/Inritsu
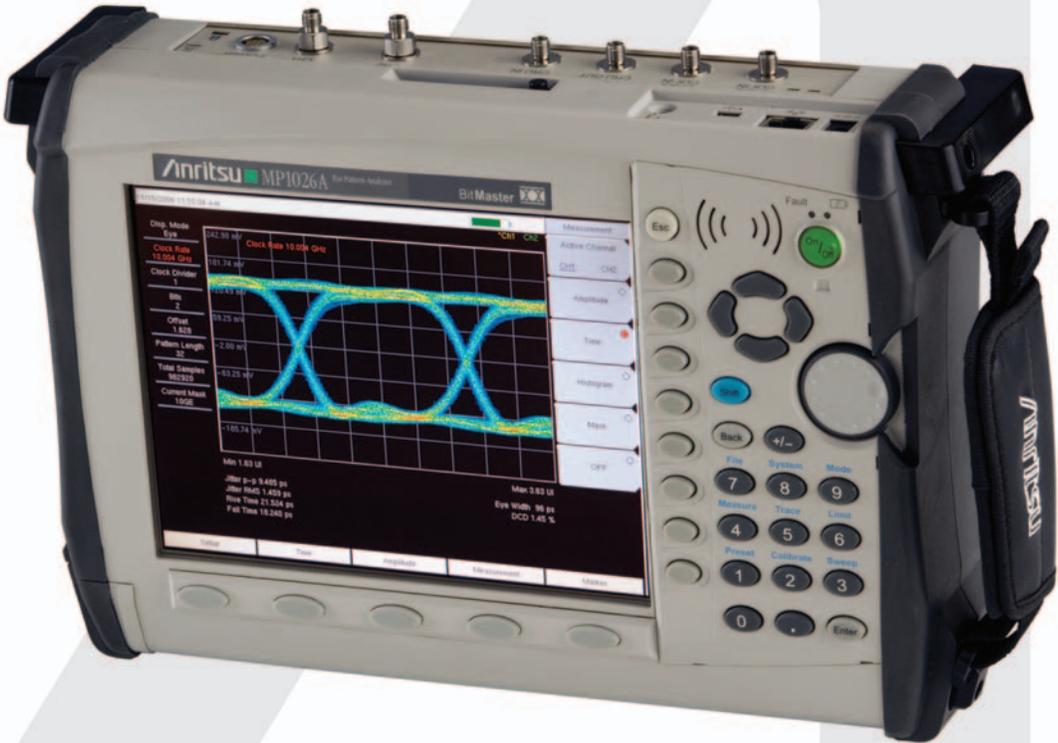
Bit Master™

MP1026A Eye Pattern Analyzer

Handheld Eye Pattern Measurements for Every Engineer

User's Guide

MP1026A

Bit Master™

User's Guide

产品中有毒有害物质或元素的名称及含量

部件名称	有毒有害物质或元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 [Cr(VI)]	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
印刷线路板 (PCA)	✕	○	✕	✕	○	○
机壳、支架 (Chassis)	✕	○	✕	✕	○	○
LCD	✕	✕	✕	✕	○	○
其他（电缆、风扇、 连接器等） (Appended goods)	✕	○	✕	✕	○	○
○：表示该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T11363-2006 标准规定的限量要求以下。 ✕：表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 SJ/T11363-2006 标准规定的限量要求。						

环保使用期限

(40) 这个标记是根据 2006/2/28 公布的「电子信息产品污染控制管理办法」以及 SJ/T 11364-2006「电子信息产品污染控制标识要求」的规定，适用于在中国销售的电子信息产品的环保使用期限。仅限于在遵守该产品的安全规范及使用注意事项的基础上，从生产日起算的该年限内，不会因产品所含有害物质的泄漏或突发性变异，而对环境污染，人身及财产产生深刻地影响。
注）电池的环保使用期限是 5 年。生产日期标于产品序号的前四码
　　（如 S/N 0728XXXX 为 07 年第 28 周生产）。

Equipment marked with the Crossed-out Wheelie
Bin symbol complies with the European
Parliament and Council Directive 2002/96/EC (the
"WEEE Directive") in the European Union.

For Products placed on the EU market after
August 13, 2005, please contact your local Anritsu
representative at the end of the product's useful
life to arrange disposal in accordance with your
initial contract and the local law.

DECLARATION OF CONFORMITY

Manufacturer's Name: ANRITSU COMPANY

Manufacturer's Address: Microwave Measurements Division
490 Jarvis Drive
Morgan Hill, CA 95037-2809
USA

declares that the product specified below:

Product Name: Bit Master

Model Number: MP1026A

conforms to the requirement of:

EMC Directive 89/336/EEC as amended by Council Directive 92/31/EEC & 93/68/EEC
Low Voltage Directive 2006/95/EC as amended by Council directive 93/68/EEC

Electromagnetic Interference: EN61326:1997 +A1: 1998 +A2:2002 A3:2003

Emissions: EN55011: 1998 +A1: 1999 +A2:2002 Group 1 Class A

Immunity: EN 61000-4-2:1995 +A1:1998 +A2:2001   - 4kV CD, 8kV AD
                    EN 61000-4-3:2002 +A1:2002   - 3V/m
                    EN 61000-4-4:2004   - 0.5kV SL, 1kV PL
                    EN 61000-4-5:1995 +A1:2001   - 1kV L-L, 2kV L-E
                    EN 61000-4-6:1996 +A1:2001   - 3V
                    EN 61000-4-11:1994 +A1:2001   - 100% @ 20msec

Electrical Safety Requirement:

Product Safety: The product complies when used with Company supplied Power Supply
                    (tested to IEC60950-1:2001)

Eric McLean, Corporate Quality Director

Morgan Hill, CA

15 March 2007
Date

European Contact: For Anritsu product EMC & LVD information, contact Anritsu LTD, Rutherford Close,
Stevenage Herts, SG1 2EF UK, (FAX 44-1438-740202)

Safety Symbols

To prevent the risk of personal injury or loss related to equipment malfunction, Anritsu Company uses the following symbols to indicate safety-related information. For your own safety, please read the information carefully *before* operating the equipment.

Symbols Used in Manuals

Danger: This indicates a very dangerous procedure that could result in serious injury or death, or loss related to equipment malfunction, if not performed properly.

WARNING ⚠

Warning: This indicates a hazardous procedure that could result in light-to-severe injury or loss related to equipment malfunction, if proper precautions are not taken.

Caution: This indicates a hazardous procedure that could result in loss related to equipment malfunction if proper precautions are not taken.

Safety Symbols Used on Equipment and in Manuals

The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Ensure that you clearly understand the meanings of the symbols and take the necessary precautions *before* operating the equipment. Some or all of the following five symbols may or may not be used on all Anritsu equipment. In addition, there may be other labels attached to products that are not shown in the diagrams in this manual.

This indicates a prohibited operation. The prohibited operation is indicated symbolically in or near the barred circle.

This indicates a compulsory safety precaution. The required operation is indicated symbolically in or near the circle.

This indicates a warning or caution. The contents are indicated symbolically in or near the triangle.

This indicates a note. The contents are described in the box.

These indicate that the marked part should be recycled.

For Safety

Warning: Always refer to the operation manual when working near locations at which the alert mark, shown on the left, is attached. If the operation, etc., is performed without heeding the advice in the operation manual, there is a risk of personal injury. In addition, the equipment performance may be reduced. Moreover, this alert mark is sometimes used with other marks and descriptions indicating other dangers.
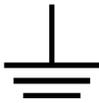
Warning: When supplying power to this equipment, connect the accessory 3-pin power cord to a 3-pin grounded power outlet. If a grounded 3-pin outlet is not available, use a conversion adapter and ground the green wire, or connect the frame ground on the rear panel of the equipment to ground. If power is supplied without grounding the equipment, there is a risk of receiving a severe or fatal electric shock.

Warning: This equipment can not be repaired by the operator. *Do not* attempt to remove the equipment covers or to disassemble internal components. Only qualified service technicians with a knowledge of electrical fire and shock hazards should service this equipment. There are high-voltage parts in this equipment presenting a risk of severe injury or fatal electric shock to untrained personnel. In addition, there is a risk of damage to precision components.

WARNING ⚠

⚠ CAUTION
>18 kg
HEAVY WEIGHT

Warning: Use two or more people to lift and move this equipment, or use an equipment cart. There is a risk of back injury if this equipment is lifted by one person.

Caution: Electrostatic Discharge (ESD) can damage the highly sensitive circuits in the instrument. ESD is most likely to occur as test devices are being connected to, or disconnected from, the instrument's front and rear panel ports and connectors. You can protect the instrument and test devices by wearing a static-discharge wristband. Alternatively, you can ground yourself to discharge any static charge by touching the outer chassis of the grounded instrument before touching the instrument's front and rear panel ports and connectors. Avoid touching the test port center conductors unless you are properly grounded and have eliminated the possibility of static discharge.

Repair of damage that is found to be caused by electrostatic discharge is not covered under warranty.

Table of Contents

Chapter 1—General Information

Chapter 2—Quick Start Guide

Table of Contents (Continued)

Table of Contents (Continued)

Chapter 1 — General Information

1-1   Introduction

This chapter provides a description, performance specifications, optional accessories, preventive maintenance, and calibration requirements for the Anritsu Handheld MP1026A Bit Master^{TM}. Throughout this manual, this instrument may be referred to as a Bit Master.

1-2   Description

The Bit Master is a handheld eye pattern analyzer capable of sampling and displaying eye patterns or pulse patterns for high speed signals such as OC192, 10 Gbps Ethernet, and Fiber Channel. It provides convenient measurements for field or lab use and can be an excellent diagnostic tool for identifying sources of noise and jitter that degrade the signal quality.

The Bit Master has two electrical input channels with 20 GHz of bandwidth. The clock used for measurements could be inputted by the user (0.1 to 12.5 Gbps) or derived from the data (using the optional Clock Recovery Unit 0.1 to 2.7 Gbps and 10 to 12.5 Gbps). An optional optical interface (using an external O/E module) will convert one of the electrical input channels into an optical input channel. The Bit Master allows either one or two channels to be displayed in eye or pulse mode. Time, amplitude, and histogram measurements can be made on either channel. Mask compliance testing can be used to verify whether that the input signal meets specified standards (using the built-in or user defined masks).

Time and date stamping of measurement data is automatic. The internal memory provides for the storage and recall of more than 1000 measurement setups. The bright daylight-viewable, high-resolution color liquid crystal display (LCD) provides easy viewing in a variety of lighting conditions. Bit Master is capable of approximately three hours of continuous operation from a fully charged battery and can be operated from a 12 Vdc source, which also simultaneously charges the battery.

Anritsu Master Software Tools, a PC-based software program, provides for storing measurement data. Master Software Tools can also convert the Bit Master display into several graphic formats. Master software tools supports all the options provided with the Bit Master.

Measurements stored in internal memory can be downloaded to a PC using the included USB or Ethernet cables. Once stored, the graph can then be displayed, scaled, or enhanced with markers. Historical graphs can be overlaid with current data using the PC mouse in a drag-and-drop fashion. The underlying data can be extracted and used in spreadsheets or for other analytical tasks.

1-3   Options and Accessories

Table 1-1.   MP1026A Options List

Option	Description
MP1026A-002	Clock Recovery Unit Option
MP1026A-003	Optical Interface Option (requires O/E Conversion Module OEC10G-1A, ordered separately)

Table 1-2.   MP1026A Standard Accessory List (supplied with shipment)

Part Number	Description
10580–00169	MP1026A User's Guide
65729	Soft Carrying Case
3-2000-1500	256 MB Compact Flash Card
64343	Tilt Bail
2300–498	Master Software Tools CD ROM
633–44	Rechargeable Li-Ion Battery
40–168	AC-DC Adapter
806–141	Automotive Cigarette Lighter 12 Vdc Adapter
3–2000–1498	USB Type-A to Mini-B Cable, 3.05 meter (10 ft.)
2000–1371	Ethernet Cable, 2.13 meter (7 ft.)
3-806-152	Crossover Ethernet Cable
2000-1501-R	256 MB USB Flash Drive
One Year Warranty (includes battery, firmware, and software)	

> **Caution:** When using the Automotive Cigarette Lighter 12 Vdc Adapter, Anritsu Part Number: 806-141, always verify that the power supply is rated for a minimum of 60 Watts @ 12 Vdc, and that the socket is clear of any dirt or debris. If the adapter plug becomes hot to the touch during operation, discontinue use immediately.

Table 1-3.   MP1026A Optional Accessory List

Part Number	Description
10580-00170	MP1026A Programming Manual
760-235	Transit Case
2000-1374	Dual External Li-Ion Charger with Universal Power Supply
15KKF50-1.5A	Armored Test Port Cable, 1.5 meter K(m) to K(f), 20 GHz
15RKKF50-1.5A	Ruggedized Armored Test Port Cable, 1.5 meter K(m) to K(f), 20 GHz
J0747B	Fixed Optical Attenuator (10 dB, FC connector)
J0747C	Fixed Optical Attenuator (15 dB, FC connector)
J0747D	Fixed Optical Attenuator (20 dB, FC connector)
J0635A	Optical Fiber Cable (SM, FC-SPC connector on both ends), 1 meter
J0635B	Optical Fiber Cable (SM, FC-SPC connector on both ends), 2 meters
J0635C	Optical Fiber Cable (SM, FC-SPC connector on both ends), 3 meters
67065-1	Loop Cable from CRU OUT to <1 GHz CLK IN (supplied with Option 002)
67065-2	Loop Cable from CRU OUT to ≥1 GHz CLK IN (supplied with Option 002)
OEC10G-1A	O/E Conversion Module (For use with Option 003. Must be ordered separately.)

1-4 Performance Specifications

Table 1-4. Performance Specifications

Standard Measurement Capabilities	
Displays	Eye Pattern Display Pulse Pattern Display
Measurements	Statistical (NRZ), Histograms, Mask Compliance (OC192, 10GE, 10GE-LX4, plus user-defined masks)

Horizontal System	
Clock Trigger Frequency	0.1 to 12.5 GHz
Clock Trigger Sensitivity	80 mV_{p-p}, typical (≥1 GHz) 200 mV_{p-p}, typical (<1 GHz)
Maximum Clock Trigger *	2 V_{p-p}, maximum input before damage
Jitter, RMS (when measured with a non-divided clock)	5 to 12.5 GHz: 1 ps typical, 1.5 ps maximum** 1 to 5 GHz: 1 ps typical 0.1 to 1 GHz: 2 ps typical
Eye Mode Scale Factor	1 UI minimum full scale
Pattern Mode Scale Factor	1 bit minimum full scale

Vertical System	
Input Range	±500 mV offset, minimum ±400 mV dynamic range, minimum ±2V maximum input before damage
Amplitude Accuracy (after internal cal)	See Figure 1-1, page 1-6
Bandwidth (-3dB)	DC to 20 GHz, minimum DC to 25 GHz, typical Flatness: ±1 dB, typical
Noise, RMS	0.75 mV typical, 1.75 mV maximum

Digital System	
Sampling Speed	100 ksamples/sec typical

* For clock trigger frequencies between 0.7 and 1.0 GHz, EMC emissions specifications are only guaranteed for a maximum input signal of 1.5 Vp-p.

** Under the condition of strong interfering RF signals, the maximum RMS jitter could be as high as 4 ps when the interfering signals are in the frequency bands 556 MHz to 693 MHz and 900 MHz to 1100 MHz, and as high as 7 ps when the interfering signals are in the band of 645 MHz to 655 MHz.

Table 1-5. Clock Recovery (Option 002) Performance Specifications

Clock Rates	9.8 to 12.5 GHz 0.1-2.7 GHz
Sensitivity	25 mV_{p-p} typical
Maximum Input	2 V_{p-p}, maximum input before damage

Table 1-5.   Clock Recovery (Option 002) Performance Specifications

Jitter, RMS (additive)	9.8 to 12.5 GHz Band: 20 mUI, maximum 0.1 to 2.7 GHz Band: 2 mUI, typical

Loop Bandwidth	9.8 to 12.5 GHz Band: 4 MHz, typical
	0.1 to 2.7 GHz Band:
	    (OC-48): 490 kHz, typical
	    (OC-12): 71 kHz, typical
	    (OC-3): 23 kHz, typical

Table 1-6.   Optical Interface (Option 003) via External O/E Module OEC10G-1A Specifications

Multimode Fiber Input (accepts single mode, too)	62.5 µm with FC
Wavelength Range	750 to 1650 nm
Bandwidth (–3dB electrical)	DC to 7.5 GHz, typical
850 nm Responsivity	0.55 A/W, typical
850 nm Conversion Gain	200 V/W, typical
1310/1550 nm Responsivity	0.95 A/W typical
1310/1550 nm Conversion Gain	350 V/W, typical
Optical Noise	15 µW, typical
Optical Sensitivity	–15 dBm, typical –8 dBm, typical (for operation with CRU, Option 002)
Optical Overload	+2 dBm +5 dBm, maximum input before damage
Optical Power Measurement Accuracy	±0.35 dB, typical, for input levels between 0 dBm and -18 dBm
Electrical Return Loss	–10 dB, typical
Optical Return Loss	–30 dB, typical

Figure 1-1.   Amplitude Accuracy

Table 1-7.   General Specifications

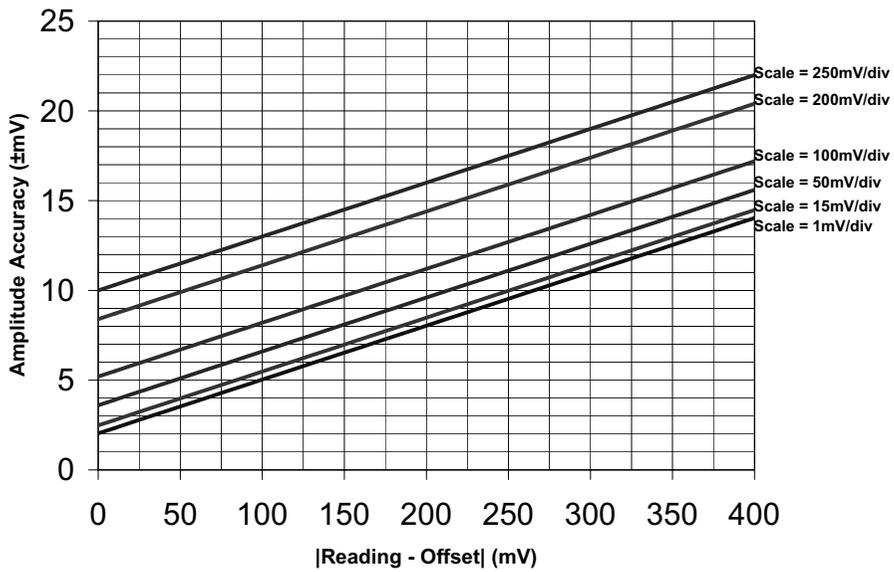|	
Maximum Electrical Input	+30 dBm
Interfaces	Type K-female Electrical In Port (x2), ±2V maximum input Type K-female CRU In Port, $2V_{p-p}$ maximum input Type K-female CRU Out Port Type K-female Clock >1 GHz In port, $2V_{p-p}$ maximum input Type K-female Clock <1 GHz In port, $2V_{p-p}$ maximum input 7-pin DC connector for O/E Power RJ45 Connector for Ethernet 10/100Base-T USB 2.0 Type-A Host connector (for USB flash drives) USB 2.0 Mini-B 5-pin connector (for data transfer to a PC) Compact Flash 2.5 mm 3-wire Cellular Headset Connector

Environmental	MIL-PRF-28800F Class 2
	Temperature Operating: -10° C to +55° C
	                          Storage: -51° C to +71° C
	Humidity Operating: 30° C at 95% RH
	                                            40° C at 75% RH
	                                            55° C at 45% RH
	Altitude: 4600 meters, operating and non-operating

Safety	Conforms to EN 61010–1 for Class 1 Portable Equipment
Electromagnetic Compatibility	Meets European Community Requirements for CE Marking
Size	313W x 211H x 77D mm (12W x 8H x 3D in.)
Weight (base unit)	<4 kg (<7.0 lbs.)

