

# AH1508

## SJA1105 Application Board

Rev. 01.30 — 22 June 2016

User Manual

### Document information

Info	Content
<b>Keywords</b>	SJA1105, SJA1105 Application Board
<b>Abstract</b>	The SJA1105 Application Board is described in this document.



**Revision history**

Rev	Date	Description
01.30	20160622	Documentation was removed from the support package
01.21	20160301	Fixed description of default xMII mode
01.20	20160219	SJA1105 Application Board version 1.2
01.00	20151106	Initial version

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## 1. Introduction

The SJA1105 Application Board demonstrates the capabilities of the SJA1105 Automotive Ethernet switch in combination with four TJA1100 Automotive Ethernet PHYs. This user manual focusses on the  $\mu$ C software included on this board and details the features it provides, the control interface, and the reprogramming procedure.

## 2. System Overview

The primary functional components of the SJA1105 Application Board are shown in Fig 1.

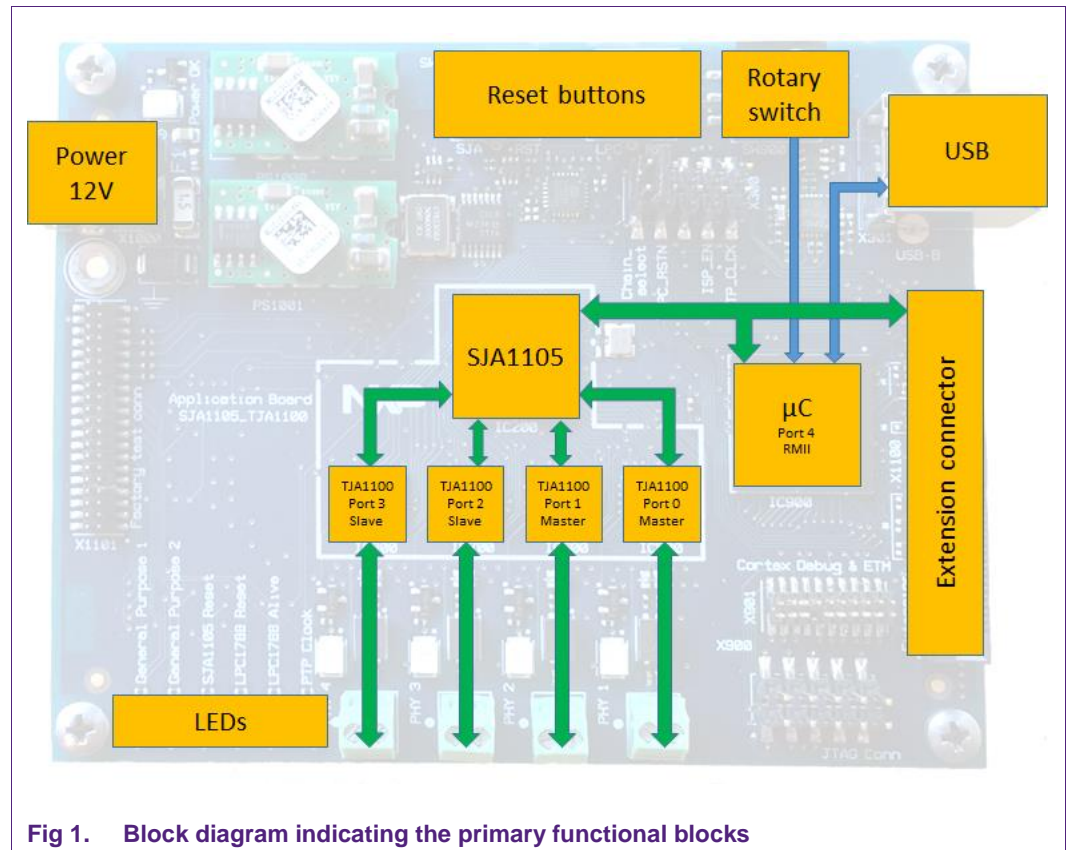


Fig 1. Block diagram indicating the primary functional blocks

### 2.1 Power

The SJA1105 Application Board is powered by a single 12 Volt input. It is advised to use an adapter that can deliver at least 1 Ampere of current.

### 2.2 SJA1105

The SJA1105 is an IEEE 802.3-compliant 5-port automotive Ethernet switch. Each of the five ports can be individually configured to operate at 100Mbit/s or 1000Mbit/s. This arrangement provides the flexibility to connect a mix of PHY devices such as the TJA1100 BroadR-Reach PHY from NXP Semiconductors and other commercially available Fast Ethernet and Gigabit Ethernet PHYs. The high-speed interface makes it easy to cascade multiple SJA1105s for scalability. It can be used in various automotive scenarios such as gateway applications, body domain controllers or for interconnecting

multiple ECUs in a daisy chain. Full Audio Video Bridging (AVB) supports means that the SJA1105 can be used in infotainment and driver assistance systems.

The SJA1105 comes in two variants. The SJA1105EL supports Ethernet and AVB. The SJA1105ELT includes additional functionality to support Time-Triggered (TT) Ethernet and Time-Sensitive Networking (TSN).

### 2.3 TJA1100

The TJA1100 is an OPEN Alliance BroadR-Reach compliant Ethernet PHY optimized for automotive use cases. The device provides 100Mbit/s transmit and receive capability over a single Unshielded Twisted Pair (UTP) cable, supporting a cable length of up to at least 15 m. Optimized for automotive use cases such as IP camera links, driver assistance systems and back-bone networks, the TJA1100 has been designed to minimize power consumption and system costs, while still providing the robustness required for automotive use cases.

The default configuration of the TJA1100 PHYs on the SJA1105 Application Board are detailed in Table 1. The default configuration can be overruled by modifying the various CONFIGx resistors on the board or by issuing SMI commands to the PHY.

**Table 1. Default TJA1100 configurations**

SJA1105 port:	TJA1100:	SMI address:	Master / Slave:	MII mode:
0	IC500	4	Master	RMII
1	IC600	5	Master	RMII
2	IC700	6	Slave	RMII
3	IC800	7	Slave	RMII

### 2.4 µC and extension connector

The on-board µC is preprogrammed with a basic application that enables a computer to control the SJA1105 and TJA1100 devices. In addition, it is capable of responding to ARP and ICMP Echo requests as detailed in Table 2.

