

Dust Networks™

Eterna® Evaluation & Development

DC9006A and DC9004B User Guide

Interface Card & Programming JTAG Adapter



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About This Guide

This document describes the DC9006 and DC9004B Eterna Evaluation & Development boards. The latest revision of this document may be found online at: www.linear.com/docs/58003.

Audience

This document is intended for system, hardware and software developers.

Related Documents

The following related documents are available:

[*DC9006 & DC9004 User Guide*](#)
[*DC9006A Interface Card Design Data*](#)
[*DC9004 Design Files*](#)
[*DC9007A SmartMesh® WirelessHART Starter Kit*](#)
[*DC9021B SmartMesh IP RF Certified Starter Kit*](#)
[*DC9022A SmartMesh WirelessHART RF Certified Starter Kit*](#)
[*SmartMesh IP Easy Start Guide*](#)
[*SmartMesh WirelessHART Easy Start Guide*](#)
[*LTC5800-IPM SmartMesh IP Mote Datasheet*](#)
[*LTC5800-IPR SmartMesh IP Manager Datasheet*](#)
[*LTC5800-WHM SmartMesh WirelessHART Mote Datasheet*](#)
[*Eterna Board Specific Parameter Configuration Guide*](#)
[*Eterna Serial Programmer Guide*](#)
[*Eterna 5800 Integration Guide*](#)
[*TAG-Connect TC2050-IDC and TC2030-CTX-20*](#)
[*DC9010 Online Documentation*](#)
[*IAR I-Jet and Segger J-Link*](#)

Conventions and Terminology

This guide uses the following text conventions:

- Computer type indicates information that you enter, such as a URL.
- **Bold type** indicates buttons, fields, and menu commands.
- *Italic type* is used to introduce a new term.
- **Note:** Notes provide more detailed information about concepts.
- **Caution:** Cautions advise about actions that might result in loss of data.
- **Warning:** Warnings advise about actions that might cause physical harm to the hardware or your person.

Getting Started

DC9006 Interface Card

The DC9006 Interface Card is a USB interface for Eterna Evaluation & Development Mote such as the DC9018.

The DC9006 may also be used as a programmer when connected to a DC9004B adapter card. In this case, the DC9006 provides access to any Eterna platforms that feature the recommended programming connectors.

The DC9006 Interface Card is to be used when communication over USB, programming or JTAG access is desired. It provides power to the Eterna Evaluation & Development Mote and an isolated interface to the USB host.

The Interface Card also features test points to monitor the mote current consumption and jumpers for various configurations.



Figure 1 DC9018B Mote (left) connected to the DC9006A Interface Card (right)

Installation

The Interface Card communicates with a host computer using a USB serial connection. When the Interface Card is first connected, the host computer may prompt to install a driver for it.

The Interface Card requires USB drivers from Future Technology Devices International (FTDI, <http://www.ftdichip.com/>). The FTDI “D2XX” drivers can be found at <http://www.ftdichip.com/Drivers/D2XX.htm>.

The FTDI serial chip set is found in many different devices and it is possible that a version of the FTDI drivers are already installed on your machine. It is important to use the latest version available on the web. The Interface Card has been tested against D2XX Drivers revision 2.08.30.

Once drivers are installed for the Interface Board, one should use the same USB port each time the manager is connected to the computer. If a different USB port is used, the setup procedure will need to be repeated for that port.

The Eterna Evaluation and Development Board Set require Windows 7 or Windows XP with SP3, or later versions of Windows.

For details regarding the FTDI drivers installation, please refer to the FDTI documentation and the [Eterna Serial Programmer Guide](#).

Setup

For details on operating the Eterna Evaluation & Development Board Set in a network, please refer to the starter kit documentation ([SmartMesh IP Easy Start Guide](#) or [SmartMesh WirelessHART Easy Start Guide](#)).



Warning

The Eterna Evaluation & Development system includes Lithium batteries.

Batteries can explode, ignite, leak, or cause personal injury if not used or disposed of properly. Do not open batteries, discard in fire, nor heat above 100°C (212°F). Do not recharge the batteries, install them backwards, install used or other battery types, nor expose battery contents to water.

