

FLASHRUNNER

High-Performance, Standalone In-System Programmer

FR01M01

User's Manual



FlashRunner FR01M01

**High-Performance,
Standalone, Eight-Site
In-System Programmer**

User's Manual

Revision 1.0 — July 2007



Copyright © 2007 SofTec Microsystems™

DC01390

We want your feedback!

SofTec Microsystems is always on the look-out for new ways to improve its Products and Services. For this reason feedback, comments, suggestions or criticisms, however small, are always welcome.



Our policy at SofTec Microsystems is to comply with all applicable worldwide safety and EMC/EMI regulations. Our products are certified to comply to the European New Approach Directives and the CE mark is applied on all our products.

This product as shipped from the factory has been verified to meet with requirements FCC as a CLASS A product.



In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate prevention measures.

Attaching additional wiring to this product or modifying the product operation from the factory default as shipped may effect its performance and cause interference with other apparatus in the immediate vicinity. If such interference is detected, suitable mitigating measures should be taken.

SofTec Microsystems

E-mail (general information): info@softecmicro.com

E-mail (technical support): support@softecmicro.com

Web: <http://www.softecmicro.com>

Important

SofTec Microsystems reserves the right to make improvements to FlashRunner, its documentation and software routines, without notice. Information in this manual is intended to be accurate and reliable. However, SofTec Microsystems assumes no responsibility for its use; nor for any infringements of rights of third parties which may result from its use.

SOFTEC MICROSYSTEMS WILL NOT BE LIABLE FOR DAMAGES RESULTING FROM LOSS OF DATA, PROFITS, USE OF PRODUCTS, OR INCIDENTAL OR CONSEQUENTIAL DAMAGES, EVEN IF ADVISED OF THE POSSIBILITY THEREOF.

Trademarks

SofTec Microsystems™ and the SofTec Microsystems logo are trademarks of SofTec Microsystems S.a.s.

All other product or service names are the property of their respective owners.

Written by Paolo Xausa

Contents

0 Before Starting 9

- 0.1 Important Notice to Users 9
- 0.2 Safety 9
- 0.3 Getting Technical Support 10
- 0.4 Additional Documentation 10

1 Overview 11

- 1.1 What is FlashRunner FR01M01? 11
 - 1.1.1 *General Features* 12
 - 1.1.2 *Hardware Features* 12
 - 1.1.3 *Software Features* 13
- 1.2 Package Checklist 13
- 1.3 Hardware Overview 13
- 1.4 Programming Algorithms and Licenses 16
 - 1.4.1 *Installing New Licenses* 16
- 1.5 Upgrading the Firmware 17

2 System Setup 19

- 2.1 Overview 19
- 2.2 Software Setup 19
- 2.3 Hardware Setup 20
 - 2.3.1 *Interfacing FlashRunner with Your Test/Programming Equipment* 20
 - 2.3.2 *Connecting FlashRunner to the Host system* 22
 - 2.3.3 *Setting Up LAN Settings* 22
- 2.4 Step-by-Step Tutorial: Sending Commands to FlashRunner 22

3 Connectors 29

- 3.1 Overview 29
- 3.2 ISP Connectors 29
- 3.3 Control Connector 33

4 Technical Specifications 37

- 4.1 Absolute Maximum Ratings 37
- 4.2 DC Characteristics and Functional Operating Range 38
- 4.3 AC Characteristics 39
- 4.4 Multiplexing Characteristics 40
- 4.5 Physical and Environmental Specifications 41

Index of Figures

- Figure 1.1: FlashRunner FR01M01 11
- Figure 1.2: FR01M01 Top Layer 14
- Figure 1.3: FR01M01 Programming Engine Layer (Top Side) 14
- Figure 1.4: FR01M01 Programming Engine Layer (Bottom Side) 15
- Figure 1.5: FR01M01 Connection Layer (Top Side) 15
- Figure 1.6: FR01M01 Connection Layer (Bottom Side) 16
- Figure 2.1: Typical Programming Connections 21
- Figure 2.2: FlashRunner Control Panel, Communication Settings 23
- Figure 2.3: FlashRunner Control Panel, Target Device Configured 25
- Figure 2.4: FlashRunner Control Panel, Binary File Conversion 26
- Figure 2.5: FlashRunner Control Panel, File Transfer 26
- Figure 2.6: FlashRunner Control Panel, Target Device Programmed 28
- Figure 3.1: ISP Connectors 30
- Figure 3.2: Main Unit Control Connector 34
- Figure 4.1: Load Conditions 40
- Figure 4.2: Connection Layer (Bottom Side) Layout 41

Index of Tables

Table 3.1: ISP Connectors Signals	31
Table 3.2: Main Unit Control Connector Signals	35
Table 4.1: Absolute Maximum Ratings	37
Table 4.2: DC Characteristics and Functional Operating Range	38
Table 4.3: AC Characteristics	39
Table 4.4: Multiplexing Characteristics	40
Table 4.5: Physical and Environmental Specifications	41

0 Before Starting



Note: *the FlashRunner System Software CD-ROM and/or SofTec Microsystems website (www.softecmicro.com) may contain an updated version of this user's manual. Please check before continuing reading this documentation.*

0.1 Important Notice to Users

While every effort has been made to ensure the accuracy of all information in this document, SofTec Microsystems assumes no liability to any party for any loss or damage caused by errors or omissions or by statements of any kind in this document, its updates, supplements, or special editions, whether such errors are omissions or statements resulting from negligence, accidents, or any other cause.

0.2 Safety

FlashRunner is a low-voltage device. However, when integrating it inside an automatic test equipment or when interfacing it with other systems, take all precautions in order to avoid electrical shocks due to, for example, different ground references.

Make all connections to the target system before applying power to the instrument.

To protect FlashRunner against electrostatic discharge (ESD), always connect yourself to ground (e.g. via wrist straps) when handling the instrument.

Always store FlashRunner inside an antistatic bag when not in use.

0.3 Getting Technical Support

SofTec Microsystems is continuously working to improve FlashRunner firmware and to release programming algorithms for new devices. SofTec Microsystems offers a fast and knowledgeable technical support to all of its customers and is always available to solve specific problems or meet specific needs.

To get in touch with SofTec Microsystems, please refer to the contact information below.

SofTec Microsystems Headquarters (Italy)

Phone: +39 0434 421111

Fax: +39 0434 639021

Technical Support: *support@softecmicro.com*

SofTec Microsystems Asia (Hong Kong)

Phone: +852 35430500

Fax: +852 35430505

Technical Support: *support@softecmicro.com*

0.4 Additional Documentation

This user's manual provides information about how to setup FlashRunner FR01M01 and its hardware characteristics.

For information about FlashRunner commands and their syntax, including specific commands for specific family of microcontrollers, please refer to the FlashRunner Programmer's Manual, included (in PDF format) in the FlashRunner CD-ROM.

1 Overview

1

1.1 What is FlashRunner FR01M01?

FlashRunner FR01M01 is a member of the FlashRunner series of a high-performance, standalone In-System Programmers specific for Flash-based microcontrollers and serial memories.

FlashRunner FR01M01 is targeted at production environments, easily interfaces to your programming system or Automatic Test Equipment (ATE) and can work either in full standalone mode or controlled by a host system.

FlashRunner FR01M01 provides connections for programming up to eight ISP sites thanks to the built-in ISP lines multiplexing.

FlashRunner FR01M01 piggybacks to your programming system through three header connectors.