1-5   Preventive Maintenance

Bit Master preventive maintenance consists of cleaning the unit and inspecting and cleaning the RF connectors on the instrument and all accessories. Clean the Bit Master with a soft, lint-free cloth dampened with water or water and a mild cleaning solution.

> **Caution:** To avoid damaging the display or case, do not use solvents or abrasive cleaners.

Clean the RF connectors and center pins with a cotton swab dampened with denatured alcohol. Visually inspect the connectors. The fingers of K (f) connectors should be unbroken and uniform in appearance. If you are unsure whether the connectors are good, gauge the connectors to confirm that their dimensions are correct.

1-6   Calibration Requirements

The Bit Master loads factory calibration data during start-up, eliminating the need for daily calibration checks. An amplitude calibration, as well as an optical power calibration, can be initiated via the front panel to maximize system accuracy if the environmental conditions change towards either hot or cold extremes. The factory calibration is performed at nominal room temperature conditions (approximately 23°C).

Although Bit Master does not require daily field calibration, Anritsu recommends annual calibration and performance verification by local Anritsu Service Centers (page 1-13).

1-7   ESD Cautions

The MP1026A, like other high performance instruments, is susceptible to ESD damage. Very often, coaxial cables build up a static charge, which, if allowed to discharge by connecting directly to the MP1026A without discharging the static charge, may damage the MP1026A input circuitry. MP1026A operators should be aware of the potential for ESD damage and take all necessary precautions.

Operators should exercise practices outlined within industry standards such as JEDEC-625 (EIA-625), MIL-HDBK-263, and MIL-STD-1686, which pertain to ESD and ESDS devices, equipment, and practices. As these apply to the MP1026A, it is recommended that any static charges that may be present be dissipated before connecting coaxial cables to the MP1026A. This may be as simple as temporarily shorting the end of the cable to a metallic surface prior to attaching it to the MP1026A. It is important to remember that the operator may also carry a static charge that can cause damage. Following the practices outlined in the above standards will ensure a safe environment for both personnel and equipment.

1-8   Battery Replacement

The battery can be replaced without the use of tools. The battery compartment is located on the lower left side of the instrument (Figure 1-2). Slide the battery door down, towards the bottom of the instrument, to remove it. Remove the battery pack from the instrument by pulling straight out on the battery lanyard. Replacement is the opposite of removal.

Battery
Compartment
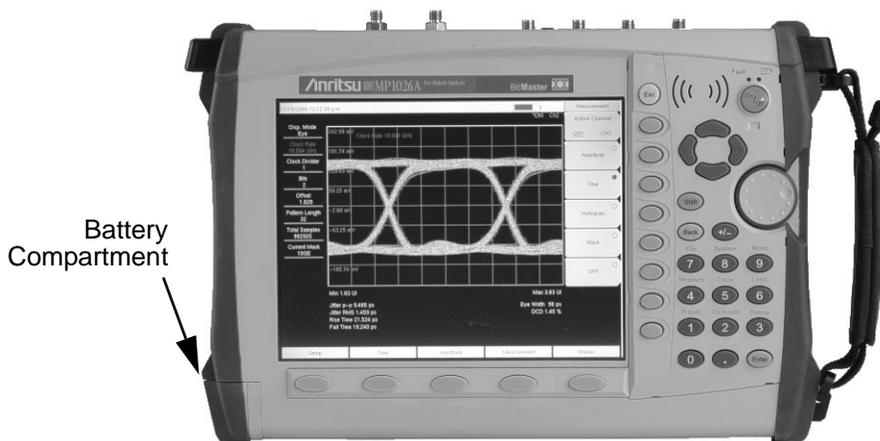
Figure 1-2.   Battery Compartment

Note: Use only Anritsu approved batteries, adapters and chargers with this instrument.

The battery supplied with the Bit Master may need charging before use. The battery can be charged in the Bit Master, using either the AC-DC Adapter (40-168) or the 12-Volt DC adapter (806-141), or separately in the optional Dual Battery Charger (2000-1374).

Caution: When using the Automotive Cigarette Lighter 12 Vdc Adapter, Anritsu Part Number: 806-141, always verify that the supply is rated for a minimum of 60 Watts @ 12 Vdc, and that the socket is clear of any dirt or debris. If the adapter plug becomes hot to the touch during operation, discontinue use immediately.

1-9   Soft Carrying Case

The instrument can be operated while in the soft carrying case. On the back of the case is a large storage pouch for accessories and supplies.

To install the instrument into the soft carrying case:

1. The front panel of the case is secured with hook and loop fasteners. Fully open the front panel of the case.

2. Place the soft carrying case face down on a stable surface, with the front panel fully open and laying flat.

3. Fully open the zippered back of the case.

> **Note:** There are two zippers around the back of the case. The zipper closest to the front of the case opens the case back, and allows access to install and remove the unit. The zipper closest to the back of the case opens a support panel that can be used to provide support for improved stability and air flow while in the case. This support panel also contains the storage pouch.

4. Insert the unit face down into the case(Figure 1-3), taking care that the connectors are properly situated in the case top opening.

Figure 1-3.   Instrument Inserted Into the Soft Carrying Case

5. Close the back panel and secure with the zipper.

FRONT PANEL
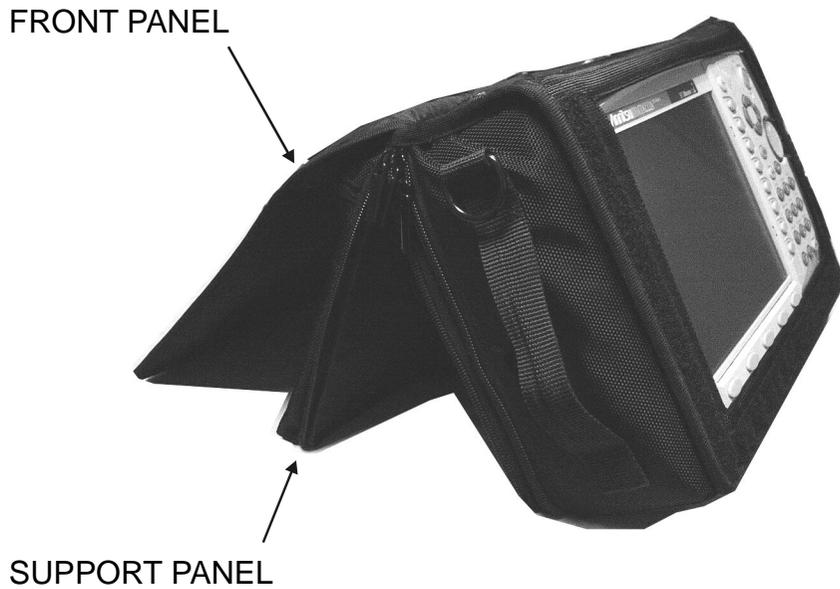
SUPPORT PANEL

Figure 1-4. Instrument Installed in Soft Case

The soft case contains a support panel, as shown in Figure 1-4, to assist in safely positioning the instrument in the testing environment.

The soft carrying case also includes a detachable shoulder strap that can be connected to the D-rings on the upper corners of the case as required for comfort or convenience.

1-10 Tilt Bail Stand

When properly installed, the Tilt Bail provides a backward tilt for improved stability and air flow. The tilt bail kit (part number 64343) is a standard accessory and consist of:

Part Number	Qty.	Description
64344	1	Tilt Bail
63763	1	Right Support Bumper Assembly
63764	1	Left Support Bumper Assembly
905-2691	2	M3 x 12 mm stainless steel slotted pan head screw
905-2692	2	6.2 mm OD stainless steel split lock washer
790-367	2	Hardware, bumper

1. Remove the instrument from the soft carrying case.

> **Note:** When the tilt bail is installed, the unit cannot be placed back into the soft carrying case.

2. With a flat-blade screwdriver, remove only the top screw from the carrying strap D-ring holder on the right side of the instrument. Save the screw and the D-ring holder, as they will need to be reinstalled if the tilt bail is removed.

3. Remove the carrying strap D-ring from the holder removed in Step 2 and install the D-ring on to the new right support bumper assembly, item number 63763.

4. Using one M3 x 12 mm stainless steel slotted pan head screw and one 6.2 mm OD stainless steel split lock washer provided, install the new right support bumper assembly.

> **Note:** Do not use the screw removed in Step 2 to install the new right support bumper assembly. Use only the screws provided with the kit.

5. Use the other M3 x 12 mm stainless steel slotted pan head screw and 6.2 mm OD stainless steel split lock washer to attach the left support bumper assembly, item number 63764, to the left side of the instrument.

6. Flex the tilt bail to install it into the two bumper assemblies (Figure 1-5).

Figure 1-5.   Tilt Bail Installed

1-11 Anritsu Customer Service Centers

Table 1-8. Anritsu Customer Service Centers

UNITED STATES	FRANCE	JAPAN
ANRITSU COMPANY	ANRITSU U.S.A.	ANRITSU CUSTOMER SERVICE LTD.
490 Jarvis Drive	9 Avenue du Quebec	5-1-1 Onna Atsugi-shi
Morgan Hill, CA 95037-2809	Zone de Courtaboeuf	Kanagawa-Prf. 243 Japan
Telephone: 1-800-ANRITSU	91951 Les Ulis Cedex	Telephone: 046-296-6688
FAX: 408-776-1744	Telephone: 016-09-21-550	FAX: 046-225-8379
	FAX: 016-44-61-065	
	GERMANY	**SINGAPORE**
ANRITSU COMPANY	ANRITSU GmbH	ANRITSU (SINGAPORE) PTE LTD.
10 New Maple Ave., Unit 305	Konrad-Zuse-Platz 1	10, Hoe Chiang Road
Pine Brook, NJ 07058	Muenchen 81829	#07-01/02 Keppel Towers
Telephone: 1-800-ANRITSU	Germany	Singapore 089315
FAX: 201-575-0092	Telephone: 089-442308-0	Telephone: 6-282-2400
	FAX: 089-442308-55	FAX: 6-282-2533
	INDIA	**SOUTH AFRICA**
ANRITSU COMPANY	MEERA AGENCIES (P) LTD.	ETECSA
1155 E. Collins Blvd	23 Community Center	12 Surrey Square Office Park
Richardson, TX 75081	Kailash Colony Extension	330 Surrey Avenue
Telephone: 1-800-ANRITSU	New Delhi, India	Ferndale, Randburg, 2194
FAX: 972-671-1877	Telephone: 91-11-6442700	South Africa
	FAX: 91-11-6442500	Telephone: 27-11-787-7200
		FAX: 27-11-787-0446
AUSTRALIA	**ISRAEL**	**SWEDEN**
ANRITSU PTY. LTD.	TECH-CENT, LTD.	ANRITSU AB
Unit 21/270 Ferntree Gully Road	4 Raul Valenberg St	Borgafjordsgatan 13
Notting Hill, Victoria 3168	Tel-Aviv 69719	164 40 Kista Sweden
Australia	Telephone: 03-64-78-563	Telephone: 46-8-53470700
Telephone: 03-9558-8177	FAX: 03-64-78-334	FAX: 46-8-53470730
FAX: 03-9558-8255		
BRAZIL	**ITALY**	**TAIWAN**
ANRITSU Eletrônica Ltda.	ANRITSU Sp.A	ANRITSU CO., INC.
Praça Amadeu Amaral 27, 1º andar.	Roma Office	7F, No. 316, Section 1
Bela Vista, São Paulo, SP, Brasil.	Via E. Vittorini, 129	Nei Hu Road
CEP: 01327-010	00144 Roma EUR	Taipei, Taiwan, R.O.C.
Telephone: 55-11-3283-2511	Telephone: 06-50-99-711	Telephone: 886-2-8751-1816
Fax: 55-11-3288-6940	FAX: 06-50-22-4252	FAX: 886-2-8751-2126
CANADA	**KOREA**	**UNITED KINGDOM**
ANRITSU INSTRUMENTS LTD.	ANRITSU CORPORATION LTD.	ANRITSU LTD.
700 Silver Seven Road, Suite 120	8F Hyunjuk Building, 832-41	200 Capability Green
Kanata, Ontario K2V 1C3	Yeoksam Dong, Kangnam-Ku	Luton, Bedfordshire
Telephone: (613) 591-2003	Seoul, South Korea 135-080	LU1 3LU, England
FAX: (613) 591-1006	Telephone: 02-553-6603	Telephone: 015-82-433200
	FAX: 02-553-6605	FAX: 015-82-731303

Chapter 2 — Quick Start Guide

2-1   Introduction

This chapter provides a brief overview of the Anritsu MP1026A Bit Master. The intent of this chapter is to provide the user with a starting point for making basic measurements. For more detailed information, refer to the specific chapters that follow.

2-2   Turning the MP1026A On for the First Time

The Anritsu MP1026A Bit Master is capable of approximately three hours of continuous operation from a fully charged, field-replaceable battery (see Chapter 1). The MP1026A can also be operated from a 12 Vdc source (which will also simultaneously charge the battery). This can be achieved with either the Anritsu AC-DC Adapter (Anritsu part number 40-168) or 12 Vdc Automotive Cigarette Lighter Adapter (Anritsu part number 806-141). Both items are included as standard accessories (see the list of accessories in Chapter 1).

> **Caution:** When using the Automotive Cigarette Lighter 12 Vdc Adapter, Anritsu Part Number: 806-141, always verify that the supply is rated for a minimum of 60 Watts @ 12 Vdc, and that the socket is clear of any dirt or debris. If the adapter plug becomes hot to the touch during operation, discontinue use immediately.

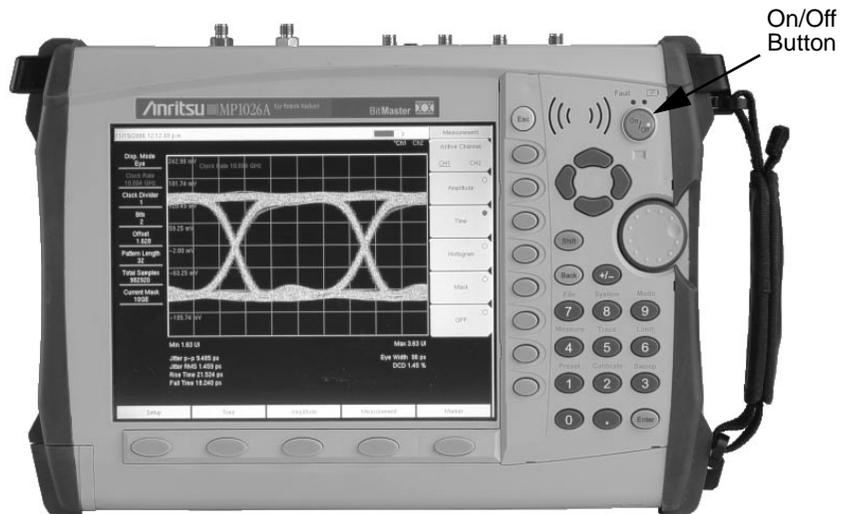To turn on the MP1026A, press the **On/Off** front panel button (Figure 2-1).

Figure 2-1.   MP1026A On/Off Button

The MP1026A Bit Master takes about thirty-five seconds to complete power up and load the application software. At the completion of this process, the instrument is ready to use.


Note: Without a clock signal present, the MP1026A may take longer to boot up as the instrument searches for a clock.

2-3   Front Panel Overview

The Bit Master menu-driven interface is easy to use and requires little training. Hard keys on the front panel are used to initiate function-specific menus. There are five function hard keys located below the display. These keys will vary in function depending on the current mode of operation.

There are 21 hard keys and a rotary knob located to the right of the display. Nine of the hard keys are dual purpose, depending on the current mode of operation. The dual-purpose keys are labeled with a number on the key itself, and the alternate function printed on the panel above the key. Use the shift key to access the functions printed on the panel. The **Escape** key, used for aborting data entry, is the round button located above soft keys. The rotary knob and the keypad can both be used to change the value of an active parameter. The rotary knob can also be pressed and duplicates the action of the **Enter** key.

There are also eight soft keys to the right of the display which change function depending upon the current menu selection. The current soft key function is indicated in the active function block to the right of the display. The locations of the keys are shown in Figure 2-2, below.
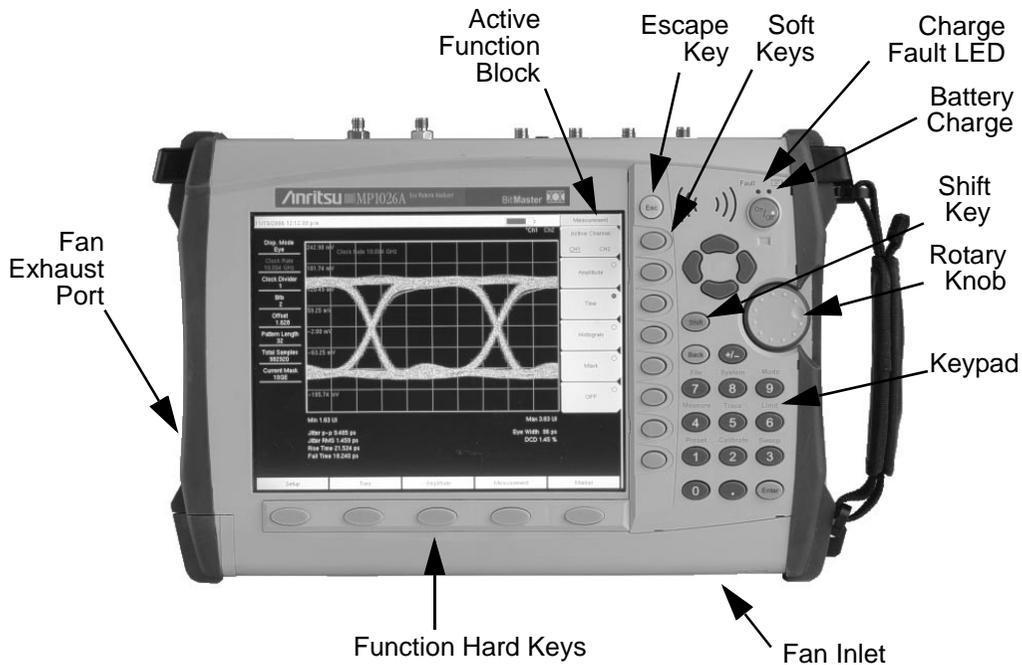
Figure 2-2.   Front Panel Overview

Other features on the front panel include:

Battery Charge LED (green)

The Battery Charge LED will flash if the battery is charging, and remain on steady when the battery is fully charged.

Charge Fault LED (red)

The Charge Fault LED will remain on steady under a battery charger fault condition. Fault conditions include a battery cell voltage that is too low to charge, or a battery temperature outside the temperature range to charge (-5º C to +50º C).