Interface Card (DC9006A)

Block Diagram

The following diagram depicts the main features of the DC9006 Interface Card.

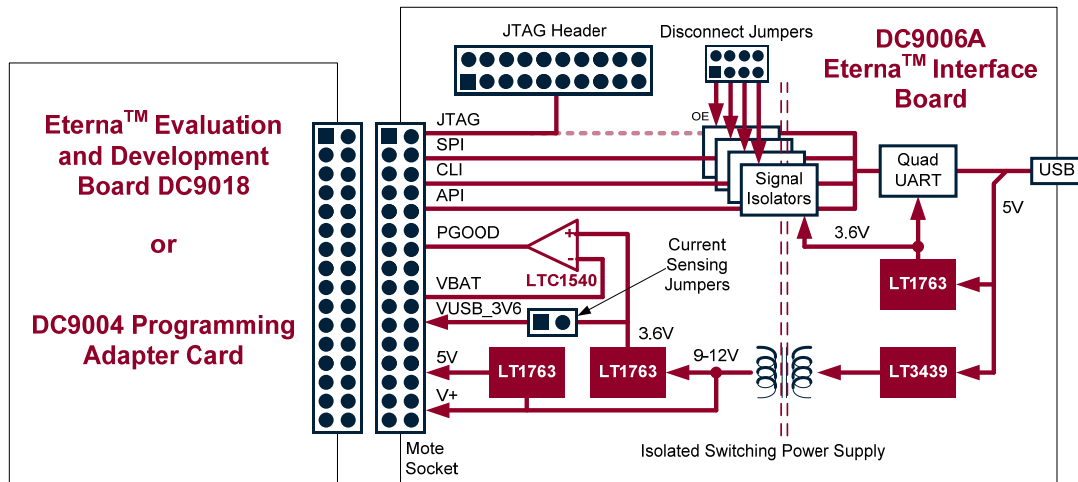


Figure 2

Diagram of the DC9006 Interface Card (right)

USB Interface

The Interface Card communication interface to the USB host consists of four serial ports. After the FTDI driver installation, sequential serial ports are allocated to the Interface Board.

JTAG

JTAG is only supported with an external JTAG device (not included), such as [I-Jet](#) from IAR with a 20pin .1" adapter or [J-Link](#) from Segger. The external JTAG device must be connected to the JTAG Header depicted in Figure 2 and JP1 jumper must be installed in the "JTAG EXT" position (see Jumper Settings section).

The USB JTAG connection shown in dotted line in Figure 2 is not supported.

SPI

The second USB serial port is connected to the Eterna Evaluation & Development Mote slave serial interface (when JP1 "SPI OFF" jumper is not installed).

Further documentation on this interface is available in the [Eterna Serial Programmer Guide](#).

CLI

The third USB serial port provides access to the UARTCO_TX and UARTCO_RX lines of the LTC5800 (when JP1 “CLI OFF” jumper is not installed).

A 2-wire serial interface is supported; typically 9600 baud, the baud rate is application dependant and is described in the [Eterna Board Specific Parameter Configuration Guide](#).

API

The fourth USB serial port provides access to the serial API of the Eterna Evaluation & Development Board EManager (when JP1 “API OFF” jumper is not installed).

The API serial interface supports from 2-wire to 6-wire communication. Typically 115200, the baud rate is application dependant and is described in the [Eterna Board Specific Parameter Configuration Guide](#).

Signal & Power Isolation

The Interface Card provides isolated power and signals to the Eterna Evaluation & Development Board from the USB micro-B interface (**J1**).

The external JTAG connector (**P1**) features signals that are directly connected to the Eterna Evaluation & Development Board connector. P1 signals are referenced to the isolated ground.

Power Switch-Over

The Interface Card compares its VCCA rail to the battery voltage from the Eterna Evaluation & Development Board. When the VCCA rail is within 150 mV of the battery voltage, the PGOOD signal is asserted.

The Eterna Evaluation & Development Board uses the PGOOD signal to switch its supply from battery to the power provided by the Interface Card (VUSB_3V6).

