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CombiProbe User's Guide

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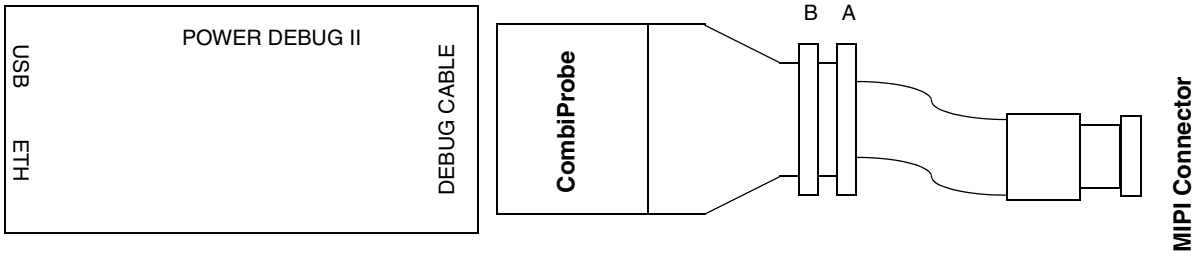
CombiProbe User's Guide

Version 29-Mar-2017

14-Sep-16 Increased maximum supported frequency of the Serial Wire Viewer protrocol to 100 MHz.

Introduction

The CombiProbe is a special debug cable that includes 128-MiByte of trace memory.



The CombiProbe can be connected to the following TRACE32 products:

- POWER DEBUG INTERFACE / USB2
- POWER DEBUG INTERFACE / USB3
- POWER DEBUG II
- POWERTRACE / ETHERNET

Older Power Debug devices especially POWER DEBUG MODULE LA-7702 and POWER DEBUG MODULE USB LA-7704 are **not** supported.

Attention: You should always prefer to connect your Debug/Trace probe to connector "A" of the CombiProbe as depicted above; so the connector located at the **edge** of the PCB of the CombiProbe.

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Keywords

Keywords	Description
JTAG	Supports JTAG debugging like a regular JTAG debug cable. Additionally supports to debug two physically separated JTAG ports.
Serial Wire	Supports ARM's Serial Wire Debug (SWD) port and ARM's Serial Wire Viewer (SWV) output.
IEEE 1149.7	Supports the IEEE 1149.7 (also known as CJTAG) two-wire debug protocol.
Trace	• Generic support for any kind of synchronous 4-pin trace (one clock + 4 data pins). • Specifically supports the "System Trace Protocol" (MIPI Alliance specification). • Specifically supports to trace ARM's Instrumentation Trace Macrocell (ITM) and Embedded Trace Macrocell (ETM), exported by a Trace Port Interface Unit (TPIU) in 4/2/1-bit continuous mode (with enabled Formatter). • Specifically supports to trace ARMs ITM protocol, exported via ARMs SerialWireOutput in UART mode.
PIPE mode	Support for a PIPE mode in which trace data can be transferred on the fly to user specific applications, while the trace recording is turned on.

Technical Details of the CombiProbe

- Debug clock frequency up to 100 MHz.
- Trace data rate up to 200Mbit/s (100Mhz DDR) per pin. 800Mbit/s total for a 4 pin trace port.
- 128 MiByte Trace RAM, up to 128 Mi 4-bit trace packets.

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Debug

The JTAG debug functionality of the CombiProbe does not require any special handling. Just connect the CombiProbe to your target and debug as you usually do with a regular debug cable.

To debug a chip which supports **ARMs Serial Wire Debug** port, you have to configure the debugger to use Serial Wire Debug mode. This can be done with:

```
System.Config SWDP ON
```

This will also enable Serial Wire Viewer support in the CombiProbe.

Any JTAG specific multicore settings will be ignored as long as Serial Wire Debug mode is used.

Trace

The trace features of the CombiProbe can be controlled with the command group

CAnalyzer

The **CAnalyzer** configuration window is similar to all other **Trace** configuration windows.

If you want to use the CombiProbe to record and analyze a flow trace (like for example ETMv3 from ARM) the following commands can be used:

```
Trace.METHOD CAnalyzer

Trace.List
```

Additionally you can use the **SystemTrace** configuration window if you want to access system traces like the ITM from ARM or MIPI STP.

