

**XA1600E**

Development Board  
Reference Manual

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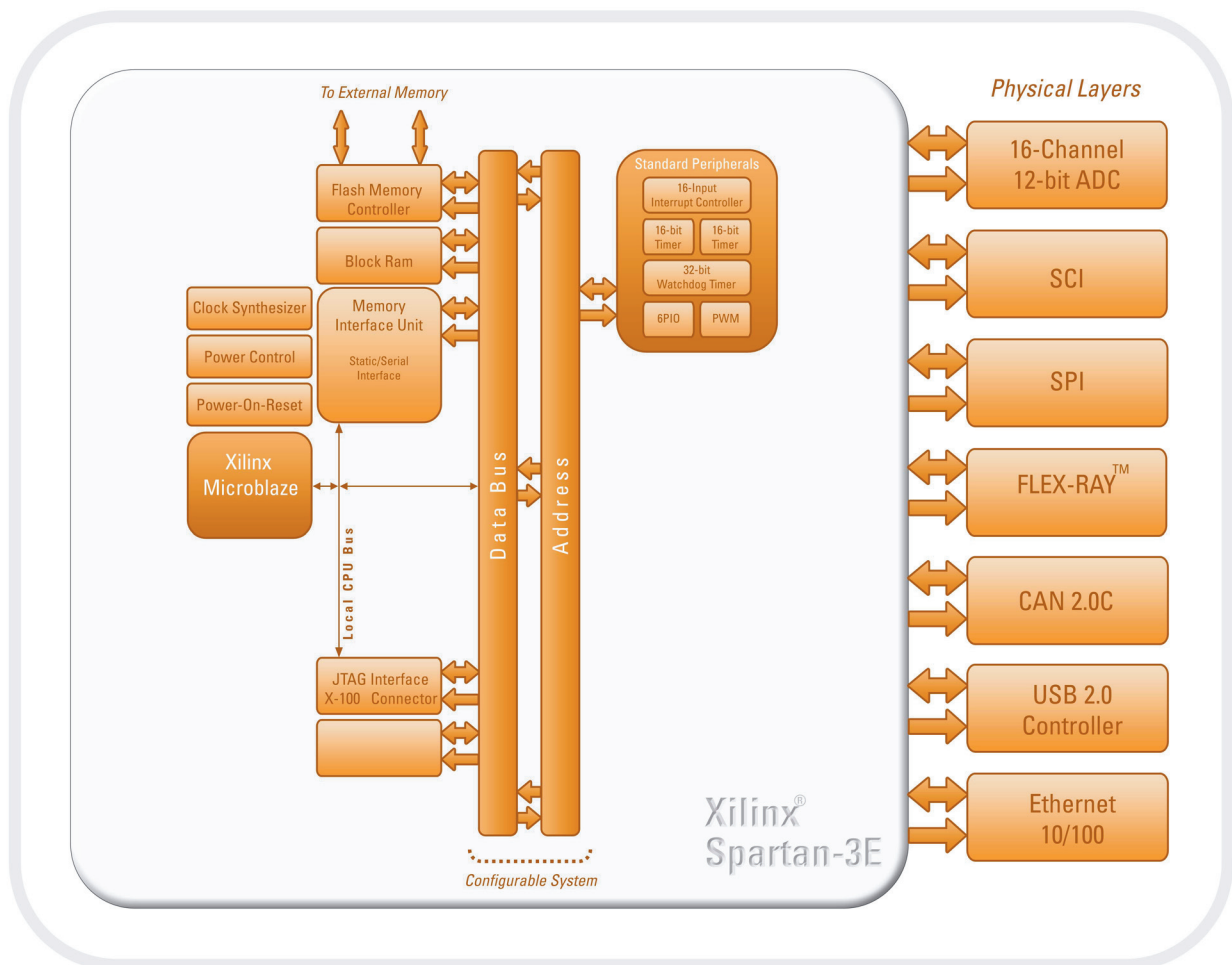
# Introduction

Congratulations on your purchase of the Xilinx Automotive ECU Development kit including the XA1600E board designed by Si-Gate.

The XA1600E provides designers with a configurable ECU right out of the box suitable for a wide range of Automotive and Industrial applications. Please review the following reference manual thoroughly to receive the most of your new purchase.

The XA1600E is a complete 32-bit Field Configurable ECU platform, combining the highly popular Xilinx MicroBlaze™ processor core with standard System-on-Chip peripherals and over 150 user programmable I/O's. It is contained within a Xilinx Spartan-3A™ FPGA with programmable logic for custom driven IP applications, a robust memory subsystem, and a full suite of Automotive and Industrial peripherals. The XA1600E enables programmable System-on-Chip applications and expands traditional development platforms by including necessary physical layers on-board the ECU. The XA1600E supports physical layers for 10/100 Ethernet, JTAG, USB 2.0, 12-bit ADC, High and Low Speed CAN, FlexRay™, LIN, K-Line, UART, and SPI along with on-board Flash and SRAM memory.

The XA1600E is ideal for projects where flexibility and expand-ability is needed for your future ECU developments. Please visit [www.xilinx.com/automotivekits](http://www.xilinx.com/automotivekits) for additional or updated information which may not be presented in this manual.



