CPC304

PC/104-*Plus*
AMD Geode LX 800 Based
Processor Module

User Manual

Rev. 003a E

November 2011

Product Title: CPC304
Document name: CPC304 User Manual
Manual version: 003a E
Ref. doc. v.:   1.5 R (467444.013)

Revision Record

Rev. Index	Brief Description of Changes	Board Index	Date of Issue
001	Initial preliminary version	CPC304	January 2008
001a	Delivery checklist corrected, document structure changed	CPC304	August 2008
002	BIOS Setup chapter added, Block diagram and board layout diagram corrected, all chapters reworked	CPC304	June 2009
003	Changes mainly following the release of v.1.3 of the module. BIOS Setup section changed; DDMA programming added; BIOS upgrade section revised; several illustrations added or corrected, multiple text changes	CPC304	July 2010
003a	J17 (TFT) pinout corrected	CPC304	November 2011

Contact Information

	Fastwel Co. Ltd	**Fastwel Corporation US**
Address:	108 Profsoyuznaya st., Moscow 117437, Russian Federation	45 Main Street, Suite 319 Brooklyn, New York 11201 USA
Tel.:	+7 (495) 232-1681	+1 (718) 554-3686
Fax:	+7 (495) 232-1654	+1 (718) 797-0600
		Toll free: +1 (877) 787-8443 (1-877-RURUGGED)
E-mail:	info@fastwel.com	
Web:	http://www.fastwel.com/	

Table of Contents

List of Tables

List of Figures

Notation Conventions

Warning, ESD Sensitive Device!

This symbol draws your attention to the information related to electro static sensitivity of your product and its components. To keep product safety and operability it is necessary to handle it with care and follow the ESD safety directions.

Warning!

This sign marks warnings about hot surfaces. The surface of the heatsink and some components can get very hot during operation. Take due care when handling, avoid touching hot surfaces!

Caution: Electric Shock!

This symbol warns about danger of electrical shock (> 60 V) when touching products or parts of them. Failure to observe the indicated precautions and directions may expose your life to danger and may lead to damage to your product.

Warning!

Information marked by this symbol is essential for human and equipment safety.
Read this information attentively, be watchful.

Note...

This symbol and title marks important information to be read attentively for your own benefit.

General Safety Precautions

This product was developed for fault-free operation. Its design provides conformance to all related safety requirements. However, the life of this product can be seriously shortened by improper handling and incorrect operation. That is why it is necessary to follow general safety and operational instructions below.

Warning!

All operations on this device must be carried out by sufficiently skilled personnel only.

Warning!

When handling this product, special care must be taken not to hit the heatsink (if installed) against another rigid object. Also, be careful not to drop the product, since this may cause damage to the heatsink, CPU or other sensitive components as well.

Please, keep in mind that any physical damage to this product is not covered under warranty.

Note:

This product is guaranteed to operate within the published temperature ranges and relevant conditions. However, prolonged operation near the maximum temperature is not recommended by Fastwel or by electronic chip manufacturers due to thermal stress related failure mechanisms. These mechanisms are common to all silicon devices, they can reduce the MTBF of the product by increasing the failure probability. Prolonged operation at the lower limits of the temperature ranges has no limitations.

Caution, Electric Shock!

Before installing this product into a system and before installing other devices on it, always ensure that your mains power is switched off.

Always disconnect external power supply cables during all handling and maintenance operations with this module to avoid serious danger of electrical shock.

Unpacking, Inspection and Handling

Please read the manual carefully before unpacking the module or mounting the device into your system. Keep in mind the following:

ESD Sensitive Device!

Electronic modules and their components are sensitive to static electricity. Even a non-perceptible by human being static discharge can be sufficient to destroy or degrade a component's operation! Therefore, all handling operations and inspections of this product must be performed with due care, in order to keep product integrity and operability:

■ Preferably, unpack or pack this product only at EOS/ESD safe workplaces. Otherwise, it is important to be electrically discharged before touching the product. This can be done by touching a metal part of your system case with your hand or tool. It is particularly important to observe anti-static precautions when setting jumpers or replacing components.

■ If the product contains batteries for RTC or memory back-up, ensure that the module is not placed on conductive surfaces, including anti-static mats or sponges. This can cause short-circuit and result in damage to the battery and other components.

■ Store this product in its protective packaging while it is not used for operational purposes.

Unpacking

The product is carefully packed in an antistatic bag and in a carton box to protect it against possible damage and harmful influence during shipping. Unpack the product indoors only at a temperature not less than +15°C and relative humidity not more than 70%. Please note, that if the product was exposed to the temperatures below 0°C for a long time, it is necessary to keep it at normal conditions for at least 24 hours before unpacking. Do not keep the product close to a heat source.

Following ESD precautions, carefully take the product out of the shipping carton box. Proper handling of the product is critical to ensure correct operation and long-term reliability. When unpacking the product, and whenever handling it thereafter, be sure to hold the module preferably by the front panel, card edges or ejector handles. Avoid touching the components and connectors.

Retain all original packaging at least until the warranty period is over. You may need it for shipments or for storage of the product.

Initial Inspection

Although the product is carefully packaged, it is still possible that shipping damages may occur. Careful inspection of the shipping carton can reveal evidence of damage or rough handling. Should you notice that the package is damaged, please notify the shipping service and the manufacturer as soon as possible. Retain the damaged packing material for inspection.

After unpacking the product, you should inspect it for visible damage that could have occurred during shipping or unpacking. If damage is observed (usually in the form of bent component leads or loose socketed components), contact Fastwel's official distributor from which you have purchased the product for additional instructions. Depending on the severity of the damage, the product may even need to be returned to the factory for repair. DO NOT apply power to the product if it has visible damage. Doing so may cause further, possibly irreparable damage, as well as result in a fire or electric shock hazard.

If the product contains socketed components, they should be inspected to make sure they are seated fully in their sockets.

Handling

In performing all necessary installation and application operations, please follow only the instructions supplied by the present manual.

In order to keep Fastwel's warranty, you must not change or modify this product in any way, other than specifically approved by Fastwel or described in this manual.

Technical characteristics of the systems in which this product is installed, such as operating temperature ranges and power supply parameters, should conform to the requirements stated by this document.

Retain all the original packaging, you will need it to pack the product for shipping in warranty cases or for safe storage. Please, pack the product for transportation in the way it was packed by the supplier.

When handling the product, please, remember that the module, its components and connectors require delicate care. Always keep in mind the ESD sensitivity of the product.

Three Year Warranty

Fastwel Co. Ltd. (Fastwel), warrants that its standard hardware products will be free from defects in materials and workmanship under normal use and service for the currently established warranty period. Fastwel's only responsibility under this warranty is, at its option, to replace or repair any defective component part of such products free of charge.

Fastwel neither assumes nor authorizes any other liability in connection with the sale, installation or use of its products. Fastwel shall have no liability for direct or consequential damages of any kind arising out of sale, delay in delivery, installation, or use of its products.

If a product should fail through Fastwel's fault during the warranty period, it will be repaired free of charge. For out of warranty repairs, the customer will be invoiced for repair charges at current standard labor and materials rates.

Warranty period for Fastwel products is 36 months since the date of purchase.

The warranty set forth above does not extend to and shall not apply to:

1. Products, including software, which have been repaired or altered by other than Fastwel personnel, unless Buyer has properly altered or repaired the products in accordance with procedures previously approved in writing by Fastwel.

2. Products, which have been subject to power supply reversal, misuse, neglect, accident, or improper installation.

Returning a product for repair

1. Apply to Fastwel company or to any of the Fastwel's official representatives for the Product Return Authorization.

2. Attach a failure inspection report with a product to be returned in the form, accepted by customer, with a description of the failure circumstances and symptoms.

3. Carefully package the product in the antistatic bag, in which the product had been supplied. Failure to package in antistatic material will VOID all warranties. Then package the product in a safe container for shipping.

4. The customer pays for shipping the product to Fastwel or to an official Fastwel representative or dealer.

1   Introduction

This document presents general information on CPC304 processor module, the details of its proper and safe installation, configuration and operation. The issues of PC/104 modules and external devices connection are also considered.

1.1   Module Introduction

CPC304 is a PC/104-Plus single board computer for embedded applications. It is designed for use in mission critical on-board systems requiring low power consumption and wide operating temperature range. CPC304 is based on AMD Geode LX800 CPU and AMD CS5536 I/O companion. CPC304 provides full support for PC/104 and PC/104-Plus expansion modules and data exchange via both 16-bit ISA and 32-bit PCI buses.

All key components including CPU, chipset, memory, and periphery controllers are soldered on-board providing excellent vibration stability and increased efficiency of protective conformal coating.

CPC304 offers wide variety of data display capabilities. It allows simultaneous operation of standard VGA interface, 24-bit LVDS interface, and 18-bit interface for TFT or DSTN LCD panels connection.

Data storage subsystem is based on single-channel IDE controller, that is able to drive two IDE devices: two external hard drives connected via on-board connectors, CompactFlash card, or soldered on-board 1 GB flash disk.

For data exchange, CPC304 uses up to two independent Fast Ethernet ports, up to four COM ports, two USB 2.0 ports, and eight programmable discrete input/output lines.

System control and management capabilities of CPC304 include two watchdog timers, opto-isolated remote Reset/IRQ input, external signal system wake-up controller, reserved BIOS, and possibility to save system configuration and emergency parameters in FRAM chip.

CPC304 is designed for operation within industrial temperature range from –40°C to +85°C.

CPC304 is manufactured in three versions: CPC30401, full function version, CPC30402, "light-weight" version without LVDS interface and on-board 1 GB NAND flash disk, with one Fast Ethernet channel and three COM ports. CPC30403 is a variant of CPC30401 Coated version with extended operating temperature range.

CPC304 is supplied with the preinstalled FDOS 6.22 operating system and supports MS DOS, Windows CE5.0, CE6.0, XPe, as well as QNX 6.3x, and Linux 2.6 operating systems.

Figure 1.1: **CPC304 Module Appearance**
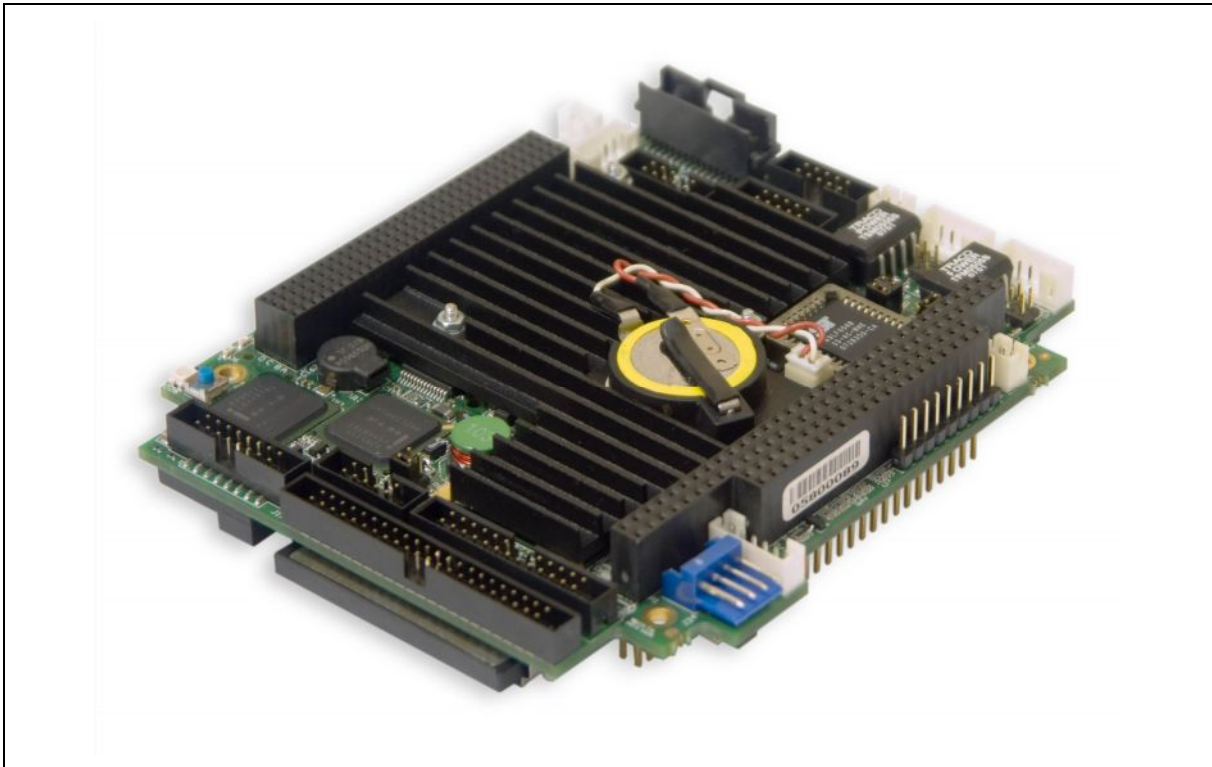
The appearance may vary for different versions of the module.

1.2 CPC304 Versions

At the present time the CPC304 module is manufactured in three basic versions differing in interface capabilities and coating. In this Manual the notes related to the CPC30401 and CPC30402 basic versions apply to their coated variants as well. The version "CPC30403 Coated" is a variant of CPC30401 with widened operating temperature range and protective coating.

Table 1.1: **CPC304 Versions**

Version	T Range	LVDS	NAND Flash	Ethernet	RS422/485	Coating
CPC30401	-40°C to +85°C	+	+	2	COM3, COM4	–
CPC30401 Coated		+	+	2	COM3, COM4	+
CPC30402		–	–	1	COM3	–
CPC30402 Coated		–	–	1	COM3	+
CPC30403 Coated	-50°C to +85°C	+	+	2	COM3, COM4	+

1.3   Delivery Checklist

Table 1.2:   **CPC304 Supplied Set**

Code	Decimal Code	Description
CPC30401 CPC30401 Coated CPC30402 CPC30402 Coated CPC30403 Coated	467444.013 467444.013-01 467444.013-02 467444.013-03 467444.013-04	CPC304 processor module
CDM02	469535.023	Adapter module for connection of 3.5" HDD or CD-ROM drive
–	685611.051	Cable for 2.5" HDD connection to 44-contact header
	469539.012	Lithium battery assembly (p/n: CR2032/1F4 DART)
ACS00023	685611.082	DB9F to IDC10 adapter cable for connection to COM1 or COM2 ports
–	–	Mounting standoffs kit
–	–	Jumpers set
–	467369.009	CD ROM with documentation and service software
–	–	Antistatic bag and consumer carton box

Note:

Keep the antistatic bag and the original package at least until the warranty period is over. It can be used for future storage or warranty shipments.

1.4   Additional Accessories

Peripheral devices are attached to the module directly or via additional accessories and cables listed in the following table. Additional accessories are not supplied with the CPU module, are ordered separately.

Table 1.3:   **CPC304 Additional Accessories**

Name	Decimal Code	Description
KIB380	469515.004	Interface expansion module with standard connectors and cable set
ACS00027	685611.123	Adapter cable (IDC10 2 mm – DHS-15F) for connection of VGA monitor to the module
ACS00031-01	467941.016	PHR-5 connector set. Includes JST PHR-5 socket and a set of contacts SPH-002T-P0.5S for connection to J9, J11, or J13 headers of the module
ACS00031-02	467941.016-01	PHR-6 connector set. Includes JST PHR-6 socket and a set of contacts SPH-002T-P0.5S for connection to J7 header of the module
ACS00031-03	467941.016-02	PHR-2 connector set. Includes JST PHR-2 socket and a set of contacts SPH-002T-P0.5S for connection to J6 or J8 headers of the module
ACS00037	–	DF13 connector set. Includes Hirose DF13-20DS-1.25C socket and a set of contacts DF13-2630SCF for connection to J16 header
ACS00038	–	Connector set for connection of a power supply unit to the module. Includes AMP 4-171822-4 socket and a set of contacts 170263-1 for connection to J24 power connector of the module
ACS00040-01	–	IDC-10 connector set. Includes Leotronics 2040-3102 socket for connection to J14, J15, J18, or J21 headers of the module
ACS00040-02	–	IDC-16 connector set. Includes Leotronics 2040-3162 socket for connection to J4 header

Name	Decimal Code	Description
ACS00040-03	–	IDC-26 connector set. Includes Leotronics 2040-3262 socket for connection to J23 header
ACS00041	–	Connector set for diskrete input/output connection (J5). Includes AMP 1-87499-5 socket and 167021-2 contacts.

1.5 Supplementary Information

1.5.1 Related Documents

Information related to this product and its components can be found in the following documents:

Table 1.4: **Related Publications**

Product	Publication
CompactFlash cards	CF+ and CompactFlash Specification Revision 1.4
Processor	AMD Geode™ LX Processor Reference Schematic AMD Geode™ LX Processors Data Book AMD Geode™ CS5536 Companion Device Preliminary Data Book AMD Geode™ LX Processor and CS5535/CS5536 Companion Devices Layout Recommendations
Super I/O	Winbond W83627 SuperIO Data sheet

2   Technical Specifications

2.1   General

- CPU: AMD Geode LX800 500 MHz:
  - 32-bit x86/x87 compatible
  - 64-bit coprocessor
  - 64-bit memory bus
  - 64 KB L1, 128 KB L2 cache
  - Integrated FPU supports the Intel MMX™ and AMD 3DNow!™ Technology instruction sets
- System memory:
  - 256 MB soldered DDR SDRAM
  - DDR333
- Flash BIOS:
  - 2x512 KB, reserved
  - In-system modification
- Solid State Disk (except for CPC30402)
  - Soldered
  - 1 GB NAND flash
  - IDE interface
  - MS DOS-compatible Fastwel file system
- CompactFlash socket:
  - Type I/II cards support (bottom side)
  - DMA mode support
- Video controller:
  - 2D accelerator
  - Video memory up to 60 MB shared with system
  - LCD (TFT or DSTN) panels support, resolution up to 1024x768 at 60 Hz
  - 18-bit color via TFT interface
  - 24-bit color via LVDS interface (except for CPC30402)
  - Analog display support,
    resolution 1600×1200 at 85 Hz, 1920×1440 at 75 Hz, 32-bit
- Ethernet:
  - Two Fast Ethernet ports 10/100 Mbit/s (for CPC30402 – one channel)
- USB:
  - Two USB 2.0 channels
  - One device can be connected to each channel

- IDE port:
  - One IDE channel (Primary)
  - Support for up to two UltraDMA-100 IDE devices (via a 10 cm cable) with NAND Flash disabled in BIOS Setup and if the CompactFlash socket (J20) is not populated
- FDD:
  - Floppy disk interface. Header shared with LPT
- Parallel port:
  - SPP/ECP/EPP compatible. Header shared with FDD controller
- Serial ports:
  - Four serial ports (three for CPC30402)
  - High speed NS16C550 compatible
  - COM1, COM2: RS232, 9 wires (complete), up to 115.2 Kb/s, console operation support
  - COM3, COM4: RS422/485, 500V isolation, up to 115.2 Kb/s, FIFO buffer for each channel – 64 bytes (for CPC30402 COM3 only)
- PS/2:
  - PS/2 keyboard and mouse interface
- AC'97 audio:
  - Stereo Line In and Line Out, microphone input
- Remote Reset/IRQ:
  - Discrete remote reset/interrupt input
  - 500V optoisolation
- RTC:
  - On-board real time clock with Li battery backup
- Safety:
  - System configuration settings stored in CMOS+Serial FRAM
  - Possibility of batteryless operation
- Two watchdog timers with LED indication:
  - WDT1 with fixed timeout period of 1.6 s
  - WDT2 with programmable timeout period from 1 s to 255 min
- Discrete I/O:
  - 8 programmable discrete I/O channels
- PME:
  - Connector for external PME signal source
- Software Support:
  - General Software® BIOS
  - Preinstalled FDOS 6.22 operating system
  - Support for MS DOS, Windows CE5.0, CE6.0, XPe, QNX 6.3x, and Linux 2.6 operating systems

2.2 Power Requirements

The module can be powered either via PC/104 ISA bus or via J24 power connector from an external DC power source providing the following characteristics:

- Voltage: +5 V ±5% (from +4.75 V to +5.25 V)
- Consumption current (without external devices): not more than 1.5 A

Important:

+12 V voltage is not used by the module. +12 V line from power supply connector is routed to the PC/104 header contact.

