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**Graphical user interface (GUI) for EVAL-L9907**

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**Introduction**

This document describes the STSW-L9907 the Graphical User Interface (GUI) dedicated to set and control the EVAL-L9907 board (3-phase BLDC motor application boards for L9907) through the SPI protocol, manage the Enable and BST\_Dis pins and read the value from the current sensing section.

The STSW-L9907 has been developed using Labview<sup>®</sup> and it works with SPC560P-DISP evaluation board programmed with a dedicated FW (GP-Pictus.elf).

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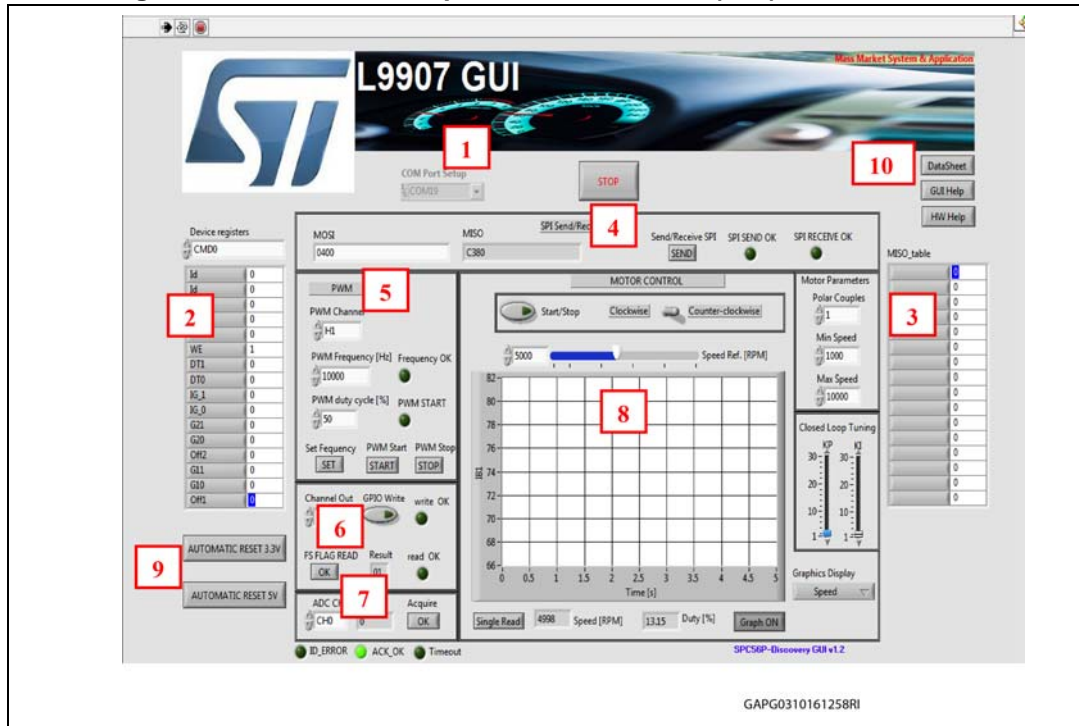
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# 1 Graphical User Interface description

The STSW-L9907 GUI includes the fields highlighted in *Figure 1*:

**Figure 1. STSW-L9907 Graphical User Interface (GUI) for EVAL-L9907**



1. **Com Port Setup:** this menu allows to set the COM port
2. **SDI:** this menu allows to select and to configure each device register. It is possible program all the bits of each register.
3. **SDO:** the value of each register is copied in the field of this menu. This portion of the GUI allows to monitor the device status.
4. **SPI Send/Receive:** in this portion of the GUI it is possible:
  - a) To end an SPI commands or configuration as programmed in the SDI menu (see #2) by pressing the **"SEND"** button.
  - b) To send a single SPI command manually written in the MOSI field (HEX format). In the same time is available to read the register value in the MISO filed.
  - c) **SPI functionality:** the LEDs, SPI SEND OK and SPI RECEIVE OK provide a visual feedback about the SPI communication status (if the LEDs are on means communication is working properly).
5. **PWM signals:** the Frequency and the Duty cycle of the each PWM signals are programmed in this frame. The **"START"** button enables the PWM signal generators (PWM signals: L1, L2, L3, H1, H2 and H3), whereas **"STOP"** button stops the the PWM

signals. Before sending a PWM configuration, the selected Frequency must be confirmed by pushing the "**SET**" button.

6. **ENABLE SETUP – BST\_DIS SETUP & FS\_FLAG STATUS:** this frame is used to configure the EN1, EN2 and BST\_DIS pins of the L9907 and to read the FS\_FLAG status.
7. **ADC READ:** this section displays the value of the Ib1 and Ib2 pins (ADC inputs).
8. **MOTOR CONTROL:** this menu is used to start a BLDC Motor Control based on Closed Loop and by using 6-Steps Algorithm technique, to setup some parameters and to view some useful waveforms:
  - a) **Motor Parameters:** through this menu it is possible to setup some parameters of the BLDC Motor, such as "Polar Couples", minimum and maximum rotation speed.
  - b) **Closed Loop Tuning:** through this menu it is possible to setup the PI parameters for Closed Loop and Kp and Ki values.
  - c) **Graphics Display:** with this button it is possible to select the a graph between Speed, Error, Duty, ADC IB1 and ADC IB2.
  - d) **Speed Ref.:** by using this cursor it is possible to set the target BLDC motor speed.
  - e) **Single Read:** this button allows to read the instantaneous speed value.
  - f) **Duty %:** it shows the value of the current Duty Cycle.
  - g) **Graph ON/OFF:** the button allows to turn ON and OFF the Graph window.
9. **Automatic Reset:** Through this two buttons it is possible to automatically reset the device at Start-up for Vcc=3,3V and Vcc=5V. Pressing the button "**Automatic Reset 3.3 V**", the procedure described at Par. 3 point A will be automatically performed. Pressing the button "**Automatic Reset 5 V**", the procedure described at Par. 3 point B will be automatically performed.
10. **HELP:** through this menu it is possible to download the SW help, the L9907 Datasheet and info about the HW.

## 2 How to use the GUI to configure and test the EVAL-L9907

The following procedure has to be followed to start the EVAL-L9907 Device using the L9907 GUI.

