

Computerized Numerical Control Unit NC-201

Hardware. Operating Instruction



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INTRODUCTION

The present Hardware Operating Instruction (HOI) V2.0 contains information on the design, set up and technical specifications of the NC-201 computerized numerical control unit (further below referred to as the CNC Unit) and its component parts. This HOI is designed for use by the CNC operating personnel in order to be able to master the set up and functions of the CNC module and also to be able to operate it properly and safely during its entire service life.

This HOI covers all the modifications of the NC-201 CNC module. In addition to the HOI the operating personnel members must acquaint themselves with those papers that are part of the operation documentation set which is delivered together with the CNC Unit and that are referred to in Section 3 here.

The following designations and abbreviations are adopted in this HOI:

- AC alternating current;
- CNC computerized numerical control unit;
- COM serial data transmission channel;
- CPU central processor unit;
- CU control unit;
- DAC digital-analog converter;
- DC direct current;
- DOC Disk-On-Chip – memory unit of the Flash Disk type;
- DOM Disk-On-Module – memory unit of the Flash Disk type;
- DOS disk operation system;
- DRAM dynamic RAM;
- FDD floppy disk drive;
- Flash disk solid-state disk;
- FS feedback sensor;
- HDD hard disk drive;
- HW hand wheel;
- In./out. input/outputs;
- LCD liquid crystal display;
- MU memory unit;
- MC machine console
- NCC normally-closed contact;
- NOC normally-opened contact;
- NMI nonmaskable interruption – a hardware error that blocks the CNC operation;
- OCP operator's control panel;
- PC personal computer;
- PL machine-tool program logic;
- PLC programmable logic controller;
- PP part program;
- PSU power supply unit;
- RAM random access memory;
- SPEPN signal/relay of the CNC readiness;
- SW software;
- SWE an error blocking the operation of the CNC and that can be discovered by software;
- TFT thin-film transistor display;

- TO TIME OUT;
- USB universal serial bus;
- VGA video graphics array;
- WD WATCH DOG.

1. GENERAL INDICATIONS

1.1 The NC-201 numerical control unit is used in the machine-building industry, the machine-tool industry, in the metal-processing industry, also in wood processing and in the other branches of industry.

1.1.1 The CNC Unit is used as a completing part for building complete equipment sets, comprising «a CNC unit + a controlled object», such sets as, e.g., production process complexes, plants, highly-automated machine-tools and processing centers, including such groups of equipment as milling-drilling-boring machine aggregates, turning-vertical lathe-turret lathe machine-tools groups, gas flame-treatment machines, laser machine-tools, woodworking machine-tools, etc.

1.2 The CNC Unit must be operated in roofed premises, meeting the following requirements regarding their operation conditions:

a) operation conditions:

ambient air temperature from +5 to +40 °C;
relative air humidity from 40 to 80% at +25 °C;

b) storage conditions:

ambient air temperature from +5 to +50 °C;
relative air humidity no over 80% at +25 °C;

Remarks

1 The air temperature inside the CNC cabinet shall not be more than 20°C above the temperature of ambient air supplied for its cooling, while the temperature inside the CNC cabinet must not exceed +60°C.

2 The upper value of the ambient air temperature for CNC modules that are designed to be built into other equipment items containing sources of heat shall be selected from the following sequence of figures: 5, 10, 15, 20.

3 For those CNC units that are designed for operation in unheated rooms higher relative air humidity level values are fixed: Rh= 98% at +25 °C.

1.3 In the operation zone of the said CNC Unit efforts are to be undertaken in order to prevent dust, moisture, oil, metal chips, cooling liquids, vapor and steam from getting onto the outer surfaces and into the interior compartments of the CNC module in concentrations that could be damaging to its metal and insulation parts, including also technical maintenance periods.

1.4 Vibration levels in the working area of production rooms, acting along the longitudinal axis of the CNC Unit, shall not exceed a frequency of 25Hz and an amplitude of movement of over 0.1 mm.

1.5 The electric power supply of the CNC Unit shall be carried with a single-phase a.c. voltage of 220 +22/-33V and a frequency of 50±1Hz.

1.6 The CNC Unit may only be connected to the factory power supply systems via an isolating transformer, with a capacity of 300 VA min.

1.7 Power supply wiring to the CNC Unit shall be laid, observing the IEC 550-77 standard requirements, regarding its protection degree against electromagnetic interference, voltage interruptions and power outages.

It is not advisable to connect to this power system any other power systems, whose operation might cause disruptions in this system, affecting the levels of feed voltage, the level and spectrum of interference, the duration of supply voltage interruptions and outages.

2. TECHNICAL SPECIFICATIONS OF THE CNC UNIT

- | | | |
|------|---|---------------------------------------|
| 2.1 | Number of controlled axes | – 4 (with a spindle) |
| 2.2 | Number of channels of the position transmitter (encoder) | – 3 |
| 2.3 | Number of DAC channels (14 digits) | – 4 |
| 2.4 | Number of electronic hand wheel channels | – 1 |
| 2.5 | Number of discrete in/out channels | – 40/24 |
| 2.6 | Memory capacity: | |
| | – RAM | – SDRAM: 64/128 MB |
| | – memory unit | – Flash Disk: DOM 32/64/128 MB |
| 2.7 | Display: | |
| | – a color, flat LCD screen | – TFT 10.4” |
| | – resolution | – 640x480 |
| | – video memory | – SDRAM 2 MB |
| 2.8 | Alpha-numeric keyboard | – 79 key, interface EXKB |
| 2.9 | Interfaces of external I/O devices: | |
| | – FDD interface | – 1 channel for 2 FDDs: 3.5” (1.44MB) |
| | – serial interface | – COM2: RS232/RS485 |
| | – LAN interface | – Ethernet: 10/100 Mbit/s |
| | – USB interface | – 1,6 Mbit/s |
| 2.10 | Rated feed voltage | – ~220 V, 50 Hz |
| 2.11 | Consumed power (without periphery devices) | – 60 VA, max. |
| 2.12 | Consumed current (without periphery devices) | – 250 mA, max. |
| 2.13 | Protection degree of the outer casing: | |
| | – front panel | – IP54 |
| | – casing | – IP20 |
| 2.14 | Overall dimensions | – 432x322x107 mm |
| 2.15 | Weight | – 9.5 kg, max. |
| 2.16 | The software characteristics are shown in the «Programmer’s Manual MS/TS» | |

3. CNC UNIT SET-UP

3.1. The Structural Diagram of the CNC Unit

3.1.1 The CNC Unit is a software-controlled device that incorporates both hardware and software (SW) parts. The CNC Unit block diagram is represented in Figure 3.1. The CNC structure incorporates a control unit (CU), operator's control panel (OCP) and a power supply unit (PSU). Connections between the component parts of the CNC Unit and its structural elements, also a brief description of the component parts are presented in Table 3.1.

3.1.2 The CU governs the CNC operation and that of its external equipment. The heart of the CU is a CPU card. The interaction of the CU modules is secured by signals originating from the external local bus of the **ISA BAS 16** processor.

Control of the following peripheral equipment is carried out through the ECDA I/O module channels:

- the electric servo drive of feed and the main motion, with feedback (control at the input of the analog voltage of ± 10 V);
- the photoelectric traverse converters (encoders) as FS (supply voltage plus 5V, the output signal – rectangular pulses);
- the machine-tool spindle;
- the photoelectric electronic hand wheel (its supply voltage is plus 5V, its output signal is shaped like rectangular pulses).

Through input/output channels the ECDA I/O module provides bi-directional communication (polling/controlling action) between the CNC Unit and the electrical units of an object to be controlled. Information exchanges are carried out under software control.

Control of additional input/output devices is carried out by the CPU card through the following interfaces of external devices: RS-232/485, FDD, LAN, USB.

3.1.3 The OCP secures the execution of all the control and monitoring functions within the «OPERATOR-CNC-CONTROLLED OBJECT» system. The OCP structure includes a display unit and a keyboard.

Control signals originating from the CPU reach the display unit via an internal cable through an LCD 24 bit interface. The connection of the keyboard with the CPU card is secured by means of signals from the EXKB keyboard interface. Signals from the D0-D10 switch module reach the CPU through the ECDA I/O board and the ISA BAS 16.

Keys, push buttons and selector switches are used to control the software, while a display screen and light-emission diodes are used as elements for monitoring. These components make it possible for the operator to control the system operation, to actively converse with it and obtain the required information about the process of governing an object to be controlled.

3.1.4 The PSU supplies the CNC Unit with the necessary range of feed voltages. Power supply from the PSU is fed to the ECDA I/O card, from where it is supplied through connectors to the CNC assembly units.

3.1.5 The CNC Unit communicates with the object under control and the external input/output devices via external connectors. A list of external CNC Unit connectors, with their positions, designations and purpose is given in Table 3.2.

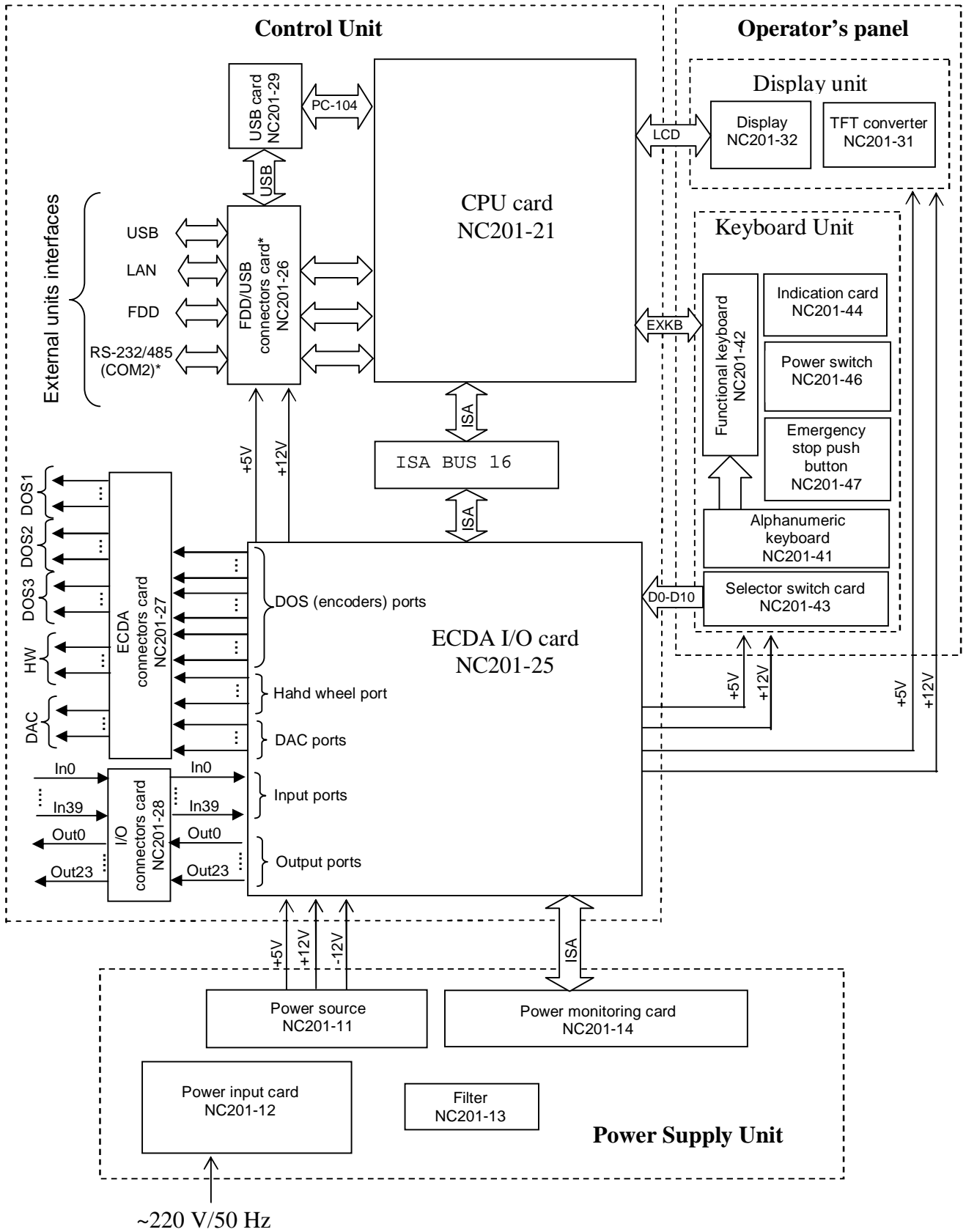


Figure 3.1 – Structural Diagram of the NC-201 Unit

Table 3.1 The NC-201 CNC Unit Set Up

CNC unit component part	Component units, modules, cards		
	Denomination	Designation	A Brief Description
Power supply unit (PSU)	Power source	NC201-11	Output voltage: +5V, 8A (adjustable $\pm 0,25$ V); +12V, 3A (not adjustable); -12V, 1A (not adjustable).
	Power input card	NC201-12	Input voltage: ~ 220 V/50 Hz, safety fuse – 3A, «AC220V» connector.
	Filter	NC201-13	~250V/3A, 50/60 Hz
	Power monitoring card	NC201-14	«SPEPN» readiness relay of the CNC Unit (one NOC)
Control unit (CU)	<u>CPU module</u> CPU card (PCA-6751)	– NC201-21	CPU: Intel Pentium MMX CPU 266; ISA BUS 16 bit; PC-104 bus; Video 2MB; interfaces: RS-232/485, EXKB, LCD, FDD, USB, Ethernet (optional).
	Memory (MU)	NC201-23	DOM: 32/64/128 MB.
	Memory (RAM)	NC201-24	SDRAM 64/128 MB.
	FDD/USB connectors card	NC201-26	Connectors: «232/485», «FDD», «USB», «LAN».
	USB card	NC201-29	USB interface
	<u>ECDA I/O module</u> ECDA card, I/O	– NC201-25	Encoder channel – 3; DAC channel 14 bits – 4; hand wheel channel – 1. Input channels (10mA/24V) – 40; output channels (50mA/24V) – 24.
	ECDA connectors card	NC201-27	ECDA connectors: encoders – «1»–«3»; the hand wheel – «4»; DAC – «5».
	I/O connectors card	NC201-28	I/O connectors: «32 IN», «8 IN», «24 OUT»; «SPEPN KEY», «ESTOP».
ISA BUS card	NC110 ISA BUS	Interaction between the CPU and peripheral ECDA I/O module trough ISA BUS.	
Operator's control panel (OCP)	<u>Display unit</u> TFT converter	– NC201-31	Converts the +12V voltage into voltage for the display cathode valves.
	Display	NC201-32	A color flat LCD screen – TFT 10.4", 640x480.
	<u>Keyboard unit</u>	–	A hermetically sealed keyboard with 80 tactile effect.
	Alphanumeric keyboard	NC201-41	36 alphanumeric keys, 29 special keys. Keyboard controller.
	Functional keyboard	NC201-42	10 functional, 5 special keys.
	Selector switch module	NC201-43	Selector switches: «F», «S», «JOG», «MDI»...«RESET»; «START» button; «STOP» button.
	Indication board	NC201-44	Power supply «AC» indicators and CNC PSU switch-on «DC» indicators, an «ER» stop indicator.
	Key	NC201-45	Used as a complete set part with the power switch.
	Power switch	NC201-46	A CNC power switch (lock and key): ~240V/3A.
Emergency stop button	NC201-47	A mushroom-shaped button of red color: ~240V/3A. (one NOC and one NCC)	
Case	–	NC201-5	Overall dimensions: 432x322x107 mm.

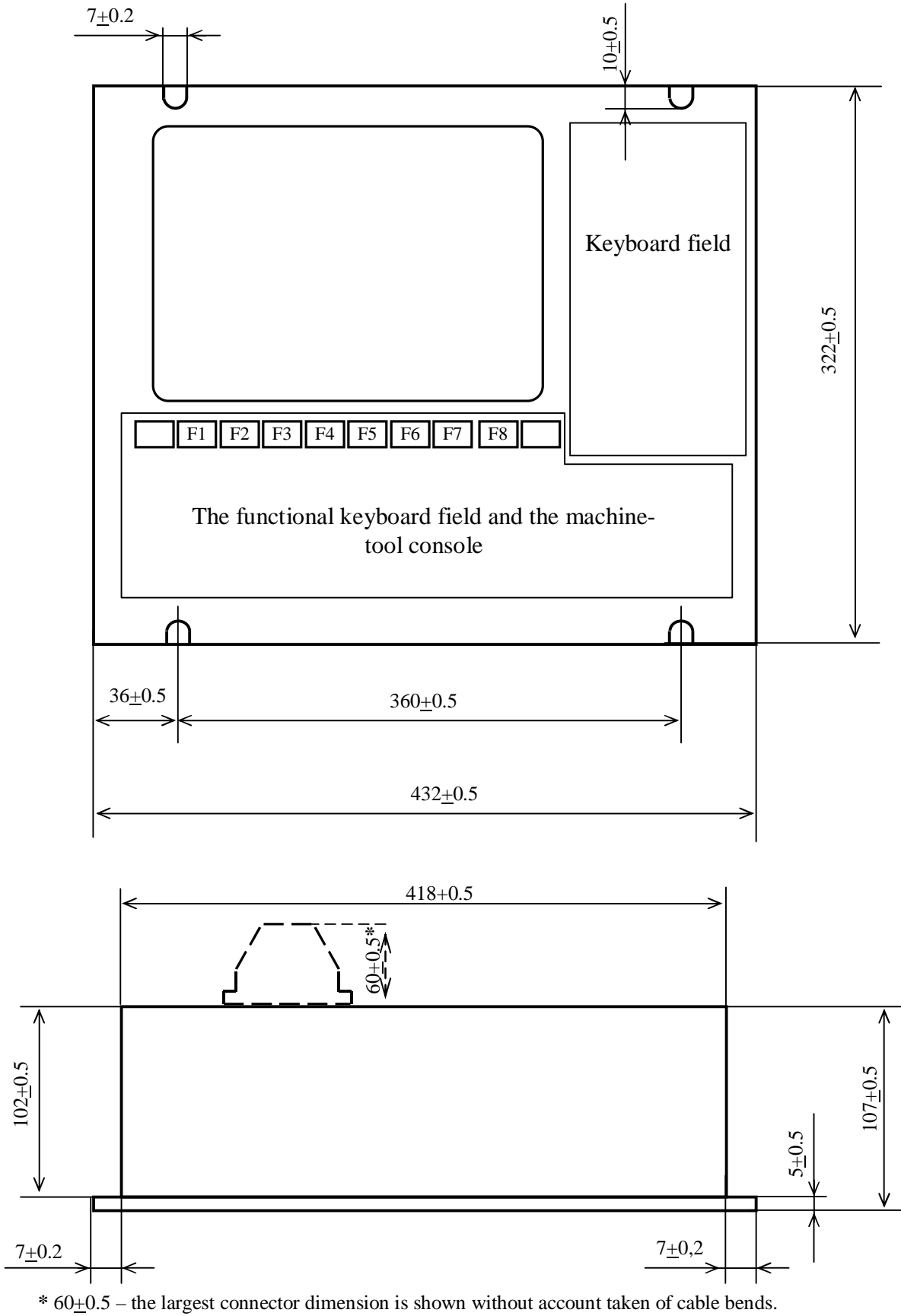
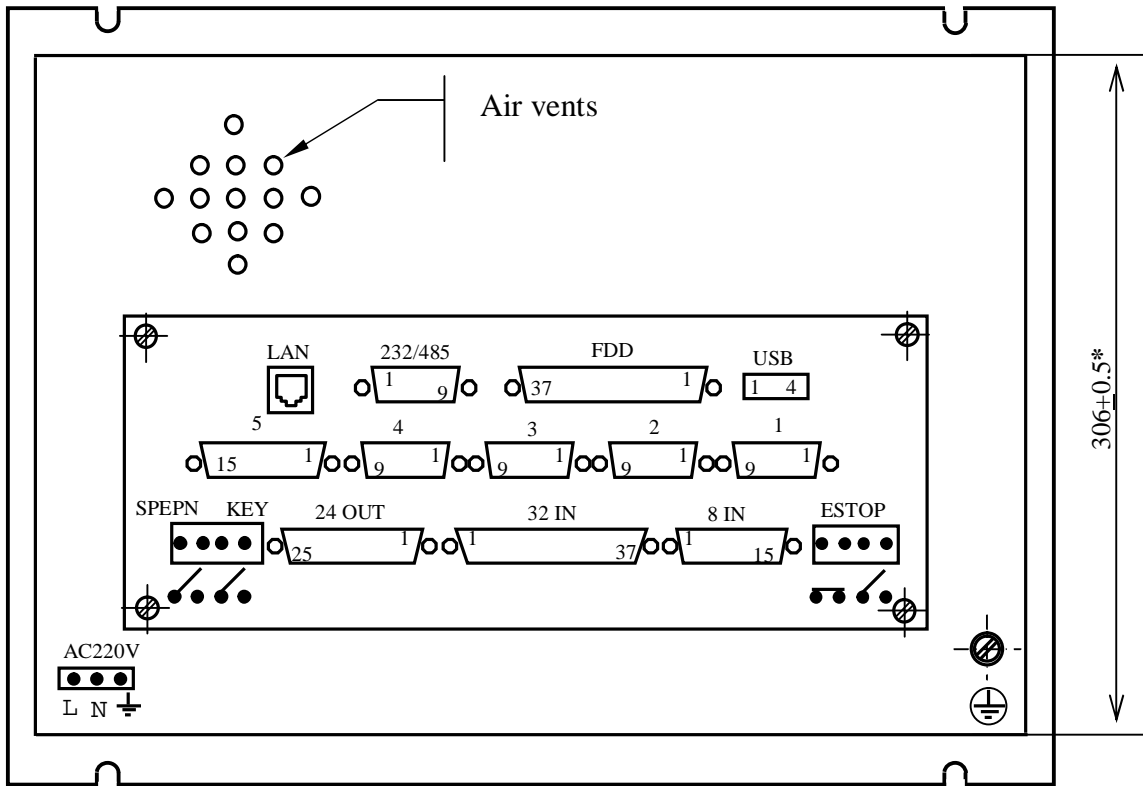