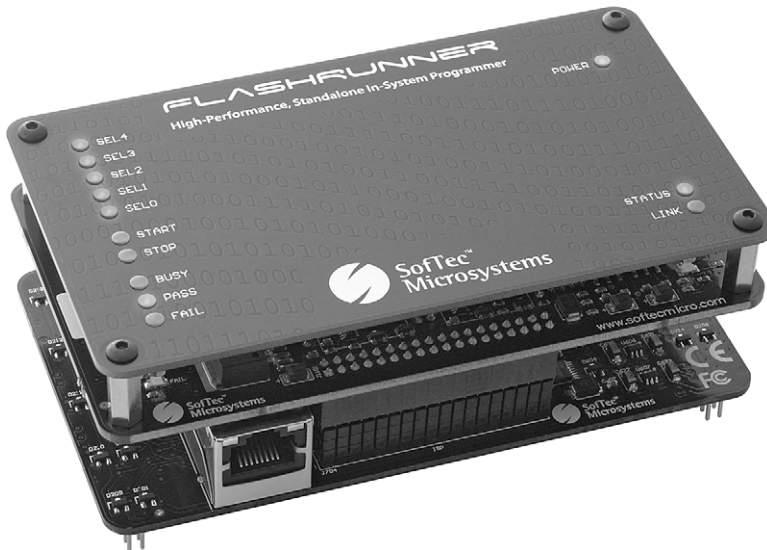


Figure 1.1: FlashRunner FR01M01

1.1.1 General Features

- Fastest programming algorithms (as fast as target device's memory technology limit), approved by silicon manufacturers;
- Easy ATE integration;
- Standalone operations (projects and code images stored on a memory card);
- Also controllable by any host system via RS-232 or Ethernet;
- Supports most ISP protocols (BDM, JTAG, SPI, I2C, MON, ICC, SCI, etc.);
- Flexible, fully configurable;
- Compact and robust design for production environments;
- Data integrity guaranteed (every data transfer to/from the host system or Secure Digital card is CRC tagged).

1.1.2 Hardware Features

- 9 to 24V power supply input;
- Five digital I/O lines per ISP site;
- Two digital I/O or analog output lines per ISP site;
- Two programmable output voltages (0 to 14.5V, 250mA and 0 to 5.5V, 500mA) per ISP site;
- One programmable clock output per ISP site;
- Secure Digital memory card (up to 2 GB);
- 512 bytes on-board dynamic memory;
- On-board timekeeper and calendar;
- I/O protection;
- Optoisolated inputs for project selection;
- Two optoisolated command inputs (START and STOP);
- Three optoisolated status outputs (FAIL, PASS, BUSY);
- One optoisolated, RS-232 channel;
- One optoisolated Ethernet channel.

1.1.3 Software Features

- Fully autonomous standalone mode thanks to its SD memory card (FAT16);
- Controllable by any host system through a terminal utility and simple ASCII protocol;
- Up to 32 hardware-selectable projects (scripts), unlimited software-selectable projects;
- Log files;
- Erase, blank check, program, read, verify, oscillator trimming, etc.

1.2 Package Checklist

The FlashRunner FR01M01 package includes the following items:

- FlashRunner FR01M01 unit, including an SD card already pre-installed with the programming algorithm(s) you specified at the time of purchase;
- An Ethernet cross cable;
- SofTec Microsystems FlashRunner “System Software” CD-ROM, containing the FlashRunner Control Panel utility and the FlashRunner Programmer’s Manual in PDF format;
- This user’s manual;
- A registration card.

1.3 Hardware Overview

FlashRunner FR01M01 is composed of three layers. From bottom to top:

- **Connection Layer.** Provides header connectors to interface to your programming/testing system. Includes optoisolation circuitry and an Ethernet connector to interface to a host system.
- **Programming Engine Layer.** Contains the FlashRunner programming engine, the core of the instrument.

- **Cover Layer.** The cover layer has the function of protecting the underlying layers and replicating the programming engine's status LEDs. If space is an issue when integrating FlashRunner in your programming/testing system, the cover layer can be easily removed.

The figures below illustrate the various FlashRunner FR01M01 layers.



Figure 1.2: FR01M01 Top Layer

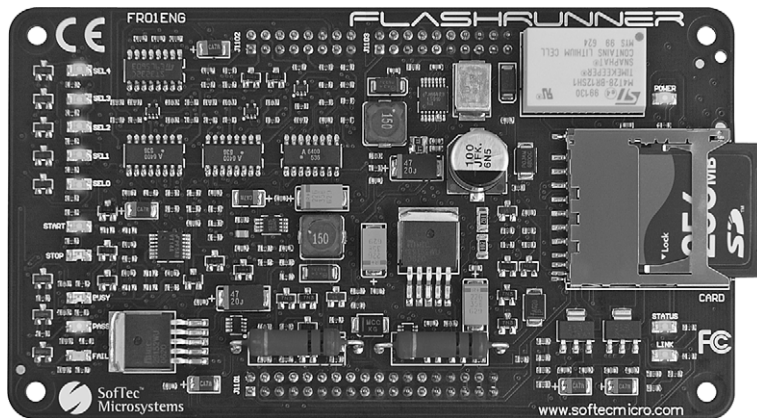


Figure 1.3: FR01M01 Programming Engine Layer (Top Side)

1

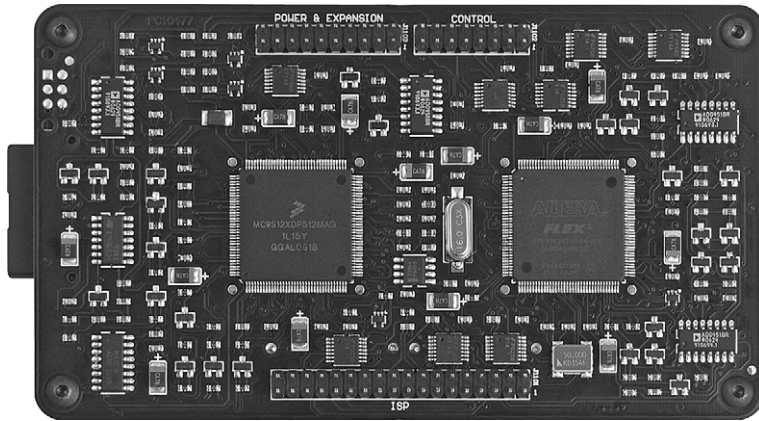


Figure 1.4: FR01M01 Programming Engine Layer (Bottom Side)

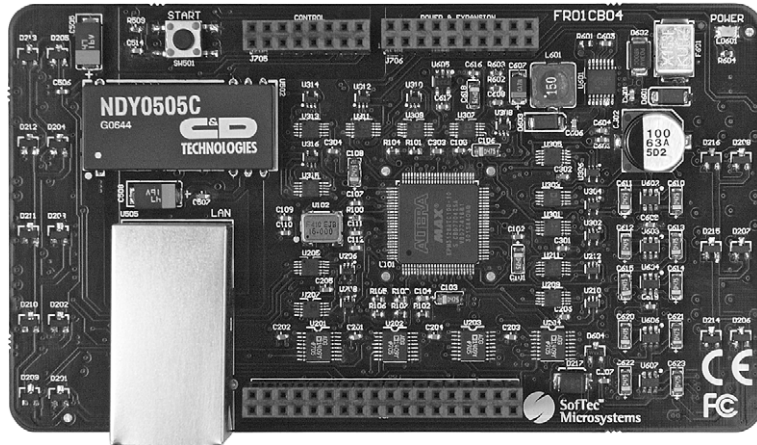


Figure 1.5: FR01M01 Connection Layer (Top Side)

