Solution Guide

For embedded Networking and Computing

ARM+Linux
Box
Computer

ARM+Linux
Programmable
Controller

ARM+Linux
Embedded
SoM

ARM+Linux
Box
Computer

Serial-to-Ethernet
Communication
Gateway

Serial-to-Ethernet
Embedded
Module

Mini-PCI
RS-232/422/485
Module

Artila

ARM9 + Linux Computers & SoM

mini-mighty computing platforms meet all your needs

By combining ultra-low power 32-bit ARM9 processor and the open-source Linux OS, Artila has developed a complete line of lean-and-mean Linux-ready box computers and SoMs (system-on-module), the Matrix family, with comprehensive network, communication and digital I/O support, making them 100% robust front-end controllers which are ideal for distributed or Web-based industrial applications.

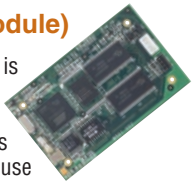
Matrix Benefits

- Pre-built Linux environment with file system support
- Built-in Web/FTP/Telnet servers, hassle free, up and run
- GNU tool chain for Linux/Windows is included
- Low power consumption, less than 3 watts in average
- FLASH-based disk, support SD memory card
- Ultra-compact and easy-mounting mechanical design

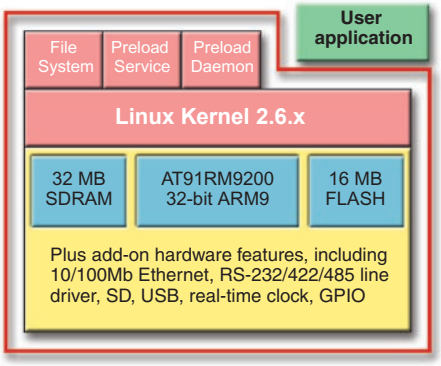
Box Computers

The Matrix-500/510/520 are ready-to-use box computers designed for applications where small form factor and low power consumption are crucial concerns. The Matrix-500 /510/520 come with Ethernet ports, RS-232/422/485 ports, and USB 2.0 compliant host ports. An SD slot is also included inside the metal housing.

SoM (System-on-Module)



The credit-card sized M-501 is the world's smallest ARM9 + Linux SoM among its kind. Using the M-501 as an powerful while easy-to-use 32-bit programmable controller, device manufacturers can quickly deliver value-added products into the market. The M-501 supports Ethernet, UART, SD, GPIO, I2C, I2S and SPI interfaces and an 8-bit local bus for function expansion.



System Architecture of Matrix family Computers & SoM

Developing user application with the Matrix family computers & SoM is very easy.

- Design and test the applications on standard Linux desktops/notebooks.
- Use the bundled tool chain to cross-compile the source codes into binary codes for ARM9 processor.
- Download the cross-compiled binary codes to the Matrix family computers using any standard FTP utility.
- Manually start the application using any standard Telnet utility.
- Or make the application run automatically by modifying the rc file.

Web-based Monitor & Control Out of a Box

The Matrix box computer are especially suitable for system integrators to implement applications that need Web-based remote monitor and control functions.

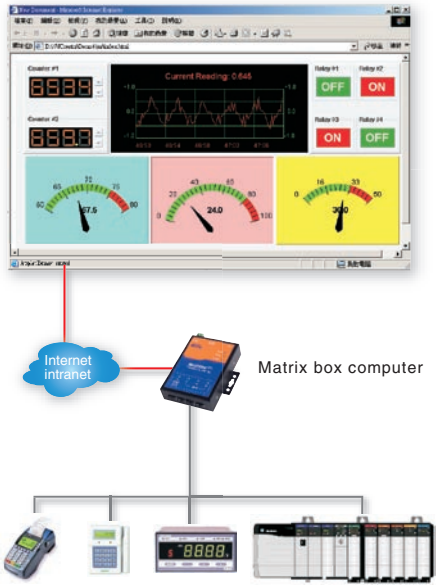
Pre-installed Web Server

The boa web server is pre-installed and activated for all the Matrix box computers

The web server accepts standard HTML files. Use any standard ftp utility to upload the web pages to the Matrix box computer.

Huge Space for Web Pages

The Matrix-500 provide 16MB FLASH memory. 4MB among which is for system use and the other 12 MB is for user programs, including web pages and CGIs. If more file storage space is needed, just insert an off-the-shelf SD memory card into the Matrix box computer to increase the storage space up to 4GB in a snap.



