FlashRunner 2.0 Series

High-Performance, Standalone In-System Programmers

User's Manual

Revision 1.8 — November 2021

SMH Technologies™

DC11342

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SMH Technologies is always on the lookout 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 SMH Technologies is to comply with all applicable worldwide safety and EMC/EMI regulations. Our products are certified to comply with 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.

SMH Technologies

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1 Before Starting

> **Note:** *Updated version of FlashRunner System Software is available on SMH Technologies website (www.smh-tech.com). Please check it before reading this documentation.*

1.1 Important Notice to Users

While every effort has been made to ensure the accuracy of all information in this document, SMH Technologies 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.

1.2 Safety

> **Note:** *Keep FlashRunner 2.0 always in a well-ventilated area to prevent product overheating, which could affect product performance and, if maintained for a long time, it could damage product hardware components.*

FlashRunner 2.0 is a low-voltage device. However, when integrating it inside an automatic test equipment or when interfacing it with other systems, take all precautions to avoid electrical shocks due to, for example, different ground references.

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

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To protect FlashRunner 2.0 against electrostatic discharge (ESD), always connect yourself to the ground (e.g. via wrist straps) when handling the instrument.

Always store FlashRunner 2.0 inside an antistatic bag when not in use.

> **Disclaimer:** *when integrating FlashRunner 2.0 please pay attention to place it in a well-ventilated area to avoid overheating related damages.*
> *FlashRunner 2.0 has been designed to reach 90 °C (194 °F) in normal operating conditions over its ends.*

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1.3 Getting Technical Support

SMH Technologies is continuously working to improve FlashRunner 2.0 firmware and to release programming algorithms for new devices. SMH Technologies offers 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 SMH Technologies, please refer to the contact information below.

Phone: +39 0434 421111

Fax: +39 0434 639021

Technical Support: support@smh-tech.com

1.4 Additional Documentation

This user's manual provides information about how to set up FlashRunner 2.0 and its hardware characteristics.

For information about FlashRunner 2.0 commands and their syntax, please refer to the FlashRunner 2.0 Programmer's Manual, included (in PDF format) in FlashRunner 2.0 setup.

2 Overview

2.1 What is FlashRunner 2.0?

FlashRunner 2.0 is a high-integration in-system gang programmer, based on the new and innovative FlashRunner 2.0 cutting-edge technology. FlashRunner 2.0 is designed for programming multi-PCB panel assemblies, with microcontroller, NOR, and NAND memories. This means:

- Extremely fast programming (the fastest in-system programming system on the market);
- Standalone operations for easy ATE integration
- Brand new Graphical User Interface focused on Setup, Production and Security features
- Compact and robust design for production environments.

Figure 1: FlashRunner 2.0

FlashRunner 2.0 is composed of a master board that hosts up to 8 programming channels and a slave board that adds up to 16 programming channels.
FlashRunner 2.0 is available in different models, to best suit different gang programming needs:

- **FR2.0A4** **4 channels universal, parallel and independent**
- **FR2.0A8** **8 channels universal, parallel and independent**
- **FR2.0A12** **12 channels universal, parallel and independent**
- **FR2.0A16** **16 channels universal, parallel and independent**

FR2.0A4 and FR2.0A8 are composed by only master-board. FR2.0A12 and FR2.0A16 are composed of a master board plus a slave board.

Products upgrade from 4 up to 8 active channels and from 12 to 16 active channels are available by asking your sales reference for a specific upgrade license.

SMH Technologies reserves the right, at its discretion, to replace the product.

In all of the above configurations, each ISP channel is composed of:

- Eight digital, bidirectional lines;
- Two power lines;
- One ground line (common for all channels).

2.1.1 General features

- Fastest programming algorithms (as fast as target device's memory technology limit), approved by silicon manufacturers;
- Up to 16 parallels and independent channels;
- Easy ATE integration;
- Standalone operations;
- Controllable by ATE through optoisolated LAN and USB, or parallel control lines;
- Supports most ISP protocols (BDM, JTAG, SPI, I2C, MON, ICC, SCI, UART, etc.);
- Flexible, fully configurable;
- Compact and robust design for production environments;

- Up to 20 Mbyte/sec host data transfer.

2.1.2 Hardware features

- ISP lines:
  - 8 digital I/O lines;
  - Two programmable output voltages;
- 1 GBytes on-board RAM;
- On-board timekeeper and calendar for time-stamped log file;
- LAN Communication Interface
- Optoisolated USB communication interface.
- Optoisolated ATE interface for standalone operations
- Programming voltage measure of each channel
- Programming current measure of each channel
- Relay control output
- Demultiplexer control

2.1.3 Software features

- Linux based operating system;
- FlashRunner 2.0 WorkBench: the new user-friendly Graphical User Interface (Windows, Linux, and Mac compatible)
- Controllable by any host system through a terminal utility and simple ASCII protocol;
- Up to 32 hardware-selectable projects in Standalone Mode, unlimited software-selectable projects in Host Mode;
- Interface Library DLL to control the instrument from within user-written applications;
- Optional customer binary file cryptography to ensure antipiracy protection
- Logfile and production report file;
- Erase, blank check, program, read, verify, oscillator trimming, etc.

2.2 Package Checklist

The FlashRunner 2.0 package includes the following items:

- FlashRunner 2.0 unit;
- Power supply unit;
- An Ethernet cross cable;
- A USB cable;
- Quick start guide

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2.3 Hardware Overview

FlashRunner is composed of a Main Board with up to 8 programming channels and an optional *sandwich* board to reach up to 16 programming channels.

2.3.1 Power Supply

FlashRunner 2.0 is powered through a 15V power supply connected to a DC plug connector.

2.3.2 ATE Control Connector

ATE Control DIN Connector is used by an ATE system to control FlashRunner 2.0 instead of communicating with the instrument through the USB or LAN port. With this simple interface is it possible to define and start a project and check the result. For more information please check chapter 4.3.

