

Instruction Manual



TMS 140

8031, 8032, 8051 & 8052 Microcontroller Support

070-9813-00

There are no current European directives that apply to this product. This product provides cable and test lead connections to a test object of electronic measuring and test equipment.

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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Table of Contents

General Safety Summary	v
Service Safety Summary	vii
Preface: Microcontroller Support Documentation	ix
Manual Conventions	ix
Logic Analyzer Documentation	x
Contacting Tektronix	x

Getting Started

Support Description	1-1
Logic Analyzer Software Compatibility	1-2
Logic Analyzer Configuration	1-2
Requirements and Restrictions	1-2
Connecting to a System Under Test	1-3
DIP Probe Adapter	1-3
DIP Probe Adapter with a DIP Clip	1-6
Without a Probe Adapter	1-7

Operating Basics

Setting Up the Support	2-1
Channel Group Definitions	2-1
Clocking Options	2-1
Symbols	2-2
Acquiring and Viewing Disassembled Data	2-3
Acquiring Data	2-3
Viewing Disassembled Data	2-3
Hardware Display Format	2-4
Software Display Format	2-5
Control Flow Display Format	2-5
Subroutine Display Format	2-6
Changing How Data is Displayed	2-6
Optional Display Selections	2-6
Marking Cycles	2-7
Viewing an Example of Disassembled Data	2-7

Specifications

Probe Adapter Description	3-1
Specifications	3-2
Channel Assignments	3-4
How Data is Acquired	3-9
Custom Clocking	3-9
Clocking Options	3-11
Alternate Microcontroller Connections	3-11
Signals Not On the Probe Adapter	3-12
Extra Channels	3-12

Maintenance

Probe Adapter Circuit Description	4-1
Replacing Signal Leads	4-1
Replacing Protective Sockets	4-1

Replaceable Electrical Parts

Parts Ordering Information	5-1
Using the Replaceable Electrical Parts List	5-1

Replaceable Mechanical Parts

Parts Ordering Information	6-1
Using the Replaceable Mechanical Parts List	6-1

Index

List of Figures

Figure 1–1: Placing a microcontroller into a DIP probe adapter	1–4
Figure 1–2: Connecting probes to a DIP probe adapter	1–5
Figure 1–3: Placing a DIP probe adapter onto the SUT	1–6
Figure 1–4: Connecting to the SUT using a DIP converter clip	1–7
Figure 2–1: Hardware display format	2–5
Figure 3–1: Minimum clearance of the DIP probe adapter.	3–4
Figure 3–2: 8031, 8032, 8051 and 8052 external program memory read timing	3–10
Figure 3–3: 8031, 8032, 8051 and 8052 external data memory read and write timing	3–11

List of Tables

Table 1–1: Supported microcontrollers	1–1
Table 1–2: 8031, 8032, 8051 and 8052 signal connections for channel probes	1–8
Table 1–3: 8031, 8032, 8051 and 8052 signal connections for clock probes	1–9
Table 2–1: Control group symbol table definitions	2–2
Table 2–2: Meaning of special characters in the display	2–4
Table 2–3: Cycle type definitions	2–4
Table 3–1: Supported microcontrollers	3–1
Table 3–2: Electrical specifications	3–2
Table 3–3: Environmental specifications	3–3
Table 3–4: Certifications and compliances	3–3
Table 3–5: Address group channel assignments	3–5
Table 3–6: Data group channel assignments	3–5
Table 3–7: Control group channel assignments	3–6
Table 3–8: Intr group channel assignments	3–6
Table 3–9: Misc group channel assignments	3–7
Table 3–10: Timer group channel assignments	3–7
Table 3–11: Serial group channel assignments	3–7
Table 3–12: Port–1 group channel assignments	3–8
Table 3–13: Clock channel assignments	3–8
Table 3–14: Extra module sections and channels	3–12

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.

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.

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

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

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

Do Not Operate in Wet/Damp Conditions.

Do Not Operate in an Explosive Atmosphere.

Keep Product Surfaces Clean and Dry.

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

Symbols and Terms

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



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



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

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

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

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

CAUTION indicates a hazard to property including the product.

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



WARNING
High Voltage



Protective Ground
(Earth) Terminal



CAUTION
Refer to Manual



Double
Insulated

Service Safety Summary

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

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

Disconnect Power. To avoid electric shock, disconnect the 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 140 8031, 8032, 8051 and 8052 microcontroller support package 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 support packages on the logic analyzer for which the TMS 140 8031, 8032, 8051 and 8052 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 support packages, 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 support packages is included with each product. Each logic analyzer has basic information that describes how to perform tasks common to support packages 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:

- 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.
- In the information on basic operations, the term XXX or P54C used in field selections and file names must be replaced with 8031. This is the name of the microcontroller in field selections and file names you must use to operate the 8031, 8032, 8051 and 8052 support.

- The term system under test (SUT) 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.
- The term module refers to a 68/102/136-channel or a 96-channel module.
- 8031 refers to all supported variations of the 8031, 8032, 8051 and 8052 microcontrollers unless otherwise noted.
- A tilde (~) following a signal name indicates an active low signal.

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 provides information on the following topics:

- A description of the TMS 140 microcontroller support
- Logic analyzer software compatibility
- Your system under test requirements
- Support restrictions
- How to configure the probe adapter
- How to connect to the system under test (SUT)

Support Description

The TMS 140 microcontroller support disassembles data from systems that are based on the Intel 8031, 8032, 8051 and 8052 microcontrollers. The TMS 140 supports all 8031 and 8051 core-type microcontrollers that are compatible with Intel MCS-51. The support runs on a compatible Tektronix logic analyzer equipped with a 68/102/136-channel module or a 96-channel module.

Refer to information on basic operations to determine how many modules and probes your logic analyzer needs to meet the minimum channel requirements for the TMS 140 microcontroller support.

NOTE. *The 8051 and 8052 have internal RAM and ROM. Only bus activity outside the microcontroller is disassembled. Internal activity is not present on the bus and cannot be disassembled.*

Table 1–1 shows the microcontrollers and packages from which the TMS 140 support can acquire and disassemble data.

Table 1–1: Supported microcontrollers

Name	Package
8031/32/51/52	Socketed/soldered 40- and 48-pin DIP
8031/32/51/52	Socketed/soldered 44-, 68- and 84-pin PLCC

A complete list of standard and optional accessories is provided at the end of the parts list in the *Replaceable Mechanical Parts* chapter.

To use this support efficiently, you need to have the items listed in the information on basic operations as well as the *8-Bit Embedded Controller's Manual*, Intel Inc., 1991

Information on basic operations also contains a general description of supports.

Logic Analyzer Software Compatibility

The label on the microcontroller support floppy disk states which version of logic analyzer software the support is compatible with.

Logic Analyzer Configuration

To use the 8031, 8032, 8051 and 8052 support, the Tektronix logic analyzer must be equipped with either a 68/102/136-channel module, or a 96-channel module at a minimum. The module must be equipped with enough probes to acquire clock and channel data from signals in your 8031, 8032, 8051 and 8052-based system.

Refer to information on basic operations to determine how many modules and probes the logic analyzer needs to meet the channel requirements.

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 8031, 8032, 8051 and 8052 support requirements and restrictions.

System Clock Rate. The microcontroller support product supports the 8031, 8032, 8051 and 8052 microcontroller at speeds of up to 30 MHz¹.

Hardware Reset. If a hardware reset occurs in your 8031, 8032, 8051 and 8052 system during an acquisition, the disassembler might acquire an invalid sample.

Internal RAM and ROM. The 8051 and 8052 are microcontrollers with internal RAM and ROM. Only external bus activity (outside the microcontroller) is disassembled. Internal activity is not present on the bus and cannot be acquired.