1

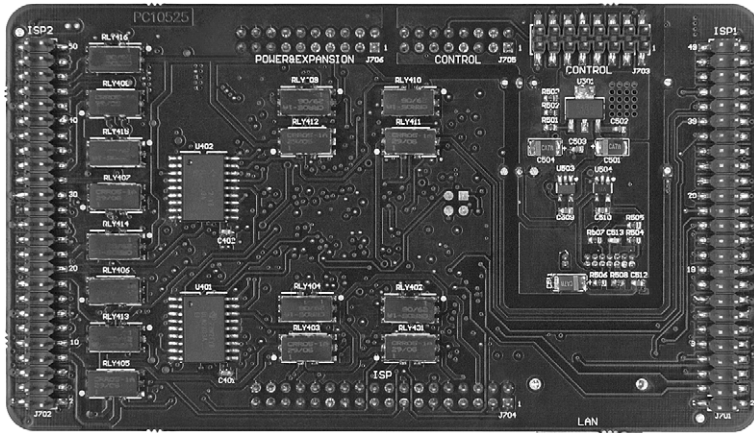


Figure 1.6: FR01M01 Connection Layer (Bottom Side)

1.4 Programming Algorithms and Licenses

FlashRunner FR01M01 includes programming algorithms for several devices. In order to program a specific device, however, a specific license file for that device must be purchased.



Note: *FlashRunner FR01M01 comes already preinstalled with the license(s) you specified at the moment of purchase. You can purchase additional licenses at any future moment.*

Programming algorithms and license files are stored in the SD card (see the FlashRunner Programmer's Manual for more information).

1.4.1 Installing New Licenses

When you buy an additional license for a specific device, you will get:

- An algorithm file (.alg);

- A license file (.lic);
- A device-specific script example (.frs).

The .alg file contains the actual programming algorithm for the requested device (and several other devices of the same family).

The .lic file contains an unlocking code which will let you use the programming algorithm. A license file enables the use of a specific programming algorithm on a specific FlashRunner instrument (licenses are serial number specific).

The script file contains an example of script to use as a starting point for your specific programming needs (for more information on scripts, see the FlashRunner Programmer's Manual).

To install the new license, do the following:

1. Copy the .alg file into the \ALGOS directory of the SD card (if an .alg file with the same name already exists, overwrite it);
2. Copy the .lic file into the \LICENSES directory of the SD card.

To copy files on the SD card, use either a standard card reader connected to a PC or transfer the files using the FlashRunner **FSENDFILE** command (for more information on FlashRunner commands, see the FlashRunner Programmer's Manual).

Alternatively, you can use the FlashRunner Control Panel utility to install new licenses. For more information on the FlashRunner Control Panel please refer to the FlashRunner Programmer's Manual.

1.5 Upgrading the Firmware

The FlashRunner firmware can be easily upgraded using the provided Control Panel utility. For more information, please refer to the FlashRunner Programmer's Manual.

2 System Setup

2.1 Overview



Note: *the example shows how to set up the system for programming a Freescale MC68HC908QY4 microcontroller. For how to connect to other target devices, please refer to the FlashRunner Programmer's Manual.*

2

This chapter will explain how to set up FlashRunner FR01M01 for the first time. Although FlashRunner is typically used for standalone operations (Standalone mode), the examples in this chapter will use the host system to send commands to FlashRunner (Host mode).

When moving FlashRunner to the production environment, you can take full advantage of the instrument's SD card to make the instrument work without being controlled by the host system.

For more information about Standalone mode and Host mode, see the FlashRunner Programmer's Manual.

2.2 Software Setup

The FlashRunner system software setup installs all of the required components to your hard drive. These components include:

- The FlashRunner Control Panel utility;
- Script examples;
- Documentation in PDF format.

To install the FlashRunner system software:

- Insert the “**System Software**” CD-ROM into your computer’s CD-ROM drive;
- A startup window will automatically appear. Choose “**Install Instrument Software**” from the main menu. Follow the on-screen instructions.



Note: *to install the FlashRunner system software on Windows 2000 or Windows XP, you must log in as Administrator.*

2.3 Hardware Setup

To set up FlashRunner FR01M01, you must follow the steps below, in the indicated order:

1. Interface FlashRunner with your test/programming equipment;
2. Connect FlashRunner to the host system;
3. Set up LAN settings (if you use the Ethernet connection);
4. Send FlashRunner commands via the FlashRunner Control Panel utility.

2.3.1 Interfacing FlashRunner with Your Test/Programming Equipment

FlashRunner FR01M01 typically piggybacks to a carrier board (designed by you) that interfaces FlashRunner to your test/programming equipment and to your target board(s). The carrier board must include three female header connectors that accept FlashRunner’s “ISP1”, “ISP2” and “CONTROL” connectors. The carrier board:

- Supplies power to FlashRunner. FlashRunner accepts any DC voltage between 9 V and 24 V.
- Routes all of the required ISP and power signals from each of the FlashRunner’s ISP sites to the target board(s).

- Routes control signals (START, STOP, BUSY, PASS, FAIL and script selection lines) to your test/programming equipment (only necessary for standalone operations).

Connections between the carrier board and the target board(s) typically consist of flat cables that plug into the ISP connectors on the target board(s) or single wires that connect to the single nails of your bed-of-nails fixture.

The figure below illustrates typical programming connections.

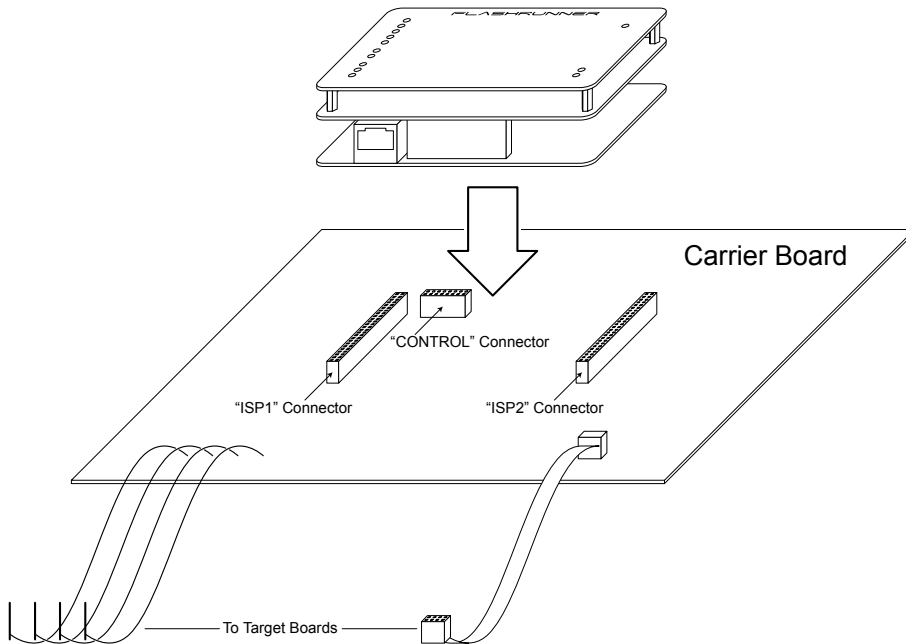


Figure 2.1: Typical Programming Connections

The specific ISP signals that must be routed from FlashRunner FR01M01 to your target board(s) depend on the specific target device. Typical connections for all the device families supported by FlashRunner are shown in the FlashRunner Programmer's Manual.