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PIPE Mode

The CombiProbe supports an additional trace mode which is called **PIPE** mode.

The PIPE mode of the CombiProbe can be enabled by selecting it with the corresponding radio button in the **CAnalyzer** configuration window or with the command **CAnalyzer.Mode PIPE**.

When the PIPE mode is selected, all data which is recorded by the CombiProbe is immediately sent to the PC. The memory of the CombiProbe acts like a huge FIFO in this mode.

The PC can then be used to process and analyze the received data in real-time or to simply store the data on a harddisk.

Trace Sinks in PIPE Mode

In PIPE mode you need to define how the trace data from the CombiProbe is processed and distributed.

This is done by defining **Trace Sinks** to which the data will be distributed.

If no trace sinks are defined, the data will be thrown away after it has been transferred to the PC.

There are several different **CAnalyzer** commands which allow you to define trace sinks.

CAnalyzer.WRITE *<file_name>* [*/<options>*]	Define a file as trace sink
CAnalyzer.PipeWRITE *<pipe_name>* [*/<option>*]	Define a named pipe as trace sink
CAnalyzer.PipePROTO *<dll_name>* [*<command_line_arguments>*]	Define a user supplied DLL as trace sink

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Examples:

```
; start application which creates a named pipe and will read the
; trace information from this pipe
OS.screen ./pread_pipe.exe \\.\pipe\proto00

WAIT 500.ms

; specify named pipe a trace sink
CAnalyzer.PipeWRITE \\.\pipe\proto00

…

; close named pipe
CAnalyzer.PipeWRITE
```

```
; start applications which create named pipes and will read the
; trace information from these pipes
OS.screen ./pread_pipe.exe \\.\pipe\proto00 0. 127.
OS.screen ./pread_pipe.exe \\.\pipe\proto01 128. 256.

WAIT 1.s

; specify named pipes a trace sink
; the ChannelID is used to direct the trace information to the
; associated pipe
CAnalyzer.PipeWRITE \\.\pipe\proto00 /ChannelID 0.--127.
CAnalyzer.PipeWRITE \\.\pipe\proto01 /ChannelID 128.--255.

…

; close all named pipes
CAnalyzer.PipeWRITE
```

Examples:

```
; start application which creates a named pipe and will read the
; trace information from this pipe
OS.screen ./pread.exe \\.\pipe\proto00

WAIT 500.ms

; specify DLL as trace sink
CAnalyzer.PipePROTO dll/pproto \\.\pipe\proto00

…

; close DLL
CAnalyzer.PipePROTO
```

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```
; start two applications which will read from two different Windows
; pipes
OS.screen ./pread2.exe \\.\pipe\proto00 0. 127.
OS.screen ./pread2.exe \\.\pipe\proto01 128. 255.

WAIT 1.s

; specify DLLs as trace sinks
; the ChannelID is used to direct the trace information to the
; associated DLL
CAnalyzer.PipePROTO dll/pproto pproto00 0. 127.
CAnalyzer.PipePROTO dll/pproto pproto01 128. 255.

…

; close all loaded DLLs
CAnalyzer.PipePROTO
```

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Quick Start for Serial Wire

1. Select chip type.

```
SYStem.CPU STM32F103ZE                ; Select the target CPU
```

2. Configure the debugger for the use of the *Serial Wire Debug Port*.

```
SYStem.CONFIG SWDP ON                 ; Inform the debugger that
                                      ; debugging is performed via
                                      ; Serial Wire Debug Port
```

3. Establish the communication between the debugger and the target CPU.

```
SYStem.Up
```

4. If your chip has an ETM, disable the ETM.

   - If your chip does *not* have an ETM, then skip this step.

```
ETM.OFF
```

5. Open a ITM configuration window.

```
ITM.state
```

6. Configure the ITM to use *Serial Wire Viewer*.

```
ITM.PortSize SWV
```

7. Specify the port mode and the frequency for the *Serial Wire Output* (*NRZ/<factor>*). Whereas *<factor>* specifies CPU_frequency/*<factor>*

```
ITM.PortMode NRZ/2                    ; Specify NRZ as PortMode
                                      ; and CPU_frequency/2 as
                                      ; port frequency
```

8. Open CAnalyzer (CompactAnalyzer) trace configuration window.

```
CAnalyzer.view
```

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9. Detect the data rate on the *Serial Wire Output*.

