UM11224

ASL5x15 Evaluation boards

Rev. 1 — 28 May 2019

ASL5x15 evaluation boards

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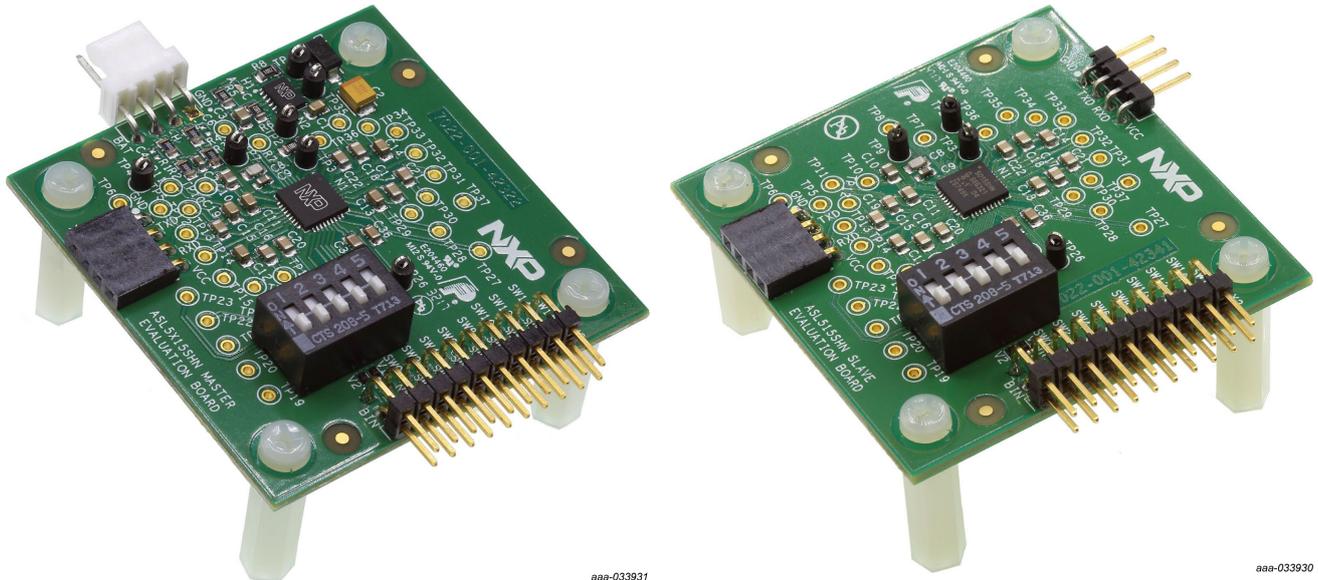
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This evaluation kit is intended for use of ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY. It is provided as a sample IC pre-soldered to a printed circuit board to make it easier to access inputs, outputs, and supply terminals. This evaluation board may be used with any development system or other source of I/O signals. To do so, connect it to the host MCU or computer board via off-the-shelf cables. This evaluation board is not a Reference Design and is not intended to represent a final design recommendation for any particular application. Final device in an application is depending on proper printed circuit board layout and heat sinking design. Also supply filtering, transient suppression, and I/O signal quality will impact the final application.

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1   Getting started

The NXP analog product development boards provide an easy-to-use platform for evaluating NXP products. These development boards support a range of analog, mixed-signal, and power solutions. These boards incorporate monolithic integrated circuits and system-in-package devices that use proven high-volume technology. NXP products offer longer battery life, a smaller form factor, reduced component counts, lower cost, and improved performance in powering state-of-the-art systems.

A description of the board, specifications, links for purchasing, and a list of related documentation can be found at:

www.nxp.com/ASL5015EVBMST or www.nxp.com/ASL5115EVBMST or www.nxp.com/ASL5015EVBSLAV or www.nxp.com/ASL5115EVBSLAV

1.1   Kit contents

The Matrix LED Controller's development kit includes:

• An assembled and tested Master or Slave evaluation board, depending on the order
• A cable harness for power supply and CAN (FD) communication (only in Master sets)

1.2   Additional hardware

To use this kit, you need:

• 12 V power supply. Current requirements depend on intended loads (number of slave boards hanging from Master board). The current consumption of each module has to be considered as 0.015 A
• S32K144EVB-Q100 to control the Matrix LED Controller's evaluation board (only in case of GUI usage)
• The NXP LED Drivers and Controllers application, a Graphical User Interface (GUI), is downloadable by searching for SW491501 in DocStore.
• (Optional) Vector CANoe software (https://www.vector.com/). Already developed simulations available on DocStore
• This kit may be used with the user's own software or different stimuli sources, however those tools are not part of this documentation.
Note: The GUI can be found in DocStore, in the following path: LED drivers and controllers / Evaluation boards / ASL45XASLX41 EVB / GUI for ASL45XASLX41 EVB

1.3   Windows PC workstation

This evaluation board requires a Windows PC workstation. Meeting these minimum specifications should produce great results when working with this evaluation board.

• Windows 10, 8 or 7 compatible PC with an available USB port

1.4   Software

Installing specific software is necessary to work with this evaluation board.

• USB UART driver from PEmicro
If the user has already installed S32K Design Studio tool, then installing USB UART drivers is not necessary, since they are installed already with the Design Studio tool.

2 Getting to know the hardware

2.1 Board overview

The ASL5x15 evaluation boards feature the ASL5x15SHN IC, a highly integrated and flexible Matrix LED Controller (MLC). The kit is designed to drive 12 LEDs or segments with up to 1.5 A maximum current. In a default application, a microprocessor unit (MCU) controls the devices through a Controller Area Network (CAN) interface. The MCU controls the dimming profiles of each individual channel. The ASL5x15SHN also features several diagnostic readings to allow a detection of errors in the system.

The boards are populated with an ASL5x15SHN Matrix LED Controller (MLC). As the MLC ICs in the series are pin compatible to each other, any of the following NXP MLC ICs can be populated on the PCB:

- ASL5015SHN
- ASL5008SHN
- ASL5115SHN
- ASL5108SHN
- ASL5015FHN
- ASL5008FHN
- ASL5115FHN
- ASL5108FHN

The master board is populated with one UJA1163 System Basic Chip (SBC) IC. This enables communication with the microcontroller or Vector CANoe through CAN (FD) protocol. This chip also supplies the MLC populated in the same board and the MLCs populated in the slave boards hanging from the master board. A maximum of nine slave boards can hang from a single master board.

The ASL5x15 evaluation boards can be controlled through the S32K144EVB-Q100 connected to the PC's USB port (SW and drivers available in NXP's DocStore). The GUI (available in NXP's DocStore) allows the user to change the configuration of the devices and send commands to the ASL Matrix ICs. The GUI can also receive status from the ASL Matrix IC. The ASL5x15 evaluation boards can also be controlled through Vector CANoe software (https://www.vector.com/). Vector CANoe's simulations are available in NXP's DocStore.