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

Interrupts and DMA Cycles. The disassembler handles interrupts and DMA cycles as regular 8031, 8032, 8051 and 8052 cycles because there are no signals on the 8031, 8032, 8051 and 8052 microcontroller to indicate an interrupt or DMA cycle. Therefore, interrupt and DMA cycles visible on the external bus are disassembled as data reads and writes.

Connecting to a System Under Test

Before you connect to the 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 channel and clock probes shown in this chapter are for a 68/102/136-channel module. The probes will look different if you are using a 96-channel module.

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.

Refer to the *Replaceable Mechanical Parts* chapter for part numbers of various clip adapters and UPIK adapters you can use to connect to a 48-pin DIP and 44-, 68- or 84-pin PLCC packages.

DIP Probe Adapter

To connect the logic analyzer to a SUT using a DIP probe adapter, follow these steps:

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



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 Figure 1–1. This prevents the circuit board from flexing and the socket pins from bending.
4. Remove the microcontroller from your SUT.

5. Line up pin 1 on the microcontroller with the pin 1 indicator on the probe adapter board.



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

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

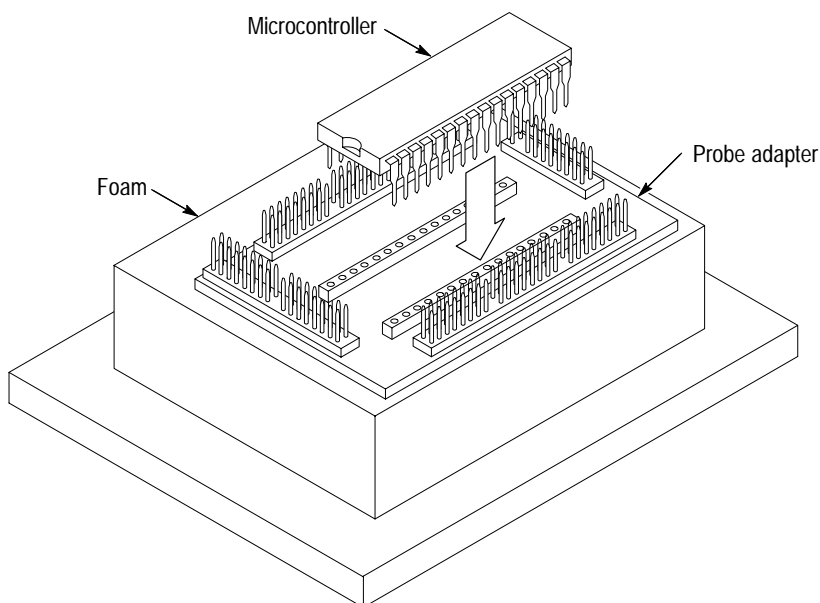


Figure 1–1: Placing a microcontroller into a DIP probe adapter

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.

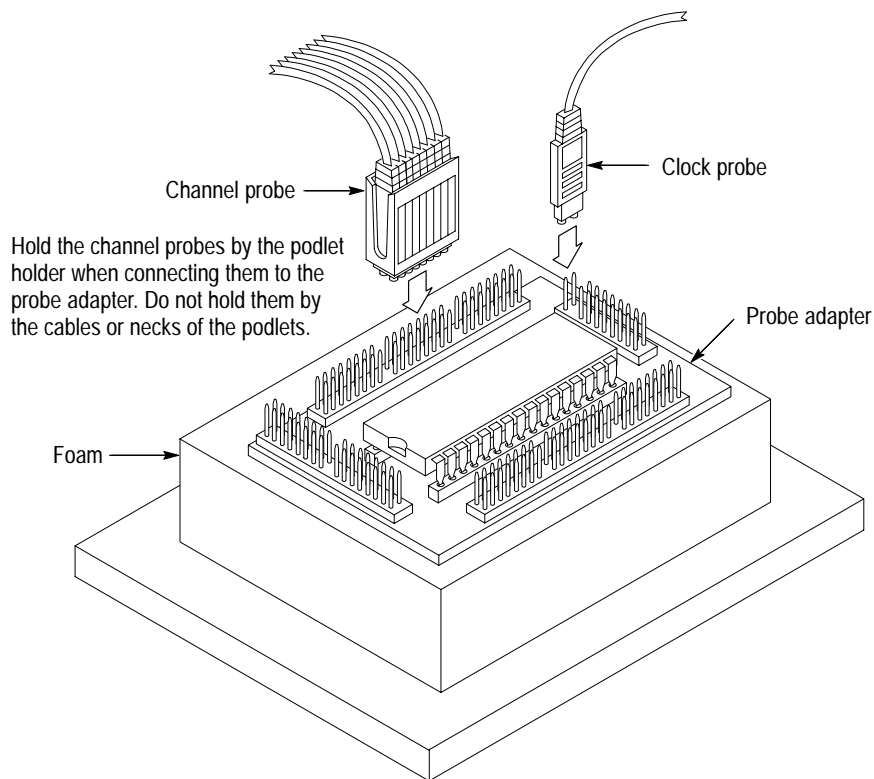


Figure 1–2: Connecting probes to a DIP probe adapter

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

NOTE. You might need to stack one or more replacement sockets between the SUT and the probe adapter to provide sufficient vertical clearance from adjacent components. However, keep in mind that this might increase loading, which can reduce the electrical performance of your probe adapter.

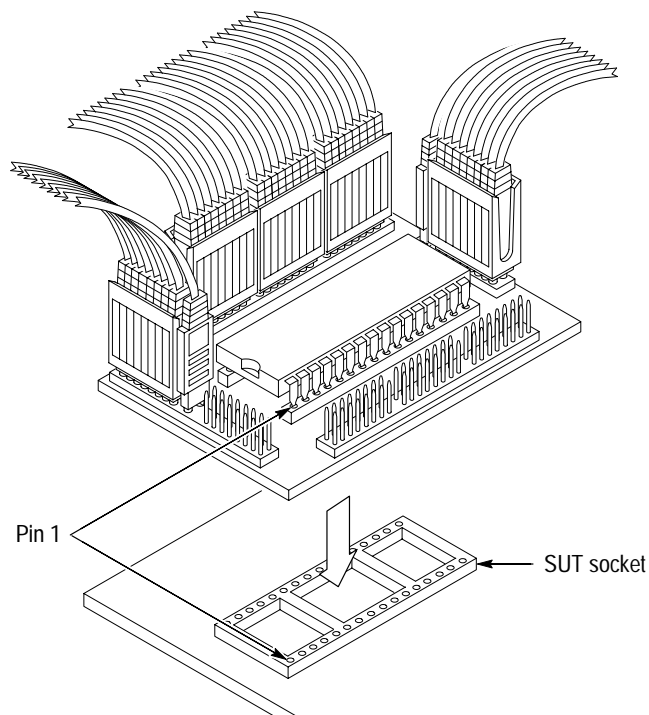


Figure 1-3: Placing a DIP probe adapter onto the SUT

DIP Probe Adapter with a DIP Clip

If your microcontroller is soldered to a circuit board and the probe adapter provides pins to which you can connect a DIP clip, you will need to use the DIP converter clip with the probe adapter.

One end of the converter clip connects to square pins on the probe adapter. The other end connects to the microcontroller in your SUT. To connect the logic analyzer to your SUT using a DIP probe adapter with a clip, refer to Figure 1-4 and follow these steps:

1. Follow steps 1 through 7 in the previous procedure.
2. Connect the cable end to the square pins on the probe adapter.

NOTE. The red strip along the side of the cable indicates that it connects to pin 1 on the probe adapter and pin 1 of the microcontroller.