### A. Start up at Vcc= 3.3 V

1. Configure the COM port
2. Press "OK" button
3. Send the SPI frame 0xC800 (0b 1100100000000000) - DIAG & 0xE000 (0b– DIAG2
4. In the field #3 (see previous paragraph) it is possible to read the device answer in bit in the field n° 4 is possible to read the SDI and SDO signals expressed in hex.
5. Check the FS\_FLAG status (field #6). The value must be 01

### B. Start up at Vcc= 5V

The Power Up default value for Vcc over voltage threshold is "10", corresponding to Vcc=3.3V application. The below procedure have to be followed in order to use Vcc=5V (for more details see the EVAL-L9907 HW Manual):

1. Configure the COM port
2. Press "OK" button"
3. In field #7, force one of the EN pins to 0
4. Send the command 0x2401 (0b 0010010000000001) – CMD1 register in order to reset the fault.
5. Press "SEND" in the field #4. If the communication has been established and the command have been sent and interpreted properly, the LED "SPI SEND OK" will be turned on. The LED "SPI RECEIVE OK" it will be turned on if the device answer has been received properly.
6. The field #3 will be updated with the device registers value as well as in the field #4 the SDI and SDO expressed in hex
7. Send the SPI frame 0xC800 (0b 1100100000000000) - DIAG & 0xE000 (0b1110000000000000) – DIAG2
8. Set High the EN pin previously set to zero (step 3).
9. Check the FS\_FLAG status (field #6): the value should be 01

### C. How to start the PWM independently

1. Set the desired channel (L1, L2, L3, H1, H2 and H3) – Field #5
2. Insert the frequency value in the field #5.
3. Press "SET".
4. Set Duty Cycle value.
5. Press "START", to enable the PWM signals
6. In the field #5, press "STOP PWM" to stop the PWM signals.
7. Press the button "STOP" on the top side of the GUI to stop the execution of Labview code and close the window.

**D. How to start the MOTOR CONTROLL**

1. STOP all the PWM signals by pressing "STOP PWM" for all 6 channels (L1, L2, L3, H1, H2 and H3), see Field #5. This action will stop all PWM signals from L9907.
2. Follow the procedure described at point A or B or press one of the two button "**Automatic Reset 3.3 V**" or "**Automatic Reset 3.3 V**" depending on the Vcc supply value.
3. Setup the BLDC motor parameters (polar couples, min and max speed)
4. Set Kp and Ki values (for example by using a for a 60W BLDC motor set Kp= 10 and Ki=5)<sup>(a)</sup>
5. Press "Start/Stop Motor" button and the motor will start to run. If the Motor shaft doesn't turn means a fault is present. Stop the Motor Control and reset the fault following the procedure at section A, point 3 to 5. Restart the motor control<sup>(b)</sup>.
6. Set the rotation direction: Clockwise or CounterClockwise
7. Press "Start/Stop Motor" to stop the Motor shaft.
8. Press the button "STOP" on the top side of the GUI to stop the execution of Labview code and close the window.

- 
- a. The Kp and Ki constants depend on the BLDC motor characteristics and must be tuned to achieve the best control
  - b. Due to the Start-up procedure developed in the Firmware, depending on the BLDC motor and the BLDC rotor position, a cross conduction between high-side and low-side Power MOSFET could happen; under this working a fault is detected.

### 3 How to plug SCP560P-DISP and EVAL-L9907

In the SPC560P-DISP is implemented a 0.1” 4x37 pin array; it is used as connector to plug the EVAL-L9907.

Figure 2. SPC560P-DISP

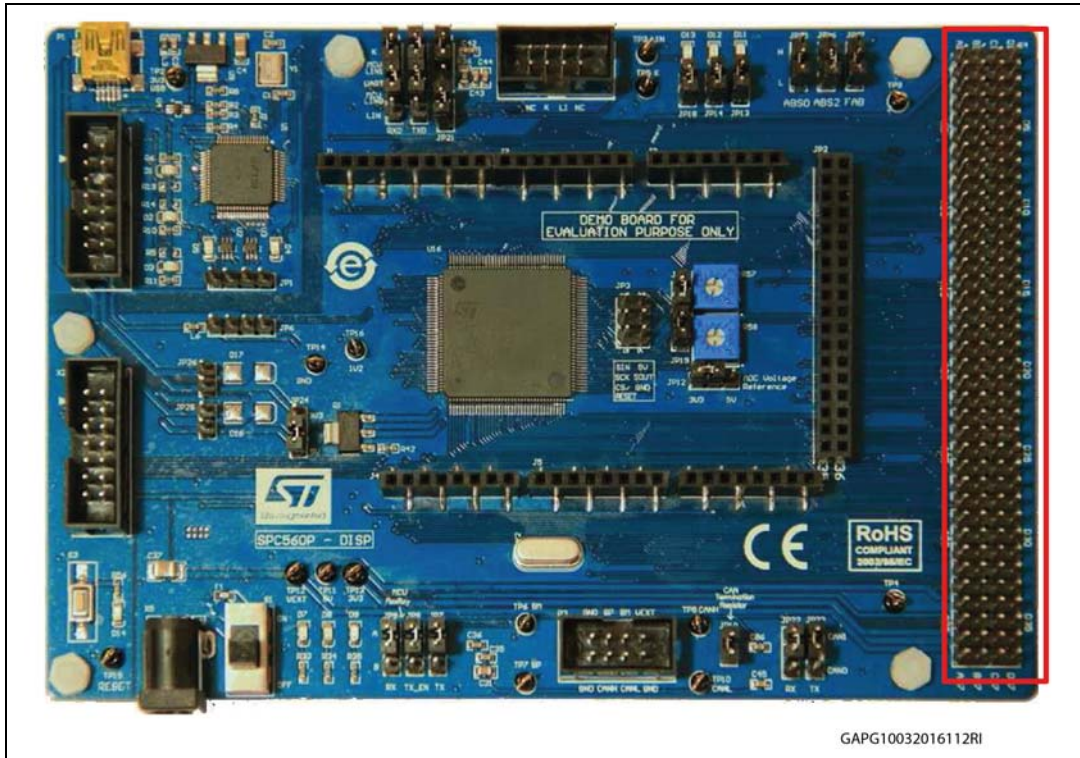


Figure 3. SPC560P-DISP – 4x37 Connector, pin “A-34”

