

User Manual



80A05 **Electrical Clock Recovery Module** **071-1467-01**

This document applies to firmware version 2.0.0
and above.

www.tektronix.com

Copyright © Tektronix. All rights reserved. Licensed software products are owned by Tektronix or its subsidiaries or suppliers, and are protected by national copyright laws and international treaty provisions.

Tektronix products are covered by U.S. and foreign patents, issued and pending. Information in this publication supercedes that in all previously published material. Specifications and price change privileges reserved.

TEKTRONIX and TEK are registered trademarks of Tektronix, Inc.

Contacting Tektronix

Tektronix, Inc.
14200 SW Karl Braun Drive
P.O. Box 500
Beaverton, OR 97077
USA

For product information, sales, service, and technical support:

- In North America, call 1-800-833-9200.
- Worldwide, visit www.tektronix.com to find contacts in your area.

Warranty 2

Tektronix warrants that this product will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If any such product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product. Parts, modules and replacement products used by Tektronix for warranty work may be new or reconditioned to like new performance. All replaced parts, modules and products become the property of Tektronix.

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

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

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

Table of Contents

General Safety Summary	iii
Environmental Considerations	v
Preface	vii
Manual Structure	vii
Related Documentation	vii
Getting Started	1
Product Description	1
Options and Accessories	3
Installation	4
Electrostatic Discharge	5
Static Controlled Workstation	5
Operating Basics	7
Usage	7
Front Panel	7
LED	7
Input and Output Connectors	8
System Interaction	8
Programmer Interface Commands	9
User Adjustments	9
Specifications	11

General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

While using this product, you may need to access other parts of the system. Read the *General Safety Summary* in other system manuals for warnings and cautions related to operating the system.

To Avoid Fire or Personal Injury

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

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

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

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

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

Do Not Operate in Wet/Damp Conditions.

Do Not Operate in an Explosive Atmosphere.

Keep Product Surfaces Clean and Dry.

Symbols and Terms

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



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



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

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

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

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

CAUTION indicates a hazard to property including the product.

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



Environmental Considerations

This section provides information about the environmental impact of the product.

Product End-of-Life Handling

Observe the following guidelines when recycling an instrument or component:

Equipment Recycling. Production of this equipment required the extraction and use of natural resources. The equipment may contain substances that could be harmful to the environment or human health if improperly handled at the product's end of life. In order to avoid release of such substances into the environment and to reduce the use of natural resources, we encourage you to recycle this product in an appropriate system that will ensure that most of the materials are reused or recycled appropriately.



The symbol shown to the left indicates that this product complies with the European Union's requirements according to Directive 2002/96/EC on waste electrical and electronic equipment (WEEE). For information about recycling options, check the Support/Service section of the Tektronix Web site (www.tektronix.com).

Restriction of Hazardous Substances

This product has been classified as Monitoring and Control equipment, and is outside the scope of the 2002/95/EC RoHS Directive. This product is known to contain lead, cadmium, and hexavalent chromium.

Preface

This is the user manual for the 80A05 Electrical Clock Recovery module. The manual covers capabilities, installation, operation, and specifications of the module.

Manual Structure

This manual is composed of the following chapters:

- *Getting Started* shows you how to configure and install your module and lists standard and optional accessories.
- *Operating Basics* describes controlling the module using the front panel and the instrument user interface, system interaction, the programmer interface, and user adjustments.
- *Specifications* lists all typical and guaranteed specifications for this product.

Related Documentation

See the following list for your main instrument operation and service documents. These documents are available on the product documentation CD-ROM (with the exception of Online Help).

Manual name	Description
Online Help	An online help system, integrated with the User Interface application that ships with the main instrument.
Programmer Online Guide	An alphabetical listing of the programming commands and other information related to controlling the instrument over the GPIB.
Service Manual	Describes how to service the instrument to the module level. This optional manual must be ordered separately.
Specifications and Performance Verification Manual	Provides a list of all specifications and performance verification procedures for the main instrument and modules.

Getting Started

The Tektronix 80A05 Electrical Clock Recovery Module will recover the clock from electrical data for all Tektronix electrical modules. The 80A05 Electrical Clock Recovery Module provides a solution for triggering the main instrument from single-ended or differential electrical signals. The 80A05 can also be used as a general purpose clock recovery solution.