The extension connector can be used to connect other µC modules to the SJA1105 Application Board.

**Table 2. Ethernet settings**

Configuration setting:	Value:
IPv4 address	169.254.115.1
MAC address	Unique value provided by the on-board EEPROM.
Services implemented	ARP ICMP Echo (a.k.a. ping)

### 2.5 Rotary switch

The µC software contains a number of built-in configurations that can be selected by the rotary switch provided on the PCB or by using the appropriate command (Section 4.3.12 or Section 5.4). A µC reset is required after the configuration has been changed.

**Table 3. Built-in configurations**

Configuration:	Description:
0	Leaves the SJA1105 unconfigured.
1	Basic switch configuration. <ul style="list-style-type: none"> <li>• Ports 0, 1, 2 and 3 are set to 100 Mbps RMII MAC mode.</li> <li>• Port 4 is set to 100 Mbps RMII PHY mode and is assumed to be connected to a <math>\mu</math>C.</li> </ul>
2	Basic switch configuration. <ul style="list-style-type: none"> <li>• Ports 0, 1, 2 and 3 are set to 100 Mbps RMII MAC mode.</li> <li>• Port 4 is set to 100 Mbps RMII PHY mode and is assumed to be connected to a <math>\mu</math>C.</li> <li>• It is assumed that an external loop is provided between port 1 and 2.</li> <li>• Ethernet frames with a destination address set to 00:10:94:00:00:01 received on port 0 and port 2 are forwarded to port 1 and 3 respectively.</li> <li>• Ethernet frames with a destination address set to 00:10:94:00:00:02 received on port 3 and port 1 are forwarded to port 2 and 0 respectively.</li> </ul>

## 2.6 LEDs

**Table 4. SJA1105 Application Board LEDs**

LED label	Description:
General Purpose 1	Connected to the on-board $\mu$ C. Currently used to indicate that the automatic configuration of the SJA1105 was successful. Can also be controlled via the script interface.
General Purpose 2	Connected to the on-board $\mu$ C. Currently used to indicate that the automatic configuration of the SJA1105 was not successful. Can also be controlled via the script interface.
SJA1105 Reset	Indicates the state of the reset input of the SJA1105.
LPC1788 Reset	Indicates the state of the reset input of the on-board $\mu$ C.
LPC1788 Alive	Connected to the on-board $\mu$ C. Currently used to by the $\mu$ C software to indicate that it is still working as expected. This LED should continuously blink.
PTP Clock	Connected to the PTP_CLK pin of the SJA1105.
PHY 1, 2, 3, 4	Connected to the WAKE/LED pin of the corresponding TJA1100 PHY.

## 2.7 USB connector

A USB-to-UART converter is included on the board to provide an easy connection between a computer and the  $\mu$ C for interacting with the SJA1105 and TJA1100 devices.

The setting for this serial connection are detailed in Table 5. The provided Python scripting environment is detailed in Section 4. Low level details of the implemented communication protocol can be found in Section 5.

It is also possible to reprogram the  $\mu\text{C}$  via this USB connector. This procedure is explained in Section 6.

**Table 5. Serial port settings**

<b>Configuration setting:</b>	<b>Value:</b>
Baud rate	115200
Data bits	8
Parity	None
Stop bits	1
Flow control	None

## 2.8 Reset buttons

Separate buttons are provided to reset the SJA1105 (“SW2”) or the  $\mu\text{C}$  (“SW1”).

### 3. Getting Started

This section will provide a quick introduction on how to setup and use the SJA1105 Application Board.

#### 3.1 Installing the software package

The provided installer will install the software components required to work with the SJA1105 Application Board.

One of the main requirements of the software package is Python 2.7. The installer looks for the windows registry entries to determine whether Python 2.7 is installed on the system and installs it automatically otherwise. Additionally, the installer tries to prepend the environment variable PATH of the current user with Python 2.7 in order to set it as the default Python used by the system.

Core Python handlers and modules, including the SJA1105 scripting environment, are packed into a python package, which is installed by the installer to the site-packages of the Python 2.7. A shortcut for locating the source codes under the site-packages is placed into the installation directory.

Additionally, the installer offers to provide example scripts for using the python package sja1105. These example scripts cover the fundamental basis of serial communications as well as configurations of the SJA1105 Application Board (see Fig 2).

A detailed view of the installation directory structure is demonstrated in Table 6.

**Table 6. Installation directory structure**

Directory / File:	Description:
example_com	Scripts to control and program the SJA1105 Application Board over the serial USB are placed under a sub directory called pyScripts. A bat file for each python script can be found here. Once executed, these bat files call the respective python scripts.
example_configs	Example scripts for creating different SJA1105 configurations in the form of a HEX file is placed under a sub directory called pyScripts. A bat file for each python script can be found here. Once executed, these bat files call the respective python scripts to create the corresponding HEX files.
sja1105_package_source	A shortcut that points to the sja1105 package installed under site-packages of the Python 2.7 installation.
Python27	If Python 2.7 is not installed on the system, this is where the installer installs the Python 2.7.
config.ini	A configuration file for defining the COM port where the SJA1105 Application Board is connected. By default, the COM port is defined to be determined automatically by the python package sja1105. The entry <i>port=auto</i> within this file is used for this purpose.
start.bat	Starts a command line interpreter running the Python 2.7.

