

Instruction Manual



TMS 143

MCS251 Microcontroller Support

070-9912-00

Warning

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

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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. 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

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

Ground the Product. This product is 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 marking on the product. Consult the product manual for further ratings information before making connections to the product.

Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.

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.

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

Symbols and Terms

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



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



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

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

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

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

CAUTION indicates a hazard to property including the product.

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



WARNING
High Voltage



Protective Ground
(Earth) Terminal



CAUTION
Refer to Manual



Double
Insulated

Service Safety Summary

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

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

Disconnect Power. To avoid electric shock, disconnect the 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: Microcontroller Support Documentation

This instruction manual contains specific information about the TMS 143 MCS251 microcontroller support and is part of a set of information on how to operate this product on compatible Tektronix logic analyzers.

If you are familiar with operating microcontroller supports on the logic analyzer for which the TMS 143 MCS251 support was purchased, you will probably only need this instruction manual to set up and run the support.

If you are not familiar with operating microcontroller supports, you will need to supplement this instruction manual with information on basic operations to set up and run the support.

Information on basic operations of microcontroller supports is included with each product. Each logic analyzer has basic information that describes how to perform tasks common to supports on that platform. This information can be in the form of online help, an installation manual, or a user manual.

This manual provides detailed information on the following topics:

- Connecting the logic analyzer to the system under test
- Setting up the logic analyzer to acquire data from the system under test
- Acquiring and viewing disassembled data
- Using the probe adapter

Manual Conventions

This manual uses the following conventions:

- In this manual, MCS251 refers to all supported variations of the MCS251 microcontroller unless otherwise noted.
- An asterisk following a signal name indicates an active low signal.
- In the information on basic operations, the term “XXX” or “P54C” used in field selections and file names must be replaced with MCS251. This is the name of the microcontroller in field selections and file names you must use to operate the MCS251 support.
- The term “disassembler” refers to the software that disassembles bus cycles into instruction mnemonics and cycle types.

- The phrase “information on basic operations” refers to online help, an installation manual, or a basic operations of microcontroller supports user manual.
- The term “SUT” (system under test) refers to the microcontroller-based system from which data will be acquired.
- The term “logic analyzer” refers to the Tektronix logic analyzer for which this product was purchased.

Logic Analyzer Documentation

A description of other documentation available for each type of Tektronix logic analyzer is located in the corresponding module user manual. The manual set provides the information necessary to install, operate, maintain, and service the logic analyzer and associated products.

Contacting Tektronix

Product Support	For application-oriented questions about a Tektronix measurement product, call toll free in North America: 1-800-TEK-WIDE (1-800-835-9433 ext. 2400) 6:00 a.m. – 5:00 p.m. Pacific time Or, contact us by e-mail: tm_app_supp@tek.com For product support outside of North America, contact your local Tektronix distributor or sales office.
Service Support	Contact your local Tektronix distributor or sales office. Or, visit our web site for a listing of worldwide service locations. http://www.tek.com
For other information	In North America: 1-800-TEK-WIDE (1-800-835-9433) An operator will direct your call.
To write us	Tektronix, Inc. P.O. Box 1000 Wilsonville, OR 97070-1000



Getting Started

Getting Started

This chapter contains information on the TMS 143 microcontroller support, and information on connecting your logic analyzer to your system under test.

Support Description

The TMS 143 microcontroller support package disassembles data from systems that are based on the Intel MCS251 Family of microprocessors.

The TMS 143 microcontroller support package can acquire and disassemble data from the TN8XC251SX in a 44-pin PLCC package.

To use this support efficiently, you need to have the items listed in the information on basic operations as well as the *8XC251Sx User's Manual*, Intel.

Logic Analyzer Software Compatibility

To find the version of logic analyzer that this support is compatible with, check the label of the floppy disk that is supplied with this support.

Logic Analyzer Configuration

For use with a TLA 700 Series the TMS 143 support requires a minimum of one 68-channel module.

For use with a DAS 9200 Series the TMS 143 support requires a minimum of one 96-channel module.

Requirements And Restrictions

You should review the general requirements and restrictions of microcontroller supports in the information on basic operations as they pertain to your SUT.

You should also review electrical, environmental, and mechanical specifications in the *Specifications* chapter in this manual as they pertain to your system under test, as well as the following descriptions of other MCS251 support requirements and restrictions.

Opcode Fetch/Read Identification. There is no signal that differentiates between an opcode fetch and a read; therefore:

- In order for the disassembly to become synchronized, the first fetch cycle is displayed as a (MEM READ), you need to mark it as an “Opcode”.
- In order for the disassembly to become synchronized when the control flow occurs and there is an address break, the first two bytes are decoded as a (MEM READ). Therefore you need to mark the first byte as an “Opcode”.

System Clock Rate. The TMS 143 support can acquire data from the MCS251 microcontroller at speeds of up to 16 MHz¹.

Hardware Reset. If a hardware reset occurs in your MCS251 system during an acquisition, the disassembler might acquire an invalid sample.

Disabling The Instruction Cache. To disassemble acquired data, you must disable the internal instruction cache. Disabling the cache makes all instruction prefetches visible on the bus so that they can be acquired and disassembled.