```
CAnalyzer.AutoFocus
```

If you know your CPU frequency you can also directly specify the *Serial Wire Output* data rate. Up to 100 MHz are currently supported. You might need to choose a larger divider by ITM.PortMode NRZ/? to remain in the allowed range.

```
CAnalyzer.TraceCLOCK 20.MHZ
```

Now your basic setup is done. If your application uses the ITM to export data, then you can just load and start your application. You might want to use the PIPE mode in this case and define some trace sinks as described above.

The ITM can also be used to trace data accesses or interrupts, without instrumenting your program.

To enable the broadcasting of data accesses to specific addresses you need to:

1. Setup what to trace in the ITM window.

```
ITM.DataTrace DataPC
```

2. Setup which addresses or address ranges should be traced.

```
Var.Break.Set flags[3] /TraceData
```

The ITM can be used to trace interrupt entries and exits.

```
ITM.InterruptTrace ON
```

Additionally the ITM can sample the PC in regular intervals.

```
ITM.PCSampler 1/1024                    ; The ITM broadcasts the PC
                                        ; for every 1024. clock cycle
```

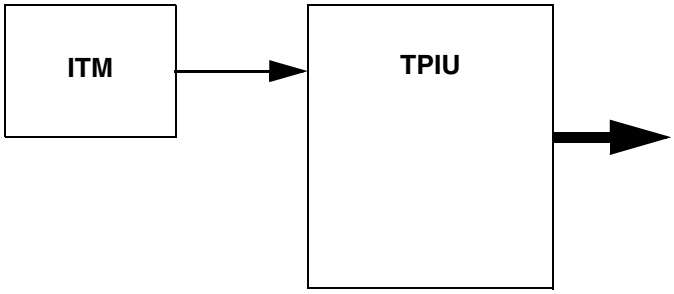
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Quick Start for CoreSight Traces with TPIU and Formatter

The CombiProbe can record trace data exported by ARMs CoreSight TPIU (Trace Port Interface Unit) with an enabled TPIU Formatter.

Configuration 1:



To set up the CombiProbe for configuration 1, proceed as follows:

1. In order to sample the trace information broadcasted via the TPIU TRACE32 needs to know which connector type you are using:

```
SYStem.CONFIG CONNECTOR MIPI34          ; A MIPI34 connector is used

SYStem.CONFIG CONNECTOR MIPI20T         ; A MIPI20 connector with
                                        ; trace is used
```

2. Establish the communication between the debugger and the target CPU.

```
SYStem.Up
```

3. Configure the TPIU for the ITM.

```
ITM.PortSize 4                          ; Specify that a 4-bit TPIU
                                        ; is used

ITM.PortMode Continuous                 ; Enable the TPIU formatter
```

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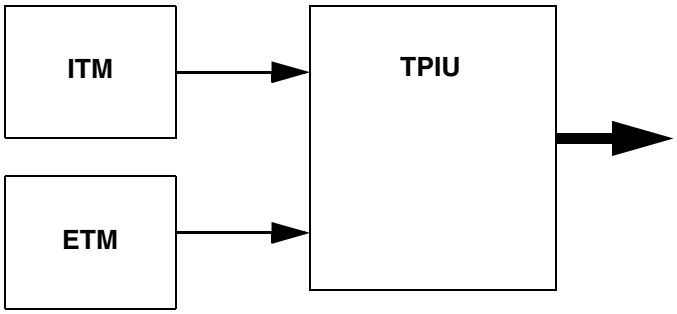
4. Set the switching threshold voltage for the CombiProbe trace inputs.

```
CAnalyzer.THreshold 1.65                ; Specify the threshold for a
                                        ; 3.3V TPIU trace port
```

5. The recorded trace data can be displayed with the following command.

```
CAnalyzer.List
```

Configuration 2:



To set up the CombiProbe for configuration 2, proceed as follows:

1. In order to sample the trace information broadcasted via the TPIU TRACE32 needs to know which connector type you are using:

```
SYStem.CONFIG CONNECTOR MIPI34          ; A MIPI34 connector is used

SYStem.CONFIG CONNECTOR MIPI20T         ; A MIPI20 connector with
                                        ; trace is used
```

2. Establish the communication between the debugger and the target CPU.

```
SYStem.Up
```

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3. Configure the TPIU for the ITM/ETM.

