



### Technical Specifications of Motherboard ::

<b>Speed</b>	16 MHz crystal operated multi-output clock source to operate various resources on Mother Board like CPU, Baud rate, T/C etc.			
<b>I/O Pins</b>	48 I/O lines through 2 Nos. of 26 pin FRC header.			
<b>Serial Interface</b>	RS-232c serial interface using RS232 driver IC through 9 Pin male D connector.			
<b>Parallel Interface</b>	25 pin male D connector for Parallel interface for JTAG based programming.			
<b>USB to Serial Interface</b>	Using USB to serial converter IC CP2102.			
<b>Display (Choose one option)</b>	16 x 2 LCD (Backlit)	16 x 2 Jumbo LCD (Backlit)	20 x 4 LCD (Backlit)	40 x 2 LCD (Backlit)
<b>Key Board (Optional)</b>	Keyboard interface to support 101 keys PC AT/PS2 / USB keyboard.			
<b>Battery Backup</b>	Lithium battery (3V/48mAH) provided to supply power to RTC.			
<b>Additional Resources</b>	<ul style="list-style-type: none"> <li>Ext. L/S (8Ω/0.5W) I/F for experiments on frequency synthesis.</li> <li>Reset push button.</li> <li>Variable Slow CLK (2Hz-64Hz) provided for internal timers/counter functions applications.</li> <li>Variable Pot (0 -5V) to stimulate analog I/P for built in ADC wherever applicable.</li> <li>General purpose bicolor SMD (green, red) 8 x 2 LEDs for status indication, 8 SMD Push Button Switches &amp; 8 DIP switch with 8 bicolour SMD (Green Red) indicator.</li> <li>Optional: 1) Bread board with 640 tie points &amp; 200 distribution points in place of I2C based 24C512 (EPROM), DS1307 (RTC), SPI (93C46). 2) DS1820 temperature sensor OR variable slow clock by changing link setting. 3) I2C based temperature sensor LM75.</li> <li>On board power supply: +3.3V, variable +1.25 to 2.5V, 3.1V to 4.2V variable.</li> </ul>			
<b>Power Supply Options (SMPS), 2 options</b>	<b>Select one of 2 options</b> I) 5V /2.5 Amp SMPS with RCA plug. II) 5V /2.5 Amp SMPS with RCA plug +12 V/ 850 mA, -12V/250 mA with 4 pin reliamate SMPS.			
<b>Application Modules (optionally) : To be inserted</b>	<ul style="list-style-type: none"> <li>VGA 15 pin D (high density F)</li> <li>Ethernet (RTL 8019)</li> <li>RS485 Interface</li> <li>Bluetooth</li> <li>Zigbee</li> <li>Graphic LCD (128 x 64) Adaptor</li> <li>Touch Panel Interface</li> <li>IR Transceiver, SD Card.</li> </ul> <p><b>Note:</b> Many more modules are in pipe line for e.g. RF ID Card Reader, RF Sensors, Altimeter, Magnetometer, Accelerometer, Gyroscope etc.</p>			
<b>Mechanical Details</b>	Aesthetically designed Injection molded plastic enclosure of size 215(L)x165(W)x75(H)mm. Weight = 900 gm.(1.5 Kg with manuals)			

Note: Specifications are subject to change.



