SMH Technologies®

FLASHRUNNER®
HIGH-SPEED

Multi-End Programming System for In-System Programming and Pre-Programming

User's Manual

Revision 2.0 — Nov 2025

SMH Technologies®

UNIVERSAL PRODUCTION IN-SYSTEM PROGRAMMING

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

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

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

FlashRunner HS 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 HS against electrostatic discharge (ESD), always connect yourself to ground (e.g. via wrist straps) when handling the instrument. Always store FlashRunner HS inside an antistatic bag when not in use.

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

FlashRunner HS has been designed to be immune to electromagnetic interference. FlashRunner HS functionalities include operating with external target devices *(e.g. serial memories, microprocessors…).* To avoid any issue during the interaction with target devices and to guarantee task reliability, FlashRunner HS is able to correctly detect **critical fault conditions** and take suitable mitigating measures such as *fail-safe state* and *functional reset procedure*.

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Introduction

FlashRunner High-Speed (HS) combines very high programming performances and high modularity to obtain a Multi-end programming solution that perfectly fits the needs of Pre-Programming and In-System Programming. This new member of the FlashRunner family is specifically designed to place the programmer header, also known as Active Module, in the near proximity of the programmable devices without being affected by long distance and guaranteeing optimal signal integrity. The programming system platform is composed by a FlashRunner HS Control Unit combined with up to 8 FlashRunner HS Active Modules. The solution's cost will be adjusted to production needs, optimizing programmer's efficiency also in respect to the economic investment.

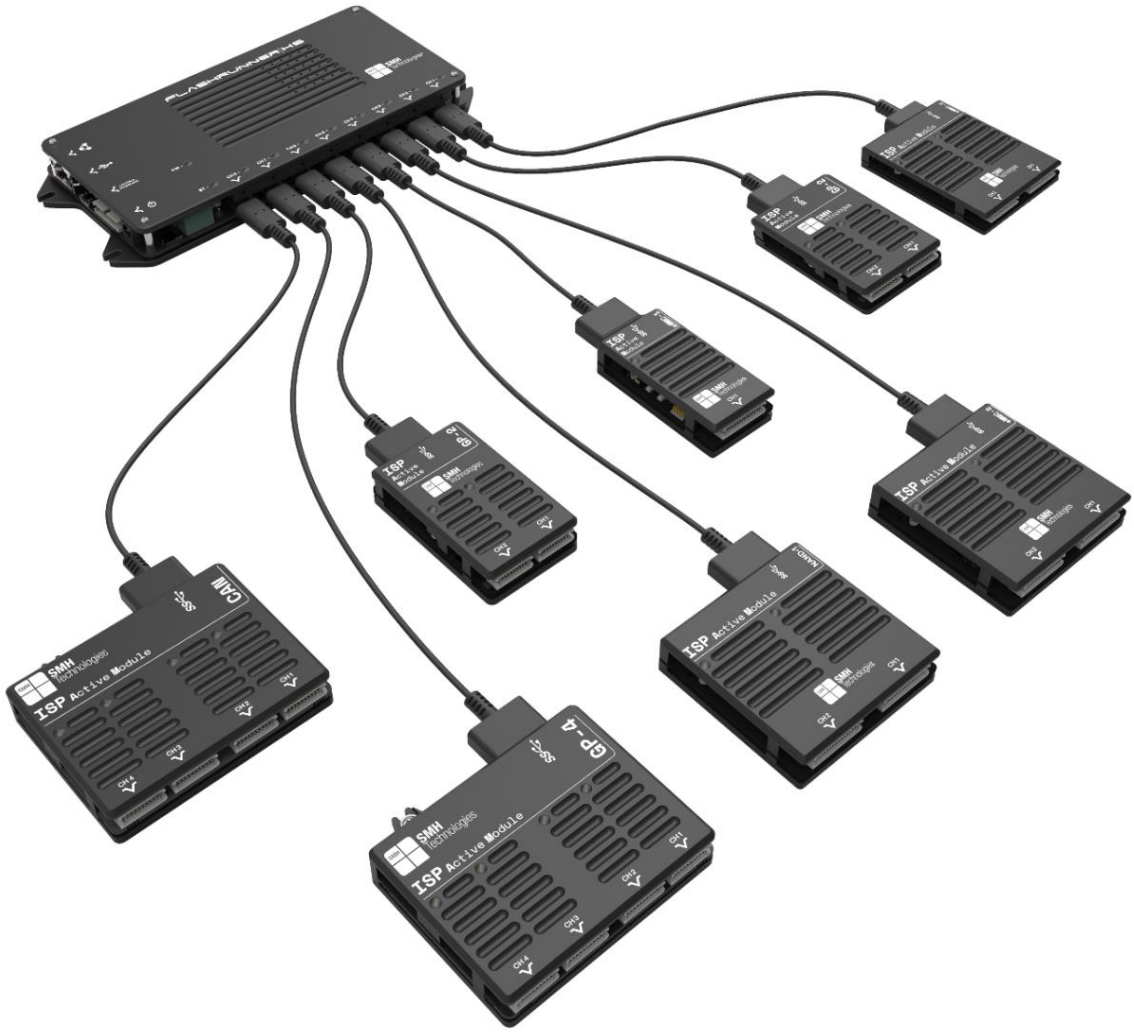


Figure 1: FlashRunner HS – Multi-End Programming System

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The new programmer implements cutting-edge technology that allows to manage really big amount of data maintaining the best possible programming performance. This is particularly suited for Pre-Programming applications since high speed performance can be better exploited in case of good contact conditions with the programmable device.

FlashRunner HS hardware capability satisfies all application fields, thanks to its Active Modules that can be employed for the programming of very specific technology such as eMMC memories, UFS memories, OCTO-SPI memories, parallel NAND memories beside microcontrollers, microprocessors and serial memories. Moreover, also to satisfy the requirements of the End-Of-Line programming, FlashRunner HS provides USB interfaces and Automotive Ethernet interfaces.

FlashRunner HS is a high performance programming system based on the well-recognized and performing FlashRunner 2.0 cutting-edge technology. This proven platform ensures robust performance and a comprehensive set of advanced features. In addition, by leveraging modularity of the system architecture, it allows to satisfy any complex programming scenarios combining very different communication interfaces altogether.



Figure 2: FlashRunner HS – Control Unit

FlashRunner HS Control Unit had been initially delivered as base version supporting FlashRunner HS Active Module. Just to support both the existing Active Module and the last introduced Active Module Plus, a new version of the Control Unit, named Control Unit Plus, has been designed and delivered to the customers. FlashRunner HS Control Unit Plus is available with 4 or 8 Active Module lines enabled to connect, respectively, up to 4 or up 8 Active Modules; the upgrade from 4 to 8 lines is available through a simple software license installation.

Description	Part Number
Control Unit Plus - 4 Active Modules lines	FR-HS-CU4L-PLUS
Control Unit Plus - 8 Active Modules lines	FR-HS-CU8L-PLUS
Control Unit Plus – 4 to 8 Active Modules lines upgrade	FR-HS-UPG08

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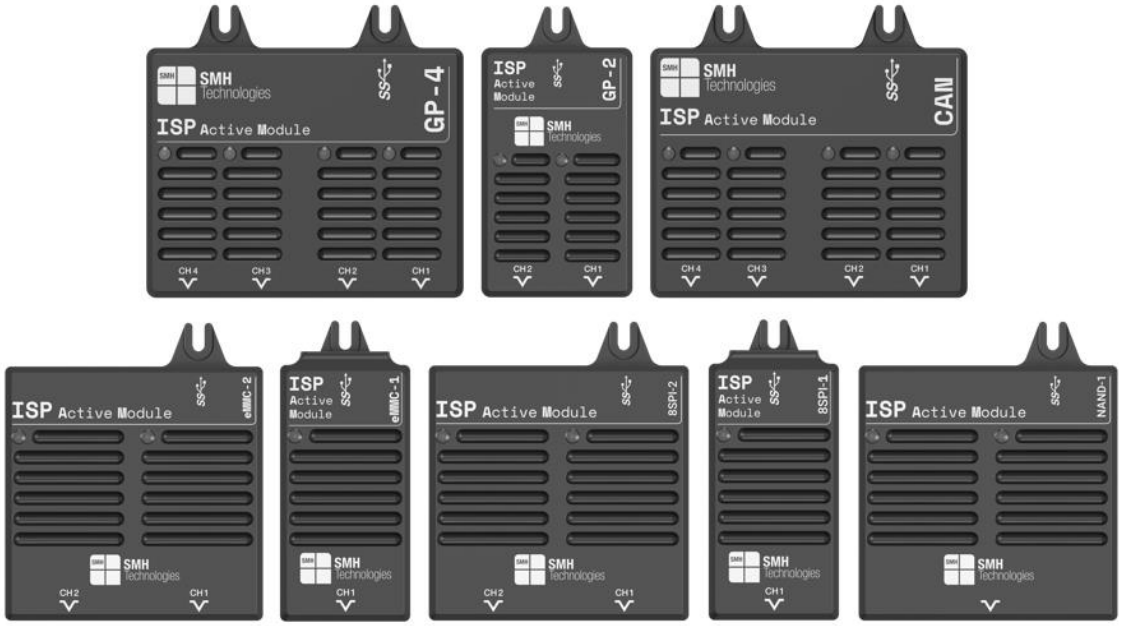


Figure 3: FlashRunner HS – Active Modules

FlashRunner HS Active Modules are designed to be technology-specific so to provide the maximum performance according to the employed communication protocol. They are, optionally, available with an integrated relay barrier to separate the programmer's device interfaces and the ISP programmable devices (DUTs).