This module can be used in the following mainframes:

- DSA8200 Digital Serial Analyzer
- CSA8000, CSA8000B, and CSA8200 Communications Signal Analyzer
- TDS8000, TDS8000B, and TDS8200 Digital Sampling Oscilloscope

NOTE. Proper operation of the 80A05 module requires that the operating system software installed on the main instrument is version 2.0 or greater. To display the version installed, select About from the Help menu in the main instrument user interface.

Product Description

The module provides the characteristics shown in Table 1. See *Specifications* for a full list of product specifications.

Table 1: 80A05 module characteristics

Characteristic	Value or description
Number of inputs	2
Input/output impedance	50 Ω
Input/output connectors	SMA
Input/output coupling	DC
Recovered clock timing jitter	50 Mb/s to 2.7 Gb/s: 0.5% of unit interval
Maximum input voltage	2.0 V _{p-p}
Analog bandwidth	3dB to 20 GHz
Minimum clock recovery sensitivity	8 mV _{p-p}



CAUTION. *To prevent electrostatic damage to the main instrument and modules, follow the precautions described in this manual and the documentation accompanying your instrument.*

(See Electrostatic Discharge starting on page 5.)

There are five (six, Option 10G) identical SMA female connectors on the front panel: two data inputs, two data outputs, one TRIGGER CLOCK output, and one 10G CLK output (Option 10G). Refer to Figures 2 and 3 on page 8.

The module receives power through the Tekprobe-Sampling interface. The Power LED indicates the clock recovery circuitry is on and programmed to the requested bit rate.



CAUTION. *To prevent electrostatic damage to the main instrument and module, follow the precautions described in this manual and the documentation accompanying your instrument. (See Electrostatic Discharge starting on page 5.)*

Options and Accessories

This section lists the standard and optional accessories available for the module.

Options Option 10G adds >4.25 Gb/s Clock recovery.

Standard Accessories The following accessories are shipped with the module:

Table 2: Standard accessories

Item	Part number
80A05 Electrical Clock Recovery Module User Manual	071-1467-xx
(5) SMA, male, 50 Ω termination caps. Option 10G (6)	011-0182-xx
Transit case, ESD protective	004-5091-xx

Optional Accessories You can order the following accessories for use with the module. Consult a current Tektronix catalog for additions, changes, and details:

Table 3: Optional accessories

Item	Part number
2X attenuator (SMA male-to-female)	015-1001-xx
5X attenuator (male-to-female)	015-1002-xx
Coaxial cable	015-0560-xx
Power divider	015-0565-xx
Asymmetrical power divider	015-0683-xx
SMA accessory kit	020-1693-xx
CSA8000 & TDS8000 Service Manual	071-0438-xx
DSA8200 Service Manual	071-2047-xx

Installation

The 80A05 module fits into one of the large module compartments on the front panel of an 8000 series instrument. See Figure 1.

To install a module, first power off the instrument using the front-panel On/Standby switch. Then place the module in a compartment, and slowly push it in with firm pressure. Once the module is seated, turn the hold-down screws on the module to tighten the module into place. See Figure 1. When an 80A05 module is installed into one of the large slots, one of the smaller slots will be disabled. Refer to the instrument's online help to identify the disabled slot.



CAUTION. *To prevent damage to the module or instrument, never install or remove a module when the instrument is powered on or when either input connector is unprotected.*

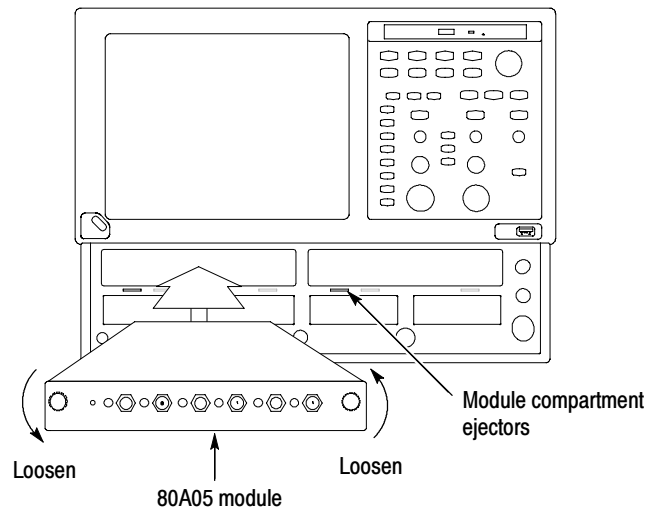


Figure 1: Installing a module

NOTE. *When removing your module, first loosen the hold-down screws, and then use the module ejector on the main instrument to eject the module.*

Electrostatic Discharge

To prevent electrostatic damage to the main instrument and modules, follow the precautions described in this manual and the manuals that come with your instrument.