Functionality Not Supported

Variable WAIT State. The TMS 143 support does not support the variable WAIT state configuration.

Connecting To A System Under Test

Before you connect to your SUT, you must connect the probes to the module. Your SUT must also have a minimum amount of clear space surrounding the microcontroller to accommodate the probe adapter. Refer to the *Specifications* chapter in this manual for the required clearances.

The general requirements and restrictions of microcontroller supports in the information on basic operations shows the vertical dimensions of a channel or clock probe connected to square pins on a circuit board.

With A PLCC Probe Adapter

To connect your logic analyzer to your SUT using a PLCC probe adapter, follow these steps:

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

¹ Specification at time of printing. Contact your Tektronix sales representative for current information on the fastest devices supported.



CAUTION. Static discharge can damage the microcontroller, the probe adapter, the probes, or the 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 microcontroller and probe adapter.

2. To discharge your stored static electricity, touch the ground connector located on the back of the logic analyzer. Then, touch any of the ground pins of the probe adapter to discharge stored static electricity from the probe adapter.
3. Place the probe adapter onto the antistatic shipping foam to support the probe as shown in Figure 1–1. This prevents the circuit board from flexing.
4. Remove the microcontroller from your SUT.
5. Line up the pin 1 indicator on the microcontroller with pin 1 of the PLCC socket on the probe adapter.



CAUTION. Failure to correctly place the microcontroller into the probe adapter may permanently damage electrical components once power is applied.

6. Place the microcontroller into the probe adapter as shown in Figure 1–1.

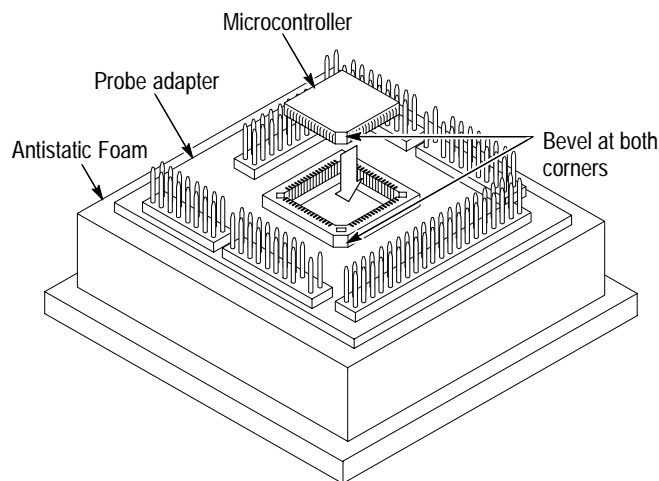


Figure 1–1: Placing a microcontroller into a PLCC probe adapter

7. Connect the channel and clock probes to the probe adapter as shown in Figure 1–2. Match the channel groups and numbers on the probe labels to the corresponding pins on the probe adapter. Match the ground pins on the probes to the corresponding pins on the probe adapter.

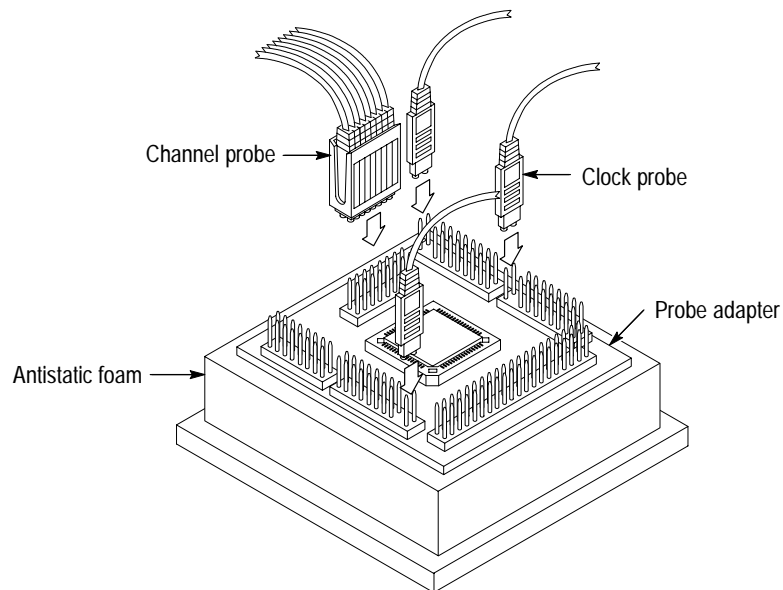


Figure 1-2: Connecting probes to a PLCC probe adapter

8. Place the probe adapter onto the SUT as shown in Figure 1-3.

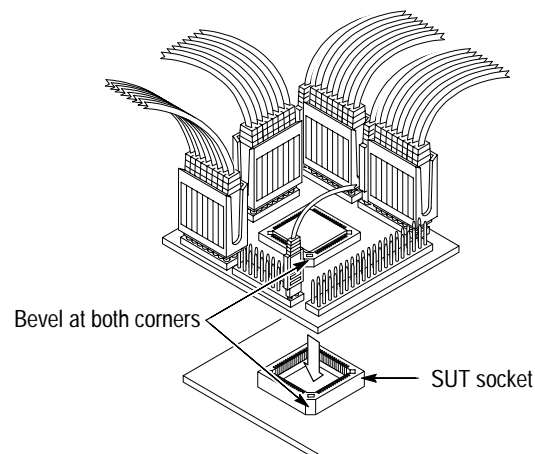


Figure 1-3: Placing a PLCC probe adapter onto the SUT

Without A Probe Adapter

You can use channel probes, clock probes, and leadsets with a commercial test clip (or adapter) to make connections between the logic analyzer and your SUT.