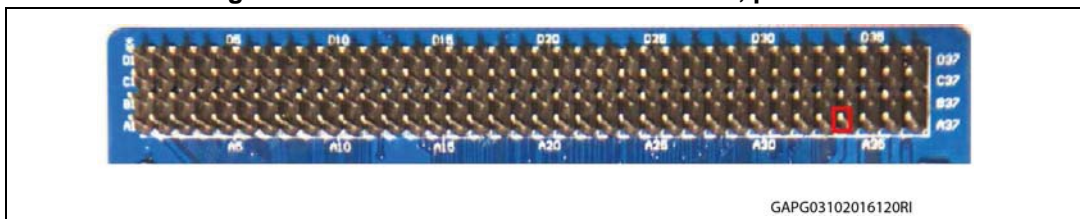


Figure 4. SPC560P-DISP – 4x37 Connector, pins used to connect the EVAL-L9907

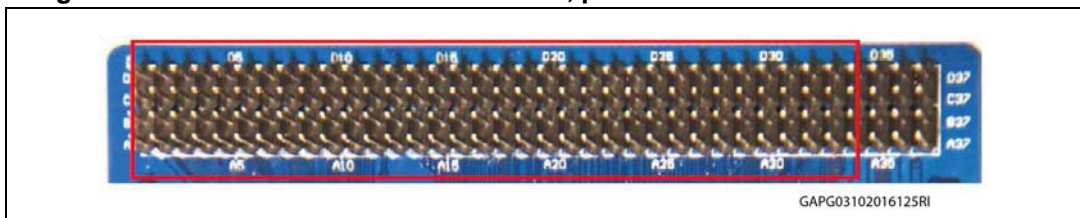




Figure 5. EVAL-L9907 and SPC560P-DISP

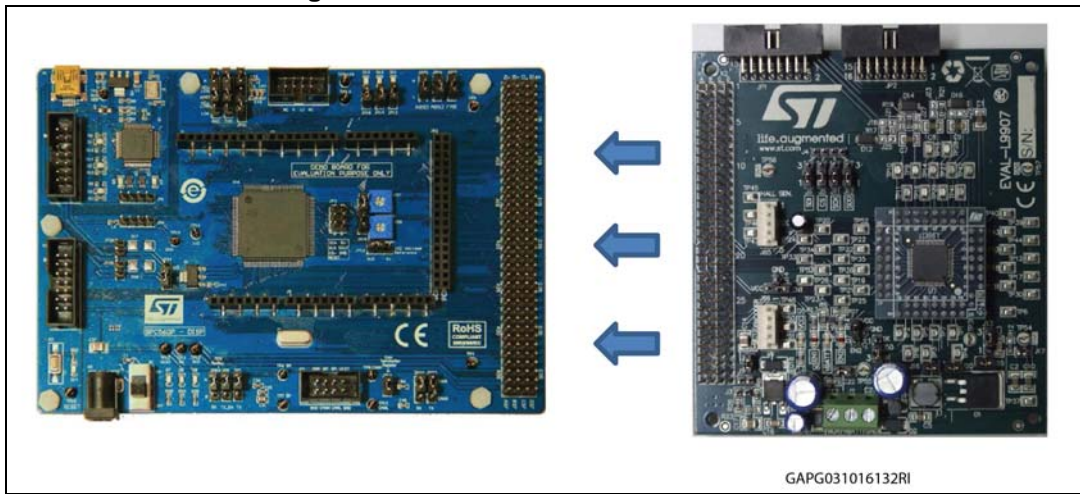
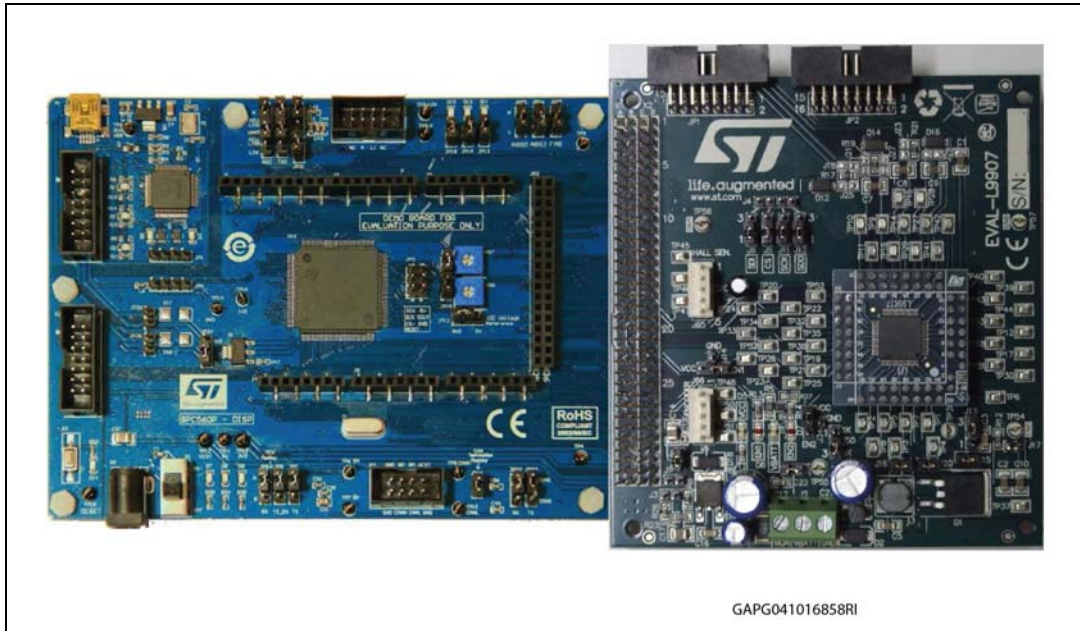


Figure 6. EVAL-L9907 and SPC560P-DISP plugged



## 4 SPC560P-DISP: USB drivers installation

The GUI needs a dedicated USB driver to enable the serial communication channel. If the driver is not yet installed or not appropriately configured, the following procedure describes how to install the Driver or to update the current version.

To install the drivers the board SPC560P-DISP does not need the external supplier; the USB connection provides the supply voltage.

1. Disconnect the USB from SPC560P-Discovery
2. If the UDE Visual Platform 4.2 is already installed as well as the drivers are updated go to step #7 otherwise continue to next step
3. Download the SPC5-UDE/STK 4.02.07 from pls-mc web site.
4. Install the SW; right click on the icon named “ude-4-02-07-spc5-udestk.exe” then select “Run as Administrator”

Figure 7. UDE software



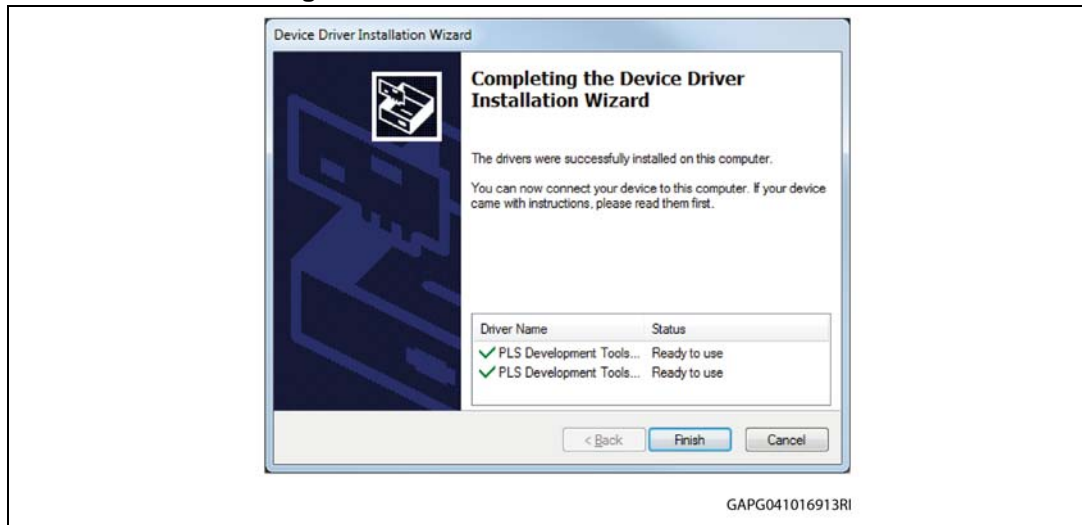
5. Accept to install the USB drivers (see [Figure 8](#))