Figure 3.2 – Major CNC Unit Dimensions



(306±0.5)*- the screw head height is taken into account in this dimension

Figure 3.3 – View of the Rear Panel of the NC-201 CNC Unit

Table 3.2 – External connectors of the CNC Unit

Designation and type of connectors	Number of pins	Number of connectors	Purpose
232/485 DBR 9-M plug	9	1	RS-232/485 channel
FDD DBR 37-F socket	37	1	Communication with FDD
LAN RJ-45 socket	8	1	A local area network (optional)
USB USBA-4G socket	4	1	USB channel
1,2,3 DBR 9-F socket	9	3	Communication with encoders
4 DBR 9-F socket	9	1	Communication with hand wheel
5 DBRH 15-F socket	15	1	DAC outputs
32IN DBR 37-M plug	37	1	Discrete inputs
8IN DBR 15-M plug	15	1	
24OUT DBR 25-F socket	25	1	Discrete outputs
AC220V Phoenix Contact MSTB 2,5/3-GF-5,08 plug	3	1	Power supply
SPEPN KEY Phoenix Contact MSTB 2,5/4-G-5,08 plug	4	1	NOC of CNC Unit readiness relay and NOC of power switch
ESTOP Phoenix Contact MSTB 2,5/4-G-5,08 plug	4	1	Emergency stop push button NOC and NCC

3.2. The CNC Unit Design

3.2.1 In terms of its design, the CNC Unit represents a single block, for built-in mounting and it incorporates a Control Unit (CU), its software and a power source. The main overall and mounting dimensions of the CNC Unit are given in Figure 3.2. The rear panel view of the CNC Unit is given in Figure 3.3. The designation, characteristics and purpose of external CNC connectors are indicated in Table 3.2.

3.2.2 OCP is shaped as the front panel of the CNC module. Installed on it are a display, light indicators, a keyboard, a power switch and a compartment for the machine-tool console, having equipment machine-tool control elements. Slots for fastening the mono-block inside a cabinet or in the controlled object equipment are provided along the perimeter of the CNC Unit front panel.

3.2.3 The PSU is installed in a separate metal compartment that is fastened to the inside of the front panel with screws. The metal walls of the compartment perform the function of protective shielding.

3.2.4 A metal screen installed behind the display is fastened on its one side to the inside of the front panel and on the other side it constitutes a base, onto which the control unit is fastened. The mounting height dimension of the screen and the control unit is determined by the posts onto which they are fastened. The control unit has a card for output connectors on which the CNC connectors installed for its connection with equipment to be controlled.

3.2.5 A removable jacket covers the entire construction from the sides and at the back. The jacket is fastened to the inside of the front panel with screws. The jacket has a slit for the card with output connectors. A fan is installed inside the jacket at the control unit level. A grounding screw is mounted below on the outside of the jacket.

3.2.6 Electrical connections between the CNC component parts are made by means of internal cabling.

3.3. The CNC Unit Software

3.3.1 The system equipment is controlled by a part program, which is to be developed by a process department programmer. The rules and methods of developing part programs are set forth in the document called "Programming and operator's manual".

3.3.2 The CNC Unit can be made compatible for running in company with some concrete system equipment by way of system characterization. The said characterization process consists in developing and writing files containing the parameters and characteristics of hardware and software modules, that completely determine the CNC configuration for a particular user. These files contain information necessary for the functioning of software, controlling this equipment operation. The ways of developing these characterization files are described in the document entitled "Software Characterization".

3.3.3 The final stage of making the CNC Unit ready for operation is the development a PL, which is a program for controlling the auxiliary mechanisms of some concrete equipment.

Any PL compilation means that it is necessary to be familiar with the basic PLC program interface and its language. The basic PLC interface is a program interface and it ensures the execution of the basic CNC software communication protocol and it is specific for any controlled object.

The PLC language is part of the basic CNC software. The PLC interface is designed for the following:

- 1) to initialize the switch-on/switch-off signals of controlled equipment;
- 2) to implement the exchange protocols as it is shown below:

THE BASIC SOFTWARE \hat{U} PL \hat{U} CONTROLLED EQUIPMENT

- 3) to process protocol signals that determine the application of the various CNC operating modes;
- 4) to secure the operation of controlled equipment safety devices;
- 5) to implement certain auxiliary functions.

PL is developed with the help of the PLC language. The description of the PLC interface, its language, its development methods, ways of debugging, compilation and activation of PL are given in the document called "The PLC Interface Programming".

PL development is not the obligation of the CNC Unit design company. The CNC Unit user is given the opportunity to develop the said PL on his own, in accordance with the document referred to.

3.3.4 The CNC software has several versions. Any software version is to be agreed upon with the manufacturer when placing a purchasing order.

The CNC software versions up to Version 3.60.E are essentially based on MS DOS. The software version 3.60.E and all subsequent versions are based on the RTOS-32 operation system, which enables to expand the software capacities, for example, it allows to use visual programming for part program compilation and editing.

When the basic software has been installed into this CNC Unit its program is to be registered. A reliable operation of the CNC hardware in company with its software is only possible, applying a software version approved by the supplier, at the time of placing an order, and which is supplied together with equipment.

IT IS FORBIDDEN TO INSTALL ANY UNLICENSED SOFTWARE, AS WELL AS ANY SOFTWARE NOT RELATED TO THE CNC UNIT.

3.3.5 The CNC Software set up includes two editors: the main editor and an editor for visual programming. Rules concerning the CNC SW running are given in the document «An Operator's Manual». This document consists of two parts and each part is published as a separate book. The first part explains rules of work with the main editor of the CNC Unit, the second part contains rules of working with the visual editor, which is used for creating and editing part programs of the CNC Unit.

3.4. The CNC Unit Delivery Set

3.4.1 The scope of any CNC Unit delivery set shall correspond to Section 4 of the Ordering Form. The obligatory set of delivery shall comprise the CNC Unit itself with its installed software version, accompanied by a set of working documentation, a mounting parts kit and tree 3.5" (1.44 MB) diskettes with a duplicate of software version:

- No.0 – «COPYFLASH»;
- No.1 – «FLASH.RAR» ;
- No.2 – «FLASH.R00».

3.4.2 The set of working documentation shall include the following:

- Hardware. Operating Instruction;
- Form sheet;
- Programming and Operator's manual (MC/TC);
- Software Characterization (MC-TC);
- PLC Interface Programming.

3.4.3 The mounting parts kit shall include mating parts for the CNC Unit output connectors, as this is shown in Table 3.2. These connectors are used to construct cables for communication with controlled objects. A list of connectors to be supplied is given in Table 3.3 below.

Table 3.3

Denomination	Number	Intended use
DB 9-F socket	1	An RS-232/485 cable
DB 9-M plug	1	The hand wheel cable
DB 9-M plug	3	A FS cable
DB 15-M plug	1	A DAC cable
DB 15-F socket	1	An input cable
DB 37-F socket	1	An input cable
DB 25-M plug	1	An output cable
MSTB socket 2.5/3-STF-5.08	1	A cable for the «AC220V» connector
MSTB socket 2.5/4-ST-5.08	1	A cable for the «ESTOP» connector
MSTB socket 2.5/4-ST-5.08	1	A cable for the «SPEPN KEY» connector

The obligatory delivery set includes ready-made cables: an **FDD cable**, 0,6 m/

When an order is placed for cables for communication with the control object by the CNC manufacturer, connectors will be removed from the set of mounting parts and they will be mounted onto the cables.

3.4.4 Spare diskettes serve for software rebooting in the event of a system files loss. The software restoration procedure is presented in the "Software Characterization".

3.4.5 On customer's request, the CNC Unit may be supplied with extra equipment items; their list is given in Table 3.4.

Table 3.4 – Additional equipment (optional)

Module designation	Module description	Quantity
	<u>External input/output modules</u>	
NC201-402	Input indication module (40): Input channels – 40	1
NC210-401	Output module with relay commutation and indication (24): Output channels – 24	1
NC210-402	Input indication module (32): Input channels – 32	1/2
	<u>Additional equipment</u>	
NC110-75	An electronic hand wheel LGF-003-100	1/2
NC310-75	An electronic hand wheel ZBG-5-003-100	1/2
NC110-78	A hand held programmable station	1

4. POWER SUPPLY UNIT

4.1. Technical Specifications of the Power Supply Unit

4.1.1 Input characteristics:

- input voltage range: ~ (187...242) V
- input voltage frequency: 49...51 Hz

4.1.2 Output characteristics:

- Output voltages:
 - adjustable +5.00±0.25 V; 8A
 - not adjustable +12.00 V; 3A
 - not adjustable -12.00 V; 1A
- Output power: 130W, max.

4.2. The Purpose and Set-up of the Power Supply Unit

4.2.1 The PSU provides the CNC unit with a set of the following voltages: +5V, +12V, -12V.

4.2.1.1 The voltage the power supply unit is fed via a cable to the control unit, to its NC201-25 card, from where it is distributed among all the CNC components with the help of cable connectors. Power to the **CPU** card comes through the NC110 **ISA BUS card** that is part of the **ECDA I/O** module. A voltage of +12V is supplied to feed the FAN. A voltage of +5V, +12V is used for the display module; for the keyboard module voltages of +5V, +12V are used.

4.2.1.2 Furthermore, the PSU voltage is also used to feed external equipment items. Voltages of +5V, +12V are delivered to the «**FDD**» connector of the NC210-26 card, to supply power for FDD. Through connectors «**1**»-«**3**» of the ECDA I/O module the +5V voltage is delivered to encoders, while through connector «**4**» it is fed to the hand wheel and through the «**USB**» connector it is supplied to the external I/O equipment connected to it.

4.2.2 The PSU composition is presented in Table 3.1.

4.2.2.1 The NC201-12 input power supply card.

The «**AC 220V**» connector for the CNC Unit power system supply is mounted on the NC201-12 card. The primary circuit of the CNC is protected against current overloads and short-circuits with a safety fuse. A fuse with a rating of 3.0A is placed in the circuit of phase wire «**L**» of the primary circuit.

The circuit of phase wire «**L**» of the primary circuit contains a power system switch NC201-46, which is connected to the power circuit through connector J2 and is mounted on the OCP. The NO contact of the switch is wired to connector «**SPEPN KEY**» on the connectors card of the CNC Unit.

A stabilizer unit converts the input voltage of ~220 V into a DC voltage of 24V and transfers it through the J6 connector to indicator «**AC**» of the NC201-44 indicators board on the OCP. The green color «**AC**» indicator determines, if power supply is normal.

4.2.2.2 The NC201-13 filter in the primary power circuit serves to suppress power system interference at the CNC input.

4.2.2.3 Current and voltage values generated by the NC201-11 power source are shown in Item 4.1.

4.2.2.4 The NC201-14 power supply monitoring card.

The NC201-14 power supply card monitors the output voltages of the power supply source. The +5V voltage is used to generate a «**Power OK**» signal. If this signal does not get through into the

CU, the CNC Unit cannot be started. Furthermore, the +5V voltage is used to indicate, if the secondary power supply is normal. The +5V voltage together with the «WATCH DOG LED» signal, which comes to the NC201-14 card from the NC201-25 card, will through connector J2 follow into the NC201-44 card to indicators «DC» and «ER». The green color «DC» indicator announces, if the secondary power source is in a normal condition, while the red color «ER» indicator informs the operator about the presence of an error detected by the «WATCH DOG» system.

Relay RL1 («SPEPN») is mounted on the NC201-14 card. Its contacts are connected to the circuit of the I06K21 signal that informs PL about the readiness of the CNC Unit to apply its control voltage to some controlled object (Ref. to «PLC Interface Programming»). When the relay contacts are opened, it means that the CNC Unit is not ready. When the contacts of this relay are closed, the CNC Unit is functionally ready. The relay contacts are operated with the help of software:

- by means of the U10K20 signal from PL;
- in case of errors indicated in word W06K3;
- in case of blocking errors SWE or NMI.

The RL1 NO contacts are wired to the «SPEPN» connector on the connector card placed on the rear wall of the CNC Unit.

ATTENTION! – IT IS RECOMMENDED TO USE THE «SPEPN» RELAY CONTACTS IN THE 24V POWER SUPPLY CIRCUIT FROM THE ELECTRICAL EQUIPMENT OF THE CONTROLLED OBJECT IN THE CNC UNIT.

5. CONTROL UNIT

5.1 Control unit composition

5.1.1 The CNC control unit consists of a **CPU** module and an **ECDA I/O** module, whose composition is presented in Table 3.1. The **CPU** module is the core of the control unit. Peripheral equipment control is carried out through the **ECDA I/O** module. Interaction between the **CPU** module with the **ECDA I/O** module is carried out through the **ISA BAS 16**.

5.1.2 The location of connectors and jumpers of the control unit modules, accompanied by the indication of their markings and purpose of use, as well as the **CPU** module interfaces are explained in Appendix A.

5.2. The CPU Module

5.2.1 Technical Specifications of the CPU module

5.2.1.1 The **CPU** module features the following characteristics:

- CPU: Intel Pentium MMX 266 MHz
- RAM: SDRAM: 8-256 MB
- Flash Disk: DOM: 32/64/128 MB
- FDD interface: 1 channel for 2 FDD: 3.5" (1.44 MB)
- EIDE HDD interface: 1 channel for 2 devices: HDD/Flash Disk: DOM
- PCI SVGA interface:
 - a) video memory: DRAM: 2 MB
 - b) VGA CRT channel:
 - display type: CRT monitor
 - resolution: 1024 x 768 (256 colors)
 - B) VGA LCD channel:
 - display type: color TFT LCD Panel
 - resolution: 640x480
- EXKB Interface: CNC keyboard: 79 key
- Serial port: COM1: RS-232
- LAN interface (optional): Ethernet: 10/100 Mbit/s
- Local bus: ISA BUS 16 bit
- Local bus: PC-104

5.2.2 CPU Module Set-up

5.2.2.1 The **CPU** card setup is shown in Table 3.1. The **CPU** card is a **PCA-6751** type built-in processor card.

5.2.2.2 A **Flash Disk** type memory unit is installed in the **CPU** card as a storage device: **DOM** NC201-23. The **Flash Disk** provides 100% compatibility with hard disk (the EIDE bus). The time of storing data in the Flash Disk is essentially unlimited. The **DOM** part is installed into connector «**IDE**». When standard software is used, the memory capacity makes 32 MB. When a special software product is ordered, the memory capacity increases up to 128 MB.

5.2.2.3 Two 144-pin **SODIMM RAM** sockets support **SDRAM** memory module from 8 to 256 MB. The NC201-24 memory (RAM) is installed in sockets «**SODIMM1**», «**SODIMM2**». Each socket accepts 8/16/32/64/128 MB 3.3 V power level **SODIMMs**. If only one **SODIMM** module is installed, it may be installed in either **SODIMM** socket on the solder side of the PCA-6751 card. The standard capacity of the working memory is 64 MB.

5.2.2.4 The initial configuration of the computer equipment and software installation are made by the manufacturer of the CNC Unit. The CNC Unit uses a **BIOS** made by the **AWARD** Company. The **BIOS** capabilities and the list of parameters set by the CNC Unit manufacturer are shown in Appendix B.

5.2.2.5 The basic software of the CNC Unit is installed in the **Flash Disk**. The operation of the basic software is under the control of the «**WATCH DOG**» circuit. An error detected by the «**WATCH DOG**» is then indicated by the red color «**ER**» LED located in the OCP, with the simultaneous reset of the CNC readiness signal. The causes of the absence of the CNC readiness signal are listed in Table 5.1.

Table 5.1

Error	OCP indicator	Indication on the display screen (its second line)
Temporary errors in the bus. The module installed in the bus is either missing or it does not respond.	ER	TIME-OUT (ТАЙМ-АУТ)
WATCH DOG. An error occurs as a consequence of software errors, also because of NC-201 module malfunctions.	ER	WAITING ERROR (ОШ. ОЖИДАНИЯ)
Power failure.	–	Power failure (Сбой питания)
An emergency stop. An error emerges, if the "EMERGENCY STOP" button is processed by the software, in which case this button must be released before turning the CNC Unit on.	–	Ан Emergency stop (Аварийный останов)
A malfunction of the CNC Unit. An error occurs, if the cause of the CNC malfunction cannot be determined due to the reasons listed in this table.	–	NMI -> А CNC error (Ошибка УЧПУ)
Not enough memory in the RAM (UMB).	–	no free memory (Нет свобод. пам.)
A servo cycle error (ticking rate must be increased in the TIM instruction of the AXCFIL file).	–	А servo cycle error (Ош серво-цикла)
Encoder initialization error.	–	Аn encoder initialization error (Ош иниц энкод *)
svdold file reading error, when the " OLD " instruction is installed in the PGCFIL file (check the disk with the scandisk.exe program). The CNC Unit must always be switched off after the machine-tool has been turned down.	–	"OLD" reading error (Ош чтения OLD)

5.2.2.6 Communication of the **CPU** card with the **TFT 10.4"** screen is accomplished directly via a cable through the «**LCD 24 bit**» connector.

Communication of the **CPU** card with the OCP keyboard is secured through the «**EXKB**» connector.

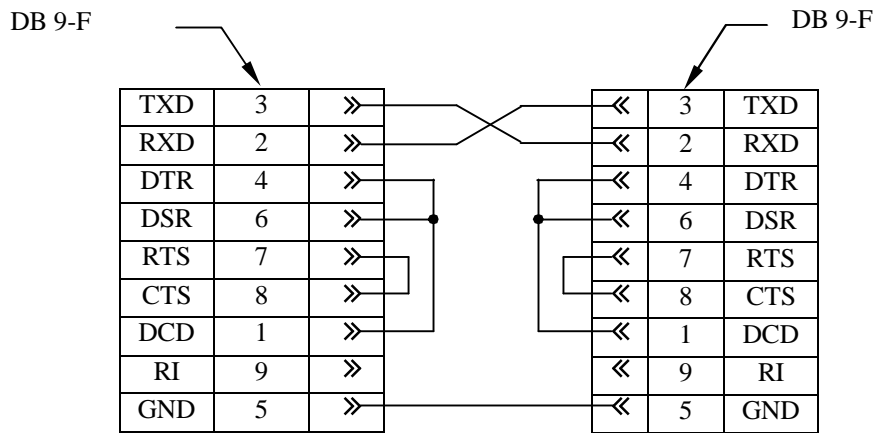
5.2.2.7 The **CPU** card has external «**232/485**», «**FDD**», «**LAN**» connectors on the connector card of the CNC unit. These external connectors are mounted on the **FDD** NC201-26 connector card (see Appendix A). Besides the said connectors, elements for the protection of **FDD** interface signals and the external connector of the **USB** channel are located on the NC201-26 card.

5.2.2.8 Signals from the **RS-232/485** serial interface of port **COM2** are wired to the «232/485» connector. The serial port channel **COM2** is selected by way of installing jumpers onto the **CPU PCA-6751** card, as described in Appendix A. By default the **RS-232** channel is installed. The connector type is indicated in Table 3.2. The **RS-232/485** connector signals are shown in Table 5.2.