**Choice of VLSI/Embedded Controller (ECU wise specifications) : A) Select any 1 ECU**

CONTROLLER DEVICE	89V51RD2 / 89C668 (optional)	PIC : 16F877/77A/ 16F876A/16F628A	PIC Microchip	18F4520 (4550)	CPLD XC95108	FPGA-I Spartan 2 XC2S50	FPGA-II Spartan 3 XC3S400	FPGA-II Cyclone II EP2C8	AVR ATMEGA32L	ARM7 LPC2148
<b>Manufacturer Model</b>	ATMEL/Philips/NXP	Microchip	Microchip	Microchip	XILINX	XILINX SPARTAN-II	XILINX SPARTAN-III	ALTERA CYCLONE-II	ATMEL ATMEGA	PHILIPS
<b>PACKAGE</b>	40 Pin DIP package 44 Pin PLCC optional (28/18 Pin optional)	40Pin DIP (28/18 Pin optional)	40 Pin DIP	40 Pin DIP	PLCC 84 pin	POG 208 pin	POG 208 pin	POG 208 pin	40 PIN DIP	LOFP64(SMD)
<b>ON CHIP RAM FLASH/EEPROM</b>	256 Bytes (1KB) 8 KB (64KB)	256 Bytes 8KB	256 Bytes 32KB	256 Bytes 32KB	108 Macrocells 1600 gates	32 Kb 50K gates	288 Kb 400K gates	162 Kb 8256LEs	2KB Int.SRAM 32KB	32KBytes 512KBytes
<b>OPERATING FREQ</b>	16 MHz	4 MHz	16 MHz	16 MHz	16 MHz	16 MHz	16 MHz	16 MHz	8 MHz	14 MHz
<b>I/O CAPACITY</b>	4 X 8 I/O ports. (32)	24 + 9 I/O	36 (35)	36 (35)	36+26	140	264	182		3247
<b>OPERATING SYSTEM ICSP SW PC PORT</b>	WinXP/7/8/10 Flash Magic (Winisp) Com Port	WinXP/7 PIC Boot loader Com Port	WinXP/7 P1618QP(HIDBL) Com Port (USB)	WinXP/7 P1618QP(HIDBL) Com Port (USB)	WinXP/7/8/10 Xilinx Web Pack Ver.14.2/10.1 containing simulation facility Parallel port JTAG (For USB, Refer cable no. 4 below)	WinXP/7/8/10 Quartus II 9.1 parallel port JTAG	WinXP/7/8/10 AVROSP/II	WinXP/7/8/10 FlashMagic Com port/USB		
<b>SPECIAL PURPOSE I/Os</b>	7 interrupt sources, depending on device.	3 * 16 bit TC 14 Ints	From flash	From flash	From flash	From SRAM optionally PROM XCF102S(256KB)	From SRAM optionally PROM XCF04S(242KB)	From SRAM optionally PROM XCF04S(242KB)	From Flash	From Flash
<b>EXECUTION METHOD</b>	From Flash	From flash	From flash	From flash	From Flash	From SRAM optionally PROM XCF102S(256KB)	From SRAM optionally PROM XCF04S(242KB)	From SRAM optionally PROM XCF04S(242KB)	From Flash	From Flash
<b>PROGRAMMING LANGUAGE +</b>	C Language Assembly Language	C Language (Optional) Assembly Language	C Language Assembly Language	C Language	VHDL / VERILOG / Schematics / Behavioural Simulation We supply free on CD webpacks / evaluation software. The responsibility of using licensed versionities with users wherever applicable				C Language	DE programmer's Notepad, GNUARM, Kiel Arm C. Optionally sorting of Free RTOS for 6 concurrent processes

**Miscellaneous :** 1)19 pin Female to 9 pin Female RS-232C cable, 2) 26 pin FRC IO cable 3) 25 pin, female to 25 pin male cable for Parallel Interface, 4)USB to JTAG cable provided with PC application to download bit / jed files for Xilinx devices. Does not work under ISE webpack. Needs Net framework installed. 5) USB to RS232 Cable 6)USB to USB Cable (optional)

**ECU-89V51RD2/89C668**



**ECU-FPGA**



**ECU-PIC**



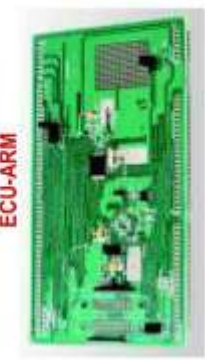
**ECU-AVR**



**ECU-CPLD**



**ECU-ARM**



**SALIENT FEATURES**

- ◆ Aesthetically designed Injection moulded Plastic enclosure.
- ◆ XPO series of VLSI / Embedded trainers VIZ: CPLD, FPGA, ARM7, 89C51Rd2, PIC16F, PIC18F, AVR, Arduino equivalent 328P, Shakti / Vega etc.
- ◆ Set of Users Guide provided with each unit with emphasis on C Programming as well as assembly language programming.
- ◆ In circuit system programming (ICSP) supported through PC ports of COM/LPT/JTAG or USB as applicable
- ◆ Can interface to application boards of XPO series microprocessor trainers saving customer investment.
- ◆ I2C, SPI bus interface.



**Application Modules (optional) :** 1] Compatible with XPO-EST. 2] Typical size of application PCB module = 46 x 56 mm. 3] Mounts using 3 SILS (8+8+9 pin) polarized head 4] not every resource can be used fully with particular ECU due to paucity of its IO capacity



#### Ethernet application module

- Input / Output: RJ45 connector with build in magnetic amplifier and LED indication, Realtek RTL8019 as ethernet controller
- Power supply : +5V
- Data rate : 10 Mbps using CAT-5 UTP cross cable
- LAN topology : CSMA/CD (full duplex).

#### List of experiments :

- Setting of IP address. Study of

various protocol like ICMP(PING), ARP, UDP, HTTP(Web page), TELNET (using hypyt WINSOCK)

- **Order Extra :** XPO-EST 89V51RD2 KIT.