Description	Part Number
GP4 Active Module – General Purpose 4 channels	AM-GP4-CS
GP4 Active Module RB – General Purpose 4 channels with Relay Barrier	AM-GP4-RB
GP2 Active Module – General Purpose 2 channels	AM-GP2-CS
GP2 Active Module RB – General Purpose 2 channels with Relay Barrier	AM-GP2-RB
GP1 Active Module – General Purpose 1 channel	AM-GP1-CS
GP1 Active Module RB – General Purpose 1 channel with Relay Barrier	AM-GP1-RB
CAN4 Active Module – CAN/CAN-FD 4 channels	AM-CAN4-CS
CAN4 Active Module RB – CAN/CAN-FD 4 channels with Relay Barrier	AM-CAN4-RB
eMMC2 Active Module – eMMC 2 channels	AM-eMMC2-CS
eMMC2 Active Module – eMMC 2 channels with Relay Barrier	AM-eMMC2-RB
eMMC1 Active Module – eMMC 1 channel	AM-eMMC1-CS
eMMC1 Active Module – eMMC 1 channel with Relay Barrier	AM-eMMC1-RB
8SPI2 Active Module – OCTO-SPI 2 channels	AM-8SPI2-CS
8SPI2 Active Module – OCTO-SPI 2 channels with Relay Barrier	AM-8SPI2-RB
8SPI1 Active Module – OCTO-SPI 1 channel	AM-8SPI1-CS
8SPI1 Active Module – OCTO-SPI 1 channel with Relay Barrier	AM-8SPI1-RB
NAND1 Active Module – Parallel NAND 1 channel	AM-NAND1-CS
NAND1 Active Module – Parallel NAND 1 channel with Relay Barrier	AM-NAND1-RB

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Figure 4: FlashRunner HS – Active Modules Plus

Description	Part Number
UFS Active Module Plus UFS direct memory interface - 1 channel	AM-PLUS-UFS1-CS
USB4 Active Module Plus USB 2.0/3.1 interfaces - 4 channels	AM-PLUS-USB4-CS
AETH4 Active Module Plus Automotive Ethernet 100/1000-BASE-T1 interfaces - 4 channels	AM-PLUS-AETH4-CS

FlashRunner HS Control Unit is connected to FlashRunner HS Active Modules through USB-C cables that carry data, commands and power supply. Different cable lengths can be provided to satisfy customer's requirements - the maximum connection length is 6 meters. These cables are equipped with mounting screws to secure cable retention.



Figure 5: FlashRunner HS – customized USB-C cables

Description	Part Number
USB-C HS connection cable 25 cm	CB-USBC3-L250
USB-C HS connection cable 50 cm	CB-USBC3-L500
USB-C HS connection cable 100 cm	CB-USBC3-L1000
USB-C HS connection cable 200 cm	CB-USBC3-L2000

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General features

- Fastest programming algorithms approved by silicon manufacturers - as fast as target device's memory technology limit;
- **up to 32 universal, parallel and independent device interfaces**;
- easy ATE and fixture integration;
- host-controlled operations through isolated LAN Ethernet interface and isolated USB-UART interface;
- stand-alone operations through an isolated parallel control interface;
- supports the most common ISP low level protocols: BDM, DAP, CSI, eMMC, JTAG, SPI, QSPI, OCTO-SPI, Parallel-NAND, I2C, ICSP, EICSP, ISSP, MON, ICC, PDI, SCI, SD, SWD, UART, USART, CAN/CAN-FD and many others;
- supports UFS memory protocol;
- supports USB 2.0/3.1 interface, Automotive Ethernet 100/1000-BASE-T1 interface;
- flexible, fully configurable;
- compact and robust design for production environments.

Hardware features

FlashRunner HS Control Unit

- isolated 10/100/1000Mbps LAN communication Interface;
- isolated USB-UART communication interface;
- isolated Stand-Alone Control Interface;
- endless combination of up to 8 Active Modules or Active Module Plus to support the required communication protocols/interfaces through USB-C ports;
- multi-core high performance processor for system management;
- 1GB dynamic memory;
- 64GB upgradable and replaceable storage memory for user data files and system files (up to 256GB);
- up to 256GB on-board high-performance storage HSMEM memory;
- on-board timekeeper and calendar (battery supplied) for system time reference and time-stamped log file.

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FlashRunner HS Active Module

- very small form factor to be placed in near proximity with the device to be programmed;
- USB-C port to establish a connection with FlashRunner HS Control Unit and FlashRunner HS Control Unit Plus;
- 1, 2 or 4 device interfaces, according to the Active Module type, featured by:
  - 8, 12 or 24 Digital Input Output signals;
  - communication signals level programmable voltage;
  - additional power supply programmable voltage;
  - ground signals.
- support the most common communication protocols with up to 8-bit data bus: BDM, DAP, CSI, eMMC, JTAG, SPI, QSPI, OCTO-SPI, Parallel-NAND, I2C, ICSP, EICSP, ISSP, MON, ICC, PDI, SCI, SD, SWD, UART, USART, CAN, CAN-FD;
- communication frequency towards DUTs up to 100MHz;
- power supply and control commands for an optional external relay barrier;
- output voltages and currents continuous monitoring[1];
- power supplied by FlashRunner HS Control Unit or FlashRunner HS Control Unit Plus through USB-C connection cable.

FlashRunner HS Active Module Plus

- very small form factor to be placed in near proximity with the device to be programmed;
- USB-C port to establish a connection with FlashRunner HS Control Unit Plus;
- one/four device interfaces with specific connectors according to the Active Module type;
- 256GB on-board memory (up to 2TB);
- active heat dissipation through cooling fan;
- supporting UFS memory communication protocol rate up to Gear3-A (5.8GHz);
- supporting USB interfaces 2.0/3.1 (480MHz/5GHz);
- supporting Automotive Ethernet protocol 100/1000Mbps (100/1000-BASE-T1);
- output voltages and currents continuous monitoring[1];
- power supplied by the FlashRunner HS Control Unit Plus and, optionally, by an auxiliary input power supply on the Active Module Plus.

[1] Although the programmer's monitoring provides valuable information regarding signal levels, ensuring the correctness of voltage and current during flashing procedures remains the sole responsibility of the end customer.

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Software features

- Linux Embedded based operating system;
- very extensive library of supported devices - enabled through software licensing;
- FlashRunner WorkBench Graphical user Interface - the most user-friendly way to discover and exploit the remarkable features of SMH Technologies programming systems (Windows, Linux and Mac compatible);
- controllable by any host system through a simple terminal utility and ASCII protocol;
- advanced Interface Library DLL to control the programming system through a user-written applications (C/C++, C#, Labview, TestStand);
- optional customer binary file cryptography to ensure user data antipiracy protection with a more secure and advanced encryption method;
- advanced system protection and access according to user settings and permission management;
- file integrity check and file authenticity check to prevent data alterations;
- flashing cycles control to limit the number of board produced;
- user data management and device-specific dynamic data management (e.g. serial number, password, configuration data, …);
- very detailed log file completed with time-stamp for programming system full monitoring;
- extensive range of flashing and verifying operations according to the target device (mass erase, sector erase, blank-check, program, verify with complete device read, verify with CRC check, read and dump data to file, device-specific operations);
- very easy software/firmware update (Operating System, Device Drivers, Licenses).

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Hardware overview

FlashRunner HS Control Unit and Control Unit Plus

FlashRunner HS Control Unit provides all the interfaces to the Host PC or Host System through several isolated interfaces:

- Ethernet LAN 10/100/1000 Mbps isolated interface;
- USB/UART isolated interface;
- Stand-Alone isolated Control Interface.

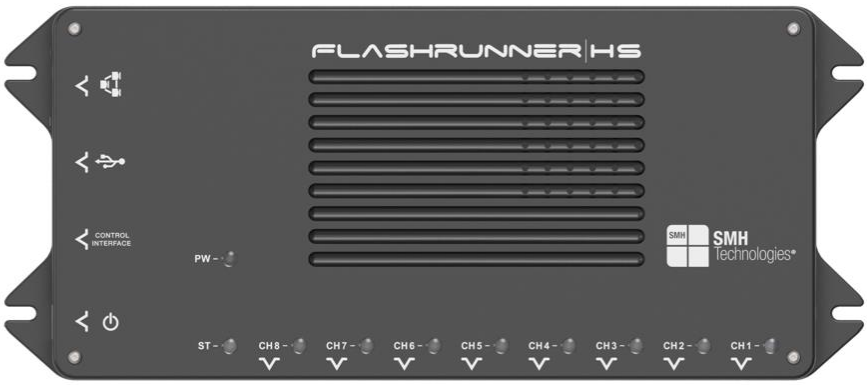
Control Unit is equipped with 8 USB-C ports to connect as many Active Module or Active Module Plus. Power supply (15V, up to 10A) is provided to the Control Unit through the dedicated connector and then distributed to the peripheral modules through the USB-C ports.

Ethernet LAN
10/100/1000 interface

USB-UART interface

Stand-Alone
Control Interface

Power Supply – 15V



USB-C ports to connect up to 8 Active Modules

Figure 6: FlashRunner HS Control Unit – top view - Host connections, Power Supply input, USB-C ports

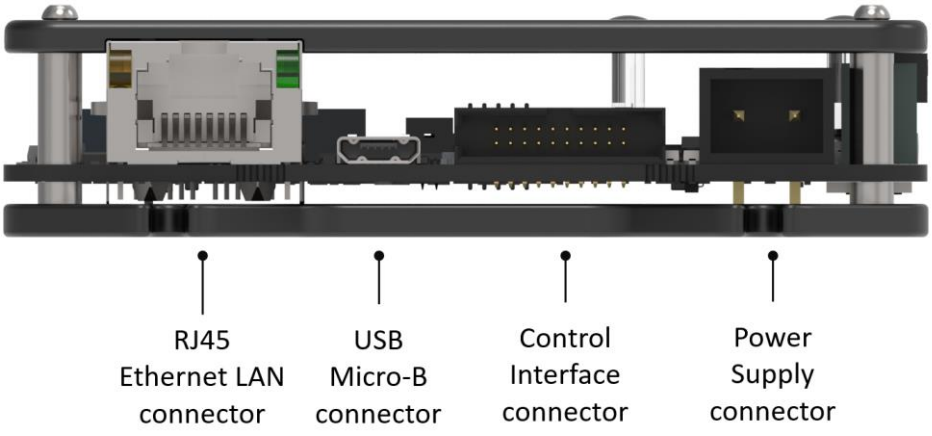


Figure 7: FlashRunner HS Control Unit – side view - Host connections (LAN, USB-UART, Control Interface, Power Supply)

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Ethernet LAN connection

Ethernet LAN RJ45 Connector is used to communicate with Host PC system. Ethernet transceiver is a 10/100/1000 Mbps single chip suitable for IEEE 802.3 applications. The automatic MDI/MDI-X feature eliminates the need to determine whether to use a straight cable or a crossover cable between the ethernet transceiver and its link partner. An isolation transformer with symmetrical transmit and receive data paths is also placed between Ethernet transceiver and RJ45 connector.