*Block Diagram of the Xilinx XA1600E Field Configurable ECU*

### **XA1600E Memory Contents:**

- 1). U140 XCF08 Configuration PROM 8MB
- 2). U650, U660 IDT71V416 SRAM 8MB(4MB x2)
- 3). U680, U690 MT28LC4M32B2-2 or EDS1232AATA-75 SDRAM 256M bits(128Mbit x2)
- 4). U640 M25P32VME Serial SPI 32Mbit (4M x 8)
- 5). U600,U610 JS28F320 FLASH 64Mbit (32Mbit x2)

## Getting Started

The standard bit stream that is delivered with the Si-Gate XA1600E includes a Xilinx Microblaze Soft Core. This is integrated with a basic RS-232 demo application which provides the user the ability to immediately connect the XA1600E to a PC serial port and start developing. When coupled together with the Xilinx EDK tool-chain (must be purchased separately) the XA1600E development kit provides everything the user needs to start writing software for Microblaze inside the Spartan-3 FPGA. If the user wants to develop new bit streams, this can be done with the purchase of the Xilinx ISE Foundation. Or the user may opt for a Si-Gate specialist to handle this integration task leaving room for the user to concentrate on their specific applications.

### Communicating with the XA1600E

Because of the constant challenge in deciding which peripherals are needed in a new automotive system, several physical layers are included with the XA1600E which allow the user to add peripherals of their choice at any time without having to re-design the hardware interfaces including:

CAN 2.0C

ETHERNET 10/100 Part # LXT971 (Ethernet MAC needed inside FPGA for operation)

USB 2.0 Controller Part # CY7C68001

SPI

SCI

12 bit ADC

With the XA1600E's FPGA architecture, the user has the complete flexibility to select any combinations of automotive peripherals, memory, and interface features that give the best system performance at the lowest costs on a single FPGA.

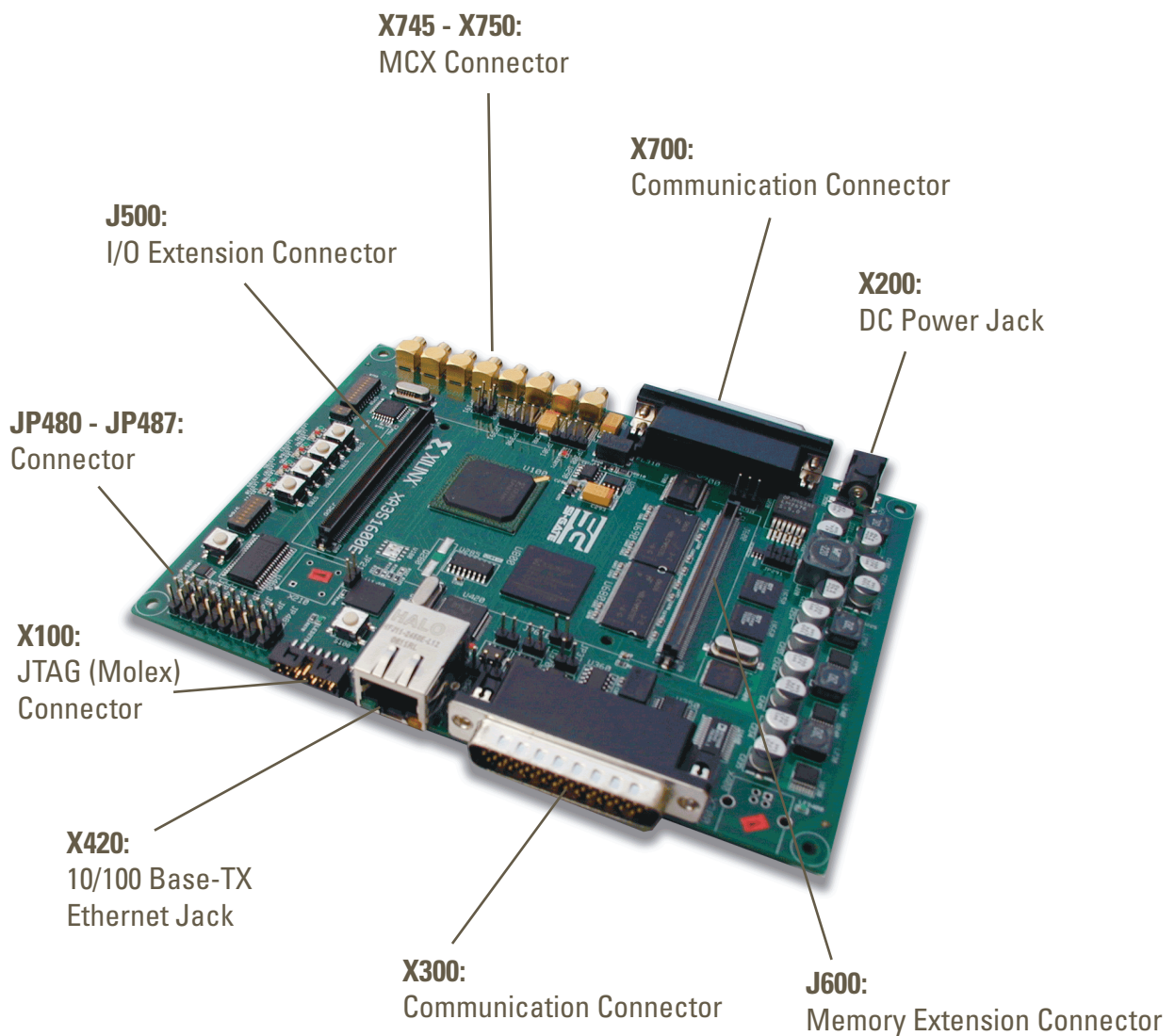
### Xilinx MicroBlaze Soft Processor Core

The MicroBlaze core is a 3-stage pipeline 32-bit RISC Harvard architecture soft processor core with 32 general purpose registers, ALU, and rich instruction set optimized for embedded applications. It supports both on-chip block RAM and/or external memory.