Circuitry in the module is very susceptible to damage from electrostatic discharge or from overdrive signals. Be sure to only operate the module in a static-controlled environment. Be sure to discharge to ground any electrostatic charge that may be present on the center and outer connectors of cables before attaching the cable to the module.

Know your signal source. If it is capable of delivering overvoltages, it is safer to not depend on the signal source settings for protection, but instead use an external attenuator that protects the input from the worst-case conditions. For example, for a 10 V maximum source connected to a 1 V maximum module, use a 10X attenuator. Where possible, connect your cables to the signal source first, and to the module second.



CAUTION. *To prevent damage from electrostatic discharge, install the attached 50 Ω terminations on the I/O connectors before removing the module from an instrument, storing, or when not in use. Store the module in a static-free container, such as the shipping container. Whenever you move the module from one instrument to another, use a static-free container to transport the module.*

To prevent damage to the module, discharge to ground any electrostatic charge that may be present on the center and outer conductors of cables before attaching the cables to the module.

To prevent damage to the module, do not create an ESD antenna by leaving cables dangling off the module input with the other end open.

To prevent damage to the module or instrument, never install or remove a module when the instrument is powered on.

Always use a wrist strap (provided with your instrument) when handling modules or making signal connections. Wear antistatic clothing and work in a static-free workstation when using modules.



To prevent damage to the module or instrument, do not apply a signal outside the Maximum Input Voltage Swing for your module.

Static Controlled Workstation

For information on creating a static-controlled workstation, consult the Electronic Industries Association document, *EIA-625; Requirements for Handling Electrostatic-Discharge-Sensitive (ESDS) Devices*.

Operating Basics

This chapter familiarizes you with the operation of your module. This chapter describes the front-panel controls and connectors, interaction of the module with your main instrument, user adjustments, and the programmer interface.

Usage

Figures 2 and 3 on page 8, show the front panel of the module and identify the connectors and indicators.



CAUTION. *To prevent damage to your module or instrument, do not apply a signal outside the Maximum Input Voltage Swing for your module.*

To prevent electrostatic damage to the instrument and modules, follow the precautions described in this manual and the documentation accompanying your instrument. (See Electrostatic Discharge starting on page 5.)



Always use a wrist strap (provided with your instrument) when handling modules or making signal connections.

The input circuitry in your module is very susceptible to damage from overdrive signals and electrostatic discharge. Never apply a DC or peak voltage greater than the Maximum Operating Range (see Table 4 on page 11) of your module. Only operate the instrument and module in a static-controlled environment.

Front Panel

The 80A05 module contains three primary features:

Hold-down screws

Use these to secure the module in the instrument module compartment once connected. Turn clockwise to secure and counterclockwise to release. To prevent damage to the module, use the compartment ejectors to remove the module from the compartment (see Figure 1 on page 4 for the location of the ejectors).

LED

The 80A05 module has one LED on its front panel. When on, it indicates the module's clock recovery output has been selected as the trigger source. The LED is off when the module is not selected as the trigger source.