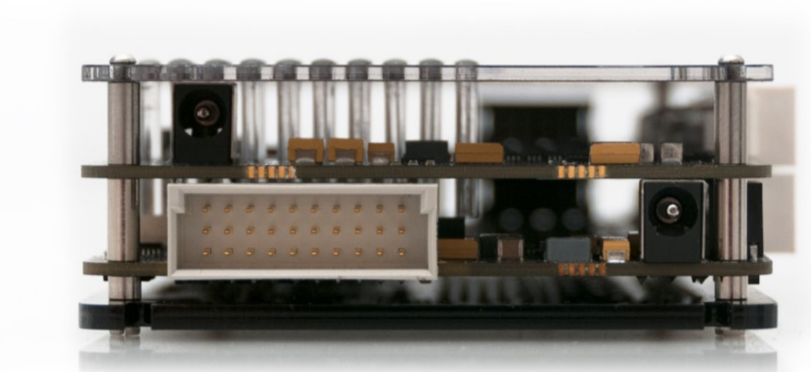

Figure 2: ATE control connector

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2.3.3 LAN Connector

LAN Connector is used to communicate with a host PC system. Please use the provided cross cable to connect FlashRunner 2.0 with your PC. For more information check chapter 2.3.3 and check related documentation on FlashRunner 2.0 Programmer's Manual to correctly set up your host PC system

2.3.4 USB Connector

Alternatively, communication with the host PC can be done with the USB B connector. Use the provided USB cable to connect FlashRunner 2.0 with your PC. For more information check chapter 2.3.4 and check related documentation on FlashRunner 2.0 Programmer's Manual to correctly set up your host PC system

2.3.5 Relay Barrier Control Connector

The "Relay Control Connector" is a group of DIN lines that can be used to control a relay barrier to isolate the target before and after a programming session. For more information please check chapter 4.4.

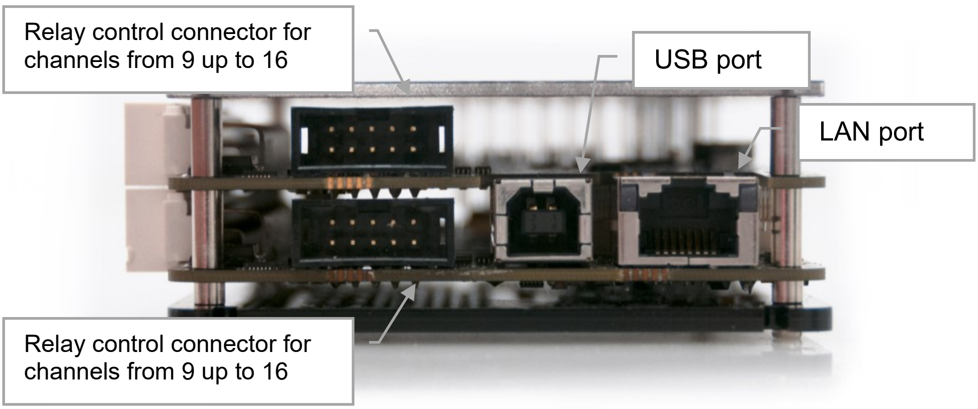

Figure 3: Control Connectors

2.3.6 ISP Connectors

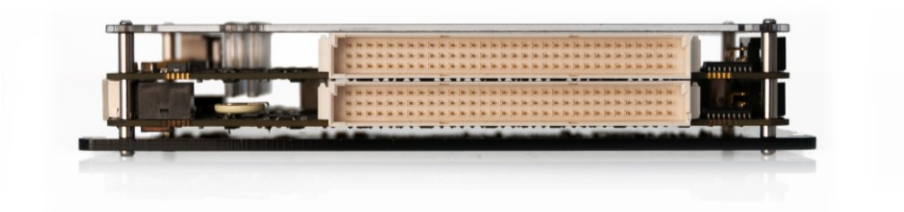

Figure 4: In System Programming DIN connectors

Figure 4 shows the two ISP connectors on the FlashRunner 2.0-16 channel.

The lower connector will define channels 1 to 8, the upper connector will define channels 9 to 16. For more information see chapter 2.3.6.

2.3.7 LEDs

- POWER: the instrument is turned on
- STATUS: indicates system warnings
- BUSY: turned on when a project is running
- CHANNEL 1..16: programming result.
  Green: programming successful, Red: programming failed

Figure 5: FlashRunner 2.0 top panel

2.4 Programming Drivers and Licenses

FlashRunner 2.0 includes programming drivers for various devices. However, to program a specific device, a specific license must be purchased for that device, family, or silicon producer.

> **Note:** *FlashRunner 2.0 comes already preinstalled with the license(s) you specified at the moment of purchase. You can purchase additional licenses at any future moment.*

Programming drivers and license files are stored inside FlashRunner 2.0 storage memory (see the FlashRunner 2.0 Programmer's Manual for more information).

There are several types of licensing:

- Single device license: only that single device programming is enabled
- Family license: only a single device family programming is enabled
- Silicon Producer license: only a single device silicon producer is enabled

2.4.1 Installing New Licenses

When you buy an additional license for a specific device, you will get a license file (.lic);

If you ordered a new device development, you will also receive:

- A driver file (.so)

For detailed information on how to update FlashRunner 2.0 please check FlashRunner 2.0 Programmer's Manual.

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2.5 Channel Upgrade Licenses

If you would like to upgrade from FR2.0A4 to FR2.0A8, or from FR2.0A12 to FR2.0A16, you could purchase a Channel Upgrade License. Please ask our Sales Team (sales@smh-tech.com).

SMH Technologies reserves the right, at its discretion, to replace the product.

2.6 Upgrading the Firmware

FlashRunner 2.0 firmware can be easily upgraded using the FlashRunner 2.0 WorkBench software. For more information, please refer to the FlashRunner 2.0 Programmer's Manual.

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3 System Setup

3.1 Overview

Note: *Keep FlashRunner 2.0 always in a well-ventilated area in order to prevent product overheating, which could affect product performance and, if maintained for a long time, it could damage product hardware components.*

This chapter will explain how to set up FlashRunner 2.0 for the first time. The new FR2.0 WorkBench project Wizard allows an easy and fast system setup.

When moving FlashRunner 2.0 to the production environment, you can take full advantage of the FR2.0 WorkBench GUI Production Tool (Host mode) or let the instrument be controlled through the “ATE Control” interface (Standalone mode).

For more information about Standalone mode and Host mode, see the FlashRunner 2.0 Programmer’s Manual.

3.2 Software Setup

Please refer to *“System Setup/Upgrade”* chapter of FlashRunner 2.0 Programmer's Manual.

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3.3 Hardware Setup

To set up FlashRunner 2.0, you must follow the steps below in the following order:

- Interface FlashRunner 2.0 with your test/programming equipment;
- Connect FlashRunner 2.0 to host PC system (if you use it in Host Mode);
- Power up FlashRunner 2.0;
- Set up LAN settings (if you use the Ethernet connection);

3.3.1 Interfacing with your Test/Programming equipment

Build one or more ISP cables to connect FlashRunner 2.0 ISP connectors to your target board(s). Wire up all the required connections (power, oscillator, ISP signals) to target microcontrollers using the Pin-Map tool (for more details please check the related chapter on FlashRunner 2.0 Programmer's Manual).