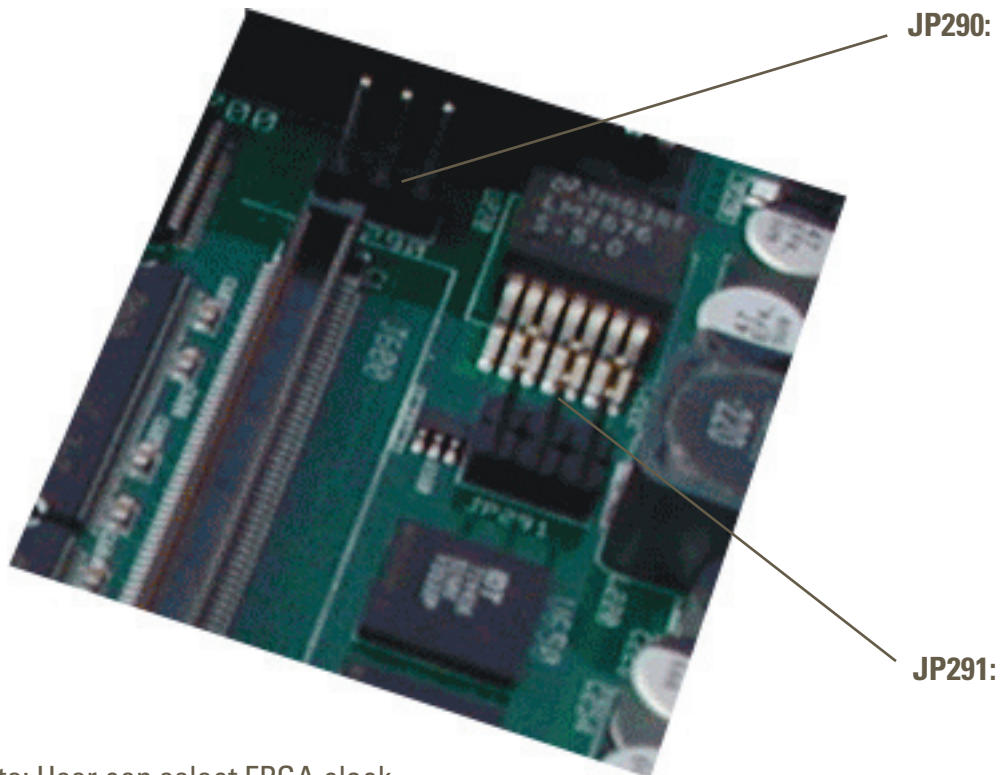
This basic design can then be configured with more advanced features such as: barrel shifter, floating-point unit (FPU), caches, exception handling, debug logic, and others. This flexibility allows the user to balance the required performance of the target application against the logic area cost of the soft processor. Additional information can be found at [www.xilinx.com](http://www.xilinx.com) and [www.xilinx.com/automotivekits](http://www.xilinx.com/automotivekits).

# Overview

The following section will inform you on the basic components of the XA1600E.



