Instruction Manual

Tektronix

DAS®/TLA LADM934
MBus Bus Support

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General Safety Summary

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

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.

Injury Precautions

Do Not Operate in an Explosive Atmosphere

To avoid injury or fire hazard, do not operate this product in an explosive atmosphere.

Avoid Exposed Circuitry

To avoid injury, remove jewelry such as rings, watches, and other metallic objects. Do not touch exposed connections and components when power is present.

Product Damage Precautions

Provide Proper Ventilation

To prevent product overheating, provide proper ventilation.

Do Not Operate With Suspected Failures

If you suspect there is damage to this product, have it inspected by qualified service personnel.

Safety Terms and Symbols

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:

DANGER
High Voltage

Protective Ground
(Earth) Terminal

ATTENTION
Refer to Manual

Double
Insulated

Certifications and Compliances

EMC Compliance

This product has demonstrated compliance to the Electromagnetic Compatibility (EMC) specifications when attached to the instrument identified in the product specifications. If this probe is attached to an instrument other than the one identified in the product specifications, the EMC performance may exceed the EMC specifications published with the instrument.

Service Safety Summary

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

Do Not Service Alone

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

Disconnect Power

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

Use Care When Servicing With Power On

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

To avoid electric shock, do not touch exposed connections.

Preface: A Guide to DAS/TLA Documentation

The Digital Analysis System (DAS) documentation package provides the information necessary to install, operate, maintain, and service the DAS/NT, DAS/XP, and 92XTerm system and modules, and TLA 510 and TLA 520 system units. The DAS/TLA documentation consists of the following:

- The *DAS System User Manual* or *TLA 500 Series Logic Analyzer User Manual*, the main reference manuals for the DAS/TLA systems, that provides an overview of the operating system, basic installation information, a tutorial for new users, and information for system-level menus.
- The *DAS 92A96 & 92C96 Acquisition Module User Manual* that provides detailed information on the 92A96 and 92C96 Data Acquisition Modules and application; consult this manual for information on the 92A96 and 92C96 Setup and Display menus, and for information on how to connect acquisition probes to the system under test.
- A series of other module user manuals that provide detailed information on the data acquisition and pattern generation modules available for use with the DAS/TLA systems; consult the individual manuals for information on the Setup and Display menus for each module and for information on how to connect the probes to the system under test.
- An *LA-OffLine User Manual* that describes how to transfer, display, and analyze data (acquired on a DAS/TLA system) from a personal computer or a workstation.
- A series of bus, microprocessor, microcontroller, data communications, and digital signal processor support product instruction manuals that describe the various support products available with the DAS/TLA systems.
- A technician's reference manual that provides service information for qualified service technician to isolate problems to the module level.
- A series of software user manuals that accompany the various software support products.

About This Manual

This manual is based on the assumption that you are familiar with how to operate the system software for the DAS, TLA 510 and TLA 520 logic analyzers, and the 92A96 acquisition module application. Therefore, details about the system software and the acquisition application, and how to move through the menu structures are not provided. An overview of some of those functions is provided so that you do not need to consult another manual.

This manual provides detailed information for the MBus support product on how to do the following:

- Install and load application software
- Connect to your system under test
- Setup the disassembler software and use it
- View acquired data

The following conventions are used in this manual:

- The terms disassembler and disassembler software are used interchangeably in reference to the MBus support software that disassembles bus cycles into instruction mnemonics and cycle types.
- The term SUT (system under test) is used to refer to the MBus from which data is being acquired.
- References to DAS include TLA 510 and TLA 520 system units unless otherwise noted; these Tektronix Logic Analyzer (TLA) products operate identically to the DAS.
- References to 92C96 Modules include all versions of this modules unless otherwise noted.
- A signal that is active low has a tilde (~) following its name.

Getting Started

The DAS 92DM900 series of support products are developed by third parties to support buses, microprocessors, microcontrollers, and digital signal processors for specific Tektronix customers. These support products are currently being successfully used by these customers. If you need assistance in using this product, contact your local Tektronix Technical Support Specialist.

This section provides information on the following:

- The MBus Support product
- Logic analyzer system software (DAS) compatibility
- Logic analyzer configuration (DAS)
- Your MBus system requirements
- MBus support restrictions
- How to install and load software
- How to configure the probe adapter
- How to connect the DAS to the system under test

Product Description

The MBus Bus Support product disassembles data from systems based on Texas Instruments SuperSPARC microprocessors using MBus protocol. The instruction mnemonics are based on the SPARC Version 8 and SuperSPARC instruction set. The MBus support product runs on a DAS logic analyzer equipped with at least two 92C96 Acquisition Modules.

These products consist of an application on a floppy disk, a probe adapter, and this manual. The application includes setup files, one demonstration reference memory, and a disassembler program. A complete list of all accessories and options is provided at the end of the mechanical parts list in the *Replaceable Mechanical Parts* section.

A demonstration reference memory is provided so you can see an example of disassembled instruction mnemonics. You can view the reference memory without connecting the DAS to your SUT. The reference memory is automatically installed on the logic analyzer when you install the disassembler software. Directions for viewing this file can be found in the *Operating Basics* section.

To use this product efficiently, you need to have the following:

- Knowledge of your specific DAS configuration and its operation
- Knowledge of your MBus and SuperSPARC system
- This manual
- The *DAS System User Manua*l, Tektronix, Inc.
- The *92C96 Module User Manual*, Tektronix, Inc.
- The *SPARC MBus Interface Specification*, SPARC International, Inc. 1991

Logic Analyzer System Software Compatibility

The LADM934 MBus Support Product is compatible with any DAS System Software Release 3, Version 1.5 or higher. You can operate the software in an X window on a workstation (X terminal) or an X11/R4-compatible display.

Logic Analyzer Configuration

To use the bus support product, your DAS must be equipped with two 92C96 Modules. The modules must be combined to form a variable–width (192–channel wide) module in a single DAS mainframe.

Figure 1–1 shows an overview of a DAS connected to a typical probe adapter.

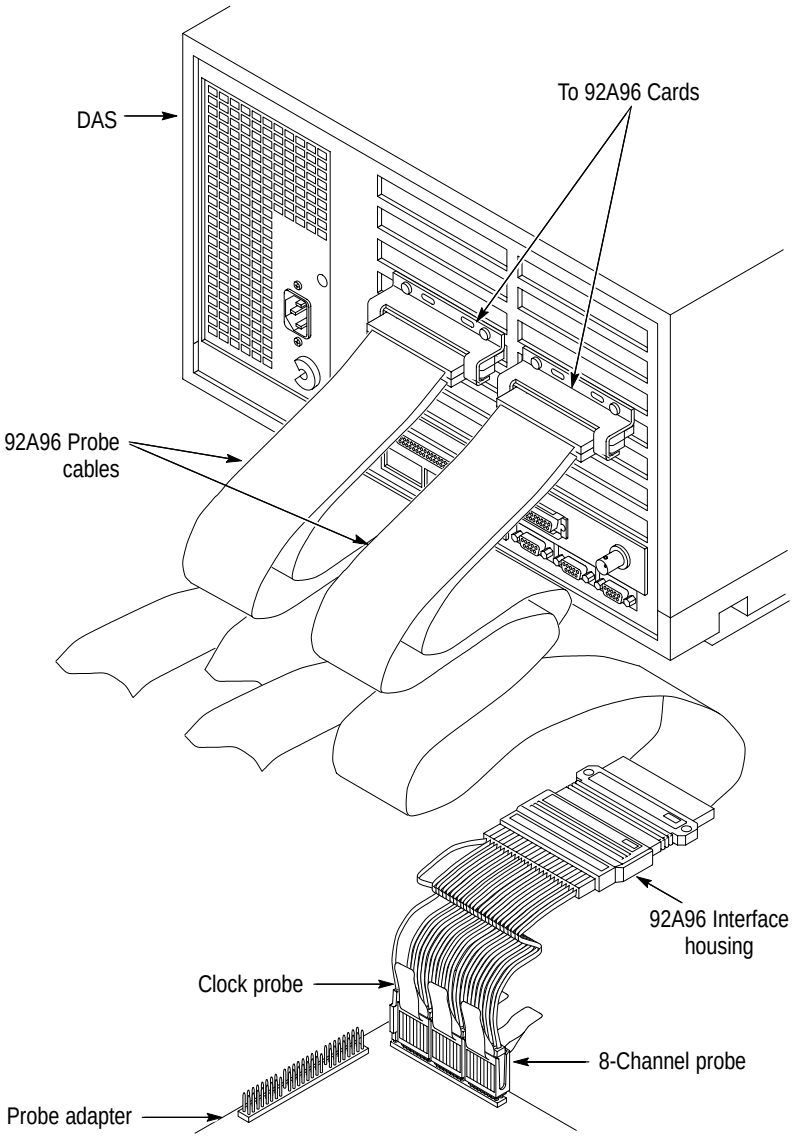


Figure 1–1: DAS connected to a typical probe adapter

Requirements and Restrictions

This section describes requirements and restrictions of the bus support product.

MBus System and Probe Adapter Cooling. You must retain the original level of cooling for your system after you install the probe adapter. To maintain the required operating temperature, you may need to provide additional cooling for the probe adapter.

Disabling the Instruction and Data Caches. To disassemble acquired data, you must disable the internal instruction and data caches on the SuperSPARC microprocessor. Disabling the cache makes all instruction prefetches visible on the MBus bus so they can be acquired and disassembled.

Configuring the DAS

When there are two or three 92C96 Modules in adjacent slots, they are automatically formed into a variable-width module by the system software at power up. If you need to to use one 92C96 Module from a variable-width module, you must reconfigure the DAS prior to selecting software support in the 92C96 Configuration menu. Refer to the discussion of the System Configuration menu in the *DAS System User Manual* for details on how to reconfigure variable-width modules.

Configuring the Variable-Width Module

To acquire data from a system using MBus protocol, two 92C96 Modules are required; they must be configured into one variable–width module (192–channels wide).

When using a variable–width module, both modules must be positioned in adjacent DAS slots in a single mainframe. You cannot use slots 1 or 8 when creating a variable–width module. The modules do not need to have the same memory depth.

Check the System Configuration menu to see if the module is defined correctly.

The Module in the higher–numbered slot is referred to as the HI module; the module in the lower–numbered slot is referred to as the LO module. Probe connections on the probe adapter board are labeled to identify which module and which probe group connects to them. For example, HI_A0 indicates the A0 probe group from the HI module.

Clock pins on the probe adapter do not have the HI/LO designation; they are just labeled CK0, CK1, CK2, and CK3. Each pair of clock pins connect to the same signal on the probe adapter. The clock probes from both modules must connect to the appropriate clock pins for custom clocking to function properly.

Refer to your module user manual for information about variable–width modules, and for additional information about connecting probe cables, and positioning and installing modules.

In a system with many modules, it is easier to identify which modules are connected to the probe adapter if slot number labels are applied to the 92C96 probe interface housings and DAS mainframe. Figure 1–2 shows where to apply slot number labels.