#### Wi-Fi Application Module

- Input: TTLRS232
- Operating Frequency Band ISM 2.402 – 2.480 MHz
- Module Specifications: RN-171-XV 802.11 bg Wireless LAN Module
- Data Rate: 464 Kbps using hardware flow control

#### List of experiments:

- Find IP of active Wi Fi devices
- Interfacing Wi-Fi module with PC
- Interfacing Wi-Fi module with Android mobile

- **Order Extra :** XPO-EST KIT



#### IR Trans receivers application module

#### Technical specifications

- Input TTL RS232
- Output : 40 KHz
- Uses emitter (TSAL6200) & detector (HS003822) pair for IR communication
- Can communicate with PC as well as embedded kit by selecting switch positions on EST-MB.

#### List of experiments:

- Serial communication between PC Hyperterminal & itself through IR.

- Serial communication between PC Hyperterminal & micro-controller through IR
- Serial communication between two micro-controller using IR circuit.
- **Order Extra :** XPO-EST 89V51RD2 KIT



#### Bluetooth application module

#### Technical specifications:

- Input: TTLRS232
- Output :RF
- **Module specs :** ESD110V2-
- Operating Frequency Band ISM 2.42.48GHz
- Modulation Method: Gaussian Freq. Shift Keying
- Output Interface: UART
- Serial UART speed up to 921.6kbps
- Bluetooth Specification: V2.0 + EDR,
- Transmit Power - Max. 18dBm, Receiving Sensitivity: -90dBm (0.1%BER)

- Compact size -27.5 x 30.0 x 14.0 (mm) \*Provides RS232 Serial Cable Replacement \* Profile: Serial Port Profile. \* Supports up to 4 multiple simultaneous connections. \* Working Distance : Normally 100 meters RSSI Indication on LCD. \* Can communicate with PC as well as micro-controller by selecting switch position on EST-MB.

#### List of experiments:

- Interfacing Bluetooth module with PC as well as embedded kit, pairing with mobile error generation study of AT commands, study of frequency band using spectrum analyzer.

- **Order Extra :** 2 nos. of XPO-EST 89V51RD2 KIT



#### Touch panel interface application module

#### Technical Specifications

- Input: stylus (finger tip)
- Output : Digital value of respective resistance which is converted into voltage.
- Uses 4 wire resistive touch panel
- Uses SPI ADC MCP3302 or Touch Panel Driver IC AD7843 (as per order).

#### List of experiment:

- Converting X & Y resistances into voltages & displaying digital value on LCD using SPI ADC MCP3302 or Touch Panel Driver IC AD7843

- **Order Extra :** 1 nos. of XPO-EST PIC18F4550 KIT



#### GSM/GPRS Application Module

#### Technical Specifications:

- Input: TTL RS 232.
- Output: External RF antenna.
- Power Supply: 3.2V – 4.8V.
- Headset with built in MIC.

#### Module Specifications:

- Frequency Band: SIM 900 Quad Band: GSM 850 MHz, EGSM 900 MHz, DCS 1800 MHz PCS 1900 MHz SIM 900 can search 4 frequency bands automatically
- Transmitting Power: Class 4 (2W) at GSM 850 and EGSM 900, Class 1(W) at DCS 1800 and PCS 1900. ● GPRS

Connectivity: GPRS multi-slot class 10 (Default), GPRS multi-slot class 8 (option). ●Data GPRS: Data downlink transfer-max 85.6Kbps, Data uplink transfer-max 42.8 Kbps, Integrate the TCP/IP Protocol. ● SIM Interface: Socket (Use local SIM card)

#### List of Experiments:

- Study of AT command using hyper terminal viz: Network Registration, Answer an incoming Call, Mobile originated call to dial a number, Message sending and reading, GPS commands etc.
- Interface GSM with Microcontroller to receive & disconnect call. ● Interface GSM module with Microcontroller to make & disconnect user defined numbers. ● Interface GSM module with Microcontroller to send SMS as text message, send show clock, temperature.