Please, find important notes on power supply in subsection 3.2.26 of this document.

2.3 Environmental

- Operating temperature range: from –40°C to +85°C
- Storage temperature: –55°C to +90°C
- Relative humidity: up to 80% at 25°C, noncondensing

Note:

Protective coating of CPC304 versions makes them resistant to damp heat cyclic exposure at temperatures up to +55±2°C and relative humidity of up to 93±3%.

2.4 Mechanical

- Vibration – 10g;
- Single shock, peak acceleration – 150 g;
- Multiple shock, peak acceleration – 50 g.

2.5 Dimensions and Weight

- Dimensions, not more: 115.6 × 101.5 × 23.7 mm (4.55" × 4" × 0.93")
  (see also section 4.4 for mounting dimensions)
- Weight, not more: 0.2 kg
  (without CompactFlash card)

2.6 MTBF

- MTBF for CPC304 is 170000 hours.

  The value is calculated according to: Telcordia Issue 1 model, Method I Case 3, for continuous operation at a surface location, at normal environmental conditions and at ambient temperature 30℃.

3 Functional Description

3.1 Structure and Layout

Functional diagram of the CPC304 module is shown in the following figure.

Figure 3.1: **CPC304 Block Diagram**
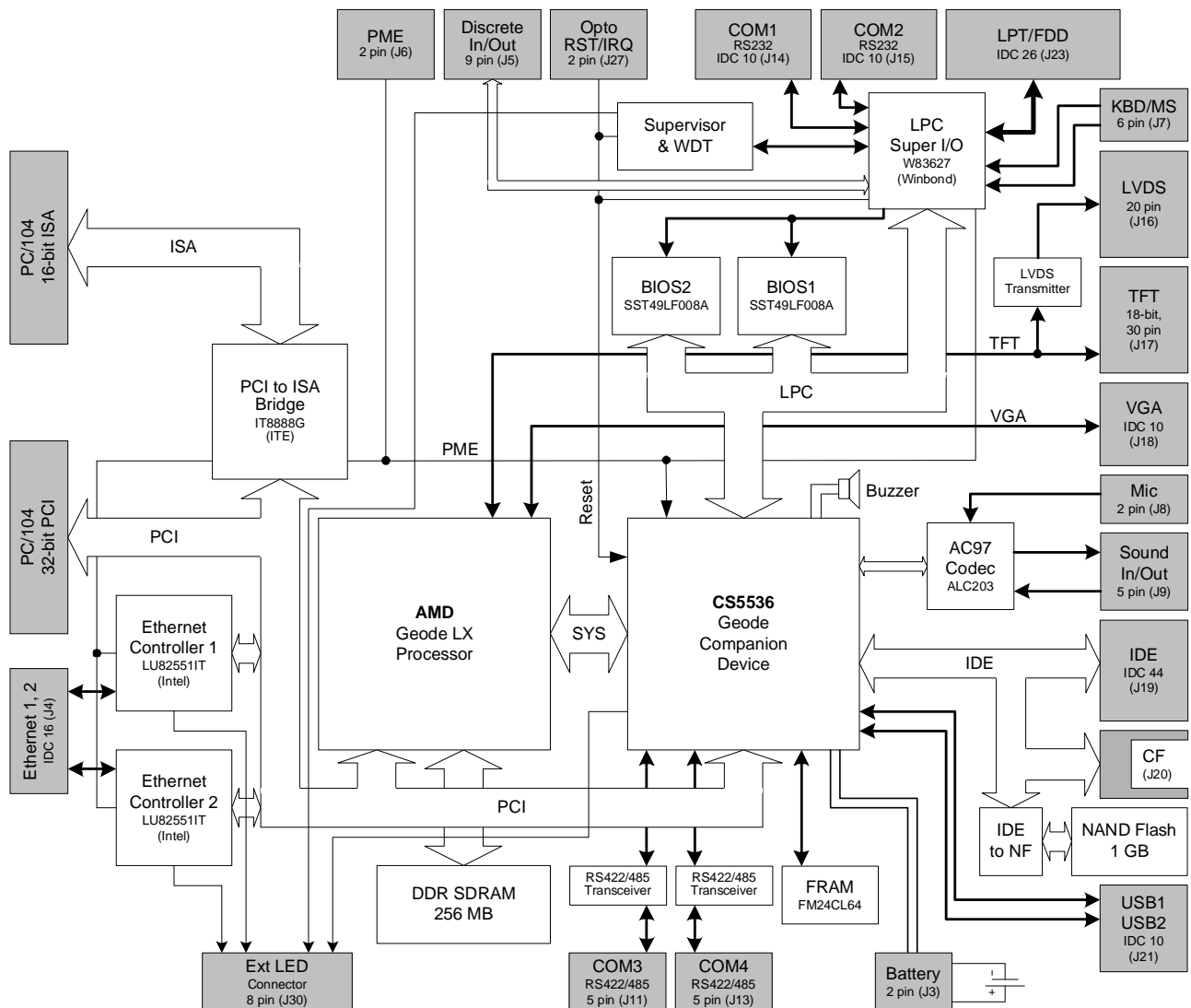
CPC304 includes the following main functional units:

- AMD Geode LX 800 500 MHz microprocessor, including 32-bit x86 core, 64-bit coprocessor, 64-bit SDRAM memory bus;
- 256 MB soldered DDR SDRAM system memory;
- Flash memory based reserved BIOS, in-system modification; 2×512 KB
- Onboard NAND flash-disk, 1 GB (CPC30401 and -03 only);
- CompactFlash socket (J20);
- Integrated graphics controller:
  - Video memory up to 60 MB, shared with system;
  - LCD (TFT or DSTN) panels support, resolution up to 1024×768 (J17);
  - Analog RGB display support (J18);
  - LVDS interface (J16, CPC30401 and -03 only)
- Two Fast Ethernet channels 10/100 Mbit/s (J4, CPC30402 has one channel);
- Two USB 2.0 channels (J21);
- IDE port with support for up to two UltraDMA/100 devices (J19);
- FDD/LPT shared header (J23);
- Serial ports:
  - COM1 (J14), COM2 (J15): RS232;
  - COM3 (J11), COM4 (J13, CPC30401 and -03 only): RS422/RS485;
- PS/2 keyboard/mouse port (J7);
- Audio port (J8, J9)
- Optoisolated remote Reset/interrupt input (J27)
- Real time clock with Li battery backup;
- CMOS+SFRAM for BIOS configuration storage;
- Two watchdog timers;
- Eight digital I/O lines (J5);
- External PME signal connector (J6);
- Lithium battery connector (J3);
- PC/104 (ISA) and PC/104-Plus (PCI) expansion connectors
- External power connector (J24)

Layouts of main CPC304 components and connectors on top and bottom sides are presented in Figures 3.2 and 3.3 respectively.

Some external devices can be connected to the module using KIB380 interface expansion module. KIB380 is equipped with standard connectors giving access to audio port, two RS232 and two RS422/485 ports, VGA, LPT, PS/2 keyboard and mouse, two Ethernet ports, and two USB ports.

KIB380 is not supplied with the module; it is ordered separately.

External connections are illustrated in .

Figure 3.2: **Top Side: Connectors and Main Components Layout**
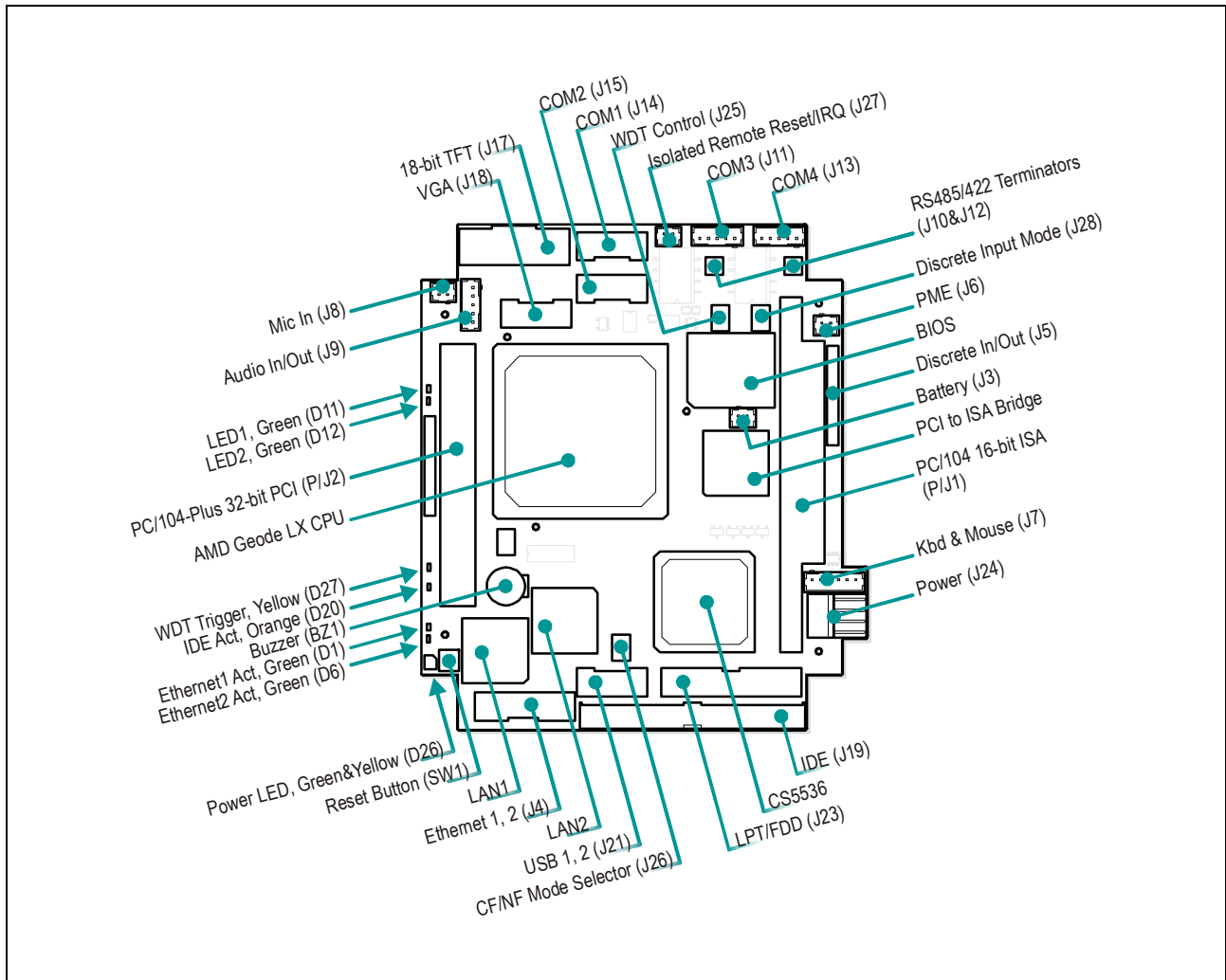
The layout may slightly differ for various versions of the module.

Figure 3.3:   Bottom Side: Connectors and Main Components Layout
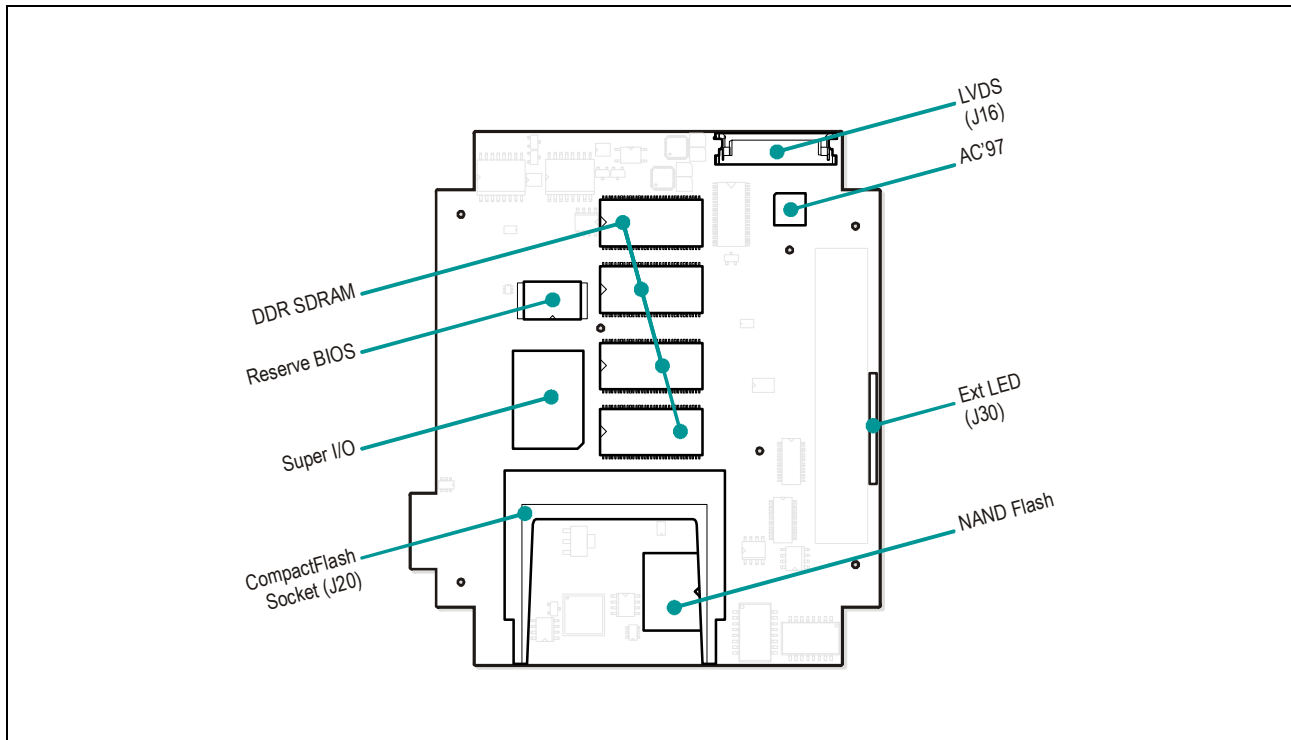
The layout may slightly differ for various versions of the board.

3.2   Functional Description

3.2.1   Microprocessor

The module is based on AMD Geode LX800 microprocessor with 1.8W typical power consumption at 500 MHz, maximum power 3.6W (TDP). The processor includes 32-bit x86 core, 64-bit coprocessor and 64-bit DDR memory bus up to 400 MHz, graphics and video controller with VGA monitors and LCD panels simultaneous operation support. FPU of the processor supports MMX™ and AMD 3DNow!™ technology instruction sets. The CPU is complemented with AMD Geode CS5536 companion device providing support for numerous I/O functions including IDE, USB, AC'97 compatible audio, and power management interfaces.

3.2.2   SDRAM Memory

Four DDR 333 SDRAM memory chips are soldered on the bottom side of the PCB. Total memory size is 256 MB.

3.2.3   Reserved Flash BIOS

The CPC304 takes advantage of flash-memory based BIOS. Two Flash BIOS chips storage capacity is 512 KB each. The main (working) copy of BIOS occupies 512 KB on a chip in 32-contact PLCC32 panel. Reserve BIOS copy is stored on a soldered chip and is used for emergency boot. Switching between the main and reserve BIOS copies is performed automatically.

It is possible to upgrade main and reserve copies of BIOS in-system. The procedure is described in section 6.3.

3.2.4   IDE Interface

One-channel IDE controller allows connection of up to two IDE devices (master and slave) and conforms to ATA-6 specification. Since soldered NAND flash disk uses IDE interface along with external devices, such as CompactFlash card in a socket or disk drives connected to J19 connector, there is a limited number of the devices connection variants:

Table 3.1:   **IDE Channel: Devices Connection Variants**

Connection Variant	IDE-Master	IDE-Slave	CF-Master	CF-Slave	NF-Master	NF-Slave
1	+	+	–	–	–	–
2	+	–	–	–	–	+
3	+	–	–	+	–	–
4	–	+	–	–	+	–
5	–	–	–	+	+	–
6	–	+	+	–	–	–
7	–	–	+	–	–	+

The combination (7) marked with red was discovered unstable and is not recommended.

3.2.4.1   Connection of External IDE Devices

IDE channel is routed to J19 connector of CPC304 (Figure 3.2); it is a 44-pin 2 mm pitch header. Its pinout is shown in the following table. UDMA-100 operation mode is supported with a 10 cm cable only provided that "Features Configuration -> IDE UDMA" and "Custom Configuration -> IDE UDMA 5" options are enabled in BIOS Setup.

Table 3.2:   **J19 HDD Connector Pinout**

Pin#	Signal	Pin#	Signal	Pin#	Signal	Pin#	Signal
1	/RESET	12	DD12	23	/IOW	34	–
2	GND	13	DD2	24	GND	35	DA0
3	DD7	14	DD13	25	/IOR	36	DA2
4	DD8	15	DD1	26	GND	37	/CS1
5	DD6	16	DD14	27	/IOCHRDY	38	/CS3
6	DD9	17	DD0	28	GND	39	DASP
7	DD5	18	DD15	29	/DACK	40	GND
8	DD10	19	GND	30	GND	41	+5V
9	DD4	20	–	31	IRQ	42	+5V
10	DD11	21	DRQ	32	/CS16	43	GND
11	DD3	22	GND	33	DA1	44	–

The cable supplied with the module (685611.051) allows direct connection of a 2.5" HDD to the J19 connector. Other IDE devices (3.5" HDD, CD-ROM) having 40-contact 2.5 mm pitch connector can be connected to CPC304 via the CDM02 (469535.023) adapter. This adapter is plugged directly to the 40-contact connector of the IDE device, and with 685611.051 cable is connected to CPC304 J19 connector. For custom cables it is recommended to use Leotronics 2040-3442 as counterpart connector for J19.