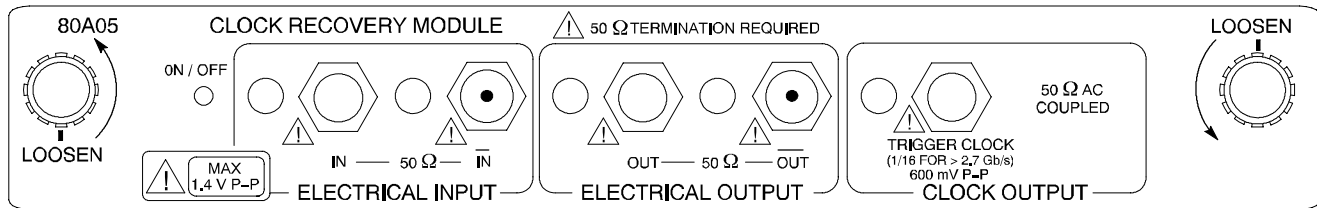


Figure 2: 80A05 module front panel

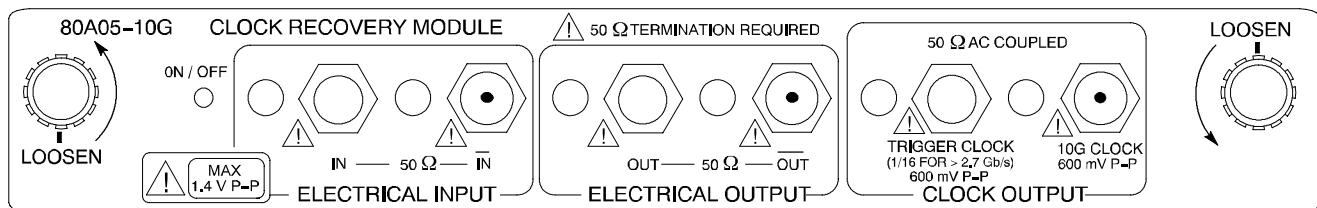


Figure 3: 80A05-10G module front panel

Input and Output Connectors

The connectors on the front panel of the 80A05 module provide connections for the input and output signals. All connectors are SMA female connectors.

Connector Care. Never attach a cable to a sampling-module connector if the cable has a worn or damaged connector because you may damage the sampling-module connector. Use extra care when attaching or removing a cable from the connectors. Turn only the nut, not the cable. When attaching a cable to a sampling-module connector, align the connectors carefully before turning the nut. Use light finger pressure to make this initial connection. Then tighten the nut lightly with a wrench.

NOTE. For best repeatability and to prolong connector life, use a torque wrench, and tighten the connection to the range of 79-112 N·cm (7-10 in lb).

If the module connectors will receive heavy use, such as in a production environment, you should install adapters (such as a Tektronix part number 015-0549-xx for 3.5 mm connectors) on the module to make connections to the device under test.

System Interaction

The mainframe acts as the host via the large module receptacles for this module. The remainder of the system interaction for this module is contained in the documentation set included with your main instrument.

Programmer Interface Commands

The remote-programming commands for all modules are documented in the Programmer Online Guide for your main instrument.

User Adjustments

All module setups, parameters, and adjustments are controlled by the instrument. To save, recall, or change any module settings, use the instrument menus or front-panel controls or consult the Online Help and other documentation that accompanied your main instrument.

Specifications

This section contains specifications for the 80A05 Electrical Clock Recovery Module. All specifications are guaranteed unless noted as “typical.” Typical specifications are provided for your convenience but are not guaranteed.

All specifications apply to all models of module unless noted otherwise. To meet specifications, three conditions must first be met:

- The instrument must have been calibrated/adjusted at an ambient temperature between +20 °C and +30 °C.
- The oscilloscope must have been operating continuously for 20 minutes within the operating temperature range specified.
- The instrument must be in an environment with temperature, altitude, and humidity, within the operating limits described in these specifications

Table 4: Module characteristics

Specifications	Characteristics
Mainframe interface	Tekprobe®-Sampling, Level 3. Hot switching is not permitted.
Number of inputs	2
Input and output connectors	SMA
Data input/output coupling	DC
Maximum non-destruct range	Either inputs: 2.5 V _{pk-pk}
Maximum operating range	Single-ended operation: Either input: 2.0 V _{pk-pk}
Maximum operating range	Complementary operation: Each input: 1 V _{pk-pk}
Maximum DC offset	±2.0 VDC
Electrical Return Loss	Data in+, data in-, data out+, data out-: 15dB or better DC to 10GHz
	Data in+, data in-, data out+, data out-: 10dB or better 10GHz to 20GHz
Electrical data attenuation	DC to 12.5 GHz: 6.6 dB ±0.6 dB
Propagation delay	Either inputs: 875 ps
Propagation Delay mismatch	Either inputs: <15 ps

Table 4: Module characteristics (Cont.)

