Abacus junior

Abacus junior vet

Abacus junior B

Hematology Analyzer

Service Manual

3.0 release

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1. INTRODUCTION

Since **Abacus junior / Abacus junior vet / Abacus junior B** have so much common characteristics, we issue a common Service Manual covering all instruments. Information herein applies for all instruments unless otherwise noted.

To be well up in the instruments, **please read this manual carefully** to have the knowledge for servicing the instruments perfectly and avoid extra costs and wasting precious time.

In this manual, we are using the following conventions:

AJ – stands for **Abacus junior**

AJvet – stands for **Abacus junior vet**

AJB – stands for **Abacus junior B**

This **Abacus junior / Abacus junior vet / Abacus junior B Service Manual** contains the functional descriptions of all analyzers, operation of the fluidic systems, adjustments and settings, and very important information for the Service Personnel about the service operations and possible problems.

1.1. Name and serial number

Name: **Abacus junior / Abacus junior vet / Abacus junior B** Hematology Analyzer
Serial No.: Every instrument has its own serial number, which is printed on the rear panel label and it can be read out from Device Information or from the self test submenu. This identity number is write-protected by DIATRON.

1.2. Intended use

Abacus junior / Abacus junior vet / Abacus junior B hematology analyzers are fully automated cell counters for *in vitro* diagnostic use. The compact instruments were developed for small clinics, point-of-cares and vet offices.

Abacus junior can process 30, **Abacus junior vet** can process 20-25 samples per hour and they are intended to determine the following 18 hematology parameters from a 25µl whole blood sample:

- WBC - LYM# - MID# - GRA# - LYM% - MID% - GRA% (three-part WBC differential)
- HGB - RBC - HCT - MCV - RDW - MCH - MCHC
- PLT - MPV - PCT – PDW

Abacus junior B can process 30 samples per hour and intended to determine the following 12 hematology parameters from a 25µl whole blood sample:

- WBC
- HGB - RBC - HCT - MCV – RDW-cv - MCH – MCHC
- PLT - MPV - PCT – PDW-cv

1.3. Integrated software

The integrated software controls the instrument operations, displays, stores, recalls data, and allows the user to perform QC and calibration procedures and modify the user settings. The software version number can be read out from the Device Information or from the Self test submenu.

Software is absolutely *"Plug and Play"*, it can read out and detect the type and the serial number of the instrument, therefore it will run the correct program for the hardware, without any user or service help. Every **Abacus junior / Abacus junior vet** software version is upgradeable (using a floppy disk) by the latest program developed by DIATRON.

Software upgrade of **Abacus Junior B** requires a special SW downloading application (more about this in Section 9.3) running on a separate PC, a standard null-modem serial cable – with 9-pin connector, and an upgrade SW from web page of DIATRON:

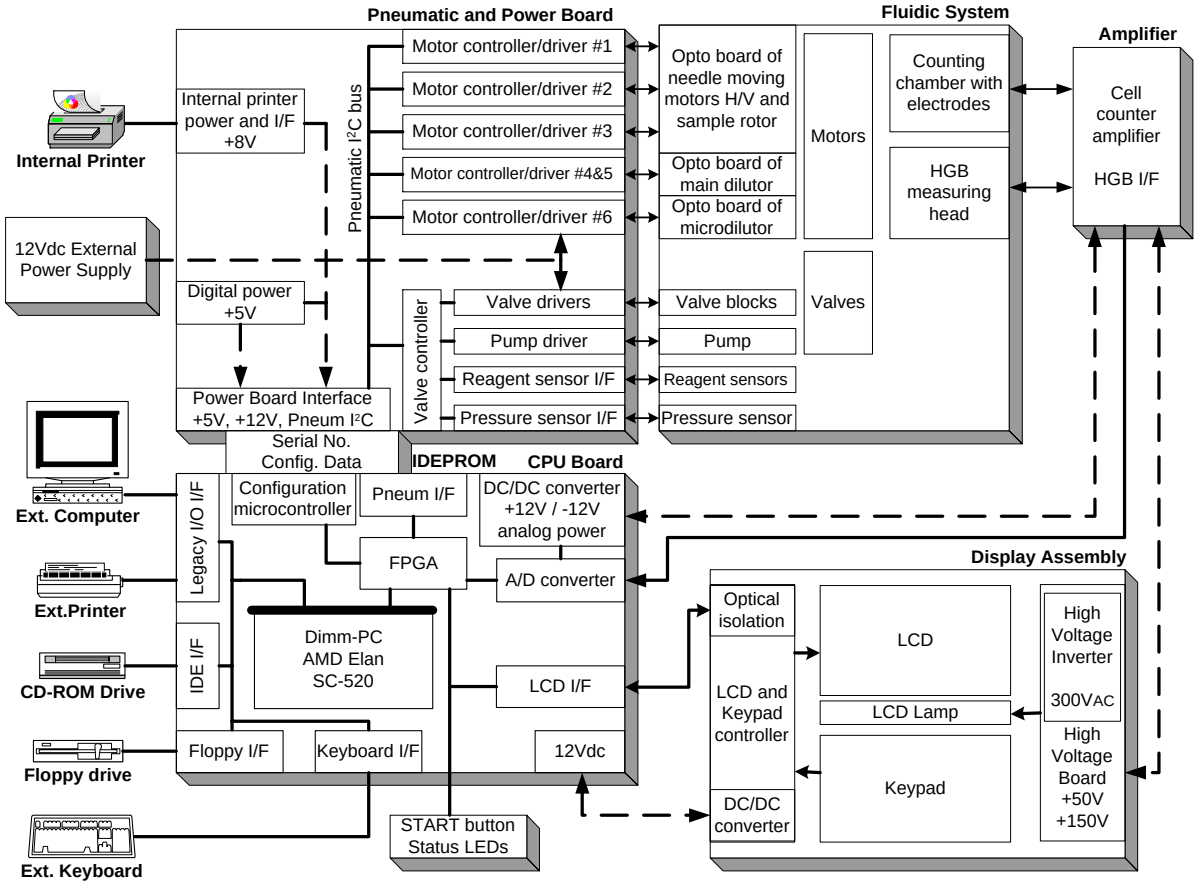
www.diatron.com

2. FUNCTIONAL DESCRIPTION

2.1. Main electronic parts of the analyzers

Abacus junior / Abacus junior vet contains the following electronic parts:

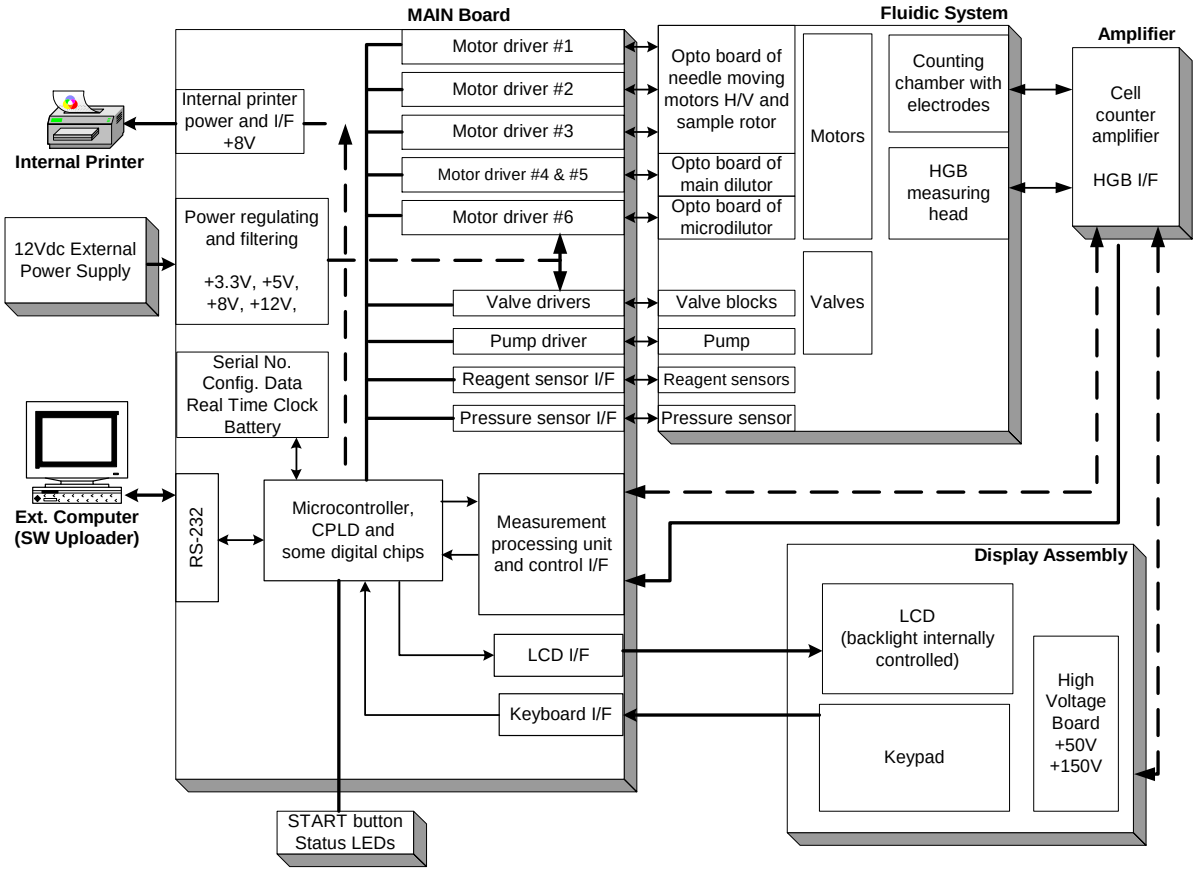
1. Counting chamber with electrodes and measuring aperture
2. HGB Measuring Head
3. Cell Counter Amplifier Board (behind the chamber)
4. CPU Board with Dimm-PC and measurement processing unit (COMB Board)
5. Safe configuration E^2PROM board connecting CPU board and PPB
6. Pneumatic and Power Board with 6 motor controllers, valve & pneumatic controller, pump driver and power supply for internal printer (+8V) and digital circuitry (+5V)
7. Motors with common opto-board of needle moving motors (H/V) and sample rotor
8. Main dilutor block with opto-board for diluent, lyse and rinse (AJVet)
9. Micro-dilutor block with opto-board for sampling
10. Valve boards (set of 5 and max. 7)
11. Peristaltic Pump
12. Pressure Sensor
13. Digital Reagent Sensor Board
14. Floppy Disk Drive and CD-ROM Drive (optional)
15. Graphic LCD Display Module with High Voltage Board
16. LCD and Keyboard controller and Keyboard Panel
17. Internal Printer



Abacus junior / Abacus junior vet *Electronic Functional Block Diagram*

Abacus junior B contains the following electronic parts:

1. Counting chamber with electrodes and measuring aperture
2. HGB Measuring Head
3. Cell Counter Amplifier Board (behind the chamber)
4. Motors with common opto-board of needle moving motors (H/V) and sample rotor
5. Main dilutor block with opto-board for diluent and lyse
6. Micro-dilutor block with opto-board for sampling
7. Valve boards (set of 5)
8. Peristaltic Pump
9. Pressure Sensor
10. Digital Reagent Sensor Board
11. Alphanumeric LCD Display Module with High Voltage Board
12. Keyboard Panel
13. Internal Printer
14. MAIN board



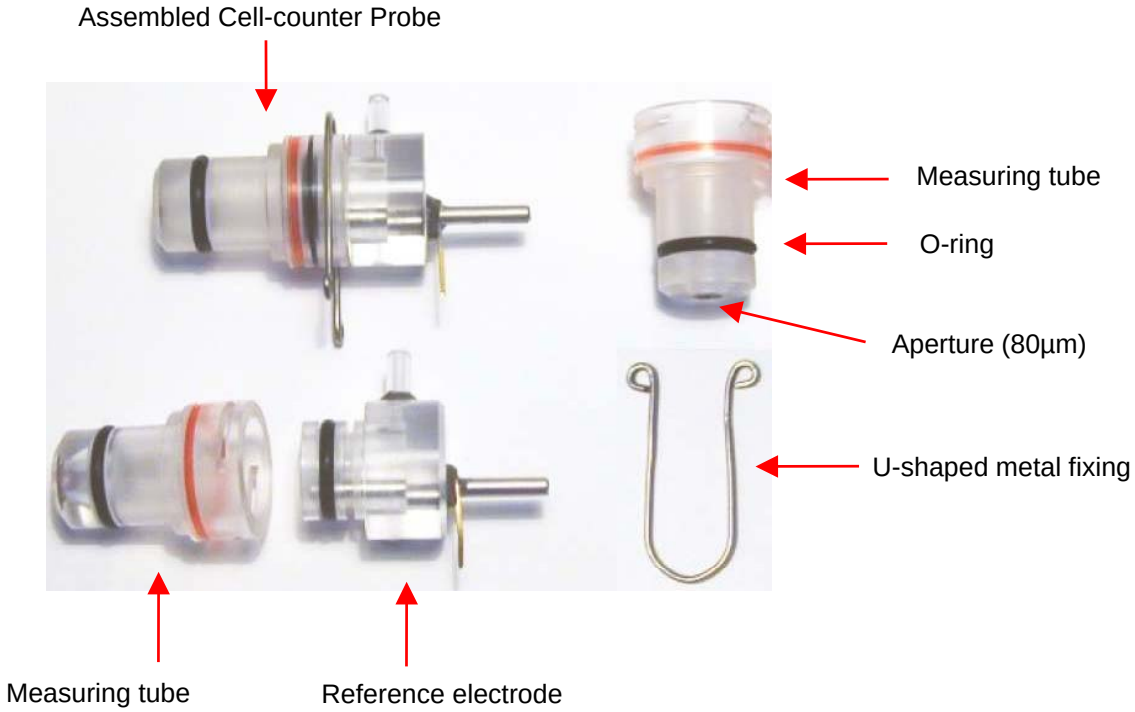
***Abacus junior B** Electronic Functional Block Diagram*

2.1.1. Counting chamber with electrodes and measuring aperture

Impedance method is used for determination of volume and number of cells. In this method a known volume of dilution is drawn through a small aperture. Constant current is passed through the aperture from one side to the other. When a cell passes through the aperture, it causes a change in resistance, which generates a voltage pulse.

The amplitude of the voltage pulse is proportional to the ratio of cell volume per aperture volume. This is used to determine the volume of cells. The number of cells can be obtained by counting the pulses.

In the instruments there is one cell-counter probe: the aperture size is 80 µm and has a reference electrode assembly and U-shaped metal fixing as it is shown in the figure below.



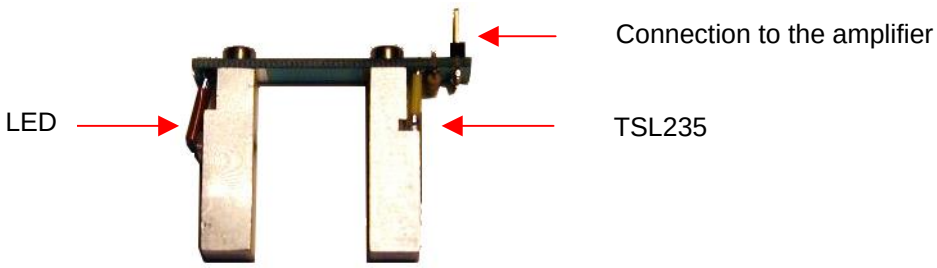
The aperture is made of ruby and it is molded into the measuring tube.

2.1.2. HGB Head

Hemoglobin head is placed around the measuring chamber in all instruments.

It contains: light source (LED) at 540 nm wavelength and Photo Detector (TSL235). The Photo Detector converts the light to frequency. The HGB concentration is a logarithmic function of this frequency measured by

- the FPGA circuit of the COMB card in **AJ/AJvet**
- the micro-controller of the MAIN board in **AJB**



The analyzers perform enhanced Hemoglobin measurement technology for HGB measurement. The output of HGB head is frequency (TSL235 detector is light to frequency converter). This signal is counted by a digital counter in the FPGA circuit/micro-controller.

This counter counts up while the LED is on and counts down while the LED is off, the LED and the counter directions are switched with a 100 Hz signal. This method provides “real time backlight correction”, which makes the HGB measurement more precise in changing backlight environment situation as well.

There are two kinds of HGB measurements:

- Sample measurement (before RBC counting)
- Diluent measurement (in WBC washing phase)

The HGB result is calculated from these measurements by:

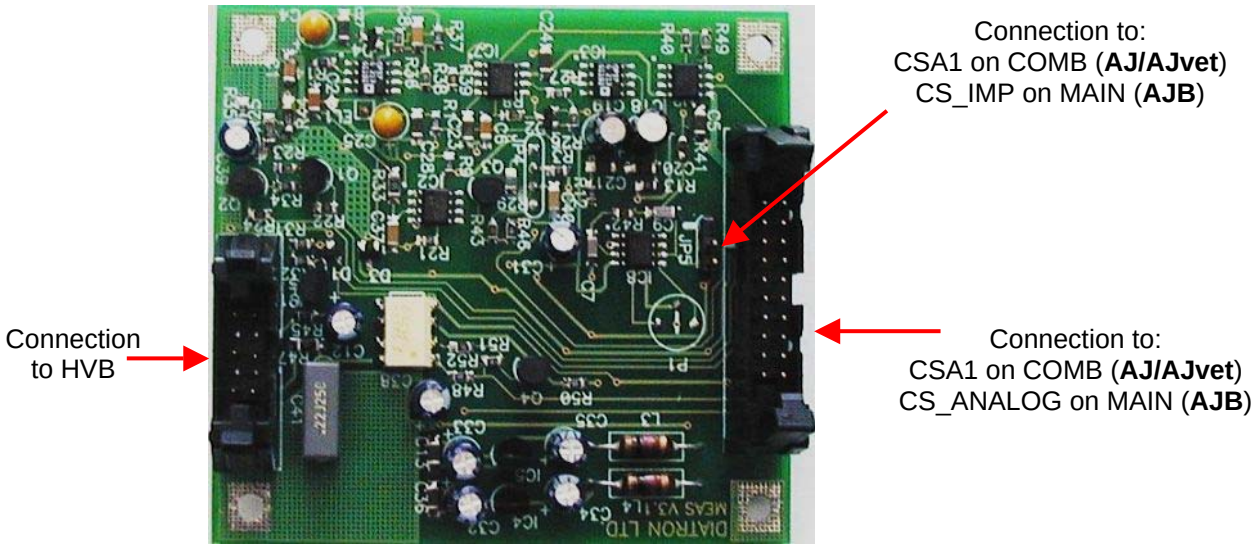
$$HGB \cong \log (CNT_{diluent\ light} / CNT_{sample\ light})$$

Due to enhanced HGB technology, junior is less sensitive to incident light changes. It is recommended to keep side door closed during measurements.

2.1.3. Cell counter Amplifier Board

Amplifier board includes its own voltage regulator, connection interfaces to HGB head, to high voltage board and to COMB in **AJ/AJvet** (to MAIN in **AJB**). In this board there is a current generator circuit, which works from 50V measuring voltage (generated by High Voltage Board) and the probe voltage (DC) is amplified with a voltage follower (output: ELV). Nominal measuring current is **870 µA**.

Amplifier board includes one input connector for the chamber (measuring electrode). There are two opto switches (U1, U3) to connect high voltage to the probe with HSW signal and isolate the input of the amplifier. Test circuit makes possible to generate test pulses (with TEST and PLS signals through FETs) for checking the proper operation of the amplifier channel.



Amplifier board includes a 3-stage main amplifier channel, which gains input signal to the 0...5 V range (this is the input range of the A/D converter, which is placed on the COMB card). The RSW signal changes the gain (RBC, WBC) in the feedback of the second amplifier stage with U2 (MAX319) analog switch. There is an offset potentiometer, P1 in the third amplifier stage, manufacturer sets the correct offset voltage.

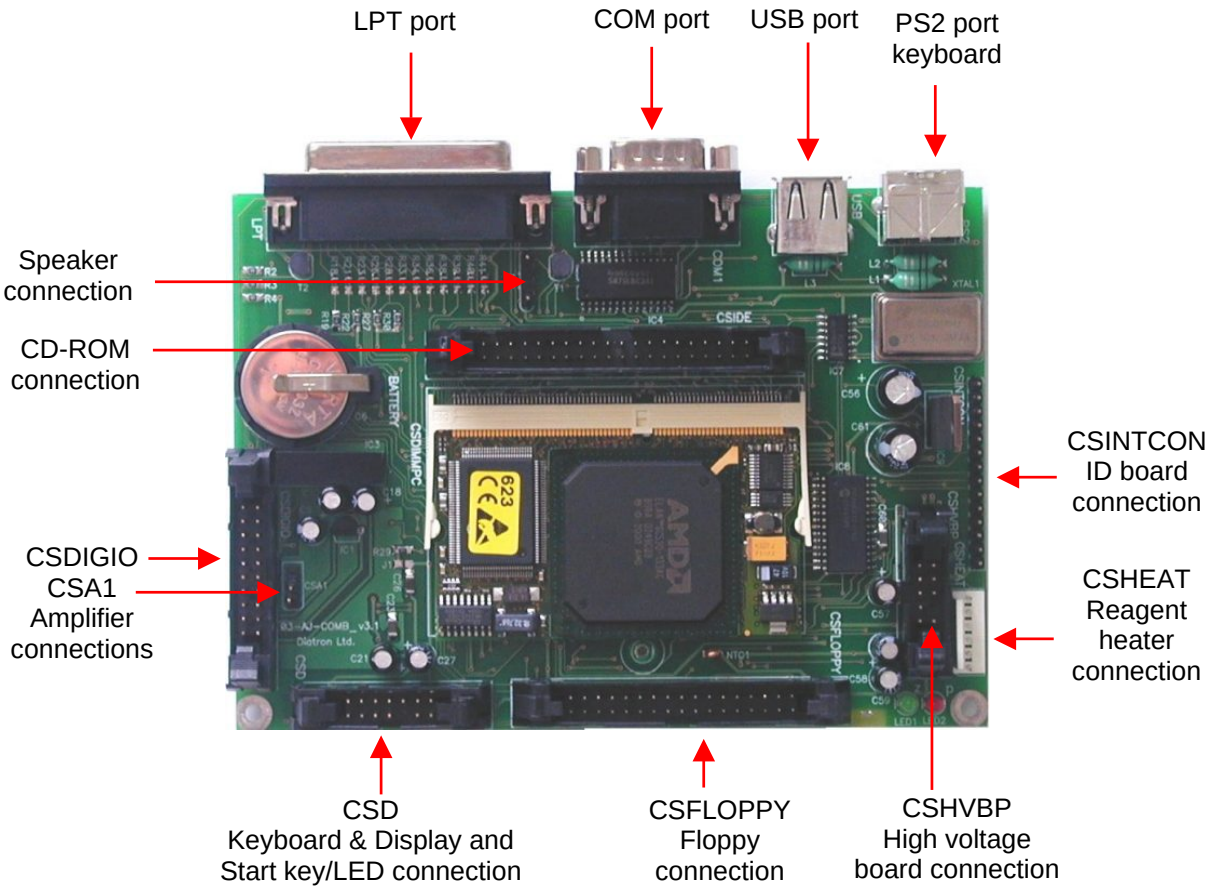
Adjust the offset voltage only in case it is out of the +/- 5mV range.

DHON signal (from the COMB board - **AJ/AJvet**; from the MAIN board - **AJB**) switches on the LED and the MVON signal – which is active during counting – switches off the Photo Detector in the HGB head, to prevent noise generated by the HGB detector.

The other side of the amplifier board contains special connectors for the chamber and the HGB head (JP4).

2.1.4. Control and Measurement Board (COMB) with Dimm-PC core - AJ/AJvet

The compact **COMB** incorporates a single PC and its environmental functions, as well as the specific measurement processing functions in one board.



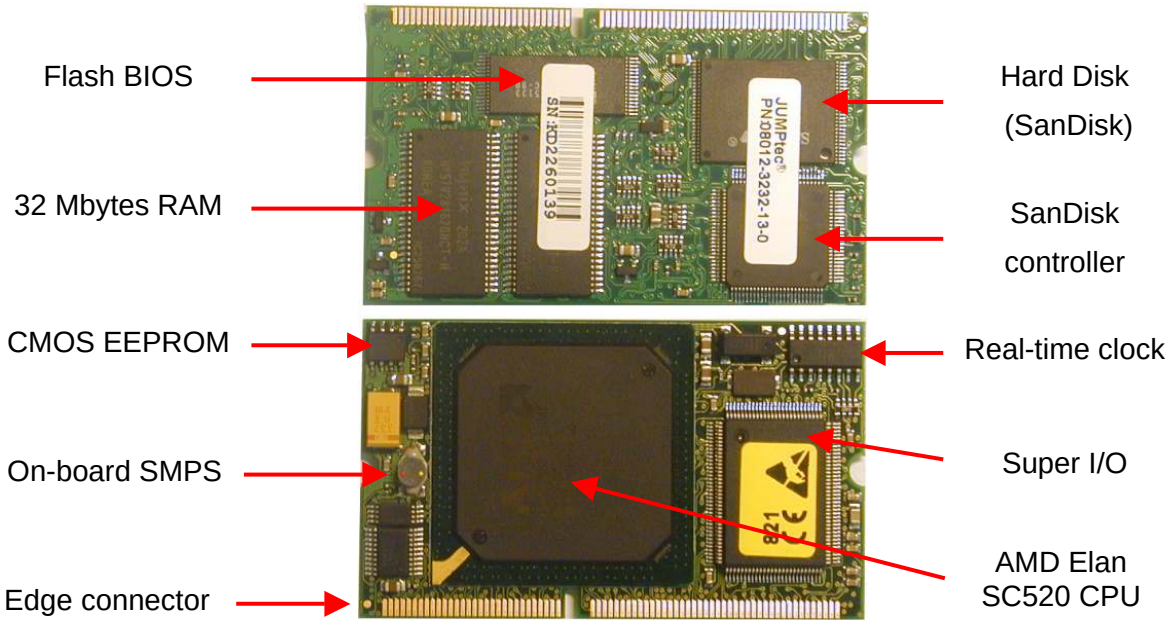
PC system of the COMB board is based on the Dimm-PC module, which is a credit card size PC with AMD Elan SC520 133 MHz micro-controller. Dimm-PC itself contains 16 or 32Mbyte RAM and same size of SanDisk that acts like a hard disk. Dimm-PC module is easily replaceable as it has an open socket (it has also a screw for safe fixing). COMB card contains single ICs and some drivers/protection-circuits for the interfaces such as LPT, COM1, PS2, USB, IDE, Floppy and Speaker.

Measurement processing is based on FPGA circuit. After power on, FPGA holds the Dimm-PC in wait state (with –IOCHRDY signal) until the PIC configures the FPGA circuit from the IDEPROM (status LED is red during configuration). After that the FPGA controls the entire pneumatic system through the Pneumatic I^2C bus, the Keyboard and Display module with video RAM for MDA (Monochrome Display Adapter) emulation, and Start button & status LED. FPGA circuit also performs measurement data acquisition by using the 10-bit A/D chip. FPGA makes digital data processing and stores the results in the internal FIFO memory. Cell parameters are sent to the Dimm-PC by single DMA cycles.

2.1.5. Dimm-PC* Module – AJ/AJvet

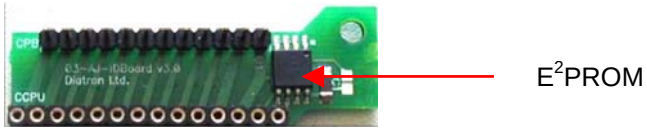
The MB4 board incorporates a credit-card sized PC, named **Dimm-PC***. The processor on the Dimm-PC is a 133MHz Pentium-class core, with 32Mbytes on-board RAM, and 32Mbytes on-board SanDisk. This is the HDD (hard disk drive) of the analyzer, so instrument software with all user settings, calibration, database, etc. is stored on the Dimm-PC.

** DimmPC® is the Trade Mark of Kontron Embedded Modules GmbH*



2.1.6. Configuration and ID E²PROM board (IDEPROM) - AJ/AJvet

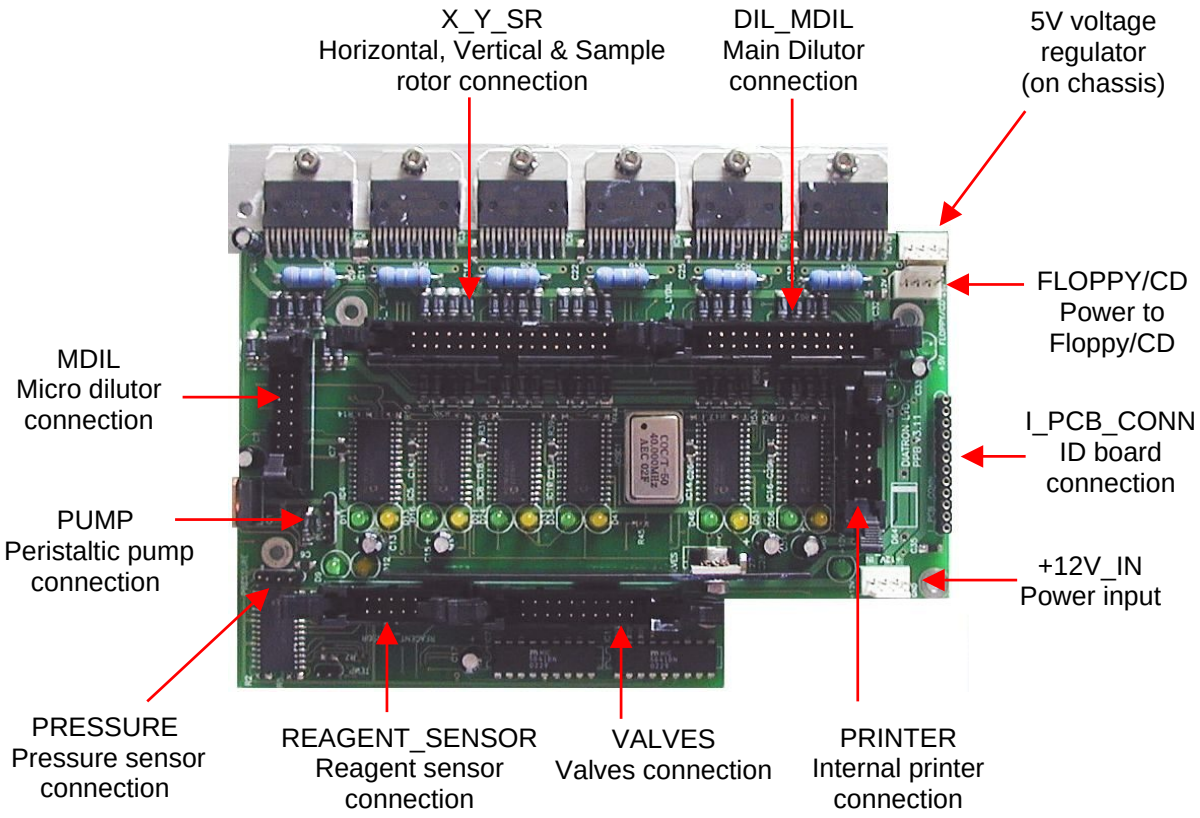
This board is the interconnection between COMB and PPB cards: Pneumatic I²C bus, power lines and internal printer signals are connected through this card. The board also contains a 24FC256 serial E²PROM, which stores the FPGA's configuration data and identity information of the instrument (Serial Number, OEM, model, etc.).



Keeping the hardware identity information (write-protected), IDEPROM makes possible to run the correct software (Human or Vet).

2.1.7. Pneumatic and Power Board (PPB) - AJ/AJvet

PPB card contains the main power regulator circuits, valve and motor driver circuits and other connections for the fluidic and pneumatic system's parts.



Power system generates +5V (Digital power), +8V (Printer power) and +12V (Motor and valve power) from the single +12V DC input signal.

Motor driver part consists of six separated PIC micro-controllers with power drivers. Horizontal, Vertical and Sample rotor motors have one combined ribbon cable connection. Main Dilutor (with two motors) and Micro-dilutor have separated connectors.