Figure 1 shows one example of a connection between a master board and a slave board. Up to nine slave boards can hang from a single Master board.
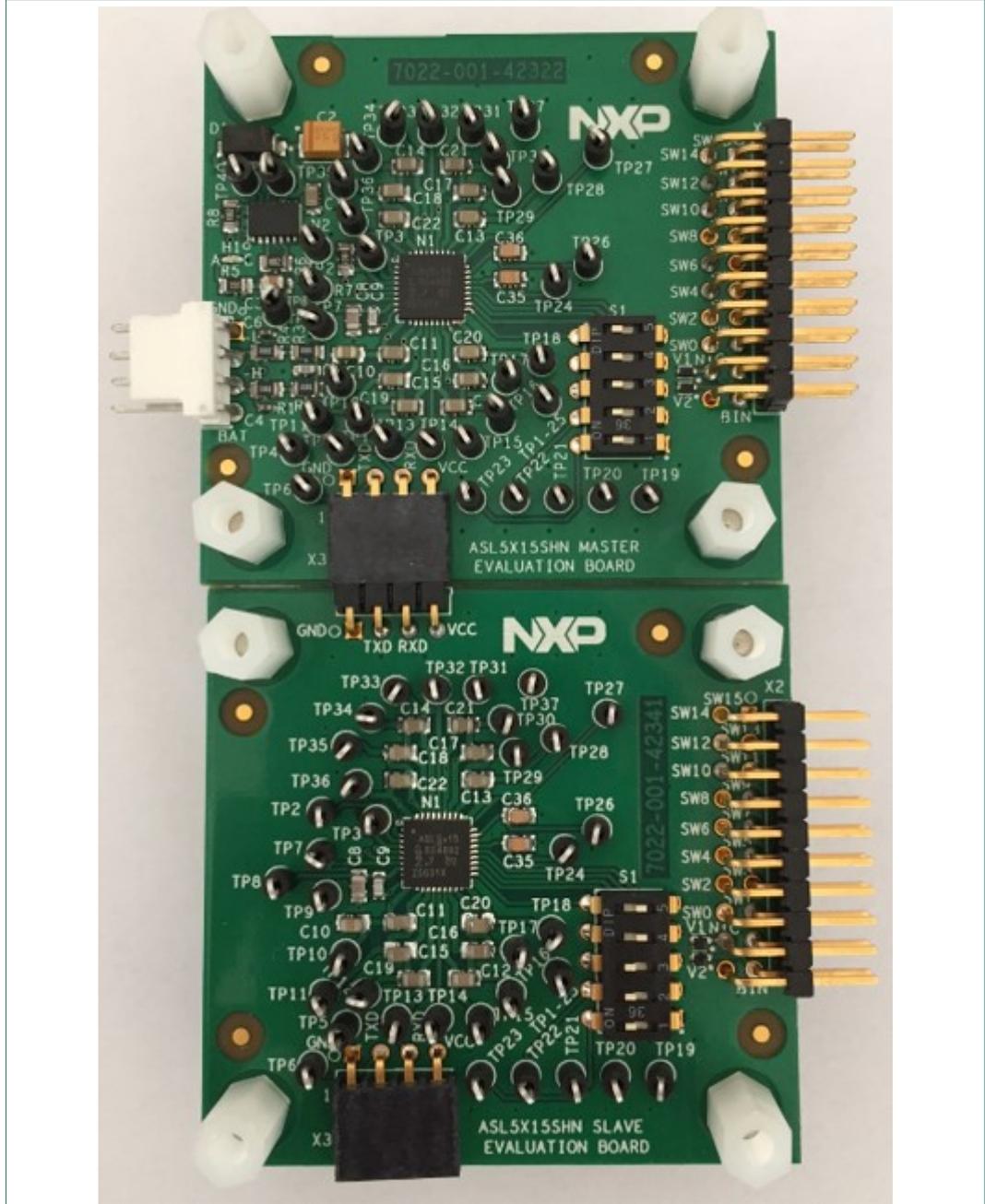
Figure 1. Connection between master and slave evaluation boards

2.1.1 Connectors

See Table 1 for descriptions of the various connectors and pins on the ASL5x15 evaluation boards.

Table 1. Connector X1 Master boards - Power supply + CAN(FD) communication

Pin	Description
1	Ground
2	CAN-L

Pin	Description
3	CAN-H
4	BAT (+12 V)

Table 2. Connector X1 Slaves boards- Connection to Master board or Slave board

Pin	Description
1	Ground
2	TXD
3	RXD
4	VCC

Table 3. Connector X2 - Connection to LED board in Master and Slave boards

Pin	Description
1	SW15
2	SW14
3	SW13
4	SW12
5	SW11
6	SW10
7	SW9
8	SW8
9	SW7
10	SW6
11	SW5
12	SW4
13	SW3
14	SW2
15	SW1
16	SW0
17	NTC
18	NC
19	ID
20	NC

Table 4. Connector X3 - Connection to slave boards

Pin	Description
1	Ground

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Pin	Description
2	TXD
3	RXD
4	VCC

2.2 Board features

The board features include:

- Control of one ASL5x15SHN Matrix LED Controller (MLC) device
- Option to control any NXP ASL5xxxyHN Matrix LED Controller (HVQFN part numbers). All part numbers are pin-to-pin compatible.
- Interface connector to the S32K144EVB-Q100, through CAN protocol communication (only available in master evaluation board)
- Power supply connector (+12 V and GND). Combined with the S32K144EVB-Q100 interface (only available in master evaluation board)
- Interface connector to a single or multiple LED boards
- Dip switch to select device address in CAN bus
- Interface connector to hang a Slave board (see Section 2.1 "Board overview")
- Interface connector to connect to a master board or other slave board (only available in slave evaluation board)

2.3 Boards description

Figure 2 identifies important components on the Master evaluation board (ASL5x15EVBMST)
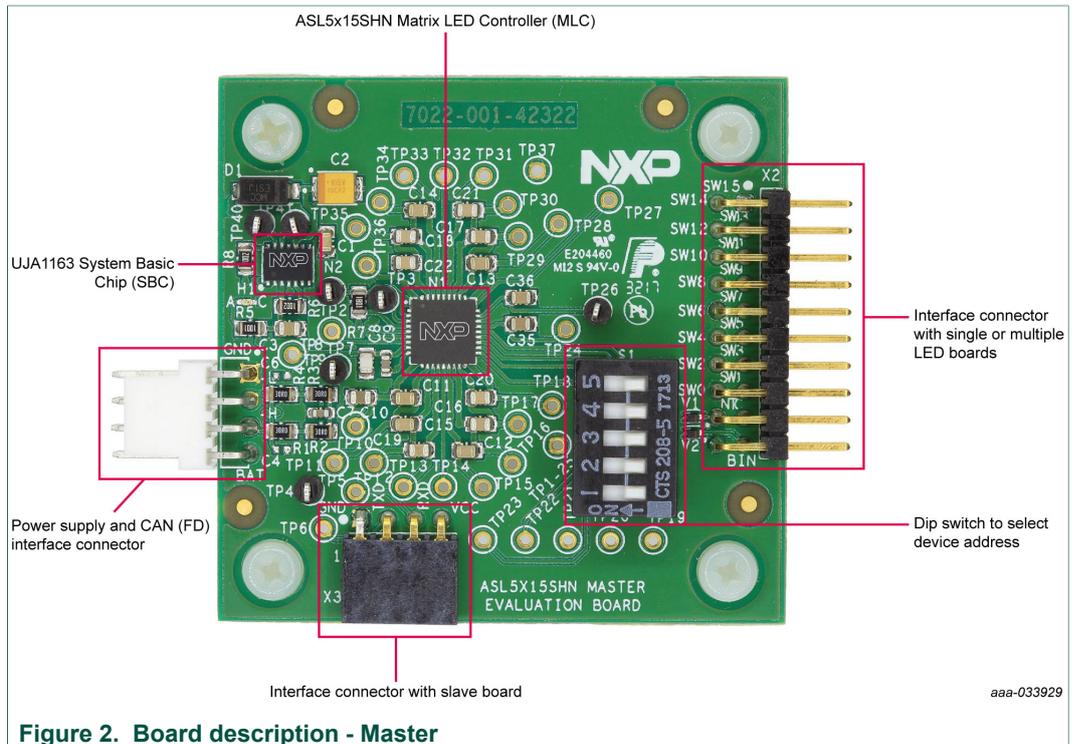