To connect the probes to MCS251 signals in the SUT using a test clip, follow these steps:

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



CAUTION. *Static discharge can damage the microcontroller, the probes, or the 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 microcontroller.

2. To discharge your stored static electricity, touch the ground connector located on the back of the logic analyzer. If you are using a test clip, touch any of the ground pins on the clip to discharge stored static electricity from it.



CAUTION. *Failure to place the SUT on a horizontal surface before connecting the test clip might permanently damage the pins on the microcontroller.*

3. Place the SUT on a horizontal static-free surface.
4. Use Tables 1–1 through 1–2 to connect the channel probes to MCS251 signal pins on the test clip or in the SUT. Use Table 1–3 to connect the clock probes and the MCS251 signals.

Use leadsets to connect at least one ground lead from each channel probe and the ground lead from each clock probe to ground pins on your test clip.

5. Align pin 1 or A1 of your test clip with the corresponding pin 1 or A1 of the MCS251 microcontroller in your SUT and attach the clip.

Channel Assignments

The following channel assignment tables show the probe section and channel assignments, and the signal to which each channel connects.

Channel assignments shown in Table 1–2 through Table 1–3 use the following conventions:

- All signals are required by the support unless indicated otherwise.
- Channels are shown starting with the most significant bit (MSB) descending to the least significant bit (LSB).
- Channel group assignments are for all modules unless otherwise noted.
- An tilde asterisk following a signal name indicates an active low signal.

By default the Control group is displayed symbolically.

Table 1-1: Control group channel assignments

Bit order	Section:channel	MCS251 signal name
3	C2:3	RD*
2	C2:2	WR*
1	C2:1	PSEN*
0	C2:0	ALE

The Data bus is multiplexed with the Address bus. Channels D1:7-0 and D0:7-0 do not need to be connected. By default this group is displayed in hexadecimal. By default the Address group is displayed in hexadecimal.

Table 1-2: Address group channel assignments

Bit order	Section:channel	MCS251 signal name
17	A2:7	A17
16	A2:6	A16
15	A1:7	A15
14	A1:6	A14
13	A1:5	A13
12	A1:4	A12
11	A1:3	A11
10	A1:2	A10
9	A1:1	A9
8	A1:0	A8
7	A0:7	AD7
6	A0:6	AD6
5	A0:5	AD5
4	A0:4	AD4
3	A0:3	AD3
2	A0:2	AD2
1	A0:1	AD1
0	A0:0	AD0

Table 1–3 lists the probe section and channel assignments for the clock probes. The clock probes are not part of any group.

Table 1–3: Clock channel assignments

Section:channel	MCS251 signal name
CLK:2	WAIT*
CLK:1	RST
CLK:0	XTAL1=

These channels are used only to clock in data; they are not acquired or displayed. To acquire data from any of the signals shown in Table 1–3, you must connect another channel probe to the signal, a technique called double probing.

CPU To Channel Probe Connections

To probe the microprocessor you will need to make connections between the CPU and the channel probes. Table 1–4 through Table 1–6 list the CPU pin to channel probe pin connections. Please pay close attention to the caution below.



CAUTION. To protect the CPU and the inputs of the module, a 180Ω resistor should be connected in series between each pin of the CPU and each pin of the channel probe connector. The resistor must be no farther away from the CPU than 1/2-inch.

Table 1–4: CPU to Address channels

LA channel	MCS251 signal name	MCS251 44-pin PLCC pin number
A3:7	P1.7	9
A3:6	P1.6	8
A3:5	P1.5	7
A3:4	P1.4	6
A3:3	P1.3	5
A3:2	P1.2	4
A3:1	P1.1	3
A3:0	P1.0	2
A2:7	A17	9
A2:6	A16	19
A2:5	XTAL1	21

Table 1-4: CPU to Address channels (cont.)

LA channel	MCS251 signal name	MCS251 44-pin PLCC pin number
A2:4	XTAL2	20
A2:3	EA*	35
A2:2	T0	16
A2:1	T1	17
A2:0	NC	—
A0:0	AD0	43
A0:1	AD1	42
A0:2	AD2	41
A0:3	AD3	40
A0:4	AD4	39
A0:5	AD5	38
A0:6	AD6	37
A0:7	AD7	36
A1:0	A8	24
A1:1	A9	25
A1:2	A10	26
A1:3	A11	27
A1:4	A12	28
A1:5	A13	29
A1:6	A14	30
A1:7	A15	31

Table 1-5: CPU to Control channels

LA channel	MCS251 signal name	MCS251 44-pin PLCC pin number
C2:7	RXD	11
C2:6	TXD	13
C2:5	INT0*	14
C2:4	INT1*	15
C2:3	RD*	19
C2:2	WR*	18

Table 1-5: CPU to Control channels (cont.)