```
ITM.PortSize 4                          ; Both commands are equivalent
(ETM.PortSize 4)

ITM.PortMode Continuous                 ; Both commands are equivalent
(ETM.PortMode Continuous)
```

4. Set the switching threshold voltage for the CombiProbe trace inputs.

```
CAnalyzer.THreshold 1.65                ; Specify the threshold for a
                                        ; 3.3V TPIU trace port
```

5. The recorded trace data can be displayed with the following command.

```
CAnalyzer.List                          ; Display the ETM trace data

ITMCAnalyzer.List                       ; Display the ITM trace data
```

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Quick-Start for XTI, SDTI and STP Traces (OMAP Chips)

The CombiProbe can record trace data exported in XTI-v2, SDTI or STP format. These formats are supported by some OMAP Chips.

To set up the CombiProbe for this scenario, do the following steps:

1. Connect to your target with JTAG.

```
System.Up
```

2. Configure and enable the trace export module of the chip via the STM configuration window.

```
STM.ON

STM.PortSize 4

STM.PortMode 1/1

STM.PortMode HalfRate
```

3. Set the switching threshold voltage for the CombiProbe trace inputs.

```
CAnalyzer.THreshold 0.9                ; Threshold for 1.8V trace
                                       ; port
```

4. Use the **CAnalyzer** window and the **CAnalyzer** commands to access the recorded SDTI data.

Now your basic setup is done. If your application uses SDTI to export data, then you can just load and start your application. You might want to use the PIPE mode in this case and define some trace sinks as described above.

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Connector

The CombiProbe natively connects to a two columns, 34 pin 0.05 inch connector (like the FTSH series from Samtec). The pin out follows the MIPI Alliance Basic Debug Connector Recommendation.

The CombiProbe also natively connects to the 20 and 10 pin variants from the MIPI Alliance Basic Debug Connector Recommendation.

Signal	Pin	Pin	Signal
VREF DEBUG	1	2	TMS
GND	3	4	TCK
GND	5	6	TDO
(KEY) GND	7	8	TDI
GND	9	10	RESET-
GND	11	12	RTCK
GND	13	14	BCE
GND	15	16	TRST-
GND	17	18	TRIGIN
GND	19	20	TRIGOUT
GND	21	22	TRC CLK
GND	23	24	TRC DATA0
GND	25	26	TRC DATA1
GND	27	28	TRC DATA2
GND	29	30	TRC DATA3
GND	31	32	TRC EXT
GND	33	34	VREF TRACE

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Product Information

OrderNo Code	Text
LA-4502 COMBIPROBE-ARM	**CombiProbe ARM-Debugger and 4-Bit Trace** Debug cable and 128-MByte of trace memory Supports Standard-JTAG, cJTAG and Serial Wire Debug Port requires at least one of the following A-licenses: LA-7742A (JTAG Debugger License for ARM9 Add.) LA-7746A (JTAG Debugger License for ARM7 Add.) LA-7765A (JTAG Debugger License for ARM11 Add.) LA-7843A (JTAG Debugger License for CORTEX-A Add.) LA-7844A (JTAG Debugger License for CORTEX-M Add.) Trace support (up to 4-bit) included: - MIPI System Trace - ITM via Serial Wire Output/TPIU - ETM Cortex-M continuous mode via TPIU Supports the following trace licenses: LA-7970X (Trace License for the ARM Architecture) requires Power Debug Interface USB 2.0/USB 3.0, Power Debug Ethernet, PowerTrace or Power Debug II 5V tolerant inputs; max. output level 3.3V