Mote Current Sensing

The Interface Card provides two current sensing headers (P3 and P4) working in conjunction with the JP5 jumper as shown in the schematics below.

With **JP5** jumper installed, a voltmeter across **P4** will measure the mote consumption: P4 voltage is equal to 10 times the mote current (voltage drop across the 10-ohm sense resistor R55 caused by the ISO_VSUPPLY current).

Alternatively and with **JP5** is removed, a ammeter may be connected across **P3** to directly measure the mote current.

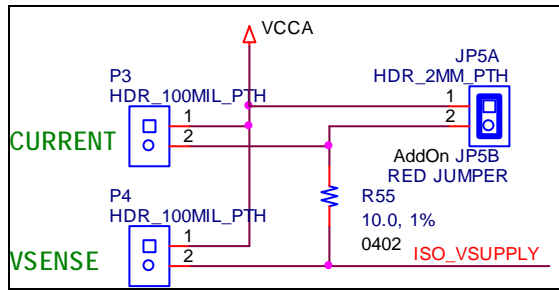


Figure 3 Current Sensing Jumpers

A third 0.100" header **P2** is provided for ground reference. Both P2 pins are connected to the isolated ground.

For accurate current measurements, all **JP1** headers shall be installed (see section: Mote Signal Disconnection).

Note: In applications where a high current is required, jumper P4 shall be installed; this shunts the sense resistor R55 and eliminates the associated voltage drop.

Jumper Settings

The Interface Card features the jumper loading options depicted below.

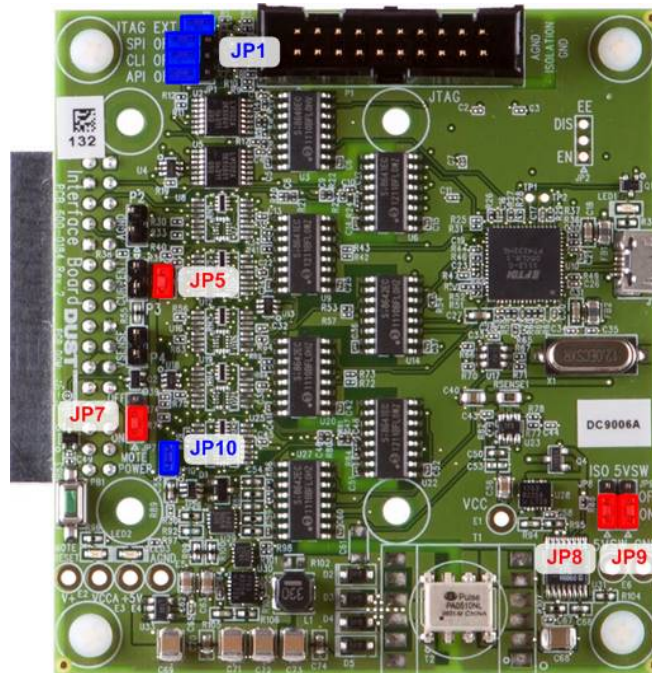


Figure 4 Interface Card Jumpers

The 2mm shorting jumpers may be installed according to the following table:

Jumper	Description	Default	Note
JP1	Disconnect signals to the Eterna Evaluation and Development Board, install JP1 jumpers as follows: "JTAG EXT" to enable the External JTAG port, this jumper	ON	