Figure 8. USB driver installation



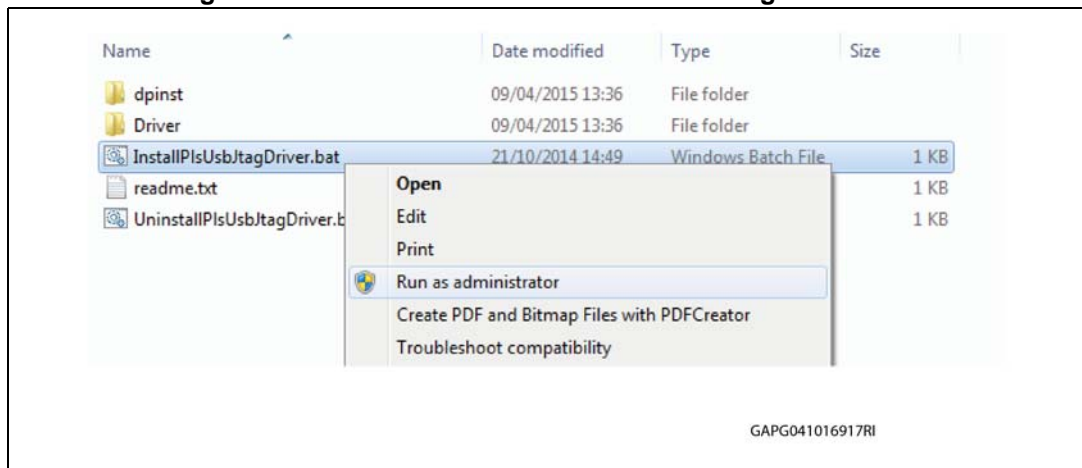
6. The Drivers installation is completed when the window here below appears (see [Figure 9](#)). Pressing the “Finish button” the installation will be completed and the installation program will be closed.

Figure 9. Device drivere installation wizard



- 7. Open the folder "C:\Program Files (x86)\pls\UDE 4.2\Driver\JtagUsbDriver"<sup>(c)</sup>
- 8. Right click on "InstallPlsUsbJtagDriver.bat" then select "Run as administrator"

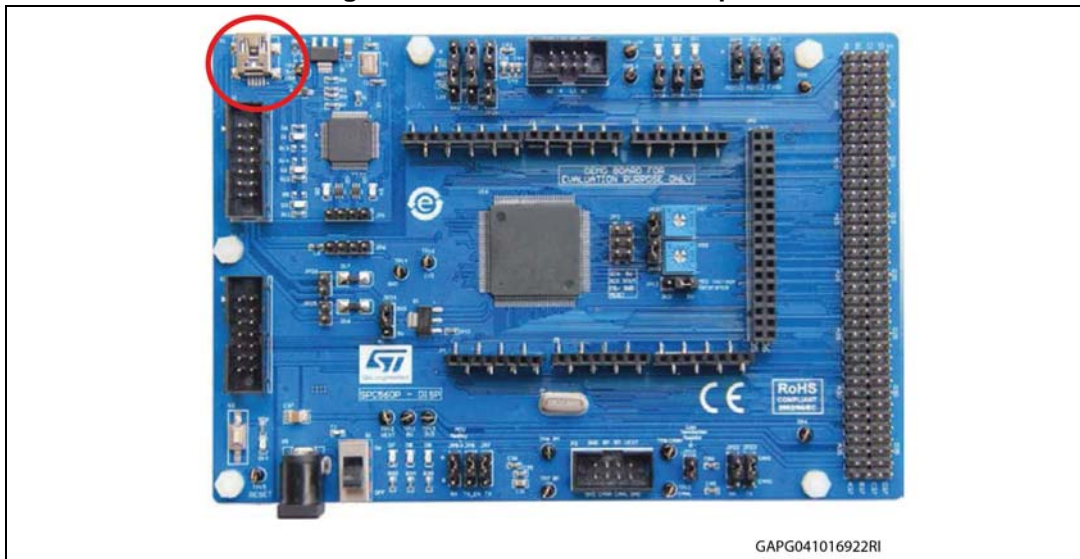
Figure 10. USB Driver Installation – folder "JtagUsbDriver"



- 9. Once the installation is completed, connect the USB cable to the SPC560P-DISP board;

c. The path could be different because it is depending on the choice the user made during the installation procedure.

Figure 11. SPC560P-DISP: USB port



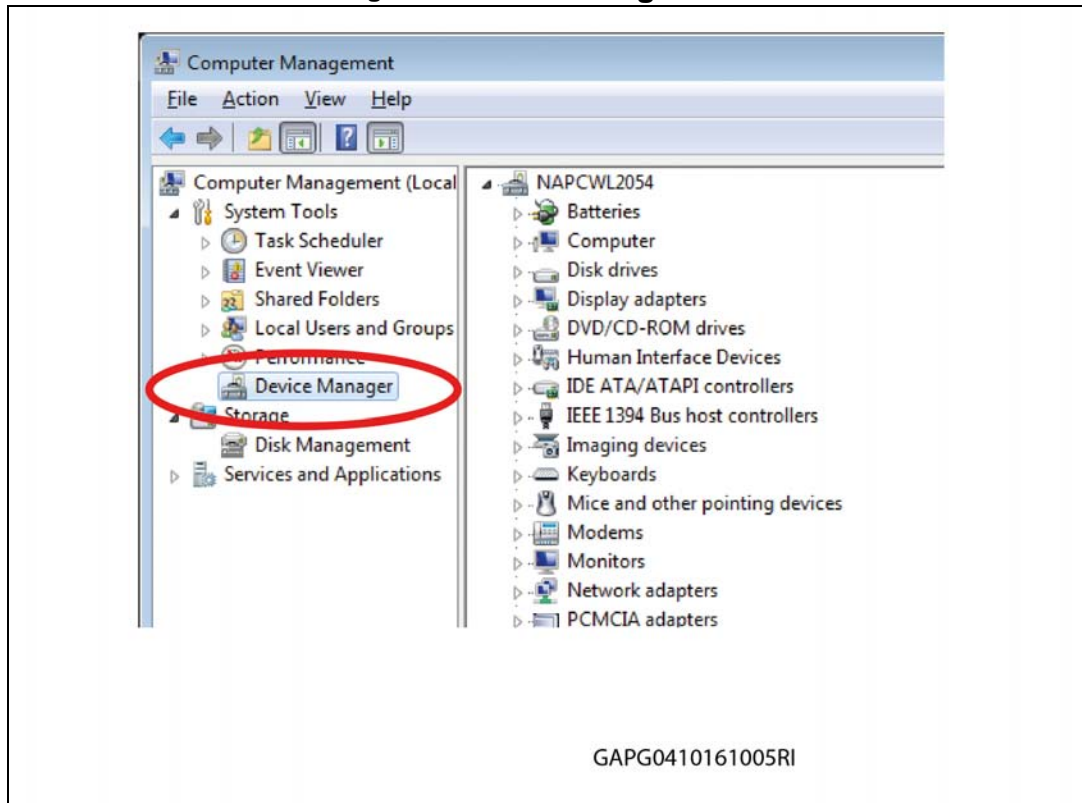
10. From “Start” Menu, right click on “Computer” item then select “Manage”.