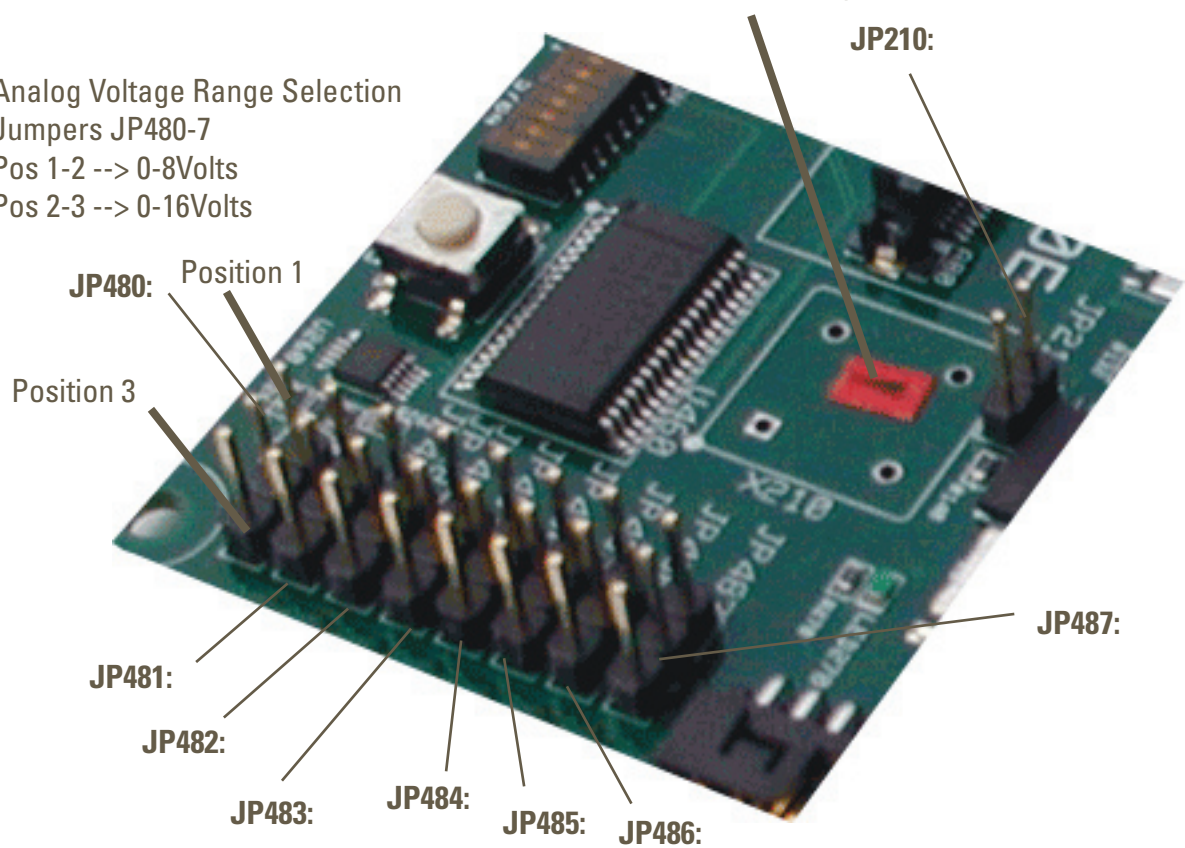
| XA1600E User Interface                         |                                                                                                         |
|------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| <b>X200:</b> DC Power Jack (+12Volts Pos. Tip) | Connect the supplied mains adapter here                                                                 |
| <b>X700:</b> Communication Connector           | See pin out descriptions on page 11                                                                     |
| <b>X745-X750:</b> SMA Connector                |                                                                                                         |
| <b>J500:</b> I/O Extension Connector           | See pin out descriptions on page 13                                                                     |
| <b>X100:</b> JTAG (Molex) Connector            |                                                                                                         |
| <b>JP480 - JP 487:</b>                         | Jumpers Selection for Analog Voltage Range Input<br>Position 1-2 --> (0-8V)<br>Position 2-3 --> (0-16V) |
| <b>X420:</b> 10/100 Base-TX Ethernet Jack      |                                                                                                         |
| <b>X300:</b> Communication Connector           | See pin out descriptions on page 12                                                                     |
| <b>J600:</b> I/O Extension Connector           | See pin out descriptions on page 14                                                                     |