2.3.2 Connecting FlashRunner to the Host system

You can connect FlashRunner FR01M01 to the host system via Ethernet or RS-232. The Ethernet connector is located in the Connection layer, while an RS-232 connector is not provided: if you want to connect to the host system via RS-232, you must provide an RS-232 connector in your carrier board, routing the appropriate signals from FlashRunner's "CONTROL" connector. FlashRunner FR01M01 comes with an Ethernet cross cable to connect directly to a host PC.

2.3.3 Setting Up LAN Settings

If you connected FlashRunner to the host PC using the Ethernet connection, you need to set up the FlashRunner IP address. For learning how to set up the FlashRunner IP address, please refer to the FlashRunner Programmer's Manual.

2.4 Step-by-Step Tutorial: Sending Commands to FlashRunner

After setting up the hardware, you are ready to send commands to the instrument. The following steps will guide you through the process of launching your first FlashRunner commands using the provided FlashRunner Control Panel utility. For detailed information about the FlashRunner Control Panel utility, see the FlashRunner Programmer's Manual.



Note: *the following steps show how to program a Freescale MC68HC908QY4 microcontroller, and the details are therefore specific for that microcontroller. However, the procedures shown are general and will allow you get a feel of how FlashRunner works.*

1. Launch the FlashRunner Control Panel utility. Select **Start > Programs > SofTec Microsystems > FlashRunner > Control Panel**. The Control Panel utility will open.

2. To establish a connection with FlashRunner, on the **“Communication Settings”** section, select:
 - **“FlashRunner serial version”**
(if you are connected to FlashRunner through a serial port), or
 - **“FlashRunner LAN version”**
(if you are connected to FlashRunner through an Ethernet port).

Next, specify:

- The COM port you are using and the baud rate (for the serial connection—by default, FlashRunner communicates at 115200 bps), or
- The instrument IP address (for the Ethernet connection). For learning how to set up the FlashRunner IP address, please refer to the FlashRunner Programmer’s Manual.

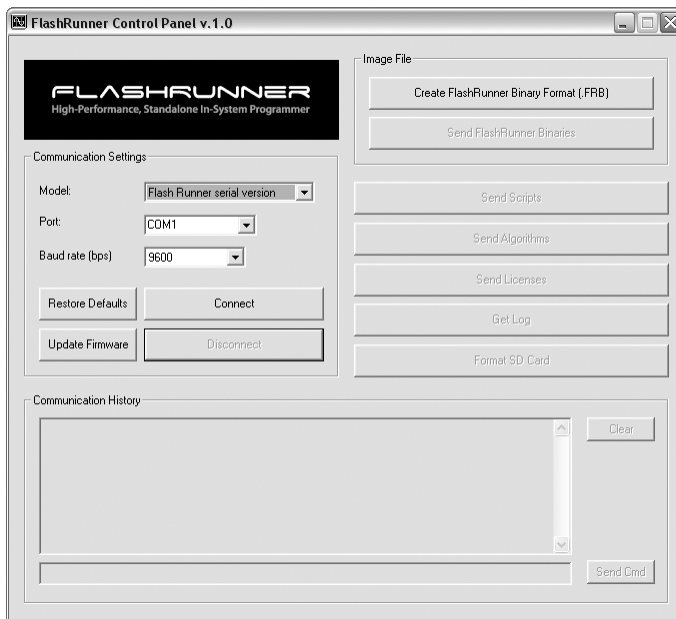


Figure 2.2: FlashRunner Control Panel, Communication Settings

3. Click the “**Connect**” button. On the “**Communication History**” section, note the commands that have been sent and received. In this case, the **SPING** command is automatically sent to FlashRunner, which replies with the **PONG>** string.
4. In the edit box below the communication history, type the following commands (each followed by Return):

```
TCSETDEV FREESCALE MC68HC908QY4 HC08
TCSETPAR FOSC 16000000
TCSETPAR FDIV 4
TCSETPAR VDD 5000
```

These commands set, respectively, the target microcontroller, the oscillator frequency, the internal divisor and the VDD voltage. In this example, we used a 16 MHz oscillator, the internal divisor for MC68HC908QY4 devices is fixed to 4, and the VDD is 5 V. FlashRunner will respond to each command with the **>** string, indicating that the command has been successfully executed. After sending these commands, the Control Panel will look like the figure below.

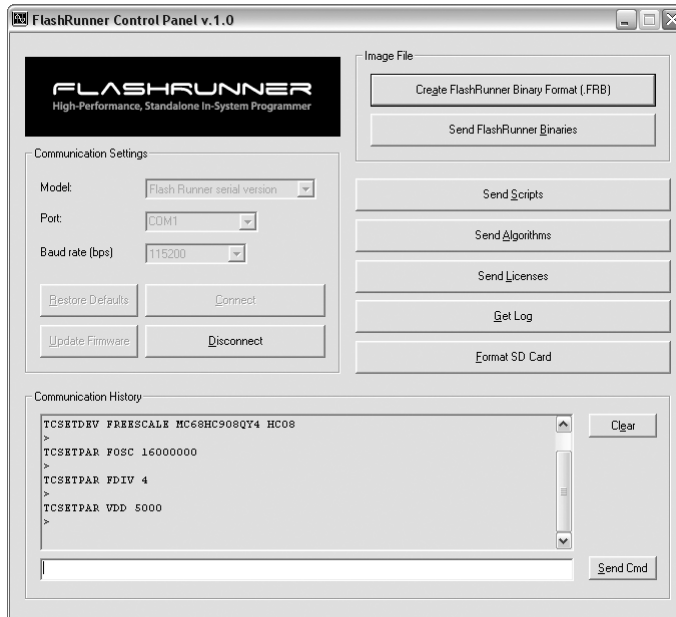


Figure 2.3: FlashRunner Control Panel, Target Device Configured

5. When working with Freescale HC08 devices, FlashRunner requires you to specify the Reset power up and power down times, in milliseconds. Send the following two commands:

```
TCSETPAR PWDOWN 10
TCSETPAR PWUP 10
```

6. After specifying up the target device settings, we are ready to transfer to FlashRunner the binary image to be programmed into the target device. FlashRunner accepts only image files in a .frb (FlashRunner Binary) format. To convert your binary, Intel-Hex or S19 image file to the FlashRunner format, click the “**Create FlashRunner Binary Format**” button. The following dialog box will appear.

2

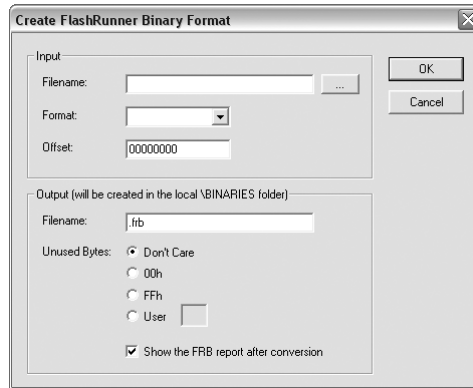


Figure 2.4: FlashRunner Control Panel, Binary File Conversion

In the **“Input”** section, specify the source file to be converted, its format, and the address from which the file conversion will start (offset). In the **“Output”** section, specify the output filename and the value used to fill unused location.