Jumper	Description	Default	Note
	<p>disconnects the JTAG lines from one of the USB serial interface and should always be installed unless the USB JTAG interface is supported in the development or evaluation tools;</p> <p>"SPI OFF" to disconnect SPI lines, RESETn and FLASH_P_ENn;</p> <p>"CLI OFF" to disconnect UARTC0 TX and RX; and,</p> <p>"API OFF" to disconnect serial API signals.</p>	<p>OFF</p> <p>OFF</p> <p>OFF</p>	
JP5	Carries current to the Eterna Evaluation and Development Board. JP5 should always be installed unless an ammeter is connected across the P3 header.	ON	
JP7	Enables the VCCA rail, the 3.6V isolated power supply to the Eterna Evaluation and Development Board. JP7 should normally be installed in the "ON" position (pin 1 & 2); the "OFF" position (pin 2 & 3) may be used to disable the VCCA rail and provide power from an external source.	ON	(1)
JP8	Controls the isolated supplies of the Interface Card (V+ and the derived VCCA and +5V rails). JP8 should normally be installed in the "ON" position (pin 1 & 2); the "OFF" position (pin 2 & 3) may be used to disable the on-board generation of the isolated V+ supply and provide power from an external source set between 9V and 12V.	ON	(1)
JP9	Controls a power switch on the USB 5V supply. JP8 should normally be installed in the "ON" position (pin 1 & 2); the "OFF" position (pin 2 & 3) may be used to disconnect the Interface Card from the USB 5V supply.	ON	(1)
JP10	Connects the Eterna Evaluation and Development Board battery to logic that determines when power is to be switched from battery to the isolated VCCA rail. JP10 jumper should normally be installed for proper power switching operation. JP10 jumper may be removed to prevent battery current flow in special situations such as unpowered Interface Card connected to the Eterna Evaluation & Development Board.	ON	

(1) when no jumper is installed, the Interface Card defaults to the "ON" state

Interface Signal Disconnection

To perform accurate current measurements, it is recommended to disconnect the Interface Card signals from the Eterna Evaluation & Development Board by installing all JP1 jumpers.

Since so little power is required by the LTC5800 to operate, the Eterna Evaluation & Development Board may gather enough power from current flowing through the Interface Card signals and its ESD protection diodes.

External JTAG & Reset Pushbutton

The external JTAG connector (**P1**) allows the use of 3rd party development systems with the Eterna Evaluation & Development Board. P1 is a 2x10 pin .100" header compatible with JTAG/SWD emulators such as IAR or Segger J-Link.

The Interface Card features a momentary push button (**PB1**). PB1 only asserts the JTAG and the Eterna Evaluation & Development Board reset signal (RESETn).

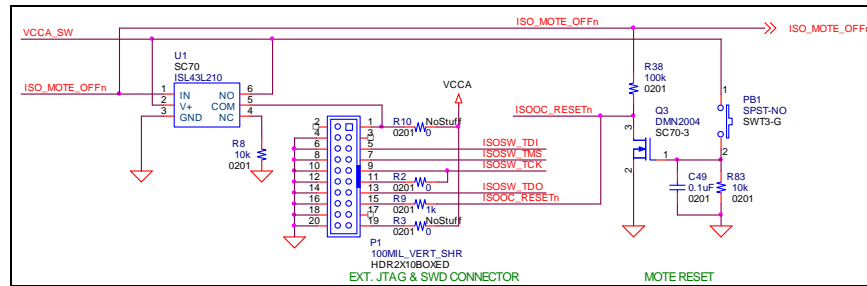


Figure 5 External JTAG Pinout, Reset & Vsense Logic

Eterna Evaluation and Development Mote Socket Pinout

The following table shows the pinout of the socket connector to the Eterna Evaluation and Development Board.

Pin #	Signal	Direction	Pin #	Signal	Direction
1	UART_TX_CTSn	O	2	UART_TX_RTSn	I
3	UART_TX	I	4	GND	-
5	UART_RX	O	6	UART_RX_RTSn	O
7	UART_RX_CTSn	I	8	UARTC0_TX/UARTC1_TX	I
9	UARTC0_RX/UARTC1_RX	O	10	GND	-
11	RESETn	O	12	FLASH_P_ENn (GPIO2)	I/O
13	IPCS_MISO (GPIO6)	I/O	14	IPCS_MOSI (GPIO5)	I/O
15	IPCS_SSn (GPIO3)	I/O	16	IPCS_SCK (GPIO4)	I/O
17	GND	-	18	TCK	O
19	TMS	O	20	TDO	I
21	TDI	O	22	VUSB_3V6	Power Out
23	PGOOD	O	24	GND	-
25	VBATTERY	I	26	KEY	NC
27	Reserved (EHORBAT)	I/O	28	Reserved (MOTE_OFF)	I/O
29	Reserved (GPIO1)	I/O	30	Reserved (GPIO2)	I/O
31	V+	Power Out	32	+5V	Power Out

Signal direction is relative to the DC9006;

Highlighted signals provide reserved connections for the evaluation of energy harvesting solutions

Connector: Samtec SSW-116-02-F-D or SSW-116-02-F-D-RA-025 (polarized right angle)

Warning: Connector pin numbering is custom, refer to layout for details.