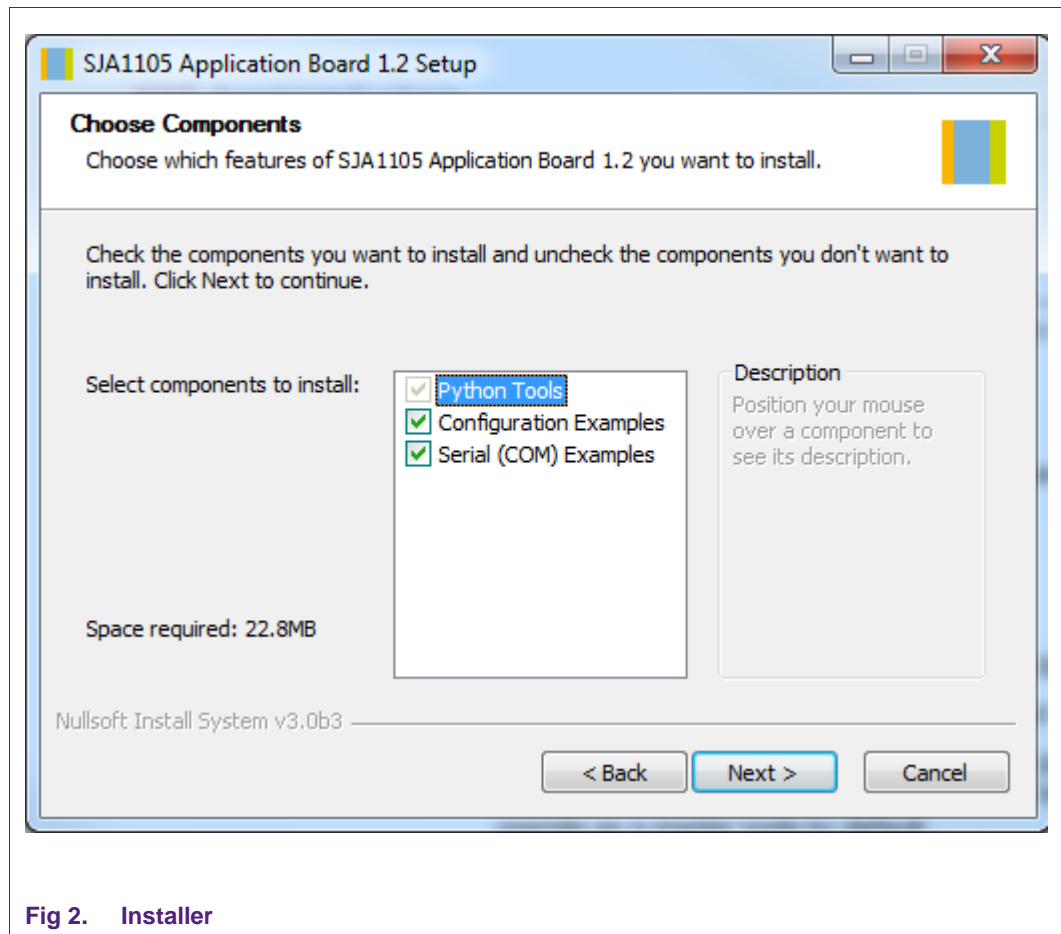


Fig 2. Installer

## 3.2 Board setup

The steps required to attach the SJA1105 Application Board to a computer are:

- Connect a USB cable between the USB port and the computer
- Connect the first OPEN Alliance BroadR-Reach port to a computer via a media converter. The media converter should be set to slave mode as this port is set to operate as a master node by default.
- Set the rotary switch to position 1.
- Connect a 12 Volt adapter to the power input socket.
- Reset the  $\mu\text{C}$  by pressing the corresponding reset button.

See Fig 3 for a connection diagram.



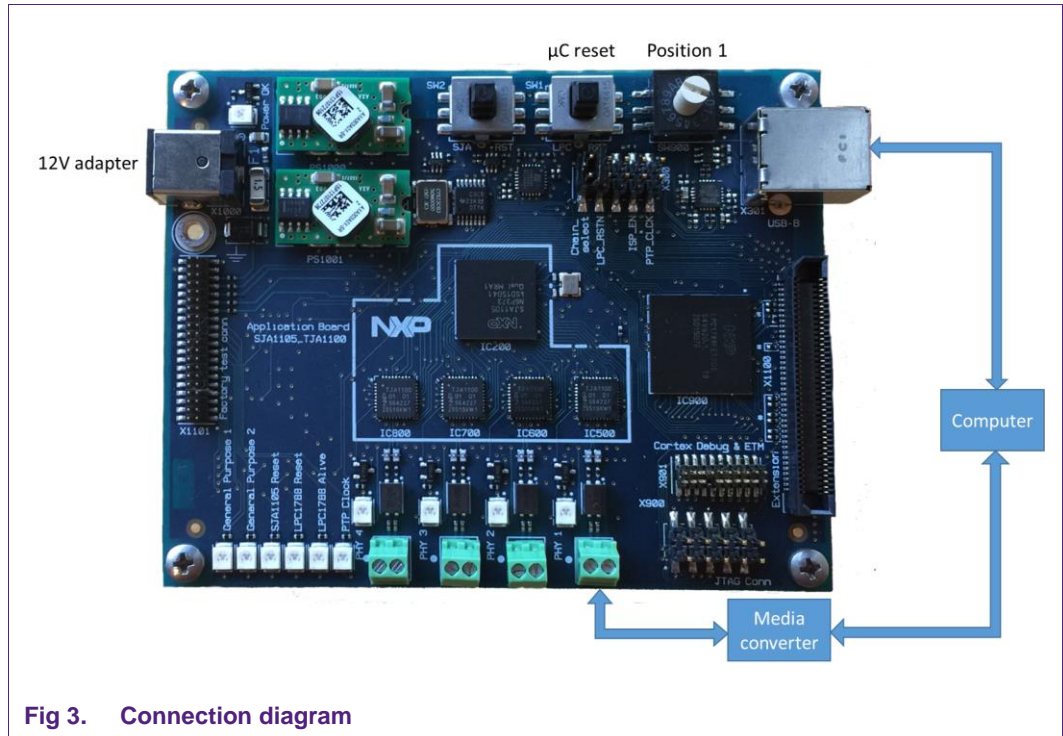


Fig 3. Connection diagram

### 3.3 Determining the serial port

The USB connector of the SJA1105 Application Board is connected to a USB-UART converter and therefore the operating system will assign a serial (or COM) port number to each connected board.