Specifications	Characteristics
Input/output impedance	50 Ω
Step response aberrations	±2% or less over zone 10 ns to 20 ps before step transition ±10% or less for the first 300 ps following step transition +1% -5% or less over zone 300 ps to 3 ns following step transition +1% -3% or less over zone 3 ns to 100 ns following step transition ±0.5% after 100 ns following step transition
Analog bandwidth	±3 dB, DC to 20 GHz
Front panel output amplitudes	Trigger clock output: 400 mV _{pk-pk} 10G clock output: 500 mV _{pk-pk}
Front panel rise and fall times	Trigger clock output: 300 ps 10G clock output: 30 ps
Recovered clock timing jitter	50 M/bs to 2.7 G/bs: < 1.0% of unit interval 2.7 G/bs to 6.375 G/bs: < 2.5 ps RMS 9.8 G/bs to 12.6 G/bs: < 2.0 ps RMS
Minimum clock recovery sensitivity	Single-ended operation: 150Mb/s to 2.7 G/bs: 10 mV _{pk-pk} 2.7 G/bs to 11.19 G/bs: 15 mV _{pk-pk} 11.19 G/bs to 12.5 G/bs: 20 mV _{pk-pk}
	Complementary operation: 150Mb/s to 2.7 G/bs: 8 mV _{pk-pk} 2.7 G/bs to 11.19 G/bs: 12 mV _{pk-pk} 11.19 G/bs to 12.5 G/bs: 15 mV _{pk-pk}
Supported data rates and formats (without Option 10G)	OC3/SMT1 155.52 Mb/s OC12/STM4 622.08 Mb/s FibreChannel 1.063 Gb/s Gigabit Ethernet 1.250 Gb/s 2 Gigabit FibreCHannel 2.125 Gb/s OC48/STM16 2.488 Gb/s 2 Gigabit Ethernet 2.500 Gb/s InfiniBand 2.500 Gb/s 2.5G G.709 FEC 2.666 Gb/s 4 Gigabit FibreChannel 4.250 Gb/s
Supported user selected clock recovery (without Option 10G)	50 Mb/s to 2.7 Gb/s 3.000 Gb/s to 3.188 Gb/s
Supported data rates and formats added with Option 10G	OC192/STM64 9.953 Gb/s 10GBase-W 9.953 Gb/s 10GBase-R 10.31 Gb/s 10G FibreChannel 10.51 Gb/s G.975 FEC 10.66 Gb/s G.709 FEC 10.71 Gb/s 10GbE w/FEC 11.10 Gb/s

Table 4: Module characteristics (Cont.)

Specifications	Characteristics
Supported user selected clock recovery with Option 10G	50 Mb/s to 3.188 Mb/s 3.267 Gb/s to 4.250 Gb/s 4.900 Gb/s to 6.375 Gb/s 9.800 Gb/s to 12.60 Gb/s

Table 5: Environmental specifications

Specification	Characteristics
Temperature	Operating: +10 °C to +40 °C
Humidity	Non-operating: 5% to 90% relative humidity Operating: 20% to 80% relative humidity

Table 6: Mechanical specifications

Specifications	Characteristics
Weight	1.22 kg (2.70 lbs.)
Overall dimensions	Height: 2.5 cm (1.0 in) Width: 16.5 cm (6.5 in) Depth: 30 cm (12 in) Does not include connectors, connector savers, connector covers, push buttons, or lock-down hardware protruding from the front or rear panels.
Construction material	Chassis aluminum alloy; Front panel plastic laminate; Circuit boards glass-laminate; Cabinet sleeve aluminum Cabinet end covers aluminum

Table 7: Electromagnetic specifications

Specification	Characteristic
Emissions	<p>The instrument meets or exceeds the EMC requirements of the following standards: Emissions European Community Requirements (including EN 61326)</p> <p>EN55011 Class A Radiated Emissions EN55011 Class A Conducted Emissions IEC 1000-3-2 Power Harmonic Current Emissions</p>
Susceptibility	<p>The instrument meets or exceeds the EMC requirements of the following standards:</p> <p>EN61326-1 European Community Requirements IEC 1000-4-2 Electrostatic Discharge Immunity 4 kV contact discharge 8 kV air discharge Performance criteria B</p>