Click the **“OK”** button. The FlashRunner Binary file will be created in the local `\BINARIES` folder.

7. To transfer the created image to FlashRunner, send the following command:

```
TPSENDFILE YMODEM DEMO.FRB
```

In this example, the image file is called `DEMO.FRB`. The following dialog box will appear.

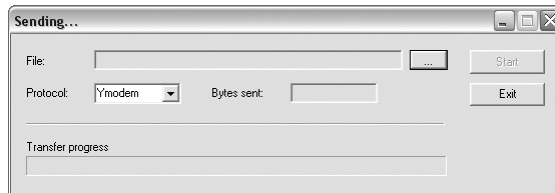


Figure 2.5: FlashRunner Control Panel, File Transfer

Click the “...” to browse for the image file to be set, then click “**Start**” to begin the transfer. The file will be saved to the FlashRunner SD card, in the `\BINARIES` folder.

8. Next, we have to specify which of the eight available ISP sites FlashRunner FR01M01 will use as output. To do this, send the following command:

```
MXCLOSE 1
```

This will select the first ISP site, routing all of the FlashRunner’s ISP lines to the target board through this site.

9. We are now ready to start the actual programming part. Send the following commands:

```
TPSETSRC FILE DEMO.FRB
TPSTART
TPCMD SETPWD CONST $FF $FF $FF $FF $FF $FF $FF $FF
TPCMD MASSERASE F
TPCMD BLANKCHECK F $EE00 4608
TPCMD PROGRAM F $EE00 $EE00 4608
TPCMD VERIFY F S $EE00 $EE00 4608
TPEND
```

The data to be programmed is taken from the image file starting at \$EE00 (offset from the beginning of the file), is programmed to the target microcontroller starting from the location \$EE00 and is 4608 bytes long.

The `TPSETSRC` command specifies the source file for the `TPCMD PROGRAM` e `TPCMD VERIFY` commands which come next. All the actual programming operations are sent between a `TPSTART` and `TPEND` command. The `TPCMD SETPWD` command sets the security bytes needed to perform subsequent operations.

After sending these commands, the Control Panel will look like the figure below.

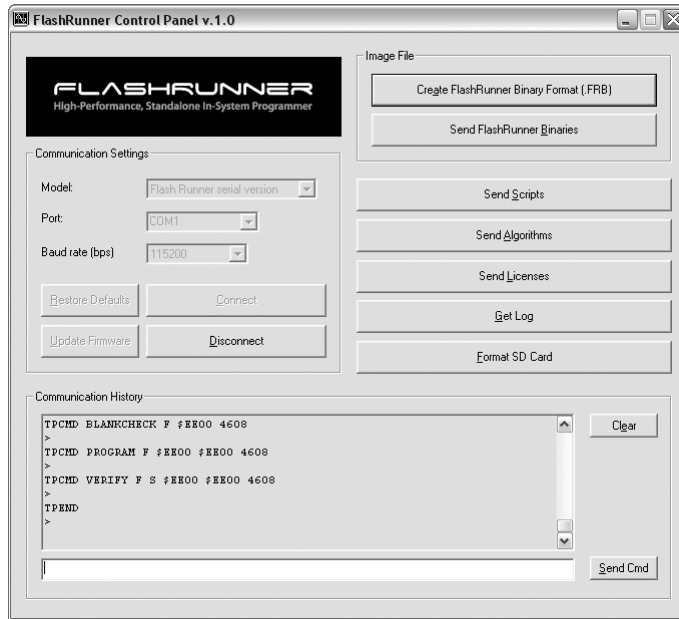


Figure 2.6: FlashRunner Control Panel, Target Device Programmed

10. We are now done with programming the target device. Click the **“Disconnect”** button to free the serial port resource.

For detailed information on all of the FlashRunner commands and their syntax, including specific commands for specific family of microcontrollers, please refer to the FlashRunner Programmer’s Manual, included (in PDF format) in the FlashRunner CD-ROM.

Programming can be automated by creating “scripts”. Scripts are text files, stored in the SD card, which contain a sequence of FlashRunner commands. See the FlashRunner Programmer’s Manual for more information about scripts.

3 Connectors

3.1 Overview

FlashRunner FR01M01 connects to your programming/testing system through three header connectors: two (“ISP1” and “ISP2”) group ISP signals of all of the eight ISP sites, and one (“CONTROL”) groups control signals.

3.2 ISP Connectors

The “ISP1” and “ISP2” connectors group the signals needed to program up to eight target device(s). These connectors have several input/output lines, both digital and analog, that are automatically configured by FlashRunner depending on the specific target device to be programmed (see the FlashRunner Programmer’s Manual to learn how to connect these lines to your specific target device).



Note: *ISP signals are not optoisolated and are referenced to GND (the power supply ground).*

Additionally, in order to avoid undesired current loops between the FlashRunner power supply and the target board, a power supply with a floating output (ground not referenced to the earth potential) should be used.