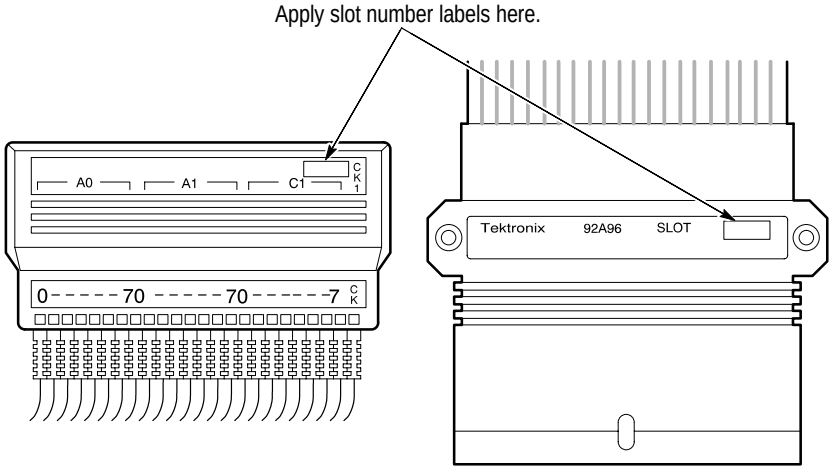


Figure 1–2: Applying slot number labels

Installing and Loading the Application

When you *install* the bus support software on the DAS system, you copy the files from the floppy disk to the mainframe's hard disk. When you *load* the application, the software from the mainframe's hard disk is loaded into the DAS system RAM.

If you have the 9201T version of the DAS system, you must change the system to the 92XTerm or 9202XT version.

Installing the Application

One floppy disk is shipped with the LADM934 support product for installing the application on a DAS system. The amount of disk free space required after installation is shown on the label of the floppy disk. During installation, you will need approximately twice that amount of disk space.

To install the application onto the DAS, follow these steps:

1. Power on the DAS mainframe.
2. Insert the disk labeled *LADM934 Bus Support* into the DAS's floppy drive.
3. Press the **Select Menu** key, and select the **Disk Services** menu.
4. Select **Install Application** in the Operation field of the menu.
5. Press **F8: EXECUTE OPERATION**, and follow the on-screen prompts.

NOTE. *After each install and load operation, a message appears on the screen informing you the operation succeeded or failed. If the message tells you the operation failed, you may need to remove applications or files from the hard disk and try installing or loading again. If the operation fails again, refer to* Appendix A: Error Messages and Disassembly Problems.

If there is inadequate disk free space available on the hard disk, you must use the Remove Application or Delete File function of the Disk Services menu to free up enough disk space to install the application.

For information on installing the LA-OffLine bus support application on your workstation, refer to the *LA-OffLine User Manual*.

Loading the Application

To load the MBus disassembler, follow these steps:

1. Press the **Menu Select** key, select the appropriate **92C96** module, and select its **Configuration** menu.
2. Select **MBus–2 Support** in the Software Support field.

When you load the disassembler, the Channel, Clock, and Trigger menus are automatically set up to acquire data from your MBus system. You can change the setups in the Clock and Trigger menus as needed. Refer to *Channel Groups and Assignments* in the next section for information on what can be changed in the Channel menu.

If you want to perform general purpose analysis, such as timing using Internal or External clocking, you need to restore the MBus_Tmg_96 Module Setup file. To do this, follow these steps:

1. Press the **Menu Select** key and select the **Save/Restore** utility menu.
2. Select **Restore Setup** in the Operation field of the Save/Restore menu.
3. Select **MBus_Tmg_96** in the File field.
4. Press **F8: EXECUTE OPERATION**.

When you restore the MBus_Tmg_96 setup file, the Channel menu is automatically set up to acquire multiplexed address and data from your MBus system.

Configuring the Probe Adapter

You can use the MCLK jumper, J150, to set the source of the clock signal on the probe adapter for proper clocking. The jumper position must match the MCLK signal used in the your MBus system: MCLK0, MCLK1, MCLK2, or MCLK3. Figure 1–3 shows the location of the MCLK jumper.

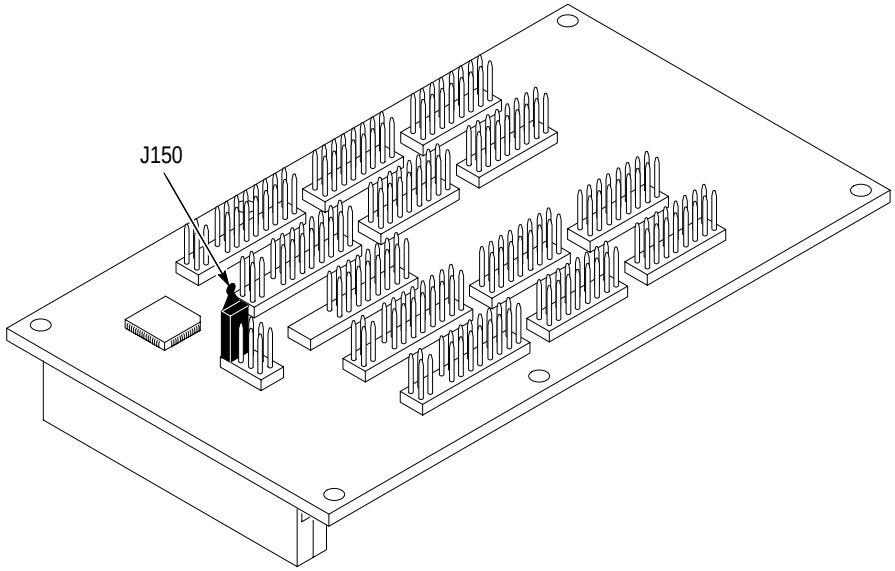


Figure 1–3: Jumper location

Connecting to the System Under Test

Before you connect to the SUT, you must connect the standard probes to the 92C96 module card. Your SUT must also have a minimum amount of clear space surrounding the MBus connector to accommodate the probe adapter.

To connect the DAS to the SUT, follow these steps:

1. Turn off power to your SUT. It is not necessary to turn off power to the DAS

CAUTION. *Static discharge can damage the microprocessor, the probe adapter, the podlets, or the 92C96 Module. To prevent static damage, handle all of the above only in a static–free environment.*

Always wear a grounding wrist strap or similar device while handling the probe adapter.

2. To discharge your stored static electricity, touch the ground jack located on the back of the DAS. Then, touch any of the ground pins of the probe adapter to discharge stored static electricity from the probe adapter.

3. Connect the 92C96 clock and 8–channel probes to the probe adapter as shown in Figures 1–4. Match the channel groups and numbers on the probe interface housing to the corresponding pins on the probe adapter. Match the ground pins on the probes to the corresponding pins on the probe adapter.

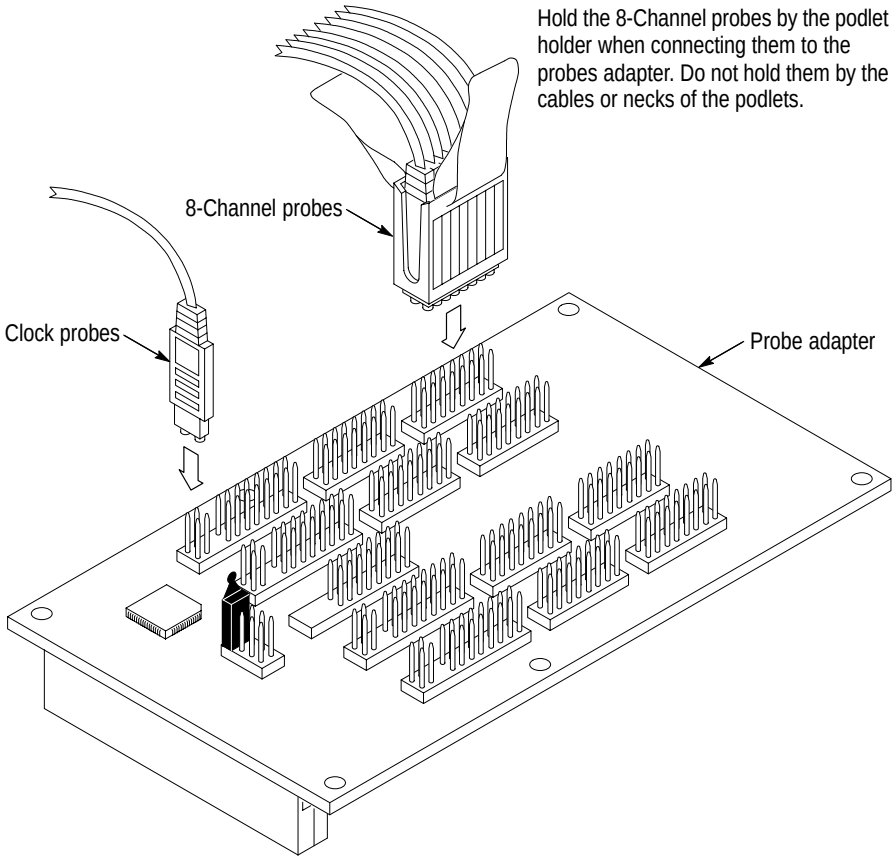


Figure 1–4: Connecting podlets to the MBus probe adapter

4. Align pin 1 on the probe adapter connector with pin 1 on the connector in your SUT and connect the two together as shown in Figure 1–4.

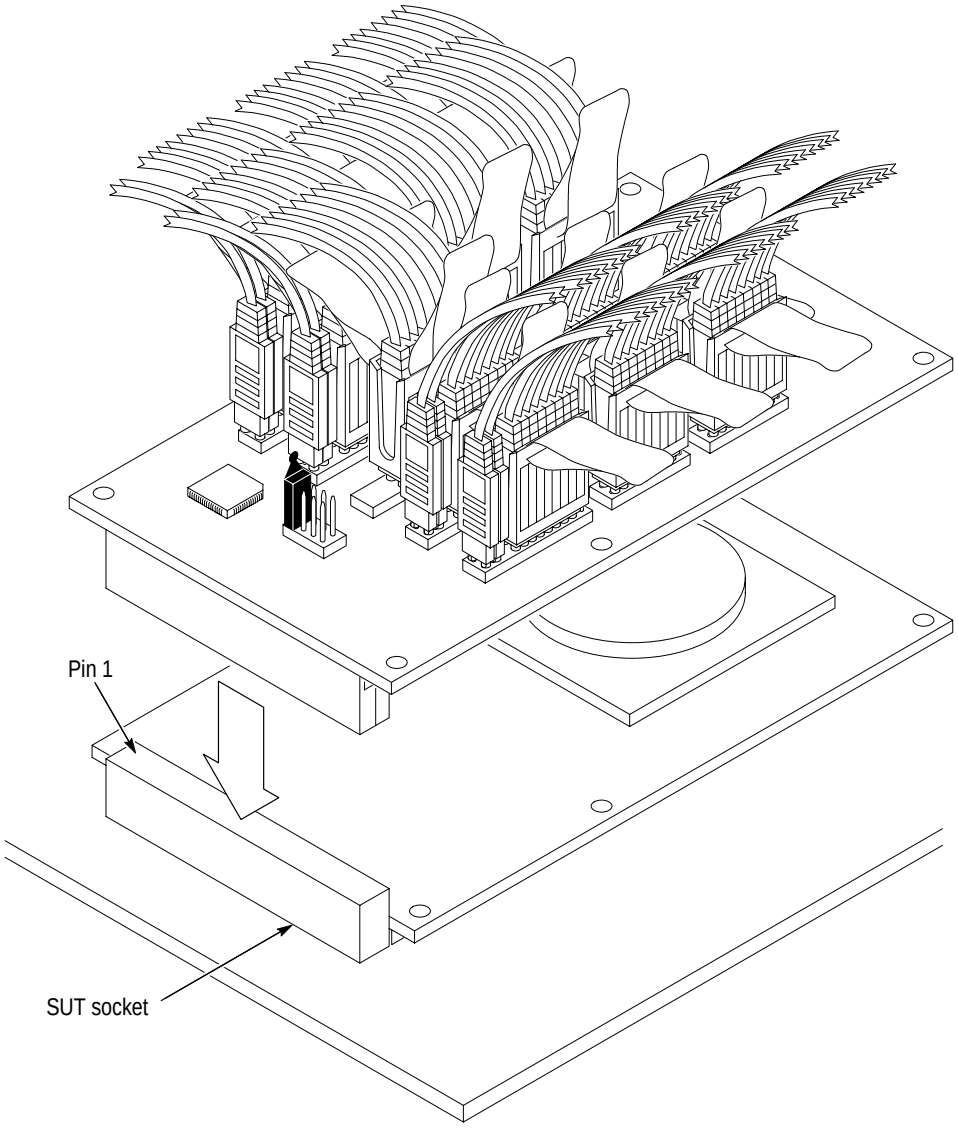


Figure 1–5: Placing the MBus probe adapter onto the SUT

Operating Basics

This section provides information on preparing the disassembler for acquiring data, and on acquiring and displaying data. Information on general purpose analysis is also provided.

