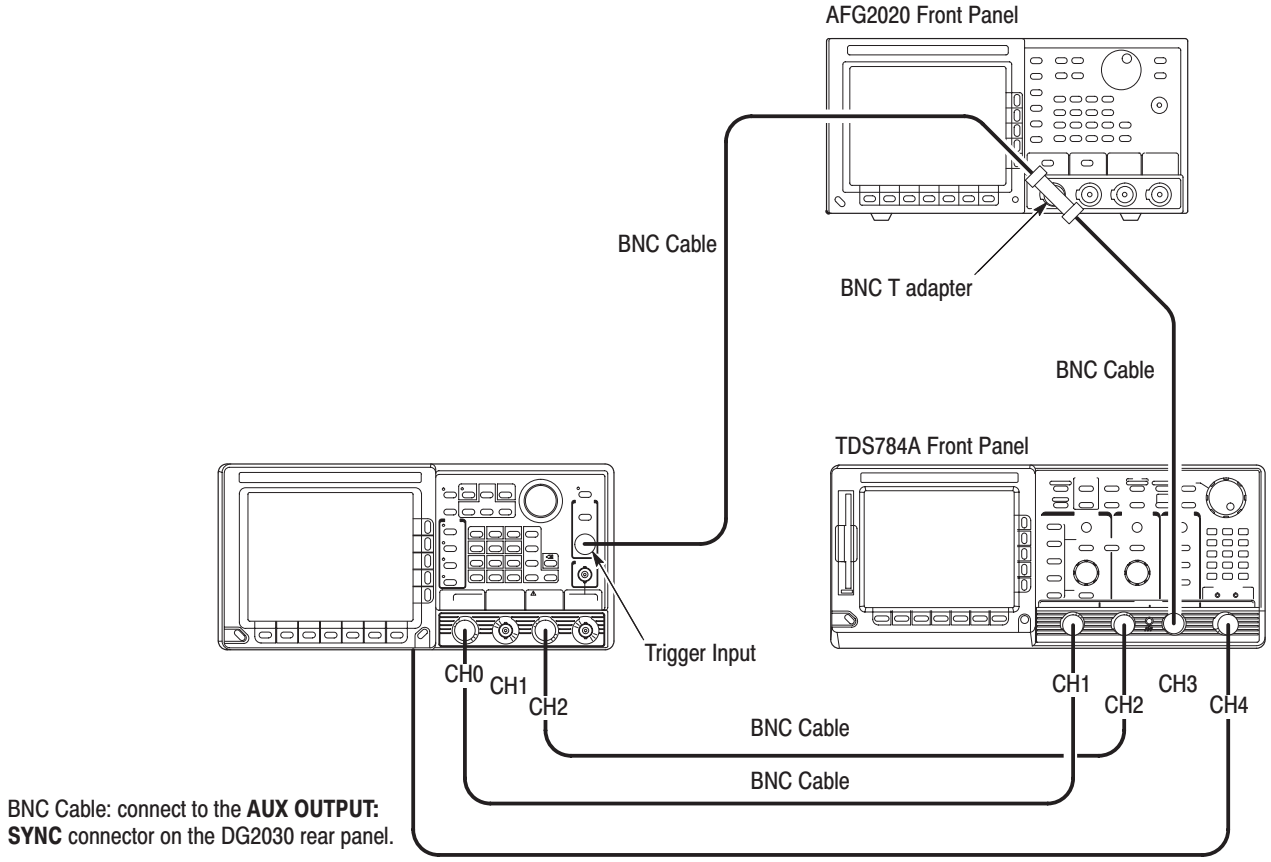


Figure 4-9: Sequence & digital output connections #3

42. Press the following buttons to set the DG2030 trigger source to **50 Ω**.

Menu button	Bottom button	Pop up menu	Side button	Front panel button
SETUP	Trigger		Impedance (Set to 50 Ω)	

43. Set the frequency setting in the function generator to 500 kHz.

44. Set the oscilloscope settings to:

Horizontal axis 400 ns/div
Record length 5000
Vertical axis . 1 V/div (for CH3 input)
Acquisition mode . . . . . Run/Stop button only (Stop After menu)
Input impedance . . . . . 50 Ω (for CH3 input)
Trigger level . 500 mV
Trigger source CH4

45. Observe the displayed waveform patterns on the oscilloscope screen, confirm that the the trigger event synchronizes with the rising edge of the input pulse.

Trigger event can be recognized by observing the CH1 output signal from the DG2030 on oscilloscope CH1 input.

46. Press the following buttons to set the DG2030 trigger slope to **Negative**.

Menu button	Bottom button	Pop up menu	Side button	Front panel button
SETUP	Trigger		Slope (Set to Negative)	

47. On the oscilloscope screen, confirm that the trigger event occurs synchronizing with the falling edge of the input pulse.

48. Press the **START/STOP** button on the DG2030 front panel to stop output (the button LED goes off).

Inhibit Function

This test confirms the inhibit function of the DG2030 outputs.

Equipment Required	Oscilloscope
	Three BNC cables
	Performance check disk

Connections. Connect the CH1 output from the DG2030 front panel to the inhibit input on the DG2030 rear panel using the BNC cable. Connect the DG2030 front panel CH2 output to the oscilloscope CH1 input. Connect the sync output from the DG2030 rear panel to the oscilloscope CH4 input. See Figure 4-10.

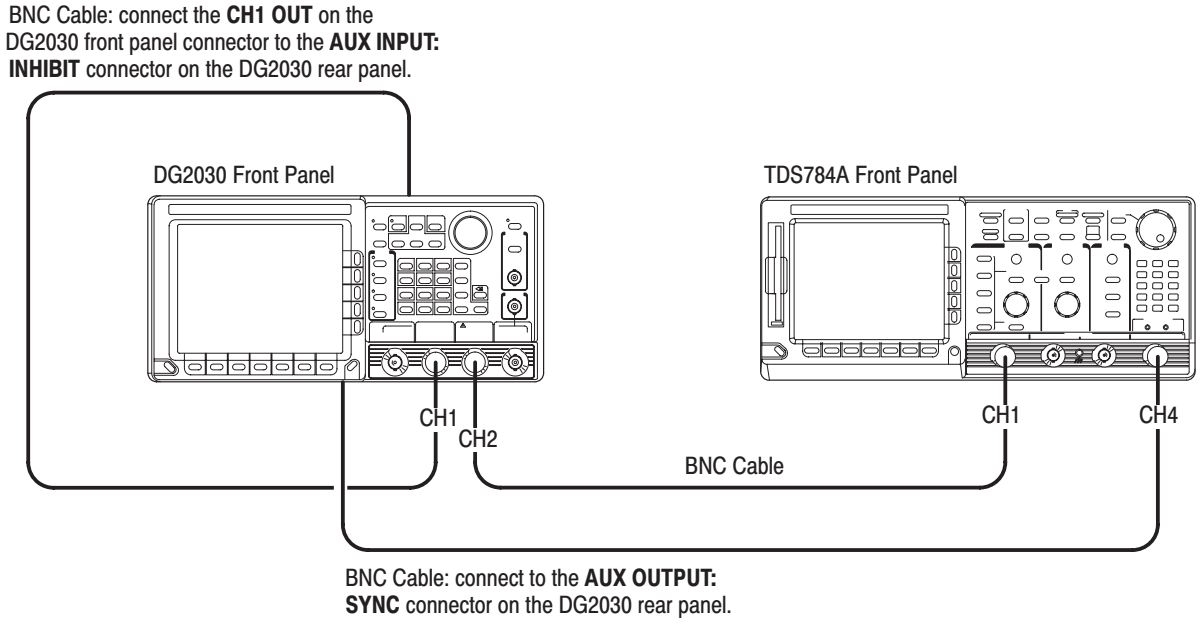


Figure 4-10: Inhibit function test connection

Setup.

- Oscilloscope

  Input coupling DC
  Input impedance . . . . . 50 Ω
  Trigger source CH4
  Trigger mode Auto
  Trigger level . 2 V

Characteristics Confirmation Procedure.

1. Load the **TP6INH.PDA** test pattern file from the performance check disk.
2. Press the **START/STOP** button on the front panel so that the button's LED indicator lights.
3. Confirm that the pulse pattern waveform with 5 MHz of frequency, +3 V of high voltage level and 0 V of low voltage level is continuously output from the DG2030 CH2 output.

***NOTE**. The first pulse, which has +3 V of high voltage level, after the sync signal went to high level state will have narrower pulse width than other pulses. This is because that the delay time of the external inhibit signal is larger than that of the internal inhibit signal.*

---

4. Change the BNC cable connection from the DG2030 front panel CH2 to the DG2030 CH3 connector, and then confirm the CH3 output waveform as was done in step 3.

   When the option 01 has been installed, confirm the output waveforms from CH4 through CH7 as changing the BNC cable connection.
5. Change the BNC cable connection from the DG2030 CH3 (or CH7) connector to the DG2030 CH0 connector.
6. Confirm that the DG2030 outputs twenty-five 5 MHz pulses with a high value of +3 V and a low value of –1 V, followed by twenty-five 5 MHz pulses with a high value of 0 V and a low value of –1 V. These two waveform patterns are continuously and repeatedly output from CH0.
7. Change the BNC cable connection from the DG2030 front panel CH1 connector to the DG2030 CH2 connector, and then the CH0 to CH1 connector.
8. Confirm that the DG2030 outputs twenty-five 5 MHz pulses with a high value of 0 V and a low value of –1 V, followed by twenty-five 5 MHz pulses with a high value of +3 V and a low value of –1 V. These two waveform patterns are continuously and repeatedly output from CH1.
9. Change the BNC cable connection from the DG2030 CH1 output to clock output on the front panel.

10. Set the inhibit control for the CH2 output channel to **OFF** as following procedures:

Menu button	Bottom button	Pop up menu	Side button	Front panel button
SETUP				
Select CH2 with the general purpose knob.				
	Output Condition		Control Condition	
			Change Inhibit Control	
		OFF		
			OK	

11. Confirm that the clock output voltage level is almost 0 V.

12. Disconnect the BNC cable from the inhibit input on the DG2030 rear panel.

13. Confirm that the pulses with 10 MHz of frequency, +3 V of high voltage level and –1 V of low voltage level are continuously output from the DG2030 clock output.

14. Press the **START/STOP** button on the front panel to stop output.

Output Level, Amplitude, Rise Time and Fall Time Accuracy

This test confirms the output level, amplitude, rise time and fall time accuracies of the DG2030 output.

Variable voltage levels for the amplitude

High level: –1.25 V to +3.50 V into 50 Ω
Low level: –1.50 V to +3.25 V into 50 Ω

Output Level (CH0 to CH7)

Accuracy: ±(3 % of setting) ±50 mV into 50 Ω

Output Amplitude (CLOCK OUT)

Accuracy: ±(5 % of setting) ±50 mV into 50 Ω

Rise / Fall Times

Accuracy: ±(10 % of setting) ±500 ps

Equipment Required	Digital multi–meter (DMM)
	Oscilloscope
	BNC cable
	Precision 50 Ω termination
	BNC to dual banana adapter
	Performance check disk

Connections. Connect the CH0 output from the DG2030 front panel to the digital multi–meter input using the BNC cable, precision 50 Ω termination and BNC to dual banana adapter as shown in Figure 4-11.

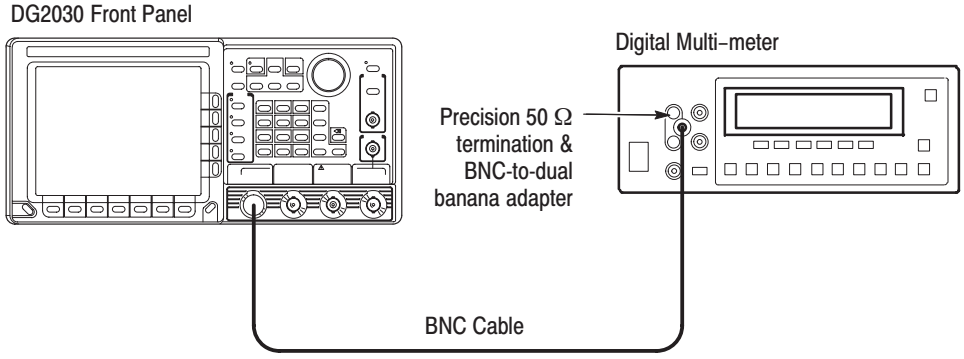


Figure 4-11: Output level measurement connections

Setup.

- Digital multi–meter

  Function . . . . . DCV
  Range . . . . . Auto

- Oscilloscope

  Vertical axis . . . . . 500 mV/div
  Horizontal axis . . . . . 2 ns/div
  Trigger source CH1
  Trigger level . . . . . 750 mV
  Display channel CH1
  Input coupling . . . . . DC
  Input impedance . . . . . 50 Ω
  Bandwidth . . . . . Full
  High Ref. (Rise/Fall Times) . . 80 %
  Low Ref (Rise/Fall Times) . . . 20 %

Characteristics Confirmation Procedure.

1. Load the **TP7LVL.PDA** test pattern file from the performance check disk.

The following steps check the high voltage levels on all output channels.

2. Press the following buttons to set the DG2030 high and low voltage levels.

Menu button	Bottom button	Pop up menu	Side button	Front panel button
SETUP	Level Condition			
Move the cursor to CH0 with the general purpose knob.				
			High	–1.25 ENTER
			Low	–1.50 ENTER

Note that the low level is automatically set to –1.50 V when the high level has been set to –1.25 V.

3. Press the **START/STOP** button on the front panel so that the button's LED indicator lights.

4. Confirm the high voltage level as following procedures:

   a. Press the **STEP/EVENT** button on the DG2030 front panel once to output high voltage level.

   b. Set the high and low voltage levels to the values indicated in Table 4-5, and confirm that the digital multi–meter reading for each high voltage level setting falls within the specified voltage range.

   c. Repeat step b for all high and low voltage settings in Table 4-5.

   d. Repeat steps from a to c for all output channels from CH0 to CH3 (or to CH7 if the option 01 has been installed) as changing the BNC cable connection.

Table 4-5: High level output voltage accuracy

Settings		
High voltage level (V)	**Low voltage level (V)**	**High level output voltage ranges**
–1.25	–1.50	–1.337 V to –1.163 V
0	–1.50	–0.050 V to +0.050 V
+1.00	–1.50	+0.920 V to +1.080 V
+2.00	–1.50	+1.89 V to +2.11 V
+3.50	–1.50	+3.35 V to +3.65 V

5. Confirm the low voltage level as following procedures:

   a. Press the **STEP/EVENT** button on the DG2030 front panel once to output low voltage level.

   b. Set the low and high voltage levels to the values as shown in Table 4-6, and confirm that the digital multi–meter reading for each voltage setting falls within the specified voltage range.

   c. Repeat step b for all high and low voltage settings in Table 4-6.

   d. Repeat steps from a to c for all output channels from CH0 to CH3 (or to CH7 if the option 01 has been installed) as changing the BNC cable connection.

Table 4-6: Low level output voltage accuracy

Settings		
Low voltage level (V)	**High voltage level (V)**	**Low level output voltage ranges**
–1.50	+3.50	–1.595 V to –1.405 V
0	+3.50	–0.050 V to +0.050 V
+1.00	+3.50	+0.920 V to +1.080 V
+2.00	+3.50	+1.89 V to +2.11 V
+3.25	+3.50	+3.11 V to +3.39 V

The following steps check the clock output amplitude accuracy.

6. Disconnect the BNC cable from both the digital multi–meter input and the DG2030. And then connect the clock output to the oscilloscope CH1 input as shown in Figure 4-12.

7. Load the **TP8PULSE.PDA** test pattern file from the performance check disk.

8. Using the oscilloscope measurement functions, perform the measurements under the low and high voltage level settings shown in Table 4-7, and confirm that the amplitude for each voltage setting is within the specified range.

Table 4-7: Output amplitude accuracy

Settings		
Low voltage level (V)	**High voltage level (V)**	**Amplitude ranges**
–1.50	–1.25	0.188 V to 0.312 V
–1.50	–0.50	0.90 V to 1.10 V
–1.50	+0.50	1.85 V to 2.15 V
–1.50	+1.50	2.80 V to 3.20 V
–1.50	+2.50	3.75 V to 4.25 V
–1.50	+3.50	4.70 V to 5.30 V

The following steps check the rise and fall time accuracies for the clock output and data outputs on all channels.

9. Using the oscilloscope measurement functions, perform the clock signal rise and fall time measurements under the low and high voltage level, and rise and fall time settings indicated in Table 4-8, and confirm that the measurement results are within the specified range.

Set the oscilloscope trigger slope to Positive for observing the pulse rising slope, and to Negative for the pulse falling slope.

Table 4-8: Rise and fall time accuracies

Voltage settings			
Low level	**High level**	**Rise/fall times**	**Rise/fall time ranges**
–1.50 V	+0.50 V	2.24 ns	1.52 ns to 2.96 ns
		3.10 ns	2.29 ns to 3.91 ns
–1.50 V	+1.50 V	3.42 ns	2.58 ns to 4.26 ns
		4.72 ns	3.75 ns to 5.69 ns
–1.50 V	+2.50 V	4.58 ns	3.63 ns to 5.53 ns
		6.36 ns	5.23 ns to 7.49 ns
–1.50 V	+3.50 V	5.74 ns	4.67 ns to 6.81 ns
		8.00 ns	6.70 ns to 9.30 ns

10. Change the BNC cable connection from the clock output to CH0 through CH3 (or CH7 for option 01) in turn, and repeat step 9 for each of these channels. Confirm the rise and fall times are within the specified ranges.

11. Press the **START/STOP** button on the front panel to stop output (the button's LED goes off).

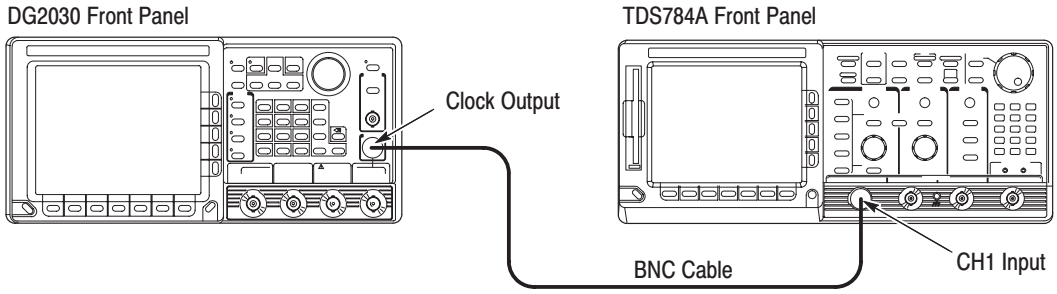


Figure 4-12: Output amplitude, rise time and fall time measurement connection

Delay Time Accuracy

This test confirms the delay time accuracy referenced to the clock output on each channel and the channel skew of the DG2030.

Accuracy: ±(3 % of setting) ±500 ps
±60 ps × | Ambient temperature (°C) − 25 |

Equipment Required	Oscilloscope
	Two BNC cables
	Performance check disk

Connections. Connect the clock and CH0 outputs from the DG2030 front panel to the oscilloscope CH1 and CH2 inputs, respectively, using the BNC cables. See Figure 4-13.

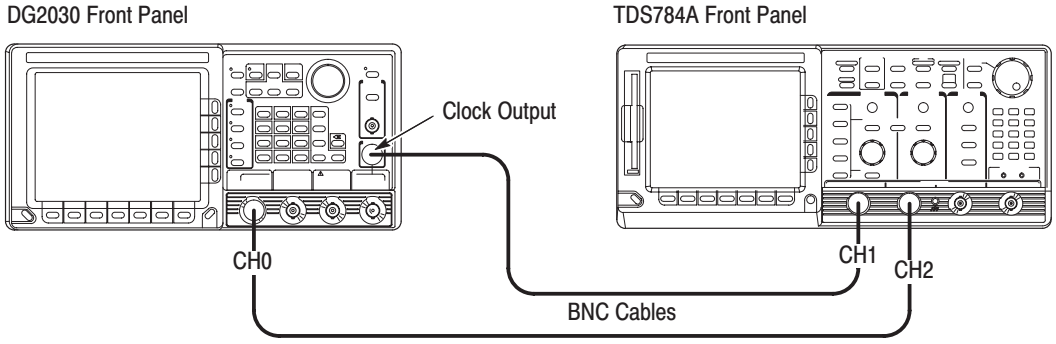


Figure 4-13: Delay time measurement connections

Setup.

- Oscilloscope

  Displayed channel . . . . . CH1 and CH2
  Vertical axis . 500 mV/div
  Horizontal axis 5 ns/div
  Trigger mode Auto
  Trigger source CH1
  Trigger level . 750 mV
  Input coupling DC
  Input impedance . . . . . 50 Ω

Characteristics Confirmation Procedure.

1. Load the **TP8PULSE.PDA** test pattern file from the performance check disk.
2. Press the **START/STOP** button on the front panel so that the button LED indicator turns on.
3. Press the following buttons to set the DG2030 CH0 output delay time to –5.00 n.

Menu button	Bottom button	Pop up menu	Side button	Front panel button
SETUP	Timing Condition			
Move the cursor to CH0 with the general purpose knob.				
			Delay	–5.0 ENTER

4. Set the delay time to –5.00 ns, 0.00 ns, +5.00 ns, +10.00 ns, +15.00 ns and +18.00 ns in turn. Perform the delay time measurement for each delay time setting with the oscilloscope. Confirm that the data output delay times referenced to the clock signal are within the specified range for each of these delay time settings.

5. Change the BNC cable connection from the CH0 to CH1 through CH3 for standard (or CH7 for option 01) in turn and repeat step 4 for each of these channels.

6. From above measurement results at 0.00 ns delay time setting on all output channels, confirm that the delay time differences between two adjacent channels is within the range from –300 ps to +300 ps.

7. Press the **START/STOP** button on the front panel to stop data output (the button's LED goes off).

Adjustment Procedures

The DG2030 does not contain any adjustments.

Maintenance

This section contains the information needed to do periodic and corrective maintenance on the DG2030 Data Generator. Specifically, the following subsections are included:

- *Preparation*. This subsection includes this introduction plus general information on preventing damage to internal modules when doing maintenance.
- *Inspection and Cleaning*. Information and procedures for inspecting the DG2030 and cleaning its external and internal modules. Refer to page 6-4.
- *Repacking*. Procedures for removing defective modules and replacing new or repaired modules. Refer to page 6-9.
- *Repacking*. Information on packaging the DG2030 properly for shipment. Refer to page 6-47.
- *Troubleshooting*. Information for isolating failed modules. Included are instructions for operating the DG2030 internal diagnostic routines and troubleshooting flowcharts for fault isolation. Most of the flowcharts make use of the internal diagnostic routines to speed fault isolation to a module. Refer to page 6-49.

Preparation

Before doing any of the procedures in the *Maintenance* section, note the following:

- Only trained service technicians should perform these procedures.
- Read the *General Safety Summary* and the *Service Safety Summary*, beginning on page vii near the beginning of this manual.
- Read the *Strategy for Servicing* on page xv near the beginning of this manual.
- Read section 2, *Operating Information*, before servicing the DG2030.

Preventing ESD

CAUTION. *Static discharge can damage any semiconductor component in the DG2030.*

Precautions. When performing service which requires internal access to the DG2030, follow these precautions to avoid damaging internal modules and their components due to electrostatic discharge (ESD).

1. Minimize handling of static-sensitive modules.
2. Transport and store static-sensitive modules in their static-protected containers or on a metal rail. Label any package that contains static-sensitive modules.
3. Discharge the static voltage from your body by wearing a grounded antistatic wrist strap while handling these modules. Do service of static-sensitive modules only at a static-free work station.
4. Do not remove the DG2030 cabinet unless you have met precaution number 3, above. Consider all internal modules static-sensitive.
5. Do not allow anything capable of generating or holding a static charge on the work station surface.
6. Handle circuit boards by the edges when possible.
7. Do not slide the modules over any surface.
8. Avoid handling modules in areas that have a floor or work-surface covering capable of generating a static charge.
9. Do not use high-velocity compressed air when cleaning dust from modules.

Susceptibility to ESD. Table 6-1 lists the relative susceptibility of various classes of semiconductors. Static voltages of 1 kV to 30 kV are common in unprotected environments.

Table 6-1: Relative susceptibility to static-discharge damage

Semiconductor classes	Relative susceptibility levels[1]
MOS or CMOS microcircuits or discrete circuits, or linear microcircuits with MOS inputs (most sensitive)	1
ECL	2
Schottky signal diodes	3
Schottky TTL	4
High-frequency bipolar transistors	5
JFET	6
Linear microcircuits	7
Low-power Schottky TTL	8
TTL (least sensitive)	9

[1] **Voltage equivalent for levels (voltage discharged from a 100 pF capacitor through resistance of 100 ohms**):

1 = 100 V to 500 V
2 = 200 V to 500 V
3 = 250 V
4 = 500 V
5 = 400 V to 600 V
6 = 600 V to 800 V
7 = 400 V to 1000 V (est.)
8 = 900 V
9 = 1200 V

Inspection and Cleaning

This subsection describes how to determine whether the DG2030 needs cleaning, and how to do the cleaning. Inspection and cleaning are preventive maintenance procedures. When done regularly, preventive maintenance may prevent DG2030 malfunction and enhance reliability.

Preventive maintenance consists of visually inspecting and cleaning the DG2030, and using general care when operating it.

How often to do maintenance depends on the severity of the environment in which the DG2030 operates.

General Care

The cabinet helps keep dust out of the DG2030 and is a major component of the instrument cooling system. The cabinet should normally be in place when operating the DG2030. The DG2030 front cover (optional accessory) protects the front panel and display from dust and damage. Install it when storing or transporting the instrument.

Inspection and Cleaning Procedures

Inspect and clean the DG2030 as operating conditions require. The collection of dirt on components inside can cause them to overheat and break down. (Dirt acts as an insulating blanket, preventing efficient heat dissipation.) Dirt also provides an electrical conduction path that can cause an instrument failure, especially under high-humidity conditions.

WARNING. *To avoid personal injury or death due to electric shock, unplug the power cord from the line voltage source before cleaning the DG2030.*

CAUTION. *To prevent damaging the plastics used in the DG2030, do not use chemical cleaning agents. Use only deionized water when cleaning the menu buttons or front-panel buttons. Use a 75% isopropyl alcohol solution as a cleaner, and rinse with deionized water. Before using any other type of cleaner, consult your Tektronix Service Center or representative.*

To prevent damaging DG2030 components, do not use high-pressure compressed air when cleaning dust from the interior of the DG2030. (High pressure air can cause electrostatic discharge.) Instead, use low pressure compressed air (about 9 psi).

Exterior Inspection. Inspect the outside of the DG2030 for damage, wear, and missing parts, using Table 6-2 as a guide. If the DG2030 appears to have been dropped or otherwise abused, check it thoroughly to verify correct operation and performance. Repair any defects that may cause personal injury or lead to further damage to the DG2030.

Table 6-2: External inspection check list

Item	Inspect for	Repair action
Cabinet, front panel, and cover	Cracks, scratches, deformations, damaged hardware or gaskets	Replace defective module.
Front-panel knobs	Missing, damaged, or loose knobs	Repair or replace missing or defective knobs.
Connectors	Broken shells, cracked insulation, and deformed contacts; dirt in connectors	Replace defective modules. Clear or wash out dirt.
Carrying handle, cabinet, feet	Correct operation	Replace defective module.
Accessories	Missing items or parts of items, bent pins, broken or frayed cables, and damaged connectors	Replace damaged or missing items, frayed cables, and defective modules.

Exterior Cleaning Procedure.

WARNING. *To avoid potential electric shock hazard or damage to the DG2030 circuits, do not allow any moisture inside the DG2030 during external cleaning; use only enough liquid to dampen the cloth or applicator.*

1. Remove loose dust on the outside of the DG2030 with a lint free cloth.
2. Remove remaining dirt with a lint free cloth dampened in a general purpose detergent-and-water solution. Do not use abrasive cleaners.
3. Clean the light filter protecting the monitor screen with a lint-free cloth dampened with either isopropyl alcohol or, preferably, a gentle, general purpose detergent-and-water solution.

