

## The DIL/NetPC *DNP/1110*

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The DIL/NetPC DNP/1110 provides a very compact Intel 206 MHz SA-1110 StrongARM-based low power embedded controller with TCP/IP stack and web server for high-speed embedded networking applications. The DIL/NetPC offers the footprint of a standard 64-pin DIL socket with 2.54mm centers and all the hardware and software features necessary to add high-speed networking capabilities to any product design. The DIL/NetPC was developed specifically for products that need to be connected to 10 or 100 Mbps Ethernet-based TCP/IP networks with minimum development costs.

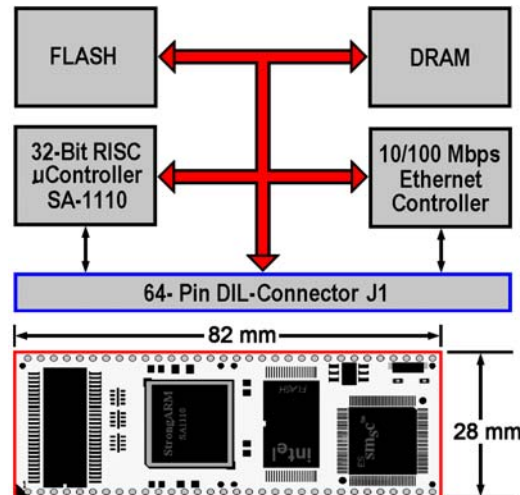


**Figure 1:** The StrongARM-based DIL/NetPC *DNP/1110*

The DNP/1110 comes as ready-to-run embedded networking system. The use of the DNP/1110 will allow you to realize a substantial time and costs savings over other chip-based approaches. Currently, there is no other 10/100 Mbps Ethernet- and TCP/IP-based embedded networking solution with more development time savings on the market. There is also no faster Time-to-Market for your product with lower costs if 10/100 Mbps Ethernet, full TCP/IP and an embedded Web server or other TCP/IP-based server software is required.

To interface the DNP/1110 with existing devices and equipment, the DNP/1110 offers two asynchronous serial RS232C interfaces with TTL levels and handshake signals (COM1/COM2 - 16550 compatible), 20-bit general purpose high-speed parallel I/Os and a 8-bit extension bus with interrupt inputs and chip select outputs. There are two ways for DNP/1110 integration: 1. Adapt the DNP/1110 to your existing product. Use the existing I/Os within your product to communicate with the DNP/1110. 2. Use the DNP/1110 to control and monitor the hardware of your existing product. This might enable you to replace your existing controller entirely. In a new product design, the DNP/1110 can be the main controller. Additional I/Os are driven by the 8-bit extension bus.

The on-board FLASH memory provides storage for the DNP/1110 operating system with TCP/IP stack and embedded web server as well as OEM applications and data. The FLASH memory is in-system programmable over JTAG, serial and the Ethernet interface.



**Figure 2:** Parts and Components of the DNP/1110

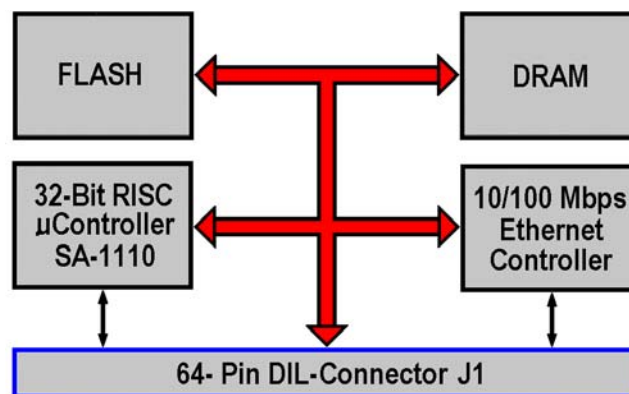
The boot block of the FLASH memory is only in-system programmable over the JTAG interface through a special cable attached to a PC parallel port. For all other FLASH blocks, you can use also a high-speed serial connection through the DNP/1110 COM1 port or the 10/100 Mbps Ethernet interface for in-system programming. The DNP/1110 in-system programming was developed for OEM application software, operating system downloads (i.e. upgrade from embedded Linux to eCos) and data download and to make it easier to update the on-board FLASH content in the field.