3

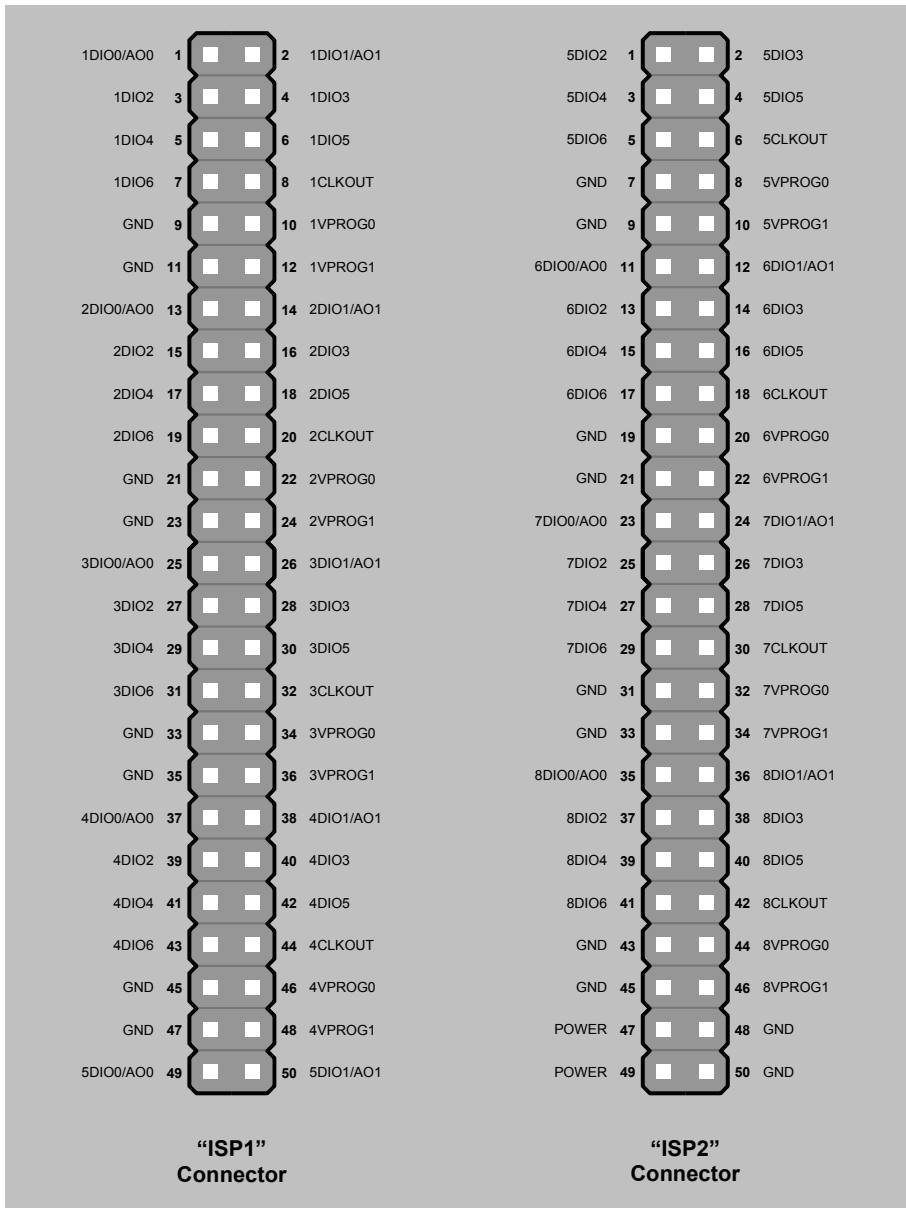


Figure 3.1: ISP Connectors

Table 3.1: ISP Connectors Signals

Connector	Pin #	Signal Name	Description
ISP1	1	1DIO0/AO0	ISP site 1: Digital input/output 0 or analog output 0
ISP1	2	1DIO1/AO1	ISP site 1: Digital input/output 1 or analog output 1
ISP1	3	1DIO2	ISP site 1: Digital input/output 2
ISP1	4	1DIO3	ISP site 1: Digital input/output 3
ISP1	5	1DIO4	ISP site 1: Digital input/output 4
ISP1	6	1DIO5	ISP site 1: Digital input/output 5
ISP1	7	1DIO6	ISP site 1: Digital input/output 6
ISP1	8	1CLKOUT	ISP site 1: Clock output
ISP1	9	GND	Ground
ISP1	10	1VPROG0	ISP site 1: Programmable voltage 0 (max 5.5V, 500mA)
ISP1	11	GND	Ground
ISP1	12	1VPROG1	ISP site 1: Programmable voltage 1 (max 14.5V, 250mA)
ISP1	13	2DIO0/AO0	ISP site 2: Digital input/output 0 or analog output 0
ISP1	14	2DIO1/AO1	ISP site 2: Digital input/output 1 or analog output 1
ISP1	15	2DIO2	ISP site 2: Digital input/output 2
ISP1	16	2DIO3	ISP site 2: Digital input/output 3
ISP1	17	2DIO4	ISP site 2: Digital input/output 4
ISP1	18	2DIO5	ISP site 2: Digital input/output 5
ISP1	19	2DIO6	ISP site 2: Digital input/output 6
ISP1	20	2CLKOUT	ISP site 2: Clock output
ISP1	21	GND	Ground
ISP1	22	2VPROG0	ISP site 2: Programmable voltage 0 (max 5.5V, 500mA)
ISP1	23	GND	Ground
ISP1	24	2VPROG1	ISP site 2: Programmable voltage 1 (max 14.5V, 250mA)
ISP1	25	3DIO0/AO0	ISP site 3: Digital input/output 0 or analog output 0
ISP1	26	3DIO1/AO1	ISP site 3: Digital input/output 1 or analog output 1
ISP1	27	3DIO2	ISP site 3: Digital input/output 2
ISP1	28	3DIO3	ISP site 3: Digital input/output 3
ISP1	29	3DIO4	ISP site 3: Digital input/output 4
ISP1	30	3DIO5	ISP site 3: Digital input/output 5
ISP1	31	3DIO6	ISP site 3: Digital input/output 6
ISP1	32	3CLKOUT	ISP site 3: Clock output
ISP1	33	GND	Ground
ISP1	34	3VPROG0	ISP site 3: Programmable voltage 0 (max 5.5V, 500mA)
ISP1	35	GND	Ground
ISP1	36	3VPROG1	ISP site 3: Programmable voltage 1 (max 14.5V, 250mA)

Connectors

3

Connector	Pin #	Signal Name	Description
ISP1	37	4DIO0/AO0	ISP site 4: Digital input/output 0 or analog output 0
ISP1	38	4DIO1/AO1	ISP site 4: Digital input/output 1 or analog output 1
ISP1	39	4DIO2	ISP site 4: Digital input/output 2
ISP1	40	4DIO3	ISP site 4: Digital input/output 3
ISP1	41	4DIO4	ISP site 4: Digital input/output 4
ISP1	42	4DIO5	ISP site 4: Digital input/output 5
ISP1	43	4DIO6	ISP site 4: Digital input/output 6
ISP1	44	4CLKOUT	ISP site 4: Clock output
ISP1	45	GND	Ground
ISP1	46	4VPROG0	ISP site 4: Programmable voltage 0 (max 5.5V, 500mA)
ISP1	47	GND	Ground
ISP1	48	4VPROG1	ISP site 4: Programmable voltage 1 (max 14.5V, 250mA)
ISP1	49	5DIO0/AO0	ISP site 5: Digital input/output 0 or analog output 0
ISP1	50	5DIO1/AO1	ISP site 5: Digital input/output 1 or analog output 1
ISP2	1	5DIO2	ISP site 5: Digital input/output 2
ISP2	2	5DIO3	ISP site 5: Digital input/output 3
ISP2	3	5DIO4	ISP site 5: Digital input/output 4
ISP2	4	5DIO5	ISP site 5: Digital input/output 5
ISP2	5	5DIO6	ISP site 5: Digital input/output 6
ISP2	6	5CLKOUT	ISP site 5: Clock output
ISP2	7	GND	Ground
ISP2	8	5VPROG0	ISP site 5: Programmable voltage 0 (max 5.5V, 500mA)
ISP2	9	GND	Ground
ISP2	10	5VPROG1	ISP site 5: Programmable voltage 1 (max 14.5V, 250mA)
ISP2	11	6DIO0/AO0	ISP site 6: Digital input/output 0 or analog output 0
ISP2	12	6DIO1/AO1	ISP site 6: Digital input/output 1 or analog output 1
ISP2	13	6DIO2	ISP site 6: Digital input/output 2
ISP2	14	6DIO3	ISP site 6: Digital input/output 3
ISP2	15	6DIO4	ISP site 6: Digital input/output 4
ISP2	16	6DIO5	ISP site 6: Digital input/output 5
ISP2	17	6DIO6	ISP site 6: Digital input/output 6
ISP2	18	6CLKOUT	ISP site 6: Clock output
ISP2	19	GND	Ground
ISP2	20	6VPROG0	ISP site 6: Programmable voltage 0 (max 5.5V, 500mA)
ISP2	21	GND	Ground
ISP2	22	6VPROG1	ISP site 6: Programmable voltage 1 (max 14.5V, 250mA)
ISP2	23	7DIO0/AO0	ISP site 7: Digital input/output 0 or analog output 0