3.3.2 Connecting to the Host PC System

You can connect FlashRunner 2.0 to the host system through either the USB or LAN port.

FlashRunner 2.0 comes with a USB cable and an Ethernet cross cable to connect directly to a host PC.

3.3.3 Powering Up

Power up FlashRunner 2.0 by connecting the included power supply to the DC plug connector.

3.3.4 Setting Up LAN Settings

If you connected FlashRunner 2.0 to the host PC using the Ethernet connection, you need to set up the FlashRunner 2.0 IP address. For learning how to set up the FlashRunner 2.0 address, please refer to the FlashRunner 2.0 Programmer's Manual.

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4 Connectors

4.1 Overview

FlashRunner 2.0 connects to your programming/testing system through:

- "ISP" connectors: 96 way, 3 row, DIN 41612, pitch = 2.54mm (male)
- "ATE CONTROL" connector: 30 way, 3 row, DIN 41612, pitch = 2.54mm (male)
- "RELAY CONTROL" connectors: 5x2 DIN connector, pitch = 2.54mm (male)
- Additionally, an USB and Ethernet connectors are provided for full interfacing with the ATE system.

4.2 ISP Connectors

"ISP" connectors group signals needed to program up to 16 target devices (depending on the FlashRunner 2.0 model). These connectors are DIN41612 with several input/output lines and power lines.

> **Note:** *ISP and I/O signals are not optoisolated and are referenced to GND (power supply ground).*
>
> *Additionally, in order to avoid undesired current loops between FlashRunner 2.0 power supply and target board, a power supply with a floating output (ground not referenced to the earth potential) should be used.*

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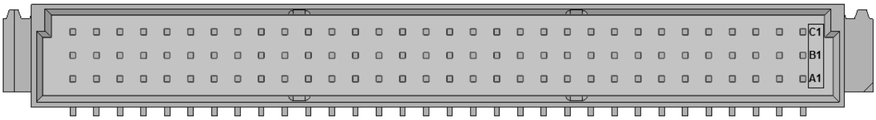

Figure 6: ISP Connector pinout

Table 1: ISP Connector Signals (Main Board)

Pin #	Signal Name	Description
A1	1DIO0	ISP Channel 1: Digital input/output 0
A2	1DIO3	ISP Channel 1: Digital input/output 3
A3	1DIO6	ISP Channel 1: Digital input/output 6
A4	1VPROG0	ISP Channel 1: Programmable voltage 0
A5	2DIO0	ISP Channel 2: Digital input/output 0
A6	2DIO3	ISP Channel 2: Digital input/output 3
A7	2DIO6	ISP Channel 2: Digital input/output 6
A8	2VPROG0	ISP Channel 2: Programmable voltage 0
A9	3DIO0	ISP Channel 3: Digital input/output 0
A10	3DIO3	ISP Channel 3: Digital input/output 3
A11	3DIO6	ISP Channel 3: Digital input/output 6
A12	3VPROG0	ISP Channel 3: Programmable voltage 0
A13	4DIO0	ISP Channel 4: Digital input/output 0
A14	4DIO3	ISP Channel 4: Digital input/output 3
A15	4DIO6	ISP Channel 4: Digital input/output 6
A16	4VPROG0	ISP Channel 4: Programmable voltage 0
A17	5DIO0	ISP Channel 5: Digital input/output 0
A18	5DIO3	ISP Channel 5: Digital input/output 3
A19	5DIO6	ISP Channel 5: Digital input/output 6
A20	5VPROG0	ISP Channel 5: Programmable voltage 0
A21	6DIO0	ISP Channel 6: Digital input/output 0
A22	6DIO3	ISP Channel 6: Digital input/output 3
A23	6DIO6	ISP Channel 6: Digital input/output 6
A24	6VPROG0	ISP Channel 6: Programmable voltage 0
A25	7DIO0	ISP Channel 7: Digital input/output 0
A26	7DIO3	ISP Channel 7: Digital input/output 3
A27	7DIO6	ISP Channel 7: Digital input/output 6
A28	7VPROG0	ISP Channel 7: Programmable voltage 0
A29	8DIO0	ISP Channel 8: Digital input/output 0
A30	8DIO3	ISP Channel 8: Digital input/output 3
A31	8DIO6	ISP Channel 8: Digital input/output 6
A32	8VPROG0	ISP Channel 8: Programmable voltage 0
B1	1DIO1	ISP Channel 1: Digital input/output 1

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Pin #	Signal Name	Description
B2	1DIO4	ISP Channel 1: Digital input/output 4
B3	GND	Ground
B4	1VPROG1	ISP Channel 1: Programmable voltage 1
B5	2DIO1	ISP Channel 2: Digital input/output 1
B6	2DIO4	ISP Channel 2: Digital input/output 4
B7	GND	Ground
B8	2VPROG1	ISP Channel 2: Programmable voltage 1
B9	3DIO1	ISP Channel 3: Digital input/output 1
B10	3DIO4	ISP Channel 3: Digital input/output 4
B11	GND	Ground
B12	3VPROG1	ISP Channel 3: Programmable voltage 1
B13	4DIO1	ISP Channel 4: Digital input/output
B14	4DIO4	ISP Channel 4: Digital input/output 4
B15	GND	Ground
B16	4VPROG1	ISP Channel 4: Programmable voltage 1
B17	5DIO1	ISP Channel 5: Digital input/output 1
B18	5DIO4	ISP Channel 5: Digital input/output 4
B19	GND	Ground
B20	5VPROG1	ISP Channel 5: Programmable voltage 1
B21	6DIO1	ISP Channel 6: Digital input/output 1
B22	6DIO4	ISP Channel 6: Digital input/output 4
B23	GND	Ground
B24	6VPROG1	ISP Channel 6: Programmable voltage 1
B25	7DIO1	ISP Channel 7: Digital input/output 1
B26	7DIO4	ISP Channel 7: Digital input/output 4
B27	GND	Ground
B28	7VPROG1	ISP Channel 7: Programmable voltage 1
B29	8DIO1	ISP Channel 8: Digital input/output 1
B30	8DIO4	ISP Channel 8: Digital input/output 4
B31	GND	Ground
B32	8VPROG1	ISP Channel 8: Programmable voltage 1
C1	1DIO2	ISP Channel 1: Digital input/output 2
C2	1DIO5	ISP Channel 1: Digital input/output 5
C3	1DIO7	ISP Channel 1: Digital input/output 7
C4	GND	Ground
C5	2DIO2	ISP Channel 2: Digital input/output 2
C6	2DIO5	ISP Channel 2: Digital input/output 5
C7	2DIO7	ISP Channel 2: Digital input/output 7
C8	GND	Ground
C9	3DIO2	ISP Channel 3: Digital input/output 2
C10	3DIO5	ISP Channel 3: Digital input/output 5
C11	3DIO7	ISP Channel 3: Digital input/output 7