Figure 12. Start menu, Computer, Manage



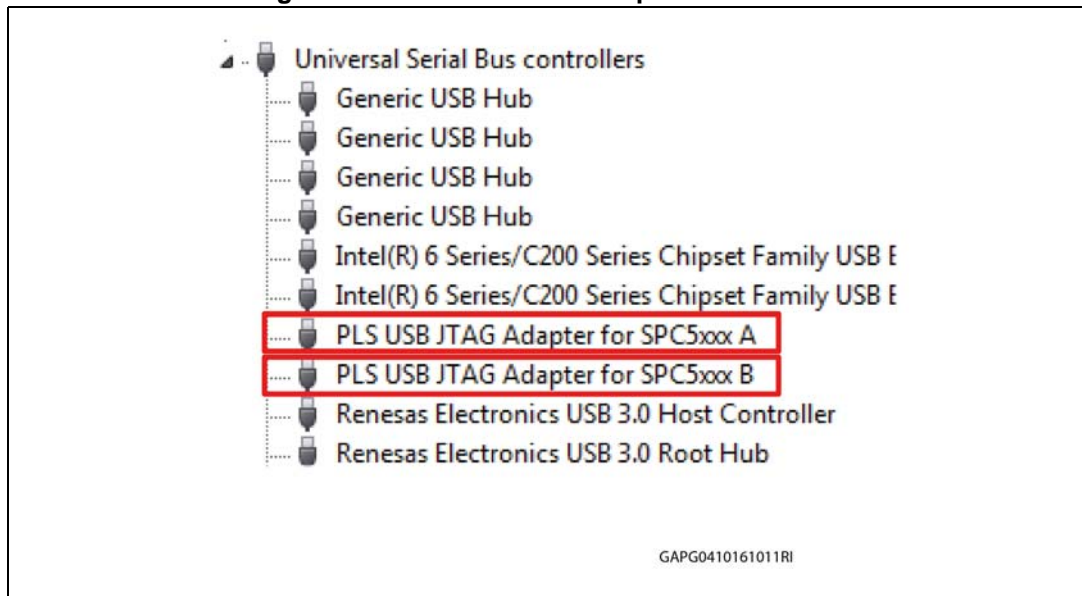
11. Once the Computer management popup appears, from the System Tools menu, select “Device Manager” from the System Tools menu

Figure 13. Disk management



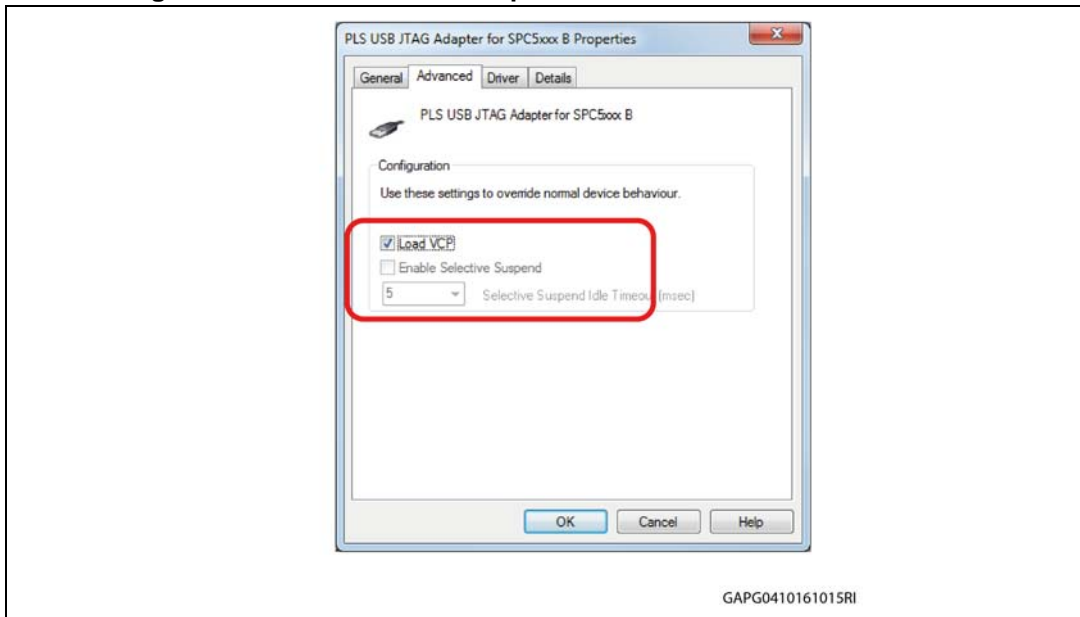
- Expand the item Universal Serial Bus controllers; Identify "PLS USB JTAG Adapter for SPC5xxx A" and "PLS USB JTAG Adapter for SPC5xxx B" (see [Figure 14](#))

Figure 14. PLS USB JTAG Adapter- COM Ports



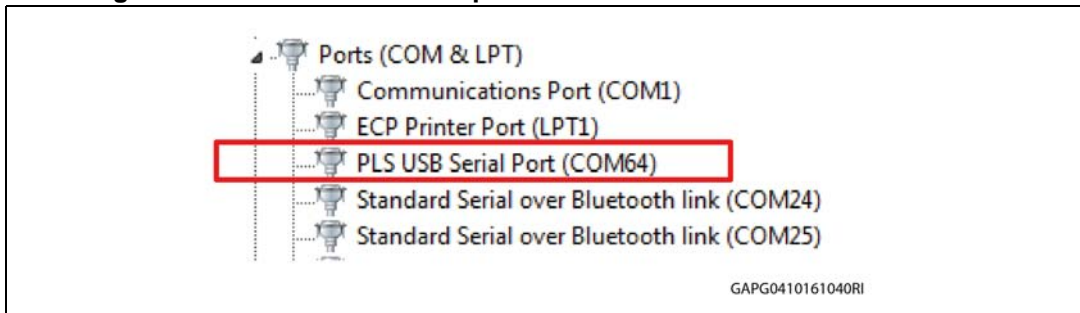
- To enable the COM port, right click on "PLS USB JTAG Adapter for SPC5xxx B" then click "Properties" and select the "Advanced" tab. Flag the "LOAD VCP" (Virtual COM Port) box.