Connector	Pin #	Signal Name	Description
ISP2	24	7DIO1/AO1	ISP site 7: Digital input/output 1 or analog output 1
ISP2	25	7DIO2	ISP site 7: Digital input/output 2
ISP2	26	7DIO3	ISP site 7: Digital input/output 3
ISP2	27	7DIO4	ISP site 7: Digital input/output 4
ISP2	28	7DIO5	ISP site 7: Digital input/output 5
ISP2	29	7DIO6	ISP site 7: Digital input/output 6
ISP2	30	7CLKOUT	ISP site 7: Clock output
ISP2	31	GND	Ground
ISP2	32	7VPROG0	ISP site 7: Programmable voltage 0 (max 5.5V, 500mA)
ISP2	33	GND	Ground
ISP2	34	7VPROG1	ISP site 7:Programmable voltage 1 (max 14.5V, 250mA)
ISP2	35	8DIO0/AO0	ISP site 8: Digital input/output 0 or analog output 0
ISP2	36	8DIO1/AO1	ISP site 8: Digital input/output 1 or analog output 1
ISP2	37	8DIO2	ISP site 8: Digital input/output 2
ISP2	38	8DIO3	ISP site 8: Digital input/output 3
ISP2	39	8DIO4	ISP site 8: Digital input/output 4
ISP2	40	8DIO5	ISP site 8: Digital input/output 5
ISP2	41	8DIO6	ISP site 8: Digital input/output 6
ISP2	42	8CLKOUT	ISP site 8: Clock output
ISP2	43	GND	Ground
ISP2	44	8VPROG0	ISP site 8: Programmable voltage 0 (max 5.5V, 500mA)
ISP2	45	GND	Ground
ISP2	46	8VPROG1	ISP site 8:Programmable voltage 1 (max 14.5V, 250mA)
ISP2	47	POWER	FlashRunner power supply (input, 9-24V)
ISP2	48	GND	Ground
ISP2	49	POWER	FlashRunner power supply (input, 9-24V)
ISP2	50	GND	Ground

3.3 Control Connector

The “CONTROL” connector is used by FlashRunner to communicate with the host system through an RS-232 line and for integration with an automatic programming/testing equipment.



Note: *all control signals are optoisolated and are referenced to OPTO_GND.*

This allows a host system to safely communicate with FlashRunner FR01M01 even when the target board has a different ground reference than the host system's (and it's not possible to connect them together).

Additionally, in order to avoid undesired current loops between the FlashRunner power supply and the target board, a power supply with a floating output (ground not referenced to the earth potential) should be used.

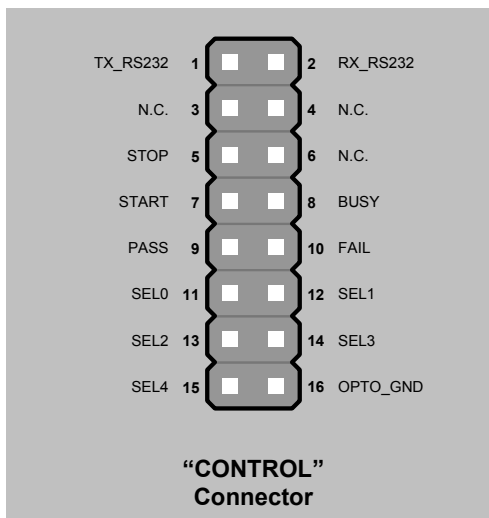


Figure 3.2: Main Unit Control Connector

Table 3.2: Main Unit Control Connector Signals

Pin #	Signal Name	Description
1	TX_RS232	TX (output, optoisolated, RS-232 levels)
2	RX_RS232	RX (input, optoisolated, RS-232 levels)
3	N.C.	Not connected
4	N.C.	Not connected
5	STOP	STOP (input , optoisolated, active low)
6	N.C.	Not connected
7	START	START (input , optoisolated, active low)
8	BUSY	BUSY (output, open-drain, optoisolated, active low)
9	PASS	PASS (output, open-drain, optoisolated, active low)
10	FAIL	FAIL (output, open-drain, optoisolated, active low)
11	SEL0	Script selection 0 (input, optoisolated)
12	SEL1	Script selection 1 (input, optoisolated)
13	SEL2	Script selection 2 (input, optoisolated)
14	SEL3	Script selection 3 (input, optoisolated)
15	SEL4	Script selection 4 (input, optoisolated)
16	OPTO_GND	Optoisolation ground. If your system doesn't require optoisolation, connect this line to the "GND" lines of the "POWER" connector.

4 Technical Specifications

4.1 Absolute Maximum Ratings

Table 4.1: Absolute Maximum Ratings

Parameter	Value
“CONTROL” Connector (all signals are referenced to OPTO_GND)	
Maximum input voltage on lines START, STOP, SEL[4..0]	-2V to +9V
Maximum input voltage on line RX_RS232	-25V to +25V
Maximum current on lines BUSY, PASS,FAIL	-50mA to 1.5mA
Maximum current on line TX_RS232	±60mA
“ISP1” and “ISP2” Connectors (all signals are referenced to GND)	
Maximum input voltage on lines DIO/AO[1..0], DIO[6..2], CLKOUT	-1V to +7V
Maximum current on lines DIO/AO[1..0], DIO[6..2], CLKOUT	±50mA
Maximum current on line VPROG0	500mA
Maximum current on line VPROG1	250mA
Maximum supply voltage on line POWER	-20V to +30V

4.2 DC Characteristics and Functional Operating Range

Table 4.2: DC Characteristics and Functional Operating Range

Parameter	Condition	Value		
		Min	Typ	Max
“CONTROL” Connector				
V _{IL} (input low voltage) on lines START, STOP, SEL[4..0]	The driver must be able to provide at least 5mA	0V	-	2V
V _{IH} (input high voltage) on lines START, STOP, SEL[4..0]		3V	-	5V
V _{IL} (input low voltage) on line RX_RS232		-	-	1.2V
V _{IH} (input high voltage) on line RX_RS232		2.4V	-	-
V _{OL} (output low voltage) on lines BUSY, FAIL, PASS	I _{OL} = 4.5mA	-	-	450mV
V _{OH} (output high voltage) on lines BUSY, FAIL, PASS		4.5V	-	5V
V _{OL} (output low voltage) on line TX_RS232	R _{LOAD} = 3KΩ	-	-	-5V
V _{OH} (output high voltage) on line TX_RS232	R _{LOAD} = 3KΩ	+5V	-	-
“ISP1” and “ISP2” Connectors (characteristics valid for all of the eight ISP sites)				
V _{IL} (input low voltage) on lines DIO[6..2], DIO[1..0]	Configured as digital lines	-	-	0.3V _{PROG0}
V _{IH} (input high voltage) on lines DIO[6..2], DIO[1..0]	Configured as digital lines	0.7V _{PROG0}	-	V _{PROG0}
V _{OL} (output low voltage) on lines DIO[6..2], DIO[1..0], CLKOUT	Configured as digital lines, V _{PROG0} = 3V, I _{OL} = 12mA	-	-	0.36V
V _{OH} (output high voltage) on lines DIO[6..2], DIO[1..0], CLKOUT	Configured as digital lines, V _{PROG0} = 3V, I _{OH} = 12mA	2.56V	-	-
V _{OL} (output low voltage) on lines DIO[6..2], DIO[1..0], CLKOUT	Configured as digital lines, V _{PROG0} = 5.5V, I _{OL} = 24mA	-	-	0.36V
V _{OH} (output high voltage) on lines DIO[6..2], DIO[1..0], CLKOUT	Configured as digital lines, V _{PROG0} = 5.5V, I _{OH} = 24mA	4.86V	-	-
I _{OH} current (source) on lines DIO[6..2], DIO[1..0]	Configured as input with active pull-ups	-	3.4mA	-
DIO/AO[1..0] voltage	Configured as analog output	3V	-	14.5V
DIO/AO[1..0] IO current (sink and source)	Configured as analog output	-	-	±40mA
I _{OH} current (source) on lines DIO/AO[1..0]	Configured as analog lines with active pull-ups	-	5.5mA	-
V _{PROG0} line output voltage		1.6V	-	5.5V
V _{PROG0} current (source)		-	-	500mA
V _{PROG1} line output voltage		3V	-	14.5V
V _{PROG1} current (source)		-	-	250mA
POWER line input voltage		9V	-	24V
POWER line consumption		-	-	2.5A

4.3 AC Characteristics

The following table summarizes AC characteristics for ISP lines on “ISP1” and “ISP2” connectors. Characteristics are valid for all of the ISP sites.