The example Python scripts provided by the installer have the ability to detect the COM port automatically, which is the default behavior. However, COM port can be specified in the config.ini file as well. By setting the “port” entry to the desired port number, auto search is disabled and the scripts use the defined port to communicate with the board.

In order to explicitly define a COM port in the config.ini, it is necessary to determine the port assigned to the board by the operating system. On a Windows based machine, this can be done by using the Device Manager application (see Fig 4). It is also possible to change the serial port number by right clicking on the current serial port number and subsequently navigating to Properties → Advanced → COM Port Number.

Once the desired port number is known – for example: COM10 -, it can be explicitly set by modifying the 4<sup>th</sup> line of the config.ini:

*port = 10*

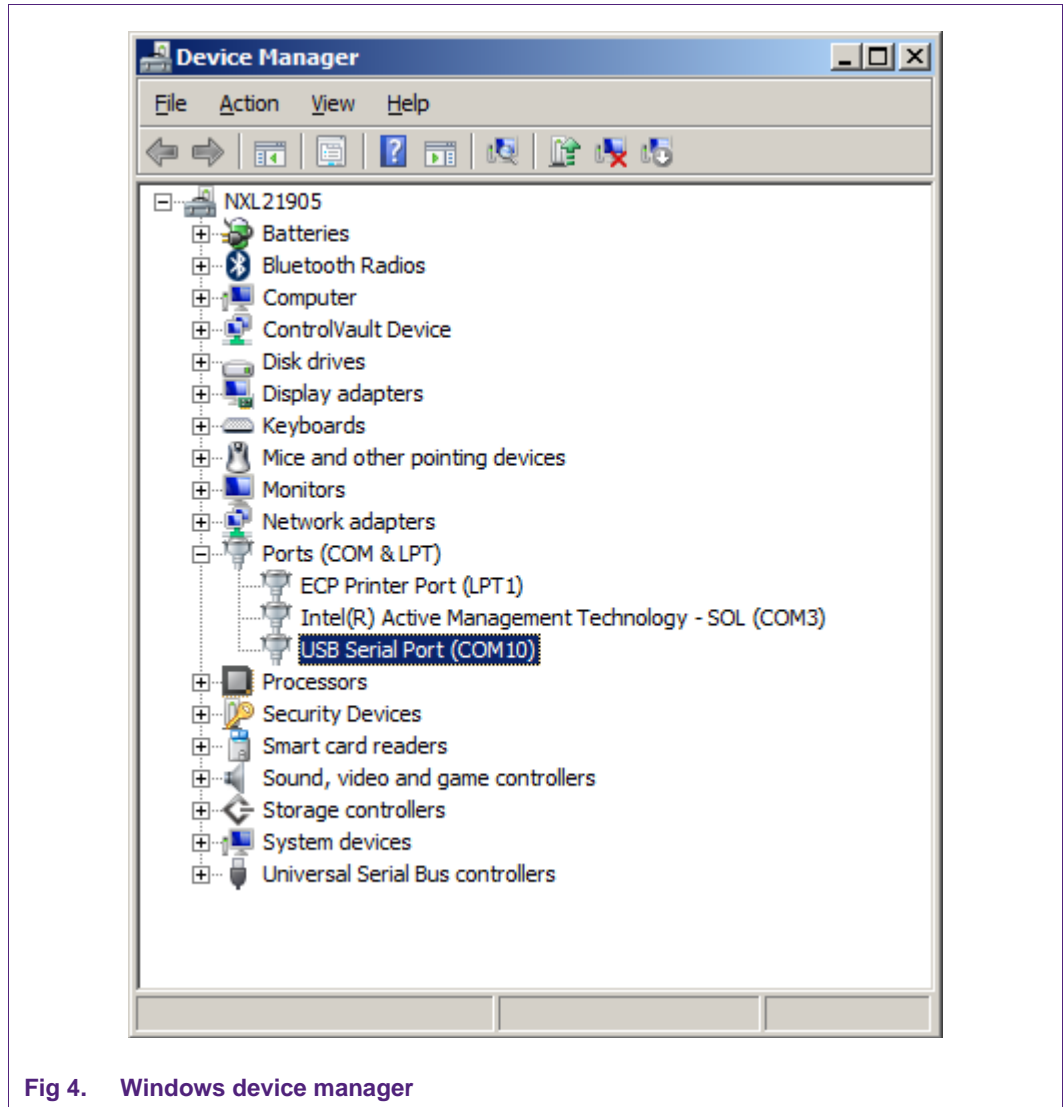


Fig 4. Windows device manager

### 3.4 SJA1105 communication

The “id.bat” batch file, from the directory “example\_com”, gives an example on how to read register values from the SJA1105. This script reads and prints the revision number of the  $\mu$ C software and the device identifier of the SJA1105.

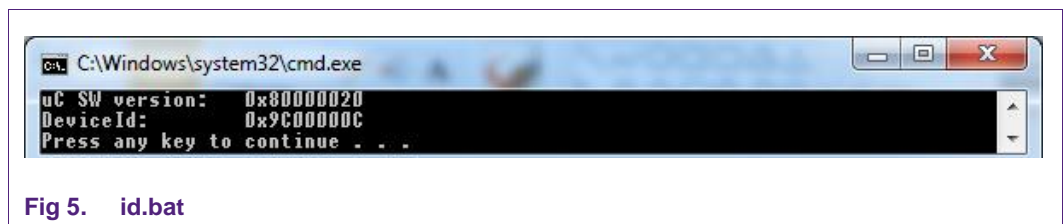


Fig 5. id.bat

### 3.5 TJA1100 communication

The “test\_phy.bat” batch file, from the directory “example\_com”, reads the PHY identification registers for all possible SMI addresses and prints these to the screen. The default SMI address range used by the TJA1100 PHYs on the SJA1105 Application Board is 4, 5, 6 and 7.