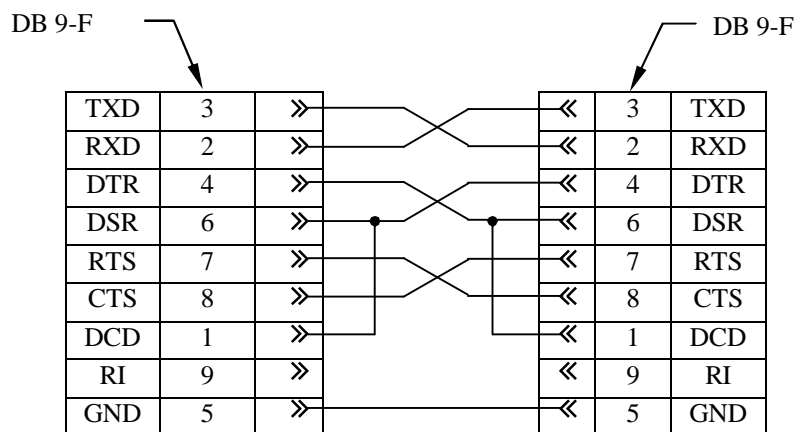
Table 5.2 – The signal types of the «232/485» connector

Pin	Signal		Pin	Signal	
	RS-232	RS-485		RS-232	RS-485
1	DCD	TX-	6	DSR	NC
2	RX	TX+	7	RTS	NC
3	TX	RX+	8	CTS	NC
4	DTR	RX-	9	RI	NC
5	GND	GND	-	-	-

Diagrams for connecting the CNC Unit with an external PC through the **RS-232** channel are shown in Figure 5.1.



a) a minimum-size cable



b) a full-size cable

Figure 5.1

The following addresses and interruption levels must be assigned to serial ports **COM1** and **COM2** for the **UART** chips in the «INTEGRATED PERIPHERALS» SETUP option. An example of this setting is as follows:

On board UART 1 3F8/IRQ4
On board UART 2 2F8/IRQ3.

5.2.2.9 The FDD interface signals are wired to Connector «**FDD**». The type of the «**FDD**» connector is indicated in Table 3.2. The signals of the «**FDD**» connector and their links to external floppy disk connectors are indicated in Table 5.3

Table 5.3

CNC connector		FDD connector	
«FDD»		34 pins	Power connector
pin	pin	pin	pin
1	GND	1	
2	GND	3	
3	GND	5	
4	GND	7	
5	GND	9	
6	GND	11	
7	GND	13	
8	GND	15	
9	GND	17	
10	GND	19	
11	GND	21	
12	GND	23	
13	GND	25	
14	GND	27	
15	GND	29	
16	GND	31	
17	GND	33	
18	+5V	-	1
19	+12V	-	4
20	High Density	2	
21	N/C	4	
22	N/C	6	
23	INDEX	8	
24	Motor Enable A	10	
25	Drive Select A	12	
26	Drive Select B	14	
27	Motor Enable B	16	
28	Direction	18	
29	Step Pulse	20	
30	WRITE DATA	22	
31	Write Enable	24	
32	TRACK 0	26	
33	Write Protect	28	
34	Read Data	30	
35	Select Head	32	
36	Disk Change	34	
37	GND	-	2, 3

Power is fed to **FDD** from the CNC Unit through its interface channel. Three pins: 18, 19 and 37 in the «**FDD**» connector are allocated for this purpose.

The FDD responds to the call name **B:**, if the CNC unit is connected with the **FDD** by a cable made in accordance with Table 5.3.

To be able to carry out the software restoration procedure from the reserve diskettes, **FDD** must respond to Name **A:**. To make the **FDD** respond to this name **A:**, it is necessary to introduce the following settings into the SETUP menu:

- 1) In the STANDARD CMOS SETUP menu option make two devices present:

Drive A: 1.44M, 3.5 in;
Drive B: 1.44M, 3.5 in.

- 2) Into the BIOS FEATURES SETUP menu option enter the following:

Boot Sequence	:A,C
Swap Floppy Driver	:Enabled
Boot Up Floppy Seek	:Disabled

5.2.2.10 **Ethernet** interface signals are brought out to the «**LAN**» connector. The **Ethernet** interface meets the international standard **IEEE 802.3**. The connector type is indicated in table 3.2. The **Ethernet** interface signals are given in Table 5.4.

Table 5.4

Pin	Signal	Pin	Signal
1	TX+	5	GND
2	TX-	6	RX-
3	RX+	7	GND
4	GND	8	GND

5.3 USB card

5.3.1 The **USB** channel is provided for on the **USB** NC201-29 card. The **USB** channel enables the CNC Unit to operate with peripheral devices in the **Plug&Play** mode. It makes it possible to connect external devices to the CNC Unit when it is running, to automatically identify them immediately after their connection and the installation of appropriate drivers that follows it. A +5V power supply is provided for low-capacity external devices in the channel

Note – The **USB** channel and the driver serving it have been developed by the manufacturer. When the CNC Unit with the USB channel is ordered, the scope of supply will include a USB Flash Disk 128/256 MB and a cable for its connection to the channel.

5.3.2 Technical characteristics of the **USB** channel:

- | | |
|---|------------------|
| a) data exchange rate: | 1.6 Mbit/s, max. |
| b) number of devices to be connected: | 1 |
| c) supply voltage for external devices to be connected: | +5 V |
| d) consumption current per device: | 250 mA, max. |
| e) length of the cable to be connected: | 1.5 m, max. |

5.3.3 The structural diagram of the **USB** channel is shown in Figure 5.2.

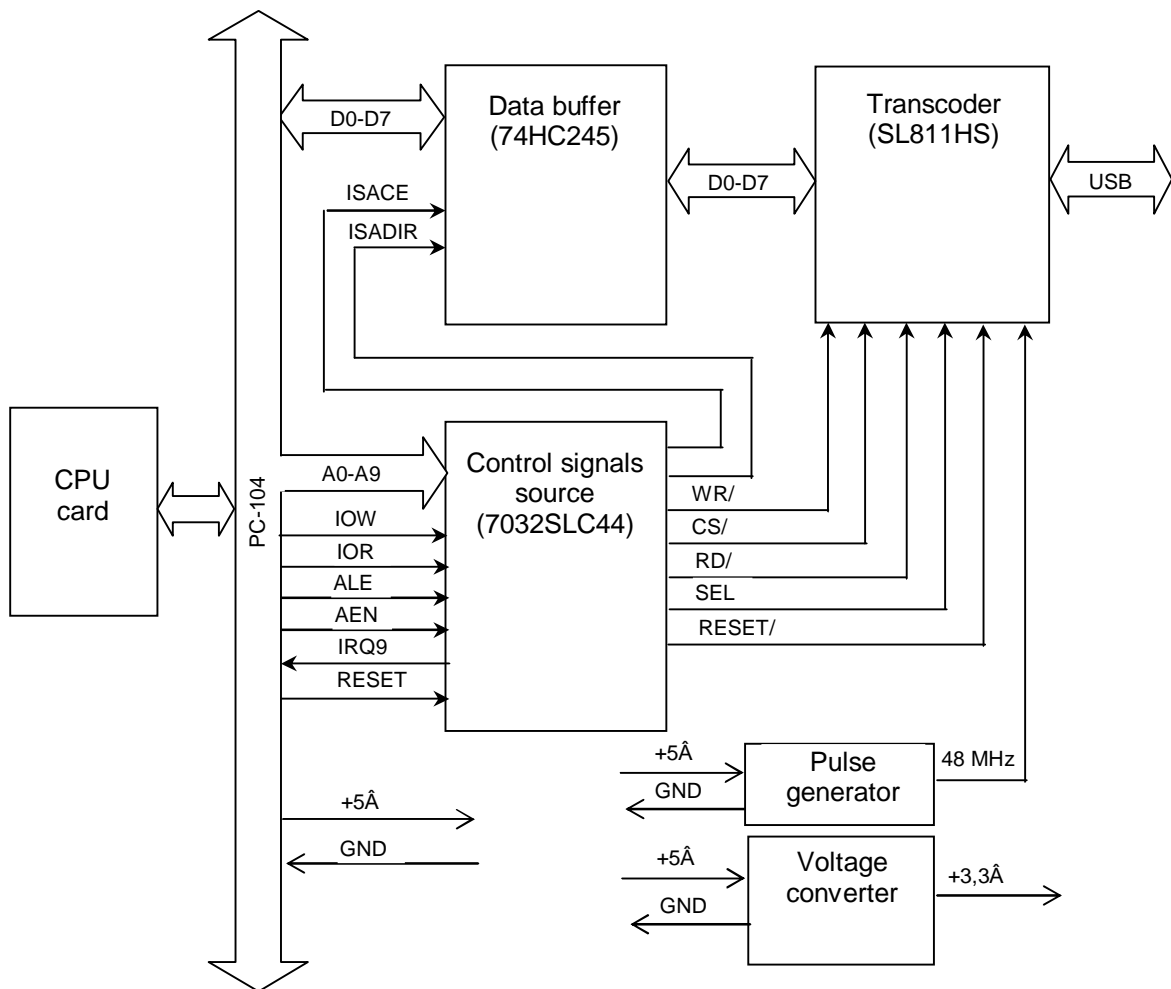


Figure 5.2 – The Structural Diagram of the **USB** Channel

The arrangement of the **USB NC201-29** card elements is indicated in Appendix A.

The **USB** channel is organized on the basis of signals of the **PC-104** processor bus. The channel converts the parallel 8-digit code D0-D7 received from the **CPU** via the **PC-104** bus into a sequence of symbols with service bits and it brings out this sequence into the **USB** communication channel and also carries out a reverse conversion – it converts a serial flow of symbols received from an external device through the **USB** channel into the parallel 8-digit code **DO-D7** coming via the **PC-104** bus into the **CPU**.

5.3.4 Data exchange between the **PC104 (J1, J2)** bus and the **USB** channel is carried out through a data buffer – a bi-directional bus generator **74HCT245 (U3)**.

The **USB** channel signal generator is based on the **7032SLC44 (U2)** chip. The addresses of input/output ports (**A0-A9** bus) and signals of access to the input/output ports of the channel (writing **IOW**/reading **IOR**) are used to form the **USB** channel control signals.

The code converter function is performed by the **SL811HST (U1)** chip. A pulse generator (**X1**) generates synchronizing pulses for the code converter with a frequency of 48 MHz.

5.3.5 The **USB** channel signals are sent from the **J3** connector through a cable and via the **FDD/USB NC201-26** connector card to the «**USB**» connector of the connector card of the CNC Unit, as this is shown in Figure 3.3.

The arrangement and purpose of the **FDD/USB NC201-26** card connectors are indicated in Appendix A. The «**USB**» connector type is indicated in Table 3.2, the channel signals are presented in Table 5.5.

Table 5.5 – **USB** Channel Signals

Pin	Purpose	Pin	Purpose
1	+5B	3	DATA+
2	DATA-	4	GND

5.4 The ECDA I/O Module

5.4.1 The Set Up of the ECDA I/O module

5.4.1.1 The set up of the ECDA I/O module is given in Table 3.1. The ECDA card is equipped with:

- encoder channels – 3;
- DAC channels – 4;
- an electronic hand wheel channel – 1;
- discrete input channels – 40;
- discrete output channels – 24.

5.4.1.2 Any channel, to which an encoder is connected, must correspond to a DAC channel connected to some electric drive. This connection is established by applying the NTC instruction in the AXCFIL file in accordance with the "Software Characterization".

5.4.1.3 One of the DAC channels is used for spindle control. The spindle control parameters are set in accordance with "Software Characterization".

5.4.1.4 An electronic hand wheel is used for manual axis travels. One electronic hand wheel, which does not require any characterization, can be connected to the CNC Unit via the hand wheel channel.

The CNC Unit software enables the hand wheel to be connected through an encoder channel and it also allows operating with two hand wheels.

The hand wheel does not belong to the obligatory CNC delivery set. The CNC Unit can be equipped with the LGF-003-100 electronic hand wheel on the basis of a special order in accordance with Table 3.5. Appendix C provides information about the LGF-003-100 hand wheel.

5.4.1.5 The arrangement of connectors and jumpers of **ECDA I/O** module is shown in Appendix A.

External connectors of the ECDA I/O module are wired to the connector card of the CPU ECDA module, as it is shown in Figure 3.3, through connector cards NC201-27 and NC201-28 (see Appendix A). The following connectors are installed on the ECDA connector card NC201-27: for the encoders - "1"- "3"; for the hand wheel - "4"; for DAC - connector "5".

The input connectors "32IN", "8IN" and the output connectors "24OUT" are installed on connector card NC201-28. The designation, markings and purpose of these connectors are given in Table 3.3.

5.4.2 The Encoder Channel

5.4.2.1 The CNC Unit can operate with three photoelectric angular or linear travel transducers generating a PI-type rectangular pulse output signal (TTL). Power to the encoders is fed from the CNC Unit through their connection channels.

5.4.2.2 The encoder channel features the following characteristics:

- a) encoder feed voltage: 5.00±0.25 V;
- b) channel input: differential;
- c) types of input signals:
 - main (A+, A-);
 - displaced (B+, B-);
 - zero-mark (Z+, Z-);

- | | |
|---|---|
| d) type of input signals: | rectangular pulses; |
| e) frequency of input signals before quadrupling: | 200 kHz, max.; |
| f) discreteness of an input signal step: | $1/(4 \times N)$, where N is the number of pulses per one sensor revolution; |
| g) input signal levels: | |
| the logic «0» | 0.50 V, max.; |
| the logic «1» | 2.50 V, max.; |
| h) connection cable length: | 50 m, not more. |

5.4.2.3 The channel operation time diagram for direct channel signals is shown in Figure 5.3 (the inverse signals **A-**, **B-**, **Z-** are not shown).

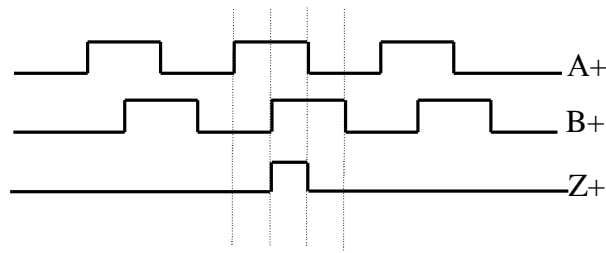


Figure 5.3

5.4.2.4 This channel performs a hardware-based check of the encoder signal interruption or of its power supply. Its operation mode is set by placing Jumper **S5** in accordance with Figure 5.4. The encoder signal break hardware checks are enabled by default.



Figure 5.4 – Selection of the Mode of Encoder Signal Hardware-Based Interruption Checks

5.4.2.5 The encoder channels are wired to Connectors «1»-«3» on the connector card of the CNC unit. The connector types are shown in Table 3.2. Connector pins arrangement is shown in Figure 5.5. This channel signals are presented in Table 5.6.

Table 5.6

Pin	Designed use
1	A+
2	B+
3	Z+
4	+5V (encoder power supply)
5	GND (encoder power supply)
6	A-
7	B-
8	Z-
9	+5V (encoder power supply)

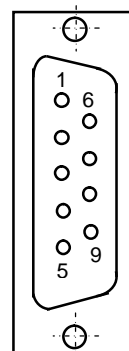


Figure 5.5

5.4.2.6 Encoders are connected to the CNC Unit according to the diagram presented in Figure 5.6. For communication between the encoders and the CNC Unit a cable with a wave resistance of 120 Ohm must be used.

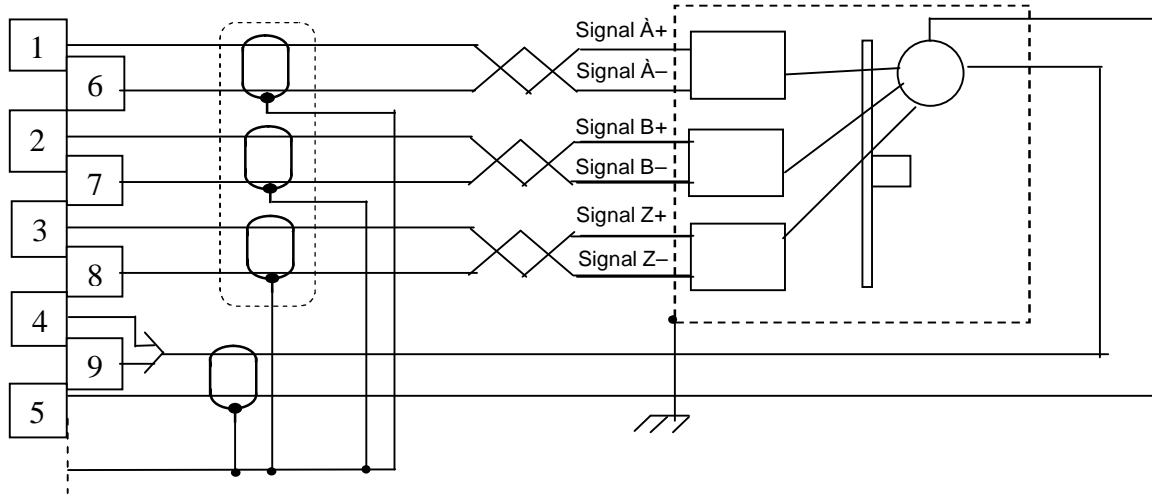


Figure 5.6

5.4.3 The Digital-to-Analog Converter (DAC)

5.4.3.1 The DAC characteristics are as follows:

- | | |
|---|-------------------------------------|
| a) number of channels: | 4; |
| b) basic chip circuit | AD7545; |
| c) output resistance: | 0.2 Ohm; |
| d) output current: | 5 mA; |
| e) output signal range: | ± 10.0 V; |
| f) linear section: | ± 8.5 V; |
| g) resolution: | 14 digits (13 digits+ 1 character); |
| h) nominal discreteness in the range: | |
| from minus 10 to minus 5 V | 2.440 mV; |
| from minus 5 to plus 5 V | 1.220 mV; |
| from plus 5 to plus 10 V | 2.440 mV; |
| i) main conversion error: | |
| in the range of ± 0.15 V | ± 2.5 mV, not more; |
| in the rest of the range | $\pm 1\%$; |
| j) additional conversion error per 10 °C: | it does not exceed the main error. |

5.4.3.2 The encoder channel connects the feedback sensor through the system bus with the CPU. The CPU processes information received from the FS and transmits the processing result in the form of a 14-digit code to the DAC. The DAC converts the code into an analog voltage and transmits the resulting action to the electric drive of controlled equipment.

Correspondence between the codes and the analog voltage at the DAC output is shown in Table 5.7. The graph of the DAC output voltage is presented in Figure 5.7.

5.4.3.3 The DAC device channels are wired to Connector «5» on the connector card of the CNC unit. The connector types are given in Table 3.2. The arrangement of connector pins is shown in Figure 5.8. The DAC channel signals are presented in Table 5.8. The wave resistance of the connecting cable must be equal to 120 Ohms.