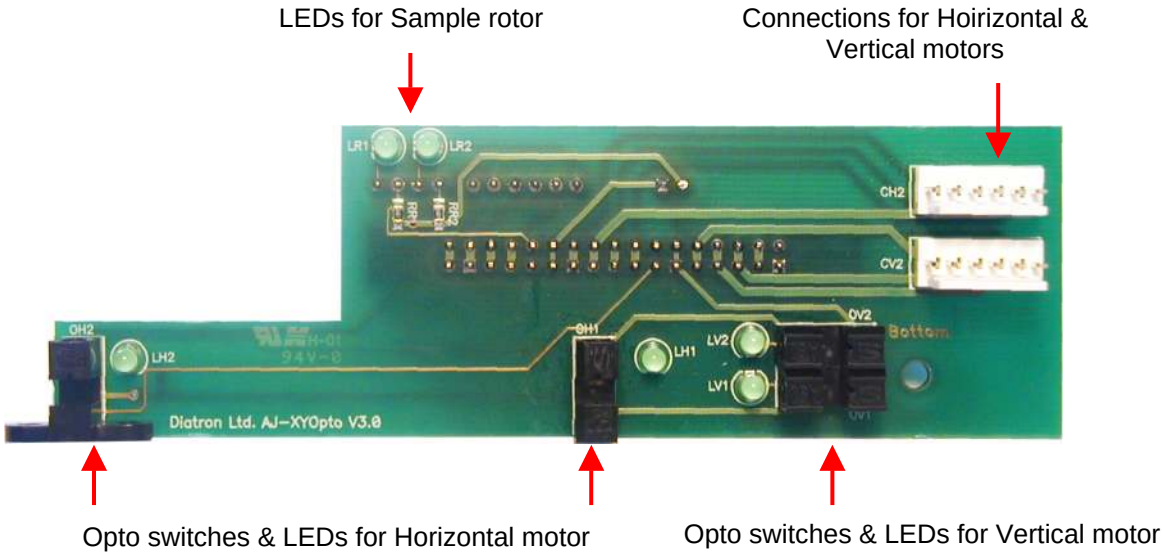
Valve driver section is based on the valve driver PIC micro-controller and two 8-bit, powered output shift registers (with built in protection diodes) and there is one common ribbon cable connection for the valve boards. The peristaltic pump has a separated Darlington driver circuit for more reliable operation.

2.1.8. Opto-boards for stepper motors

There are six stepper motors in the system: Horizontal and Vertical motors, which make the movements of the sampling needle; the main Dilutor motors (2), which move the syringes (macro, lyse, rinse); the micro Dilutor motor, which drives the sampling phase and the motor moving the sample rotor. The stepper motor opto boards make the connections between the motor driver ICs and motors, and have opto switches for the motor's home and end positions. The actual status of the stepper motor's optos is indicated by two LEDs on each stepper motor opto boards.

Dilutor and Micro-dilutor have its own separated opto-board, located directly in the units.

Horizontal and Vertical motors and the sample rotor unit have a common Opto-board, called XYOpto Board:

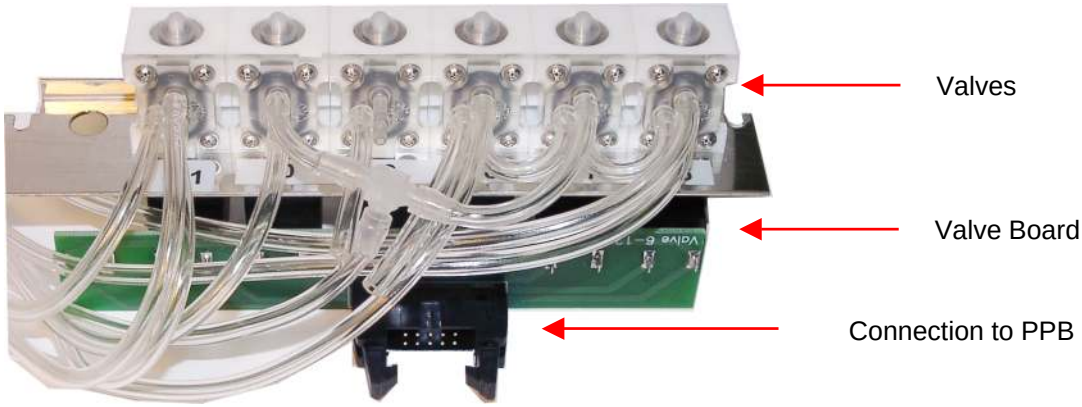


The other side of the board contains the connection for the Sample rotor and a ribbon cable connection to the COMB (**AJ/AJvet***)* or to the MAIN board (**AJB***)*.

2.1.9. Valve boards

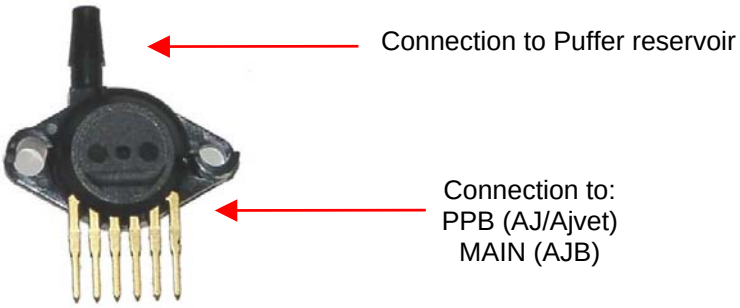
There are two kinds of valve boards: Valve board 1-5 and Valve board 6-12.

AJ and **AJB** have 5 valves, while **AJvet** has 6 valves in Valve board 6-12 module. The valve boards are connected to controller and driver chips are located on the PPB.



2.1.10. Pressure Sensor

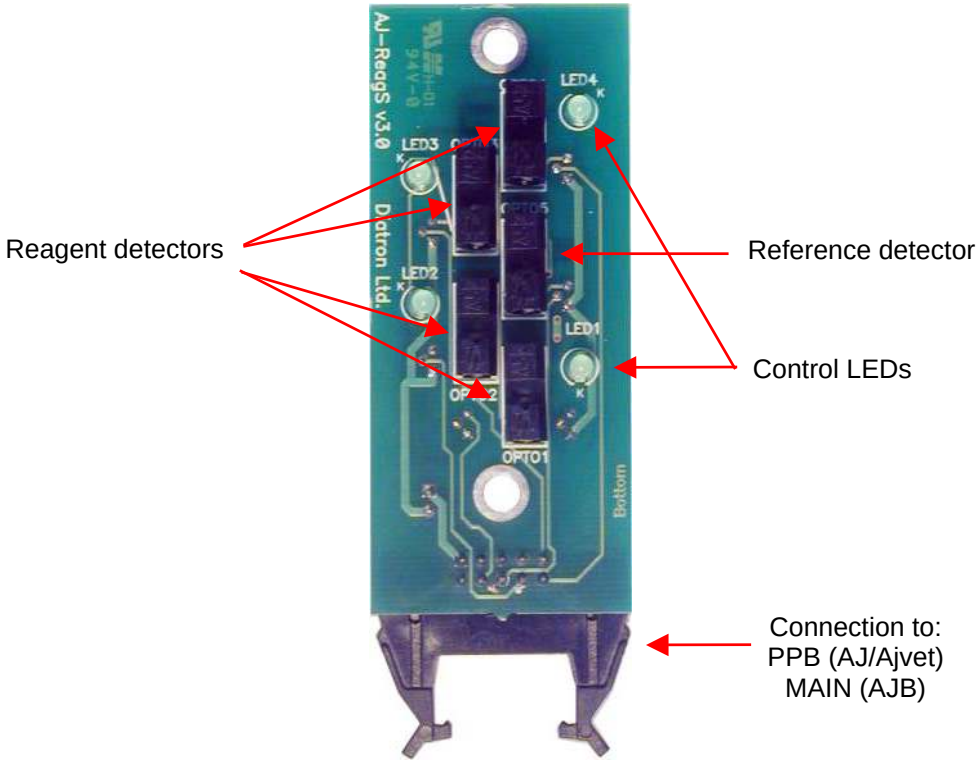
This is an MPX5100AP calibrated pressure sensor, which can measure the required air pressure and vacuum. The Pressure Sensor is connected directly to the PPB card (AJ/Ajvet) or to the MAIN board (AJB).



The pressure sensor can operate from +5V only. It is a calibrated sensor with 0-1.1 Bar input range. Do not apply more than 1.5 Bar to it, because it can ruin the pressure sensor.

2.1.11. Digital Reagent Sensor Board

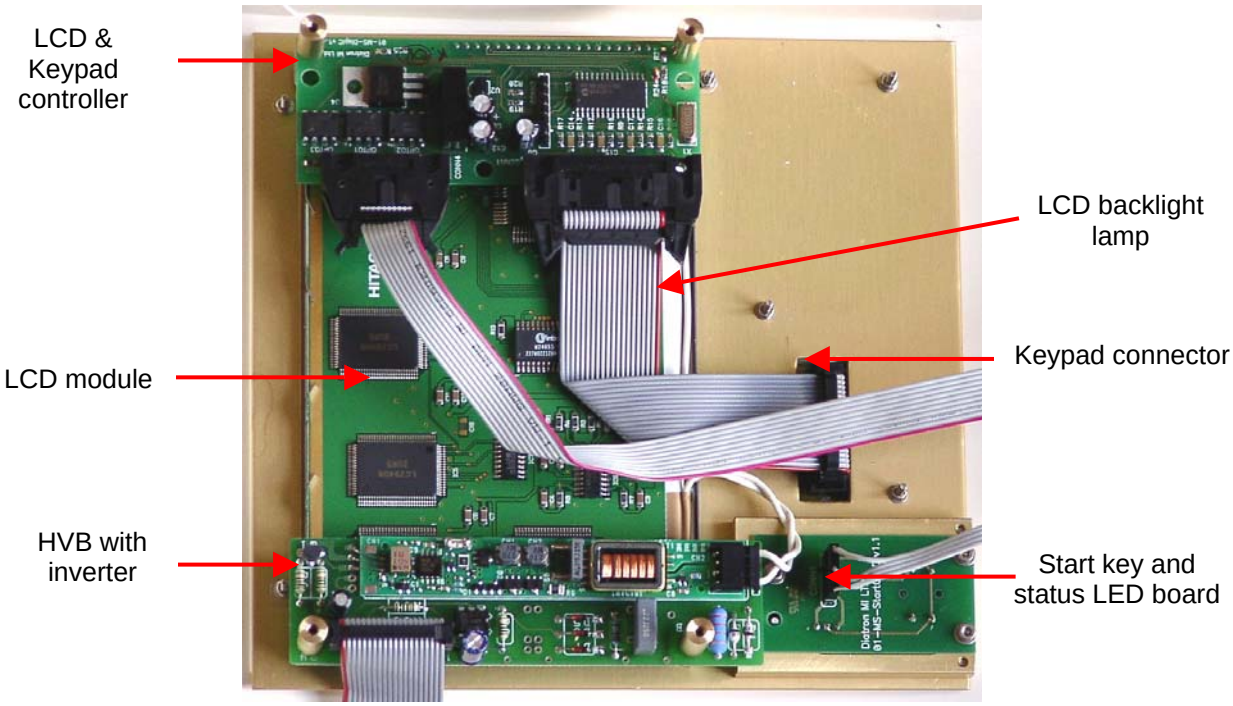
This board contains four liquid detector opto-detectors (optos) and a reference opto for automatic temperature and stray light compensation. The reference opto is located in the middle and it has the same temperature and backlight conditions as the sensing ones.



The Reagent Sensor Board is connected to the PPB card in **AJ/AJvet**, and the valve driver micro-controller makes the sensing and compensating operations. In **AJB,** this board is connected to the MAIN board and the micro-controller controls the operation of the Reagent Sensor Board.

Instrument makes automatic initialization – called calibration – of reagent sensors during priming phase of fluidics.

2.1.12. LCD Display Module with High Voltage Board of AJ/AJvet



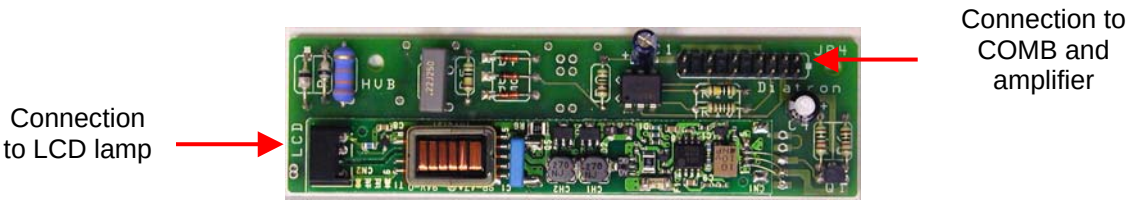
Display assembly contains the 240x128 dots graphics LCD display and the high voltage board. LCD has a high voltage backlight lamp (high voltage board generates the required voltage).

There is a special temperature compensation circuit in the display module, which makes possible to use the LCD module in wide temperature ranges with the adjusted contrast.

High Voltage Board (HVB) generates LCD backlight voltage (300V), aperture cleaning voltage (150V), and measuring voltage (50V). The high voltage board is connected to the system through the amplifier board and the COMB card. This unit contains INVC191 inverter, which is a high voltage, high frequency circuit producing suitable voltage for CCFL (cold cathode fluorescent lamp) of the LCD.

The CFSW digital signal (from the COMB card) controls HVB: logical LOW turns inverter on. The MVON digital signal (from the COMB card) switches the measuring voltage (50 V) on/off by O1 opto switch.

> ***Warning! Be careful with servicing this board in active state, because the high voltage (300V) at LCD lamp connector can cause damages or electric shock.***
>
> ***Never operate the analyzer without the LCD backlight connected to the HVB, because the over-voltage on the output of the HVB can damage the HVB board and the amplifier.***



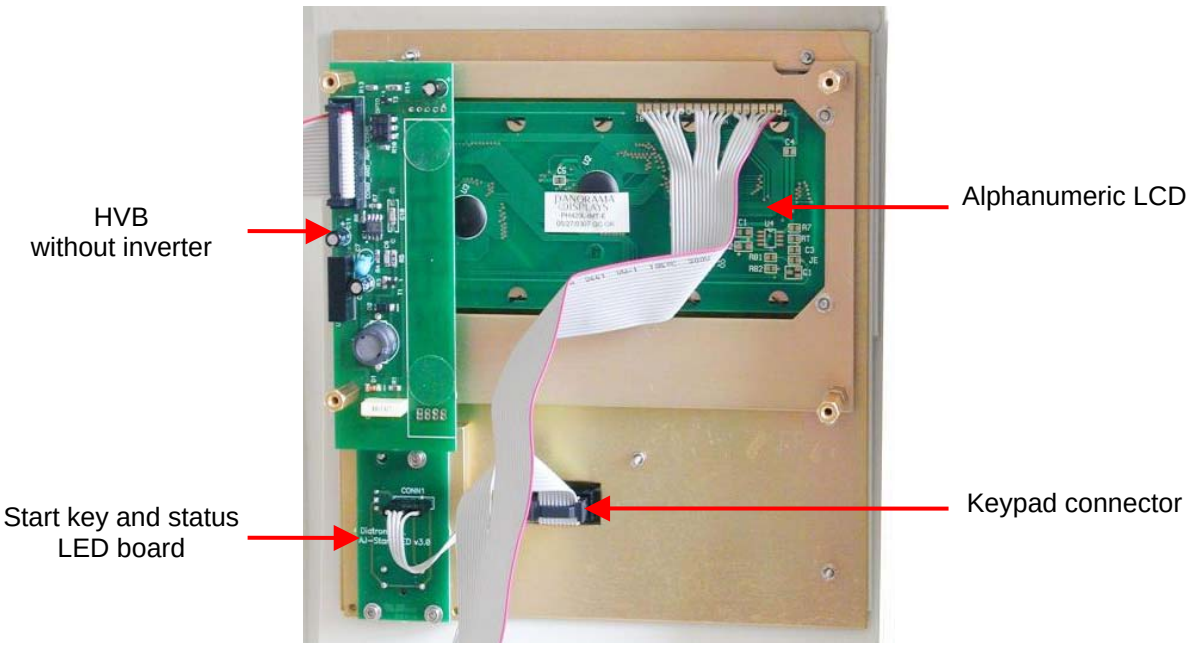
In Abacus Junior B, we needed a new high voltage board, because in this instrument there's no need for the inverter on the previous HVB (the alphanumeric display has no CCFL backlight), but the measuring and cleaning voltage generation based on the inverter's high voltage. That's why we developed HVB v2.1, which is still capable to carry and feed the inverter, but the board has its own high voltage generation circuitry, so can be used without the inverter placed on it.

HVB v2.1:

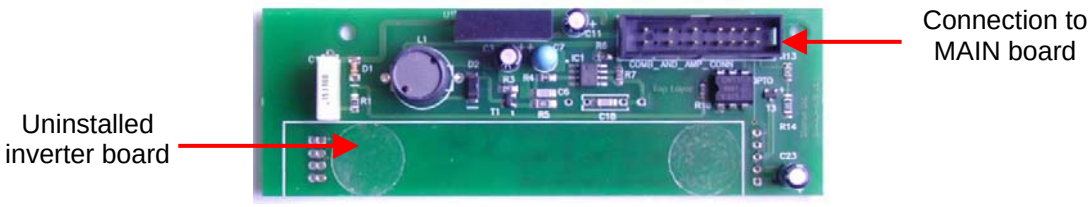
Start key is a micro-switch, connected to the COMB card (through the Display ribbon cable). The status LED indicates the actual status of the analyzer and it has three colors: red, green and amber (See User's Manual). The LED has three pins and the actual color depends on the controlled pins. Start key and status LED are controlled by COMB.

2.1.13. LCD Display Module with High Voltage Board of Abacus Junior B

The display assembly in Abacus Junior B contains a 4x20 characters alphanumeric display, a high voltage board, a Start key and status LED board. The alphanumeric display has internal LED based backlight, which is driven and controlled by the MAIN board.



High Voltage Board (HVB) generates the aperture cleaning voltage (150V), and measuring voltage (50V). The high voltage board is connected to the system through the amplifier board and the MAIN board.



CFSW signal (from MAIN board) controls HVB: logical LOW turns inverter on. MVON signal (from MAIN board) switches the measuring voltage (50 V) on/off by O1 opto switch.

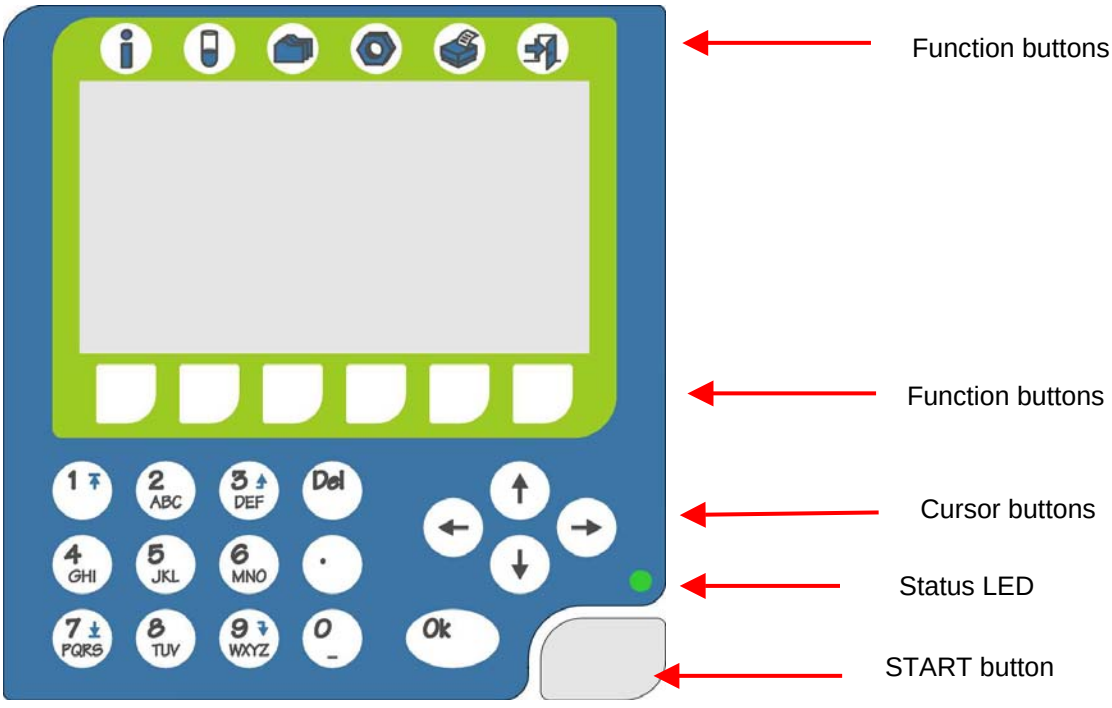
> ***Warning! Be careful with servicing this board in active state, because the high voltage can make damages or electric shock!***

Start key is a micro-switch, connected to the MAIN board (through the Display ribbon cable). The status LED indicates the actual status of the analyzer and it has three colors: red, green and amber (See User's Manual). The LED has three pins and the actual color depends on the controlled pins. The MAIN board controls start key and status LED.

In Abacus Junior B the LCD controlling and keypad reading are handled by the micro-controller of the MAIN board via some interface circuitry.

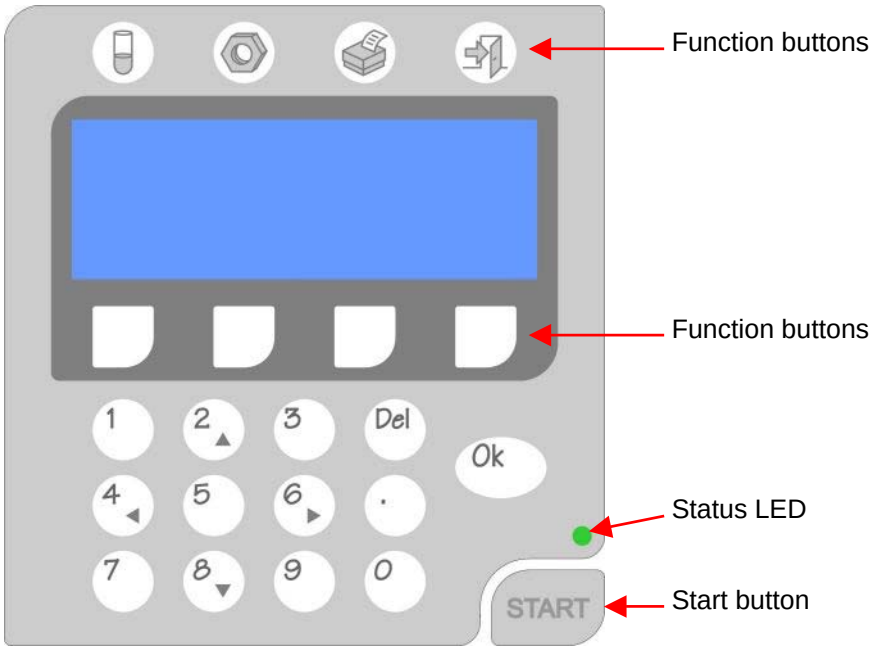
2.1.14. Keypad of Abacus junior/Abacus junior vet

The analyzer has a 29-button **foil keypad** including numerical keypad (0-9, "."), cursor moving, OK and Del buttons, and 6-6 function buttons, above and under the LCD display as it is shown in the picture below:



2.1.15. Keypad of Abacus junior B

The analyzer has a 21-button **foil keypad** including numerical keypad (0-9, "."), OK and Del buttons, and 4-4 function buttons, above and under the LCD display as it is shown in the picture below:

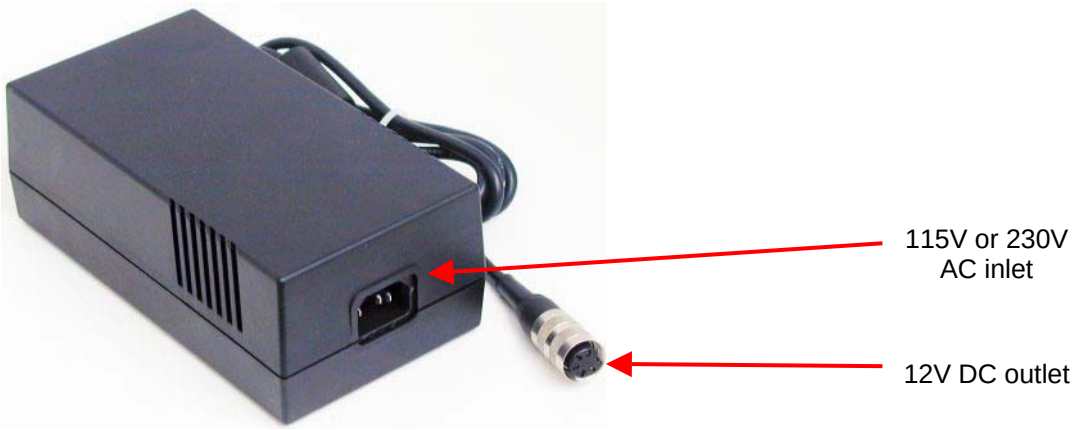


2.1.16. Floppy Disk Drive and CD-ROM Drive - AJ/AJvet

The built-in Floppy Disk Drive makes possible to save data on floppy disks, and to install (or upgrade) the software. The optional CD-ROM drive can be used to install software (only read actions from CD-ROM, as write operations are not supported by the instrument's operating system). Both units are connected to COMB card: CD-ROM to IDE interface, FDD to Floppy interface.

2.1.17. External Power Supply

The analyzer works with an external power supply. The next figure shows the power supply unit generating 12VDC.



The power supply modules have an auto range input, which makes possible to use them with 230V or 115V mains outlet and it has the CE and UL safety certification. The input socket of the power supply is a standard 3-terminal plug, with power cable connection; the output is a special, lockable socket as it is shown in the picture.

2.1.18. MAIN board - AJB

MAIN board is responsible to control the instrument: contains the main power regulator circuits, valve and motor driver circuits and other connections for the fluidic and pneumatic system's parts, responsible for the specific measurement processing functions.

The board also contains two 24FC256 serial E^2PROMs, which store the settings and identity information of the instrument (Serial Number, OEM, model, etc.) and the measurement database.

The central micro-controller with a CPLD and with several other digital chips (buffers, decoder, multiplexer) handles the pneumatic system, displaying, measurement and data management.

Power system: filtering the +12V Input and generates +3.3V (CPLD), +5V (Digital power), +8V (Printer power). Filtered +12V is used for the power of motors and valves.

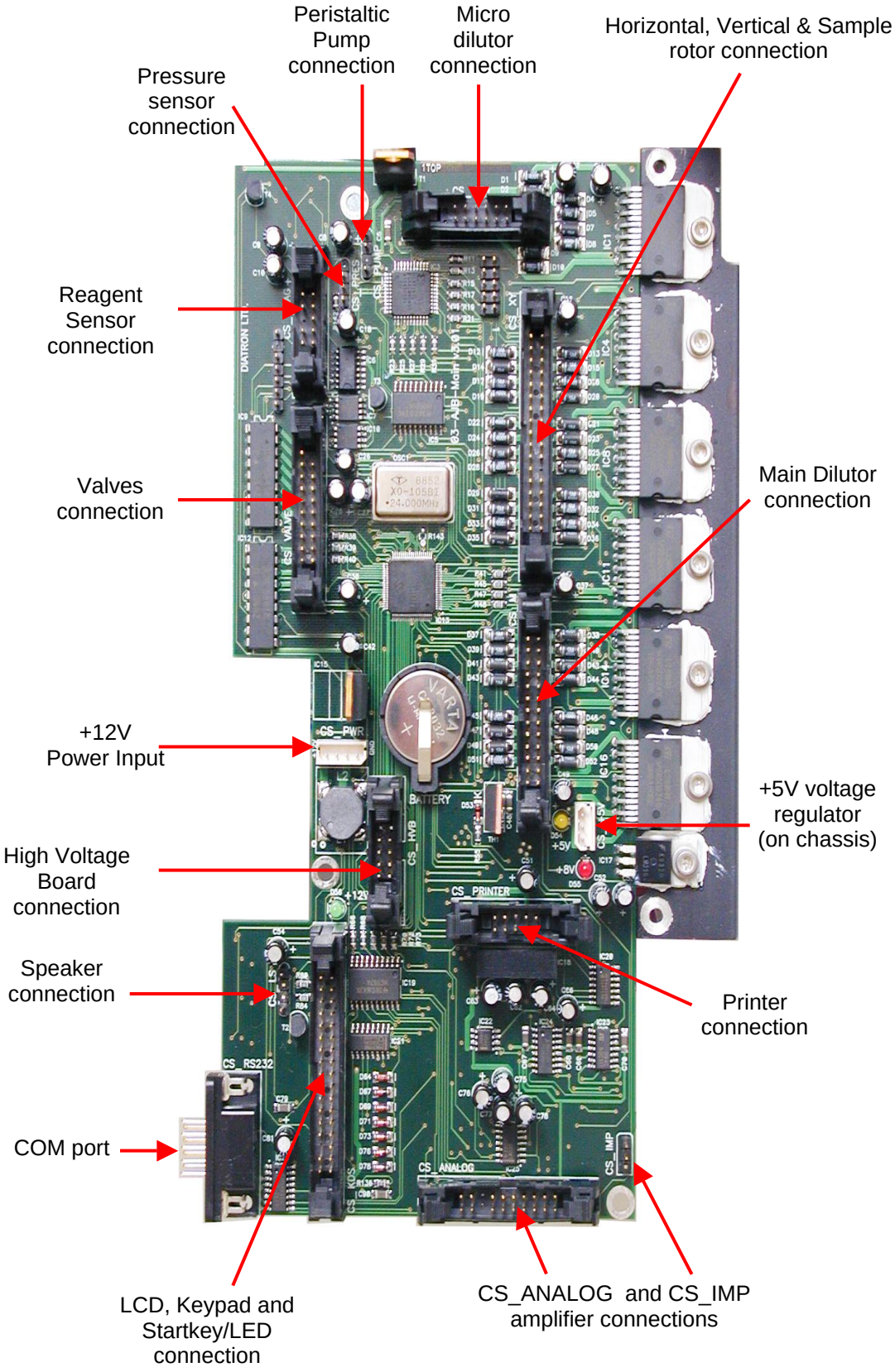
Motor drivers: 6 power drivers; Horizontal, Vertical and Sample rotor motors have one combined ribbon cable connection. Main Dilutor (with two motors) and Micro-dilutor have separated connectors.

Valve driver: consists two 8-bit, powered output shift registers (with built in protection diodes) and there is one common ribbon cable connection for the valve boards. The peristaltic pump has a separated Darlington driver circuit for more reliable operation.

Real Time Clock: for TIME/DATE functions; powered by Battery at switched off state.

Measurement processing: the A/D conversion made by the micro-controller itself, but several preprocessing steps (time limits, noise handling, pulse integration) taken by the external analog circuitry.

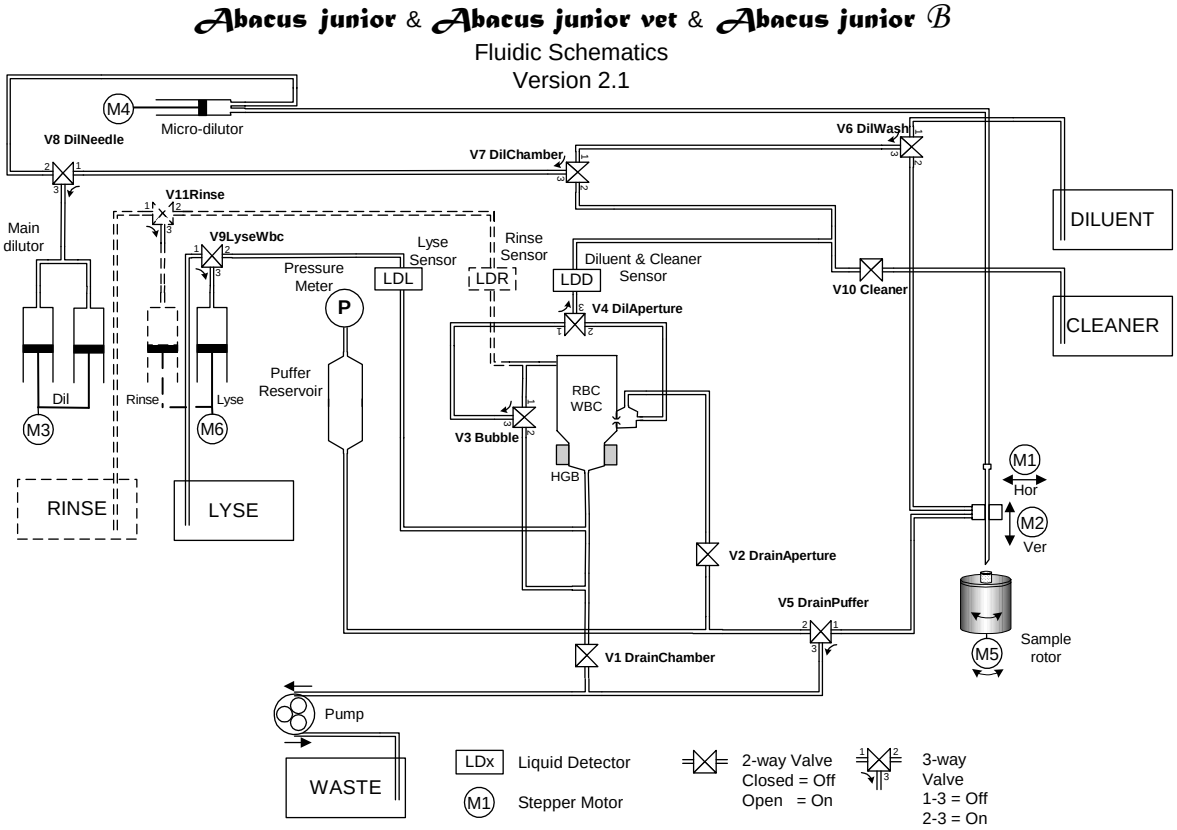
External communication through RS232 makes possible to update the firmware of the micro-controller with an external PC.