Interior Inspection. To access the inside of the DG2030 for inspection and cleaning, refer to the *Removal and Installation Procedures* in this section.

Inspect the interior of the DG2030 for damage and wear using Table 6-3 as a guide. Repair any defects immediately.

CAUTION. *To prevent damage from electrical arcing, ensure that circuit boards and components are dry before applying power to the DG2030.*

Table 6-3: Internal inspection check list

Item	Inspect for	Repair action
Circuit boards	Loose, broken, or corroded solder connections; burned circuit boards; burned, broken, or cracked circuit-run plating	Remove failed modules and replace with a new module.
Resistors	Burned, cracked, broken, blistered condition	Replace failed module and replace with a new module.
Solder connections	Cold solder or rosin joints	Resolder joint and clean with isopropyl alcohol.
Capacitors	Damaged or leaking cases; corroded solder on leads or terminals	Remove damaged module and replace with a new module from the factory.
Semiconductors	Loosely inserted in sockets.; distorted pins.	Firmly seat loose semiconductors. Remove devices that have distorted pins. Carefully straighten pins (as required to fit the socket), using long-nose pliers, and reinsert firmly. Ensure that straightening action does not crack pins, causing them to break off.
Wiring and cables	Loose plugs or connectors; burned, broken, or frayed wiring.	Firmly seat connectors. Repair or replace modules with defective wires or cables.
Chassis	Dents, deformations, and damaged hardware	Straighten, repair, or replace defective hardware.

Interior Cleaning Procedure. If, after doing steps 1 and 2, a module is clean upon inspection, skip the remaining steps.

1. Blow off dust with dry, low-pressure, deionized air (approximately 9 psi).
2. Remove any remaining dust with a lint-free cloth dampened in isopropyl alcohol (75% solution), and rinse with warm deionized water. (A cotton-tipped applicator is useful for cleaning in narrow spaces and on circuit boards.)
3. If steps 1 and 2 do not remove all the dust or dirt, the DG2030 may be spray washed using a solution of 75% isopropyl alcohol by doing step 4 through 8.

4. Gain access to the parts to be cleaned by removing easily accessible shields and panels (see *Removal and Installation Procedures* in this section).
5. Spray wash dirty parts with the isopropyl alcohol, and wait 60 seconds for the majority of the alcohol to evaporate.
6. Use hot (48.9° C to 60° C/120° F to 140° F) deionized water to thoroughly rinse the parts.
7. Dry all parts with low-pressure, deionized air.
8. Dry all components and assemblies in an oven or drying compartment using low-temperature (51.7° C to 65.6° C/125° F to 150° F) circulating air.

Removal and Installation Procedures

This subsection describes removing and installing the DG2030 mechanical and electrical modules.

Preparation

This subsection contains the following information:

- Preparatory information needed to properly do the procedures that follow
- A list of equipment required when removing modules
- Module locator diagrams for finding each module in the DG2030
- Procedures for removing and installing electrical and mechanical modules

WARNING. *To avoid possible personal injury or damage to DG2030 components, read the* Preparation for Use *subsection on page 2-1, and* Preventing ESD *on page 6-2. Before doing this or any other procedure in this manual, read the* General Safety Summary *and the* Service Safety Summary, *beginning on page vii near the beginning of this manual.*

To avoid possible personal injury or death, disconnect the power cord from the line voltage source before doing any procedures in this section.

List of Mechanical Parts

Section 10, *Mechanical Parts List*, lists all mechanical parts in the DG2030.

General Instructions

NOTE*. Read these general instructions before removing a module.*

First read over the *Summary of Procedures* that follows to understand how the procedures are organized. Then read *Equipment Required* to find out the tools needed to remove and install modules.

To remove a module, begin by doing the *Access Procedure* beginning on page 6-12. By following the instructions in that procedure, you can remove the desired module without unnecessarily removing other modules.

Summary of Procedures

The *Access Procedure* on page 6-12 identifies the procedure for removing each module. These categories separate the procedures based on their location in the DG2030.

- *Procedures for External Modules* on page 6-15 describes how to remove modules that do not require internal access to the DG2030.
- *Procedures for Internal Modules* on page 6-26 describes how to remove modules that require internal access to the DG2030.

Equipment Required

The removal of most modules in the DG2030 requires only a screwdriver handle mounted with a size T-15, Torx® screwdriver tip. Use this tool whenever a procedure step instructs you to remove or install a screw, unless a different size screwdriver is specified in that step. The first step of a module procedure lists all equipment required to remove and reinstall the module.

Table 6-4: Equipment required

Name	Description	Part Number
Screwdriver handle	Accepts Torx®-driver bits	003-0524-00
T-9 Torx® tip	Torx®-driver bit for T-9 size screw heads	003-0965-00
T-10 Torx® tip	Torx®-driver bit for T-10 size screw heads	003-0815-00
T-15 Torx® tip	Torx®-driver bit for T-15 size screw heads	003-0966-00
#1 Phillips tip	Phillips-driver bit for #1 size screw heads	003-0335-00
Flat-bladed screwdriver	Screwdriver for removing standard-headed screws	
Hex wrench, 0.050 inch	Standard tool	
Hex wrench, $^{1}/_{16}$ inch	Standard tool	
Needle-nose pliers	Standard tool	
Nut driver, $^{1}/_{2}$ inch	Standard tool	
Nut driver, $^{1}/_{4}$ inch	Standard tool	
Nut driver, $^{5}/_{16}$ inch	Standard tool	
Nut driver, 5 mm	Standard tool	
Open-end wrench $^{1}/_{2}$ inch	Standard tool	
Soldering iron	Standard tool	

DG2030 Orientation

In this manual, procedures refer to “front,” “back,” “top,” and so on of the DG2030. Figure 6-1 shows how the sides are referenced.

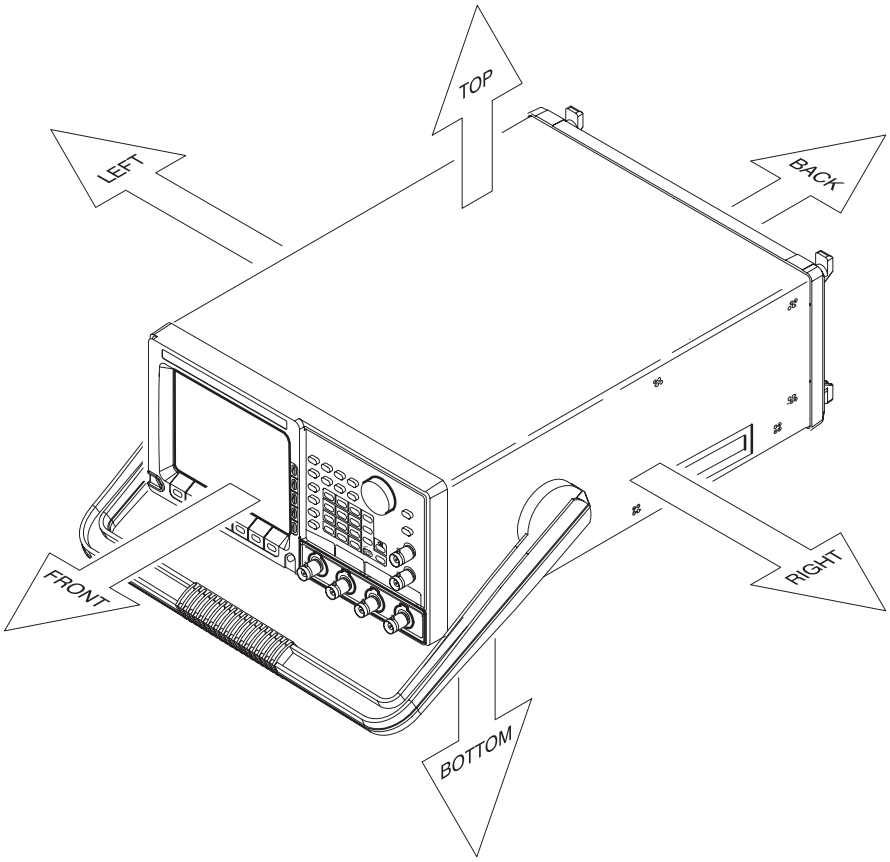


Figure 6-1: DG2030 orientation

Access Procedure

Use the flowchart in Figure 6-2 to determine which procedures to use for removing the module. The removal procedures end with reinstallation instructions.

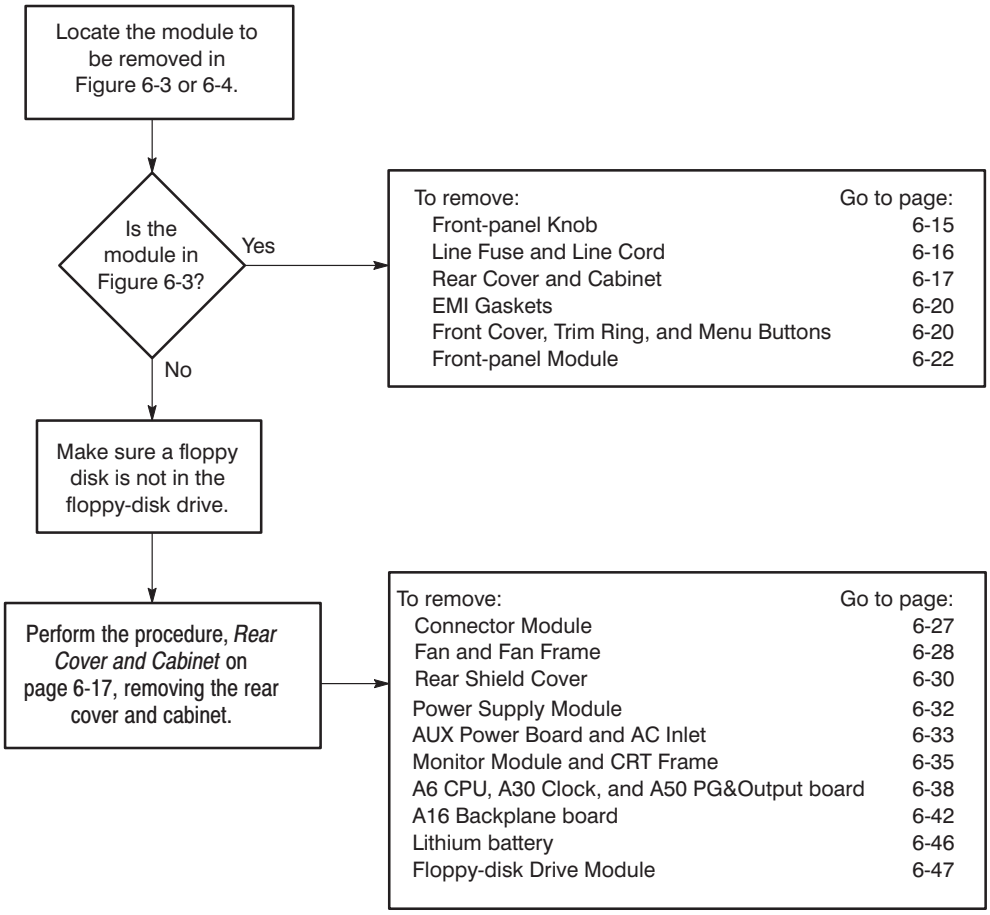


Figure 6-2: Guide to removal procedures

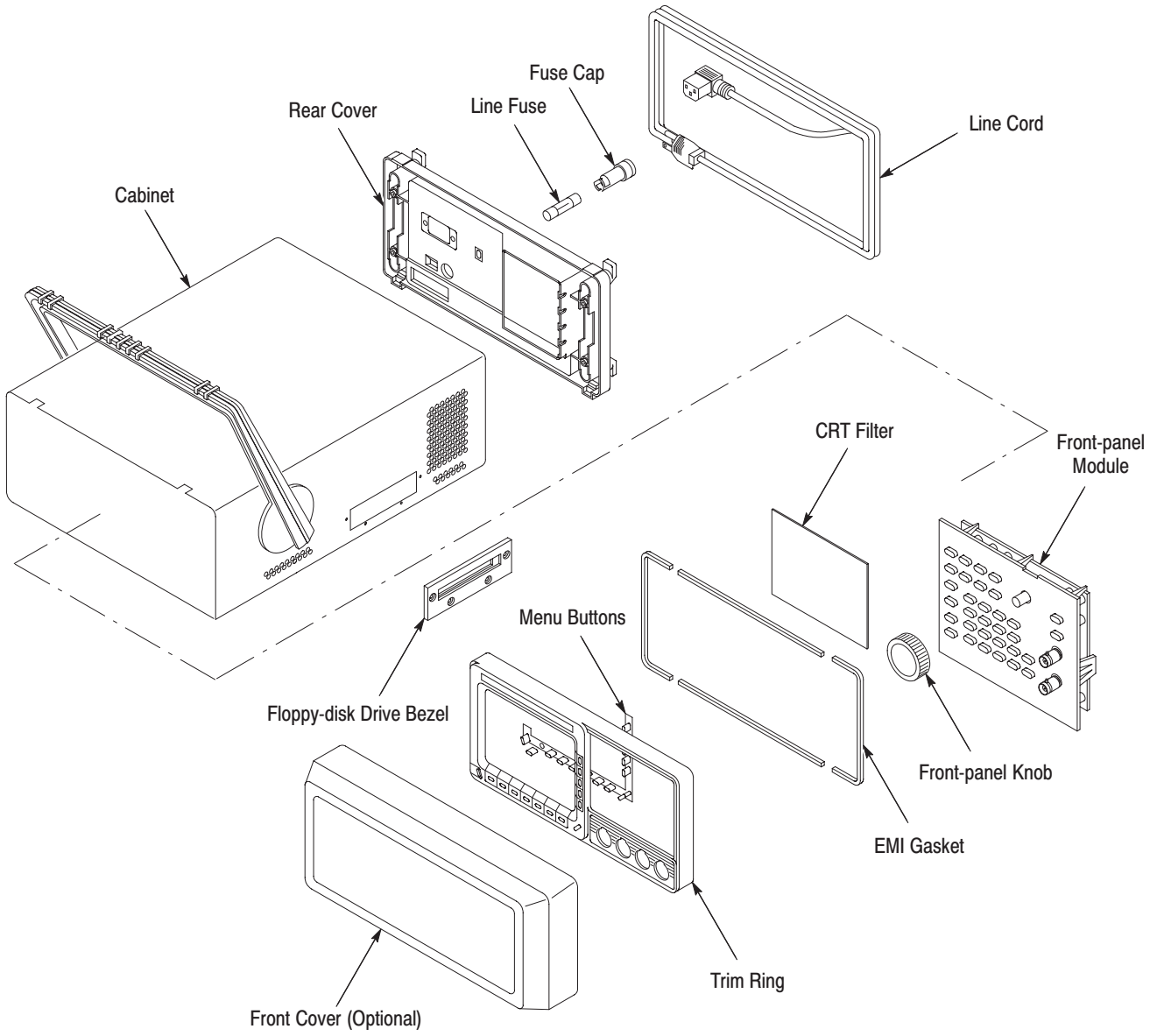


Figure 6-3: External modules

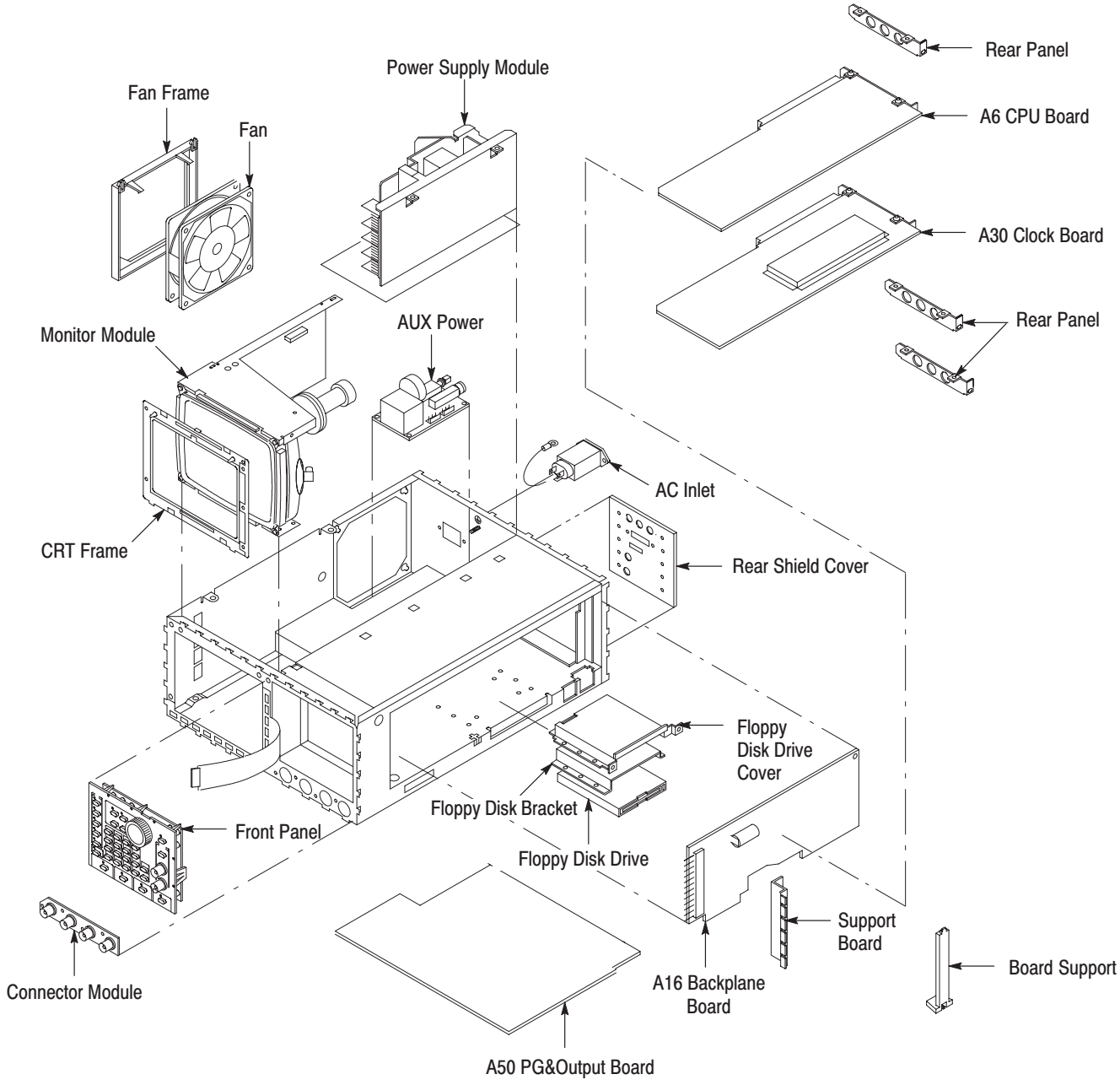


Figure 6-4: Internal modules

Procedures for External Modules

Perform the *Access Procedure* (page 6-12) before doing any procedure in this group.

This group contains the following procedures:

- Front-panel Knob
- Line Fuse and Line Cord
- Rear Cover and Cabinet
- EMI Gaskets
- Front Cover, Trim Ring, and Menu Buttons
- Front-panel Module

Front-panel Knob

1. *Assemble equipment and locate modules to be removed:* You will need a $\frac{1}{16}$-inch hex wrench for this procedure. Find the front-panel knob on the front panel in the locator diagram, *External Modules*, Figure 6-3.
2. *Orient instrument:* Set the DG2030 with the bottom down on the work surface and the front facing you (see Figure 6-5).
3. *Remove front cover:* If the optional front cover is installed, grasp the front cover by the left and right edges and snap it off of the trim ring. (When reinstalling, align and snap back on.)
4. *Remove knob:* Loosen the setscrew securing the knob using the $\frac{1}{16}$-inch hex wrench. Pull the knob toward you to remove it.
5. *Reinstallation:* Place the knob onto the shaft, and tighten the setscrew using the $\frac{1}{16}$-inch hex wrench.

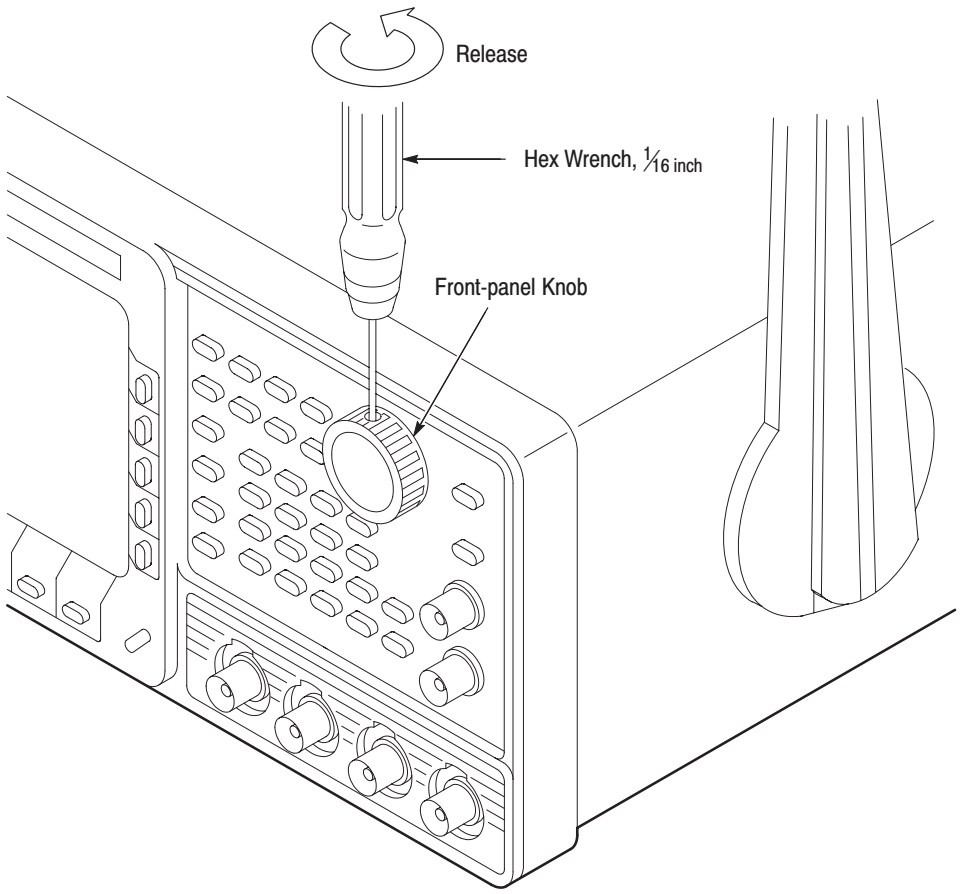


Figure 6-5: Front-panel knob removal

Line Fuse and Line Cord

1. *Assemble equipment and locate modules to be removed:* You will need a flat-bladed screwdriver for this procedure. Locate the line fuse and line cord in the locator diagram, *External Modules*, Figure 6-3.
2. *Orient instrument:* Set the DG2030 with the bottom down on the work surface and the back facing you. If you are servicing the line fuse, do the next step; if you are servicing the line cord, skip to step 4.
3. *Remove line fuse:* Find the fuse cap on the rear panel. See Figure 6-6. Now, remove the fuse cap by turning it counter-clockwise using a flat-bladed screwdriver, and remove the line fuse. Reverse the procedure to reinstall.
4. *Remove line cord:* Find the line cord on the rear cover. See Figure 6-6. Now, remove the line-cord retaining clamp by first unplugging the line cord from the line cord receptacle (1). Next, grasp both the line cord and the retaining clamp and rotate it 90 degrees, counter-clockwise (2). Pull the line cord and clamp away to complete the removal (3). Reverse the procedure to reinstall.

5. *Reinstallation:* Perform steps 3 and 4 in reverse order to reinstall the line cord, and then the line fuse.

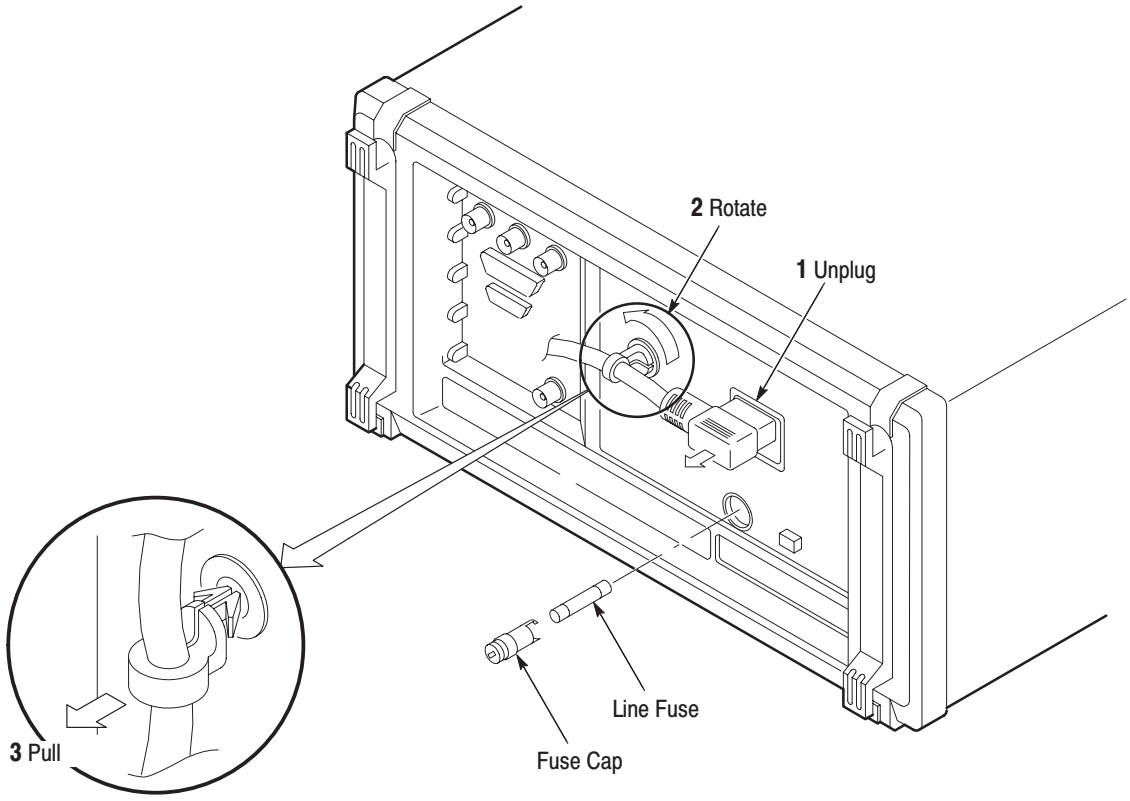


Figure 6-6: Line fuse and line cord removal

Rear Cover and Cabinet

1. *Assemble equipment and locate modules to be removed:*
   - **a.** You will need a screwdriver with size T-9 and T-15 Torx tips for this procedure.
   - **b.** Make sure the DG2030 front cover (optional accessory) is installed. If it is not, install it by snapping the edges of the front cover over the trim ring.
   - **c.** Locate the rear cover and cabinet in the locator diagram, *External Modules*, Figure 6-3.
2. *Orient instrument:* Set the DG2030 front down, with the front cover on the work surface and the instrument bottom facing you (see Figure 6-7).
3. *Disconnect line cord:* Perform the *Line Fuse and Line Cord* procedure on page 6-16, removing only the line cord.

4. *Remove rear cover:* Using a screwdriver with a size T-15 Torx tip, remove the four screws securing the rear cover to the instrument. Lift off the rear cover.

5. *Orient instrument:* Set the DG2030 face down, with the front cover on the work surface and right side facing you.

6. *Remove floppy disk drive bezel:* Using a screwdriver with a size T-9 Torx tip, remove the four screws securing the floppy-disk drive bezel to the cabinet. Lift off the floppy-disk drive bezel.

7. *Remove cabinet:*

CAUTION. *To prevent damaging the eject button, make sure floppy disk is not inserted in the floppy disk drive, before removing the cabinet from the DG2030.*

   a. Using a screwdriver with a size T-15 Torx tip, remove the screw securing the left side of the cabinet to the instrument.

   b. Grasp the right and left edges of the cabinet toward the back.

   c. Pull upward to slide the cabinet off the instrument. Take care not to bind or snag the cabinet on internal cabling as you remove it.