Setting Up Disassembler Software

This part of the section discusses the following:

- Channel groups and assignments
- Changes that affect disassembly
- Clocking options
- Symbols

Before you acquire and disassemble data, you need to load disassembler software and specify setups for clocking, triggering, and using symbols. The disassembly software provides default values for each of these setup controls, but you can change them as needed.

Channel Groups and Assignments

The disassembler software automatically defines the channel groups for the MBus. The channel groups for the MBus are found in the channel assignment tables in the Specifications section.

Channel groups cannot be changed nor can the channels be reused in another group, but you can define and display additional groups. Channel assignments are also shown in the 92C96 Channel Setup menu.

Changes that Affect Disassembly

You can change part of the default setups for the 92C96 Module. If you change the threshold voltage or display polarity, the disassembled data will be affected.

Custom Clocking

You can use the 92C96 Clock menu to set clocking choices to control data sampling. The MBus application offers a specific clocking mode for MBus protocol. This clocking mode (Custom) is the default choice whenever you select MBus-2 Support in the Configuration menu.

The MBus application acquires all MBus cycles. No clocking options are available. A description of how cycles are sampled by the disassembler, probe adapter and 92C96 module is found in the *Specifications* section.

To select the clocking mode, follow these steps:

1. Press the **Select Menu** key.
2. Select the **Clock** menu for the module you want to use.

Disassembly will not be correct with the Internal or External clocking modes. Descriptions of using the other clock selections with the MBus support product can be found later in this section.

Symbols

Symbols can be used to represent data as a specific value (pattern symbols) or as a range of channel group values (range symbols are defined by upper and lower bounds.

A table of pattern symbols for the Control channel group is supplied by the disassembler and is automatically loaded with the disassembler software. You can use symbol tables to display channel group information symbolically in the State and Disassembly menus and to control triggering.

Table 2–1 shows the name, bit pattern, and meaning for the symbols in the Control group symbol table. The Control group symbol table file name is MBus-2_Ctrl.

Table 2–1: Control group symbol table definitions

Symbol	Control group value			Meaning
	MERR~	WRDY~ WRDY~ MSH_L MSI_L	MAD39 MAD38 MAD37 MAD39	
CRI	1	0 1 1 0	0 1 0 1	Coherent Read and Invalidate
CRI_O_DATA	1	0 1 1 0	0 1 0 1	Coherent Read and Invalidate (of owned data)
CWI	1	0 1 X X	0 1 0 0	Coherent Write and Invalidate
CR_Sh_Data	1	0 1 0 1	0 0 1 1	Coherent Read and Invalidate (of Shared Data)
CR_O_Data_LLM	1	0 1 0 0	0 0 1 1	Coherent Read of Owned data (long-latency memory)
CR_O_Data_FM	1	0 1 1 1	0 0 1 1	Coherent Read of Owned data (fast memory)
CI	1	0 1 X X	0 0 1 0	Coherent Invalidate
RD	1	0 1 X X	0 0 0 1	Any memory or I/O read
WR	1	0 1 X X	0 0 0 0	Any memory or I/O write
IDLE	1	1 1 X X	X X X X	Idle Cycles
R&R	1	1 0 X X	X X XX	Relinquish and Retry
Valid_Data	1	0 1 X X	X X X X	Valid Data Transfer
Bus_Error	0	1 1 X X	X X X X	Bus Error
Timeout	0	1 0 X X	X X X X	Timeout
Uncorrectable	0	0 1 X X	X X X X	Uncorrectable
Retry*	0	0 0 X X	X X X X	Retry
Undefine	X	X X X X	X X X X	Reserved for future use or undefined

*** Symbols used only for triggering with the Internal or External clock mode; they do not appear in the Disassembly or State displays.**

Table 2–2 shows the name, bit pattern, and meaning for the symbols in the Size group symbol table. The Size group symbol table file name is MBus-2_Size.

Table 2–2: Size group symbol table definitions

Symbol	Size group value MAD39 MAD37 MAD39	Meaning
Byte	0 0 0	Byte access (8 bits)
Half-word	0 0 1	Half word access (16 bits)
Word	0 1 0	Word access (32 bits)
Double-word	0 1 1	Double word access (64bits)
16-byte-Burst	1 0 0	Burst 16 bytes
32-byte-Burst	1 0 1	Burst 32 bytes
64-byte-Burst	1 1 0	Burst 64 bytes
128-byte-Burst	1 1 1	Burst 128 byte

Table 2–3 shows the name, bit pattern, and meaning for the symbols in the Irl_0 and Irl_1 group symbol table. The Irl_0 and Irl_1 group symbol table file name is MBus-2_Intr.

Table 2–3: Irl_0 and Irl_1 group symbol table definition

Symbol	Irl_0 and Irl_1 group value IRL[3] IRL[2] IRL[1] IRL[0]	Meaning
INT 15	1 1 1 1	Interrupt Request Level 15
INT 14	1 1 1 0	Interrupt Request Level 14
INT 13	1 1 0 1	Interrupt Request Level 13
INT 12	1 1 0 0	Interrupt Request Level 12
INT 11	1 0 1 1	Interrupt Request Level 11
INT 10	1 0 1 0	Interrupt Request Level 10
INT 9	1 0 0 1	Interrupt Request Level 9
INT 8	1 0 0 0	Interrupt Request Level 8
INT 7	0 1 1 1	Interrupt Request Level 7
INT 6	0 1 1 0	Interrupt Request Level 6
INT 5	0 1 0 1	Interrupt Request Level 5
INT 4	0 1 0 0	Interrupt Request Level 4

Table 2–3: Irl_0 and Irl_1 group symbol table definition (Cont.)

Symbol	Irl_0 and Irl_1 group value IRL[3] IRL[2] IRL[1] IRL[0]	Meaning
INT 3	0 0 1 1	Interrupt Request Level 3
INT 2	0 0 1 0	Interrupt Request Level 2
INT 1	0 0 0 1	Interrupt Request Level 1
–	0 0 0 0	No Interrupt

Refer to *Displaying Channel Groups Symbolically* in this section for more information on displaying symbolic values. Refer also to *Searching Through Disassembled Data* in this section for information on how to use symbol table values for 92C96 data searches.

Copying and Editing the Predefined Symbol Tables. You cannot directly edit any symbol tables supplied by bus support. But you can make a copy of a predefined symbol table and then edit the copy for your specific use.

To create a new symbol table, follow these steps:

1. Select the **Symbol Editor** menu from the Menu Selection overlay.
2. Press **F2: FILE FUNCTIONS**.
3. Select **Open File** in the Function field, and press **Return**.
4. Select **New File** in the Edit Status field, and press **Return**.
5. Enter a new symbol table file name in the New File Name field.
6. Select **Pattern** or **Range** in the Table Type field to match the symbol table you are copying, and press **Return**.
7. Press **F5: EXECUTE FUNCTION**.
8. Select **Merge Files** in the Function field, and press **Return**.
9. Select the file to base your new symbol table on, such as the MBus-2_Ctrl file.
10. Press **F5: EXECUTE FUNCTION**.
11. Press **F8: EXIT & SAVE**.
12. Edit the file as desired keeping the following in mind:

- If the new symbol has fewer don't cares than an existing symbol, it must be placed ahead of the existing symbol.
- If the new symbol has more don't cares than an existing symbol, it must be placed after the existing symbol.
- Do not duplicate symbol names.

Also refer to your system user manual for more information on editing the symbol table.

13. Select the **Channel** menu from the Menu Selection overlay.
14. Change the file name of the symbol table for the Control group (or the group's symbol table you are replacing) to the one that you specified in step 5.

Acquiring and Displaying Disassembled Data

This part of this section describes how to acquire data and view it disassembled in the Disassembly menu of the DAS. These descriptions include:

- Acquiring data
- Viewing disassembled data in various formats
- Functions of the Disassembly Format Definition overlay
- Displaying groups symbolically
- Searching through data
- Printing data
- Viewing the demonstration reference memory

Acquiring Data

Once you load the MBus-2 Support, choose a clocking mode, and specify the trigger, you are ready to acquire and disassemble data.

On the DAS, press the F1: START acquisition key to begin the acquisition. You can press the F1: STOP key at any time to stop acquisition.

If you have any problems acquiring data, refer to *Appendix A: Error Messages and Disassembly Problems*.

Viewing Disassembled Data

Disassembled data is displayed in the Disassembly menu of the DAS in four different formats: Hardware, Software, Control Flow, and Subroutine (State display is also a selection you can choose, but you will not see disassembled data.)

To select a format in the Disassembly menu of the DAS, follow these steps:

1. Press the **Select Menu** key and select the **Disasm** menu.
2. Press **F5: DEFINE FORMAT**.
3. Select the desired format in the **Display Mode** field.
4. Press **F8: EXIT & SAVE**.

You can select the display format and tailor it for your application using the Disassembly Format Definition overlay. Figure 2–1 shows an example of MBus data.

NOTE. *Selections in the Disassembly Format Definition overlay must be set correctly in order for your acquired data to be disassembled correctly. Refer to* Disassembly Format Definition Overlay *later in this section.*

Hardware Display Format. The Hardware display format shows the Hi, P_Addr_L, Data_H, and Data_L channels for each sample of acquired data. In Hardware data format, all bus cycles are shown in the order that they occurred. Instruction Mnemonics are displayed on assumed instruction Fetch cycles and cycle-type information is displayed for all other cycles. The disassembler cannot detect flushes following a branch instruction. Non-instruction bus cycles are displayed as either 32-bit or 64-bit wide data transfers.

The Hi group column in the Disassembly display shows the high-order 4 bits of the address. If your MBus system is restricted to a 32-bit physical address, you can make this group invisible in the Disassembly Format Definition overlay. However, making this group invisible will not stop the disassembler from displaying the appropriate value in the operand.

The P_Addr_L group column in the Disassembly display shows value for the low-order 32 bits of the address at each sequence. The module latches the value during the address part of the MAD bus as P_Addr_L, and, based on that value, the disassembler synthesizes the addresses for the data cycles.

For block reads and writes, the calculated address follows the rules of Sub-block Ordering. For each double-word cycles, the address calculated for the first line will be modulo-8 and the address calculated for the second line will be modulo-8 plus 4.