Peristaltic Pump connection
Micro dilutor connection
Horizontal, Vertical & Sample rotor connection
Pressure sensor connection
Reagent Sensor connection
Valves connection
Main Dilutor connection
+12V Power Input
+5V voltage regulator (on chassis)
High Voltage Board connection
Speaker connection
Printer connection
COM port
LCD, Keypad and Startkey/LED connection
CS_ANALOG and CS_IMP amplifier connections

2.2. Main mechanic and fluidic parts of the Analyzer

Abacus junior / Abacus junior vet / Abacus junior B Hematology Analyzers consist of the following mechanic and fluidic parts:

1. Sample rotor
2. Sampling needle
3. Washing head
4. H&V moving unit
5. Micro Dilutor
6. Dilutor
7. Chamber
8. Cell-counter probe
9. Puffer reservoir
10. Pump
11. Valves
12. Tubing



The main fluidic schematics are almost the same for the three models. The only exception is the Rinse reagent and the corresponding Rinse syringe and Rinse valve (V11), which is present for the **AJvet** model only.

2.2.1. Sample rotor

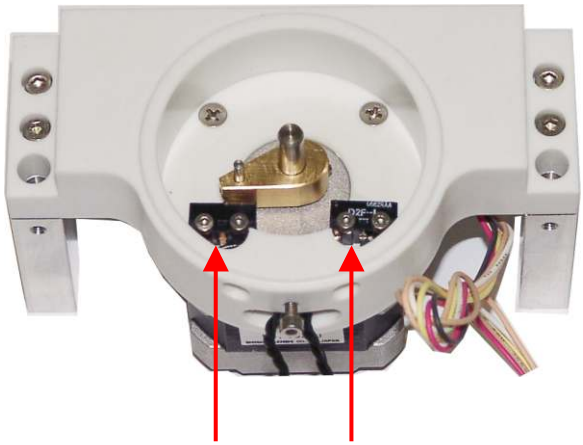
Abacus junior / Abacus junior vet / Abacus junior B hematology Analyzers has a sample rotor for safety and more precise sample handling. Commonly used sample tubes are supported by replaceable tube adapters.

The Sample rotor unit uses a stepper motor, connected to the PPB (**AJ/AJvet**) or to the MAIN board (**AJB**), through the XY opto board. The rotor has micro switches for positioning.

The unit blocks itself in the home and end position with mechanical parts and has a special cap that prevents the damage of the electronic and mechanic parts caused by any fluid.

Sample rotor is maintenance-free.

Replaceable tube adapter



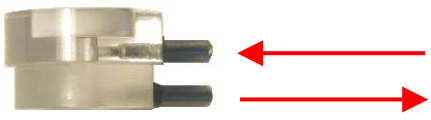
Micro switches for positioning

2.2.2. Sampling needle

Sampling needle is assembled in the H&V moving unit and it makes the sample aspirations. Correct setting of sampling needle is necessary and very important (see Chapter Adjustments).

2.2.3. Washing head

Washing head is located at the bottom of the H&V moving unit and it is for cleaning the outer surface of the sampling needle. This washing process is made with diluent reagent and the fluid is drained by the pump. The arrows on the picture show the direction of diluent flow during sampling needle washing.



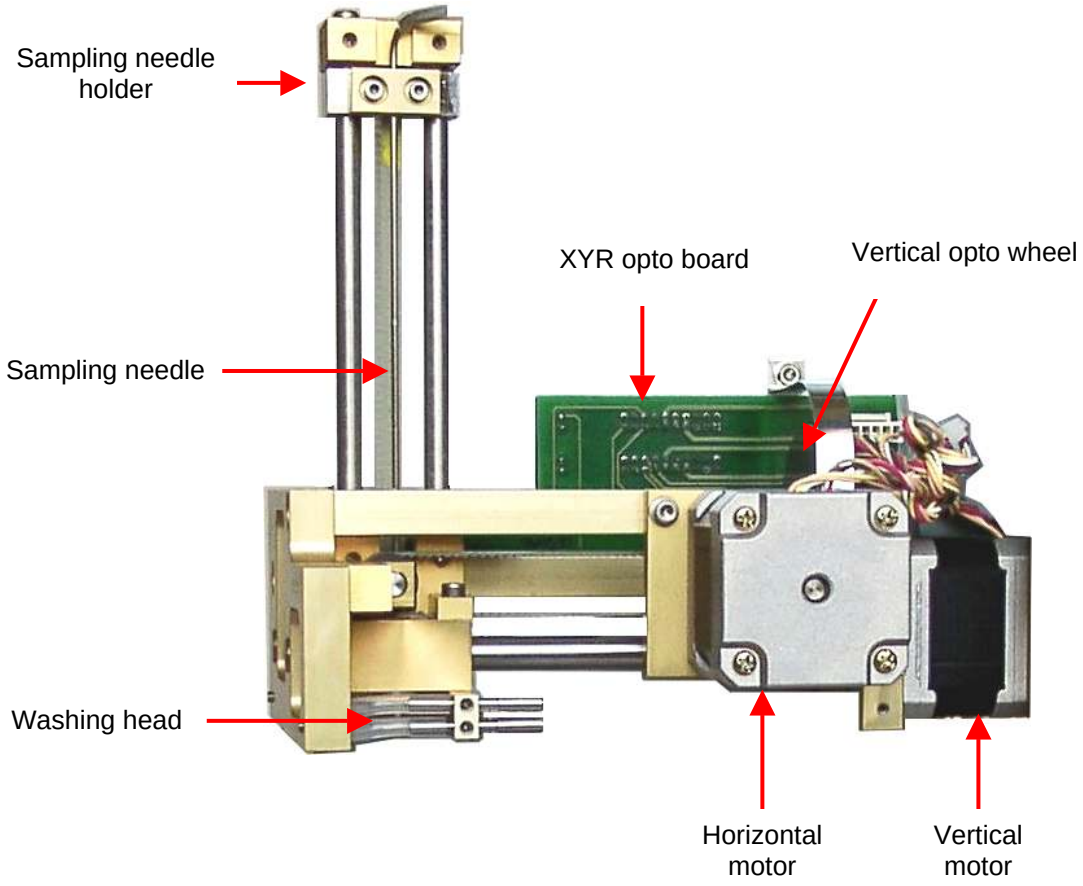
Clean diluent
Pump to waste

Clean or replace washing head yearly, or after 10 000 measurements.

2.2.4. H&V moving unit

All three instruments use the same H&V moving unit.

This unit contains slides to move the sample sampling needle in Horizontal and Vertical directions, two stepper motors, XYR opto board, opto wheel, washing head and the sampling needle. It moves the needle to the desired position: from sampling position, to washing head, and to the measuring chamber.



Both stepper motors have optical end-switch sensors for detecting these positions. These are required for correct initialization and error detection. All sensors have status LEDs to show actual conditions.

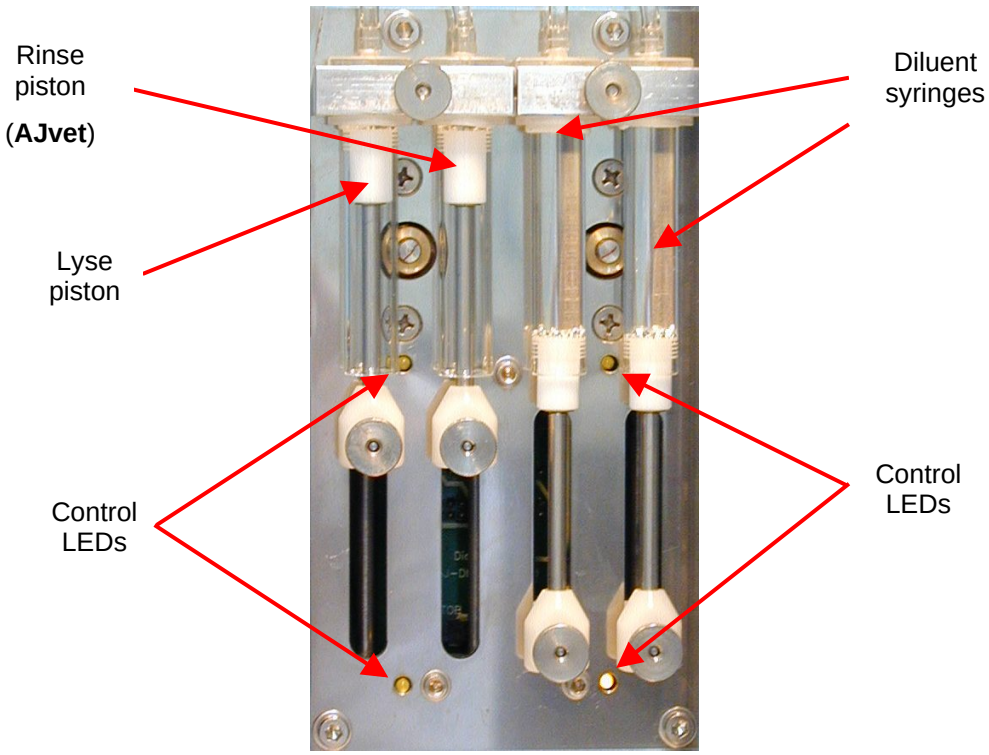
The Vertical motor works with a special opto wheel for detecting home & end positions. See the Adjustment section of this manual to place this wheel to the proper position.

> ***Greasing of the horizontal/vertical guiding rods should be done regularly using "Photorub", a PTFE-based thin lubricant.***
>
> ***It is recommended to check and repeat greasing of guiding rods every year, or after 10000 measurements.***

2.2.5. Main Dilutor

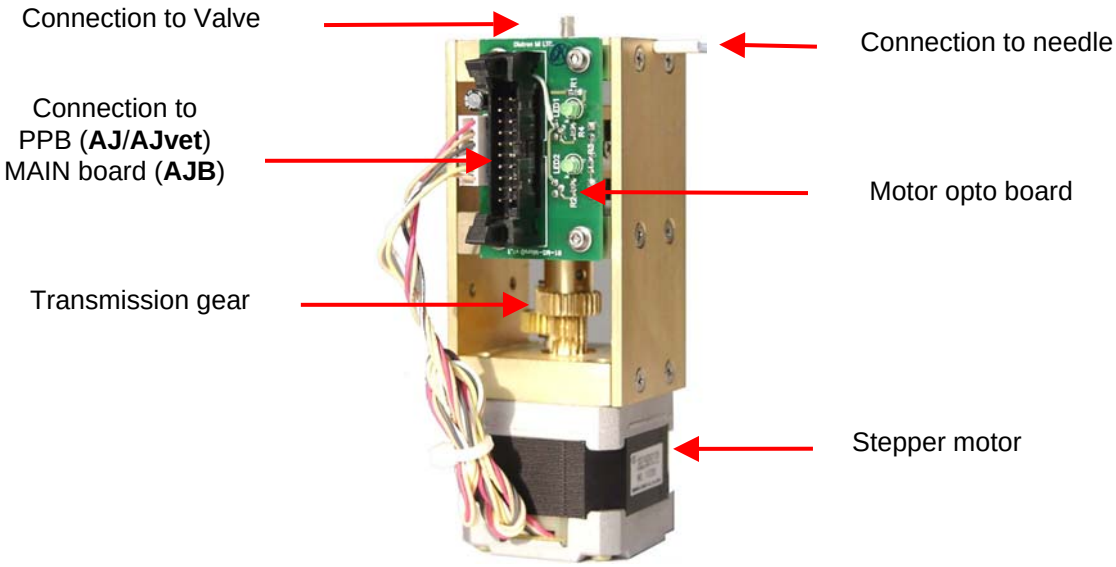
In case of **AJ** and **AJB** this unit includes two dilutor channels – one for diluent, and another one for lyse reagents. (There's another channel for Rinse in the **AJvet** model). There are two stepper motors, a common motor opto board, three (**AJ**/**AJB**) or four (**AJvet**) syringes and piston rods with gear transmission.

> ***Maintenance should be provided to the piston tips, by applying neutral silicon grease to the cogged end of the Macro and Lyse pistons, between the syringe and the tip itself. This will ensure optimum sealing and longer lifetime of piston tips.***
>
> ***Greasing of the cogged transmission parts (cogwheel and cogged bar) should be done regularly using machine grease.***
>
> ***It is recommended to check and repeat greasing of piston tips, and transmission gear every year, or after 10000 measurements.***



2.2.6. Micro Dilutor

Micro dilutor is taking the precise sample (25 or 50µl) into the sampling needle. It includes a stepper motor, a motor opto board and the micro syringe.



2.2.7. Puffer reservoir

The glass puffer reservoir is directly connected to the pressure sensor.

During measurement, there is no pump activity, so the puffer reservoir maintains measuring vacuum stable. The instrument measures atmospheric pressure and adjusts measuring vacuum according to it.

2.2.8. Pump

Pump generates regulated vacuum and drains the fluidic system. It is connected to the PPB (**AJ**/**AJvet**) or to the MAIN board (**AJB**) and it has its own driver circuit (Darlington).

If the tube of the peristaltic pump becomes worn, it can be broken, causing Pressure error.

> ***It is recommended to check the state of the tube, and replace it every 2 years, or after 20 000 measurements. Always replace the peristaltic pump tube to the same PharMed® type, with the same length.***

For servicing the tube of the pump, open the peristaltic pump from its top (see picture) and remove the tube together with the white plastic side wall (see picture):

In case of damaged tubes, it can be replaced by a new one by opening the two metal locks located at the two ends of the tube (see picture).

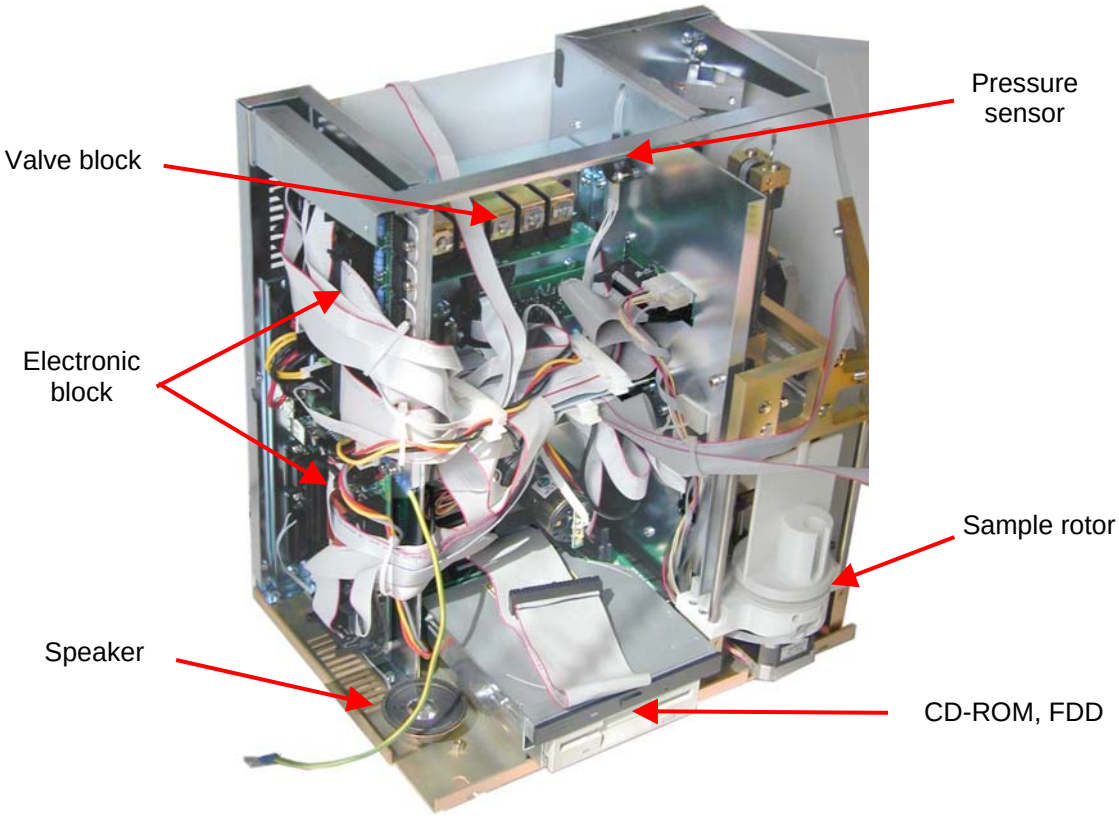
2.3. Assembled Analyzer

2.3.1. Abacus junior / Abacus junior vet

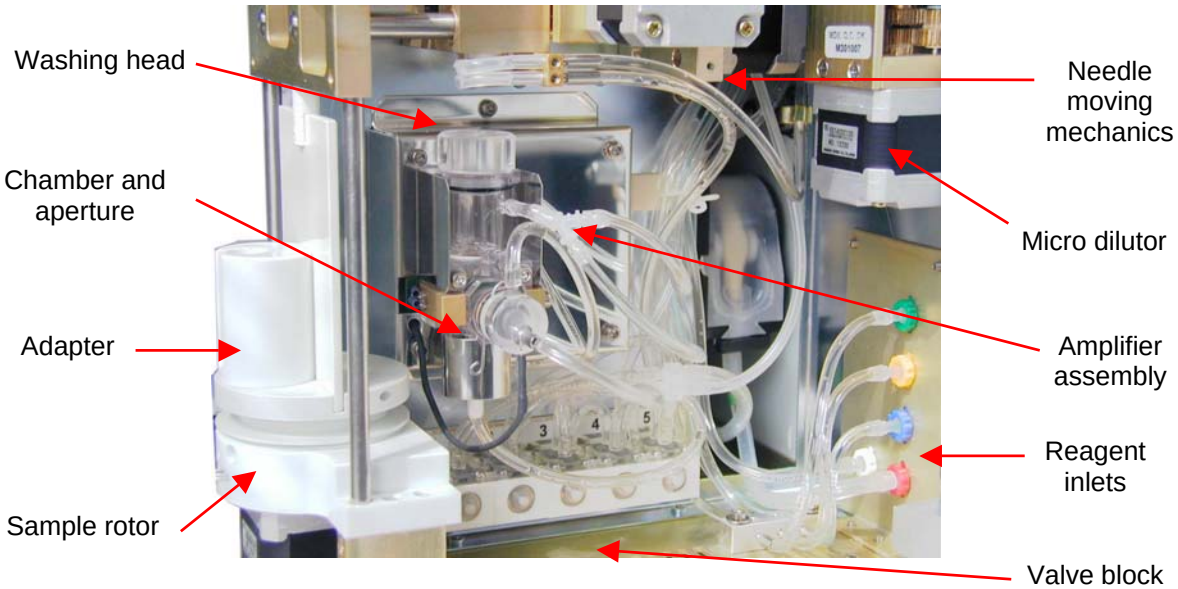
Front Panel (note display logo: it is an Abacus Junior model; and missing optional CD-ROM drive module):

Rear panel (note reagent inlets: it is an Abacus Junior model as there is no Rinse connection):

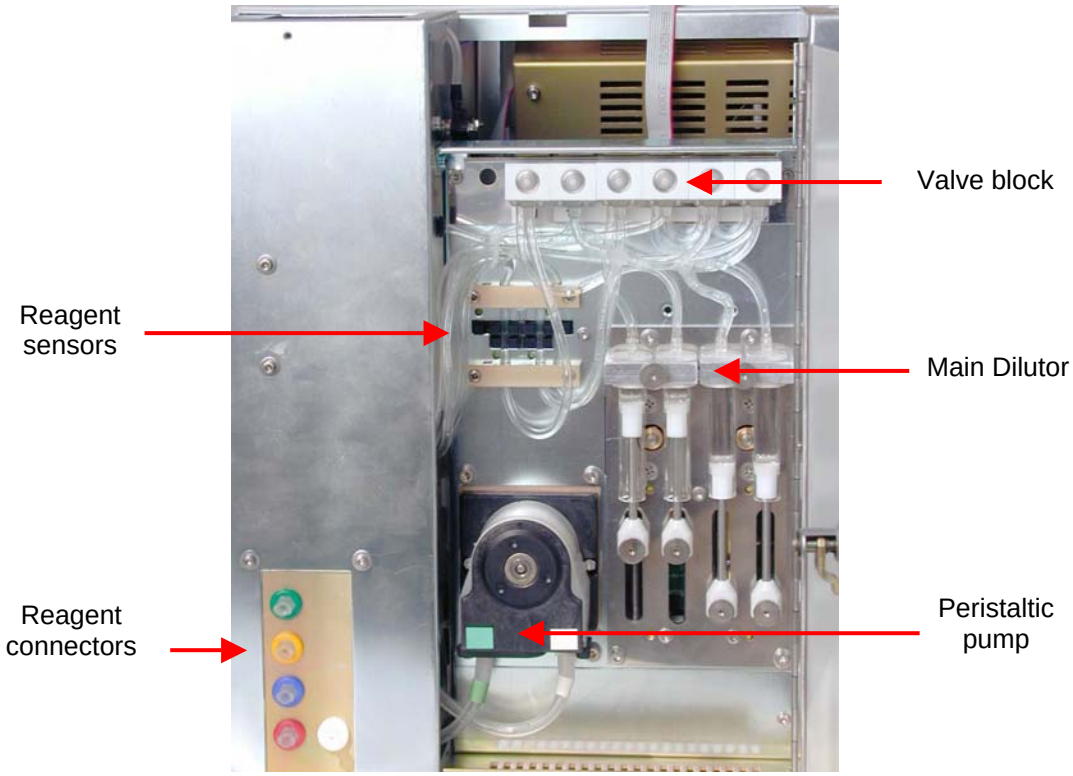
Construction – front (note optional CD-ROM drive):



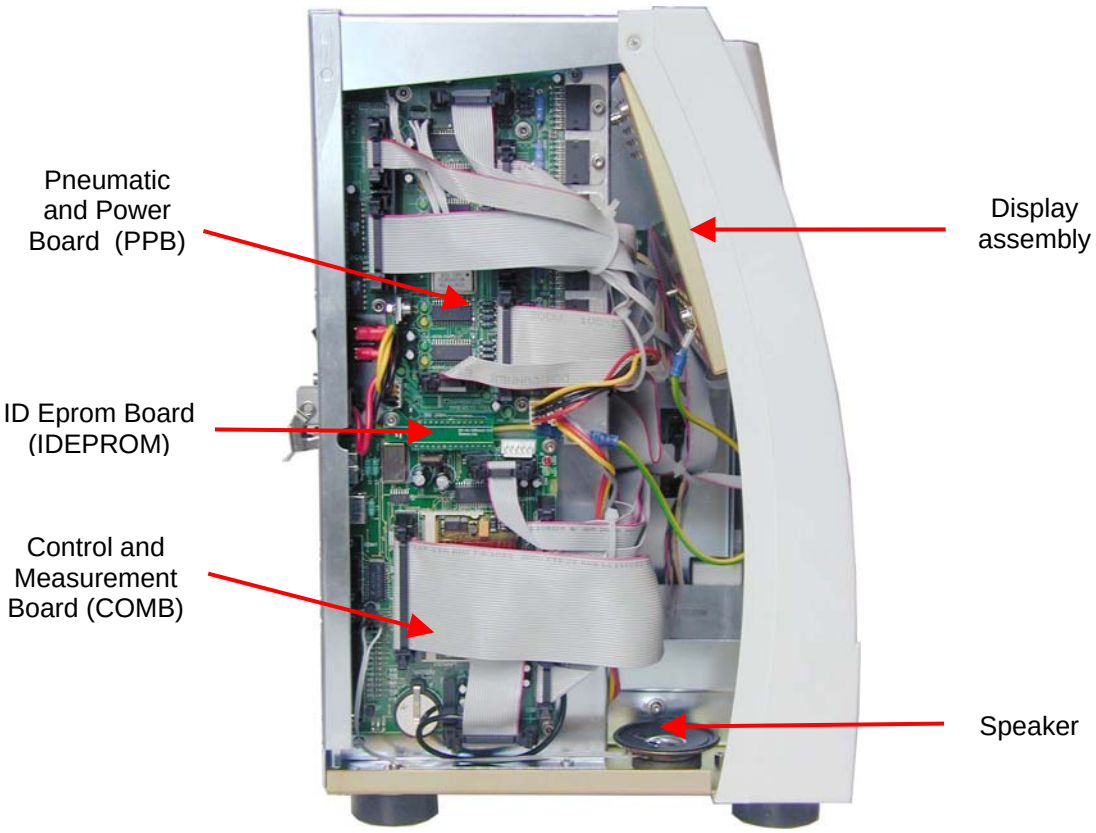
Construction – right side (note white reagent inlet for Rinse: it is an Abacus Junior Vet model):



Construction – back (note white reagent inlet for Rinse, main dilutor and valve block with 6 valves: it is an Abacus Junior Vet model):



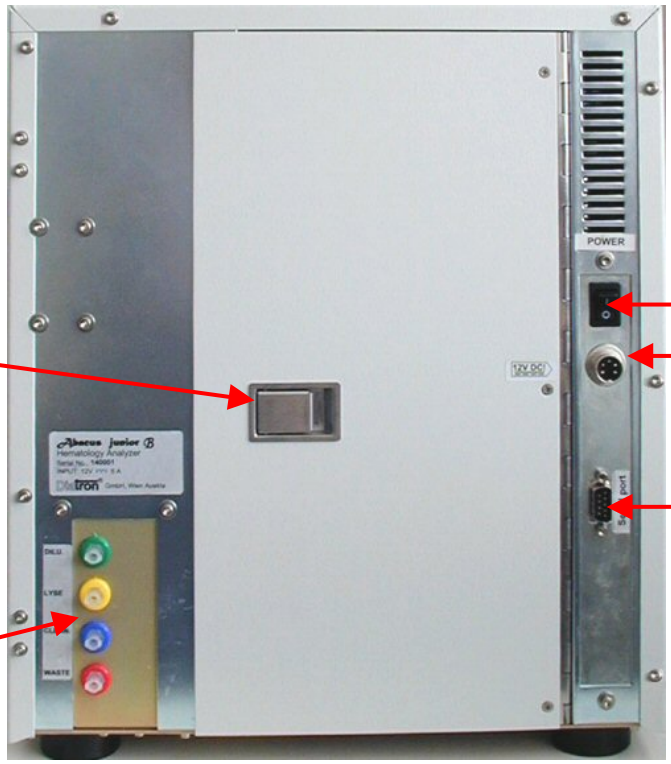
Construction – left side (note connected IDE ribbon cable):



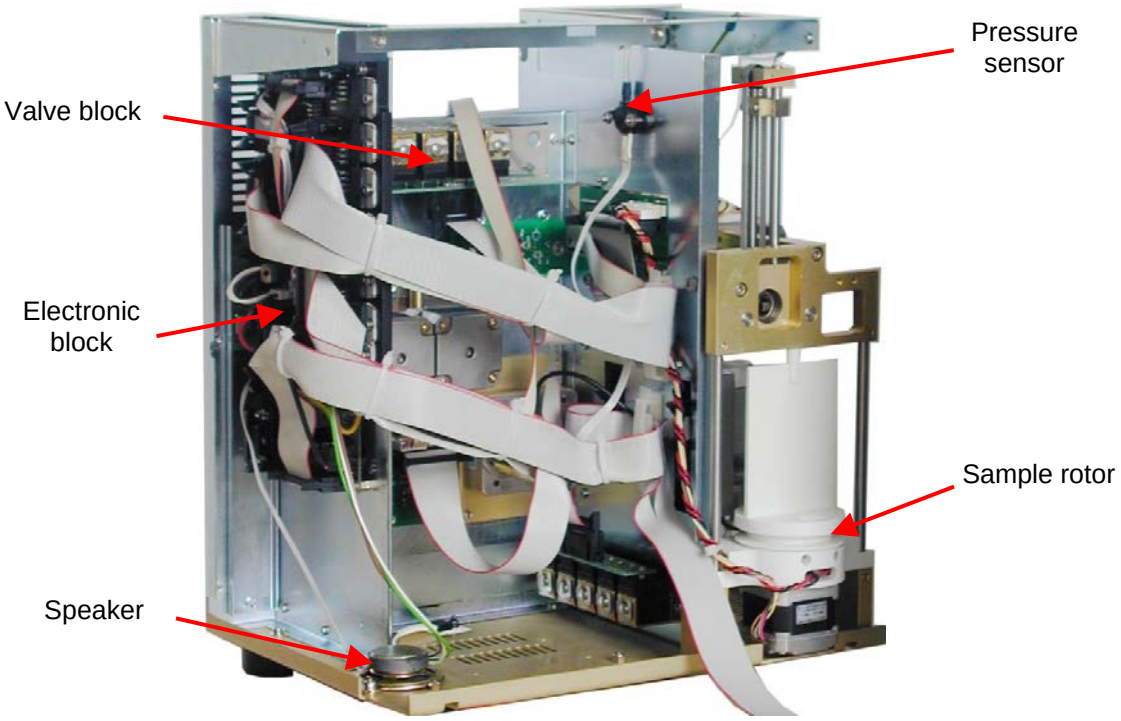
2.3.2. Abacus junior B

Front panel (note missing floppy and CD-ROM drives):

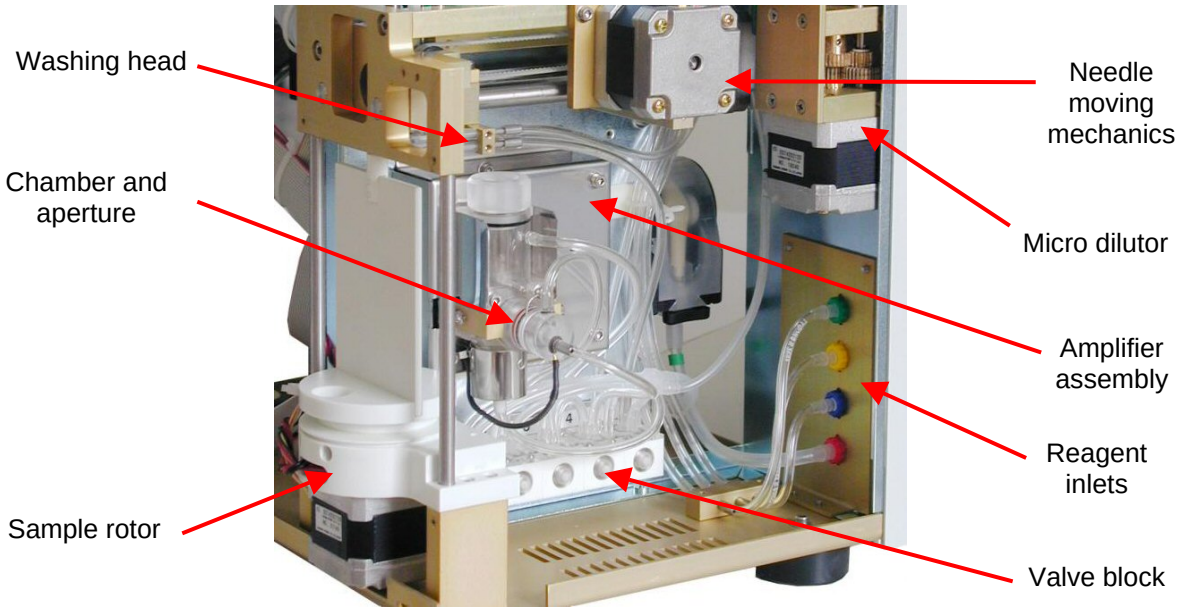
Rear panel (note Serial Port as the only interface):