Table 5.7 – Correspondence of Codes to the DAC Output Voltage

Hexadecimal code (Hex)	DAC output voltage, mV
9FFF	-10000.00
9CCF	- 9000.24
9B35	- 8500.00
999B	- 8000.48
9802	- 7500.00
9668	- 7000.73
9336	- 6000.97
8FFF	- 5000.00
8CCF	- 4000.24
8998	- 3000.48
8801	- 2500.00
8667	- 2000.73
8334	- 1000.93
8194	- 500.48
80A4	- 200.18
8052	- 100.09
8040	- 78.12
8020	- 39.06
8010	- 19.53
8008	- 9.76
8004	- 4.88
8002	- 2.44
8001	- 1.22
0000	0.00
0001	+ 1.22
0002	+ 2.44
0003	+ 3.66
0005	+ 6.10
0009	+ 10.98
0011	+ 20.75
0020	+ 39.06
0041	+ 79.34
0052	+ 100.97
00A4	+ 200.19
019A	+ 500.19
0334	+ 1000.95
0667	+ 2000.73
0801	+ 2500.00
0998	+ 3000.00
0CCF	+ 4000.24
0FFF	+ 5000.00
1336	+ 6000.97
1668	+ 7000.73
1802	+ 7500.00
199B	+ 8000.48
1B35	+ 8500.00
1CCF	+ 9000.24
1FFF	+ 9998.77

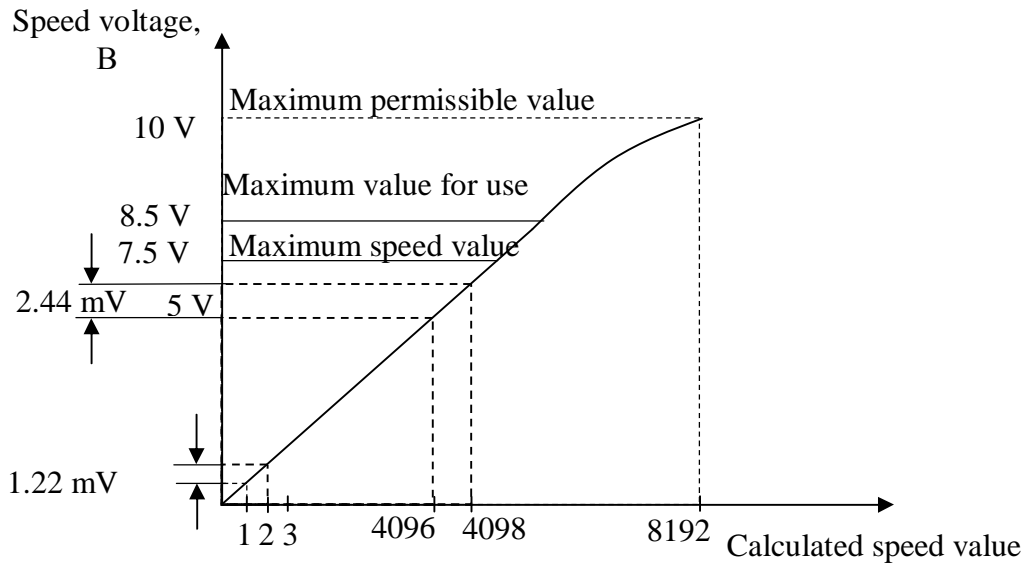


Figure 5.7 – The graph of the DAC output voltage (14 digits)

Table 5.8

Pin	Designed use	Pin	Designed use
1	DAC1 channel	9	GND A DAC1
2	DAC2 channel	10	GND A DAC2
3	DAC3 channel	11	GND A DAC3
4	DAC4 channel	12	GND A DAC4
5	GND A	13	–
6	–	14	–
7	–	15	–
8	–	–	–

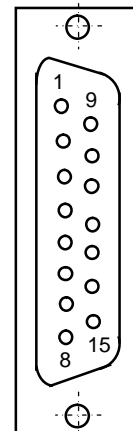


Figure 5.8

5.4.4 The Electronic Hand Wheel Channel

5.4.4.1 The CNC Unit has one electronic hand wheel channel. Power is fed to the hand wheel from the CNC Unit through its channel.

5.4.4.2 Characteristics of the electronic hand wheel channel:

- a) hand wheel supply voltage: 5.00±0.25 V;
- b) input type: differential/single (direct);
- c) nomenclature of input signals:
 - main (A+, A-/A+);
 - displaced (B+, B-/B+);
- d) type of input signals: rectangular pulses;
- e) input signal frequency to quadrupling: 200 kHz, not more;
- f) the discreteness of input signal step: 1/(4xN), where N is the number of pulses per one sensor revolution;
- g) input signal levels:
 - the logic «0» 0.50 V, not more;

- the logic «1» 2.50 V, not less;
 h) connection cable length: 50 m, not more.

5.4.4.3 The hand wheel channel allows to operate this unit both with hand wheels having differential (direct and inverse) signals **A+**, **A-** and **B+**, **B-** and with hand wheels having single-type (direct) signals **A+** and **B+**. The type of the hand wheel input can be selected by means of Jumpers S1-S4 on the NC201-25 card (see Appendix A) according to Table 5.9.

Table 5.9

Input type	S1	S2	S3	S4
single (direct)	open	open	closed	closed
differential	closed	closed	open	open

5.4.4.4 The hand wheel channel is linked to Connector «4» on the connector card of the CNC unit. The connector type is shown in Table 3.2. The arrangement of connector pins is shown in Figure 5.9. The channel signals are given in Table 5.10.

Table 5.10

Pin	Purpose
1	A+
2	B+
3	Not used
4	+5 V (hand wheel power supply)
5	GND (hand wheel power supply)
6	A-
7	B-
8	Not used
9	+5 V (hand wheel power supply)

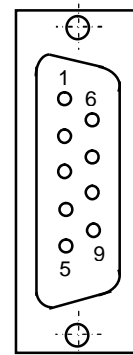


Figure 5.9

ATTENTION! POWER IS SUPPLIED TO THE HAND WHEEL FROM THE CNC UNIT THROUGH ITS CHANNEL. CONNECTION OF THE COMMUNICATION CABLE COMING FROM THE CNC UNIT TO THE HAND WHEEL REQUIRES SPECIAL ATTENTION. THE FEED WIRES «+5V» AND «GND» OF THE SIDE OF THE HAND WHEEL MUST BE CLEARLY DEFINED (WITH A CLEAR MARKING OR COLOR). IT IS NOT ALLOWED TO REVERSE THE FEED WIRES «+5V» AND «GND». NON-COMPLIANCE WITH THIS REQUIREMENT LEADS TO A FAILURE OF THE PHOTOCCELL AND OF THE HAND WHEEL MICROCIRCUIT.

5.4.5 Discrete Input/Output Channels

5.4.5.1 Discrete input characteristics:

- a) number of input channels: 40;
 b) form of input signal: D.C. voltage;
 c) input signal level:
 the Logic «0» 0–7 V;
 the Logic «1» 15–30 V;
 d) nominal input current at 24 V: 12 mA;
 e) time constant of the input filter: 5 ms;

- f) electric strength of opto-isolation: 1500 kV, min.

5.4.5.2 Discrete output characteristics:

- a) number of output channels: 24;
 b) output type: an open collector;
 c) commutated voltage: 15–30 V;
 d) nominal output current at 24 V: 50 mA;

5.4.5.3 The discrete input/output channels secure the physical connection of the CNC Unit and controlling, monitoring and protection elements, etc., in the electric circuits of controlled objects.

The input/output channel signals are discrete signals and they can assume the value of either the logic «1» or the logic «0». The input signals inform the CNC Unit on the status of an element being polled in the control circuits. Output signals pass through the CNC output channels into controlled equipment, switching on/off certain elements in control circuits.

Information exchanges between the CNC Unit and the electrical equipment of an object to be controlled are carried out under software control. A part program ensures information transfer via a **PLC** interface both from controlled equipment to **PL** and in the opposite direction.

5.4.5.4 The input/output channel signals are physical package «A» signals of the **PLC** interface. Information about the «A»-package signals is contained in the “Programming and Operator's Manual” and in the “PLC Interface Programming”.

Connectors **00-03, 08-11** are assigned to input signals in the «A» package by using the CNC software, while Connectors **04,05,12,13** are assigned to output signals. Determination of input/output channel parameters, when characterizing the controlled equipment logic, is given in “Software Characterization”.

5.4.5.5 The input/output channels are wired through Connectors **I/O NC201-28** card to the connector card of the CNC Unit, which is presented in Figure 3.3. The input channels are wired to Connectors «**32 IN**» and «**8 IN**», while the output channels are linked to Connector «**24 OUT**». The types of connectors are indicated in Table 3.2.

An example of signals distribution in input Connectors **00, 01** and in output adapter connector **04** of the «A» package belonging to the **PLC** interface between the CNC Unit connectors is given in Table 5.11.

Table 5.11 – An example of signals distribution of the PLC interface

No. of the module	PLC signals(«A» package)		
	Connectors of the CNC Unit		
	« 32 IN »	« 8 IN »	« 24 OUT »
0	I00A00-I00A31	I01A00-I01A07	U04A00-U04A23

5.4.5.6 The input/output signal distribution between the CNC Unit connectors is indicated in Table 5.12.

5.4.5.7 It is recommended to implement the connection of the discrete input/output channels of the CNC Unit to the electric automation devices of controlled equipment through external input/output modules. A list of external input/output modules, their characteristics, and their diagram of connection to the CNC Unit and the table of soldered connections for communication cables are contained in Appendix D.

ATTENTION! POWER SUPPLY TO EXTERNAL INPUT/OUTPUT MODULES FROM THE CONTROL OBJECT SHALL BE PROVIDED VIA THE «SPEPN» RELAY CONTACTS, SINCE THE MOMENT OF ENABLING/REMOVING POWER SUPPLY IS PROGRAMME-CONTROLLED.

Table 5.12 – I/O signals of the NC-201 CNC Unit

Connector «32 IN»		Connector «8 IN»		Connector «24 OUT»	
Signal	Pin	Signal	Pin	Signal	Pin
In0 (I00A00)	1	In32 (I01A00)	1	Out0 (U04A00)	1
In1 (I00A01)	2	In33 (I01A01)	2	Out1 (U04A01)	2
In2 (I00A02)	3	In34 (I01A02)	3	Out2 (U04A02)	3
In3 (I00A03)	4	In35 (I01A03)	4	Out3 (U04A03)	4
In4 (I00A04)	5	0V	5	Out4 (U04A04)	5
In5 (I00A05)	6	0V	6	Out5 (U04A05)	6
In6 (I00A06)	7	+24V	7	Out6 (U04A06)	7
In7 (I00A07)	8	+24V	8	Out7 (U04A07)	8
In8 (I00A08)	9	In36 (I01A04)	9	Out8 (U04A08)	9
In9 (I00A09)	10	In37 (I01A05)	10	Out9 (U04A09)	10
In10 (I00A10)	11	In38 (I01A06)	11	Out10 (U04A10)	11
In11 (I00A11)	12	In39 (I01A07)	12	Out11 (U04A11)	12
In12 (I00A12)	13	0V	13	Out23 (U04A23)	13
In13 (I00A13)	14	0V	14	Out12 (U04A12)	14
In14 (I00A14)	15	+24V	15	Out13 (U04A13)	15
In15 (I00A15)	16	–	–	Out14 (U04A14)	16
0V	17	–	–	Out15 (U04A15)	17
0V	18	–	–	Out16 (U04A16)	18
0V	19	–	–	Out17 (U04A17)	19
In16 (I00A16)	20	–	–	Out18 (U04A18)	20
In17 (I00A17)	21	–	–	Out19 (U04A19)	21
In18 (I00A18)	22	–	–	Out20 (U04A20)	22
In19 (I00A19)	23	–	–	Out21 (U04A21)	23
In20 (I00A20)	24	–	–	Out22 (U04A22)	24
In21 (I00A21)	25	–	–	+24V	25
In22 (I00A22)	26	–	–	–	–
In23 (I00A23)	27	–	–	–	–
In24 (I00A24)	28	–	–	–	–
In25 (I00A25)	29	–	–	–	–
In26 (I00A26)	30	–	–	–	–
In27 (I00A27)	31	–	–	–	–
In28 (I00A28)	32	–	–	–	–
In29 (I00A29)	33	–	–	–	–
In30 (I00A30)	34	–	–	–	–
In31 (I00A31)	35	–	–	–	–
0V	36	–	–	–	–
0V	37	–	–	–	–

6 OPERATOR'S CONTROL PANEL

6.1 The Set Up of the Operator's Control Panel

6.1.1 The operator's control panel (OCP) comprises a display unit and a keyboard unit. The set up of these units is presented in Table 3.1. The front panel of the OCP, its overall and mounting dimensions are shown in Figure 3.2. The following elements are located on the front surface of the OCP:

- a flat-screen, liquid-crystal color display unit, type TFT 10.4", 640x480;
- an alphanumeric keyboard module:
 - § 36 alphanumeric keys;
 - § 29 special-purpose keys;
- a functional keyboard module:
 - § 10 functional keys;
 - § 5 special-purpose keys;
- a console:
 - § the CNC power switch (a lock with a key);
 - § light-emission diodes (LEDs):
 - “AC” – a power supply indicator;
 - “DC” – an indicator of the healthy status of the secondary power supply;
 - “ER” – the CNC operation error indicator;
 - § a “START” key “1” (driven by the basic software);
 - § a “STOP” key “0” (driven by the basic software);
 - § a EMERGENCY STOP button (a red color, mushroom-shaped button);
 - § a feed corrector “F”;
 - § a spindle rotational speed corrector “S”;
 - § an operation mode selector switch “MDI, AUTO, STEP, ..., RESET”.

6.1.2 A description of OCP control elements and their application are presented in “Programming and Operator’s Manual”.

6.1.3 Both the display and the keyboard are controlled from the CPU card. Control signals come onto the NC201-32 display from the CPU via an internal cable through the **LCD 24 bit** interface. The keyboard unit and the CPU card are connected by an internal cable through the **EXKB** keyboard interface.

6.1.4 By pressing the **EMERGENCY STOP** pushbutton of NC201-47 control voltage can only be removed from the machine-tool alone. The “**ESTOP**” connector to which the contacts of the **EMERGENCY STOP** knob are wired – one is a normally-open contact and one is a normally-closed contact - is placed on the connector card of the CNC Unit.

The normally-open contact of the power switch (“**KEY**”) is wired to the “**SPEPN KEY**” connector of the CNC Unit connector card.

7 SAFETY INDICATIONS

7.1 Personnel members admitted to the operation of the CNC Unit must be attested in terms of observing safety regulations.

7.2 Before connecting the CNC Unit to the power supply system of ~220 V, 50 Hz, the outer casing of the CNC Unit and that of the controlled object must be reliably grounded.

7.2.1 The resistance value between any grounding component (either a bolt, a screw, or a pin) and any non-conducting metal part of the CNC Unit, which might happen to be accessible to human contacts and might bear a voltage, may not exceed 0.1 Ohm.

7.2.2 The grounding resistance value may not be more than 4 Ohms.

7.3 Connection of the CNC Unit to the factory power system is allowed through an isolation transformer only, with a capacity of not less than 300 VA.

7.4 Operation of the CNC Unit, when its power supply is turned on, must be carried out with its cabinet doors closed.

7.5 Any repair works, or replacement of CNC modules, installation of selector switches into the modules and connection/disconnection of external cables may only be carried out after switsching off power supply, because voltage jumps can damage electronic components or the entire CNC Unit. It is necessary to wait during 10 seconds after disconnecting the power supply from the CNC Unit, for the device to be able return back to its static condition.

7.6 ATTENTION! INTEGRATED CIRCUITS OF THE MOS, CMOS FAMILY, ETC. ARE SENSITIVE TO STATIC ELECTRICITY. THEREFORE, BEFORE CONTACTING ANY PARTS INSIDE THE CNC UNIT OR BEFORE WORKING WITH ANY MODULES OUTSIDE THE DEVICE, IT IS NECESSARY TO CONTACT THE GROUNDED METAL CABINET OF THE CNC UNIT, IN ORDER TO REMOVE ANY STATIC VOLTAGE FROM YOUR BODY.

7.7 It is necessary to keep to the following sequence of actions, when taking CNC modules out of its casing:

- switch off the CNC Unit;
- disconnect the controlled equipment from its power supply;
- disconnect the CNC Unit from power its supply;
- disconnect external module connectors;
- unscrew evenly the external mounting screws and remove the housing;
- remove any electrostatic voltage from your body;
- carefully take out the module from its case.

7.8 Any installation works inside the CNC Unit and modules should be done with a soldering iron designed for an operation voltage of 36 V. The soldering iron must have well-insulated conductive parts in relation to its own body. The soldering iron body must be grounded.

8 SPECIFIC FEATURES OF CABLE LAYING

8.1 The reliable operation of this equipment complex which is made up of the CNC Unit and a controlled object directly depends on the way cables between the component parts of this equipment set are laid out. A remote location of the CNC Unit in relation to its feedback sensors and drives predetermines the laying out of a great number of data transfer cables, which will be placed near electric power cables.

8.2 Cables classification.

8.2.1 The following cables should be referred to as information cables:

- cables for communication with the digital-to-analog converter (DAC);
- cables for communication with the feedback sensors (FS);
- an RS-232/485 interface cable, an FDD interface cable; an USB interface cable, an LAN interface cable.

8.2.2 The following cables should be referred to as power-transmission cables:

- cables of the D.C. voltage source, $U = +24 \text{ V}$;
- power cables with a voltage of $\sim 220 \text{ V}$, $\sim 380 \text{ V}$;
- supply cables for contactors.

8.3 When laying cables, it is necessary to adhere to the requirements set in the IEC 550 Standard, taking into account the following recommendations:

1) the distance between data transfer and power cables laid inside the cabinet must be as big as possible; while the shortest possible spacing between them, if they are laid in parallel, must be not less than 20 cm; in case it is impossible to meet this requirement, it is necessary to ensure that cables are laid in a shielding, in grounded cable ducts or to use shielded metal boxes or partitions;

2) external cables connecting the component parts of this equipment set must be laid close to the cabinet walls, metal structural elements or metal buses; all cable brackets must be grounded;

3) information and power cables must not:

- run next to devices emitting a strong external electromagnetic radiation;
- run next to cables relaying impulse signals;

4) information cables must be shielded and have special connectors ensuring connection of the shielding with the body (casing) at both cable ends; yet, cables for analog DAC signals of $\pm 10 \text{ V}$ are an exception, when connection of the shielding with the body is made only at the side of the CNC Unit, which increases resistance against interference;

5) in case of any information cable rupture, the point of damage must be shielded and cable shielding sections must be reconnected;

6) conductors of cables for discrete input/output signals (DC voltage) may be arranged close to one another;

7) the chosen cable lengths must be justified from the technological point of view; in order to increase their resistance to the effect of inductive and capacitive factors, cables must not be excessively long, nor may they be tensioned at their connection and bend points;

8) It is necessary to ensure that electrical potentials are equalized with an extra wire in the data communication cables, for example, in the cable connecting the CNC Unit with the remote PC; it is also necessary to ensure a reliable sort of grounding for these devices.

9 INSTALLATION PROCEDURES, PREPARATION FOR OPERATION, THE CNC UNIT OPERATION PROCEDURE

9.1 Compliance with requirements related to operating conditions with regard to any mechanical and environmental factors must be ensured, as well as concerning requirements set to the power supply system in accordance with the requirements of Section 1.

9.2 Measures shall be undertaken to suppress any interference from the inductive loads of electric automation devices, in accordance with IEC 550.

9.3 The CNC Unit must be installed in a cabinet (housing) with a protection degree according to IP54. The main mounting and overall dimensions of the CNC Unit are indicated in Figure 3.2 and Figure 3.3.

9.3.1 The CNC Unit must be fixed vertically or at an angle in relation to the operator.

9.3.2 Any equipment parts with a high level of heat emission shall be placed above the CNC Unit.

9.3.3 Any heat emitted by the CNC Unit shall be evacuated by applying inner cabinet or housing ventilation systems, taking into account the requirements set in Section 1 (See the Note).

9.4 This device must be grounded in accordance with the recommended diagram of Appendix E, taking into account the requirements of Clause 7.2. The grounding conductor cross-section shall be as follows:

- for flexible wires – 0.75-1.00 mm²;
- for other wires – 1.00-2.50 mm².

9.5 Cables for connecting the CNC Unit to controlled equipment must be prepared. To make the above cables, connectors included in the CNC delivery set shall be used (see Table 3.3). Tables with data on how output connectors of the CNC modules are soldered are given in this manual.

9.6 Connect the CNC Unit and the controlled equipment with cables, using Table 3.2 and Figure 3.3 for that. When laying connector cables take into account the requirements set forth in Section 8.

9.7 Connect the «SPEPN» connector to the switch-on circuit of controlled equipment. Ensure the supply of +24V from the controlled equipment power source through the «SPEPN» connector to the external relay modules.

9.8 Connect the EMERGENCY STOP button to the machine emergency disconnection circuit.

9.9 Study the CNC switch-on/off sequence and the control guidelines for the CNC Unit with an OCP, which are contained in the “Programming and Operator's Manual”.

9.10 Deliver the power supply line voltage to the «AC220V» connector. When power supply is connected, the «AC» LED will light up on the front panel of the CNC Unit.

9.11 Switch on the CNC power supply by setting the key in the lock on the OCP into the «ON» position, in which case the «DC» indicator lights up, the fan starts on, the CNC self-diagnostics systems are started and the operation system will be loaded.

It is further advised to select out from the menu the **DEBUG/CNC** operating mode within two-three seconds. The CNC Unit automatically will load by default “**CNC**”, and video-page # 1 appears on the monitor screen.

9.12 During the subsequent operation of the CNC Unit the « Programming and Operator's Manual» should be used.

10. APPENDICES

10.1 APPENDIX A (obligatory)

Connectors and Jumpers of the Control Unit

10.1.1 PCA-6751 CPU Card (NC201-21)

10.1.1.1 The arrangement of connectors, jumpers and electronic components of the **PCA-6751** type **CPU card** NC201-21 is presented in Figure A.1. The marking given on the card is: «**JP**» – a jumper.