Software features of the Matrix box computer

General

- OS: Linux, kernel 2.6.x
- Boot Loader: U-Boot 1.1.2
- File Systems: JFFS2, ETX2/ETX3, VFAT/FAT, NFS

Protocol stacks

- IPv4, ICMP, ARP, DHCP, NTP, TCP, UDP, FTP, Telnet, HTTP, PPP, PPPoE, CHAP, PAP, SMTP, SNMP V1/V2, SSL, SSH 1.0/2.0

Utilities

- bash: shell command
- tinylogin: login and user manager utility
- telnet: Telnet client program
- busybox: Linux utility collection
- ftp: FTP client program

Daemon

- pppd: Dial in/out over serial port and PPPoE
- snmpd: SNMP agent program
- telnetd: Telnet server program
- inetd: TCP server program
- ftpd: FTP server program
- boa: Web server program
- sshd: secured shell server
- iptables: Firewall service manager
- armd: Artila manager daemon

Tool Chain for Linux/Cygwin

- GCC: C/C++ PC cross compiler
- GLIBC: POSIX Library

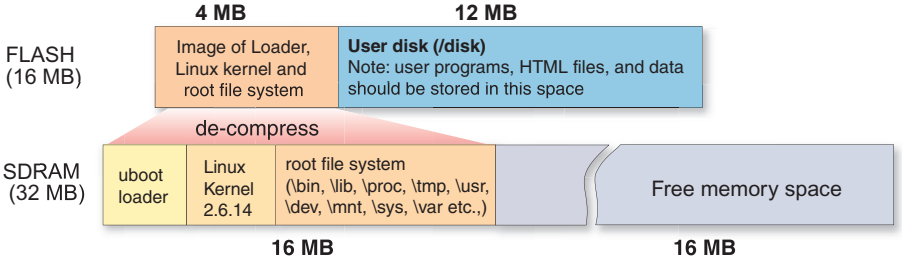
Device Drivers

- SD/MMC, UART, Real Time Clock, Buzzer, Digital I/O, Ethernet, Watchdog Timer

USB Host Drivers

- Flash disk
- WiFi (IEEE-802.11b/g)
- RS-232 adaptors
- Bluetooth

Memory Map and File System

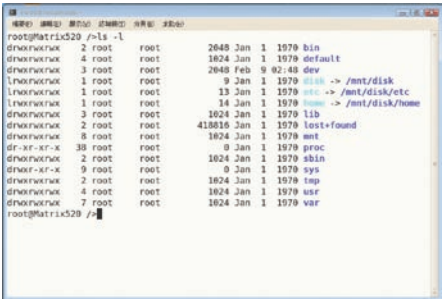


Matrix bootup sequence

After power on, the Matrix will load the image (stored in FLASH) , create an 8MB RAM disk, and de-compress the image into the RAM disk for the loader, Linux kernel and the root file system. There are 16MB free SDRAM space left for user application after system bootup.

User disk (/disk)

The Matrix provides 16MB FLASH in total, 4MB for system use and 12MB for user programs. User programs should be stored in /disk directory. Files stores in the other directories will be lost after power off.



Matrix file system tree

Upload user programs

Be sure to save the user programs to the Matrix's /disk directory or any sub-directory of /disk.

Upload user HTML files

Be sure to save user HTML files to the Matrix's /disk/home/httpd directory. The home page filename should be "index.html".

- Save the user programs to an USB thumb disk, then plug it into the Matrix and copy the user programs to the Matrix.
- Use ftp utility to transfer the user programs to the Matrix directly.

System update

Matrix provides the "update" utility for users to FORMAT the user disk (/disk) and update the loader, Linux kernel and the root file system image.

Install more utilities

More utilities can be found in the CD-ROM, such as ntpclient, ssh-keygen and bluez utilities.