The Data_H and Data_L in the Disassembly shows value for the data part of the MAD bus. Valid data bytes of the data will be shown during data transfers. All invalid bytes will be dashed (– –) out.

Due to superscaler architecture, the SuperSPARC microprocessor reads two instructions simultaneously. If the microprocessor cannot execute two instructions simultaneously, it reads the same instructions again. Since the bus does not indicate which instruction was executed or not, instruction mnemonics are displayed on all assumed instruction fetch cycles.

Table 2–4 shows cycle type labels and gives a definition of the cycle they represent.

Table 2–4: Cycle type definitions

Cycle type	Definition
(IDLE)	Idle cycles
(Relinquish & Retry)	Relinquish and retry
(ERROR 1: Bus Error)	Bus error
(ERROR 2: Bus Timeout)	Timeout
(ERROR 3: Bus Uncorrectable)	Uncorrectable
(CRI)	Coherent read and invalidate
(CRI Owned Data)	Coherent read and invalidate of owned data
(CWI)	Coherent write and invalidate
(CR Shared Data)	Coherent read and invalidate of shared data
(CR Owned Data LLM)	Coherent read of owned data (long-latency memory)
(CR Owned Data FM)	Coherent read of owned data (fast memory)
(CI)	Coherent invalidate
(RD)	Any memory or I/O read
(WR)	Any memory or I/O write
(Undefine)	Undefined

Figure 2–1 shows an example of disassembled MBus data in the Hardware display format.

```
Sequence  Hi  P_Addr_L  Data_H    Data_L    Mnemonic
-----------------------------------------------------------------
       9  F   F00109A0  01000000  10800010  NOP
          F   F00109A4  01000000  10800010  BA F:F00109E4
      10  F   F00109A8  01000000  A8102700  NOP
          F   F00109AC  01000000  A8102700  OR %g0, 0700, %l4
      11  F   F00109E0  EAA00080  27380004  STA %l5, [%g0 + %g0] 04
          F   F00109E4  EAA00080  27380004  SETHI 380004, %l3
      12  F   F00109E8  A614E008  EC84C5E0  OR %l3, 0008, %l3
          F   F00109EC  A614E008  EC84C5E0  LDA [%l3 + %g0] 2F, %l6
      13  F   F00109F0  AC2DA00E  EA800080  ANDN %l6, 000E, %l6
          F   F00109F4  AC2DA00E  EA800080  LDA [%g0 + %g0] 04, %l5
      14  F   E0001008  00000003  --------  ( RD )
      15  F   F00109F8  A935601C  80A52000  SRL %l5, 001C, %l4
          F   F00109FC  A935601C  80A52000  SUBcc %l4, 0000, %g0
      16  F   F00109F8  A935601C  80A52000  SRL %l5, 001C, %l4
          F   F00109FC  A935601C  80A52000  SUBcc %l4, 0000, %g0
      17  F   F0010A00  22800005  A8102008  BE, a F:F0010A14
          F   F0010A04  22800005  A8102008  OR %g0, 0008, %l4
      18  F   F0010A08  A935600F  1080000A  SRL %l5, 000F, %l4
          F   F0010A0C  A935600F  1080000A  BA F:F0010A34
      19  F   F0010A10  A80D200F  808D6800  AND %l4, 000F, %l4
          F   F0010A14  A80D200F  808D6800  ANDcc %l5, 0800, %g0
```

Figure 2–1: Disassembled data in the Hardware display format

Software display Format. The Software display format displays all assumed instruction fetches. Labels that indicate the beginning of exception handler routines are displayed. All other cycle types are suppressed. The disassembler cannot detect flushes following branch instruction. The display is designed to resemble assembly language listings.

Control Flow Display Format. The Control Flow display format shows instructions that change the flow of control. Some instructions that do not actually change the control flow are displayed, such as a conditional branch that is not taken.

Exception handler entry labels and the instruction at that location will be displayed for control flow instructions. The label is always displayed regardless of the type of instruction.

Subroutine Display Format. The Subroutine display format shows the first fetch of subroutine calls and return instructions. Subroutine call are assumed to be branch and jump instructions that perform a link. Because the disassembler cannot detect when a flush occurs, conditional branches are always displayed.

Disassembly Format Definition Overlay

The Disassembly Format Definition overlay allows you to make optional display selections for the Disassembly menu and tailor it for your applications.

You can use this overlay to do the following:

- Choose the format (mode) in which the Disassembly menu displays disassembled data
- Set the interval in which the data cursor will scroll through disassembled data
- Display and define the format of the timestamp
- Highlight various types of disassembled cycles
- Choose to disassemble across gaps
- Specify the starting address of the trap area
- Specify the total number of traps
- Specify the starting address of program code area
- Specify the size of program code area
- Change the position of any channel group in the display
- Change the radix for any channel group
- Choose which symbol tables are to be used when channel groups are displayed symbolically

Press **F5: DEFINE FORMAT** from the Disassembly menu to see the overlay. The following paragraphs describe the fields and selections available in the Disassembly Format Definition overlay.

Display Mode. You can select Hardware, Software, Control Flow, or Subroutine format.

Timestamp. You can display the timestamp as an Absolute, Relative, or Delta value. You can also set the timestamp display to Off.

Timestamp values show the amount of time that has elapsed between data samples. An Absolute timestamp shows the amount of time elapsed between when the acquisition was started (after pressing F1: START) and each subsequent data sample. A Relative timestamp shows the amount of time elapsed between successive samples. A Delta timestamp shows the amount of time elapsed between the sample with the delta user mark and each previous or subsequent data sample.

Scroll By. You can scroll by Sequence, Instruction, Control Flow, or Subroutine.

Highlight. You can highlight Instructions, Control Flow, or Subroutines. With highlighting on, only the selected type of samples are shown as white text with a black background; all other samples are shown as gray text with a black background. You can also set the highlighting to Off.

Highlight Gaps. You can choose to highlight or not to highlight gaps. Gaps are caused by qualifying data storage in the Trigger menu and are indicated by a gray background behind the address values.

Disasm Across Gaps. You can choose to continue or not to continue to disassemble data across gaps. Disassembling data across gaps causes the disassembler to disassemble data as if no gap existed. Disassembled data will be invalid if the last sample before the gap does not logically match the sample immediately following the gap.

Trap Base Address. You must enter the base address for the trap area. The default trap area base value is 0.

Total Number of Traps. You must enter the total number of hardware and software traps. The default number of traps is 100.

Program Area Begin [35-32]. Since the MBus does not indicate whether a read is filling the instruction cache or the data cache, you must enter the upper four bits of the beginning address and size of the program code area. The default value is F.

The disassembler assumes that read cycles are instructions within the address range specified in the Program Area Begin fields and the Program Area Size field.

Program Area Begin [31-0]. Since the MBus does not indicate whether a read is filling the instruction cache or the data cache, you must enter the lower 32 bits of address and size of the program code area. The default value is F0000000.

Program Area Size. You can enter the size of the program code area. The default value is 100000.

Group Name. You can specify the name of the group that displays in the column in which the cursor is positioned. When you move a group, the group is inserted in the new column position and removed from its old position. Remaining groups will move one column position to the left or right as appropriate.

Group Radix. You can select the radix in which each group displays. The radix selections for most groups are Binary, Octal, Hexadecimal, Symbol, and Off. The only selections for the Data group are Hexadecimal or Off. The only selections for Mnemonics group are ASCII or Off. You should only select the symbolic radix when a symbol table is available for that group. The timestamp value always displays in decimal.

Symbol Table. You can specify a symbol table to use for each group where symbolic is the selected radix.

F1: ESCAPE & CANCEL. Closes the overlay and discards any changes you have made since entering it.

F5: RESTORE FORMAT. Displays a list of saved disassembly formats for the current module or cluster setup. Use the cursor keys to select the desired format to restore, and press the Open/Close key.

F6: SAVE FORMAT. Saves the current selections for the Disassembly Format Definition overlay in a file on disk. You can enter a file name up to ten characters long.

F7: DELETE FORMAT. Displays a list of saved disassembly format files for the current module or cluster setup. Use the cursor keys to select the desired format to delete, and press the Open/Close key. You cannot delete the Default format.

F8: EXIT & SAVE. Exits the overlay and executes or saves any changes made.

Displaying Channel Groups Symbolically

Any channel group can be displayed as symbolic values in the Disassembly menu similar to the way the Control group can be displayed as symbolic values.

If you create a range symbol table for the Address group, the address will also be displayed symbolically when it appears in the operand field of a mnemonic.

You can use the Symbol Editor menu to create symbol tables in which symbols are assigned to various channel group values (ranges or patterns). You can then change the radix of the channel group in the Disassembly menu using the Disassembly Format Definition overlay, and select the symbol table you created to use for display, triggering, or data search purposes.

Searching Through Disassembled Data

The MBus application does not have a Disassembly Search Definition overlay. However, you can effectively search through disassembled data by following these steps:

1. Press **F2: SPLIT DISPLAY** to use the split-screen display.
2. Press **F5: SPLIT HORIZ** to split the screen into two horizontal displays.
3. Press **F2: LOCK CURSOR**. A list of selections appears.
4. Select **lock cursors at the same sequence**, and press Return.
5. Press **F8: EXIT & SAVE** to display the menus in a split screen.
6. If the active window is the Disassembly menu, press **F3: SWITCH WINDOWS** to make the State menu active. The cursor and Cursor field are yellow in the active window.
7. Press **F6: DEFINE SEARCH** to use the search function of the State menu to search for the desired sequence.

To search on Control group values, change the radix to binary and refer to Table 2–1 in this section to find the binary equivalent values for the cycles you want to locate. You can also use this method to search on binary equivalent values for other channel groups with symbol tables.

When searching for data in a clustered module setup in the State menu, the searches are conducted only for the master module. You can, however, define either module to be the master module. Refer to the description of the State Search Definition overlay in your *92C96 Module User Manual* for a description of how to search through state data. Also refer to that manual for a description of how to return to a full screen display.

To abort a search, press the **Esc** (escape) key.

Printing Disassembled Data

To print disassembled data, use the Disassembly Print overlay. To access this overlay, press the Print Screen key from the Disassembly menu. The Disassembly Print overlay is exactly the same as the State Print overlay. Refer to your module user manual for a description of this overlay.

Reference Memory

A demonstration reference memory file is provided so you can see an example of how data from your system based on a SuperSPARC microprocessor using MBus protocol looks when it is displayed. Viewing the reference memory is not a requirement for preparing the 92C96 module for use. You can view the reference memory file without connecting the DAS to your SUT.

To view the MBus_Demo Refmem, follow these steps:

1. Press the **Select Menu** key and select the **MBus_Demo** file from the Refmem column.
2. Select the **Disasm** menu from the Display column and press **Return**.

You can change the display of disassembled data from the Disassembly Format Definition overlay, which you can access through the Disassembly menu.

If there is not enough free space on the hard disk, you can delete the MBus_Demo reference memory file. They are not necessary to the operation of the application.

General Purpose Analysis

You may need to perform general purpose (timing) analysis on your MBus system prior to, during, and after attempting to integrate your software with the MBus system hardware. When performing hardware analysis, you will want to use the data acquisition module to acquire data with a finer resolution. When more data samples are taken in a given period of time, the resolution in the Timing display increases, letting you see signal activity that would otherwise go undetected.