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Pin #	Signal Name	Description
C12	GND	Ground
C13	4DIO2	ISP Channel 4: Digital input/output 2
C14	4DIO5	ISP Channel 4: Digital input/output 5
C15	4DIO7	ISP Channel 4: Digital input/output 7
C16	GND	Ground
C17	5DIO2	ISP Channel 5: Digital input/output 2
C18	5DIO5	ISP Channel 5: Digital input/output 5
C19	5DIO7	ISP Channel 5: Digital input/output 7
C20	GND	Ground
C21	6DIO2	ISP Channel 6: Digital input/output 2
C22	6DIO5	ISP Channel 6: Digital input/output 5
C23	6DIO7	ISP Channel 6: Digital input/output 7
C24	GND	Ground
C25	7DIO2	ISP Channel 7: Digital input/output 2
C26	7DIO5	ISP Channel 7: Digital input/output 5
C27	7DIO7	ISP Channel 7: Digital input/output 7
C28	GND	Ground
C29	8DIO2	ISP Channel 8: Digital input/output 2
C30	8DIO5	ISP Channel 8: Digital input/output 5
C31	8DIO7	ISP Channel 8: Digital input/output 7
C32	GND	Ground

Table 2: ISP Connector Signals (Slave Board)

Pin #	Signal Name	DeProjection
A1	9DIO0	ISP Channel 9: Digital input/output 0
A2	9DIO3	ISP Channel 9: Digital input/output 3
A3	9DIO6	ISP Channel 9: Digital input/output 6
A4	9VPROG0	ISP Channel 9: Programmable voltage 0
A5	10DIO0	ISP Channel 10: Digital input/output 0
A6	10DIO3	ISP Channel 10: Digital input/output 3
A7	10DIO6	ISP Channel 10: Digital input/output 6
A8	10VPROG0	ISP Channel 10: Programmable voltage 0
A9	11DIO0	ISP Channel 11: Digital input/output 0
A10	11DIO3	ISP Channel 11: Digital input/output 3
A11	11DIO6	ISP Channel 11: Digital input/output 6
A12	11VPROG0	ISP Channel 11: Programmable voltage 0
A13	12DIO0	ISP Channel 12: Digital input/output 0
A14	12DIO3	ISP Channel 12: Digital input/output 3
A15	12DIO6	ISP Channel 12: Digital input/output 6
A16	12VPROG0	ISP Channel 12: Programmable voltage 0

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Pin #	Signal Name	DeProjection
A17	13DIO0	ISP Channel 13: Digital input/output 0
A18	13DIO3	ISP Channel 13: Digital input/output 3
A19	13DIO6	ISP Channel 13: Digital input/output 6
A20	13VPROG0	ISP Channel 13: Programmable voltage 0
A21	14DIO0	ISP Channel 14: Digital input/output 0
A22	14DIO3	ISP Channel 14: Digital input/output 3
A23	14DIO6	ISP Channel 14: Digital input/output 6
A24	14VPROG0	ISP Channel 14: Programmable voltage 0
A25	15DIO0	ISP Channel 15: Digital input/output 0
A26	15DIO3	ISP Channel 15: Digital input/output 3
A27	15DIO6	ISP Channel 15: Digital input/output 6
A28	15VPROG0	ISP Channel 15: Programmable voltage 0
A29	16DIO0	ISP Channel 16: Digital input/output 0
A30	16DIO3	ISP Channel 16: Digital input/output 3
A31	16DIO6	ISP Channel 16: Digital input/output 6
A32	16VPROG0	ISP Channel 16: Programmable voltage 0
B1	9DIO1	ISP Channel 9: Digital input/output 1
B2	9DIO4	ISP Channel 9: Digital input/output 4
B3	GND	Ground
B4	9VPROG1	ISP Channel 9: Programmable voltage 1
B5	10DIO1	ISP Channel 10: Digital input/output
B6	10DIO4	ISP Channel 10: Digital input/output 4
B7	GND	Ground
B8	10VPROG1	ISP Channel 10: Programmable voltage 1
B9	11DIO1	ISP Channel 11: Digital input/output 1
B10	11DIO4	ISP Channel 11: Digital input/output 4
B11	GND	Ground
B12	11VPROG1	ISP Channel 11: Programmable voltage 1
B13	12DIO1	ISP Channel 12: Digital input/output 1
B14	12DIO4	ISP Channel 12: Digital input/output 4
B15	GND	Ground
B16	12VPROG1	ISP Channel 12: Programmable voltage 1
B17	13DIO1	ISP Channel 13: Digital input/output 1
B18	13DIO4	ISP Channel 13: Digital input/output 4
B19	GND	Ground
B20	13VPROG1	ISP Channel 13: Programmable voltage 1
B21	14DIO1	ISP Channel 14: Digital input/output 1
B22	14DIO4	ISP Channel 14: Digital input/output 4
B23	GND	Ground
B24	14VPROG1	ISP Channel 14: Programmable voltage 1
B25	15DIO1	ISP Channel 15: Digital input/output 1
B26	15DIO4	ISP Channel 15: Digital input/output 4