Note – The jumper consists of two or three metal contacts on a plastic basis mounted on the board and a small plastic "cap" with a metal contact inside it for closing the contacts. Therefore, it is convenient to use jumpers for setting the CPU configuration by opening or closing the jumper contacts.

10.1.1.2 Designation and purpose of jumpers of the PCA-6751 type CPU card is indicated in Table A.1.

Table A.1 – Designation and purpose of jumpers

Jumper	Purpose
JP1	COM2 setting for RS-232/422/485
JP2	LCD panel select
JP3	CMOS backup select
JP4	Watchdog timer configuration
JP5	Closed 2-3

10.1.1.3 Designation and purpose of connectors of the PCA-6751 type CPU card is indicated in Table A.2.

Table A.2 – Designation and purpose of connectors

Обозначение	Назначение	Обозначение	Назначение
CN1	FDD connector	CN15	COM2 RS-232 connector
CN2	Parallel port connector	CN16	COM1 RS-232 connector
CN3	Keyboard lock, LED connector	CN17	External keyboard connector (EXKB)
CN4	USB connector	CN18	ATX power connector
CN5	24 bit LCD display connector	CN19	Reserved
CN6	36 bit LCD display connector	CN20	AT power connector
CN7	LCD inverter connector	CN21	Keyboard and PS/2 Mouse connector
CN8	IR connector	CN22	ISA gold finger connector
CN9	External speaker connector	CN23	ISA gold finger connector
CN10	Reserved	CN24	CompactFlash card connector
CN11	VGA connector	CN25	HDD LED connector
CN12	PC-104 connector	CN26	System reset switch connector
CN13	Ethernet connector	CN27	ATX power button
CN14	COM2 RS-422/485 connector	CN28	Enhanced IDE connector

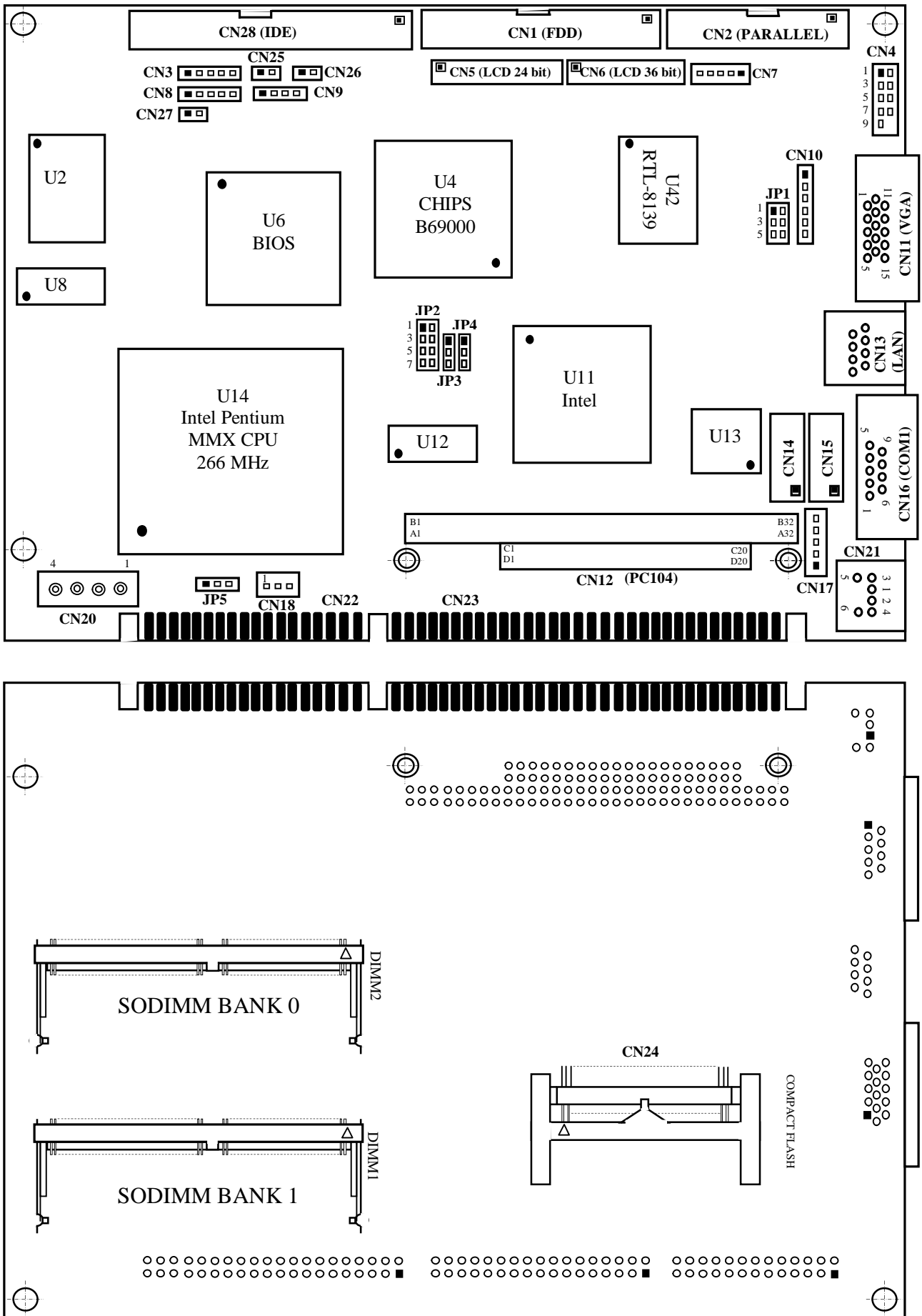


Figure A.1 – Arrangement of Connectors and Jumpers of the PCA-6751 CPU Board

10.1.1.4 Tables A.3–A.29 indicate information necessary to select CPU interfaces, the on-line memory configuration and they also present the interfaces used in the CNC Unit.

Table A.3 – COM2 interface selection RS232/422/485 (JP1)

COM2	JP1
RS-232	Closed 5-6
RS-422	Closed 3-4
RS-485	Closed 1-2

Table A.4 –LCD panel select (JP2)

LCD type	JP2
1024x600 TFT 48K	All contacts are opened
800x600 DSTN2 48K	Closed 5-6
1280x1024 DSTN 48K	Closed 3-4
800x600 TFT2 48K	Closed 3-4, 5-6
1024x600 DSTN	Closed 1-2
800x600 DSTN 48K	Closed 1-2, 5-6
1024x768 DSTN 48K	Closed 1-2, 3-4
800x600 TFT1 48K	Closed 1-2, 3-4, 5-6
800x600 DSTN	Closed 7-8
800x600 DSTN	Closed 5-6, 7-8
640x480 TFT 18 bit	Closed 3-4, 7-8
1280x1024 TFT	Closed 3-4, 5-6, 7-8
1024x768 TFT	Closed 1-2, 7-8
640x480 DSTN	Closed 1-2, 5-6, 7-8
640x480 Sharp TFT	Closed 1-2, 3-4, 7-8
1024x768 DSTN	Closed 1-2, 3-4, 5-6, 7-8

Table A.5 – CMOS backup select (JP3)

Режим	JP3
Normal	Closed 1-2
CMOS data clear	Closed 2-3

Table A.6 - Watchdog timer configuration (JP4)

Режим	JP4
System reset	Closed 2-3
IRQ11 interrupt	Closed 1-2

Table A.7 –FDD connector (CN1)

Pin	Signal	Pin	Signal
1	GND	2	Densiti selecн
3	GND	4	No connect
5	GND	6	No connect
7	GND	8	Index
9	GND	10	Motor 0
11	GND	12	Drive select 1
13	GND	14	Drive select 0
15	GND	16	Motor 1
17	GND	18	Direction
19	GND	20	Step
21	GND	22	Write data
23	GND	24	Write gate
25	GND	26	Track 0
27	GND	28	Write protect
29	GND	30	Read data
31	GND	32	Head select
33	GND	34	Disk change

Table A.8 –USB connector (CN4)

Pin	USB1: Signal	Pin	USB2: Signal
1	+5V	2	+5V
3	UV-	4	UV-
5	UV+	6	UV+
7	GND	8	GND
9	GND	10	No connect

Table A.9 – 24-bit LCD display connector (CN5)

Pin	Signal	Pin	Signal
1	VDDSAFE5	2	VDDSAFE5
3	GND	4	GND
5	VDDSAFE3	6	VDDSAFE3
7	V _{CON}	8	GND
9	P0	10	P1
11	P2	12	P3
13	P4	14	P5
15	P6	16	P7
17	P8	18	P9
19	P10	20	P11
21	P12	22	P13
23	P14	24	P15
25	P16	26	P17
27	P18	28	P19
29	P20	30	P21
31	P22	32	P23
33	GND	34	GND
35	SHIFT CLOCK	36	FILM
37	M	38	LP
39	No connect	20	ENAVEE

Table A.10 – 36-bit LCD display connector (CN6)

Pin	Signal	Pin	Signal
1	GND	2	GND
3	P24	4	P25
5	P26	6	P27
7	P28	8	P29
9	P30	10	P31
11	P32	12	P33
13	P34	14	P35
15	GND	16	GND
17	No connect	18	No connect
19	No connect	40	No connect

Table A.11 –LCD inverter connector (CN7)

Pin	Signal
1	+12V
2	GND
3	ENABKL
4	VBR
5	+5V

Table A.12 –IR connector (CN8)

Pin	Signal
1	+5V
2	No connect
3	IR_RX
4	GND
5	IR_TX

Table A.13 – External speaker connector (CN9)

Pin	Signal
1	+5V
2	No connect
3	Internal speaker
4	External speaker

Table A.14 – VGA display connector (CN11)

Pin	Signal	Pin	Signal	Pin	Signal
1	Red	6	GND	11	No connect
2	Green	7	GND	12	No connect
3	Blue	8	GND	13	H-Sync
4	No connect	9	No connect	14	V-Sync
5	GND	10	GND	15	No connect

Table A.15 – PC/104 connector (CN12)

CN12				CN12			
Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
A1	IOCHK	B1	GND	C1	GND	D1	GND
A2	D7	B2	REST	C2	SBHE	D2	MEMCS16
A3	D6	B3	+5V	C3	LA23	D3	IOCS16
A4	D5	B4	IRQ9	C4	LA22	D4	IRQ10
A5	D4	B5	-5V	C5	LA21	D5	IRQ11
A6	D3	B6	DRQ2	C6	LA20	D6	IRQ12
A7	D2	B7	-12V	C7	LA19	D7	IRQ15
A8	D1	B8	0WS	C8	LA18	D8	IRQ14
A9	D0	B9	+12V	C9	LA17	D9	DACK0
A10	IOCHRDY	B10	GND	C10	MEMR	D10	DRQ0
A11	AEN	B11	SMEMW	C11	MEMW	D11	DACK5
A12	A19	B12	SMEMR	C12	D8	D12	DRQ5
A13	A18	B13	IOW	C13	D9	D13	DACK6
A14	A17	B14	IOR	C14	D10	D14	DRQ6
A15	A16	B15	DACK3	C15	D11	D15	DACK7
A16	A15	B16	DRQ3	C16	D12	D16	DRQ7
A17	A14	B17	DACK1	C17	D13	D17	+5V
A18	A13	B18	DRQ1	C18	D14	D18	MASTER
A19	A12	B19	REFRESH	C19	D15	D19	GND
A20	A11	B20	CLK	C20	KEYPIN	D20	GND
A21	A10	B21	IRQ7	-	-	-	-
A22	A9	B22	IRQ6	-	-	-	-
A23	A8	B23	IRQ5	-	-	-	-
A24	A7	B24	IRQ4	-	-	-	-
A25	A6	B25	IRQ3	-	-	-	-
A26	A5	B26	DACK2	-	-	-	-
A27	A4	B27	TC	-	-	-	-
A28	A3	B28	BALE	-	-	-	-
A29	A2	B29	+5V	-	-	-	-
A30	A1	B30	OSC	-	-	-	-
A31	A0	B31	GND	-	-	-	-
A32	GND	B32	GND	-	-	-	-

Table A.16 – Ethernet connector RJ-45A (CN13)

Pin	Signal	Pin	Signal
1	+5V	2	ACTLED-
3	RX+	4	RX-
5	LILED-	6	GND
7	No connect	8	GND
9	TX+	10	TX-

Table A.17 – Serial port COM2: RS-232/422/485 (CN14)

Pin	Signal		
	RS-232	RS-422	RS-485
1	Data Carrier Detect (DCD)	TX-	DATA-
2	Data Set Ready (DSR)	No connect	No connect
3	Receive Data (RXD)	TX+	DATA+
4	Request to Send (RTS)	No connect	No connect
5	Transmit Data (TXD)	RX+	No connect
6	Clear to Send (CTS)	No connect	No connect
7	Data Terminal Ready (DTR)	RX-	No connect
8	Ring Indicator (RI)	No connect	No connect
9	GND	GND	GND
10	No connect	No connect	No connect

Table A.18 – Serial port COM2: RS-232 (CN15)

Pin	Signal	Pin	Signal
1	DCD	2	DSR
3	RxD	4	RTS
5	TxD	6	CTS
7	DTR	8	RI
9	GND	10	No connect

Table A.19 – Serial port COM1: RS-232 (CN16)

Pin	Signal	Pin	Signal
1	DCD	6	DSR
2	RxD	7	RTS
3	TxD	8	CTS
4	DTR	9	RI
5	GND	-	-

Table A.20 – External keyboard connector (CN17)

Pin	Signal	Pin	Signal
1	Clock	2	Data
3	No connect	4	GND
5	+5V	-	-

Table A.21 – ATX power connector (CN18)

Pin	Signal
1	+5VSB
2	No connect
3	PS_ON

Table A.22 – AT power connector (CN20)

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

Table A.23 – Keyboard & PS/2 Mouse connector (CN21)

Pin	Signal	Pin	Signal	Pin	Signal
1	KB DATA	2	MS DATA	3	GND
4	+5V	5	KB CLCK	6	MS CLCK

Table A.24 –ISA gold fingers (CN22, CN23)

CN23				CN22			
A		B		C		D	
Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
A1	-IOCHCHK	B1	GND	C1	SBHE	D1	-MEMCS16
A2	SD07	B2	RESET	C2	LA23	D2	+HOCS16
A3	SD06	B3	+5V	C3	LA22	D3	IRQ10
A4	SD05	B4	IRQ9	C4	LA21	D4	IRQ11
A5	SD04	B5	-5V	C5	LA20	D5	IRQ12
A6	SD03	B6	DRQ2	C6	LA19	D6	IRQ15
A7	SD02	B7	-12V	C7	LA18	D7	IRQ14
A8	SD01	B8	OWS	C8	LA17	D8	-DACK0
A9	SD00	B9	+12V	C9	-MEMR	D9	DRQ0
A10	-IOCHRDY	B10	GND	C10	-MEMW	D10	-DACK5
A11	AEN	B11	-SMEMW	C11	SD08	D11	DRQ5
A12	SA19	B12	-SMEMR	C12	SD09	D12	-DACK6
A13	SA18	B13	-IOW	C13	SD10	D13	DRQ6
A14	SA17	B14	-IOR	C14	SD11	D14	-DACK7
A15	SA16	B15	-DACK3	C15	SD12	D15	DRQ7
A16	SA15	B16	-DRQ3	C16	SD13	D16	+5V
A17	SA14	B17	-DACK1	C17	SD14	D17	-MASTER
A18	SA13	B18	-DRQ1	C18	SD15	D18	GND
A19	SA12	B19	-REFRESH	-	-	-	-
A20	SA11	B20	BCLK	-	-	-	-
A21	SA10	B21	IRQ7	-	-	-	-
A22	SA09	B22	IRQ6	-	-	-	-
A23	SA08	B23	IRQ5	-	-	-	-
A24	SA07	B24	IRQ4	-	-	-	-
A25	SA06	B25	IRQ3	-	-	-	-
A26	SA05	B26	-DACK2	-	-	-	-
A27	SA04	B27	T/C	-	-	-	-
A28	SA03	B28	BALE	-	-	-	-
A29	SA02	B29	+5V	-	-	-	-
A30	SA01	B30	OSC	-	-	-	-
A31	SA00	B31	GND	-	-	-	-

Table A.25 – HDD LED (CN25)

Pin	Signal
1	IDE LED+
2	IDE LED-

Table A.26 – Reset switch (CN26)

Pin	Signal
1	MR_RESET
2	GND

Table A.27 – ATX power button (CN27)

Pin	Signal
1	Standby 5V
2	Power ON

Table A.28 – CompactFlash disk (CN24)

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

Table A.29 – EIDE connector (CN28)

Pin	Signal	Pin	Signal
1	IDE RESET	2	GND
3	DATA7	4	DATA8
5	DATA6	6	DATA9
7	DATA5	8	DATA10
9	DATA4	10	DATA11
11	DATA3	12	DATA12
13	DATA2	14	DATA13
15	DATA1	16	DATA14
17	DATA0	18	DATA15
19	SIGNAL GND	20	N/C
21	N/C	22	GND
23	IO WRITE	24	GND
25	IO READ	26	GND
27	IO CHANNEL READY	28	N/C
29	HDACKO	30	GND
31	IRQ14	32	IOCS16
33	ADDR1	34	N/C
35	ADDR0	36	ADDR2
37	HARD DISK SELECT 0	38	HARD DISK SELECT 1
39	IDE ACTIVE	40	GND

10.1.2 ECDA I/O Card (NC201-25)

10.1.2.1 The arrangement of connectors and jumpers of the **ECDA I/O** card NC201-25 is shown in Figure A.2.

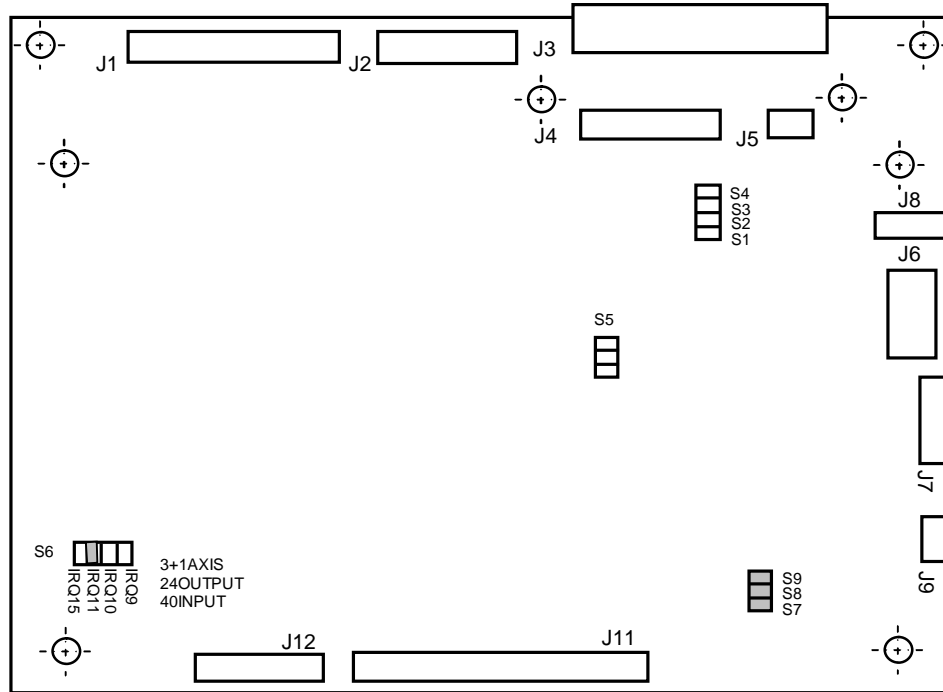


Figure A.2 – Arrangement of Connectors and Jumpers of the NC201-25 Card

Purpose of connectors and jumpers of the NC201-25 card:

- **J1** – the adapter connector of discrete input channels (socket PVD-50G1); it ensures the reception of input signals from the NC201-28 (J1) card;
- **J2** – the adapter connector of discrete output channels (socket PVD-34G1); it ensures the transmission of output signals to the NC201-28 (J2) card;
- **J3** – an adapter (socket LBHR 26-G); it ensures data exchange between the NC201-43 (J1) keyboard unit and the control unit via a cable;
- **J4** – an adapter connector for the encoder channels and the hand wheel (socket PVD-34G1); it ensures signal transmission in the three encoder channels and in one hand wheel channel to the NC201-27 (J1) card;
- **J5** – the adapter connector of the D-A converter channels (socket PVD-10G1); it ensures the transmission of DAC signals to the NC201-27 (J2) card;
- **J6** – a power connector (plug MF 10-M-R); it receives power voltage from the NC201-11 power-supply source for all the component parts of the CNC Unit;

- **J7** – an adapter connector (plug PW 10-6-M) for service signal exchange with the NC201-14 (J3) power control card via a cable;
- **J8** – an adapter power connector (plug PW 10-5-M); supply voltage goes from it by cable to the NC201-26 card (J3);
- **J9** – an adapter power connector (plug PW 10-4-M); supply voltage goes from it by cable to the TFT NC201-31 (CN1) converter card;
- **S1-S4** – jumpers used to determine the electronic hand wheel input type:
 - a differential input (for direct and inverse signals):
 - closed **S1, S2**;
 - open **S3, S4**;
 - a unitary input (for the direct signal):
 - open **S1, S2**;
 - closed **S3, S4**;
- **S5** – this jumper sets the mode of hardware-based encoder signal interruption checks: enabled/disabled:
 - closed 1-2: - enabled;
 - closed 2-3: - disabled;
- **S6** – the break level selection jumper from WATCHDOG:
 - ◆ 1-2 closed: IRQ9;
 - ◆ 3-4 closed: IRQ10;
 - ◆ 5-6 closed: IRQ11;
 - ◆ 7-8 closed: IRQ15;
- **S7-S9** – technological jumpers for testing the system; they must be closed during the operation of the CNC Unit.