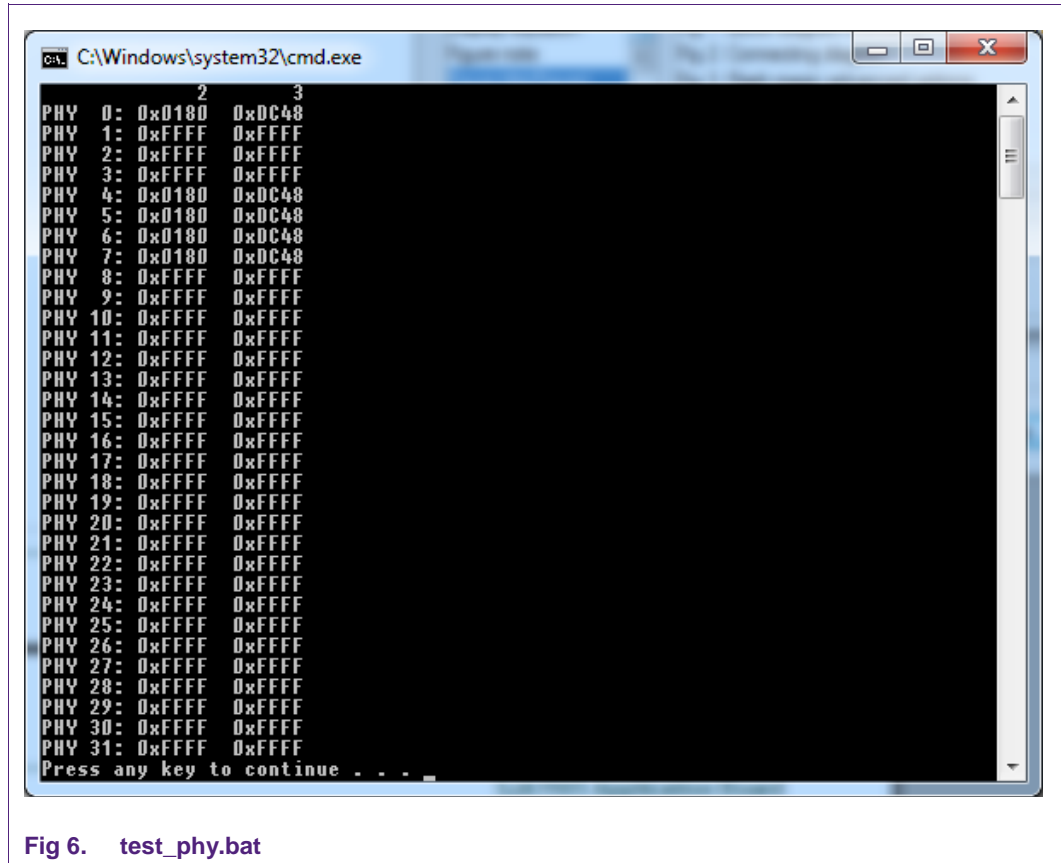


Fig 6. test\_phy.bat

### 3.6 Ping

The  $\mu$ C software is capable of responding to ARP and ICMP Echo requests and therefore the connection through the TJA1100 can easily be tested by pinging the board. To do this, open a command line interface and execute “ping 169.254.115.1”.

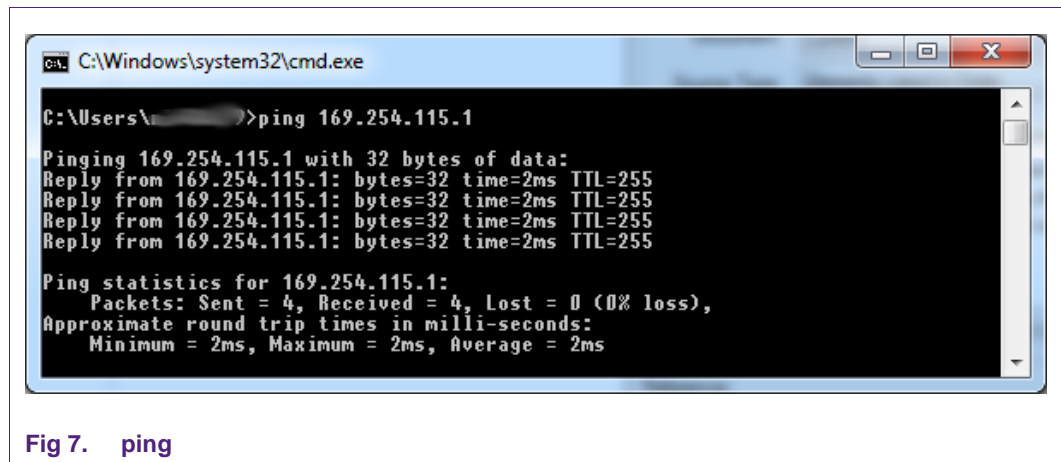


Fig 7. ping

### 3.7 Creating a new SJA1105 configuration

Creating a new configuration for the SJA1105 involves the following steps:

1. Open the `example_configs\pyScripts` directory.
2. Create a copy of one of the provided example configuration sources and rename it as desired.
3. Set the name of the configuration file to be created by locating and modifying the following line. The last argument “`output.hex`” in this example determines the name of the generated configuration.

```
swc.create_nvme_file(join ( local_dir, “output.hex” ) )
```

4. Modify the remainder of the configuration source as desired.
5. Save the configuration source.
6. Navigate to the directory above (`example_configs`).
7. Make a copy of one of the batch files and edit the following line by replacing the script to be executed by the configuration source created.

```
%pythondir%python pyScripts\<name_of_the_configuration_source_created>
```

8. Save the batch file and run it.
9. A new configuration in the Intel HEX file format should appear with the specified name.

It is possible to test the new configuration by renaming it to “`test_config.hex`” and overwriting the one present in the directory `example_configs`. Running the `test.bat` from the directory `example_com` will reprogram the SJA1105 with this new configuration.

## 4. Python scripting

### 4.1 Directory structure

As previously mentioned, the directory structure of the Python scripting environment contains two significant directories: `example_com` and `example_configs`. Under each of these directories there are batch files together with their respective python scripts located inside the folder `pyScripts`. Table 7 and Table 8 describe these python scripts.