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Pin #	Signal Name	DeProjection
B27	GND	Ground
B28	15VPROG1	ISP Channel 15: Programmable voltage 1
B29	16DIO1	ISP Channel 16: Digital input/output 1
B30	16DIO4	ISP Channel 16: Digital input/output 4
B31	GND	Ground
B32	16VPROG1	ISP Channel 16: Programmable voltage 1
C1	9DIO2	ISP Channel 9: Digital input/output 2
C2	9DIO5	ISP Channel 9: Digital input/output 5
C3	9DIO7	ISP Channel 9: Digital input/output 7
C4	GND	Ground
C5	10DIO2	ISP Channel 10: Digital input/output 2
C6	10DIO5	ISP Channel 10: Digital input/output 5
C7	10DIO7	ISP Channel 10: Digital input/output 7
C8	GND	Ground
C9	11DIO2	ISP Channel 11: Digital input/output 2
C10	11DIO5	ISP Channel 11: Digital input/output 5
C11	11DIO7	ISP Channel 11: Digital input/output 7
C12	GND	Ground
C13	12DIO2	ISP Channel 12: Digital input/output 2
C14	12DIO5	ISP Channel 12: Digital input/output 5
C15	12DIO7	ISP Channel 12: Digital input/output 7
C16	GND	Ground
C17	13DIO2	ISP Channel 13: Digital input/output 2
C18	13DIO5	ISP Channel 13: Digital input/output 5
C19	13DIO7	ISP Channel 13: Digital input/output 7
C20	GND	Ground
C21	14DIO2	ISP Channel 14: Digital input/output 2
C22	14DIO5	ISP Channel 14: Digital input/output 5
C23	14DIO7	ISP Channel 14: Digital input/output 7
C24	GND	Ground
C25	15DIO2	ISP Channel 15: Digital input/output 2
C26	15DIO5	ISP Channel 15: Digital input/output 5
C27	15DIO7	ISP Channel 15: Digital input/output 7
C28	GND	Ground
C29	16DIO2	ISP Channel 16: Digital input/output 2
C30	16DIO5	ISP Channel 16: Digital input/output 5
C31	16DIO7	ISP Channel 16: Digital input/output 7
C32	GND	Ground

4.3 ATE Control Connector

ATE Control Connector is used to communicate with the host system and for integration with automatic programming/testing equipment (ATE).

> **Note:** *all control signals are referenced to GND_I, separate from GND. This allows a host system to safely communicate with FlashRunner 2.0 even when the target boards have different ground reference compared to the host system's (and it's not possible to connect them together).*

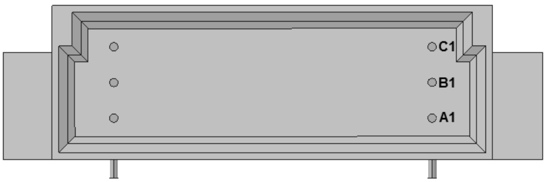

Figure 7: ATE CONTROL Connector

Table 3: Control Connector Signals

Pin #	Signal Name	Description
A1	SEL0	Project selection 0 (input, referenced to GND_I)
A2	SEL1	Project selection 1 (input, referenced to GND_I)
A3	SEL2	Project selection 2 (input, referenced to GND_I)
A4	SEL3	Project selection 3 (input, referenced to GND_I)
A5	SEL4	Project selection 4 (input, referenced to GND_I)
A6	GND_I	Ground
A7	PASS/FAIL1	Programming channel 1 PASS/FAIL (output, referenced to GND_I)
A8	PASS/FAIL2	Programming channel 2 PASS/FAIL (output, referenced to GND_I)
A9	PASS/FAIL3	Programming channel 3 PASS/FAIL (output, referenced to GND_I)
A10	PASS/FAIL4	Programming channel 4 PASS/FAIL (output, referenced to GND_I)
B1	START	Selected Project START (input, referenced to GND_I, active low)
B2	5V_I_FUSE	5V output (output, fuse-protected, referenced to GND_I)
B3	5V_I_FUSE	5V output (output, fuse-protected, referenced to GND_I)
B4	GND_I	Ground

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Pin #	Signal Name	Description
B5	GND_I	Ground
B6	GND_I	Ground
B7	PASS/FAIL5	Programming channel 5 PASS/FAIL (output, referenced to GND_I)
B8	PASS/FAIL6	Programming channel 6 PASS/FAIL (output, referenced to GND_I)
B9	PASS/FAIL7	Programming channel 47PASS/FAIL (output, referenced to GND_I)
B10	PASS/FAIL8	Programming channel 8 PASS/FAIL (output, referenced to GND_I)
C1	GND_I	Ground
C2	PASS/FAIL9	Programming channel 9 PASS/FAIL (output, referenced to GND_I)
C3	PASS/FAIL10	Programming channel 10 PASS/FAIL (output, referenced to GND_I)
C4	PASS/FAIL11	Programming channel 11 PASS/FAIL (output, referenced to GND_I)
C5	PASS/FAIL12	Programming channel 12 PASS/FAIL (output, referenced to GND_I)
C6	BUSY	Selected Project BUSY (output, referenced to GND_I, active low)
C7	PASS/FAIL13	Programming channel 13 PASS/FAIL (output, referenced to GND_I)
C8	PASS/FAIL14	Programming channel 14 PASS/FAIL (output, referenced to GND_I)
C9	PASS/FAIL15	Programming channel 15 PASS/FAIL (output, referenced to GND_I)
C10	PASS/FAIL16	Programming channel 16 PASS/FAIL (output, referenced to GND_I)

4.4 Relay Barrier Control Connector

5.4 Relay Barrier Control Connector allows to control an external relay barrier.

The outputs 1RLY…7RLY and 8RLY…16RLY are the collector output of a Darlington Driver.

With the command RLYCLOSE (please check FlashRunner 2.0 Programmer's Manual for more details) the Darlington driver of the specific channel is activated and the current can flow through the external relay coils closing the relay.

The command RLYOPEN disables the Darlington driver releasing the relays.

Relay Barrier version with the AUXILIARY connector:

- **RLYOPEN** command**:** If the relay switches are in the (normally) OPEN position, the ISP Output lines of the Relay barrier are connected to the AUX connector.
- **RLYCLOSE** command: When the relay switches are CLOSED, the ISP Output lines are connected to the FlashRunner ISP Output Connector.