10.1.3 Connector Card FDD/USB (NC201-26)

10.1.3.1 The arrangement of connectors and jumpers of the **FDD/USB** connector card NC201-26 is shown in Figure A.3.

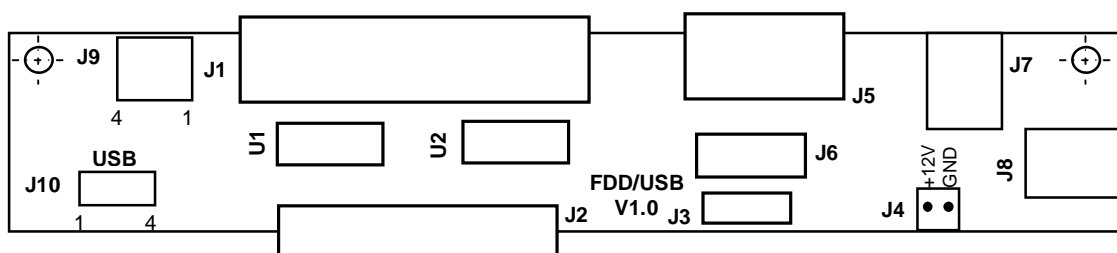


Figure A.3 – Arrangement of the Elements of the NC201-26 Card

Purpose of the Elements of the **FDD/USB** Connector Card NC201-26:

- **J1** – the output connector of the FDD channel; it has the marking «**FDD**» on the connector panel; the «**FDD**» connector type is indicated in Table 3.2, the channel signals are presented in Table 5.3;

- **J2** – the adapter connector of the FDD channel (plug BHR 34-G); it ensures the reception of FDD channel signals from the CPU NC201-21 card via a cable;
- **J3** – a power connector (plug PW 10-5-M); the supply voltage from the NC201-25 (J8) comes to it by cable. The supply voltage is used to supply power to the NC201-26, FDD, the FAN, connected to the USB channel of the devices;
- **J4** – the FAN power-supply connector (a plug with 2 pins: +12V, GND);
- **J5** – the output connector of the RS-232/485 channel (port COM2); it has the marking «232/485» on the connector card; the «232/485» connector type is indicated in Table 3.2, the channel signals are presented in Table 5.2;
- **J6** – the adapter connector of the RS-232/485 channel (plug BH 10-G); it ensures reception of COM2 port signals from the CPU card to the NC201-26 card via a cable;
- **J7** – the output adapter of the LAN channel; it has the marking «LAN» on the connector card; the «LAN» connector type is indicated in Table 3.2, the channel signals are presented in Table 5.4;
- **J8** – the adapter connector of the LAN channel (Ethernet interface); it ensures reception of **Ethernet** interface signals from the CPU card to the NC201-26 card via a cable;
- **J9** – the output adapter of the **USB** channel; it has the marking «USB» on the connector card; the «USB» connector type is indicated in Table 3.2, the channel signals are presented in Table 5.5;
- **J10** – the adapter connector of the **USB** channel (plug PW 10-4-M); it ensures reception of **USB** channel signals from the NC201-29 (J3) module to the NC201-26 card via a cable;
- **U1, U2** – **SN74HCT244N** chips; they ensure protection of **FDD** channel signals.

10.1.4 ECDA connector card (NC201-27)

10.1.4.1 The arrangement of the elements of the NC201-27 connector board is shown in Figure A.4.

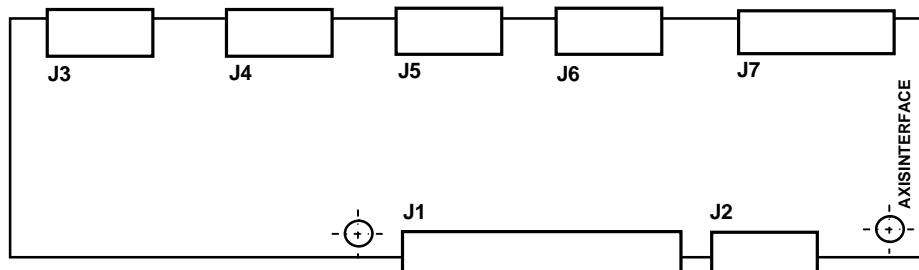


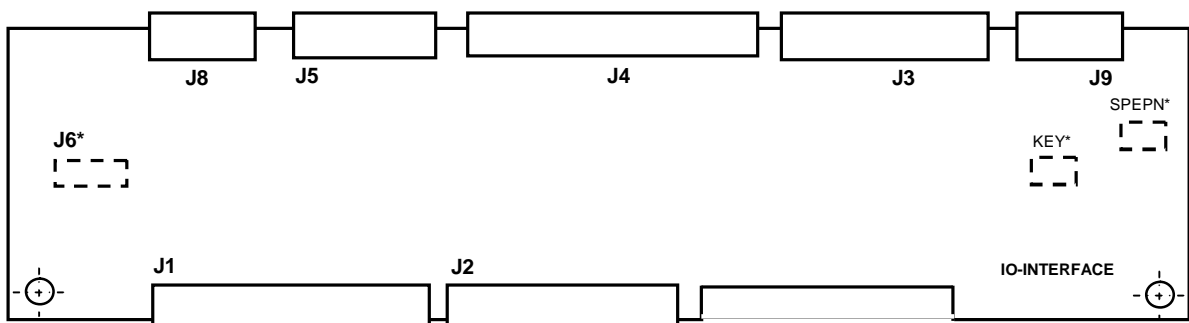
Figure A.4 – Arrangement of the Elements of the NC201-27 Card

Purpose of the Elements of the ECDA NC201-27 Connector Card:

- **J1** – the adapter connector of the encoder channels and the hand wheel (plug PLDR 34-G); it ensures the reception of signals of three encoder channels and one hand wheel channel from the NC201-25 (J4) module via a cable;
- **J2** – the adapter connector of the d-a converter (plug PLDR 10-G); it ensures the reception of d-a converter signals from the NC201-25 (J5) module to the card via a cable;
- **J3-J5** – the output connectors of the encoder channels; they have the marking «1», «2» and «3» on the connector card; the connector type is indicated in Table 3.2, the encoder channel signals are presented in Table 5.6;
- **J6** – the output connector of the electronic hand wheel channel; it has the marking «4» on the connector card; the connector type is indicated in Table 3.2, the hand wheel signals are presented in Table 5.10;
- **J7** – the output connector of the DAC channels; it has the marking «5» on the connector card; the connector type is indicated in Table 3.2, the DAC channel signals are presented in Table 5.8.

10.1.5 I/O Connector Card (NC201-28)

10.1.5.1 The arrangement of the elements of the I/O connector card NC201-28 is shown in Figure A.5.



FigureA.5 – Arrangement of the NC201-28 Card Connectors

Purpose of the Elements of the I/O NC201-28 Connector Card:

- **J1** – the adapter connector of discrete input channels (plug PLDR 50-G); it ensures the transmission of input signals to the NC201-25 (J1) module;
- **J2** – the adapter connector of the discrete output channels (plug PLDR 34-G); it ensures the reception of output signals from the NC201-25 (J2) module;
- **J3** – the connector of discrete output channels; it has the marking «24 OUT» on the connector card; the connector type is indicated in Table 3.2, the channel signals are presented in Table 5.12;

- **J4** – the connector of discrete input channels; it has the marking «**32 IN**» on the connector card; the connector type is indicated in Table 3.2, the channel signals are presented in Table 5.12;
- **J5** – the connector of discrete input channels; it has the marking «**8 IN**» on the connector card; the connector type is indicated in Table 3.2, the channel signals are presented in Table 5.12;
- **J6*** – an adapter connector (4-pin plug); it ensures the reception of signals from the **EMERGENCY STOP** NC201-47 mushroom-shaped knob;
- **J8** – an output connector to which the contacts of the mushroom-shaped Emergency Stop knob are wired; it has the marking «**ESTOP**» on the connector card; the connector type is indicated in Table 3.2;
- **J9** – an adapter connector to which the «**SPEPN**» relay contacts and the power switch contacts of the CNC Unit wired; it has the marking «**SPEPN KEY**» on the connector card; the type of connectors is indicated in Table 3.2;
- **SPEPN*** – an adapter connector (2-pin plug), between the «**SPEPN**» relay contacts and the J9 connector of the card;
- **KEY*** – an adapter connector (2-pin plug), between the power switch contacts of the CNC Unit and the J9 connector of the card.

Note – Connectors marked with the (*) symbol and with a dotted line in figure A.6 are mounted on the reverse side of the NC201-28 card.

10.1.6 USB Card (NC201-29)

10.1.6.1 Arrangement of the elements of the **USB** card NC201-29 is shown in Figure A.6.

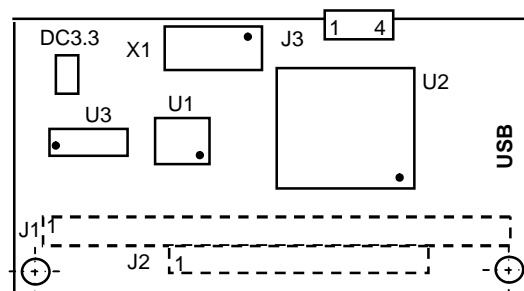


Figure A.6 – Arrangement of USB Card Elements

Purpose of the **USB Card** NC201-29 connectors:

- **J1, J2** – these the connectors of the PC104 board (plugs PLD 64-G and PLD 40-G), they ensure the reception of signals of the PC104 bus from the CPU card; they are located on the reverse side of the card;
- **J3** – the adapter connector of the USB channel (plug PW 10-4-M), ensures the channel signal transmission by cable to the FDD/USB NC201-26 (J8) channel connector card.

10.2 APPENDIX B (for reference) BIOS

10.2.1 BIOS Configuration

BIOS – this is the basic input/output system, it is the main software saved in the CPU module. The initial BIOS Setup configuration (hereinafter – “Setup”) is installed by the CNC manufacturer, with the possibility left for its later modification, in case any additional equipment is going to be mounted. When the CNC Unit is started, the program that is stored in BIOS will be launched.

As a structural element, BIOS is shaped as a ROM IC. When the CNC Unit is started, BIOS will carry out its minimum-level testing, its memory check and will compute all the sums to be checked and only after that it will program the microchips and issue a command to start the DOS program. The results of BIOS operation are shown on the screen: there appears first a static screen picture on it, then the size of operating memory is shown and the test itself will be carried out. Then the Plug and Play devices will be checked and the system proper will be started.

All the necessary settings are kept in BIOS. However, there exists some information about the equipment, which may be changed (for example, information about HDD, about the initial memory testing method, the device response to errors, etc.). All the parameters that may change are stored in the CMOS microcircuit. This microcircuit also stores all the settings, when power is off.

To change the main device settings, one should use the BIOS Setup utility. To call it up, the “Del” key should be pressed and held down. A BIOS memory of the Award Company is used in this CNC Unit. After loading the Setup program the main menu appears (Figure B.1).


ROM PCI/ISA BIOS ()
CMOS SETUP UTILITY
AWARD SOFTWARE, INC.

STANDARD CMOS SETUP BIOS FEATURES SETUP CHIPSET FEATURES SETUP POWER MANAGEMENT SETUP PNP/PCI CONFIGURATION LOAD BIOS DEFAULTS LOAD SETUP DEFAULTS	INTEGRATED PERIPHERALS PASSWORD SETTING IDE HDD AUTODETECTION HDD LOW LEVEL FORMAT SAVE & EXIT SETUP EXIT WITHOUT SAVING
Esc: Quit F10: Save & Exit Setup Time, Date, Hard Disk Type...	: Select Item (Shift)F2 :Change Color

Figure B.1 – Main Menu of the BIOS SETUP Utility

10.2.2 Control Keys in the SETUP Program

The required SECTION is chosen by shifting the cursor control keys “MOVE THE LINE FORWARD” or “MOVE THE LINE BACK” to a given point, to be followed by pressing the “Enter” key. When this selection operation has been made, the selected menu item will appear, which allows to modify the configuration parameters with the “+” (“PgUp”) or «*» (“PgDn”) keys. To return to the

previous menu, the “Esc” key must be used. In the upper menu the “Esc” key can be used to exit SETUP without saving changes in CMOS.  – means “Save all CMOS changes”.

10.2.3 Section “Standard CMOS Setup”

The very first item is the “STANDARD CMOS SETUP”. Upon pressing the “Enter” key, at this point there appears the menu shown in Figure B.2.

In this menu, likes in all the others, shifting is carried out by means of the cursor control keys, while parameter values are changed with the "PageUp" and “PageDown” keys.

```

ROM PCI/ISA BIOS ( )
STANDARD CMOS SETUP
AWARD SOFTWARE, INC.

Date (mm:dd:yy) : Sun, Jun, 1 1997
Time (hh:mm:ss) : 10 : 42 : 40

          CYLS. HEADS PRECOMP  LANDZONE  SECTORS MODE
-----
Primary Master :( 0Mb)  0      0      0      0      0      ----
Primary Slave  :( 0Mb)  0      0      0      0      0      ----

Drive A : None
Drive B : None

Video   : EGA/VGA
Halt On : All Errors

ESC : Quit          ↑↓→← : Select Item      PU/PD/+/- : Modify
F1  : Help          (Shift) F2 : Change Color
    
```

Figure B.2 – Menu of the Section “STANDARD CMOS SETUP”

The “STANDARD CMOS SETUP” SECTION contains a minimum information about the device configuration. This information includes its memory size, the number and type of hard disks, the presence of disk drives in the system. A reservation should be made here that in this present description not all the menu items are dealt with. The very first settings are “Date” and “Time”.

They are necessary to allow this device to “know” both the current time and date. Then follow the hard disk parameters. There are four types of them: Primary, Master and Slave, as well as the Secondary ones. The following parameters are indicated for every disk: its size in MB, the number of cylinders (Cyls), the number heads (Head) on the disk and the number of sectors (Sector) on the track.

All these parameters are indicated on the hard disk outer body.

To enable the system to work with hard disks, it is absolutely necessary to indicate their parameters on these lines. Below you will find information on how to preset hard disk parameters (see the SECTION “IDE HDD AUTO DETECTION”).

NOTE – AN UNASSISTED INSTALLATION OF THE HARD DISK BY THE HARD DISK USER:

- SUBSTITUTION OF HDD FOR FLASH REQUIRES ITS REGISTRATION BY THE CNC MANUFACTURER.
- UNDER THE NAME «D:» IT DOES NOT REQUIRE REGISTRATION BY THE CNC MANUFACTURER.

The main problem consists in the hard disk parameter determination mode.

The thing is that DOS cannot be run with disks having more than 1024 cylinders. The disk capacity for DOS is not more than 540 MB, even if you have a disk with a capacity of 1 GB. However, a solution was found: the LBA-mode began to be used in computers. When it is installed, DOS can sense disks with a volume of more than 540 MB. One can see this mode setting in the Mode column. The “Normal” indication can be there in it for disks with a volume of less than 540 MB, the “LBA” Indication – for disks of more than 540 MB and finally "Auto" – for automatic mode determination. It is strongly recommended not to experiment with this column. If your disk is set in the LBA mode and it has been shifted to Normal, then almost all information on the disk may be lost! No should one experiment with the other columns.

Pay attention to the “Type” column determining the installed disk type. The number of these types is rather large, but only the three basic ones are important to us: “None”, “User” and “Auto”.

The “None” mode is an indication for the device that there is no hard disk in the system. If the hard disk is physically unavailable and the “None” mode is set in the Setup, the device will not sense it and will require a loading diskette to be inserted during the loading (since the system can be loaded not only from the Winchester disk, but also from an ordinary diskette). And, vice versa, if the hard disk is not present or it is disconnected and its type is indicated in the Setup (that means, it exists), then it will wait a little during the switching on of the device and signal an error “HARD DISK FAIL”.

The “User” mode means a fixed setting procedure for the hard disk type. The parameters indicated on this line influence its volume. The volume is calculated this way:
Cyls x Head x Sector x 512.

We receive an answer in bytes. If for some reason one hard disk (even a similar one) was substituted for another, these parameters must be set again. Read below how it is done (Cf. the Section “IDE HDD AUTO DETECTION”).

The “Auto” mode implies the automatic determination of the hard disk parameters. It is a very convenient parameter. When it is set, then in case of the hard disk change one doesn't have to install its parameters in the Setup every time. The device will determine them by itself. But one must be careful: make sure that the “Auto” mode is also put into the “Mode” column!

This is to be followed by setting the floppy disk parameters into the system. There can be two of them in general. The system supports different types of floppy disks - from 360 KB to 2.88 MB.

The “Hold On” Item makes it possible to define the types of errors that will cause the device stopping during its loading, if they should occur. For example, if you try to switch on the device without connecting the keyboard, the “Keyboard error” message will appear, and the system will stop. If you intend for some reason to switch on the device without connecting the keyboard, you should indicate: “All, But Keyboard”.

In the bottom right-hand corner it is written how much and what memory the device has. Exit from the SECTION and return to the main menu can be made by pressing the “Esc” key.

10.2.4 Section “BIOS Features SETUP”

Let us examine the following item: the “BIOS FEATURES SETUP”. After entering it you will see the menu presented in Figure B.3.

The “Virus Warning” feature gives a warning on the screen, if some program should attempt to write something into the Boot Sector or format the disk. Such events, as a rule, may occur as a consequence of a computer virus working or a careless handling of some programs. If some loading manager is installed in your computer, or you have decided to install another operational system, then this point should better be disabled. But during the normal work in DOS it is desirable to enable it, since it gives some guarantee against any infection with booting viruses.

The “CPU Internal Cache, External Cache” features, i.e. the switching on/off of the internal and external cache devices – for getting a maximum productivity, these features must always be enabled.

BIOS Configuration
 ROM PCI/ISA BIOS ()
 BIOS FEATURES SETUP
 AWARD SOFTWARE, INC.

Virus Warning	:Disabled	Vide BIOS Shadow	:Enabled
CPU Internal Cache	:Enabled	C8000-CBFFF Shadow	:Disabled
External Cache	:Enabled	CC000-CFFFF Shadow	:Disabled
Quick Power On Self Test	:Enabled	D0000-D3FFF Shadow	:Disabled
Boot Sequence	:C,A	D4000-D7FFF Shadow	:Disabled
Swap Floppy Driver	:Disabled	D8000-DBFFF Shadow	:Disabled
Boot Up Floppy Seek	:Disabled	DC000-DFFFF Shadow	:Disabled
Boot Up NumLock Status	:Off	Cyrix 6x86/MII CPUID	:Enabled
Boot Up System Speed	:High		
Gate A20 Option	:Fast		
Typematic Rate Setting	:Enabled		
Typematic Rate (Chars/Sec)	:30	Esc: Quit	↑ ↓ → ← Select Item
Typematic Delay (ms)	:500	F1 : Help	PU/PD/+/-: Modify
Security Option	:Setup	F5 : Old Values (Shift)	F2: Color
PCI/VGA Palette Snoop	:Disabled	F6 : Load BIOS Defaults	
OS Select For DRAM > 64 MB	Non-OS2	F7 : Load Setup Defaults	

Figure B.3 – The Menu of the SECTION “BIOS FEATURES SETUP”

The “Boot Sequence” feature will signal to the device on which data carrier to search for the system in the first place. If “A” and “C:” stand there, then during booting the first disk drive A is interrogated and only after that hard disk “C:”. In this case, if the system diskette is inserted into the disk drive “A:”, the system will be booted from it. If you rarely use the system diskette, then the symbols “C:”, “A”: should be inserted, to speed up the loading.