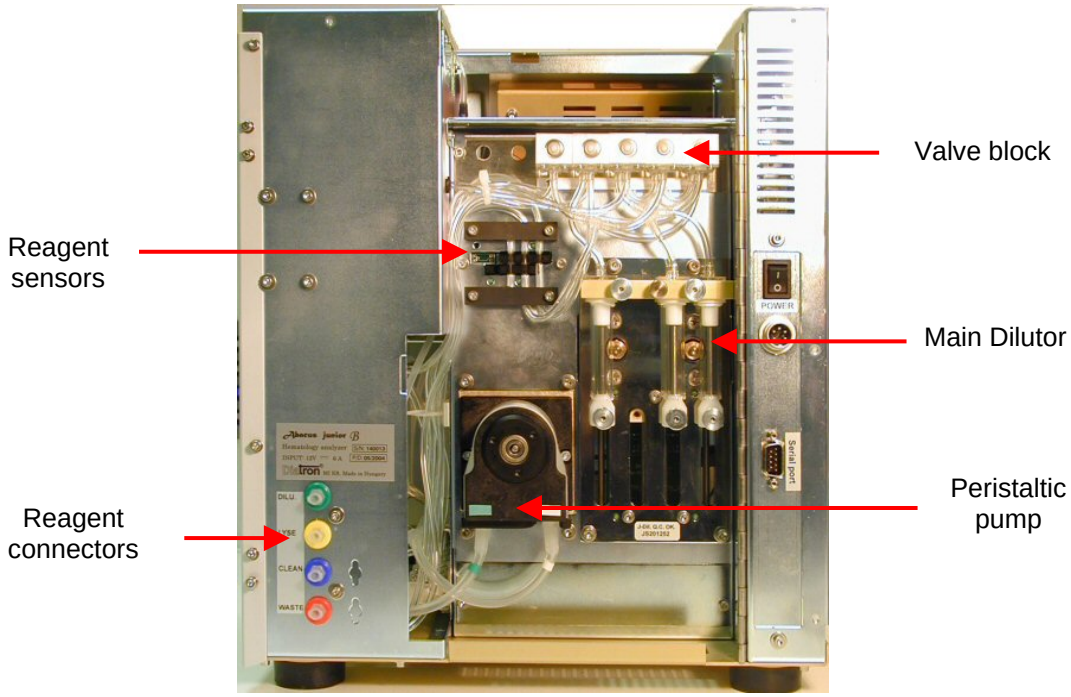
Construction – front:



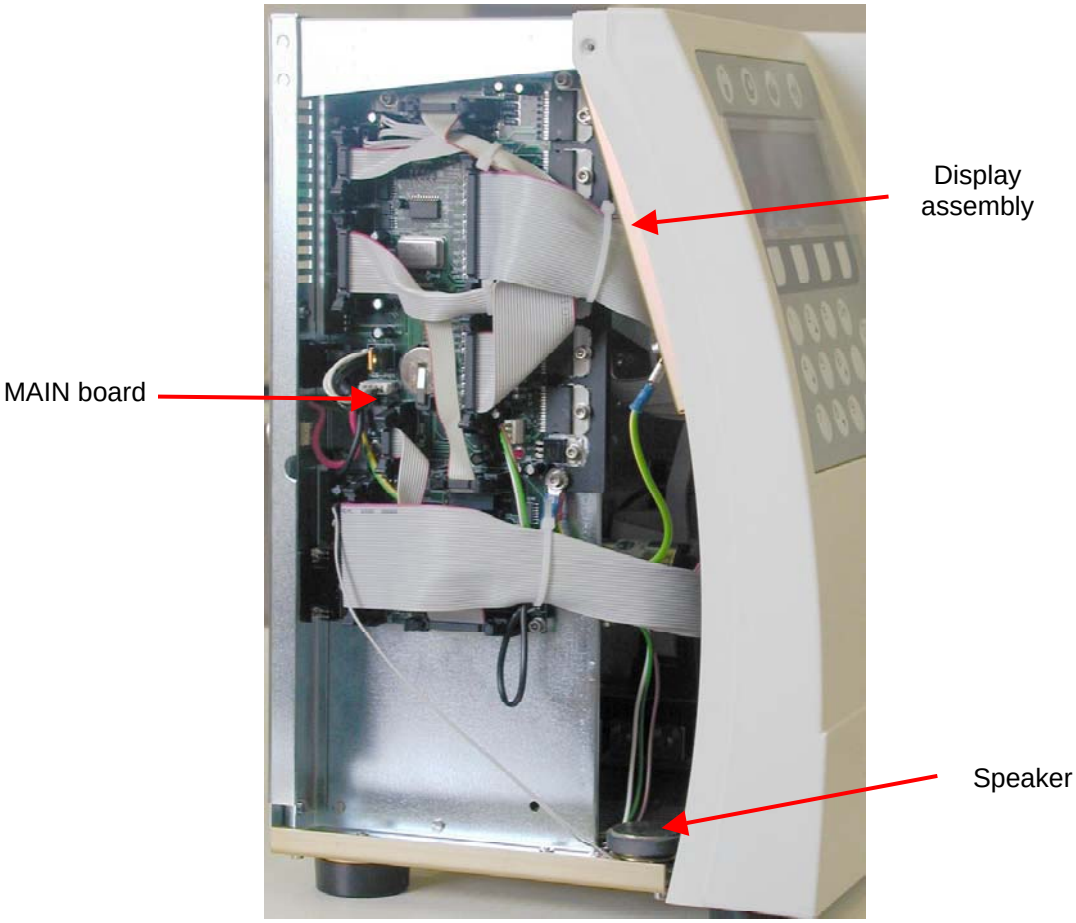
Construction - right side:



Construction – back (note valve block with 5 valves):



Construction - left side:



3. OPERATION OF THE FLUIDIC SYSTEM

This section describes the main fluidic steps of **Abacus junior / Abacus junior vet / Abacus junior B** measurement cycle. The instrument's Fluidic Schematics are shown in Section 2.2. of this manual. The following figures show total measurement flow diagram and detailed descriptions of processes for understanding the fluidic system work.

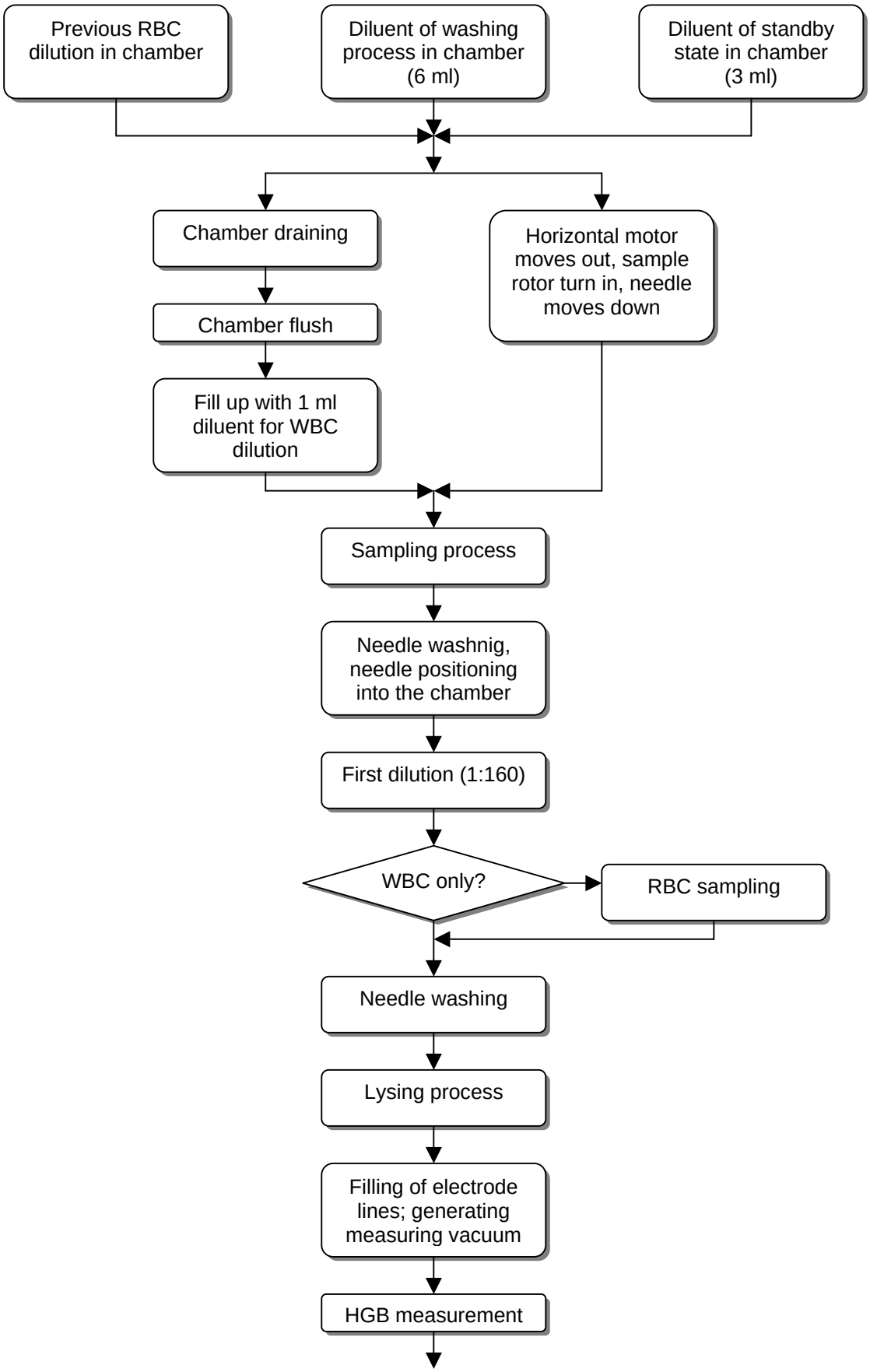
The following steps are introduced in this section:

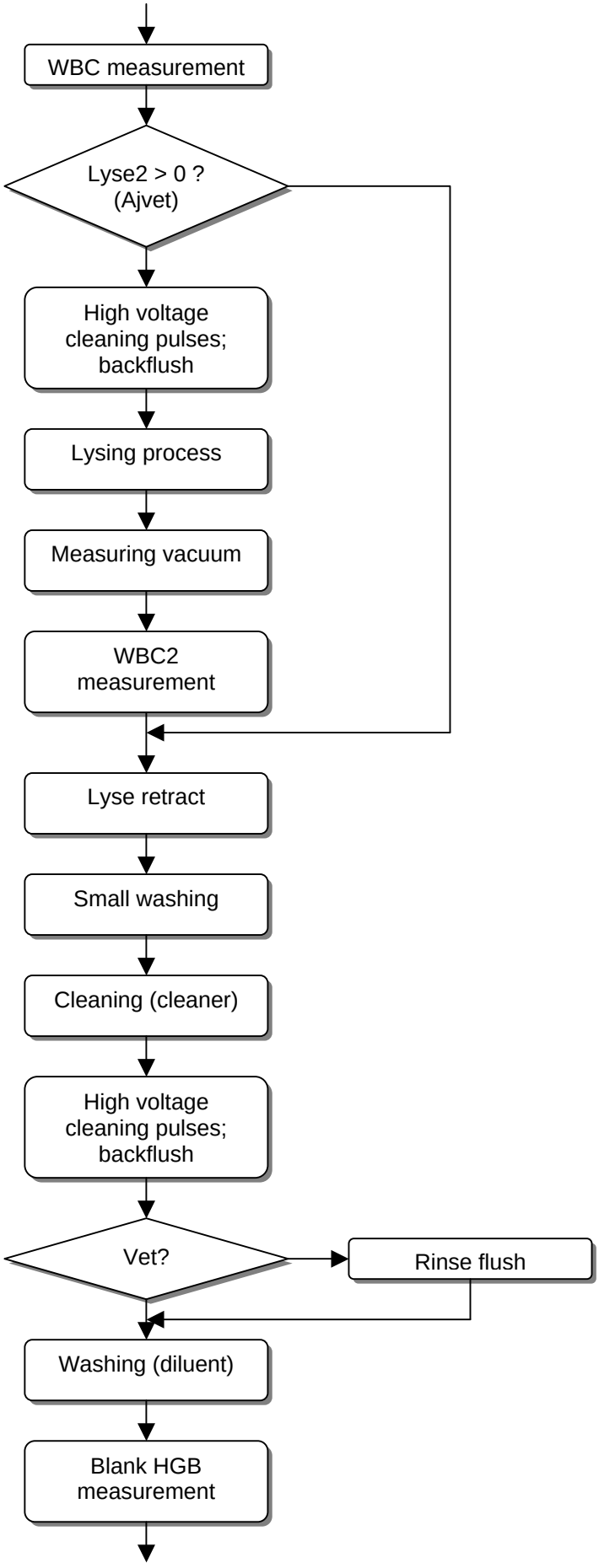
1. Flow diagram of measurement
2. Initialization process
3. Sampling process
4. Needle washing process
5. Diluting process
6. Lysing process
7. Counting process
8. Chamber draining process
9. Cleaning process
10. Shutdown process

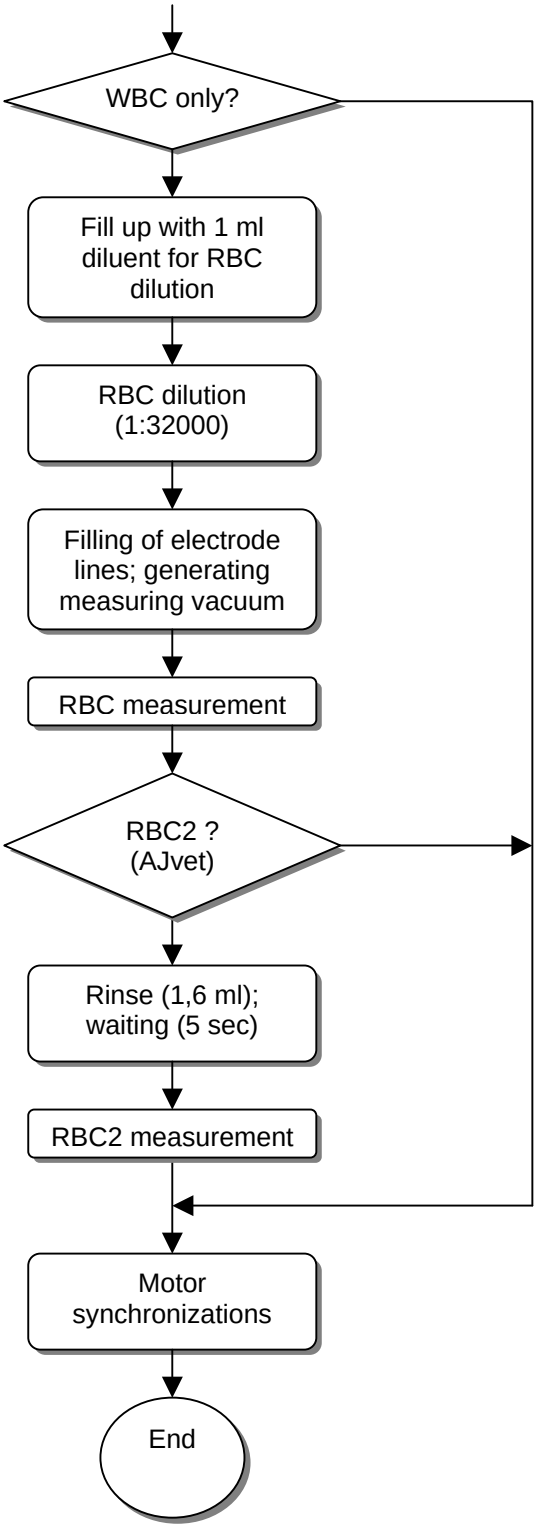
In the detailed process description figures, the active tube is filled with black color, while an arrow (→) shows the direction of the flow. Moving mechanic parts have another arrow indicating direction of movement. Only opened (On) valves are mentioned in this section while all the other valves are closed (Off).

Abacus junior / Abacus junior vet / Abacus junior B employs a software waste full checking feature. Software integrates volume of the reagents used, and gives a message when this volume reaches the preset tank capacity.

3.1. Flow diagram of measurement




WBC measurement
Lyse2 > 0 ?
(Ajvet)
High voltage
cleaning pulses;
backflush
Lysing process
Measuring vacuum
WBC2
measurement
Lyse retract
Small washing
Cleaning (cleaner)
High voltage
cleaning pulses;
backflush
Vet?
Rinse flush
Washing (diluent)
Blank HGB
measurement


WBC only?
Fill up with 1 ml diluent for RBC dilution
RBC dilution (1:32000)
Filling of electrode lines; generating measuring vacuum
RBC measurement
RBC2 ? (AJvet)
Rinse (1,6 ml); waiting (5 sec)
RBC2 measurement
Motor synchronizations
End

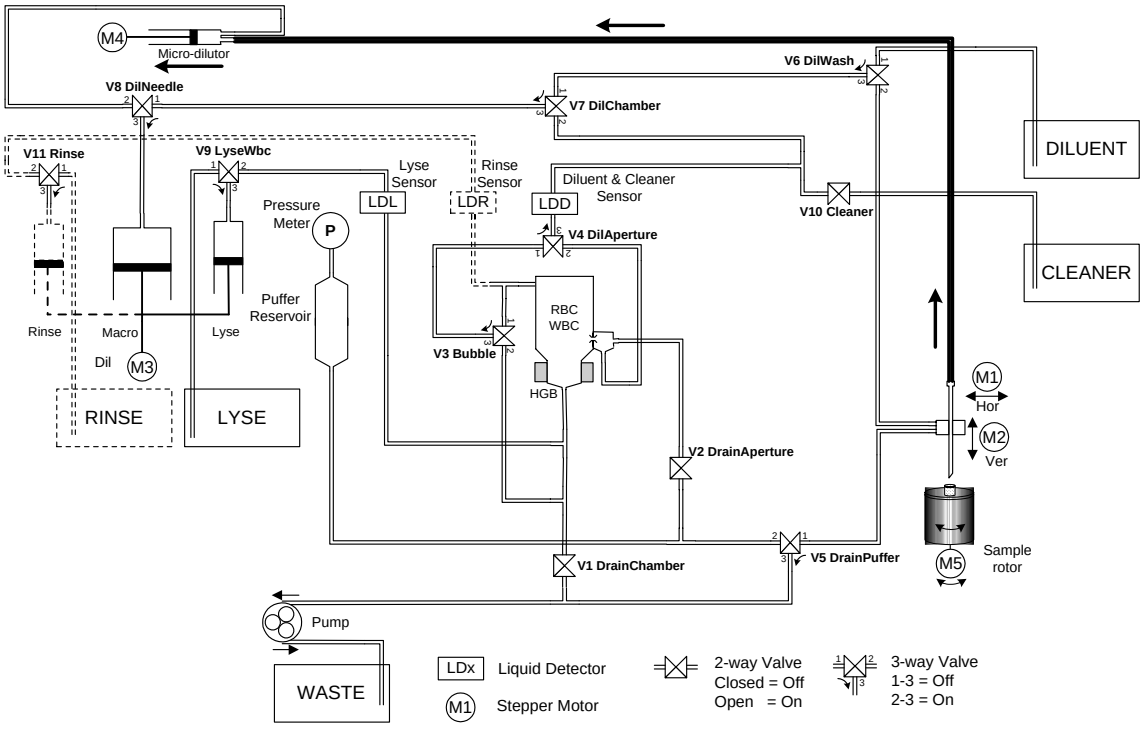
3.2. Initialization of the Fluidic System

Fluidic initialization process performs the following steps:

- Checking of valves by turning all on/off
- Checking of pump and pressure sensor by generating measuring vacuum
- Positioning all mechanical components by scanning moving range (with end-switches)
- Priming of reagents and calibrating reagent sensors
- Cleaning of tubing & measuring chamber
- Cleaning of aperture with high-pressure back-flush, cleaner reagent & high-voltage burning

3.3. Sampling process

The aspirating needle aspirates 25 µl (50 µl in prediluted mode) of blood sample. The Micro-dilutor syringe makes the aspirating while the M4 Micro-dilutor motor moves down.



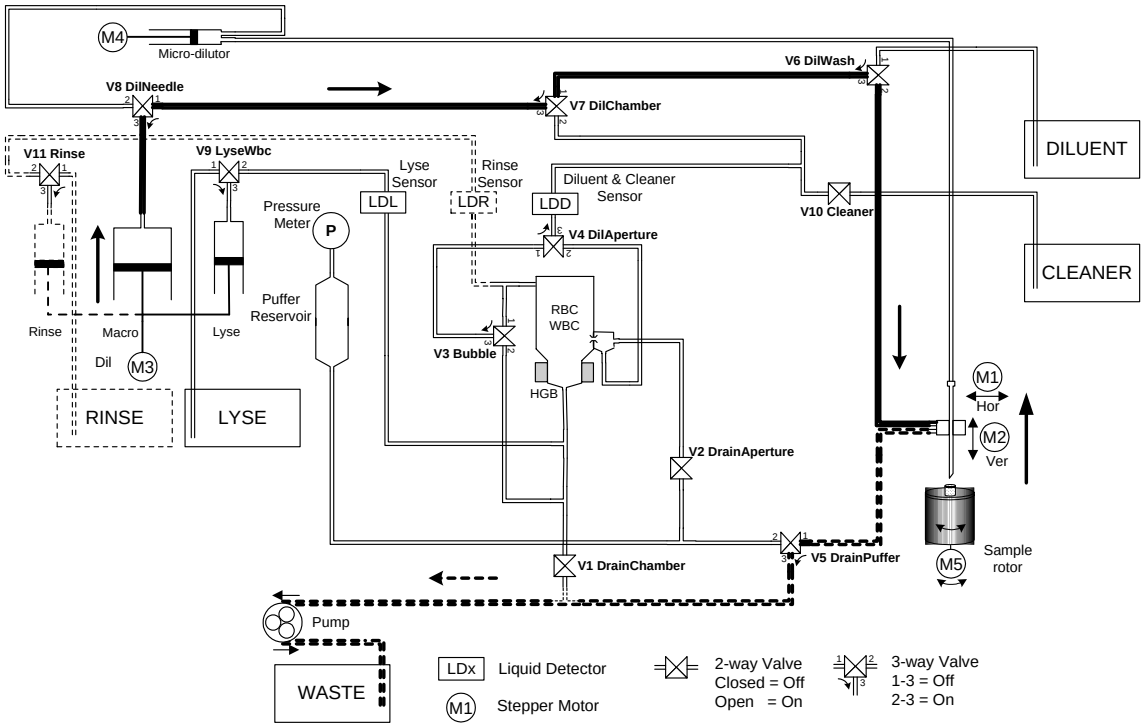
There is also another sampling process for the second (RBC) dilution, 25 µl of primary dilution is aspirated by the sampling needle from the chamber but it is kept in the sampling needle during the WBC measurement and the cleaning process.

3.4. Needle washing process

Both instruments clean the sampling needle with diluent in the washing head after sampling. It is important to clean the outer surface of the sampling needle to avoid inaccurate sampling.

The Macro syringe doses and the pump drains the diluent from the washing head, while the sampling needle moves upwards so that the total length of it is washed and cleaned. This process is called total sampling needle washing, and it is mainly used after taking primary sample from sample tube.

Another process, which is washing only a smaller part of the sampling needle, is the same but the needle does not move in the total length. Some procedures perform this kind of sampling needle washing.

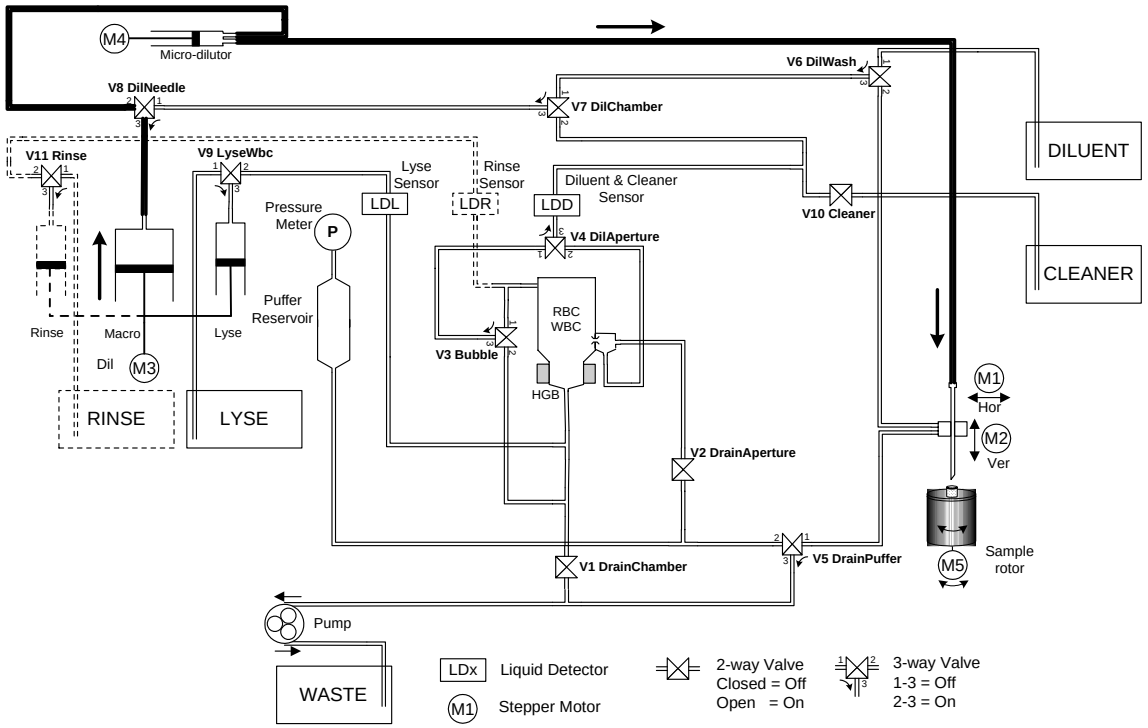


The Macro syringe pushes the diluent through V8 (Off), V7 (Off), V6 (On). The Pump aspirates the diluent from the washing head through V5 (On), while the M2 Vertical motor moves the sampling needle up.

3.5. Diluting process

The parts of the fluidics are rinsed with diluent reagent. The measuring chamber is filled up with 1 ml of diluent. This method prevents the chamber from dirt and makes the diluting process faster.

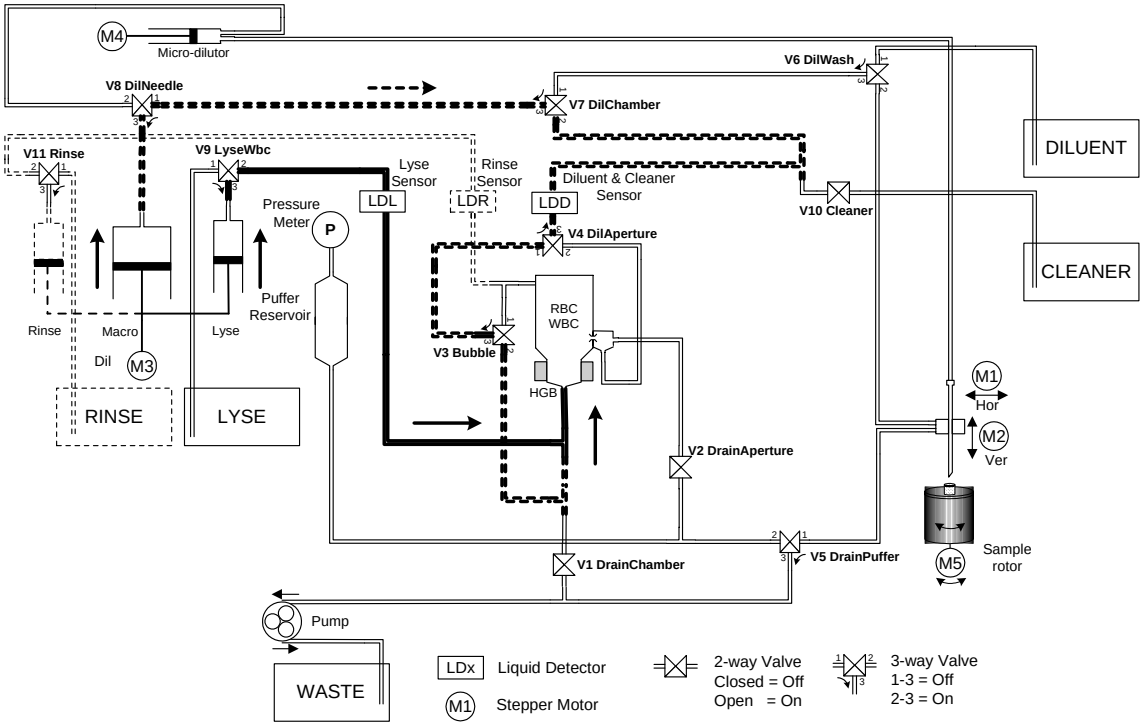
The sampling process has aspirated 25 µl of sample, which is in the sampling needle. In the first diluting step the sample is dispensed into the measuring chamber with 3 ml of diluent, which comes from the Macro syringe through V8 (On) and Micro-dilutor, while the M3 Dilutor motor moves upwards. This process makes the 1:160 first dilution rate in the chamber.



The second sample – 25 µl of primary dilution – is stored in the sampling needle during the WBC measurement and the cleaning process. The instrument makes the second (RBC) dilution into the chamber after these processes.

3.6. Lysing process

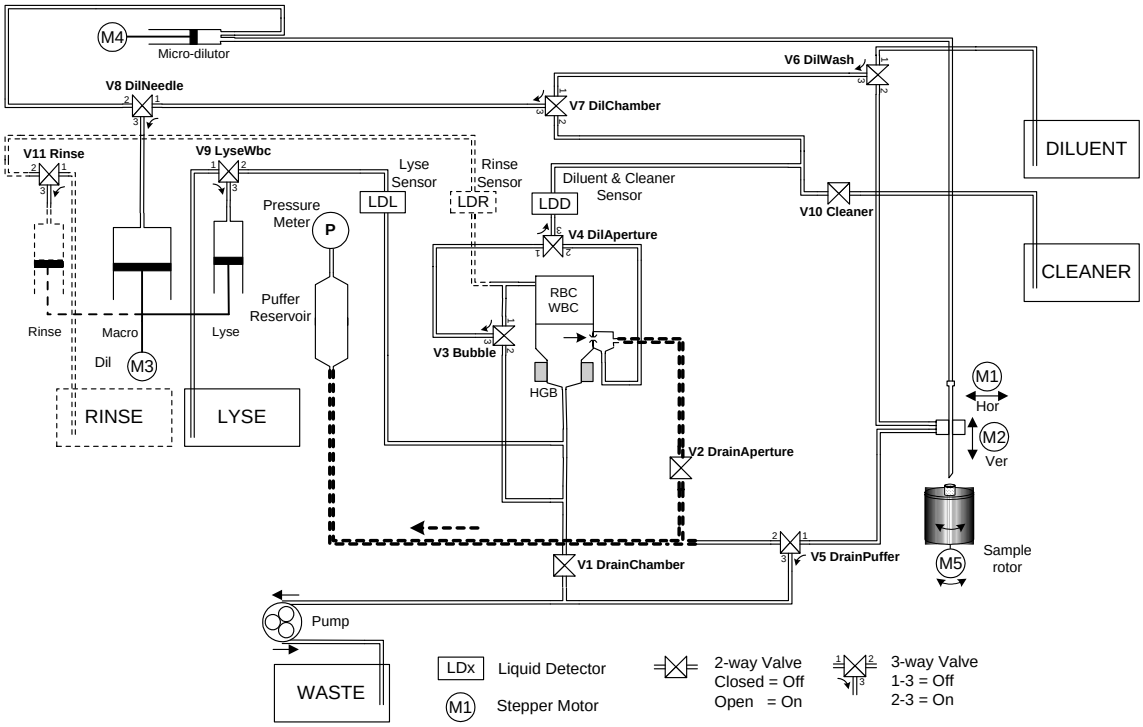
In this step the set lysing reagent is added into the measuring chamber through V9 (On), while the Lyse syringe moves upwards. This process makes the WBC/HGB dilution with lyse reagent.



For better mixing the macro syringe pushes some air bubbles (aspirated through the washing inlet of the chamber and V3) after the lysing process through V8 (Off), V7 (On), V4 (Off) V3 (On).

