SMH Technologies®

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Driver v. 2.01

Marco Burzo

Interfacing FlashRunner 2.0 with ELMOS_LIN

SMH Technologies S.r.l.

UNIVERSAL PRODUCTION IN-SYSTEM PROGRAMMING

HQ and Registered Office
Via Giovanni Agnelli 1
33083 Villotta di Chions (PN) Italy
Società Unipersonale

Capitale sociale €102.040
P.I. 01697470936
C.F. 01697470936
REA PN-97255

D-U-N-S® 51-724-9350
T + 39 0434 421 111
F + 39 0434 639 021

→smh-tech.com

info@smh-tech.com

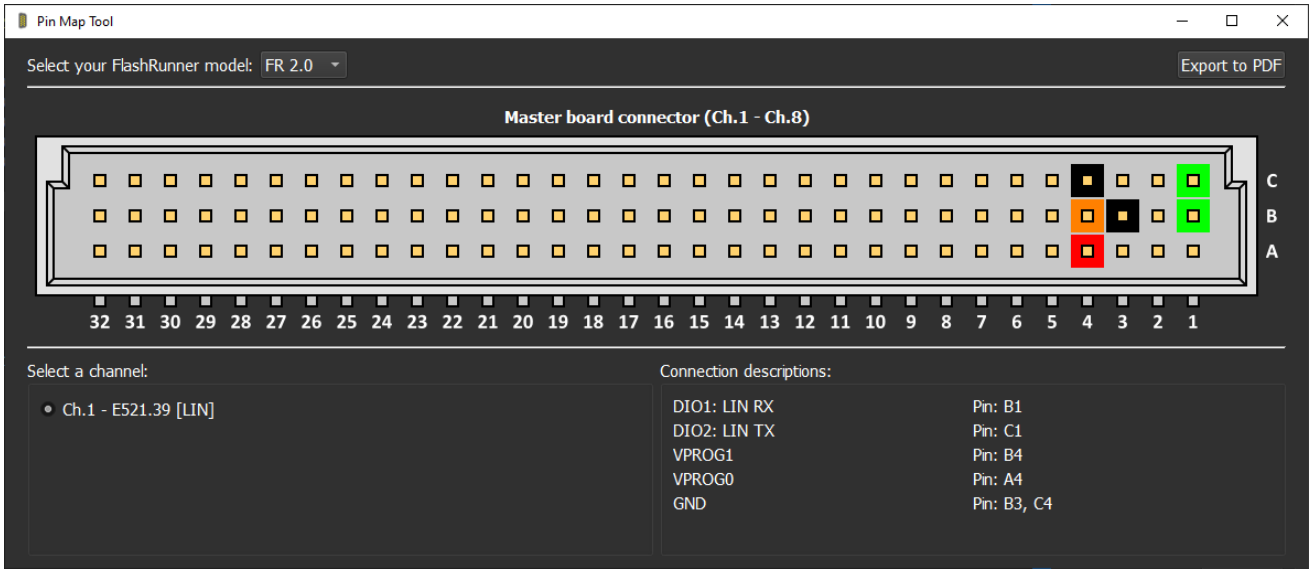
ELMOS LIN Protocol, Pin Map and Memory Map

The driver *ELMOS LIN* supports some of the ELMOS microcontrollers with LIN interface.

ELMOS LIN driver supports only LIN protocol. Baudrates between 2500 bps and 120000 bps are supported. The driver will automatically calculate the closest accepted baudrate by the device.

```
#TCSETPAR CMODE <LIN>
```

ELMOS LIN PIN MAP



LIN: (External Hardware VPROG1_LEVEL_SHIFTER_PC10719)

The following PIN MAP refers to the external hardware released by SMH Technologies.

- DIO 1 - TRANSCEIVER RX
- DIO 2 - TRANSCEIVER TX

ELMOS LIN MEMORIES

Supported Memories for E521.39

- **Flash [F]**: addresses 0x8000-FFFF. Fully programmable.
- **EEPROM (NVM) [N]**: addresses 0x400-46F. Can be programmed without being erased first. The addresses 0x470-0x47F are reserved for the Runtime Configuration registers, and thus they are not programmable.
- **User Configuration [U]**: addresses 0x1200-13FF. Fully programmable.
- **Static Configuration [S]**: addresses 0x1000-11FF, read-only.
- **Key (virtual address) [K]**: addresses 0x60000-60007. Used only with dynamic memory to send the key to the device for key protected operations.