LA channel	MCS251 signal name	MCS251 44-pin PLCC pin number
C2:1	PSEN*	32
C2:0	ALE	33

Table 1-6: CPU to Clock channels

LA channel	MCS251 signal name	MCS251 44-pin PLCC pin number
Clock:0	XTAL1 =	21
Clock:1	RST †	10
Clock:2	WAIT* †	8

= Signal is double probed

† Signal used as a qualifier

Table 1-7 lists the Pin-out of connector J110. Connector J110 can be used for oscilloscope probe connections of the MCS251 microcontroller signals.

Table 1-7: J110 pin-out

MCS251 pin number	MCS251 signal name
1	Vcc
2	AD0
3	AD1
4	AD2
5	AD3
6	AD4
7	AD5
8	AD6
9	AD7
10	EA*
11	ALE
12	PSEN*
13	A15
14	A14

Table 1-7: J110 pin-out (cont.)

MCS251 pin number	MCS251 signal name
15	A13
16	A12
17	A11
18	A10
19	A9
20	A8
21	Vss
22	XTAL1
23	XTAL2
24	A16/RD*
25	WR*
26	T1
27	T0
28	INT1*
29	INT2*
30	TXD*
31	RXD*
32	RST
33	P1.7/A17
34	P1.6/WAIT*
35	P1.5
36	P1.4
37	P1.3
38	P1.2
39	P1.1
40	P1.0



Operating Basics

Setting Up the Support

Information in this section is specific to the operations and functions of the TMS 143 MCS251 support on any Tektronix logic analyzer for which it can be purchased.

Before you acquire and disassemble data, you need to load the support and specify setups for clocking and triggering as described in the information on basic operations. The support provides default values for each of these setups, but you can change them as needed.

Channel Group Definitions

The software automatically defines channel groups for the support. The channel groups for the MCS251 support are: Address, Data, Control, and Clock. If you want to know which signal is in which group, refer to the channel assignment tables beginning on page 1–5.

How Data Is Acquired

This part of this chapter explains how the module acquires MCS251 signals using the TMS 143 software and probe adapter. This part also provides additional information on microcontroller signals accessible on or not accessible on the probe adapter, and on extra probe channels available for you to use for additional connections.

Clocking Options

The TMS 143 support offers a microcontroller-specific clocking mode for the MCS251. This clocking mode is “Custom” and is the default selection whenever you load the support.

Disassembly will not be correct with the Internal or External clocking modes. Information on basic operations describes how to use these clock selections for general purpose analysis.

Custom Clocking

A special clocking program is loaded to the module every time you load the support. This special clocking is called Custom.

With Custom clocking, the module logs in signals from multiple groups of channels at different times as they become valid on the MCS251 bus. The

module then sends all the logged-in signals to the trigger machine and to the memory of the module for storage.

In Custom clocking, the module clocking state machine generates one master sample for each microcontroller bus cycle, no matter how many clock cycles are contained in the bus cycle.

Figure 2–1 shows the sample points and the master sample point.

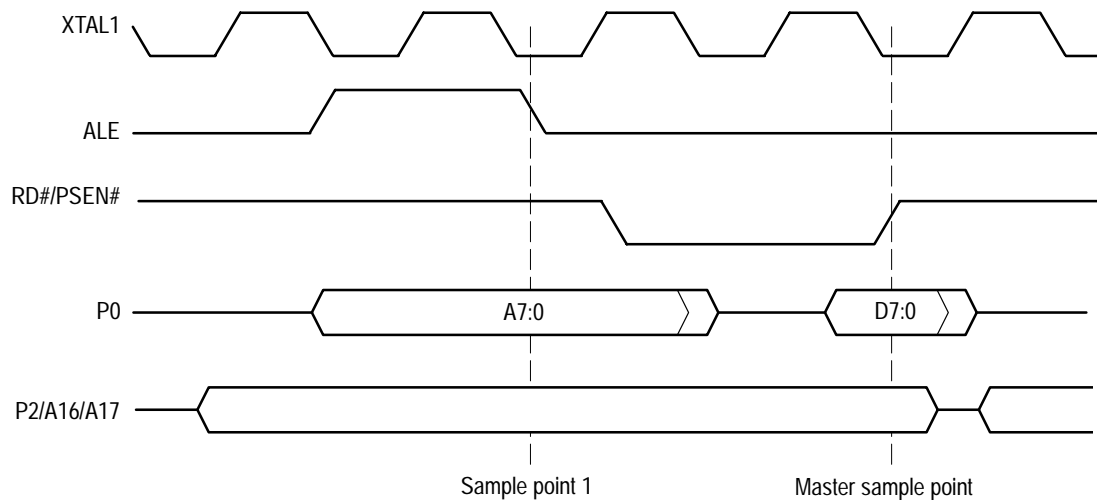


Figure 2–1: MCS251 bus timing

The Setup menu for the MCS251 has the additional selection “Custom” defined for the Clocking mode field. “Custom” is the default selection whenever the MCS251 support is loaded.