3.7. Counting process

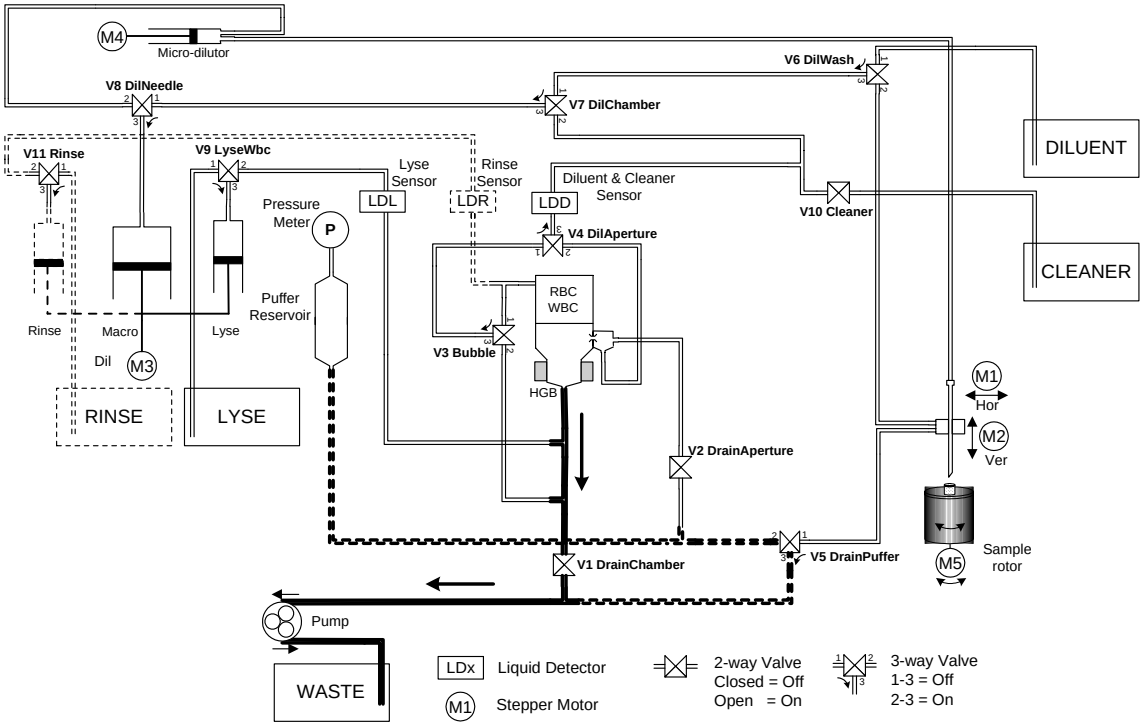
The regulated vacuum (it is generated by the pump in the puffer reservoir) aspirates the diluted sample (WBC or RBC) from the chamber through V2 (On) valve. There is no volume limiter in the system, the instrument counts the cells for 8 seconds in both counting phases (WBC and RBC).



For noise prevention there is no mechanical or electronic activity during the counting process and the door should be closed for better shielding.

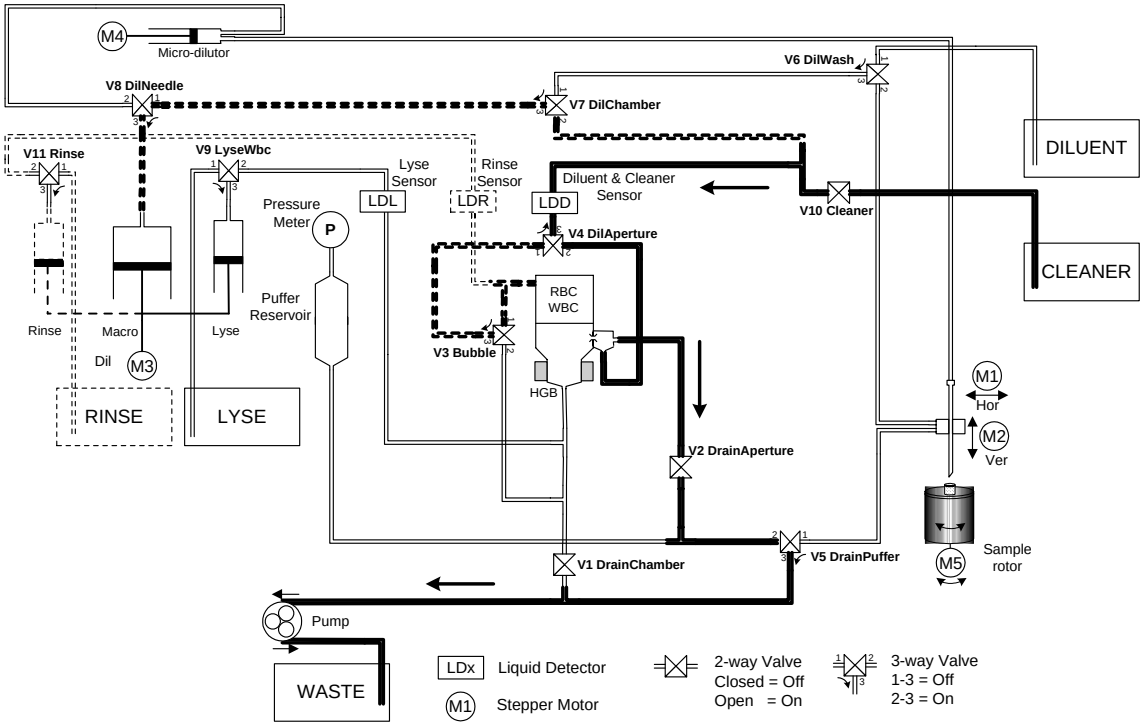
3.8. Chamber draining process

Chamber draining is made under pressure control. Pump drains chamber while puffer reservoir and thus the pressure sensor is connected to the draining tube. The instrument can detect the empty state of the chamber from drop of vacuum.



3.9. Cleaning process

The pump aspirates the cleaner through the V5 (On), V2 (On), V4 (On) and V10 (On) valves to puffer the cleaner reagent in the tubes between V7 and V4.



After that the Macro syringe pushes the cleaner reagent remaining in the tube between V10 and V4 into the chamber. The liquid detector (Diluent & Cleaner detector) can detect the existence of cleaner solution.

3.10. Shutdown process

The fluidic shutdown performs the following steps:

- Priming chamber with reagent to avoid drying out of aperture
- Sampling needle is positioned above counting chamber, needle up
- Lyse and Rinse syringes are positioned up
- Diluent syringes are positioned down
- Sample rotor moved out

4. ADJUSTMENT

Mechanical and hardware adjustments are described in this section. Software settings are included in Section 5.2.

4.1. Mechanical settings

There are two important mechanical settings in the system:

- **Opto wheel setting (Vertical motor)**
- **Sampling needle setting**

> ***The manufacturer adjusts the analyzer during production. However, in case of repairs in the mechanical system, these adjustments should be checked. The omission of these settings can cause malfunction or damages to the instrument.***

4.1.1. Opto wheel setting

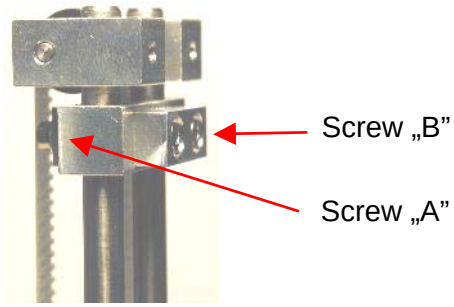
This setting is necessary for the vertical motor movements because this adjustment sets the opto end-switches of the H&V moving unit. The top of this block is called HV head and it is shown in the figure below.

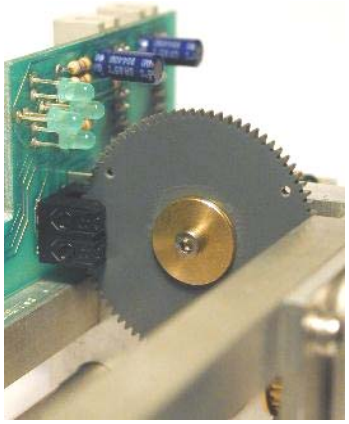
Set the distance to **1-2 mm** between the moving carriage and the stable part of the head.

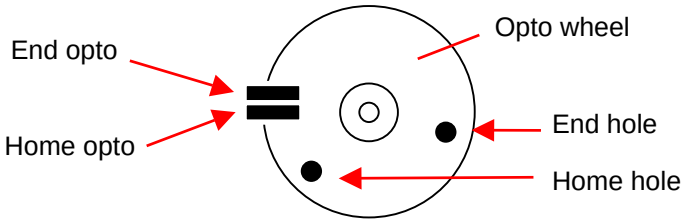
Loose „A” screws to allow free movement of the timing belt.

Adjust the opto wheel to home position, i.e. home hole must be in home sensor, and LED corresponding to home opto sensor goes on.

Fasten „A” screws.







Check the end position as well: move the needle down. Adjustment is successful if end LED goes on before moving part reaches end of mechanical range.

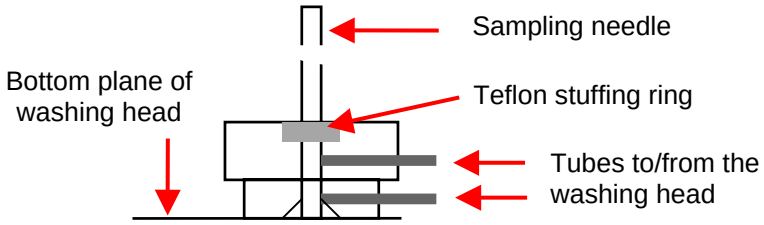
Once this adjustment is necessary, never miss sampling needle setting described in the next section.

4.1.2. Sampling needle setting

This adjustment sets the sampling needle to the operational position.

In Service menu, in Miscellaneous submenu of AJ/AJvet and in Service menu of AJB select *Needle setting*.

The software moves the needle back and up, and turns on horizontal and vertical motors (AJ/AJvet) to keep needle in place. AJB holds only the vertical motor during needle setting.



Check the setting of the needle. If end of the needle is at the bottom of the washing head, needle is set correctly. If not, open screws “B” (see above), and adjust the needle to the bottom of the washing head. Fasten “B” screws.

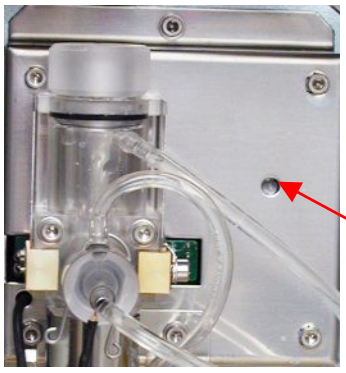
> ***Set the end of the tip to the washing head’s bottom plane, while the carriage is held by motors. (Needle setting menu). Fix the „B” screws.***

> ***Be careful with the bent upper end of the sampling needle, because if badly aligned, during movement it can hit other mechanical components causing mechanical jam, and therefore damages or error.***

4.2. Hardware settings

4.2.1. Amplifier offset setting

Amplifier offset should be between ±5mV. Run self test to determine whether offset is within this range. If it is out of range, it should be re-set, by the following way.



1. Locate the opening for offset setting potentiometer on the measuring block (see enclosed picture).
2. In Service menu select Offset adjustment menu.
3. Adjust the potentiometer to reach 0 mV.

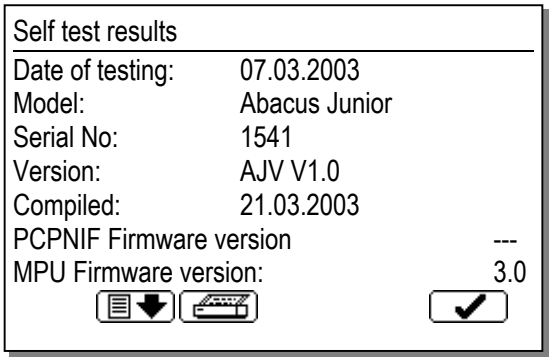
Opening for offset adjustment on measuring block

5. CHECKING THE PROPER OPERATION

There is a built-in Self test and Service menu in each models.

5.1. Self test of Abacus junior and Vet

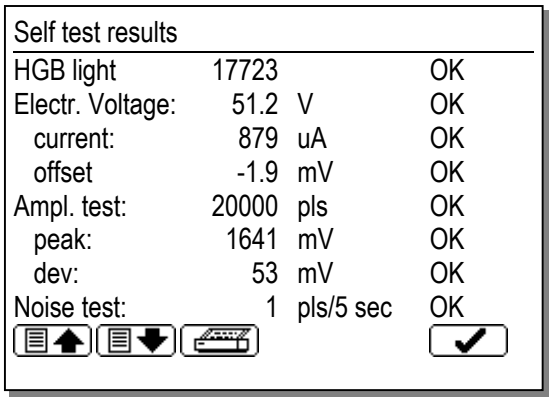
5.1.1. Self test Screens (AJ/AJvet)



Self test can be used to check the operation of the instrument.

The first panel shows general information about the instrument. (See menu on the left.)

With the new COMB card, the PCPNIF firmware version is empty, and the MPU firmware version holds the COMB version number**.**



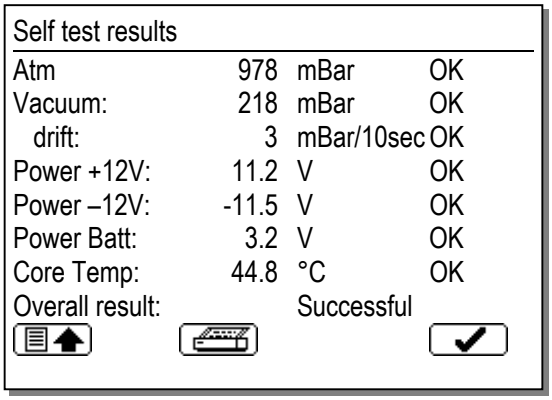
The second and third panel contains tested parameters, as follow:

HGB light (LED is on).

Measuring **Electrode voltage**, **current** and **offset**.

Amplifier transfer by generating 20000 **test** pulses, incl. gain related **peak** value, noise related **dev**iation.

Amplifier **Noise test** during a 5-second period.



Atmospheric pressure stands for outer pressure.

Vacuum reports pump operation (vacuum made by the pump in a 10-second period of time).

Drift represents pressure loss of vacuum measured in a 10-second period of time.

Power ±12V shows the amplifier voltage value.

Power Batt reports the voltage value of the battery. If battery fails, system time will stop.

Core Temp shows CPU temperature of the Control and Measurement Board (COMB).

Overall test result is displayed, which can be *Successful* (in case of every test result is *OK*) or *Errors* (if *HIGH, LOW* or *ERROR*).

At the end of a **result line status message** is displayed, which means that the actual test result is at the normal range (*OK*), higher (*HIGH*), lower (*LOW*) than the pre-determined limits, or the result is an error (*ERROR*).

5.1.2. Normal range of Self Test parameters (AJ/AJvet)

Parameter	Unit	Lower bound	Upper bound
HGB light	count	3000	50000
Electrode voltage	V	45	55
Current	µA	830	930
Offset	mV	-5.0	5.0
Amplifier test	count	19990	20050
Peak of test pulses	mV	1300	1700
deviation (noise)	mV	0	100
Noise test	pls/5sec	0	50
Outer pressure	mBar	600	1100
Vacuum	mBar	125	250
Drift	mBar/10sec	0	10
Power +12V	V	11.0	12.5
Power –12V	V	-12.5	-11.0
Power Batt.	V	3.0	4.5
Core Temp.	°C	-	-

5.1.3. Troubleshooting Guide for Self test

Parameter	Mark	Possible reason	Remedy
HGB dark	*HIGH*	Instrument door open	Close instrument door
HGB light	*LOW*	HGB head not connected or HGB LED out of order	Check HGB head connections check HGB LED during measurement
	HIGH	Instrument door open or HGB LED too bright	Close door or replace HGB LED resistor on amplifier board
Electrode voltage	*LOW* or *HIGH*	Fault on High Voltage or Amplifier board	Check measuring voltage (50V) on High voltage and Amplifier boards
Current	*LOW* or *HIGH*	Fault on Amplifier board	Check current generator, and test generator FET on Amplifier board
Offset	*LOW* or *HIGH*	Fault on Amplifier board	Check the offset potentiometer on Amplifier board
Amplifier test	*LOW*	Amplifier Boards is not connected to main board	Check cables and connectors coming from the Amplifier
	HIGH	Instrument not grounded	Check mains ground lead
Peak of pulses	*LOW* or *HIGH*	Fault on Amplifier board	Check current generator, and test generator FET on Amplifier board
Dev. (noise)	*HIGH*	Instrument not grounded	Check mains ground lead
Noise	*HIGH*	Instrument not grounded	Check mains ground lead
Outer pressure	*LOW* or *HIGH*	Pressure sensor, cable or connector problem	Check pressure sensor, cable connections and controller board pressure connector
Vacuum	*LOW*	Peristaltic pump failure	Check peristaltic pump
Drift	*HIGH*	Leakage in pneumatics	Check tubing in pneumatics

5.2. Self Test of Abacus Junior B

There is a built-in Self test and Service menu in Abacus junior B.

5.2.1. Self Test Menu

```
UTILITIES
   Select Submenu

DATA SET  DIAG PNEU
```

To run a self test go to UTILITIES menu, by pressing  , then press 'DIAG' function to reach DIAGNOSTICS menu.

```
Diagnostics


TEST STAT
```

DIAGNOSTICS menu.

Press 'TEST' to perform Self test

Press 'STAT' to check statistics of instrument's operation.

```
Statistics          ↓
 DB capacity:41/100
 Samples run:    21
Pneumatic Errors:
```

STATistics contain: database capacity, number of samples, pneumatic errors listed in order: Clogging, Sensor, Vacuum, MDilu, MMicro, MLyse, MRotor, MHori, MVert.

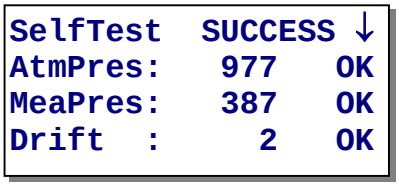
Press '↓' to browse amongst listed parameters.

You can also print Statistics list:

```
DIATRON Abacus Junior B
      - Statistics –
S/N: 140001 SW: 1.56/1.0

Date      04.06.2004.

SWDate: Jun  3 2004

Statistics

DB capacity: 40/100
Samples run: 31
Pneumatical Errors

Clogging      :0
Sensor        :0
Vacuum        :0
Mdilu         :0
MMicro        :0
Mlyse         :0
MRotor        :1
MHori         :0
MVert         :0
```

If you press '**TEST'**, a self-test is going to perform.

After the pneumatical initialization (if required) several test is made by the system. The results will come out from the internal printer.



Self Test result screen.

Press '↓' to browse amongst listed parameters.

Self test results and their meanings:

```
DIATRON Abacus Junior B
     - Self test -
S/N: 140001 SW: 1.56/1.0

Date      04.06.2004.

SWDate:Jun  3 2004

AtmPres:   979   mBar OK
MeaPres:   398   mBar OK
Drift  :     1   mBar OK

HGB    :  7587   pls  OK

TestPLS:  9998   pls  OK
TestA/D: 10000   pls  OK
TestAMP:  1426   mV   OK
TestDEV:    80   mV   OK
NoiseLO:     0   pls  OK
NoiseHI:     0   pls  OK

MeasCur:   868   uA   OK
MeasVlt:    50   V    OK
MeasOfs:     0   mV   OK

Overall:     SUCCESS
```

Title

Instruments serial number, Software version

Date of testing

Software compilation date

AtmPres: stands for Atmospheric or ambient pressure.

MeaPres: stands for Measurement pressure: reports pump operation. (Vacuum made by the pump in a 10-second period of time)

Drift: represents pressure loss of vacuum measured in a 10-second period of time.

HGB: for testing the HGB measurement.

TestPLS: number of detected test pulses from the 10000 ones created by the microcontroller.

TestA/D: number of digitalized pulses from the 10000 pulses mentioned before.

TestAMP: peak voltage of test pulses.

TestDEV: deviation of the received and digitalized test pulses.

NoiseLO: number of pulses falls below the low pulse threshold.

NoiseHi: number of pulses falls beyond the high pulse threshold.

MeasCur: measuring current that is measured under the self test process.

MeasVlt: measuring voltage: refers to the electrode voltage under measurement.

MeasOffs: refers to electrode offset.

Overall test result displayed, which can be **SUCCESS** (in case of every test result is OK) or **FAILED** (If any of the result is Hi or Lo).

At the end of every result line a status message is displayed, which means that the actual test result is at the normal range(OK), higher(Hi) or Lower(Lo) than the pre-determined limits listed below.

5.2.2. Normal range of Self Test parameters (AJB)

Parameter	Unit	Lower bound	Upper bound
Outer pressure	mBar	600	1050
Vacuum	mBar	200	450
Drift	mBar(/10sec)	-5	10
HGB light	pulse	3000	25000
Amplifier test	pulse	8000	10000
TEST A/D	pulse	8000	10000
deviation (noise)	mV	0	120
Amp pulse peak	mV	1300	1600
NOISELo	pulse	0	90
NOISEHI	pulse	0	90
Current	µA	800	950
Electrode voltage	V	45	55
Offset	mV	-10	10

5.3. Service Menu - AJ/AJvet

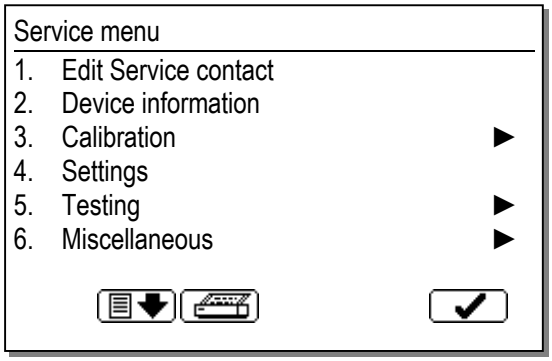
5.3.1. Entering to Service Menu

There is a Service menu for servicing and operation checking purposes. The entry point is in the User's Service screen, where Service Information is displayed.

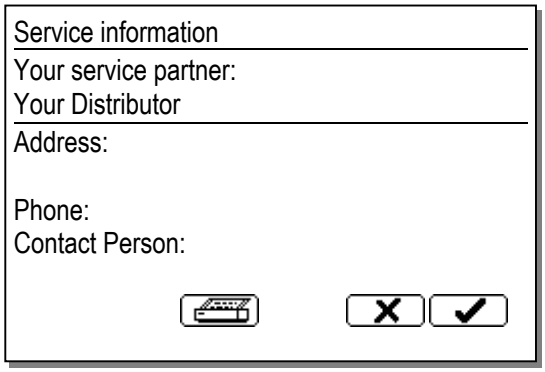
Enter the code to access Service menu: 6484

5.3.2. Main Service Menu

The Main Service menu provides access to submenus and service utilities.



5.3.3. Edit service contact

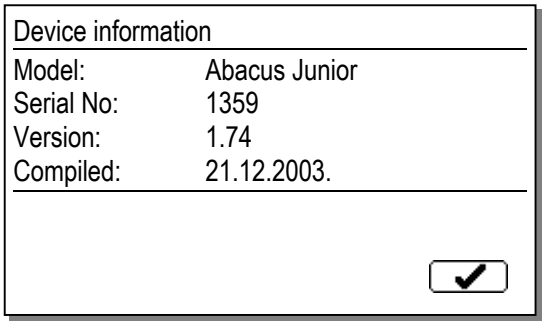


Here you can edit the Information card fields by cursor keys, or by an external keyboard.

Press the OK button, if a field is completed.

This information will appear in the User Service menu.

5.3.4. Device Information



In the Device Information menu the model name, the serial number, the software version and compilation date appear.

5.3.5. Service Calibration

The analyzer provides a menu for Service calibration purposes.

In result calculations the service calibration factors are used as the user calibration factors, so they are multiplied for each parameter: $\mathbf{RBC_{Disp.} = Fact_{RBC\ User} * Fact_{RBC\ Serv.} * RBC_{Measured}}$

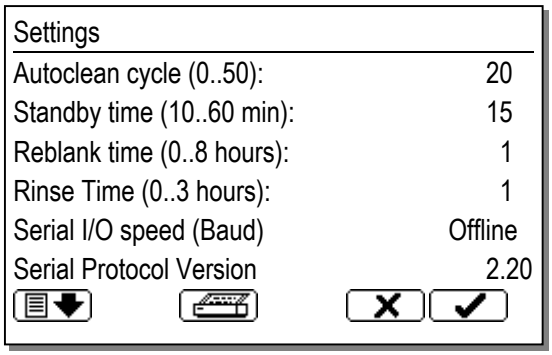
If the user factor is near the bound (0.80 - 1.20), by setting the corresponding service factor, the user factor can be adjusted to 1.00.

Example: **Fact** $_{\text{RBC User}}$ = 1.19 and **Fact** $_{\text{RBC Serv}}$ = 0.96, and
Fact $_{\text{RBC User}}$ = 1.00 and **Fact** $_{\text{RBC Serv}}$ = 1.14 gives the same result for RBC.

Apply user calibration **factors** function is used to combine user and service calibration factors. The software will multiply the existing factors, and move them to the Service level to set user factors to 1.00.

5.3.6. Software Settings

Service Person can set the parameters of the automatic functions in this dialog menu.



Autoclean cycle: after how many measurements the instrument makes an autocleaning

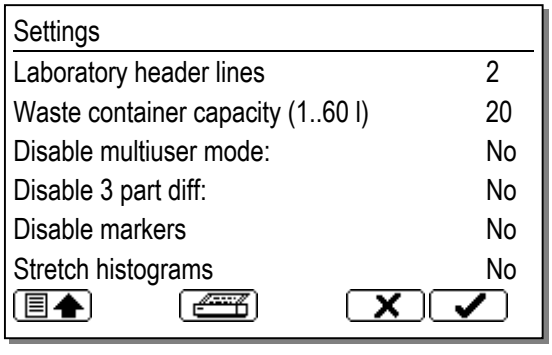
Standby time: after how many minutes the instrument goes to standby mode (default = 15 min).

Reblank time: after how many minutes the instrument makes a blank measurement if it was in standby mode (default = 1 hour). If it is set to 0, then no ReBlank is performed.

Rinse time: If this time is set, then the instrument will make an automatic, extended washing procedure (with more diluent) of the chamber(s) to get wash dirt out of the chambers (dust). If it is set to 0, then no Rinse is performed.

Serial I/O speed: instrument can send results to a host computer via serial port with the RS 232 V24 protocol. The baud rate of this serial communication must be selected at this point. For details of the serial communication protocol, see Appendix 9.2 in this manual.

Serial Protocol Version: with this option, the used protocol (sending specific fields of data) can be selected. This is useful when you upgrade the analyzer with new software, but the laboratory system is compatible with an earlier serial protocol. Just select the previous protocol number from the list.



Laboratory header lines: you can choose how many lines to contain the header of the blood result.

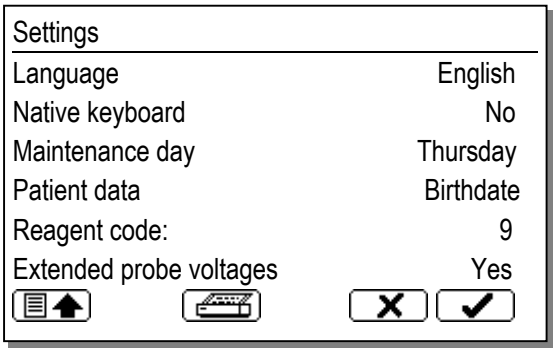
Waste container capacity: it essential to set the correct volume of the waste container for proper usage of the software ”waste full” alert. Set this value two liters less than the total volume of waste container.

Disable multi-user mode: by this setting the multi-user mode can be disabled

Disable 3-part diff.: for using quick lyse (without 3-part differential) the errors and the bad 3-part parameters can be excluded from the results

Disable markers: setting this option to Yes will omit the vertical markers from printed reports

Stretch histogram: setting this option to Yes will modify the WBC histogram range from 0-300 fl instead of 0-400 fl (this is recommended for Veterinary mode)



Language: this setting will adjust the user language. The Service menu always uses English language.

Available languages: Chinese, English, French, German, Greek, Indonesian, Italian, Persian, Polish, Portuguese, Romanian, Russian, Spanish, Turkish, and Vietnamese.

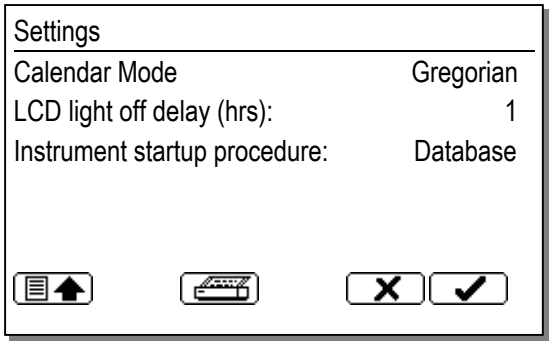
Native keyboard: Setting it to Yes will utilize the external PC keyboard with the language specific layout.

Maintenance day: You can select from week days. According to this setting, the instrument will ask the user to do weekly maintenance during shut down.

Patient data: There are two options: Birthdate and Age. According to this setting, both in the sample information dialog and in the database, the instrument will prompt for the age or the date of birth. If age is specified, it can be given in years or months.

Reagent code: This code can be used to modify the offset of the HGB function. Enter a value between 0 and 30 (default is 9).

Extend Probe Voltages: This option is ON by default. It makes the instrument accept the physically highest probe voltages to allow operation at lower operating temperature range.



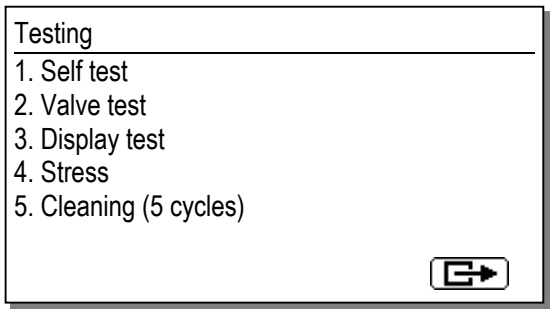
Calendar mode: You can select between the Gregorian and the Jalaali (Persian) calendar. All dates will be converted accordingly.

LCD light off delay: LCD backlight switches off after 4 hours, by pressing key switches back. Still the light is off, the LED is flashing yellow.

Instrument startup procedure: You can select to start the instrument with Database screen (without any pneumatic initialization) or with Measurement screen (with pneumatic initialization).

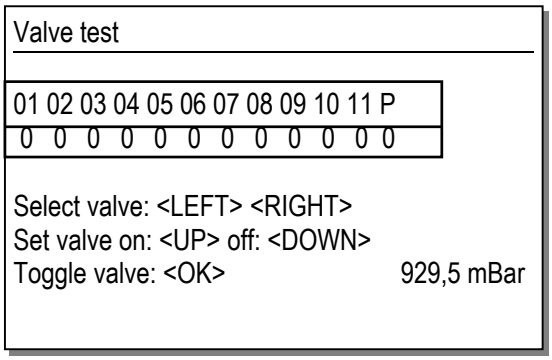
5.3.7. Service Testing Menu

Service Testing menu provides tools for checking hardware.



From this submenu the Service Person can directly run the built-in **Self test** (see 5.1).

5.3.8. Valve Test Menu

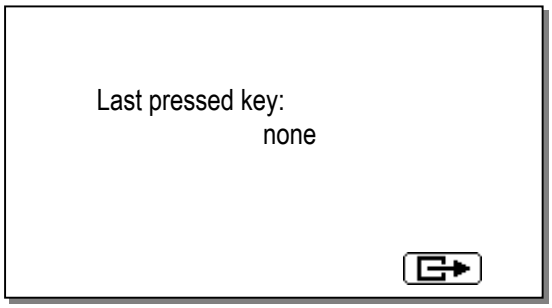


In the menu on the left you can see the valve numbers and a number under each that represents the actual state of the valve. **P means peristaltic pump**.

Selected valve number is shown in inverse. 0 is **Off** state, 1 is **On** state.

Use cursor keys for selecting and setting valve state, or press OK to toggle state.

5.3.9. Display and Keyboard Test



Display and keyboard test is provided to check keypad and LCD panel.

Press a key to test and the LCD will show the code of the pressed key, and will be invert the colors at each touch of a key for testing that every LCD dot is functioning.