This part of this section provides information on the following:

- Timing analysis
- State analysis
- Displaying data
- Supplied Timing Format Definition file

Keep in mind when you view state data in the State menu (92C96) that it uses the default channel grouping setup with all groups visible and that disassembly does not occur. All channel groups will display in the default order and and will look different than disassembled data.

Refer to the channel assignment tables in the *Specifications* section to see which channels are not required for disassembly. You can disconnect these channels to make other MBus system connections.

Clocking

To change the data sampling rate, use the 92C96 Clock menu.

When using the 92C96 Module for timing analysis, you will want to use the Internal or External clocking modes. The Internal clock selection can sample data up to 100 MHz, which has a 10 ns resolution between samples. The External clock selection samples data on every active clock edge on the 92C96 clock inputs up to 100 MHz.

The default clocking mode is Custom when MBus-2 Support is selected in the Configuration menu; you will need to change it to either Internal or External. Your module user manual contains an in-depth description of Internal and External clocking.

Custom Clocking. Custom clocking only stores one data sample for each bus transaction, which can take one or more clock cycles. Custom clocking also time aligns certain signals that otherwise would be skewed relative to the current bus transaction. This clocking selection is generally unproductive for timing analysis. Refer to the *Specifications* section for a more in depth description of how Custom clocking is used with the probe adapter to acquire data.

Internal Clocking. Because the Data_H and Data_L groups are demultiplexed from the MAD bus by Custom Clocking, in Internal Clocking, this data cannot be acquired and displayed. You should use MBus_Tmg_96 Module Setup for timing analysis. Information on how to restore this setup is under *Loading the Application* in the *Getting Started* section.

When you select Internal as the clocking mode, the 92C96 Module stores one data sample as often as every 10 ns (100 MHz). This clocking selection is commonly referred to as asynchronous.

Two typical uses of Internal clocking might be to verify that all the MBus signals are transitioning as expected or to measure timing relationship between signal transitions.

It is possible to acquire asynchronous data at rates of 200 MHz and 400 MHz. The faster the 92C96 Module acquires data, the fewer channels it can acquire data on. A single 92C96 Module can acquire data on 24 channels at 400 MHz or 2.5 ns resolution. Refer to your *92C96 Module User Manual* for information on sampling data at speeds faster than 100 MHz.

External Clocking. Because the Data_H and Data_L groups are demultiplexed from the MAD bus by Custom Clocking, in External Clocking, this data cannot be acquired and displayed. You should use MBus_Tmg_96 Module Setup for timing analysis. Information on how to restore this setup is under *Loading the Application* in the *Getting Started* section.

When you select External as the clocking mode, the 92C96 Module acquires and stores data based on the clock channel up to 100 MHz. This clocking selection is commonly referred to as synchronous.

Searching Through State and Timing Data

To search through 92C96 data, you can use either the Timing Search Definition overlay or the State Search Definition overlay. You can use these overlays and search through data as described in your *92C96 Module User Manual*.

Before performing a search in the Timing menu, be sure to check the State Format Definition overlay and make sure the channels on which you want to conduct the search will be displayed (radix is not Off). Channels in the TIming menu cannot be searched on unless they can also be displayed in the State menu.

Printing State and Timing Data

To print 92C96 state data, you can use the State Table Print overlay. To access this overlay, press the Shift and Print keys at the same time from the State menu.

To print timing data, you can use the Timing Print overlay. To access this overlay, press the Shift and Print keys at the same time from the Timing menu.

For detailed information on the State Table Print overlay or the Timing Print overlay, refer to your *92C96 Module User Manual*.

Timing Display

General purpose analysis requires that you view data in either the State or Timing display menus (or both). In the Timing display, every channel is shown as a waveform, and groups of channels (such as the P_Addr_L group) are shown as bus forms.

Two predefined Timing Format Definition overlay files, part of the MBus support product, are available for you to use when viewing data in the Timing display. The MBus-2_96 and MBus_Tmg_96 files are installed on the DAS when you install the application.

The MBus-2_96 Timing Format Definition file places the Hi, P_Addr_L, Data_H, and Data_L groups first and displays them as bus forms containing bus values instead of as individual timing waveforms. These groups are followed by other important control signals.

The MBus_Tmg_96 Timing Format Definition file places the MAD_H and MAD_L groups first and displays them as bus forms containing bus values instead of as individual timing waveforms. These groups are followed by other important control signals.

To select a supplied Timing Format Definition file, follow these steps:

1. Press the **Select Menu** key, select the **Timing** menu and press **F5: DEFINE FORMAT**.
2. Press **F5: RESTORE FORMAT**.

3. Select **MBus_96** if you are using the MBus-2 Support setup, or select **MBus_Tmg_96** if you are using the MBus_Tmg_96 Module setup and press the **Return** key.

4. Press **F8: EXIT & SAVE** to return to the Timing menu.

Refer to the channel assignment tables in the *Specifications* section for the lists of individual channels and their MBus signal names.

State Display

In the State menu, all channel group values are shown based on the selected radix in the Channel menu or the State Format Definition overlay. Disassembly does not occur.

If you want to display other channel groups (such as Misc), access the State Format Definition overlay and change the radix for the group from Off to Hex, Bin, or Oct. This overlay also allows you to add the Timestamp group (and change the radix) to the data display.

Specifications

This section contains the following information:

- Brief description of the probe adapter
- Channel assignment tables
- Description of how the 92C96 Module acquires MBus signals
- List of accessible MBus signals and extra 92C96 channels

Probe Adapter Description

The probe adapter is a nonintrusive piece of hardware that allows the 92C96 to acquire data from an MBus in its own operating environment with little affect, if any, on that system. Refer to the DAS overview figure in the *Getting Started* section while reading the next paragraph.

The probe adapter consists of a circuit board and a socket for the MBus. The probe adapter connects to the bus in the SUT (system under test). Signals from the MBus system flow from the probe adapter to the probes (podlet groups). The signals flow through the probe signal leads to either the 92C96 Acquisition Module.

All circuitry on the probe adapter is powered from the SUT.

The probe adapter accommodates the MBus signals in a 100-pin connector.

There is one jumper, J150, used to set the MCLK signal source on the probe adapter for proper clocking. The jumper position must match the MCLK signal used in the SUT: MCLK1, MCLK1, MCLK2, or MCLK3. A description of configuring the probe adapter is located in the *Operating Basics* section.

Figure 3–1 shows the dimensions of the probe adapter.

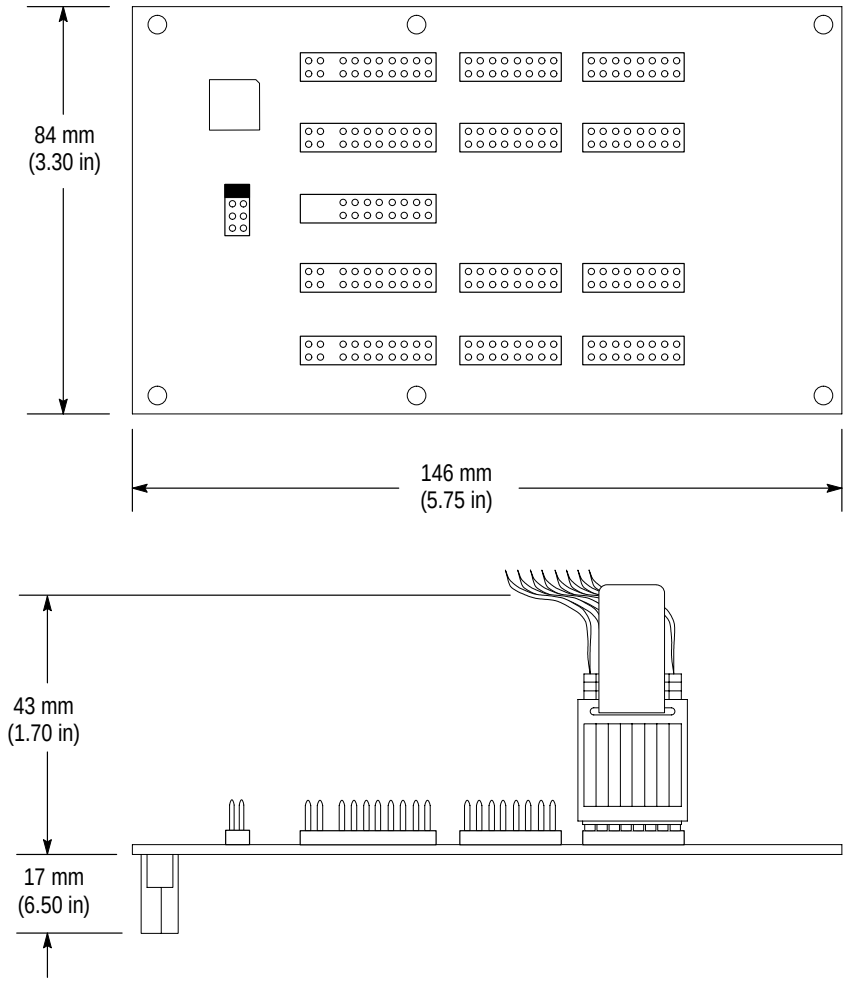


Figure 3–1: Minimum clearance of the probe adapter

Channel Assignments

Channel assignments shown in Table 3–1 through Table 3–20 use the following conventions:

- All signals are required for disassembly (MBus-2 Support with Custom clocking) or general purpose analysis (MBus_Tmg_96 Module Setup with External or Internal clocking) unless indicated otherwise
- Channels are shown starting with the most significant bit (MSB) descending to the least significant bit (LSB)
- A tilde sign (~) following a signal name indicates an active low signal
- An equals sign (=) following a signal name indicates that the signal is double probed

- The module in the higher-numbered slot is referred to as the HI module; the module in the lower-numbered slot is referred to as the LO module

MBus-2 Support Setup

Tables 3–1 through 3–12 show the channel assignments for the MBus-2 Support setup used to disassemble data with Custom clocking.

Table 3–1 shows the 92C96 section and channel assignments for the V_Addr group, and the MBus signal and pin number to which each channel connects. The default display radix is OFF.

Table 3–1: MBus-2: V_Addr group channel assignments

Acq. module bit order and channel		MBus	
Bit no.	**92C96**	**Signal name**	**Pin no.**
7	HI_A2:5	MAD53	80
6	HI_A2:4	MAD52	79
5	HI_A2:3	MAD51	78
4	HI_A2:2	MAD50	77
3	HI_A2:1	MAD49	76
2	HI_A2:0	MAD48	75
1	LO_A3:7	MAD47	74
0	LO_A3:6	MAD46	73

Table 3–2 shows the 92C96 section and channel assignments for the Hi group, and the MBus signal and pin number to which each channel connects. The default display radix is Hex.

Table 3–2: MBus-2: Hi group channel assignments

Acq. module bit order and channel		MBus	
Bit no.	**92C96**	**Signal name**	**Pin no.**
3	LO_A2:3	MAD35	62
2	LO_A2:2	MAD34	61
1	LO_A2:1	MAD33	60
0	LO_A2:0	MAD32	59

Table 3–3 shows the 92C96 section and channel assignments for the P_Addr_L group, and the MBus signal and pin number to which each channel connects. The default display radix is Hex.