Matrix Box Computer Selection Guide

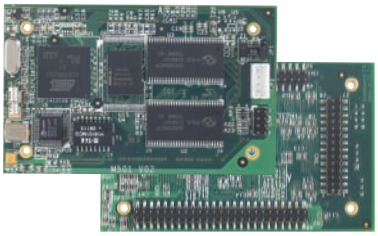


Key Specifications		Matrix-520	Matrix-510	Matrix-500
System	CPU	ATMEL AT91RM9200 (ARM9-core, w/ MMU)		
	SDRAM	32MB		
	FLASH	16MB		
	EEPROM	2KB		
	Linux Kernel	2.6.x		
Display	Graphic mode	144 x 32 pixels	-	-
	Text mode	18 x 2 lines	-	-
Ethernet (10/100M)	No. of ports	x 2		x 1
TTY (Serial)	No. of ports	x 8		x 4
	RS-232/422/485 3-in1 ports	x 5		x 1
	RS-232 ports	x 3		x 3
	Modem support	x 5		x 1
	Max. baud rate	921.6Kbps		
	Connector	RJ-45		
USB Host	No. of ports	x 2		
	Speed	USB 2.0 compliant supports 1.5Mbps and 12Mbps data rate		
USB Client	No. of ports	-		x 1
SD card	No. of slots	x 1 (inside the box)		
	Compliance	SD 1.0		
	Max. size	4GB		
Digital I/O	No. of pins	x 21		x 16
	Connector	standard DB25, female		20p header, inside the box
	Signal level	TTL compatible		
Power input	Input range	9-40VDC		9-48VDC
	Polarity protection	yes		yes *
Dimension	W x L x H (mm)	160 x 104 x 38.5	160 x 104 x 32	78 x 108 x 24

*: Matrix-500, shipped after September 2007, also support polarity protection

M-501

Linux-based ARM9 System-on-Module



Why build everything from the scratch?

The M-501 is a high-end Linux-based ARM9 programmable controller with 180MHz 32-bit computing power and rich I/O controls, including Ethernet, UART, SPI, I2S, I2C, GPIO and an 8-bit local bus.

With the M-501, device manufacturers can benefit from the small-footprint Linux OS to build powerful industrial automation devices with strong network and web service supports.

M-501 Benefits

32-bit Processor with MMU

The ATMEL AM91RM9200 is definitely an outstanding ARM9 processor among its kind. The AM91RM9200 supports MMU (memory management unit) which ensures 100% source-level compatibility between desktop Linux and embedded Linux.

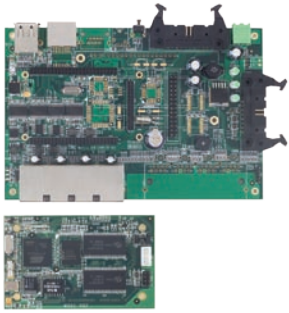
Up and run, 100% hassle free

Why spend time to build an embedded computing engine by yourselves from the scratch if there is an affordable proven one in the market? Artila's M-501 SoM already integrates appropriate FLASH, SDRAM and Ethernet PHY/Transformer chips into a single board, together with a sophisticated port of Linux 2.6.x with all necessary device drivers. With the M-501, R&D people only need to focus on developing real application using C/C++ programming language.

Free sample codes & reference design

The M-501 starter kit provides a lot of sample codes in its CD-ROM, including TCP server, TCP client, GPIO controls, serial communication and more. Also a complete circuit diagram of its carrier board is included as a user design reference.

M-501 Starter Kit



Starter kit content

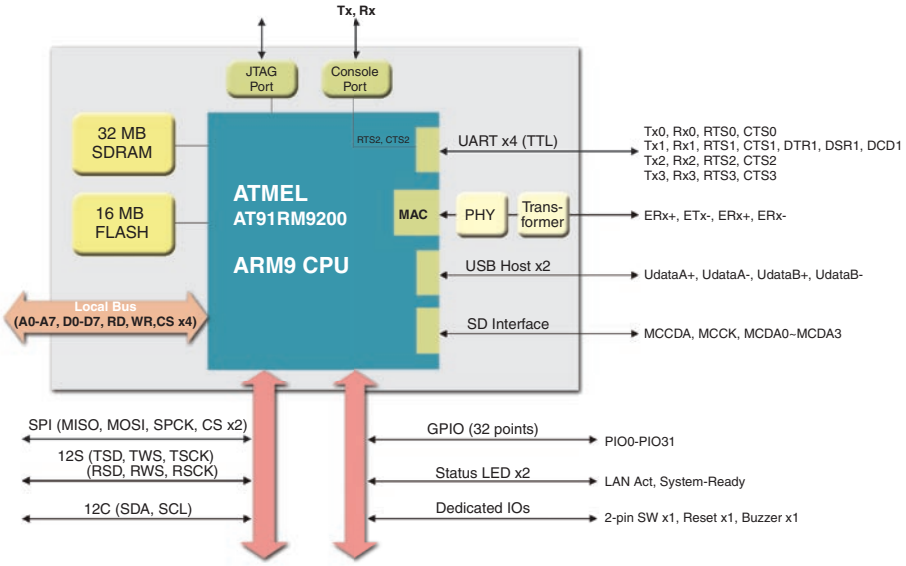
- One M-501 SoM
- One carrier board
- One console cable
- Artila CD-ROM, including GNU tool chain and example programs