## DNP/1110 Key Features

- Intel StrongARM SA-1110 CPU with 206 MHz Clock Speed
- 32 MByte SDRAM Memory, 16 MByte FLASH Memory
- 10/100 Mbps Ethernet Interface
- Two 16550 Serial Ports (one with all Handshakes)
- 20-bit General Purpose high-speed Parallel I/O
- 8-bit I/O Expansion Bus
- 5 Interrupt Inputs, 4 Chip Select Outputs
- Programmable Watchdog Timer
- JTAG IEEE 1149.1 Test Interface
- In-System Programming Features
- 64-pin JEDEC DIL-64 Connector, 2.54mm Centers
- 3.3 Volt Low Power Design, Supply Voltage 3.3 VDC (+- 5%)
- Supply Current 300 mA typ. at 206 MHz
- Size 82mm \* 28mm

## DNP/1110 Description

The DNP/1110 is built around the Intel StrongARM SA-1110 32-bit RISC microcontroller running with 206 MHz. The SA-1110 has a large instruction and data cache, memory-management unit (MMU), and read/write buffers. The SA-1110 offers high-performance processing power with up to 235 Dhrystone 2.1 MIPS. The SA-1110 CPU core implements the ARM V4 architecture as defined in the *ARM Architecture Reference Manual*. The SA-1110 provides a complete set of internal peripherals. There are multiple serial communication channels, general-purpose I/O ports, timers, interrupt control, reset control, and power management functions.



**Figure 3:** Diagram of the DNP/1110

The external main components around the Intel StrongARM SA-1110 32-bit RISC microcontroller on the DNP/1110 are one FLASH chip with 16 MBytes, one 32 MByte SDRAM chip, and one 10/100 Mbps Ethernet LAN controller with 10BASE-T and 100BASE-TX physical layer interface. The FLASH stores the hardware setup code, the SSV Flash Loader, the boot loader, operating system, and OEM applications. The SDRAM access and the refresh operation is driven by the SA-1110 integrated SDRAM controller.

The DNP/1110 10/100 Mbps Ethernet controller is a SMSC LAN91C111 single chip MAC+PHY. This highly-integrated Ethernet LAN controller includes 8 KByte internal memory for receive and transmit FIFO buffers, a IEEE 802.3/802.3u Ethernet MAC engine, and internal 10BASE-T and 100BASE-TX transmit and receive filters. The SMSC LAN91C111 supports full-duplex switched Ethernet operation and auto negotiation for 10 and 100 Mbps. For the DNP/1110 LAN integration, the PHY interface needs only a external low-cost isolation transformer.

The mechanical interface between the DNP/1110 and existing devices and equipment is a JEDEC 64-pin DIL connector with 2.54mm centers. This allows the direct integration to a standard 64-pin DIL socket. The 64 pins in total are used for 3.3 volt power supply (2 pins), Reset in and out (2 pins), two serial interfaces (10 pins), 10/100 Mbps Ethernet interface (4 pins), general purpose parallel I/O (20 pins) and the extension bus (26 pins).