**Table 7. Scripts from `example_com\pyScripts`**

Script:	Description:
<code>calculate_l2_hash.py</code>	Calculates possible indices for a MAC and VLAN.
<code>eprom_ip_address.py</code>	Reads the ip address of the board.
<code>eprom_ip_address_169_254_115_0.py</code>	Sets the ip address of the board to 169.254.115.0.
<code>eprom_ip_address_169_254_115_15.py</code>	Sets the ip address of the board to 169.254.115.15.
<code>eprom_ip_address_clear.py</code>	Clears the previously set ip address. After the execution ip address of the board becomes 0.0.0.0.
<code>eprom_mac_address.py</code>	Reads the MAC address of the board.
<code>id.py</code>	Example script that reads the DEVICEID register of the SJA1105.
<code>interactive.py</code>	Base script for an interactive session.
<code>read_highlevel_diagnostic_registers.py</code>	Reads Rx and Tx diagnostic registers for all ports.
<code>read_l2_address_lookup_table.py</code>	Reads L2 address lookup table.
<code>read_l2_management_lookup_table.py</code>	Reads L2 management route table.
<code>test.py</code>	Example script that loads the <code>test_config.hex</code> (located under <code>example_configs</code> ) and flashes the red and green LEDs.
<code>test_auto_config.py</code>	Example script to cycle through all the standard configurations available in the $\mu$ C software.
<code>test_phy.py</code>	Example script that reads the PHY identifier registers (register 2 and 3) of all the possible PHY addresses.
<code>write_l2_address_lookup_table.py</code>	Writes L2 address table entry.
<code>write_management_entry_lookup_table.py</code>	Writes L2 management table entry.
<code>write_vlan_lookup_table.py</code>	Writes a VLAN entry.

**Table 8. Scripts from example\_configs\pyScripts**

Script:	Description:
Create_config_Basic_L2_Switching_<config_type>.py	There are 8 different example scripts for creating hex configuration files according to the <config_type> stated by the script name. Once executed these scripts create the respective hex file for the example configuration.
hex_config_to_c.py	Converts a given hex file to C code. Expects two arguments: <ul style="list-style-type: none"> <li>• Path to the hex file</li> <li>• Path for the output (optional)</li> </ul>

## 4.2 Python package sja1105

As previously mentioned, the python package sja1105 contains the fundamental handlers, modules and most importantly the SJA1105 scripting interface.

**Table 9. Package contents**

Directory:	Description:	
config_mra2	Low-level python scripts to generate the HEX files.	
handlers	File:	Description:
	configHandler.py	Parses the config.ini by using the default Python library ConfigParser. Includes two methods: <ul style="list-style-type: none"> <li>• get_config_dict(): returns the config.ini in the form of a dictionary with sections as keys and further dictionaries with key – value pairs for each entry.</li> <li>• port_from_config(): returns the COM port defined in the config.ini. Return type is string.</li> </ul>
	converter.py	Contains the class Converter, which provides the functionality of converting a HEX file into C code. This class can be imported by the statement: <i>from sja1105 import Converter</i> .
	logger.py	Provides logging functionality to the package, uses the default Python package logging for this purpose. Creates two separate logs for serial communications and the main flow. Contains the following objects, which can be imported from the sja1105 package: <ul style="list-style-type: none"> <li>• logLevel: a dictionary containing different levels for logs such as info, debug, warning, error and critical.</li> <li>• comLog: logging object used for logging the serial communication related information. Usage: <i>comLog.log(logLevel[&lt;level&gt;], msg)</i>.</li> <li>• mainLog: similar to comLog, a logging object used for logging the main flow related information.</li> </ul>
pathFinder.py	Offers functionality for retrieving certain paths. Contains 3	

Directory:	Description:
	public methods: <ul style="list-style-type: none"> <li>• getInstallDir(): Returns a path to the installation directory of the SJA1105 Application Board package.</li> <li>• getPythonDir(): Returns a path to the installation directory of Python 2.7.</li> <li>• getScriptName(file): Returns the name of the given file.</li> </ul>
portFinder.py	Provides the ability of scanning all COM ports and determining the port that is used by SJA1105 Application Board. Contains the method <i>get_sja1105_port()</i> , which returns the COM port depending the port entry in the config.ini. If the port entry is set to auto, it determines to port by scanning all COM ports.
sja1105_serial.py	Contains a class named Serial, which extends the Pyserial class with the same name. Adds logging functionality to the Pyserial methods open, close, write and read. The package sja1105 is configured to automatically import the extended version. Usage: <i>from sja1105 import serial</i>
modules	Contains the package Pyserial including a script from this package, which is modified to offer its functionality in the form of a method. scanwin32.py is the aforementioned script with the method <i>get_all_com_ports()</i> .
platform	Contains sja1105_platform.py, which contains the scripting interface together with its helper classes. (see section 4.3)

### 4.3 Scripting interface

Python package – sja1105 - installed by the installer comes with a scripting interface called SJA1105\_Platform, which is realized as a class. The file sja1105\_platform.py, which contains this class together with its helper classes, is located in the site-packages of the Python 2.7 installation. By using the shortcut 'sja1105\_package\_source' from the installation directory, source codes of the package can be located. The aforementioned file containing the scripting interface can be found under the sub directory 'platform'. This public interface and its methods are described in this section.

#### 4.3.1 `__init__( serial_port )`

Initializes the SJA1105\_Platform object.

**Table 10. Arguments of `__init__( serial_port )`**

Argument:	Description
serial_port	The number of the serial port to which the SJA1105 evaluation board is connected (e.g., the value 22 corresponds to 'COM22' on a Windows computer).

#### 4.3.2 `sja1105_spi_config( config_file )`

Configures the SJA1105 with the configuration contained in an Intel HEX-file.

Table 11. Arguments of `spi_config( config_file )`

Argument:	Description:
<code>config_file</code>	The path to the aforementioned Intel HEX-file containing the desired configuration for the SJA1105.

### 4.3.3 `spi_write( address, data )`

Writes a value to a SJA1105 register defined by the argument `address`.