3.2.4.2   CompactFlash Socket

CompactFlash Type I/II cards can be connected to J20 socket on the bottom side of CPC304. The device in this socket shares Primary channel with other IDE devices. When CompactFlash socket is populated, only one more IDE device can be connected to CPC304. CompactFlash device can operate as Master or Slave (see J26 jumper positions description) and can be designated as bootable device. The pinout of the J20 socket is presented in the following table.

Table 3.3:   J20 CompactFlash Socket Pinout

Pin #	Function	Pin #	Function
1	GND	26	/CD1
2	D03	27	D11
3	D04	28	D12
4	D05	29	D13
5	D06	30	D14
6	D07	31	D15
7	/CS0	32	/CS1
8	A10 (NC)	33	/VS1
9	/ATA SEL	34	/IORD
10	A09 (NC)	35	/IOWR
11	A08 (NC)	36	/WE
12	A07 (NC)	37	INTRQ
13	VCC (+5V)	38	VCC (+5V)
14	A06 (NC)	39	/CSEL
15	A05 (NC)	40	/VS2
16	A04 (NC)	41	/RESET
17	A03 (NC)	42	IORDY
18	A02	43	/INPACK
19	A01	44	/REG
20	A00	45	/DASP
21	D00	46	/PDIAG
22	D01	47	D08
23	D02	48	D09
24	/IOCS16	49	D10
25	/CD2	50	GND

Note: (NC) indicates that this contact is not connected to the module's circuits.

Note!

If the module is operated in harsh environment with high vibration load, it is necessary to make additional arrangements to fix the CompactFlash card in the socket.

3.2.4.3   NAND Flash

The capacity of the soldered on-board NAND flash memory chip is 1 GB (CPC30401 and CPC30403 only). The generations of the module below 1.3 have 128 MB NAND flash memory with no UDMA support. This flash drive can be used as a bootable disk or can be disabled in BIOS Setup. NAND flash disk contains the preinstalled FDOS 6.22 operating system compatible with MS DOS 6.22 and some software utilities providing operational availability of the module. NAND flash chip is connected to IDE controller via SM223AT IDE-to-NAND flash bridge and uses a standard IDE driver. The other operating systems require installation of an appropriate driver, which can be found on the CD supplied with the module.

Compact Flash and NAND flash operation mode ("master" or "slave") is selected by setting jumpers at J26 pinpad: 1-2 closed NAND flash Master, CF Slave; 3-4 closed CF Master, NAND flash Slave. "3-4" is the factory setting.

> **Note!**
>
> For generations of the module below 1.3: In case the NAND flash chip is not used ("Onboard NAND Flash" option in BIOS setup is set to "Disable"), the jumper at J26 pinpad should be removed or set to the position 3-4.

> **Note!**
>
> In case the NAND flash chip is not used ("Onboard Flash Disk" option in BIOS setup is set to "Disable") it is possible that some CompactFlash cards will operate only in one mode – Master or Slave. For correct operation it is necessary to set the required configuration using J26 jumper switch and settings in "Basic CMOS Configuration" section of BIOS Setup.

3.2.5   Video Controller and Connection of Monitors

The module utilizes graphics controller integrated in Geode LX CPU with the following main features:

- Video memory size up to 60 MB shared with system. It is recommended to use 32 MB as set by default in "Custom Configuration" section of BIOS Setup.
- Supported resolution up to 1024×768 @ 60 Hz for TFT or DSTN LCD-panels at 18 bpp; for LVDS (CPC30401 and 03 only) panels – at 24 bpp only;
- Support of VGA CRT monitors with resolution up to 1600×1200 @ 85 Hz or 1920×1440 @ 75 Hz, 32-bit color
- CRT display and LCD panel simultaneous operation

TFT LCD panels with color depth of 9, 12, or 18 bits are connected directly to J17 header (IDC30, 1.27 mm pitch, AMP 1-111196-9 counterpart) of CPC304 using custom interface cable. The following table presents its pinout.

Table 3.4:   TFT: J17 Header Pinout

Pin#	Signal	Pin#	Signal
1	GND	16	DRGB13 (G3)
2	DOT_CLK	17	DRGB14 (G4)
3	HSYNC	18	DRGB15 (G5)
4	VSYNC	19	GND
5	GND	20	DRGB2 (B0)
6	DRGB18 (R0)	21	DRGB3 (B1)
7	DRGB19 (R1)	22	DRGB4 (B2)
8	DRGB20 (R2)	23	DRGB5 (B3)
9	DRGB21 (R3)	24	DRGB6 (B4)
10	DRGB22 (R4)	25	DRGB7 (B5)
11	DRGB23 (R5)	26	GND
12	GND	27	DISPEN
13	DRGB10 (G0)	28	+3.3V
14	DRGB11 (G1)	29	+3.3V
15	DRGB12 (G2)	30	GND

The figure below illustrates connection of Sharp LQ104V1DG61 panel to CPC304 module.

Figure 3.4:   **Connection of Sharp LQ104V1DG61 Panel to CPC304**

To J17 Connector of CPC304

To Interface Connector of LQ104V1DG61 Panel

Signal	Cont		Cont	Signal
GND	1		1	GND
DOT_CLK	2		2	CK
HSYNC	3		3	HSYNC
VSYNC	4		4	VSYNC
GND	5		5	GND
R0	6		6	R0
R1	7		7	R1
R2	8		8	R2
R3	9		9	R3
R4	10		10	R4
R5	11		11	R5
GND	12		12	GND
G0	13		13	G0
G1	14		14	G1
G2	15		15	G2
G3	16		16	G3
G4	17		17	G4
G5	18		18	G5
GND	19		19	GND
B0	20		20	B0
B1	21		21	B1
B2	22		22	B2
B3	23		23	B3
B4	24		24	B4
B5	25		25	B5
GND	26		26	GND
DISPEN	27		27	ENAB
+3.3V	28		28	VCC
+3.3V	29		29	VCC
GND	30		30	R/L
			31	U/D

AMP 1-111196-9
Socket

Hirose DF9-31S-1V(32)
Socket

J16 connector (Hirose DF13-20DP-1.25V) of CPC304 (CPC30401 and 03 only) is used for connection of LCD panels to single-channel LVDS interface using custom adapter cable (counterpart connector Hirose DF13-20DS-1.25C with Hirose DF13-2630SCF contacts) or using the accessory ACS00037. Only 24-bit panels are supported.

Table 3.5:   **LVDS: J16 Connector Pinout**

Pin #	Signal	Pin #	Signal
1	VDD_EN	11	TxOUT2+
2	DISPEN	12	TxOUT2-
3	TxOUT0+	13	GND
4	TxOUT0-	14	GND
5	GND	15	TxOUT3+
6	GND	16	TxOUT3-
7	TxOUT1+	17	GND
8	TxOUT1-	18	GND
9	GND	19	TxCLK+
10	GND	20	TxCLK-

Figure 3.5:   **Connection of Sharp LQ150X1LW72 Panel to CPC304**
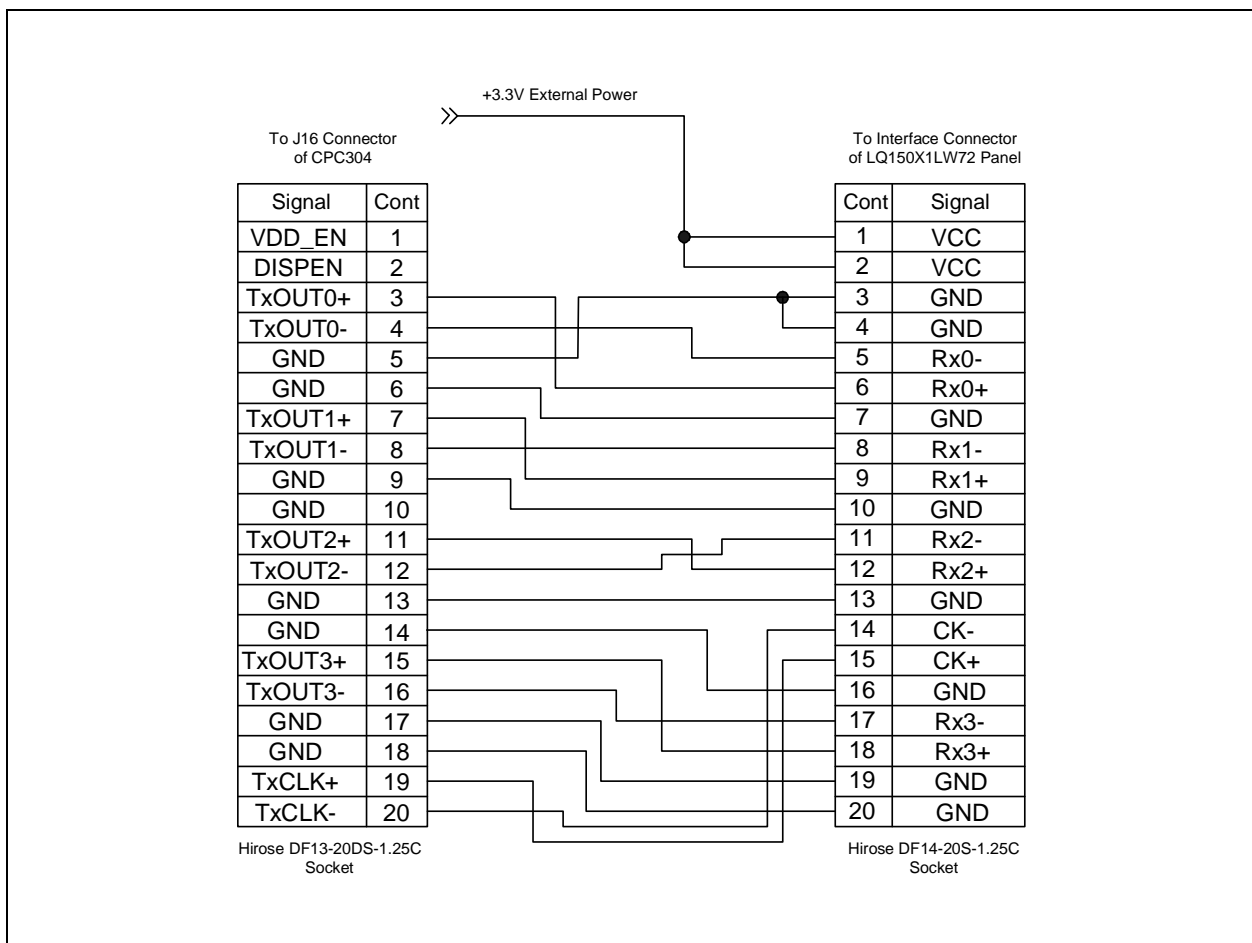
CRT VGA monitor is connected to J18 header (IDC, 2 mm pitch) of CPC304 via a custom adapter cable (Leotronics 2040-3102 counterpart socket) or using the accessory ACS00040-01. It is also possible to connect VGA monitor to "VGA" D-Sub connector (J16) of KIB380 interface module. In this case J18 (CPC304) and J15 (KIB380) headers are connected with the adaptor cable supplied with KIB380 module. The table below shows J18 header pinout.

Table 3.6:   VGA: J18 Connector Pinout

Pin#	Signal	Pin#	Signal
1	RED	6	GND
2	GND	7	HSYNC
3	GREEN	8	VSYNC
4	GND	9	–
5	BLUE	10	–

3.2.6   Fast Ethernet Interface

The CPC304 has two (one for CPC30402) 10/100Base-T independent Ethernet channels provided by two Intel LU82551IT controllers. Both Ethernet ports are available via one 16-pin 2 mm pitch IDC header J4 on the top side of the board (see Figure 3.2). Ethernet channels are connected to this header via custom adaptor cable with Leotronics 2040-3162 counterpart connector or ACS00040-02 accessory.

Table 3.7:   J4 Ethernet Header Pinout

Pin Number	Signal	Pin Number	Signal
1	LAN1_TX+	9	LAN2_TX+
2	LAN1_TX-	10	LAN2_TX-
3	LAN1_RX+	11	LAN2_RX+
4	NC	12	NC
5	NC	13	NC
6	LAN1_RX-	14	LAN2_RX-
7	NC	15	NC
8	NC	16	NC

Both channels are available via standard RJ45 connectors on KIB380 interface expansion module. In this case Ethernet channels are connected directly to J9 (LAN1) and J12 (LAN2) RJ45 connectors of KIB380. J4 CPC304 header is connected to J8 KIB380 header using the adapter cable supplied with KIB380. Please, refer to the connections diagram in Chapter 4.

3.2.7   USB Interface

Figure 3.6:   J21 IDC10 Pins Numbering
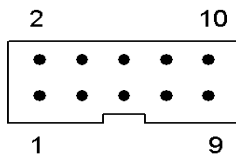
The module is equipped with two USB 2.0 host ports. Each channel has separate power control circuit. One USB device may be connected to each port. USB drive boot is supported. Both ports are available via IDC10 2 mm pitch header J21.

USB devices can be connected to J21 header using a custom adaptor cable with Leotronics 2040-3102 counterpart connector or using ACS00040-01 accessory.

Table 3.8:   J21 Connector Pinout

Pin Number	Signal	Pin Number	Signal
1	USB1_+5V	6	USB2_DAT+
2	USB2_+5V	7	USB1_GND
3	USB1_DAT-	8	USB2_GND
4	USB2_DAT-	9	–
5	USB1_DAT+	10	–

USB devices can also be connected to CPC304 via KIB380 interface expansion module, which has two standard 4-contact Type A USB connectors: USB1 (J4) and USB2 (J5). In this case, J21 header of CPC304 is connected to J2 header of KIB380 with the adaptor cable supplied with KIB380. Please, refer to the connections diagram in Chapter 4.

3.2.8   FDD/LPT Port

J23 is a 26-pin 2 mm pitch IDC connector shared by LPT and FDD ports. Switching between LPT and FDD ports is performed in BIOS Setup. LPT port of CPC304 supports EPP and ECP operation modes. ECP & EPP 1.7 is the default mode. The operation modes are switched in BIOS Setup.

LPT uses IRQ7 interrupt line, IRQ6 is assigned to FDD port. Interrupts from these ports can be disabled and switched for use by ISA bus devices in BIOS Setup program.

A floppy disk drive or printer are connected to J23 header of CPC304 via custom cable. The recommended counterpart connector for J23 is Leotronics 2040-3262 (see ACS00040-03 accessory).

The table below describes pin assignments of J23 connector.

Table 3.9:   LPT/FDD J23 Connector Pinout

Pin #	LPT1 Signals	FDD Signals
1	/STB	–
2	/AFD	DRVDEN
3	PD0	/INDEX
4	/ERROR	/HEAD

Pin #	LPT1 Signals	FDD Signals
5	PD1	/TRACK
6	/INIT	/DIR
7	PD2	/WP
8	/SLCTIN	/STEP
9	PD3	/RDATA
10	GND	GND
11	PD4	/DSKCHG
12	GND	GND
13	PD5	–
14	GND	GND
15	PD6	/MOA
16	GND	GND
17	PD7	/DSA
18	GND	GND
19	/ACK	/DSB
20	GND	GND
21	BUSY	/MOB
22	GND	GND
23	PE	/WD
24	GND	GND
25	SLCT	/WE
26	+5V	+5V

A printer can also be connected to DB25F connector (J21) at KIB380 interface expansion module. The connection between J23 at CPC304 and J20 at KIB380 is made with one of the interface cables supplied with KIB380 (see the connections diagram in Chapter 4).

3.2.9   Serial Ports

The CPC304-01 and -03 are furnished with four serial ports, CPC304-02 – with three.

3.2.9.1   COM1 and COM2 (RS232)

Figure 3.7:   IDC10 Pins Numbering
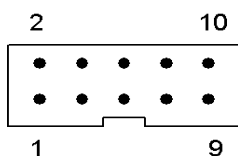
COM1 and COM2 ports have standard PC AT base addresses. They are routed to J14 and J15 IDC10 connectors (2 mm pitch) respectively and operate as full function 9-wire RS232 interfaces with maximum transfer rate of 115.2 Kb/s. They are fully compatible with UART16550.

Both COM1 and COM2 ports can be used for communication with a remote PC; the port number is selected in BIOS Setup. COM1 is used for this purpose by default. For console operation and file exchange a null-modem and ACS00023 (685611.082) cables are needed. Recommended counterpart connectors type for custom cables is Leotronics 2040-3102 (ACS00040-01 accessory).

The following table shows pins designation for J14 and J15 headers.

Table 3.10:   J14 and J15 Pin Assignments

Pin #	Signal	Pin #	Signal
1	DCD	2	DSR
3	RXD	4	RTS
5	TXD	6	CTS
7	DTR	8	RI
9	GND	10	+5V

When using KIB380 interface expansion module, both ports are available via two standard DB9F connectors COM1 (J7) and COM2 (J3). The connection between J14 and J15 at CPC304 and J6 and J1 at KIB380 are made with the interface cables supplied with KIB380 as shown in the connections diagram in Chapter 4.

3.2.9.2   COM3 and COM4 (RS485/RS422)

COM3 and COM4 ports allow data transmission rates up to 115.2 Kb/s and support RS422/RS485 interfaces with 500 V isolation. They have standard PC/AT base addresses and interrupts. RS485 interface operates in echo mode. These two ports are routed to J11 and J13 one-row 5-pin (JST type, 2 mm pitch) on-board connectors. CPC30402 version has COM3 only.

The jumpers of the J10 (for COM3) and J12 (for COM4) pinpads connect terminators to RS485/RS422 signal lines (see table Jumper Settings). The pins of these pinpads have identical designation shown in the following figure. Pins 1-2 are connected at the factory.

Figure 3.8:   J10 and J12 Pinpads
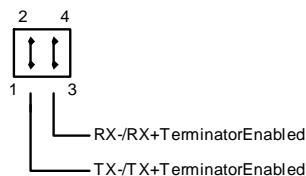
To use COM3 or COM4 ports in RS422 or RS485 mode, do the following:
- Set jumpers on the pinpad corresponding to the port;
- Initialize the port by software

Figure below shows two modules connected in RS422 mode. The jumper connecting terminator is set on receive lines only (lines RX+ and RX-). In RS485 mode the terminators are connected only on devices at the ends of the line (on the next figure). The terminators' resistance is 120 Ohm.