## DNP/1110 Memory Map

Physical Addr.	Virtual Addr.	Description	Cached	Buffered	Access
0x00000000-0x07FFFFFFF	0xE8000000-0xEFFFFFFF	16 MByte FLASH	No	No	R/W
0x20000000-0x20FFFFFFF	0xF6000000-0xF6FFFFFFF	Ethernet Controller	No	No	R/W
0x30000000-0x30FFFFFFF	None	Chip Select Signal CS1	No	No	R/W
0x31000000-0x31FFFFFFF	None	Chip Select Signal CS2	No	No	R/W
0x32000000-0x32FFFFFFF	None	Chip Select Signal CS3	No	No	R/W
0x33000000-0x33FFFFFFF	None	Chip Select Signal CS4	No	No	R/W
0x80000000-0xB7FFFFFFF	0x80000000-0xB7FFFFFFF	SA-1110 internal Registers	No	No	R/W
0xC0000000-0xC7FFFFFFF	0x00000000-0x07FFFFFFF	32 MByte SDRAM	Yes	Yes	R/W

**Table 1:** DNP/1110 Memory Map

## DNP/1110 Ordering Information

The DIL/NetPC DNP/1110 provides the dimensions of a standard JEDEC 64-pin DIL socket and will be delivered with a preinstalled embedded Linux operating system (kernel version 2.4), TCP/IP stack, *thttpd* embedded web server, FTP server for file transfers to and from the DNP/1110, and Telnet server for remote login via Ethernet. There is also the SSV Flash Loader preinstalled for update the operating system components (kernel and/or root file system) or download a other operating system image file to the on-board FLASH.

The module is based on a Intel StrongARM SA-1110 32-bit RISC microcontroller. This processor runs with 206 MHz clock. There are 32 MByte SDRAM and 16 MByte FLASH memory on-board. Two serial interfaces (COM1, COM2), 20 digital I/Os and one 8 bit expansion bus with four chip select output signals and five interrupt input signals offers the interface to higher level systems and devices by using the standard JEDEC 64-pin DIL interface with 2.54mm centers. The network interface is made by a 10BASE-T/100BASE-TX Ethernet interface with embedded RAM for packet buffering and support for full-duplex operation and auto negotiation for 10 and 100 Mbps.

As development support we offer a starterkit with DNP/1110, DNP/EVA2 evaluation board (special version – without the ST16C2550 dual uart and the uart support chips), 110-230 VAC to 5 VDC international power supply, nullmodem cable, CD-ROM, and user manual for the first steps. The CD-

ROM comes with a full GNU cross tool chain for C/C++ software development. This binary files of the tool chain runs on a x86 Linux-based host (SuSE, Red Hat or other) and builds ELF binary files for the Intel StrongARM SA-1110 32-bit RISC microcontroller.

## DNP/1110 Ordercodes

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Ordercode	Product
DNP1110	DIL/NetPC with Intel 206 MHz SA-1110 and Firmware in FLASH, 3.3 VDC Vcc.
DNP/EVA2-SV1	Evaluation Board for DNP/1110 with 64-pin DIL Socket.
DNP/SK5	Starterkit with DNP/1110, DNP/EVA2-SV1, CD-ROM and Null-Modemcable.