Figure 15. PLS USB JTAG Adapter for SPC5xxx B – Load VCP box



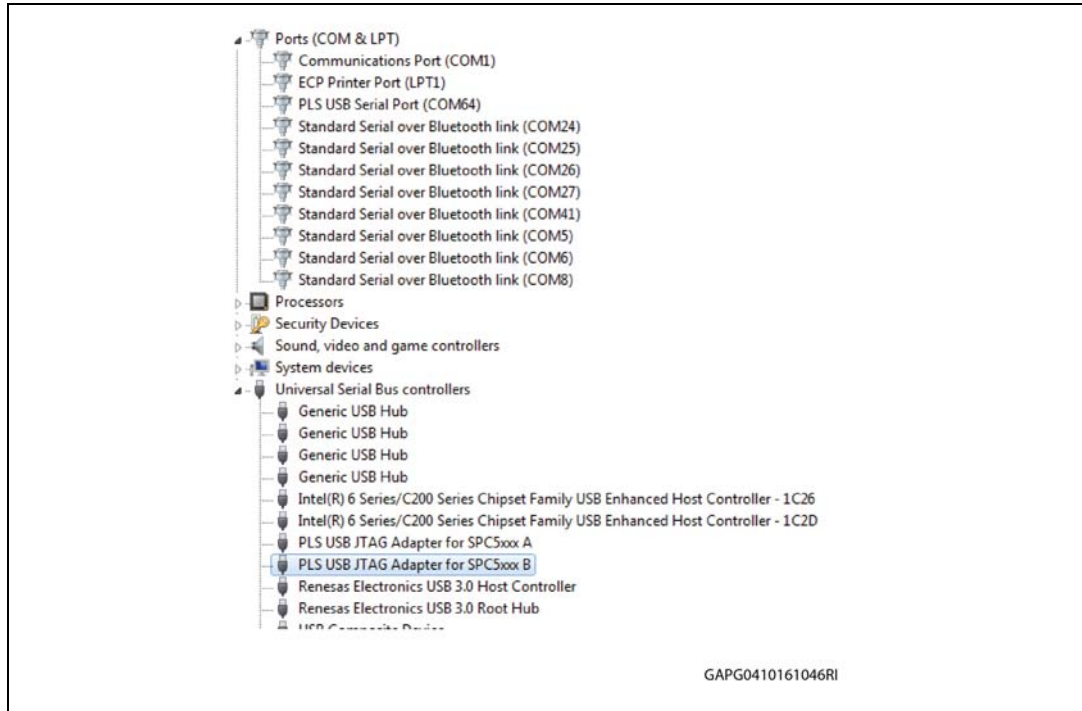
14. Disconnect the USB cable from the SPC56P-Discovery then reconnect. A new COM port appears, and Windows will install the new drivers automatically. From the Device Manager window check the new COM port available.

Figure 16. PLS USB JTAG Adapter for SPC5xxx B – PLS USB Serial Port



15. The COM port is configured and available to be used for serial communication with the PC.

Figure 17. PLS USB drivers and serial port – Device manager window after installation procedure



## 5 Labview Driver: Installation Guide

The STSW-L9907 GUI can be used stand alone without a Labview license installing the free SW named "Runtime Engine for Labview" and "VISA Runtime", last versions can be downloaded from NI web site.



## 6 SPC560P-DISP: Load Firmware

To use the STSW-L9907 GUI a dedicated FW (file name: "GP-Pictus.elf") must to be loaded on the microcontroller in the SPC560P-DISP board following the below procedure (the board is supplied by the USB cable thus the external PSU is not required):

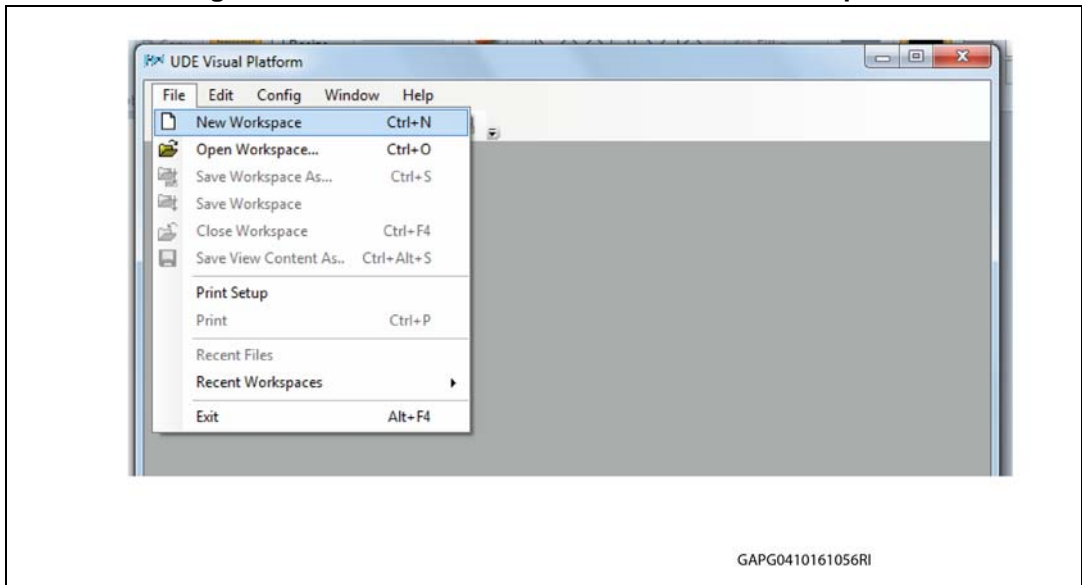
1. Run "UDE Visual Platform";

Figure 18. UDE Visual Platform icon



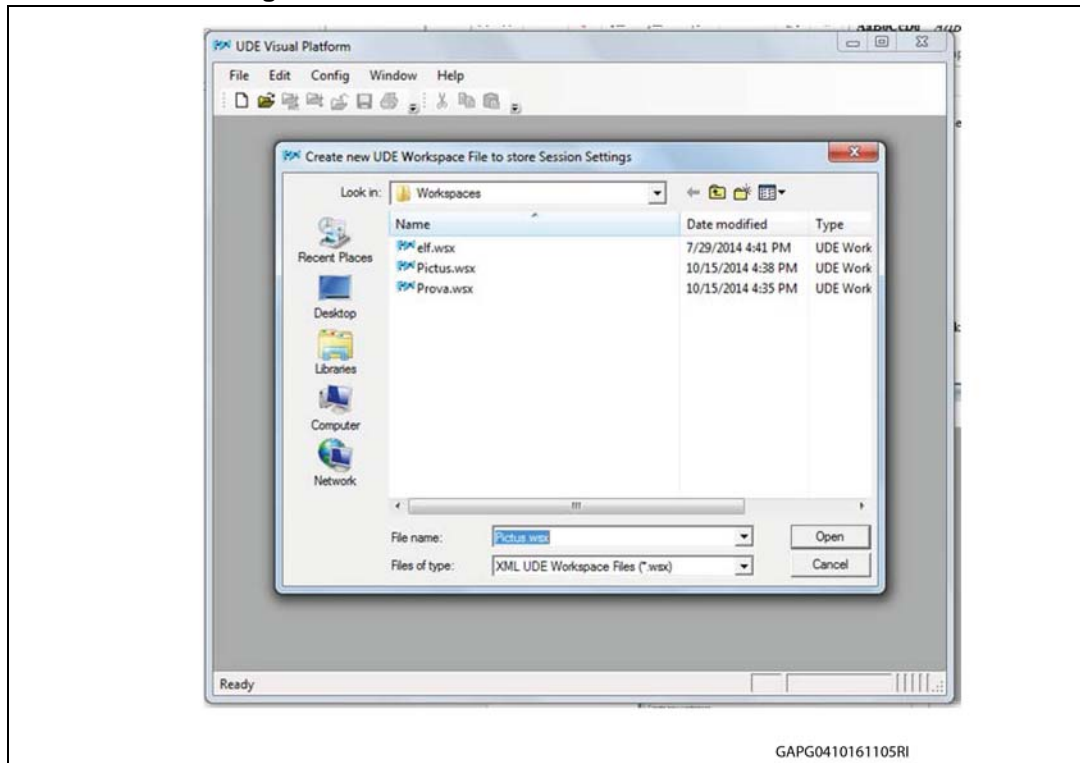
2. Create a New Workspace for SPC560P-DISP. Click File>New Workspace