Table 3–3: MBus-2: P_Addr_L group channel assignments

Acq. module bit order and channel		MBus	
Bit no.	**92C96**	**Signal name**	**Pin no.**
31	HI_A1:7	MAD31	42
30	HI_A1:6	MAD30	41
29	HI_A1:5	MAD29	40
28	HI_A1:4	MAD28	39
27	HI_A1:3	MAD27	38
26	HI_A1:2	MAD26	37
25	HI_A1:1	MAD25	36
24	HI_A1:0	MAD24	35
23	HI_A0:7	MAD23	34
22	HI_A0:6	MAD22	33
21	HI_A0:5	MAD21	32
20	HI_A0:4	MAD20	31
19	HI_A0:3	MAD19	30
18	HI_A0:2	MAD18	29
17	HI_A0:1	MAD17	28
16	HI_A0:0	MAD16	27
15	LO_A1:7	MAD15	26
14	LO_A1:6	MAD14	25
13	LO_A1:5	MAD13	24
12	LO_A1:4	MAD12	23
11	LO_A1:3	MAD11	22
10	LO_A1:2	MAD10	21
9	LO_A1:1	MAD9	20
8	LO_A1:0	MAD8	19
7	LO_A0:7	MAD7	18
6	LO_A0:6	MAD6	17
5	LO_A0:5	MAD5	16
4	LO_A0:4	MAD4	15
3	LO_A0:3	MAD3	14
2	LO_A0:2	MAD2	13
1	LO_A0:1	MAD1	12
0	LO_A0:0	MAD0	11

Table 3–4 shows the 92C96 section and channel assignments for the Data_H group, and the MBus signal and pin number to which each channel connects. The default display radix is HEX.

Table 3–4: MBus-2: Data_H group channel assignments

Acq. module bit order and channel		MBus	
Bit no.	**92C96**	**Signal name**	**Pin no.**
31	HI_A3:7	MAD63	90
30	HI_A3:6	MAD62	89
29	HI_A3:5	MAD61	88
28	HI_A3:4	MAD60	87
27	HI_A3:3	MAD59	86
26	HI_A3:2	MAD58	85
25	HI_A3:1	MAD57	84
24	HI_A3:0	MAD56	83
23	HI_A2:7	MAD55	82
22	HI_D2:6	MAD54	81
21	HI_D2:5	MAD53	80
20	HI_D2:4	MAD52	79
19	HI_D2:3	MAD51	78
18	HI_D2:2	MAD50	77
17	HI_D2:1	MAD49	76
16	HI_D2:0	MAD48	75
15	LO_D3:7	MAD47	74
14	LO_D3:6	MAD46	73
13	LO_D3:5	MAD45	72
12	LO_D3:4	MAD44	71
11	LO_D3:3	MAD43	70
10	LO_D3:2	MAD42	69
9	LO_D3:1	MAD41	68
8	LO_D3:0	MAD40	67
7	LO_D2:7	MAD39	66
6	LO_D2:6	MAD38	65
5	LO_D2:5	MAD37	64
4	LO_D2:4	MAD36	63
3	LO_D2:3	MAD35	62
2	LO_D2:2	MAD34	61

Table 3–4: MBus-2: Data_H group channel assignments (Cont.)

Acq. module bit order and channel		MBus	
Bit no.	**92C96**	**Signal name**	**Pin no.**
1	LO_D2:1	MAD33	60
0	LO_D2:0	MAD32	59

Table 3–5 shows the 92C96 section and channel assignments for the Data_L group, and the MBus signal and pin number to which each channel connects. The default display radix is HEX.

Table 3–5: MBus-2: Data_L group channel assignments

Acq. module bit order and channel		MBus	
Bit no.	**92C96**	**Signal name**	**Pin no.**
31	HI_D1:7	MAD31	42
30	HI_D1:6	MAD30	41
29	HI_D1:5	MAD29	40
28	HI_D1:4	MAD28	39
27	HI_D1:3	MAD27	38
26	HI_D1:2	MAD26	37
25	HI_D1:1	MAD25	36
24	HI_D1:0	MAD24	35
23	HI_D0:7	MAD23	34
22	HI_D0:6	MAD22	33
21	HI_D0:5	MAD21	32
20	HI_D0:4	MAD20	31
19	HI_D0:3	MAD19	30
18	HI_D0:2	MAD18	29
17	HI_D0:1	MAD17	28
16	HI_D0:0	MAD16	27
15	LO_D1:7	MAD15	26
14	LO_D1:6	MAD14	25
13	LO_D1:5	MAD13	24
12	LO_D1:4	MAD12	23
11	LO_D1:3	MAD11	22
10	LO_D1:2	MAD10	21
9	LO_D1:1	MAD9	20

Table 3–5: MBus-2: Data_L group channel assignments (Cont.)

Acq. module bit order and channel		MBus	
Bit no.	**92C96**	**Signal name**	**Pin no.**
8	LO_D1:0	MAD8	19
7	LO_D0:7	MAD7	18
6	LO_D0:6	MAD6	17
5	LO_D0:5	MAD5	16
4	LO_D0:4	MAD4	15
3	LO_D0:3	MAD3	14
2	LO_D0:2	MAD2	13
1	LO_D0:1	MAD1	12
0	LO_D0:0	MAD0	11

Table 3–6 shows the 92C96 section and channel assignments for the Control group, and the MBus signal and pin number to which each channel connects. The default display radix is SYM for MBus Support.

Table 3–6: MBus-2: Control group channel assignments

Acq. module bit order and channel		MBus	
Bit no.	**92C96**	**Signal name**	**Pin no.**
8	HI_ & LO_C2:2	MERR~	52
7	HI_ & LO_C2:3	MRDY~	50
6	LO_C2:7	MRTY~	48
5	LO_C2:5	MSH_L	none
4	LO_C2:4	MIH_L	none
3	LO_A2:7	MAD39	66
2	LO_A2:6	MAD38	65
1	LO_A2:5	MAD37	64
0	LO_A2:4	MAD36	63

Table 3–7 shows the 92C96 section and channel assignments for the Size group, and the MBus signal and pin number to which each channel connects. The default display radix is SYM for MBus Support.

Table 3–7: MBus-2: Size group channel assignments

Acq. module bit order and channel		MBus	
Bit no.	**92C96**	**Signal name**	**Pin no.**
2	LO_A3:2	MAD42	69
1	LO_A3:1	MAD41	68
0	LO_A3:0	MAD40	57

Table 3–8 shows the 92C96 section and channel assignments for the Irl_0 group, and the MBus signal and pin number to which each channel connects. The default display radix is SYM for MBus Support.

Table 3–8: MBus-2: Irl_0 group channel assignments

Acq. module bit order and channel		MBus	
Bit no.	**92C96**	**Signal name**	**Pin no.**
3	LO_C0:3	IRL03*†	8
2	LO_C0:2	IRL02*†	9
1	LO_C0:1	IRL01*†	6
0	LO_C0:0	IRL00*†	7

*** Signals not required for disassembly.**

† Signal is not available on the standard MBus connector; these are dedicated signals.

Table 3–9 shows the 92C96 section and channel assignments for the Irl_1 group, and the MBus signal and pin number to which each channel connects. The default display radix is SYM for MBus Support.

Table 3–9: MBus-2: Irl_1 group channel assignments

Acq. module bit order and channel		MBus	
Bit no.	**92C96**	**Signal name**	**Pin no.**
3	LO_C3:1	IRL13*†	95
2	LO_C3:0	IRL12*†	94
1	LO_C1:1	IRL11*†	93
0	LO_C1:0	IRL10*†	92

*** Signals not required for disassembly.**

† Signal is not available on the standard MBus connector; these are dedicated signals.

Table 3–10 shows the 92C96 section and channel assignments for the JTAG group, and the MBus signal and pin number to which each channel connects. The default display radix is OFF.

Table 3–10: MBus-2: JTAG group channel assignments

Acq. module bit order and channel		MBus	
Bit no.	**92C96**	**Signal name**	**Pin no.**
4	LO_C2:6	SCANCLK*	5
3	HI_C2:7	SCANTMS2*	4
2	HI_C2:6	SCANTMS1*	2
1	HI_C2:5	SCAND1*†	1
0	HI_C2:4	SCAND0*†	3

***** **Signals not required for disassembly.**

† **Signal is not available on the standard MBus connector; these are dedicated signals.**

Table 3–11 shows the 92C96 section and channel assignments for the Misc group, and the MBus signal and pin number to which each channel connects. The default display radix is OFF.

Table 3–11: MBus-2: Misc group channel assignments

Acq. module bit order and channel		MBus	
Bit no.	**92C96**	**Signal name**	**Pin no.**
17	LO_C1:6	MBR1~*†	55
16	LO_C0:7	MBR0~*†	43
15	LO_C1:7	MBG0~*†	45
14	HI_ & LO_C2:1	MAS~	54
13	HI_ & LO_C2:0	MBB~	56
12	LO_C3:7	MBG1~*†	57
11	LO_C3:3	AEER~*	96
10	LO_C3:2	RSTIN~*†	97
9	LO_C3:6	ID3*†	100
8	LO_C3:5	ID2*†	99
7	LO_C3:4	ID1*†	98
6	LO_C0:6	MSH~*	44
5	LO_C0:5	MIH~*	46
4	LO_C0:4	INTOUT~*	10

Table 3–11: MBus-2: Misc group channel assignments (Cont.)

Acq. module bit order and channel		MBus	
Bit no.	**92C96**	**Signal name**	**Pin no.**
3	LO_C1:5	MCLK3*	53
2	LO_C1:4	MCLK2*	51
1	LO_C1:3	MCLK1*	49
0	LO_C1:2	MCLK0*	47

***** **Signals not required for disassembly.**

† **Signal is not available on the standard MBus connector; these are dedicated signals.**

Table 3–12 shows the 92C96 section and channel assignments for the clock channels (not part of any group), and the MBus signal and pin number to which each channel connects. These channels are used only to clock in data; they are not acquired or displayed.

Table 3–12: MBus-2: Clock channel assignments

	MBus	
Acq. module and channel	**Signal name**	**Pin no.**
HI_ & LO_Clk:3	MBG1~=	57
HI_ & LO_Clk:2	MRTY~=	48
HI_ & LO_Clk:1	MBG0~=	45
HI_ & LO_Clk:0	MCLK	none

MBus_Tmg_96 Module Setup

Tables 3–13 through 3–20 show the channel assignments for the MBus_Tmg_96 Module setup used for general purpose analysis with External or Internal clocking.

Table 3–13 shows the 92C96 section and channel assignments for the MAD_H group, and the MBus signal and pin number to which each channel connects. The default display radix is Hex.

Table 3–13: MBus_Tmg_96: MAD_H group channel assignments

Acq. module bit order and channel		MBus	
Bit no.	**92C96**	**Signal name**	**Pin no.**
31	HI_A3:7	MAD63	90
30	HI_A3:6	MAD61	89
29	HI_A3:5	MAD60	88
28	HI_A3:4	MAD59	87
27	HI_A3:3	MAD58	86
26	HI_A3:2	MAD57	85
25	HI_A3:1	MAD58	84
24	HI_A3:0	MAD56	83
23	HI_A2:7	MAD55	82
22	HI_A2:6	MAD54	81
21	HI_A2:5	MAD53	80
20	HI_A2:4	MAD52	79
19	HI_A2:3	MAD51	78
18	HI_A2:2	MAD50	77
17	HI_A2:1	MAD49	76
16	HI_A2:0	MAD48	75
15	LO_A3:7	MAD47	74
14	LO_A3:6	MAD46	73
13	LO_A3:5	MAD45	72
12	LO_A3:4	MAD44	71
11	LO_A3:3	MAD43	70
10	LO_A3:2	MAD42	69
9	LO_A3:1	MAD41	68
8	LO_A3:0	MAD40	67
7	LO_A2:7	MAD39	66
6	LO_A2:6	MAD38	65
5	LO_A2:5	MAD37	64
4	LO_A2:4	MAD36	63
3	LO_A2:3	MAD35	62
2	LO_A2:2	MAD34	61
1	LO_A2:1	MAD33	60
0	LO_A2:0	MAD32	59

Table 3–14 shows the 92C96 section and channel assignments for the MAD_L group, and the MBus signal and pin number to which each channel connects. The default display radix is HEX.