Programming Adapter (DC9004B)

Introduction

The DC9004B Programming Adapter enables the DC9006 Interface card to connect to a variety of interfaces on a customer board featuring an Eterna chip.

The DC9004B supports the following customer board connections:

- the 2x5 2mm pitch programming header, described in the integration guide;
- a .050" pitch variant of the programming header;
- a 2x5 surface mount programming footprint, matching the Tag-Connect TC2050-IDC ribbon cable with a 100" socket;
- the 2x5 2mm pitch JTAG header described in the integration guide; and,
- a 2x3 surface mount SWD footprint matching Tag-Connect TC2030-CDX cable for the IAR I-Jet MIPI-20 connector.

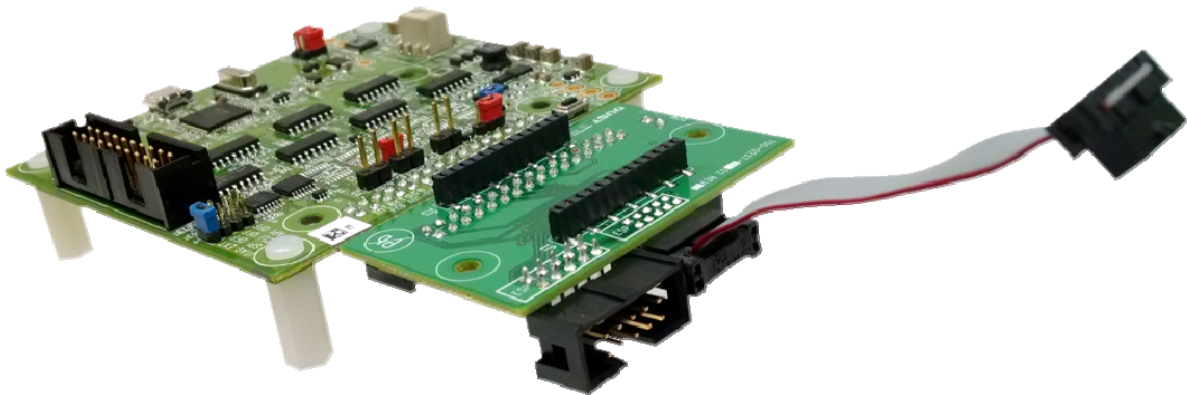


Figure 6

DC9004B installed on a DC9006 (left)

Usage

For a non-powered customer board, where the customer board is powered by the VSUPPLY and GND signals of the DC9004, simply connect the ribbon cable.

For an independently powered customer board, first place the DC9006 JP7 jumper (see Figure 4) in the “OFF” position, then connect the ribbon cable. Note that in this configuration the DC9006 will draw some power from the customer board to power some of its circuitry.