Figure 2. Board description - Master

Figure 3 identifies important components on the Slave evaluation board (ASL5x15EVBSLAV)
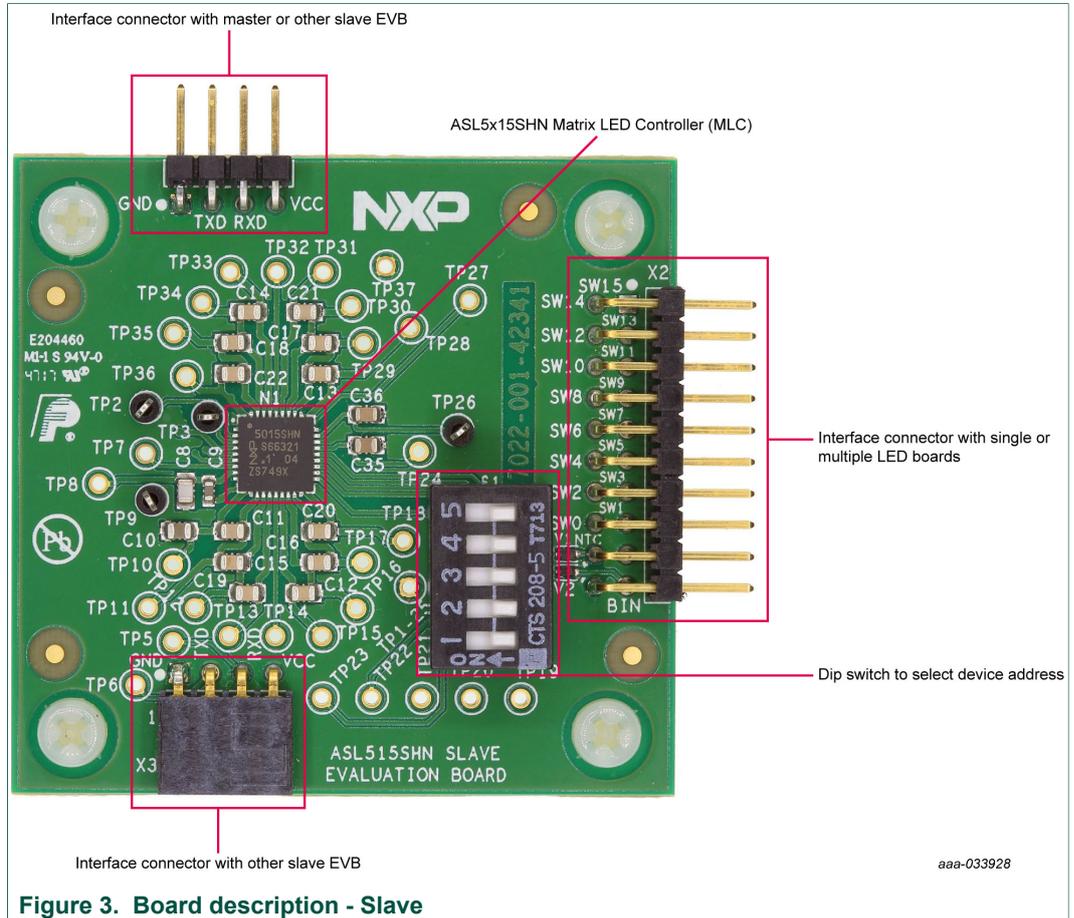

Figure 3. Board description - Slave

2.4 Device address selection

The dip switch is connected to the address pins (A0 to A4) of the ASL5x15SHN MLC IC. The dip switch is used to select the address of the device in the CAN bus. When the switch is ON, the pin Ax is connected to ground, representing a 0 in the address.

Example: To make the device's address 00000, all switches in the dip switch must be in the ON state.

ID	Description
S1-1	Connected to pin A4
S1-2	Connected to pin A3
S1-3	Connected to pin A2
S1-4	Connected to pin A1
S1-5	Connected to pin A0

2.5 Evaluation boards schematic, board layout and bill of materials

The current schematic, board layout and bill of materials for the evaluation boards are available in NXP's DocStore.

2.6 NTC and ID resistors

The ASL5x15 evaluation boards can be connected to NTC and ID resistors populated in the LED board. All ESD protections are populated in the ASL5x15 evaluation boards.

The NTC pin and its ESD protection are connected to pin 18 of connector X2. The ID pin and its ESD protection are connected to pin 19 of connector X2.

3 Accessory boards

3.1 S32K144EVB-Q100: S32K144 evaluation board

The ASL5015EVBMST and ASL5115EVBMST are compatible with the S32K144EVB-Q100.

The S32K144EVB-Q100 provides the control signals (through CAN (FD) communication) for the ASL5x15SHN devices. When used with the GUI, the S32K144EVB-Q100 drives the channels in the way as selected on the GUI. The S32K144EVB-Q100 can also be used as a system processor to create standalone applications or prototype systems.

Download the GUI by searching for SW491501 in DocStore.

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Figure 4. S32K144 Evaluation Board

3.1.1 Connecting the S32K144 evaluation board

The connection from the S32K144EVB-Q100 to the ASL5015EVBMST or ASL5115EVBMST is done by connecting the CAN twisted cable (physical bus) to S42K144EVB-Q100's CAN connector and power supply connector to Vsup output of S32K144EVB-Q100. See Figure 5 for Kit completion.

The CAN-H line of the physical bus should be connected to the pin marked as "HI". The CAN-L line of the physical bus should be connected to the pin marked as "LOW".

In the ASL5x15EVBMST, the CAN-H line of the physical bus should be connected to the pin marked as "H" (pin 3). The CAN-L line of the physical bus should be connected to the pin marked as "L" (pin 2).

The S32K144EVB-Q100 must be supplied with 12 V to enable the System Basic Chip (SBC) and allow the communication with the ASL5x15EVBMST.

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Figure 5. ASL5x15EVBMST connected to the S32K144EVB-Q100

3.2 ASL45XASLX41: Multichannel LED driver ICs demo boards

The ASL45XASLX41 evaluation board can be used to supply power to the LED boards connected to the MLC's evaluation board.

The GUI and standalone software are already prepared for driving the ASL45XASLX41 board. Documentation for using the Multichannel LED driver ICs (Boost and Buck ICs) can be found in a separate document.

Download the GUI by searching for SW491501 in DocStore.

Download the ASL45XASLX41 evaluation board user manual by searching for UM491701 in DocStore.

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Figure 6. ASL45XASLX41 board

3.2.1 Connecting the ASL45XASLX41 evaluation board

The MLC's evaluation board is not directly connected to the ASL45XASLX41 evaluation board. The ASL5x15EVBMST are only connected to the CAN physical bus of the S32K144EVB-Q100 and to the LEDs. More information on the connection of the ASL45XASLX41 evaluation board can be found in the ASL45XASLX41 user guide. A setup with the ASL45XASLX41, S32K144EVB-Q100 and the ASL5115EVBMST is shown in Figure 7.