Figure 19. UDE Visual Platform: File and New Workspace



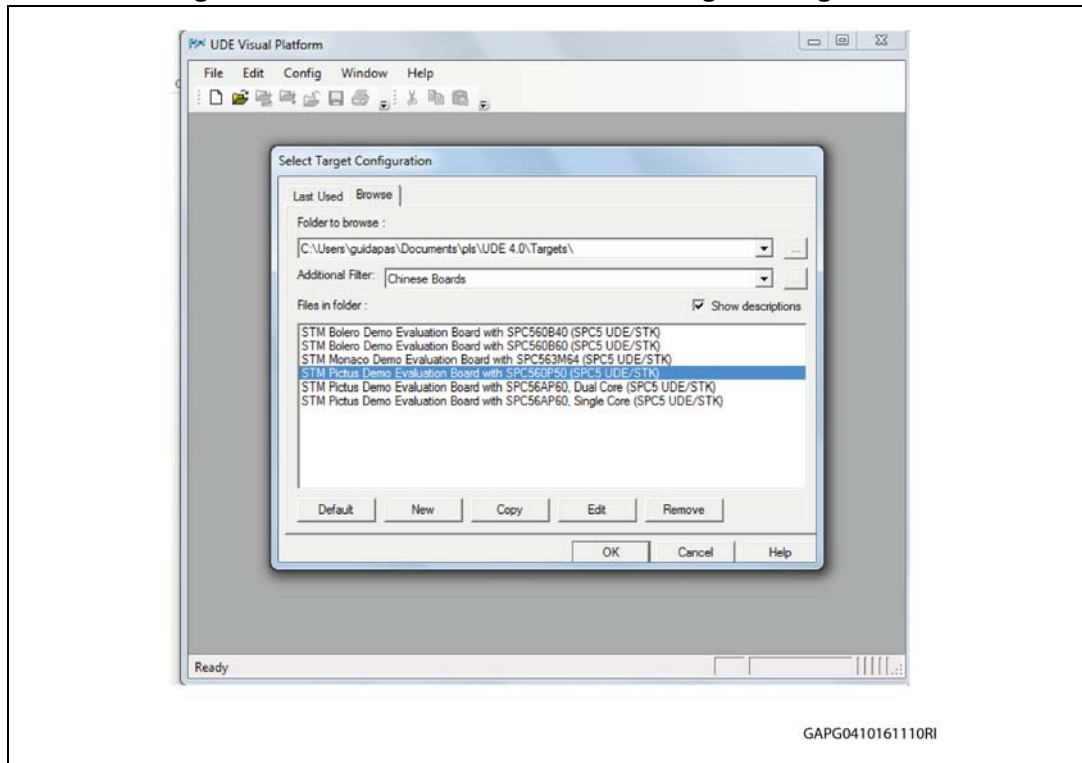
3. Name the new Workspace i.e. *Pictus* then select OPEN

Figure 20. UDE Visual Platform: Define File name



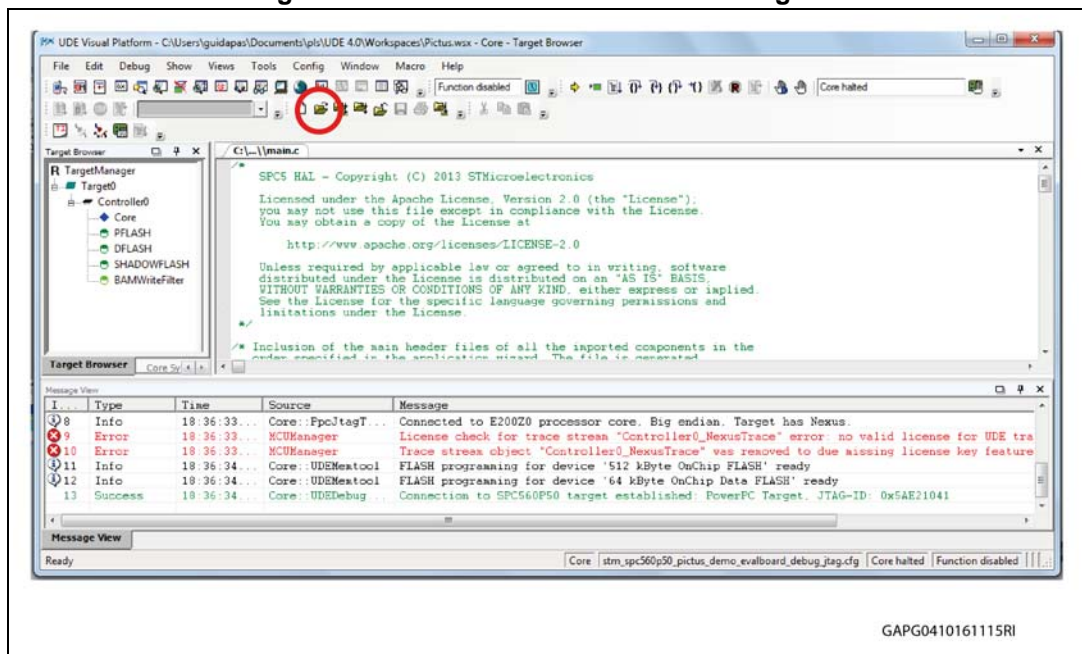
4. Select "STM Pictus Evaluation Board with SPC560P50(SPC5 UDE/STK)" then click OK