Fan Inlet and Exhaust Ports

It is important to keep the fan inlet and exhaust ports clear of obstructions at all times for proper ventilation and cooling of the instrument.

2-4 Display Overview

Figure 2-3 shows the key information areas for a typical Eye mode display. Refer to Chapter 4, "Measurements" for more information on measurements and settings.
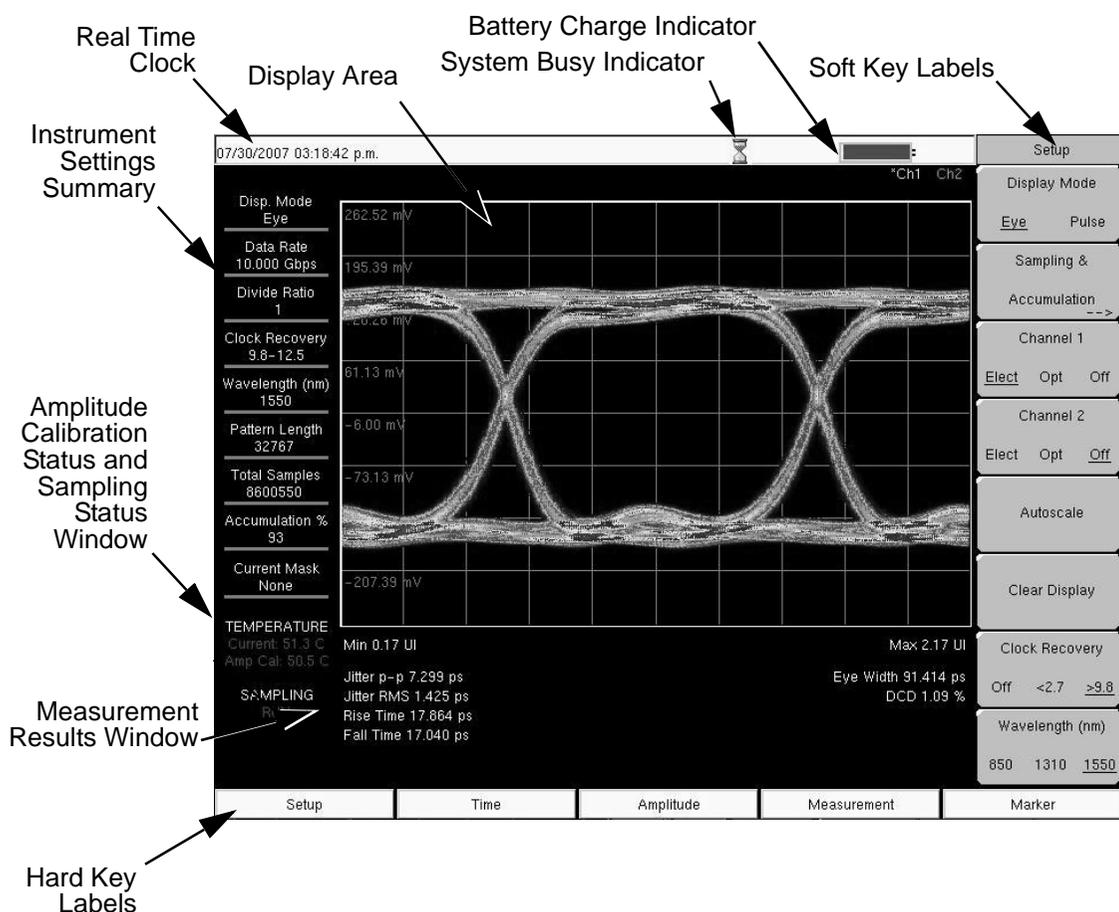

Figure 2-3. MP1026A Display Overview

2-5   Test Panel Connectors

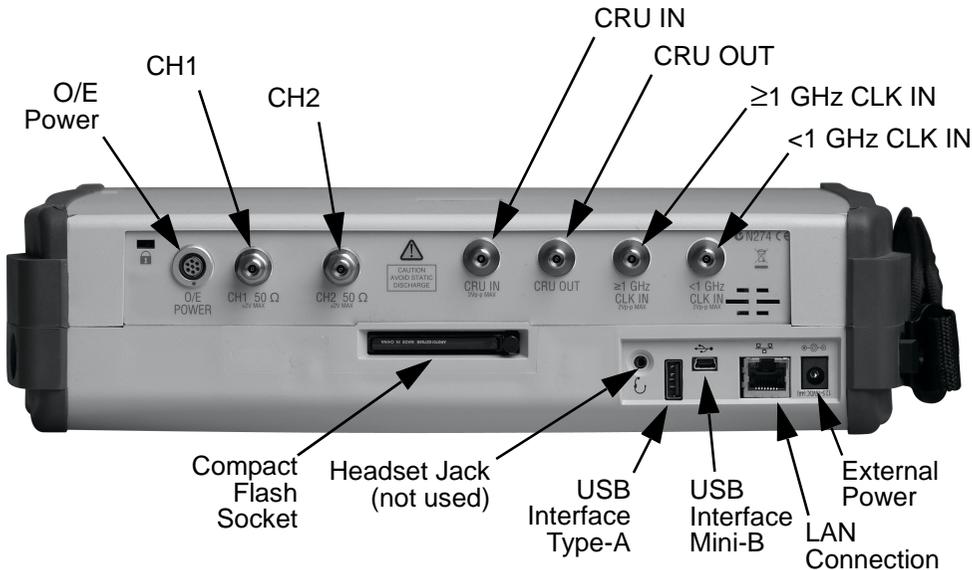The connectors and indicators located on the test panel are shown in Figure 2-4 and are described below.

Figure 2-4.   Test Panel Connectors

External Power

The external power connector is used to power the unit and for battery charging. Input is 12 to 15 Vdc at up to 5.0A. A green flashing indicator light near the power switch shows that the instrument battery is being charged by the external charging unit. The indicator is steadily illuminated when the battery is fully charged.

Warning: When using the AC-DC Adapter, always use a three-wire power cable connected to a three-wire power line outlet. If power is supplied without grounding the equipment in this manner, there is a risk of receiving a severe or fatal electric shock.

LAN Connections

The RJ-45 connector is used to connect the Bit Master to a local area network. Integrated into this connector are two LEDs. The amber LED indicates the presence of LAN voltages—a live LAN connection—while the green LED flashes to show that LAN traffic is present. The instrument IP address is set by pressing the **Shift** key, then the **System** (8) key followed by the System Options soft key and the Ethernet Config soft key. The instrument Ethernet address can be set automatically using DHCP, or manually by entering the desired IP address, gateway address and subnet mask.

Dynamic Host Configuration Protocol (DHCP) is an Internet protocol that automates the process of setting IP addresses for devices that use TCP/IP, and is the most common method of configuring a device for network use. To determine if a network is set up for DHCP, connect the MP1026A to the network and select DHCP protocol in the Ethernet Config menu.

Turn the Bit Master off, and then on. If the network is set up for DHCP, the assigned IP address should be displayed briefly after the power up sequence.

To display the IP address with the instrument on, press the **Shift** key, then the **System** key, then the System Options soft key and the Ethernet Config soft key. The IP address will be displayed as shown in Figure 2-5. For more information about DHCP, refer to Appendix B, "More About DHCP".
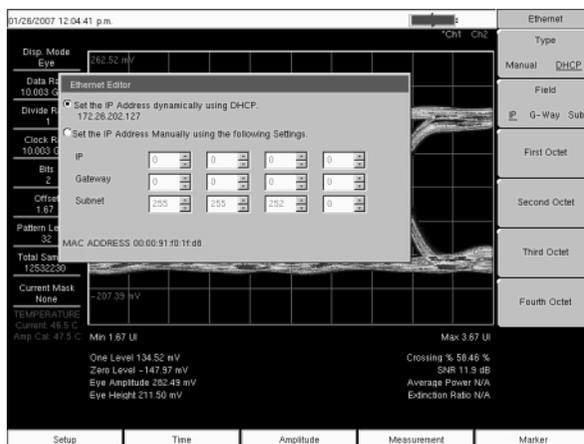
Figure 2-5.   IP Address Assigned Using DHCP

USB Interface, Type Mini-B

The USB 2.0 Mini-B device connector can be used to connect the MP1026A Bit Master directly to a PC. The first time the MP1026A is connected to a PC, the normal USB device detection by the computer operating system will take place. The CD-ROM shipped with the instrument contains a driver for Windows 2000, Windows XP and Windows Vista that is installed when Master Software Tools is installed. Drivers are not available for earlier versions of the Windows operating system. During the driver installation process, place the CD-ROM in the computer drive and specify that the installation wizard should search the CD-ROM for the driver.

Note: For proper detection, Master Software Tools should be installed on the PC prior to connecting the Bit Master to the USB port.

USB Interface, Type-A

The Bit Master can also be a USB Host (via the Type-A connector) and allow various USB Flash Memory devices to be connected to the instrument for storing measurements, setups, etc. It can not be used to connect to other devices such as printers or mass storage devices.

Headset Jack

The headset jack is not currently used in the Bit Master.

O/E Power

This 7-pin DC connector provides the interface for the external O/E module. This interface is active only with Option 003.

CH1

CH1 is the electrical input port for channel 1. It uses a type K-female connector.

CH2

CH2 is the electrical input port for channel 2. It uses a type K-female connector.

CRU IN

CRU IN is the input port to the optional Clock Recovery Unit (CRU), available with Option 002. It uses a type K-female connector.

CRU OUT

CRU OUT is the output port of the optional Clock Recovery Unit (CRU). When a data signal is applied to CRU IN (within the available CRU clock rate bands), the recovered clock signal is generated and output via this type K-female connector. A coaxial loop cable must connect this port to one of the two input clock ports below for the recovered clock to be used by the Bit Master.

$\geq$1 GHz CLK IN

This type K-female connector accepts clock signals greater than or equal to 1 GHz.

$<$1 GHz CLK IN

This type K-female connector accepts clock signals less than 1 GHz.

Compact Flash

Accepts a 256 MB Compact Flash Memory Module, Anritsu Part Number 3-2000-1500 or other commercially available equivalent. The contents of the internal memory can be copied to and from a removable Compact Flash card. The flash card can be any size, although it must be a minimum of 256 MB to be able to hold the entire contents of the internal flash memory.

2-6   Symbols and Indicators

The following symbols and indicators convey the instrument status or condition on the display.

Battery Symbol:

The battery symbol above the display (Figure 2-6) indicates the charge remaining in the battery. The colored section inside the symbol changes size and color with the charge level.

Figure 2-6.   Battery Charge Indicator

Green: Battery is 30 to 100% charged
Yellow: Battery is 10 to 30% charged
Red: Battery 0 to 10% charged

When the battery is charging, either from the AC-DC Adapter (40-168) or the 12 Volt DC adapter (806-141), the symbol will change as shown in Figure 2-7:
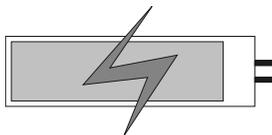
Figure 2-7.   Battery Charging Indicator

The Battery Charge LED will flash when the battery is charging, and remain on steady when the battery is fully charged.

Note: Use only Anritsu approved batteries, adapters and chargers with this instrument.

2-7   Self Test

At turn on, the Bit Master runs through a series of quick checks to ensure the system is functioning properly. The System self test runs a series of test related to the instrument.

If the self test fails, and the battery is fully charged, and the Bit Master is within the specified operating temperature range, contact your Anritsu Service Center.

To initiate a self test when the system is already powered up:

1. Press the **Shift** key and then the **System** (8) key.

2. Select the Self Test soft key. The Self Test results will be displayed.

3. Press the **Esc** key to continue.

Chapter 3 — Making Connections

3-1   Introduction

This chapter provides information on the various connections necessary before making measurements with the MP1026A Bit Master. The connections depend on the input signal type and the availability of a synchronized clock. After making the connections, proceed to Chapter 4 for additional software setup steps to begin making measurements.

3-2   Connections Overview

In general, the MP1026A Bit Master requires that the input signal be synchronized with a clock. If the clock is not available, then the optional clock recovery feature can be used to extract the clock from the signal. The following five setup configurations are available for making measurements with Bit Master:

- Electrical Data and Electrical Clock
- Electrical Data and Clock Recovery
- Optical Data and Electrical Clock
- Optical Data and Clock Recovery
- Alternative O/E Module Setup Configuration.

Choose the correct setup for the application by identifying whether the measurement type is electrical or optical, usually a function of the output type of the Device-Under-Test (DUT). If the DUT output type is electrical (for example, a K-connector) then directly connect the DUT output to CH1 or CH2 of the Bit Master. For a DUT with an optical output, connect the DUT output to the optional external O/E module Flat Connector (FC) input and then connect the O/E module to either CH1 or CH2 of the Bit Master. Additional connections are necessary when using the external O/E module.

If a synchronized clock is conveniently available, connect it to one of the two CLK IN Connectors on the MP1026A Bit Master. Clock signals that are ≥1 GHz (typically, full data rate clocks) should be connected to the ≥1 GHz CLK IN port.

Clock signals that are <1 GHz (typically, divided clock signals) should be connected to the <1 GHz CLK IN port. Additional connections are necessary when using the optional Internal Clock Recovery feature.

3-3   Electrical Data and Electrical Clock

When the DUT output is electrical and a clock is conveniently available, connect the instrument as shown in Figure 3-1.
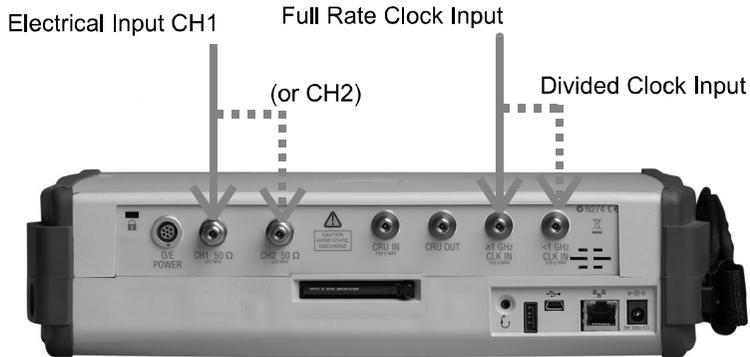
Figure 3-1.   Making connections using electrical data and electrical clock.

Note: Be careful to check that the input signal levels do not damage the Bit Master. CH1 and CH2 damage levels are ±2V. The CRU IN and Clock input damage levels are 2 V_{p-p}. The optimum signal level for measurements into CH1 and CH2 are ±0.4V or less. The use of a fixed 20 dB attenuator can provide protection from excessive signal levels from a DUT.

To make electrical measurements with the MP1026A:

1. Connect the DUT output electrical signal directly to the CH1 (or CH2) input port on the MP1026A.

2. Connect the available electrical clock to the appropriate CLK IN port (depending on the frequency of the clock signal).

Once the proper electrical connections have been made, proceed to Chapter 4 for the additional software setup steps to begin making measurements.

3-4   Electrical Data and Clock Recovery

When the DUT output is electrical, but a clock is not conveniently available, use an external power splitter and the connections shown in Figure 3-2 for measurements. In this setup the clock rate is the same as data rate.

Figure 3-2.   Making connections using electrical data and clock recovery.

> **Note:** Be careful to check that the input signal levels do not damage the Bit Master. CH1 and CH2 damage levels are ±2V. The CRU IN and Clock input damage levels are 2 V_{p-p}. The optimum signal level for measurements into CH1 and CH2 are ±0.4V or less. The use of a fixed 20 dB attenuator can provide protection from excessive signal levels from a DUT.
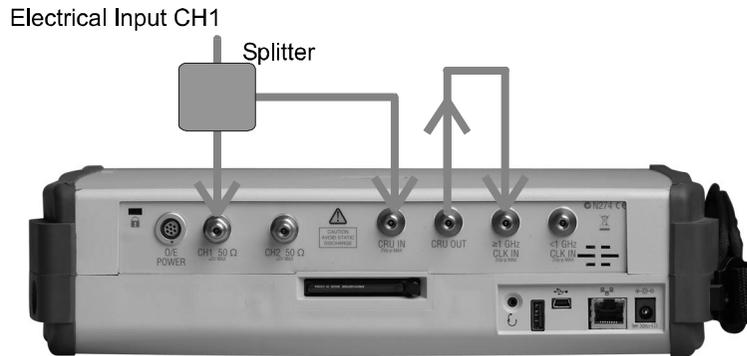
When configured with Option 2, the MP1026A can extract a clock signal from a pulse pattern if the data rate is within the 0.1 to 2.7 GHz or 9.8 to 12.5 GHz frequency bands. Connect a portion of the pulse pattern to the CRU IN and connect a cable between the CRU OUT port and the appropriate CLK IN port (depending on the frequency of the clock signal).

To make electrical measurements with the MP1026A (with Option 2):

   1. Connect the DUT Output to a splitter.

   2. Connect one of the splitter outputs directly to the CH1 (or CH2) input port on the MP1026A.

   3. Connect the other splitter output to the CRU IN port on the MP1026A to extract the clock from the electrical signal.

   4. Connect a cable between the CRU OUT port and the appropriate CLK IN port (depending on the frequency of the clock signal).

With the MP1026A Bit Master hardware setup connections properly configured for the application, proceed to Chapter 4 for the additional software setup steps to begin making measurements.

3-5 Optical Data and Electrical Clock

When the DUT output is optical and an electrical clock is conveniently available, use the connections shown in Figure 3-3 for measurements. The clock rate can be either full rate or divided and must be connected to the proper clock input connector.
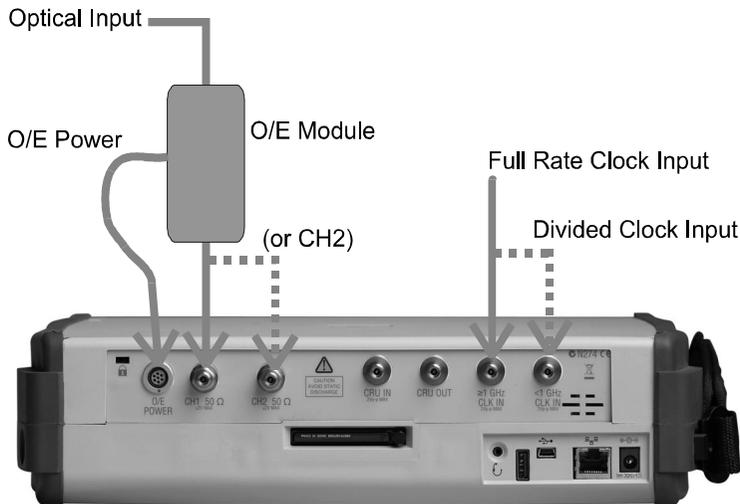
Figure 3-3.   Making connections using optical data and electrical clock.

> **Note:** Be careful to check that the input signal levels do not damage the Bit Master. CH1 and CH2 damage levels are ±2V. The CRU IN and Clock input damage levels are 2 V_{p-p}. The optimum signal level for measurements into CH1 and CH2 are ±0.4V or less. The use of a fixed 20 dB attenuator can provide protection from excessive signal levels from a DUT.
>
> Connect the O/E module to the Bit Master and set the appropriate channel to Optical before connecting any optical signals to the O/E module. This sequence protects the O/E module from possible damage due to high optical signal levels.

To make optical measurements with the MP1026A (with Option 3):

1. Connect the electrical output port of the external O/E module to the CH1 (or CH2) input port on the MP1026A.

2. Connect the DC power cable between the O/E POWER output on the MP1026A and the power input connector on the O/E module.