The LED boards shown in the kit are not available for purchasing. Schematics, Layouts and gerber files are available in NXP's DocStore.
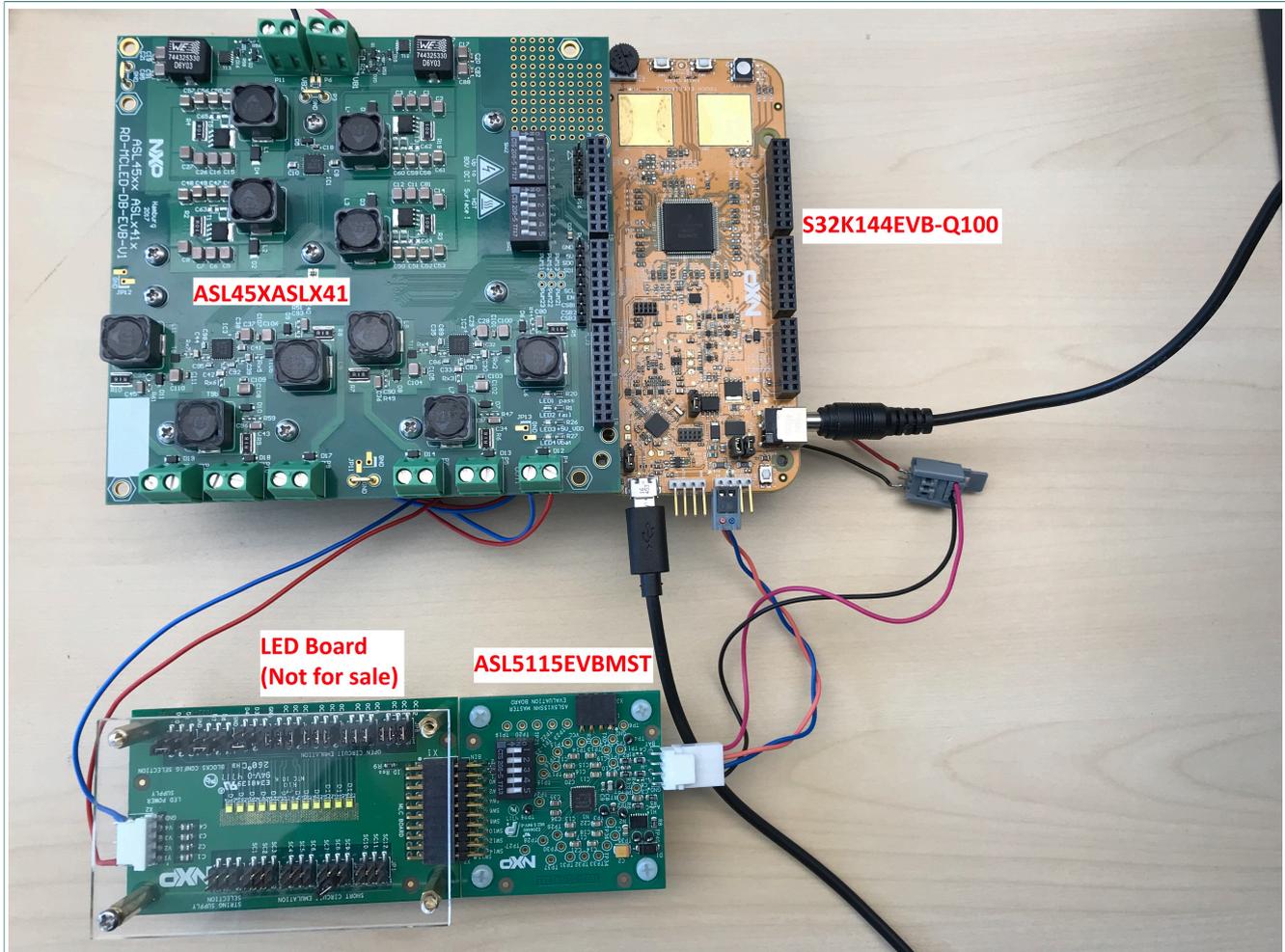
Figure 7. Full ASL evaluation kit

3.3 Setting up the hardware

To start working with the ASL5x15 EVB, the following connections and setup must be performed:

1. Connect the ASL5x15EVBMST to the S32K144EVB-Q100 as indicated in Section 3.1.1 "Connecting the S32K144 evaluation board". Do not forget to supply S32K144EVB-Q100 with 12 V, to enable the CAN communication through the SBC.

2. With power turned off, attach a 12 V DC power supply to ASL5x15EVBMST's supply terminals.

3. Attach a customer LED board similar to the one pictured above to the ASL5x15EVBMST.

4. If there is one or several slave EVBs in the system, create a chain with the master board using connectors X1 and X3. Also attach customer LED boards to the slave EVBs. See Section 2.1 for details on master and slave evaluation boards connection. The LED board shown in this user manual is not available for purchase. The schematics, layouts and gerber files can be downloaded from NXP's DocStore.

5. (Optional) If using the optional ASL45XASLX41 EVB: attach the S32K144EVB-Q100 to ASL45XASLX41, and supply the LED boards with any of the available buck outputs.
6. Plug the USB cable from the mini connector end into the S32K144EVB-Q100.
7. Plug the USB cable standard connector end into the computer.
8. Turn on the power supply. The supply indicator LED (Red LED in ASL5x15EVBMST) (Green LED3 and LED4 in ASL45XASLX41) shall light up.
9. (Optional) Use the GUI to drive all the evaluation boards (S32K144EVB-Q100, ASL45XASLX41 and all MLC's evaluation boards)
   Download the GUI by searching for SW491501 in DocStore
10. (Optional) Use Vector's CANoe software (https://www.vector.com/) to drive MLC's evaluation boards
11. (Optional) Use your own software, microcontroller and LED driver module to evaluate the NXP's Matrix LED Controller using its EVB.

4 Software installation and setup

4.1 Downloading and flashing the S32K144EVB

To download and install the latest version of the S32K144EVB-Q100 software:

1. Go to http://www.nxp.com/ASL45XASLX41.
2. Go to the documents and software section and download the Software and Design files (NDA required)
3. Unzip the files to your computer.

Flash the S32K144EVB:

1. Connect the S32K144EVB-Q100 to your PC with a micro USB cable.
2. The S32K144EVB-Q100 is shown as a USB drive.
3. Copy the flash image (*.srec) file from the one downloaded and unzipped before to the root directory of the S32K144EVB-Q100 USB drive.
4. The copy process will take about one minute. Once completed, the S32K144EVB-Q100 is flashed and is ready to be used with the GUI, the ASL5x15EVBMST, ASL5x15EVBSLAV and the ASL45XASLX41.

4.2 Launching the GUI on your computer

The GUI provides easy control of all ASL5x15 EVB and ASL45XASLX41 EVB. To launch the GUI:

Download the GUI by searching for SW491501 in DocStore.

1. Locate the GUI folder where you unzipped the GUI.
2. Start the GUI by calling the executable (*.exe) file.
3. The GUI opens with the startup window.

5 GUI interface introduction

The GUI is divided into several pages. Each page gives some control options to the user. The GUI will always start up with the Setup page.