Supported Memories for E523.62-63

- **Flash [F]**: addresses 0x0000-FFFF. Fully programmable.
- **EEPROM [E]s**: addresses 0x04000000-040001FF.

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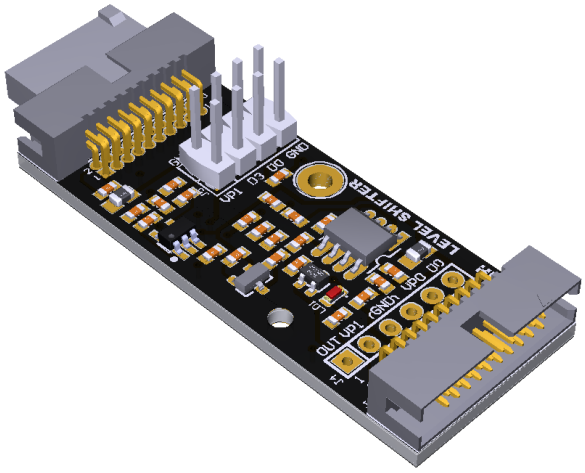
ELMOS LIN SMH LIN ADAPTER

The LIN Adapter for FlashRunner 2.0 and FlashRunner LAN 2.0 Next Generation is a compact high-integration device that converts the signals from the FlashRunner 2.0 output port to the levels of the LIN Bus.



Board: **PC10719**

The microcontroller lines needed to program a device through LIN protocol are the following:

LIN_IO: Data RX/TX.
VSUP: Device Power Supply Voltage.
GND: Device Power Supply Ground.

When the FlashRunner 2.0 is interfaced through our adapter VP1_EXT power supply line voltage can be in the range 2.7 V – 27 V. The pull-up resistor is directly integrated into the adapter board with no need for external components.

Typically, a value of 0.6 V of dropout is present in the power line.
For this reason, if the customer wants to provide 12 V to the board, at least 12.6 V has to be provided.

As a standard, the VP1_OUT line has a fixed output value of 12 V.
If the customer needs a different value on the power or communication line, he has to inform SMH Technologies' Team during the evaluation phase.

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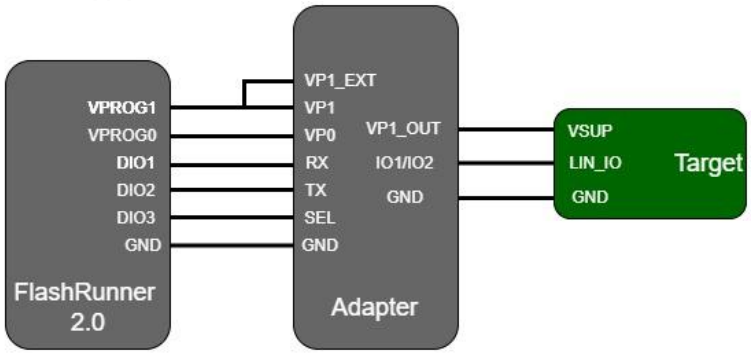
According to customers' needs and configuration, there are two possible layouts of integration:

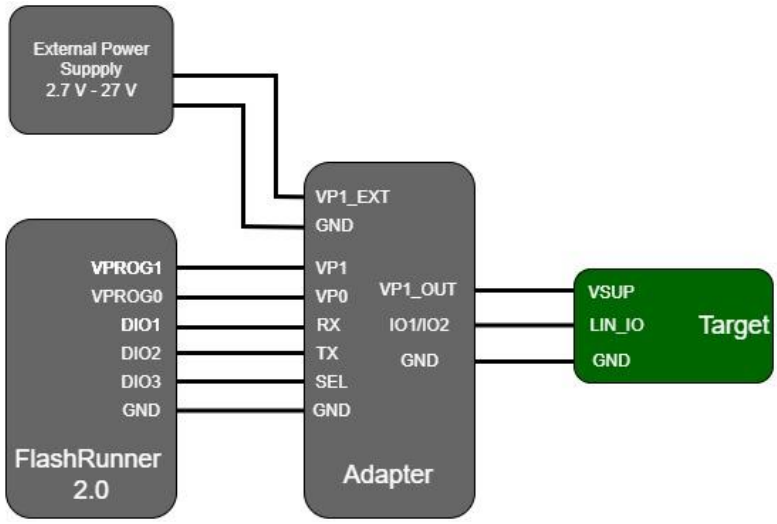
Power Supply from VPROG1:



In this configuration, if the boards are powered using FlashRunner, the limits of the VPROG1 line are applied.

A maximum of 200 mA of current absorption is supported for each channel.
The voltage range is from 13.5 V to 6 V; please take into consideration the dropout value of 0.6 V and that the default voltage output of the Adapter is 12 V.
If another value is needed, the customer has to inform SMH Technologies during the evaluation phase.

Power Supply from an External Power Supply:



In this configuration, the boards are powered by an External Power Supply.
The VP1_EXT input voltage range is from 2.7 V to 27 V; please take into consideration the dropout value of 0.6 V and that the default voltage output of the Adapter is 12 V, so at least 12.6 V has to be provided.

If another value is needed, the customer has to inform SMH Technologies during the evaluation phase.

Important Note:

If FlashRunner 2.0 is used also to power the device (case 1 above), VPROG1 provided by FlashRunner 2.0 shall be connected to both VP1_EXT and VP1 contacts on the J5 connector (see connectors' chapter for more details).
Alternatively, if VP1 is provided directly through J1/J2 then VP1_EXT and VP1 on the J5 connector shall be connected through a jumper socket. In this case, the VPROG1 voltage provided by FlashRunner 2.0 is used also to supply the target device.

If an external power supply is used (case 2 above), VP1_EXT has to be connected to the power supply and VP1 to the VPROG1 of the FlashRunner.

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ELMOS LIN Driver Commands

Here you can find the complete list of all available commands for ELMOS LIN driver.

The letter after the command names specifies on which memory region the command is to be executed:
Many commands support the parameters <start_addr> and <size>, that specify to execute the command, respectively, from which address and for how many addresses.

CONNECT
Powers-on the device, enters programming mode and checks the connection.

MASSERASE <F|N|U>
Erases the selected memory.

BLANKCHECK <F|N|U>, or BLANKCHECK <F|N|U> <start_addr> <size>
Checks that the selected memory is blank by reading back the selected memory.

BLANKCHECK <F|N|U> S, or BLANKCHECK <F|N|U> S <start_addr> <size>
Checks that the selected memory is blank by comparing the expected CRC value, calculated on the selected memory, to the CRC calculated by the device. Warning: This command is not recognized by the FlashRunner Workbench software, and thus it must be added manually to the projects.

PROGRAM <F|N|U>, or PROGRAM <F|N|U> <start_addr> <size>
Programs the selected memory using the data loaded into the FRB file.

VERIFY <F|N|U> R, or VERIFY <F|N|U> R <start_addr> <size>
Verifies that the data written into the selected memory corresponds to the data of the FRB file.

VERIFY <F|N|U> S, or VERIFY <F|N|U> S <start_addr> <size>
Verifies the content of the memory by comparing the expected CRC value, calculated on the selected memory, to the CRC calculated by the device.

READ <F|N|U|S>, or READ <F|N|U|S> <start_addr> <size>
Reads the selected memory, printing it into the terminal.

DUMP <F|N|U|S>, or DUMP <F|N|U|S> <start_addr> <size>
Reads the selected memory, dumping it into the dumping file.

SEARCH_DEVICES
Finds all slave devices searching for all possible NADs.

AUTO_ADDRESSING <SAVE|DONT_SAVE> <NAD1> <NAD2> ...
Executes the auto-addressing procedure, setting the specified NAD values for each device of the daisy-chain. If the saving option is set to SAVE, the new NADs will be permanently stored inside the memory of the devices.

SELECT_DEVICES BROADCAST or SELECT_DEVICES <SEPARATE_ALL|SEPARATE_READS> <NAD1> <NAD2> ...
Selects the transmission mode and NADs to which to communicate with for the commands that follow. Depending on the mode, certain commands will be transmitted in broadcast or separately for each specified NAD.