Table 4.3: AC Characteristics

Parameter	Condition	Value		
		Min	Typ	Max
t_{RISE} on lines DIO[6..2], DIO[1..0], CLKOUT when configured as digital output push-pull	$V_{PROG0} = 1.8V$	-	40ns	-
	$V_{PROG0} = 3.3V$	-	30ns	-
	$V_{PROG0} = 5V$	-	25ns	-
t_{FALL} on lines DIO[6..2], DIO[1..0], CLKOUT when configured as digital output push-pull	$V_{PROG0} = 1.8V$	-	35ns	-
	$V_{PROG0} = 3.3V$	-	25ns	-
	$V_{PROG0} = 5V$	-	25ns	-
t_{RISE} on lines DIO/AO[1..0] configured as analog output	$V_{PROG1} = 3V$	-	7 μ s	-
	$V_{PROG1} = 12V$	-	11 μ s	-
	$V_{PROG1} = 14.5V$	-	12 μ s	-
t_{FALL} on lines DIO/AO[1..0] configured as analog output	$V_{PROG1} = 3V$	-	8 μ s	-
	$V_{PROG1} = 12V$	-	20 μ s	-
	$V_{PROG1} = 14.5V$	-	30 μ s	-
t_{RISE} on line VPROG0	$V_{PROG0} = 0-1.8V$	-	10ms	-
	$V_{PROG0} = 0-3.3V$	-	15ms	-
	$V_{PROG0} = 0-5.5V$	-	20ms	-
t_{FALL} on line VPROG0	$V_{PROG0} = 1.8-0V$	-	300ms	-
	$V_{PROG0} = 3.3-0V$	-	350ms	-
	$V_{PROG0} = 5.5-0V$	-	350ms	-
t_{RISE} on line VPROG1	$V_{PROG1} = 0-3V$	-	1.3ms	-
	$V_{PROG1} = 0-5V$	-	1.8ms	-
	$V_{PROG1} = 0-14.5V$	-	13ms	-
t_{FALL} on line VPROG1	$V_{PROG1} = 3-0V$	-	18ms	-
	$V_{PROG1} = 5-0V$	-	30ms	-
	$V_{PROG1} = 14.5-0V$	-	45ms	-
CLKOUT frequency		0MHz	-	50MHz

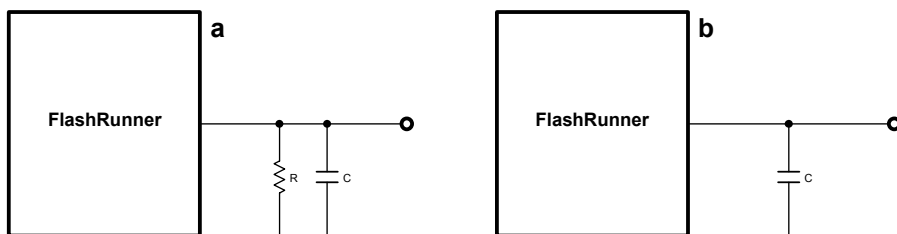


Figure 4.1: Load Conditions

4.4 Multiplexing Characteristics

The following table summarizes multiplexing characteristics for ISP lines on “ISP1” and “ISP2” connectors. Characteristics are valid for all of the ISP sites.

Table 4.4: Multiplexing Characteristics

Parameter	Value
Switch type on lines DIO/AO[1..0], DIO[6..2], CLKOUT	CMOS
Switch type on lines VPROG[1..0]	Reed Relay
Off resistance on lines DIO/AO[1..0]	$2^9\Omega$ Typ
Off resistance on lines DIO[6..2], CLKOUT	$15^9\Omega$ Typ
Off resistance on lines VPROG[1..0]	$10^{12}\Omega$ Typ
On resistance on lines DIO/AO[1..0]	4Ω Typ
On resistance on lines DIO[6..2], CLKOUT	2.5Ω Typ
On resistance on lines VPROG[1..0]	100m Ω Max
Bandwidth on lines DIO/AO[1..0]	120MHz Typ
Bandwidth on lines DIO[6..2], CLKOUT	200MHz Typ
Open time	20 μ s Max
Close time	100 μ s Max
Relay life on lines DIO/AO[1..0], DIO[6..2], CLKOUT	Unlimited
Relay life on lines VPROG[1..0]	100MCycles Typ

4.5 Physical and Environmental Specifications

Table 4.5: Physical and Environmental Specifications

Parameter	Value
Dimensions	130 x 74 x 50 mm
"ISP1" and "ISP2" connectors type	50-pin, 2.54mm-pitch, dual-row header (male)
"CONTROL" connector type	16-pin, 2.54mm-pitch, dual-row header (male)
Operating temperature	0-50°C
Operating humidity	90% max (without condensation)
Storage temperature	0-70°C
Storage humidity	90% max (without condensation)

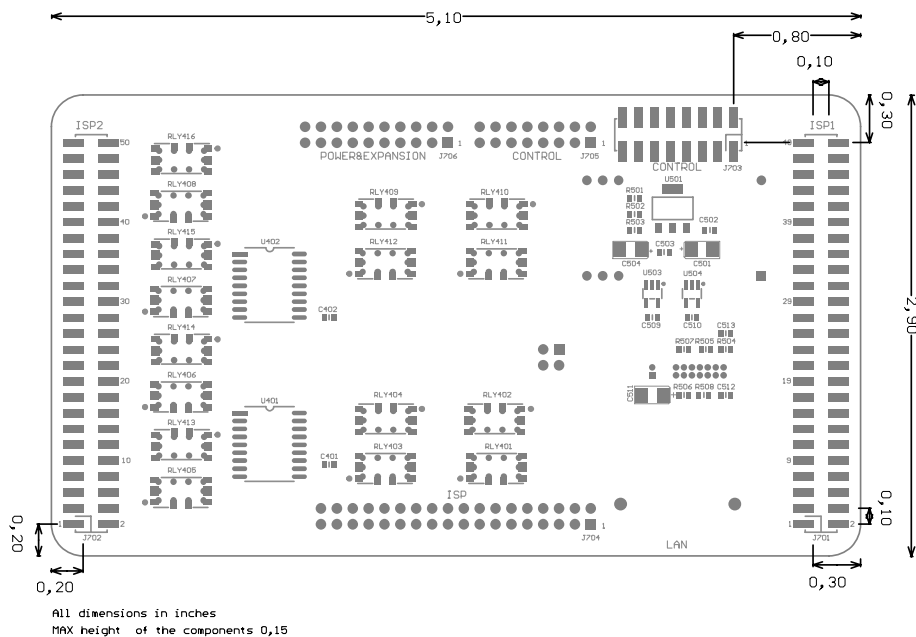


Figure 4.2: Connection Layer (Bottom Side) Layout