5.1 Setup page

The system parameters for the demo are set up in the GUI Setup page.
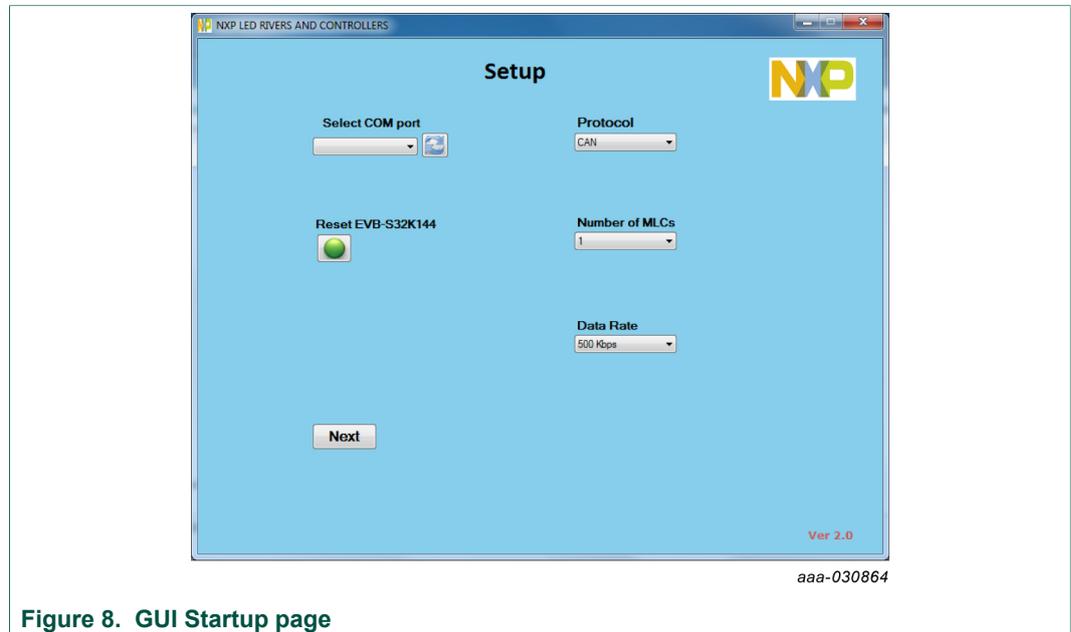

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Figure 8. GUI Startup page

- **Select COM port**
  Set the COM port used for communication between the computer running the GUI and the S32K144EVB-Q100. Once the S32K144EVB-Q100 is connected to the computer, the computer automatically assigns a COM port to the board. If multiple COM ports appear, the correct COM port can be identified via the Windows Device Manager.
- **Reset EVB-S32K144**
  Initiate a reset of the S32K144EVB-Q100.
- **Next**
  Starts the system, runs a few checks for the Matrix controller and brings up the GUI Menu page.
- Potocol
  The user can select the communication protocol to be used with the Matrix LED Controller from the drop-dawn menu.
- Number of MLCs
  The user must indicate the number of MLCs to be controlled from the drop-dawn menu. The devices addresses are not relevant at this stage.
- Data Rate
  The user must select the CAN communication data rate. The default data rate in the evaluation board is 500 Kbps.

5.2 Menu page
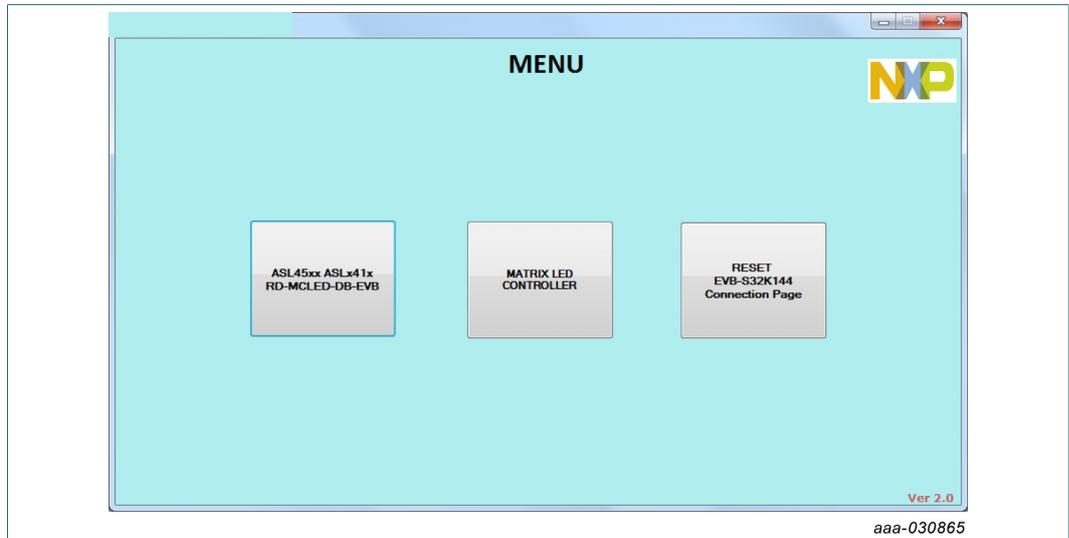
The GUI Menu displays buttons to select a control page.

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Figure 9. Register SPI write

- **ASL45xx ASLx41x RD-MCLED-DB-EVB** opens the page to control the ASL45XASLX41.
- **MATRIX LED CONTROLLER** opens another menu to select different options to control ASL5x15EVBMST or ASL5x15EVBSLAV.
- **Reset EVB-S32K144 Connection Page** issues a reset of the S32K144EVB-Q100 and opens the setup page.

5.2.1 Matrix LED Controller menu

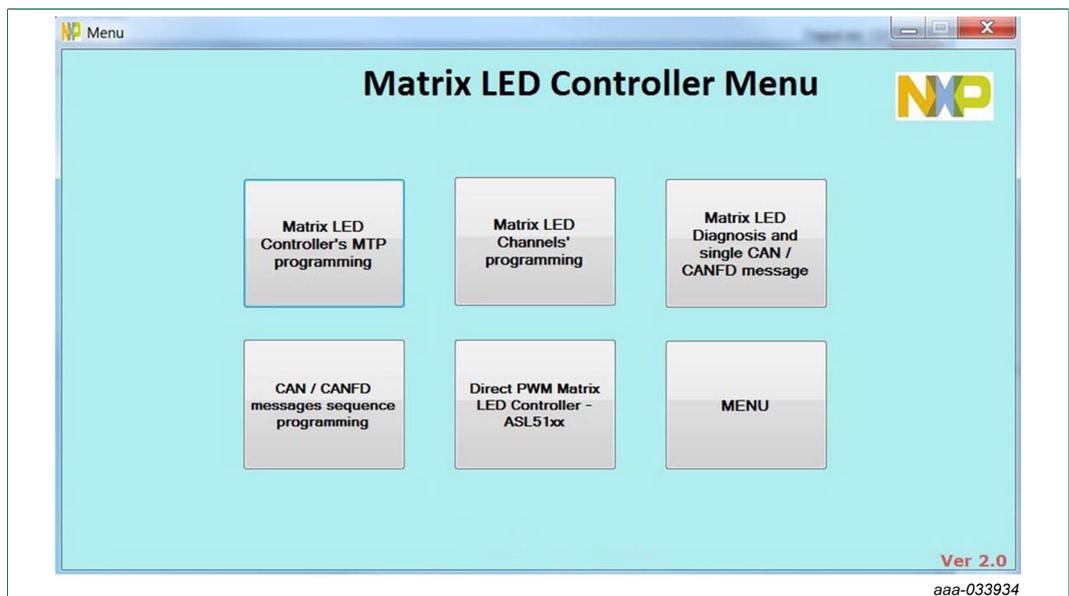All content to drive ASL5xxxyHz Matrix LED Controllers family can be accessed from this menu

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Figure 10. Matrix LED Controller menu page

- The **Matrix LED Controller's MTP programming** option will drive the user to a new window to configure all internal MTP registers of the MLC.