LA-4504 COMBIPROBE-MIPS32	**CombiProbe MIPS32-Debugger and 4-Bit IFLOW** Debug cable and 128-MByte of trace memory requires the following A-license: LA-7760A (JTAG Debugger for MIPS32) 4-Bit IFlow program trace requires: LA-7971X (Trace License for the MIPS32) requires Power Debug Interface USB 2.0/USB 3.0, Power Debug Ethernet, PowerTrace or Power Debug II 5V tolerant inputs; max. output level 3.3V
LA-4506 COMBIPROBE-C166V2	**CombiProbe C166V2-Debugger and 4-Bit Trace** supports C166 V2 Debug cable and 128-MByte of trace memory requires the following A-license: LA-7759A (OCDS Debugger for C166S V2) optional LA-7789A (JTAG Debugger for OAK/Teaklite-SEIB Add.) MCDS program flow trace requires: LA-7975X (Off-Chip Trace for MCDS of C166S-V2) requires Power Debug Interface USB 2.0/USB 3.0, Power Debug Ethernet, PowerTrace or Power Debug II 5V tolerant inputs; max. output level 3.3V
LA-4508 CON-COMBIPROBE-AP	**Conv. CombiProbe/uTrace to PI-Analog Probe** Converter CombiProbe/uTrace to LA-7949 Analog Probe for PowerIntegrator
LA-3783 CON-MIPI34/C166	**Converter MIPI-34 to C166-16** Converter MIPI-34 to 16 pin C166 target adapter
LA-3771 CON-MIPI34/ARM20	**ARM Converter MIPI-34 to ARM-20 or TI-14** Converter to connect the CombiProbe to an ARM-20 connector specified by ARM or to a TI-14 connector specified by Texas Instruments Converts to debug cable connector Can be used together with LA-3772 Converter MIPI-34 to STI-12 or XTI-12

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OrderNo Code	Text
LA-3782 CON-MIPI34/TI20-COMP	**Converter MIPI-34 to TI-20-Compact** Converter to connect the CombiProbe to a connector specified by Texas Instruments (TI) which is used on a few targets with TI processors.
LA-3781 CON-MIPI34/MIPS14	**Converter MIPI-34 to JTAG MIPS14 + IFLOW** Converter MIPI-34 to 14 pin JTAG MIPS and IFLOW Trace10 includes 10 pin Cable 100 mm
LA-3768 CON-ETM1-MIPI34SAM60	**ETMv1 Conv. Mictor-38, 2x MIPI-34 to MIPI-60** ARM Converter to connect an ARM Preprocessor with one Mictor-38 for 16-bit ETMv1 and two CombiProbes for two 4-bit system trace ports to a MIPI-60 connector on the target.
LA-3769 CON-ETM3-MIPI34SAM60	**ETMv3 Conv. Mictor-38, 2x MIPI-34 to MIPI-60** ARM Converter to connect an ARM Preprocessor with one Mictor-38 for 16-bit ETMv3 and two CombiProbes for two 4-bit system trace ports to a MIPI-60 connector on the target.
LA-3813 CONV-OMAP35XX-MIPI	**OMAP3 Conv. Mictor-38, MIPI-34 to Mictor-38** Converter to connect an ARM Preprocessor and a CombiProbe to a Mictor connector on the target. This converter is designed for the OMAP3503 board from Spectrum Digital. The upper ETM signals on the Mictor can alternatively be used for system trace (SDTI).
LA-3784 CON-MIPI34-MIPI60	**Converter MIPI-34 to MIPI-60** Converter to connect the CombiProbe to a MIPI-60 connector on the target
LA-3810 CONV-U8500-MIPI	**U8500 Conv. 2x Mictor38, 3x MIPI34 to MIPI60** Converter to connect an ARM Preprocessor (up to 24-bit PTM/ETMv3) and up to three CombiProbes (3x STM/STP) to a MIPI-60 connector on the target. This converter is designed for U8500/U5500 from ST Ericsson.
LA-3812 CONV-OMAP4XXX-MIPI60	**OMAP4 Conv. 2xMictor, ARM20, MIPI34 to MIPI60** Converter to connect an ARM Preprocessor (up to 18-bit PTM) and one CombiProbe (STM; two connection options) or a Debug Cable to a MIPI-60 connector on the target. This converter is designed for OMAP4xxx based boards from Texas Instruments.