Table 3–14: MBus_Tmg_96: MAD_L group channel assignments

Acq. module bit order and channel		MBus	
Bit no.	**92C96**	**Signal name**	**Pin no.**
31	HI_A1:7	MAD31	42
30	HI_A1:6	MAD30	41
29	HI_A1:5	MAD29	40
28	HI_A1:4	MAD28	39
27	HI_A1:3	MAD27	38
26	HI_A1:2	MAD26	37
25	HI_A1:1	MAD25	36
24	HI_A1:0	MAD24	35
23	HI_A0:7	MAD23	34
22	HI_A0:6	MAD22	33
21	HI_A0:5	MAD21	32
20	HI_A0:4	MAD20	31
19	HI_A0:3	MAD19	30
18	HI_A0:2	MAD18	29
17	HI_A0:1	MAD17	28
16	HI_A0:0	MAD16	27
15	LO_A1:7	MAD15	26
14	LO_A1:6	MAD14	25
13	LO_A1:5	MAD13	24
12	LO_A1:4	MAD12	23
11	LO_A1:3	MAD11	22
10	LO_A1:2	MAD10	21
9	LO_A1:1	MAD9	20
8	LO_A1:0	MAD8	19
7	LO_A0:7	MAD7	18
6	LO_A0:6	MAD6	17
5	LO_A0:5	MAD5	16
4	LO_A0:4	MAD4	15

Table 3–14: MBus_Tmg_96: MAD_L group channel assignments (Cont.)

Acq. module bit order and channel		MBus	
Bit no.	**92C96**	**Signal name**	**Pin no.**
3	LO_A0:3	MAD3	14
2	LO_A0:2	MAD2	13
1	LO_A0:1	MAD1	12
0	LO_A0:0	MAD0	11

Table 3–15 shows the 92C96 section and channel assignments for the Control group, and the MBus signal and pin number to which each channel connects. The default display radix is BIN for MBus Support.

Table 3–15: MBus_Tmg_96: Control group channel assignments

Acq. module bit order and channel		MBus	
Bit no.	**92C96**	**Signal name**	**Pin no.**
4	LO_C2:2	MERR~	52
3	LO_C2:3	MRDY~	50
2	LO_C2:7	MRTY~	48
1	LO_C2:5	MSH_L	none
0	LO_C2:4	MIH_L	none

Table 3–16 shows the 92C96 section and channel assignments for the Intr_0 group, and the MBus signal and pin number to which each channel connects. The default display radix is SYM for MBus Support.

Table 3–16: MBus_Tmg_96: Intr_0 group channel assignments

Acq. module bit order and channel		MBus	
Bit no.	**92C96**	**Signal name**	**Pin no.**
3	LO_C0:3	IRL03*	8
2	LO_C0:2	IRL02*	9
1	LO_C0:1	IRL01*	6
0	LO_C0:0	IRL00*	7

*** Signal is not available on the standard MBus connector; these are dedicated signals.**

Table 3–17 shows the 92C96 section and channel assignments for the Intr_1 group, and the MBus signal and pin number to which each channel connects. The default display radix is SYM for MBus Support.

Table 3–17: MBus_Tmg_96: Intr_1 group channel assignments

Acq. module bit order and channel		MBus	
Bit no.	**92C96**	**Signal name**	**Pin no.**
3	LO_C3:1	IRL13*	95
2	LO_C3:0	IRL12*	94
1	LO_C1:1	IRL11*	93
0	LO_C1:0	IRL10*	92

*** Signal is not available on the standard MBus connector; these are dedicated signals.**

Table 3–18 shows the 92C96 section and channel assignments for the JTAG group, and the MBus signal and pin number to which each channel connects. The default display radix is OFF.

Table 3–18: MBus_Tmg_96: JTAG group channel assignments

Acq. module bit order and channel		MBus	
Bit no.	**92C96**	**Signal name**	**Pin no.**
4	LO_C2:6	SCANCLK	5
3	HI_C2:7	SCANTMS2	4
2	HI_C2:6	SCANTMS1	2
1	HI_C2:5	SCAND1*	1
0	HI_C2:4	SCAND0*	3

*** Signal is not available on the standard MBus connector; these are dedicated signals.**

Table 3–19 shows the 92C96 section and channel assignments for the MISC group, and the MBus signal and pin number to which each channel connects. The default display radix is OFF.

Table 3–19: MBus_Tmg_96: MISC group channel assignments

Acq. module bit order and channel		MBus	
Bit no.	**92C96**	**Signal name**	**Pin no.**
17	LO_C1:6	MBR1~*	55
16	LO_C0:7	MBR0~*	43
15	LO_C1:7	MBG0~*	45

Table 3–19: MBus_Tmg_96: MISC group channel assignments (Cont.)

Acq. module bit order and channel		MBus	
Bit no.	92C96	Signal name	Pin no.
14	LO_C2:1	MAS~	54
13	LO_C2:0	MBB~	56
12	LO_C3:7	MBG1~*	57
11	LO_C3:3	AEER~	96
10	LO_C3:2	RSTIN~*	97
9	LO_C3:6	ID3*	100
8	LO_C3:5	ID2*	99
7	LO_C3:4	ID1*	98
6	LO_C0:6	MSH~	44
5	LO_C0:5	MIH~	46
4	LO_C0:4	INTOUT~	10
3	LO_C1:5	MCLK3	53
2	LO_C1:4	MCLK2	51
1	LO_C1:3	MCLK1	49
0	LO_C1:2	MCLK0	47

*** Signal is not available on the standard MBus connector; these are dedicated signals.**

Table 3–20 shows the 92C96 section and channel assignments for the clock channels (not part of any group), and the MBus signal and pin number to which each channel connects. These channels are used only to clock in data; they are not acquired or displayed.

Table 3–20: MBus_Tmg_96: Clock channel assignments

	MBus	
Acq. module and channel	Signal name	Pin no.
HI_ & LO_Clk:3	MBG1~=	57
HI_ & LO_Clk:2	MRTY~=	48
HI_ & LO_Clk:1	MBG0~=	45
HI_ & LO_Clk:0	MCLK	none

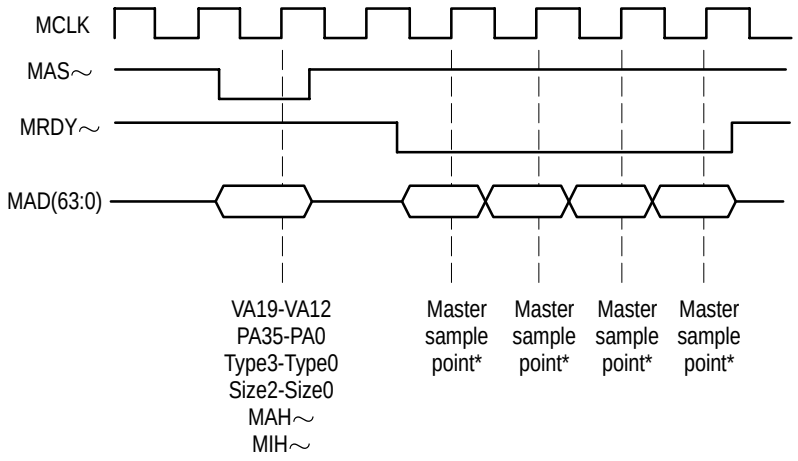
How Data is Acquired

This part explains how the acquisition module acquires MBus signals using the MBus probe adapter and application It also provides additional information on MBus signals accessible on or not accessible on the probe adapter, and on extra 92C96 channels available for you to use for additional connections.

A special clocking program is loaded to the acquisition module every time the MBus-2 Support is selected in the Configuration menu. The module logs in signals from multiple groups of channels at different times when they are valid on the MBus bus. The module then sends all the logged in signals to the trigger machine and to the acquisition memory of the module for storage.

In Custom clocking, the module's clocking state machine (CSM) generates one master sample for each MBus bus cycle, no matter how many clock cycles are contained in that cycle.

Figure 3–2 shows the sample points and the master sample.



* The Data_H, Data_L, IRL03-IRL00, IRL13-IRL10, ID3-ID1 and JTAG groups are logged.

Figure 3–2: MBus bus timing

MAS~ is active (low) whenever the Address, Size, and Type signals are present on the MAD bus. These signals are latched internally until the next assertion of the MAS~ signal. Data with this information is sampled by MCLK whenever the MRDY~ signal is active (low). The probe adapter contains circuitry that latches the MSH and MIH signals. The latched signal names are MSH_L and MIH_L.

Alternate Connections

You can connect to MBus signals that are not required for disassembly so you can do more advanced timing analysis. These signals might or might not be accessible on the probe adapter board. The following paragraphs list signals channels that are or are not accessible on the probe adapter board, and extra 92C96 channels.

For a list of signals required or not required for disassembly, refer to the channel group assignment tables earlier in this section.

Signals Not On the Probe Adapter

All MBus signals are accessible on the probe adapter. However, the probe adapter only monitors common bus signals.

Dedicated signals in a standard MBus system are as follows:

- Interrupt signals: IRL03-IRL00, IRL13-IRL10
- Bus Arbitration Signals: MBR1, MBR0, MBG1, MBG0
- Module ID signals: ID3-ID1
- SCAND1, SCAND0, RSTIN

There are two ways to access dedicated MBus signals. One way is to jumper the signals from the Target MPU to the probe adapter on the back of the board to which the probe adapter connects. Figure 3–3 shows an example of how to jumper connections for dedicated MBus signals.

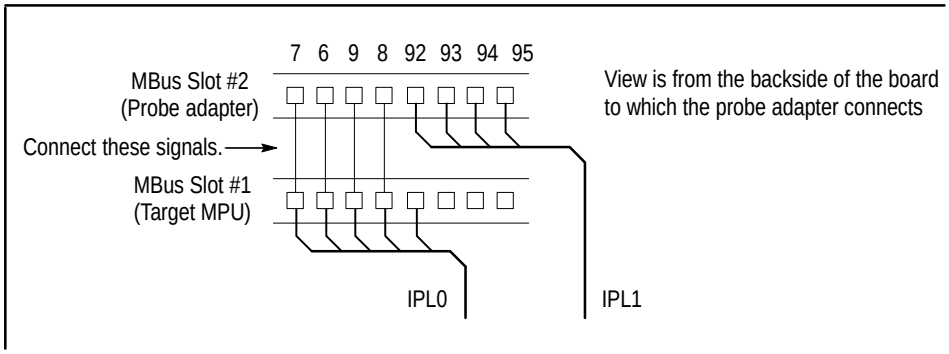


Figure 3–3: An example of jumper connections for dedicated MBus signals

The channel assignment tables in this section show the pin numbers for the MBus connector. Since the MBus multiplexes Address and Data signals, pin numbers for those signals are listed in two channel assignment tables.

Another way to access dedicated MBus signals is to use extra 92C96 channels to connect directly to the signals in your SUT.