Figure 3.9:   Point-to-Point Connection of Two Modules in RS422 Mode
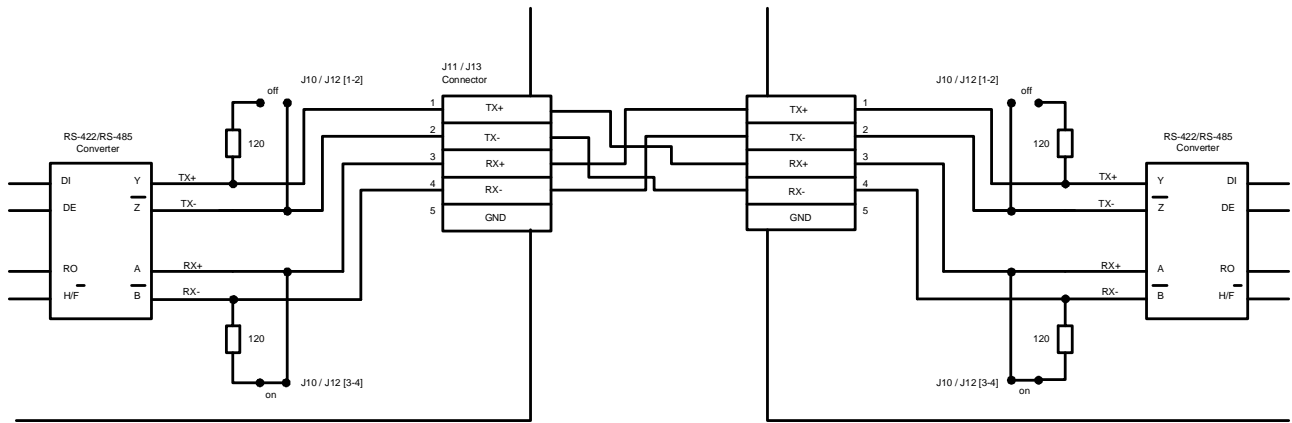
Figure 3.10:   Connection of Several Devices in RS485 Mode
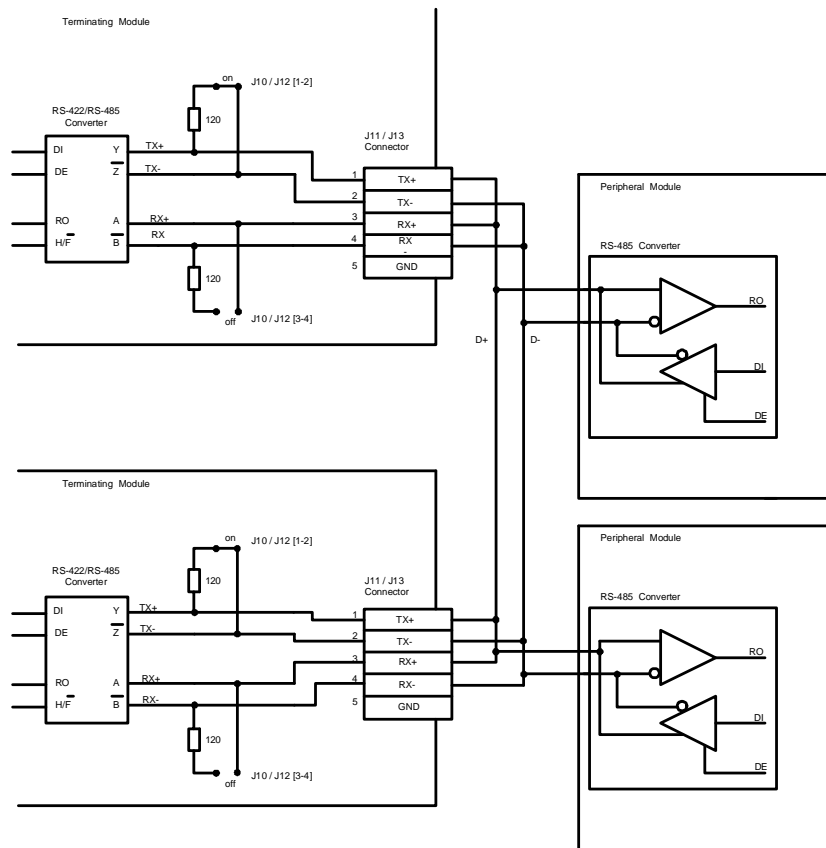
RS422/485 transmitters are controlled via GPIO5 (COM3) and GPIO6 (COM4) lines of CS5536 GPIO port. Setting these lines to logical "1" or "0" switches the tranmitters "on" or "off" respectively. GPIO lines programming samples can be found in subsection 5.9.5 of this Manual.

Custom cables can be used to connect external devices to RS422/485 interfaces. The recommended counterpart connectors for J11 and J13 headers of CPC304 are JST PHR-5 with JST SPH-002T-P0.5S contacts for crimping or ACS00031 accessory.

The following table shows contacts designation for J11 and J13 connectors.

Table 3.11: **J11 and J13 Contact Assignments**

Pin #	Signal	Pin #	Signal
1	TX+	2	TX-
3	RX+	4	RX-
5	GND		

External devices can be connected to RS422/485 interfaces using KIB380 interface expansion module. The devices are connected to "1 RS 485" (J11) and "2 RS 485" (J14) WAGO terminal blocks of KIB380. The supplied with KIB380 interface cables are used to connect COM3 (J11) and COM4 (J13) headers of CPC304 to J10 and J13 connectors of KIB380 respectively. The connections diagram in Chapter 4 illustrates the wiring layout.

3.2.10 PS/2 Keyboard and Mouse Interface

PS/2 keyboard and mouse interface is routed to J7 6-pin 2 mm pitch JST header. Simultaneous connection of these two devices to J7 connector of CPC304 require a "Y"-cable purchased separately.

To make a custom cable it is recommended to use the JST PHR-6 socket with JST SPH-002T-P0.5S contacts for crimping (see ACS00031-02 accessory) as a counterpart connector.

The following table shows pinout of CPC304 J7 connector.

Table 3.12: **J7 Contacts Designation**

Pin Number	Signal	Pin Number	Signal
1	KBD CLK	4	GND
2	KBD DATA	5	+5V
3	MOUSE CLK	6	MOUSE DATA

Mouse and keyboard can be connected via KIB380 interface expansion module with "KB" and "Mouse" standard PS/2 connectors (J17 and J19). J7 of CPC304 and J18 of KIB380 are connected with the cable supplied with KIB380 interface module (see the connections diagram in Chapter 4).

3.2.11   Audio Port

The audio port of CPC304 is realized on the basis of AC'97 compatible audio controller supporting 16-bit sound synthesis industry standard and OPL3 mode emulation. External audio devices are connected to the module via two 2 mm pitch JST connectors: 5-contact J9 (stereo line in/line out) and 2-contact J8 (microphone in).

For making custom cables it is recommended to use as counterpart connectors JST PHR-5 and PHR-2 sockets for J9 and J8 headers respectively with JST SPH-002T-P0.5S contacts for crimping (see ACS00031-01 and ACS00031-03 accessories respectively).

Table 3.13:   Audio: J9 and J8 Pinouts

J9:

Pin Number	Signal
1	Lin_In_L
2	Lin_In_R
3	GND
4	Lin_Out_R
5	Lin_Out_L

J8:

Pin Number	Signal
1	Mic_In
2	GND

Audio devices can also be connected to CPC304 using KIB380 interface module via its standard 3.5 mm audio connectors: Audio In (J24), Audio Out (J26), and Mic (J22). J9 and J8 audio connectors of CPC304 are connected to J25 and J23 connectors of KIB380 respectively using the interface cables supplied with KIB380 interface module as shown in the connections diagram in Chapter 4.

3.2.12   Optoisolated Reset/IRQ Input

J27 is a 2-pin JST 2 mm pitch header that is intended for connection of a remote Reset/IRQ signal source with voltage of 3 to 5 V. The discrete input has 500 V optoisolation.

Optoisolated Reset circuitry sample is shown in the figure below.

Figure 3.11:   Discrete Input Optoisolation
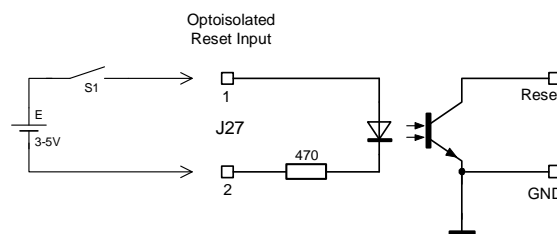
For making a custom cable it is recommended to use as a counterpart connector JST PHR-2 socket with JST SPH-002T-P0.5S contacts for crimping (see ACS00031-03 accessory).

J28 pinpad is used to switch between the discrete input operation modes: Reset input or IRQ input. Closing contacts 3-5 and 2-4 enables IRQ input, closing contacts 1-3 (factory setting) enables Reset input, closing 4-6 enables IRQ on PFO (see Custom Configuration section).

3.2.13　RTC and CMOS + Serial FRAM

The module is equipped with a standard Real Time Clock. The supplied with CPC304 3 V lithium battery assembly is installed in a holder on the processor heatsink. Being connected to J3 power connector (#1 - +3V, #2 - GND), it is used to power the RTC and CMOS memory when the system power is off.

FRAM is non-volatile memory with I^2C serial interface. It serves as a back-up storage for BIOS Setup parameters and for restoration of the RTC memory (except the time and date settings) if an error is detected. This feature enables the possibility to operate the module even when the battery is disconnected. Free FRAM memory units (7 KB) are available to the user via INT17H BIOS extensions (see subsection 5.9.3 for details).

For long-term storage of the CPC304 module disconnect RTC battery by disengaging power cable from J3 connector.

In case of operating system crash and if BIOS Setup program can not be started, BIOS settings can be reset using CMOS_RST.COM program. It is started under FDOS 6.22 on a remote PC connected to CPC304 module with a null-modem cable via COM1 port. After this procedure, BIOS settings are reset to default ones on module's power-up (see section 6.2 for details of the procedure).

3.2.14　Watchdog Timers

CPC304 has two watchdog timers. WDT1 is integrated in ADM706T supervisor chip and has fixed timeout period of 1.6 s. After power-up and POST WDT1 is disabled. WDT1 is controlled via INT 17h BIOS extensions and by setting the SuperIO (W83627HG) GPIO port lines; see subsection 5.9.1. WDT1 can induce Reset only if pins 1 and 2 on J25 pinpad are closed (factory setting).

WDT2 is a function of Winbond W83627HG SuperIO chip. It has programmable timeout period from 1 s to 255 minutes. Its setup and control are described in W83627 chip datasheet (*W83627.pdf* file on the CD supplied with CPC304). Super IO chip is available via 2Eh port. WDT2 can induce Reset only if pins 3 and 4 on J25 pinpad are closed (factory setting).

Operation of each watchdog timer trigger special registers, which are available to BIOS function for reading after reboot. If SuperIO line GPIO20 is set to logical "1", WDT operated; to "0" – WDT did not operate. The fact of watchdog operation is also reflected by lighting D27 yellow LED.

3.2.15　J25 Pinpad

J25 pinpad jumpers allow to enable/disable inducing Reset by watchdog timers of the module. CPC304 is supplied with pins 1-2 and 3-4 closed. To disable Reset by a watchdog timer remove the jumper from the appropriate pins.

Table 3.14:　　J25 Jumpers Positions

Jumper Position	Function
1-2 closed	Enable Reset from WDT1
3-4 closed	Enable Reset from WDT2

3.2.16   J26 Pinpad

Compact Flash and NAND flash operation mode ("master" or "slave") is selected by setting jumpers at J26 pinpad.

Table 3.15:   J26 Jumper Positions

Jumper Position	Function
3-4	Compact Flash – Master, Nand Flash – Slave (factory setting)
1-2	Compact Flash – Slave, Nand Flash – Master

Note!

For generations of the module below 1.3: In case the NAND flash chip is not used ("Onboard NAND Flash" option in BIOS setup is set to "Disable"), the jumper at J26 pinpad should be removed or set to the position 3-4.

Note!

In case the NAND flash chip is not used ("Onboard Flash Disk" option in BIOS setup is set to "Disable") it is possible that some CompactFlash cards will operate only in one mode – Master or Slave. For correct operation it is necessary to set the required configuration using J26 jumper switch and settings in "Basic CMOS Configuration" section of BIOS Setup.

3.2.17   J28 Pinpad

J28 pinpad is used to switch between the discrete input (J27) operation modes: Reset input or IRQ input. Pins 4-6 allow to enable IRQ on PFO. Closed [1-3] and [4-6] – factory setting.

Table 3.16:   J28 Jumpers Positions

Jumper Position	Function
1-3 closed	Reset input enabled
3-5 and 2-4 closed	IRQ input enabled
4-6 closed	IRQ on PFO enabled. IRQ is set in BIOS Setup (see Custom Configuration section)

3.2.18   Discrete Input/Output

CPC304 offers 8 programmable input/output channels routed to J5 one-row connector (AMP PLSx9, 2.5 mm pitch) on the top side of the module. Discrete input/output lines are connected to Super IO (W83627HG) GPIO lines via protective current-limiting circuits. Maximum output current is 20 mA per channel. The channels have outputs imitating open collector. Samples of Winbond W83627HG Super IO GPIO programming can be found in *W83627.pdf* file on the documentation CD. The following table shows J5 contacts designation.

Table 3.17:   **J5 Contacts Designation**

Contact	GPIO Line	Signal
1	GPIO10	DISCIO_0
2	GPIO11	DISCIO_1
3	GPIO12	DISCIO_2
4	GPIO13	DISCIO_3
5	GPIO14	DISCIO_4
6	GPIO15	DISCIO_5
7	GPIO16	DISCIO_6
8	GPIO17	DISCIO_7
9	–	GND

For custom cables the AMP 1-87499-5 socket with contacts 167021-2 are recommended (see ACS00041 accessory).

3.2.19   External PME Signal Connector

An external PME signal source can be connected to the module via the 2-contact, 2 mm pitch JST header (J6). The system can be woken up by the PME# signal.

Table 3.18:   **J6 PME Connector Pinout**

Contact	Signal
1	PME#
2	GND

For making a custom cable it is recommended to use JST PHR-2 counterpart socket with JST SPH-002T-P0.5S contacts for crimping (ACS00031-03 accessory).

3.2.20   Battery Connector

The module is equipped with the 2-contact, 2 mm pitch JST header (J3) for connection of the supplied with the module 3V lithium battery (assembly 469539.012). The battery assembly is inserted in the plastic holder mounted (see section 4.2.3) on the processor heatsink next to J3 connector.

The battery is used to power the RTC and CMOS memory where BIOS Setup parameters are stored while the power is off. However, the module can be operated without the battery (see subsection 3.2.15 for details).

Table 3.19:   J3 Battery Connector Pinout

Contact	Signal
1	+3V
2	GND

Note...

It is recommended to disconnect the battery from J3 connector if the module is not operated for a long time.

3.2.21   Diagnostic LEDs

CPC304 has seven diagnostic LEDs (D1, D6, D11, D12, D20, D26, D27; Figure 3.2) on the top side of the module. If the processor module is installed into the mounting cage, additional light pipes can be provided to conduct the light to the front panel. The following table describes the function of these LEDs.

Table 3.20:   CPC304 Diagnostic LEDs Function

LED	Color	Function
D11	Green	User LED1
D12	Green	User LED2
D27	Yellow	Processor reset by WDT. This LED lights up when the processor had been reset on WDT timeout expiry. It is not lit during normal operation.
D20	Orange	IDE activity
D1	Green	Ethernet controller 1 activity
D6	Green	Ethernet controller 2 activity
D26	Green/Yellow	Power mode: green = operation, yellow = sleep

User LEDs are controlled via the Super IO GPIO port lines: LED1 via GPIO23 and LED2 via GPIO35 (1 = LED is off, 0 = LED is on). See also subsection 5.9.4 for details.

On the module version 1.3 and higher there is an additional connector (J30) enabling operation with external diagnostic LEDs. It is 8-pin one-row connector on the bottom side of the module. Recommended counterpart for making a custom cable is Leotronics 2018-3081 socket with Leotronics 2023 contacts.

Table 3.21:   J30 External LEDs Connector

Pin #	Signal	Description
1	HDD_LED	IDE activity external LED (cathode)
2	WDT_LED	Watchdog timer timeout expiry external LED (cathode)
3	GND	Ground of the module
4	VCC	+3.3 V
5	LAN1+	LAN1 Ethernet controller activity external LED (anode)
6	LAN1-	LAN1 Ethernet controller activity external LED (cathode)
7	LAN2+	LAN2 Ethernet controller activity external LED (anode)
8	LAN2-	LAN2 Ethernet controller activity external LED (cathode)

Figure 3.12:   External LEDs Connection
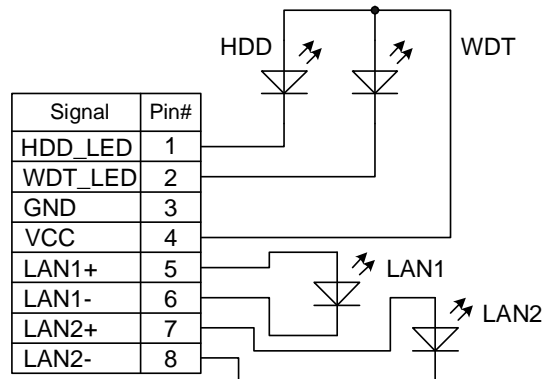
3.2.22   Reset Button

In the event of a contingency (module hang-up, for example) use the Reset button SW1 on the top side of the module to reset the system.

3.2.23   Expansion Buses: ISA and PCI

The module is equipped with two interface expansion headers stipulated by PC/104-Plus specification – 104-pin ISA and 120-pin PCI connectors. They allow stacking up to four PC/104 modules or up to three PC/104-Plus expansion modules. Both connectors are available as a socket at the top side of the module and as a pin array at the bottom side of CPC304.

Attention!

CPC304 does not support PC/104 (ISA) external graphics controllers. Only PC/104-Plus (PCI) graphics controllers are supported.

3.2.23.1   ISA Header

P/J1 header mounted on CPC304 allows connection of PC/104 expansion modules via 16-bit ISA bus. The processor module can accommodate four PC/104 expansion modules maximum. The contact configuration of P/J1 header is shown in the figure below. The tables following the figure give the designation of its contacts.