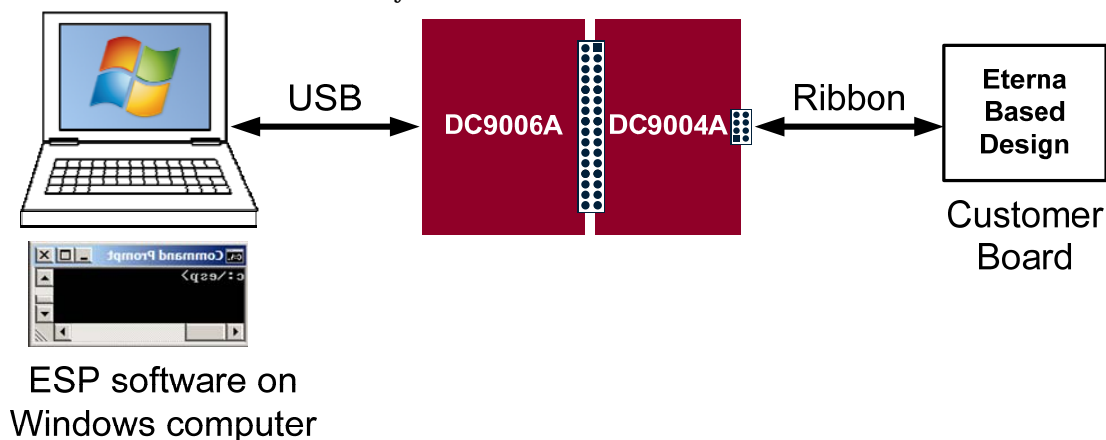


Figure 7

Connecting an Eterna Design to the DC9004B

Interfaces

DC9006 Interface

The interface to the DC9006 consists of a 0.1” pitch 2x16 header with the same signals described in section “Eterna Evaluation and Development Mote Socket Pinout”.

Programming Interface Headers (2x5 0.050”, 2mm and .100” pitch)

The programming headers are indicated with the marking “ESP” on the DC9004B silkscreen.

The following table describes the pinouts of P2 (MOLEX/87833-1020), P3 (SAMTEC/FTSH-105-01-F-DV-K) and P5 (SAMTEC/TST-105-04-L-D-RA).

Pin #	Signal	Direction	Pin #	Signal	Direction
1	IPCS_SSn	O	2	FLASH_P_ENn	O
3	IPCS_SCK	O	4	IPCS_MOSI	O
5	IPCS_MISO	I	6	RESETn	O
7	VSUPPLY	-	8	GND	-
9	UARTC0_TX/UARTC1_TX	I	10	UARTC0_RX/UARTC1_RX	O

Signal direction is relative to the Programming Adapter board.

The .100” pitch programming connector (P5) is intended to be used in conjunction with the TC2050-IDC cable from Tag-Connect, described in <http://www.tag-connect.com/TC2050-IDC>.

In order to use the Tag-Connect TC2050-IDC cable, a surface mount footprint located on the customer board shall match the following pin numbering.