8. *Reinstall cabinet and rear cover:*

   a. Perform steps 3 through 7 in reverse order to reinstall the cabinet.

   b. Take care not to bind or snag the cabinet on internal cabling; redress cables as necessary.

   c. When sliding the cabinet, be sure that the front edge of the cabinet aligns with the groove containing the four EMI shields on the trim ring.

   d. When reinstalling the four screws at the rear panel, tighten them to a torque of 16 kg-cm (6 in-lbs).

   e. See the procedure, *Line Fuse and Line Cord,* on page 6-16 to reinstall the line cord. This completes the DG2030 reassembly procedure.

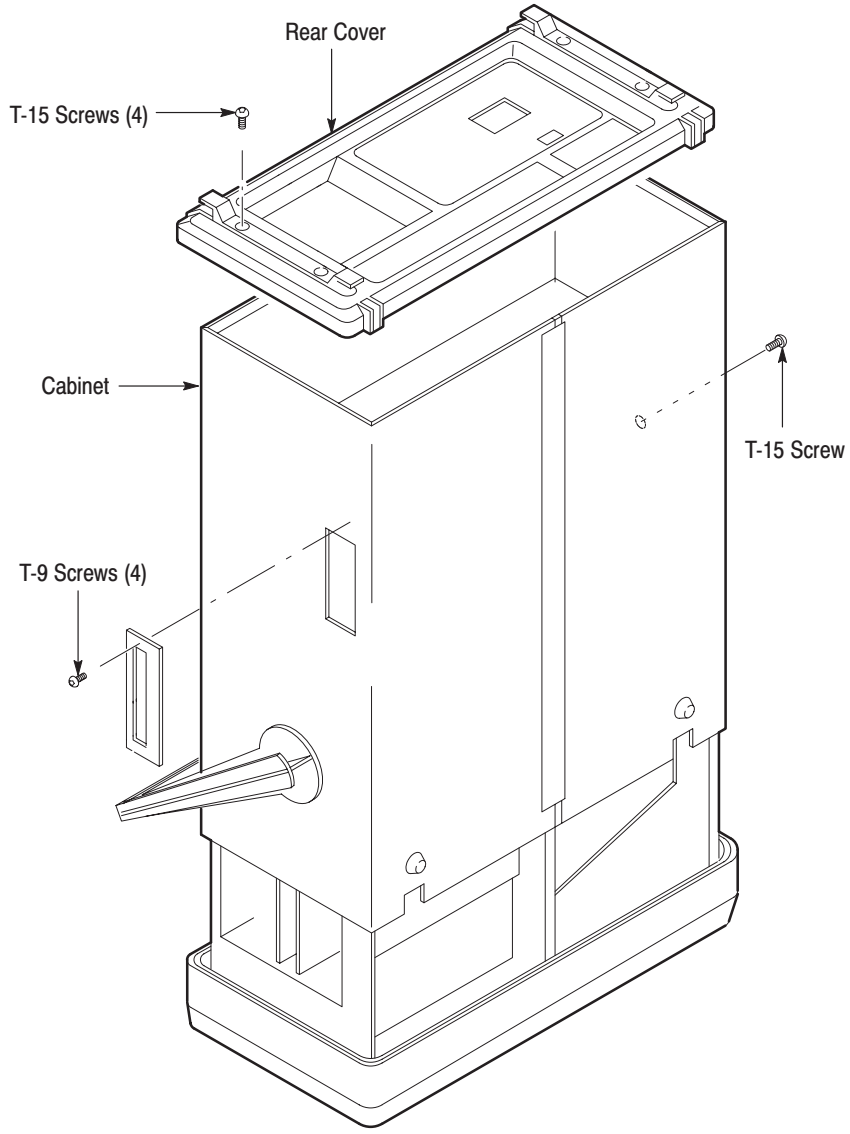


Figure 6-7: Rear cover and cabinet removal

EMI Gaskets

1. *Remove front cover and trim ring:* Perform the *Front Cover, Trim Ring, and Menu Buttons* procedure on page 6-20, removing only the front cover and trim ring.

CAUTION. *To prevent exceeding the environmental characteristics for EMI, carefully follow the instructions given, when reinstalling the EMI gaskets and/or the DG2030 cabinet.*

2. *Remove EMI gaskets:*
   - **a.** You will need a needle-nose pliers for this part of the procedure.
   - **b.** Locate the EMI gaskets in the locator diagram, *External Modules*, in Figure 6-3.
   - **c.** Use a pair of needle-nose pliers to remove the four sections of EMI gaskets from the groove in the trim ring.
3. *Reinstall EMI gaskets:* Press the EMI gaskets back into the groove in the trim ring.

Front Cover, Trim Ring, and Menu Buttons

1. *Assemble equipment and locate modules to be removed:* No tools are needed. Locate the modules to be removed in the locator diagram, *External Modules*, in Figure 6-3.
2. *Orient instrument:* Set the DG2030 with the back down on the work surface and bottom facing you (see Figure 6-8).
3. *Remove front cover:* If the optional front cover is installed, grasp the front cover by the left and right edges and snap it off of the trim ring. (When reinstalling, align and snap back on.)
4. *Remove front-panel knob:* Perform the *Front-panel Knob* procedure, on page 6-15.

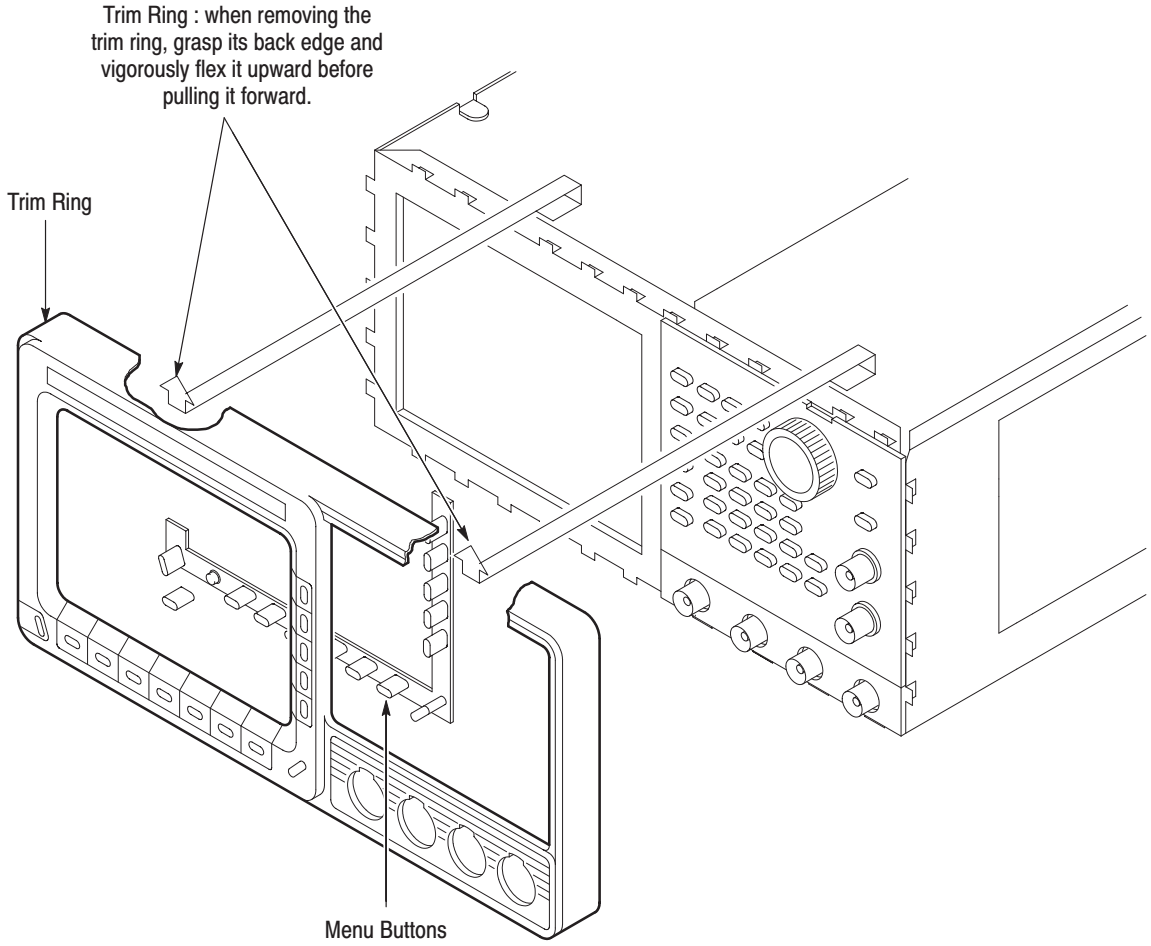


Figure 6-8: Front cover, trim ring, and menu button removal (front cover not shown)

CAUTION. *To prevent contaminating DG2030 parts, do not touch the carbon contact points on the menu buttons installed in the trim ring. Also, do not touch the contacts on the flex circuit exposed when you remove the trim ring.*

5. *Remove trim ring:* Grasp the trim ring by the top edge and pry it up and lift it forward to snap it off of the trim ring. If servicing the menu buttons, lift them out of the trim ring. (When reinstalling, reinsert the menu buttons, align the trim ring to the chassis and press it back on.)

6. *Reinstallation:* Perform steps 3–5 in reverse order to reinstall the menu buttons, trim ring and the front cover, following the reinstallation instructions found in each step.

Front-panel Module

***NOTE**. This procedure includes removal and reinstallation instructions for the front-panel module and front-panel buttons. Unless either of those modules are being serviced, do not do step 6, "Further disassembly of Front-panel Module."*

1. *Assemble equipment and locate modules to be removed:*
   a. You will need a flat-bladed screwdriver and a 0.05-inch and $\frac{1}{16}$-inch hex wrench for this procedure.
   b. Locate the modules to be removed in the locator diagram, *External Modules*, in Figure 6-3.
   c. Perform the procedure, *Front Cover, Trim Ring, and Menu Buttons*, steps 1–6 (immediately preceding this procedure).
2. *Remove front-panel knob:* Perform the *Front-panel Knob* procedure on page 6-15.
3. *Remove front cover, trim ring, and menu buttons:* Perform the *Front Cover, Trim Ring, and Menu Button*s procedure on page 6-20 removing only the module(s) you want to service.
4. *Orient instrument:* Set the DG2030 with the bottom down on the work surface and the front facing you.
5. *Remove front-panel module:*
   a. As shown in Figure 6-9, release the snap at the right of the front-panel module using a flat-bladed screwdriver. Lift the front-panel module out of the chassis until you can reach the interconnect cable.
   b. Disconnect the ribbon interconnect cable at J101 and flexible board connector at JP301 on the A12 Keyboard assembly.
   c. Finally, lift the front-panel module out of the chassis to complete the removal.

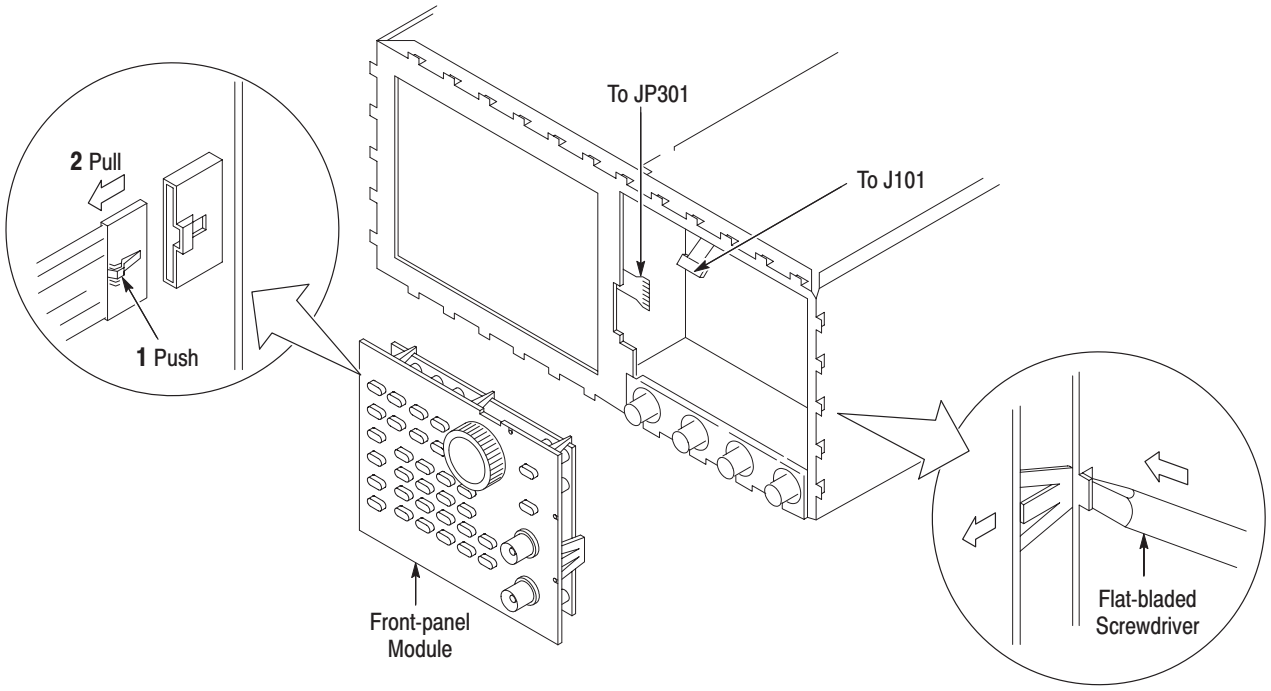


Figure 6-9: Front-panel module removal

6. *Further disassembly of front-panel module:* If the front-panel module or the front-panel buttons are to be serviced, do the following steps:

   a. Remove the front-panel knob from the front-panel module using the method described in the procedure, *Front-panel Knob,* on page 6-15.

   b. Remove the setscrew completely from the extension using the 0.05-inch hex wrench, and then remove the extension from the shaft of the rotary switch.

   c. As shown in Figure 6-10, release the four hooks, and then remove the A12 Keyboard from the chassis.

   d. Disassemble the front-panel module components using Figure 6-11 as a guide. Reverse the procedure to reassemble.

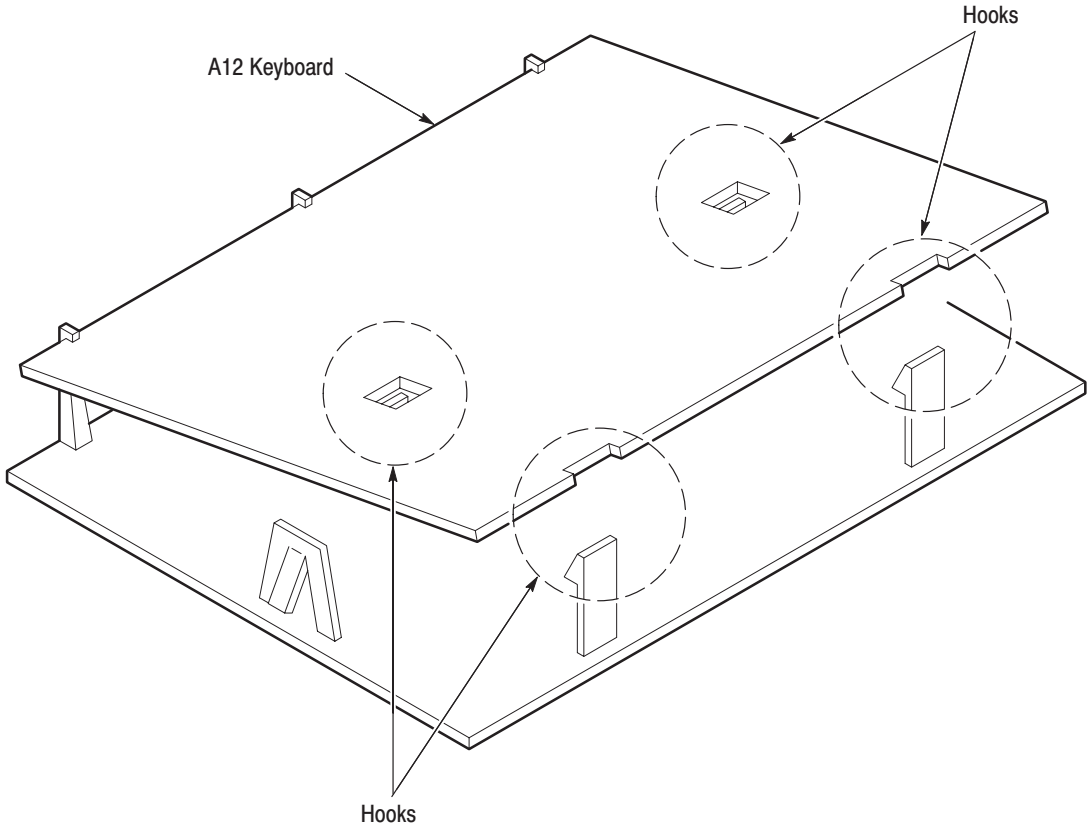


Figure 6-10: A12 keyboard removal

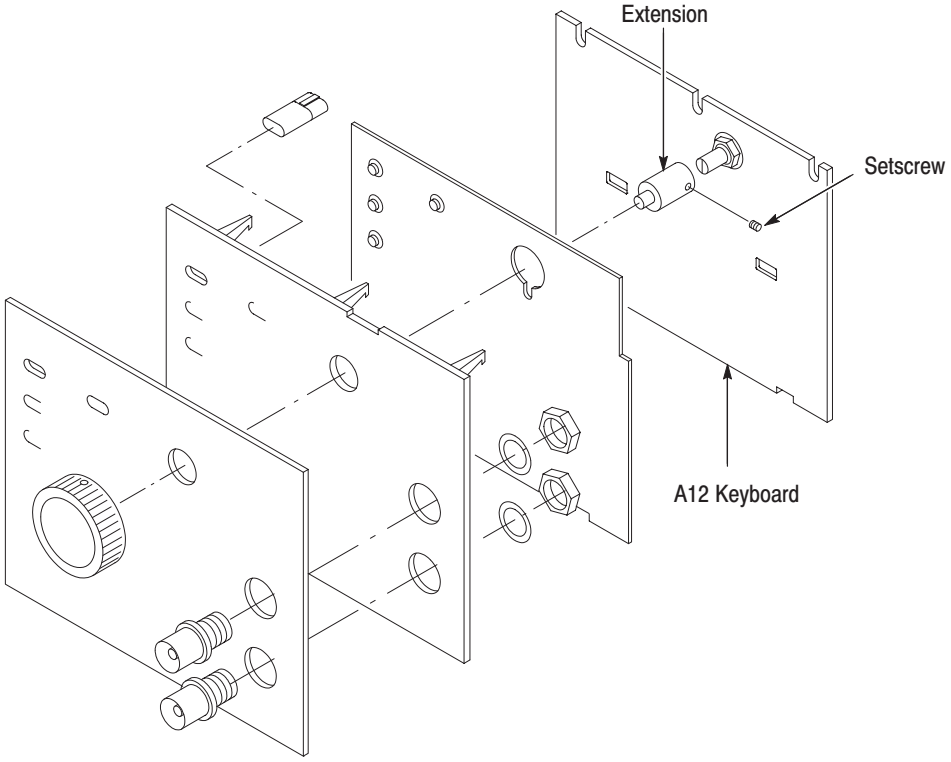


Figure 6-11: Front-panel module disassembly

7. *Reinstallation:* If the front-panel module was further disassembled in step 6, then reverse steps 6a–6d to reassemble, using Figure 6-11 as a guide. Then do the steps in step 3 in reverse order. Last, reinstall the trim ring and, if desired, the front cover, referring to the procedure, *Front Cover, Trim Ring, and Menu Buttons* (page 6-20).

Procedures for Internal Modules

Perform the *Access Procedure* (on page 6-12) before doing any procedure in this group.

This part contains the following removal and installation procedures; the procedures are presented in the order listed:

- Connector Module
- Fan and Fan Frame
- Rear Shield Cover
- Power Supply Module
- AC Inlet and AUX Power Board
- Monitor Module and CRT Frame
- Circuit Boards:
  - A6 CPU Board
  - A30 Clock Board
  - A50 PG&Output Board
- A16 Backplane Board
- Lithium Battery
- Floppy Disk Drive Module

Connector Module

1. *Assemble equipment and locate modules to be removed:*
   a. You will need a screwdriver with a size T-9 Torx tip and a ½-inch nut driver for this procedure.
   b. Locate the modules to be removed in the locator diagram, *Internal Modules*, in Figure 6-4.
2. *Remove front-panel knob:* Perform the *Front-panel Knob* procedure, on page 6-15.
3. *Remove front cover, trim ring, and menu buttons:* Perform the *Front Cover, Trim Ring, and Menu Buttons* procedure on page 6-20.
4. *Orient instrument:* Set the DG2030 with the top down on the work surface and the right side facing you.
5. *Remove connector module:*
   a. Disconnect the interconnect cables at the CH 0, CH1, CH 2, and CH 3 connector.
   b. Using the screwdriver with a size T-9 Torx tip, remove the four screws attaching the connector module to the chassis. See Figure 6-12.
6. *Remove BNC connector:* To remove a BNC connector, remove the nut attaching the BNC connector to the panel using a ½-inch nut driver, and then remove the BNC connector from the panel.
7. *Reinstallation:*
   a. *Install BNC connector:* Perform step 6, reversing the order of the items in the substep.
   b. *Install connector module:* Install the connector module by doing steps 5a–5b in reverse order.

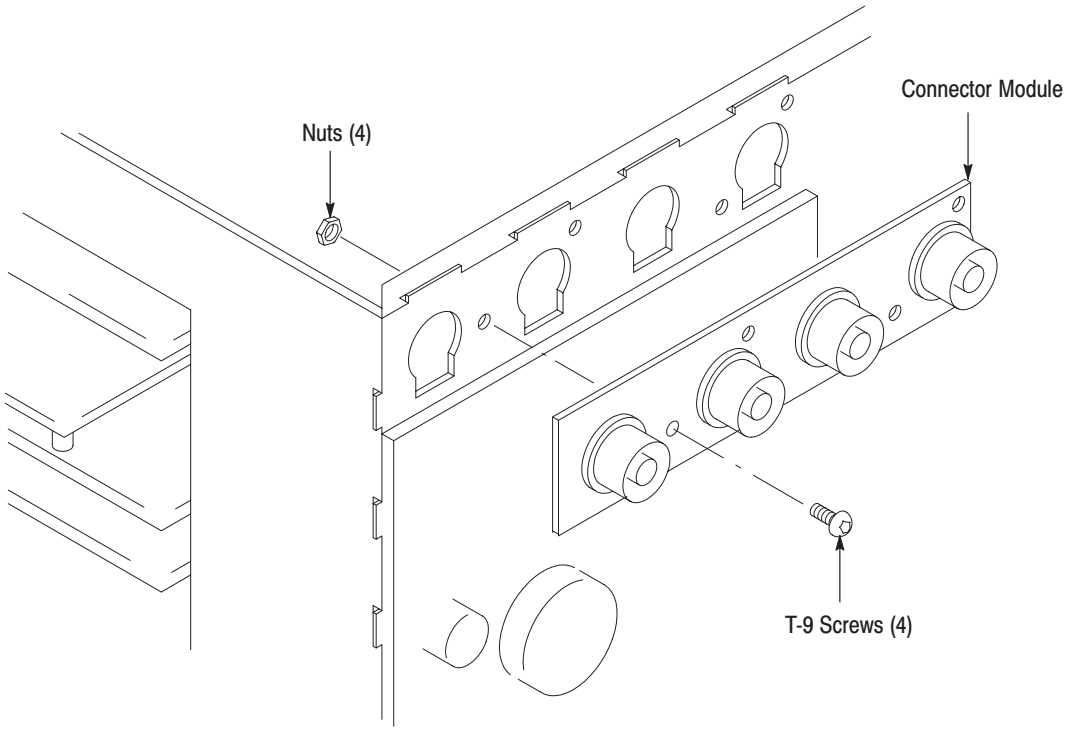


Figure 6-12: Connector module removal

Fan and Fan Frame

1. *Assemble equipment and locate modules to be removed:*
   - **a.** No tools are needed for this procedure.
   - **b.** Locate the modules to be removed in the locator diagram, *Internal Modules*, in Figure 6-4.
2. *Orient instrument:* Set the DG2030 with the bottom down on the work surface and the left side facing you.
3. *Remove fan and fan frame:*
   - **a.** Disconnect the ribbon interconnect cable from J3 of the power supply module. See Figure 6-13.
   - **b.** As shown in Figure 6-13, slide (2) in the direction indicated by arrow (1) while pushing it, and then remove the fan and fan frame.
   - **c.** Release the four hooks securing the fan, separate the fan and fan frame.

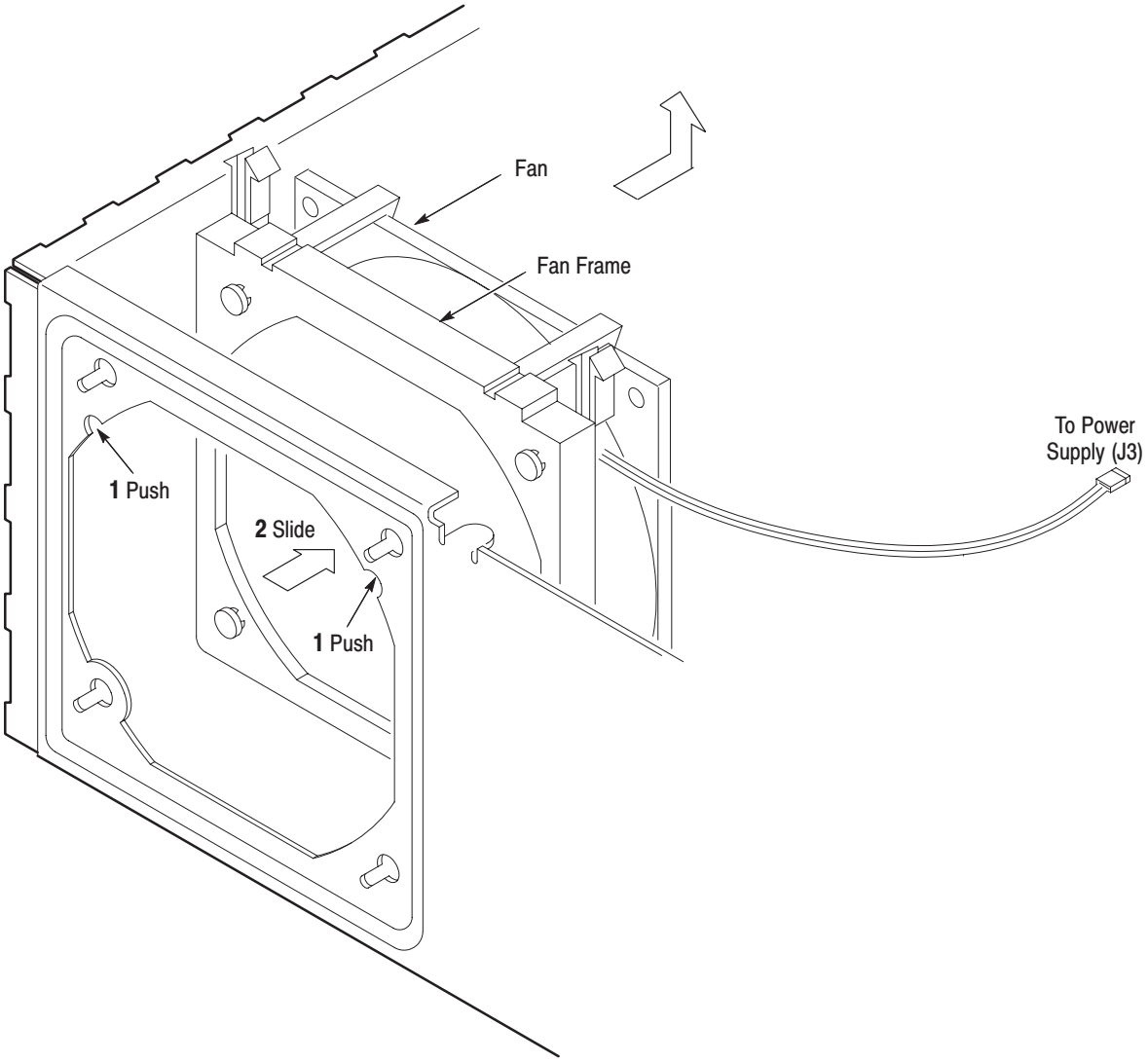


Figure 6-13: Fan and fan frame removal

4. *Reinstallation:*
   a. Secure the fan to the fan frame.
   b. Connect the cable (J3) to power supply module.
   c. Align the four protrusions of the fan frame with the holes of the chassis, slide the fan and fan frame to the lower left, and then install them.