- **Order Extra :** XPO-EST 89V51RD2 KIT



#### Zigbee application module

#### Technical specifications:

- Input: TTLRS232
- Output :RF
- Module Specifications: X'bee series pro2-
- Operating Frequency Band ISM 2.4 GHz
- Indoor/Urban: up to 133' (40 m)
- Outdoor line-of-sight: up to 400' (120 m)
- Transmit Power: 2 mW (+3 dBm)
- Receiver Sensitivity: -95 dBm RF Data Rate: 250,000 bps ● TX Current: 40 mA (@3.3 V)
- RX Current: 40 mA (@3.3 V)
- Power-down Current: < 1 μA @ 250C

- Each direct sequence channel has over 65,000 unique network addresses available Point-to-point, point-to-multipoint and peer-to-peer topologies supported Self-routing, self-healing and fault-tolerant mesh networking
- Working Distance : Normally 100 meter ● RSSI Indication on LCD.
- Can communicate with PC as well as micro-controller by selecting switch position on EST-MB.

#### List of experiments:

- Interfacing Zigbee module with PC as well as embedded kit, error generation, study of AT commands, study of frequency band using spectrum analyzer.

- **Order Extra :** XPO-EST 89V51RD2 KIT



#### GPS Application Module

#### Technical Specifications:

- Input: TTL RS 232.
- Output: External RF antenna.
- Power Supply: 3.3V.
- Provided with patch antenna.

#### Module Specifications:

- Update rate : 1 Hz (Default) upto 10Hz.
- Horizontal position accuracy : <2.5m CEP.
- Vertical accuracy : <0.1m/s

- Acceleration Accuracy : 0.1m/s<sup>2</sup>, Timing Accuracy : 10ns
- Sensitivity - acquisition : -148dBm, Tracking: -165 dBm, Reacquisition : -160dBm, 66 acquisition channels, 22 tracking channels.

#### List of Experiments :

- Study of AT commands using hyper terminal viz. determination of latitude & longitude.

- **Order Extra :** XPO-EST 89V51RD2 KIT

Note: Specifications are subject to change.





### SD card module

#### Technical specifications:

- Input: TTL Rs232
- Output Interface: SPI
- Power supply : +5V
- Uses Micro SD card Adaptor and Micro SD card

#### List of Experiments:

- How to format (Micro) SD Memory chip/stick with FAT32 format

- Interfacing SD Card application module with embedded Kit : i. List of Files present in SD card, ii. Reading content of files, iii. Writing new file, iv. Delete files, v. Read Capacity of SD Card
- **Order Extra** : XPO-EST AVR KIT.



### RS485 Interface application module

#### Technical specifications:

- Input: TTL RS232
- Output RS485 differential
- Power supply : +5V
- Uses IC MAX 485 & communicates with PC using Modscan
- LAN topology : MODBUS (half duplex)
- RS232 to RS485 converter at PC side

#### List of Experiments:

- Select device ID/Transmits key, Led status, frequency on PC using MODSCAN
- **Order Extra** : XPO-EST 89V51RD2 KIT
- **Optionally** 15 pin HD (F) for VGA (Separate assembly)



### EM-18 RFID Reader

#### Technical specifications

- Input: TTL Rs232
- Power supply: +5V
- Baud rate: 9600
- Frequency : 125KHz

#### List of experiments:

- Interfacing EM-18 RFID Reader module to PC.
- Interfacing EM-18 RFID Reader module to EST-AVR
- **Order Extra** : XPO-EST KIT.



### ESP8266 WiFi module

#### Technical Specifications

- Input : TTL RS232
- Power supply: +3.3V
- Baud rate: 9600

#### List of experiment:

- How to find IP of connected Wi-Fi devices
- Interfacing Wi-Fi module to PC using Realterm software

- Communication between Wi-Fi module (in client/station mode) and connected Android mobile using Mobile Apps (IP is known)
- Interfacing Wi-Fi module to PC using Real term software
- Communication between Wi-Fi module (in AP/server mode) and connected Android mobile using TCP Client application
- Study of wi-fi protocol in embedded application. Interfacing wi-fi module with micro controller send text messages, Led status through wi-fi app. module to Android mobile.
- **Order Extra** : EST 89V51RD2 KIT



### HC-06 Bluetooth Module

#### Technical Specifications:

- Input: TTL RS 232.
- Power Supply: 5V.
- Baud rate: 38400

#### List of Experiments :

- Communication of Bluetooth module to PC using Realterm software and AT command..
- Communication of Bluetooth module HC-06 with android mobile using Serial Bluetooth Terminal app..

- **Order Extra** : XPO-EST KIT.



