

User Manual

FC401 USB SMI/SPI Adapter
Version 1.2.0

February 14, 2024
Build 2
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1 Overview

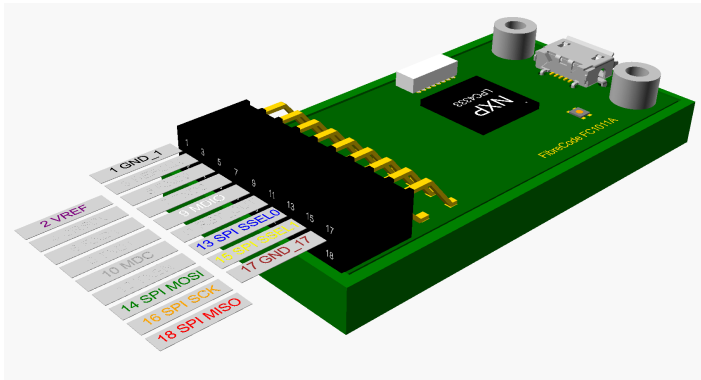
Pos	Use-Case	Description
1	NXP OM14500	Connect SMI to TJA110x
2	NXP SJA1105Q-EVB	Connect SMI to TJA1102, SPI to SJA1105Q
3	NXP SJA1105SMBEVM	Connect SMI to TJA1102, SPI to both SJA1105S
4	NXP SJA1110EVM	Connect SMI to all Phys, SPI to both SJA1110
5	ADI ADIN1100EVB	Connect SMI to ADIN1100
6	NXP TJA1103EVB	Connect SMI to TJA1103A

1.1 Details on SMI

Moving forward to Gig-Phys and Multi-Gig Phy Transceivers, more and more devices support SMI Clause-45 only or at least SMI Clause-22 and Clause-45 register access. To simplify this for easy connectivity, FC401 comes with full support for both standards including auto-detection for right clause protocol. In current designs, we found NXP Phy Transceivers TJA110x supporting Clause-22, NXP SJA1110, TJA1103 and ADI ADIN1100 supporting Clause-45.

2 Hardware

FC401 device is based on FC1011 PCB-Design with compatible Broadway2 firmware like FC602, FC611 and FC612. Means: BASE-T1 transceiver is not part of design to connect to external board connections if pin-header for SMI/SPI is available. This could be any evaluation board available with different types of transceivers from NXP, ADI, ... or own custom designs where SMI and/or SPI is accessible via test-points. In case custom board is used and there is parallel SoC connected to SMI/SPI, make sure to keep pins High-Z by reset of local SoC or unsoldering/jumper to external mode.



2.1 Connector

Pin-Out of 2.54 Dupont Connector is:

Pin	Name	Comment	Color
1	GND	Ground	Black
2	VREF	Ext. IO-Voltage	Purple
3	REFCLK	50 MHz Clock for RMII	-
4	CRSDV	RMII CRSDV	-
5	RXD0	RMII Rx Data0	-
6	RXD1	RMII Rx Data1	-
7	TXD0	RMII Tx Data0	-
8	TXD1	RMII Tx Data1	-
9	MDIO	SMI MDIO	White
10	MDC	SMI MDC	Grey
11	RST_OUT	Reset	-
12	TXEN	RMII TxEnable	-
13	SPI SSEL0	SPI CS0	Blue
14	SPI MOSI	SPI Data-Out	Green
15	IRQ/SPI SSEL1	Interrupt (In) or SPI CS1	Yellow
16	SPI SCK	SPI Clock	Orange
17	GND	Ground	Brown
18	SPI MISO	SPI Data-In	Red

For attached cable, we propose to use color coding as mentioned.