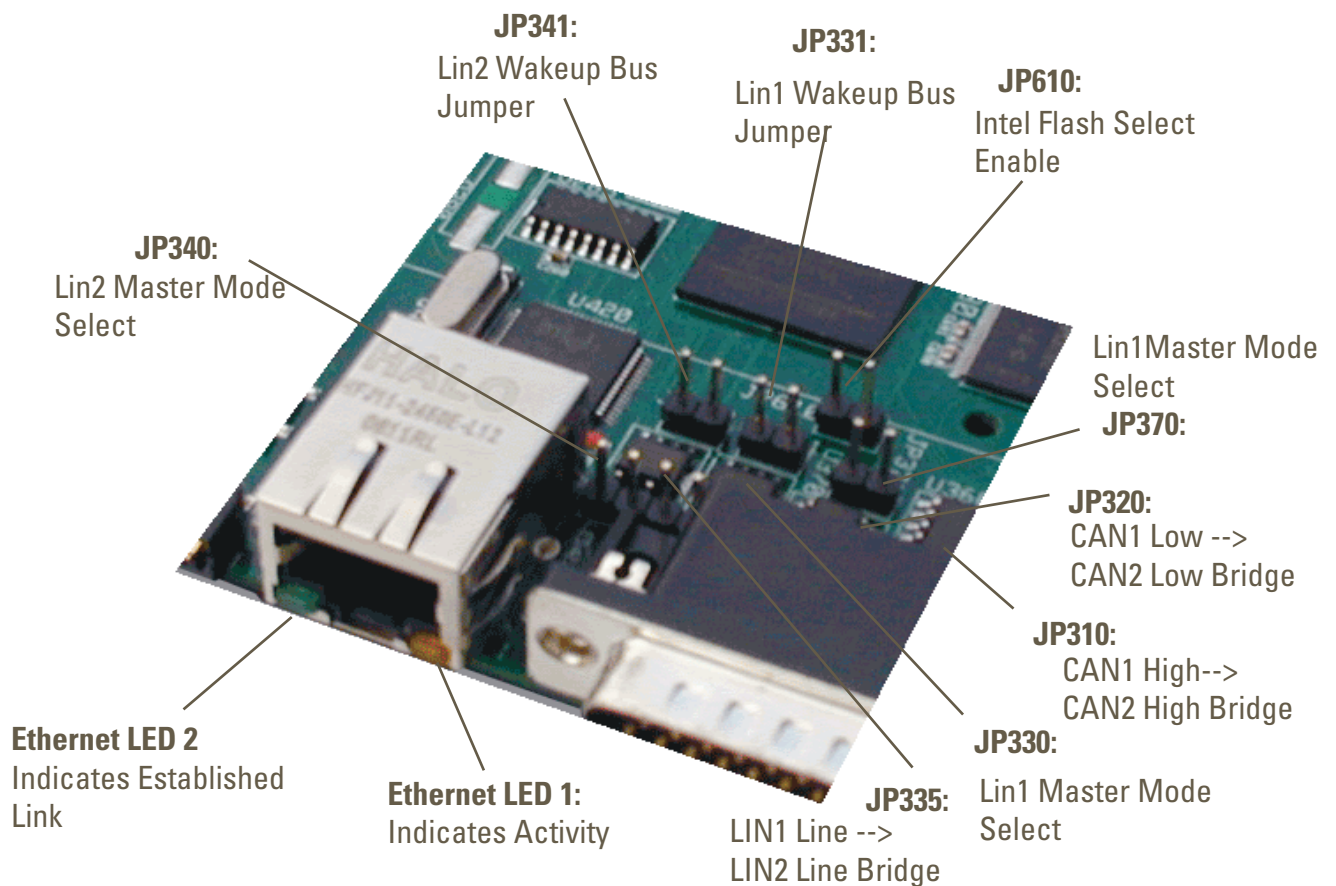
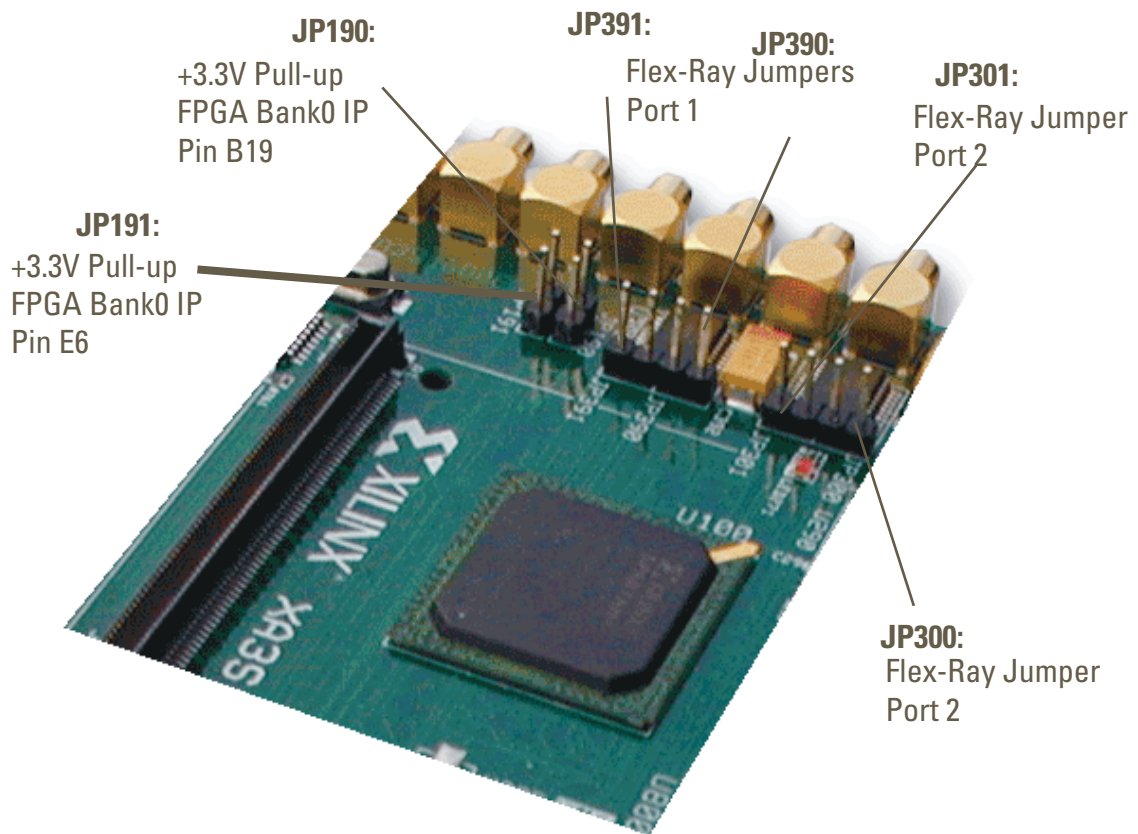
Note: User can select FPGA clock source from 24Mhz Y280 Crystal, Clock Synthesizer X750-1, X210 socket not shown, or external clk JP210. Refer to schematic PDF for FPGA Hookup.