Rear Shield Cover

1. *Assemble equipment and locate modules to be removed:*

   a. You will need a screwdriver with a size T-9 Torx tip, a size T-15 Torx tip, and a $^1/_4$-inch nut driver, and a 5 mm nut driver for this procedure.

   b. Locate the modules to be removed in the locator diagram, *Internal Modules*, Figure 6-4.

2. *Orient instrument:* Set the DG2030 with the bottom down on the work surface and the back facing you (see Figure 6-14).

3. *Remove rear shield cover:*

   a. Disconnect the ribbon interconnect cable from J30 on the A6 CPU board. See Figure 6-14 .

   b. Using a screwdriver with a size T-9 Torx tip, remove the ten screws securing the rear shield cover to the chassis from the back side.

   c. Using a $^1/_4$-inch nut driver, remove the IEEE STD 488 PORT cover by removing the two spacer posts.

   d. Grasp the serial interface connector, pull the rear shield cover toward you taking care not to damege the cable, and then remove the rear shield cover.

4. *Remove serial interface connector:* Use a 5 mm nut driver to remove the nut attaching the serial interface connector to the rear shield cover, then remove the connector.

5. *Remove rear panel:*

   a. Using a screwdriver with a size T-15 Torx tip, remove the three screws securing the rear shield cover to the chassis from the left side.

   b. You can remove the rear panel of a slot in which no board is mounted.

6. *Reinstallation:*

   a. Install the rear panel if you removed it by reversing the items in step 5.

   b. Install the serial interface connector if you removed it by rever sing the items in step 4.

   c. Install the rear shield cover by doing steps 3a–3d in reverse order.

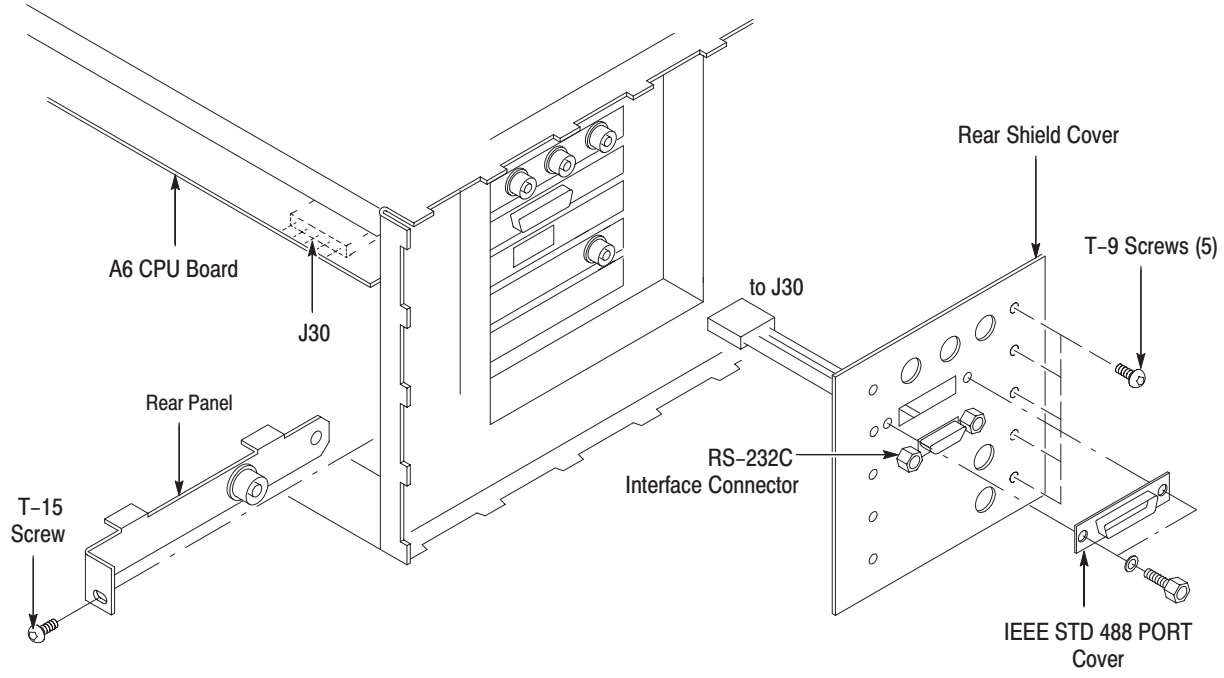


Figure 6-14: Rear shield cover removal

Power Supply Module

1. *Assemble equipment and locate modules to be removed:* You will need a screwdriver with a size T-15 Torx tip for this procedure. Locate the modules to be removed in the locator diagram, *Internal Modules*, in Figure 6-4.
2. *Orient instrument:* Set the DG2030 with the bottom down on the work surface and the left side facing you.
3. *Remove power supply module:*
   - **a.** Disconnect the ribbon interconnect cables at J1, J3, J4, and J5 on the power supply module. See Figure 6-15.
   - **b.** Disconnect the flat cable at J2 on the power supply module.
   - **c.** Using a screwdriver with a size T-15 Torx tip, remove the two screws attaching the power supply module to chassis.
4. *Reinstallation:* Perform steps 3a–3c in reverse order to reinstall the power supply module.

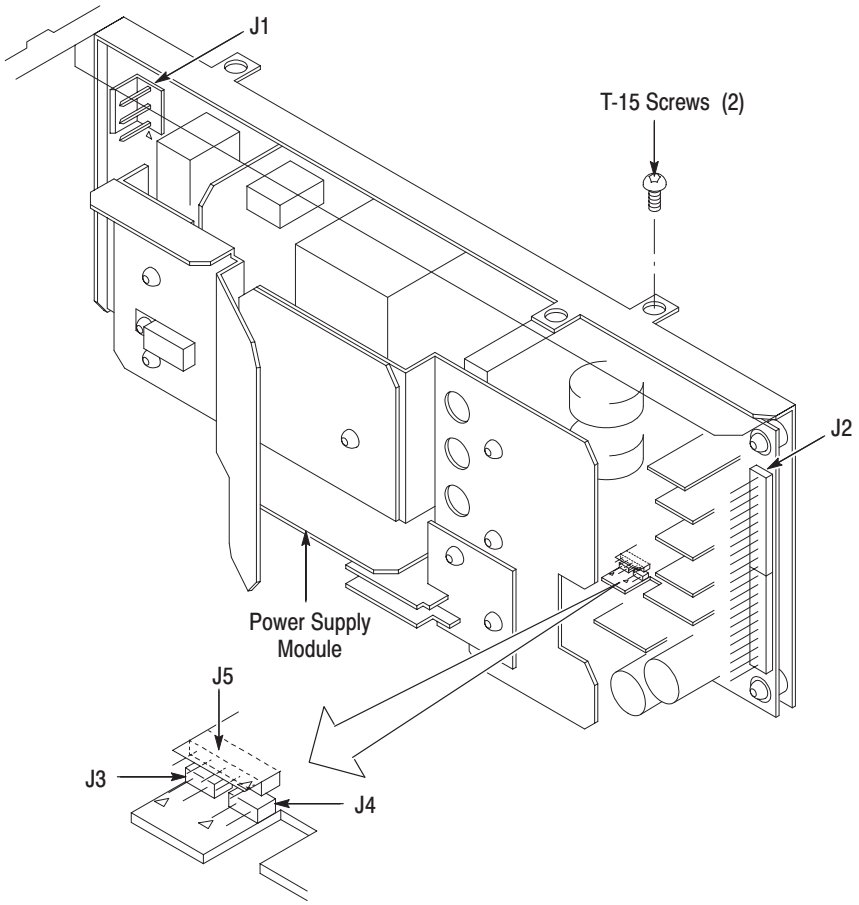


Figure 6-15: Power supply module removal

AC Inlet and AUX Power Board

1. *Assemble equipment and locate modules to be removed:*
   a. You will need a screwdriver with a size T-15 Torx tip and a 5/16-inch nut driver and a soldering iron for this procedure.
   b. Locate the modules to be removed in the locator diagram, *Internal Modules*, in Figure 6-4.
2. *Remove fan and fan frame:* Perform the *Fan and Fan Frame* procedure on page 6-28.
3. *Orient instrument:* Set the DG2030 with the bottom down on the work surface and the back facing you (see Figure 6-16).
4. *Remove the power supply module:* Perform the procedure, *Power Supply Module*, on page 6-32.
5. *Remove AC inlet:*
   a. Disconnect the interconnect cable at CN1 on the AUX Power board.
   b. Using a 5/16-inch nut driver, remove the nut attaching the ground wire to the chassis.
   c. Remove the two insulating tubes of cables attached to the AC inlet.
   d. Unsolder the three interconnect cables attached to the AC inlet.
   e. Using a screwdriver with a size T-15 Torx tip, remove the two screws securing the AC inlet to the chassis.
6. *Remove AUX Power board:*
   a. Disconnect the interconnect cable at CN2 on the AUX Power board.
   b. Remove the three screws attaching the AUX Power board to the chassis.
   c. Lift the AUX Power board up and away from the chassis to complete the removal.
7. *Reinstallation:*
   a. Install the AUX Power board by doing steps 6a–6c in reverse order.
   b. Install the AC Inlet by doing steps 5a–5e in reverse order.

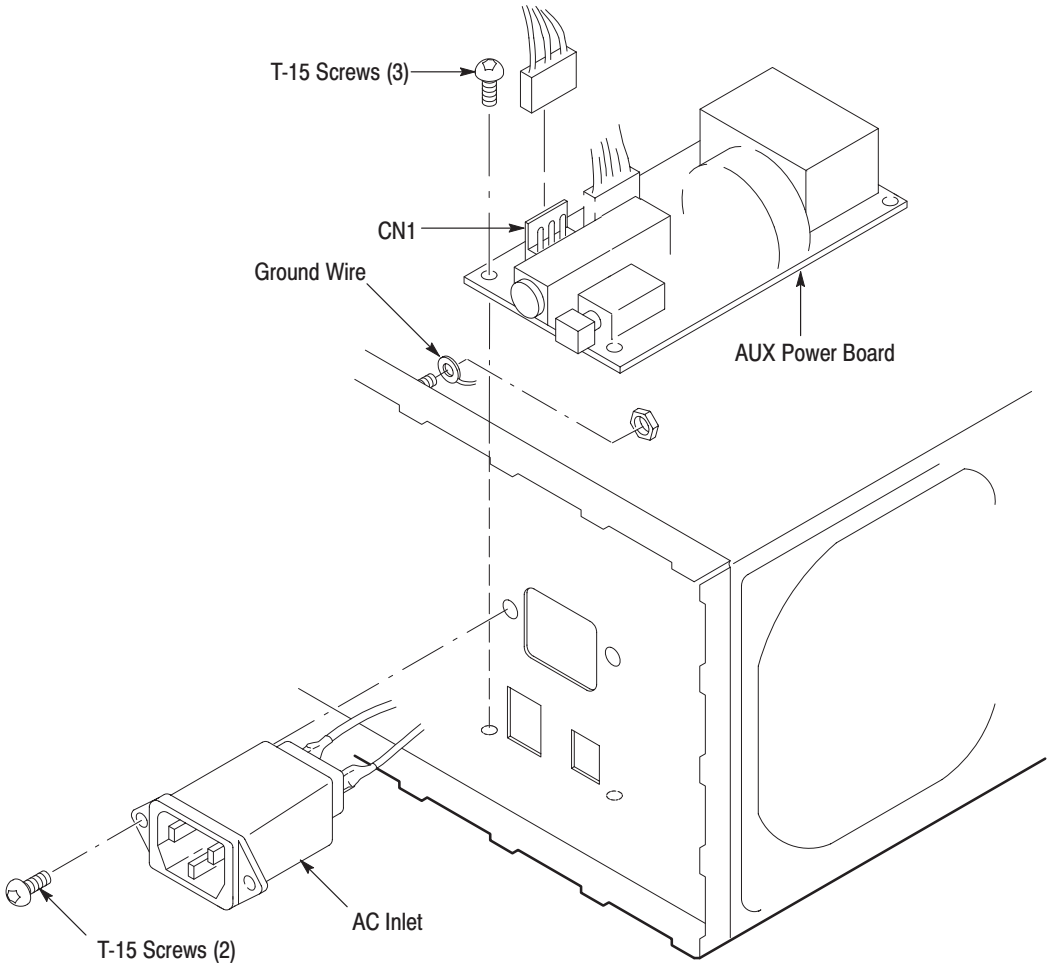


Figure 6-16: AUX power board and AC inlet removal

Monitor Module and CRT Frame

1. *Assemble equipment and locate modules to be removed:*

   a. You will need a screwdriver with a size T-15 Torx tip for this procedure.

   b. Locate the modules to be removed in the locator diagram, *Internal Modules,* in Figure 6-4.

2. *Remove front cover, trim ring, and menu buttons:* Perform the *Front Cover, Trim Ring, and Menu Button*s procedure on page 6-20.

3. *Orient instrument:* Set the DG2030 with the bottom down on the work surface and the left side facing you.

4. *Remove monitor module:*

NOTE*. Take care not to damage the CRT surface when installing or removing the monitor module.*

---

   a. Disconnect the ribbon interconnect cable at J901 on the monitor module. See Figure 6-17.

   b. Remove the five screws securing the monitor module top and bottom to the chassis.

   c. Release the snap at the right of the front-panel module and shift the assembly. Insert the screwdriver with a size T-15 Torx tip into the right hole of the chassis, and then remove the screw securing the monitor module.

   d. Lift the monitor module up and away from the chassis to complete the removal.

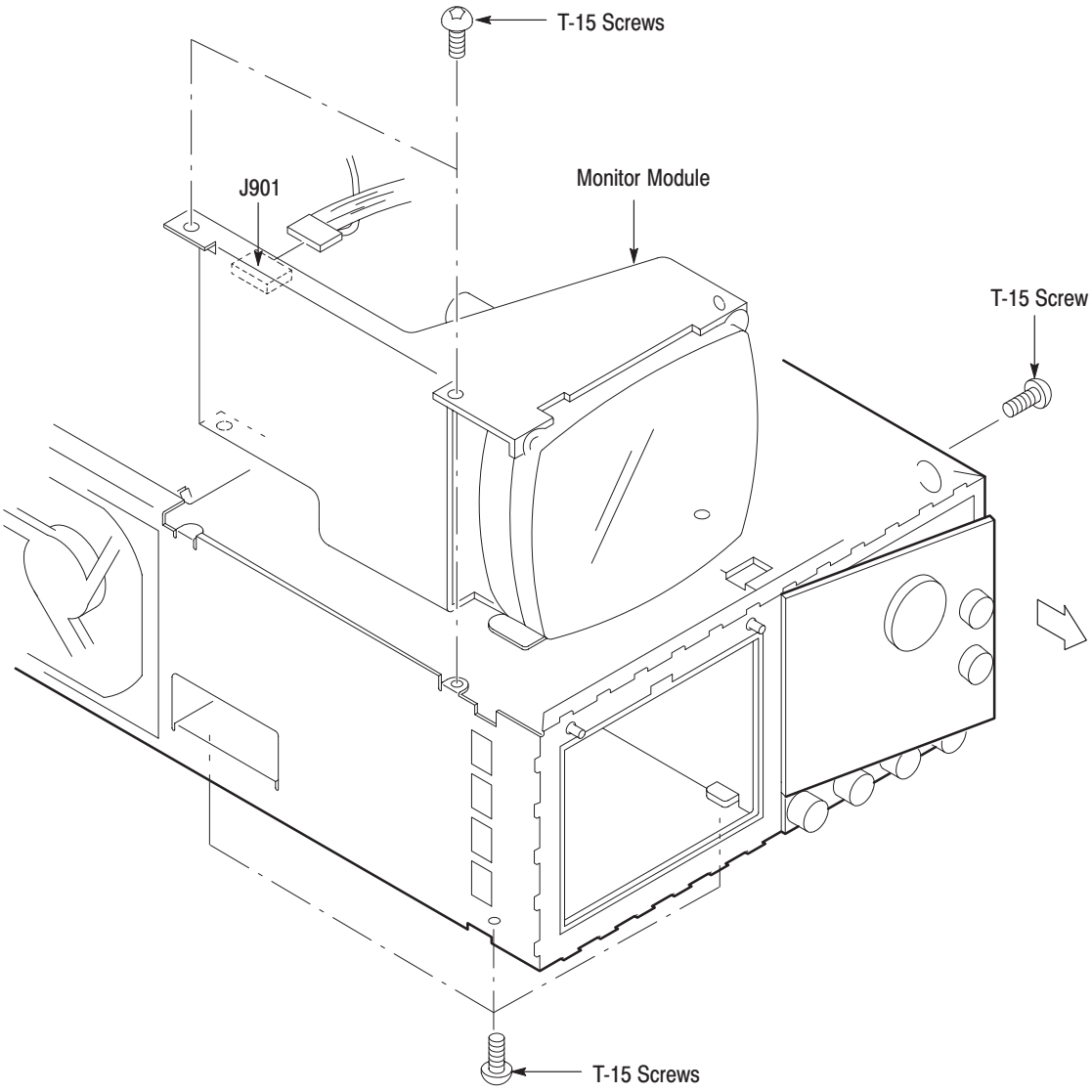


Figure 6-17: Monitor module removal

5. *Remove CRT frame:* Grasp the upper part of the CRT frame and take it out as shown in Figure 6-18.

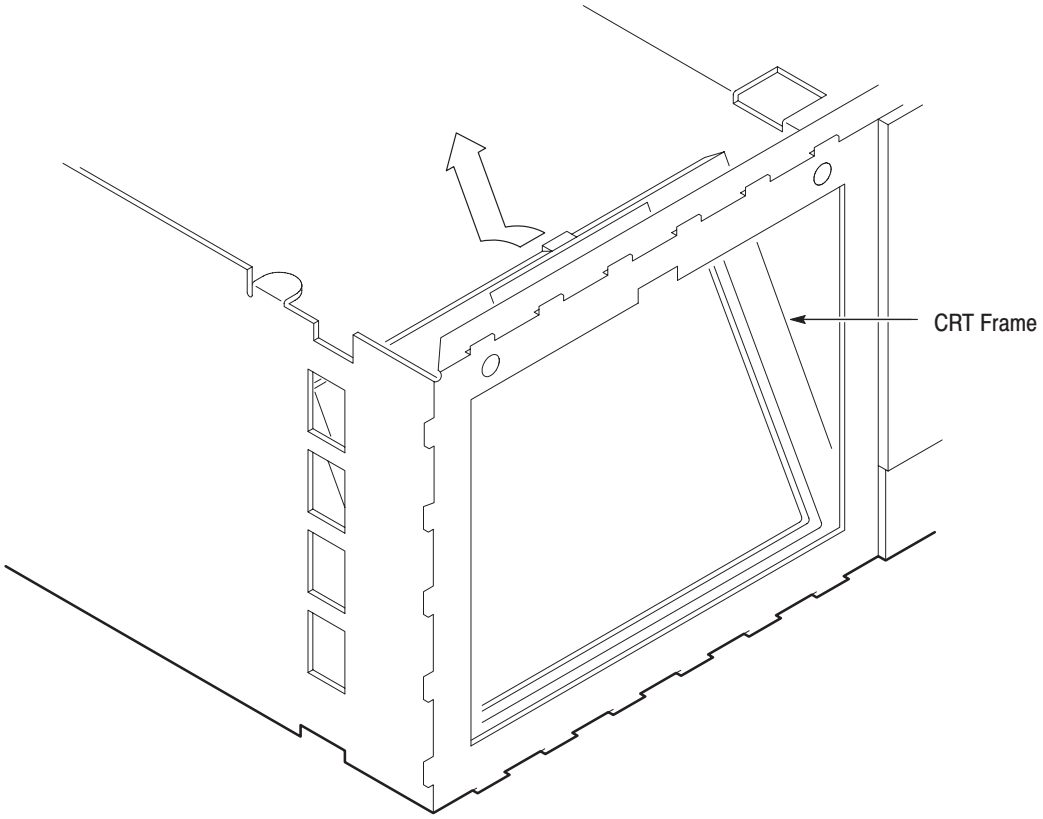


Figure 6-18: CRT frame removal

6. *Reinstallation:*

a. Grasp the upper part of the CRT frame, align the notch of the chassis with the protrusion of the CRT frame, and place the CRT frame in the chassis.

b. Install the monitor module by doing steps from 4.a to 4.d in reverse order.

Circuit Boards

This procedure describes how to remove these circuit boards:

- A6 CPU Board
- A30 Clock Board
- A50 PG&Output Board

A6 CPU Board and A30 Clock Board.

1. *Assemble equipment and locate modules to be removed:* Locate the modules to be removed in the locator diagram, *Internal Modules*, in Figure 6-4.
2. *Remove the rear shield cover:* Perform the procedure, *Rear Shield Cover*, on page 6-30.
3. *Orient instrument:* Set the DG2030 with the left side down on the work surface and the top facing you.
4. *Remove board support:* Remove the board support upward while pushing its hook to the inside.
5. *Remove A6 CPU board:*

CAUTION. *To avoid permanent loss of pattern data file, note the following: A lithium battery which maintains the nonvolatile memory during power-off time is located on the A16 Backplane board. The nonvolatile memory that contains the pattern data and its setup parameter data is located on the A6 CPU board. Removing either board will cause the pattern data file in nonvolatile memory to be permanently lost. Before removing either the A6 CPU board or the A16 Backplane board, save the pattern data file in the instrument nonvolatile memory to a floppy disk. Then, after reinstalling the board(s), reload the file into nonvolatile memory.*

   a. Disconnect the ribbon interconnect cables at J30, J50 and J64 on the A6 CPU board (see Figure 6-19).
   b. Disconnect the flat cable at J75 on the A6 CPU board. Remove the flat cable as shown in Figure 6-19.
   c. Grasp the upper part of the A6 CPU board, and pull upward to remove it.

6. *Remove A30 Clock board:*

a. Disconnect the ribbon cable at J030 on the A30 PG Clock board (see Figure 6-19).

b. Disconnect the interconnect cables at J010, J011, J200 and J450 on the A30 Clock board (see Figure 6-19).

c. Grasp the upper part of the A30 Clock board and pull upward to remove it.

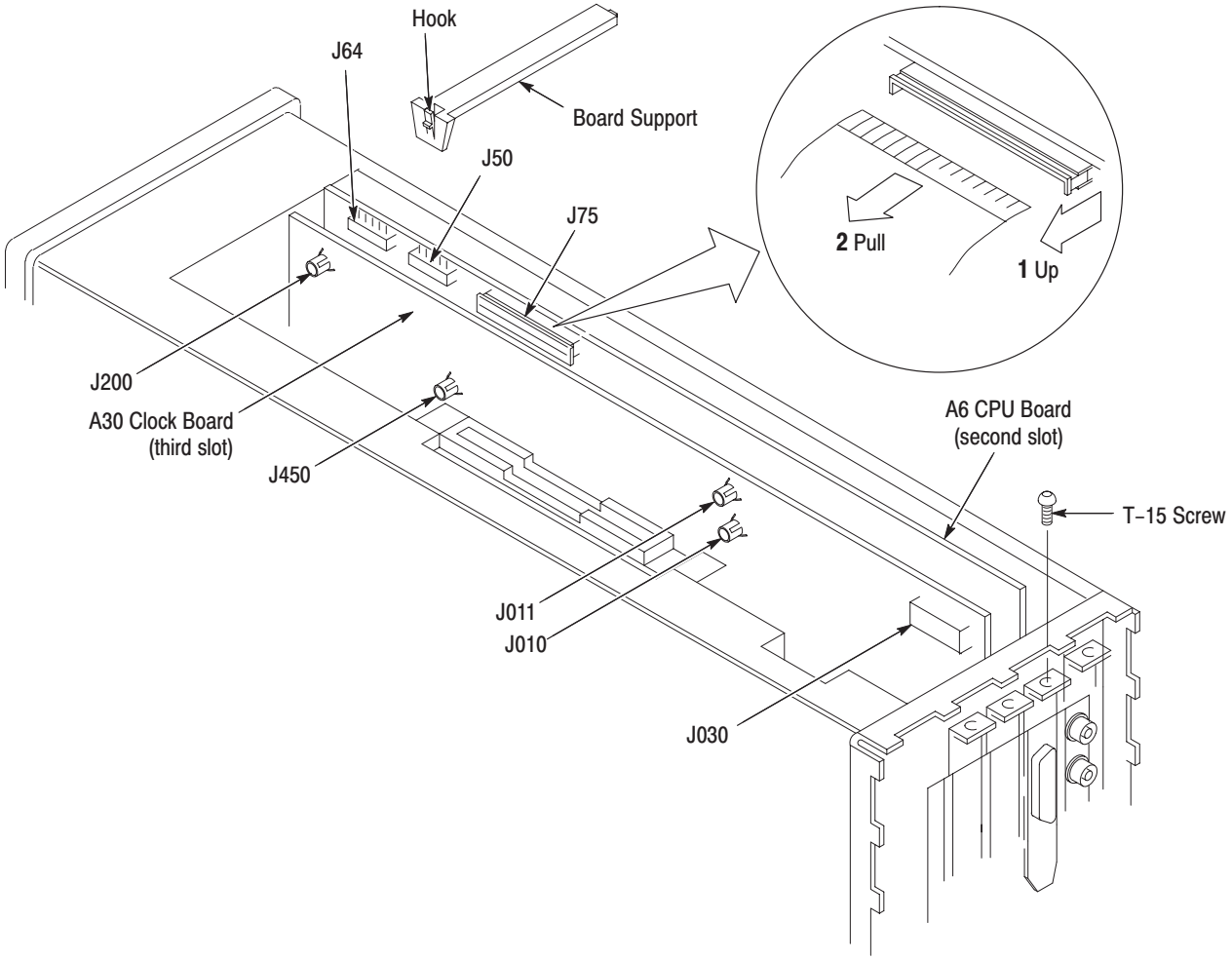


Figure 6-19: A6 CPU board and A30 Clock board removal

A50 PG&Output Board.

1. *Assemble equipment and locate modules to be removed:*

   a. You will need a screwdriver with a size T-10 Torx tip to do this procedure. (see Figure 6-19).

   b. Locate the modules to be removed in the locator diagram, *Internal Modules*, in Figure 6-4.

2. *Orient instrument:* Set the DG2030 with the top down on the work surface and the right side facing you.

3. *Remove A50 PG&Output board*

   a. Disconnect the nineteen interconnect cables at J800, J810, J1100, J1110, J1240, J1270, J1245, J1275, J2100, J2200, J2300, J2400, J2600, J2800, J2802, J3100, J3200, J3300, and J3400. See Figure 6-20.

      The W100 on the A50 PG&Output board is connected with the J030 connector on the A30 Clock board. To disconnect the J030 connector, release the latch on W100 plug ang pull upward.

      The W1300 on the A50 PG&Output board is connected with the J15 connector on the A30 Clock board. To disconnect the J030 connector, release the latch on W1300 plug ang pull upward.

   b. Using a screwdriver with a size T-10 Torx tip, remove the nine screws attaching the A50 PG&Output board.

   c. Lift the A50 PG&Output board up and away from the chassis to complete the removal.

4. *Reinstallation:* Do steps 3a through 3c in reverse order to reinstall the A50 PG&Output board.