3. Connect the clip end to the microcontroller.

NOTE. If you are having problems acquiring data, removing pins 18 (XTAL1) and 19 (XTAL2) from the DIP clip may restore proper operation.

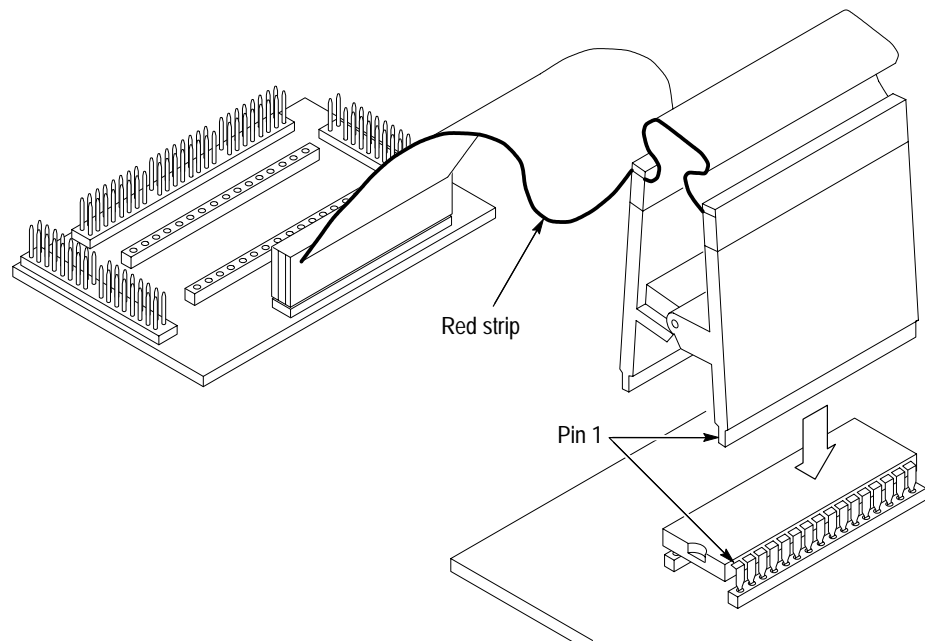


Figure 1–4: Connecting to the SUT using a DIP converter clip

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 8031, 8032, 8051 and 8052 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.
3. Use Table 1–2 to connect the channel probes to 8031, 8032, 8051 and 8052 signal pins on the test clip or in the SUT.

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.

NOTE. Since the microcontroller multiplexes address A7-A0 and data D7-D0 (as the AD7-AD0 signals), the D0:7-0 channel probe does not need to be connected.

These channels are not considered to be extra channels, even though they are not connected. Do not use them to make connections to other signals in your SUT.

Table 1–2: 8031, 8032, 8051 and 8052 signal connections for channel probes

Section:channel	8031, 8032, 8051 and 8052 signal	Section:channel	8031, 8032, 8051 and 8052 signal
A2:7	P1_7_B*	D0:7	AD7
A2:6	P1_6_B*	D0:6	AD6
A2:5	P1_5_B*	D0:5	AD5
A2:4	P1_4_B*	D0:4	AD4
A2:3	P1_3_B*	D0:3	AD3
A2:2	P1_2_B*	D0:2	AD2
A2:1	P1_1_B*	D0:1	AD1
A2:0	P1_0_B*	D0:0	AD0
A1:7	A15	D1:7	Not connected
A1:6	A14	D1:6	Not connected
A1:5	A13	D1:5	Not connected
A1:4	A12	D1:4	Not connected
A1:3	A11	D1:3	RST*
A1:2	A10	D1:2	EA~*
A1:1	A9	D1:1	WR_B~*
A1:0	A8	D1:0	RD_B~*
A0:7	AD7	C2:7	RXD_B*
A0:6	AD6	C2:6	TXD_B*
A0:5	AD5	C2:5	INT0_B~*
A0:4	AD4	C2:4	INT1_B~*
A0:3	AD3	C2:3	T0_B*
A0:2	AD2	C2:2	T1_B*
A0:1	AD1	C2:1	PSEN_B~
A0:0	AD0	C2:0	ALE_B

* Signal not required for disassembly.

Table 1–3 shows the clock probes and the 8031, 8032, 8051 and 8052 signal to which they must connect for disassembly to be correct.

Table 1–3: 8031, 8032, 8051 and 8052 signal connections for clock probes

Section:channel	8031, 8032, 8051 and 8052 signal
CK:3	ALE_B
CK:2	PSEN_B
CK:1	RD_B~
CK:0	WR_B~

4. Align pin 1 of your test clip with the corresponding pin 1 of the 8031, 8032, 8051 and 8052 microcontroller in your SUT and attach the clip.



Operating Basics

Setting Up the Support

This section provides information on how to set up the support. Information covers the following topics:

- Channel group definitions
- Clocking options
- Symbol table files

Remember that the information in this section is specific to the operations and functions of the TMS 140 8031, 8032, 8051 and 8052 support on any Tektronix logic analyzer for which it can be purchased. Information on basic operations describes general tasks and functions.

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 8031, 8032, 8051 and 8052 support are Address, Data, and Control. If you want to know which signal is in which group, refer to the channel assignment tables beginning on page 3–4.

Clocking Options

The TMS 140 support offers a microcontroller-specific clocking mode for the 8031, 8032, 8051 and 8052 microcontroller. This clocking mode is the default selection whenever you load the 8031 support.

A description of how cycles are sampled by the module using the TMS 140 support and probe adapter is found in the *Specifications* chapter.

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.

The TMS 140 support acquires all cycles. No clocking options are available.

Symbols

The TMS 140 support supplies one symbol table file. The 8031_Ctrl file replaces specific Control channel group values with symbolic values when Symbolic is the radix for the Control channel group.

Table 2–1 shows the name, bit pattern, and meaning for the symbols in the file 8031_Ctrl, the Control channel group symbol table.

Table 2–1: Control group symbol table definitions

Symbol	Control group value	Meaning
	ALE_B- PSEN_B- RD_B- WR_B-	
FETCH	X 0 1 1	An Opcode fetch
DATA_RD	X 1 0 1	A read from memory
DATA_WR	X 1 1 0	A write to memory

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

This section describes how to acquire data and view it disassembled. Information covers the following topics:

- Acquiring data
- Viewing disassembled data in various display formats
- Cycle type labels
- How to change the way data is displayed
- How to change disassembled cycles with the mark cycles function

Acquiring Data

Once you load the 8031 support 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, whichever is available.

Viewing Disassembled Data

You can view disassembled data in four different 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 2–6.*

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 shows these special characters and strings, and gives a definition of what they represent.

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

Character or string displayed	Meaning
>> or m	The instruction was manually marked as a program fetch
****	Indicates there is insufficient data available for complete disassembly of the instruction; the number of asterisks will indicate the width of the data that is unavailable. Each two asterisks represent a byte.
#	Indicates an immediate value

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.

Table 2–3: Cycle type definitions

Cycle type	Definition
(FLUSH)*	A cycle discarded by the microcontroller because of a change in control flow
(EXTENSION)*	An extension byte for a multiple byte instruction
(PGM MEM READ)*	A read from program memory that is not an opcode fetch
(DATA READ)	A read from data memory (not program memory)
(DATA WRITE)	A write to data memory (not program memory)
(DISCARDED_OPCODE)*	A cycle discarded by the microcontroller and refetched later
(ILLEGAL_CYCLE_TYPE)*	Not a legitimate cycle type
(ILLEGAL_INSTRUCTION)*	Not a legitimate instruction type

* Computed cycle types.

Figure 2–1 shows an example of the Hardware display.