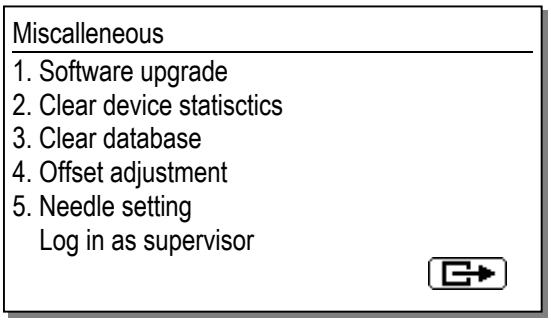
5.3.10. Stress Mode

In **Stress mode,** the instrument performs measuring cycles without sample (blank measurements) continuously. This can be used for burn-in tests, or to check pneumatic system after changing any main fluidic parts.

You can have information about stability, cleanliness, HGB operation, and counting time stability. Results of the last 10 PLT and HGB blank is displayed as well.

You can detect any kind of noise, or bubbles in the system if the PLT is not stable low, or HGB has big variation. To exit from this mode **press the START button** (at the end of a normal cycle) until the Stress operation is finished.

5.3.11. Miscellaneous Settings



In this menu, you can directly perform **Software upgrade** (this will restart the instrument).

Clear Device Statistics: Device statistics (number of measurements, aperture-clogging and other errors) can be cleared.

Clear Database: The whole Database (measurement results including histograms) can be cleared.

Offset adjustment: You can adjust the offset on the amplifier board.

Needle setting: By entering this menu the needle will go to the position you can adjust it.

You can **Log in as supervisor** if the Multi-user mode was selected in the User's Settings submenu. (Number 4 if present, shows the availability of this function.)

In supervisor mode, you have the ability to change any user passwords and you have full access over user settings. **Always log out after this supervisor log in.**

5.3.12. Multi-user Rescue Code

It the supervisor password has been forgotten, there is a rescue code for service purposes to access the supervisor level. The Service user data are as follows:

User ID: **0** (zero),
Name: **Service,**
Password: **729456** (This forms a capital "A" on the keypad)

5.4. Service Menu (AJB)

Service menu is provided for servicing and checking proper operation. The entry point is the Utilities menu.

> ***Enter the code to access Service menu: 6484***

5.4.1. MAIN Service Menu

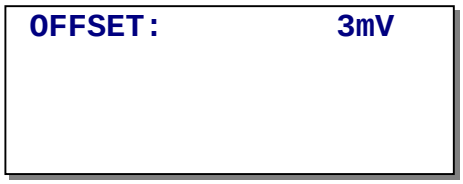
The main Service Menu provides access to submenus and service utilities.

In this Menu you can reach **MAINT**ainance, **CAL**ibration or **CL**ea**R** menu.

With the CLEAR option, you can erase all the data in the pneumatic error statistics (what you can reach in Utilities\Diagnostics\STAT).

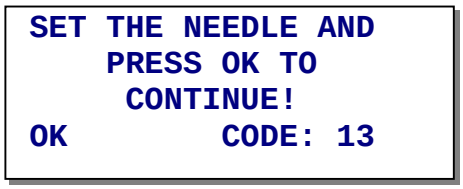
MAINTENANCE Menu

In this menu you can access **OFFSET** setting, **NEEDLE** setting, **STRESS**, Valve and Motor tests under **TEST** submenu.



OFFSET setting screen

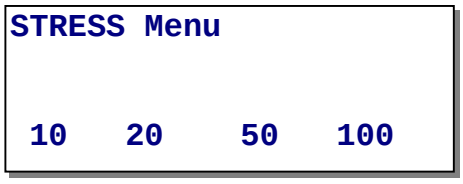
You can set the offset to zero with the potentiometer of amplifier board, while then actual offset is displayed.



NEEDLE Setting screen

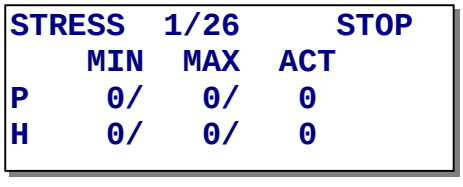
By pressing '**NDLE'** function button, instrument moves the needle to a safe location where you can check and set the needle into the proper position.

(Code: 13 is an internal code, representing this Needle setting process)



STRESS Menu

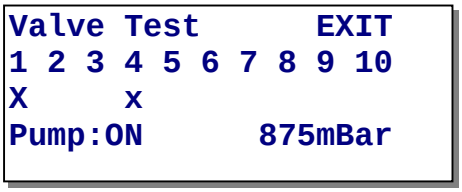
Select the number of Blank measurement cycles to run, by pressing the corresponding function button: **'10', '20', '50'** or **'100'.**



STRESS screen

During Stress PLT and HGB blank results are displayed, in the following order **MIN**imum, **MAX**imum and **ACT**ual value. You can monitor stability, and cleanliness.

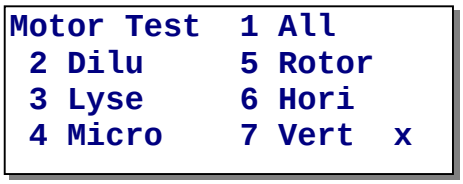
The first line indicates number of stress cycles/all cycles run.



VALVE TEST screen

Press numeric buttons '1' to '9' to turn on/off corresponding valve. Use '0' for valve10 and '.' for pump.

Active state is indicated by 'x' under each valve number. Pressure of vacuum chamber is indicated as well.



MOTOR TEST screen

Press a number button from '1' to '7' to make the corresponding motor move. Pressing '1' pneumatic initialization will run. Moving motor is marked by 'x'.

5.4.2. Service Calibration of Abacus Junior B

The analyzer provides a menu for Service Calibration purposes.

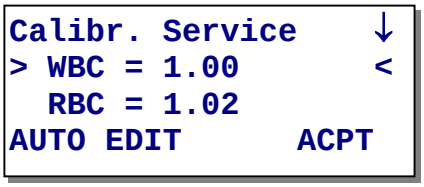
In result calculations the service calibration factors are used as the user calibration factors, so they are multiplied for each parameter: $\mathbf{RBC_{Disp.} = Fact_{RBC\ User} * Fact_{RBC\ Serv.} * RBC_{Measured}}$

If the user factor is near the bound (0.80 - 1.20), by setting the corresponding service factor, the user factor can be adjusted to 1.00.

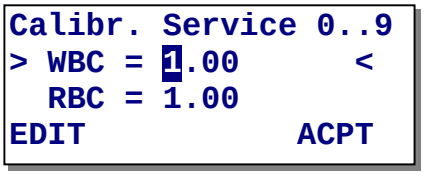
Example: **Fact** $_{\text{RBC User}}$ = 1.19 and **Fact** $_{\text{RBC Serv}}$ = 0.96, and
Fact $_{\text{RBC User}}$ = 1.00 and **Fact** $_{\text{RBC Serv}}$ = 1.14 gives the same result for RBC.

By pressing **'AUTO'** key, user and service calibration factors can be combined automatically. The software will multiply the existing factors, and move them to the Service level to set user factors to 1.00.

If all service factors were 1.00, after this function all service factors hold the previous user factors, and all user factors become 1.00.



In CALIB screen you can review/modify actual Service Calibration Factors, in the following order: WBC, RBC, HGB, MCV, RDWc, PLT, MPV, PDWc.



Press **EDIT** to modify a factor. 0..9 in the upper right corner indicates you can use the number buttons on the keypad.

To stop editing a calibration factor press **OK**. To accept new calibration factors press **ACPT** button.

6. SERVICE OPERATION

6.1. Opening the instrument

On the right side and the rear side of both instruments there is a side door, which allows reaching of the fluidic system and the mechanical parts. Other parts of the analyzer (electronic parts, etc.) can be reached by opening the front and rear covers.

- How to take off the **rear cover**:

First unscrew the 5 cover fixing screws located on the rear panel, 2 screws on the upper side and 3 screws on the vertical side. After this, pull the cover backwards a few centimeters to release sliding locks, and then you can turn it upwards to take it off completely. In this way you will be able to reach the electronics: COMB and PPB (AJ/AJvet), or MAIN board (AJB). In AJ/AJvet, do not forget that you can take them off only if you take off IDEPROM Card first.

- How to take off the **front cover**:

First unscrew the 2 screws located on right and left part of the upper side and the 3 screws located on the bottom side. After this, pull the cover towards you to take it off.

6.2. MDA (Monochrome Display Adapter) emulation mode – AJ/AJvet

MDA emulation mode was developed to help the manufacturer and Service Personnel in the checking phase of the instruments. This mode is available during the total operation but especially useful for checking the BIOS setup and OS functions. This mode should be handled the same as the service menu, the user does not have to know these options.

At power-on, the controller PIC display module displays the greeting screen. After 6 seconds, it starts to scan the keypad and behaves like an **MDA** adapter to the PC, although the displayed screen is still holding the greeting screen.

If you switch to **MDA emulation mode**, the system boot events can be displayed, and the CMOS SETUP program can be started, if necessary.

If the main program will not start in 90 seconds, the PIC will automatically switch to MDA displaying mode to give information about the reason of hang-up. This can be some CMOS failure, if the motherboard settings are lost for some reason, and the system is waiting for user confirmation: F1 **on external keyboard,** or running setup - both require external keyboard to be connected.

Hold the „**i**" button, and press and release the „**.**" button on the foil keyboard of the analyzer to activate the **MDA** mode, which uses the LCD like a primary computer monitor (80 characters by 25 rows). The LCD is smaller than the standard monitor area therefore just about a quarter of the total screen is displayed (40 characters by 16 rows).

Quarter 1 on LCD	Quarter 2 on LCD
Quarter 3 on LCD	Quarter 4 on LCD

Definition of displayed LCD quarters in MDA emulation mode

- to change the actual quarter displayed, use the arrows (cursor keys) on the keypad,
- to find the cursor, press the „**i**" button,
- to go back to the normal graphic displaying mode press „**i .**" again.

6.3. Key BIOS settings for correct operation – AJ/AJvet

The required settings are enclosed in this section.

(In MDA mode, continuous changing of screen may appear. To avoid this, press left and up arrow on the keypad in any order.)

- **MAIN:**
- Legacy Diskette A: 1.44/1.25 MB
- Primary Master: SanDisk SDTE-XX
- **ADVANCED:**
  - PNP OS Installed: No
  - Reset Configuration Data: No
    - **I/O device configuration:**
      - Local Bus IDE Adapter: Enabled ; [in case of CD-ROM]
      - Floppy disk controller: Enabled ; [in case of Floppy drive]
        Base I/O address: Primary
      - Serial Port A: Enabled
        Base I/O address: 3F8
        Interrupt: IRQ4
      - Serial Port B: Enabled
        Base I/O address: 2F8
        Interrupt: IRQ3
      - Parallel Port: Enabled
        Mode: EPP
        Base I/O address: 378
        Interrupt: IRQ7
      - Watchdog Settings
        Mode: Disabled
      - I/O Chip Select:
        I/O Base: Disabled
  - Halt on Errors: No
- **SECURITY:**
- Fixed disk boot sector: Normal
- Virus check reminder: Disabled
- System backup reminder: Disabled
- **BOOT:**
- Quick Boot mode: Enabled
    - **Boot Device Priority:**
      - CD-ROM Drive
      - Hard Drive
        DV-XX (Slave device)
        SanDisk SDTE-XX
        Bootable Add-in Cards
      - Removable Devices
        Legacy Floppy Drives
      - Network Boot

6.4. Checking the BIOS setup – AJ/AJvet

It is suggested to check it if the instrument hangs after switching on, or software does not start (or cannot be upgraded from floppy disk).

- Connect an external keyboard (US layout) to the instrument and switch it on
- Press F2 repeatedly until the instrument beeps.
- Switch the instrument to MDA emulation mode (by pressing "i**.**" on the keypad)
- Check the key points listed above (or from the enclosed Main Board Manual), if you find differences, set these settings
- Go to the ***Exit*** menu (upper right quarter of the display) and select ***Exit Saving Changes***. Confirm this by selecting ***Yes*** in the pop up window.
- The instrument will restart with the new (correct) BIOS setup configurations

6.5. BIOS-Description – AJ/AJvet

The ***DIMM-PC/520-I*** is equipped with a JUMPtec Embedded BIOS, which is located in a Flash EPROM onboard. This device has an 8bit wide access. Faster access is provided by the shadow RAM feature (default). For a detailed description of the BIOS Setup, please refer to the section below.

The Setup Guide

With the PhoenixBIOS Setup program, it is possible to modify BIOS settings and control the special features of the computer. The setup program uses a number of menus for making changes and turning the special features on or off.

General Information

To start the PhoenixBIOS setup utility press <F2> during the string, Press <F2> to enter, setup is displayed during boot-up. The Main Menu will be displayed.

The Menu Bar

The Menu Bar at the top of the window lists all the different menus. Use the left/right arrows to make a selection.

The Legend Bar

Use the keys listed in the legend bar on the bottom to make your selection or exit the current menu. The list below describes the legend keys and their alternates:

Key	Function
<F1> or <Alt-H>	General help window
<Esc>	Exit this menu
¬ or ® Arrow key	Select a different menu
- or ¯ Arrow key	Move cursor up and down
<Tap> or <Shift-Tap>	Cycle cursor up and down
<Home> or <End>	Move cursor to top or bottom of current window
<PgUp> or <PgDn>	Move cursor to next or previous page
<F5> or <->	Select the previous value for the current field
<F6> or <+> or <Space>	Select the next value for the current field
<F9>	Load default configuration values for this menu
<F10>	Save and Exit
<Enter>	Execute command or select submenu
<Alt-R>	Refresh screen

To select an item, simply use the arrow key to move the cursor to the field you want. Then use the plus and minus keys to select a value for that field. The Save Value commands in the Exit Menu save the values currently displayed in all the menus.

To display a sub menu, use the arrow keys to move the cursor to the sub menu you want. Then press <Enter>. A pointer (4) marks all sub menus.

The Field Help Window

The help window on the right side of each menu displays the help text for the currently selected field. It is updates as the cursor is moved to each field.

The General Help Window

Pressing <F1> or <Alt-F1> on any menu brings up the General Help Window that describes the legend keys and their alternates. Press <Esc> to exit the General Help Window.

The Main Menu

You can make the following selections on the Main Menu itself. Use the sub menus for other selections.

6.6. DOS functions on the instrument – AJ/AJvet

To run the computer part of the instrument like a normal PC, the Service Personnel should have an **MS-DOS** 6.22 operating system **boot floppy** disk.

- Connect an external keyboard
- Put the MS-DOS boot floppy into the floppy disk drive
- After turning on, go to the BIOS setup (press F2 repeatedly on the keyboard and switch to MDA mode by pressing "i**.**").
- Change the ***Boot Device Priority*** in the ***BOOT*** menu: The ***Removable Devices*** must be the first in the list. Select ***Removable Devices*** and move it up by pressing “+” on the keyboard.
- Save the actual settings to CMOS, the instrument will restart (***Exit Saving Changes***)
- The instrument will boot from the floppy and the software will be terminated
- Switch to MDA mode by pressing "**i.**"
- Do not forget to restart the instrument and set back ***Boot Priority*** list after servicing, (***Hard Drive*** first)

6.7. Error messages – AJ/AJvet

The analyzer checks the operations of several mechanic, fluidic and electronic parts during measurement. The system shows the type of the error on the LCD display if any kind of malfunction is detected.

The electronic parts have a very little chance to fail, only the connections and cables could disconnect, which can cause the malfunction of the electronic system. The mechanic and fluidic system have a bit more chance to go wrong because it has moving parts.

In 6.7.1 section there is the total error code list.

6.7.1. Abacus Junior / Abacus Junior Vet error code list

%s: filename concerned, %d: error type concerned, %u: error specific string

Code	Error text	Reason(s)	Remedy
1000	Out of memory in %s	Fatal system or program error!	Check the COMB card and Dimm-PC module for proper insertion. Try to make a software upgrade.
1001	Error %d on opening file %s	Fatal system or program error!	The same as in case of error code 1000.
1002	Cannot create file %s	Fatal system or program error!	The same as in case of error code 1000.
1003	Data file %s is corrupt, new will be created, all stored measure data will be lost	Stored data file is corrupt or missing! Disk or software error.	New stored data file will be created automatically (by a User confirmation).
1004	Error %d on indexing file %s	Fatal system or program error!	The same as in case of error code 1000.
1100	Pressure error.\n Power off the system	Cannot make the measuring vacuum!!	Check the pump and the tubes, fittings and valves around the puffer reservoir.
1101	Waste is full! Empty waste container! The system assumes that you will do it before going on!	Waste container is full!	Empty waste container! If it is not full, there is a clogging in the waste sensor line.
1102	Check Diluent container!	Diluent tank is empty, or the dil./clean sensor is too sensitive (try recalibrating the sensors), or there are lot of bubbles in the diluent tube	Replace the diluent reagent container with a filled one. If this is still a problem with a filled diluent container, run Reagent sensor calibration and check the tubing and fittings of diluent path.
1103	Check Lyse container!	Lyse tank is empty, or the lyse sensor is too sensitive (try recalibrating the sensors), or there are lot of bubbles in the lyse tube	Replace the lyse reagent container with a filled one. If this is still a problem with a filled lyse reagent container, run Reagent sensor calibration and check the tubing and fittings of lyse path.
1105	Vacuum error	The measuring vacuum has been dramatically decreasing during the measurement or absolutely lost!	Leakage in the pneumatic system (check the pump, fittings, tubing, pressure sensor, puffer reservoir and valves).
1106	Pneumatical error occurred! Device: %s Error code: %s Status: %x Retry?	Fatal error in mechanical subsystem.	If frequently happens this error check the proper operation of the motor modules (home/end opto switches, ribbon cables and moving of motors).

Code	Error text	Reason(s)	Remedy
1107	Check Cleaner container!	Cleaner tank is empty, or the dil./cleaner sensor is too sensitive (try recalibrating the sensors), or there are lot of bubbles in the cleaner tube	Replace the cleaner reagent container with a filled one. If this is still a problem with a filled cleaner container, run Reagent sensor calibration and check the tubing and fittings of cleaner path.
1110	Check Rinse container!	Rinse tank is empty, or the rinse sensor is too sensitive (try recalibrating the sensors), or there are lot of bubbles in the rinse tube	Replace the rinse reagent container with a filled one. If this is still a problem with a filled rinse container, run Reagent sensor calibration and check the tubing and fittings of rinse path.
1111	The sampler rotor was jammed during sampling process! Retry sampling?	Cap was not taken off from the sample tube, or tube is not placed correctly, or other mechanical jam	Check the adapter and the tube. Press Retry or Stop.
1112	The sampler rotor was jammed!	Mechanical problems like adapter is moved out from the right place	Check the adapter and the tube. Press the ✔ button
1113	Unrecoverable pneumatical error occurred!\n Device: %s\n Error code: %s\n Status: %x\n Please turn off the instrument and turn it on again!	Fatal error in mechanical subsystem. Possibly mechanical jam.	Check the proper operation of the motor modules (home/end opto switches, ribbon cables and the motor moving).
1200	Fatal MeasInit error. Power off the system!	Fatal COMB error.	Replace the COMB board.
1201	Fatal HGB error. Power off the system!	HGB channel did not give a ready signal!	Replace the COMB board.
1300	Cannot write archive data! Check disk! It may be unformatted, full or bad! Do you want to retry?	Cannot write archive data because some disk errors!	Change the floppy disk.
1301	Cannot read archive data! Do you want to retry?	Archive disk is damaged or not an archive disk!	Change the floppy disk (archive).
1302	Cannot load archive data.	Disk is not an archive disk or damaged!	Change the floppy disk (archive).
1400	Printer error %d	Printer error!	Check the connections between instrument and printer and check printer setup in Printer Settings

Code	Error text	Reason(s)	Remedy
1401	Printer is out of paper and error %d	Printer is out of paper and there are some other printer errors!	Feed the printer with paper. Check the connections between the instrument and the printer and check the printer setup in the Settings/Printer settings sub-menu.
1402	Printer is out of paper	Printer is out of paper!	Feed the printer with paper.
1403	Printer was not set up correctly	The selected printer type does not match to the printer!	Modify the printer setup in the Settings/Printer settings sub-menu.
1404	Paper width is too large	Paper width overstep the margin.	Modify the paper setup in the Settings/Printer settings sub-menu.
1405	Paper height is too large	Paper height overstep the margin!	Modify the paper setup in the Settings/Printer settings sub-menu.
1406	Paper width is too small	Paper width overstep the margin!	Modify the paper setup in the Settings/Printer settings sub-menu.
1407	Paper height is too small	Paper height overstep the margin!	Modify the paper setup in the Settings/Printer settings sub-menu.
1408	Left margin is too large	Left margin is too large!	Modify the margin setup in the Settings/Printer settings sub-menu.
1409	Top margin is too large	Top margin is too large!	Modify the margin setup in the Settings/Printer settings sub-menu.
1410	Spacing is too large	The distance between two results is too high!	Modify the vertical spacing setup in the Settings/Printer settings submenu.
1411	Error #%d in printer initialization!	Printer software error!	Check the connections between the instrument and the printer and check the printer setup in the Settings/Printer settings sub-menu. Try to make a software upgrade.
1900	You have to add at least one user to use multi user mode!	Multi-user problem.	Follow the instruction, or change to single user mode in the User settings submenu.
1921	%s sensor calibration failed! The system turned off the %s sensor.	Reagent container became empty, or there are lot of bubbles in reagent tubes.	Replace the reagent container with a filled one. If this is still a problem with a filled reagent container, turn on the sensor and try recalibrating and check the tubings and the fittings.

6.7.2. Abacus Junior / Abacus Junior Vet message code list

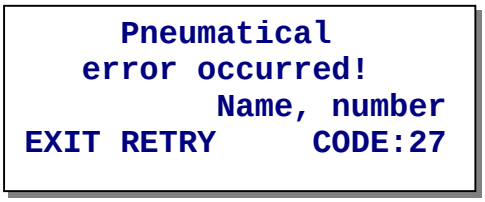
Code	Message text
5001	Remove reagent tubing at rear reagent inputs (Diluent, Lyse, and Cleaner).
5002	Connect min. 100 ml distilled water to reagent inputs using cleaning tube kit.
5003	Remove cleaning tube kit. Keep reagent inputs free.
5004	You can power off the system!
5005	Apertures are partially clogged. Try cleaning!
5006	Please empty waste container!
5100	%u data record(s) will be copied to the database.
5101	%u data record(s) is selected.
5102	Insert data disk!
5103	Insert data disk #1 of 1!
5104	xx data record(s) will be saved on 1 disk(s). Insert an empty floppy disk!
5105	Insert next empty floppy disk!
5106	No such type of data
5200	Your previous QC data will be lost. Are you sure?
5300	Some or all of the calibration factors are out of range!
5400	+12V too low!
5401	+12V too high!
5402	Battery voltage too low!
5900	This function is not available because there are no accepted blank values. Try blank measurement!
5901	Insert software update disk! The system will restart.
5902	Are you sure to delete all device statistics?
5903	This function will delete all measured results. Are you sure?
5904	This function will delete all selected records. Are you sure?
5905	Are you sure?
5906	You can power off the system now or restart it by pressing any key!
5907	Now it is time to clean the washing head with a damp cloth, and check the pump cleanliness. Make sure they are all clean, then you can proceed.
5908	Set the needle and press any key to continue!

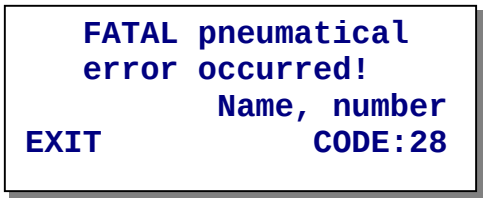
6.8. Warnings and Error Codes for Abacus Junior B

Code	Message	Remedy
10	REMOVE REAGENT TUBINGS! LEAVE WASTE CONNECTED!	Message during Preparing for shipment. Disconnect reagent tubes but Waste.
11	CONNECT DISTILLED WATER!	Message during Preparing for shipment. Connect distilled water to all inlets.
12	REMOVE DISTILLED WATER! LEAVE WASTE CONNECTED!	Message during Preparing for shipment. Disconnect reagent tubes but Waste.
13	SET THE NEEDLE AND PRESS OK TO CONTINUE!	Message during needle setting. Adjust needle to bottom of washing head.
80	Some factors are out of range	Use the Service calibration factors to extend user calibration range if needed.
81	No results found for selected operation	No CAL/QC type of measurement has been selected before trying to use them.
20	REMOVE ALL TUBINGS FROM INPUTS! LEAVE WASTE CONNECTED!	Message during Preparing for shipment. Disconnect reagent tubes but Waste.
21	CONNECT DISTILLED WATER!	Message during Preparing for shipment. Connect distilled water to all inlets.
22	CHECK DILUENT CONTAINER!	Check Diluent tank, probably it is empty.
23	CHECK CLEANER CONTAINER!	Check Cleaner tank, probably it is empty.
24	CHECK LYSE CONTAINER!	Check Lyse tank, probably it is empty.
25	SAMPLER ROTOR WAS JAMMED!!	Sample rotor blocked, check for reason.
26	SAMPLING ERROR!!	Needle is blocked while sampling. Check needle height setting for sample tube.
27	PNEUMATICAL ERROR OCCURED!	See below.
28	FATAL PNEUMATICAL ERROR OCCURED!	See below.
29	VACUUM ERROR!	Pressure drop in vacuum chamber is too high. Check for diluent reagent (maybe DIL sensor is off, while diluent tank is empty), fittings of tubing, and integrity of pump tube. Replace if necessary.
30	PRINTER ERROR!	There is no paper loaded in printer.

In case of Pneumatic errors (Code 27,28), you will see one of these screens:

Name corresponds to one of the motors detailed below.





Press **'RETRY'** to make initialization, and then retry the last action. Press **'EXIT'** to turn off machine.

Number	Name	Explanation
1	MHori	can't reach HOME opto (step error)
2	MVert	can't reach HOME opto (step error)
3	MRotor	can't reach HOME opto (step error)
4	MMicro	can't reach HOME opto (step error)
5	MDilu	can't reach HOME opto (step error)
6	MLyse	can't reach HOME opto (step error)
7	MHori	can't reach HOME opto (step error)
8	MHori	HOME-END distance too long/short
9	MVert	can't reach END opto (step error)
10	MVert	HOME-END distance too long/short (range error)
11	MMicro	can't reach HOME opto (step error)
12	MMicro	HOME-END distance too long/short (range error)
13	MRotor	turn-in error
14	MRotor	turn-out error
15	MDilu	can't reach END opto (step error)
16	MDilu	HOME-END distance too long/short (range error)
17	MLyse	can't reach END opto
18	MLyse	HOME-END distance too long/short (range error)
19	Vacuum	Can't create/sense vacuum
20	Vacuum	Can't execute vacuum controlled draining
21	Vacuum	Can't measure ambient pressure
22	Vacuum	Ambient pressure out of 600-1100 mBar region
23	Vacuum	Can't create vacuum to v. controlled draining
24	Sensor	Can't discriminate between empty and full state (Diluent)
25	MRotor	Can't turn out (or before can't turn in)
26	Sensor	Can't discriminate between empty and full state (Lyse)
27	MDilu	Opto found ! (range error)
28	MLyse	Opto found ! (range error)
29	MMicro	Opto found ! (range error)
30	MVert	Opto found ! (range error)
31	MHori, MVert, MLyse, MDilu, MMicro, MRotor	Can't reach opto (step error)

Step error: the motor moves to either of end switches. This should be done within a specified number of steps, but it failed, due to one of the reasons:

- Mechanics is jammed, so that movement is not possible
- The corresponding opto sensor is bad
- Connector of the erroneous motor is off.

Range error: the motor moves specified number of steps, and it should not have reached one of the end switches, but it did. Possible reasons:

- Mechanics is partly jammed, or blocked, so that the previous movement was shorter
- Connector of the erroneous motor is off.

Always check reagent tubing for blockage or clogging if MDilu or Mlyse range/step error.

Distance error: number of steps from home opto to end opto is too low.

6.9. Possible Causes of Noise

Generally high count of any particle - even if you think it should be low, or near zero - can be caused by NOISE, i.e. something interferes with measurement.

The most important thing in these cases to identify the source of NOISE, otherwise you cannot protect the system against it.

NOISE can come from has several sources, and the different NOISE sources are added.

Sometimes we have to fight one of them, but sometimes more. Only one of them is enough to make problem.

6.9.1. Contaminated reagent

The most probable cause: real particles are in the reagent, and therefore the PLT blank is continuously high (e.g. always 30-40). You can easily sort out this case by replacing diluent by opening a new tank. PLT blank must go down is several blank measurements (below 10).

How can a good reagent become bad by time?

- If the reagent tube was contaminated, and some bacteria begin to grow inside, once you put an infected reagent tube into a new tank, by time it can become infected as well, i.e. the background (PLT blank) becomes high. Wash the reagent tube - which is in connection with the reagent - with 1% of bleach solution, then rinse with clean distilled water or diluent. It can avoid the bacteria to grow inside.
- If tank is open – and cap is not installed or closed - external dust can make reagent dirty.

6.9.2. Bad earth grounding

In this case external - ground referenced - noise can get into the system by ground coupling. If system ground is not good enough, ground terminal can become a noise source as well, i.e. external signals will be coupled into the system instead of protecting it.

If no earth ground is available, you can use a screw at the rear panel to connect a ground potential to the case, so that noise immunity can be increased.

Measure voltage on ground terminal to make sure earth grounding is correct. AC voltage lower than 1V is accepted in this case.

At some places - as a bad practice - electricians like to connect earth ground terminal to neutral wire. Depending on the resistance of the neutral back wire (where it is really earthed), several volts can appear, and this way any inductive noise will be coupled into the instrument. It is better to create a real earth grounding and connecting it to the rear screw.

6.9.3. External electrical noise

If another instrument is near the analyzer can radiate electromagnetic signals in the 1 kHz - 100 kHz frequency region it can be picked up by the system (especially if they are very close to each other, or the grounding is not quite perfect).

You can easily identify this noise source: by relocating the instrument noise (high PLT blank) disappears. In this case you have to identify the possible noise source (switch mode power supplies, computer monitors, since they are not shielded, centrifuges due to high switching noise of rotor contacts, etc.), the power of the electromagnetic source, because if high power is present, maybe relocation does not solve your problems, sometimes the electric power supply makes the coupling, so UPS solves the problem.

Another source of coupling in external noise can be the reagent tanks and tubes. Especially radio transmitters can cause problems of radiating so that even the reagents (diluent) guides in the noise. A metal pack for the diluent tank, then a good earth grounding of this metal box allows this coupling to disappear forever.

6.9.4. Internal noise sources

The most annoying but real cause is some sort of internal noise. The reason for this phenomenon is that inside electrode - hot point - of the measuring circuit must be well insulated from surrounding electronics, otherwise inside noise sources can take their effect.

A. Bad chamber insulation:

- **bad shielding of the chamber** (floating shield couples signals to the chamber, and does not prevent against them). Check grounding of shield, remove it and clean the surface between the shield and the metal base.
- **bad reference electrode connection** (floating ground reference). Repair is required.
- **bad sealing of aperture**. Replacement of measuring tube is required.
- **broken measuring chamber** starts to conduct through the gaps (ground path). Replacement of chamber is required.
- **contaminated draining tube** starts to conduct due to protein or lipid build-up. It is very easy to identify this case. After replacing the drain tube of the measuring chamber (mainly WBC), WBC histogram peak, or PLT becomes low soon. Normally a good cleaner is required to dissolve lipid or protein build-up. Sometimes the cleaner is not strong enough to keep this tube clean enough. Periodic washing using 1% hand warm bleach solution helps.

B. Bad insulation of electronic signal paths:

In these cases check for any capacitive coupling of electronic signals to the chamber:

- **interference with HGB head** (high-frequency signal is coupled to the chamber). HGB head metal parts must be grounded. The ground comes externally, it must be in place, otherwise HGB head does not shield, but couples in noise.
- **interference with internal high voltage inverter** (high-frequency signal is coupled to the chamber). Repair is required: avoid near contact of HVB cable to chamber or shielded amplifier cable.
- **interference with internal start button** (polling signal to start button may cause noise). Guide start button wires as far from chamber as possible. You may try mix them up on the start micro-switch if applicable.
- **interference with display cable** (high-frequency LCD signal is coupled to the chamber by the ribbon cable). Keep the ribbon cable far from the chamber.
- **interference with CPU fan or other digital logic traces** (CPU fan or other digital signal radiates to chamber or to the shielded amplifier cable). Try keeping the ribbon cables far from the chamber and shielded cable.