3. Connect the available electrical clock to the appropriate CLK IN port (depending on the frequency of the clock signal).

4. For optimum performance, terminate the unused AUX OUTPUT port of the O/E module with a 50 ohm termination.

With the MP1026A Bit Master hardware setup connections properly configured for the application, proceed to Chapter 4 for the additional software setup steps to begin making measurements.

3-6   Optical Data and Clock Recovery

When the DUT output is optical, but a clock is not conveniently available, use the connections shown in Figure 3-4 for measurements. In this setup, the clock rate is the same as data rate.
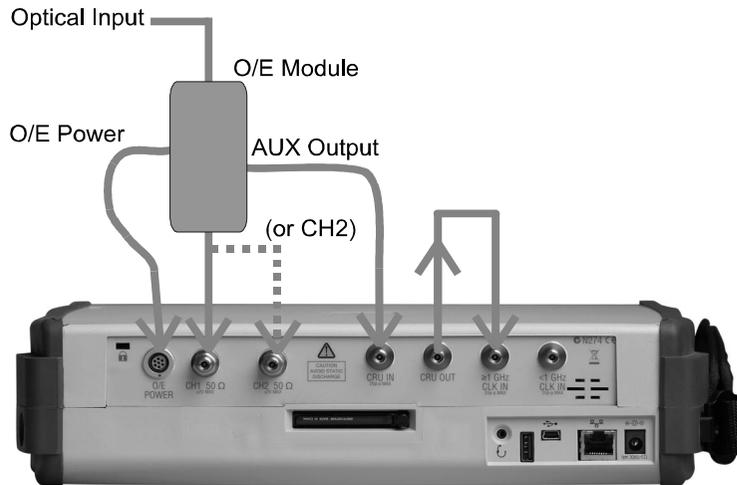
Figure 3-4.   Making connections using optical data and clock recovery.

> **Note:** Be careful to check that the input signal levels do not damage the Bit Master. CH1 and CH2 damage levels are ±2V. The CRU IN and Clock input damage levels are 2 V_{p-p}. The optimum signal level for measurements into CH1 and CH2 are ±0.4V or less. The use of a fixed 20 dB attenuator can provide protection from excessive signal levels from a DUT.
>
> Connect the O/E module to the Bit Master and set the appropriate channel to Optical before connecting any optical signals to the O/E module. This sequence protects the O/E module from possible damage due to high optical signal levels.

When configured with Option 2, the MP1026A can extract a clock signal from a pulse pattern if the data rate is within the 0.1 to 2.7 GHz or 9.8 to 12.5 GHz frequency bands. Connect the AUX output from the optical module to CRU IN and connect a cable between the CRU OUT port and the appropriate CLK IN port (depending on the frequency of the clock signal).

To make optical measurements with the MP1026A (with Options 2 and 3):

1. Connect the electrical output port of the external O/E module to the CH1 (or CH2) input port on the MP1026A.

2. Connect the DC power cable between the O/E POWER output on the MP1026A and the POWER input connector on the O/E module.

3. Extract the clock from the optical signal by connecting the AUX OUTPUT port of the O/E module to the CRU IN port on the MP1026A.

4. Connect a cable between the CRU OUT port and the appropriate CLK IN port (depending on the frequency of the clock signal).

With the MP1026A Bit Master hardware setup connections properly configured for the application, proceed to Chapter 4 for the additional software setup steps to begin making measurements.

3-7   Alternative O/E Module Setup Configuration

The previous optical setups offer convenient mobility for conducting measurements anytime, anywhere. An alternative approach to conducting optical measurements is shown in Figure 3-5.
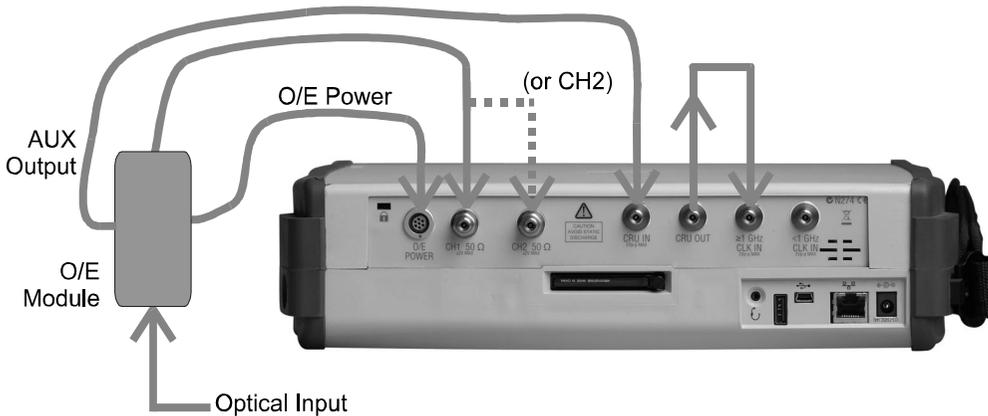
Figure 3-5.   Alternative O/E Module Setup Configuration (using additional cables not provided).

In this setup, two additional cables (not provided) are used to position the O/E module more conveniently at the side of Bit Master. The original DC power cable must still be used and limits how far the O/E module can be positioned away from the Bit Master.

Chapter 4 — Measurements

4-1 Introduction

This chapter provides information on making measurements with the MP1026A Bit Master. The chapter covers all of the system settings as well as the different measurement settings. The available soft key menus are presented at the end of the chapter with a description of each function.

4-2 Making Eye Pattern Measurements

To make an eye pattern measurement, use the SETUP menu to set the appropriate channel(s) to electrical or optical (depending on the input signal type). Channel 1 and Channel 2 can be set independently of each other. Set the display mode to Eye. Set the Clock Recovery to one of the two available bands, <2.7 or >9.8, if a clock is not available.

In the TIME menu, the Clock Rate must be set to the value of the clock input into the Bit Master. Either the Data Rate and Divide Ratio or the Clock Rate and Divide Ratio must be entered. The third parameter that is not entered will be calculated.

The Clock Rate is equal to the Data Rate divided by the Divide Ratio. The Clock Rate can also be acquired by the Bit Master. In that case, the Data Rate parameter is calculated based on the entered Divide Ratio. For example, for a 10.3125 Gbps data rate with a 10.3125/16 or 0.645 GHz clock rate, the user can enter the Data Rate of 10.3125 Gbps and a Divide Ratio of 16. The Bit Master will then calculate the Clock Rate to be 0.645 GHz. Alternatively, the user can enter the Clock rate of 0.645 GHz (or have it acquired automatically) and can enter a Divide Ratio of 16 and have the Bit Master calculate the Data Rate parameter.

Before proceeding to make measurements, the Eye Pattern display must be scaled correctly so that the eye is centered on the screen. The simplest way to do that is to execute the Autoscale feature under the Setup menu. Autoscale will acquire the clock rate, set the time offset, and set the amplitude scale and offset in order to center the eye in the display. Before executing Autoscale, the Divide Ratio must be set correctly to insure that the Data Rate value is correct.

The offset and scale values can also be set manually. The time offset can be changed in the TIME menu. The amplitude scale and offset values for each channel can be modified in the AMPLITUDE menu. For eye pattern measurements, two eyes must be displayed; therefore, the number of bits must be set to 2.

Note: The time axis scale can be set to either pico-seconds (ps) or Unit Intervals (UI), which is basically the number of bits. The amplitude axis scale is in Volts for an electrical signal and in Watts for an optical signal.

Before proceeding to make measurements, the sample accumulation limit must be set, using the SAMPLING & ACCUMULATION submenu. The Bit Master continuously samples the incoming data and uses one of three different ways of accumulating the data before displaying them:

- The default setting is for no accumulation, in which case the display is cleared and updated with every new set of sampled data.

- When set to infinite, the sampled data are accumulated indefinitely (or until sampling is halted by the user) and the data persist on the screen until the screen is cleared.
- The accumulation limits method allows the setting of a limit which, when exceeded, automatically halts the sampling and holds the persistence of the data that is already on the display. The limit can be based on time (stop sampling after a set number of seconds) or number of samples (set in millions of samples).

In addition to being able to stop the sampling using the accumulation limits method, the sampling status can also be manually changed from Run to Hold using the Sampling Status soft key.

Once the accumulation limits are set, the MP1026A is now ready to make measurements. Even though measurements can be made on the displayed data while the instrument is still sampling, it is better to set the sampling status to Hold before making measurements. Doing so ensures that any drift or changes in the test setup do not corrupt the displayed data while measurements are underway.

With the accumulation settings completed, measurements can be made on the displayed data Under the MEASUREMENT menu, enable either the time or amplitude measurements to view statistical data related to the time axis or amplitude axis, respectively. These measurements include standard statistical measurements performed on eye patterns. Some of the amplitude measurements only apply to optical measurements. For custom measurements, a histogram window can be set to measure the mean and standard deviation of specific portions of the data. Finally, for compliance-type testing, mask measurements could be made on the eye pattern. For more details on the measurements available, see Chapter 4.

In addition to the measurement capabilities, X-axis and Y-axis markers can be used to measure the location and the distance between any two points on the display. The MARKER menu allows each marker to be turned on or off independently. The location of each marker and the distance between the two markers in each plane are displayed at the top of the screen.

Problems that show up in eye pattern displays can sometimes be analyzed by looking at the data in pulse pattern mode. The next section describes how to set up the MP1026A for these measurements.

Figure 4-1 shows a typical eye pattern measurement with no accumulation. The amplitude statistical measurements for the active channel (Ch1) are displayed in the measurement results window.
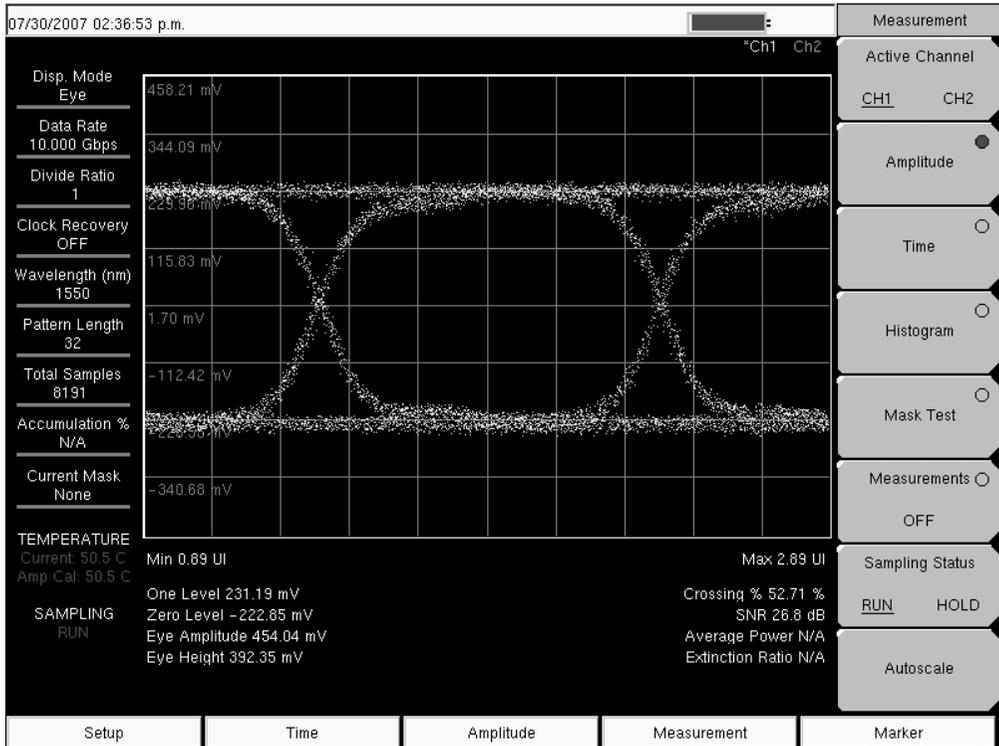

Figure 4-1.   Eye pattern measurement display with no accumulation.

Figure 4-2 shows a typical eye pattern measurement with infinite accumulation and a mask measurement. The total number of samples and the number of failed samples are displayed in the measurement results window.
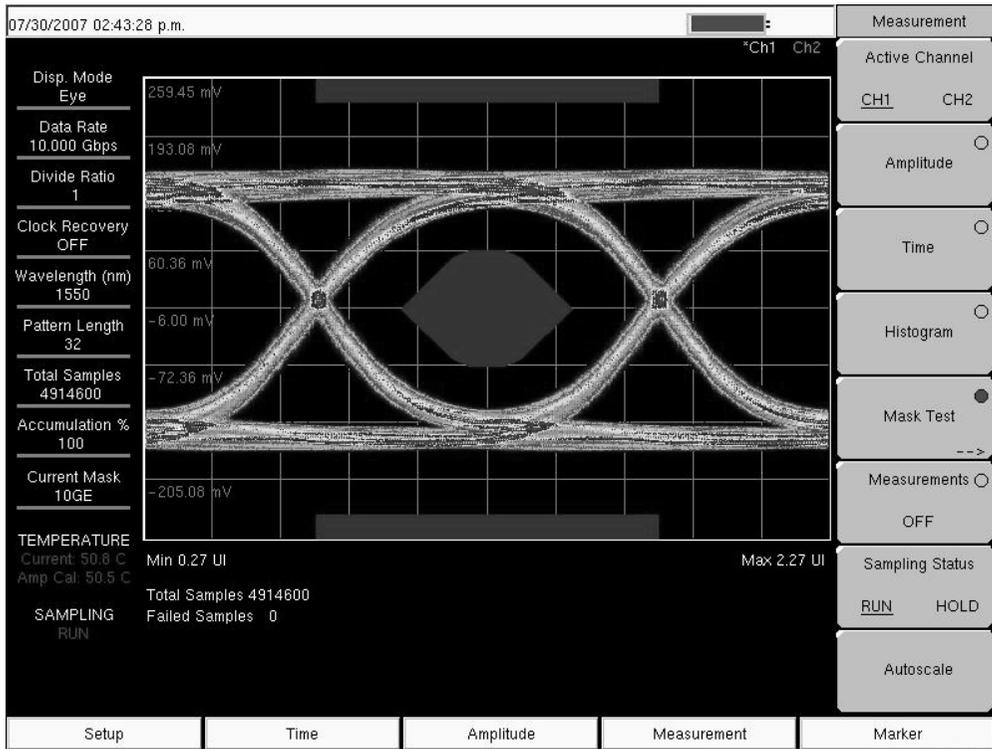
Figure 4-2.   Eye pattern display with infinite accumulation and a mask measurement.

4-3   Making Pulse Pattern Measurements

The MP1026A can display the data as a pulse pattern. To be displayed correctly, however, the length of the pattern must be known exactly.

As with the eye pattern setup, set the channels to either electrical or optical. Enter to the correct clock rate or acquire the clock. In the SETUP menu, set the Display Mode to Pulse.

Under the TIME menu, enter the total length of the pulse pattern. For example, for a 2^{15} - 1 PRBS pattern, enter the total length of 32767. If the number of bits is not set correctly, the pattern displayed on the screen will not be a pulse pattern (it will look like an eye pattern).

Set the number of bits to display and the offset (in bits) to view a particular pulse sequence. For example, to view the bits 131 to 145 of a particular pattern, set the number of bits to 15 and set the offset to 131.

The autoscale feature is not available in pulse mode. Set the amplitude scale and offset manually to optimize the pulse pattern display on the screen.

> **Note:** The Bit Masters supports pattern lengths up to 65536.

The standard eye-pattern time and amplitude measurements are also not available in pulse mode. Histograms, masks, and markers can be used to make measurements and to analyze the pulse pattern.

Figure 4-3 shows a Pulse Pattern display with histogram measurements on the time axis of the active channel (Ch1). The mean, standard deviation, and the peak-to-peak values of the data in the histogram window are displayed in the measurement results window.
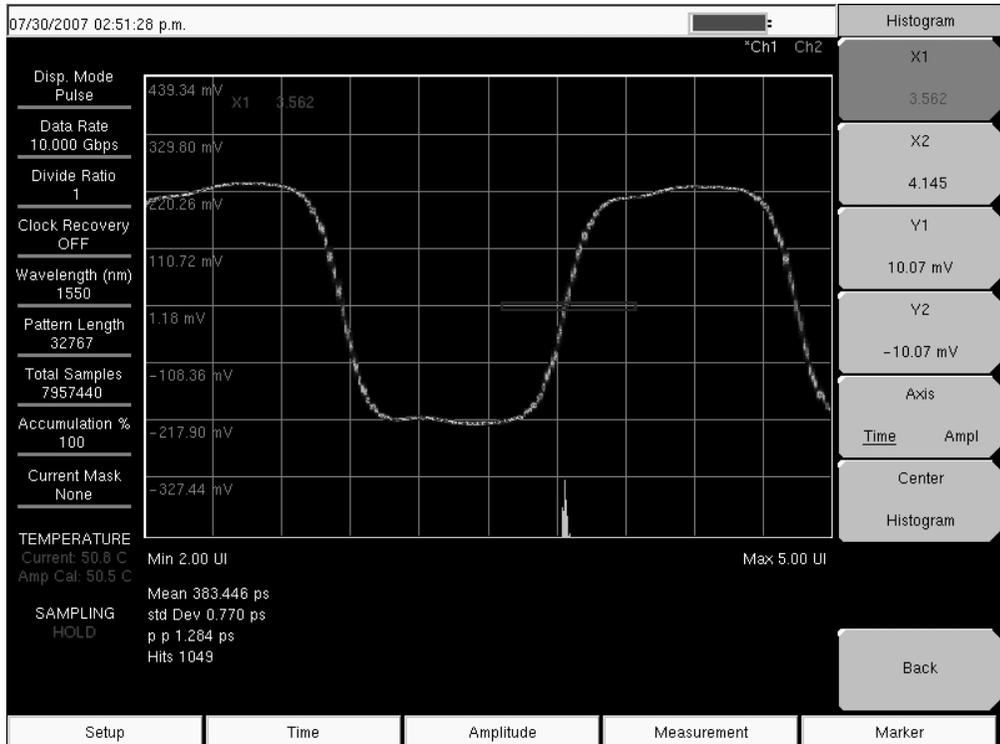
Figure 4-3.   Pulse pattern display with a histogram measurement.