1	2	3	4	5	6
Sample	Address	Data	Mnemonics	Control	Timestamp
772	0317	50	JNC 0319	FETCH	250 ns
773	0318	00	(DISCARDED OP CODE)	FETCH	250 ns
774	0318	00	(EXTENSION)	FETCH	250 ns
775	0319	60	(DISCARDED OP CODE)	FETCH	250 ns
776	0319	60	JZ 031B	FETCH	250 ns
777	031A	00	(DISCARDED OP CODE)	FETCH	250 ns
778	031A	00	(EXTENSION)	FETCH	250 ns
779	031B	70	(DISCARDED OP CODE)	FETCH	250 ns
780	031B	70	JNZ 031D	FETCH	250 ns
781	031C	00	(DISCARDED OP CODE)	FETCH	250 ns
782	031C	00	(EXTENSION)	FETCH	250 ns
783	031D	80	(DISCARDED OP CODE)	FETCH	250 ns
784	031D	80	SJMP 031F	FETCH	250 ns
785	031E	00	(FLUSH)	FETCH	250 ns
786	031E	00	(EXTENSION)	FETCH	250 ns
787	031F	B8	(DISCARDED OP CODE)	FETCH	250 ns
788	031F	B8	CJNE R0,#20,0322	FETCH	250 ns
789	0320	20	(EXTENSION)	FETCH	250 ns
790	0321	00	(EXTENSION)	FETCH	250 ns
791	0322	C2	(DISCARDED OP CODE)	FETCH	250 ns
792	0322	C2	CLR PSW.7	FETCH	250 ns
793	0323	D7	(EXTENSION)	FETCH	250 ns

Figure 2–1: Hardware display format

- 1 **Sample Column.** Lists the memory locations for the acquired data.
- 2 **Address Group.** Lists data from channels connected to the 8031, 8032, 8051 and 8052 microcontroller address bus.
- 3 **Data Group.** Lists data from channels connected to the 8031, 8032, 8051 and 8052 microcontroller data bus.
- 4 **Mnemonic Column.** Lists the disassembled instructions and cycle types.
- 5 **Control Group.** Lists data from channels connected to 8031, 8032, 8051 and 8052 microcontroller control signals (shown symbolically).
- 6 **Timestamp.** Lists the timestamp values when a timestamp selection is made. Information on basic operations describes how you can select a timestamp.

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.

Control Flow Display Format

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

Instructions that generate a change in the flow of control in the 8031, 8032, 8051 and 8052 microcontroller are as follows:

ACALL	JB	JNB	LCALL	SJMP
AJMP	JBC	JNC	LJMP	
CJNE	JC	JNZ	RET	
DJNZ	JMP	JZ	RETI	

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.

ACALL	LCALL	RET	RETI
-------	-------	-----	------

Instructions that generate a subroutine call or a return in the 8031, 8032, 8051 and 8052 microcontroller are as follows:

BGND	DIVS	LPSTOP	RTS
BKPT	DIVSL	RESET	STOP

Changing How Data is Displayed

There are fields and features that allow you to further modify displayed data to suit your needs. You can make selections unique to the 8031, 8032, 8051 and 8052 support to do the following tasks:

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

Optional Display Selections

You can make optional display selections for disassembled data to help you analyze the data. You can make these selections in the Disassembly property page (the Disassembly Format Definition overlay).

In addition to the common display options (described in the information on basic operations), you can select the microcontroller from which to disassemble data.

The Processor field selection determines how Special Function Registers (SFRs) are decoded. Selections are 8031/51 or 8032/52. If you select the incorrect microcontroller, some registers will be labeled incorrectly.

Marking Cycles

The disassembler has a Mark Opcode function that allows you to change the interpretation of a cycle type. Using this function, you can select a cycle and change it to one of the following cycle types:

- Opcode (the first word of an instruction)
- Extension (a subsequent word of an instruction)
- Flush (an opcode or extension that is fetched but not executed)

Mark selections are as follows:

Opcode
Extension
Flush

Undo mark

Information on basic operations contains more details on marking cycles.

Viewing an Example of Disassembled Data

A demonstration system file (or demonstration reference memory) is provided so you can see an example of how your 8031, 8032, 8051 and 8052 microcontroller bus cycles and instruction mnemonics look when they are disassembled. Viewing the system file is not a requirement for preparing the module for use and you can view it without connecting the logic analyzer to your SUT.

Information on basic operations describes how to view the file.



Specifications

Specifications

This chapter contains the following information:

- Probe adapter description
- Specification tables
- Dimensions of the probe adapter
- Channel assignment tables
- Description of how the module acquires 8031, 8032, 8051 and 8052 signals
- List of other accessible microcontroller signals and extra acquisition channels

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, if any, 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 8031, 8032, 8051 and 8052 microcontroller. The probe adapter connects to the microcontroller in the SUT. Signals from the microcontroller-based system flow from the probe adapter to the channel groups and through the probe signal leads to the module.

The probe adapter accommodates the Intel 8031, 8032, 8051 and 8052 microcontroller in a 40-pin DIP package. You can also use other clips and adapters with the probe adapter to connect to the microcontrollers listed in Table 3–1.

Table 3–1: Supported microcontrollers

Name	Package
8031/32/51/52	Socketed/soldered 40- and 48-pin DIP
8031/32/51/52	Socketed/soldered 44-, 68- and 84-pin PLCC

Refer to the *Replaceable Mechanical Parts* chapter for part numbers of the various clip and adapters.

Specifications

These specifications are for a probe adapter connected between a compatible Tektronix logic analyzer and a SUT. Table 3–2 shows the electrical requirements the SUT must produce for the support to acquire correct data.

In Table 3–2, for the 68/102/136-channel module, one podlet load is 20 k Ω in parallel with 2 pF. For the 96-channel module, one podlet load is 100 k Ω in parallel with 10 pF.

Table 3–2: Electrical specifications

Characteristics	Requirements		
SUT DC power requirements			
Voltage	5.0 V \pm 25 V		
Current	75 mA (I max), 26 mA (I typical)		
SUT clock rate	Max. 30 MHz		
Minimum setup time required			
A15-A0 (with respect to falling ALE)	8.3 ns		
D7-D0 (with respect to rising RD $\bar{~}$, to rising PSEN $\bar{~}$ and/or to rising WR $\bar{~}$)	8.3 ns		
RST	5.0 ns		
All other signals	8.3 ns		
Minimum hold time required			
A15-A0 (with respect to falling ALE)	3.3 ns		
D7-D0 (with respect to rising RD $\bar{~}$, to rising PSEN $\bar{~}$ and/or to rising WR $\bar{~}$)	3.3 ns		
RST	0 ns		
All other signals	3.3 ns		
Measured typical SUT signal loading	Specification		
	AC load	DC load	
	A15-A0, P1_0-P1_7, RXD, TXD, INT0 $\bar{~}$, INT1 $\bar{~}$, T0, T1	10 pF	1, 74FCT541A
	WR $\bar{~}$, RD $\bar{~}$, ALE, PSEN $\bar{~}$	10 pF	1, 74FCT244AT
RST, EA $\bar{~}$	5 pF & 1 podlet	1 podlet	

Table 3–3 shows the environmental specifications.

Table 3–3: 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 8031, 8032, 8051 and 8052 microcontroller thermal considerations. Forced air cooling might be required across the CPU.**

Table 3–4 shows the certifications and compliances that apply to the probe adapter.

Table 3–4: Certifications and compliances

EC Compliance	There are no current European Directives that apply to this product.
---------------	--

Figure 3–1 shows the dimensions of the probe adapter. Information on basic operations shows the vertical clearance of the channel and clock probes when connected to a probe adapter in the description of general requirements and restrictions.