### VGA Module

#### Technical Specifications:

- Input TTL RS 232.
- Power Supply: 5V.
- With FPGA -II-3S400

#### List of Experiments :

- Display "Hello world" text on video monitor in four quadrant by interfacing VGA application module with FPGA.
- **Order Extra** : XPO-EST Spartan 3 KIT



### Finger Print Sensor Module

#### Technical Specifications

- Input: TTL RS -232
- Power supply
- Baud Rate : 9600
- Window area : 14 x 18 mm

#### List of experiments:

- Enrol finger print
- Finger print authentication
- **Order Extra** : EST AVR KIT



### Camera module

- Input: TTL Rs232
- Image sensor: CMOS ¼ inch
- CMOS Pixels: 0.3M
- Pixel Size: 5.6µm\*5.6µm
- Output Format: Standard JPEG/M-JPEG
- Baud rate: Default 38400
- Output Interface: UART
- Power Supply: +5V

#### List of experiments :

- Capturing Image using PC software (VC0706 Comm tool).
- **Order Extra** : XPO-EST KIT.

Note: Specifications are subject to change.



**B) Choice of Advance ECUs (Motor DSP, Multimedia DSP, VLSI Adv. FPGAs, Shakti/Vega micro-processors etc.)**

IC No.	FPGA-IV Spartan 6 XC6SLX4	Xilinx	FPGA-IV Cyclone 4 EPC4CE10	Altera	mDSP TMS320F28335	Texas	MSP MSP430F5438	Texas	Arduino equivalent Atmega328P	ATMEL/ATMEGA	Xilinx	XC6SLX4 (Standalone) (CDAC-TOT)	Xilinx	Shakti/Vega (Artix 7 35T/100T)
Manufacturer	Xilinx	Altera	Texas	Texas	ATMEL/ATMEGA	Xilinx	Arduino equivalent	ATMEL/ATMEGA	Xilinx	Shakti/Vega				
Package	144-pin TQFP	144-pin TQFP	176-pin LQFP	100-pin LQFP	28-pin DIP	TOG 144 pin								
Operating Voltage	1.2, 2.5, 3.3V	1.2, 2.5, 3.3V	1.8, 3.3V	3.3V	5V	3.3V								
Crystal/Operating Freq.	16MHz / 375MHz	16MHz / 200MHz	20MHz / 100MHz using PLL	32 MHz	16 MHz	25 MHz								
Bit Capacity (Data width)	3,840 logic cells	10,320 logic cells	32 Bit / Floating point	32 Bit / Floating point	8 bit	3,840 gates, 28 global clocks								
Flash / EEPROM / Number of Logic elements	600 Logic Array Blocks, 216Kb RAM	645 Logic Array Blocks 414Kb RAM	256K x 16 FLASH, 34K x 16 RAM, 8K x 16 BOOT ROM	128KB flash, 30KB SRAM, 1 KB ROM	2Kb Int SRAM 32Kb/1Kb	600 Logic Array Blocks, 216KB RAM								
GPIO	102 GPIOs	92 GPIOs	88 GPIOs	Upto 48 GPIOs	20 GPIO	102 GPIOs								
Special function pins	28 global clocks	10 global clocks	16 (12-bit) ADC channels, 12 PWM, 1 CAN, 1SCI, 1SPI, 1 I2C, 4CH DAC (Optional)	Upto 4 SCI modules, Upto 4 SPI & I2C modules, 12-bit 14 External & 2 internal modules with conversion time	10 Bit ADC, DAC IPWM, connect to IOT MB as sensor board & uno shield	Works on USB 5V supply, 4 digit 7 Seg. Display, 8 LEDs, 4 push button switches 12 SPDT switches, UART interface 15 x 2 DL (F) and 6 x 2 DL (M) for external IO. I/F.								
Programming Language	VHDL / Verilog	VHDL / Verilog	C	C	C	VHDL / Verilog								
Software tool provided	Xilinx Web pack V14.7 containing simulation facility	Quartus Web Edition 13.0 containing simulation facility WIN10	CCSV7.2, Uniflashed 2.0 for Win7 / 8 Uniflashed 3.3.0 for Win10.	CCSV7.2, Uniflashed 2.0 for Win7 / 8 Uniflashed 3.3.0 for Win10.	Arduino IDE	Xilinx Web pack V14.7 containing simulation facility								
PC Port / JTAG Emulator / Debugger	FT JTAG Module (FT232H)	FT JTAG Module (FT232H)	USB to Serial Converter (Default) XDS100v2 JTAG (Optional)	USB Debugger MSP-FET430UIF	Arduino bootloader with Arduino IDE through USB port.	Built in USB JTAG with GUI provided, 4 DIP switches for mode selection.								
Advance Experiments (optional)			Digital Filtering :- 1) FR (6), IR (4), FFT & convolution (!) 2) Order Combo application board separately to be used for applying Digital Filtering on Human voice											

ECU mDSP TMS320F28335



ECU Atmega328P



CDAC SPARTAN-6 (Standalone)



Note: Specifications are subject to change.