Figure 3.13:   **ISA Header Contacts Layout**
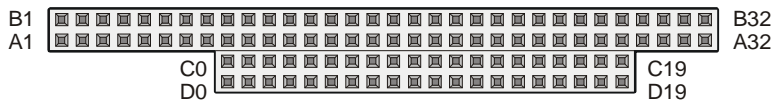
Table 3.22:   **ISA P/J1 Connector (Rows A and B) Contacts Designation**

Pin #	Signal	In/Out	Pin #	Signal	In/Out
A1	/IOCHK	–	B1	GND	Power
A2	SD7	In/Out	B2	RESET	Out
A3	SD6	In/Out	B3	+5V	Power
A4	SD5	In/Out	B4	IRQ9	In
A5	SD4	In/Out	B5	-5V	Power
A6	SD3	In/Out	B6	DRQ2	In
A7	SD2	In/Out	B7	-12V	Power
A8	SD1	In/Out	B8	0WS	In
A9	SD0	In/Out	B9	+12V	Power
A10	IOCHRDY	In	B10	GND	Power
A11	AEN	Out	B11	/SMEMW	Out
A12	SA19	Out	B12	/SMEMR	Out
A13	SA18	Out	B13	/IOW	Out
A14	SA17	Out	B14	/IOR	Out
A15	SA16	Out	B15	/DACK3	Out
A16	SA15	Out	B16	DRQ3	In
A17	SA14	Out	B17	/DACK1	Out

Pin #	Signal	In/Out	Pin #	Signal	In/Out
A18	SA13	Out	B18	DRQ1	In
A19	SA12	Out	B19	/REFRESH	Out
A20	SA11	Out	B20	BCLK	Out
A21	SA10	Out	B21	IRQ7	In
A22	SA9	Out	B22	IRQ6	In
A23	SA8	Out	B23	IRQ5	In
A24	SA7	Out	B24	IRQ4	In
A25	SA6	Out	B25	IRQ3	In
A26	SA5	Out	B26	/DACK2	Out
A27	SA4	Out	B27	TC	Out
A28	SA3	Out	B28	BALE	Out
A29	SA2	Out	B29	+5V	Power
A30	SA1	Out	B30	OSC	Out
A31	SA0	Out	B31	GND	Power
A32	GND	Power	B32	GND	Power

Table 3.23:   **ISA P/J1 (Rows C and D) Contacts Designation**

Pin #	Signal	In/Out	Pin #	Signal	In/Out
C0	GND	Power	D0	GND	Power
C1	/SBHE	Out	D1	/MEMCS16	In
C2	LA23	Out	D2	/IOCS16	In
C3	LA22	Out	D3	IRQ10	In
C4	LA21	Out	D4	IRQ11	In
C5	LA20	Out	D5	IRQ12	In
C6	LA19	Out	D6	IRQ13	In
C7	LA18	Out	D7	IRQ14	In
C8	LA17	Out	D8	/DACK0	Out
C9	/MEMR	Out	D9	DRQ0	In
C10	/MEMW	Out	D10	/DACK5	Out
C11	SD8	In/Out	D11	DRQ5	In
C12	SD9	In/Out	D12	/DACK6	Out
C13	SD10	In/Out	D13	DRQ6	In
C14	SD11	In/Out	D14	/DACK7	Out
C15	SD12	In/Out	D15	DRQ7	In
C16	SD13	In/Out	D16	+5V	Power
C17	SD14	In/Out	D17	/MASTER	In
C18	SD15	In/Out	D18	GND	Power
C19	KEY	–	D19	GND	Power

> **Note:**
>
> In two tables above:
>> "–" – Not used;
>> "Power" – supplied to the stacked modules
>> In/Out column shows the data transfer direction for a processor
>>   module being the bus master.

3.2.23.2   PCI Header

PC/104-Plus standard specifies availability of 120-pin (30x4) 2 mm header (P/J2 or U49). This interface header accepts 3 stackable PC/104-Plus modules and carries all of the appropriate 32-bit 33 MHz PCI signals. PCI signals are available both via the socket at the top side of the module and via a pin array at the bottom side of CPC304. Three PCI bus mastering devices are supported on the P/J2 header.

Figure 3.14:   PCI P/J2 Connector Contacts Layout
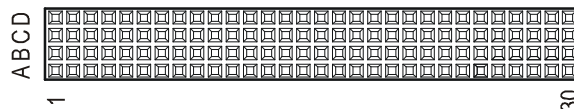
Table 3.24:   PCI P/J2 Connector Contacts Designation

Pin	A	B	C	D
1	GND	Reserved	+5V	AD00
2	VI/O	AD02	AD01	+5V
3	AD05	GND	AD04	AD03
4	C/BE0#	AD07	GND	AD06
5	GND	AD09	AD08	GND
6	AD11	VI/O	AD10	M66EN
7	AD14	AD13	GND	AD12
8	+3.3V*	C/BE1#	AD15	+3.3V*
9	SERR#	GND	Reserved	PAR
10	GND	PERR#	+3.3V*	Reserved
11	STOP#	+3.3V*	LOCK#	GND
12	+3.3V*	TRDY#	GND	DEVSEL#
13	FRAME#	GND	IRDY#	+3.3V*
14	GND	AD16	+3.3V*	C/BE2#
15	AD18	+3.3V*	AD17	GND
16	AD21	AD20	GND	AD19
17	+3.3V*	AD23	AD22	+3.3V*
18	IDSEL0	GND	IDSEL1	IDSEL2
19	AD24	C/BE3#	VI/O	IDSEL3
20	GND	AD26	AD25	GND
21	AD29	+5V	AD28	AD27
22	+5V	AD30	GND	AD31
23	REQ0#	GND	REQ1#	VI/O

Pin	A	B	C	D
24	GND	REQ2#	+5V	GNT0#
25	GNT1#	VI/O	GNT2#	GND
26	+5V	CLK0	GND	CLK1
27	CLK2	+5V	CLK3	GND
28	GND	INTD#	+5V	RST#
29	+12V	INTA#	INTB#	INTC#
30	-12V	REQ3#	GNT3#	GND

Attention!

The module itself does not supply +3.3V power to the contacts marked with (*) in the table above. These contacts are used to supply +3.3V power to PC/104-Plus expansion modules from an external PC/104-Plus power supply unit.

3.2.24   Power Supply

The power is supplied to CPC304 via PC/104 connector or via dedicated J24 connector from a power source with characteristics specified in <u>section 2.2</u>.

Figure 3.15:   **J24 Power Supply Connector**
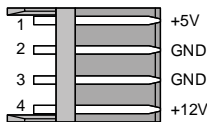
The main power voltage of the processor module is +5V ±5%. +12 V is supplied via J24 connector for use by PC/104 expansion modules, but is not used in CPC304. The following table gives assignments of J24 contacts.

Table 3.25:   **J24 Power Connector Pinout**

Pin	Assignment
1	+5 V
2	GND
3	GND
4	+12 V

For making a custom power cable it is recommended to use AMP 4-171822-4 socket with 170263-1 contacts or ACS00038 accessory.

Important:

If PC/104 or PC/104-Plus expansion modules with aggregate consumption more than 4 W are used, it is not allowed to power the stack via J24 connector. In this case the stack must be powered via PC/104 connector.

Important:

For stable operation of the module (without external devices) it is recommended to use a power supply unit with maximum current not less than 3 A!

When operating the module with a HDD, consider using a power supply unit with maximum current not less than 4 A!

Important:

After switching power off do not switch it back on in less than 5 seconds!

Important:

+5V voltage build-up time of a power supply unit must be less than 10 ms.

The supplied +5V voltage is monitored during operation. If this voltage is dropped below 4.75V, the PFO interrupt is generated provided the jumper is set to position 4-6 on J28 jumper switch. The ISA interrupt line corresponding to PFO is set in BIOS Setup utility as described in Section 5.5 of this Manual.

Important:

Assigning IRQ5, IRQ10, or IRQ11 lines for use with PFO signal, make sure that these lines are not set for use by PCI or ISA devices and are not assigned to PCI devices using INT A, INT B, INT C, and INT D lines in Custom Configuration section of BIOS Setup.

3.3   Address Mapping

3.3.1   Memory Addressing

Table 3.26:   **Memory Address Mapping**

Address Range	Size	Description
00000h – 9FFFFh	640 KB	System memory
A0000h – BFFFFh	128 KB	Video memory
C0000h – C7FFFh	32 KB	Display BIOS memory or external bus memory
C8000h – DFFFFh	96 KB	External bus memory
E0000h – FFFFFh	128 KB	System BIOS area
100000h – XXXXXXXh	255 MB	Extended system memory. Higher addresses are allocated for use as video memory. Its size is set in BIOS Setup, "Custom Configuration" menu.
XXXXXXXh – FFFFFFFh		
FFFFFFFh – 10007FFFFh	512 KB	BIOS ROM

3.3.2   I/O Addressing

Table 3.27:   I/O Address Space

Address Range	Function	Note
0000h – 001Fh	DMA1	–
0020h – 0021h	PIC Master	–
0022h – 0023h	LX Configuration	–
0028h – 002Fh	Local Bus	–
0040h – 005Fh	Timer	–
0060h – 006Fh	POST, Keyboard, Shadow registers	–
0070h – 007Fh	CMOS, NMI Mask control registers	–
0080h – 009Fh	DMA Page registers	–
00A0h – 00BFh	PIC Slave	–
00C0h – 00DFh	DMA2	–
00F0h – 00FFh	Numeric coprocessor	–
0100h – 016Fh	External ISA bus	External bus access
0170h – 0177h	Reserved	No access
0180h – 01BFh	External ISA bus	External bus access
01C0h – 01DFh	External ISA bus or not available	This range is not available, when COM3 and COM4 are disabled in BIOS Setup
01E0h – 01EFh	Reserved	No access
01F0h – 01F7h	Primary IDE	–
0200h – 026Fh	External ISA bus	External bus access
0270h – 02E7h	Reserved	No access
02E8h – 02EFh	COM4	RS422/485
02F0h – 02F7h	Reserved	No access
02F8h – 02FFh	COM2	RS232
0300h – 033Fh	External ISA bus	External bus access
0340h – 035Fh	External ISA bus or not available	This range is not available, when COM3 and COM4 are disabled in BIOS Setup
0360h – 0377h	Reserved	No access
0378h – 037Fh	LPT1	–
0380h – 03AFh	Reserved	No access
03B0h – 03DFh	Video	–
03E0h – 03E7h	Not available or External ISA bus	This range is available only when COM3 and COM4 are disabled in BIOS Setup
03E8h – 03EFh	COM3 or External ISA bus	RS422/485. When COM3 and COM4 are disabled in BIOS Setup, external ISA bus access
03F0h – 03F5h	FDD Controller	–
03F6h	Reserved	No access
03F7h	FDD Controller	–
03F8h – 03FFh	COM1	RS232
0400h – FFFFh	External ISA bus	External bus access
0CF8H – 0CFFh	Host PCI controller configuration registers	–

3.3.3 Interrupt settings

By default, interrupts are generated by the devices belonging to the CPC304 module. Among the alternative interrupt generating devices are: expansion modules on ISA or PCI bus (PC/104 and PCI-104 connectors), optoisolated Reset input, PFO signal.

Table below presents interrupt settings. Interrupt request configuration is performed in BIOS Setup.

Table 3.28: **Interrupt Settings**

IRQ	Default Source	Alternative Source
IRQ0	System timer	–
IRQ1	PS/2 keyboard	–
IRQ2	8259 interrupt	–
IRQ3	COM2	IRQ3 line of external ISA bus, PFO/Opto IRQ
IRQ4	COM1	IRQ4 line of external ISA bus, PFO/Opto IRQ
IRQ5	Ethernet / USB / Audio	PC/104 (ISA), PC/104-Plus (PCI) expansion modules, PFO/Opto IRQ
IRQ6	FDD	IRQ6 line of external ISA bus, PFO/Opto IRQ
IRQ7	LPT	IRQ7 line of external ISA bus, PFO/Opto IRQ
IRQ8	RTC	PFO/Opto IRQ
IRQ9	ACPI	IRQ9 line of external ISA bus, PFO/Opto IRQ
IRQ10	Ethernet / USB / Audio	IRQ10 line of external ISA bus, PFO/Opto IRQ
IRQ11	Ethernet / USB / Audio	IRQ11 line of external ISA bus, PFO/Opto IRQ
IRQ12	PS/2 mouse	IRQ12 line of external ISA bus, PFO/Opto IRQ
IRQ13	Reserved for math. coprocessor	–
IRQ14	HDD, CompactFlash, NAND flash	PFO/Opto IRQ
IRQ15	COM3, COM4	PFO/Opto IRQ

3.3.4 DMA Channels

By default, DMA channels are assigned for use by internal units of the module. Channel 1 is used by LPT port, channel 2 – by FDD controller. A DDMA controller of IT8888G PCI-ISA bridge is used to provide access to DMA channels for external PC/104 devices. DDMA controller programming is described in Subsection 5.10.6 of this document.

3.4   Overall and Mounting Dimensions

Figure 3.16:   CPC304: Overall and Mounting Dimensions
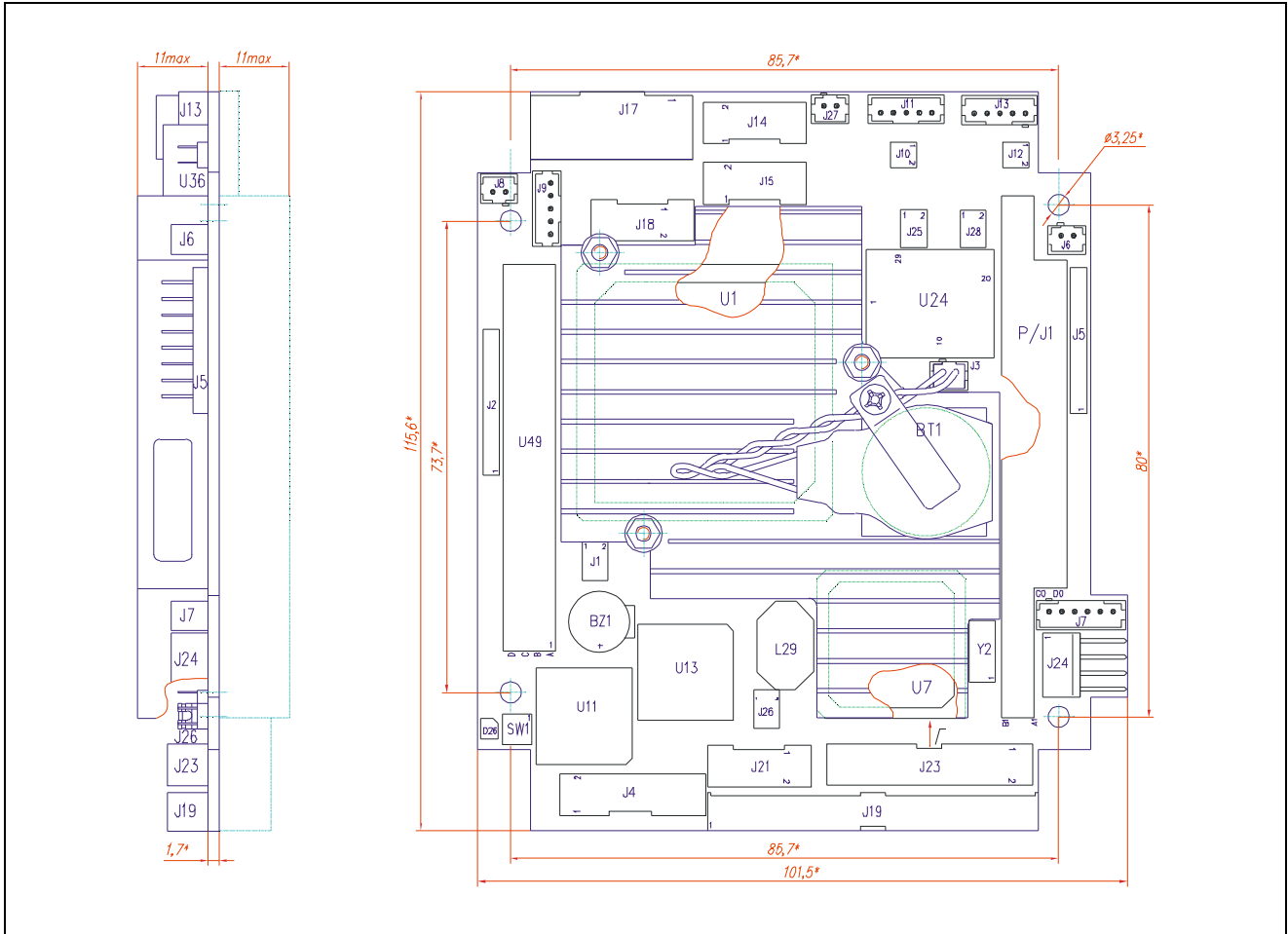
4   External Connections

The following precautions must be observed to ensure proper installation and to avoid damage to the module, other system components, or harm to personnel.

4.1   Safety Regulations

The following safety regulations must be observed when installing or operating the module. Fastwel assumes no responsibility for any damage resulting from infringement of these rules.

Warning!

When handling or operating the module, special attention should be paid to the heatsink, because it can get very hot during operation. Do not touch the heatsink when installing or removing the module.

Moreover, the module should not be placed on any surface or in any kind of package until the module and its heatsink have cooled down to ambient temperature.

ESD Sensitive Equipment!

This product comprises electrostatically sensitive components. Please follow the ESD safety instructions to ensure module's operability and reliability:

- Use grounding equipment, if working at an anti-static workbench. Otherwise, discharge yourself and the tools in use before touching the sensitive equipment.
- Try to avoid touching contacts, leads and components.

Extra caution should be taken in cold and dry weather.

4.2 Connection of Peripheral Devices

External devices are connected to CPC304 directly or via KIB380 interface expansion module.