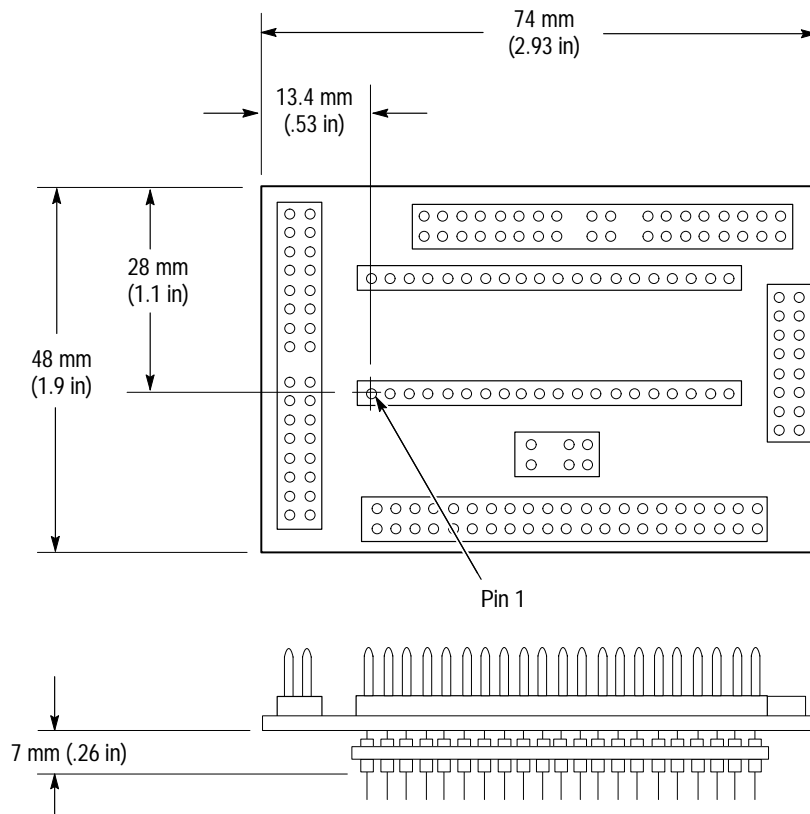


Figure 3-1: Minimum clearance of the DIP probe adapter.

Channel Assignments

Channel assignments shown in Table 3-5 through Table 3-13 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.
- A tilde (~) following a signal name indicates an active low signal.
- A signal that is buffered on the probe adapter has an `_B` following its name.
- An equals sign (=) following a signal name indicates that it is double probed.

Table 3-5 shows the probe section and channel assignments for the Address group and the microcontroller signal to which each channel connects. By default, this channel group is displayed in hexadecimal.

Table 3–5: Address group channel assignments

Bit order	Section: channel	8031, 8032, 8051 and 8052 signal name	Derived signal name
15	A1:7	A15	A15
14	A1:6	A14	A14
13	A1:5	A13	A13
12	A1:4	A12	A12
11	A1:3	A11	A11
10	A1:2	A10	A10
9	A1:1	A9	A9
8	A1:0	A8	A8
7	A0:7	AD7	A7
6	A0:6	AD6	A6
5	A0:5	AD5	A5
4	A0:4	AD4	A4
3	A0:3	AD3	A3
2	A0:2	AD2	A2
1	A0:1	AD1	A1
0	A0:0	AD0	A0

Table 3–6 shows the probe section and channel assignments for the Data group and the microcontroller signal to which each channel connects. By default, this channel group is displayed in hexadecimal.

NOTE. Since the microcontroller multiplexes address A7-A0 and data D7-D0 (as the AD7-AD0 signals), the D0:7-0 channel probe does not need to be connected.

These channels are not considered to be extra channels, even though they are not connected. Do not use them to make connections to other signals in your SUT.

Table 3–6: Data group channel assignments

Bit order	Section: channel	8031, 8032, 8051 and 8052 signal name	Derived signal name
7	D0:7	AD7	D7
6	D0:6	AD6	D6
5	D0:5	AD5	D5
4	D0:4	AD4	D4
3	D0:3	AD3	D3
2	D0:2	AD2	D2

Table 3–6: Data group channel assignments

Bit order	Section: channel	8031, 8032, 8051 and 8052 signal name	Derived signal name
1	D0:1	AD1	D1
0	D0:0	AD0	D0

Table 3–7 shows the probe section and channel assignments for the Control group and the microcontroller signal to which each channel connects. By default, this channel group is displayed symbolically.

Table 3–7: Control group channel assignments

Bit order	Section: channel	8031, 8032, 8051 and 8052 signal name	Derived signal name
3	C2:0	ALE	ALE_B
2	C2:1	PSEN~	PSEN_B~
1	D1:0	RD~	RD_B~
0	D1:1	WR~	WR_B~

Table 3–8 shows the probe section and channel assignments for the Intr group and the microcontroller signal to which each channel connects. By default, this channel group is not visible.

Table 3–8: Intr group channel assignments

Bit order	Section: channel	8031, 8032, 8051 and 8052 signal name	Derived signal name
1	C2:5	INT0~*	INT0_B~
0	C2:4	INT1~*	INT1_B~

* Signal not required for disassembly.

Table 3–9 shows the probe section and channel assignments for the Misc group and the microcontroller signal to which each channel connects. By default, this channel group is not visible.

Table 3–9: Misc group channel assignments

Bit order	Section: channel	8031, 8032, 8051 and 8052 signal name	Derived signal name
1	D1:3	RST*	RST
0	D1:2	EA~*	EA~

* Signal not required for disassembly.

Table 3–10 shows the probe section and channel assignments for the Timer group and the microcontroller signal to which each channel connects. By default, this channel group is not visible.

Table 3–10: Timer group channel assignments

Bit order	Section: channel	8031, 8032, 8051 and 8052 signal name	Derived signal name
1	C2:2	T1*	T1_B
0	C2:3	T0*	T0_B

* Signal not required for disassembly.

Table 3–11 shows the probe section and channel assignments for the Serial group and the microcontroller signal to which each channel connects. By default, this channel group is not visible.

Table 3–11: Serial group channel assignments

Bit order	Section: channel	8031, 8032, 8051 and 8052 signal name	Derived signal name
1	C2:7	RXD*	RXD_B
0	C2:6	TXD*	TXD_B

* Signal not required for disassembly.

Table 3–12 shows the probe section and channel assignments for the Port_1 group and the microcontroller signal to which each channel connects. By default, this channel group is not visible.

Table 3–12: Port–1 group channel assignments

Bit order	Section: channel	8031, 8032, 8051 and 8052 signal name	Derived signal name
7	A2:7	P1_7*	P1_7_B
6	A2:6	P1_6*	P1_6_B
5	A2:5	P1_5*	P1_5_B
4	A2:4	P1_4*	P1_4_B
3	A2:3	P1_3*	P1_3_B
2	A2:2	P1_2*	P1_2_B
1	A2:1	P1_1*	P1_1_B
0	A2:0	P1_0*	P1_0_B

* Signal not required for disassembly.

Table 3–13 shows the probe section and channel assignments for the clock probes (not part of any group) and the 8031, 8032, 8051 and 8052 signal to which each channel connects.

Table 3–13: Clock channel assignments

Section:channel	8031, 8032, 8051 and 8052 signal name	Derived signal name
CK:3	ALE	ALE_B=
CK:2	PSEN~	PSEN_B~=
CK:1	RD~	RD_B~=
CK:0	WR~	WR_B~=

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 3–13, you must connect another channel probe to the signal, a technique called double probing. An equals sign (=) following a signal name indicates that it is already double probed.

How Data is Acquired

This part of this chapter explains how the module acquires 8031, 8032, 8051 and 8052 signals using the TMS 140 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 acquisition channels available for you to use for additional connections.