Carrier board key specs

- Ethernet x1
- Serial port x 4
- Digital I/Os
- USB x2
- SD socket

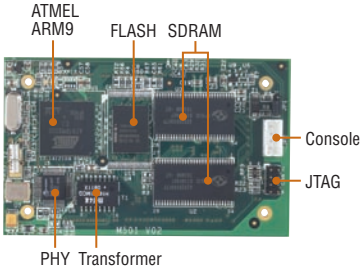
Note: Artila's Matrix-510/520 and iPAC-5010 are the best application examples using the M-501 as the core module.

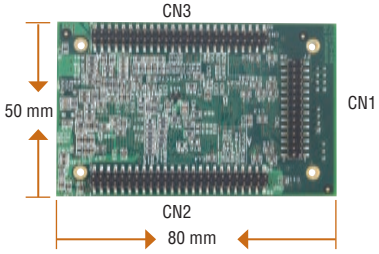
M-501 Block Diagram



M-501 Key Specification

- ATMEL AT91RM9200, 200MIPS @180MHz, with MMU.
- 32MB SDRAM, 16MB NOR FLASH memory
- One 10/100 Mbps Ethernet interface with on-board PHY and transformer
- USB 2.0 compatible Host ports, supports full speed (12 Mbps)
- One SD (secure digital) interface, supports SD mode.
- Four 921.6kbps UARTs supports hardware flow control
- I2C (Inter-IC) bus
- I2S (Inter-IC Sound) bus, supports one transmitter and one receiver
- SPI (Serial Peripheral Interface) with 2x chip select signals
- 32x general-purpose IOs (GPIO), CMOS/3.3V compatible
- Local bus (A0-A7, D0-D7), with 4x chip select signals
- Ultra low power consumption, less than 2.5W
- Linux 2.6.x OS is pre-built, supports file system
- GNU C/C++ tool chain is included



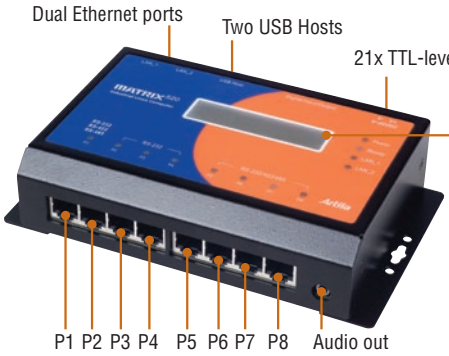


Supported Device Drivers

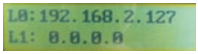
- SD/MMC, UART, Ethernet, GPIO, Buzzer
- Real Time Clock: Ricoh RS5C372
- EEPROM: ATMEL AT24C16 and compatibles
- USB Flash thumb disk
- USB IEEE-802.11b/g WiFi adapter (Ralink)
- USB 10/100Mbps Fast Ethernet adapter (Rt8150)
- USB RS-232 adapter (prolific)
- USB ADSL modem
- USB ISDN modem (CDC/ACM compatible)

Matrix-520/510

Book-size Linux-ready ARM9 Computer



18 x 2 Display Panel



- 144x32 dot-matrix LCM, supporting 18 x 2 text mode
- Software utility included for panel ON/OFF and displaying message

Eight 921.6Kbps high speed serial ports

- P1,P5,P6,P7 and P8 are RS-232/422/485 universal ports; supporting hardware data flow control for RS-485 mode.
- P2,P3 and P4 are standard RS-232 ports
- P2,P5,P6,P7 and P8 supports modem signals

Serial Port Pin Assignment of the Matrix-520/510/500

built-in RJ-45 connector

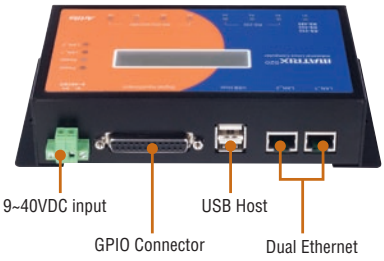
PIN	RS-232	RS-422	RS-485
1	DSR	-	-
2	RTS	Tx+	Data+
3	GND	GND	GND
4	Tx	Tx-	Data-
5	Rx	Rx+	-
6	DCD	Rx-	-
7	CTS	-	-
8	DTR	-	-

with CB-RJ45F9-150

PIN	RS-232	RS-422	RS-485
1	DCD	Rx-	-
2	Rx	Rx+	-
3	Tx	Tx-	Data-
4	DTR	-	-
5	GND	GND	GND
6	DSR	-	-
7	RTS	Tx+	Data+
8	CTS	-	-
9	-	-	-