LA-3814 CON-ETM3-MIPI34+60	**ETMv3 Conv. Mictor-38, MIPI-34 to MIPI-60** ARM Converter to connect an ARM Preprocessor with one Mictor-38 for 16-bit ETMv3 and one CombiProbe for a 4-bit system trace port to a MIPI-60 connector on the target

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OrderNo Code	Text
LA-3840 CONV-OMAP4430-PANDAB	**Trace Converter for OMAP4430 PandaBoard** Converter to connect an ARM Preprocessor (16-bit PTM) or a CombiProbe (4-bit STM) to the OMAP4430 PandaBoard
LA-3787 CON-MIPI34/MICRO-SD	**Converter MIPI-34 to SD or Micro SD Socket** Converter to connect the CombiProbe to a SD or Micro SD card connector in case the signals alternatively provide debug functionality
LA-3862 CON-ARM/MIPI34-MIC	**ARM Conv. ARM-20, MIPI-34 to Mictor-38** Converter to connect the ARM Debug Cable or the CombiProbe to a Mictor connector on the target. This is needed if you want to debug without a Preprocessor and if there is only a Mictor connector on the target. The trace signals of the CombiProbe are connected to the lowest four trace signals of the Mictor (ETMv3 pinout, continuous mode). But tracing is normally no use case due to the bandwidth limitations of the CombiProbe.

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Order Information

Order No.	Code	Text
LA-4502	**COMBIPROBE-ARM**	**CombiProbe ARM-Debugger and 4-Bit Trace**
LA-4504	**COMBIPROBE-MIPS32**	**CombiProbe MIPS32-Debugger and 4-Bit IFLOW**
LA-4506	**COMBIPROBE-C166V2**	**CombiProbe C166V2-Debugger and 4-Bit Trace**
LA-4508	**CON-COMBIPROBE-AP**	**Conv. CombiProbe/uTrace to PI-Analog Probe**
LA-3783	**CON-MIPI34/C166**	**Converter MIPI-34 to C166-16**
LA-3771	**CON-MIPI34/ARM20**	**ARM Converter MIPI-34 to ARM-20 or TI-14**
LA-3782	**CON-MIPI34/TI20-COMP**	**Converter MIPI-34 to TI-20-Compact**
LA-3781	**CON-MIPI34/MIPS14**	**Converter MIPI-34 to JTAG MIPS14 + IFLOW**
LA-3768	**CON-ETM1-MIPI34SAM60**	**ETMv1 Conv. Mictor-38, 2x MIPI-34 to MIPI-60**
LA-3769	**CON-ETM3-MIPI34SAM60**	**ETMv3 Conv. Mictor-38, 2x MIPI-34 to MIPI-60**
LA-3813	**CONV-OMAP35XX-MIPI**	**OMAP3 Conv. Mictor-38, MIPI-34 to Mictor-38**
LA-3784	**CON-MIPI34-MIPI60**	**Converter MIPI-34 to MIPI-60**
LA-3810	**CONV-U8500-MIPI**	**U8500 Conv. 2x Mictor38, 3x MIPI34 to MIPI60**
LA-3812	**CONV-OMAP4XXX-MIPI60**	**OMAP4 Conv. 2xMictor, ARM20, MIPI34 to MIPI60**
LA-3814	**CON-ETM3-MIPI34+60**	**ETMv3 Conv. Mictor-38, MIPI-34 to MIPI-60**
LA-3840	**CONV-OMAP4430-PANDAB**	**Trace Converter for OMAP4430 PandaBoard**
LA-3787	**CON-MIPI34/MICRO-SD**	**Converter MIPI-34 to SD or Micro SD Socket**
LA-3862	**CON-ARM/MIPI34-MIC**	**ARM Conv. ARM-20, MIPI-34 to Mictor-38**
Additional Options		
LA-3808	CONV-L8540-MIPI	L8540 Conv. 2xMic, 2xMIPI34, ARM20 to MIPI60
LA-3750A	JTAG-ARC-A	JTAG Debugger License for ARC Add.
LA-7765A	JTAG-ARM11-A	JTAG Debugger License for ARM11 Add.
LA-7746A	JTAG-ARM7-A	JTAG Debugger License for ARM7 Add.
LA-7742A	JTAG-ARM9-A	JTAG Debugger License for ARM9 Add.
LA-7843A	JTAG-CORTEX-A/R-A	JTAG Debugger License for Cortex-A/-R Add.
LA-7844A	JTAG-CORTEX_M-A	JTAG Debugger License for Cortex-M Add.
LA-7836A	JTAG-MMDSP-A	JTAG Debugger License for MMDSP
LA-3760A	JTAG-XTENSA-A	JTAG Debugger License for Xtensa Add.
LA-3712A	JTAG-ZSP500-A	JTAG Debugger for ZSP500 DSP Core Additional
LA-7949	PI-ANALOG	Analog Probe for PI, PT-II and CombiProbe

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