When “Custom” is selected, the Custom Clocking Options menu will have the sub-title “MCS251 Microprocessor Clocking Support” added, and the clocking options will be displayed as shown below:

- NO OF SW_WAIT: 0 (default setting)
- 1
- 2
- 3

- MODE SELECT: NON PAGE (default setting)
- PAGE

Symbols

The TMS 143 support supplies one symbol table file. The MCS251_Ctrl file replaces specific Control channel group values with symbolic values when Symbolic is the radix for the channel group.

Symbol tables are generally not for use in timing or MCS251_T support disassembly.

Table 2–1 shows the name, bit pattern, and a description for the symbols in the file MCS251_Ctrl, the Control channel group symbol table.

Table 2–1: Control group symbol table definitions

Symbol	Control group value				Description
	RD*	WR*	PSEN*	ALE	
WRITE	1	0	1	X	Write to memory
READ	0	1	1	X	Read from memory
FETCH	X	X	0	X	Fetch

Information on basic operations describes how to use symbolic values for triggering and for displaying other channel groups symbolically, such as the Address channel group.

Acquiring and Viewing Disassembled Data

Acquiring Data

Once you load the MCS251 support, choose a clocking mode and specify the trigger, you are ready to acquire and disassemble data.

If you have any problems acquiring data, refer to information on basic operations in your online help or *Appendix A: Error Messages and Disassembly Problems* in the basic operations user manual.

Viewing Disassembled Data

You can view disassembled data in four display formats: Hardware, Software, Control Flow, and Subroutine. The information on basic operations describes how to select the disassembly display formats.

NOTE. *Selections in the Disassembly property page (the Disassembly Format Definition overlay) must be set correctly for your acquired data to be disassembled correctly. Refer to Changing How Data is Displayed on page 2–8.*

The default display format shows the Address, Data, and Control channel group values for each sample of acquired data.

The disassembler displays special characters and strings in the instruction mnemonics to indicate significant events. Table 2–2 lists these special characters and strings, and gives a description of what they represent.

Table 2–2: Meaning of special characters in the display

Character or string displayed	Description
#	Indicates an immediate value
>	Indicates there is insufficient room on the screen to show all available data
>> m	On the TLA 700 On the DAS 9200 The instruction was manually marked as a program fetch
t	Indicates the number shown is in decimal, such as #12t
****	Indicates there is insufficient data available for complete disassembly of the instruction; the number of asterisks indicates the width of the data that is unavailable. Each two asterisks represent one byte.

Hardware Display Format

In Hardware display format, the disassembler displays certain cycle type labels in parentheses. Table 2–3 shows these cycle type labels and gives a definition of the cycle they represent. Reads to interrupt and exception vectors will be labeled with the vector name.

Table 2–3: Cycle type definitions

Cycle type	Definition
(READ)	Read from memory
(WRITE)	Write to memory
(MEM READ) §	Code fetch
(RESET LOCATION)	The processor has reset and started fetching from location "----"
(UNKNOWN)	The combination of control bits is unexpected and/or unrecognized
(FLUSH) §	This cycle was fetched but not executed
(EXTENSION) §	This cycle is an extension to a preceding instruction opcode
(ILLEGAL INST) §	The data could not be decoded into a valid instruction

§ Computed cycle types

Figure 2–2 shows an example of the Hardware display.

1	2	3	4	5	6
Sample	Address	Pg_Data	N_Pg_Dta	Mnemonics	Control
863	32324	2D	24	ADD A,#26	FETCH
864	32326	D2	26	(EXTENSION)	FETCH
865	32327	E2	27	ADD A,@R1	FETCH
866	32328	20	28	ADD A,R0	FETCH
867	32329	E2	29	ADD A,R1	FETCH
868	3232A	02	2A	ADD A,R2	FETCH
869	3232B	2D	2B	ADD A,R3	FETCH
870	3232D	A9	2D	ADD A,R5	FETCH
871	3232E	23	2E	ADD A,R6	FETCH
872	3232F	74	2F	ADD A,R7	FETCH
873	32330	04	30	JNB 31,32365	FETCH
874	32331	7E	31	(EXTENSION)	FETCH
875	32332	83	32	(EXTENSION)	FETCH
876	32333	00	33	RLC A	FETCH
877	32334	74	34	ADDC A,#35	FETCH
878	32335	75	35	(EXTENSION)	FETCH
879	32336	E0	36	ADDC A,@R0	FETCH
880	32337	56	37	ADDC A,@R1	FETCH
881	32338	A9	38	ADDC A,R0	FETCH
882	32339	33	39	ADDC A,R1	FETCH
883	3233A	74	3A	ADDC A,R2	FETCH
884	3233B	04	3B	ADDC A,R3	FETCH

Figure 2–2: Hardware display format

- 1 **Sample Column.** Lists the memory locations for the acquired data.
- 2 **Address Group.** Lists data from channels connected to the MCS251 Address bus.
- 3 **Pg_Data.** Lists data from channels connected to the Pg_Data MCS251 Data bus.
- 4 **N_Pg_Dta.** Lists data from channels connected to the N_Pg_Dta MCS251 Data bus.
- 5 **Mnemonic Column.** Lists the disassembled instructions and cycle types.
- 6 **Control.** Lists the Control function.