Figure 8: FlashRunner HS Control Unit – Etherner LAN RJ45 connector – LEDs

RJ45 connector is equipped with two LEDs:

- Green LED is on when the Etherent link is up (any speed);
- Orange LED blinks when there is TX/RX activity on the link.

Connector part-number: Belfuse L829-1J1T-43

For more information, please refer to FlashRunner Programmer's Manual in order to correctly setup your Host PC system.

USB-UART connection

Alternatively, communication with the Host PC can be done with the micro-B USB connector through a UART serial connection. Also this connection is isolated.

Connector part-number: CUI Devices UJ2-MIBH-4-SMT



Figure 9: FlashRunner HS Control Unit – USB-UART connector

For more information, please refer to FlashRunner Programmer's Manual in order to correctly setup your Host PC system.

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Control Interface connection

Control Connector, on FlashRunner HS unit, is used by the host system to control the programming system without using USB port or LAN port.

Through the Control Interface, it is possible:

- to select a project (up to 32 selections);
- to start a project;
- to check project state;
- to check programmer's state and channels' state.



Figure 10: Control Interface connector - Right Angle, 20-position, 2-row, 1.27mm pitch male

Right-angle 20-pin 2-row 1.27mm pitch male connector
Connector part-number: CNC Tech 3220-20-0200-00
Mating connector: CNC Tech 3230-20-0102-00

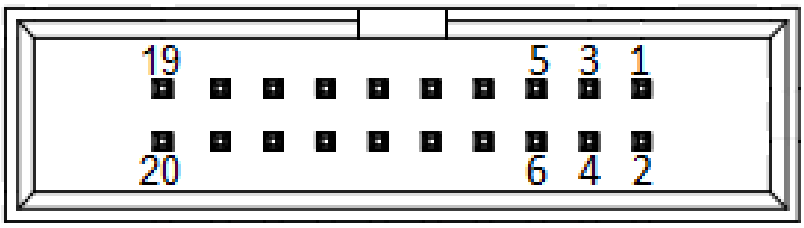


Figure 11: FlashRunner HS – Control Interface connector pin numbering

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Pin #	Signal Name	Input/Output	Description
1	PRJ_SEL[0]	I	Project selection 0
2	CH_INDEX[0]	O	Channel Index 0
3	PRJ_SEL[1]	I	Project selection 1
4	CH_INDEX[1]	O	Channel Index 1
5	PRJ_SEL[2]	I	Project selection 2
6	CH_INDEX[2]	O	Channel Index 2
7	PRJ_SEL[3]	I	Project selection 3
8	CH_INDEX[3]	O	Channel Index 3
9	PRJ_SEL[4]	I	Project selection 4
10	CH_INDEX[4]	O	Channel Index 4
11	START_PRJ	I	Selected Project START (active low)
12	FAIL_CH	O	FAIL on selected channel
13	GND_I	-	Isolated GND
14	PASS_CH	O	PASS on selected channel
15	BUSY	O	Selected Project BUSY (active low)
16	VALID_CH	O	Channel PASS and PASS/FAIL valid signal
17	GND_I	-	Isolated GND
18	GND_I	-	Isolated GND
19	5V_I_FUSE	P	5V output (output, fuse-protected)
20	5V_I_FUSE	P	5V output (output, fuse-protected)

Table 1: FlashRunner HS – Control Interface connector pinout

Note: *all control signals are ground-referenced to GND_I (separated from HS unit common GND) and power-referenced to 5V_I_FUSE (both obtained with an isolated DC/DC converter). This allows a host system to safely communicate with FlashRunner HS even when the target boards have different ground reference compared to the host system's (and it's not possible to connect them together).*

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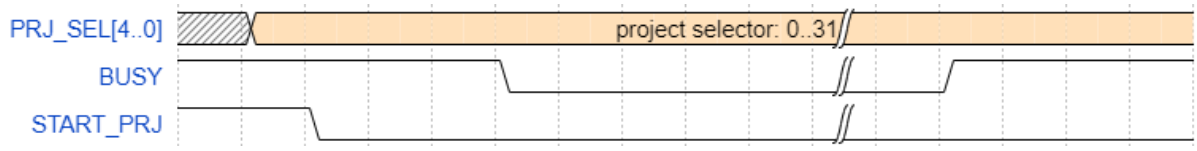


Figure 12: Control Interface: project start timing diagram (100ms/div)

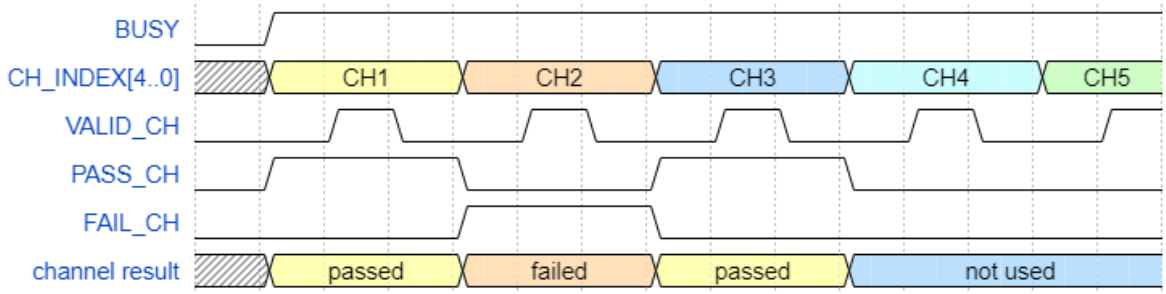


Figure 13: Control Interface: project results (first channels) timing diagram (300us/div)

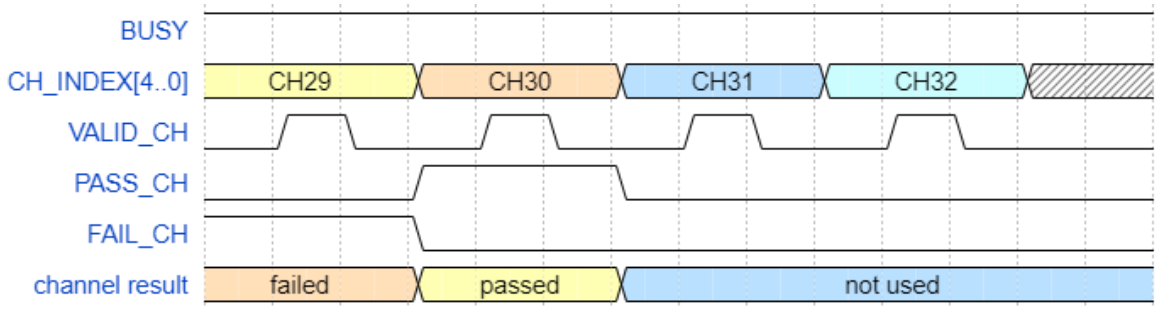


Figure 14: Control Interface: project results (last channels) timing diagram (300us/div)

A typical sequence of commands given through the ATE Control Interface is listed in the following:

- drive PRJ_SEL[4..0] input signals to select up to 32 different projects previously stored into FlashRunner HS;
- if the programmer is not BUSY, drive the START_PRJ input signal to trigger the project start;
- verify BUSY to check if the project execution is completed;
- read the state of the channels at the end of the programming sequence using CH_INDEX[4..0], FAIL_CH, PASS_CH and VALID_CH.

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Power Supply connector

FlashRunner HS Control Unit is powered through 15V power supply up to 10A.

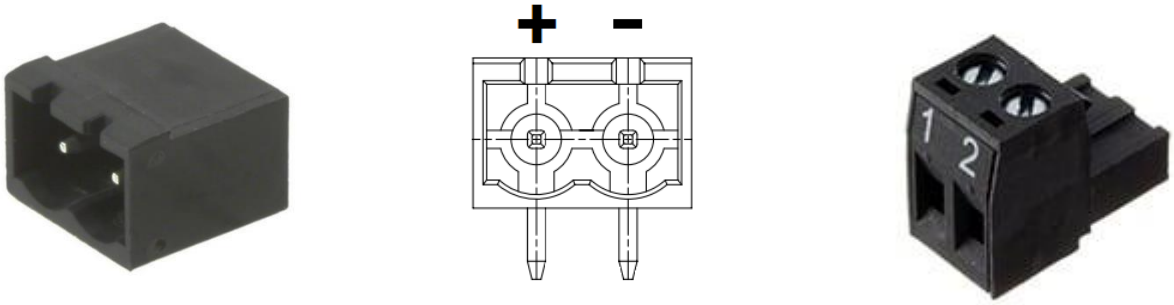


Figure 15: FlashRunner HS Control Unit – Power supply connector and mating connector

Connector part-number: Molex 0395321002
Mating connector part-number: Molex 0395300102

USB-C port connector

FlashRunner HS Control Unit is equipped with 8 USB-C ports to connect as many Active Module or Active Module Plus. Power supply is provided to the Control Unit through the dedicated connector and then distributed to the peripheral modules through the USB-C ports.



Figure 16: FlashRunner HS Control Unit – USB-C port

Connector part-number: Molex 105450-0101

Please use the USB-C cables provided by SMH Technologies to connect FlashRunner HS Control Unit and FlashRunner HS Active Modules.

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FlashRunner HS Active Module and Active Module Plus

FlashRunner HS Active Modules and Active Modules Plus are all equipped with a USB-C port to be connected to FlashRunner HS Control Unit. In addition, FlashRunner HS Active Modules Plus are equipped with an auxiliary input power connector. The other connectors depends on the specific type of Active Module.

Please refer to the FlashRunner HS Active Module User's Manual or FlashRunner HS Active Module Plus User's Manual to obtain further information.

USB-C port connector

FlashRunner HS Active Module and Active Module Plus are equipped with one USB-C ports to be connected to the FlashRunner HS Control Unit. Active Modules receive data, commands and power supply from this connector from the Control Unit. The data throughput to and from the related Control Unit is 250MB/s for each direction (full-duplex mode). Power supply provided to Active Module is 15V and up to 1A. The maximum length of the connection is 6 meters.