Table 12. Arguments of `spi_write( address, data )`

Argument:	Description:
<code>address</code>	The address of the register to write to. The range of valid addresses is 0x0000_0000 to 0x001F_FFFF.
<code>data</code>	The unsigned 32-bit integer data value to write to the register.

### 4.3.4 `spi_read ( address )`

Returns the value of a SJA1105 register (unsigned 32-bit integer) with the given `address`.

Table 13. Arguments of `spi_read( address )`

Argument:	Description:
<code>address</code>	The address of the register to read from. The range of valid addresses is 0x0000_0000 to 0x001F_FFFF.

### 4.3.5 `spi_read_print( address )`

Reads the value of a SJA1105 register defined by the `address` and prints this value to the standard output as a formatted string.

Table 14. Arguments of `spi_read_print( address )`

Argument:	Description:
<code>address</code>	The address of the register to read from. The range of valid addresses is 0x0000_0000 to 0x001F_FFFF.

### 4.3.6 `smi_write( phy, address, data )`

Writes to an SMI register inside one of the PHYs,

Table 15. Arguments of `smi_write( phy, address, data )`

Argument:	Description:
<code>phy</code>	The address of the PHY. The range of valid PHY addresses is 0 to 31.
<code>address</code>	The address of the register to write to. The range of valid addresses is 0 to 31.
<code>data</code>	The unsigned 16-bit integer data value to write to the register.



#### 4.3.7 smi\_read( phy, address )

Reads from an SMI register inside one of the PHYs and returns this value (unsigned 16-bit integer).

**Table 16. Arguments of smi\_read( phy, address )**

Argument:	Description:
phy	The address of the PHY. The range of valid addresses is 0 to 31.
address	The address of the register to write to. The range of valid addresses is 0 to 31.

#### 4.3.8 smi\_read\_print( phy, address )

Reads from an SMI register inside one of the PHYs and prints this value to the standard output as a formatted string.

**Table 17. Arguments of smi\_read\_print( phy, address )**

Argument:	Description:
phy	The address of the PHY. The range of valid PHY addresses is 0 to 31.
address	The address of the register to write to. The range of valid addresses is 0 to 31.

#### 4.3.9 reset()

Resets the SJA1105.

#### 4.3.10 get\_version()

Returns the  $\mu$ C software revision number (unsigned 32-bit integer).

#### 4.3.11 set\_leds( red=False, green=False)

Turns the red and green LEDs on or off.

**Table 18. Arguments of set\_leds( red=False, green=False)**

Argument:	Description>
red	Turns the red LED on (True) or off (False).
green	Turns the green LED on (True) or off (False).

#### 4.3.12 auto\_configure( config\_number )

Uses a configuration stored in the  $\mu$ C to configure the SJA1105. A boolean value is returned to indicate whether the configuration procedure was successful (True) or not (False).

**Table 19. Arguments of auto\_configure( config\_number )**

Argument:	Description:
config_number	The configuration to use (unsigned 8-bit integer).

## 5. Serial commands and responses

The various commands accepted by the  $\mu$ C software are detailed in this section.

### 5.1 Basic structure

The interface implemented by the  $\mu$ C software is based on the command-response pattern. The computer will send a command to the  $\mu$ C and, if the command is accepted, a response is returned.

Each command is delimited by the '<' and '>' characters. Responses are delimited by the '[' and ']' characters.

Each command and response is identified by a 4 ASCII character string (e.g., 'LEDR'). Command and response arguments are also ASCII encoded according to these conversion rules:

- Boolean values are converted to 'T' or 'F' character to indicate a true or false value respectively.
- Unsigned integer values are encoded into a sequence of ASCII characters that match the hexadecimal representation of the value. Unsigned 8-bit (e.g., 0x12 → '12'), 16-bit (e.g., 0x1234 → '1234') and 32-bit (e.g., 0x12345678 → '12345678') values are supported.

### 5.2 Read $\mu$ C software revision number

This command read the revision number of the  $\mu$ C software.

Command: <VERS>

Response: [VERSaaaaaaaa]

**Table 20. Arguments of the VERS command and response**

Argument:	Description:
a	The revision number of the $\mu$ C software (32-bit unsigned integer).

### 5.3 SJA1105 reset

This command enables resetting the SJA1105 from software.

Command: <PRSTa>

Response: [PRSTa]

**Table 21. Arguments of the PRST command and response**

Argument:	Description:
a	Boolean value indicating whether the SJA1105 is reset ('T') or not ('F').

### 5.4 SJA1105 built-in configuration

This command configures the SJA1105 with a built in configuration.

Command: <CNFGaa>

Response: [CNFGaab]

**Table 22. Arguments of the CNFG command and response**

Argument:	Description:
a	The configuration to set (8-bit unsigned integer).
b	Indicates whether the configuration was successful ('T') or not ('F').

Notes:

- This command is available starting with revision 7.

## 5.5 SJA1105 register write

This command writes to a register inside the SJA1105.

Command: <SPIWaaaaaaaaabbbbbbbb>

Response: [SPIWaaaaaaaaabbbbbbbb]

**Table 23. Arguments of the SPIW command and response**

Argument:	Description:
a	The register to write to (32-bit unsigned integer).
b	The value to write (32-bit unsigned integer).

## 5.6 SJA1105 register read

This command reads from a register inside the SJA1105.

Command: <SPIWaaaaaaaa>

Response: [SPIWaaaaaaaaabbbbbbbb]

**Table 24. Arguments of the SPIR command and response**

Argument:	Description:
a	The register to read from (32-bit unsigned integer).
b	The value read (32-bit unsigned integer).

## 5.7 SJA1105 low level SPI access

This command implements a low-level interface to the SJA1105. Its primary use is for writing configurations in a more efficient way.

Command: <SPIX(aaaa)+>

Response: [SPIX(aaaa)+]

**Table 25. Arguments of the SPIX command and response**

Argument:	Description:
(aaaa)+	One or more 16-bit unsigned integer values to transfer on the SPI interface.

## 5.8 PHY register write

This command writes to a register inside an Ethernet PHY.