Figure 21. UDE Visual Platform: Select Target Configuration



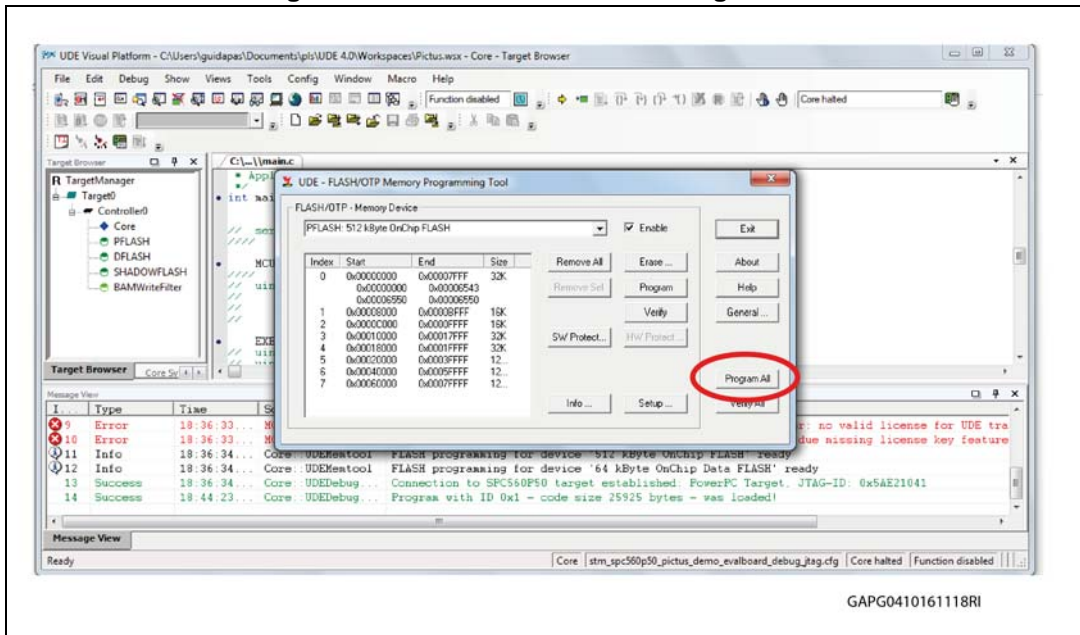
- UDE Visual Platform window will be refreshed and new functionalities will appear, then click on the icon “Load Program” highlighted in the red circle; browse the file “GP-Pictus.elf” then click “Open”.

Figure 22. UDE Visual Platform: Load Program



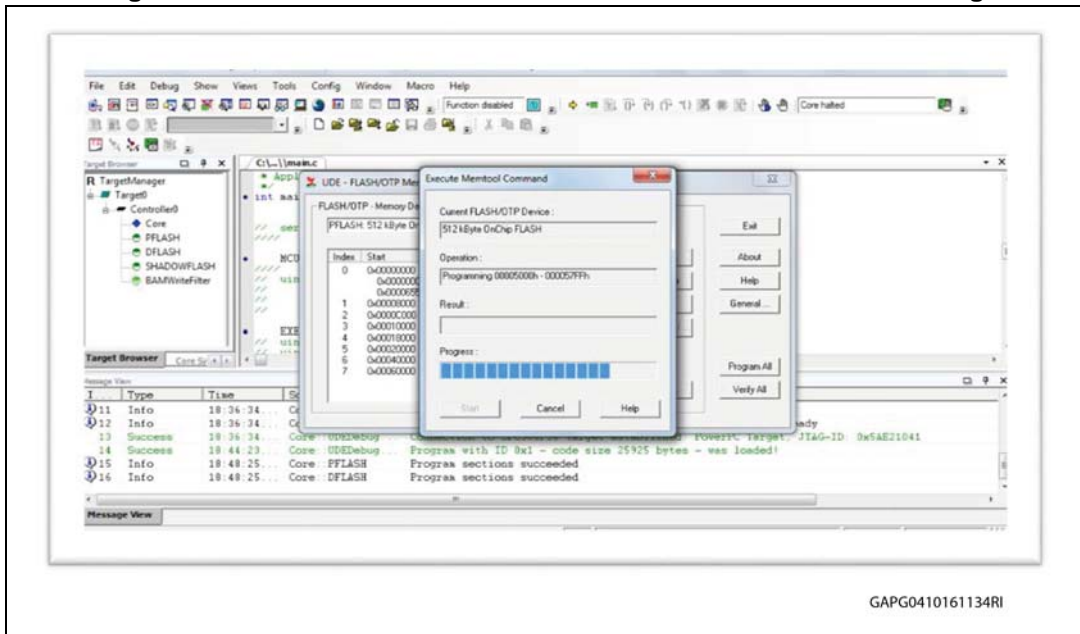
- Click on “Program All”.

Figure 23. UDE Visual Platform: Program All



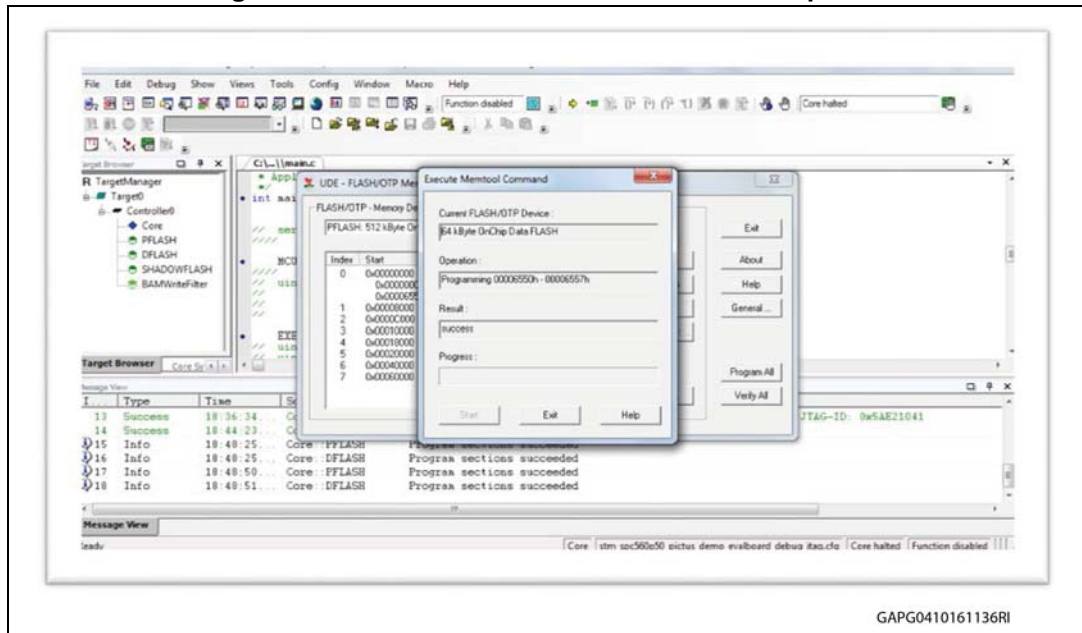
GAPG0410161118RI

Figure 24. UDE Visual Platform: Execute Memtool Command - loading



GAPG0410161134RI

Figure 25. UDE Visual Platform: Procedure completed



GAPG0410161136RI

- When the procedure is completed click on "Exit" button. The microcontroller in the SPC560P-DISP board is programmed now and the board is ready to be used with the Graphical User Interface (GUI) STSW-L9907 and configure and control the evaluation board EVAL-L9907.

## 7 Revision history

Table 1. Document revision history

Date	Revision	Changes
04-Oct-2016	1	Initial release.

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