**Table 2:** DNP/1110 Ordercodes

## Appendix 1: DNP/1110 Pinout - JEDEC 64-pin DIL Connector (1. Part)

Pin	Name	Group	Function
1	PA0	PIO	Parallel I/O, Port A, Bit 0
2	PA1	PIO	Parallel I/O, Port A, Bit 1
3	PA2	PIO	Parallel I/O, Port A, Bit 2
4	PA3	PIO	Parallel I/O, Port A, Bit 3
5	PA4	PIO	Parallel I/O, Port A, Bit 4
6	PA5	PIO	Parallel I/O, Port A, Bit 5
7	PA6	PIO	Parallel I/O, Port A, Bit 6
8	PA7	PIO	Parallel I/O, Port A, Bit 7
9	PB0	PIO	Parallel I/O, Port B, Bit 0
10	PB1	PIO	Parallel I/O, Port B, Bit 1
11	PB2	PIO	Parallel I/O, Port B, Bit 2
12	PB3	PIO	Parallel I/O, Port B, Bit 3
13	PB4	PIO	Parallel I/O, Port B, Bit 4
14	PB5	PIO	Parallel I/O, Port B, Bit 5
15	PB6	PIO	Parallel I/O, Port B, Bit 6
16	PB7	PIO	Parallel I/O, Port B, Bit 7
17	PC0	PIO	Parallel I/O, Port C, Bit 0
18	PC1	PIO	Parallel I/O, Port C, Bit 1
19	PC2	PIO	Parallel I/O, Port C, Bit 2
20	PC3	PIO	Parallel I/O, Port C, Bit 3
21	RXD1	SIO	COM1 Serial Port, RXD Pin
22	TXD1	SIO	COM1 Serial Port, TXD Pin
23	CTS1	SIO	COM1 Serial Port, CTS Pin
24	RTS1	SIO	COM1 Serial Port, RTS Pin
25	DCD1	SIO	COM1 Serial Port, DCD Pin
26	DSR1	SIO	COM1 Serial Port, DSR Pin
27	DTR1	SIO	COM1 Serial Port, DTR Pin
28	RI	SIO	COM1 Serial Port, RI Pin
29	RESIN	RESET	RESET Input
30	TX+	LAN	Ethernet Interface, TX+ Pin
31	TX-	LAN	Ethernet Interface, TX- Pin
32	GND	----	Ground

**Table 3:** DNP/1110 Pinout - Pin 1 to 32

## Appendix 2: DNP/1110 Pinout - JEDEC 64-pin DIL Connector (2. Part)

Pin	Name	Group	Function
33	RX+	LAN	Ethernet Interface, RX+ Pin
34	RX-	LAN	Ethernet Interface, RX- Pin
35	RESOUT	RESET	RESET Output
36	VBAT	PSP	Real Time Clock Battery Input
37	CLKOUT	PSP	Clock Output (Default 3.6864 MHz)
38	TXD2	PSP	COM2 Serial Port, TXD Pin
39	RXD2	PSP	COM2 Serial Port, RXD Pin
40	INT5	PSP	Interrupt Input 5
41	INT4	PSP	Interrupt Input 4
42	INT3	PSP	Interrupt Input 3
43	INT2	PSP	Interrupt Input 2
44	INT1	PSP	Interrupt Input 1
45	CS4	PSP	Chip Select Output 4
46	CS3	PSP	Chip Select Output 3
47	CS2	PSP	Chip Select Output 2
48	CS1	PSP	Chip Select Output 1
49	RDY	PSP	External Ready Input
50	RD	PSP	Read Signal, Expansion Bus
51	WR	PSP	Write Signal, Expansion Bus
52	SA3	PSP	Expansion Bus, Address Bit 3
53	SA2	PSP	Expansion Bus, Address Bit 2
54	SA1	PSP	Expansion Bus, Address Bit 1
55	SA0	PSP	Expansion Bus, Address Bit 0
56	SD7	PSP	Expansion Bus, Data Bit 7
57	SD6	PSP	Expansion Bus, Data Bit 6
58	SD5	PSP	Expansion Bus, Data Bit 5
59	SD4	PSP	Expansion Bus, Data Bit 4
60	SD3	PSP	Expansion Bus, Data Bit 3
61	SD2	PSP	Expansion Bus, Data Bit 2
62	SD1	PSP	Expansion Bus, Data Bit 1
63	SD0	PSP	Expansion Bus, Data Bit 0
64	VCC	----	3.3 Volt Power Input

**Table 4:** DNP/1110 Pinout - Pin 33 to 64



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## Contact

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SSV Embedded Systems  
 Heisterbergallee 72  
 D-30453 Hannover  
 Tel. +49-(0)511-40000-0  
 Fax. +49-(0)511-40000-40  
 Email: [sales@ist1.de](mailto:sales@ist1.de)  
 Web: [www.ssv-embedded.de](http://www.ssv-embedded.de)

## Document History (Sadnp01.Doc)

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Revision	Date		Name
1.00	23.01.2002	First Version	KDW
1.01	13.08.2002	New Names for Chip Select Signals in Table 1.	KDW

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