Extra Channels

Table 3–21 lists extra 92C96 channels that are left after you have connected all the channels used by the application. You can use these extra channels to make alternate connections to your SUT, such as to dedicated MBus signals. You can also disconnect channels not required for disassembly to make alternate connections. The channel assignment tables in this section indicate channels not required for disassembly.

Table 3–21: Extra 92C96 groups and channels

92C96 group	Channels	92C96 group	Channels
HI_C3	7-0	LO_C3	7-0
HI_C2	7-4	LO_C2	6
HI_C1	7-0	LO_C1	7-0
HI_C0	7-0	LO_C0	7-0

WARNING

The following servicing instructions are for use only by qualified personnel. To avoid injury, do not perform any servicing other than that stated in the operating instructions unless you are qualified to do so. Refer to all Safety Summaries before performing any service.

Maintenance

This section contains information on care and maintenance.

Care and Maintenance

The probe adapter does not require scheduled or periodic maintenance. To maintain good electrical contact, keep the probe adapter free of dirt, dust, and contaminants. Also, ensure that any electrically conductive contaminants are removed.

Dirt and dust can usually be removed with a soft brush. For more extensive cleaning, use only a damp cloth. Abrasive cleaners and organic solvents should never be used.

CAUTION. *CAUTION. The semiconductor devices contained on the probe adapter are susceptible to static–discharge damage. To prevent damage, service the probe adapter only in a static–free environment.*

If the probe adapter is connected to your system, grasp the ground lug on the back of the DAS mainframe to discharge your stored static electricity. If the probe adapter is not connected, touch any of the ground pins (row of square pins closest to the edge of the probe adapter circuit board labeled GND) to discharge stored static electricity from the probe adapter.

Always wear a grounding wrist strap, or similar device, while servicing the instrument.

Exercise care when soldering on a multilayer circuit board. Excessive heat can damage the throughhole plating or lift a run or pad and damage the board beyond repair. Do not apply heat for longer than three seconds. Do not apply heat consecutively to adjacent leads. Allow a moment for the board to cool between each operation.

If you must replace an electrical component on a circuit board, exercise extreme caution while unsoldering or soldering the new component. Use a penciltype soldering iron of less than 18 watts and an approved unsoldering tool. Ensure that the replacement is an equivalent part.

Removing And Replacing Signal Leads

Refer to your 92C96 module user manual for information on how to replace signal leads.

Replaceable Parts

This section contains a list of the replaceable modules unique to the LADM934 Mbus support product. Use this list to identify and order replacement parts.

The basic operations user manual contains a list of common replaceable parts.

Parts Ordering Information

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

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

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

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

Part Number Revision Level

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

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

Module Servicing

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

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

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

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

Using the Replaceable Parts List

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

Parts List Column Descriptions

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

Abbreviations

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

Mfr. Code to Manufacturer Cross Index

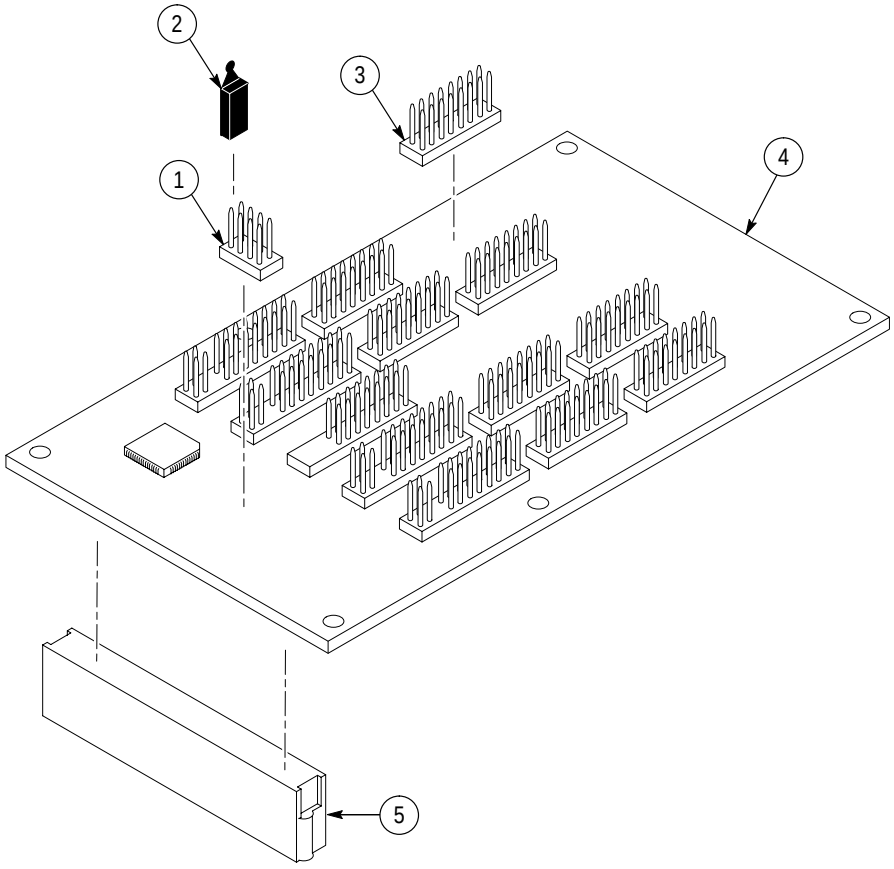
The table titled Manufacturers Cross Index shows codes, names, and addresses of manufacturers or vendors of components listed in the parts list.

Manufacturers Cross Index

Mfr. Code	Manufacturer	Address	City, State, Zip Code
00779	AMP INC	2800 FULLING MILL PO BOX 3608	HARRISBURG PA 17105
26742	METHODE ELECTRONICS INC	7447 W WILSON AVE	CHICAGO IL 60656–4548
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON, OR 97077–0001
TK0860	LABEL GRAPHICS INC	ATTN: DALE GREMAUX 6700 SW BRADBURY CT	PORTLAND, OR 97224

Replaceable Parts List

Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
1	131–5267–00			1	CONN,HDR:PCB,MALE,STR,2 X 40,0.1 CTR,0.235 MLG X 0.110 TAIL,30GOLD	00779	104326–4
2	131–4356–00			1	CONN,SHUNT:SHUNT/SHORTING,FEMALE,1 X 2,0.1 CTR, 0.63 H,BLK,W/HANDLE,JUMPER,	26742	9618–302–50
3	131–5267–00			4	CONN,HDR:PCB,MALE,STR,2 X 40,0.1 CTR,0.235 MLG X 0.110 TAIL,30GOLD	00779	104326–4
4	671–3729–00			1	CIRCUT BRD ASSY:MBUS,OEM 119–5140–00,LADM934	80009	671–3729–00
	334–4645–00			1	MARKER,IDENT:MKD TEKTRONIX	TK0860	ORDER BY DESCRIPTION
5	none			1	AMP MICRO–STRIP CONNECTOR, 100 PIN	00779	121354–4
					STANDARD ACCESSORIES		
	070–9366–XX			1	MANUAL,TECH:INSTRUCTION,MBUS,DISSASEMBLER,LADM934	80009	070–9366–XX



Mbus probe adapter exploded view

Appendix A: Error Messages and Disassembly

This appendix describes error messages and disassembly problems that you may encounter while acquiring data.

Module Error Messages

These error messages will appear in the Module Monitor menu when there are problems with acquiring data or satisfying the trigger program. The error messages are listed in alphabetical order; a description of the error message and the recommended solution follow the error message.

Slow Clock

This message appears when the active clock channel (or channels) is not changing, is typically changing at 1 ms or slower intervals, or one of the clock qualifiers is held in the wrong state. Check for the following:

1. The MBus system is powered on and running. Be sure the system is not halted.
2. MBus-2 Support is selected in the appropriate 92C96 Configuration menu.
3. Custom is selected in the Clock menu.
4. The connections between the 92C96 Module and the probe adapter are correct.
   - The clock and 8–channel probe connections between the interface housings and probe adapter are correct (module name, clock, section names, and channel numbers match), are properly oriented (GND connects to ground), and are fully engaged.
   - The connections between the interface housings and 92C96 probe cables have matched color labels, matched slot numbers, and are properly keyed.
   - The connections between the 92C96 probe cables and probe connectors have matched color labels, matched slot numbers, and are properly keyed.
5. The orientation of pin 1 on the connector on the probe adapter, and the connector in the SUT are correct.
6. No bent or missing pins on the MBus connector in the SUT or on the connector on the probe adapter.
7. The MCLK jumper is in the proper clock position.

Waiting for Stop

This message appears when the trigger condition is satisfied and memory is full but the Manual Stop mode is selected in the Cluster Setup menu. The solution is to manually stop the DAS 9200 by pressing F1: STOP.

This message can also appear when other modules in the cluster have not filled their memories. Wait for the other modules to fill their memories. If the message does not disappear in a short time, press F1: STOP.

Waiting for Stop-Store

This message appears when the trigger condition is satisfied but the amount of post–fill memory specified in the trigger position field is not yet filled. Press F1: STOP to view the acquired data, then check for the following:

1. The trigger program in the Trigger menu is correct.
2. The storage qualification in the Trigger menu is correct.
3. The system or the module does not have an exception or fault. The MBus system or acquisition module might have experienced a hardware or software exception or fault after the trigger condition was satisfied.

Waiting for Trigger

This message appears when the trigger condition does not occur. Check for the following:

1. The MBus system is powered on and running. Be sure the system is not halted.
2. The trigger conditions are not being satisfied. The Module Monitor menu shows which state events are not occurring. Press F1: STOP, access the Trigger menu, and redefine the conditions for that state. Also refer to the description on Triggering in the Operating Basics section.

Disassembly Problems

There may be problems with disassembly for which no error messages are displayed. Some of these problems and their recommended solutions follow.

Incorrect Data

If the data acquired is obviously incorrect, check the following:

1. MBus-2 Support is selected in the 92C96 Configuration menu.
2. Custom is selected in the Clock menu.
3. The internal instruction and data caches on the SuperSPARC microprocessor using the MBus are turned off. Disable the internal instruction and data caches.

4. The connections between the 92C96 Module and the probe adapter are correct.

   - The clock and 8 channel probe connections between the interface housings and probe adapter are correct (module name, clock, section names, and channel numbers match), are properly oriented (GND connects to ground), and are fully engaged.
   - The connections between the interface housings and 92C96 probe cables have matched color labels, matched slot numbers, and are properly keyed.
   - The connections between the 92C96 probe cables and probe connectors have matched color labels, matched slot numbers, and are properly keyed.

5. No bent or missing pins on the MBus connector in the SUT or on the connector on the probe adapter.

Other Suggestions

If the previous suggestions do not fix the problem with acquiring data disassembled bus cycles or instruction mnemonics, try the following:

1. Reload the module setup; select MBus Support in the 92C96 Configuration menu to restore the 92C96 Module to a known state.

If the 92C96 still is not acquiring data after trying these solutions, there may be a problem with your MBus system. Try performing hardware analysis with your 92C96 system to ensure that the MBus signals are valid at the time the probe adapter samples them.

Refer to *General Purpose Analysis* in the *Operating Basics* section.for information on data sampling rates using either the Internal or External clocking selections in the Clock menu. Also refer to *How Data is Acquired* in the *Specifications* section to see when the support software disassembler, probe adapter, and 92C96 Module sample the various MBus system signals.

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