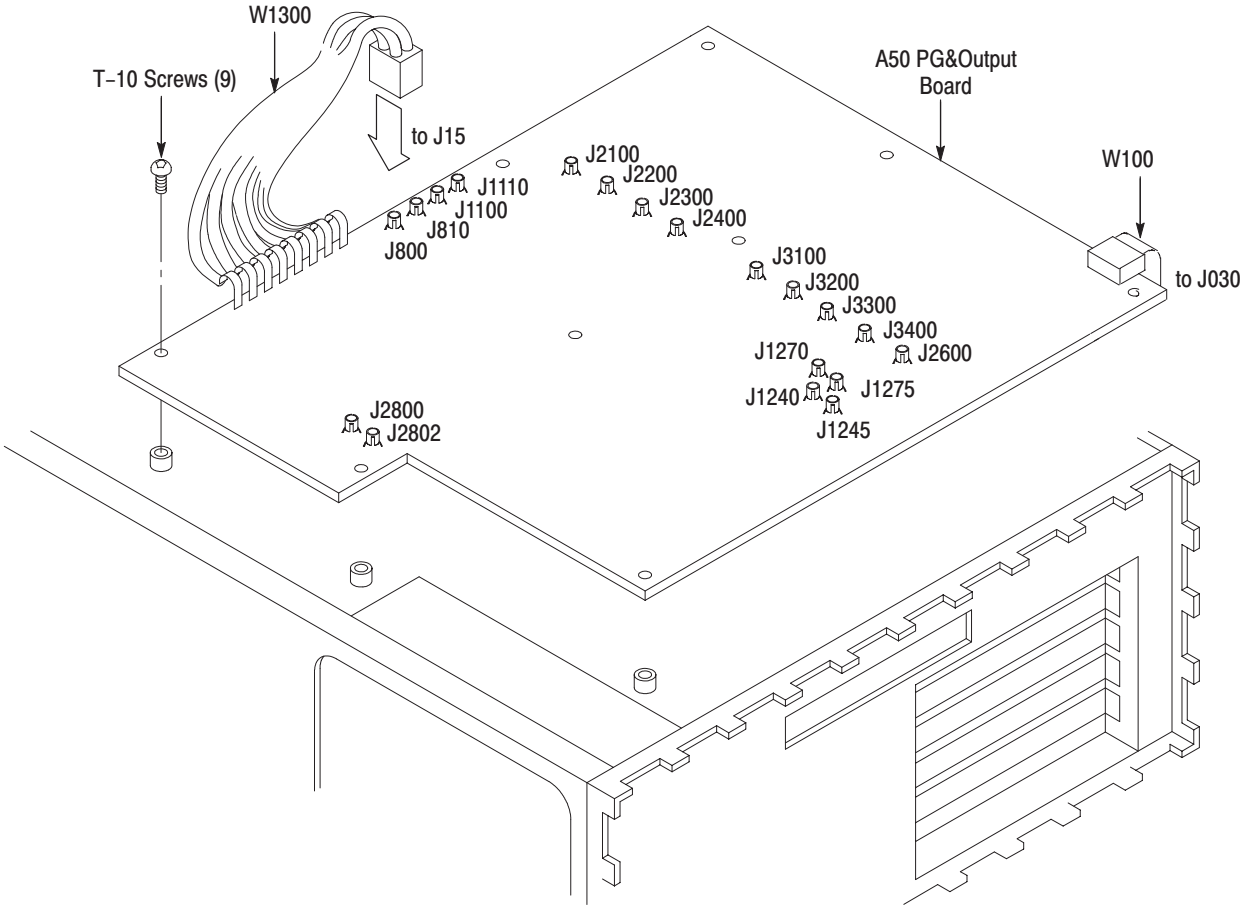


Figure 6-20: A50 PG&Output board removal

A16 Backplane Board

CAUTION. *To avoid the permanent loss of pattern data file, note the following: A lithium battery which maintains the nonvolatile memory during power-off time is located on the A16 Backplane board. The nonvolatile memory that contains the pattern data and its setup parameter data is located on the A6 CPU board.*

Removing either board will cause the pattern data file in nonvolatile memory to be permanently lost. Before removing either the A6 CPU board or the A16 Backplane board, save the pattern data file in the instrument nonvolatile memory to a floppy disk. Then, after reinstalling the board(s), reload the file into nonvolatile memory.

1. *Assemble equipment and locate modules to be removed:*
   - **a.** You will need a screwdriver with a size T-15 Torx tip and a flat-bladed screwdriver for this procedure.
   - **b.** Locate the modules to be removed in the locator diagram, *Internal Modules*, in Figure 6-4.
2. *Orient instrument:* Set the DG2030 with the left side down on the work surface and the top facing you.
3. *Remove all boards:* Perform the procedure, *Circuit Boards*, on page 6-38.
4. *Remove A16 Backplane board:*
   - **a.** Remove the five screws and a nut securing the shield cover (see Figure 6-21).
   - **b.** Grasp the shield cover, and take it out.
   - **c.** Disconnect the ribbon interconnect cable at J10 on the A16 Backplane board.
   - **d.** Disconnect the flat cable at J6 on the A16 Backplane board.
   - **e.** Remove the remaining four screws securing the A16 Backplane board to the chassis.
   - **f.** Using a flat-bladed screwdriver, release the four hooks of the circuit board support that holds the A16 Backplane board, lift the A16 Backplane board sideways, and then take it out.

5. *Reinstallation:*

a. *Install the A16 Backplane board:* Perform steps 4a–4f in reverse order to install the board.

b. *Install the other boards:* Perform the procedure, *Circuit Boards,* on page 6-38, in reverse order, reversing the items in each step.

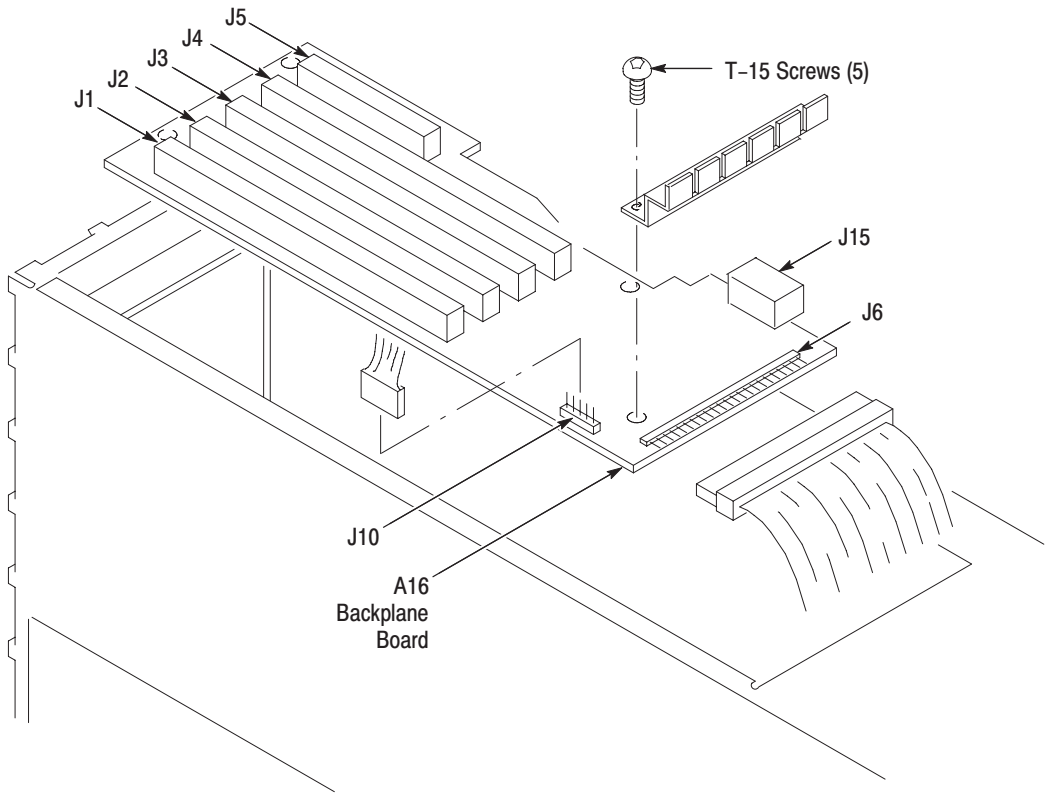


Figure 6-21: A16 Backplane board removal

Lithium Battery

WARNING. *To avoid the risk of fire or explosion, install a new battery that has the same part number as listed in section 10,* Mechanical Parts List, *for a replacement battery.*

To avoid the risk of fire or explosion, do not recharge, rapidly discharge, or disassemble the battery, heat it above 100° C, or incinerate it.

Dispose of used batteries promptly. Small quantities of used batteries may be disposed of in normal refuse. Keep lithium batteries away from children.

1. *Assemble equipment and locate modules to be removed:*

- **a.** You will need a soldering iron for this procedure.
- **b.** You will also need a replacement lithium battery having the part number listed in section 10, *Mechanical Parts List.*
- **c.** Locate the battery to be removed in the locator diagram, *Internal Modules*, in Figure 6-4.

2. *Remove A16 Backplane board:* Perform the *A16 Backplane Board* procedure on page 6-42.

3. *Orient board:* Set the A16 Backplane board on an insulating surface.

4. *Remove used battery:*

- **a.** Unsolder the tabs at the ends of the battery, taking care not to heat the battery (see Figure 6-22).
- **b.** Grasp the battery, and lift it away from the board.

5. *Install new battery:*

- **a.** Place the new battery on the board with the negative tab of the battery closest to the board edge connector.
- **b.** Solder the tabs to the board.

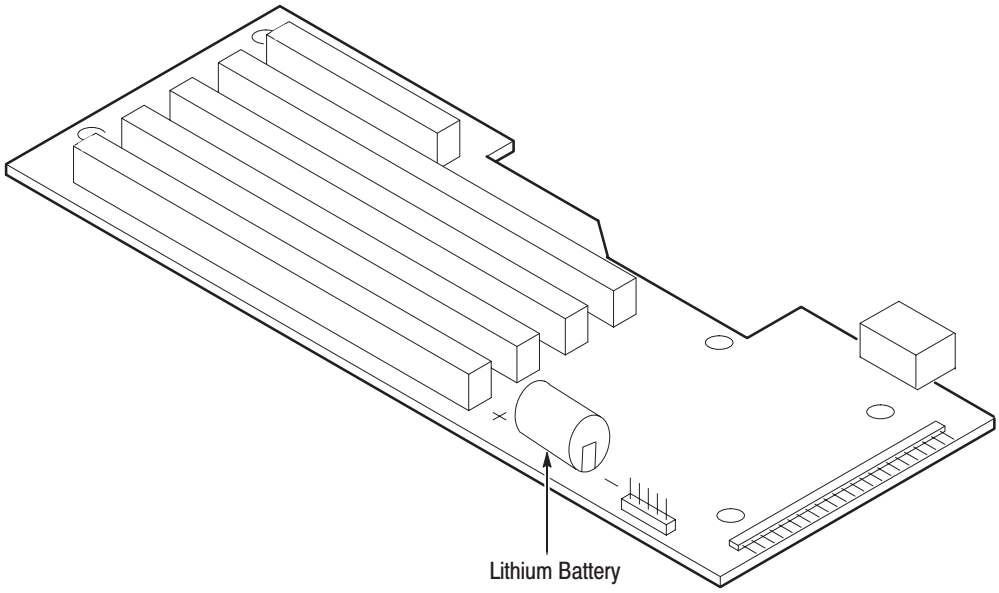


Figure 6-22: Battery location on the A16 Backplane board

Floppy-disk Drive Module

1. *Assemble equipment and locate modules to be removed:*
   - **a.** You will need a screwdriver with a size T-10 Torx tip and a size #1 Phillips tip for this procedure.
   - **b.** Locate the modules to be removed in the locator diagram, *Internal Modules*, in Figure 6-4.
2. *Remove rear shield cover:* Perform the *Rear Shield Cover* procedure on page 6-30.
3. *Orient instrument:* Set the DG2030 with the left side down on the work surface and the bottom facing you.
4. *Remove all circuit boards:* Perform the procedure, *Circuit Boards*, on page 6-38.
5. *Remove floppy-disk drive module:*
   - **a.** Using a screwdriver with a size T-10 Torx tip, remove the six screws securing the floppy-disk drive cover to the chassis (see Figure 6-23).
   - **b.** Using a screwdriver with a size #1 Phillips tip, remove the three screws securing the floppy-disk drive to the chassis.
   - **c.** Grasp the upper part of the floppy-disk, and pull it upward to remove it.
   - **d.** Disconnect the flat cable of the floppy disk drive to complete removal.

6. *Reinstallation:*

   a. *Install floppy-disk drive module:* Perform steps 5a–5d in reverse order.

   b. *Install circuit boards:* Perform the procedure, *Circuit Boards*, on page 6-38, in reverse order.

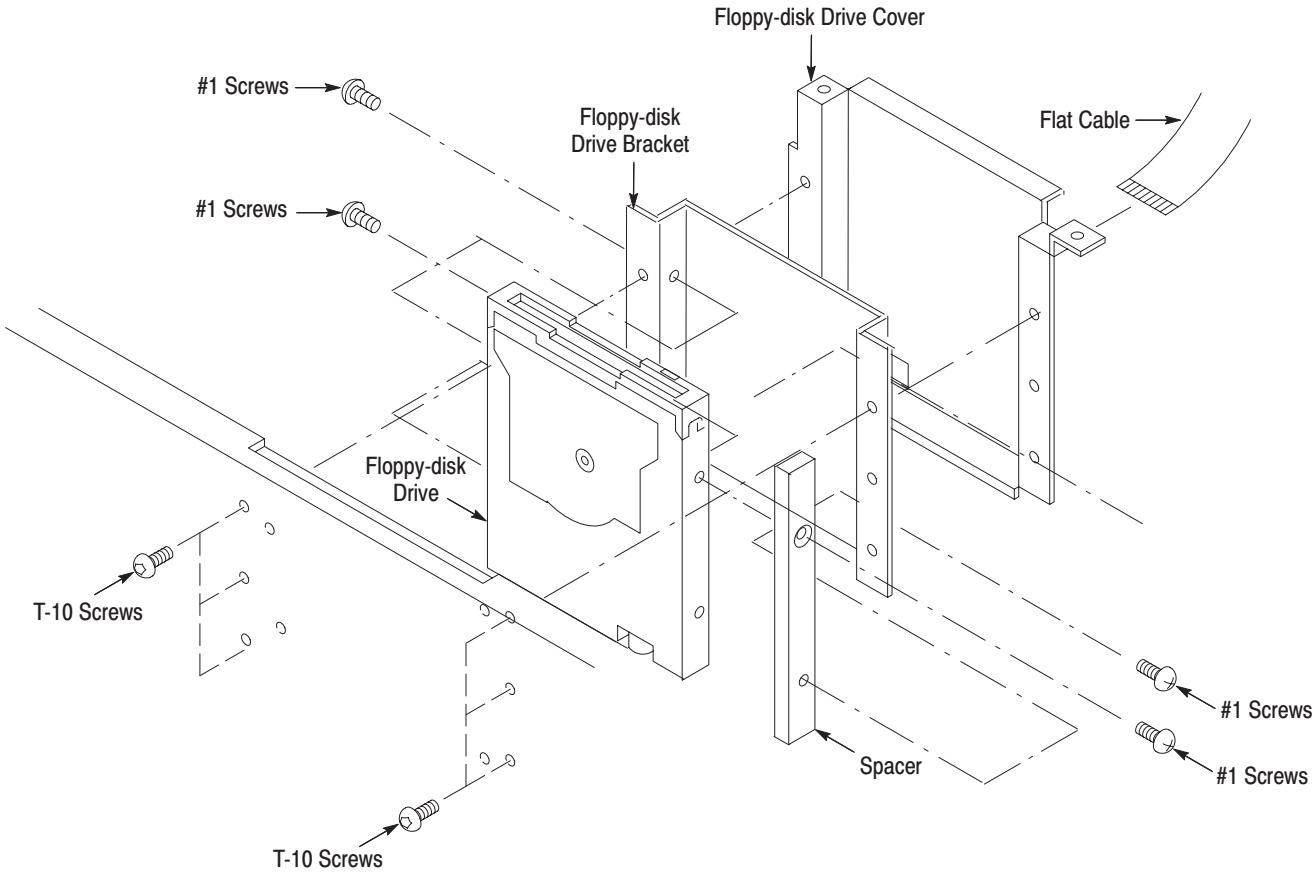


Figure 6-23: Floppy-disk drive module removal

Repackaging

This subsection contains information about repackaging the DG2030 for shipment.

Repackaging Instructions

Use a corrugated cardboard shipping carton having a test strength of at least 275 pounds and with an inside dimension at least six inches greater than the DG2030 dimensions. (If available, use the original shipping carton, which meets these requirements.)

If the DG2030 is shipped to a Tektronix Service Center, enclose the following information:

- The owner's address
- Name and phone number of a contact person
- Type and serial number of the DG2030
- Reason for returning
- A complete description of the service required

Seal the shipping carton with an industrial stapler or strapping tape.

Mark the address of the Tektronix Service Center and your own return address on the shipping carton in two prominent locations.

Troubleshooting

This subsection contains information and procedures designed to isolate faulty modules in the DG2030 Data Generator. If these procedures indicate a module needs to be replaced, follow the *Removal and Installation Procedures* in the preceding subsection.

Troubleshooting Procedures

The troubleshooting procedures in this subsection consist of the following flowcharts:

- Primary Troubleshooting Procedure (Figure 6-25)
- Power Supply Module (Figure 6-27)
- A6 CPU Board or Front-panel Module (Figure 6-30)
- Monitor Module (Figure 6-32)
- A30 Clock Board or A50 PG&Output Board (Figure 6-36)
- Module Isolation (Figure 6-37)

To use these procedures, begin with the Primary Troubleshooting Procedure. It prompts you to check various indications of DG2030 functionality and directs you to the other troubleshooting procedures.

DG2030 Diagnostics

The DG2030 has internal diagnostics that verify circuit functionality. The DG2030 automatically executes the internal diagnostics at power-on. You can also run the internal diagnostics by using the **UTILITY** menu. Refer to *Checking Diagnostics Tests* on page 6-50. The difference between the two methods of running the internal diagnostics routine is that the power-on method does not do as much memory checking.

If the internal diagnostics indicate a test in the internal diagnostics failed, use the troubleshooting procedures in this subsection to determine which module to replace.

Checking Diagnostics Tests

Prerequisites. Power on the DG2030 and allow a 20 minute warm up before doing this procedure.

1. Push the **UTILITY→Diag** bottom button.
2. Select **Type** from the side menu.
3. Select **All** with the general purpose knob.
4. Select **Execute** from the side menu. This executes all the diagnostics automatically. As each test finishes, the result is displayed on the screen.
5. Check the diagnostic test results. If any test failed, go to *Troubleshooting Procedure 5 — Module Isolation* on page 6-61. The table in the flowchart shows which module is related to each diagnostic test. If the tests pass but there is still a problem, go to the *Primary Troubleshooting Procedure* on page 6-51.