Software Display Format

The Software display format shows only the first fetch of executed instructions. Flushed cycles and extensions are not shown, even though they are part of the executed instruction. Read extensions will be used to disassemble the instruction, but will not be displayed as a separate cycle in the Software display format. Data reads and writes are not displayed.

Control Flow Display Format

The Control Flow display format shows only the first fetch of instructions that change the flow of control.

Instructions that unconditionally generate a change in the flow of control in the MCS251 microcontroller are as follows:

JMP	AJMP	SJMP	LJMP
EJMP	ACALL	ECALL	LCALL
RET	ERET		

Instructions that conditionally generate a change in the flow of control in the MCS251 microcontroller are as follows:

JC	JNC	JB	JNB
JZ	JNZ	JE	JNE
JG	JLE	JSL	JSLE
JSG	JSGE	CJNE	DJNZ

Subroutine Display Format

The Subroutine display format shows only the first fetch of subroutine call and return instructions. It will display conditional subroutine calls if they are considered to be taken.

Instructions that unconditionally generate a subroutine call or a return in the MCS251 microcontroller are as follows:

ACALL	ECALL	LCALL
RET	ERET	RETI

Changing How Data Is Displayed

There are common fields and features that allow you to further modify displayed data to suit your needs. You can make common and optional display selections in the Disassembly property page (the Disassembly Format Definition overlay).

You can make selections unique to the MCS251 support to do the following tasks:

- Change how data is displayed across all display formats
- Change the interpretation of disassembled cycles
- Display exception vectors

There are no optional fields for this support package. Refer to the information on basic operations for descriptions of common fields.

Cycle Marking

The support allows marking of instructional fetch/read cycles, including read extensions and flush cycles. If the cursor is placed on any other cycle type, the software will return a warning that: “An Opcode Mark cannot be placed at the selected sample.” The following marks are available for instructional cycles:

- Opcode marks the current sequence as an opcode fetch cycle
- Extension marks the current sequence as an extension cycle
- Read marks the current sequence as a read cycle
- Flush marks the current sequence as flush cycle

Information on basic operations contains more details on marking cycles.

Optional Display Selections

You can make optional selections for disassembled data. In addition to the common selections (described in the information on basic operations), the MCS251 can be operated in two different modes. Dependent on the mode selected, the data will be received at different ports. The two selections are:

Mode Select: Non Page (default selection)
Page

The bit pattern generated by the MCS251 depends whether the MCS251 is in Binary or Source mode. The available selections are:

Bin_Src: Binary (default selection)
Source

Displaying Exception Vectors

The TMS 143 will label all exception vector reads using the labels listed in Table 2–4. Refer to the 8XC251Sx Microprocessor User’s manual (listed on page 1–1) for an explanation of these labels. These exception labels will be displayed in parentheses in the disassembly window.

The exception vector table must reside in external memory to be visible to the disassembler software.

Table 2–4 lists the MCS251 exception vectors.

Table 2–4: Exception vectors

Exception number	Location in Interrupt Vector (IV) table (in hexadecimal)	Displayed exception name
0	0x0033	(PCA INTERRUPT)
1	0x002B	(TIMER 2 INTERRUPT)
2	0x0023	(SERIAL PORT INTERRUPT)
3	0x001B	(TIMER 1 INTERRUPT)
4	0x0013	(INT1 INTERRUPT)
5	0x000B	(TIMER 0 INTERRUPT)
6	0x0003	(INTO INTERRUPT)



Specifications

Specifications

This chapter contains information regarding the specifications of the support.

Probe Adapter Description

The probe adapter is nonintrusive hardware that allows the logic analyzer to acquire data from a microcontroller in its own operating environment with little effect on that system. Information on basic operations contains a figure showing the logic analyzer connected to a typical probe adapter. Refer to that figure while reading the following description.

The probe adapter consists of a circuit board and a socket for a MCS251 microcontroller. The probe adapter connects to the microcontroller on your SUT. Signals from the microcontroller-based system flow from the probe adapter to the channel groups and through the probe signal leads to the logic analyzer module.

The probe adapter accommodates the Intel MCS251 microcontroller in a 44-pin PLCC package, or a 40-pin DIP package.

Specification Tables

These specifications are for a probe adapter connected between a compatible Tektronix logic analyzer and a SUT.

Table 3–1 shows the electrical requirements the SUT must produce for the support to acquire correct data. Table 3–2 shows the environmental specifications.

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

Table 3–1: Electrical specifications

Characteristics	Requirements
SUT clock	
Clock rate	16 MHz
Minimum setup time required	
TLA 700	2.5 ns
DAS 9200	5 ns

Table 3–1: Electrical specifications (cont.)