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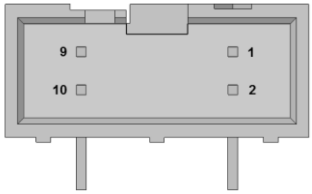

Figure 8: RELAY CONTROL Connector

Table 4: Relays Control Signals (Master Board)

Pin #	Signal Name	Description
1	1RLY	Channel 1 Darlington collector output
2	2RLY	Channel 2 Darlington collector output
3	3RLY	Channel 3 Darlington collector output
4	4RLY	Channel 4 Darlington collector output
5	5RLY	Channel 5 Darlington collector output
6	6RLY	Channel 6 Darlington collector output
7	7RLY	Channel 7 Darlington collector output
8	8RLY	Channel 8 Darlington collector output
9	GND	Ground
10	GND	Ground

Table 5: Relays Control Signals (Slave Board)

Pin #	Signal Name	Description
1	1RLY	Channel 9 Darlington collector output
2	2RLY	Channel 10 Darlington collector output
3	3RLY	Channel 11 Darlington collector output
4	4RLY	Channel 12 Darlington collector output
5	5RLY	Channel 13 Darlington collector output
6	6RLY	Channel 14 Darlington collector output
7	7RLY	Channel 15 Darlington collector output
8	8RLY	Channel 16 Darlington collector output
9	GND	Ground
10	GND	Ground

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4.4.1 Application Example

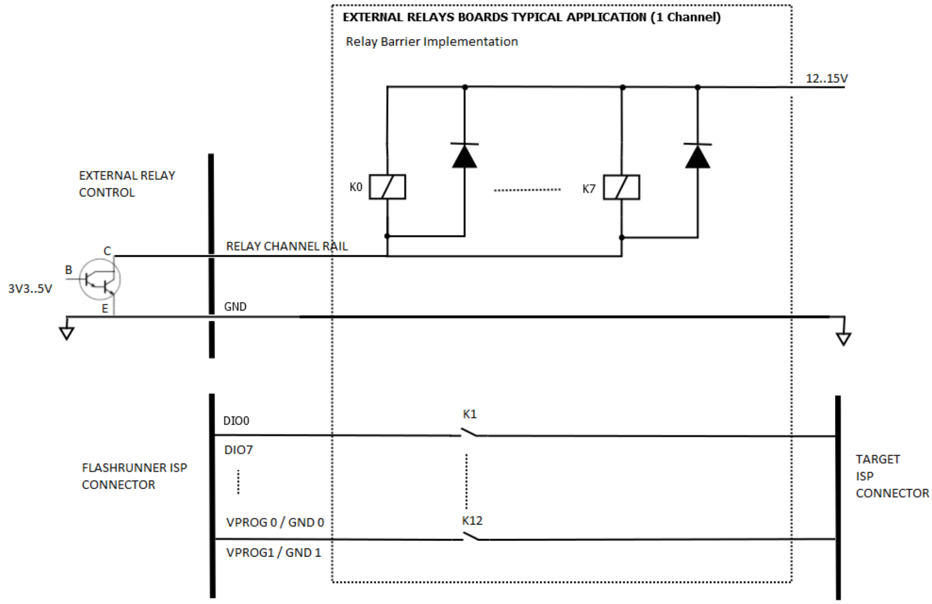

Figure 9: Relay Control Application Example

- Relay OMRON G6K2FYTR12DC , *Omron signal relay 12V 1A 2CO*
- Darlington $V_{CE}(SAT)$ ~ 1V (see Technical Specification Chapter)
- R_{COIL} = 1315Ω (en-g6k datasheet)

$I_{COIL} = (V_{SUP} - V_{CE}(SAT)) / R_{COIL} = \sim 10{,}5mA$

Total (I_{COIL}) per channel = 8CH+4(V_{PROG}0, V_{PROG}1/GND0, GND01). x I_{COIL} = ~130mA

$\text{Total } I_{COIL\ (8\ channels)} = 12 \times 8 \times I_{COIL} = \sim 1A$

$\text{Total } I_{COIL\ (16\ channels)} = 12 \times 16 \times I_{COIL} = \sim 2.1A$

Demultiplexer Control Connector

The demultiplexer control connector is the same used for the Relay Barrier. Working conditions are explained below:

Command SETMUX 0: All the lines are disconnected
Command SETMUX 1: ISP Input lines are connected to output 1 (J1-J3)
Command SETMUX 2: ISP Input lines are connected to output 2 (J2-J4)

Pin #	Signal Name	Description
1	1RLY	Output 1 Darlington collector output
2	2RLY	Output 2 Darlington collector output
9	GND	Ground
10	GND	Ground

For reference schematics, please refer to *Relay Barrier Application Example.*

Total $I_{COIL\ (8\ channels)} = 12 \times 8 \times I_{COIL} = \sim 1A$
Total $I_{COIL\ (16\ channels)} = 12 \times 16 \times I_{COIL} = \sim 2.1A$

4.5 USB Connector

The USB-B connector can be used to communicate with the ATE system.

> Note: *USB signals are referenced to GND_USB, that is separate from the GND, and from the GND_I.*

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5 FlashRunner 2.0 Tools

5.1 Relay Barrier

Relay barrier is functional to provide galvanic isolation between FlashRunner and the UUTs. It is available in two versions:

- FR2P0RB08 (Relay Barrier for FR2P0-A08)
- FR2P0RB16 (Relay Barrier for FR2P0-A16)

Figure 10: FR2P0RB16: Relay Barrier for FR2.0A16

The relay barrier must be powered by connecting the 15 V supply adapter to one of the female plug on the right side.

In case of FR2P0RB08 the other female plug must be connected to the FR2P0-A8.

In case of FR2P0RB16 the female plug on the same board must be connected to one of the female plug on the other stacked board. The remaining plug must be connected to the FR2P0-A16.

For the Output ISP Connector pinout please refer to "*Table 1: ISP Connector Signals (Main Board)*".

The driving signal for the relays are given by the FlashRunner through the 10 wire flat cable. Each FR2.0 relay control connector must be connected to the relay barrier board at the same level.

Then connect the FR2P0 DIN41612 male connector to the FR2P0RB DIN41612 female connector.

The pinout of the FR2P0RB08 and FR2P0RB16 male connector remain the same as in table 3.1 and 3.2

Parameter	Value
Supply voltage on line POWER (reference GND)	+15V
FR2P0RB08 Dimensions	184 x 60 x 19 mm
FR2P0RB16 Dimensions	184 x 60 x 30 mm
“ISP” connectors type	96 way, 3 row, DIN 41612, pitch = 2.54mm

5.2 Demultiplexer

FlashRunner 2.0 demultiplexer allows to double the active channels.