Figure 4.1: **External Devices Connection**
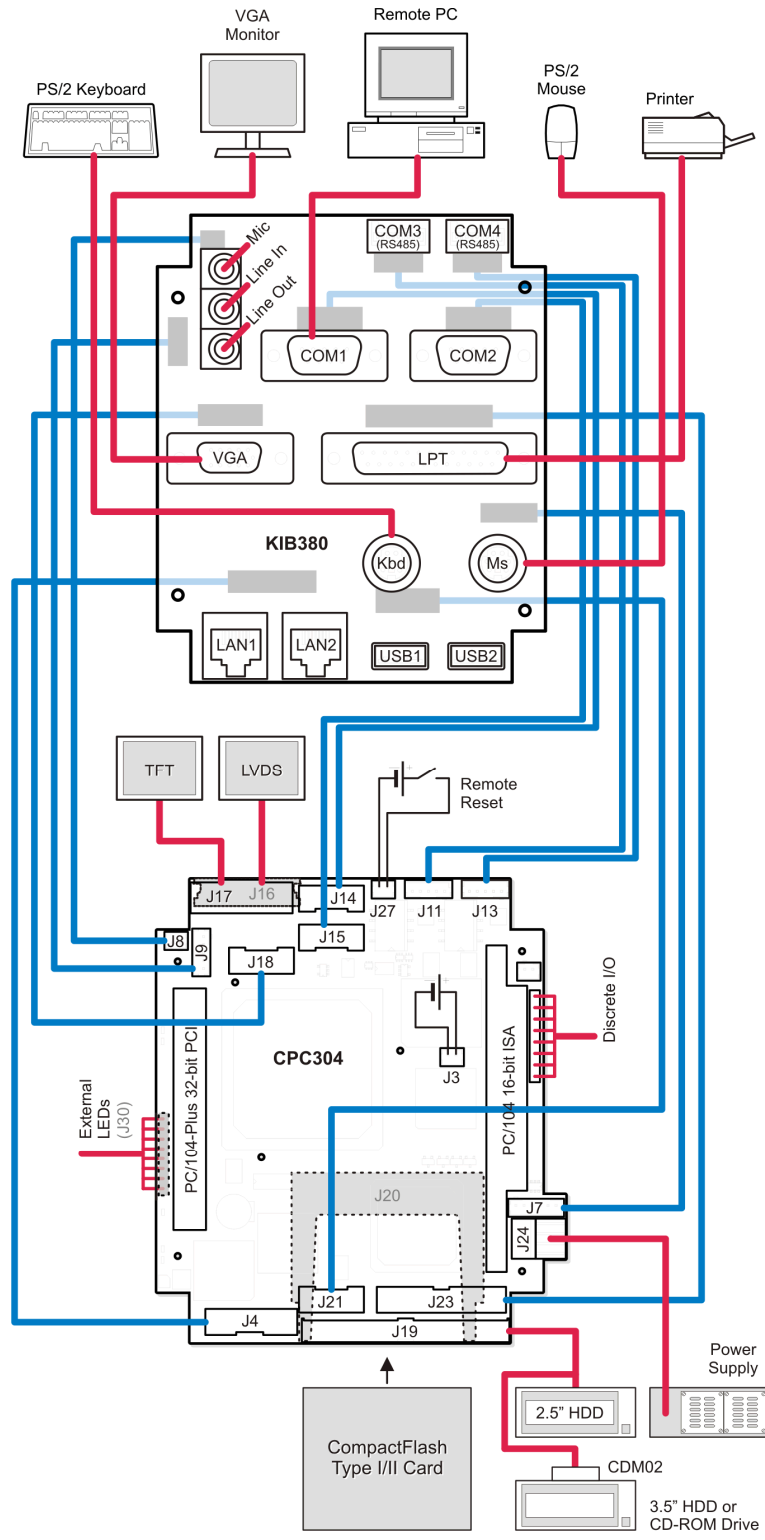
The following devices are necessary to put the module into operation:

■ PC/104 power supply connected through P/J1 and U49 headers or an external power supply unit with +5 V and not less than 3 A output connected to J24 power connector. If the module is intended for operation with PC/104 modules requiring +12 V, then this voltage should be supplied to the appropriate J24 contact. For checkout and adjustment purposes the AT or ATX power supply units are recommended (see details in Power Supply section of this document);

■ The following devices may be connected to the module to serve as a display unit:

▪ Monitor of a remote PC (console operation) connected via DB9F – IDC10 adapter cable to J14 connector or via a null-modem cable to COM1 connector of KIB380;

▪ SVGA monitor directly connected to VGA connector of KIB380 interface expansion module or to CPC304 J18 connector via adapter;

▪ TFT/DSTN panel connected to J17 connector of CPC304;

■ Y-cable allowing to connect a mouse and a keyboard to the module's J7 connector. These two devices can also be connected directly to PS/2 connectors of KIB380 expansion module.

The operating system is loaded from the on-board NAND Flash memory. Operating system on this flash-disk is FDOS supplemented with some service software utilities.

The lithium battery assembly supplied with CPC304 may be installed in a holder on the CPU heatsink to power the RTC and CMOS memory for storage of BIOS Setup parameters. However, the module can operate without the battery thanks to the fact, that system configuration parameters (except the current time and date settings) are stored in serial FRAM.

The figure below shows how cables (a null-modem cable and ACS00023 adapter cable) are connected for console operation via COM1 (J14) or COM2 (J15) ports of CPC304. The number of the serial port for console operation is assigned in BIOS Setup. To connect to a remote PC using KIB380 interface module, only the null-modem cable is needed.

Figure 4.2:   **Cables Connection for Console Operation**
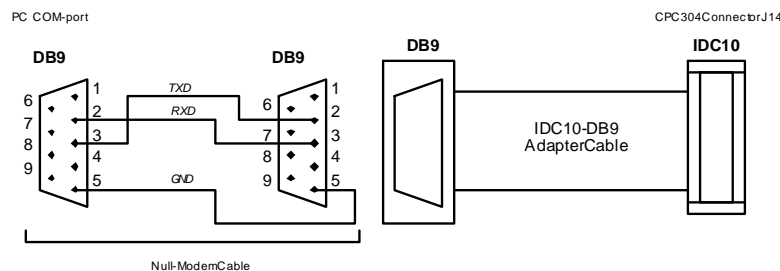
The HyperTerminal program running on the PC to support console operation should have the following settings:

Transfer rate –   115200 bit/s

Data bits –   8

Stop bits –   1

Parity check –   Off

4.2.1   CompactFlash Cards Installation

CompactFlash socket of CPC304 (J20) supports 5 V CompactFlash ATA type I/II cards. Carefully slide in the correctly oriented card and gently press to engage the contacts completely.

> **Note:**
>
> Connection of the CompactFlash cards while the power is on may damage your system.

CompactFlash socket description can be found in <u>subsection 3.2.5</u>.

4.2.2   USB Devices Connection

CPC304 can accept Plug&Play connection of USB 2.0 computer peripheral devices (printers, keyboards, mice, etc.) All USB devices may be connected or disconnected while the host power is on. Direct USB devices connection is possible via KIB380 interface expansion module.

4.2.3   Battery Replacement

The lithium battery assembly must be replaced with the battery assembly 469539.012 supplied by Fastwel.

The expected life of a 190 mAh battery is about 5 years. However, this typical value may vary because battery life depends on the operating temperature and the shutdown time of the system in which the battery is installed.

> **Note...**
>
> It is recommended to replace the battery after approximately 4 years to be sure it is operational.
>
> It is recommended to disconnect the battery if the module is not operated for a long time.

> **Important:**
>
> Replacing the battery, make sure the polarity is correct.
>
> Dispose of used batteries according to the local regulations.

4.3   Software Installation

The installation of the peripheral drivers is described in the accompanying information files. For details on installation of an operating system, please refer to the relevant software documentation.

5   General Software® BIOS

The General Software® BIOS in CPC304 is an adapted version of a standard BIOS for IBM PC AT-compatible personal computers equipped with x86 compatible processors. BIOS provides low-level support for the central processing, memory, and I/O system units. System settings can be changed using the BIOS Setup program.

5.1   BIOS Setup Program. Introduction

With the BIOS Setup program, you can modify BIOS settings and control special features of the module. The Setup program offers a convenient menu interface to modify basic system configuration settings and switching between the subsystems operation modes. These settings are stored in a dedicated battery-backed memory, CMOS RAM, that keeps the information while the power is switched off. For extra safety, the system settings are stored also in the nonvolatile serial FRAM.

5.2   Main Menu

To start the BIOS Setup program switch on the power or restart the system. By default the startup screen looks like this:

```
General Software Embedded BIOS(R) 2000 Revision 5.3
Copyright (C) 2005 General Software, Inc.  All rights reserved.
Fastwel adaptation for board CPC304. Revision 2.4.0
Copyright (C) 2006..2009 Fastwel Co., Ltd.
Hit <Del> if you want to run SETUP.
00000640K Low Memory
00228352K Ext Memory


PCI Device Table.
Bus Dev Func VendID DevID Class                Irq
 00  01  00   1022   2080  Host Bridge
 00  01  01   1022   2081  VGA Display          11
 00  01  02   1022   2082  Unknown Device       11
 00  0C  00   1283   8888  PCI Bridge
 00  0D  00   8086   1209  Ethernet             10
 00  0E  00   8086   1209  Ethernet             5
 00  0F  00   1022   2090  ISA Bridge
 00  0F  02   1022   209A  IDE Controller
 00  0F  03   1022   2093  Audio                10
 00  0F  04   1022   2094  Serial Bus           11
 00  0F  05   1022   2095  Serial Bus           11
Core CPU Frequency : 500 MHz
Memory Frequency   : 333 MHz
Node ID            : 00000000h

C:\>
```

To start BIOS Setup, press "Del" key on a keyboard after the message

```
"Hit <Del> if you want to run SETUP"
```

appeared on the screen. This will lead you to the Main Menu screen, shown in the Figure below.

⚠️ **Attention!**

In remote console mode the BIOS Setup utility is started by using «ctrl+c» combination on the keyboard of a remote PC.

Figure 5.1:   Main Menu Screen Image

```
                   System BIOS Setup – Utility v5.3
            (C) 2005 General Software, Inc. All rights reserved




                        >Basic CMOS Configuration
                         Features Configuration
                          Custom Configuration
                       CPC304 Specific Configuration
                            PnP Configuration
                          Shadow Configuration
                     Start RS232 Manufacturing Link
                     Reset CMOS to last known values
                     Reset CMOS to factory defaults
                         Write to CMOS and Exit
                       Exit without changing CMOS




             ↑/↓/<Tab> to select.   <Esc> to continue (no save)
                    www.gensw.com   www.fastwel.ru
```

The Main Menu items and their functions are described in the table below.

Table 5.1:   Main Menu Items

Menu Item	Purpose
Basic CMOS Configuration	This item lead you to the menu which allows you to setup the main system parameters, such as System date and time; Disk drives types definition and letter assignments, Boot sequence and others.
Features Configuration	This item allows to set such system features as Ultra DMA mode, ACPI support, and boot options.
Custom Configuration	This item opens a menu screen, where you can setup interrupt levels of PCI and ISA devices, select console I/O devices, set video memory size, LCD panel parameters, CPU frequency etc.
CPC304 Specific Configuration	The item specific for CPC304: COM3 and COM4 ports setup
PnP Configuration	This menu item gives you access to Plug-and-Play related IRQ and DMA settings.
Shadow Configuration	Shadow memory configuration item allows you to select BIOS extensions memory blocks to copy into RAM on module initialization.
Start RS232 Manufacturing Link	This menu item starts the service mode, which allows to explore the disk drives of the CPC304 from a remote PC using a RS232 link between the module and a remote PC (see section 5.8.1).

Menu Item	Purpose
Reset CMOS to last known values	This menu command allows you to reset the BIOS configuration parameters to the values, with which the system has switched on last time, and continue with BIOS Setup.
Reset CMOS to factory defaults	This command allows you to reset the BIOS configuration parameters to the values set by the manufacturer.
Write to CMOS and Exit	This command lets you write the configuration parameters into CMOS memory and exit BIOS Setup.
Exit without changing CMOS	This command allows you to exit the Setup program without writing any possible changes into the CMOS memory, thus keeping intact the previously saved configuration.

Use "Up" and "Down" cursor keys or <Tab> key to move between menu items. <Enter> selects the item and allows to proceed with the command or opens the submenu screen.

5.3   Basic CMOS configuration

On selection of this Main menu item the following screen is shown:

Figure 5.2:   Basic CMOS Configuration Screen Image

```
              System BIOS Setup - Basic CMOS Configuration
           (C) 2005 General Software, Inc. All rights reserved

                         IDE DRIVE GEOMETRY:        Sect  Hds  Cyls
 Date:>Feb 12, 2010      Master:        Not installed
 Time: 00 : 23 : 29      Slave:         Not installed

                         USB Hard Drive(s):   Disabled

                         Onboard Flash Disk:  Enabled
 First Boot From : C:
 F1 Error Wait   : Enabled    1st Disk (Disk C:)   IDE Master
 NumLock         : Disabled
 Typematic Rate  : 30.0 cps    Floppy Disk Drive:  Not installed
 Typematic Delay :   0.25 s

                                               Memory
                                               Base : 631KB
                                               Ext. : 219MB

     ↑/↓/←/→/<CR>/<Tab> to select  or  <PgUp>/<PgDn>/+/- to modify
                    <Esc> to return to main Menu
```

The figure shows the default parameters.

Use arrow keys, <Tab> key and <Enter> to move between items and for selection.
<PgUp>, <PgDn>, <+> or <-> are used to change the selected parameter (<Space> in console operation). <Esc> – to return to the Main Menu.

The following table presents explanations on "Basic CMOS Configuration" menu screen.

Table 5.2:   **Basic CMOS Configuration Menu Items**

Menu Item	Function
Date Time	These items allow you to set system date and time. Date format: Mmm DD, YYYY; time format: hh:mm:ss
First Boot From	Selection of disk name to boot from first. Choice set: A:, C:, CDROM:
F1 Error Wait	Enables or disables waiting for pressing of <F1> key on POST error, enabled by default

NumLock	Allows to control the numeric keypad state after boot
	         Enabled – NumLock On;
	         Disabled – NumLock Off (default)

Typematic Rate	Keyboard: autorepeat rate setting in characters per second (2...30) or disabled
Typematic Delay	Sets typematic delay of the keyboard in seconds (0.25, 0.5, 0.7, 1.0)

IDE DRIVE GEOMETRY:
  Master
  Slave
	IDE disk drive geometry selection for Primary Master (Master) and Primary Slave (Slave).
	Options:
	Not installed – disk drive not connected, default setting;
	Autoconfig, Normal – automatic geometry detection without disk parameters translation;
	Autoconfig, LBA – automatic geometry detection with translation of disk parameters into linear address;
	Autoconfig, Large – disk parameters translation using Phoenix algorithm;
	User Type – user enters custom parameters in *Sect*, *Hds*, and *Cyls* fields;
	CDROM – CDROM drive installed

USB Hard Drive(s)	Enables use of USB disks; options: 1 Drive, 2 Drives, Disabled (default)
Onboard Flash Disk	Enables or disables the onboard flash disk (1 GB, enabled by default)
1st Disk (Disk C:)	Selection of a disk drive to assign "C:" Options: IDE Master; (default) IDE Slave

Floppy Disk Drive	FDD (Floppy 0) type selection.
	Options: Not Installed – FDD is not connected (default)
	             360 KB, 5.25";
	             1.2 MB, 5.25";
	             720 KB, 3.5";
	             1.44 MB, 3.5";
	             2.88 MB, 3.5"

Memory:
  Base:
  Ext:
	Indication of Base and Extended memory size available for applications

5.4   Features Configuration

Features Configuration menu screen is shown on the following figure:

Figure 5.3:   Features Configuration Menu Screen

```
             System BIOS Setup - Custom Configuration
          (C) 2005 General Software, Inc. All rights reserved

 ACPI 1.0                    : Enabled   Advanced Power Management: Enabled
 POST Memory Manager         : Disabled  IDE UDMA                 : Enabled
 UsbMassStorage              : Enabled   Usb20                    : Disabled



















   ↑/↓/→/<CR>/<Tab> to select  or  <PgUp>/<PgDn>/+/- to modify
                <Esc> to return to main menu
```
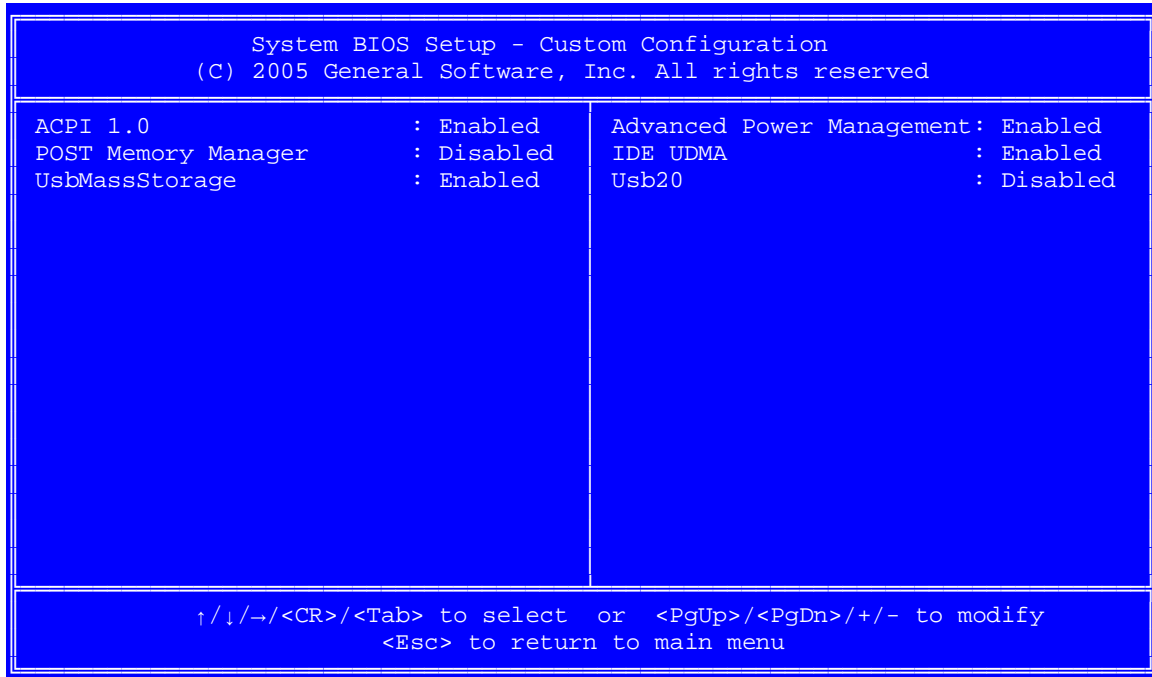
The figure shows the default settings.

Features Configuration menu items are described in the table below.

Table 5.3:   Features Configuration Menu Items

Menu Item	Options	Description
ACPI 1.0	Enabled Disabled	ACPI features support (for OS Windows, Linux). Enabled by default.
POST Memory Manager	Disabled Enabled	POST procedures skipped (default) POST enabled
USBMassStorage	Enabled Disabled	USB disk drives support, enabled by default
Advanced Power Management	Enabled Disabled	APM support (advanced power supply units management). Enabled by default.
IDE UDMA	Disabled Enabled	Enables/disables UltraDMA mode for Primary IDE channel. Disabled by default.
USB20	Enabled Disabled	USB 2.0 devices support; disabled by default.
Remember! Wrong or incorrect settings may lead to abnormal system performance. To correct possible errors, restart the BIOS Setup program and restore manufacturer's settings by selection of "Reset CMOS to factory defaults" command in Main menu.		

5.5 Custom Configuration

Custom Configuration menu screen is shown on the following figure:

Figure 5.4: **Custom Configuration Menu Screen**

```
        System BIOS Setup - Custom Configuration
       (C) 2005 General Software, Inc. All rights reserved

 Primary video device  : Auto       PCI INT A Assignment  : Auto
 Geode LX graphics      : 32 MB      PCI INT B Assignment  : Auto
 Video device mode      : Disabled   PCI INT C Assignment  : Auto
 Video refresh rate     : 60 Hz      PCI INT D Assignment  : Auto
 Horizontal sync        : positive   PFO/OPTO -> IRQ#       : Disabled
 Vertical sync          : positive   LPT Mode              : ECP & EPP 1.7
 Video panel type       : TFT        IRQ3                  : COM2
 Console Input          : COM+KBD    IRQ4                  : COM1
 Console Output         : COM+VGA    IRQ5                  : PCI
 Console/MFG Port       : COM1       IRQ6                  : FDC
 IDE UDMA5              : Disabled   IRQ7                  : LPT
 Legacy USB support     : Enabled    IRQ9                  : ACPI
 CPU/GLIU speed         : 500/333 MHz IRQ10                : PCI
 LPT/FDC                : Disabled   IRQ11                 : PCI
 Periodic SMI           : non-maskable IRQ12               : PS2 Mouse
 Periodic SMI Period    : 55 ms      IRQ14                 : IDE
 COM3 & COM4            : Enabled    IRQ15                 : COM3/COM4

    ↑/↓/→/<CR>/<Tab> to select  or  <PgUp>/<PgDn>/+/- to modify
                  <Esc> to return to main menu
```

The figure shows the default settings.