Characteristics	Requirements	
Minimum hold time required		
TLA 700	0 ns	
DAS 9200	0 ns	
	Specification	
Measured typical SUT signal loading	AC load	DC load
XTAL1	19.6 pF	2 podlets
A17	14.4 pF	2 podlets
A16	17.0 pF	2 podlets
All other signals	< 18 pF	1 podlet
Mictor Loading		
TLA 700 podlet load	20 K Ω in parallel with 2 pF	
DAS 9200 podlet load	100 K Ω in parallel with 10 pF	

Table 3–2: Environmental specifications*

Characteristic	Description
Temperature	
Maximum operating	+50° C (+122° F) †
Minimum operating	0° C (+32° F)
Non-operating	–55° C to +75° C (–67° to +167° F)
Humidity	10 to 95% relative humidity
Altitude	
Operating	4.5 km (15,000 ft) maximum
Non-operating	15 km (50,000 ft) maximum
Electrostatic immunity	The probe adapter is static sensitive

* Designed to meet Tektronix standard 062-2847-00 class 5

† Not to exceed MCS251 microcontroller thermal considerations. Forced air cooling might be required across the CPU.

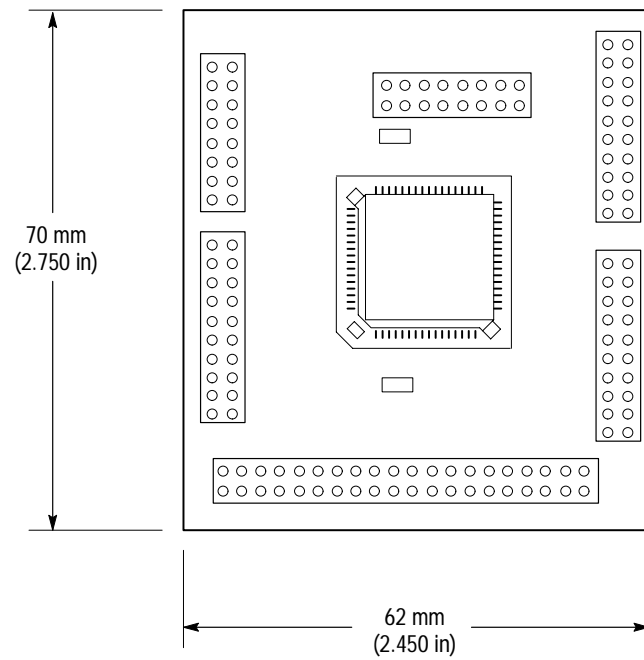


Figure 3-1: Dimensions of the probe adapter

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



Maintenance

Replacing Signal Leads

Information on basic operations describes how to replace signal leads (individual channel and clock probes).

Replacing Protective Sockets

Information on basic operations describes how to replace protective sockets.



Replaceable Electrical Parts

Replaceable Electrical Parts

This chapter contains a list of the replaceable electrical components for the TMS 143 MCS251 microcontroller support.

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
- Instrument type or model number
- Instrument serial number
- Instrument modification number, if applicable

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

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

Using the Replaceable Electrical Parts List

The tabular information in the Replaceable Electrical Parts List is arranged for quick retrieval. Understanding the structure and features of the list will help you find all of the information you need for ordering replacement parts. The following table describes each column of the electrical parts list.

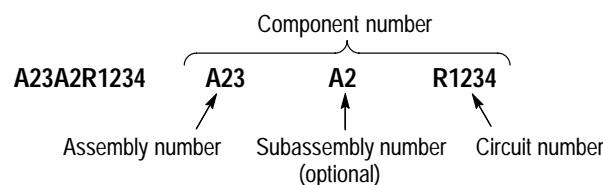
Parts list column descriptions

Column	Column name	Description
1	Component number	<p>The component number appears on diagrams and circuit board illustrations, located in the diagrams section. Assembly numbers are clearly marked on each diagram and circuit board illustration in the <i>Diagrams</i> section, and on the mechanical exploded views in the <i>Replaceable Mechanical Parts</i> list section. The component number is obtained by adding the assembly number prefix to the circuit number (see Component Number illustration following this table).</p> <p>The electrical parts list is arranged by assemblies in numerical sequence (A1, with its subassemblies and parts, precedes A2, with its subassemblies and parts).</p> <p>Chassis-mounted parts have no assembly number prefix, and they are located at the end of the electrical parts list.</p>
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 entry indicates the part is good for all serial numbers.
5	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.
6	Mfr. code	This indicates the code number of the actual manufacturer of the part.
7	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.

Component Number



Read: Resistor 1234 (of Subassembly 2) of Assembly 23

List of Assemblies

A list of assemblies is located at the beginning of the electrical parts list. The assemblies are listed in numerical order. When a part's complete component number is known, this list will identify the assembly in which the part is located.

Chassis Parts

Chassis-mounted parts and cable assemblies are located at the end of the Replaceable Electrical Parts List.