The “Swap Floppy Driver” feature reverses the disk drives “A:” and “B:”. If you have two disk drives “A:” (5.25”) and “B:” (3.5”) and the system diskette is only of 3.5” (for disk drive “B”), this setting may be enabled (We remind you that it is possible to carry out the booting from the diskette from disk drive “A:” only). In this case the loading diskette may be inserted into the 3.5” disk drive, since it will become a disk with the letter “A:”.

The “Boot Up Floppy Seek” feature – if there stands the word “Enabled”, then each time the device is switched on, the disk drive will be interrogated. It should better be disabled to speed up the loading.

The “Boot Up NumLock Status” command – if there stands “ON” in it, then the keys in the additional keyboard section will be used as numeric ones, if “OFF” is chosen, then they will be used as cursor control keys.

The command “Typematic Rate Setting, Typematic Rate” refers to keyboard adjustments. If the key is held pressed for a long time, the symbol begins to recur. This parameter shows the frequency of such recurrences.

The “Typematic Delay” feature means the delay time before the beginning of a symbol recurrence.

The “Video BIOS Shadow, ... Shadow” feature means the copying of the BIOS adapter areas into the operation memory. These parameters should better be not touched at all, or they should be disabled, except for Video BIOS.

The “Cyrix 6x86/MII CPUID” feature – by setting the “enable/disable” of the identification of the Cyrix 6x86/MII CPUID processor BIOS can be forced to automatically display this processor’s parameters on the screen. This processor is not used in our device. Therefore one can set for it the parameter: “disabled”.

10.2.5 Section “CHIPSET FEATURES SETUP”

The “CHIPSET FEATURES SETUP” feature: the operating modes of the memory and the bus are the major points that are paid attention to in this section. The menu of this SECTION is presented in Figure B.4.

```

ROM PCI/ISA BIOS ( )
CHIPSET FEATURES SETUP
AWARD SOFTWARE, INC.

Auto Configuration      :Enabled      Memory Parity / ECC Check:Auto
DRAM Read Timing        :70ns          Single Bit Error Report  :Enabled
DRAM RAS# Precharge Time:4          L2 Cache Cachable Size  :64MB
DRAM R/W Leadoff Timing :7/6          Chipset NA# Asserted    :Enabled
Fast RAS# To CAS# Delay :3           Pipeline Cache Timing    :Faster
DRAM Read Burst(EDO/FPM):x333/x444  Passive Release          :Enabled
DRAM Write Burst Timing :x333         Delayed Transaction      :Disabled
Turbo Read Leadoff      :Disabled
DRAM Speculative Leadoff:Enabled
Turn-Around Insertion   :Disabled
ISA Clock                :PCICLK/4
System BIOS Cacheable   :Disabled
Video BIOS Cacheable    :Disabled
8 Bit I/O Recovery Time :1
16 Bit I/O Recovery Time:1
Memory Hole At 15M-16M  :Disabled
Peer Concurrency        :Enabled
Chipset Special Features:Enabled
DRAM ECC/RARITY Select  :Parity
Esc: Quit      ↑↓→ ←↔ Select Item
F1: Help      PU/PD/+/- :Modify
Old Values (Shift) F2: Color
F6 : Load BIOS Defaults
F7 : Load Setup Defaults

```

Figure B.4 – Menu of the Section “CHIPSET FEATURES SETUP”

Do not change the settings here to increase the device productivity. It is best not to do that, since you won't make the CNC Unit run much faster, but will increase the load on its internal components instead, which may lead to its unstable operation. You better trust the manufacturing plant settings.

10.2.6 Integrated Peripherals

The menu of the Section “INTEGRATED PERIPHERALS” is shown in Figure B.5.

The “IDE HDD Block” Mode will speed up the process of sending data to the hard disk. It must always be enabled.

The “IDE Primary Master PIO” mode sets the speed modes of the hard disk function. They can be set manually (Mode 0 — Mode 4). The quickest mode is Mode 4. But your hard disk may not always support such a mode. Therefore, let the device determine the capacity of your hard disk by itself (**Auto**). The next three settings are related to additional hard disks.

The “IDE Primary Slave PIO” setting fixes the speed figures for hard disk functioning. They can be set manually (Mode 0 — Mode 4). The fastest mode is Mode 4. But your hard disk may not always support such a mode. Therefore let the device determine the capacity of your hard disk by itself (**Auto**). The next three settings are related to additional hard disks.

The “On-Chip Primary PCI IDE” setting enables or disables the operation of the main hard disk controller.

The “Onboard FDD Controller” setting enables or disables the operation of the floppy disk controller.

The “Onboard Parallel Port” is a port configuration for the printer. Its address and interruption alternatives are set here. It can use interruptions IRQ7 or IRQ5.

```

ROM PCI/ISA BIOS
INTEGRATED PERIPHERALS
AWARD SOWTWARE, INC

IDE HDD Block Mode           : Enabled
PCI Slot IDE 2nd Channel     : Enabled
On-Chip primary PCI IDE     : Enabled

IDE Primary Master PIO      : AUTO
IDE Primary Slave PIO       : AUTO

Onboard FDD Controller      : Enabled
Onboard UART 1              : 3F8/IRQ4
Onboard UART 2              : 2F8/IRQ3
Onboard Parallel Port       : 378/IRQ7
Parallel Port Mode          : Normal
Esc: Quit                    ↑↓→← : Select Item
F1 : Help                    PU/PD/+/- :Modify
F5 : Old Values              (Shift)F2 : Color
F6 : Load BIOS Defaults
F7 : Load Setup Defaults
    
```

Figure B.5 – The Menu of the Section “INTEGRATED PERIPHERALS”

10.2.7 Section “Password Setting”

This Section of the main menu “PASSWORD SETTING” enables a password to be introduced into the CNC Unit. It is best not experiment with it, since, as a rule, it ends up in a failure: the user makes an accidental mistake and, not knowing the password, cannot enter the Setup mode any more or, what is even worse, he cannot load the CNC Unit. While an expert can break up the password in any case.

10.2.8 Section “Power Management Setup”

The next Section of the main menu is “POWER MANAGEMENT SETUP”. It was made up with the aim to reduce the CNC Unit power consumption. The idea was to allow to the device to “pass over into the sleeping mode”, if it has not been used for a certain period of time, in other words, to switch it off, but to make it “alive” again after pressing any key. However, it is not recommended to use this function, for its performance is not quite correct as a rule.

10.2.9 Section “PCI/PNP Configuration Setup”

The Section “PCI/PNP CONFIGURATION SETUP” is meant only for use by experts. The settings in it are used to distribute hardware interruptions between the devices located on the ISA and PCI buses, as well as for Plug&Play devices.

10.2.10 Sections “Load BIOS Defaults” and “Load SETUP Defaults”

The utilities “LOAD BIOS DEFAULTS” load all settings by default. We recommend you not to touch them, since while making adjustments the Setup content in your device is arranged in such a way that so that no conflicts should emerge between all its internal components. And the use of Setup by default may upset these settings. But, in an extreme case, if you have seriously distorted all the

settings with your actions and have become confused about them, these points will help you restore everything anew.

10.2.11 Section “IDE HDD Auto Detection”

“IDE HDD AUTO DETECTION” – this means an automatic determination of the hard disk type. When installing a new hard disk, it is worthwhile to consult this SECTION. If no automatic detection is set in your STANDARD CMOS SETUP, then it is necessary to determine the disk parameters. Press “Enter”. After a short pause the hard disk parameters will be highlighted on the screen. As a rule, “Y” and “Enter” should be pressed. However, as many as three parameter versions may be highlighted. At this point one must act carefully: if your disk is more than 540 MB, then LBA should be chosen, if less, then the “Normal” mode is to be taken..

It should be noted that the device will try to define the hard disk type four times. The first time it will define it as the Primary Master, then as the Primary Slave, next as the Secondary Master and finally as the Secondary Slave. The main hard disk is the Primary Master, and it must be definable during the first attempt. If, however, it should be defined as the Secondary Master, it means that the stub from it was connected to an additional controller, and it is necessary to shift it to the main one.

10.2.12 Section “HDD Low Level Format”

“HDD LOW LEVEL FORMAT” – you please never start this utility! The provision is, of course, made in it for your accidental interference, and before formatting begins at a low level you will be asked a number of questions with the request to confirm the actions being carried out, but if you safely come to the end, always answering with a “Y”, then you will lose forever all the data stored on the hard disk.

10.2.13 Items “SAVE & EXIT SETUP” and “EXIT WITHOUT SAVING”

“SAVE & EXIT SETUP” – this is a command for the device to save all the new changes made by you. You should answer the question with “Y”, if you agree to exit Setup, by saving data.

“EXIT WITHOUT SAVING” this means exit from Setup without saving data. If you are not sure of your new settings or are confused, then select this point, in order not to save the changes.

ATTENTION!

- **DO NOT TOUCH SETUP WITHOUT A SPECIAL NEED TO DO SO. IF THE CNC UNIT IS WORKING WELL, LET IT CONTINUE TO WORK THAT WAY.**
- **WHEN INSTALLING NEW HARD DISKS MAKE SURE THAT THEIR DETERMINATION MODE (THE MODE COLUMN IN THE INITIAL FIRST MENU POINT “STANDARD CMOS SETUP”) CORRESPONDS TO THEIR CAPACITY. IF IT IS LESS THAN 540 MB, SET NORMAL, IF IT IS MORE, SET LBA.**

The list of the parameters set by the manufacturer of CNC Units is presented in Figures B.6 and B.7.

NOTE – IN THESE OPERATION INSTRUCTIONS ONLY ONE BIOS VERSION IS USED AS AN EXAMPLE OF SETTINGS. THEREFORE, FOR OTHER BIOS VERSIONS THE SETTINGS REFERRED TO HERE CAN BE USED AS A REFERENCE MATERIAL.

```

ROM PCI/ISA BIOS ( )
STANDARD CMOS SETUP
AWARD SOFTWARE, INC.

Date (mm:dd:yy) : Sun, Jun, 1 1997
Time (hh:mm:ss) : 10 : 42 : 40

HARD DISKS          CYLS HEAD PRECOMP LANDZONE SECTORS  MODE
-----
Primary Master : ( 0Mb) 0 0      0          0          0  -----
Primary Slave  : ( 0Mb) 0 0      0          0          0  -----

Drive A : 1.44, 3.5 in*
Drive B : 1.44, 3.5 in*

Video   : EGA/VGA
Halt On : All, But Disk/Key

ESC : Quit          ↑↓→ ← : Select Item          PU/PD/+/- : Modify
F1  : Help
    
```

Figure B.6 – Menu of the Section “STANDARD CMOS SETUP”

```

BIOS Configuration
ROM PCI/ISA BIOS ( )
BIOS FEATURES SETUP
AWARD SOFTWARE, INC.
    
```

Virus Warning	:Enabled	Vide BIOS Shadow	:Enabled
CPU Internal Cache	:Enabled	C8000-CBFFF Shadow	:Disabled
External Cache	:Enabled	CC000-CFFFF Shadow	:Disabled
Quick Power On Self Test	:Enabled	D0000-D3FFF Shadow	:Disabled
Boot Sequence	:C,A	D4000-D7FFF Shadow	:Disabled
Swap Floppy Driver	:Enabled *	D8000-DBFFF Shadow	:Disabled
Boot Up Floppy Seek	:Disabled	DC000-DFFFF Shadow	:Disabled
Boot Up NumLock Status	:Off	Cyrix 6x86/MI CPUID	:Enabled
Boot Up System Speed	:High		
Gate A20 Option	:Fast		
Typematic Rate Setting	:Enabled		
Typematic Rate (Chars/Sec)	:30	Esc: Quit	↑↓→ ← Select Item
Typematic Delay (Msec)	:500	F1 : Help	PU/PD/+/-: Modify
Security Option	:Setup	F5 : Old Values (Shift)	F2: Color
PCI/VGA Palette Snoop	:Disabled	F6 : Load BIOS Defaults	
OS Select For DRAM > 64 MB	Non-OS2	F7 : Load Setup Defaults	

Figure B.7 – Menu of the Section “BIOS FEATURES SETUP”

10.2.14 Restoration of SETUP Settings

To restore any changed settings, it is necessary to carry out the menu option “LOAD SETUP DEFAULTS” and then enter data for the options of the menu “STANDARD CMOS SETUP” and “BIOS FEATURES”.

NOTE – THE SETTINGS MARKED WITH AN ASTERISK (*) ARE VALID ONLY FOR FDD, WHOSE CABLE PIN SOLDERING PATTERN IS ACCORDING TO THE TABLE OF SECTION 5.

10.3 APPENDIX C

(obligatory)

Electronic Hand Wheel LGF-003-100

10.3.1 The Purpose of the Electronic Hand Wheel LGF-003-100

10.3.1.1 The electronic hand wheel LGF-003-100 (hereinafter referred to as the “hand wheel”) is used for machining parts in the manual mode. The axes are then moved manually by means of the hand wheel. Its main overall and mounting dimensions are indicated in Figure C.1.

10.3.2 Characteristics of the Electronic Hand Wheel LGF-003-100

10.3.2.1 Main technical data of the hand wheel LGF-003-100:

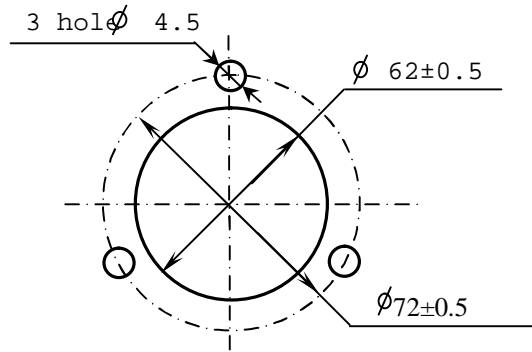
a) Supply voltage:	5.00±0.25 V
b) Current consumption:	160 mA, max.
c) Output type:	differential
d) Nomenclature of output signals:	
– main	A+, A–
– offset	B+, B–
e) Output signal type:	rectangular pulses
f) Output signal frequency:	5 kHz, max.
g) Duration of the leading and trailing output signal edges:	0.1 µs, max.
h) Output signal levels:	
– logic «0»	0.50 V, max.
– logic «1»	2.50 V, max.
i) Number of output signal periods	100 periods/rev.
j) Speed of shaft rotation:	600 rpm, max.
k) Nominal speed of shaft rotation	200 rpm, max.
l) Mean-time-between-failures:	3x10 ⁵ rpm at ≤200 rpm
m) Weight	270 g
n) Operation temperature range	0 to +60°C

10.3.3 Operation Description and Hand Wheel Connections

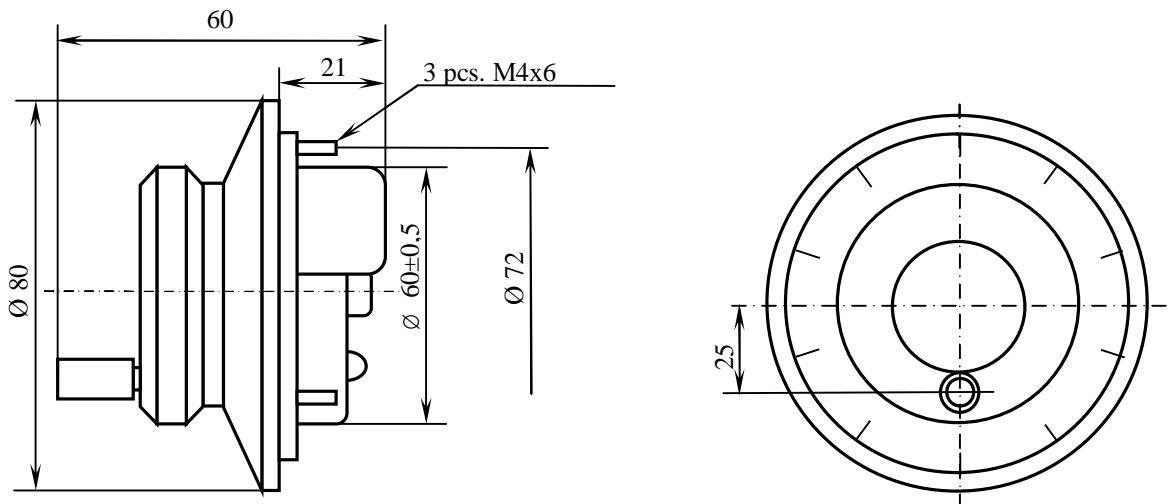
10.3.3.1 The hand wheel is a photoelectric angular travel transducer with a rectangular pulse output signal (TTL). The hand wheel has two output channels “A” and “B”. Each channel generates differential signals A+, A–, B+, B–, as it is shown in Figure C.2. The hand wheel performance diagram in time is shown in Figure C.3. Signal distribution between the hand wheel output pins is presented in Table C.1

Table C.1

Pin	1	2	3	4	5	6
Signal	5 V	0 V	A+	A–	B+	B–



a) marking the positions of holes for the hand wheel installation



b) main overall and mounting dimensions of the hand wheel

Figure C.1 – Electronic hand wheel LGF-003-100

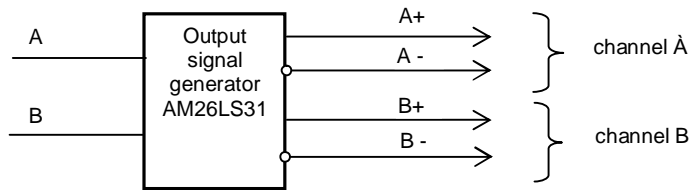


Figure C.2 – Output channels of hand wheel

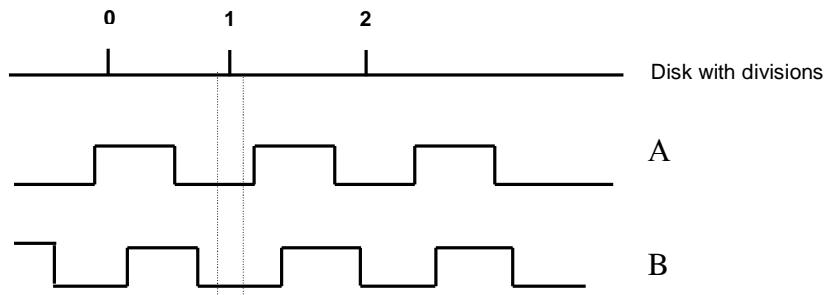


Figure C.3 – Timing hand wheel performance chart

10.3.3.2 Connection of the hand wheel to the CNC Unit can be made as follows:

- via the CNC hand wheel channel;
- via the CNC encoder channel.

In any connection alternative power supply for the hand wheel is secured from the CNC Unit through the connected channel. The CNC Unit can work both with one or two hand wheels.

Hand wheel connection via the CNC hand wheel channel does not require any device characterization. In this case internal hand wheel control is carried out by means of the software.

For hand wheel connection through any encoder channel it is necessary to define the hand wheel as an axis in the **AXCFIL** and in the **IOCFIL** characterization files.

The software of the CNC Unit makes it possible to work with two hand wheels via two independent channels. Working with two hand wheels requires their characterization in the **AXCFIL** (**CAS** instruction) and **IOCFIL** (**ADV** instruction) files.

External control of the hand wheel/hand wheels is carried out in the case of connecting the hand wheel through the encoder channel or when working with two hand wheels. External control is carried out by means of the software and it is activated by PL in any operating mode.

Problems concerning the hand wheel(s) characterization are examined in the following documents: "Software Characterization".

10.4 APPENDIX D *(obligatory)* **External Input/Output Modules**

10.4.1 The Purpose of External Input/Output Modules

10.4.1.1 External input/output modules ensure adjustment between the discrete CNC input/output channels and the electric automation channels of equipment to be controlled. The following external modules are used with the CNC Unit:

- NC201-402 – an input indication module (40)
- NC210-401 – an output module with relay commutation and indication (24);

10.4.1.2 The input indication module translates signals arriving from the electrical equipment of this system to the CNC discrete channels without transforming them. All the channels of this module have light-emission diodes, which indicate that the information being transferred is of a high level.

10.4.1.3 The outputs module with relay-based commutation and indication is designed to extend the capacity of CNC discrete output channels. All module channels have light-emission diodes and a relay controlled by the CNC output channel signals. The contacts of this relay allow to commutate both DC and AC voltages, accompanied by a considerable increase in the commuted current.

10.4.1.4 The power supply of external input/output modules must be applied from the power source of controlled equipment units through the pins of «SPEPN» relay of the CNC Unit. The rated supply voltage of the modules +24V.