- The **Matrix LED Channels' programming** option will drive the user to a new window to drive SMART PWM part numbers of the ASL5xxxyHz family.
- The **Matrix LED Diagnosis and single CAN / CANFD message** option will drive the user to a new window to manage all diagnostic registers, clear flags and to send single CAN (FD) messages to the Matrix LED Controller. This page is common for SMART PWM and Direct PWM devices.
- The **CAN / CANFD messages sequence programming** option will drive the user to a new window where it can be loaded a sequence of messages created in the existing Excel tool. This sequence will not only includes the messages but also the protocol to be used and the time between messages.
- The **Direct PWM Matrix LED Controller - ASL51xx** option will drive the user to a new window to drive Direct PWM part numbers (ASL51xx) of the ASL5xxxyHz family.
- The **Menu** option will drive the user back to the menu page.

5.2.1.1 MTP programming

This page is used to program and read the Multi-Time Programmable memory (MTP) that is inside of the Matrix LED Controller (MLC)
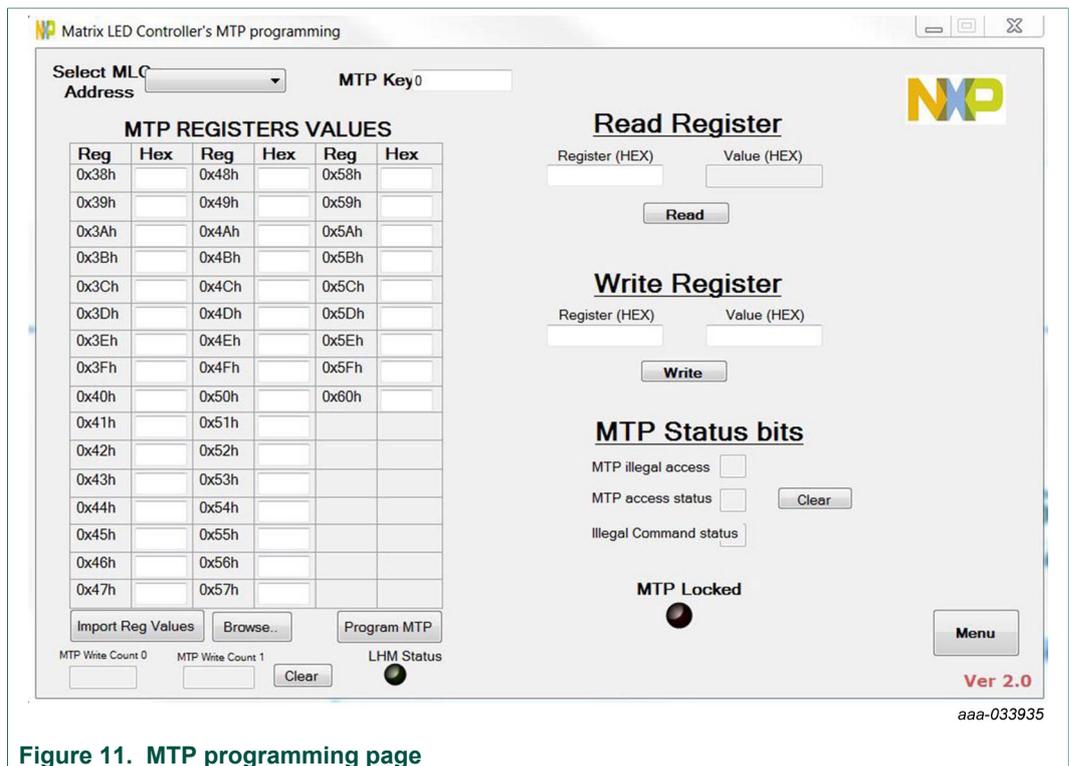

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Figure 11. MTP programming page

The first things the user must do are:

- Select the MLC you want to read or write its MTP. You can select the MLC address in the drop-down menu next to the text "Select MLC Address". Check the address you have set in your MLC evaluation board (switch S1: ON = 0 and OFF = 1).
- Introduce the MTP Key in the box next to the text "MTP Key". The default key is "0".

The user has 3 different options to write in the MTP:

Import the registers from the file created with the Excel Emulator Tool

1. Check the MLC is not in LHM state (LHM Status light is black)

2. Check the MTP is not locked (MTP Locked light is black)

3. Click the "Browse.." button and search for the created TXT file.

4. Once you found it and accept the path, click the "Import Reg Values" button and all the registers values will appear in the "MTP REGISTERS VALUES" table.

5. Click the "Program MTP" button to program the MTP with the imported values. Wait until the GUI shows the MTP Write Count 0 and 1. These two values inform the user how many times the MTPs were written.

6. Check the "MTP illegal access" bit and the "MTP access status" bit. The first one should be "0" and the second one should be "1". The "Illegal Command status" bit should also be "0", what means that you have used the right MTP Key.

Manually type the registers' values in the "MTP REGISTERS VALUES" table and follow steps "e" and "f"

Use the "Write Register" section

1. Type the register in hexadecimal in the first box and the desired value in the second box, also in hexadecimal and with 4 digits (the MLC has a 16 bit base register MTP)

2. Click the "Write" button to program the MTP's register

3. Type the same register in the box below the "Read Register" section

4. Click the "Read" button to check the register's value.
   The user can use the Clear button before next programming action (to be sure that the status is updated)
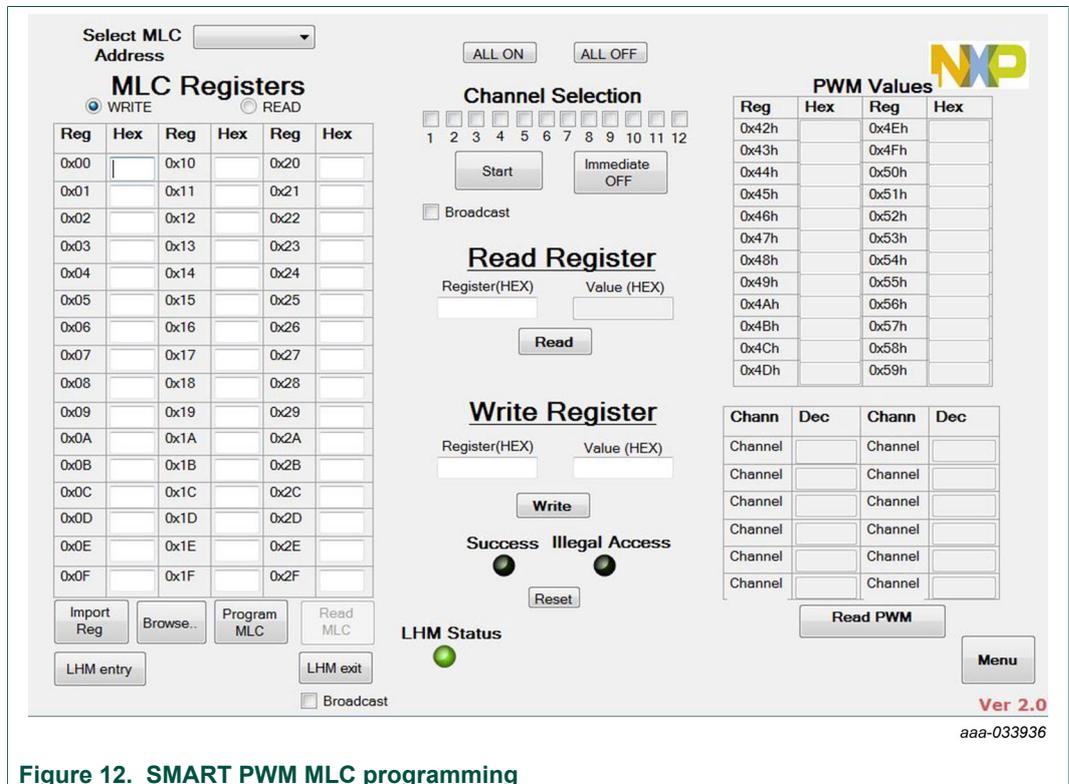
5.2.1.2 SMART MLC

Figure 12. SMART PWM MLC programming

This page is used to program the "Smart" MLC registers (ASL5015SHN or ASL5008SHN).