X210 Crystal Socket not shown in photo

Analog Voltage Range Selection  
Jumpers JP480-7  
Pos 1-2 --> 0-8Volts  
Pos 2-3 --> 0-16Volts





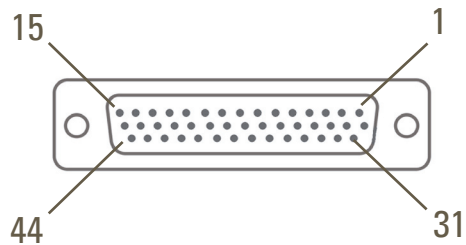


| XA1600E LED's, Buttons, & Jump-            |                                                                   |
|--------------------------------------------|-------------------------------------------------------------------|
| <b>Power LED</b>                           | Indicates power is being supplied to the XA1600E                  |
| <b>JP290:</b>                              |                                                                   |
| <b>JP210:</b>                              |                                                                   |
| <b>Reset LED: User or Power Fail Reset</b> | Indicates power failure, power on or user reset                   |
| <b>Config Done LED: FPGA Configured</b>    | Indicates that FPGA is configured                                 |
| <b>USBLED 400</b>                          | Power active on USB socket                                        |
| <b>LED 392: User LED 1</b>                 | User programmable LED 1                                           |
| <b>LED 393: User LED 2</b>                 | User programmable LED 2                                           |
| <b>JP190:</b>                              | +3.3V Pull-up FPGA Bank0 IP Pin B19                               |
| <b>JP191:</b>                              | Stuff to enable LIN2 master configuration                         |
|                                            |                                                                   |
| <b>Ethernet LED 3</b>                      | User programmable LED of ethernet PHY                             |
| <b>S100:</b>                               | Restart fpga configuration                                        |
| <b>S260: User Reset Button</b>             | Manual reset button                                               |
| <b>S700:</b>                               | User programmable push button 1                                   |
| <b>S701:</b>                               | User programmable push button 2                                   |
| <b>S702:</b>                               | User programmable push button 3                                   |
| <b>S703:</b>                               | User programmable push button 4                                   |
| <b>JP391:</b>                              | Flex-Ray Jumper Port 1                                            |
| <b>JP390:</b>                              | Flex-Ray Jumper Port 1                                            |
| <b>JP301:</b>                              | Flex-Ray Jumper Port 2                                            |
| <b>JP300:</b>                              | Flex-Ray Jumper Port 2                                            |
| <b>JP341:</b>                              | Lin2 Wakeup Jumper                                                |
| <b>JP331:</b>                              | Lin1 Wakeup Jumper                                                |
| <b>JP610:</b>                              | Intel Flash Enable                                                |
| <b>JP370:</b>                              | Lin Master Mode Select                                            |
| <b>Ethernet LED 1</b>                      | User programmable LED of ethernet PHY (default shows activity)    |
| <b>Ethernet LED 2</b>                      | User programmable LED of ethernet PHY (default shows link status) |

# Pin Out Descriptions

## X700:

Communication Connector

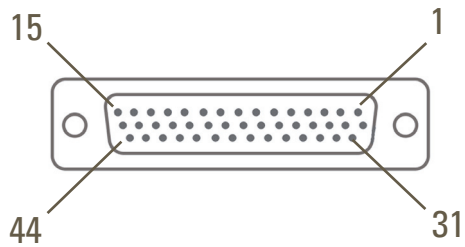


| Pin | Signal   |
|-----|----------|
| 1   | CON_SG0  |
| 2   | CON_SG1  |
| 3   | CON_SG2  |
| 4   | CON_SG3  |
| 5   | CON_SG4  |
| 6   | CON_SG5  |
| 7   | CON_SG6  |
| 8   | CON_SG7  |
| 9   | CON_SG8  |
| 10  | CON_SG9  |
| 11  | CON_SG10 |
| 12  | CON_SG11 |
| 13  | CON_SG12 |
| 14  | CON_SG13 |
| 15  | CON_SP0  |
| 16  | CON_SP1  |
| 17  | CON_SP2  |
| 18  | CON_SP3  |
| 19  | CON_SP4  |
| 20  | CON_SP5  |
| 21  | CON_SP6  |
| 22  | CON_SP7  |

| Pin | Signal     |
|-----|------------|
| 23  | CON_HSLS1  |
| 24  | CON_HSLS2  |
| 25  | CON_HSLS3  |
| 26  | CON_HSLS4  |
| 27  | CON_HSLS5  |
| 28  | CON_HSLS6  |
| 29  | CON_HSLS7  |
| 30  | CON_HSLS8  |
| 31  | FLEXRAY1 P |
| 32  | FLEXRAY1 M |
| 33  | FLEXRAY2 P |
| 34  | FLEXRAY2 M |
| 35  | IN CAN1 H  |
| 36  | IN CAN1 L  |
| 37  | +5V        |
| 38  | VIGN       |
| 39  | PGND       |
| 40  | PGND       |
| 41  | PGND       |
| 42  | VBAT       |
| 43  | VBAT       |
| 44  | VBAT       |