Command: <SMIWaabbcccc>

Response: [SMIWaabbcccc]

**Table 26. Arguments of the SMIW command and response**

Argument:	Description:
a	The SMI address of the PHY (8-bit unsigned integer, range 0 to 31).
b	The register to write to (8-bit unsigned integer, range 0 to 31).
c	The value to write (16-bit unsigned integer).

## 5.9 PHY register read

This command reads from a register inside an Ethernet PHY.

Command: <SMIRaabb>

Response: [SMIRaabbcccc]

**Table 27. Arguments of the SMIR command and response**

Argument:	Description:
a	The SMI address of the PHY (8-bit unsigned integer, range 0 to 31).
b	The register to read from (8-bit unsigned integer, range 0 to 31).
c	The value read (16-bit unsigned integer).

## 5.10 IPv4 address write

This command writes a new IPv4 address to the EEPROM. This value will be ignored by the  $\mu$ C software if it is equal to 0x00000000 or 0xFFFFFFFF. A reset is required before this value is used by the  $\mu$ C software.

Command: <IP4Waaaaaaaa>

Response: [IP4Waaaaaaaa]

**Table 28. Arguments of the IP4W command and response**

Argument:	Description:
a	The new IPv4 address to store in the EEPROM. For example, the address 169.254.115.1 would be encoded as 0xA9FE7301.

## 5.11 IPv4 address read

This command reads the IPv4 address stored in the EEPROM. This value will be ignored by the  $\mu$ C software if it is equal to 0x00000000 or 0xFFFFFFFF.

Command: <IP4R>

Response: [IP4Raaaaaaaa]

**Table 29. Arguments of the IP4R command and response**

Argument:	Description:
a	The new IPv4 address to store in the EEPROM. For example, the address 169.254.115.1 would be encoded as 0xA9FE7301

## 6. In-system programming

The  $\mu$ C software can be reprogrammed via the serial port.

### 6.1 Installation

- Install the Flash Magic application (<http://www.flashmagictool.com/download.html>).
- Use the “Advanced Options...” item in the “Options” menu to open the tabbed pane with advanced options. The controls in the second tab should be changed to conform to Fig 8.

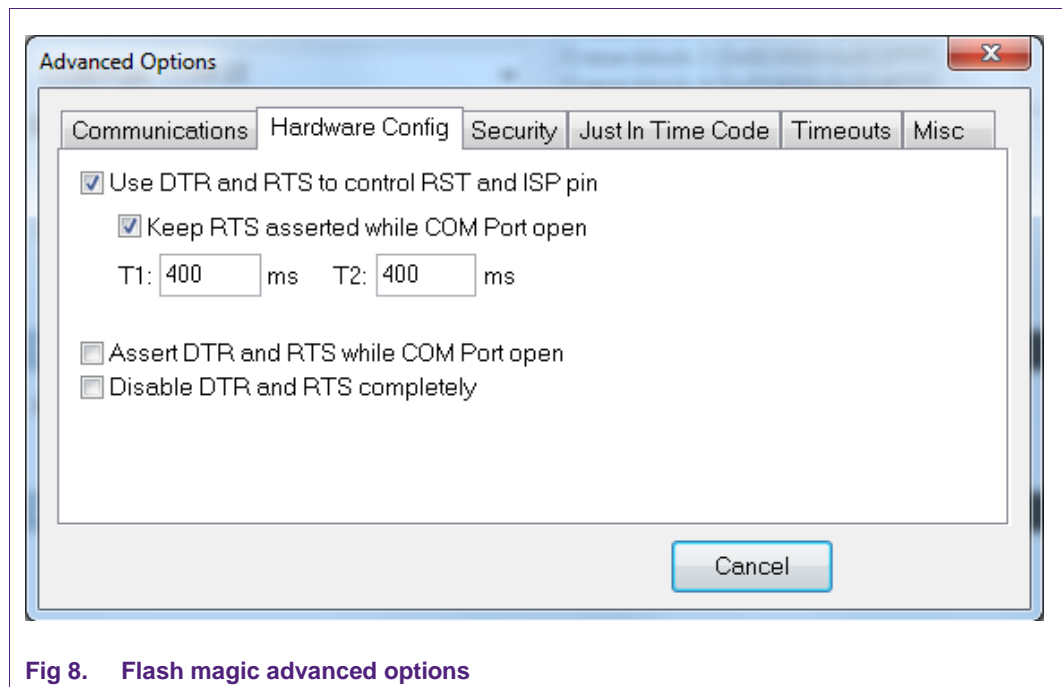


Fig 8. Flash magic advanced options

### 6.2 Preparation

The following actions are required to prepare the SJA1105 Application Board for reprogramming:

- Supply power to the board.
- Connect a USB cable between the board and the computer.
- Place a jumper to short pins 3 and 4 of connector X300. These pins are labelled “ISP\_EN” on the silkscreen.

### 6.3 Programming

The main user interface of the Flash Magic application is divided into 5 numbered steps and the actions per step are:

Step 1:

- Select LPC1788 microcontroller.
- Select the serial port used by the SJA1105 Application Board.
- Set the baudrate to 57600.

- Set interface to “None (ISP)”.
- Set the oscillator to 12 MHz.

Step 2:

- Select “Erase blocks used by Hex File”.

Step 3:

- Select the Intel Hex file to program.

Step 4:

- Optionally select “Verify after programming”.

Step 5:

- Click the Start button.

## 7. Abbreviations

**Table 30. Abbreviations)**

Acronym	Description
μC	Microcontroller
ARP	Address Resolution Protocol
AVB	Audio/Video Bridging (IEEE 802.1BA)
IC	Integrated Circuit
ICMP	Internet Control Message Protocol
ISP	In-System Programming
LED	Light Emitting Diode
MII	Media Independent Interface
OABR	OPEN Alliance BroadR-Reach
PHY	Physical layer
RMII	Reduced Media Independent Interface
SMI	Serial Management Interface, a.k.a. Media Independent Interface Management
SPI	Serial Peripheral Interface
TSN	Time Sensitive Networking
TT	Time-triggered
UART	Universal Asynchronous Receiver/Transmitter
USB	Universal Serial Bus

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