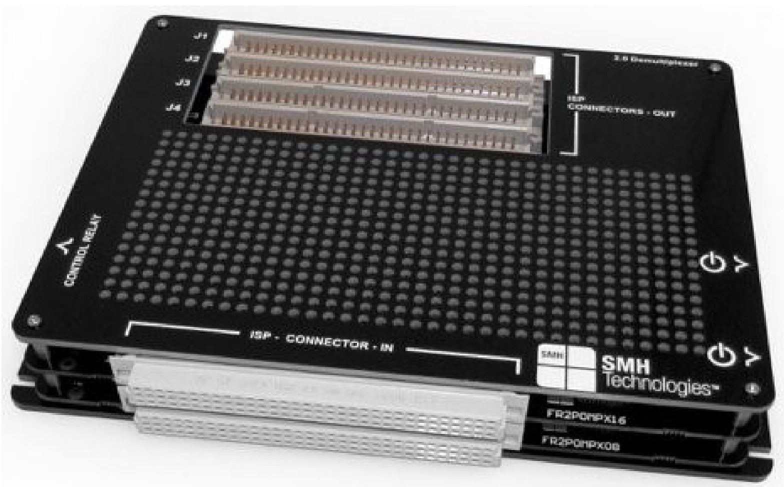

Figure 11: Demultiplexer 16 to 32 channels

Demultiplexer is available for **both FlashRunner 8 channels** and **FlashRunner 16 channels versions**, thus reaching up to 16 or 32 channels per model. It provides also galvanic isolation disconnecting all the ISP, power, and ground lines.

With this demultiplexer, each FlashRunner 2.0 physical channel corresponds to 2 demultiplexed output channels in series.

Demultiplexer must be powered by connecting the 15V supply adapter to one of the female plug on the right side. The other female plug must be connected to the FR2P0 power connector.

The relay control signals are supplied by the FlashRunner via the 10 wire flat cable provided. Each FR2.0 relay control connector must be connected to the relay barrier board at the same level, two flat cables for the FR2P0 16 channels, one flat cable for the FR2.0 8 channels.

The FR2.0 DIN41612 male connectors must be connected to the FR2P0MPX DIN41612 female connectors.

The DIN41612 male connector of the FR2.0 master board, which contains the programming site 1-8 is demultiplexed into the two DIN41612 male connectors: J1 and J2.

The DIN41612 male connector of the FR2.0 slave board (for the 16 channels version), which contains the programming site 9-16, is demultiplexed into the two DIN41612 male connectors J3 and J4.

The pinout of the FR2P0MPX320 male connector is specified in table 3.1 and 3.2

For information on how to drive demultiplexer please please refer to the "*SETMUX*" command description on the *"Programmer's Manual"*.

For the Output ISP Connector pinout please refer to *Table 1: ISP Connector Signals (Main Board).*

Parameter	Value
Supply voltage on line POWER (reference GND)	+15V
FR2P0MPX160 Dimensions	184 x 130 x 19 mm
FR2P0MPX320 Dimensions	184 x 130 x 30 mm
“ISP” connectors type	96 way, 3 row, DIN 41612, pitch = 2.54mm

5.3 Cable interface

Figure 12: Cable interface for FR2.0A16

Cable Interface allows to connect target directly using our cables and adapters keeping good signals integrity.

Each header connector (H1..H8) is the output of one programming channel and must be connected to a FRHDRPSTR through a FRCABLE. On the FRHDRPSTR there is a header pin strip with the output signals.

Parameter	Value
FR2P0INTF08 Dimensions	184 x 35 x 19 mm
FR2P0INTF16 Dimensions	184 x 35 x 30 mm
FRHDRPSTR Dimensions	46 x 30 mm
“ISP” connectors type	96 way, 3 row, DIN 41612, pitch = 2.54mm
Header connectors type	20 way, 2 row, pitch =1,27mm

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6 Technical Specifications

6.1 Absolute Maximum Ratings

Table 4.1: Absolute Maximum Ratings

Parameter	Value
"POWER" Connector	
Supply voltage on line POWER (reference GND)	+15V
"CONTROL" Connector	
Maximum input voltage on lines START, SEL[4..0], SG[1..0]	-2V to +20V
Maximum current on lines BUSY, PASS, FAIL	±10mA
"ISP GROUP" Connectors	
Maximum input voltage on lines DIO	-1V to +7V
Maximum current on lines DIO	±50mA
Maximum current on the VPROG0 line	250 mA
Maximum current on the VPROG1 line	200 mA
"Relays Control" Connector	
Coil Supply Voltage	50V
Max Collector Current per Channel	500mA

6.2 DC Characteristics and Functional Operating Range

Table 4.2: DC Characteristics and Functional Operating Range

Parameter	Condition	Value		
		Min	Typ	Max
"ATE CONTROL" Connector				
V_{IL} (input low voltage) on lines START, SEL[4..0]		0V	-	0.8V
V_{IH} (input high voltage) on lines START, SEL[4..0]		2.4V	-	15V
V_{OL} (output low voltage) on lines BUSY, FAIL, PASS	I_{OL} = 4mA	-	-	0.8V

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Parameter	Condition	Value		
		Min	Typ	Max
V_{OH} (output high voltage) on lines BUSY, FAIL, PASS		4.5V	-	5V
"Relays Control" Connector				
Coil Supply Voltage			12V	50V
Collector Current per Channel				500mA
V_{CE}(sat)	I_{COIL} = 200mA		1V	1.3V
"ISP" Connectors				
V_{IL} (input low voltage) on lines DIO		-	-	0.3V_{PROG0}
V_{IH} (input high voltage) on lines DIO	Configured as digital lines	0.7V_{PROG0}	-	V_{PROG0}
V_{OL} (output low voltage) on lines DIO, CLKOUT	Configured as digital lines, V_{PROG0} = 3V, I_{OL} = 12mA	-	-	0.36V
V_{OH} (output high voltage) on lines DIO, CLKOUT	Configured as digital lines, V_{PROG0} = 3V, I_{OH} = 12mA	2.56V	-	-
V_{OL} (output low voltage) on lines DIO, CLKOUT	Configured as digital lines, V_{PROG0} = 5.5V, I_{OL} = 24mA	-	-	0.36V
V_{OH} (output high voltage) on lines DIO, CLKOUT	Configured as digital lines, V_{PROG0} = 5.5V, I_{OH} = 24mA	4.86V	-	-
I_{OH} current (source) on lines DIO	Configured as input with active pull-ups	-	3.8mA	-
VPROG0 output voltage		1.65V	-	5.5V
VPROG0 current (source)		-	-	250mA
VPROG1 output voltage		6V	-	13.5V
VPROG1 current (source)		-	-	200mA
"POWER" Connector				
Supply voltage		15V	-	15V
Power consumption 8CH		-	-	5A
Power consumption 16CH		-	-	8A

Note: *Keep FlashRunner 2.0 always in a well-ventilated area in order to prevent product overheating, which could affect product performance and, if maintained for long time, it could damage product hardware components.*