C. Bad components, or connections:

- **bad soldering, salt residuals or component failure on amplifier** (especially if some reagent could get in the amplifier section). Cleaning of PCB/electrode socket or replacement of amplifier is required. Check for the correct soldering of reference cable and its connector.
- **circuit board bad soldering or component failure**. Check the shielded cable connections as well. Sometimes inside out connection (hot electrode goes outside as a shield) is the problem: both ends of amplifier signal cable must be reversed.
- **analog signal ribbon cable** (it picks up noise). Check the ribbon cable between the circuit board and the amplifier. Maybe it is pinched under some screws or components. This may cause trouble and even noise.

D. Pneumatic failures, liquid paths that conduct noise into the chamber:

- **liquid remains under the chamber in drain tube** (during measurement the conducting liquid remains inside the drain tube making noise to appear there).
    - Check chamber draining path for clogging or salt crystals.
    - Check the pump operation. Since draining of the chamber goes under pressure control, maybe a bad pressure sensor or connection can cause trouble.
    - Clean the draining path. Do not use alcohol, but bleach. Replace chamber if necessary.
- **liquid remains in the washing inlet at top of the chamber** (during measurement the conducting liquid remains inside the chamber wash tube making noise to appear). The software is not compatible with the mechanics, or related valve is bad/partly clogged, or the tubing is clogged/loose.
- **lyse path guides in noise** (during counting, if the a liquid in the draining tube is touching lyse reagent in T-fitting, noise can appear). Check the lyse path, and the lyse valve as well.

7. MAINTENANCE

7.1. Weekly Maintenance by User

User should carry out on the first workday, before starting up the analyzer.

7.1.1. Cleaning the washing head

User should clean the lower surface of the sampling needle washing head using a soft cloth, immersed in warm tap water to remove salt build-up.

7.2. Periodic Maintenance by Service

The instruments should be checked and maintenance must be carried out in every 6-12 months, or after 10 000 measurement cycles.

7.2.1. Check Self test and Device statistics

Run the built-in Self test and check the overall test result. Check the device statistics to find common problems.

7.2.2. Cleaning and Greasing Dilutor Block

The dilutor block driving wheels and gear bar should be cleaned from dirt and must be greased between the gear bar and the support, and between cogged wheels.

7.2.3. Checking and Lubricating Dilutor Piston Tips

The cogged end of PTFE dilutor pistons should be cleaned and lubricated by neutral silicon grease. Apply just a thin layer, and move it along the perimeter of the piston, so that some of the material goes into the gaps between the sealing rings.

Repeat this step for lyse and dilutor pistons as well. Check the condition of the micro piston sealing, and replace if necessary.

7.2.4. Cleaning and Lubricating Needle Moving Mechanics

The H&V moving mechanics sliding bars should be cleaned from dust.

Lubricating of the sliding bars must be made using „**Photorube**” oil containing PTFE. **Grease or pure lubricating oil is not suitable.**

7.2.5. Checking and Replacing Washing Head

Check the state of the washing head, and replace if necessary. After replacing washing head, do not forget to perform correct adjustment of sampling needle height (see Section 4.1.2).

7.2.6. Checking and Replacing Peristaltic Pump Tube

Replace peristaltic pump tube if needed. You can check it by opening the lock, and removing the tube for inspection.

Check for leakage of the tubing. Reassemble the head.

Warning! Be careful, DO NOT twist the tube while reposition it into the head, because it will cause malfunction in a very short period of time.

7.2.7. Checking of the Power Supply

Open the instrument for regular cleaning inside. Check the cleanliness and operation of the cooling fan of the power supply. Clean or replace the fan if necessary.

7.2.8. Bleaching of Fluidic System

It is recommended to run a bleaching procedure to remove stains from the fluidic system.

1. Connect 2-5%, hand warm, clean bleach solution to all reagent inputs, and perform priming on all reagent inputs.
2. Leave it in the tubing for not more than 2-3 minutes.
3. Remove the bleach, prime on air.
4. Connect distilled water (100 ml), and perform priming all reagents, again.

   Connect reagents, and run priming again.

8. SPARE PARTS

CODE	PART NAME	AJ	AJ-Vet	AJ-B
A133	HVB BOARD WITH INVERTER	x	x	
J134	HVB BOARD WITHOUT INVERTER			x
J135	LCD DISPLAY (Alpha-Numeric, 4x20 chars.)			x
A136	LCD DISPLAY (Graphics, 240x128 pixels)	x	x	
A137	LAMP FOR LCD	x	x	
A192	DIMMPC (CPU)	x	x	
A193	HEAT SINK FOR DIMMPC	x	x	
A302	STEPPER MOTOR	x	x	x
A304	TIMING PULLEY FOR X	x	x	x
A305	TIMING PULLEY FOR Y	x	x	x
A308	OPTO SWITCH I.	x	x	x
A309	OPTO SWITCH II.	x	x	x
A310	WASHING HEAD	x	x	x
A402	SEALING RING FOR CHAMBERS	x	x	x
A403	U-SHAPED METAL FIXING FOR APERTURE	x	x	x
A421	APERTURE (80 µm)	x	x	x
A422	GROUND ELECTRODE	x	x	x
A430	MEASURING CHAMBER	x	x	x
A434	HGB MEAS HEAD (COMPLETE)	x	x	x
A504	2/2 VALVE	x	x	x
A505	3/2 VALVE	x	x	x
A506	VALVE COIL FOR BOTH VALVES	x	x	x
A507	2/2 VALVE HEAD	x	x	x
A508	3/2 VALVE HEAD	x	x	x
A509	VALVE MEMBRANE	x	x	x
A541	4/2 PLASTIC TUBE (SILICON)	x	x	x
A542	5/3 PLASTIC TUBE (SILICON)	x	x	x
A543	4/1.8 TYGON TUBE	x	x	x
A544	5/3 REAGENT TUBE	x	x	x
A545	3,2 mm T CONNECTOR	x	x	x
A546	Y CONNECTOR	x	x	x
A551	COLOUR LOCKING RING	x	x	x
A552	COLOUR LOCK NUT (INSIDE)	x	x	x

CODE	PART NAME	AJ	AJ-Vet	AJ-B
A553	COLOUR CODING RING (OUTSIDE)	x	x	x
A554	LUER FEMALE	x	x	x
A555	LUER MALE	x	x	x
A556	2,3 mm T-CONNECTOR	x	x	x
A560	PERISTALTIC PUMP	x	x	x
A561	TUBE FOR PERISTALTIC PUMP	x	x	x
A563	CASSETTE FOR PUMP	x	x	x
A564	FIXING FOR PUMP (PAIR)	x	x	x
A565	CONNECTOR FOR PUMP (PAIR)	x	x	x
A640	INSTRUMENT FOOT	x	x	x
A701	MAINS CABLE (220V)	x	x	x
A702	MAINS CABLE (110V)	x	x	x
S800	THERMAL PRINTER (INTERNAL)	x	x	x
S801	MECHANICS FOR INTERNAL PRINTER	x	x	x
S802	ELECTRONICS FOR INTERNAL PRINTER	x	x	x
S803	CASE FOR INTERNAL PRINTER	x	x	x
C400	MEASURING BLOCK EXCLUDING AMPLIFIER	x	x	x
C510	PUFFER RESERVOIR	x	x	x
J100	POWER & PNEUMATIC BOARD (PPB)	x	x	
J110	CONTROL BOARD (COMB)	x	x	
J111	CONTROL BOARD (COMB) & DIMMPC	x	x	
J120	MAIN BOARD			x
J139	FOIL KEYBOARD (Junior B)			x
J132	FOIL KEYBOARD (Junior, Junior Vet)	x	x	
J138	DISPLAY BOARD	x	x	
J140	AMPLIFIER BOARD	x	x	x
J156	POWER SUPPLY	x	x	x
J157	MAINS SWITCH	x	x	x
J170	IDEPROM BOARD	x	x	
J214	DILUTOR BOARD	x	x	x
J224	MICRODILUTOR BOARD	x	x	x
J240	REAGENT SENSOR BOARD	x	x	x
J250	DILUTOR BLOCK COMPLETE (2 MOTORS)	x	x	x
J251	SYRINGE+PISTON (MOUNTED /2ML)	x	x	x
J252	PISTON LOCKING SCREW	x	x	x

CODE	PART NAME	AJ	AJ-Vet	AJ-B
J300	XY MOVEMENT BLOCK	x	x	x
J301	TIMING BELT FOR X	x	x	x
J302	TIMING BELT FOR Y	x	x	x
J306	GEAR FOR Y OPTO	x	x	x
J307	H&V MOTOR OPTO BOARD	x	x	x
J311	SAMPLING NEEDLE	x	x	x
J501	VALVE UNIT I. (valve 1-5)	x	x	x
J502	VALVE UNIT II. (valve 11-15)	x		x
J503	VALVE UNIT II. (valve 11-16) (Junior VET)		x	
J530	PRESSURE SENSOR (COMPLETE)	x	x	x
J558	REAGENT TUBING SET (HUMAN)	x		x
J559	REAGENT TUBING SET (VET)		x	
J610	MICRO SWITCH	x	x	x
J613	LED BOARD	x	x	x
J721	AMPLIFIER BOARD CABLE	x	x	x
J750	CABLE SET (Junior, Junior Vet)	x	x	
J751	CABLE SET (Junior B)			x
J900	MICRODILUTOR UNIT	x	x	x
J901	MICRO PISTON	x	x	x
J902	MICRO SYRINGE COVER	x	x	x
J903	ADAPTOR I. for 1-0,3ml microtainers (Greiner, BD,..) max. Ø11mm	x	x	x
J904	ADAPTOR II. for 3ml vacutainers max. Ø12,5mm, max. height 76mm	x	x	x
J905	ADAPTOR III. for R&D 2ml blood control	x	x	x
S210	BEARING FOR DILUTOR	x	x	x
S211	SEEGER RING	x	x	x

9. APPENDICES

9.1. Warning flags - AJ/AJvet only

Uppercase letters refer to WBC or HGB problems:

Flag	Meaning	Recommended user action
E	No WBC 3-part differential	Possible lyse problem. May occur in pathological lymphocytosis.
H	HGB blank is high, or no HGB blank	Repeat blank measurement. If HGB blank is not stable, there are probably bubbles in the WBC chamber: Run a cleaning and try blank again. Close the side door if it was open during measurement.
B	WBC blank is high, or no WBC blank	Repeat blank measurement, or run prime lyse and try blank again. Possible lyse contamination, or noise problem.
C, Q	WBC clogging	Aperture clogging. Perform cleaning and repeat the measurement. If it is a general problem, please contact your Service Personnel. Low temperature reagents can cause it as well (mainly diluent), in this case you will have to wait until they reach room temperature.

Warning flags in lowercase refer to RBC or PLT problems:

Flag	Meaning	Recommended user action
p	PLT blank is high, or no PLT blank	Run cleaning and repeat the blank measurement. Diluent or system cleanliness problem. If it is stable high, replace the diluent by opening a new tank.
b	RBC blank is high, or no RBC blank	Same action as in case of warning flag **p**.
c	RBC/PLT clogging	The same action as in case of the **C** warning flag.

9.2. Serial Communication Protocol

9.2.1. General Description

The analyzer is able to make serial connection link to a receiver device (e.g. computer) connected to the serial port. If Baud Rate setting in Service Menu is set to a valid value (other than Not Connected), the instrument will try to initiate a communication sequence.

Once the analyzer starts serial communication, the receiver should respond to it.

The hardware protocol: **8 data bit, 1 stop bit, no parity**. If the other side is not responding in 1 second, the instrument will repeat the transmission twice, but if there is still no response, the other side will be supposed to be not ready to receive data, and thus the analyzer will not try to communicate any more.

From this state it can wake up by receiving an <ENQ> (ASCII code 5) character from the other side, and the instrument will immediately respond an <ACK> (ASCII code 6). From this point the instrument will send data if it is ready for transmission.

The communication is based on packages.

There are 5 package types:

- INIT package: Device identification, software version, current date and time.
- DATA package: Sample and patient information, measured parameters, and markers.
- RBC package: Sample information, RBC histogram.
- WBC package: Sample information, WBC histogram.
- PLT package: Sample information, PLT histogram.

The communication sequence is always started with an INIT package. If the link is successful, the instrument will send DATA package, and the receiver can request RBC, WBC and PLT packages at acknowledge.

Special characters used in the communication:

Character	ASCII code
<SOH>	1
<STX>	2
<ETX>	3
<EOT>	4
<ENQ>	5
<ACK>	6
<HT>	9
<LF>	10
<NAK>	21
<SPACE>	32

9.2.2. Format of Packages Sent

Packages sent by the analyzer are always between <SOH> and <EOT> characters, and they consist of header, data and tail. The header consists of a package identifier and a package type descriptor. The tail includes the checksum. Typical format:

<SOH>MID CMD**<STX>**MESSAGE**<ETX>**CHKSUM**<EOT>**

MID: Message ID, one capital letter between 'A' and 'Z'

CMD: Command, one capital letter, package type descriptor

- 'I' for INIT;
- 'D' for DATA;
- 'R' for RBC;
- 'W' for WBC;
- 'P' for PLT.

MESSAGE: the message consists of ASCII characters (between 32..128)

CHKSUM: two hexadecimal digits of a one-byte checksum which contains the lower byte of the sum of characters between the <SOH> and <ETX> (incl. those, too).

9.2.3. Format of Acknowledge of the Receiver

The receiver must acknowledge transmission by the following message:

<ACK>CMD MID

CMD: the type of the next package to send – this makes possible to a request for histograms. If no more packages are required, <SPACE> should be sent.

MID: the identifier of the package that acknowledged by this message.

If receiving of the message was not successful, <NAK> should be sent, and the analyzer will repeat the last package.

The receiver has approx. 1 second to reply, otherwise the analyzer will repeat the last transmission, twice automatically. But if still no response after 3 trials, the analyzer will not start to communicate any more, even if there is data to send (see General Description).

9.2.4. Detailed Description of Packages

The packages sent by the analyzer are placed between a header and a tail. There are 3 main types of them: INIT, DATA and histogram packages. The histogram package can be: RBC, WBC, and PLT. The format of histograms are the same, type descriptor differs only.

INIT package

Analyzer sends the general identifiers by this package during initiation of communication:

DEVICE**<HT>**VERSION**<HT>**DATE**<HT**>TIME

DEVICE: device identifier

VERSION: version of the software, e.g. „1.7"

DATE: date in YYYYMMDD format

TIME: time in HHMMSS format

DATA package

This package contains sample and patient data, the measured parameters and the markers of histograms. One data element consists of two items: name and value, which are separated by a <HT> character, and closed by <LF>.

Important! SNO, DATE, TIME, SID and PID fields will always be present in this order, but other fields may be omitted.

SNO**<HT>**152**<LF>**	internal identifier
DATE**<HT>**19980715**<LF>**	date of measurement (YYYYMMDD)
TIME**<HT>**114500**<LF>**	time of measurement (HHMMSS)
SID**<HT>**1AXX435**<LF>**	sample identifier (alphanumeric)
PID**<HT>**B72D44**<LF>**	patient identifier (alphanumeric)
NAME**<HT>**JOE SMITH**<LF>**	patient name (alphanumeric)
BIRTH**<HT>**19650208**<LF>**	birth date of patient (YYYYMMDD)
SEX**<HT>**0**<LF>**	patient sex (0-male, 1-female)
DOC**<HT>**Dr John Gold**<LF>**	doctor's name
OPID**<HT>**1172**<LF>**	operator identifier (alphanumeric)
MODE**<HT>**0**<LF>**	patient type
WRN**<HT>**0**<LF>**	warning bits[1] (32-bit hexadecimal)
PM1**<HT>**12**<LF>**	PLT lower marker[2]
PM2**<HT>**204**<LF>**	PLT upper marker[2]
RM1**<HT>**51**<LF>**	RBC lower marker[2]
WM1**<HT>**23**<LF>**	WBC upper marker[2]
WM2**<HT>**57**<LF>**	WBC LYM-MID marker[2]
WM3**<HT>**92**<LF>**	WBC MID-GRA marker[2]
PARN**<HT>**22**<LF>**	number of parameters to send
P01**<HT>** 6.6**<HT>**0**<LF>**	first parameter ID[3], value and flag[4]
P02**<HT>**4.29**<HT>**0**<LF>**	second parameter ID, value and flag
...	
P22**<HT>** 8.2**<HT>**0**<LF>**	last parameter ID, value and flag

Remarks:

[1] Position and meaning of the warning flags:

Bit	Mask	Letter	Meaning
0	0x00001	c	RBC/PLT clogging.
6	0x00040	b	RBC blank is high, or no RBC blank.
7	0x00080	p	PLT blank is high, or no PLT blank.
8	0x00100	C,Q	WBC clogging.
14	0x04000	B	WBC blank is high, or no WBC blank.
15	0x08000	H	HGB blank is high, or no HGB blank.
16	0x10000	E	No WBC three part.

[2] The markers are given in histogram channel between 0 and 255, where 0 means that the marker could not be found.

[3] The parameter IDs in the analyzer are: P01: WBC (10^9/l); P02: RBC (10^{12}/l); P03: HGB (g/l); P04: HCT (%); P05: MCV (fl); P06: MCH (pg); P07: MCHC (g/l); P08: PLT (10^9/l); P09: PCT (%); P10: MPV (fl); P11: PDWsd (fl); P12: PDWcv (%); P13: RDWsd (fl); P14: RDWcv (%); P15: LYM (10^9/l); P16: MID (10^9/l); P17: GRA (10^9/l); P18: LYM% (%); P19: MID% (%); P20: GRA% (%); P21: RBCtime (sec); P22: WBCtime (sec).

[4]The parameter value is always 4 characters wide, spaces from left added if necessary. It can be 9999, if the value could not be displayed in 4 digits, or '----' if the value could not be calculated because of an error.

The meaning of the parameter flags:

Flag	Displayed	Meaning
0		Value correct.
1	+	Value high (more than upper limit)
2	–	Value low (less than lower limit)
3	*	Value is unreliable.
4	E	Value not given because of error. Value is ----.
5		Value cannot be calculated. There is no value!

RBC, WBC and PLT package

The format of the histogram packages are the same, they differ in type descriptor only. The package contains the sample data (to identify the package) and the histogram.

SNO**<HT>**152**<LF>**	internal identifier
DATE**<HT>**19980715**<LF>**	date of measurement (YYYYMMDD)
TIME**<HT>**114500**<LF>**	time of measurement (HHMMSS)
SID**<HT>**1AXX435**<LF>**	sample identifier (alphanumeric)
PID**<HT>**B72D44**<LF>**	patient identifier (alphanumeric)
CHN**<HT>**256**<LF>**	number of histogram channels (256)
9**<HT>**	value of first histogram channel
...	
1**<HT>**	value of 255th histogram channel
0	value of the last histogram channel

Example

Let us suppose that the receiver was not ready to receive when the analyzer was switched on, therefore the instrument is not starting a communication.

Receiver sends that it is ready to receive now, the analyzer sends acknowledge.

<ENQ>

<ACK>

Analyzer sends INIT next time to initiate link (there is data to send):

<SOH>AI<STX>Abacus<HT>1.5<HT>20030405<HT>160734<ETX>E4<EOT>

Receiver sends acknowledge:

<ACK><SPACE>A

The analyzer sends DATA package:

<SOH>BD<STX>SNO<HT>1<LF>DATE<HT>20010405<LF>TIME<HT>163800<LF>SID<HT>1<LF>PID
<HT><LF>NAME<HT><LF>BIRTH<HT>00000000<LF>SEX<HT>0<LF>DOC<HT><LF>OPID<HT>0<LF>
MODE<HT>0<LF>WRN<HT>0<LF>PM1<HT>10<LF>PM2<HT>135<LF>RM1<HT>34<LF>WM1<HT>21<LF>W
M2<HT>55<LF>WM3<HT>91<LF>PARN<HT>22<LF>P01<HT>6.4<HT>0<LF>P02<HT>4.36<HT>0<LF>
P03<HT>131<HT>0<LF>04<HT>39.0<HT>0<LF>P05<HT>90<HT>0<LF>P06<HT>30.0<HT>0<LF>P07<HT>33
5<HT>0<LF>P08<HT>262<HT>0<LF>P09<HT>0.24<HT>0<LF>P10<HT>9.2<HT>0<LF>P11<HT>12.0
<HT>0<LF>P12<HT>36.9<HT>0<LF>P13<HT>52.3<HT>1<LF>P14<HT>16.3<HT>0<LF>P15<HT>2.1<HT>0<L
F>P16<HT>0.5<HT>0<LF>P17<HT>3.7<HT>0<LF>P18<HT>33.4<HT>0<LF>P19<HT>7.8<HT>1<LF>P20<HT>
58.8<HT>0<LF>P21<HT>8.4<HT>0<LF>P22<HT> 5.0<HT>0<LF><ETX>89<EOT>

Receiver acknowledges DATA transmission, and requests for RBC package:

<ACK>RB

The analyzer sends RBC package:

<SOH>CR<STX>SNO<HT>1<LF>DATE<HT>20010405<LF>TIME<HT>163800<LF>SID<HT>1<LF>PID
<HT>57290<LF>CHN<HT>256<LF>4<HT>9<HT>17<HT>27<HT>37<HT>48<HT>58<HT>66<HT>70<HT>72
<HT>70<HT>66<HT>60<HT>54<HT>47<HT>39<HT>33<HT>28<HT>22<HT>18<HT>15<HT>11<HT>9<HT>8<
HT>7<HT>5<HT>4<HT>4<HT>3<HT>3<HT>2<HT>2<HT>1<HT>1<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<H
T>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>
1<HT>1<HT>1<HT>2<HT>2<HT>3<HT>4<HT>5<HT>6<HT>7<HT>8<HT>9<HT>10<HT>11<HT>12<HT>14<H
T>16<HT>18<HT>21<HT>24<HT>28<HT>31<HT>35<HT>38<HT>43<HT>47<HT>53<HT>58<HT>65<HT>71<
HT>78<HT>86<HT>94<HT>103<HT>113<HT>121<HT>130<HT>139<HT>149<HT>160<HT>171<HT>184<HT>
196<HT>207<HT>217<HT>225<HT>231<HT>237<HT>242<HT>245<HT>248<HT>251<HT>252<HT>253<HT>
253<HT>253<HT>253<HT>253<HT>254<HT>255<HT>254<HT>252<HT>248<HT>243<HT>236<HT>229<HT>
221<HT>214<HT>207<HT>199<HT>192<HT>185<HT>178<HT>170<HT>162<HT>154<HT>146<HT>137<HT>
129<HT>121<HT>113<HT>104<HT>96<HT>88<HT>82<HT>75<HT>71<HT>66<HT>62<HT>58<HT>55<HT>51
<HT>47<HT>43<HT>38<HT>35<HT>31<HT>28<HT>25<HT>22<HT>19<HT>18<HT>16<HT>14<HT>12<HT>1
1<HT>10<HT>9<HT>9<HT>9<HT>9<HT>8<HT>8<HT>7<HT>7<HT>6<HT>6<HT>5<HT>5<HT>5<HT>4<HT>4
<HT>3<HT>3<HT>3<HT>2<HT>2<HT>2<HT>1<HT>1<HT>1<HT>1<HT>1<HT>1<HT>1<HT>1<HT>2<HT>2<HT>2<H
T>2<HT>2<HT>2<HT>2<HT>1<HT>1<HT>1<HT>1<HT>1<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>
0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<
HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<H
T>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<ETX>60<EOT>

Receiver acknowledges RBC transmission, and requests for WBC package:

<ACK>WC

The analyzer sends WBC package:

<SOH>DW<STX>SNO<HT>1<LF>DATE<HT>20010405<LF>TIME<HT>163800<LF>SID<HT>1<LF>PID
<HT>57290<LF>CHN<HT>256<LF>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>0<HT>255<H
T>255<HT>255<HT>251<HT>209<HT>163<HT>118<HT>82<HT>56<HT>40<HT>32<HT>29<HT>29<HT>30<H
T>34<HT>40<HT>47<HT>55<HT>64<HT>76<HT>88<HT>103<HT>119<HT>136<HT>155<HT>174<HT>195<H
T>215<HT>233<HT>246<HT>254<HT>255<HT>249<HT>240<HT>227<HT>213<HT>200<HT>187<HT>176<H
T>164<HT>153<HT>141<HT>129<HT>118<HT>108<HT>99<HT>92<HT>86<HT>81<HT>76<HT>71<HT>67<H
T>64<HT>62<HT>61<HT>60<HT>60<HT>60<HT>57<HT>55<HT>51<HT>47<HT>44<HT>43<HT>42<HT>42<
HT>43<HT>44<HT>45<HT>47<HT>47<HT>46<HT>45<HT>43<HT>40<HT>37<HT>34<HT>32<HT>30<HT>30
<HT>30<HT>30<HT>29<HT>28<HT>26<HT>24<HT>21<HT>19<HT>17<HT>15<HT>14<HT>13<HT>12<HT>1
3<HT>13<HT>13<HT>13<HT>13<HT>12<HT>11<HT>11<HT>11<HT>12<HT>12<HT>14<HT>15<HT>16<HT>
17<HT>17<HT>17<HT>17<HT>17<HT>17<HT>17<HT>17<HT>17<HT>17<HT>18<HT>19<HT>21<HT>22<HT>23<HT
>24<HT>25<HT>25<HT>25<HT>26<HT>29<HT>31<HT>34<HT>35<HT>36<HT>36<HT>35<HT>35<HT>35<H
T>37<HT>38<HT>41<HT>43<HT>46<HT>47<HT>48<HT>50<HT>52<HT>56<HT>60<HT>64<HT>70<HT>74<
HT>79<HT>82<HT>86<HT>89<HT>92<HT>95<HT>99<HT>102<HT>103<HT>104<HT>105<HT>105<HT>106<
HT>108<HT>110<HT>112<HT>115<HT>117<HT>119<HT>120<HT>121<HT>120<HT>120<HT>120<HT>121<
HT>122<HT>125<HT>129<HT>132<HT>136<HT>139<HT>141<HT>142<HT>142<HT>140<HT>138<HT>135<
HT>132<HT>129<HT>127<HT>125<HT>123<HT>122<HT>120<HT>117<HT>115<HT>112<HT>109<HT>108<
HT>108<HT>109<HT>110<HT>110<HT>108<HT>104<HT>99<HT>94<HT>89<HT>85<HT>82<HT>80<HT>79<
HT>78<HT>77<HT>75<HT>72<HT>68<HT>63<HT>58<HT>54<HT>50<HT>47<HT>44<HT>43<HT>41<HT>41
<HT>42<HT>42<HT>42<HT>42<HT>39<HT>37<HT>34<HT>30<HT>28<HT>25<HT>24<HT>23<HT>22<HT>2
2<HT>21<HT>21<HT>19<HT>17<HT>13<HT>9<HT>5<ETX>F7<EOT>

Receiver acknowledges WBC transmission, and closes the link. It is possible to request for PLT histogram if the acknowledge contains a “P” instead of <SPACE>, but it is not shown in this example.

<ACK><SPACE>D

9.3. UPLOADER: Software upgrading tool for Abacus Junior B

This tool allows you to update AJB's software core, language module, settings and profiles.

In AJB there's a controller card which has a microcontroller responsible for the instrument operations. There's a special part of the microcontroler firmware (a kind of software) which provides the upgradeability of its core functions. This special part of the firmware is called boot loader.

For the software update you need:

- Abacus Junior B
- Serial cable (9-pin)
- A PC with Windows OS
- …and the uploader software called ProjectCloud.

Installing Uploader:

1. Create somewhere on your PC's harddrive a directory for example ABJB.
2. you have to copy thefollowing files into this directory:

```
ProjectCloud.exe
ProjectCloud.res
borIndmm.dll
CC3250mt.dll
CportLibCB5.bpl
vcl50.bpl
vcbde50.bpl
vcldb50.bpl
```

3. Create a directory for the source file of the firmware to be updated. The PC's software automatically will search for a \HEX directory, so it is not cumpolsory but advisable name your directory HEX and place it into the installation directory.

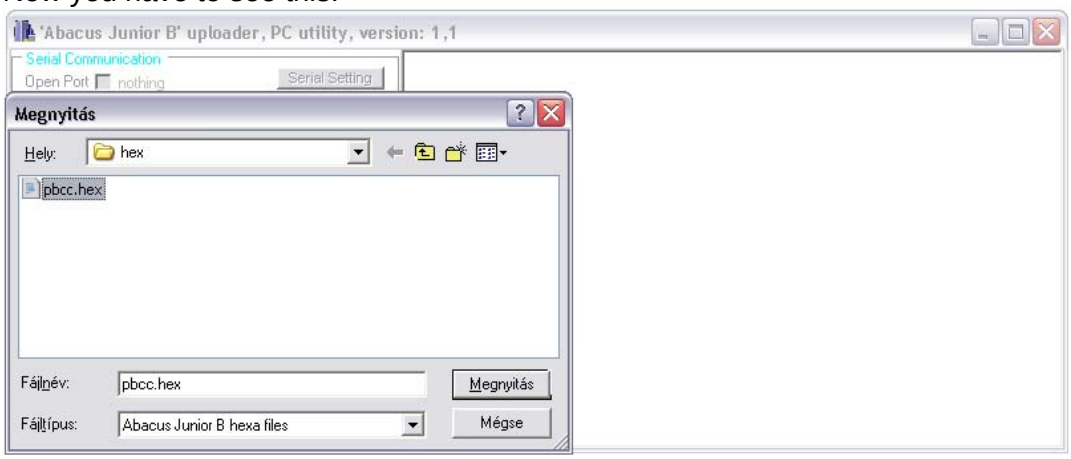
   Now, we have the following structure:

```
D:\ABJB:
2004.05.26.  11:59    <DIR>          .
2004.05.26.  11:59    <DIR>          ..
2004.05.26.  11:55    <DIR>          HEX
2000.01.31.  05:00                25600 borlndmm.dll
2000.01.31.  05:00              1496064 cc3250mt.dll
2003.12.11.  16:17               142848 CportLibCB5.bpl
2004.05.26.  12:08                 3534 dir.txt
2004.05.25.  14:36                89600 ProjectCloud.exe
2004.04.14.  13:33                  876 ProjectCloud.res
2000.01.24.  05:01              2023424 vcl50.bpl
2000.01.24.  05:01               300032 vclbde50.bpl
2000.01.24.  05:01               558080 vcldb50.bpl
```

4. Place the file to be uploaded into HEX directory

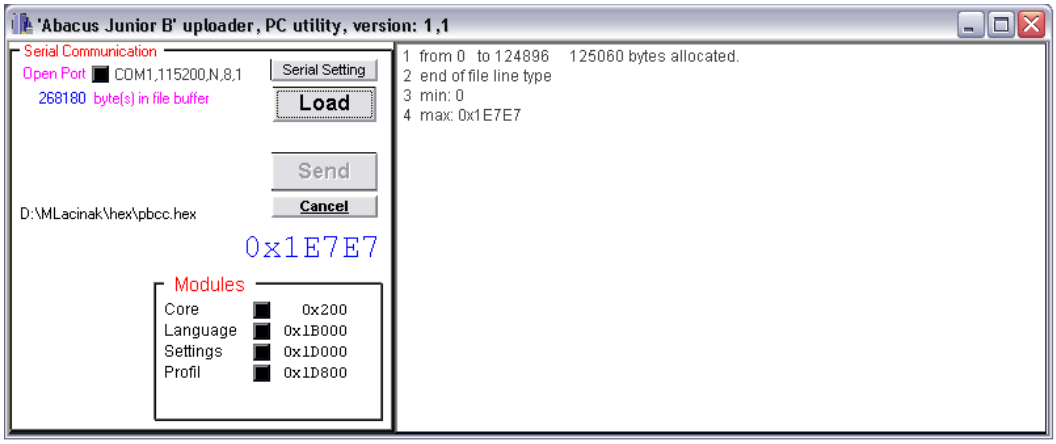
9.3.1. Process of SW download (AJB)

1. **At AJB's POWER OFF state** connect the serial cable to the PC's serial port. IMPORTANT: Your PC has to be equipped with at least one serial port, which is enabled by BIOS and Win OS, too. This port must not be used by any other device or application during the upload process.
2. Switch on the PC (but don't switch on the instrument!), login to windows and start **projectcloud.exe**
3. Now you have to see this:



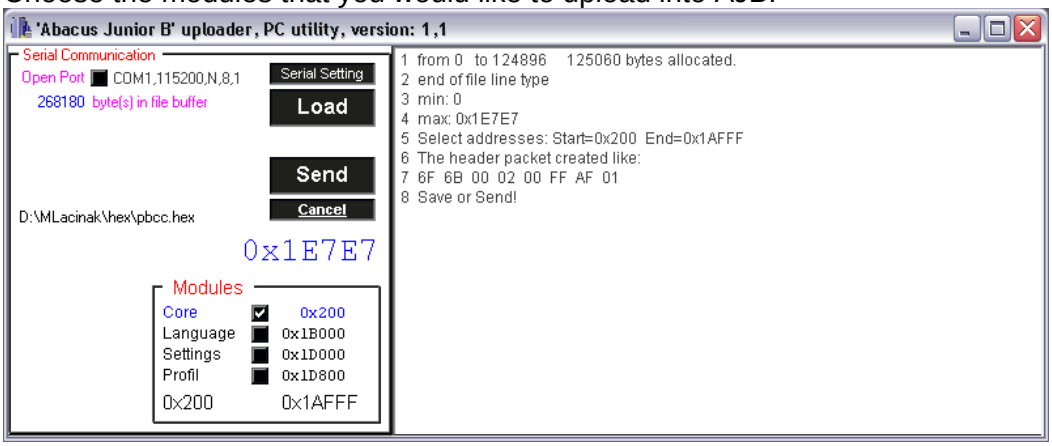
…the program started with a LOAD dialog. Select the hex file you want to upload and press Open.
If you press Cancel, the program closes itself.