Pin1: Upper Left

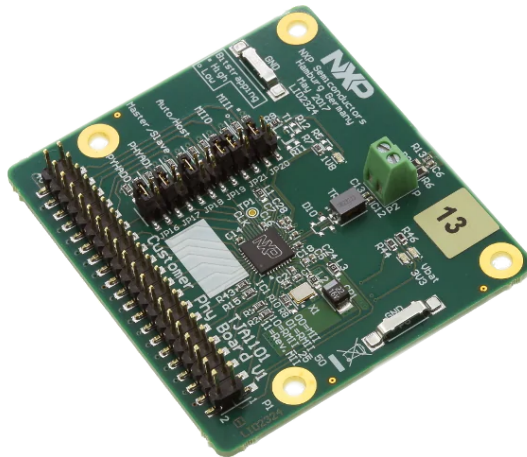
Always connect wires for SMI/SPI with USB unplugged! After powering-up the target/EVB, plug-in USB to Windows/Linux host. In case SMI is used, LED should switch to fast-blinking mode. If only SPI is used, no change/auto-detection is possible. In this case, LED will continue slow-blinking. Both interfaces can be used independent on each adapter.

Note:

Due to bad signals for using cable-connection on RMII (50 MHz Clock), this mode is currently not supported.

2.2 Examples

2.2.1 NXP OM14500TJA1101



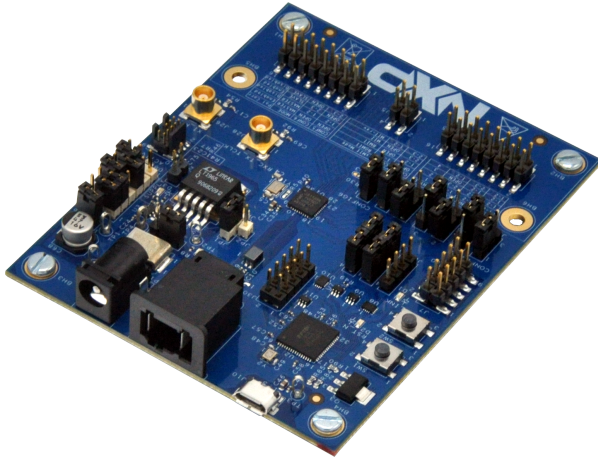
This setup is valid for TJA1101AHN and TJA1101BHN. For Power-Up, OM14500 requires:

Pin	Signal	Comment
34	GND	Ground
36	3V3	3.3V Power-Supply
38	GND	Ground
40	VBAT	Also possible to use 3.3V

Wires to connect for SMI:

OM14500	FC401	Comment	Color
4	1	Ground	Black
9	9	SMI MDIO	White
7	10	SMI MDC	Grey

2.2.2 NXP TJA1103EVB



This setup is valid for TJA1103AHN.

For Power-Up, TJA1103EVB requires USB-Power or 12V Power-Adapter.

Note: TJA1103EVB supports USB (FTDI via ComPort) or SMI-Ext. To use FC401, jumper settings needs to be configured for external use-case.

Refer to User Manual for TJA1103EVB to setup correct jumpers.

Connecting own designs based on TJA103 and FC401 is identical using same software and tools and fastens learning curve on TJA1103 with easy move to real custom designs using 3 test-points on ECU to setup test-modes, loop-back, ...

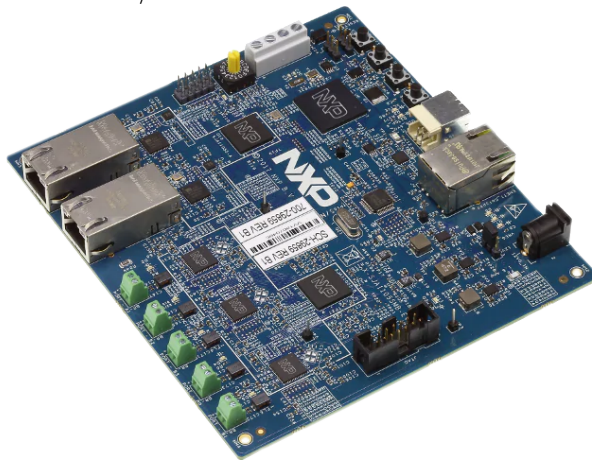
Wires to connect for SMI:

TJA1103EVB	FC401	Comment	Color
J5.4	1	Ground	Black
J5.1	9	SMI MDIO	White
J5.2	10	SMI MDC	Grey

2.2.3 NXP SJA1105SMB

In this example, SJA1105SMVEVM is used to show connected device which includes several TJA1102 on SMI and two SJA1105S connected to SPI. Using FC401 on extension connector enables full access to Phys and Switch without using integrated Micro-Controller on the SJA1105SMB and enables focus on Ethernet.