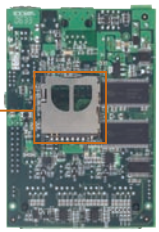
Front view of the Matrix-510

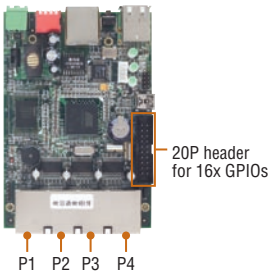
Rear view of the Matrix-520/510



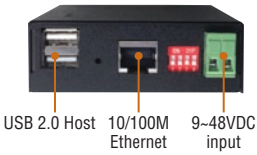
Matrix-500

Palm-size Linux-ready ARM9 Computer





Rear view of the Matrix-500

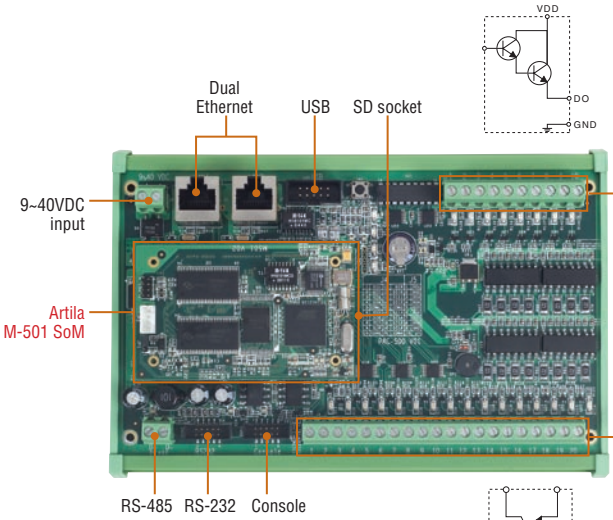


Four 921.6Kbps high speed serial ports

- P1 is RS-232/422/485 universal port; supporting hardware data flow control for RS-485 mode.
- P2,P3 and P4 are standard RS-232 ports
- P2 supports modem signals

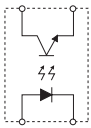
iPAC-5010

Linux-based Programmable Automation Controller



Digital Output Spec.

- Type: Darlington Transistor
- Voltage(VDD): 5 to 35VDC
- Current: 500mA max., source



Digital Input Spec.

- Input range: 0 to 24VDC
- Opto-isolation: 2500Vrms

Serial-to-Ethernet Gateway

Access serial device via Web/Internet/Intranet

Artila's Aport family state-of-the-art serial-to-Ethernet gateways are designed for applications requiring quick, reliable and seamless integration of existing RS-232/422/485 devices to an Ethernet network, so that users can access any legacy serial device via Web browser, Internet or intranet, anywhere anytime.

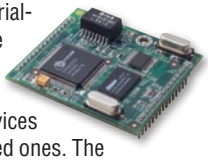
Aport Benefits

- Supports versatile operation modes, including TCP server, TCP client and UDP mode
- Supports Web-based configuration
- Supports user Web space (Aport-211W)
- Built-in GPIOs for remote ON/OFF controls (Aport-211S/W)
- Support virtual COM driver (Aport-311/312)
- Wide range of power input

Serial-to-Ethernet Gateway

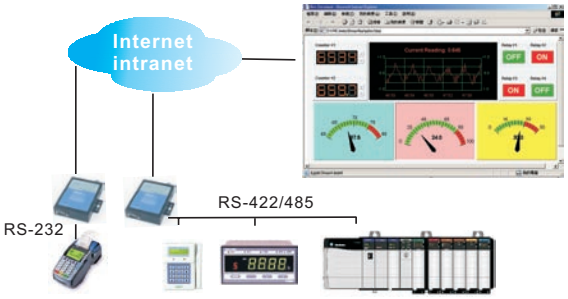
The Aport family are ready-to-use Serial-to-Ethernet gateways which are suitable for system integrators to bring existing RS-232/422/485 devices onto the network. Users can access serial devices through standard TCP/IP protocols or through Virtual COM driver.

Serial-to-Ethernet Module



The SE/WE embedded Serial-to-Ethernet modules are designed for device manufacturers to turn their RS-232/422/485 devices into modern Ethernet-based ones. The SE/WE modules provide one UART interface, one Ethernet interface and 8x GPIOs. The SE/WE standard firmware supports TCP server, TCP client and UDP. Custom hardware/firmware modification is welcome.