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.	CUSTOMER SERVICE DEPT PO BOX 3608	HARRISBURG, PA 17105-3608
22526	BERG ELECTRONICS INC	825 OLD TRAIL ROAD	ETTERS, PA 17319
63058	BERG ELECTRONICS INC.	MCKENZIE SOCKET DIV 910 PAGE AVE	FREMONT, CA 94538-7340
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON, OR 97077-0001

Replaceable electrical parts list

Component number	Tektronix part number	Serial no. effective	Serial no. discontin'd	Name & description	Mfr. code	Mfr. part number
A01	010-0617-00			PROBE ADAPTER: PLCC-44, SOCKETED, MCS251SX, TMS143 OPT 01	80009	010-0617-00
A01	131-5267-00			CONN, HDR: PCB, MALE, STR, 2 X 40, 0.1 CTR, 0.235 MLG X 0.110 TAIL, 30GOLD, HIGH TEMP,	00779	104326-4
A01	131-5489-00			CONN, ADPT: SMD, PLCC, MALE, STR, 44 POS, 0.05 CTR, 0.268H, PLCC MALE TO SMD PADS ON 0.05 CTR,	63058	ADP44PLCC-SM
A01	136-5012-00			SOCKET, PLCC: SMD, 44 POS, 0.05 CTR, 0.186 H, TIN, W/PLZ POSTS, TUBE PACK,	22526	69802-044
A01	671-4190-00			CIRCUIT BD ASSY: PLCC-44, SOCKETED, 8XC251SX, 389-2454-00 WIRED, TMS143 OPT 01	80009	671-4190-00



Replaceable Mechanical Parts

Replaceable Mechanical Parts

This chapter contains a list of the replaceable mechanical components for the TMS 143 MCS251 microcontroller support.

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
- Instrument type or model number
- Instrument serial number
- Instrument modification number, if applicable

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

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

Using the Replaceable Mechanical Parts List

The tabular information in the Replaceable Mechanical Parts List is arranged for quick retrieval. Understanding the structure and features of the list will help you find all of the information you need for ordering replacement parts. The following table describes the content of 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.

Chassis Parts Chassis-mounted parts and cable assemblies are located at the end of the Replaceable Electrical Parts List.

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
22526	BERG ELECTRONICS INC	825 OLD TRAIL ROAD	ETTERS, PA 17319
63058	BERG ELECTRONICS INC.	MCKENZIE SOCKET DIV 910 PAGE AVE	FREMONT, CA 94538-7340
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077-0001

Replaceable mechanical parts list

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discontinued	Qty	Name & description	Mfr. code	Mfr. part number
1-0	671-4190-00			1	CIRCUIT BD ASSY: PLCC-44, SOCKETED, 8XC251SX, 389-2454-00 WIRED, TMS143 OPT 01	80009	671-4190-00
-1	136-5012-00			1	SOCKET, PLCC: SMD, 44 POS, 0.05 CTR, 0.186 H, TIN, W/PLZ POSTS, TUBE PACK,	22526	69802-044
-2	131-5267-00			1	CONN, HDR: PCB, MALE, STR, 2 X 40, 0.1 CTR, 0.235 MLG X 0.110 TAIL, 30GOLD (J110, J120, J130, J230, J320, J330)	80009	131526700
					STANDARD ACCESSORIES		
	070-9803-00			1	MANUAL, TECH: TLA 700 SERIES MICROPROCESSOR SUPPORT INSTALLATION	80009	070-9803-00
	070-9802-00			1	MANUAL, TECH: BASIC OPS MICROPROCESSOR SUPPORT ON DAS/TLA 500 SERIES LOGIC ANALYZERS	80009	070-9802-00
	070-9912-00			1	MANUAL, TECH: INSTRUCTION, MCS251, DISSASSEMBLER, TMS 143	80009	070-9912-00

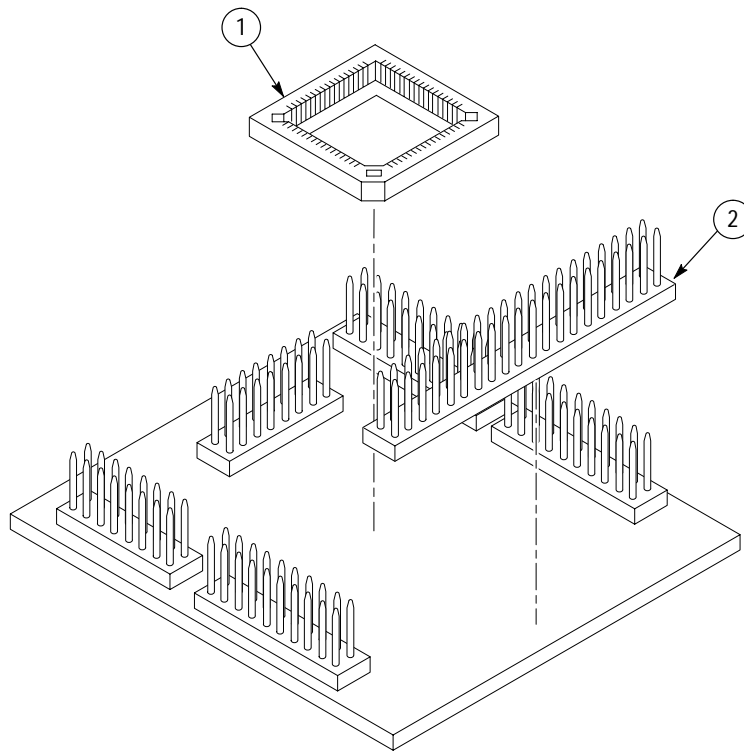


Figure 1: MCS251 probe adapter exploded view



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