Select the MLC address to inform the GUI which MLC you want to program. Check your MLC evaluation board address (switch S1: ON = 0 and OFF = 1)

The user can read or write the MLC registers. Select the preferred option clicking the "WRITE" or "READ" selection button.

The user has 3 different options to write in the MLC registers:

1. Import the registers from the file created with the Excel Emulator Tool
   a. Check the MLC is not in LHM state (LHM Status light is black). Writing action is only allowed when the MLC is in normal operation. In Limp Home Mode, the register can only be read.
   b. Click the the "Browse.." button and search for the created TXT file.
   c. Once you found it and accept the path, click the "Import Reg" button and all the registers values will appear in the "MLC Registers" table.
   d. Click the "Program MLC" button to program the registers with the imported values. Wait until the GUI shows the "Success" light green, or repeat the above steps if the GUI shows the "Illegal Access" light in red.
2. Manually type the registers' values in the "MLC Registers" table and repeat step "d"
3. Use the "Write Register" section
   a. Type the register in hexadecimal in the first box and the desired value in the second box, also in hexadecimal and with 2 digits (the MLC has a 8 bit base register)
   b. Click the "Write" button to program the MLC's register
   c. Type the same register in the box below the "Read Register" section
   d. Click the "Read" button to check the register's value. Note: be aware that same time the read value could not be the Same of the write value, since some bit are Auto-Cleared bits, like for Example the NOW and AUTO bits.

To read the MLC registers, follow the nest steps:

1. Select the "read" option at the top of the Register's table
2. The GUI will enable the "Read MLC" button. Click it and the GUI will show the registers' values.

To start or immediate off individual channels, follow the next steps:

1. Select the channel you want to drive in the "Channel Selection" section, or click the "ALL ON" button to enable all the channels.
2. Click the "Start" button to start the sequence in all selected channels
3. Click the "Immediate OFF" button to turn off the selected channels
4. If the user wants to send a broadcast Start command or Broadcast Immediate OFF command, then check the "Broadcast" option.
5. The use can also deselect all the channels by clicking the "ALL OFF" button.

To read the current PWM value in every channel, click the "Read PWM" button, located in the bottom left corner of the window. The GUI will show both, the hexadecimal and the decimal value of the current PWM in each channel.

To refresh the status light, click the "Reset" button.

In this window, the user can also test the Limp Home Mode (LHM) functionality

1. Click the "LHM entry" button to enter in Limp Home Mode state. When the user clicks this button, the Microcontroller will stop sending the cycle LHM_Refresh command,

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so the MLC will enter in LHM state. The "LHM Status" light should be automatically lighted in green by the GUI.

2. Click "LHM exit" to enter in normal operation again. In this step, the microcontroller will send the LHM exit sequence and will start sending the LHM_refresh again in a cycle mode. The "LHM Status" light should be automatically turned off by the GUI.

This option can be used with a selective MLC or broadcast. If the user wants to make it broadcast, the "broadcast" option (below the "LHM exit" button) must be checked.

5.2.1.3 Diagnostic
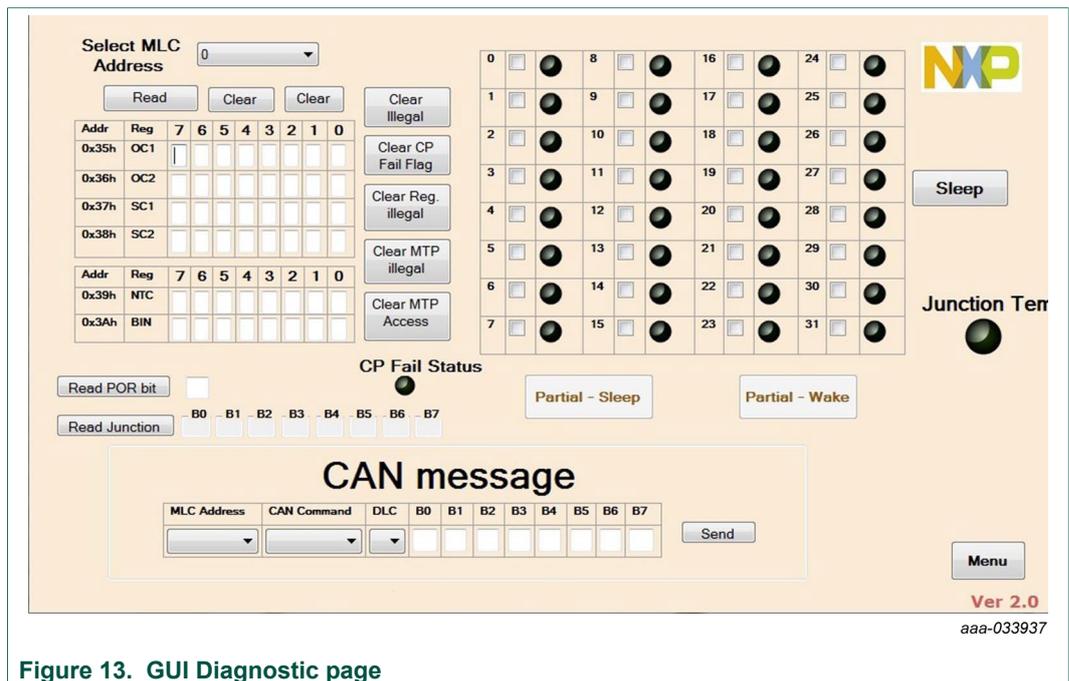
Figure 13. GUI Diagnostic page

In this page, the user can:

- Check the Matrix LED Controller (MLC) diagnosis
- Clear flags
- Check for the Power On Reset (POR) bit
- Check the MLC Junction temperature
- Send a specific CAN message
- Put the MLC on Sleep (if MTP bit "Partial Netw" bit is set to "0")
- Put the MLC on Partial Sleep (if MTP bit "Partial Netw" bit is set to "1")
- Wake the MLC from Partial sleep (specific command) or from broadcast Sleep (asking for diagnosis or sending any valid CAN message)
- Check if there is a failure in the Charge pump

The first thing the user must do is to select the MLC address. Check your MLC evaluation board address (dip switch S1: ON = 0 and OFF = 1).

Diagnostic read and flag clearing:

1. Click "Read" to get the MLC diagnosis on the Below tables. The use can compare the register values with the registers' explanation in the Matrix LED Controller datasheet.
2. Use the clear buttons to clear the specific flags.

The user can read the Power on Reset bit (POR) status clicking the "Read POR bit" button. The result should be "1" if it was set during the start-up or by writing this register (the user must set it), or will be "0" if it was not set. This bit is used to check if a Power on Reset has happened due to a power supply problem.

The user can read the IC junction temperature by clicking the "Read junction" button. The GUI will show the raw values that the MLC has provided to it. The used must compare this values with the table provided in the Emulator Excel tool. See also the application notes to check how to read the junction temperature from the raw values.

Send CAN messages:

1. Select the MLC address, CAN command and DLC from the drop-down menus.
2. Fulfil the Data bytes with "Hexadecimal values". The fulfilled data-bytes must fit with the selected DLC. Check all the valid combinations for every CAN command in the datasheet and application notes.
3. Click the "Send" button to send the desire CAN message.