Browser-based device monitor/control



Not only supporting standard serial-to-Ethernet conversion, Artila's Aport-211W and WE-200M also provide a separate web space to store user HTML files (up to 64KB), which is convenient for users to implement simple web-based device monitor & control, by using Java Applet or ActiveX technologies.

Serial-to-Ethernt Gateways




Key Specifications		Aport-312	Aport-311	Aport-211W	Aport-211S
System	CPU	16-bit		8-bit	
Ethernet	Type	10/100Mbps, auto-detect			
Serial	RS-232/422/485 3-in1 port	x 1	x 1	x 1	x 1
	RS-232 port	x 1	-	-	-
	Max. baud rate	230.4Kbps		38.4Kbps	
	Data bits	5, 6, 7, 8		7, 8	
	Stop bits	1, 1.5, 2		1, 2	
	Parity	None, Even, Odd, Mark, Space		None, Even, Odd,	
	Connector	standard DB9, male			
Digital I/O	No. of pins	-		8x, TTL compatible	
	Connector	-		standard DB9, female	
Power	Input range	9-15VDC		9-40VDC	
Dimension	W x L x H (mm)	81 x 113 x 24		78 x 108 x 25	
Software	Protocols	TCP, UDP, HTTP, Telnet, IP, ICMP, ARP			
	IP modes	DHCP, Static IP			
	Virtual COM	yes		-	
	Configuration	Web/Telnet/serial console and Windows Utility			
	Web Space	-		yes, 64KB	-

Serial-to-Ethernt Modules

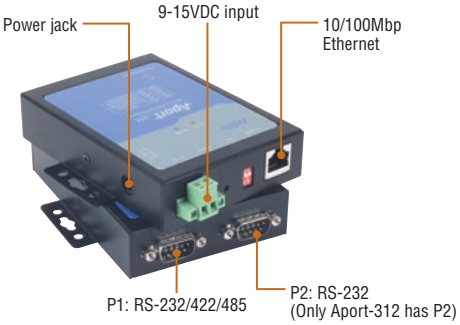
Key Specifications		SE-100M	WE-200M
System	CPU	8051	
Memory	FLASH	64KB	128KB
	E2PROM	2KB	
Ethernet	Type	10/100Mbps, auto-detect	
	MAC+PHY	DaviCOM DM9000	
	Transformer	on-board	
UART	Signals	TxD, RxD, RTS, CTS, DTR, DSR, DCD, GND	
	Max. baud rate	38,400 bps	
	Data bits	7, 8	
	Stop bits	1, 2	
	Parity	None, Even, Odd	
	Flow control	RTS/CTS, XON/XOFF, None	
Digital I/O	No. of pins	x9	
	Signal level	PIO0~PIO5: TTL; PIO6~PIO8: CMOS	
Power	Input range	5VDC	
Dimension	W x L (mm)	40x45	
Software	Protocols	TCP, UDP, HTTP, Telnet, IP, ICMP, ARP	
	IP modes	DHCP, Static IP	
	Configuration	Web/Telnet/serial console and Windows Utility	
Web Space	System space	for configuration	
	User space	-	64KB

Aport-312/311

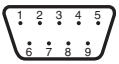
High-speed Serial-to-Ethernet Gateway

Windows Virtual COM driver

With the Virtual COM driver, the serial ports on the Aport-312/311 can be mapped as local COM ports on the host computer. Thus, no software modification is needed to benefit from modern TCP/IP networking technology.



PIN	RS-232	RS-422	RS-485
1	DCD	Rx-	-
2	Rx	Rx+	-
3	Tx	Tx+	Data+
4	DTR	Tx-	Data-
5	GND	GND	GND
6	DSR	CTS-	-
7	RTS	CTS+	-
8	CTS	RTS+	-
9	RI	RTS-	-



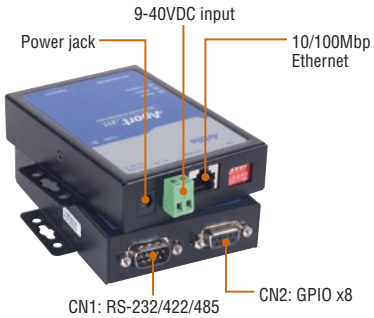
Aport-312/311 Pin Assignment

Aport-211W/211S

Low-cost Serial-to-Ethernet Gateway with I/O

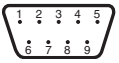
Built-in Digital I/Os

The Aport-211W/211S comes with 8x programmable digital I/O pins on CN2, making it convenient for remote ON/OFF controls.