This also demonstrates usage of FC401 to typical system-design based on NXP SJA1105x/TJA110x.



For power-up, SJA1105SMBEVM comes with 12V Power-Adapter.

To use external Host-Connector, there is 10-pin connector (2x5) for SMI/SPI at J9.

Please refer to UM of NXP SJA1105SMB, how to avoid collision on SMI/SPI. Options could be using the rotary switch to disable SMI/SPI access or using JTAG and erase firmware of MCU complete.

Wires to connect for SMI:

J9 (2x5)	FC401	Comment	Color
1	1	Ground	Black
3	9	SMI MDIO	White
5	10	SMI MDC	Grey

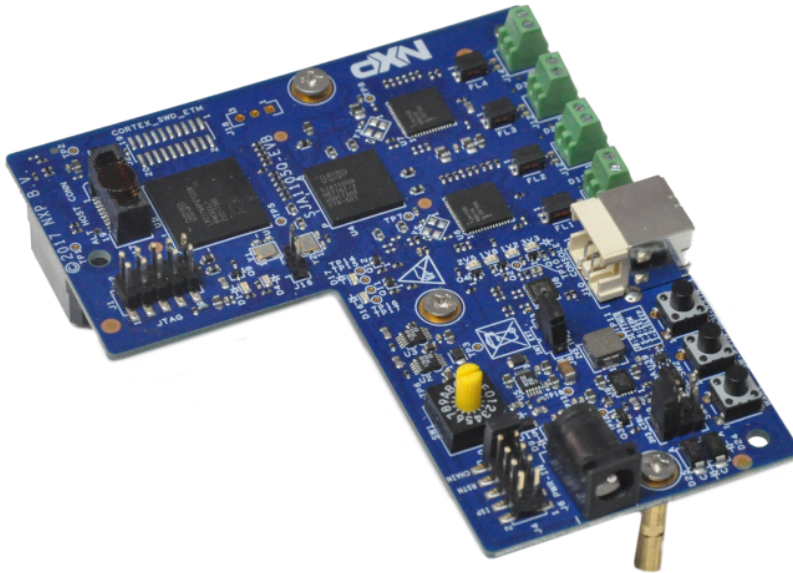
Wires to connect for SPI:

J9 (2x5)	FC401	Comment	Color
1	17	Ground	Brown
2	16	SPI SCK	Orange
4	14	SPI MOSI	Green
6	18	SPI MISO	Red
8	13	SPI CS0	Blue
10	15	SPI CS1	Yellow
3V3	2	VREF	Purple

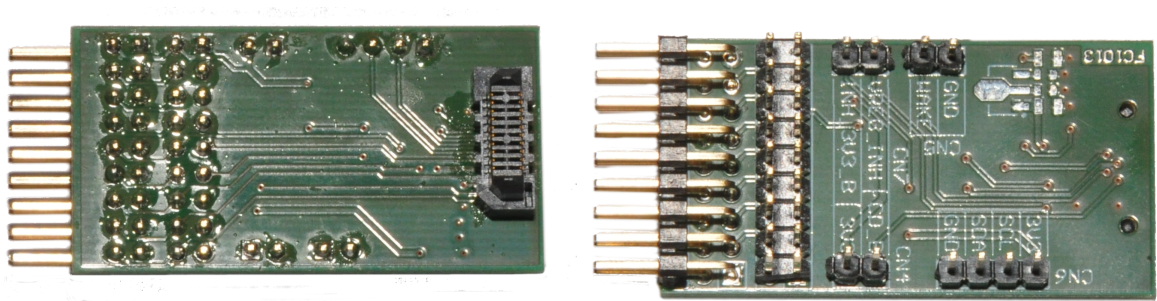
Please note: For the 3V3 spi reference voltage, there is no external pin on SJA1105SMB. Best option is to solder pin near Reset-pin to get 3V3 for FC401. Connect this pin to pin2 of FC401 using purple wire.