Custom Configuration menu items are described in the table below.

Table 5.4: **Custom Configuration Menu Items**

Menu Item	Options	Description
Primary video device	Auto LX Graphics PCI VGA Card None	In absence of an external graphics controller, the internal one is selected Internal graphics controller enabled External PCI graphics enabled No graphics controller enabled; graphics memory is released for use by system
Geode LX Graphics	4...60, Disabled	System memory size intended for use by CPU graphics core, MB; 32 MB is the default setting; CPU graphics subsystem is switched off (0 MB used)
Video device mode	Disabled 320x240, 640x480, 800x600, 1024x768	LCD panel is not used (default); Resolution of the LCD panel in use.
Video refresh rate	60, 70, 75, 85, 100	LCD panel video refresh rate, Hz
Horizontal sync	Positive Negative	Horizontal synchronization polarity; positive by default

Menu Item	Options	Description
Vertical sync	Positive Negative	Vertical synchronization polarity; positive by default
Video panel type	TFT, LVDS	LCD panel interface
Console Input	COM KBD COM+KBD	Console input (INT 16h BIOS) options: Input via COM port; the number of COM port is selected in «Custom Configuration» > «Console/MFG Port» Input via keyboard port; Input via keyboard port and COM-port (default). Terminal settings should be: 115200, n, 8, 1
Console Output	COM VGA COM+VGA	Console output (INT 10h BIOS) options: Output to COM; the number of COM port is selected in «Custom Configuration» > «Console/MFG Port» Output to video-controller; Output to COM and video-controller (default). Transmission parameters: 115200, n, 8, 1
Console/MFG Port	COM1, COM2	Serial port number selection for operation in the console or Manufacturing Link modes. COM1 is the default port.
IDE UDMA5	Enabled, Disabled	UDMA5 mode support; disabled by default.
Legacy USB support	Enabled, Disabled, Auto	Legacy USB devices support, enabled by default (support for USB keyboards and mice).
CPU/GLIU speed	300/266, 333/333, 400/266, 400/333, 500/333	CPU/system memory clock speed in MHz; 500/333 MHz – default.
LPT/FDC	LPT FDC Disabled	J23 connector operation mode: LPT – parallel port, FDC – for connection of a floppy disk drive. When "Disabled" is selected (default), the assigned interrupt lines can be used by other devices.
Periodic SMIs	Non-maskable, Maskable	Periodic SMI requests type; "Non-maskable" by default.
Periodic SMI Interval	55, 110, 220, 440, 880, 1760	Periodic SMI requests interval in ms; 55 ms by default
COM3 & COM4	Enabled, Disabled	COM3 and COM4 serial ports control. Enabled – default setting. ⚠ For BIOS version 1.2 it is necessary to disable COM3 and COM4 ports when using the operating systems with ACPI support (Windows, Linux).
PCI INT A Assignment, PCI INT B Assignment, PCI INT C Assignment, PCI INT D Assignment	Auto, IRQ5, IRQ10 IRQ11	Interrupt assignment for PCI devices using INT A, INT B, INT C, and INT D lines: Automatic interrupt assignment (default), IRQ5, IRQ10, or IRQ11

Menu Item	Options	Description
PFO/OPTO -> IRQ#	Disabled IRQ3, IRQ4, IRQ5, IRQ6, IRQ7, IRQ8, IRQ9, IRQ10, IRQ11, IRQ12, IRQ13, IRQ14, IRQ15	The interrupt at a selected line is generated upon PFO signal, as well as on optoisolated remote reset input. Disabled by default.
LPT Mode	ECP & EPP 1.7 ECP & EPP 1.9 ECP EPP 1.7 & SPP EPP 1.9 & SPP SPP (bi-dir), Standard	LPT port operation mode; ECP & EPP 1.7 – default.
IRQ3	COM2, ISA IRQ3	IRQ3 interrupt source selection; COM2 – default
IRQ4	COM1, ISA IRQ4	IRQ4 interrupt source selection; COM1 – default
IRQ5	PCI ISA IRQ5	IRQ5 interrupt source selection; PCI device – default
IRQ6	FDC ISA IRQ6	IRQ6 interrupt source selection; floppy disk controller – default
IRQ7	LPT, ISA IRQ7	IRQ7 interrupt source selection; LPT port – default
IRQ9	ACPI ISA IRQ9	IRQ9 interrupt source selection; ACPI controller – default
IRQ10	PCI ISA IRQ10	IRQ10 interrupt source selection; PCI device – default
IRQ11	PCI ISA IRQ11	IRQ11 interrupt source selection; PCI device – default
IRQ12	PS2 Mouse ISA IRQ12	IRQ12 interrupt source selection; PS/2 mouse – default
IRQ14	IDE ISA IRQ14	IRQ14 interrupt source selection; IDE controller – default
IRQ15	COM3/COM4 OPTO IRQ	IRQ15 interrupt source selection; COM3, COM4 ports – default Reserved for optoisolated Reset input

Remember! Wrong or incorrect settings may lead to abnormal system performance.
To correct possible errors, restart the BIOS Setup program and restore manufacturer's settings
by selection of "Reset CMOS to factory defaults" command in the Main menu.

5.6   CPC304 Specific Configuration

This BIOS Setup section contains only one item – «RS485 Default» – allowing to set data transfer direction for COM3 and COM4 RS485/422 ports enabled at startup.

Table 5.5:   CPC304 Specific Configuration Menu Item

Menu Item	Options	Description
RS485 Default	Transmit	Default setting. Transmitters of COM3 and COM4 ports are enabled at startup; this is used for full-duplex connection or for operation in RS422 mode.
	Receive	This setting disables transmitters of COM3 and COM4 ports; the ports are set to receive data at startup. This is used for half-duplex connection to the RS485 multiuser network.

5.7   PnP Configuration

This BIOS Setup section provides access to Plug-and-Play related IRQ and DMA assignments. The menu screen is shown in the figure below.

Figure 5.5:   Plug-n-Play Configuration Menu Screen Image

```
              System BIOS Setup - Plug-n-Play Configuration
          (C) 2005 General Software, Inc. All rights reserved

 Enable PnP Support        :>Enabled     Enable PnP O/S           : Enabled

 Assign IRQ0 to PnP        : Disabled    Assign IRQ8 to PnP       : Disabled
 Assign IRQ1 to PnP        : Enabled     Assign IRQ9 to PnP       : Disabled
 Assign IRQ2 to PnP        : Enabled     Assign IRQ10 to PnP      : Disabled
 Assign IRQ3 to PnP        : Enabled     Assign IRQ11 to PnP      : Enabled
 Assign IRQ4 to PnP        : Disabled    Assign IRQ12 to PnP      : Enabled
 Assign IRQ5 to PnP        : Enabled     Assign IRQ13 to PnP      : Enabled
 Assign IRQ6 to PnP        : Disabled    Assign IRQ14 to PnP      : Enabled
 Assign IRQ7 to PnP        : Disabled    Assign IRQ15 to PnP      : Enabled

 Assign DMA0 to PnP        : Disabled    Assign DMA4 to PnP       : Enabled
 Assign DMA1 to PnP        : Disabled    Assign DMA5 to PnP       : Enabled
 Assign DMA2 to PnP        : Disabled    Assign DMA6 to PnP       : Disabled
 Assign DMA3 to PnP        : Enabled     Assign DMA7 to PnP       : Enabled



     ↑/↓/→/<CR>/<Tab> to select  or  <PgUp>/<PgDn>/+/- to modify
                    <Esc> to return to main menu
```

The figure shows the default settings.

All items allow to choose between the two options – "Enabled" or "Disabled". Use arrow keys, <Tab> key and <Enter> to move between items and for selection. <PgUp>, <PgDn>, <+> or <-> are used to change the selected parameter, <Esc> – to return to the Main Menu.

5.8　　　Shadow Configuration

The figure below presents the Shadow Configuration menu screen.

Figure 5.6:　　　　**Shadow Configuration Menu Screen Image**

```
           System BIOS Setup - Shadow/Cache Configuration
              (C) 2003 General Software, Inc. All rights reserved

Shadowing              : Chipset   Shadow 16KB ROM at C000 : Enabled
Shadow 16KB ROM at C400 : Enabled   Shadow 16KB ROM at C800 : Disabled
Shadow 16KB ROM at CC00 : Disabled  Shadow 16KB ROM at D000 : Disabled
Shadow 16KB ROM at D400 : Disabled  Shadow 16KB ROM at D800 : Disabled
Shadow 16KB ROM at DC00 : Disabled  Shadow 16KB ROM at E000 : Enabled
Shadow 16KB ROM at E400 : Enabled   Shadow 16KB ROM at E800 : Enabled
Shadow 16KB ROM at EC00 : Enabled   Shadow 16KB ROM at F000 : Enabled




        ↑/↓/→/<CR>/<Tab> to select  or  <PgUp>/<PgDn>/+/- to modify
                     <Esc> to return to main menu
```
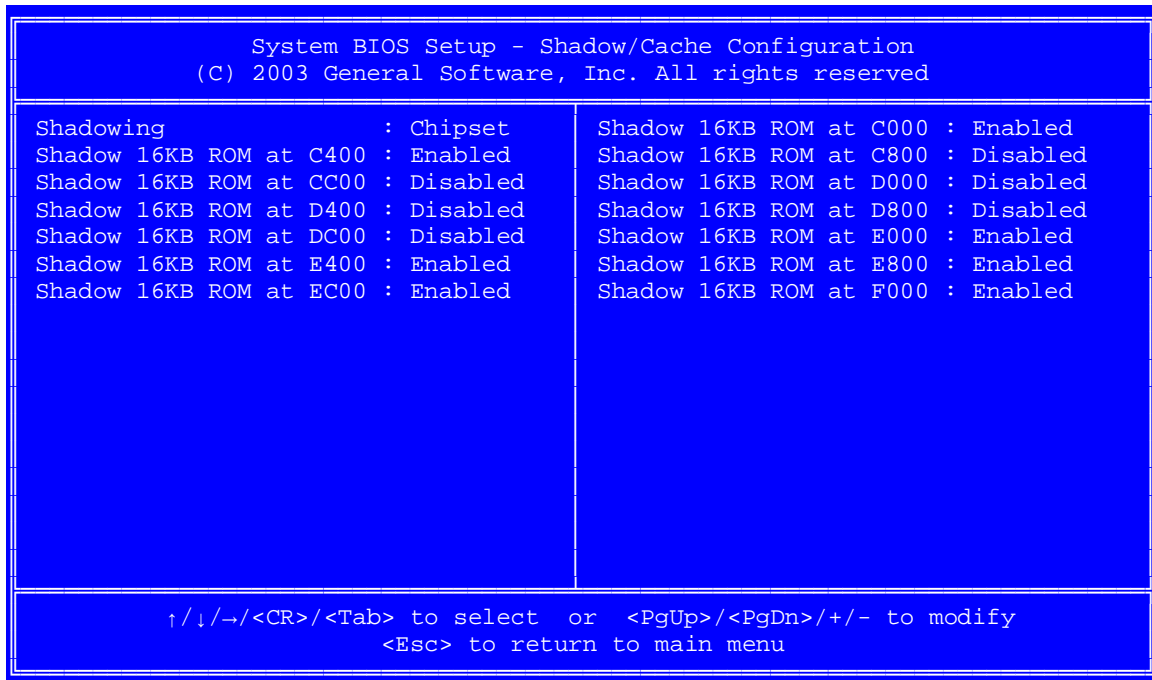
The figure shows the default settings.

The «Shadowing» parameter can be either «Chipset» or «None». All other items allow to choose between the two options – "Enabled" or "Disabled". Use arrow keys, <Tab> key and <Enter> to move between items and for selection. <PgUp>, <PgDn>, <+> or <-> are used to change the selected parameter, <Esc> – to return to the Main Menu.

If "Enabled" is selected, Shadow Configuration menu items allow to copy BIOSes of extension modules into operating memory by 16 KB blocks on initialization of the processor module.

5.9　　　The Rest Main Menu Commands

5.9.1　　　Start RS232 Manufacturing Link

Manufacturing Link mode allows to modify the flash-based BIOS of the CPC304 module (with *fwflash.exe* or *fwflash_win.exe* utility) or to exchange files between the module and a remote PC via RS232 link. To exchange files the driver *remdisk.sys* should be loaded into PC memory, it is described in section 6.4 of this document; *fwflash.exe* and *fwflash_win.exe* utilities operation is described in section 6.3. The COM port number for operations in Manufacturing Link mode is set by «Console/MFG Port» parameter in «Custom Configuration» (see section 5.5 of this Manual).

5.9.2   Reset CMOS to Last Known Values

If you changed your mind and decided not to write the changes you have made in BIOS Setup program and have not yet saved the values in CMOS memory, you may select this command to return to the last saved parameters (i.e. to those with which the system was successfully booted last time) and continue with BIOS Setup.

On selection of this command the following message appears:

```
Reset CMOS to last known values? (Y/N):
```

Pressing "Y" resets the parameters in CMOS memory and returns you to the Main menu, "N" – returns you to the Main menu without making any changes.

5.9.3   Reset CMOS to Factory Defaults

To reset the BIOS parameters to the values defined by the manufacturer, select this Main menu command. The program responds with this message:

```
Reset CMOS to factory defaults? (Y/N):
```

Pressing "Y" resets the values stored in CMOS to the factory defaults and returns you to the Main menu, "N" returns you to the Main menu without changing anything.

5.9.4   Write to CMOS and Exit

After making your changes on the BIOS Setup menus, always select "Write to CMOS and Exit" to store the selections displayed in the menus in CMOS (short for "battery-backed CMOS RAM"), a special section of nonvolatile memory that stays on after you power down your system. The next time you boot your computer, the BIOS configures your system according to the Setup parameters stored in CMOS memory.

On selection of this Main menu command, the program displays this message:

```
Save Changes and Exit? (Y/N):
```

If you choose "Y", the program saves the BIOS Setup parameters to CMOS, exits BIOS Setup and reboots the system. "N" returns you to the Main menu without making any changes.

During boot up, General Software® BIOS attempts to load and use the values stored in CMOS. If system does not boot with those values, reboot and press <Del> to enter BIOS Setup. In Setup, you can try to change the parameters that caused the boot failure or get the Factory Default Values.

5.9.5   Exit without Changing CMOS

Use this option to exit Setup without storing in CMOS any changes you may have made. The previous parameters remain in effect.

The program displays this message:

```
Exit Without Saving Changes? (Y/N):
```

"Y" confirms exiting without saving any changes, closes Setup and reboots the system, "N" – returns you to the Main menu without making any changes.

5.10   Extended BIOS Functions

5.10.1   ADM706T Supervisor Chip-Based Watchdog Timer Control

WDT1 is a watchdog timer with fixed timeout period of 1.6 s; it is a part of the ADM706T (U63) Supervisor IC. After completion of POST (Power On Self Test) WD1 watchdog timer is disabled. User can control this WDT in one of the two ways:

- Using INT 17h BIOS extension;
- Using GPIO port lines of the SuperIO W83627HG (U15). Setting the GPIO22 line to "1" enables WDT1, "0" – disables it; GPIO30 line is used for strobing.

Attention!

For correct programming of the WDT1 watchdog timer and SuperIO GPIO port lines, please, refer to the SuperIO datasheet (*W83627.pdf*) on the CD supplied with the module.

5.10.1.1   Using INT 17H BIOS Extension to Control the Watchdog Timer

	Input/Output	Assembler Code

WDT enable	Input: AH FDh
	            AL 01h
	            DX FFFFh
	Output: No
		mov ax, 0FD01h
		mov dx, 0FFFFh
		int 17h

WDT disable	Input: AH FDh
	            AL 03h
	            DX FFFFh
	Output: No
		mov ax, 0FD03h
		mov dx, 0FFFFh
		int 17h

WDT strobing	Input: AH FDh
	            AL 02h
	            DX FFFFh
	Output: No
		mov ax, 0FD02h
		mov dx, 0FFFFh
		int 17h

5.10.2   SMI Control

It is possible to temporarily disable SMI, for example, for manipulations with precise timing diagrams. User can control SMI using INT 17h BIOS extension.

	Input/Output	Assembler Code

SMI disable	Input: AX D000h
	           DX FFFFh
	Output: No
		mov ax, 0D000h
		mov dx, 0FFFFh
		int 17h

SMI enable	Input: AX D001h
	           DX FFFFh
	Output: No
		mov ax, 0D001h
		mov dx, 0FFFFh
		int 17h

5.10.3   FRAM Memory Access

User applications can access free FRAM cells using INT 17h BIOS extension. FRAM volume available to user programs is 7 KB.

To read, the following input parameters should be set:

> ah = 0;
>
> bx = Address (offset) in FRAM area available to user application (0…1BFFh);
>
> cx = The number of bytes to read;
>
> dx = 4657h ('FW');
>
> es:[di] = The buffer for the read data.

To write, set the following input parameters:

> ah = 1;
>
> bx = Address (offset) in FRAM area available to user application (0…1BFFh);
>
> cx = The number of bytes to write;
>
> dx = 4657h ('FW');
>
> ds:[si] = The buffer for the data to write.

On operation completion the functions return the result in C flag (CF):

> NC = OK, CY = Error.

5.10.4   User LEDs Control

LED1 (D11) and LED2 (D12) user LEDs are switched on and off by setting the appropriate W83627HG SuperIO GPIO line to logical 0 or 1 respectively:

User LED	GPIO Line	On	Off
LED1	GPIO23	0	1
LED2	GPIO35	0	1

Attention!

For correct programming of the SuperIO GPIO port lines, please, refer to the SuperIO datasheet (*W83627.pdf*) on the CD supplied with the module.

5.10.5   RS 422/485 Transmitters Control (Ports COM3, COM4)

Ports COM3 and COM4 RS 422/485 transmitters are controlled via GPIO5 and GPIO6 channels of CS5536 companion. To switch RS 422/485 transmitters on and off it is necessary to set these channels to logical "1" or "0" respectively.