Sleep and Partial Sleep functionalities:

The Matrix LED controller has two possible sleep modes:

1. Broadcast Sleep: All the MLCs in the bus are putted into Sleep mode and any change in the CAN bus will wake them up (standard sleep mode). The "Partial Network" bit in the MTP must be in "0" to enable this sleep mode.
2. Partial networking: The microcontroller can put some of the MLCs on sleep mode and continue working with the CAN bus to control other MLCs. The MLCs that were putted into sleep mode will not wake up until they receive a specific wake-up message. The "Partial Netw" bit in the MTP must be in "1" to enable this sleep mode.

Step to enter the Sleep mode and wake the MLC up:

1. Broadcast Sleep
   a. Click the "Sleep" button to put all the MLCs in the bus on sleep mode. The microcontroller will also stop sending any other message. The GUI will show the green light next to the MLCs that were putted on Sleep. The "Partial Network" bit in the MTP must be in "0" to enable this sleep mode.
   b. When the user wants to wake the MLCs up, just send a valid CAN message or just ask for diagnosis. The MLCs will wake up and the microcontroller will start all the normal operation cycle messages again.
2. Partial Sleep
   a. Select the MLCs that you one to put on partial sleep mode in the table above the Partial buttons.
   b. Click the "Partial-Sleep" button to get the selected MLCs on Partial sleep mode. The GUI will show the green light next to the MLCs that were putted on Partial-Sleep. The Microcontroller will continue sending all cycle messages, like in normal operation, since this will not wake the MLCs up.
   c. Click the "Partial-Wake" button to wake up the MLCs. Note: do not uncheck the MLCs in the above table, if you want to wake them up. The GUI will turn off the lights of the MLCs that were waked up.

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5.2.1.4 Automated sequence

Figure 14. GUI automated message sequence

In this page, the user can select a TXT file (already created with the Emulator Excel tool) where a sequence of CAN (FD) messages was programmed.

1. Click the "Browse…" button to look for the TXT file
2. Once the file's path is accepted, click the "Start Programming" button to start sending all the programmed CAN commands that were programmed or listed with the Emulator Excel tool.

This feature is very similar to the "Automated Sequences" that can be programmed with the Vector's CANoe tool (https://www.vector.com/). .

5.2.1.5 Direct PWM MLC
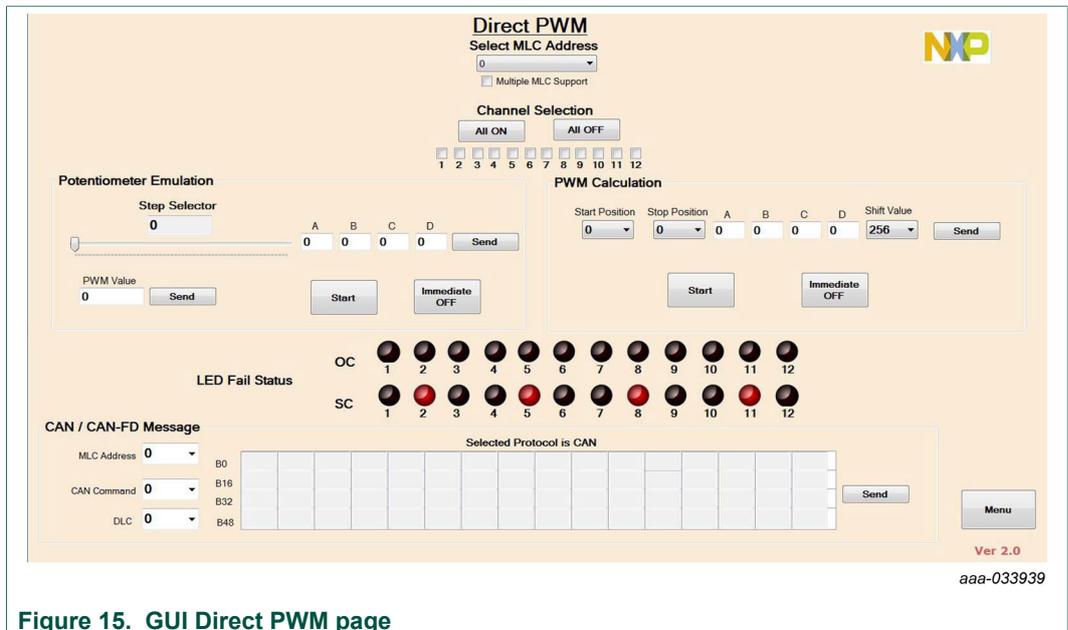
Figure 15. GUI Direct PWM page

This page is used to program the "Smart" MLC registers (ASL5115SHN or ASL5108SHN).

The user must elect the MLC address to inform the GUI which MLC wants to program. Check the MLC evaluation board address (switch S1: ON = 0 and OFF = 1)

In case the user wants to drive multiple MLCs with a single command (only available with CAN-FD protocol), "Multiple MLC Support" option must be checked.

Channels to be operated should be checked in the "Channel selection" section.

The user has 3 different options to drive the MLC:

1. Use the "Potentiometer emulation" section. Two different approachs can be used
   a. Define the coefficients of a third-grade polynomial in the boxes A, B, C and D. Being "D" the linear coefficient. Click the "send" button to inform the software of the selected coefficients. With the potentiometer, select the Stop position in the curve (8-bit resolution, 255 steps possible). The start position is "0" when is used for the first time, then it is the last defined step. The light will follow the third-grade polynomial and the software will send a new PWM value in each refreshing step. Click the "Start" button to start the Fade sequence. Clock on "Immediate OFF" button to turn all LEDs OFF. The curve can be used in both direction, fade-in and fade-out.
   b. Set a PWM value (from 0 to 4095, 12-bit resolution) in the box "PWM Value" and click the "Send" button to set this PWM value in all selected channels. Start command is only needed in the very first send value or after an immediate off command, all other new values don't need a start command.
2. Use "PWM Calculation" section: Set all the required values: Third-grade polynomial coefficients, start position and stop position (always respecting an 8-bit resolution step count) and the division factor (shift value). Grater division factor makes the fade curve slower. Click the "Send" button to inform all value to the software. Click the "Start" button to start the selected fade curve in the checked channels. Curves can be used in both direction, fade-in and out. Click the "Immediate OFF" button to turn OFF all selected channels
3. Use the "CAN / CAN-FD Message" section: Select the MLC address, command and DLC in the drop-down menus. Fulfill the bytes in the data field (always in hexadecimal value). Click the "Send" button to send the message with the fulfilled data.

The **Menu** option will drive the user back to the Matrix LED Controller menu page.

6   References

Information on related NXP products and application solutions may be found at:

Table 5. URLs for NXP product and application solutions support pages

NXP.com Support Pages	Description	URL
LED driver and controller page	Product overview page	https://www.nxp.com/products/:MC_71502
ASL45XASLX41EVB	Tool overview page, Get Started section	http://www.nxp.com/ASL45XASLX41
S32K1 Microcontroller	Product overview page	https://www.nxp.com/products/:S32K
S32K144EVB	Tool overview page	https://www.nxp.com/products/:S32K144EVB
ASL5xxxyHz family	Product overview page	http://www.nxp.com/ASL5xxxx

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NXP.com Support Pages	Description	URL
ASL5015EVBMST	Tool overview page	http://www.nxp.com/ASL5015EVBMST
ASL5015EVBSLAV	Tool overview page	http://www.nxp.com/ASL5015EVBSLAV
ASL5115EVBMST	Tool overview page	http://www.nxp.com/ASL5115EVBMST
ASL5115EVBSLAV	Tool overview page	http://www.nxp.com/ASL5115EVBSLAV

7 Revision history

Revision	Date	Description
v.1	20190528	Initial release

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