Custom Clocking

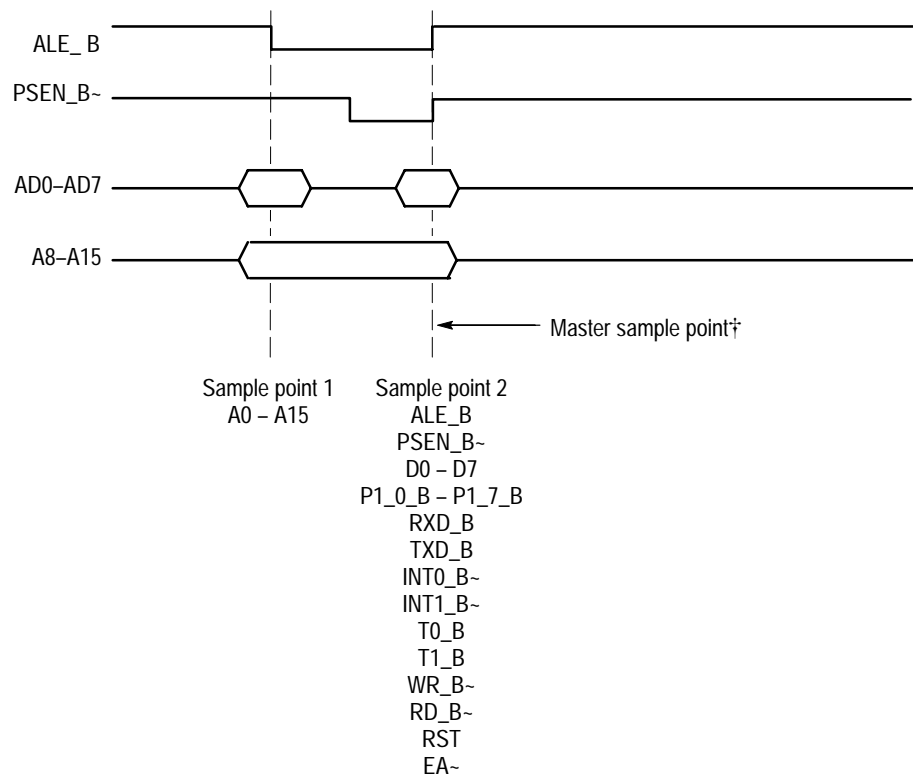
A special clocking program is loaded to the module every time you load the 8031 support. This special clocking is called Custom.

With Custom clocking, the module logs in signals from multiple groups of channels at different times as they become valid on the 8031, 8032, 8051 and 8052 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 clocking state machine (CSM) generates one master sample for each microcontroller bus cycle, no matter how many clock cycles are contained in the bus cycle.

Acquiring Read cycles from External Program Memory. Lower address and data buses are multiplexed on every version of the 8031, 8032, 8051 and 8052 microcontroller. The first sample point of program memory acquires only address signals valid on the falling edge of ALE_B. The second sample point acquires data and control signals on the rising edge of the PSEN_B~ signal.

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

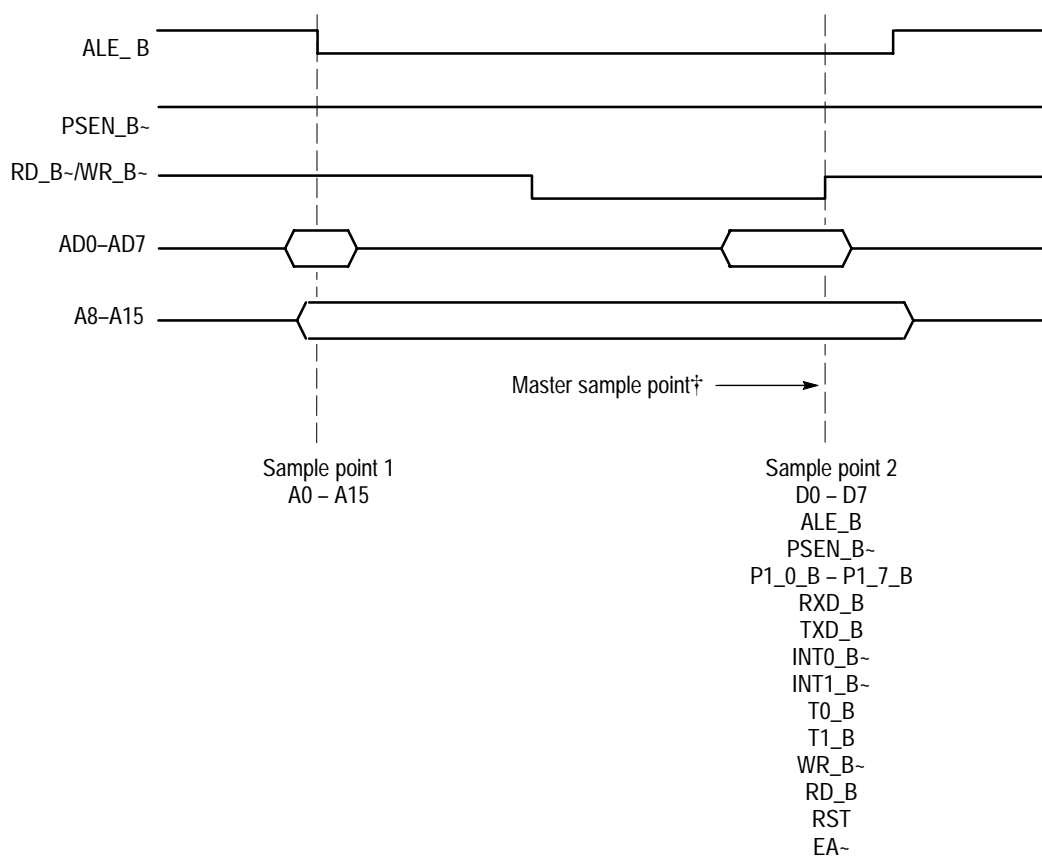


†Channels not set up in a channel group by the TMS 140 software are logged with the Master sample.

Figure 3-2: 8031, 8032, 8051 and 8052 external program memory read timing

Acquiring Read and Write cycles from External Data Memory. The first sample point of data memory acquires all 16 bits of data memory address signals that are valid on the falling edge of ALE_B. The second sample point acquires data and control signals on the rising edge of either RD_B~ or WR_B~.

Figure 3-3 shows the sample points and the master sample for data memory.



†Channels not set up in a channel group by the TMS 140 software are logged with the Master sample.

Figure 3–3: 8031, 8032, 8051 and 8052 external data memory read and write timing

Clocking Options No variations are available for the clocking algorithm for the 8031, 8032, 8051 and 8052 microcontrollers.

Alternate Microcontroller Connections

You can connect to other signals that are not required by the support so that you can analyze other signal activity in your system. These signals might or might not be accessible on the probe adapter board. The following paragraphs and table list signals that are not accessible on the probe adapter board.

For a list of signals required or not required for disassembly, refer to the channel assignment tables beginning on page 3–4. Remember that these channels are already included in a channel group. If you do connect these channels to other signals, you should set up another channel group for them.

Signals Not On the Probe Adapter

The probe adapter does not provide access for the XTAL1 or XTAL2 signals.

Extra Channels

Table 3–14 lists extra sections and channels that are left after you have connected all the probes used by the support. You can use these extra channels to make alternate SUT connections.

Channels not defined in a channel group by the TMS 140 software are logged in with the Master sample point.