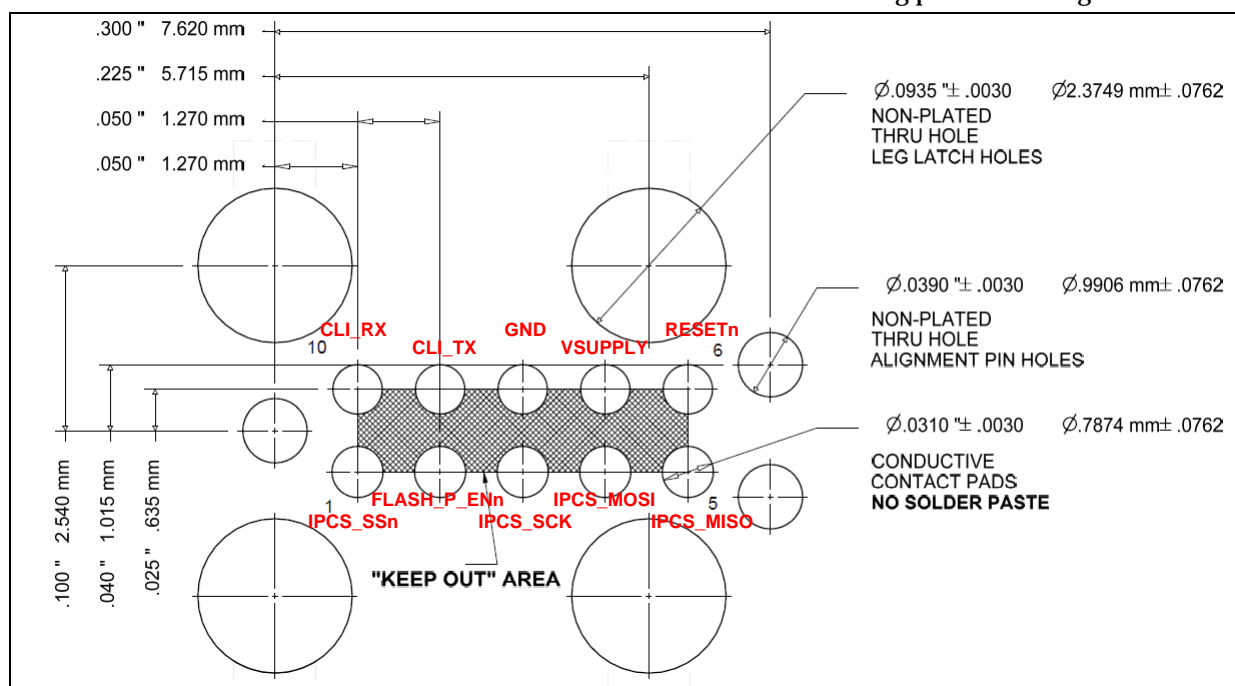


Figure 8 Tag-Connect Programming Footprint

JTAG and SWD Interfaces (2x5 2mm" pitch header)

The following table describes the pinout of the JTAG P6 (MOLEX/878321020).

Pin #	Signal	Direction	Pin #	Signal	Direction
1	TCK	O	2	GND	O
3	TMS	O	4	TDO	I
5	GND	-	6	TDI	O
7	GND	-	8	RESETn	-
9	VSUPPLY	-	10	NC	-

Signal direction is relative to the Programming Adapter board.

The following table describes the pinout of the SWD ("Single Wire Debug") P4 (SAMTEC/FTSH-110-01-L-DV-K-P). P4 is intended to be used in conjunction with the TC2030-CTX-20 cable from Tag-Connect, described in <http://www.tag-connect.com/TC2030-CTX-20>.

Pin #	Signal	Direction	Pin #	Signal	Direction
1	NC (VCC)	-	2	TMS (SWDIO)	O
3	GND	-	4	TCK (SWCLK)	O
5	GND	-	6	TDO (SWO)	I
7	NC	-	8	TDI	O
9	GND	-	10	RESETn	-
1	NC	-	12	NC	-
3	NC	-	14	NC	-
5	GND	-	16	NC	-

Pin #	Signal	Direction	Pin #	Signal	Direction
7	GND	-	18	NC	-
9	GND	-	20	NC	-

Notes:

Pin#1 may be connected to VSUPPLY when P8 jumper is installed (not recommended with self-powered board).

Signal direction is relative to the Programming Adapter board.

The Tag-Connect cable TC2030-CTX-20 only support SWD mode and connect the following signals to the customer board footprint below.