The USB-C connector used is the same employed on the Control Unit.

Additional power supply

FlashRunner HS Active Module Plus can be, optionally, powered through a 15V power supply (up to 5A) connected to a DC power jack connector. For instance, USB4 Active Module Plus should be powered with the additional power supply in case of significant power requirement by the USB ports. Please refer to Technical Specification for a detailed parameters description.

Connector part-number: Same Sky (formerly CUI Devices) PJ-202AH
Mating plug connector: Same Sky (formerly CUI Devices) PP3-002AH

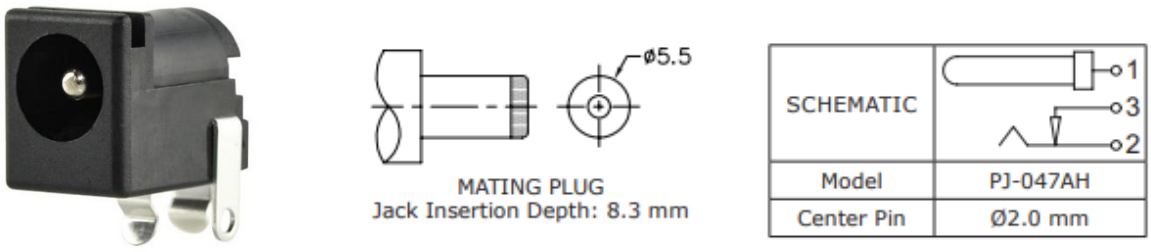


Figure 17: FlashRunner HS – Active Module Plus - Power Supply connector

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Programming system sizes

FlashRunner HS Control Unit

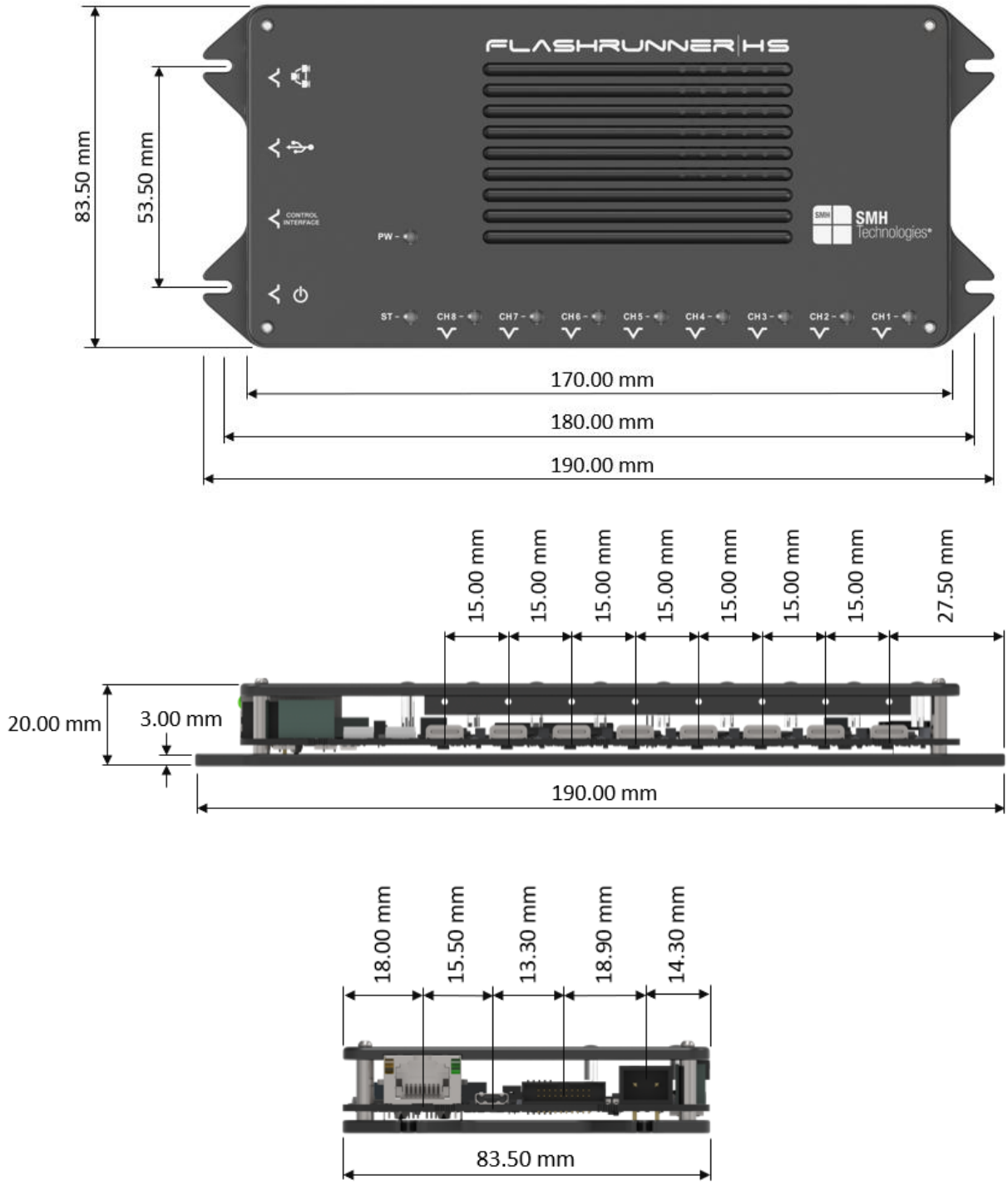


Figure 20: FlashRunner HS Control Unit - sizes

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FlashRunner HS Active Modules and Active Module Plus

The sizes of the Active Module and Active Module Plus are listed in the below table.

Active Module		Sizes
GP-2	without case	66mm x 40mm x 9mm
	with case	66mm x 40mm x 15mm
	with relay barrier	66mm x 40mm x 28mm
GP-4	without case	63mm x 80mm x 9mm
	with case	63mm x 80mm x 15mm
	with relay barrier	63mm x 80mm x 28mm
eMMC-1	without case	63mm x 32mm x 9mm
	with case	63mm x 32mm x 15mm
	with relay barrier	63mm x 32mm x 28mm
eMMC-2	without case	63mm x 64mm x 9mm
	with case	63mm x 64mm x 15mm
	with relay barrier	63mm x 64mm x 28mm
8SPI-1	without case	63mm x 32mm x 9mm
	with case	63mm x 32mm x 15mm
	with relay barrier	63mm x 32mm x 28mm
8SPI-2	without case	63mm x 64mm x 9mm
	with case	63mm x 64mm x 15mm
	with relay barrier	63mm x 64mm x 28mm
NAND-1	without case	63mm x 64mm x 9mm
	with case	63mm x 64mm x 15mm
	with relay barrier	63mm x 64mm x 28mm
CAN-4	without case	63mm x 80mm x 9mm
	with case	63mm x 80mm x 15mm
	with relay barrier	63mm x 80mm x 28mm
UFS-1	with case	73.8mm x 83.8mm x 33mm
USB-4	with case	73.8mm x 83.8mm x 33mm
AETH-4	with case	73.8mm x 83.8mm x 33mm

Please refer to the FlashRunner HS Active Module User's Manual or FlashRunner HS Active Module Plus User's Manual to obtain further information.

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Programming system technical Specifications

FlashRunner HS Control Unit

Absolute Maximum Ratings

Parameter	Value
"POWER" Connector	
Supply voltage on line POWER (reference GND)	+17V
Control Interface Connector	
Maximum input voltage on lines START_PRJ, PRJ_SEL[4..0]	-2V to +20V
Maximum current on lines BUSY, CH_INDEX[4..0], PASS_CH, FAIL_CH, VALID_CH	±10mA

Table 5: FlashRunner HS – Abolute maximum ratings

DC Characteristics and Functional Operating Range

Parameter	Condition	Value		
		Min	Typ	Max
"POWER" Connector				
Supply voltage		14,5V	-	15,5V
Supply current		-	-	9.6A
Power consumption		-	-	140W
Control Interface Connector				
V_{IL} (input low voltage) on lines START_PRJ, PRJ_SEL[4..0]		0V	-	0.8V
V_{IH} (input high voltage) on lines START_PRJ, PRJ_SEL[4..0]		2.4V	-	15V
V_{OL} (output low voltage) on lines BUSY, CH_INDEX[4..0], PASS_CH, FAIL_CH, VALID_CH	I_{OL} = 4mA	-	-	0.8V
V_{OH} (output high voltage) on lines BUSY, CH_INDEX[4..0], PASS_CH, FAIL_CH, VALID_CH		4.5V	-	5.5V

Table 6: FlashRunner HS – DC characteristics and functional operating range

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Physical and Environmental Specifications

Parameter	Value
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

Table 7: FlashRunner HS – DC characteristics and functional operating range

Note: *Keep FlashRunner HS **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.*

FlashRunner HS Active Module and Active Module Plus

Please refer to the FlashRunner HS Active Module User's Manual or FlashRunner HS Active Module Plus User's Manual to obtain further information.

Programming system package checklist

FlashRunner HS Control Unit

Qty.	Description
1	FlashRunner HS Control Unit 4L or 8L
1	Ethernet cross cable 2 meter RJ45
1	USB 2.0 cable 1.8 meter (type-A to type-B micro)
1	15V 140W AC/DC Wall Switching Power Adapter
1	3-Year Warranty Sheet
1	FR_HS_CU Pinout Reference
1	FR_HS_CU Quick Start Guide
1	FR_HS_CU Connection Reference Document

Table 3: FlashRunner HS Control Unit package checklist

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Programming system setup

The present section explains how to set up FlashRunner HS for the first time from a software and hardware point of view. In the following, **it gives some fundamental directions on how to manage correctly the software update in a production environment**.

Workbench Graphical User Interface (GUI)

FlashRunner Workbench GUI offers several fundamental features to set up quickly the programming system according to the project requirements:

- check projects features through the **Project Setup** tab;
- run projects through the **Production Control** tab;
- create a new project using the wizard application to be guided in device selection, protocol parameters selection, ISP channels management, user data selection, programming phases and parameters choice;
- modify an existing project through the wizard application or manual **Project Editor** tab;
- open a previously created project;
- user data management to be guided in a proper programming data generation according to the device memory map;
- discover the programming system ISP connector pinout according to the current project;
- explore, upload and download data stored into the programming system (projects, user data, device drivers, licenses, log files,…);
- send commands through text terminal;
- check programming system time-stamped activities through Real-Time Log;
- setup Cybersecurity features through **Cyber Security** tab.