DISCONNECT
Powers-off the device.

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ELMOS LIN Key Management

If the device is key protected, the driver can use dynamic memory to set it in order to enter.
Take the next project as example:

```
!ENGINEMASK 0x00000001
#LOADDRIVER libelmos_lin.so ELMOS E521 E521.39
#TCSETDEV VDDMIN 5000
#TCSETDEV VDDMAX 5000
#TCSETDEV MEMMAP 0 F 0 0x00008000 0x0000FFFF 0x100 0x4 0 0 0x0 0x0 0xFF 0x0 0
#TCSETDEV MEMMAP 1 N 0 0x00000400 0x0000046F 0x4 0x2 0 0 0x0 0x0 0x0 0x0 0
#TCSETDEV MEMMAP 2 S 0 0x00001000 0x000011FF 0x0 0x0 0 0 0x0 0x0 0xFF 0x0 0
#TCSETDEV MEMMAP 3 U 0 0x00001200 0x000013FF 0x100 0x4 0 0 0x0 0x0 0xFF 0x0 0
#TCSETDEV MEMMAP 4 K 0 0x00060000 0x00060007 0x0 0x0 0 0 0x0 0x0 0x0 0x0 0
!CRC 0xC3027038
#TCSETPAR PROTCLK 120000
#TCSETPAR PWDOWN 100
#TCSETPAR PWUP 100
#TCSETPAR VPROG0 5000
#TCSETPAR VPROG1 12000
#TCSETPAR CMODE LIN
#DYNMEMCLEAR
#DYNMEMSET2 0x00060000 8 AABBCCDDAABBCCDD
#TPSTART
#TPCMD CONNECT
#TPCMD DISCONNECT
#TPEND
#DYNMEMCLEAR
```

By using the command **#DYNMEMSET2** 0x00060000 8 AABBCCDDAABBCCDD we set at address 0x00060000 (virtual address of the key memory section) a key that is 8 byte long. In this case, the key is AABBCCDDAABBCCDD. Command #DYNMEMCLEAR is used to clear the dynamic memory.
For more information about Dynamic Memory, see the FlashRunner Programmer's Manual.

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ELMOS LIN Daisy-Chain Management (Only E521.39)

The elmos lin driver can manage multiple devices on the same LIN bus, setting/changing their NAD and executing commands on single devices, sets of devices or on all devices.
The specific commands for the Daisy-chain management are:

- **SEARCH_DEVICES**: finds all slave devices by searching for all possible NADs. If the devices of the LIN bus are blank, they will all have the NAD 0x01, and thus only one device will be found.
- **AUTO_ADDRESSING**: executes the auto-addressing procedure, setting the specified NAD values for each device of the daisy-chain. These NADs can be permanently stored in the memory of the devices, so that they will keep the new NAD even after a reset.
- **SELECT_DEVICES**: Selects the transmission mode and the NADs to which to communicate with. There are 3 available transmission modes:
    - **BROADCAST mode**: Default mode, transmits using the broadcast NAD 0x7F. All the devices of the daisy-chain will receive the commands sent with this mode. Use this mode when there is only one device on the daisy-chain, or if you want to repeat a command only once for all the devices. All the devices will receive and execute the requests sent by the driver, but only one can respond to the requests, and so the response of the other devices will be lost. Thus, the broadcast option is not suggested for reading commands (BLANKCHECK and VERIFY), on a daisy-chain with more than one device.
    - **SEPARATE_ALL mode**: You can specify a single NAD value, or multiple NADs. The driver will communicate separately with each device, and thus it will repeat the transmissions for each specified NAD. This is the safest mode of transmission for daisy-chains with several devices, but it is also the slowest, since each command must be repeated for each device.
    - **SEPARATE_READS mode**: Intermediate mode between the BROADCAST and SEPARATE_ALL modes. Commands MASSERASE and PROGRAM are transmitted in broadcast, while commands BLANKCHECK and VERIFY are repeated for each device. This allows to reduce the cycle times, since the commands MASSERASE and PROGRAM are done only once.

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