

Application Note 80501

In-System Programming of Logic Devices

This application note describes how a wide range of logic devices from various manufacturers may be programmed in-circuit using the dedicated JTAG/ISP connector on the Pin-Master 48 universal programmer. The programming cable, the design of the target board, and programming procedures are described.

INTRODUCTION

An increasing number of devices have an in system programming capability, allowing the devices to be programmed while soldered onto a system board.

The programming data is transmitted and received over a serial interface. On many devices this interface conforms to the JTAG (IEEE Std 1149.1) standard or in some cases to a proprietary standard.

The Pin-Master 48 universal programmer has a dedicated JTAG/ISP connector fitted to the top of the unit. A cable made up to the users own requirements connects the socket to the target board.

In this way single devices can be remotely programmed, the system does not yet support daisy chained devices.

JTAG/ISP SOCKET

The socket is a standard 10 way 0.1" header. A diagram of the socket is shown below:

Viewed from top, front of programmer

2 GND	4 GND	6 GND	8 GND	10 GND
1 TCK	3 TMS	5 TDI	7 TDO	9 TRST*

* May be Enable, Vpp, or No Connect

1	TCK/SCLK Device input	Test Clock
2	GND	Ground
3	TMS/MODE Device input	Test Mode Select
4	GND	Ground
5	TDI/SDI input	Test Data input Device
6	GND	Ground
7	TDO/SDO Device Output	Test Data Output
8	GND	Ground
9	TRST* Device input	Test Reset

* TRST is an optional signal on a JTAG interface. On some devices it is used for an ENABLE or Vpp high voltage signal. On Lattice ISPLSI devices it is the /ispEN signal.

CABLE

A ribbon cable with alternate wires connected to ground is used between the Pin-Master 48 and the target board. The cable should be kept as short as possible (maximum length 1.5m).

TARGET BOARD

The target board should be equipped with a suitable connector. This could be most simply achieved with a similar connector and pin layout to that used at the programmer end of the cable. We recommend that all the ground wires are connected to the target board ground to maintain the transmission line effect.

For target boards with more than one device to be programmed a connector per device will currently be required.

A JTAG interface implies the use of internal pull up resistors on input pins. The user would be advised to check the device specification before deciding if external resistors are required.

Please note that during programming all normal outputs on the device will be tri-stated. The design of the target board should be such that this does not cause any problems to any other circuitry.

DEVICE PIN-OUTS

Table 1 - Device Pin-outs

DEVICE	PACKAGE	TCK /SCLK	TMS /MODE	TDI /SDI	TDO /SDO	TRST /ispEN
MACH111SP	44 PLCC	13	32	10	35	NC
MACH111SP	44 TQFP	7	26	4	29	NC
MACH131SP	84 PLCC	23	41	83	73	62(VPP)
MACH131SP	100 PQFP	28	53	3	78	NC
MACH211SP	44 PLCC	13	32	10	35	NC
MACH231/1	84 PLCC	23	41	83	73	62(VPP)
MACH231/1	100 PQFP	28	53	3	78	NC
ISPGAL22V10	28 PLCC	1	8	15	22	NC
ISPGDS14	20 DIP	14	7	4	17	NC
ISPGDS18	24 DIP	16	9	4	21	NC
ISPGDS22	28 DIP	18	11	4	25	NC
ISPLSI1016	44 PLCC	33	36	14	24	13
ISPLSI1016E	44 PLCC	33	36	14	24	13
ISPLSI1024	68 PLCC	49	55	21	34	19
ISPLSI1024E	68PLCC	49	55	21	34	19
ISPLSI1032	84 PLCC	61	42	25	44	23
ISPLSI1032E	84 PLCC	61	42	25	44	23
ISPLSI1048	120 PQFP	73	44	19	47	17
ISPLSI1048C	129 PQFP	78	46	20	50	18
ISPLSI1048E	128 PLCC	78	46	20	50	18
ISPLSI2032	44 PLCC	33	36	14	24	13
ISPLSI2064	84 PLCC	61	42	25	44	23
ISPLSI2096	128 PQFP	78	46	20	50	18
ISPLSI2128	160 MQFP	23	24	22	104	21
ISPLSI3192	240 MQFP	29	28	30	27	32

PROGRAMMING PROCEDURE

As no power is provided by the programmer, the target board must be independently powered.

To avoid earth potential differences the programmer and target board should be connected to a common mains supply.

- Connect the cable to the target board and the programmer.
- Power up the target board and proceed with programming in the normal way.
- If there are any other devices to be programmed on the board move the cable and repeat the procedure. This could be simplified by using a batch file which would automatically change the device type and instruct the operator where to plug in the cable.

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