Table 3–14: Extra module sections and channels

Module	Section: channels
68-channels	A3:7-0, C3:7-0
102-channels	A3:7-0, C3:7-0, C1:7-0, C0:7-0, D3:7-0, D2:7-0, Qual:1, Qual:0
136-channels	A3:7-0, C3:7-0, C1:7-0, C0:7-0, D3:7-0, D2:7-0, E3:7-0, E2:7-0, E1:7-0, E0:7-0, Qual:3-0
96-channels	A3:7-0, C3:7-0, C1:7-0, C0:7-0, D3:7-0, D2:7-0

These channels are not defined in any channel group and data acquired from them is not displayed. To display data, you will need to define a channel group.

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

This chapter contains a circuit description of the probe adapter.

Probe Adapter Circuit Description

The probe adapter contains four buffers, U210, U240, U310, and U340, to reduce the electrical loading on the microcontroller signals. Another buffer, U230, suppresses spurious noise on critical clock lines.

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 140 8031, 8032, 8051 and 8052 microcontroller support. Use this list to identify and order replacement parts.

Parts Ordering Information

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

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

- Part number
- 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.

CROSS INDEX – MFR CODE NUMBER TO MANUFACTURER

Mfr Code	Manufacturer	Address	City, State, Zip Code
04222	AVX CERAMICS DIV OF AVX CORP	19TH AVE SOUTH P O BOX 867	MYRTLE BEACH SC 29577
53387	MINNESOTA MINING MFG CO	PO BOX 2963	AUSTIN TX 78769-2963
61772	INTEGRATED DEVICE TECHNOLOGY	3236 SCOTT BLVD	SANTA CLARA CA 95051
61857	SAN-O INDUSTRIAL CORP	85 ORVILLE DR	BOHEMIA LONG ISLAND NY 11716-2501
63058	MCKENZIE TECHNOLOGY	44370 OLD WARMS SPRINGS BLVD	FREMONT CA 94538
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR	BEAVERTON OR 97077-0001
TK0875	MATSUO ELECTRONICS INC	831 S DOUBLAS ST	EL SEGUNDO CA 92641

Replaceable Electrical Parts

Component No.	Tektronix Part Number	Serial Number Effect	Discont	Part Name & Description	Mfr Code	Mfr Part Number
A01	671-2445-00			CIRCUIT BD ASSY:8031/51 DIP40 SOCKETED	80009	671-2445-00
A01C110	290-5005-00			CAP,FXD,ELCTLT:47MF,10%,10V,TANTLUM	TK0875	267M-1002-476-KR-533
A01C210	283-5004-00			CAP,FXD,CER DI:0.1UF,10%,25V	04222	W1206X104K1B01
A01C230	283-5004-00			CAP,FXD,CER DI:0.1UF,10%,25V	04222	W1206X104K1B01
A01C240	283-5004-00			CAP,FXD,CER DI:0.1UF,10%,25V	04222	W1206X104K1B01
A01C310	283-5004-00			CAP,FXD,CER DI:0.1UF,10%,25V	04222	W1206X104K1B01
A01C340	283-5004-00			CAP,FXD,CER DI:0.1UF,10%,25V	04222	W1206X104K1B01
A01F310	-----			FUSE,WIRE LEAD:3.0A,125V,5 SECONDS (SEE RMPL)	61857	SP7-3A
A01J130	-----			CONN,HDR:PCB,;MALE,STR,2 X 40,0.1 CTR,0.235 (SEE RMPL)	53387	2480-6122-TB
A01J200	-----			CONN,HDR:PCB,;MALE,STR,2 X 40,0.1 CTR,0.235 (SEE RMPL)	53387	2480-6122-TB
A01J250	-----			CONN,HDR:PCB,;MALE,STR,2 X 40,0.1 CTR,0.235 (SEE RMPL)	53387	2480-6122-TB
A01J330	-----			CONN,HDR:PCB,;MALE,STR,2 X 40,0.1 CTR,0.235 (SEE RMPL)	53387	2480-6122-TB
A01J430	-----			CONN,HDR:PCB,;MALE,STR,2 X 40,0.1 CTR,0.235 (SEE RMPL)	53387	2480-6122-TB
A01U210	156-5793-00			IC,DIGITAL:FCTQMOS,BUFFER:OCTAL, 3-STATE	61772	IDT74FCT541AS0
A01U220	-----			SOCKET,DIP:PCB,;FEMALE,STR,2 X 20,0.1 X 0.6	63058	DIP-640-101B
A01U230	156-6260-00			IC,DIGITAL:FCTQMOS,BUFFER:OCTAL, 3-STATE	61772	74FCT244ATS0
A01U240	156-5793-00			IC,DIGITAL:FCTQMOS,BUFFER:OCTAL, 3-STATE	61772	IDT74FCT541AS0
A01U310	156-5793-00			IC,DIGITAL:FCTQMOS,BUFFER:OCTAL, 3-STATE	61772	IDT74FCT541AS0
A01U340	156-5793-00			IC,DIGITAL:FCTQMOS,BUFFER:OCTAL, 3-STATE	61772	IDT74FCT541AS0



Replaceable Mechanical Parts

Replaceable Mechanical Parts

This chapter contains a list of the replaceable mechanical components for the TMS 140 8031, 8032, 8051 and 8052 microcontroller support. Use this list to identify and order replacement parts.

Parts Ordering Information

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

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

- Part number
- 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
05276	ITT POMONA ELECTRONICS DIV	1500 E 9TH ST PO BOX 2767	POMONA CA 91766-3835
1Y013	ACACIA/DEANCO	3101 SW 153RD DRIVE	BEAVERTON OR 97006
53387	MINNESOTA MINING MFG CO	PO BOX 2963	AUSTIN TX 78769-2963
63058	MCKENZIE TECHNOLOGY	44370 OLD WARMS SPRINGS BLVD	FREMONT CA 94538
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON, OR 97077-0001
TK007	AP PRODUCTS INC	72 CORWIN DRIVE PO BOX 110	PAINESVILLE OH 44077

Replaceable mechanical parts list

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description	Mfr. code	Mfr. part number
1-0	010-0548-00			1	PROBE ADAPTER,8031/32/51/52, DIP40 SOCKETED,	80009	010-0548-00
-2	131-5267-00			2	CONN,HDR:PCB,MALE,STR,2 X 40,0.1 CTR,0.235 MLG X 0.110 TAIL,30GOLD (J130, J200, J250, J330, J430)	00779	104326-4
-3	671-2445-00			1	CIRCUIT BD ASSY:8031/32/51/52,DIP-40,SOCKETED	80009	671-2445-00
-4	136-0916-00			2	SOCKET,DIP:PCB,FEMALE,STR,2 X 20, 0.1 X 0 (U220)	63058	DIP-640-101B
STANDARD ACCESSORIES							
	070-9813-00			1	MANUAL,TECH:INSTRUCTION,8031/32/51/52,DISSASSEMBLER, TMS 140	80009	070-9813-00
	070-9803-00			1	MANUAL, TECH:TLA 700 SERIES MICRO SUPPORT INSTALLATION	80009	070-9803-00
OPTIONAL ACCESSORIES							
-1	015-0646-00			1	TEST CLIP ASSY: RIBBON:MXD,40,28 AWG	53387	015-0646-00
	159-0204-00			1	FUSE, WIRE LEAD; 3.0A, 125V, 5 SECONDS (F310)	61857	SP7-3A
-5	013-0266-00			1	CLIP, TEST: 40 PIN FOR DIP	TK007	923690-40
	013-0266-00			1	CLIP, TEST: 48 PIN FOR DIP	TK007	923690-48
-6	013-0248-00			1	ADAPTER, TEST: 44 PIN PLCC	05276	E11884
	013-0250-00			1	ADAPTER, TEST: 68 PIN PLCC	05276	E11886
	013-0263-00			1	ADAPTER, TEST: 84 PIN PLCC	05276	E11979
-7	020-1386-01			1	ACCESSORY KIT PACKAGE OF 12 (206-0364-00)	80009	020-1386-01
-8	012-1378-00			1	LEAD SET ELEC:4, 22 AWG, STRD, 2.33 L	1Y013	012-1378-00
-9	012-1377-00			1	LEAD SET ELEC:2, 26 AWG, STRD, 2.03 L	1Y013	66156
	070-9802-00			1	MANUAL, TECH:BASIC OPS MICRO SUP ON DAS/TLA 500 SERIES LOGIC ANALYZERS	80009	070-9802-00