Another example of pulse pattern measurements is shown in Figure 4-4. This measurement shows a two channel overlay.
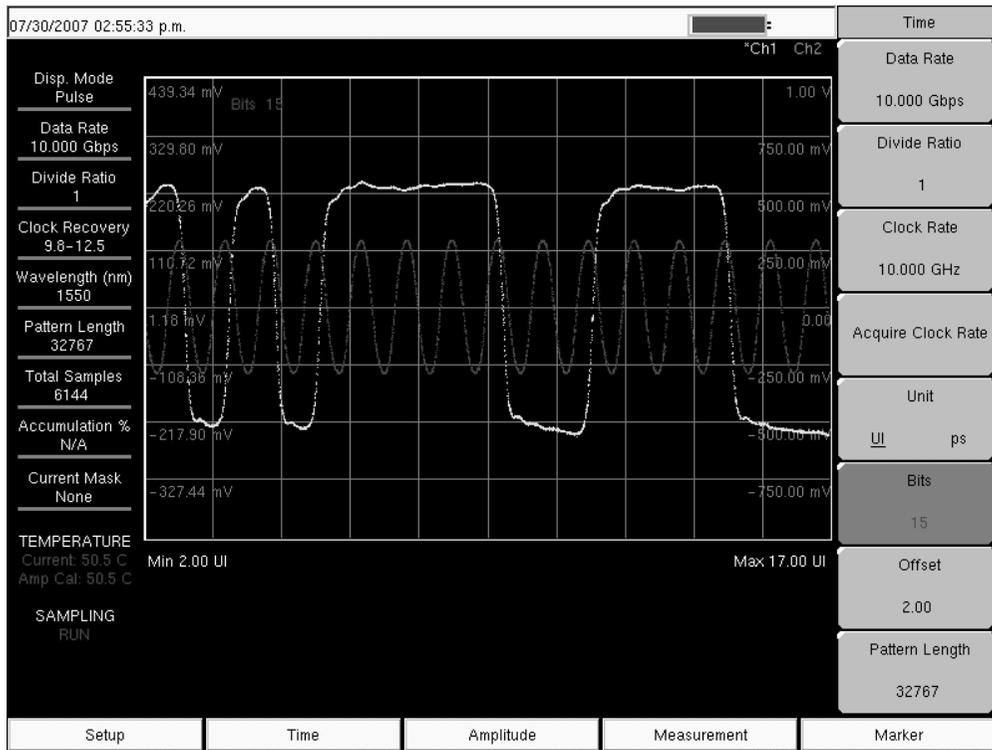
Figure 4-4.   Two channel pulse pattern display.

4-4   User Calibrations

The MP1026A Bit Master uses internal calibration coefficients to ensure amplitude accuracy of measurements over the full range of input voltages. It is recommended that these coefficients be routinely updated, especially when the operating temperature conditions change.

Calibrate Amplitude

To help identify when to perform an amplitude calibration, the Bit Master displays the current instrument temperature as well as the temperature at the last amplitude calibration at the bottom of the Settings Summary window (Figure 4-4). When the difference between the current and calibration temperature values is small, the displayed values are shown in green, indicating that the amplitude calibration does not require an update. As the difference in temperatures grows, the display for the calibration temperatures turns yellow to indicate that the instrument may require a calibration soon. When the temperature difference grows further, the calibration temperature is displayed in red to indicate that a new amplitude calibration is recommended. If there is no temperature display for the amplitude calibration (N/A may be displayed) then the calibration may be invalid and a new calibration should be initiated.

The amplitude accuracy specifications of the Bit Master are only guaranteed after a calibration has been performed.

The calibration can be initiated via the CALIBRATE menu (Shift-2). All input data and clock signals must be turned off before starting the calibration, otherwise the calibration may fail or may produce corrupted coefficients. The calibration process, which updates the coefficients for both input channels, takes less than one minute to complete.

Note: For the Amplitude calibration to be most effective, enter the actual clock rate and data rate values into the Bit Master before starting the calibration. This allows the Bit Master to optimize the amplitude calibration for those specific rates. The calibration will still be valid even if the clock and data rates are not entered correctly. However, to maximize the accuracy of certain measurements, such as the extinction ratio, this optimization step is very critical.

Calibrate O/E Module

The O/E module can be calibrated to ensure that optical measurements remain accurate with changing operating conditions.There are two types of calibrations that are performed as part of the O/E module calibration: power meter and dark level. For both these calibrations, the O/E module must remain powered up and connected to the MP1026A, but no input optical signal can be present. Note that to power up the O/E module, one of the channels in the MP1026A must be set to optical

The O/E module calibration can be initiated via the CALIBRATE O/E MODULE soft key in the CALIBRATE menu (Shift-2). It is recommended that the O/E module calibration be performed just before a measurement is made in order to ensure that the optical measurements made by the Bit Master remain accurate.

a) Power Meter Calibration

The first step of the O/E module calibration is the power meter calibration. The O/E module can be used to measure the average power of the input optical signal. The power is calculated by dividing the DC current from the photo-diode by its responsivity value. To maximize the accuracy of this measurement for various operating temperature conditions, the current meter used in measuring the photo-current must be calibrated over a range of input current values. This calibration step is performed first during the O/E module calibration and a "cal passed" message is displayed once this part of the calibration is successfully completed.

b) Dark Level Calibration

The second step of the O/E module calibration is the dark level calibration. The O/E module used with the Bit Master is calibrated in the factory to remove the effect of residual dark level currents. These currents, which are present with no optical input into the O/E module, may produce an offset in the zero level of the input data signal. With the factory calibration, the effect of the dark level currents is minimized. However, with time or with changes in the operating temperature of the O/E module, the effect of these dark level currents may become more noticeable requiring that they be calibrated out. The second step in the O/E module calibration performs this dark level calibration and a "cal passed" message is displayed once it is successfully completed.

O/E Module Responsivity and Conversion Gain

The conversion gain parameter (volts/watt) of the O/E module is used to calculate the optical input power level (in watts) from the measured electrical output of the module (in volts). This conversion gain parameter takes into account the gain of the entire O/E chain including the photo-diode and transimpedance amplifier (TIA). The responsivity parameter (amps/watt) is used to calculate the optical input power level (in watts) from the DC current in the photo-diode (in amps). The MP1026A uses the photo-diode current and the responsivity parameter to calculate the average optical power of the input signal. All other statistical optical measurements are derived from the optical eye pattern data, which are equal to the electrical eye pattern data (the sampled electrical output of the O/E module in volts) divided by the conversion gain parameter.

When using the Anritsu O/E module, the conversion gain and responsivity values of the module are read directly from the module's internal memory into the MP1026A. This process occurs when a module is connected to the MP1026A and a channel is set to optical. These values are adjusted based on the wavelength of the input signal (as set in the SETUP menu). The conversion gain and responsivity values can be adjusted in the CALIBRATE menu. This should only be necessary if a non-Anritsu O/E module is used with the MP1026A.

4-5 Menu Structure

This section describes the keys available on the front panel of the Bit Master and their functions.

> **Note:** The following hard keys, available on the front panel, are not used in the Bit Master: Sweep (3), Measure (4), Trace (5), Limit (6), and Mode (9).

Setup Menu

To select the Setup menu, press the **SETUP** hard key.

Setup
Display Mode Eye   _Pulse_
Sampling & Accumulation -->
Channel 1 _Elect_ Opt Off
Channel 2 _Elect_ Opt Off
AutoScale
Clear Display
Clock Recovery _Off_ <2.7 >9.8
Wavelength (nm) 850 1310 _1550_

Display Mode: Use this button to select the display mode, which can be either an Eye Pattern or a Pulse Pattern mode. In Eye pattern mode, the Bit Master will generate an eye pattern display from the input pulse pattern. This eye pattern is used to perform different measurements such as mask compliance, statistical analysis, or histogram measurements. In Pulse pattern mode, the individual bits of the pulse pattern are displayed. The pattern must be a repeating pattern of a known length (the pattern length must be entered in the Time menu). The selected mode is underlined in the button window.

Sampling & Accumulation: Pressing this button selects the Sampling & Accumulation Submenu. See the **Sampling & Accumulation Submenu** on page 4-11.

Channel 1: Channel 1 can be set either as an Electrical channel, an Optical channel, or can be turned Off . The Optical channel option is only available with Option 003.

Channel 2: Channel 2 can be set either as an Electrical channel, an Optical channel, or turns it Off. The Optical channel option is only available with Option 003.

AutoScale: The Eye pattern display must be centered in the screen in order for the Bit Master to make the correct measurements on the data. The Autoscale button re-scales the display to the proper amplitude ("one" level two gridlines above center of grid, "zero" level two gridlines below center of grid). Also the Autoscale button centers the eye horizontally on the screen (there are a total of two eyes displayed – one in the middle, a half of an eye to the left of the central eye and a half of an eye to the right of the central eye). If the Bit Master sampling status is set to Hold, initiating the AutoScale routine will automatically set the sampling status to Run before proceeding with adjusting the scale.

Figure 4-5. Setup Menu (1 of 2)

Setup
Display Mode Eye   <u>Pulse</u>
Sampling & Accumulation -->
Channel 1 <u>Elect</u> Opt   Off
Channel 2 <u>Elect</u> Opt   Off
AutoScale
Clear Display
Clock Recovery <u>Off</u> <2.7 >9.8
Wavelength (nm) 850 1310 <u>1550</u>

Clear Display: The Clear Display button clears the data and refreshes the display. This is most useful when the accumulation level is set to infinite.

Clock Recovery: The Clock Recovery button allows the selection of the settings of the clock recovery function. The clock recovery can be set to the band < 2.7 (0.1-2.7 GHz), or the band of >9.8 (9.8 -12.5 GHz). The clock recovery function can also be turned Off. Choose the appropriate setting based on the data rate of the input data pattern. The < 2.7 and >9.8 choices are only available with Option 002.

Wavelength: When testing fiber optic outputs, select the corresponding wavelength so Bit Master can apply the proper conversion factors for the O/E module. See Shift-Calibrate for additional information on correction factors.

Figure 4-6.   Setup Menu (2 of 2)

Sampling & Accumulation Submenu

To select the Sampling & Accumulation Submenu, select the Sampling & Accumulation soft key.

Accumulation	
Sampling Status <u>RUN</u> HOLD	**Sampling Status:** Pressing this soft key sets the status of data sampling to either RUN (default) or HOLD. When RUN is selected, the screen is cleared and the sampling and display of data is started. When HOLD is selected, sampling is halted and the last data shown on the screen are kept so that measurements and markers can be used on the data. Parameter changes can be made while on HOLD, however, most parameter changes (such as changing scale or channel type) will cause the data on the screen to be lost and the screen cleared. Functions and parameter changes that can be executed while in HOLD without causing the data on the screen to be lost are:
No ○ Accumulation	
Infinite ○ Accumulation	Wavelength Active Channel Measurement Setting (Amplitude, Time, Histogram, Mask Test, Off)
Limited ◉ Accumulation	All Marker Functions Responsivity Conversion Gain Calibrate Amplitude
Limit Type <u>Time</u> Sample	Calibrate O/E Module Save Measurement Save Setup Save Screen as JPG
Time Limit (sec) 60	With any of these changes, the Sampling Status remains in HOLD. Once the status is changed to RUN, sampling restarts using the newly changed parameter values. If AutoScale is selected while the Bit Master is in HOLD, the sampling status automatically switches to RUN before the AutoScale function is executed. A sampling status indicator is shown in the bottom left hand corner of the display.
Sample Limit (million) 10	
Back <--	

No Accumulation: With this setting, the data are not accumulated on the display but are refreshed with every new set of samples. With this setting, there is no data persistence on the display.

Infinite Accumulation: With this setting, the data are accumulated indefinitely on the display, and there is infinite persistence on the display.

Limited Accumulation: With this setting, the data are accumulated on the display until a limit is exceeded. The limit is set using the Limit Type, Time Limit, and Sample Limit soft keys. Once the limit is exceeded, the Sampling Status is switched to HOLD. There is an Accumulation % indicator on the left side of the display that indicates the % reached towards the limit.

Figure 4-7.   Sampling & Accumulation Submenu (1 of 2)

Accumulation	
Sampling Status RUN HOLD	
No ○ Accumulation	
Infinite ○ Accumulation	
Limited ◉ Accumulation	
Limit Type Time Sample	**Limit Type:** This soft key selects the limit type, either TIME (default) or SAMPLE, that determines which limit is used to stop the accumulation when Limited Accumulation is set. The limit values used are set by the next two soft keys.
Time Limit (sec) 60	**Time Limit:** This soft key sets the value of the Time Limit, in seconds, when Limited Accumulation is selected and the Limit Type is set to Time.
Sample Limit (million) 10	**Samples Limit:** This soft key sets the value of the Samples Limit, in units of millions of samples, when Limited Accumulation is selected and the Limit Type is set to Sample.
Back <—	**Back:** Returns to the SETUP menu

Figure 4-8. Sampling & Accumulation Submenu (2 of 2)

Time Menu

To select the Time menu, press the **TIME** hard key.

Time	**Data Rate:** The data rate associated with the signal can be entered by the user. Whenever the data rate is changed, the clock rate value is recalculated. Alternatively, the data rate can be automatically calculated by entering the clock rate and divide ratio. The data rate is equal to the clock rate multiplied by the divide ratio.
Data Rate **10.000 Gbps**	
Divide Ratio **1**	**Divide Ratio:** Typically, the clock rate and the data rate are equal, in which case the clock divide ratio must be set to 1 (a ratio of 1/1), which is the default value. In some cases, only a low frequency divided clock is available from the device under test. If that is the case, the divider value must be entered using this button. The divider must be an integer (1/divider). For example, if the data rate is 10 Gbps and the available clock is only 156.25 MHz (1/64th of the data rate), then enter a divide ratio of 64. The user has a choice of entering either the data rate or clock rate before entering the divide ratio. The third parameter will be calculated. Pressing this button brings up a dialog box showing the current data rate, divide ratio, and clock rate values. The user can change the divide ratio and then must choose to recalculate either the clock or data rate. The recalculated value is displayed next to the current value. Press Enter to accept the changes and exit. Press Esc to keep the current settings.
Clock Rate **10.000 GHz**	
Acquire Clock Rate	
Unit <u>UI</u> ps	
Bits **2**	**Clock Rate:** Instead of entering a data rate and divide ratio and having the instrument calculate the clock rate, the (divided) clock rate can be entered directly using this button. Alternatively, the clock rate could be acquired by the instrument (see button description below). Whenever the clock rate is changed, the data rate value is recalculated.
Offset **0.00**	**Acquire Clock Rate:** This button initiates an internal frequency counter function that acquires the clock rate of the input signal. The returned result of this acquisition is displayed in the Clock Rate button window. Once the clock rate is determined, the divide ratio must be set correctly in order to have a correct data rate value.
Pattern Length **32**	

Figure 4-9. Time Menu (1 of 2)

Time
Data Rate   **10.000 Gbps**
Divide Ratio   **1**
Clock Rate   **10.000 GHz**
Acquire Clock Rate
Unit   **UI**   **ps**
Bits   **2**
Offset   **0.00**
Pattern Length   **32**

Unit: The units for the time axis can be selected using this button. The units can be either in ps or in UI. The ps mode uses units of picoseconds on the time axis. The UI mode uses unit intervals as the time axis unit. A unit interval is bit period.

Bits: Use this button to enter the number of bits displayed on the screen. The value entered must be an integer (1 to 100). For example, when the units setting is UI, setting the Bits value to 2 will generate a time axis of 0.00 UI to 2.00 UI (i.e. two bits or two unit intervals will be displayed). When the units setting is ps, the instrument will convert the period of the bits into time. For a 10 GHz data rate, the width of one bit is 100 ps. Therefore, for a Bits setting of 2, the time axis will have a minimum of 0 ps and a maximum of 200 ps.

Offset: Use this button to enter the amount of horizontal shift to apply to the display. This value can be a decimal value (i.e. fractional value of a bit). Using the example above, with the time axis having a minimum value of 0.00 UI (0 ps) and a maximum of 2.00 UI (200 ps), setting this offset to 1.5 will change the min/max values to 1.5 UI (150 ps) and 3.5 UI (350 ps), respectively. The offset value is always in units of UI or fractions of a bit.

Pattern Length: If the length of the input repeating pulse pattern is known, enter this value using this button. This value is needed to correctly display the pulse pattern data in Pulse mode. This value must be an integer.

Commonly used PRBS data rates are:

2^7-1 = 127
2^9-1 = 511
2^{10}-1 = 1023
2^{11}-1 = 2047
2^{15}-1 = 32767

Figure 4-10. Time Menu (2 of 2)

Amplitude Menu

To select the Amplitude menu, press the **AMPLITUDE** hard key.

Amplitude
Channel 1
<u>Elect</u> Opt Off
Scale
250.0 mV
Offset
25.0 mV
Attenuation
0.0 dB
Channel 2
<u>Elect</u> Opt Off
Scale
125.0 mV
Offset
-25.0 mV
Attenuation
0.0 dB

Channel 1: Use this button to set channel 1 to either have an electrical input (Elect), an optical input (Opt), or to be turned Off. The optical input is only available with option 003.

Scale: Use this button to set the scale of the amplitude axis for channel 1. When the channel is set to electrical, the scale will be in mV/div. When the channel is set to optical, the scale will be in µW/div.

Offset: Use this button to enter an offset to the amplitude axis for channel 1. This offset will be in mV when the channel is set to electrical and in µW when the channel is set to optical.

Attenuation: For input signals with amplitude levels greater than the Bit Master's specified input range, an external attenuator must be used at the input port. The value of the attenuator must be large enough to bring the amplitude level of the signal at channel 1 into the specified range. Enter the value of this attenuator in dB and the Bit Master automatically scales the amplitude to compensate for the external attenuation. For optical signals, the Bit Master scales the amplitude levels as well as the Average Power measurement. Note that if the attenuation level entered is wrong, then all the scales and measurements will be wrong.

Channel 2: Use this button to set channel 2 to either have an electrical input (Elect), an optical input (Opt), or to be turned off. The optical input is only available with option 003.

Scale: Use this button to set the scale of the amplitude axis for channel 2. When the channel is set to electrical, the scale will be in mV/div. When the channel is set to optical, the scale will be in µW/div.

Offset: Use this button to enter an offset to the amplitude axis for channel 2. This offset will be in mV when the channel is set to electrical and in µW when the channel is set to optical.

Attenuation: For input signals with amplitude levels greater than the Bit Master's specified input range, an external attenuator must be used at the input port. The value of the attenuator must be large enough to bring the amplitude level of the signal at channel 2 into the specified range. Enter the value of this attenuator in dB and the Bit Master automatically scales the amplitude to compensate for the external attenuation. For optical signals, the Bit Master scales the amplitude levels as well as the Average Power measurement. Note that if the attenuation level entered is wrong, then all the scales and measurements will be wrong.

Figure 4-11. Amplitude Menu

Measurement Menu

To select the Measurement menu, press the **MEASUREMENT** hard key.

Measurement
Active Channel
CH1   CH2
○ Amplitude
○ Time
○ Histogram -->
○ Mask -->
○ Measurements Off
Sampling Status
RUN   HOLD
Autoscale

Active Channel: All measurements in this menu can only be performed on one channel at a time. Use this button to set either CH1 or CH2 as the active channel. The active channel is identified by a "*" next to its name in the top right corner of the display. A channel must be set to either Electrical or Optical before it can be set to active (it cannot be off). If an active channel is turned off, then the measurement function will be set to OFF automatically.

Amplitude: Select this button to make eye pattern amplitude measurements on the active channel. The results of all the measurements will be shown in the measurement window at the bottom of the screen. The following amplitude measurements are performed on the data: One Level, Zero Level, Eye Amplitude, Eye Height, Crossing %, and SNR. For optical signals only, Average Power and Extinction Ratio are also performed. For accurate measurements, an autoscale must be performed on the data to center the eye in the middle of the screen.

Time: Select this button to make eye pattern time measurements on the active channel. The results of all the measurements will be shown in the measurement window at the bottom of the screen. The following time measurements are performed on the data: Jitter p-p, Jitter RMS, Rise Time, Fall Time, Eye Width, and Duty Cycle Distortion (DCD). For accurate measurements, an autoscale must be performed on the data to center the eye in the middle of the screen.

Histogram: Pressing the Histogram button selects the Histogram Submenu. See "Histogram Submenu" on page 4-18.