10.4.2 Technical Characteristics of External Input/Output Modules

10.4.2.1 Characteristics of input module NC201-402:

- | | |
|----------------------------------|------------|
| a) Number of indicated channels: | 40 |
| b) Rated input current: | 12 mA/24 V |

10.4.2.2 Characteristics of output module NC210-401:

- | | |
|--|---------------------------------|
| a) Number of commuted output channels: | 24 |
| b) Commuted voltage: | DC/AC |
| c) Rated commuted current value: | 3A/28V;
3A/~110V; 1.5A/~220V |

10.4.3 Input Indication Module (32) NC201-402

10.4.3.1 The external view of the NC201-402 module is presented in Figure D.1. The module height is 50 mm max. The module can be mounted onto a DIN-strip.

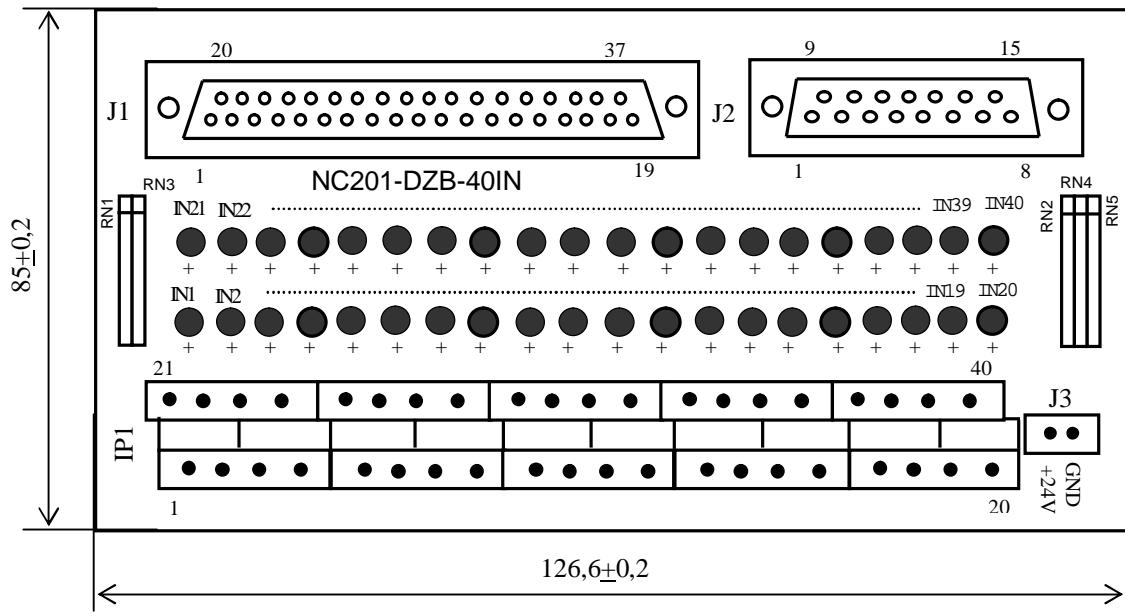


Figure D.1

10.4.3.2 Designation and purpose of the NC201-402 module elements:

- **IN1-IN40:** light-emission diodes to indicate the input status;
- **IP1:** it is a two-row, two-level connector for screw mounting with 40 pins for connecting 40 input channels from the controlled equipment (10 connectors MDSTBV 2,5/2-G-5,08). This module delivery set includes the mating part of the IP1 connector: 10 sockets, type MVSTBR 2,5/4-ST-5,08 with 4 pins and a fixing screw;
- **J1:** it is a connector (socket DPS 37-F) for connecting the communication cable of the I/O module inputs (connector «32 IN») with the NC201-402 module;
- **J2:** it is a connector (socket DPS 15-F) for connecting the communication cable of the I/O module inputs (connector «8 IN») with the NC201-402 module;
- **J3:** it is a connector with 2 pins for screw mounting (MSTBV 2,5/2-G-5,08) for connecting DC voltage from an external power source +24V. This module delivery set includes the mating part of the J3 connector: 1 socket, type MSTBR 2,5/2-ST-5,08 or MSTB 2,5/2-ST-5,08 with 2 pins and a fixing screw.

10.4.3.3 The assignment of discrete input signals to connector pins «J1», «J2» and «IP1» of the NC201-402 module, as well as to connector pins «32 IN» and «8 IN» of the CNC is presented in Table D.1. The data of this table should be used when making up an input cable.

10.4.3.4 The diagram showing the connection of the NC201-402 module to the CNC given in Figure D.2.

Table D.1

Signal	CNC Unit		NC201-402		
	connector		connector		
	32 IN	8 IN	J1	J2	IP1
	pin		pin		
In0 (I00A00)	01	-	1	-	1
In1 (I00A01)	02	-	2	-	2
In2 (I00A02)	03	-	3	-	3
In3 (I00A03)	04	-	4	-	4
In4 (I00A04)	05	-	5	-	5
In5 (I00A05)	06	-	6	-	6
In6 (I00A06)	07	-	7	-	7
In7 (I00A07)	08	-	8	-	8
In8 (I00A08)	09	-	9	-	9
In9 (I00A09)	10	-	10	-	10
In10 (I00A10)	11	-	11	-	11
In11 (I00A11)	12	-	12	-	12
In12 (I00A12)	13	-	13	-	13
In13 (I00A13)	14	-	14	-	14
In14 (I00A14)	15	-	15	-	15
In15 (I00A15)	16	-	16	-	16
0V	17	-	17	-	-
0V	18	-	18	-	-
0V	19	-	19	-	-
In16 (I00A16)	20	-	20	-	17
In17 (I00A17)	21	-	21	-	18
In18 (I00A18)	22	-	22	-	19
In19 (I00A19)	23	-	23	-	20
In20 (I00A20)	24	-	24	-	21
In21 (I00A21)	25	-	25	-	22
In22 (I00A22)	26	-	26	-	23
In23 (I00A23)	27	-	27	-	24
In24 (I00A24)	28	-	28	-	25
In25 (I00A25)	29	-	29	-	26
In26 (I00A26)	30	-	30	-	27
In27 (I00A27)	31	-	31	-	28
In28 (I00A28)	32	-	32	-	29
In29 (I00A29)	33	-	33	-	30
In30 (I00A30)	34	-	34	-	31
In31 (I00A31)	35	-	35	-	32
0V	36	-	36	-	-
0V	37	-	37	-	-
In32 (I01A00)	-	1	-	1	33
In33 (I01A01)	-	2	-	2	34
In34 (I01A02)	-	3	-	3	35
In35 (I01A03)	-	4	-	4	36
0V	-	5	-	5	-
0V	-	6	-	6	-
+24V	-	7	-	7	-
+24V	-	8	-	8	-
In36 (I01A04)	-	9	-	9	37
In37 (I01A05)	-	10	-	10	38
In38 (I01A06)	-	11	-	11	39
In39 (I01A07)	-	12	-	12	40
0V	-	13	-	13	-
0V	-	14	-	14	-
+24V	-	15	-	15	-
0V	-	-	-	-	-

Supply voltage must be delivered through the SPEPN relay contacts

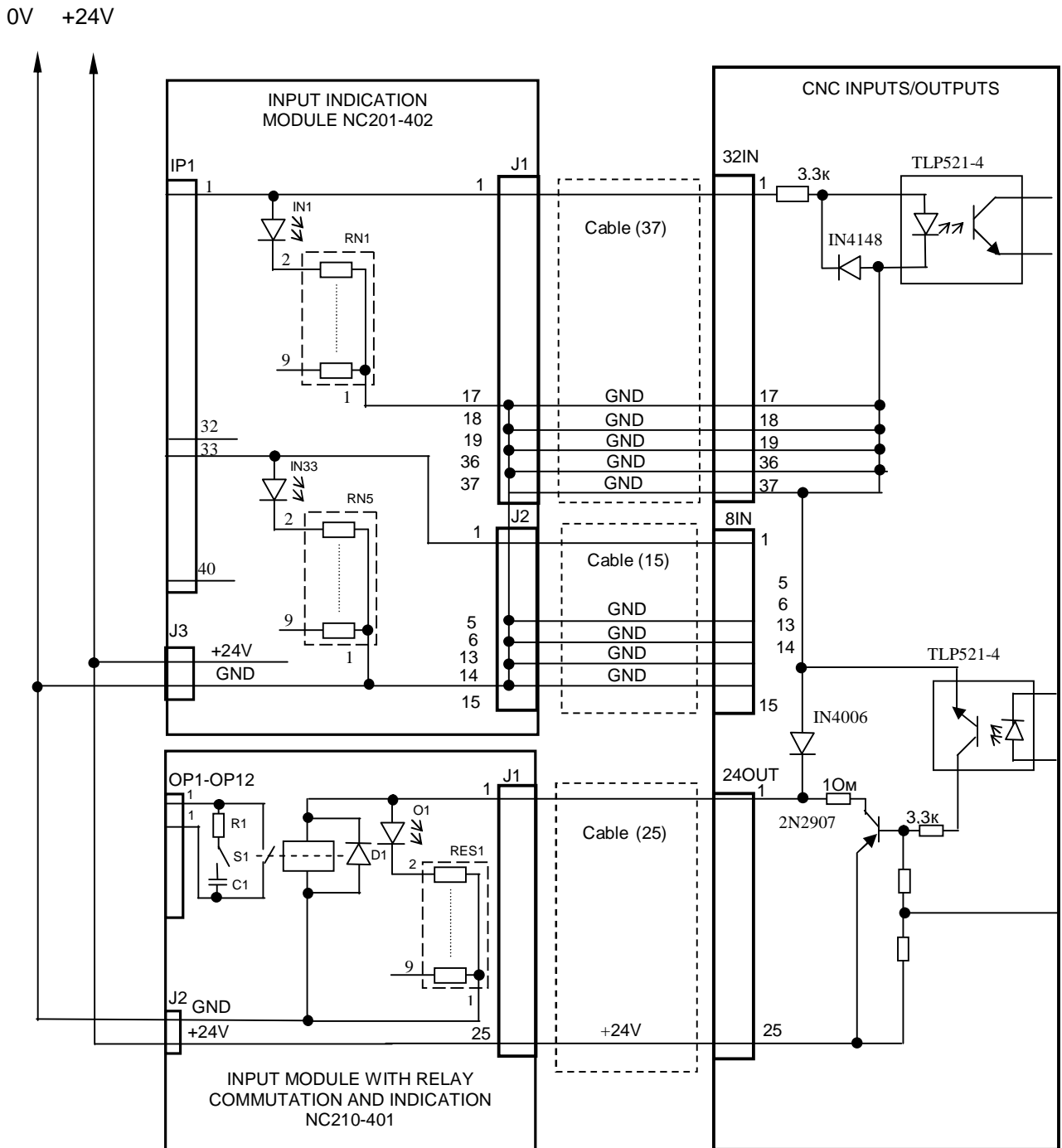


Figure D.2 – Connections Diagram of the NC201-402 and NC210-401 Modules to the CNC Unit

10.4.4 Output Module with Relay Commutation and Indication (24) NC210-401

10.4.4.1 The external view of the NC210-401 module is presented in Figure D.3. The module height is 56 mm max. The module can be mounted onto a DIN-strip.

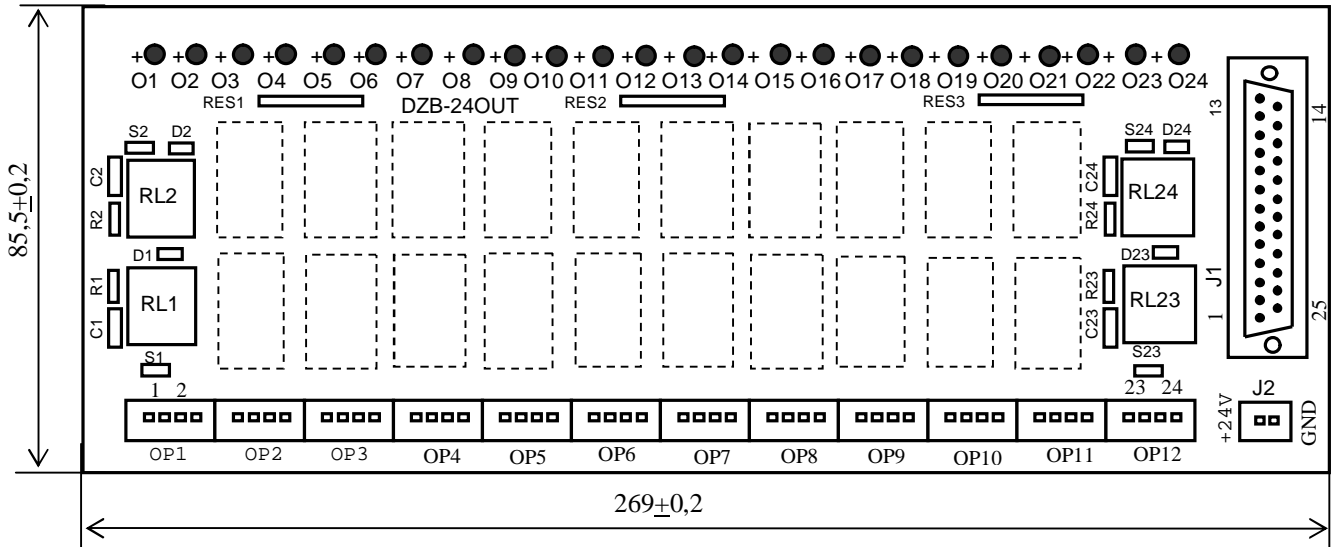


Figure D.3

10.4.4.2. The designation and purpose of the NC210-401 module elements are as follows:

- **J1** - a connector (a DPS 25-M plug) for connecting the communication cable of the outputs (connector «**24 OUT**») with the NC210-401 module;
- **J2** - it is a connector with 2 pins (a plug, type MSTBV 2,5/2-G-5,08) for connecting DC voltage from an external +24V power source.
This module delivery set includes the mating part of the **J2** connector: 1 socket, type MSTBR 2,5/2-ST-5,08 with 2 pins and a fixing screw;
- **O1–O24** - light-emission diodes to indicate the status of the outputs;
- **OP1-OP12** - 12 connectors (a plug, type MSTBV 2,5/4-G-5,08) for 2 commuted signals each: 2 pins per signal; the normally-open contacts of the **RL1-RL24** relay are wired to 48 pins for the commutation of 24 equipment controlling signals.
The delivery set of this module includes mating parts for the **OP1-OP12** connectors: 12 sockets, type MVSTBR 2,5/4-ST-5,08 with 4 pins with a fixing screw;
- **R1C1-R24C24 - RC** - chains (24 pcs.) are installed parallel to relay commutating contacts;
- **RES1-RES3** - resistors limiting the **LED** circuit currents (3 resistor assemblies)
- **RL1-RL24** - 24 relays, type **NT73CS10DC24** commuting 24 equipment control signals; it is allowed to apply the following voltages: 28B/3A; ~110B/3A or ~220V/1.5A to the relay contacts;

- **S1-S24** - 24 jumpers for switching on/off **RC** - chains.

10.4.4.3 The allocation of discrete output signals to connector pins «**J1**» and «**OP1**»-«**OP12**» of the NC210-401 module as well as to connector pins «**24 OUT**» of the CNC Unit is presented in Table D.2. The data of said table should be used for making up a cable for outputs.

Table D.2

Signal	CNC Unit		NC210-401	
	connector		connector	
	24 OUT		J1	OP1 - OP12
	pin		pin	
Out0 (U04A00)	01	1	1-1	
Out1 (U04A01)	02	2	2-2	
Out2 (U04A02)	03	3	3-3	
Out3 (U04A03)	04	4	4-4	
Out4 (U04A04)	05	5	5-5	
Out5 (U04A05)	06	6	6-6	
Out6 (U04A06)	07	7	7-7	
Out7 (U04A07)	08	8	8-8	
Out8 (U04A08)	09	9	9-9	
Out9 (U04A09)	10	10	10-10	
Out10 (U04A10)	11	11	11-11	
Out11 (U04A11)	12	12	12-12	
Out23 (U04A23)	13	13	13-13	
Out12 (U04A12)	14	14	14-14	
Out13 (U04A13)	15	15	15-15	
Out14 (U04A14)	16	16	16-16	
Out15 (U04A15)	17	17	17-17	
Out16 (U04A16)	18	18	18-18	
Out17 (U04A17)	19	19	19-19	
Out18 (U04A18)	20	20	20-20	
Out19 (U04A19)	21	21	21-21	
Out20 (U04A20)	22	22	22-22	
Out21 (U04A21)	23	23	23-23	
Out22 (U04A22)	24	24	24-24	
+24V	25	25	-	

10.4.4.4 The diagram for the connection of the NC210-401 module to the CNC Unit is shown in Figure D.2.

10.5 APPENDIX E (for reference) CNC Unit Connection Diagram

E.1. The diagram for the connection of the CNC Unit to the machine-tool is shown in Figure E.1.

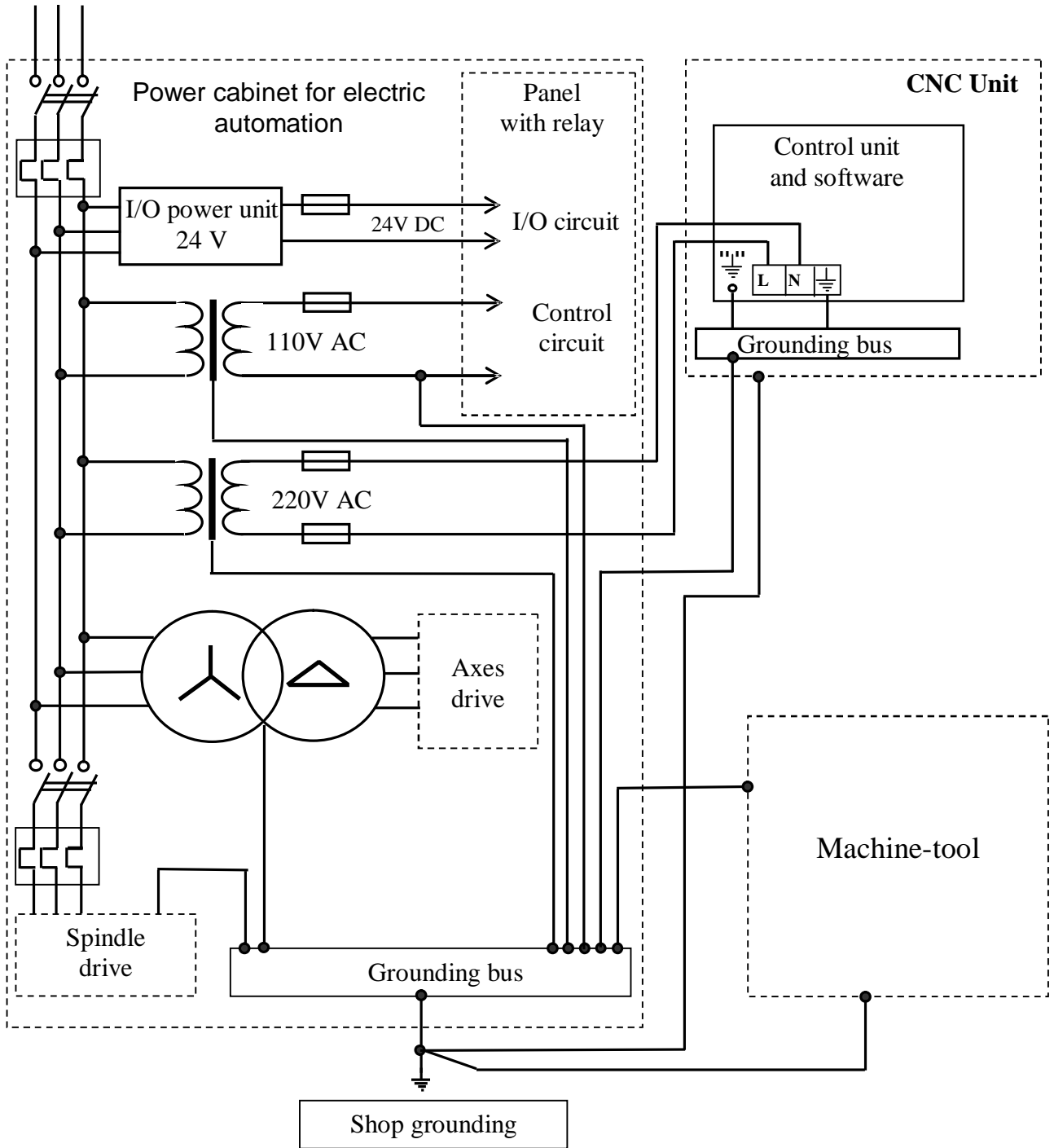


Figure E.1