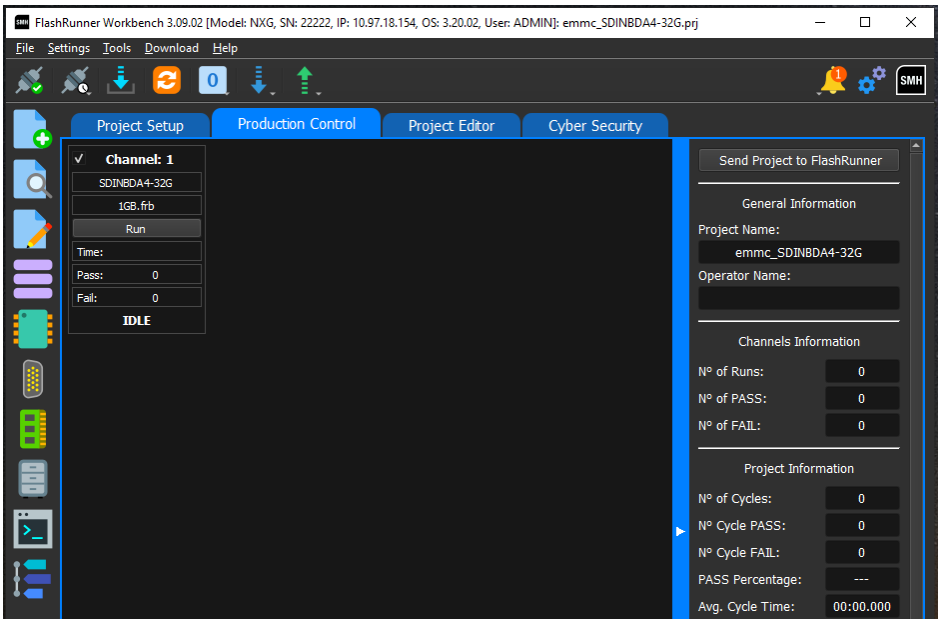


Figure 20: FlashRunner Workbench Graphical User Interface (GUI)

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Workbench GUI application can be used when the programming system is connected to a host-system such as a PC system through LAN Ethernet or USB-UART interface in **host mode**. The programming system can be driven also through the Control Interface in **stand-alone mode**. Projects previously defined and stored into the programming system, together with their user data, can be easily triggered. Morover, the results of the programming sequence can be detected in a concise manner.

Please refer to FlashRunner 2.0 Programmer's Manual for further details.

Hardware setup

Please follow the steps below to set up FlashRunner HS programming system:

- power up FlashRunner HS Control Unit and Active Modules;
- connect FlashRunner HS Control Unit to a host system (host mode);
- setting up LAN Ethernet or USB-UART of the programming system;
- verify the connection between Control Unit and Active Modules;
- interface FlashRunner HS Active Module with the target devices (i.e. DUTs).

Power up FlashRunner HS Control Unit

Using the included power supply adapter and cable, provide the power supply to the Control Unit of the programming system. The power supply is provided to the Active Modules by the Control Unit through the USB-C cables. Please refer to the Hardware overview for further details.

Connecting FlashRunner HS Control Unit to a host system

Assuming to employ the programming system in host mode, we can connect FlashRunner HS Control Unit to a host system, such as a PC system, through USB-UART interface or LAN Ethernet interface. The connectors used have been already described in the Hardware overview section. Moreover, the proper cables are included into the programming system package.

Setting up connection parameters

To connect the programming system through LAN Ethernet connection, use the **factory default IP address 192.168.1.100**, or, if it is unknown, configure it through the USB-UART connection following the below steps:

- connect the programming system to the host system through USB-UART interface using the included USB cable;
- open the Workbench GUI;
- open Workbench Settings window clicking on Settings/Settings;

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- chose Serial as FlashRunner Connection Type and chose the proper Com Port;
- close Workbench Settings window clicking OK;
- connect the host system to the programming system clicking the button 
- open the Terminal window and click on the SETIP button;
- insert the proper network parameters and wait for the automatic system reboot;

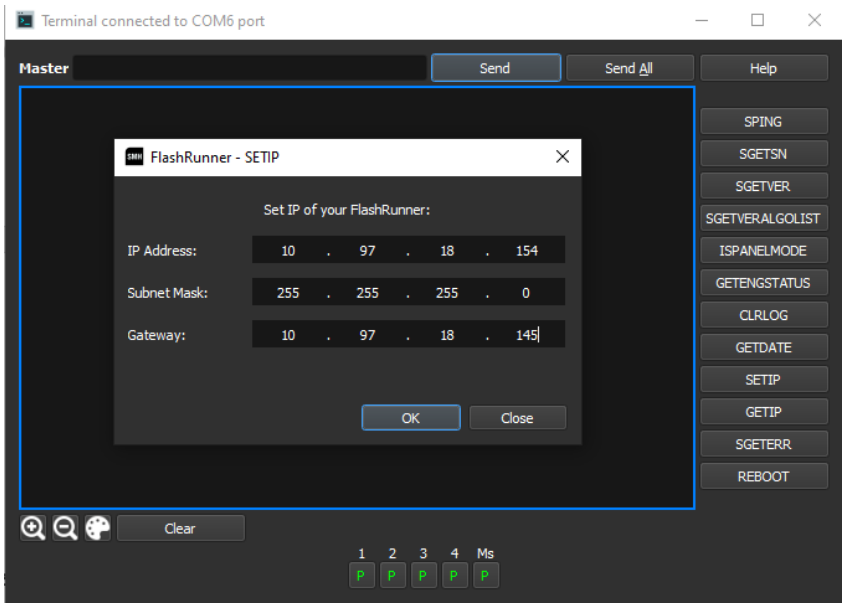


Figure 21: FlashRunner Workbench Graphical User Interface (GUI) – SETIP function

- once the system has completed the reboot, open Workbench Settings window clicking on Settings/Settings;
- chose LAN as FlashRunner Connection Type and chose the proper LAN IP address;
- close Workbench Settings window clicking OK;
- connect the host system to the programming system clicking the button 

Please refer to FlashRunner 2.0 Programmer's Manual for further details.

Verify the connection between Control Unit and Active Modules

The connection of the Active Modules to the Control Unit can be verified through the Workbench GUI using the HS Detect Configuration (clicking on Tools\FlashRunner HS\HS Detect Configuration). Once FlashRunner HS Control Unit is power supplied and all the Active Modules are connected to the Control Unit, just opening this tool allows to discover which are the peripheral modules connected to FlashRunner HS platform. In the picture below, the detection procedure has been applied to a configuration composed by a Control Unit with two GP4 Active Modules, connected on USB-C port 1 and USB-C port 2, making available 8 device interfaces (CH1..CH8).

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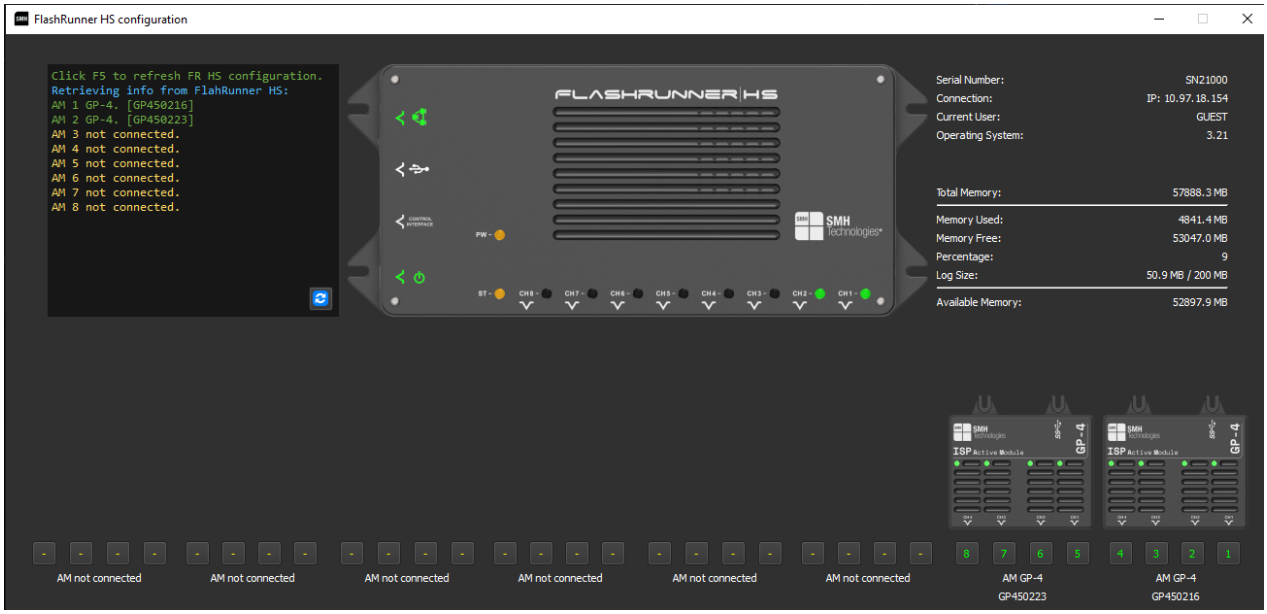


Figure 21: FlashRunner Workbench Graphical User Interface (GUI) – HS Detect Configuration tool