### X300:

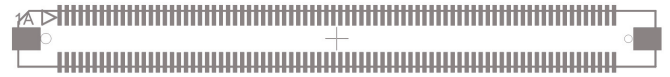
#### Communication Connector



| Pin | Signal       |
|-----|--------------|
| 1   | LIN1 LINE    |
| 2   | IN KLINE/LIN |
| 3   | GND          |
| 4   | CANB H       |
| 5   | IN CAN2 L    |
| 6   | GND          |
| 7   | RS2 RX       |
| 8   | RS1 IX       |
| 9   | GND          |
| 10  | RS0 RX       |
| 11  | ANA15        |
| 12  | ANA13        |
| 13  | ANA11        |
| 14  | +2V5         |
| 15  | +5V          |
| 16  | LIN2 LINE    |
| 17  | GND          |
| 18  | OUT LLINE    |
| 19  | CANB L       |
| 20  | GND          |
| 21  | IN CAN2 H    |
| 22  | RS2 IX       |

| Pin | Signal  |
|-----|---------|
| 23  | GND     |
| 24  | RS1 RX  |
| 25  | RS0 TX  |
| 26  | GND     |
| 27  | ANA14   |
| 28  | ANA12   |
| 29  | ANA10   |
| 30  | +3V5    |
| 31  | GNDA    |
| 32  | GNDA    |
| 33  | VDDA+5V |
| 34  | VDDA+5V |
| 35  | ANA9    |
| 36  | ANA8    |
| 37  | LS ANA7 |
| 38  | LS ANA6 |
| 39  | LS ANA5 |
| 40  | LS ANA4 |
| 41  | LS ANA3 |
| 42  | LS ANA2 |
| 43  | LS ANA1 |
| 44  | LS ANA0 |

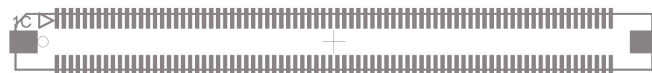
## J500: I/O Extension Connector



| Signal | Pin | Pin | Signal |
|--------|-----|-----|--------|
| PA0    | 1A  | 1B  | PC0    |
| PA1    | 2A  | 2B  | PC1    |
| PA2    | 3A  | 3B  | PC2    |
| PA3    | 4A  | 4B  | PC3    |
| +3V3   | 5A  | 5B  | GND    |
| PA4    | 6A  | 6B  | PC4    |
| PA5    | 7A  | 7B  | PC5    |
| PA6    | 8A  | 8B  | PC6    |
| PA7    | 9A  | 9B  | PC7    |
| +3V3   | 10A | 10B | GND    |
| PA8    | 11A | 11B | PC8    |
| PA9    | 12A | 12B | PC9    |
| PA10   | 13A | 13B | PC10   |
| PA11   | 14A | 14B | PC11   |
| +3V3   | 15A | 15B | GND    |
| PA12   | 16A | 16B | PC12   |
| PA13   | 17A | 17B | PC13   |
| PA14   | 18A | 18B | PC14   |
| PA15   | 19A | 19B | PC15   |
| +3V3   | 20A | 20B | GND    |
| PA16   | 21A | 21B | PC16   |
| PA17   | 22A | 22B | PC17   |
| PA18   | 23A | 23B | PC18   |
| PA19   | 24A | 24B | PC19   |
| +3V3   | 25A | 25B | GND    |
| PA20   | 26A | 26B | PC20   |
| PA21   | 27A | 27B | PC21   |
| PA22   | 28A | 28B | PC22   |
| PA23   | 29A | 29B | PC23   |
| +3V3   | 30A | 30B | GND    |
| PA24   | 31A | 31B | PC24   |
| PA25   | 32A | 32B | PC25   |
| PA26   | 33A | 33B | PC26   |
| PA27   | 34A | 34B | PC27   |
| +3V3   | 35A | 35B | GND    |
| PA28   | 36A | 36B | PC28   |
| PA29   | 37A | 37B | PC29   |
| PA30   | 38A | 38B | PC30   |
| PA31   | 39A | 39B | PC31   |
| +3V3   | 40A | 40B | GND    |

| Signal | Pin | Pin | Signal |
|--------|-----|-----|--------|
| PB0    | 41A | 41B | PD0    |
| PB1    | 42A | 42B | PD1    |
| PB2    | 43A | 43B | PD2    |
| PB3    | 44A | 44B | PD3    |
| +1V2   | 45A | 45B | GND    |
| PB4    | 46A | 46B | PD4    |
| PB5    | 47A | 47B | PD5    |
| PB6    | 48A | 48B | PD6    |
| PB7    | 49A | 49B | PD7    |
| +1V2   | 50A | 50B | GND    |
| PB8    | 51A | 51B | PD8    |
| PB9    | 52A | 52B | PD9    |
| PB10   | 53A | 53B | PD10   |
| PB11   | 54A | 54B | PD11   |
| +1V2   | 55A | 55B | GND    |
| PB12   | 56A | 56B | PD12   |
| PB13   | 57A | 57B | PD13   |
| PB14   | 58A | 58B | PD14   |
| PB15   | 59A | 59B | PD15   |
| +1V2   | 60A | 60B | GND    |
| PB16   | 61A | 61B | PD16   |
| PB17   | 62A | 62B | PD17   |
| PB18   | 63A | 63B | PD18   |
| PB19   | 64A | 64B | PD19   |
| +1V2   | 65A | 65B | GND    |
| PB20   | 66A | 66B | PD20   |
| PB21   | 67A | 67B | PD21   |
| PB22   | 68A | 68B | PD22   |
| PB23   | 69A | 69B | PD23   |
| +1V2   | 70A | 70B | GND    |
| PB24   | 71A | 71B | PD24   |
| PB25   | 72A | 72B | PD25   |
| PB26   | 73A | 73B | PD26   |
| PB27   | 74A | 74B | PD27   |
| +1V2   | 75A | 75B | GND    |
| PB28   | 76A | 76B | PD28   |
| PB29   | 77A | 77B | PD29   |
| PB30   | 78A | 78B | PD30   |
| PB31   | 79A | 79B | PD31   |
| +1V2   | 80A | 80B | GND    |