2.2.4 NXP SJA1105Q-EVB

In this example, SJA1105Q-EVB is used to show similar use-cases like SJA1105SMB board. Major difference is, SJA1105Q-EVB has only one SJA1105Q and two TJA1102. For external connectivity, available connector is not easy to connect using fly-wires.



FibreCode provides here add-on board to break-out the samteq connector to standard 2.54 mm connector which fits then to FC401 pins.



All pins are then aligned to FC401, means pin-order is 1:1 matching to connect FC1013 to FC401.

For power-up, SJA1105Q-EVB comes with 12V Power-Adapter. To enable external access, internal LPC-MCU needs to put in reset state. Also here refer to NXP UserManual of SJA1105Q-EVB how-to disable SMI/SPI access using rotary switch or erase firmware using flashmagic via USB/COMPort. To use external Host-Connector using FC1013:

Wires to connect for SMI:

FC1013	FC401	Comment	Color
1	1	Ground	Black
9	9	SMI MDIO	White
10	10	SMI MDC	Grey

Wires to connect for SPI:

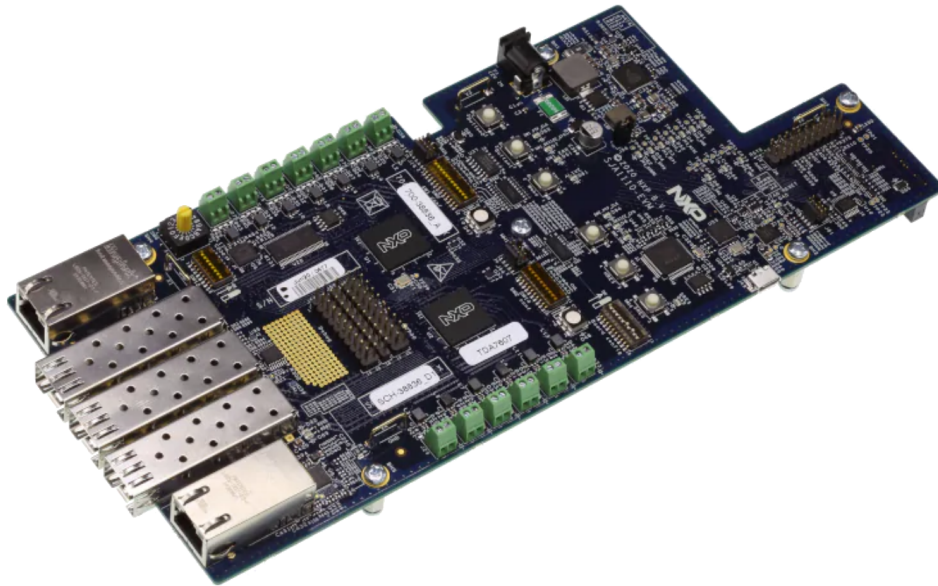
FC1013	FC401	Comment	Color
17	17	Ground	Brown
16	16	SPI SCK	Orange
14	14	SPI MOSI	Green
18	18	SPI MISO	Red
13	13	SPI CS0	Blue
15	15	SPI CS1	Yellow

2.2.5 NXP SJA1110EVM

In another example, latest NXP SJA1110EVM can be used to have also connection to both SJA1110 and all internal and external Phys connected to SMI.