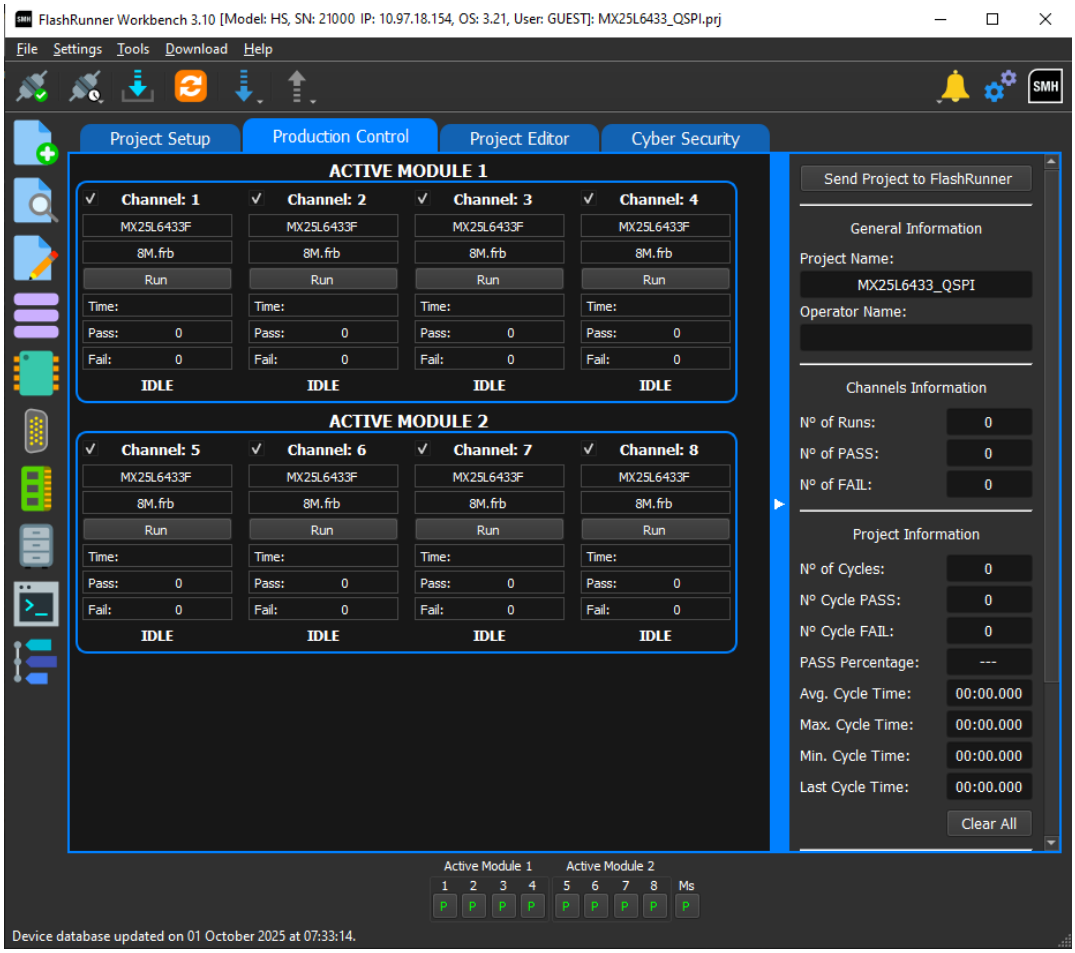


Figure 21: FlashRunner Workbench Graphical User Interface (GUI) – Production Control tab

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Interface FlashRunner HS Active Module with the target device

Build the required ISP cables to establish a connection between FlashRunner HS Active Module ISP connectors and the target devices. The best way to discover the ISP connectors pinout is through the Pin Map tool of the Workbench GUI software application (working also when the programming system is not connected, just opening the related project).

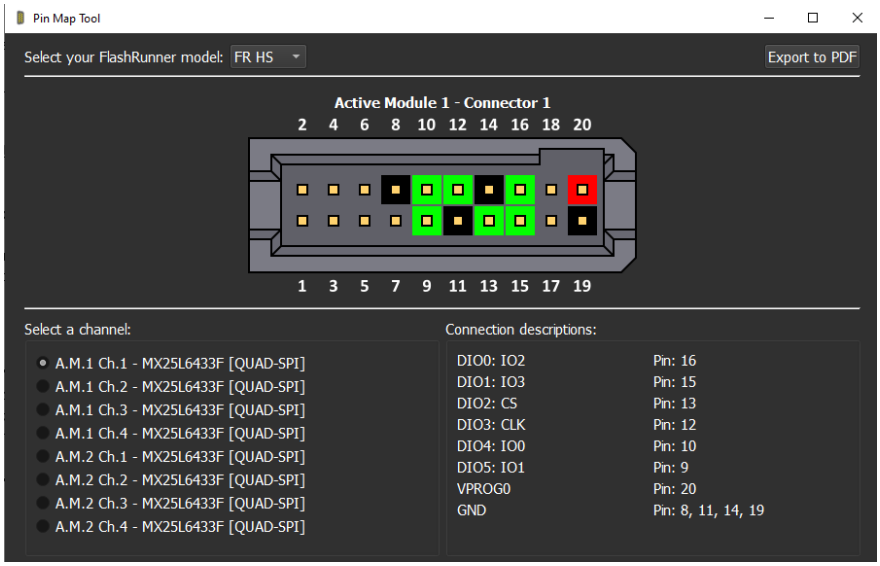


Figure 20: FlashRunner Workbench Graphical User Interface (GUI) – Pin Map tool

Moreover, similar information regarding this matter can be spotted in the ISP connectors section of the FlashRunner HS Active Module User's Manual or FlashRunner HS Active Module Plus User's Manual and on the Project Setup tab of the Workbench GUI software application.

Note: *connect very carefully communication lines, ground references and power supply lines of target devices and boards; an incorrect connection of the devices can cause a severe damage both to the customer's hardware and to the programming system.*

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Software update in production environment

FlashRunner HS programming systems employ a comprehensive set of software packages, also known as **Operating System**, to guarantee the programmer's general operations and several **Device Drivers**, also known as algorithm**,** to support the specific communication protocols and devices.

Operating System and Device Drivers evolve in order to introduce new features and parameters, to increase performance in terms of programming speed and, although rarely, to correct inaccuracies in the previous versions. When such software packages are updated, the new software released is subjected to in-depth testing procedures using several ISP devices that well represents those available in the relevant device class to that device driver. The new software is therefore released with the guarantee of having tested the updated software along substantial number of hardware configurations with complete coverage of the configuration parameters.

Please consider that the software is used on a hardware system (i.e. programming system, integration wiring and connections, bed of nails) that is only partially controlled by SMH Technologies. Infact the programming setup implemented by the customer, fully verified and validated by the customer itself, is rarely disclosed and cannot be replicated by SMH Technologies.



If the customer decides, for any reasons, to update the programming system software (i.e. operating system, device drivers) in a already verified and validated hardware/software configuration, **the customer must proceed on its own with a new verification and validation procedure**.

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Industrial interconnection for FlashRunner HS integration

FlashRunner HS architecture brings several benefits in term of signal integrity improvement and flashing performance. FlashRunner HS Control Unit can be placed in the machinery, becoming a capitalizable cost, and used for several different projects. Conversely, to obtain all the advantages allowed by this architercture, Active Modules have to be, conveniently, placed inside the fixture (Interchangeable Test Adapter) at least for the high performance Active Module such as UFS, eMMC, 8SPI and Parallel NAND.

The connection between Control Unit and Active Modules through USB-C cables is featured by a very high communication frequency (up to 2.5GHz). If FlashRunner HS has to be integrated into a machinery featured by interchangeable sections (fixtures), a proper industrial interconnection has to be employed to support the signals needed to establish the communication. In addition to the performance in term of signal frequency, the industrial interconnection shall guarantee also a high minimum number of mating cycles (more than 100.000). Among the industrial interconnection on the market, we chose VTAC Interconnection provided by Virginia Panel Corporation and ODU Silver Line Interconnection provided by ODU.

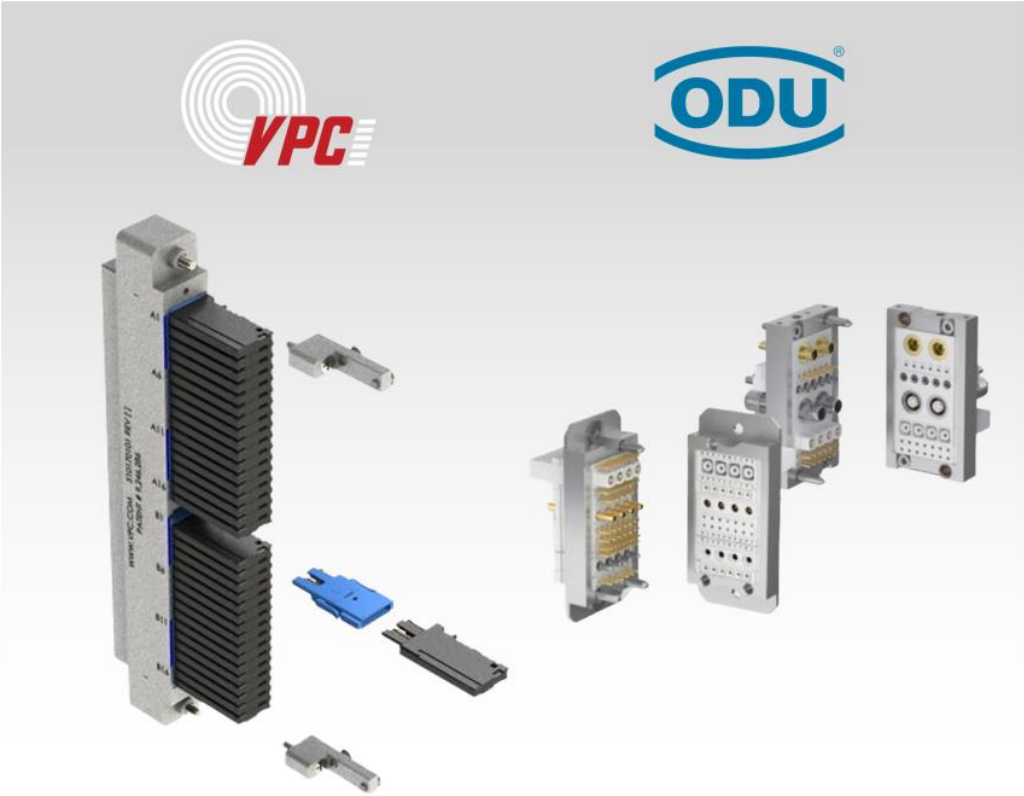


Figure 20: High-performance industrial interconnection system provided by VPC and ODU

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VPC Industrial Interconnection – 8 USB-C cables to cables

A high performance Junction Box can be implemented with this industrial interconnection that supports up to 8 USB-C links between machine and fixture (interchangeable part) allowing the installation of up to 8 Active Modules into the fixture.