Masks: Pressing this button will turn on the mask measurement for the active channel using the mask file that was last selected from the list of available masks. To select a new mask, press the Mask key again and use the arrow keys or knob make the appropriate selection from the Mask Selector box. The number of masks listed and their order may vary because this list can be modified by the user via the Master Software Tools PC program. The mask test will display the total number of samples on the screen as well as the number of failed samples (those that fall in the masked or keep-out regions). This feature is most useful when Infinite Accumulation is selected. Use Clear Display to restart the Pass/Fail test.

Measurements Off: This button will turn off all measurements.

Figure 4-12. Measurement Menu (1 of 2)

Measurement

Active Channel

CH1   CH2

○
Amplitude

○
Time

○
Histogram
-->

○
Mask
-->

○
Measurements
Off

Sampling Status

RUN   HOLD

Autoscale

Sampling Status: Pressing this soft key sets the status of data sampling to either RUN (default) or HOLD. When RUN is selected, the screen is cleared and the sampling and display of data is started. When HOLD is selected, sampling is halted and the last data shown on the screen are kept so that measurements and markers can be used on the data.

AutoScale: The Eye pattern display must be centered in the screen in order for the Bit Master to make the correct measurements on the data. The Autoscale button re-scales the display to the proper amplitude ("one" level two gridlines above center of grid, "zero" level two gridlines below center of grid). Also the Autoscale button centers the eye horizontally on the screen (there are a total of two eyes displayed – one in the middle, a half of an eye to the left of the central eye and a half of an eye to the right of the central eye). If the Bit Master sampling status is set to Hold, initiating the AutoScale routine will automatically set the sampling status to Run before proceeding with adjusting the scale.

Figure 4-13. Measurement Menu (2 of 2)

Histogram Submenu

To select the Histogram submenu, press the **MEASUREMENT** hard key, and then select the Histogram submenu.

Histogram	
X1 4.500	**X1:** This button sets the value of the first x-axis coordinate for the histogram window. Edit the value using the numeric keypad or change the value using the arrow keys or knob.
X2 5.500	**X2:** This button sets the value of the second x-axis coordinate for the histogram window. Edit the value using the numeric keypad or change the value using the arrow keys or knob.
Y1 375.00 mV	**Y1:** This button sets the value of the first y-axis coordinate for the histogram window. Edit the value using the numeric keypad or change the value using the arrow keys or knob.
Y2 -375.00 mV	**Y2:** This button sets the value of the second y-axis coordinate for the histogram window. Edit the value using the numeric keypad or change the value using the arrow keys or knob.
Axis Time Ampl	**Axis:** Use this button to select the axis of the histogram window on which the actual histogram will be performed: Select Time to observe the histogram on the time portion of the window. Select Ampl to observe the histogram on the amplitude portion of window.
Center Histogram	**Center Histogram:** When the histogram measurement is turned on, depending on the previous settings, the X and Y coordinates of the histogram window may be set beyond the boundaries of the current display screen. Use this button to center the window in the middle of the screen. From this default location, it should be much easier to adjust the X and Y values as needed to zoom-in on the portion of the data to be measured.
Back <--	**Back:** Press this button to return to the measurement menu.

Figure 4-14. Histogram Submenu

Marker Menu

To select the Marker menu, press the **MARKER** hard key.

| Marker |
| Active Channel |
| <u>CH1</u>   CH2 |
| X1 |
| On   <u>Off</u> |
| X2 |
| On   <u>Off</u> |
| Y1 |
| On   <u>Off</u> |
| Y2 |
| On   <u>Off</u> |
| Center Markers |
| All Markers Off |

Active Channel: Use this button to set either CH1 or CH2 as the active channel for marker measurements (as well as all other measurements). The active channel is identified by a "*" next to its name in the top right corner of the display. A channel must be set to either Electrical or Optical before it can be set to active (it cannot be off). If an active channel is turned off, then the markers will be turned off automatically.

X1 and X2: The X1 and X2 buttons turn each x-axis marker on or off. Once the marker is on, the user can enter a value for the coordinate or can use the arrow keys and knob to adjust the current value. The location of each marker for the active channel is displayed at the top left of the screen. If both markers are on, then a delta (absolute value of the difference between X1 and X2) is also displayed.

Y1 and Y2: The Y1 and Y2 buttons turn each y-axis marker on or off. Once the marker is on, the user can enter a value for the coordinate or can use the arrow keys and knob to adjust the current value. The location of each marker for the active channel is displayed at the top left of the screen. If both markers are on, then a delta (absolute value of the difference between Y1 and Y2) is also displayed.

Center Makers: When the markers are turned on individually, depending on the previous settings, the X and Y marker coordinates may be set beyond the boundaries of the current display screen. Use this button to turn on all markers and have them centered in the middle of the current display screen. From this default location, it should be much easier to adjust the X and Y values as needed for extracting results.

All Markers Off: This button turns all markers off. This may be more convenient that turning off each marker individually.

Figure 4-15. Marker Menu

Calibrate Menu

To select the Calibrate menu, press the **Shift** hard key followed by the **Calibrate** (2) hard key.

Calibrate	**Calibrate Amplitude:** It is recommended that a user routinely update the Bit Master's internal amplitude calibration coefficients, especially when the operating temperature conditions change. The current temperature and the calibration temperature are both displayed and color coded to help indicate when to perform a new calibration (see Section 4-4, page 4-6). The calibration can be initiated by pressing this button. A dialog box will appear instructing the user to turn off or disconnect all input data and clock signals before starting the calibration; otherwise, the calibration will fail. Press **Enter** to continue. The calibration process, which updates the coefficients for both input channels, takes less than one minute to complete.

Calibrate

Amplitude

Calibrate
O/E
Module

Calibrate O/E Module: It is recommended that the O/E module be calibrated just before making a measurement to ensure that the optical measurements made by the Bit Master remain accurate with changing operating conditions. Power meter and dark level calibrations are performed as part of the O/E module calibration. See Section 4-4, on page 4-6.

Responsivity (A/W)

0.950

Responsivity (A/W): The responsivity value (Amps to Watts conversion ratio) displayed on this button is read automatically from the O/E module when it is connected to the Bit Master and a channel is set to optical. If an O/E module is not connected, a default value is displayed. A user can edit this value by pressing the button and entering a new value. The value will be adjusted based on the wavelength of the input signal to compensate for the variation of the photo-receiver's responsivity with wavelength.

Conversion Gain (V/W)

350

Conversion Gain (V/W): The Conversion Gain value (Volts to Watts conversion ratio) displayed on this button is read automatically from the O/E module when it is connected to the Bit Master and a channel is set to optical. If an O/E module is not connected, a default value is displayed. A user can edit this value by pressing the button and entering a new value. The value will be adjusted based on the wavelength of the input signal to compensate for the variation of the photo-receiver's conversion gain with wavelength.

Wavelength (nm)

850   1310   1550

Wavelength (nm): Set the wavelength of the optical signal into the O/E module. The Bit Master will adjust the Responsivity and Conversion Gain factors based on the wavelength selected.

Back
<—

Back: Return to previous menu

Figure 4-16. Calibrate Menu

File Menu

To access the functions under the File menu, select the **Shift** key, then the **File** (7) key. The File menu soft keys are:
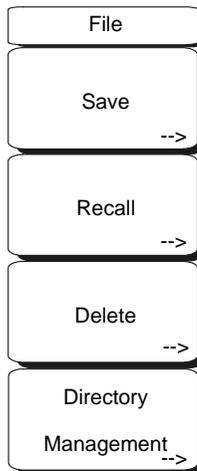
File Save --> Recall --> Delete --> Directory Management -->	**Save:** Measurements may be saved to the internal memory or to a Type-1 Compact Flash module, or to a USB flash drive. The Bit Master is shipped with a 256 MB Compact Flash Drive, Anritsu Part Number 3-2000-1500 and a 256 MB USB flash drive, Anritsu Part Number 2000-1501-R. A maximum of 1000 internally saved measurements may be listed even though more may be saved. Anritsu recommends saving to external storage if a large number of measurements are going to be saved. The removable compact flash card or USB flash drive must be a minimum of 256 MB to be able to hold the entire contents of the internal memory. Compact flash modules up to 512 MB have been tested. Modules with greater storage capacity may not function properly, and should be properly tested before relying on them. **Recall:** Previously saved measurements and setups may be recalled using this menu. **Delete:** Brings up a selection box that shows the first 1000 stored setups and measurements in the currently selected location (see Directory Management, page 4-25). The list shows the setup and measurement names, the type (stp for a saved setup, scope for a saved measurement, jpg for a JPEG file) and the date and time the information was saved. Use the rotary knob or the Up/Down arrow keys to highlight the file to be deleted, and press Enter, or the Delete soft key to delete. Press the Esc key to cancel the operation. Note that there is no mechanism to retrieve deleted files. **Directory Management:** See Directory Management Menu, page 4-25.

Figure 4-17. File Menu

Save soft key menu.

Save Save Setup Save Measurement Save On Event --> Save Screen as JPEG Directory Management_{->} Back <--	**Save Setup** Opens a dialog box to name and save the current operating settings, allowing them to be recalled later to return the instrument to the state it was in at the time the setup was saved. The saved setup can be named using the keypad to select numbers, the rotary knob to highlight a number or character and pressing the knob to select, or by selecting the soft key for each letter. Use the **Shift** key to select an upper case letter. Use the Left/ Right directional arrows to move the cursor position. Press **Enter** to save the setup.

Save Measurement Initiates a dialog box to name and save the current measurement data from all channels that are currently on. The saved measurement data can be named using the keypad to select numbers, the rotary knob to highlight a number or character and pressing the knob to select, or by selecting the soft key for each letter. Use the **Shift** key to select an upper case letter. Use the Left/Right directional arrows to move the cursor position. Press **Enter** to save the measurement data. Measurements are saved in a directory called /usr on the Compact Flash memory module and the USB flash drive.

Note: If a measurement has been previously saved, the Save Measurement dialog box will open with the previously saved name displayed. To save the new measurement with a similar name (for example, Measurement-1, Measurement-2, etc.) simply press the Right directional arrow and add the changes. To create a completely new name, use the keypad, the rotary knob or select the soft key for each letter.

Save On Event… This function is not available in the Bit Master.

Save Screen as JPEG This function saves the measurement display as a graphics file. The saved measurement can be named using the keypad to select numbers, the rotary knob to highlight a number or character and pressing the knob to select, or by selecting the soft key for each letter. Use the **Shift** key to select an upper case letter. Use the Left/Right directional arrows to move the cursor position. Press **Enter** to save the measurement after entering the file name. The file is saved in the internal memory with the specified name, with .jpg appended.

Note: If a measurement has been previously saved, the Save Measurement dialog box will open with the previously saved name displayed. To save the new measurement with a similar name (for example, Measurement-1, Measurement-2, etc.) simply press the Right directional arrow and add the changes. To create a completely new name, use the keypad, the rotary knob or select the soft key for each letter.

Directory Management See Directory Management Menu, page 4-25.

Figure 4-18. Save Menu

Recall soft key menu.

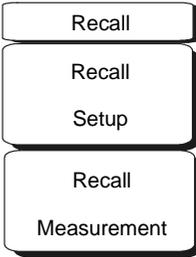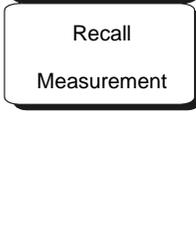|	
Recall Recall Setup Recall Measurement	**Recall Setup** This soft key brings up a selection box that allows selection and recall of a previously stored instrument setup in the current storage location. Use the rotary knob or the Up/Down arrow keys to highlight the saved setup, and press **Enter**, the rotary knob, or the Recall soft key to select. All current instrument settings are replaced by the stored setup information. Press the **Esc** key to cancel the recall.
	Recall Measurement Brings up a selection box that allows recall of previously stored measurement data from the currently selected storage location. Use the rotary knob or the Up/Down arrow keys to highlight the saved measurement data, and press **Enter**, the rotary knob, or the Recall soft key to select. Use the rotary knob or the Up/Down arrow keys to highlight the recalled measurement data option, and press the **Enter** key to select. Press the **Esc** key to cancel the recall.
Directory Management --> Back <--	**NOTE**: Recalling a measurement that was saved after a long accumulation time could take several seconds to be displayed depending on how many channels are on and how many samples have been accumulated. Using Master Software Tools to download the measurement file and view it on a PC may be faster. **Directory Management** See Directory Management Menu, page 4-25. **Back** Returns to the previous menu.

Figure 4-19. Recall Menu

Delete soft key menu.

Delete Delete Selected File Delete All Measurements Delete All Mode Files Delete All Contents Back <--	**Delete Selected File** Use the up and down arrow buttons or the rotary knob to select the file that is to be deleted. Press **Enter** to confirm that you want to delete the file or **Esc** to exit without deleting. **Delete All Measurements** Deletes all measurements of the current mode in the currently selected storage location. The memory from which measurements will be deleted is set in the Directory Management menu and is the Current Location. **Delete All Mode Files** Deletes all measurements of the type saved in the current operating mode of the instrument. In addition all .jpg and setup files (regardless of the mode) are deleted. **Delete All Contents** Deletes all measurements, .jpg files and setup files of all measurement types. All contents of external devices are deleted (Compact Flash and USB drive). For internal memory, all user files are deleted. **Use with caution.** **Back** The Back key returns to the previous menu.

Figure 4-20. Delete Menu

Directory Management soft key menu.

Directory Management Sort Method <u>Name</u> Type Date Sort Ascend <u>Descend</u> Current Location <u>Int</u> USB CF Copy to Destination Int USB <u>CF</u> Copy from Current Location to Destination Format Compact Flash Back <--	**Sort Method** File lists can be sorted by the name of the file, the type of file (Scope file, STP file, etc.) or by the date that the file was saved. **Sort** Selects whether the selected sort is sorted from lowest to highest (ascending) or highest to lowest (descending). When sorting by name, the sort will place file names that start with numbers before file names that start with letters (an ASCII sort). **Current Location** This choice lets you select where measurements and setups will be saved. Pressing the soft key toggles between storing files on the internal memory, the USB flash drive, or a Compact Flash memory module. The "current location" and the "copy to destination" may not be the same. Changing the current location to save files causes the "copy to destination" to be automatically changed if the selected storage location is the same as the selected current location. **Copy to Destination** This choice lets you select where measurements and setups in the "current location" will be copied. The "current location" and the "copy to destination" may not be the same. If you change the destination to which the instrument will copy files, the current location is automatically changed if the current location is the same as the selected copy to destination.. **Copy From Current Location To Destination** Pressing this soft key causes all measurements, setups and jpg files stored in the user selected "current location" to be copied to the "copy to destination". If no storage module is installed in the instrument, an error message is displayed. **Format Compact Flash** This selection erases all files on an installed Compact Flash module. A message is displayed warning that all files will be erased. Press Enter to confirm that you want to erase and Esc to quit without erasing. In addition to erasing all files stored on the Compact Flash, the /usr directory is created for storage of measurements, setups and jpg files. **Back** The Back key returns to the previous menu.

Figure 4-21. Directory Management Menu

4-6   System Menu

To access the System menu, press the **Shift** hard key followed by the **System** (8) hard key. The
System menu is used to interact with the system attributes of the Bit Master. System Status,
Self Test, Application Options, and System Options can be found in this menu.

System	**Status:** Pressing this soft key displays the current system status, including the operating system and firmware versions, temperatures, and other details, such as current battery information. Press **Esc** or **Enter** to return to normal operation.
Status	**Self Test:** This soft key initiates a series of diagnostic tests that test the general components of the instrument. A display lists the individual tests with a pass or fail indication. Press **Esc** or **Enter** to return to normal operation.
Self **Test**	**Application Self Test:** This soft key initiates a series of diagnostic tests that are related to the specific performance of the Bit Master. A display lists the individual tests with a pass or fail indication. In addition, revision numbers of FPGA code are displayed at the bottom of the list. Press **Esc** or **Enter** to return to normal operation.
Application **Self** **Test**	**Application Options:** The Application Options menu is not used in the Bit Master.
	System Options: This soft key brings up the System Options Submenu. See "System Options Submenu" on page 4-27.
Application **Options -->**	
System **Options -->**	

Figure 4-22. System Menu

System Options Submenu

To select the System Options submenu, press the **Shift** hard key followed by the **System** (8) hard key, and then select the System Options submenu.

System Options	**Date and Time:** This soft key brings up a dialog box for setting the current date and time. Use the keypad, the arrows, or the rotary knob to select the date and time.
Date & Time	**Ethernet Configuration:** This soft key brings up a dialog box to set the IP address of the instrument. Use the Manual/DHCP soft key to select whether the address will be entered manually or supplied automatically by a network DHCP server. If manual is selected, then use the soft keys or the arrow keys to select the field to be modified. For more information on LAN connections and DHCP, refer to "LAN Connections" on page 2-4.
Ethernet Config	
Language	**Language:** This soft key allows selection from a list of built-in languages. Use the rotary knob or Up/Down arrow keys to highlight a selection and press Enter to select. The languages currently available are English, French, German, Spanish, Japanese, Chinese, Korean, and Italian. In addition, two custom languages may be selected if they have been defined in the Master Software Tools Software Language Editor and loaded into the unit. For more information how to create custom defined languages, refer to the Master Software Tools help files or user guide.
Brightness	
Name	**Brightness:** The brightness of the display can be adjusted to optimize viewing under a variety of lighting conditions. Use the keypad, the Up/Down arrow keys, or the rotary knob to select a brightness level from 1–9 and press Enter to select.
Volume	**Name:** The Bit Master can be named by using the keypad to select numbers, the rotary knob to highlight a number or character (pressing the knob to select), or by selecting the soft key for each letter. Use the Shift key to select an upper case letter. Use the Left/ Right directional arrows to move the cursor position. Press Enter to save the name.
Reset -->	**Volume:** This soft key opens a dialog box to change the speaker volume of the unit. Use the keypad, the Up/Down arrow keys, or the rotary knob to select a volume level from 0–90 and press Enter to select.
Back <--	**Reset:** This soft key brings up the Reset Submenu. See "Reset Submenu" on page 4-28.
	Back: The soft key brings back the previous SYSTEM menu.