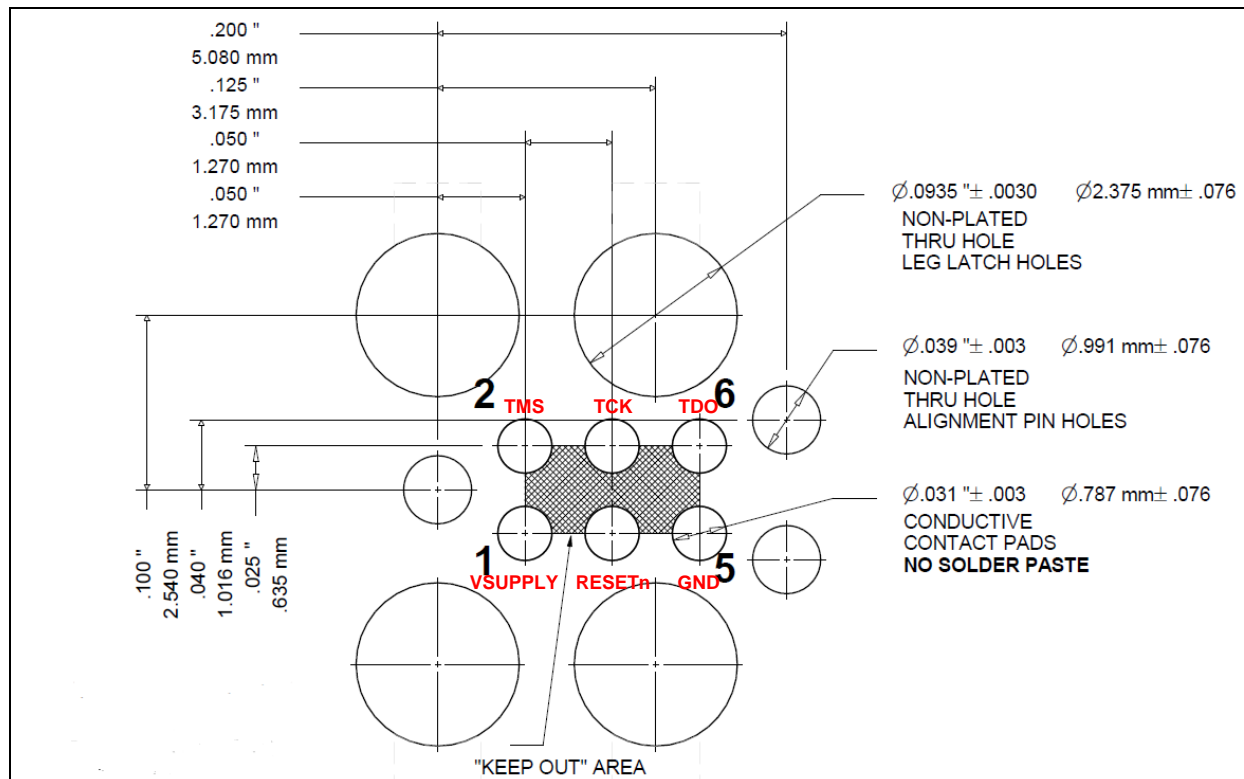


Figure 9

Tag-Connect SWD Footprint

LTP5900 Socket (26-pin, 2mm pitch)

The following table describes the pinouts of J1/J2 (SAMTEC/MMS-113-02-L-SV).

Pin #	Signal (J1)	Dir.
1	UARTC0_RX (UARTC1_RX)	O
2	UARTC0_TX (UARTC1_TX)	I
3	GND	-
4	VSUPPLY	-
5	KEY	-
6	UART_RX	O
7	UART_TX	I
8	UART_RX_RTSn	O
9	UART_TX_RTSn	I
10	UART_RX_CTSn	I
11	UART_TX_CTSn	O
12	NC	-

Pin #	Signal (J2)	Dir.
1	NC	-
2	NC	-
3	RESETn	O
4	IPCS_SSn	O
5	KEY	-
6	IPCS_MISO	I
7	IPCS_MOSI	O
8	IPCS_SCK	O
9	TCK	O
10	TDO	I
11	TDI	O
12	TMS	O

Pin #	Signal (J1)	Dir.	Pin #	Signal (J2)	Dir.
13	NC	-	13	FLASH_P_ENn	O
Signal direction is relative to the Programming Adapter board					

Limitations

Ribbon Cable Length

Evaluation kits are shipped with the latest version for the DC9006. However, for early versions of the DC9006 (700-0184 rev5 or earlier), the maximum recommended ribbon cable length is 2 inches.

Voltage Level

In the configuration where the customer board is independently powered, JP7 on the DC9006 Interface card must be set to the “OFF” position and the voltage supply must be greater than 2.7V.

Current Limit

In the configuration where the customer board requires high current, jumper P4 on the DC9006 Interface card shall be installed in order to short the sense resistor R55 (see Figure 3, Current Sensing Jumpers, for details).

Feature Comparison with DC9010

The following table shows a feature comparison between the DC9006 and the DC9010 Eterna Programmer (See [Eterna Serial Programmer Guide](#)).

	Eterna FLASH SPI Programming			JTAG Adapter		DUT Power Auto-Detection	Crystal Calibration	LTP5900
	Header (2x5 2mm)	Header (2x5 .050")	TAG-Connect (TC2050-IDC)	Header (2x5 2mm)	TAG-Connect (TC2030-CTX-20)		4 Hz PPS with TCXO	22/26-pin 2mm socket
DC9006 w/DC9004A	✓							
DC9006 w/DC9004B	✓	✓	✓	✓	✓			✓ (*)
DC9010A	✓	✓ (**)				✓	✓	✓ (*) (**)

(*) LTP5900 does not include CLI; (**) Requires opening the DC9010A enclosure.

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Document Status	Product Status	Definition
Advanced Information	Planned or under development	This document contains the design specifications for product development. Dust Networks reserves the right to change specifications in any manner without notice.
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