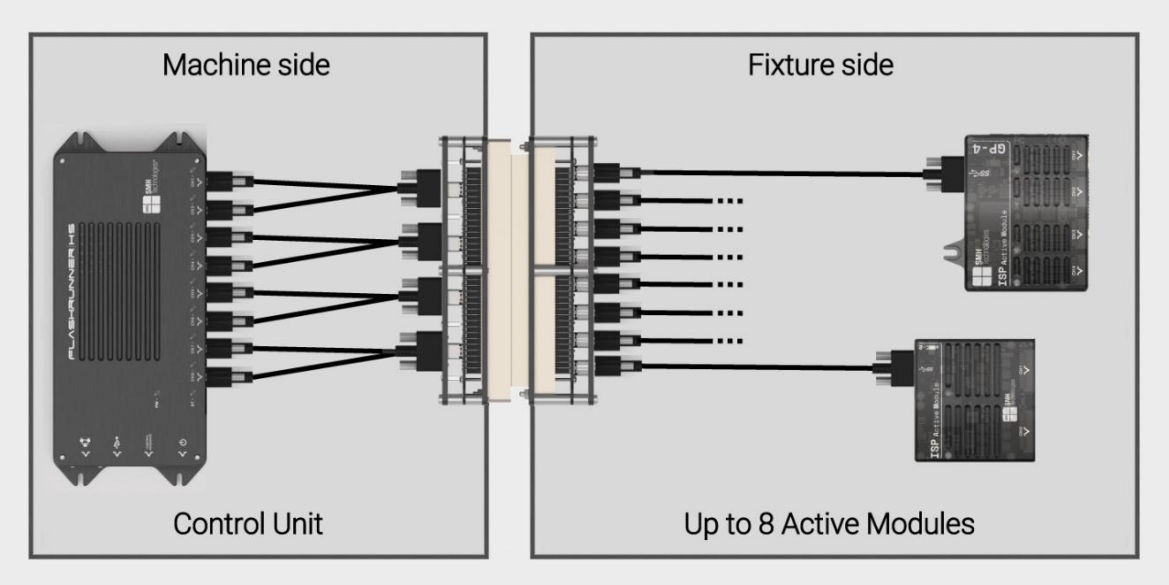


Figure 48: FlashRunner HS architecture – Control Unit on the machine side and up to 8 Active Modules on the fixture side

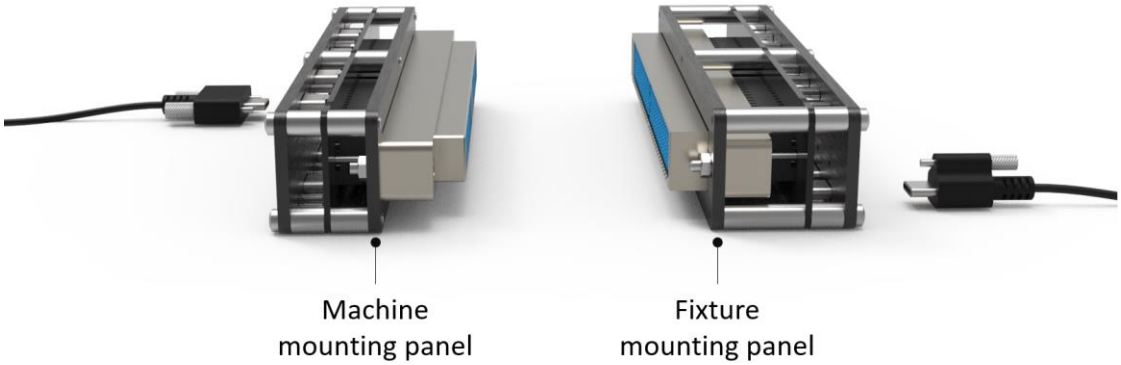


Figure 49: FlashRunner HS VPC 8 USB-C interconnection – from left to right: USB-C cable coming from Control, VPC 8 USB-C interconnection machine side, VPC 8 USB-C interconnection fixture side, USB-C cable towards Active Module

Description	Part Number
Junction Box VPC8-USBC – Machinery Side	JB-VPC8-MAC
Junction Box VPC8-USBC – Fixture Side	JB-VPC8-FIX

Machine and fixture mounting panels are showed just to made clear how the interconnection shall be mounted on the customer's system. Please refer to SMH Technologies Support Service (support@smh-tech.com) to request drawings and 3D step files of the mounting panels.

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VPC Industrial Interconnection – 8 USB-C Direct Plug to cables

A high performance Junction Box can be implemented with this industrial interconnection that supports up to 8 USB-C links between machine (direct plug connection) and fixture (interchangeable part) allowing the installation of up to 8 Active Modules inside the fixture.

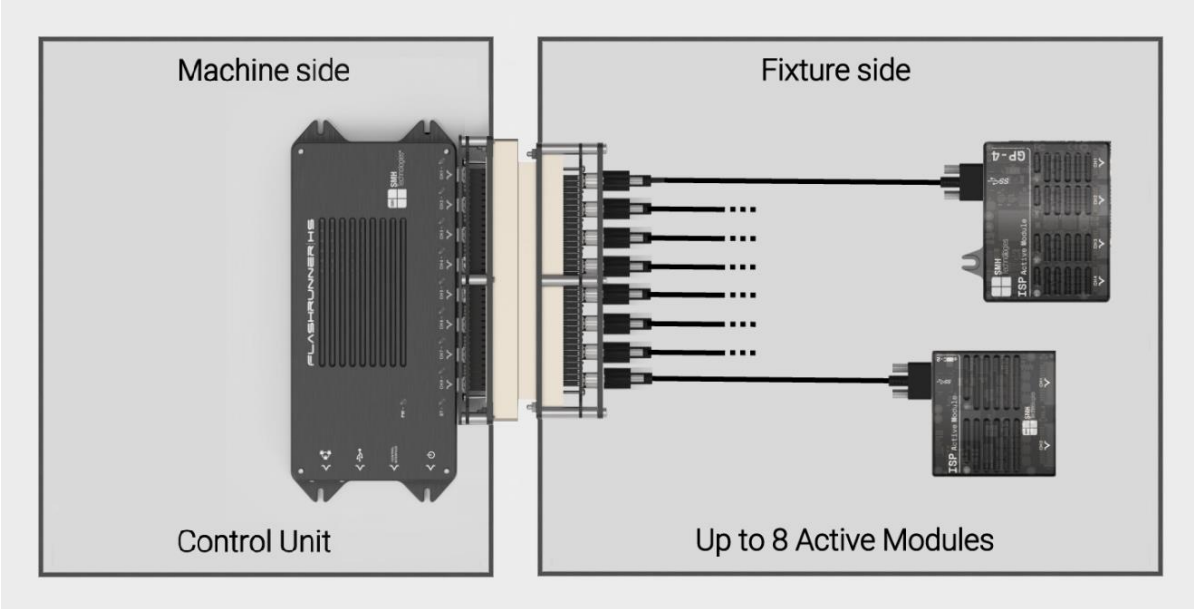


Figure 50: FlashRunner HS architecture – Control Unit on the machine side and up to 8 Active Modules on the fixture side

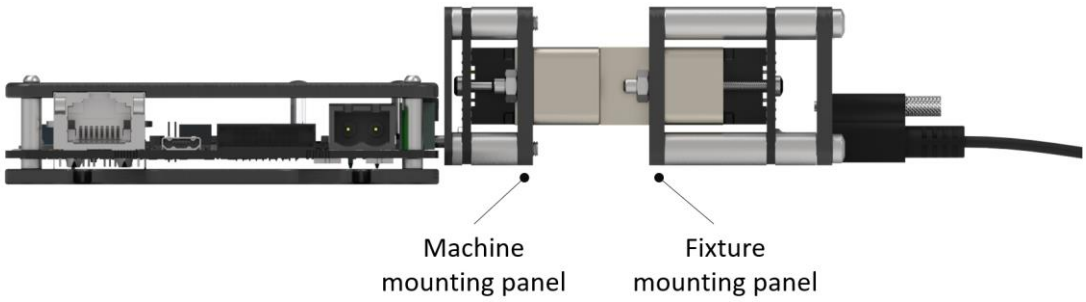


Figure 51: FlashRunner HS VPC 8 USB-C Direct Plug interconnection side view – from left to right: Control Unit, VPC 8 USB-C Direct Plug machine side, VPC 8 USB-C fixture side, USB-C cables towards Active Modules

Description	Part Number
Junction Box VPC8-USBC – Machinery Side – Direct Plug	JB-VPC8-DP
Junction Box VPC8-USBC – Fixture Side	JB-VPC8-FIX

Machine and fixture mounting panels are showed just to made clear how the interconnection shall be mounted on the customer's system. Please refer to SMH Technologies Support Service (support@smh-tech.com) to request drawings and 3D step files of the mounting panels.

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ODU Industrial Interconnection – 4 USB-C cables to cables

A high performance Junction Box can be implemented with this industrial interconnection that supports up to 4 USB-C links between machine and fixture (interchangeable part) allowing the installation of up to 4 Active Modules inside the fixture.