PIN	RS-232	RS-422	RS-485
1	DCD	Tx-	-
2	Rx	Tx+	-
3	Tx	Rx+	Data+
4	DTR	Rx-	Data-
5	GND	GND	GND
6	DSR	-	-
7	RTS	-	-
8	CTS	-	-
9	-	-	-

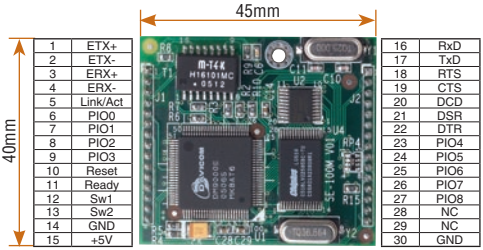
PIN	GPIO
1	PIO 0
2	PIO 1
3	PIO 2
4	PIO 3
5	PIO 4
6	PIO 5
7	PIO 6
8	PIO 7
9	GND



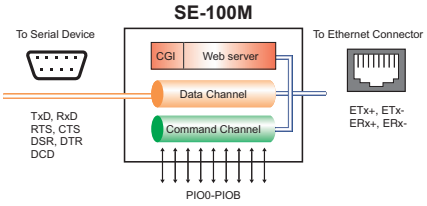
Aport-211W/211S Pin Assignment

SE-100M

Embedded Serial-to-Ethernet Module

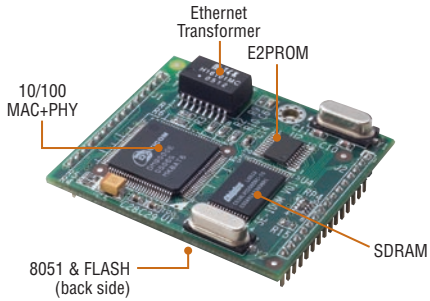


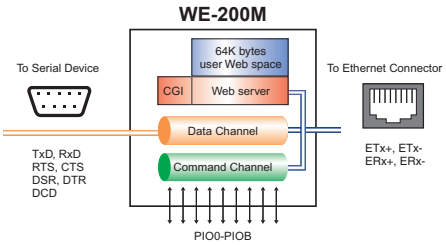
1	ETX+	16	RxD
2	ETX-	17	TxD
3	ERX+	18	RTS
4	ERX-	19	CTS
5	Link/Act	20	DCD
6	PIO0	21	DSR
7	PIO1	22	DTR
8	PIO2	23	PIO4
9	PIO3	24	PIO5
10	Reset	25	PIO6
11	Ready	26	PIO7
12	Sw1	27	PIO8
13	Sw2	28	NC
14	GND	29	NC
15	+5V	30	GND



WE-200M

Embedded Serial-to-Ethernet Module w/ 64KB Web





SE-100M-EV
WE-200M-EV

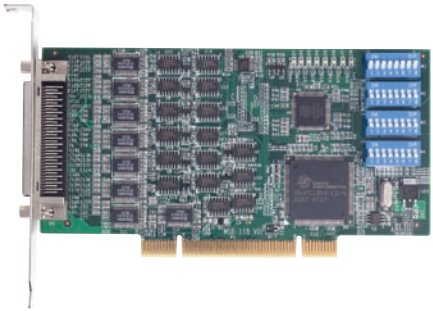
Evaluation kit for the SE-100M/WE-200M

The evaluation kit includes

- One SE-100M or WE-200M
- One full-function carrier board
- One power adapter
- One CD-ROM for SDK and document

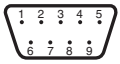
MSB-118

8-port RS-232/422/485 UPCI Serial Board



- Each port can be independently configured as RS-232, RS-422 or RS-485 serial Interface
- High performance 16C950 compatible UART with 128-byte FIFO
- Over 700Kbps data throughput for each port when all ports run concurrently
- Hardware auto-direction control for RS-485
- Baud rate from 50bps to 921.6Kbps
- On-board bi-color LEDs as status indicators
- Compatible with 3.3V or 5V 32-bit PCI slots
- Windows/Linux driver included

PIN	RS-232	RS-422	RS-485
1	DCD	Tx-	-
2	Rx	Tx+	-
3	Tx	Rx+	Data+
4	DTR	Rx-	Data-
5	GND	GND	GND
6	DSR	RTS-	-
7	RTS	RTS+	-
8	CTS	CTS+	-
9	RI	CTS-	-