## J600: I/O Extension Connector



| Signal | Pin | Pin | Signal     |
|--------|-----|-----|------------|
| BD0    | 1C  | 1D  | MEM_#RD    |
| BD1    | 2C  | 2D  | MEM_#OE    |
| BD2    | 3C  | 3D  | MEM_#WE    |
| BD3    | 4C  | 4D  | UNUSED     |
| +5V    | 5C  | 5D  | GND        |
| BD4    | 6C  | 6D  | MEM_#BE3   |
| BD5    | 7C  | 7D  | MEM_#BE2   |
| BD6    | 8C  | 8D  | MEM_#BE1   |
| BD7    | 9C  | 9D  | MEM_#BE0   |
| +5V    | 10C | 10D | GND        |
| BD8    | 11C | 11D | SRAM_#CS   |
| BD9    | 12C | 12D | FLASH_#CS  |
| BD10   | 13C | 13D | FLASH_#RP  |
| BD11   | 14C | 14D | FLASH_STS  |
| +5V    | 15C | 15D | GND        |
| BD12   | 16C | 16D | USB_#CS    |
| BD13   | 17C | 17D | USB_#RESET |
| BD14   | 18C | 18D | USB_#IFCLK |
| BD15   | 19C | 19D | USB_#INT   |
| +5V    | 20C | 20D | GND        |
| BD16   | 21C | 21D | USB_WAKEUP |
| BD17   | 22C | 22D | USB_READY  |
| BD18   | 23C | 23D | USB_FLAGA  |
| BD19   | 24C | 24D | USB_FLAGB  |
| +5V    | 25C | 25D | GND        |
| BD20   | 26C | 26D | USB_FLAGC  |
| BD21   | 27C | 27D | USB_PKTEND |
| BD22   | 28C | 28D | EXT1_#CS   |
| BD23   | 29C | 29D | SDRAM_#CS  |
| +5V    | 30C | 30D | GND        |
| BD24   | 31C | 31D | EXT_TDO    |
| BD25   | 32C | 32D | EXT_TDI    |
| BD26   | 33C | 33D | CFG_TMS    |
| BD27   | 34C | 34D | CFG_TCK    |
| +5V    | 35C | 35D | GND        |
| BD28   | 36C | 36D | BYPASS_#OE |
| BD29   | 37C | 37D | +2V5       |
| BD30   | 38C | 38D | CFG_DONE2  |
| BD31   | 39C | 39D | UNUSED     |
| +5V    | 40C | 40D | GND        |

| Signal | Pin | Pin | Signal    |
|--------|-----|-----|-----------|
| BA31   | 41C | 41D | SPI0_MISO |
| BA30   | 42C | 42D | SPI0_MOSI |
| BA29   | 43C | 43D | SPI0_SCLK |
| BA28   | 44C | 44D | SPI1_#CS0 |
| +2V5   | 45C | 45D | GND       |
| BA27   | 46C | 46D | SPI1_#CS1 |
| BA26   | 47C | 47D | SPI1_#CS2 |
| BA25   | 48C | 48D | SPI0_#CS2 |
| BA24   | 49C | 49D | SPI0_#CS1 |
| +2V5   | 50C | 50D | GND       |
| BA23   | 51C | 51D | SPI0_#CS0 |
| BA22   | 52C | 52D | SPI0_SCLK |
| BA21   | 53C | 53D | SPI0_MOSI |
| BA20   | 54C | 54D | SPI0_MISO |
| +2V5   | 55C | 55D | GND       |
| BA19   | 56C | 56D | UNUSED    |
| BA18   | 57C | 57D | USW_EXT0  |
| BA17   | 58C | 58D | USWEXT1   |
| BA16   | 59C | 59D | USWEXT2   |
| +2V5   | 60C | 60D | GND       |
| BA15   | 61C | 61D | UNUSED    |
| BA14   | 62C | 62D | UNUSED    |
| BA13   | 63C | 63D | UNUSED    |
| BA12   | 64C | 64D | UNUSED    |
| +2V5   | 65C | 65D | GND       |
| BA11   | 66C | 66D | UNUSED    |
| BA10   | 67C | 67D | UNUSED    |
| BA9    | 68C | 68D | UNUSED    |
| BA8    | 69C | 69D | UNUSED    |
| +2V5   | 70C | 70D | GND       |
| BA7    | 71C | 71D | UNUSED    |
| BA6    | 72C | 72D | UNUSED    |
| BA5    | 73C | 73D | UNUSED    |
| BA4    | 74C | 74D | UNUSED    |
| +2V5   | 75C | 75D | GND       |
| BA3    | 76C | 76D | VSUPPLY   |
| BA2    | 77C | 77D | VSUPPLY   |
| BA1    | 78C | 78D | VSUPPLY   |
| BA0    | 79C | 79D | VSUPPLY   |
| +2V5   | 80C | 80D | GND       |

For more information about available IP cores to integrate on XA1600E platform please visit:

[www.xilinx.com/automotivekits](http://www.xilinx.com/automotivekits)