Please, find below the GPIO control functions program code fragments (Borland C 3.1 MS DOS).

```
//Function: void gpio_low_out_en(BYTE gpio_num)
//Purpose: Sets the given GPIO to output mode
//Parameters: gpio_num – GPIO number
//----------------------------------------------------------------
void gpio_low_out_en(BYTE gpio_num)
{
  DWORD val;
  val = inpd(gpio_ba+4);
  val|=(((DWORD)1)<<gpio_num);
  val&=(~(((DWORD)1)<<(gpio_num+16)));
  outpd(gpio_ba+4,val);
}

//Function: void gpio_low_set_value(BYTE gpio_num,BOOL value)
//Purpose: Switches GPIO with specified number on/off
//Parameters:  gpio_num - GPIO number
//----------------------------------------------------------------
void gpio_low_set_value(BYTE gpio_num,BOOL value)
{
  DWORD val;
  val = inpd(gpio_ba);
  if(value)
  {
    val|=(((DWORD)1)<<gpio_num);
    val&=(~(((DWORD)1)<<(gpio_num+16)));
  }
  else
  {
    val&=(~(((DWORD)1)<<gpio_num));
    val|=(((DWORD)1)<<(gpio_num+16));
  }
  outpd(gpio_ba,val);
}
```

For the above program code samples, the parameter `gpio_ba` should be described this way: `UINT gpio_ba=0xF000` (for BIOS v.1.2) or `UINT gpio_ba=0xEC00` (for BIOS v.3.4.0 and above).

Attention!

When developing applications that use COM3 and COM4 ports, remember, that these ports use 03E8h and 02E8h addresses respectively and IRQ15 interrupt.

5.10.6　　Programming of DDMA Controller of IT8888G Bridge

IT8888G PCI-to-ISA bridge integrates two four-channel DMA controllers (8237) to provide 7 independent DMA channels, since channel 4 is used for cascading. Each channel has its own base address and can be enabled or disabled separately. When programming DDMA, in certain cases it is implied that commands relate to 4-channel group like in 8237 controller. The DDMA channels 0-3 are fixed at 8-bit transfer width, and channels 5-7 are fixed at 16-bit transfer width. Channels 0-3 are function of the first controller, channels 5-7 are function of the second controller. In CPC304 only 5 DDMA channels are available: 0, 1, 3, 5, 7.

On initialization for each DDMA channel a base address is assigned.

Table 5.6:　　　**CPC304 DDMA Channels Base Addresses**

Channel	Base Address
0	2000h
1	2100h
3	2300h
5	2500h
7	2700h

Each channel has 16 registers – 8 data registers (A3=0) and 8 control registers (A3=1).

The following table describes the data registers of the DDMA controller.

Table 5.7:　　　**DDMA Controller Data Registers**

Offset	Data Register
+0	Base address / Current address, A7:A0
+1	Base address / Current address, A15:A8
+2	Base address / Current address, A23:A16
+3	Base address / Current address, A31:A24
+4	Word counter, D7:D0
+5	Word counter, D15:D8
+6	Word counter, D23:D16

Possibility to use the upper byte of an address and a counter is set by a bit in configuration register for each channel.

8237 controller has 16-bit data registers, so to access them two consecutive input/output operations are needed. First operation moves the lower byte of the value. Though DDMA controller allows to access each byte in these registers at separate addresses, there is still possibility to write in Legacy DMA style. The high/low switch is reset to initial state by writing to register with 0Ch offset, like in 8237, although the ITE documentation states that write operation is ignored. Like in 8237, the switch affects all channels of the controller, and changes its value both on writing to or on reading from the register. Thus, reading the register right after writing to it returns the next byte, but not the written value.

DDMA control registers addressing in IT8888G is similar to the one of 8237, but some registers are not used. Also, there are some differences in interpreting bit fields due to DMA channels sharing.

> **Attention!**
>
> The command register (offset +8) allows to change the controller settings, although the ITE documentation states that the value necessary for normal operation is hardware fixed.
>
> In this connection, writing to this register is not recommended.

Reading is allowed only from state register (+8) and from mask register (+0Fh), but for DDMA the state is read individually for each channel. To get the 'request' flag and 'terminal count' flag for all channels, it is possible to use the same mask (00010001b). The channel mask can be received from the lower bit.

To write to request registers (+9) and to mode registers (+0Bh) the register format of 8237 is used, but the values in bits 0 and 1 (channel number) are ignored.

When writing to the mask register (+0Fh), the value should be written to bit 0, not to bit 2 as it is done for 8237.

External, with respect to 8237, address page registers are used in Legacy DMA for programming of A23:A16 address digits. Page addresses are presented in the following page.

Table 5.8:   **Legacy DMA Page Register Addresses**

Legacy DMA Channel	Page Register Address
0	87h
1	83h
2	81h
3	82h
4	8Bh
5	89h
6	8Ah
7	87h

In DDMA, high address bits registers having offset +2 for each channel correspond to them, but these registers have 16-bit width.

DDMA controller programming virtually does not differ from 8237 programming.

For a IBM PC legacy DMA controller the following register addresses are defined:

```
    DMA_COMMAND     EQU     008h    ; Command register
    DMA_CLEAR       EQU     00Dh    ; Clear register (Master Clear)
    DMA_REQUEST     EQU     009h    ; Request register
    DMA_MASK        EQU     00Ah    ; Channel mask register (Single Mask)
    DMA_MODE        EQU     00Bh    ; Mode register
    DMA_FF          EQU     00Ch    ; High/low switch register
```

Let's take DMA#2 channel (floppy disk drive) as a sample:

```
    DMA2ADR         EQU     04h     ; DMA#2 channel current address register
    DMA2CNT         EQU     05h     ; DMA#2 channel counter register
    DMAPG2          EQU     81h     ; DMA#2 page register
    DMARST          EQU     00h     ; Mask or request reset command
    DMACH2          EQU     02h     ; Channel bits for reset command
```

Legacy DMA controller programming for reading from FDD (data preparation and other transformations omitted):

```
mov      AL,46h            ; DMA reading mode
mov      DX,DMA_MODE       ; DMA controller mode register
out      DX,AL

; Set counter for bytes read from AX

mov      DX,DMA_FF         ; High/low switch register
out      DX,AL             ; Clear high/low switch
IODELAY                    ; Delay for bus recovery

mov      DX,DMA2CNT        ; DMA#2 channel counter register
out      DX,AL             ; Set lower byte of the counter
IODELAY                    ; Delay for bus recovery

xchg     AL,AH             ; Higher byte of the counter to AL
out      DX,AL             ; Set the higher byte of the counter
IODELAY                    ; Delay for bus recovery

; Set 0-23 address bits from CL:BX

mov      DX,DMA2ADR        ; DMA#2 channel buffer address register
mov      AL,BL             ; Put lower address bits to AL
out      DX,AL             ; Set lower address byte
IODELAY                    ; Delay for bus recovery

mov      AL,BH             ; Put 8-15 address bits to AL
out      DX,AL             ; Set middle address byte
IODELAY                    ; Delay for bus recovery

mov      AL,CL             ; Put 16-23 address bits to AL
mov      DX,DMAPG2         ; Channel 2 page register address
out      DX,AL             ; Set higher address byte
IODELAY

; Enable DMA request for FDD

mov      DX,DMA_MASK       ; Channel mask register
mov      AL,DMARST+DMACH2  ; Reset mask command for DMA#2 channel
out      DX,AL             ; Enable DMA request
```

`IODELAY` is a macro providing pause for bus recovery by slow 8237 controller.

This code with minimal changes can be used for programming DDMA. For example, channel DDMA3.

It is necessary to replace the registers' addresses of Legacy DMA by the default addresses of DDMA3 channel:

```
DMA_COMMAND    EQU 02308h  ; Command register
DMA_CLEAR      EQU 0230Dh  ; Clear register (Master Clear)
DMA_REQUEST    EQU 02309h  ; Request register
; DMA_MASK     EQU 0230Ah  ; Channel mask register – not used
DMA_MODE       EQU 0230Bh  ; Mode register
DMA_FF         EQU 0230Ch  ; High/low switch register
DMA_MULTIMASK  EQU 0230Fh  ; Mask register for all channels (Multimask)
```

The data registers' addresses are changed compared to Legacy DMA, and page registers are linked to the registers of DDMA channel.

```
DMA3ADR         EQU 02300h   ; DMA#3 channel current address register
DMA3CNT         EQU 02304h   ; DMA#3 channel counter register
DMAPG2          EQU 02302h   ; Page register of DMA#3
```

After replacement of addresses, the DDMA programming for reading differs only in the DMA request enabling procedure:

```
; Enable DMA3 request

mov        DX,DMA_MULTIMASK  ; Mask register
mov        AL,0              ; Reset mask command
out        DX,AL             ; Enable DMA request
```

According to the IT8888G bridge documentation, the channel mask register is not used; instead of it, it is recommended to use Multimask register for all channels writing 0 or 1 to it the same way as for channel 0.

DDMA controller allows to simplify programming of channel registers by writing words to data registers.

Besides, 32-bit addressing is allowed:

```
mov        AL,46h           ; DMA reading mode
mov        DX,DMA_MODE      ; DMA controller mode register
out        DX,AL

; Set counter for bytes read from AX

mov        DX,DMA3CNT       ; DMA#3 channel counter register
out        DX,AX            ; Set the value of the counter

; Set 0-31 address bits from из CX:BX

mov        DX,DMA3ADR       ; Buffer address register for DMA#3 channel
mov        AX,BX            ; Put lower address bits to AX
out        DX,AX            ; Set lower address word
mov        AX,BX            ; Put 16-31 address bits to AX
mov        DX,DMAPG3        ; Channel 3 page register address
out        DX,AL            ; Set higher address word

; Enable DMA request

mov        DX,DMA_MULTIMASK  ; Mask register
mov        AL,0              ; Reset mask command
out        DX,AL             ; Enable DMA request
```

In DDMA controller programming, an additional pause for bus recovery after input/output operations is not required.

6   Basic Software

6.1   Supplied Software

The module is supplied ready for operation with the pre-installed FDOS 6.22 operating system compatible with MS DOS 6.22. FDOS and some service utilities (FWFLASH, for example) are located at the on-board flash-disk.

To use the module with other operating systems, the appropriate drivers should be installed. The CD supplied with the module contains necessary service software utilities (such as CMOS_RST, FWFLASH) and drivers (remdisk.sys and others) including the drivers necessary to run the supported operating systems.

6.2   Reset CMOS to Factory Defaults from a Remote PC

If current BIOS parameters do not provide normal operation of the module, and the BIOS Setup program can not be started to change incorrect settings, use CMOS_RST (`cmos_rst.com`) software utility, which allows to reset the BIOS setup parameters stored in CMOS memory to factory defaults from a remote PC. To do so, follow the procedure below.

1. Connect COM1 port (J14) of the switched off CPC304 to a PC COM port with a null-modem cable and ACS00023 (685611.082) adapter cable;

2. Start `cmos_rst.com` on a remote PC using MS DOS with the parameter:

   `CMOS_RST.COM COM2`

   where COM2 is a name of a PC COM port, to which the module is connected. The following message is displayed on the PC monitor:

   ```
   Remote CMOS Reset  Version 2.1  Copyright (C) 2000, 2005 Fastwel Inc.
   sending "reset" sequence through COM2. press a key to abort ;
   ```

3. Switch on the module. The remote PC monitor should display the following message:

   `"Reset acknowledged"`

BIOS Setup parameters are now reset to factory defaults. Now you can start BIOS Setup utility on the module to make necessary settings.

On a supplied CD v. 1.4 and above there is also a utility `cmos_rst.exe` operating under Windows XP. This utility is started from the command prompt window. The startup parameters are the same as for `cmos_rst.com`.

6.3   BIOS Upgrade

The CPC304 has two Flash BIOS chips with storage capacity of 512 KB each. The main (working) copy of BIOS occupies 512 KB on a chip in PLCC32 panel. Reserve BIOS copy is stored on a soldered chip and is used for emergency boot. It is possible to upgrade the main and reserve copies of BIOS in-system. This can be done with the help of `fwflash.exe` or `fwflash_win.exe` utility programs supplied on CD.

`fwflash.exe` operates on the module under MS-DOS or FDOS only.

To modify the main BIOS copy, run this utility with a parameter:

> `fwflash.exe biosXXX.bin`
>
>> where   `biosXXX.bin` – BIOS binary image file name.

and wait for "`Mission complete`" message.

To modify the reserve BIOS copy, run this utility with an additional parameter "`reserve`":

> `fwflash.exe biosXXX.bin reserve`
>
>> where   `biosXXX.bin` – BIOS binary image file name.

and wait for "`Mission complete`" message.

BIOS can be upgraded via RS232 (COM1, COM2) serial port in console operation mode with the help of `fwflash_win.exe` utility started on a remote PC running Windows XP operating system. To do this:

- ■ Connect, for example, COM1 port (J14) of the module and a COM port of a remote PC with null-modem cable and ACS00023 (685611.082) adapter cable;
- ■ In BIOS Setup enable the RS232 Manufacturing Link mode on the module; make sure that in "Custom configuration Menu" COM port, to which remote PC is connected, is selected. "Manufacturing Mode entered, Keyboard Frozen" message should appear.
- ■ On a remote PC running Windows XP select Start->Run...

- ■ Run `cmd` to open the command prompt window.
- ■ Run `fwflash_win.exe` utility from the command prompt at a remote PC with the following parameters:

> `fwflash_win.exe FILENAME=biosXXX.bin COM=1`
>
>> where   `biosXXX.bin` – BIOS binary image file name
>>
>> `1` – PC COM port number (COM1)

It is necessary to observe the case. The files `biosXXX.bin` and `fwflash_win.exe` should be located in the same folder with the BIOS binary image file, preferably in the root folder.

The screen of the remote PC should display the following messages:

```
Fastwel Flash Writer  Version 1.1 Copyright (C) 2000..2007 Fastwel Co., Ltd.
Updates Flash BIOS and/or Node ID on CPU686 series module.

Trying switch on manufacturing mode... Manufacturing mode OK
Segment address 0xfff80000:
Sending...OK
Erasing...OK
Writing...OK
Segment address 0xfff90000:
Sending...OK
Erasing...OK
Writing...OK
Segment address 0xfffa0000:
Sending...OK
Erasing...OK
Writing...OK
Segment address 0xfffb0000:
Sending...OK
Erasing...OK
Writing...OK
Segment address 0xfffc0000:
Sending...OK
Erasing...OK
Writing...OK
Segment address 0xfffd0000:
Sending...OK
Erasing...OK
Writing...OK
Segment address 0xfffe0000:
Sending...OK
Erasing...OK
Writing...OK
Segment address 0xffff0000:
Sending...OK
Erasing...OK
Writing...OK
```

If you see the command line, the BIOS is successfully upgraded. Reboot to enable the upgraded BIOS copy.

The Copy2Res.com utility is used for copying BIOS from the main storage to Reserve. To do so, run this utility under MS-DOS or FDOS on the module and wait for the command line. If no error messages appeared, the Reserve BIOS is modified correctly.

Note!

fwflash.exe is a software utility operating under MS DOS or FDOS only. fwflash_win.exe is run only from the command line of Windows XP.

Important!

If an error message appears during or after the BIOS upgrade, run `fwflash.exe` or `fwflash_win.exe` utility once again with the module power switched on. Do not switch the power off!

It is possible to abort operation of `fwflash.exe` or `fwflash_win.exe` by pressing <Esc> at a PC keyboard only before the first BIOS file segment (64 KB) is transmitted.

Important!

If the module is operated with different BIOS versions in the main and the reserve storage, BIOS Setup parameters can be possibly reset to factory defaults when switching between the main and the reserve BIOS copies. To avoid this, it is necessary to have identical BIOS versions on both chips. This can be achieved by using either `fwflash.exe` or `copy2res.com` utilities as described above.

Important!

It is not allowed to use BIOS files other than explicitly specified by Fastwel as suitable for this purpose.

6.4   Manufacturing Link Mode

Manufacturing Link mode allows to exchange files between the module and a remote PC via RS232 link. The COM port number for operations in Manufacturing Link mode is set by «Console/MFG Port» parameter in «Custom Configuration» menu of BIOS Setup (see <u>section 5.5</u> of this Manual).

To exchange files the driver `remdisk.sys` should be loaded into memory of a PC running MS DOS 6.22. This make the disk drives of the CPC304 available at the remote PC as logical units. The `config.sys` initialization string for loading `remdisk.sys` into PC memory should look like this:

> `DEVICE= C:\remdisk.sys COMn XXXX`
>
> where: `COMn` – PC COM port number – COM1 (default) , COM2;
>   `XXXX` – Data transfer rate – 9600 or 115200 (default) Mbit/s

After initialization of the driver `remdisk.sys` and selection of "Start RS232 Manufacturing Link" command in BIOS Setup, a new logical device "D:" appears at the PC, corresponding to C: drive of the module.

Manufacturing Link mode can also be used for formatting of the CPC304 disks and transferring of MS DOS 6.22 or FDOS 6.22 operating systems.

To format a CPC304 disk and to transfer MS DOS operating system:

1) Boot a PC with the operating system, which is to be transferred onto a CPC304 disk, and start the Manufacturing link mode at the module;

2) On the PC enter the command

   `FORMAT Z: /S`

   where: `Z:` is a CPC304 drive name,
            `/S` – operating system transfer option.

3) Wait until the message "`System transferred`" appears.

To format a CPC304 disk and to transfer FDOS 6.22 operating system:

1) Copy the FDOS system folder to a PC. Establish a connection between CPC304 and a PC in Manufacturing Link mode;

2) If Windows is running on the PC, enter the following command

   `LOCK Z:`

   where `Z:` stands for a CPC304 disk name

3) From FDOS system directory (file attributes "System" and "Hidden" removed) on the PC enter the next command

   `SYS Z: /F:. /C`

   where
        `Z:` is a CPC304 drive name,
        `/F:.` – FDOS 6.22 operating system files transfer option;
        `/C` – *command.com* transfer option

4) Wait until the messages "`System transferred`" and "`COMMAND.COM transferred`" appear.

7   Appendices

7.1   Jumper Settings by Function

Table 7.1:   **Jumper Settings by Function**

Function	Jumper	Short Description (*)
Terminators on COM3 in RS422/RS485 modes	J10: 1-2	Enable terminator between D+ and D- lines of COM3 port in RS485 mode
	J10: 3-4	Enable terminator between RX+ and RX- lines of COM3 port in RS422 mode or in full-duplex RS485 mode
Terminators on COM4 in RS422/RS485 modes	J12: 1-2	Enable terminator between D+ and D- lines of COM4 port in RS485 mode
	J12: 3-4	Enable terminator between RX+ and RX- lines of COM4 port in RS422 mode or in full-duplex RS485 mode
Enable/Disable WDTs	J25: 1-2	Enable WDT1 (Reset from WDT1 enabled)
	J25: 3-4	Enable WDT2 (Reset from WDT2 enabled)
CompactFlash and NAND Flash operation mode	J26: 3-4	CompactFlash – Master, NAND Flash – Slave
	J26: 1-2	CompactFlash – Slave, NAND Flash – Master
Optoisolated discrete input operation mode and PFO signal connection	J28: [1-3]	Remote Reset mode enabled
	J28: [3-5], [2-4]	Remote IRQ mode enabled
	J28: [4-6]	Interrupt enabled on PFO signal
		(*) *The action described in this column corresponds to the closed jumper contacts*