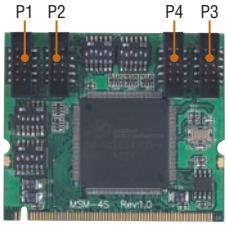


CBL-M68M9x8-100

1-to-8 connection cable, 100cm (SCSI3 male for host side, DB9 male for device side)

MSM-4S

4-port RS-232/422/485 mini-PCI Serial Module



- P1 and P2 are RS-232/422/485 3-in-1 ports
- P3 and P4 are RS-232 ports
- 16C950 compatible UART w/ 128-byte FIFO
- Windows/Linux driver included

PIN	RS-232	RS-422	RS-485
1	DCD	Tx-	-
2	DSR	-	-
3	Rx	Tx+	-
4	RTS	-	-
5	Tx	Rx+	Data+
6	CTS	-	-
7	DTR	Rx-	Data-
8	RI	-	-
9	GND	GND	GND
10	-	-	-

CBL-F10M9-20
connection cable, 20cm

PIN	RS-232	RS-422	RS-485
1	DCD	Tx-	-
2	Rx	Tx+	-
3	Tx	Rx+	Data+
4	DTR	Rx-	Data-
5	GND	GND	GND
6	DSR	-	-
7	RTS	-	-
8	CTS	-	-
9	-	-	-

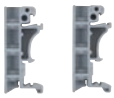
Ordering Information

Matrix Family	
Matrix-520	ARM9+Linux Box Computer w/ 2x LAN, 8x Serial & LCD
Matrix-510	ARM9+Linux Box Computer w/ 2x LAN, 8x Serial
Matrix-500	ARM9+Linux Box Computer w/ 1x LAN, 4x Serial
M-501	ARM9+Linux System-on-Module
M-501 Stater kit	M-501 starter kit, including one M-501, carrier board and CD
iPAC Family	
iPAC-5010	Linux-based PAC w/ 2xLAN, 2x Serial, 8x DO and 16x DI
Aport Family	
Aport-312	Two-port Serial-to-Ethenet Gateway w/ Virtual COM
Aport-311	One-port Serial-to-Ethernet Gateway w/ Virtual COM
Aport-211W	One-port Serial-to-Ethernet Gateway w/ User Web Space
Aport-211S	One-port Serial-to-Ethernet Gateway w/ 8x GPIO
WE-200M	Embedded Serial-to-Ethernet module w/ User Web Space
SE-100M	Embedded Serial-to-Ethernet module
WE-200M-EV	Evaluation kit of WE-200M, including one WE-200M, carrier board and CD
SE-100M-EV	Evaluation kit of SE-100M, including one SE-100M, carrier board and CD
Multi-port Serial Board	
MSB-118	8-port RS-232/422/485 UPCI Serial Board
MSM-4S	4-port RS-232/422/485 mini-PCI Serial Module
Accessories	
CBL-M68M9x8-100	Connection Cable for MSB-118, 100cm
CBL-F10M9-20	Connection Cable for MSM-4S, 20cm
CB-RJ45F9-150	RJ45-to-DB9F connection cable for Matrix-520/510/500
CB-RJCON-100	Serial console cable for Matrix-520/510/500
PWR-12V-1A	100-240VAC to12VDC 1A Power Adpater, American type
PWR-12V-1A-EU	100-240VAC to12VDC 1A Power Adpater, EU type
DK-35A	DIN-rail mounting kit for Matrix/Aport products

CB-RJ45F9-150

PWR-12V-1A

PWR-12V-1A-EU



DK-35A

Embedded Networking & Computing

Linux

RoHS compliant
2002/95/EC

Artila Electronics Co., Ltd. is an emerging force in the industrial computer field, dedicated to minimizing mass while maximizing utility. Unlike other industrial computer providers in the market who mainly use x86 plus Windows solutions, Artila focuses on ARM-core RISC CPU with embedded Linux solutions, matched with Artila's 10 plus years of experience in RS-232/422/485 industrial communication and TCP/IP networking. Artila's product range consists of Serial-to-Ethernet embedded modules, ARM9/Linux box computers, and ARM9/Linux SOMs (system-on-modules).

OEM/ODM Welcome

Apart from standard products, Artila is highly willing to accept OEM/ODM request to design and manufacture custom-specified hardware and software. Our service includes: private labeling, hardware & software customization and firmware license.

Artila

www.artila.com