Figure 4-23. System Options Submenu

Reset Submenu

To select the Reset submenu, press the **Shift** hard key followed by the **System** (8) hard key, and then select the System Options submenu followed by the Reset submenu.
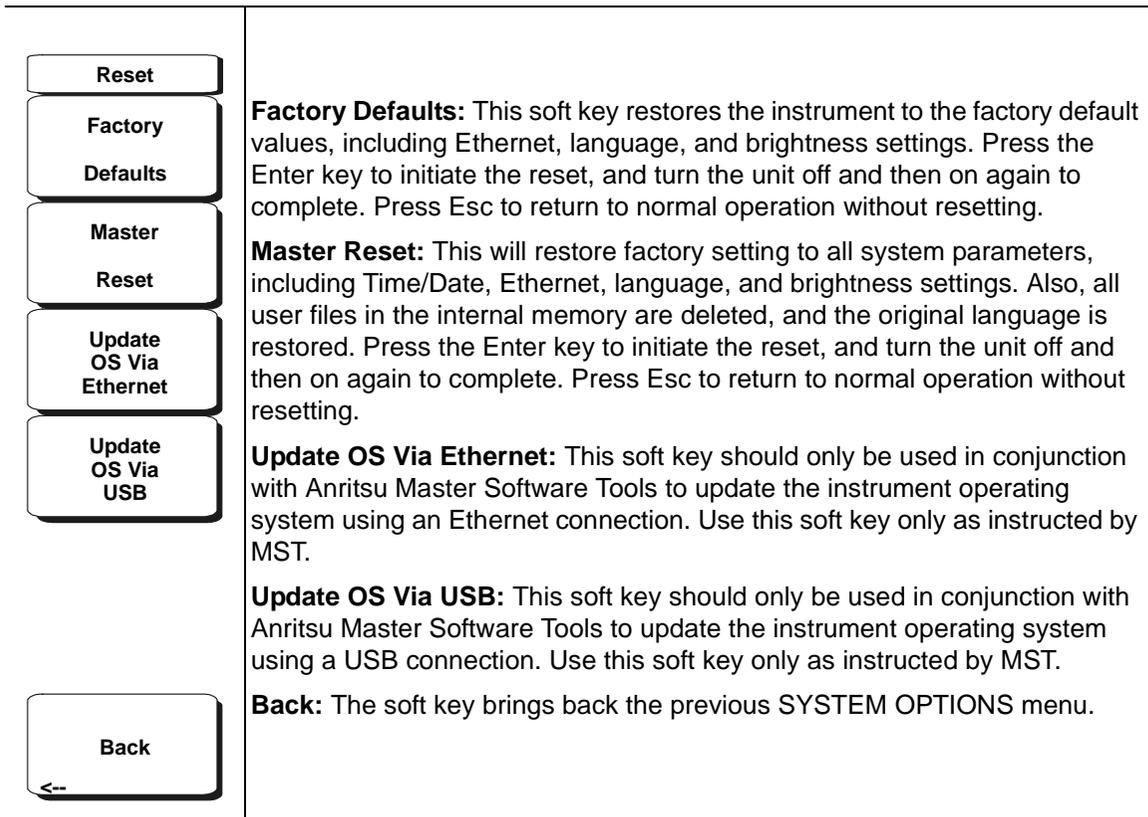
Reset	
Factory **Defaults**	**Factory Defaults:** This soft key restores the instrument to the factory default values, including Ethernet, language, and brightness settings. Press the Enter key to initiate the reset, and turn the unit off and then on again to complete. Press Esc to return to normal operation without resetting.
Master **Reset**	**Master Reset:** This will restore factory setting to all system parameters, including Time/Date, Ethernet, language, and brightness settings. Also, all user files in the internal memory are deleted, and the original language is restored. Press the Enter key to initiate the reset, and turn the unit off and then on again to complete. Press Esc to return to normal operation without resetting.
Update **OS Via** **Ethernet**	**Update OS Via Ethernet:** This soft key should only be used in conjunction with Anritsu Master Software Tools to update the instrument operating system using an Ethernet connection. Use this soft key only as instructed by MST.
Update **OS Via** **USB**	**Update OS Via USB:** This soft key should only be used in conjunction with Anritsu Master Software Tools to update the instrument operating system using a USB connection. Use this soft key only as instructed by MST.
Back **<--**	**Back:** The soft key brings back the previous SYSTEM OPTIONS menu.

Figure 4-24. Reset Submenu

Preset Menu

To access the Preset menu, press the **Shift** hard key followed by the **Preset** (1) hard key.
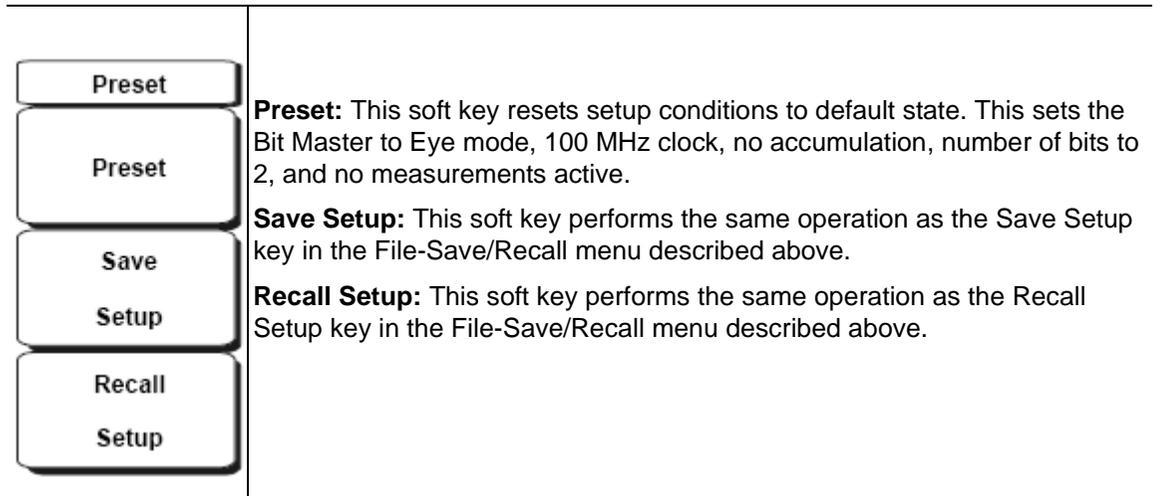
Preset: This soft key resets setup conditions to default state. This sets the Bit Master to Eye mode, 100 MHz clock, no accumulation, number of bits to 2, and no measurements active.

Save Setup: This soft key performs the same operation as the Save Setup key in the File-Save/Recall menu described above.

Recall Setup: This soft key performs the same operation as the Recall Setup key in the File-Save/Recall menu described above.

Figure 4-25. Preset Menu

Chapter 5 — Measurements, Histograms, and Masks

5-1   Introduction

This chapter describes in more detail the built-in measurements that the Bit Master performs. The measurements include statistical measurements (amplitude, time), histograms, and masks.

5-2   Statistical Measurements

The Bit Masters samples the data patterns and generates a 2-dimensional x-y database representing time (x-axis) and voltage (y-axis). For optical measurements, power replaces voltage on the y-axis. The Bit Master maps the database points to pixels on the display. As more samples are accumulated (when accumulation is set to infinite or with a specified limit), the database grows in the third dimension, which represents the number of pixels that fall in the same x-y location on the display. This third dimension is represented by a color grade (with red representing the highest number of pixels and blue representing the lowest number of pixels).

Statistical analysis is performed by using a histogram window to select a certain number of pixels of the display (or database). By calculating the mean and standard deviation of this select number of pixels, specific statistical measurements can be extracted from the data. The standard amplitude and time measurements outlined in the next two sections apply to eye pattern displays only and are not available in pulse mode.

The following sections describe the built-in measurements for statistical amplitude and time measurements.

Statistical Amplitude Measurements

Six amplitude related measurements are performed by the Bit Master using a histogram window on the amplitude axis (or y-axis): one level, zero level, eye height, eye amplitude, eye crossing percentage, signal to noise ratio. For optical measurements, two additional measurements are performed: extinction ratio and average power.

To perform these measurements accurately, the Autoscale function must be executed first to center the position of the eye pattern on the display. Afterwards, histogram measurements are used automatically to calculate the statistical data.

Refer to Figure 5-1 and the following explanation of standard built-in statistical amplitude measurements.
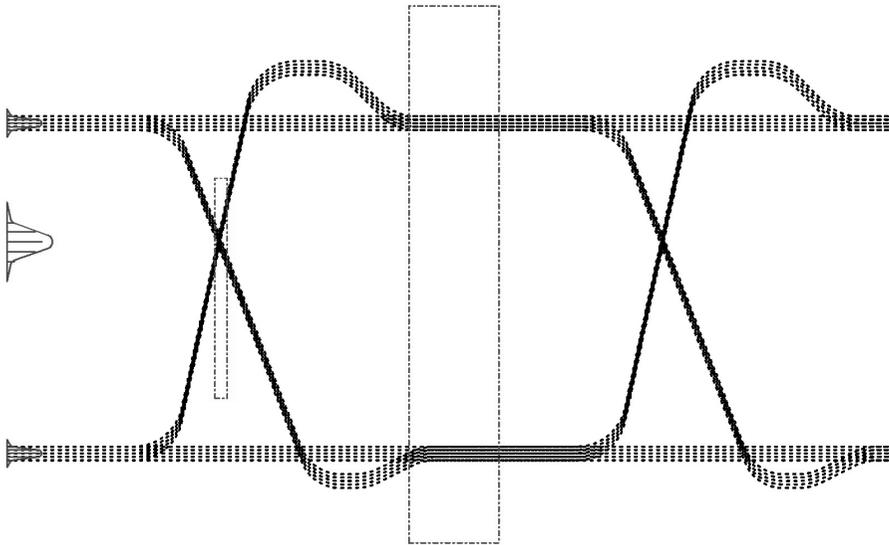
Figure 5-1.   Eye pattern histograms for making statistical amplitude measurements.

One Level

The mean value of the top histogram distribution in the middle 20% of the eye generates the One level.

Zero Level

The mean value of the bottom histogram distribution in the middle 20% of the eye generates the Zero level.

Eye Amplitude

The difference between the One level and Zero level generates the eye amplitude.

Eye Height

The eye height is calculated using the following equation:

```
Eye Height=(One Level - 3 x Std Dev(One Level)) - (Zero Level + 3
x Std Dev(Zero Level))
```

Eye Crossing Percentage

Crossing percentage is a measure of the amplitude of the crossing points relative to the one level and the zero level. To determine the eye crossing percentage, the One level, Zero level and crossing level must first be found. The crossing level is determined by taking the mean value of a thin vertical histogram window centered on the crossing point. The eye crossing percentage is calculated using the following equation:

```
Crossing % = 100 x [(Crossing Level – Zero Level) / (One Level –
Zero Level)]
```

SNR

The signal to noise ratio (SNR) is calculated using the following equation:

```
SNR=(One Level - Zero Level)/(Std Dev(One Level) + Std Dev(Zero
Level))
```

Extinction Ratio

The extinction ratio only applies to optical signals (measured in Watts) and is a measure of the ratio of the One level to the Zero level. The extinction ratio is calculated using the following equation:

$$\text{Extinction Ratio} = 10\log_{10} [\text{One Level} / \text{Zero Level}]$$

Note: The Extinction Ratio measurement is very sensitive to the value of the zero level. For maximum accuracy, it is critical that an Amplitude calibration and Optical Module calibration be performed before making the Extinction Ratio measurement. Performing these calibrations helps maximize amplitude accuracy and reduce dark level currents. For the Amplitude calibration to be most effective, enter the actual clock rate and data rate values into the Bit Master before starting the calibration. This allows the Bit Master to optimize the amplitude calibration for those specific rates.

In addition to the calibration steps, the Bit Master optimizes the extinction ratio measurement by using a built-in correction factor that adjusts the extinction ratio result to account for the non-ideal frequency response characteristics of the O/E module. This correction factor is dependent on the data rate of the input signal and is applied automatically to the measurement result.


Average Power

The average power measurement only applies to optical measurements using the Anritsu O/E module. The average power level is derived from the average photodiode current and is not determined from the pixel database

Statistical Time Measurements

Six time related measurements are performed by the Bit Master using a histogram window on the time axis (or x-axis): peak-to-peak jitter, RMS jitter, rise time, fall time, eye width, and duty cycle distortion. To perform these measurements accurately, the Autoscale function must be executed first to center the position of the eye pattern on the display. Afterwards, histogram measurements are used automatically to calculate the statistical data.

Refer to Figure 5-2 and the following explanation of standard built-in statistical time measurements.

Peak-to-Peak Jitter and RMS
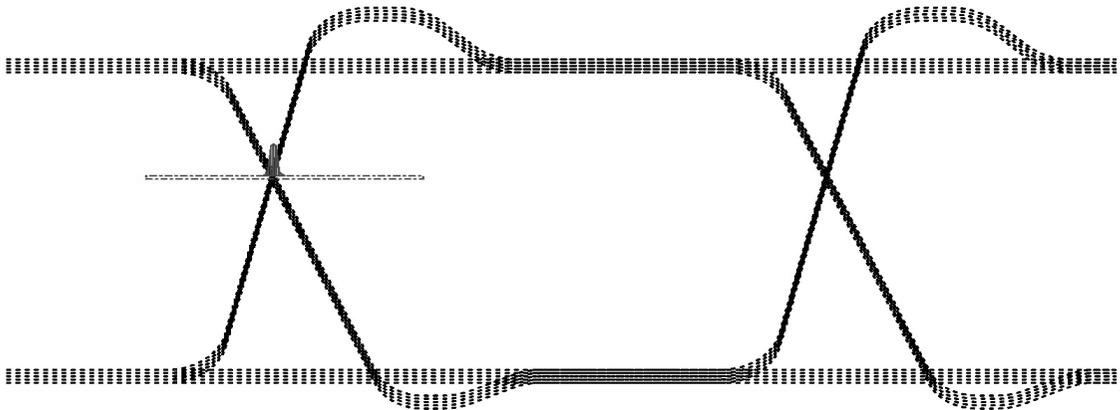
Figure 5-2.   Eye pattern histograms for making jitter measurements.

NRZ Eye Jitter is the measure of the time variances of the rising and falling edges of an eye diagram as these edges affect the crossing points of the eye. To compute jitter, the amplitude of the crossing points of the eye is first determined. Then a vertically thin measurement window is placed horizontally through the crossing points, and a time histogram is generated. The histogram mean determines the center of the crossing points. The histograms are analyzed to determine the amount of jitter. Jitter is measured and displayed in either of the following formats:

- **Jitter p-p:** full width of the histogram at the eye crossing point
- **Jitter RMS:** 1s from the histogram mean

Rise / Fall Time Measurement
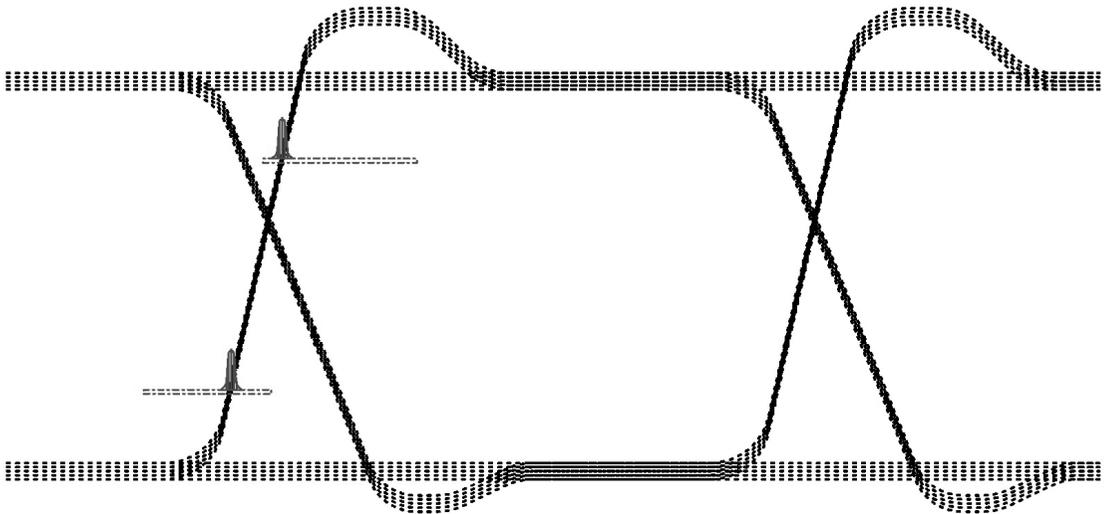
Figure 5-3.   Eye pattern histograms for making rise time and fall time measurements.

Rise Time

Rise time is a measure of the mean transition time of the data on the upward slope of an eye diagram. To Measure 20-80% rise time, a thin horizontal histogram slice is placed at the 20% level to the left of the eye crossing and at the 80% level to the right of the eye crossing. The Rise Time is then calculated using the following equation:

```
Rise Time = Mean (80% time level) - Mean (20% time level)
```

Fall Time

Fall time is a measure of the mean transition time of the data on the downward slope of an eye diagram. Measuring fall times is similar, but in this case a thin horizontal histogram slice is placed at the 20% level to the right of the eye crossing and at the 80% level to the left of the eye crossing. The Fall Time is then calculated using the following equation:

```
Fall Time = Mean (20% time level) - Mean (80% time level)
```

Eye Width
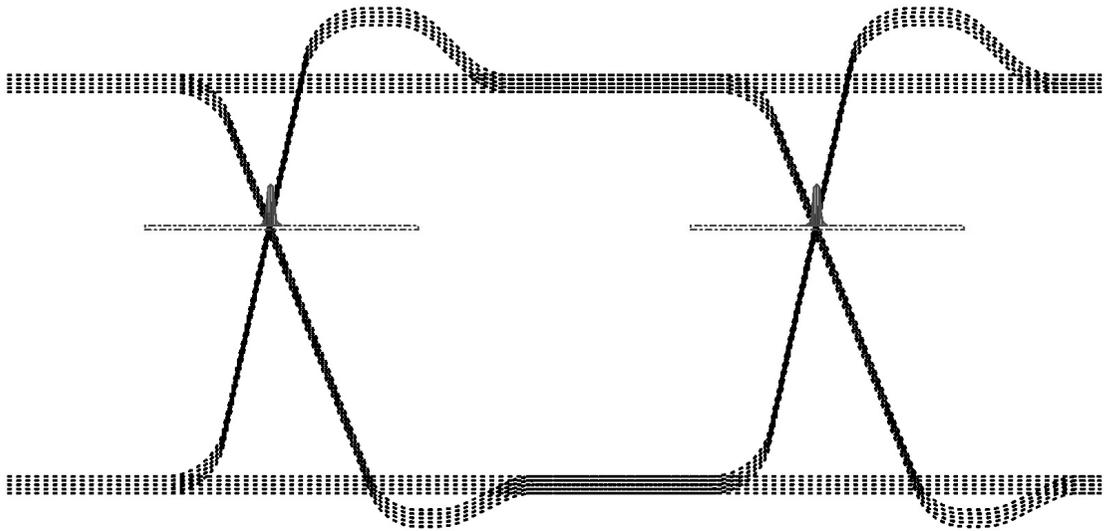
Figure 5-4.   Eye pattern histograms for making eye width measurements.

Eye Width

Eye width is a measure of the horizontal opening of an eye diagram. Eye width is calcu-lated by first placing thin horizontal histograms at the two crossing points and then using the following equation:

```
Eye Width = (Mean(crossing pt 2) - 3 x Std Dev(crossing pt 2)) -
(Mean(crossing pt 1) + 3 x Std Dev(crossing pt 1))
```

Duty Cycle Distortion (DCD)

Duty Cycle distortion is a measure of the time separation between the rising edge and falling edge at the 50% level of the eye diagram. To measure the DCD, the 50% level of the edges is calculated using the same histograms that are used in the Rise Time and Fall Time measurements (take the center of the 20% to 80% measurement). The DCD is then calculated using the following equation:

```
DCD = 100 x [Time difference between rising and falling edges @
50% level / Bit period]
```

5-3   Histogram Measurements

In addition to the standard statistical measurements, the Bit Master allows the user to set a histogram window in any location in the display window. The Bit Master calculates the total number of pixels (or Hits) inside the window, in addition to the mean, the standard deviation, and the peak-to-peak values for the enclosed pixels.