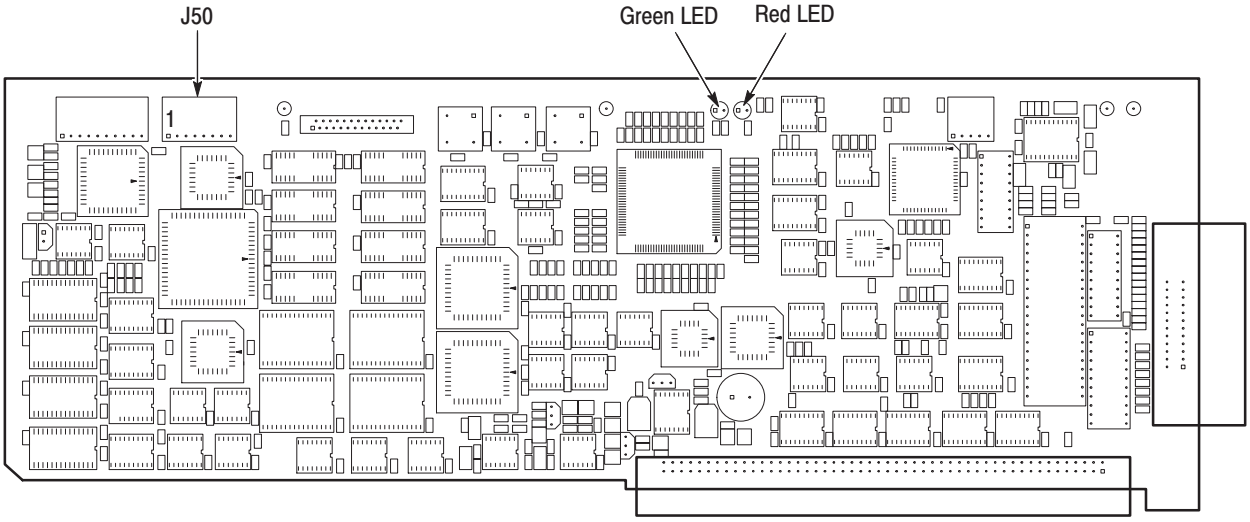


Figure 6-24: A6 CPU Board

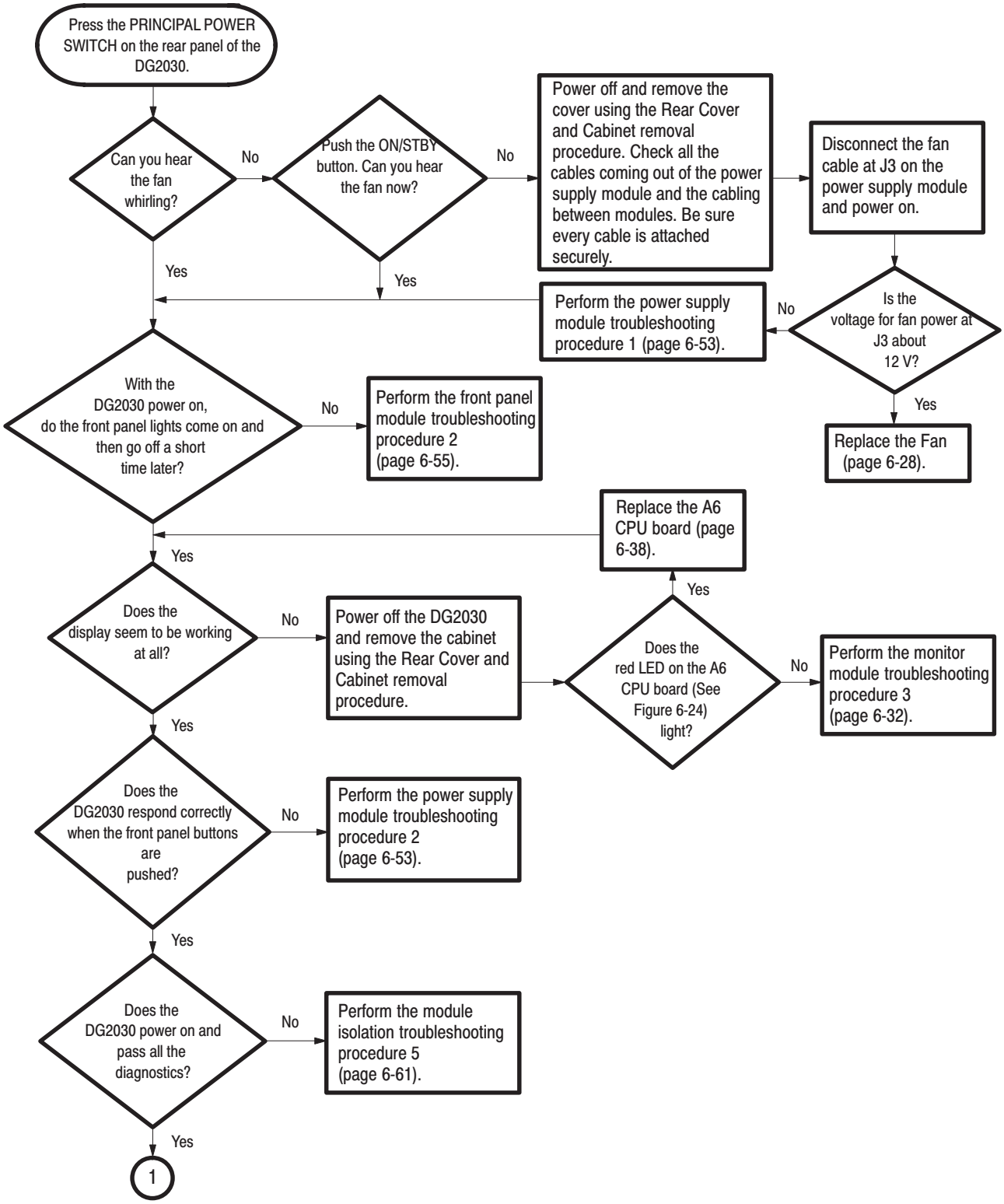


Figure 6-25: Primary troubleshooting procedure 1

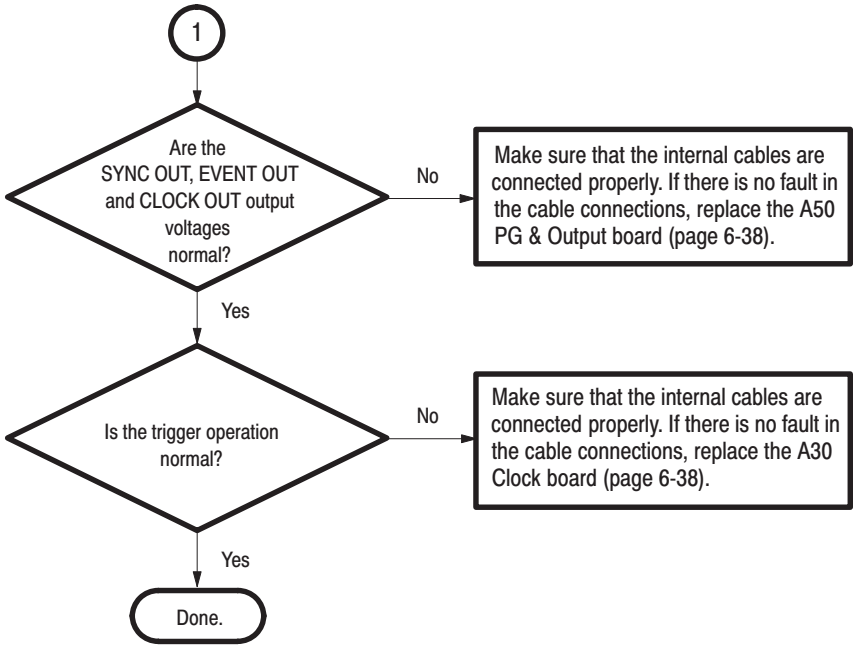


Figure 6-26: Primary troubleshooting procedure 2

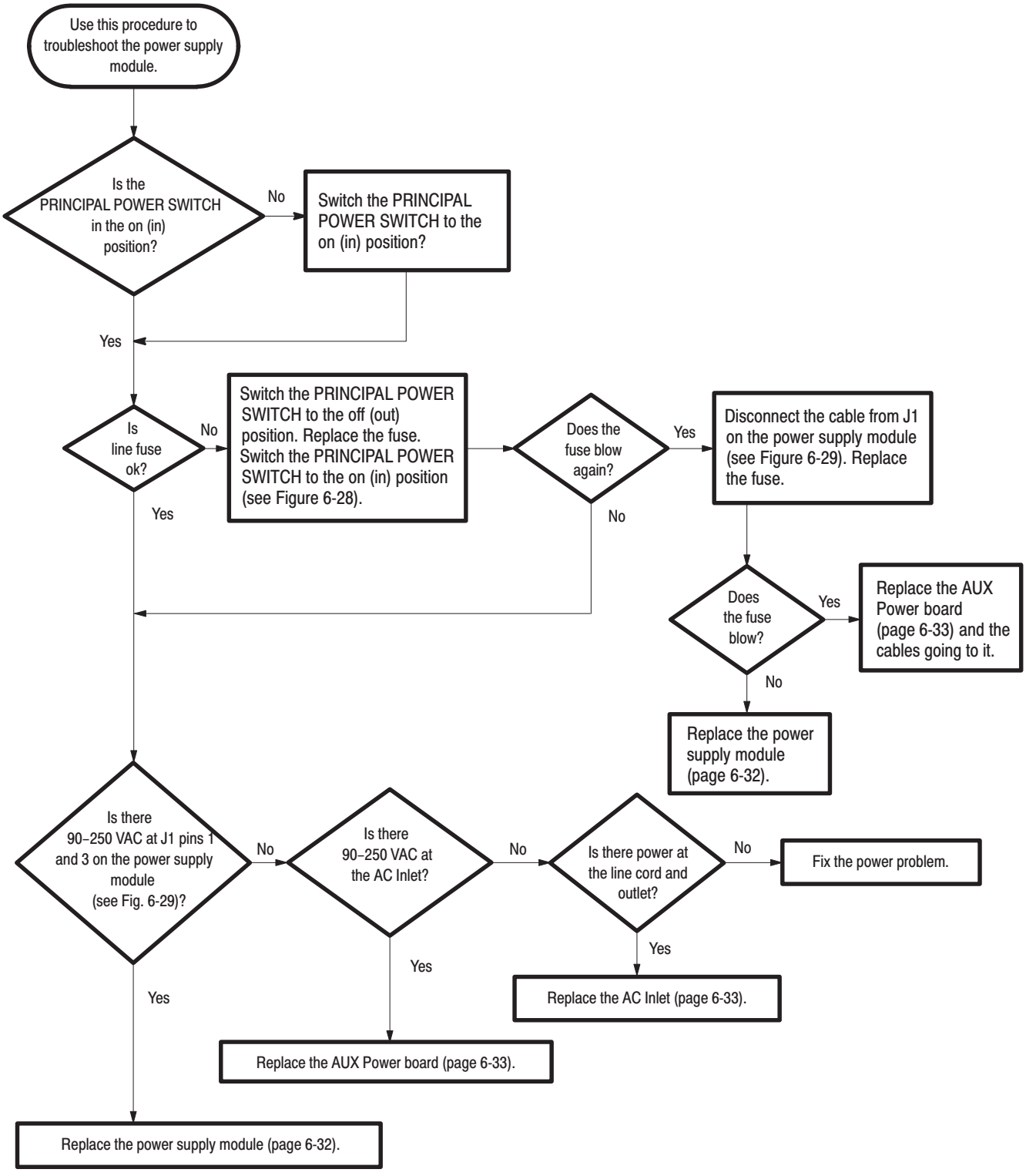


Figure 6-27: Power Supply module troubleshooting procedure

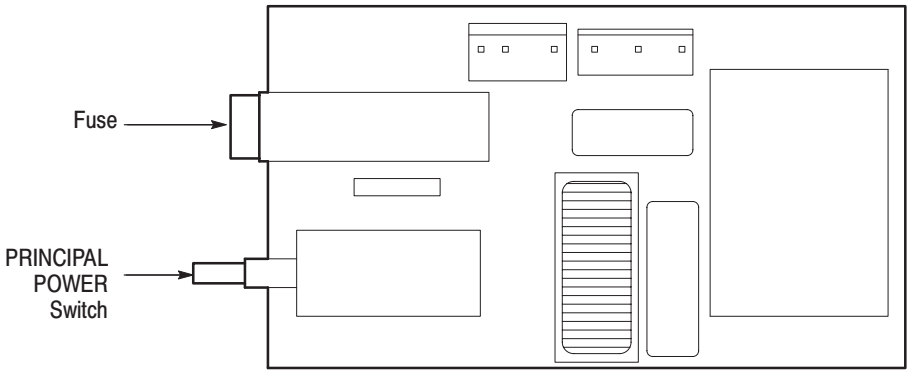


Figure 6-28: AUX Power board

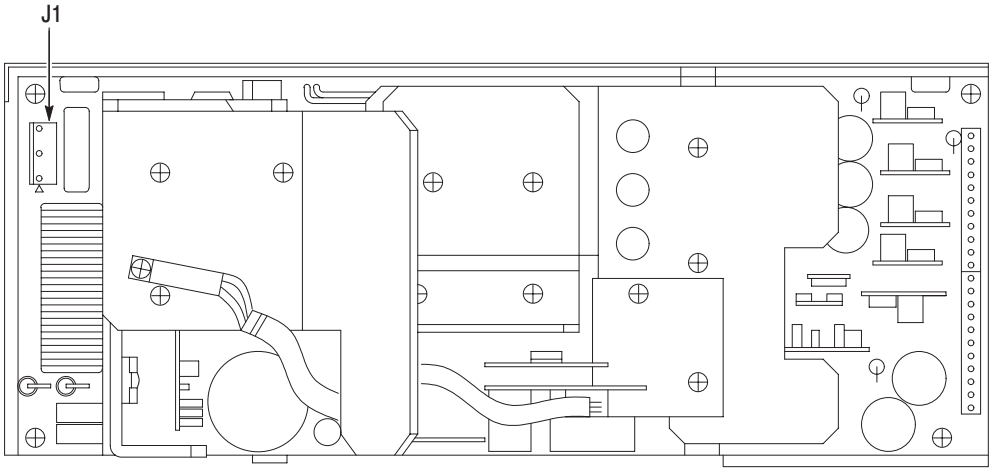


Figure 6-29: Power Supply module

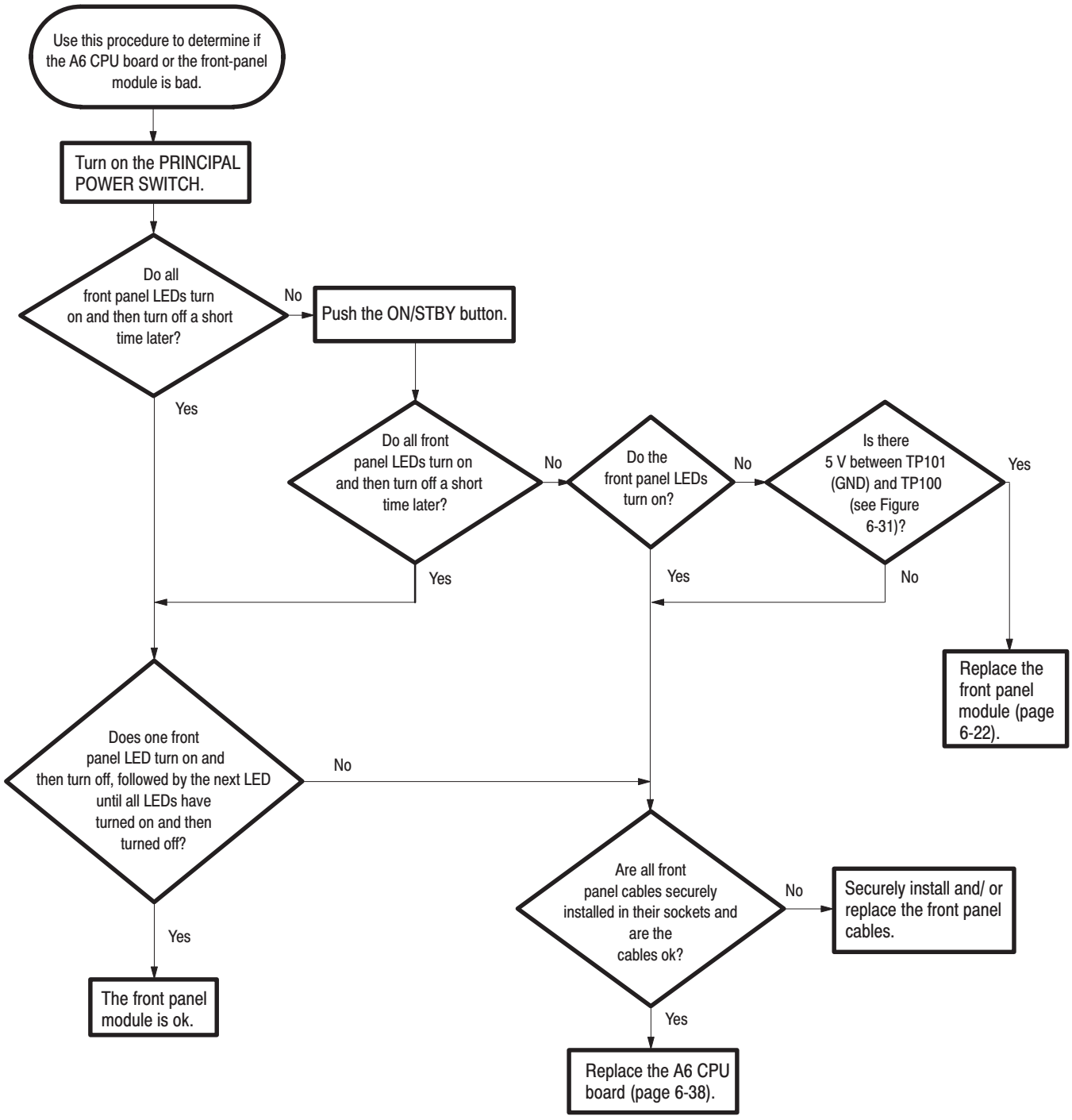


Figure 6-30: A6 CPU Board or front-panel module troubleshooting procedure

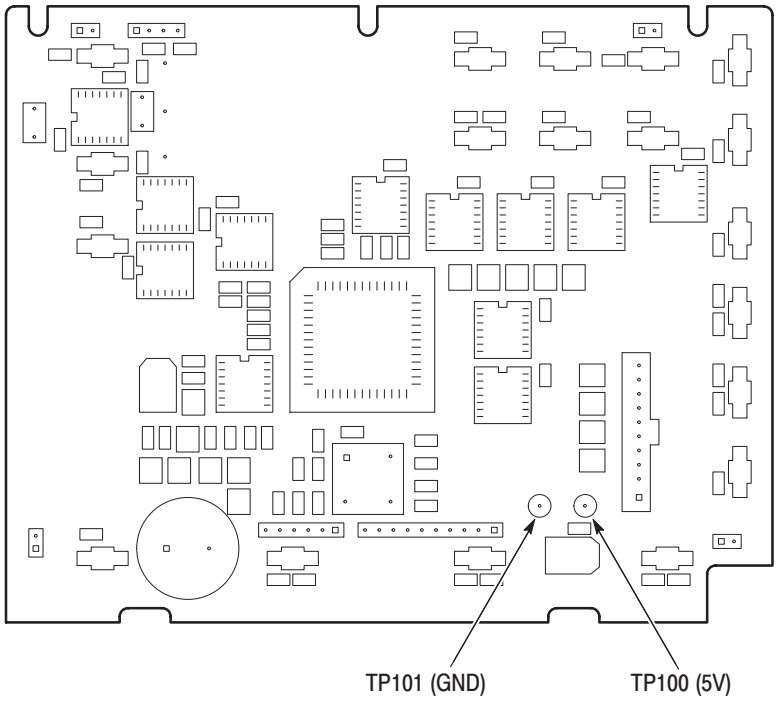


Figure 6-31: Key board

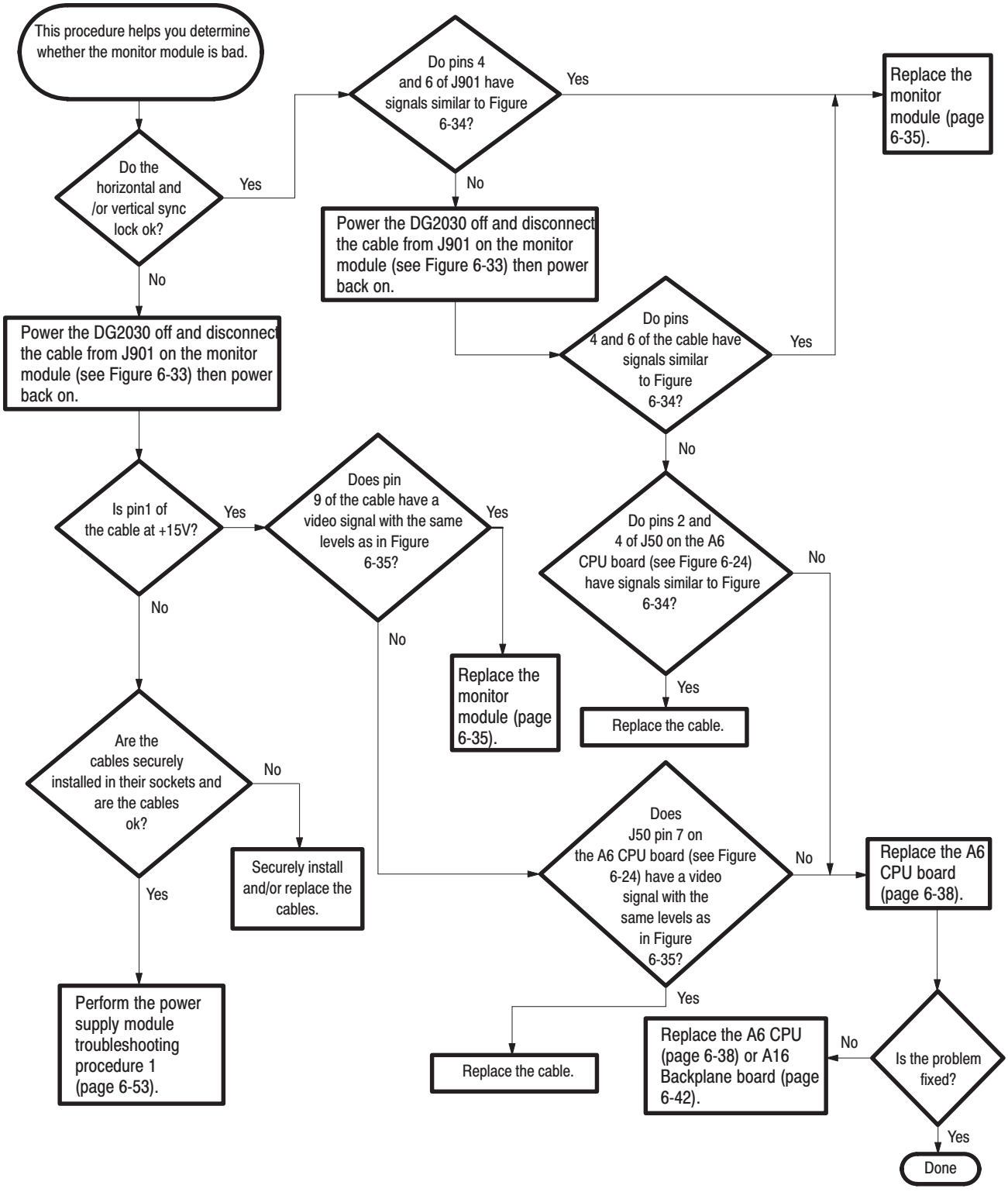


Figure 6-32: Monitor module troubleshooting procedure

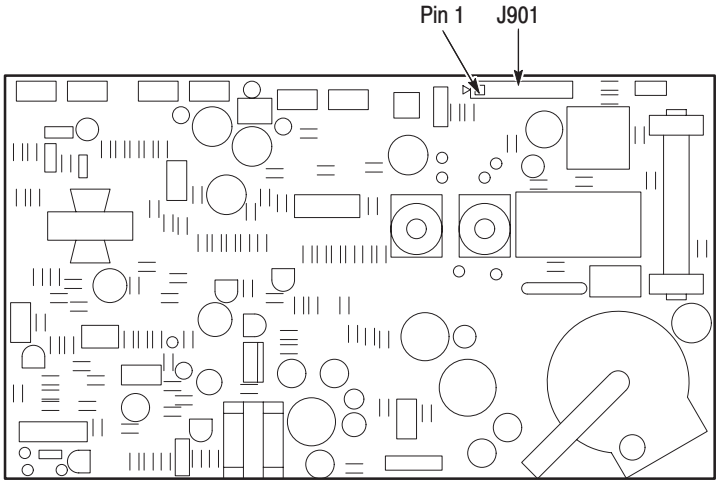


Figure 6-33: Monitor module

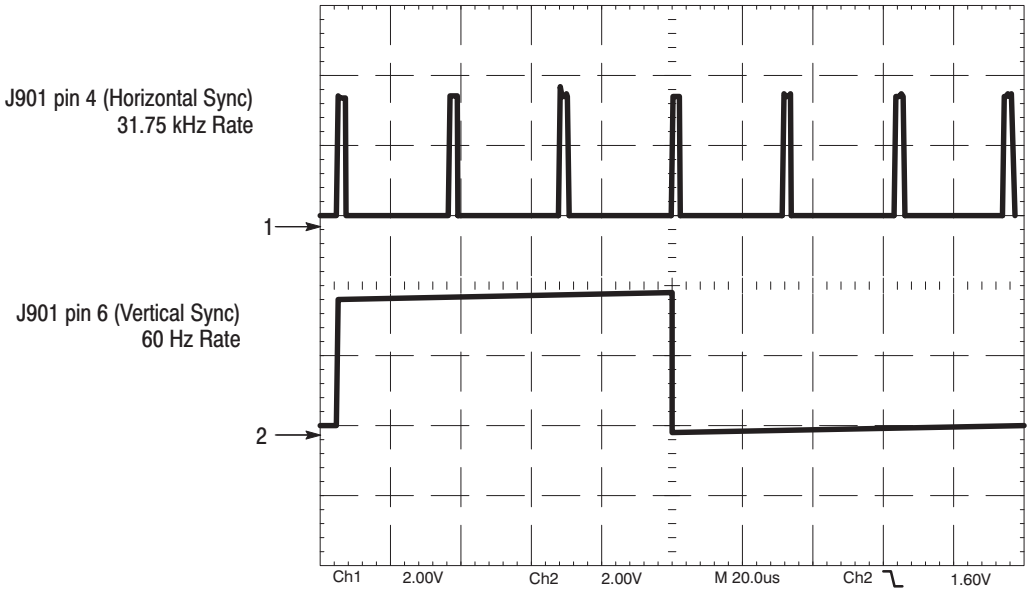


Figure 6-34: Horizontal and vertical sync signals

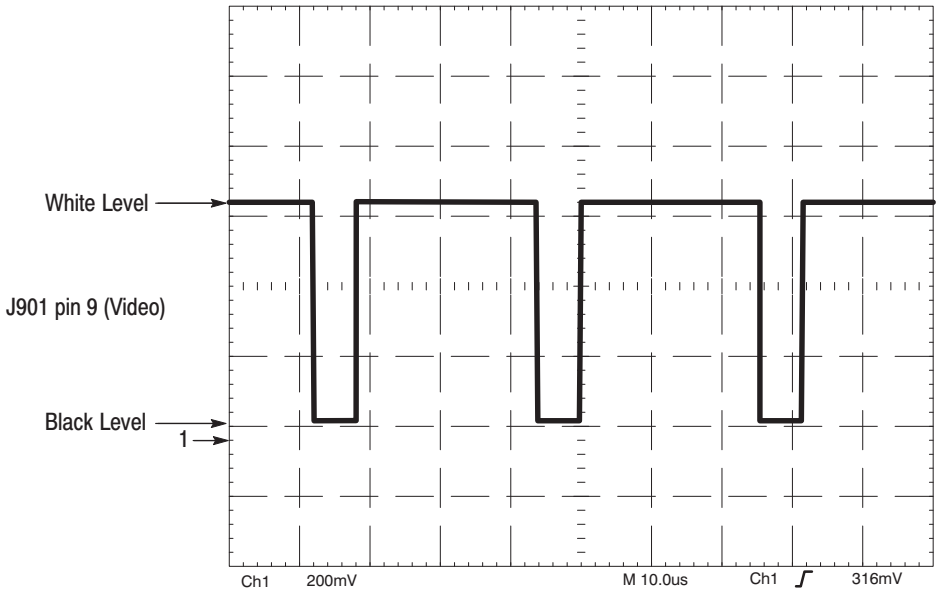


Figure 6-35: A video signal with white and black levels

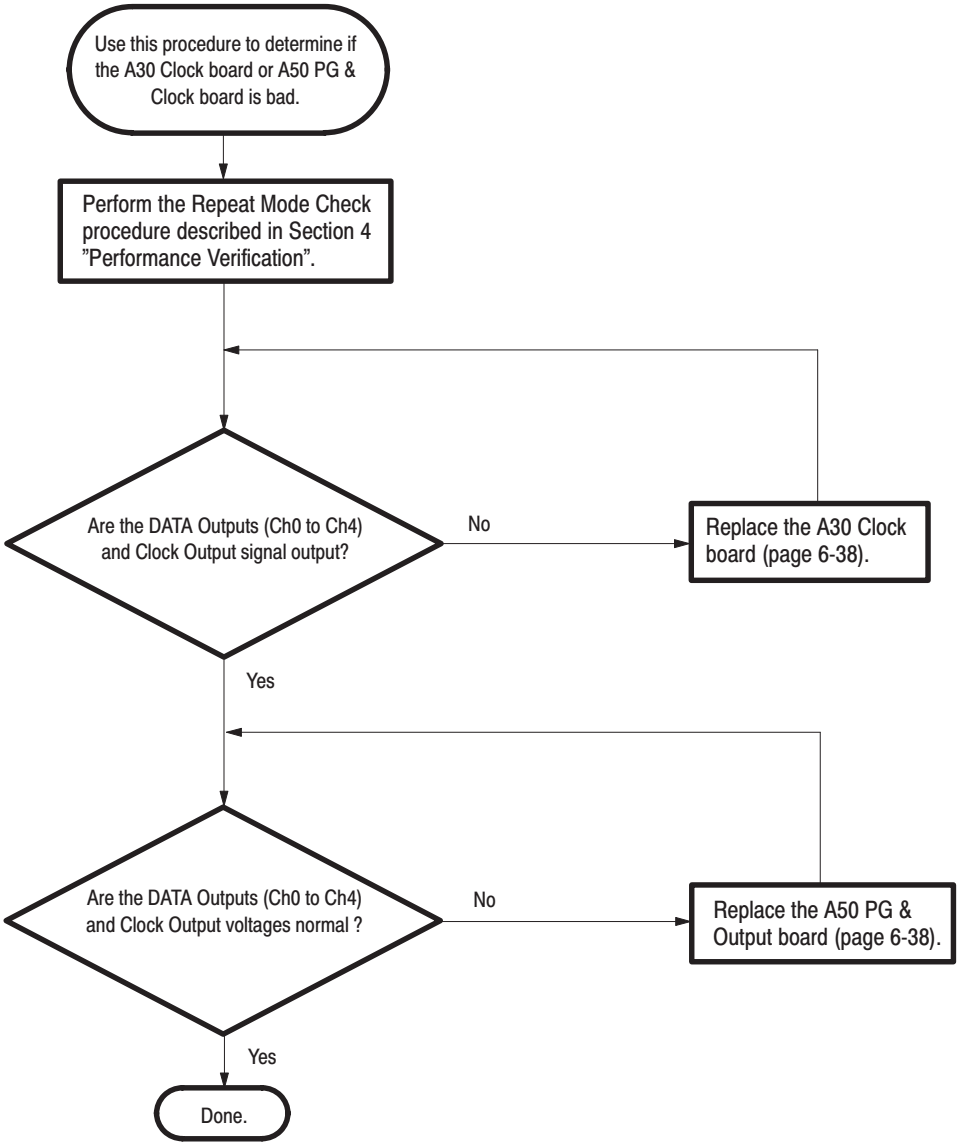
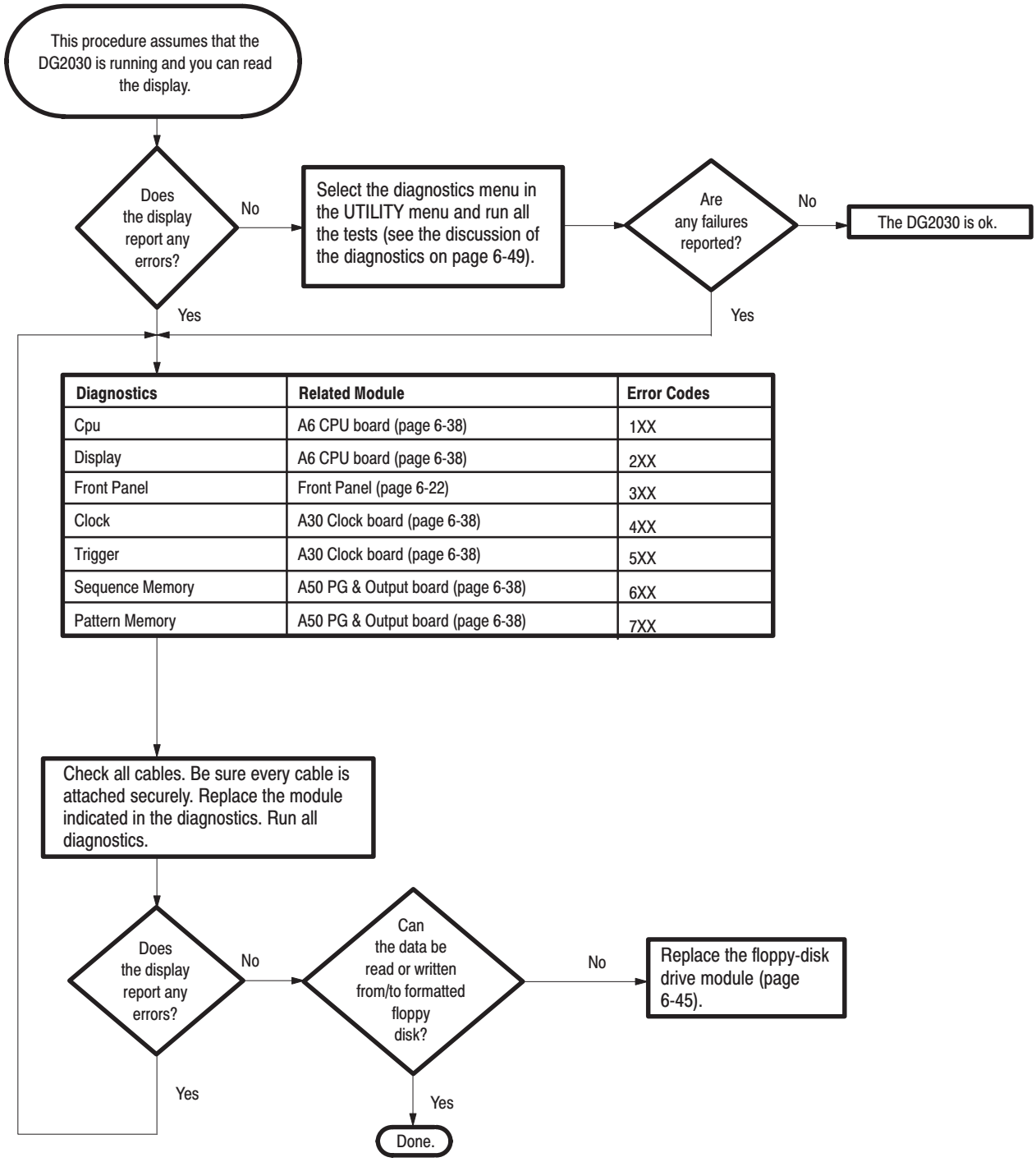


Figure 6-36: A30 Clock board or A50 PG & Output board troubleshooting procedure



Diagnostics	Related Module	Error Codes
Cpu	A6 CPU board (page 6-38)	1XX
Display	A6 CPU board (page 6-38)	2XX
Front Panel	Front Panel (page 6-22)	3XX
Clock	A30 Clock board (page 6-38)	4XX
Trigger	A30 Clock board (page 6-38)	5XX
Sequence Memory	A50 PG & Output board (page 6-38)	6XX
Pattern Memory	A50 PG & Output board (page 6-38)	7XX

Figure 6-37: Module isolation troubleshooting procedure

Options and Accessories

This section describes the various options as well as the standard and optional accessories that are available for the DG2030 Data Generator.

The following options are available:

- *Option A1–A5* changes the standard power cord to one of five alternate power cord configurations. Refer to page 7-1 for details.
- *Option 01* adds 4-channels output. Refer to page 7-1 for details.
- *Option 1R* ships the data generator configured for installation in an instrument rack. Refer to page 7-2 for details.
- *Option 95* ships with test result report. Refer to page 7-2 for details.
- *Option B1* adds the Service Manual and the Performance Check Disk.

Options A1–A5

In place of the standard North American, 110 V, 60 Hz power cord, Tektronix ships any of five alternate power cord configurations with the data generator. See Table 7-1 for a list of the power cord configurations.

Table 7-1: International Power Cords

Option	Power Cord
Option A1	Universal European — 220 V, 50 Hz
Option A2	United Kingdom — 240 V, 50 Hz
Option A3	Australian — 240 V, 50 Hz
Option A4	North American — 240 V, 60 Hz
Option A5	Switzerland — 220 V, 50 Hz

Option 01 Description

This option has another 4 channels to allow the instrument to output a total of 8 channels.