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6.3 AC Characteristics (TBW)

Table 4.3: AC Characteristics

Parameter	Condition		Value		
			Min	Typ	Max
t_{RISE} on lines DIO[7..0], when configured as digital output push-pull	V_{PROG0} = 1.8V	Load: 470Ω//100pF (see Figure 13)	-	40ns	-
	V_{PROG0} = 3.3V		-	30ns	-
	V_{PROG0} = 5V		-	25ns	-
t_{FALL} on lines DIO[7..0], when configured as digital output push-pull	V_{PROG0} = 1.8V	Load: 470Ω//100pF (see Figure 13)	-	35ns	-
	V_{PROG0} = 3.3V		-	25ns	-
	V_{PROG0} = 5V		-	25ns	-
	V_{PROG1} = 12V		-	20µs	-
	V_{PROG1} = 14.5V		-	30µs	-
t_{RISE} on line VPROG0	V_{PROG0} = 0-1.8V	Load: 15Ω//10mF (see Figure 13)	-	10ms	-
	V_{PROG0} = 0-3.3V	Load: 22Ω//10mF (see Figure 13)	-	15ms	-
	V_{PROG0} = 0-5.5V	Load: 22Ω//10mF (see Figure 13)	-	20ms	-
t_{FALL} on line VPROG0	V_{PROG0} = 1.8-0V	Load: 10mF (see Figure 13)	-	300ms	-
	V_{PROG0} = 3.3-0V		-	350ms	-
	V_{PROG0} = 5.5-0V		-	350ms	-
t_{RISE} on line VPROG1	V_{PROG1} = 0-3V	Load: 10Ω//1mF (see Figure 13)	-	1.3ms	-
	V_{PROG1} = 0-5V	Load: 47Ω//1mF (see Figure 13)	-	1.8ms	-
	V_{PROG1} = 0-14.5V	Load: 94Ω//1mF (see Figure 13)	-	13ms	-
t_{FALL} on line VPROG1	V_{PROG1} = 3-0V	Load: 1mF (see Figure 13)	-	18ms	-
	V_{PROG1} = 5-0V		-	30ms	-
	V_{PROG1} = 14.5-0V		-	45ms	-

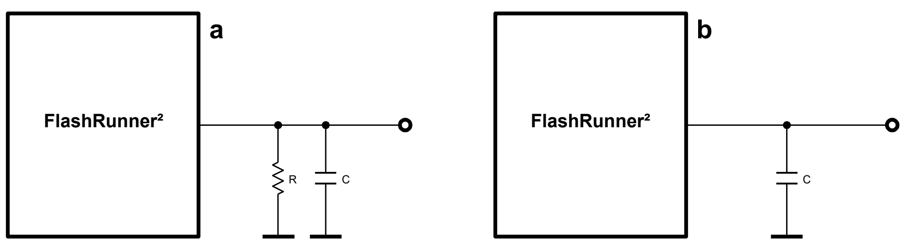

Figure 13: Load Conditions

6.4 Physical and Environmental Specifications

Table 4.6: Physical and Environmental Specifications

Parameter	Value
Dimensions: 8channels - without slave board	170 x 83 x 19 mm
Dimensions: 16 channels - with slave board	170 x 83 x 30 mm
Dimensions: 16 channels with relay barrier	170 x 159 x 30 mm
“ISP” connectors type	96 way, 3 row, DIN 41612, pitch = 2.54mm (male)
“ATE CONTROL” connector type	30 way, 3 row, DIN 41612, pitch = 2.54mm (male)
“USB” connector type	USB-B receptacle
“LAN” connector type	RJ-45 connector
“RELAYS CONTROL” connector type	5x2 DIN connector, pitch = 2.54mm
“POWER” connector type	DC Plug
Operating temperature	0-50°C
Operating humidity	90% max (without condensation)
Storage temperature	0-70°C
Storage humidity	90% max (without condensation)
EMC (EMI/EMS)	CE, FCC
Sd card size	Up to 256 GB, default 32GB

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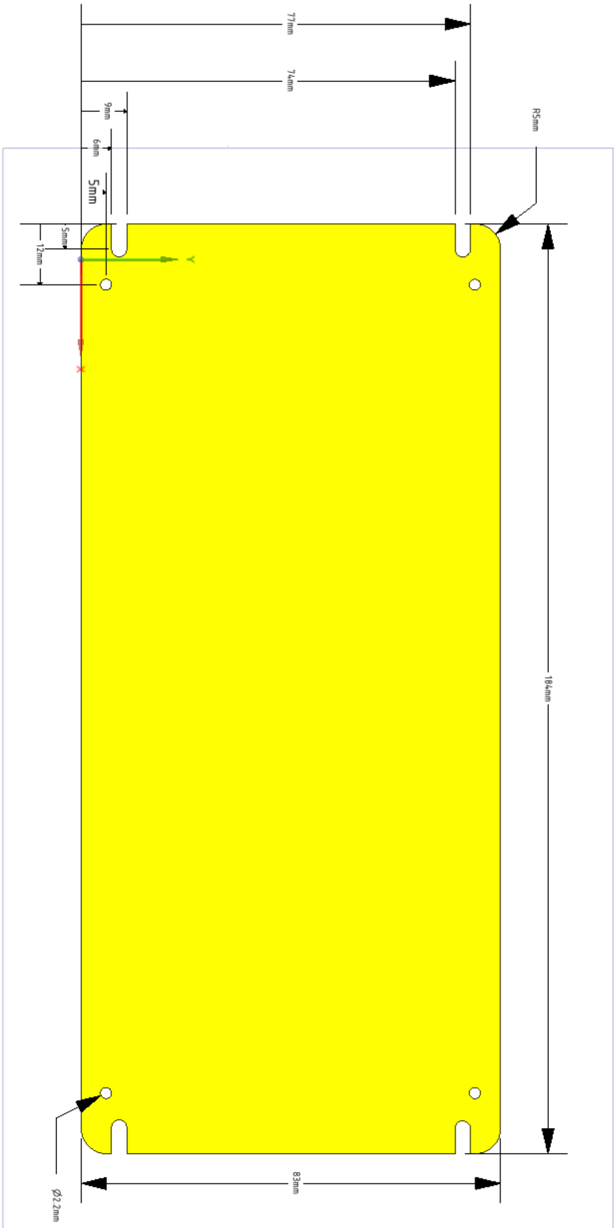

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