The histogram measurements can be made on both eye and pulse patterns and on either the amplitude axis or time axis, as shown the following two figures.
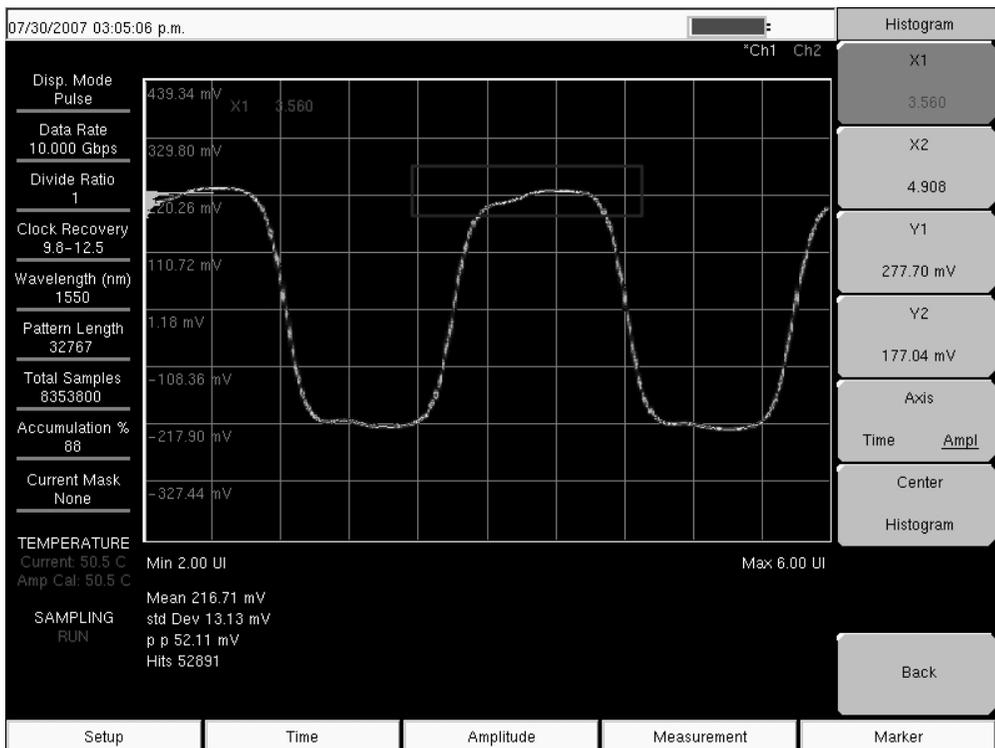
Figure 5-5.   Histogram Measurement on Amplitude Axis of a Pulse Pattern
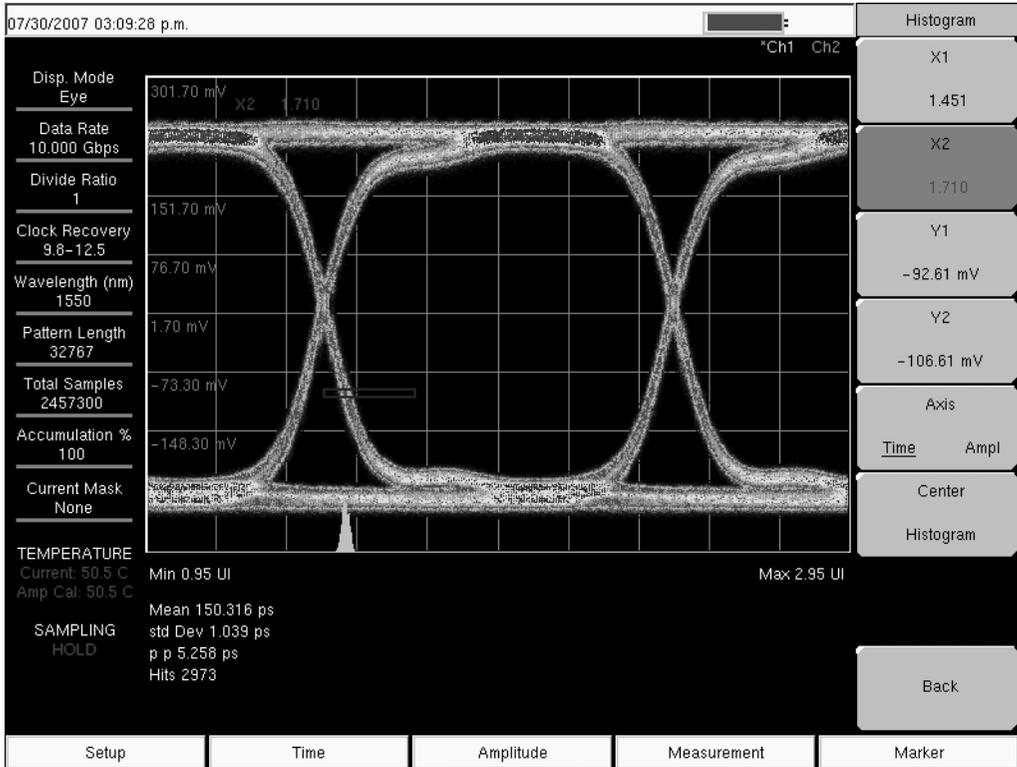
Figure 5-6.   Histogram Measurement on Time Axis of Eye Pattern

5-4   Masks

A mask test is used to confirm that an eye pattern fits within an industry standard shape. The Bit Master includes several industry standard masks. In addition, using the PC-based software program Master Software Tools (which is supplied with each unit), the Bit Master allows the user to edit these masks or create new custom masks and upload them to the instrument.

When performing a mask measurement, the Bit Master display shows the keep out areas defined by the mask. In addition, the total number of samples on the screen as well as any failed sample points (points that fall in the shaded areas) are displayed, as shown in the figure below.
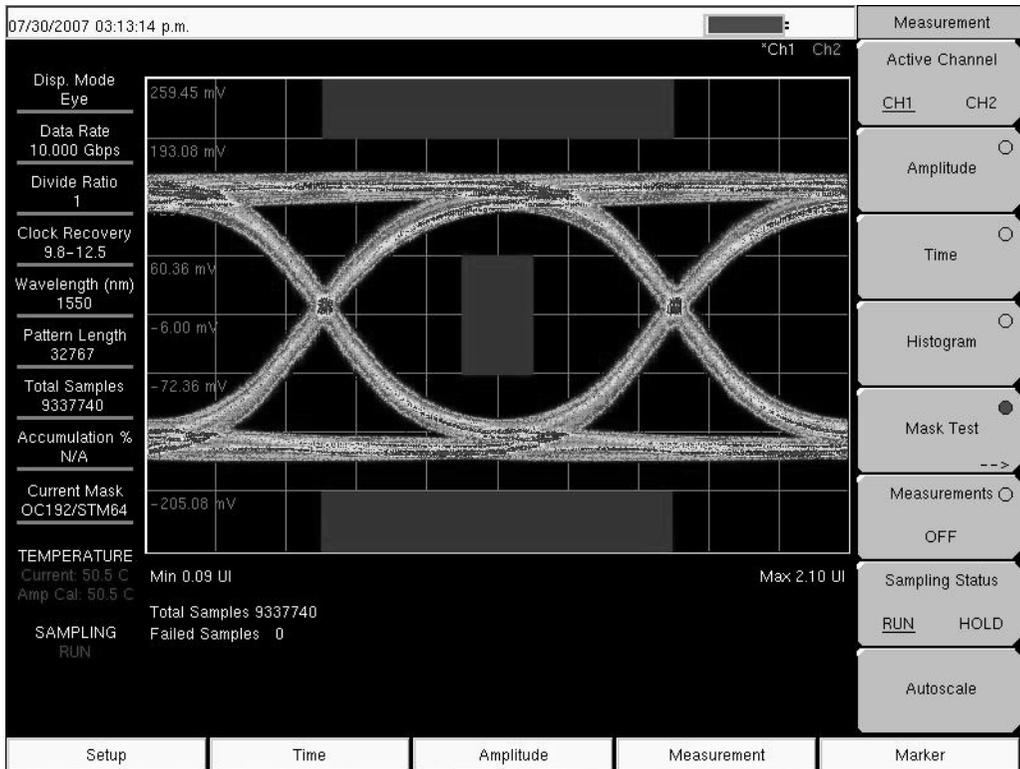
Figure 5-7.   Mask measurement on eye pattern display.

Appendix A — Error and Warning Messages

A-1 Introduction

This appendix provides a list of information and error messages that could be displayed on the Bit Master. If any error condition persists, then contact your local Anritsu Service Center (page 1-13).

A-2 Application Self Test Error Messages

The application self test runs three different tests: power, frequency, and amplitude. If the power test fails, a message will be printed with the actual voltage level that has failed. Make a note of that voltage. Repeat the test. If the same error persists, contact your Anritsu Service Center.

If the frequency test fails, check that there is no signal at the clock inputs. Repeat the test if necessary. If the error persists, contact your Anritsu Service Center.

If the amplitude test fails, check to see that all input data and clock signals have been turned off. Perform an amplitude calibration. Repeat the test if necessary. If the error persists, contact your Anritsu Service Center.

A-3 Operation or General Self Test Error Messages

Could not detect valid clock; clock rate not updated

The Acquire Clock Rate soft key was pressed but no clock was detected at either clock port. The Bit Master will continue to use the current clock rate setting. This message will continue to be displayed until the data rate or clock rate is manually entered or until the Acquire Clock Rate soft key is pressed again.

Operation not Permitted in Pulse Mode

In Pulse mode, amplitude and time measurements are not permitted.

Operation not Permitted when channel is OFF

An operation is being performed on a channel that is currently set to off. Set the channel to electrical or optical before proceeding with the operation.

Amplitude Calibration Failure

The amplitude calibration can fail if there is any input data or clock signals that have not been turned off. A message will appear indicating either Cal Passed or Cal Failed. Following the Cal Failed message will be the channel that failed (CH1, CH2 or both). If the calibration fails, turn off any input signals and then repeat the calibration. If that still does not work, try resetting the unit to the factory defaults with either Factory Defaults, ESC+ON. Caution: Use of MASTER RESET, System+ON, will erase all user saved setups and measurements and return the unit to a fully Factory Default condition. If the error persists, then contact your Anritsu Service Center.

O/E Calibration Failure

The O/E calibration can fail if there are any optical input signals into the O/E module. A message will appear indicating either Cal Passed or Cal Failed. If the calibration fails, turn off any input signals and then repeat the calibration. If that still does not work, try resetting the unit to the factory defaults with either Factory Defaults, ESC+ON.

Caution: Use of MASTER RESET, System+ON, will erase all user saved setups and measurements and return the unit to a fully Factory Default condition. If the error persists, then contact your Anritsu Service Center.

Active Channel is Currently Turned OFF

The active channel has been turned off. When this occurs, any measurements or markers associated with this active channel will be turned OFF. Also, this message will be displayed if a channel that is off has been set as the active channel.

Operation not Permitted in Recall Mode

Attempted to perform an operation on a recalled measurement. Many operations are valid only on a live or active measurement.

Fan Failure

The system has determined that the fan should be running due to the internal temperature of the unit, but cannot detect that the fan is actually running. It is important to keep the fan inlet and exhaust ports clear of obstructions. The cooling fan will vary the speed in relation to the internal temperature of the instrument. The fan will turn on at low speed when the internal temperature of the instrument reaches 44ºC, and will increase the fan speed to maximum at 54ºC. As the internal temperature of the instrument decreases, the fan will reduce speed until the temperature reaches 39ºC, at which point the fan will turn off.
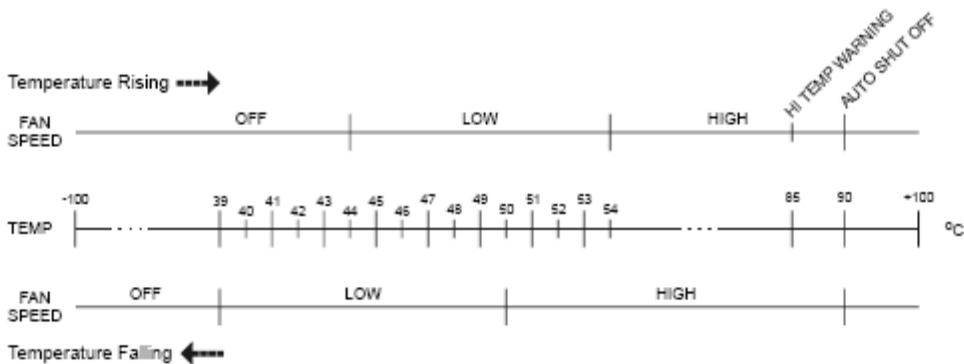

Figure A-1.　Fan Speed vs. Temperature

High Temp Warning

The internal temperature has reached an excessive level, 85°C. Verify that the ventilation openings are unobstructed and that the fan is running. Internal temperatures may be manually verified by using the SELF TEST function. Turn off the unit and allow the temperature to cool down. If the fault is not resolved and the internal temperature reaches 90°C, then a countdown of 10 seconds will begin to give the user a chance to save the current setup before it will turn itself off before internal temperatures can cause any damage. If the error persists after removing any obstructions and allowing the unit to cool, then reset to the factory defaults with either Factory Defaults, ESC+ON. Caution: Use of MASTER RESET, System+ON, will erase all user saved setups and measurements and return the unit to a fully Factory Default condition. If the error persists, then contact your Anritsu Service Center.

Copy failed. Please check External Card

Attempt to copy user saved data to the external Compact Flash Card has failed. Be sure that the CF card was not removed while the copy was in progress. Be sure that the CF is not already full and that it is fully inserted into the CF-Card slot.

Destination USB full, could not copy

An attempt to copy user-saved data to the external USB flash has failed. Be sure that the USB flash was not removed while the copy was in progress. Be sure that the USB flash is not already full and that it is fully inserted into the USB slot.

Power Supply

This message indicates that the Power Supply has failed. Charge the battery.

Fatal Error

This error is usually caused by a failure in communication between one section of the instrument and another. Sometimes this error is resolved by restarting the unit or by Factory Defaults, ESC+ON, resetting of the unit. Under extreme cases the use of MASTER RESET, System+ON, may resolve the issue. Caution: Use of MASTER RESET, System+ON, will erase all user saved setups and measurements and return the unit to a fully Factory Default condition. If the error persists, then contact your Anritsu Service Center.

DSP Memory Failure, Address, Ext High, Ext Middle, Ext low, Ext1, Ext2

This message indicates that one of the DSP memory locations has failed. The DSP will attempt to resolve the memory Failure location and Byte. There are two external memory banks (Ext1 = bank one, Ext2 = Bank 2) with three bytes wide (Ext High, Ext Middle and Ext Low. Byte)

Overall Status FAILED

This message indicates that one or more elements of the System or Application Self Test has failed. Refer to the other pass fail tests listed below to determine which specific test failed.

Lock Test FAILED

This message indicates that one or more Phase Lock Loops Failed to properly achieve Lock Status. Insure that the battery level is adequate for operation or that temperature is within acceptable limits. Reset to factory defaults with Factory Defaults, ESC+ON.

EEPROM TEST: FAIL

This message indicates that hardware communication between modules has failed. Insure that the battery level is adequate for operation or that temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON.

Caution: Use of MASTER RESET, System+ON, will erase all user saved setups and measurements and return the unit to a fully Factory Default condition.

EEPROM TEST: UNKNOWN ERROR

This message indicates that hardware communication between modules has failed. Insure that the battery level is adequate for operation or that temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON.

Caution: Use of MASTER RESET, System+ON, will erase all user saved setups and measurements and return the unit to a fully Factory Default condition.

Fatal error, EEPROM failed

This message indicates that hardware communication between modules has failed. Insure that the battery level is adequate for operation or that temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON.

Caution: Use of MASTER RESET, System+ON, will erase all user saved setups and measurements and return the unit to a fully Factory Default condition.

DSP version different from released version

This message may occur during firmware update. Likely cause is incomplete firmware package installation. Finish the complete firmware update with Master Code Loader.

Appendix B — More About DHCP

B-1   Introduction

DHCP stands for Dynamic Host Configuration Protocol. This protocol allows a server to dynamically assign IP addresses to devices that are connected to the network. Most networks include a DHCP server to manage IP addresses. When a DHCP server is available on the network, DHCP is the preferred IP address mode.

B-2   Using DHCP

When using DHCP, no setup is required to lease and use a dynamic IP address. In a dynamic IP operation, the assigned IP address may change from use to use. The DHCP server assigns IP addresses on a time rotation basis. As soon as the device is disconnected from the network, the IP address that it was using becomes available to lease to the next unit requesting an IP address. Normally, some amount of lag time occurs on the DHCP server end, so if the device is connected again reasonably soon, it may receive the same address.

Note: The Bit Master must be connected to the network before it is turned on in order to allow DHCP to work. Key elements of the DHCP lease are performed only during the instrument startup operations or when switching from manual to DHCP.

B-3   Static IP Address

When a DHCP server is not available, a Static IP address can be used. A Static IP address is a fixed address. After being set, it will always remain the same, and care must be taken to avoid conflict with other equipment on the network.

When using a static IP address on an established network, always request a Static IP address from the network administrator. Randomly choosing a Static IP address on an established network may result in duplicate IP addresses or other conflicts. Three parameters must be set prior to using a Static IP address:

IP Address

This is the Static IP address on the network.

Default Gateway

Often when a static IP address is assigned, a default gateway is also identified. If the default gateway is unknown, then type in the Static IP address so that the Static IP address and Default Gateway are the same number.

Subnet Mask

This parameter is usually extracted from the Static IP address based upon the class of the address. It determines the destination of any broadcast messages that might be sent from the instrument. It can be customized if necessary. The subnet mask may also be provided with the Static IP address.

Example 1

In this example, a Static IP address has been chosen because no network is available. The instrument is connected to the network port on the PC with a crossover Ethernet cable (not included). This is also referred to as Direct Connect:

```
IP Address: 10.0.0.2
Default Gateway: 10.0.0.2
Subnet Mask: 255.255.0.0
```

Example 2

In this example, the Static IP address has been assigned with an associated gateway and sub-net mask:

```
IP Address: 153.56.100.42
Default Gateway: 153.56.100.1
Subnet Mask: 255.255.252.0
```

B-4 Operating System Tools

A few tools that are built into the Microsoft Windows operating system can assist in making some determinations about the network that the PC is plugged into. Typing `ipconfig` at a command prompt will display information about the in-use parameters of the PC and its network connection. Below is an example of the typical results expected.

> **Note:** The ipconfig display does not report if the information is from a DHCP server or a Static IP setup.

```
Y:\>ipconfig
Windows 2000 IP Configuration
Ethernet adapter Local Area Connection:
Connection-specific DNS Suffix. : us.anritsu.com
IP Address . . . . . . . . . . . . : 172.26.202.172
Subnet Mask . . . . . . . . . . . : 255.255.252.0
Default Gateway . . . . . . . . . : 172.26.200.1
```

Another tool that can find out if a selected IP address is already on the network is ping. Ping is a harmless way to determine if an address is found on the network and, if it is found, for it to reply. Greatly simplified, ping sends out a request to a specific address to determine if it is there. If the specific address is found, then it will respond by sending back the same message that was received. If it is not found, then the response will be "request timed out." This means that no reply was received from that IP address.

```
Y:\>ping 172.26.202.172
Pinging 172.26.202.172 with 32 bytes of data:
Reply from 172.26.202.172: bytes=32 time<10ms TTL=128
Reply from 172.26.202.172: bytes=32 time<10ms TTL=128
Reply from 172.26.202.172: bytes=32 time<10ms TTL=128
Reply from 172.26.202.172: bytes=32 time<10ms TTL=128
Ping statistics for 172.26.202.172:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milliseconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

Subject Index

Anritsu