Option 1R Description

When option 1R is specified, the DG2030 is shipped for mounting in a 19-inch rack. The floppy disk drive is moved so that it can be accessed from the front panel. Contact your Tektronix sales representative for details on converting a non-rack mounting DG2030 to rack mounting.

See the instruction sheet provided with the rack mounting kit for details on the rack mounting adapter.

Option 95 Description

A test result report will be provided with the DG2030 when this option is specified.

Accessories

Standard Accessories

The following standard accessories are provided with each instrument:

Table 7-2: Standard Accessories

Standard Accessory	Part Number
User Manual	071-0059-XX
Programmer Manual	071-0057-XX
Performance Check Disk, 3.5-inch	063-2922-XX
GPIB Sample Program Disk, 3.5-inch	063-2921-XX
DG-LINK Application Program Disk, 3.5-inch	063-2920-XX
Power cord 125V/6A	161-0230-01
Certificate of Calibration	

Optional Accessories

Table 7-3 lists the optional accessories that are recommended for use with the DG2030.

Table 7-3: Optional Accessories

Optional Accessory	Part Number
Service Manual	071-0058-XX
Front Cover	200-3232-01
Accessory Pouch	016-1159-00
Rackmount kit	040-1444-XX
Fuse 6A Fast (UL198G/3AG)	159-0239-00
Fuse cap	200-2264-00
Fuse 5A (T) (IEC127)	159-0210-00
Fuse cap	200-2265-00
GPIB Cable, 2m (Double shied)	012-0991-00
50 Ω BNC Cable, 2m	012-0057–52
50 Ω BNC Cable, 1m (Double shield)	012-1256-00
50 Ω SMB Cable, 1 m (Double shield)	012-1458-00
50 Ω BNC to SMB Cable, 1 m (Double shield)	012-1459-00
50 Ω termination	011-0049-02
50 Ω BNC Power Divider	015-0660-00
Output Cable, 50 Ω SMB to Pin-header Cable, 51 cm	012-1503-00
Output Cable, 50 Ω SMB to Pin-header Cable, 127 cm	012-1506-00
Adaptor, 50 Ω SMB(Fe) to BNC(Ma)	015-0671-00
Lead Set, 1 ch lead set (set of 5) [1]	012-1508-00
Lead Set, 4 ch lead set (set of 3) [1]	012-1509-00

1 Used to provide the flexible connection for output signal and grounding by attaching to the pin-header end of the 50 Ω cable (SMB to pin header or pin header to pin header).

Electrical Parts List

All replaceable modules are listed in section 10, *Mechanical Parts List.* Refer to that section for part numbers when using this manual.

Diagrams

This section contains the following diagrams:

- Block Diagram of DG2030 with Options 01
- Interconnect Diagram of DG2030 with Options 01

Block diagrams show the modules and functional blocks in the DG2030. Interconnect diagrams show how the modules in the DG2030 connect together.

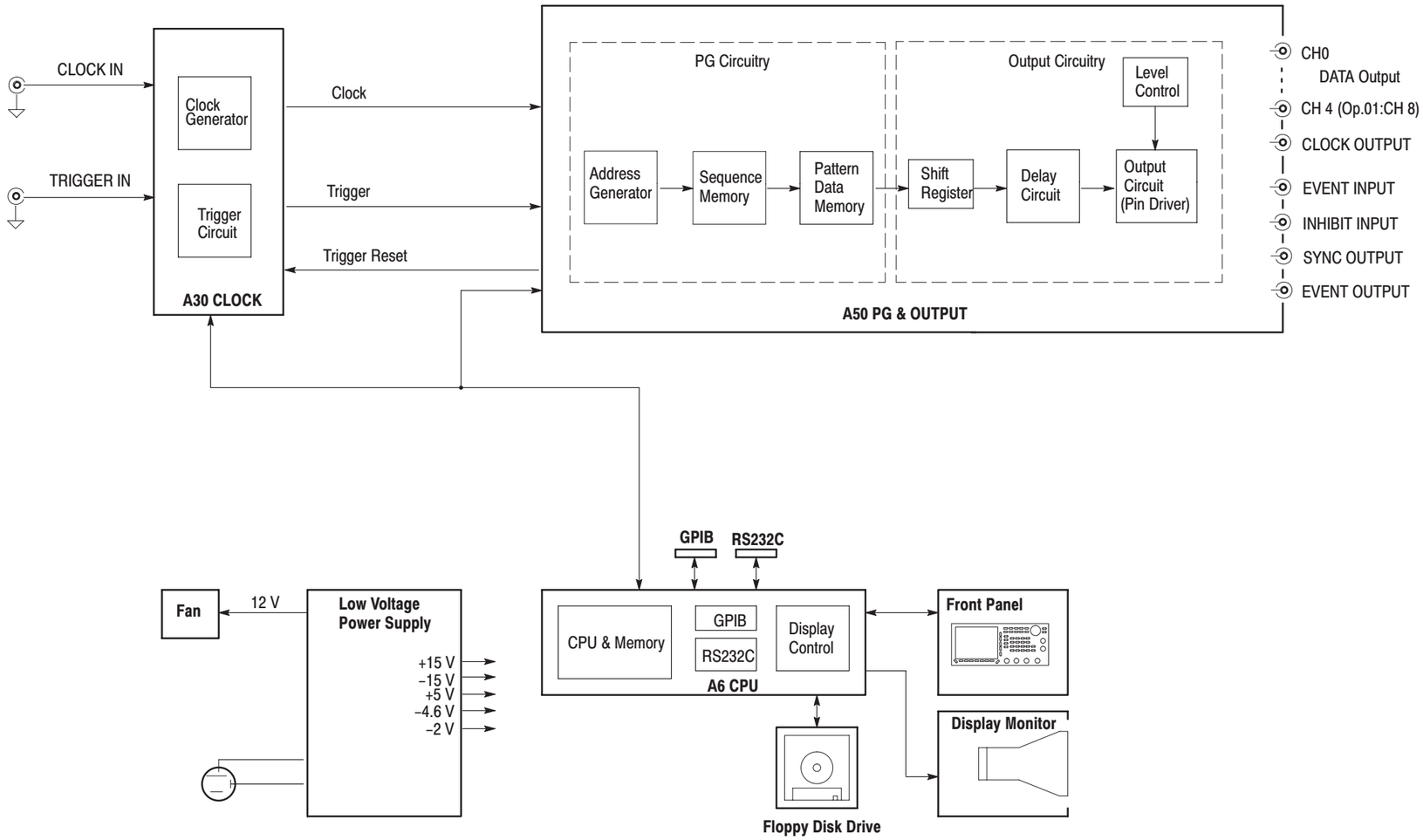


Figure 9-1: DG2030 block diagram

Please cut away this area below the lines

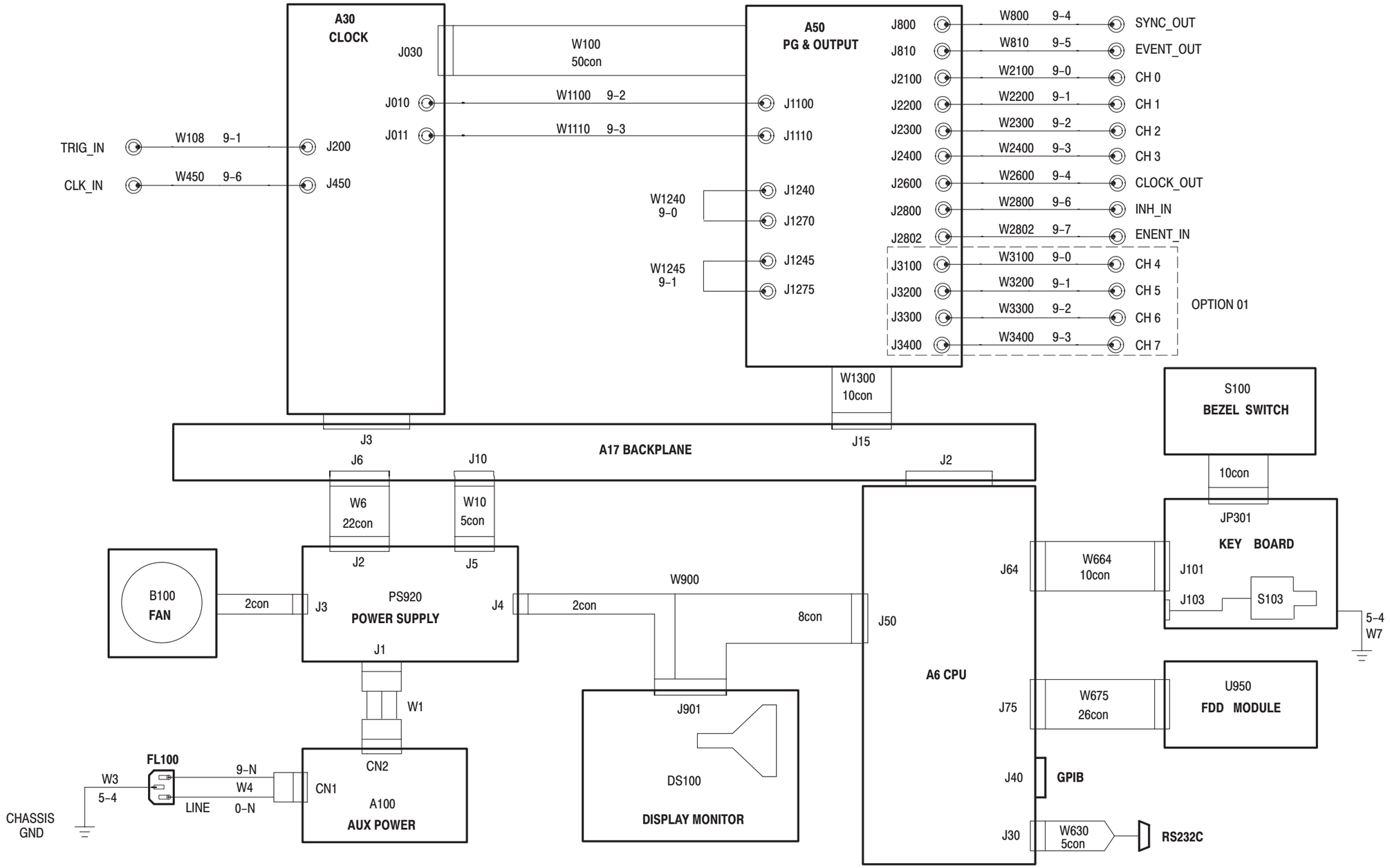


Figure 9-2: DG2030 interconnect diagram

Please cut away this area below the lines

Replaceable Mechanical Parts

This section contains a list of the replaceable modules for the DG2030. Use this list to identify and order replacement parts.

Parts Ordering Information

Replacement parts are available through your local Tektronix field office or representative.

Changes to Tektronix products are sometimes made to accommodate improved components as they become available and to give you the benefit of the latest improvements. Therefore, when ordering parts, it is important to include the following information in your order.

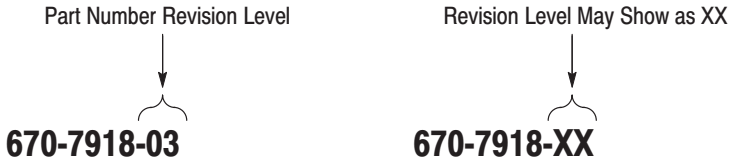
- Part number (see Part Number Revision Level below)
- Instrument type or model number
- Instrument serial number
- Instrument modification number, if applicable

If you order a part that has been replaced with a different or improved part, your local Tektronix field office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

Part Number Revision Level

Tektronix part numbers contain two digits that show the revision level of the part. For most parts in this manual, you will find the letters XX in place of the revision level number.



When you order parts, Tektronix will provide you with the most current part for your product type, serial number, and modification (if applicable). At the time of your order, Tektronix will determine the part number revision level needed for your product, based on the information you provide.

Module Servicing

Modules can be serviced by selecting one of the following three options. Contact your local Tektronix service center or representative for repair assistance.

Module Exchange. In some cases you may exchange your module for a remanufactured module. These modules cost significantly less than new modules and meet the same factory specifications. For more information about the module exchange program, call 1-800-TEK-WIDE, extension 6630.

Module Repair and Return. You may ship your module to us for repair, after which we will return it to you.

New Modules. You may purchase replacement modules in the same way as other replacement parts.

Using the Replaceable Parts List

This section contains a list of the mechanical and/or electrical components that are replaceable for the DG2030. Use this list to identify and order replacement parts. The following table describes each column in the parts list.

Parts List Column Descriptions

Column	Column Name	Description
1	Figure & Index Number	Items in this section are referenced by figure and index numbers to the exploded view illustrations that follow.
2	Tektronix Part Number	Use this part number when ordering replacement parts from Tektronix.
3 and 4	Serial Number	Column three indicates the serial number at which the part was first effective. Column four indicates the serial number at which the part was discontinued. No entries indicates the part is good for all serial numbers.
5	Qty	This indicates the quantity of parts used.
6	Name & Description	An item name is separated from the description by a colon (:). Because of space limitations, an item name may sometimes appear as incomplete. Use the U.S. Federal Catalog handbook H6-1 for further item name identification.
7	Mfr. Code	This indicates the code of the actual manufacturer of the part.
8	Mfr. Part Number	This indicates the actual manufacturer's or vendor's part number.

Abbreviations

Abbreviations conform to American National Standard ANSI Y1.1–1972.

Mfr. Code to Manufacturer Cross Index

The table titled Manufacturers Cross Index shows codes, names, and addresses of manufacturers or vendors of components listed in the parts list.

Manufacturers Cross Index

Mfr. Code	Manufacturer	Address	City, State, Zip Code
80009	TEKTRONIX, INC.	P.O. BOX 500	BEAVERTON, OR, 97077-0001
K1072	GREENPAR CONNECTORS LTD	PO BOX 15	HARLOW ESSEX, CM20 2ER UK
S3109	FELLER	72 VERONICA AVE UNIT 4	SUMMERSET NJ 08873
TK0BD	TAISHO ELECTRIC IND CO LTD	5-28-16 OKUSAWA SETAGAYA-KU	TOKYO JAPAN
TK0191	TEKTRONIX JAPAN	PO BOX 5209 TOKYO INTERNATIONAL	TOKYO JAPAN 100-31
TK0392	NORTHWEST FASTENER SALES INC	7923 SW CIRRUS DRIVE	BEAVERTON OR 97005-6448
TK0435	LEWIS SCREW CO	4300 S RACINE AVE	CHICAGO IL 60609-3320
TK1163	POLYCAST INC	9898 SW TIGARD ST	TIGARD OR 97223
TK1572	RAN-ROB INC	631 85TH AVE	OAKLAND CA 94621-1254
TK1908	PLASTIC MOLDED PRODUCTS	4336 SO ADAMS	TACOMA WA 98409
TK1918	SHIN-ETSU POLYMER AMERICA INC	1181 NORTH 4TH ST	SAN JOSE CA 95112
TK2058	TDK CORPORATION OF AMERICA	1600 FEEHANVILLE DRIVE	MOUNT PROSPECT, IL 60056
TK2432	UNION ELECTRIC	15/F #1, FU-SHING N. ROAD	TAIPEI, TAIWAN ROC
TK2548	XEROX BUSINESS SERVICES DIV OF XEROX CORPORATION	14181 SW MILLIKAN WAY	BEAVERTON OR 97077
0JR05	TRIQUEST CORP	3000 LEWIS AND CLARK HWY	VANCOUVER WA 98661-2999
0KB01	STAUFFER SUPPLY	810 SE SHERMAN	PORTLAND OR 97214
00779	AMP INC	2800 FULLING MILL PO BOX 3608	HARRISBURG PA 17105
07416	NELSON NAME PLATE CO	3191 CASITAS	LOS ANGELES CA 90039-2410
2W733	BELDEN CORPORATION	2200 US HIGHWAY 27 SOUTH PO BOX 1980	RICHMOND IN 47375-0010
24931	SPECIALTY CONNECTOR CO INC	2100 EARLYWOOD DR PO BOX 547	FRANKLIN IN 46131
6D224	HARBOR TRI-TEC A BERG ELECTRONICS COMPANY	14500 SOUTH BROADWAY	GARDENA, CA 90248
61058	MATSUSHITA ELECTRIC CORP OF AMERICA PANASONIC INDUSTRIAL CO DIV	TWO PANASONIC WAY	SECAUCUS NJ 07094
61857	SAN-0 INDUSTRIAL CORP	91-3 COLIN DRIVE	HOLBROOK NY 11741
61935	SCHURTER INC	1016 CLEGG COURT	PETALUMA CA 94952-1152
64537	KDI/TRIANGLE ELECTRONICS	60 S JEFFERSON ROAD	WHIPPANY, NJ 07981
73743	FISCHER SPECIAL MFG CO	111 INDUSTRIAL RD	COLD SPRING KY 41076-9749
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF DIV	ST CHARLES ROAD	ELGIN IL 60120
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077-0001
86928	SEASTROM MFG CO INC	701 SONORA AVE	GLENDALE CA 91201-2431

Replaceable Parts List

Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
10–1–1	343–1213–00			1	CLAMP,PWR CORD:POLYMIDE	TK1163	ORDER BY DESC
–2	161–0230–XX			1	CABLE ASSY,PWR,:3,18 AWG,92 L,SVT,TAN (STANDARD ACCESSORY)	TK2432	ORDER BY DESC
–3	----------			1	S/N LABEL	80009	
–4	334–8410–XX			1	MARKER,IDENT:BLANK,POLYESTER	80009	3348410XX
–5	334–8705–XX			1	MARKER,IDENT:MKD WARNING/FUSE DATASAFETY CONTROLLED,POLYCARBONATE	80009	3348705XX
–6	334–9114–00			1	MARKER,IDENT:BLANK,POLYCABONATE	80009	3349114XX
–7	211–0691–00			4	SCREW,MACHINE:6–32 X 0.625,PNH,STL CD PL,TORX,T15	0KB01	ORDER BY DESC
–8	200–3991–01			1	COVER,REAR	TK1163	ORDER BY DESC
–9	----------			2	FOOT,REAR (ATTACHING PART OF 10–1–15)	80009	ORDER BY DESC
–10	390–1134–XX			1	CABINET:EMI ,AL	80009	3901145XX
–11	211–0378–00			4	SCR,ASSEM WSHR:4–40 X 0.375.PNH,STL,CD PL	0KB01	ORDER BY DESC
–12	200–3983–00			1	BEZEL:FDD,AL	80009	2003983XX
–13	348–1276–00			35.5 cm	GASKET,SHIELD:CONDUCTIVE FORM STRIP	80009	3481276XX
–14	367–0356–01			1	HANDLE,CARRING	80009	3670359XX
–15	348–0659–00			2	FOOT,CABINET:BLACK POLYURETHANE	80009	3480659XX
–16	260–2539–00			1	SWITCH SET:BEZEL	TK1918	2602539XX
–17	366–0753–XX			14	PUSH BUTTON:SMOKE TAN	80009	3660753XX
–18	354–0709–00			1	RING,TRIM:LEXAN 940	80009	3540709XX
–19	334–9562–XX			1	MARKER,IDENT:MKD DG2030,	80009	3349115XX
–20	378–0404–00			1	FILTER,LT,CRT:BLUE SMOKE,112MM X 145MM	80009	3780404XX
–21	348–1289–00			23 cm	SHLD GSKT,ELEC:MESH TYPE,3.2MM X 4.7MM,SI SPONGE CORE,100M ROOL [EMS–32–47–MSS]	80009	3481289XX
–22	212–0144–00			2	SCREW,TPG,TF:8–16 X 0.562 L,PLASTITE,SPCL HD	0KB01	ORDER BY DESC
–23	211–0722–00			1	SCREW,MACHINE:6–32 X 0.25,PNH,STL	0KB01	ORDER BY DESC
–24	348–0764–XX			84 cm	SHLD GASKET,ELEC:0.125 X 0.188,WIRE MESH,37L	80009	3480764XX

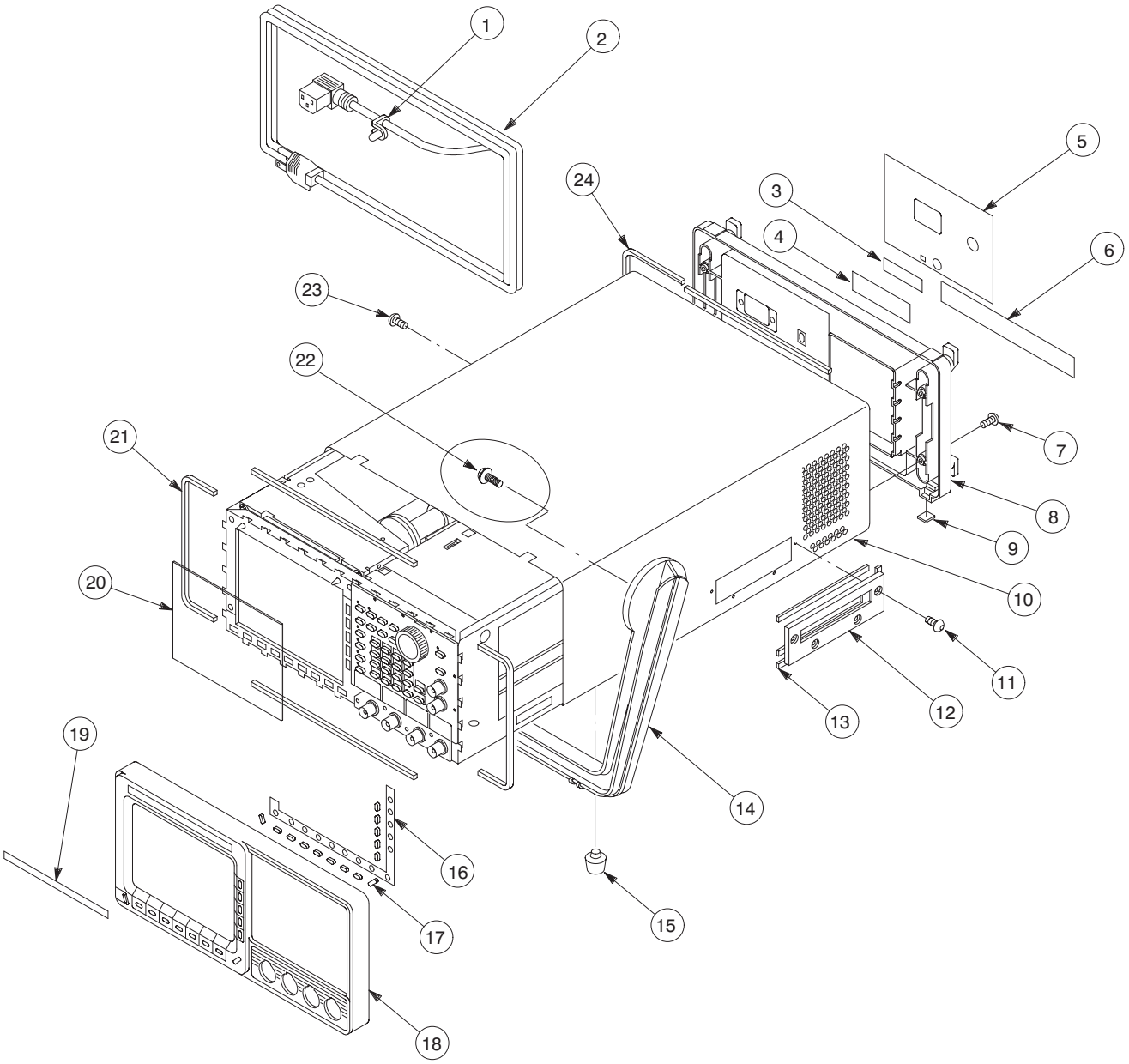


Figure 10-1: Cabinet

Replaceable parts list

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description	Mfr. code	Mfr. part number
10–2–1	213–0882–00			6	SCREW,TPG,TR:6–32 X 0.437 TAPTITE,PNH,STL	0KB01	ORDER BY DESC
–2	119–4322–00			1	FAN,TUBAXIAL:12VDC,2.4M/M,5.8MM HZO,6W,0.5A	80009	119–4322–00
–3	252–0571–33			1	PLASTIC SHEET:EXTR CHAN,5MM X 3.3MM	85471	ORDER BY DESC
–4	342–0993–00			1	INSULATOR,FILM:PWR SPLY,POLYCARBONATE	80009	342–0993–00
–5	211–0722–00			2	SCREW,MACHINE:6–32 X 0.25,PNH,STL	0KB01	ORDER BY DESC
–6	620–0058–XX			1	POWER SUPPLY:185W;SWITCHING,15V/4A,12V/0.5A	TK0191	620–0058–XX
–7	213–0882–00			4	SCREW,TPG,TR:6–32 X 0.437 TAPTITE,PNH,STL	0KB01	ORDER BY DESC
–8	366–1480–00			1	PUSH BUTTON:BLK,0.328 X 0.253 X 0.43	0JR05	ORDER BY DESC
–9	671–3351–XX			1	CIRCUIT BD ASSY:AUX,POWER SUPPLY	80009	671–3351–XX
–10	213–0882–00			2	SCREW,TPG,TR:6–32 X 0.437 TAPTITE,PNH,STL	0KB01	ORDER BY DESC
–11	119–2683–XX			1	FILTER,RFI:50/60HZ,250VAC,6A	TK2058	ZUB2206H–F
–12	426–2426–00			1	FRAME,FAN MTG:POLYCARBONATE	80009	426–2426–XX
–13	210–0457–00			1	NUT,PL,ASSEM WA:6–32 X 0.312,STL CD PL	TK0435	ORDER BY DESC
–14	334–3379–00			1	MARKER,GROUND:6MM DIAMETER	07416	ORDER BY DESC
–15	441–2055–XX			1	CHASSIS ASSY:AL	TK0191	441–2055–XX
–16	343–1182–00			1	CLAMP,LOOP:10MM ID,NYLON	80009	343–1182–00
–17	210–0586–00			2	NUT,PL,ASSEM WA:4–40 X 0.25,STL CD PL	TK0435	ORDER BY DESC
–18	344–0472–00			1	CLIP,CABLE:NYLON,GRAY	80009	344–0472–00
–19	407–4394–00			1	BRKT,CMPNT,BNC:ALUMINUM,5.250 X 1.050	TK0191	407–4394–XX
–20	131–1315–01			4	CONN, RF, JACK: BNC, FEMALE, STA, PELTORA, PANEL MOUNT	TK0191	131–1315–XX
–21	211–0325–00			4	SCR,ASSEM WSHR:4–40 X 0.25,PNH,STL	0KB01	ORDER BY DESC
–22	259–0086–XX			1	FLEX CIRCUIT:BEZEL BUTTON	07416	ORDER BY DESC
–23	348–1313–00			10 cm	GASKET,SHIELD:CONDUCTIVE URETHANE FORM	80009	348–1313–00
–24	426–2436–01			1	FRAME,CRT FLTR:POLYCARBONATE	TK1163	ORDER BY DESC
–25	348–1302–00			11 cm	GASKET,SHIELD:CONDUCTIVE URETHANE FORM	80009	348–1302–XX
–26	640–0081–00			1	DISPLAY MONITOR:7 INCH,480 X 640 PIXEL,MONO	80009	640–0081–00
–27	333–4251–XX			3	PANEL,REAR:DATA OUT, STL	TK0191	333–4251–XX
–28	211–0722–00			5	SCREW,MACHINE:6–32 X 0.25,PNH,STL CD PL,TORX,T15	0KB01	ORDER BY DESC
–29	671–4272–XX			1	CKT BD ASSY:CPU,A6	TK0191	671–4272–XX
–30	386–6158–00			1	SUPPORT,CKT BD:MAT MATERIAL	80009	386–6158–00
–31	671–4276–XX			1	CKT BD ASSY:CPU INTERFACE,A30	TK0191	671–4276–XX
–32	163–1046–XX			1	IC,MEMORY:CMOS,EPROM,256K X 16, 100NS,PRGM,PLCC40,SMD,U305	TK0191	163–1046–XX
–33	163–1045–XX			1	IC,MEMORY:CMOS,EPROM,256K X 16, 100NS,PRGM,PLCC40,SMD,U300	TK0191	163–1045–XX