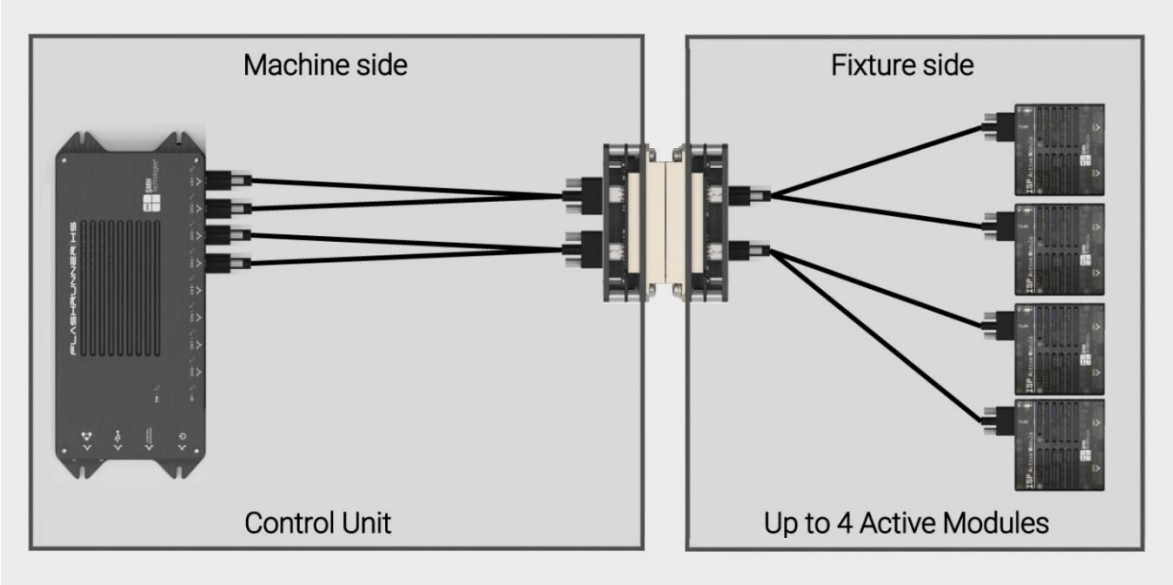


Figure 52: FlashRunner HS architecture – Control Unit on the machine side and up to 4 Active Modules on the fixture side

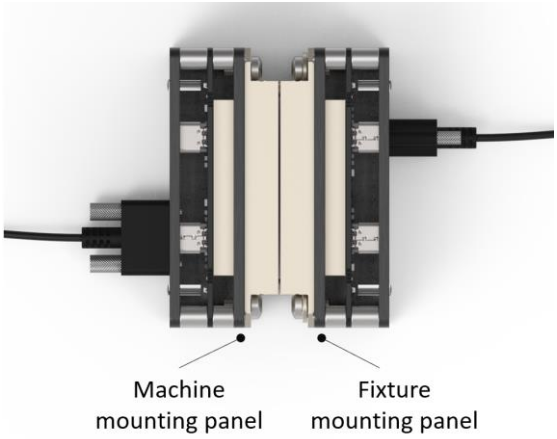


Figure 53: FlashRunner HS ODU 4 USB-C interconnection side view – from left to right: USB-C cable coming from Control Unit, ODU 4 USB-C interconnection machine side, ODU 4 USB-C interconnection fixture side, USB-C cable towards Active Module

Description	Part Number
Junction Box ODU4M-USBC – Machinery Side	JB-ODU4-MAC
Junction Box ODU4F-USBC – Fixture Side	JB-ODU4-FIX

Machine and fixture mounting panels are showed just to made clear how the interconnection shall be mounted on the customer's system. Please refer to SMH Technologies Support Service (support@smh-tech.com) to request drawings and 3D step files of the mounting panels.

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ODU Industrial Interconnection – 2 USB-C cables to cables

A high performance Junction Box can be implemented with this industrial interconnection that supports up to 2 USB-C links between machine and fixture (interchangeable part) allowing the installation of up to 2 Active Modules inside the fixture.

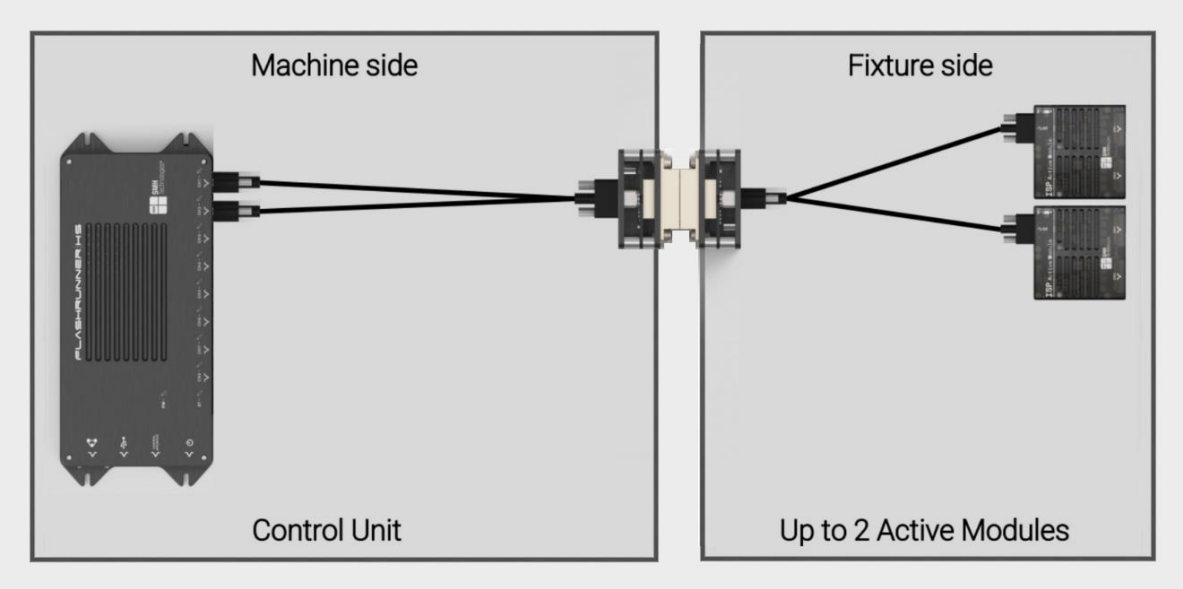


Figure 54: FlashRunner HS architecture – Control Unit on the machine side and up to 2 Active Modules on the fixture side

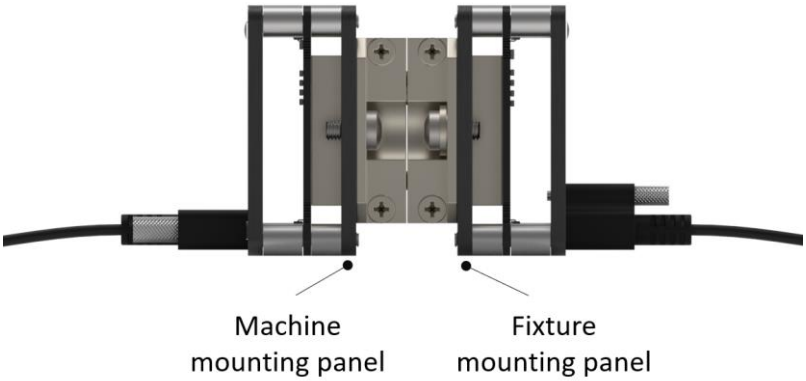


Figure 55: FlashRunner HS ODU 2 USB-C interconnection side view – from left to right: USB-C cable coming from Control Unit, ODU 2 USB-C interconnection machine side, ODU 2 USB-C interconnection fixture side, USB-C cable towards Active Module

Description	Part Number
Junction Box ODU2M-USBC – Machinery Side	JB-ODU2-MAC
Junction Box ODU2F-USBC – Fixture Side	JB-ODU2-FIX

Machine and fixture mounting panels are showed just to made clear how the interconnection shall be mounted on the customer's system. Please refer to SMH Technologies Support Service (support@smh-tech.com) to request drawings and 3D step files of the mounting panels.

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Hybrid interconnection – typical application

Although the Active Modules have been conceived to stay inside the fixture to optimize the performance and the signal integrity, there are some conditions in which the Active Module can conveniently stay outside of the fixture on the machine side. This happens when low performance protocols have to be implemented: if the signal frequency is low or if the requirements in terms of programming time are not very constraining. In the following figure, up to 4 Active Modules can be installed inside the fixture, likely high performance module such as UFS, eMMC, 8SPI or Parallel NAND, and up to 4 Active Module can be installed on the machine side. This allows to find a tradeoff between performance and cost since the investiment of the Active Module outside the fixture can be easily capitalizable on several projects. Signals generated by the Active Module on the machine side can be brought into the fixture using the usual interconnection such as connectors or pylon blocks.

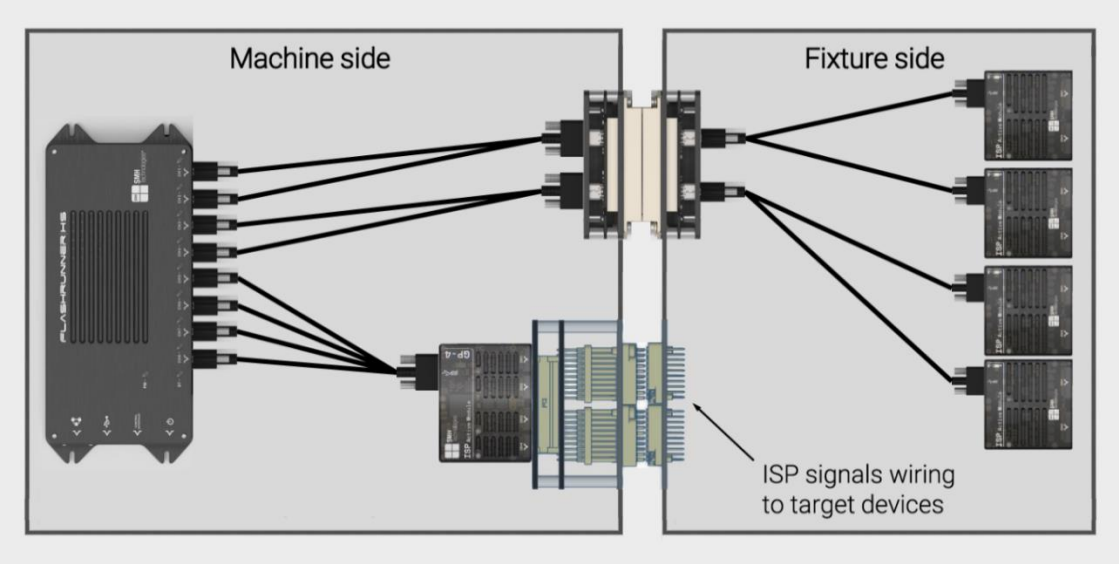


Figure 56: FlashRunner HS architecture – Control Unit on the machine side,
up to 4 Active Modules on the machine side and up to 4 Active Modules on the fixture side

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