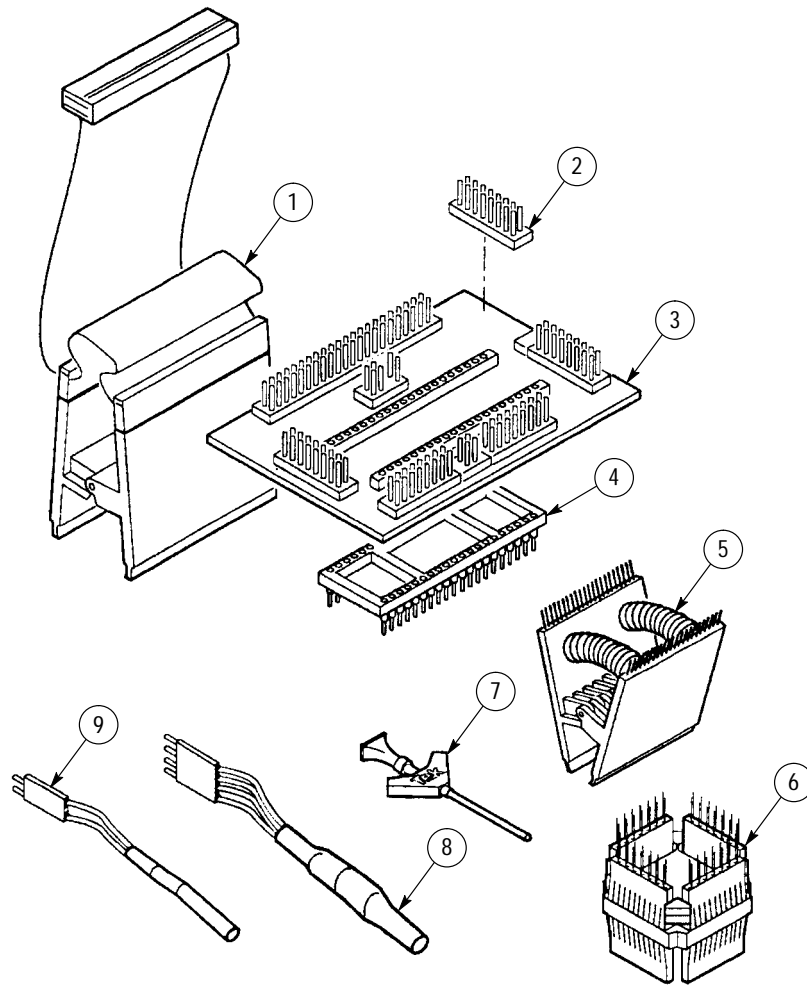


Figure 1: 8031, 8032, 8051 and 8052 probe adapter exploded view



Index

Index

Numbers

- 8031/51 microcontroller, timing, data memory, 3–11
- 8031/51 system
 - clock rate, 1–2
 - DMA cycles, 1–3
 - interrupt cycles, 1–3
- 8051/52 system, internal RAM and ROM, 1–2

A

- about this manual set, ix
- acquiring data, 2–3
- Address group
 - channel assignments, 3–4
 - display column, 2–5
- alternate connections
 - extra channel probes, 3–12
 - to other signals, 3–11

B

- basic operations, where to find information, ix
- bus cycles, displayed cycle types, 2–4
- bus timing, 3–10

C

- certifications, 3–3
- channel assignments
 - Address group, 3–4
 - clocks, 3–8
 - Control group, 3–6
 - Data group, 3–5
 - Intr group, 3–6
 - Misc group, 3–6
 - Port_1 group, 3–7
 - Serial group, 3–7
 - Timer group, 3–7
- channel groups, 2–1
- clock channel assignments, 3–8
- clock rate, 1–2
- clocking, Custom, 2–1
 - how data is acquired, 3–9
- clocking options
 - how data is acquired, 3–11
 - none available, 2–1
- compliances, 3–3

- connections
 - no probe adapter, 1–7
 - channel probes, 1–7
 - clock probes, 1–8
 - other microprocessor signals, 3–11
 - probe adapter to SUT, DIP, 1–3
 - using converter clip, 1–6
- Control Flow display format, 2–5
- Control group
 - channel assignments, 3–6
 - display column, 2–5
 - symbol table, 2–2
- Custom clocking, 2–1
 - how data is acquired, 3–9
- cycle types, 2–4

D

- data
 - acquiring, 2–3
 - disassembly formats
 - Control Flow, 2–5
 - Hardware, 2–4
 - Software, 2–5
 - Subroutine, 2–6
 - how it is acquired, 3–9
- data display, changing, 2–6
- Data group
 - channel assignments, 3–5
 - display column, 2–5
- data memory timing, 3–11
- demonstration file, 2–7
- dimensions, probe adapter, 3–3
- disassembled data
 - cycle type definitions, 2–4
 - viewing, 2–3
 - viewing an example, 2–7
- disassembler
 - definition, ix
 - logic analyzer configuration, 1–2
 - setup, 2–1
- Disassembly Format Definition overlay, 2–6
- Disassembly property page, 2–6
- display formats
 - Control Flow, 2–5
 - Hardware, 2–4
 - Software, 2–5
 - special characters, 2–3
 - Subroutine, 2–6

DMA cycles, 1–3

E

electrical specifications, 3–2
environmental specifications, 3–3

H

Hardware display format, 2–4
cycle type definitions, 2–4

I

installing hardware. *See* connections
internal RAM and ROM, 8051/52, 1–2
interrupt cycles, 1–3
Intr group, channel assignments, 3–6

L

leads (podlets). *See* connections
logic analyzer
configuration for disassembler, 1–2
software compatibility, 1–2

M

manual
conventions, ix
how to use the set, ix
Mark Cycle function, 2–7
Mark Opcode function, 2–7
marking cycles, definition of, 2–7
microprocessor
package types supported, 1–1
signals not accessible on probe adapter, 3–12
specific clocking and how data is acquired, 3–9
Misc group, channel assignments, 3–6
Mnemonic display column, 2–5

P

Port_1 group, channel assignments, 3–7
probe adapter
circuit description, 4–1
clearance, 1–3
adding sockets, 1–5

dimensions, 3–3
connecting leads, 1–4
hardware description, 3–1
not using one, 1–7
placing the microprocessor in, 1–4
Processor field, 2–6

R

reference memory, 2–7
Reset, SUT hardware, 1–2
restrictions, 1–2
without a probe adapter, 1–7

S

Serial group, channel assignments, 3–7
service information, 4–1
setups, disassembler, 2–1
signals
active low sign, x
buffered signal sign (_B), 3–4
extra channel probes, 3–12
Software display format, 2–5
special characters displayed, 2–3
specifications, 3–1
certifications, 3–3
channel assignments, 3–4
compliances, 3–3
electrical, 3–2
environmental, 3–3
mechanical (dimensions), 3–3
Subroutine display format, 2–6
support setup, 2–1
SUT, definition, ix
SUT hardware Reset, 1–2
symbol table, Control channel group, 2–2
system file, demonstration, 2–7

T

terminology, ix
Timer group, channel assignments, 3–7
Timestamp display column, 2–5

V

viewing disassembled data, 2–3