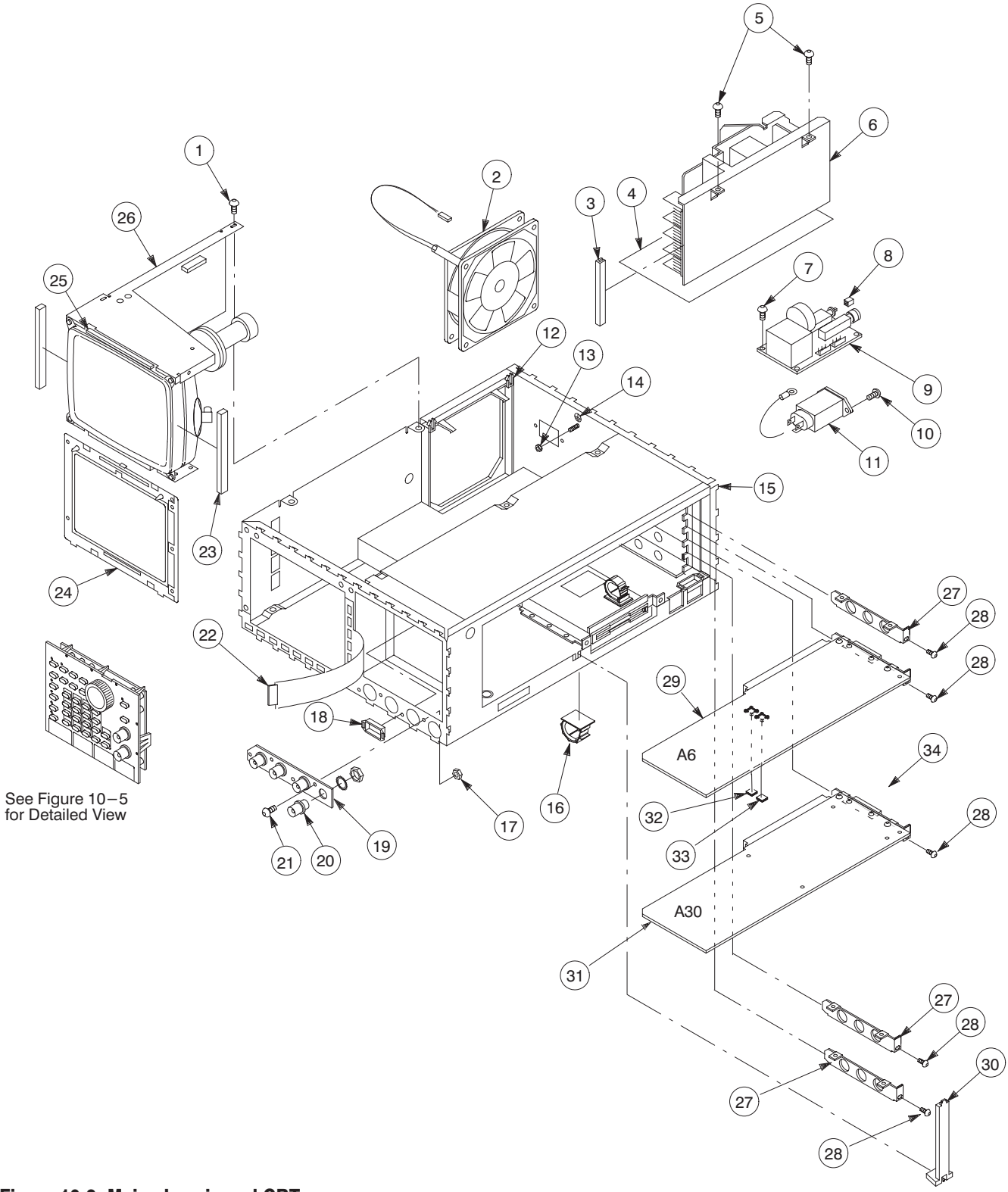


Figure 10-2: Main chassis and CRT

Replaceable parts list

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description	Mfr. code	Mfr. part number
10–3–1	----------			2	NUT(ATTACHING PART OF 10–3–7)		----------
–2	----------			2	WASHER,LOCK,HELICAL (ATTACHING PART OF 10–3–7)		----------
–3	----------			1	SEE W630		----------
–4	211–0378–00			10	SCR,ASSEM WSHR:4–40 X 0.375.PNH,STL,T9	0KB01	ORDER BY DESC
–5	----------			2	WASHER,PLAIN (ATTACHING PART OF 10–3–7)		----------
–6	129–1051–00			2	SPACER,POST:4.8 MM L,4–40 INT/4–40EXT,STL,4.8 MM HEX W/WASHER	80009	129–1051–00
–7	----------			1	SHIELD (ATTACHING PART OF W630)		
–8	129–1443–01			2	SPACER,POST:0.98 L,M3.5 INT & 6–32 EXT,STL,7MM HEX	80009	129–1443–01
–9	337–4147–00			1	SHIELD,ELEC:REAR,AL (STANDARD ONLY, SEE 10–4–1 FOR OPTION 01)	80009	3374147XX
–10	255–1106–00			6 cm	PLASTIC CHANNEL:1.3 X 3.3 X 4.0MM,NYLON	80009	255–1106–00
–11	255–0334–00			6 cm	PLASTIC CHANNEL:2.4 X 4.4 X 4.0MM,NYLON	11897	122–NN–2500–060A
–12	252–0571–33			1	PLASTIC SHEET:EXTR CHAN,5MM X 3.3MM,NYLON	80009	252–0571–00
–13	342–0302–XX			1	INSULATOR,FILM:CHASSIS,MYLAR	80009	342–0302–00
–14	343–1639–00			3	CLAMP,CABLE:9–13MM ID,NYLON W/CUSSHION	TK0191	343–1639–00
–15	337–4088–02			1	SHIELD,ELEC:FDD,AL	TK0191	337–4088–XX
–16	348–1276–00			2	GASKET,SHIELD:CONDUCTIVE FORM STRIP,3.3MM X 4.8MM,W/ADHESIVE TAPE, 1M L	80009	348–1276–00
–17	119–5953–XX			1	DISK DRIVE:FLOPPY,3.5 INCH W/INTERFACE (U950)	TK0191	119–5953–XX
–18	105–1081–00			1	BRACKET,,SPACER	TK1163	105–1081–XX
–19	211–1032–00			1	SCREW,MACHINE:M2.6 X 8MM L,PNH,STL,MFZN–C,CROSS REC	TK0191	211–1032–XX
–20	211–1033–00			3	SCREW,MACHINE:M2.6 X 3MM L,PNH,STL,MFZN–C,CROSS REC	TK0191	211–1033–XX
–21	211–0373–00			6	SCREW,MACHINE:4–40 X 0.250,PNH,STL,T–10	0KB01	ORDER BY DESC
–22	343–1084–00			1	CLAMP,CABLE:NYLON	80009	343–1084–00
–23	348–0948–00			1	GROMMET,PLASTIC:BLACK,RING,9.5MM ID	80009	348–0948–00
–24	211–0722–00			4	SCREW,MACHINE:6–32 X 0.250,PNH,STL,T–15	0KB01	ORDER BY DESC
–25	671–3092–XX			1	CKT BD ASSY:A16 BACKPLANE (A16)	TK0191	671–3092–XX
–26	146–0055–XX			1	BATTERY,DRY:3.0V,1200 MAH,LITHIUM (A5BT001)	61058	BR–2/3A–E2P
–27	211–0722–00			2	SCREW,MACHINE:6–32 X 0.250,PNH,STL,T–15	0KB01	ORDER BY DESC
–28	337–4030–01			1	SHIELD,ELEC:CENTER,AL	80009	337–4030–01
–29	386–1657–00			1	SPACER,CKT BD	0JR05	ORDER BY DESCRIPTION
–30	211–0325–XX			9	SRC,ASSEM WSHR:4–40 X 0.25,PNH,STL,TORX T9 MACHINE	0KB01	ORDER BY DESC
–31	671–4277–XX			1	CKT BD ASSY:A50 PG&OUTPUT	80009	6174277XX
–32	252–0571–33			1	PLASTIC SHEET:EXTR CHAN,5MM X 3.3MM,NYLON	80009	252–0571–33

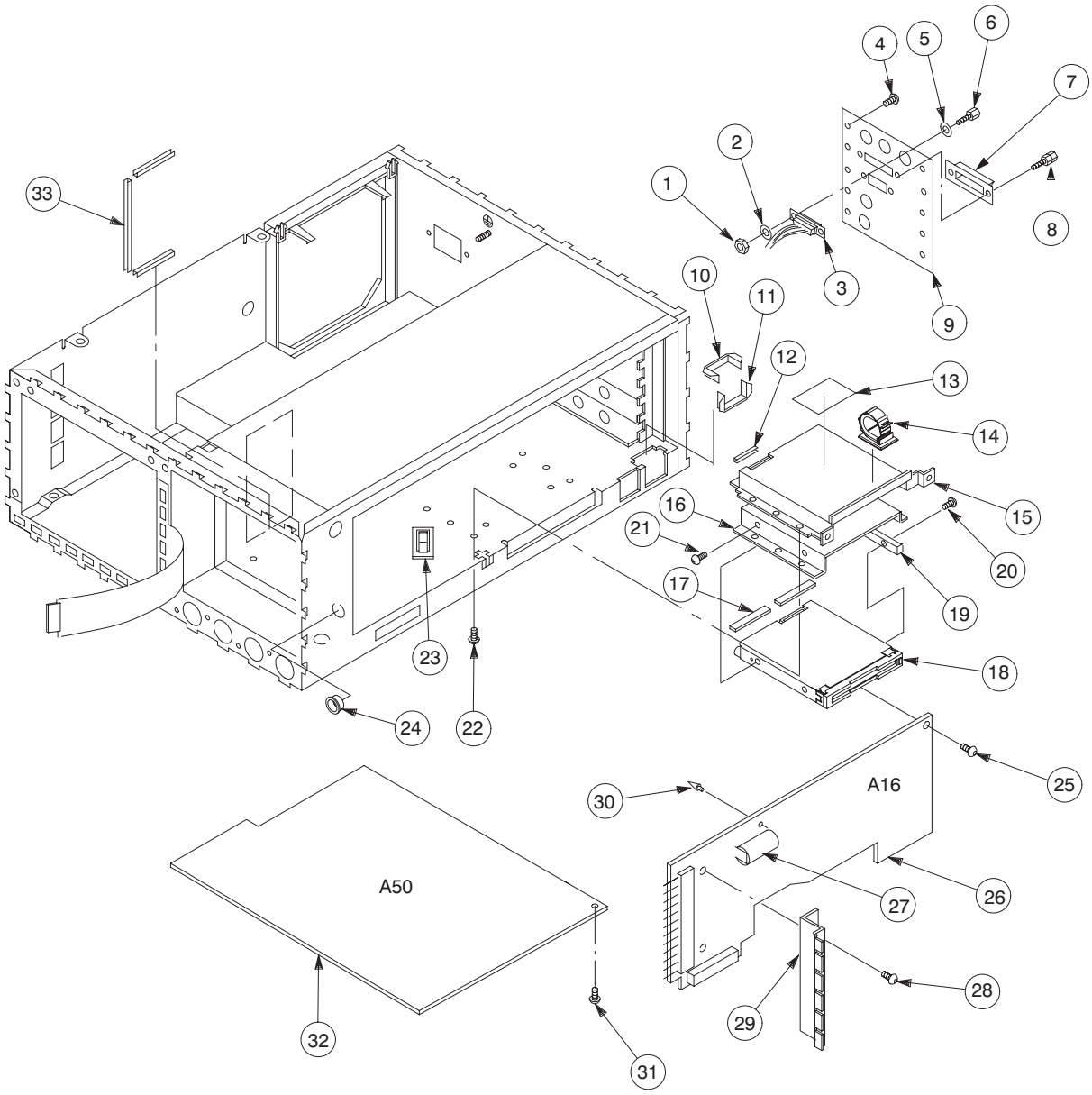


Figure 10-3: Main chassis and circuit boards

Replaceable Parts List

Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
					OPTION 01		
10–4–1	337–4145–00			1	SHIELD,ELEC:REAR,AL	80009	3374145XX

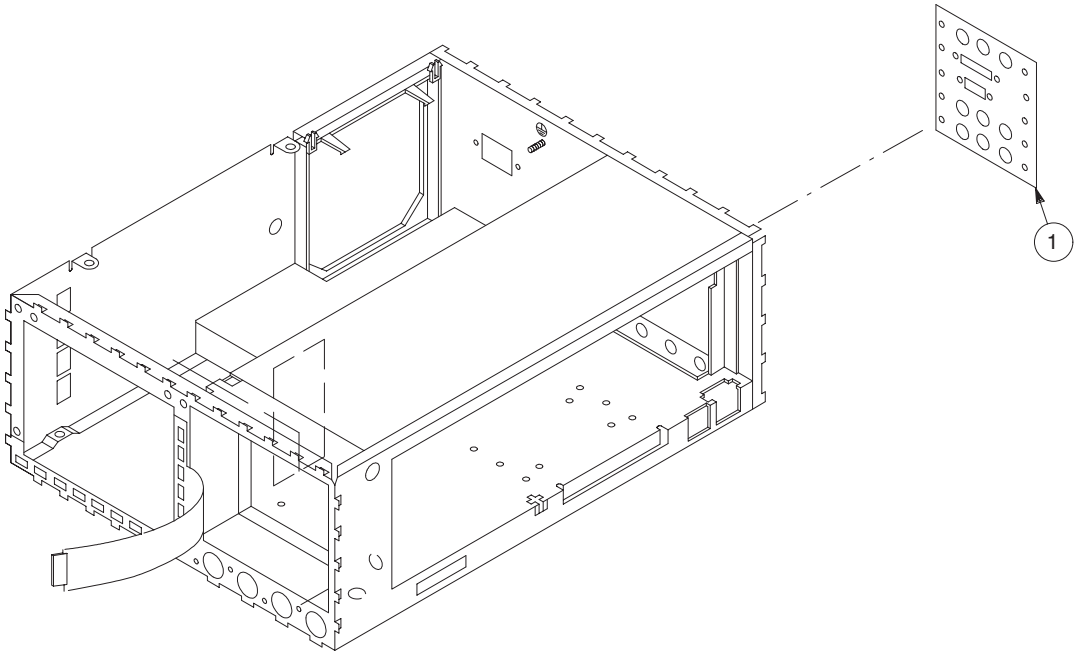


Figure 10-4: Option 01

Replaceable Parts List

Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
10–5–1	671–3783–XX			1	CKT BD ASSY:KEYBOARD	80009	6713783XX
–2	213–0048–00			1	SETSCREW:4–40 X 0.125,STL	TK0392	ORDER BY DESC
–3	260–2497–XX			1	SWITCH,ROTARY:ENCODER,5VDC,70MA,INCREMENTAL	80009	2602497XX
–4	384–1686–00			1	EXTENSION SHAFT:0.790 L X 0.500 DIA,PLASTIC	80009	3841686XX
–5	348–1276–00			40 cm	GASKET,SHIELD:CONDUCTIVE FORM STRIP	80009	3481276XX
–6	131–1315–01			2	CONN,RF JACK:BNC/PNL,;50 OHM,FEMALE	24931	28JR306–1
–7	366–0768–00			1	KNOB:IVORY GRAY,SCROLL,1.243 IDX 1.4 OD	80009	3660768XX
–8	213–0153–00			1	SETSCREW:5–40 X 0.125,STL	TK0392	ORDER BY DESCP
–9	333–4250–00			1	PANEL,FRONT:MAIN KEY,POLYCARBONATE	80009	3334250XX
–10	380–1060–01			1	HOUSING,SWITCH:POLYCARBONATE	80009	3801060XX
–11	260–2552–00			1	SWITCH,PUSH:50 BUTTON,SP/ST	80009	2602552XX
–12	366–0769–00			30	PUSH BUTTON:IVORY GRAY,OVAL	80009	3660769XX

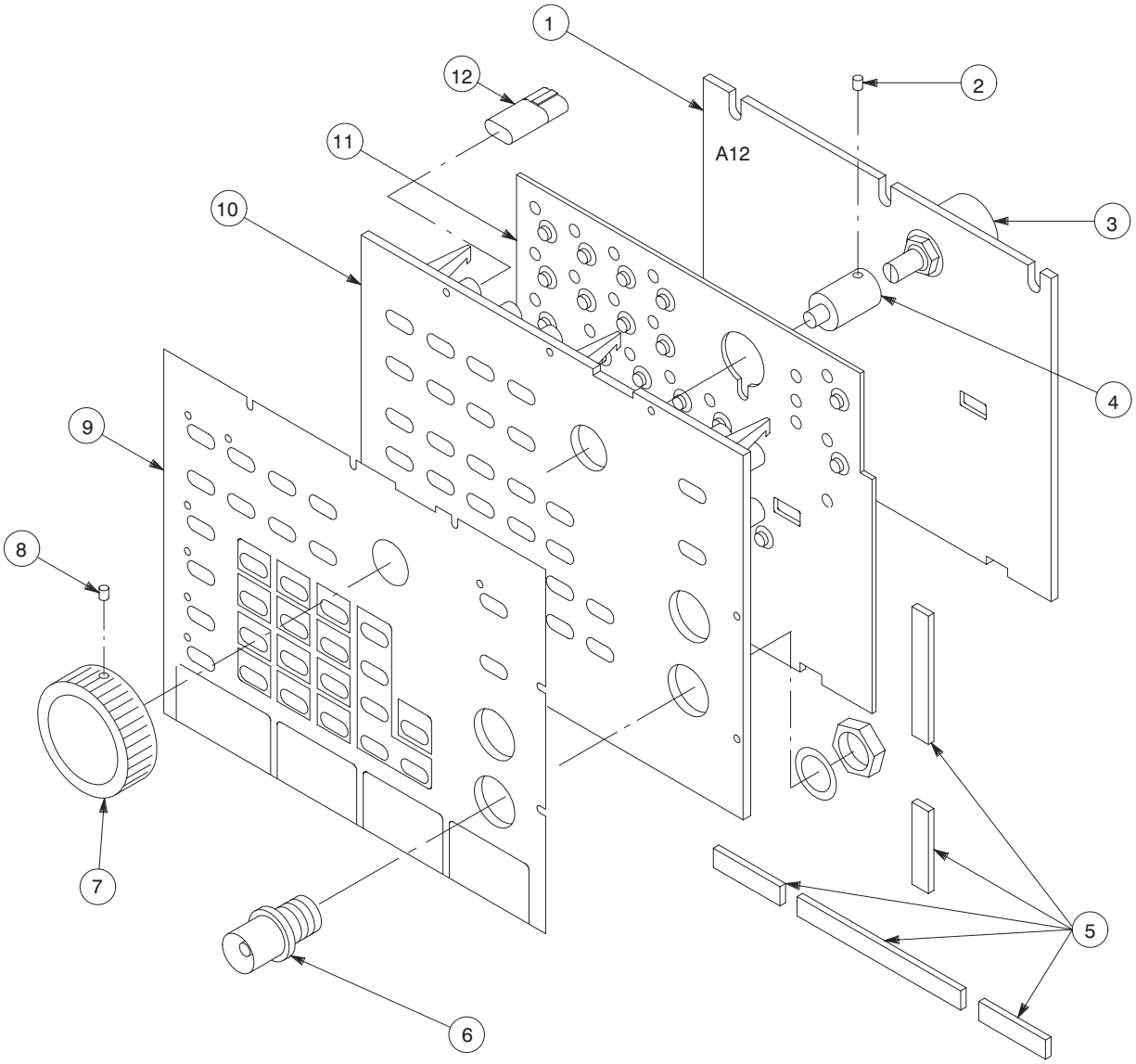


Figure 10-5: Front panel assembly

Replaceable Parts List

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
					CABLE ASSEMBLIES		
W1	174–2934–00				CA ASSY,SP,ELEC:3,18 AWG,18CM L	80009	1742934XX
W3	196–3112–00				LEAD,ELECTRICAL:18 AWG,6.0 L,5–4	80009	1963112XX
W4	174–2803–00				CA ASSY,SP,ELEC:2,18 AWG,12CM L,W/FSTN	80009	1742803XX
W6	174–2971–00				CA ASSY,SP,ELEC:22,18 AWG,10CM L	80009	1742971XX
W7	196–3389–00				LEAS,ELECTRICAL:18 AWG,15CM L,5–4,W/TERM LUG	80009	1963389XX
W10	174–2936–00				CA ASSY,SP,ELEC:5,26 AWG,26CM L,RIBBON	80009	1742936XX
W108	174–3201–00				CA ASSY,RF:50 OHM COAX,20CM L,9–1,W/PELTOLA	80009	1743201XX
W450	012–1537–00				CA ASSY,RF:50 OHM COAX,40CM L,9–6, W/PELTOLA	80009	0121537XX
W630	174–2933–00				CA ASSY,SP,ELEC:5,26 AWG,15CM L,RIBBON W/O–SUB	80009	1742933XX
W664	174–2945–00				CA ASSY,SP,ELEC:10,26 AWG,23CM L,RIBBON	80009	1742945XX
W675	174–2775–00				CA ASSY,SP,ELEC:26,350MM L,FLAT FLEX	80009	1742775XX
W800	----------				CA ASSY,RF:50 OHM COAX,60CM L,9–4, W/PELTOLA (INCLUDED IN 012–1537–XX)	80009	
W810	----------				CA ASSY,RF:50 OHM COAX,60CM L,9–5, W/PELTOLA (INCLUDED IN 012–1537–XX)	80009	
W900	174–2770–00				CA ASSY,SP,ELEC:10,26 AWG,390MM L,RIBBON	80009	1742770XX
W1100	012–1538–00				CA ASSY,RF:50 OHM COAX,48CM L,9–2, W/PELTOLA	80009	0121538XX
W1110	----------				CA ASSY,RF:50 OHM COAX,48CM L,9–3, W/PELTOLA (INCLUDED IN 012–1538–XX)		
W1240	----------				CA ASSY,RF:50 OHM COAX,290CM L,9–0, W/PELTOLA (INCLUDED IN 012–1538–XX)	80009	
W1245	----------				CA ASSY,RF:50 OHM COAX,290CM L,9–1, W/PELTOLA (INCLUDED IN 012–1538–XX)	80009	
W2100	012–1539–00				CA ASSY,RF:50 OHM COAX,40CM L,9–0, W/PELTOLA	80009	0121539XX
W2200	----------				CA ASSY,RF:50 OHM COAX,40CM L,9–1, W/PELTOLA (INCLUDED IN 012–1539–XX)	80009	
W2300	----------				CA ASSY,RF:50 OHM COAX,40CM L,9–2, W/PELTOLA (INCLUDED IN 012–1539–XX)	80009	
W2400	----------				CA ASSY,RF:50 OHM COAX,40CM L,9–3, W/PELTOLA (INCLUDED IN 012–1539–XX)	80009	
W2600	----------				CA ASSY,RF:50 OHM COAX,60CM L,9–4, W/PELTOLA (INCLUDED IN 012–1537–XX)	80009	
W2800	----------				CA ASSY,RF:50 OHM COAX,60CM L,9–6, W/PELTOLA (INCLUDED IN 012–1537–XX)	80009	
W2802	----------				CA ASSY,RF:50 OHM COAX,60CM L,9–7, W/PELTOLA (INCLUDED IN 012–1537–XX)	80009	
					DG2030 OPTION 01 ONLY		
W3100	----------				CA ASSY,RF:50 OHM COAX,40CM L,9–0, W/PELTOLA (INCLUDED IN 012–1539–XX)	80009	
W3200	----------				CA ASSY,RF:50 OHM COAX,40CM L,9–1, W/PELTOLA (INCLUDED IN 012–1539–XX)	80009	
W3300	----------				CA ASSY,RF:50 OHM COAX,40CM L,9–2, W/PELTOLA (INCLUDED IN 012–1539–XX)	80009	
W3400	----------				CA ASSY,RF:50 OHM COAX,40CM L,9–3, W/PELTOLA (INCLUDED IN 012–1539–XX)	80009	

Replaceable Parts List (Cont.)

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
					STANDARD ACCESSORIES		
	063–2922–XX			1	SOFTWARE PKG:PERFORMANCE,3.5IN	80009	0632922XX
	063–2921–XX			1	SOFTWARE PKG:GPIB SAMPLE PROGRAM,3.5IN	80009	0632921XX
	071–0059–XX			1	MANUAL,TECH:USERS	80009	0710059XX
	071–0057–XX			1	MANUAL,TECH:PROGRAMMER	80009	0710057XX
	161–0230–XX			1	CABLE ASSY,PWR,:3,18 AWG,92 L,SVT,TAN (SEE FIGURE 2–1)		
	161–0104–05			1	CABLE ASSY,PWR,:3,18 AWG,240V,98.0 L (OPTION A3–AUSTRALIAN)	S3109	SAA/3-OD3CCFC3X
	161–0104–06			1	CABLE ASSY,PWR,:3 X 0.75MM SQ,220V,98.0 L (OPTION A1–EUROPEAN)	S3109	VIIGSOPO-HO5VVF
	161–0104–07			1	CABLE ASSY,PWR,:3,1.0MM SQ,240 VOLT,2.5 M (OPTION A2–UNITED KINGDOM)	S3109	ORDER BY DESC
	161–0104–08			1	CABLE ASSY,PWR,:3,18 AWG,98 L,SVT,GREY/BLK (OPTION A4–NORTH AMERICAN)	70903	ORDER BY DESC
	161–0167–00			1	CABLE ASSY,PWR,:3.0 X 0.75,6A,240V,2.5M L (OPTION A5–SWITZERLAND)	S3109	ORDER BY DESC
					OPTIONAL ACCESSORIES		
	071–0058–XX			1	MANUAL,TECH:SERVICE	80009	0710058XX
	200–3232–01			1	COVER,FRONT:ABS	TK1908	ORDER BY DESC
	016–1159–00			1	POUCH:POUCH & PLATE,GPS SIZE	80009	0161159XX
	040–1444–XX			1	RACKMOUNT KIT	80009	0401444XX
	159–0210–00			1	FUSE,CARTRIDGE:DIN 5 x 20MM,5A,250V,SLOW	80009	1590210XX
	159–0239–00			1	FUSE,CARTRIDGE:3AG,6A,250V,MEDIUM	80009	1590239XX
	200–2264–00			1	CAP,FUSEHOLDER:3AG FUSE SAFETY CONTROLLED (FOR 159–0239–XX)	80009	2002264XX
	200–2265–00			1	CAP,FUSEHOLDER:5 X 20MM,FUSE SAFETY CONTROLLED (FOR 159–0210–XX)	80009	2002265XX
	011–0049–02			1	TERMN,COAXIAL:50 OHM,2W,BNC	80009	0110049XX
	012–0991–00			1	CABLE,COMPOSITE:IDC,GPIB:2 METER	00779	553577-3
	012–1256–00			1	CABLE ASSY, SP:50 OHM COAX, DOUBLE SHIELD 98.0 L	80009	0121256XX
	012–0057–52			1	CABLE ASSY,RF:50 OHM COAX,2000 MM L	80009	012005752
	012–1458–00			1	CABLE ASSY,RF:50 OHM,100 CM L,SMB TO SMB,DOUBLE SHIELD CABLE	80009	0121458XX
	012–1459–00			1	CABLE ASSY,RF:50 OHM,100 CM L,SMB TO BNC,DOUBLE SHIELD CABLE	80009	0121459XX
	012–1503–00			1	CABLE ASSY,RF:50 OHM COAX,50CM L,W/SMB & HEADER	80009	0121503XX
	012–1506–00			1	CABLE ASSY,RF:50 OHM COAX,SMB TO PIN,50 INCH L	80009	0121506XX
	012–1508–00			1	LEAD SET,ELEC:2,26 AWG,7.5 CM L,PKG OF 5 EA	80009	0121508XX
	012–1509–00			1	LEAD SET,ELEC:8,26 AWG,12 CM L,PKG OF 3 EA	80009	0121509XX
	015–0660–00			1	DISTRIBUTOR:50 OHM, 0.5 W, BNC	80009	0150660XX
	015–0671–00			1	ADAPTER,CONN:SMB(FEMALE) TO BNC(MALE)	80009	0150671XX