Access is done here using AHC connector pins which fits direct to fly-wires of FC401. As FC401 also supports 2xCS, both switches can be used. Refer to

UM of SJA1110EVM to setup correct configuration for external access using DIP-switches



To use external Host-Connector using 20-pin AHC (J27):

Wires to connect for SMI:

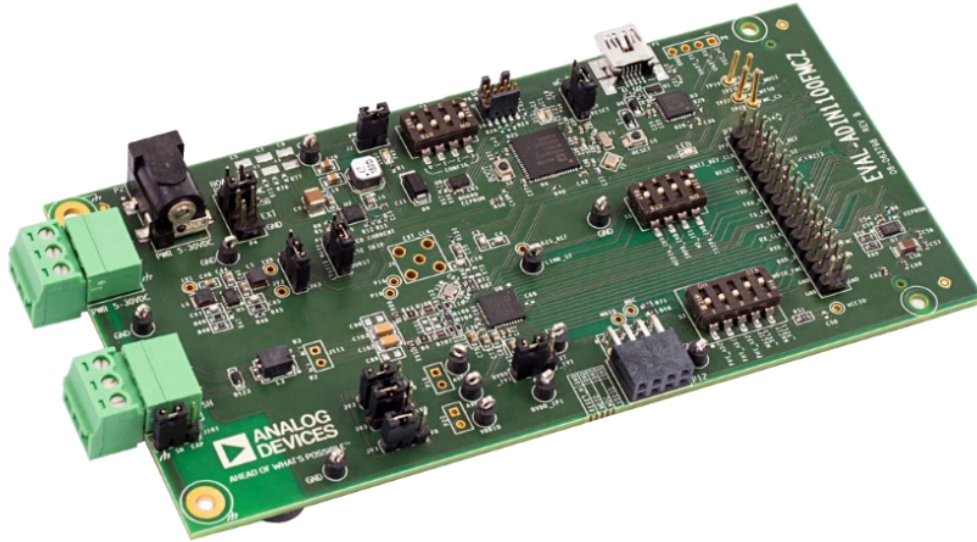
AHC J27	FC401	Comment	Color
1	1	Ground	Black
16	9	SMI MDIO	White
14	10	SMI MDC	Grey

Wires to connect for SPI:

AHC J27	FC401	Comment	Color
3	1	Ground	Black
4	16	SPI SCK	Orange
6	14	SMI MOSI	Green
8	18	SMI MISO	Red
10	14	SMI CS0	Blue
12	15	SMI CS1	Yellow
18	2	VREF3V3	Purple

2.2.6 ADI ADIN1100-EVB

In another example, 10BASE-T1L Eval-Board from Analog Devices is used.



Please note: New Broadway V2.3.0 software package includes also Firmware update for FC401 to support SMI Clause-22 and Clause-45 MDIO protocol. Without update of FC401 to latest firmware, only clause-22 is supported. On this board there is 28-pin-connector which also includes 3 pins for SMI connection.

Wires to connect for SMI:

P7	FC401	Comment	Color
28 GND	1	Ground	Black
22 MDIO_FMC	9	SMI MDIO	White
23 MDC_FMC	10	SMI MDC	Grey

3 Software

Following modes are detected and supported:

1. no Phy: No Phy detected on MDIO - Orange blinking slow
2. Phy MDIO-only: Phy detected - Orange blinks fast.

3.1 Python 3

Broadway2 Installation package includes sub-folder `tool` which contains samples for using FC401 on all described hardware setups.

For easy start, connect SMI/SPI wires to target board and restart FC401 (unplug/plug after connection is made)).

Download/Install Broadway2 software package and find python 3 examples in sub-folder `python3/app/tool`.

Note: Broadway2 supports common Software-API to simplify use-cases of internal Phy-Transceivers on FC6xx USB-Sticks and FC401 connecting external Phy-Transceivers. Software-API to access all Phy-Transceiver registers is identical except `PhyAddr`. Refer to `SmiAccess` and `detect()` helpers to scan SMI-bus.

4 Firmware Update

For each variant, FibreCode supports easy USB update package which is always found in latest `WFP_xxxx.zip` file under Firmware.

Important: Update is NOT supported on Linux

For update of FC401, follow next steps:

1. Login to Windows 7 or Windows 10 PC
2. Unzip `WFP_FC401_xxxxx`
3. Connect exactly one FC401 to Windows
4. Open console in extracted firmware folder and enter:
`update_app_stick_FC401.cmd FC300107_V_xx.yy.zz-n.bin`