4. The file loads into the PC's memory, and right after this it will be preprocessed (converted into binary format).



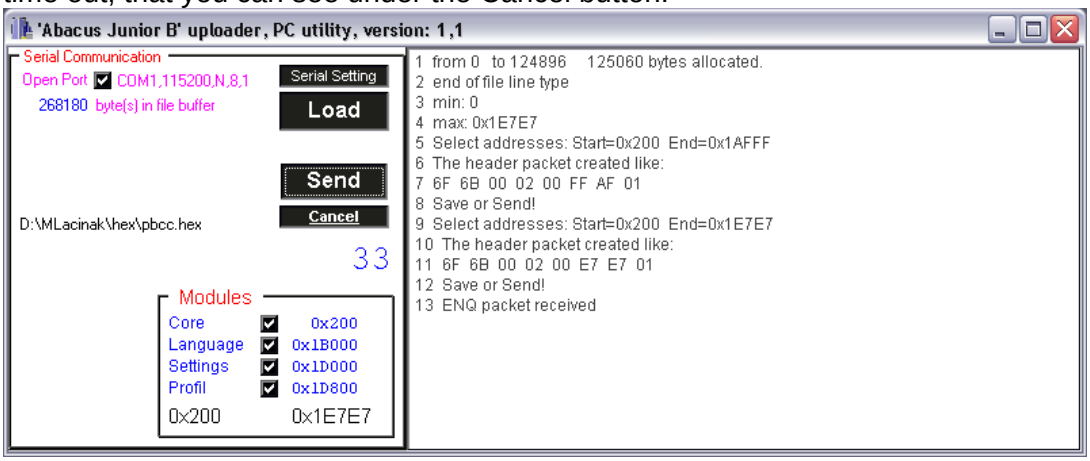
5. You don't need to open(it will be opened automatically) the serial port if all the default settings of the port are correct.

6. Choose the modules that you would like to upload into AJB.

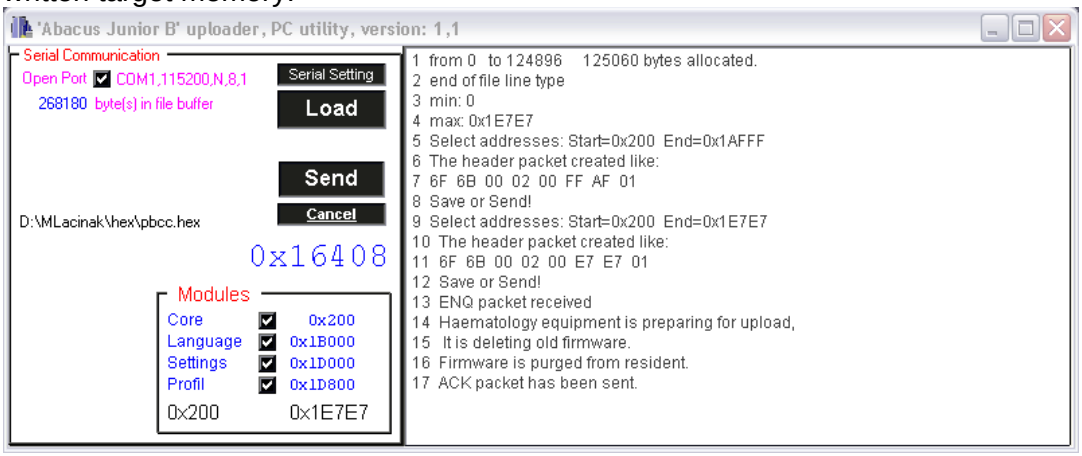


This section is hierarchical up to down, so if you want to choose „Language" the „Core" will be selected as well and if you want to select „Settings" the „Core" and the „Language" modules will be selected as well, and of course if you want to select „Profil" all the modules will be selected.

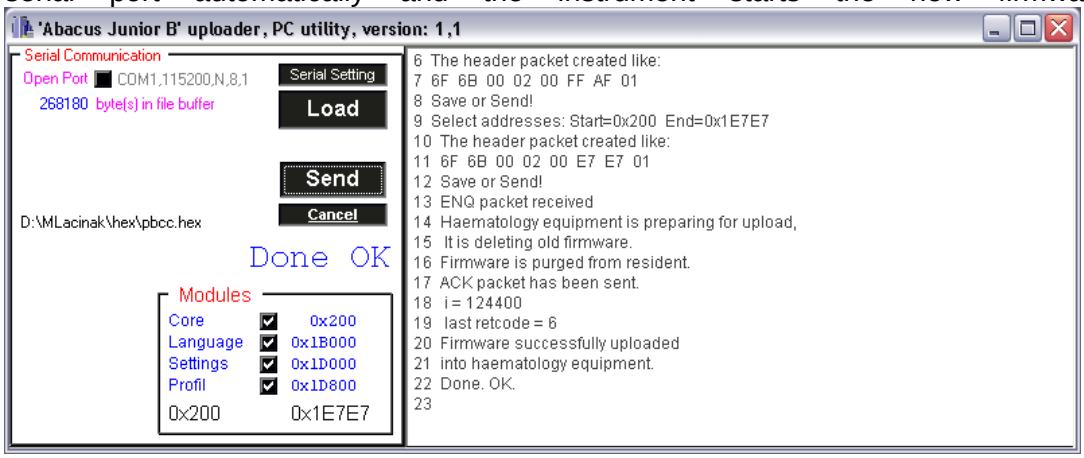
7. Click on SEND button.
This will automatically open the serial port and wait for an „Enquery packet" from the Instrument. **So NOW, please switch on the Instrument !** This action has 2 minutes time out, that you can see under the Cancel button.



8. On the right hand side of the application's window you will see the message of the Enquiry packet's arrival. After this, several seconds needs for the Instrument to free the memory. Finally, a counter will count down with the addresses of the currently written target memory.

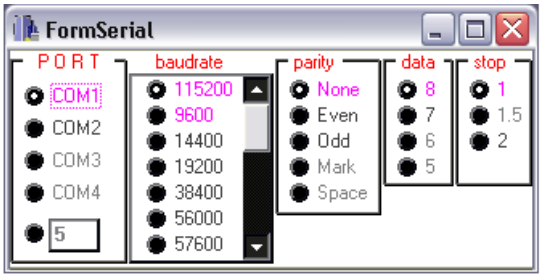


9. If everything went OK you get an „Done OK" message. The applicaton closes the serial port automatically and the instrument starts the new firmware.



You get a popup error message if something's wrong with the communication or the port's settings wrong.

You can change the settings of the serial port by clicking the „serial setting" button.



In this application there are only two valid settings:

- baud rate: **115200**, parity: **None**, data: **8**, stop:**1**
- baud rate: **9600**, parity: **None**, data: **8**, stop:**1**

For the ease of usage, this values are highlighted in the window.

If the port is open the changes of settings won't take effect until you close the port.

Important !

The instrument's default communication settings are:

baud rate: **115200**, parity: **None**, data: **8**, stop:**1**.

To start the instrument with the slower settings hold down Start Button while you switch on the instrument.

(baud rate: **9600**, parity: **None**, data: **8**, stop:**1**)

9.3.2. Troubleshooting of SW download (AJB)

If PC and AJB cannot communicate with each other, but everything (cables, program, settings) seems to be all right…

1. Is COM port disabled by BIOS?
2. Is COM port disabled by the operating system (WIN)?
3. Does the PC's mother board have IrDA port? On several motherboards if it's enabled COM1 turns into COM2 and COM1 will be used by IrDA.
4. Is it a shared IRQ problem in the operating system?
5. Is COM port used by another application/device? Several applications can change the parameters of the COM port by the PC's startup.

Fail-safe addresses and IRQ's for COM ports:

- COM1: 03F8h, 4
- COM2: 02F8h, 3
- COM3: 02E8h, 4
- COM4: 03E8h, 3

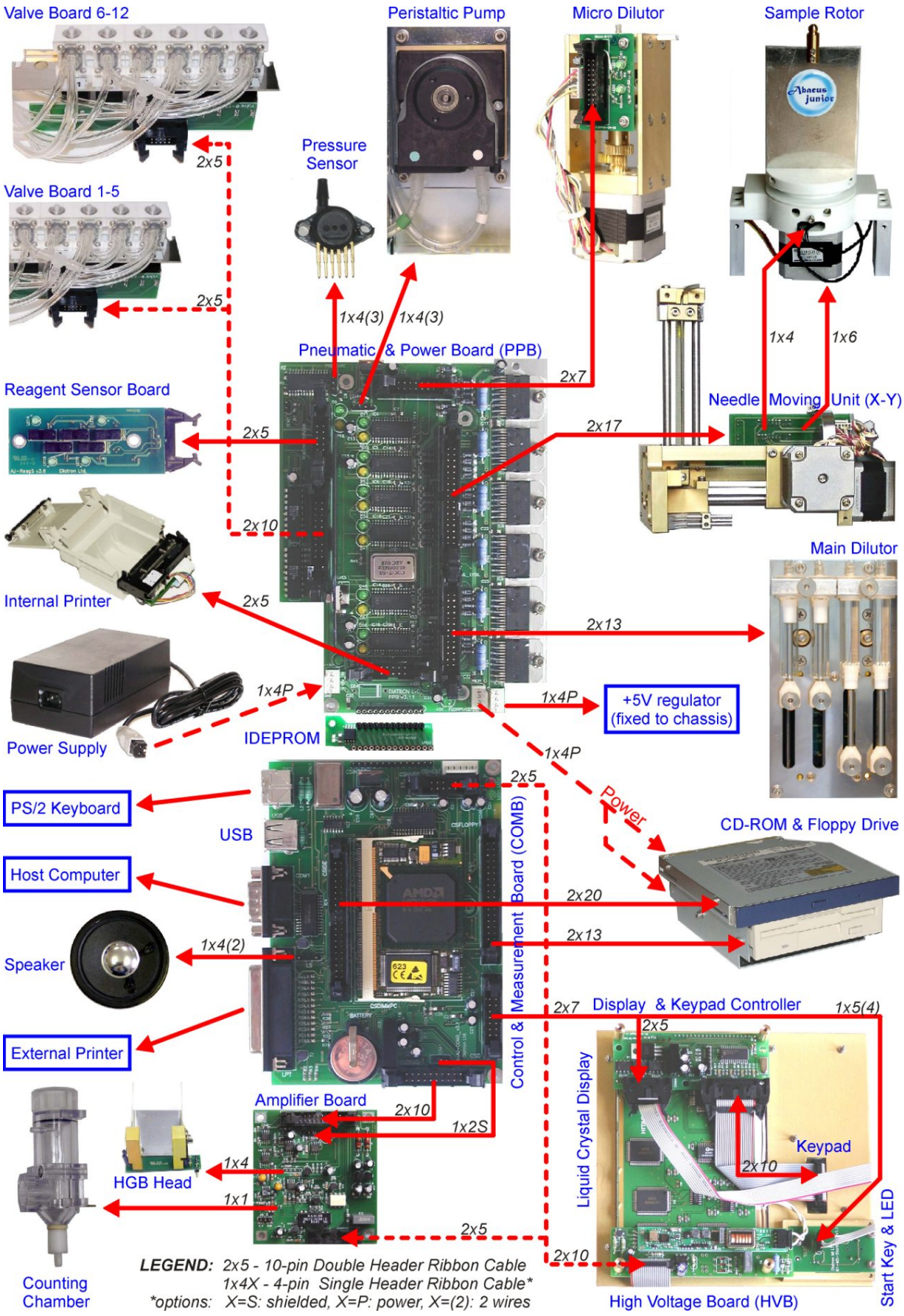
If you think that your AJB's COM port doesn't function, you can check it with an oscilloscope, because the instruments serial port sends 10 bytes out on it every time you power on the system.

- 00: 05
- 01: 117
- 02: 112
- 03: version of the boot loader
- 04: version of the software High byte
- 05: version of the software Low byte
- 06: 00
- 07: 00
- 08: 00
- 09: Checksum

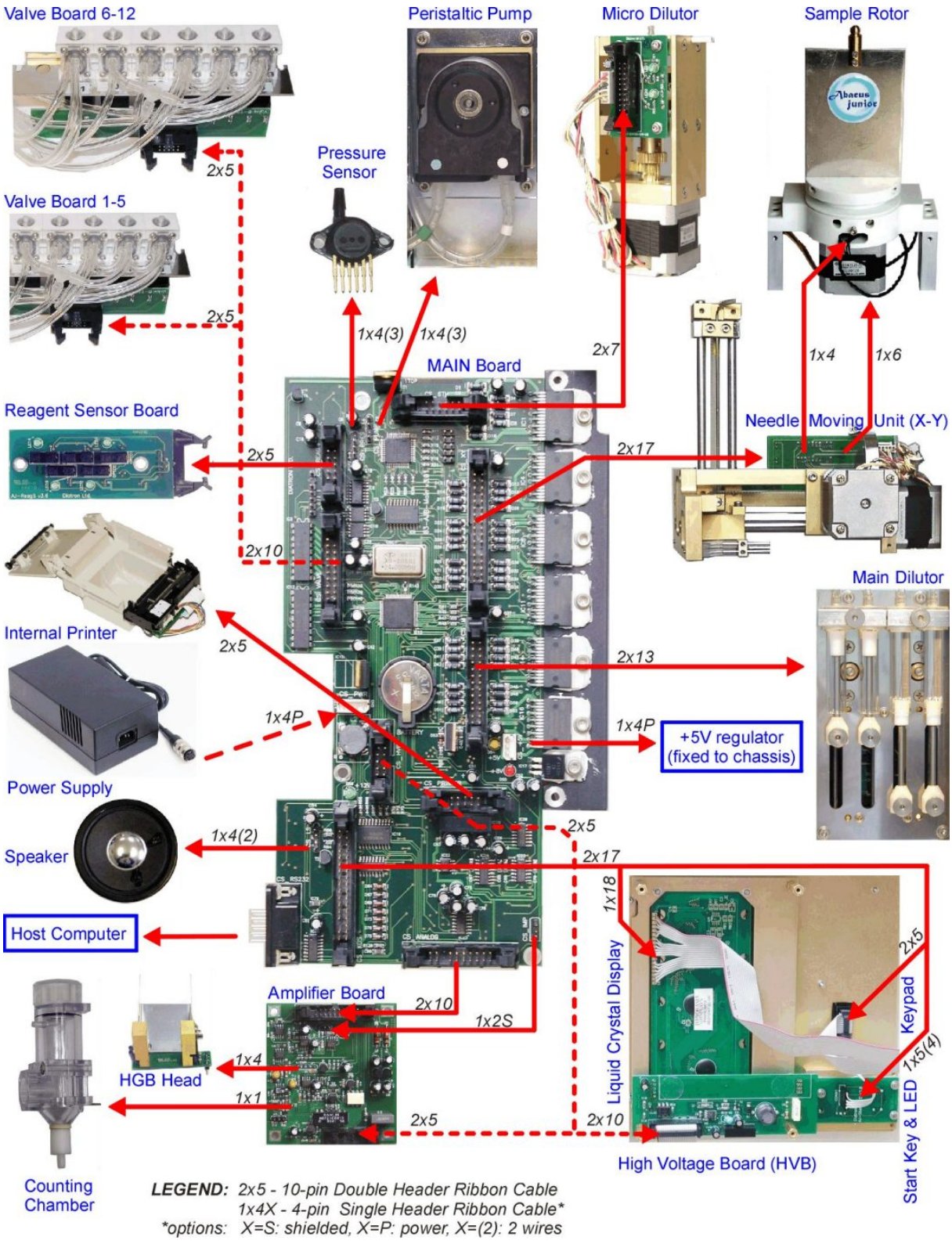
Checksum can be calculated by the following formula:

256- (Low byte of (SUM(00-08 bytes)))

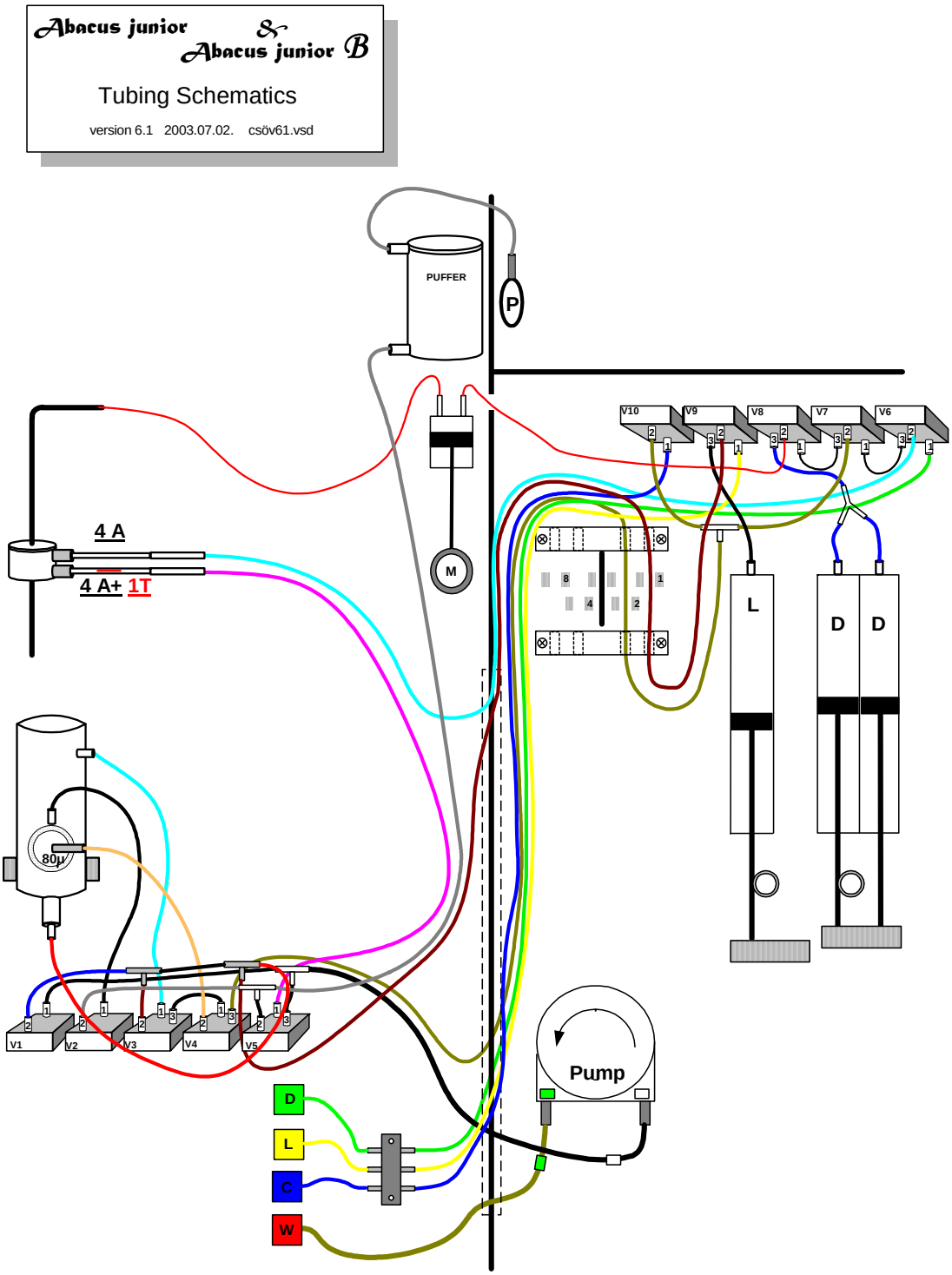
9.4. Abacus junior cabling diagram - AJ/AJvet



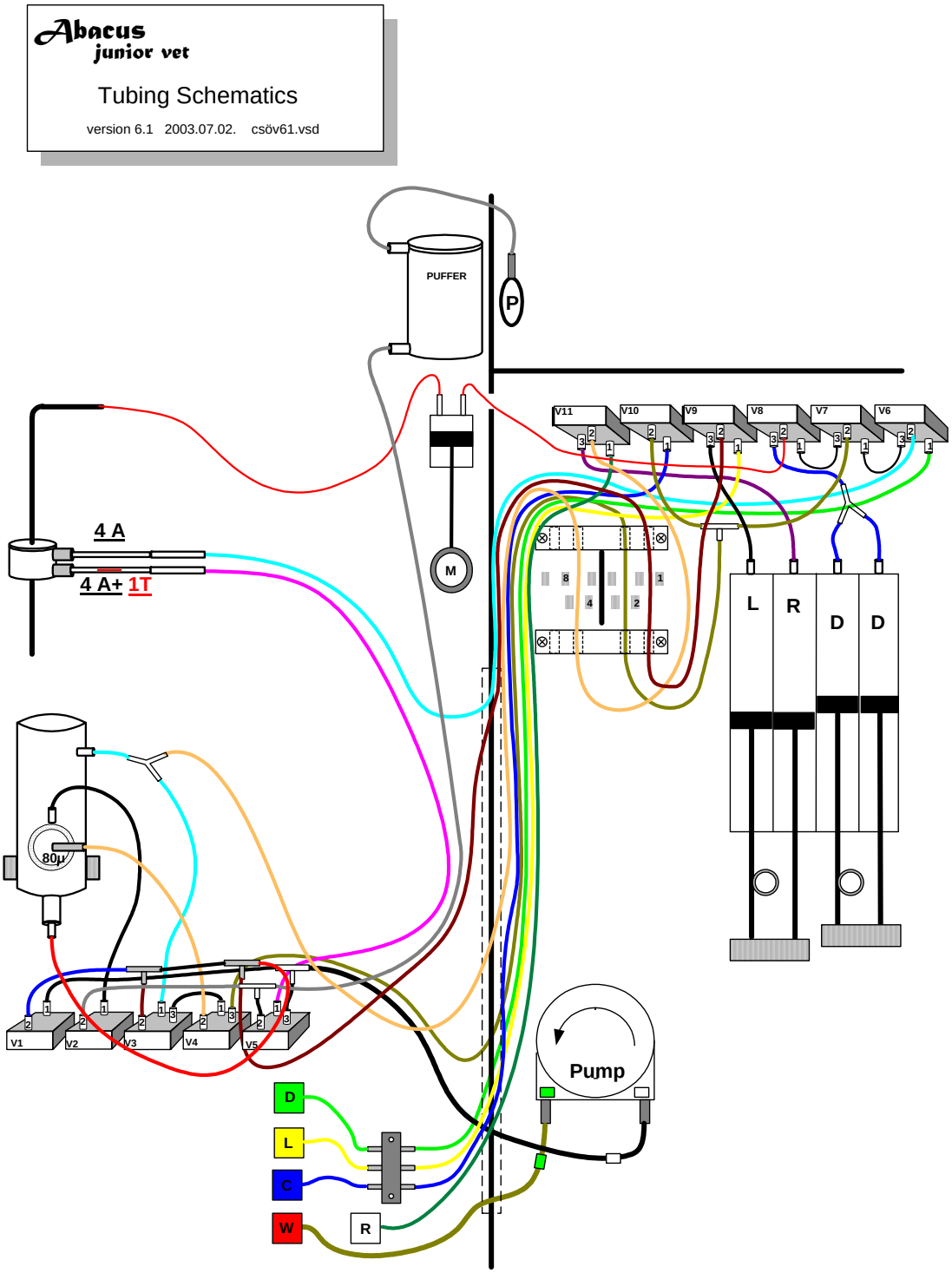
9.5. Abacus junior B cabling diagram - AJB



9.6. Abacus junior / Abacus Junior B tubing schematics - AJ/AJB



9.7. Abacus junior Vet tubing schematics - AJvet



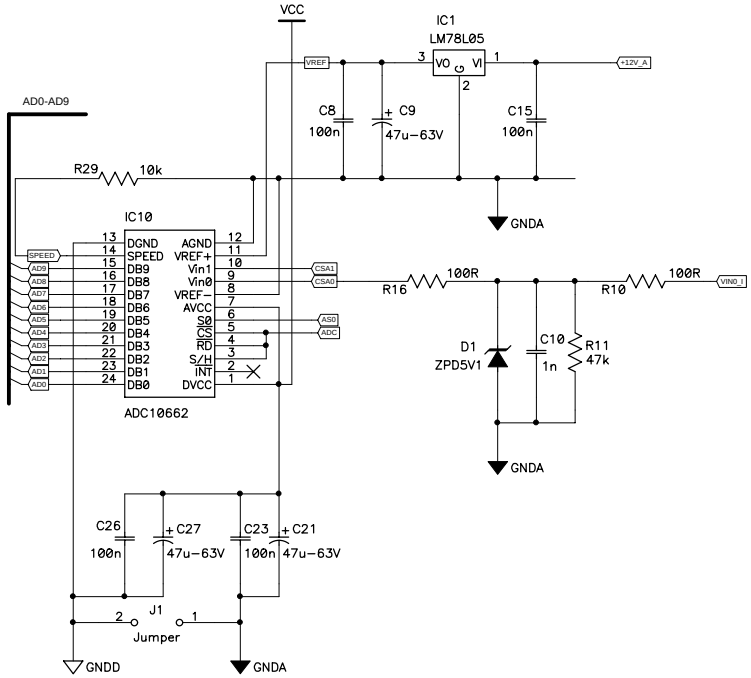
9.8. Recommended kit of tools

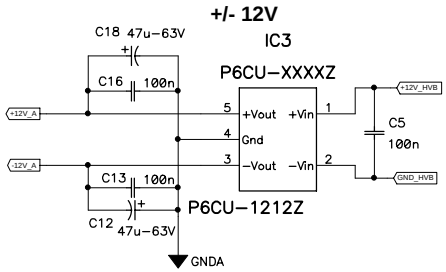
- PC standard keyboard (PS/2)
- Screwdrivers:
  - Cross Slot Screwdrivers (Philips)
  - Slot Screwdrivers
  - Hexagon Screwdrivers (3.5, 2.5, 2.0, 1.5 mm sizes)
- Pocket digital multimeter
- Diagonal Cutter (plier)
- Nipper

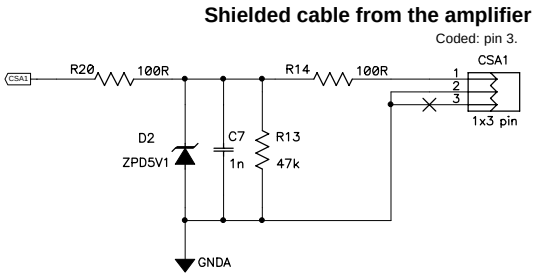
9.9. Electronic schematics

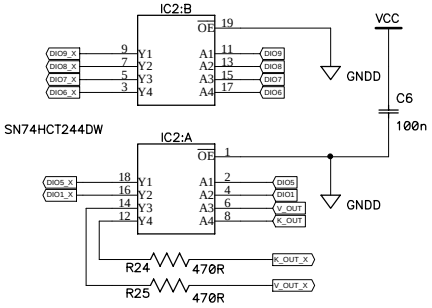
Electronic schematics can be found in the following Appendices (in PDF).

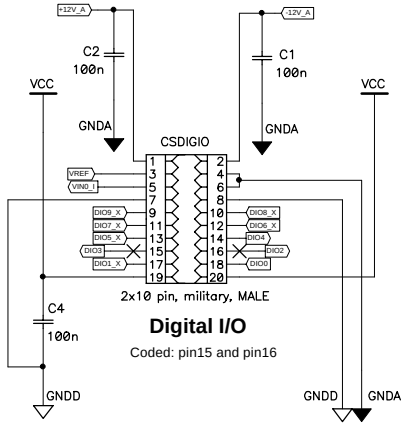
Board name	File name	AJ/AJvet	AJB
COMB board	AJ-Comb_v3.14	x	
PPB board	AJ-PPB_v3.14	x	
IDEEPROM board	AJ-IDBoard_v3.0	x	
Measuring board	AJ-Meas_v3.1	x	x
Dilutor Opto board	AJ-DilOpt2M_v3.1	x	x
Micro Dilutor board	AJ-MicroD_v3.0	x	x
Display board	AJ-DispIC_v3.1	x	
Keypad	AJ-mckeyb_v2.1	x	
Reagent Sensor board	AJ-ReagS_v3.0	x	x
START button and LED	AJ-StartGLED_v3.0	x	x
XYR Opto board	AJ-XYROpto_v3.1	x	x
Valve Module 1-5	AJ-valve_1-5v30	x	x
Valve Module 6-12	AJ-valve_6-12_v31	x	x
Main_v3.01	AJ-Main_v3.01		x





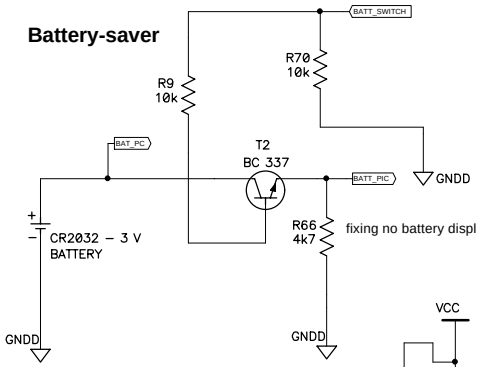


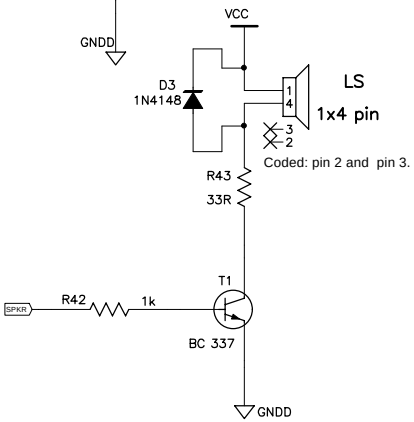


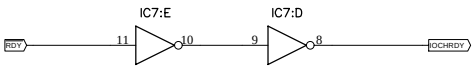


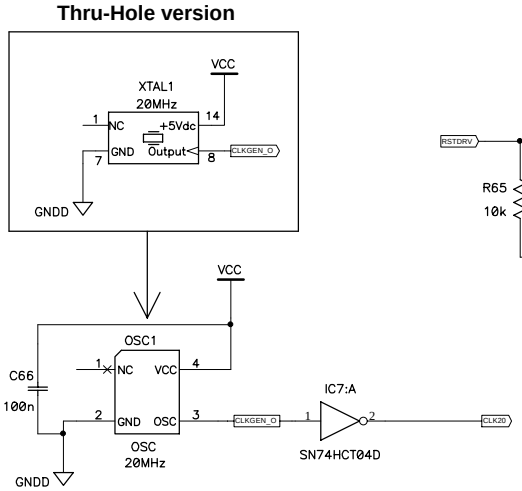
DIO table:

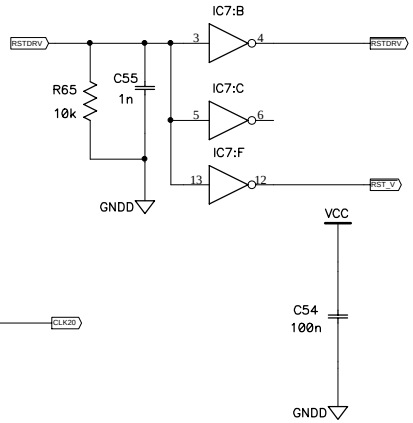
DIO9_X --- HSW
DIO8_X --- CFSW
DIO7_X --- TEST
DIO6_X --- RSW
DIO5_X --- PLS
DIO4 --- DHM
DIO3 --- VMU
DIO2 --- VML
DIO1_X --- MVON
DIO0 --- DHON





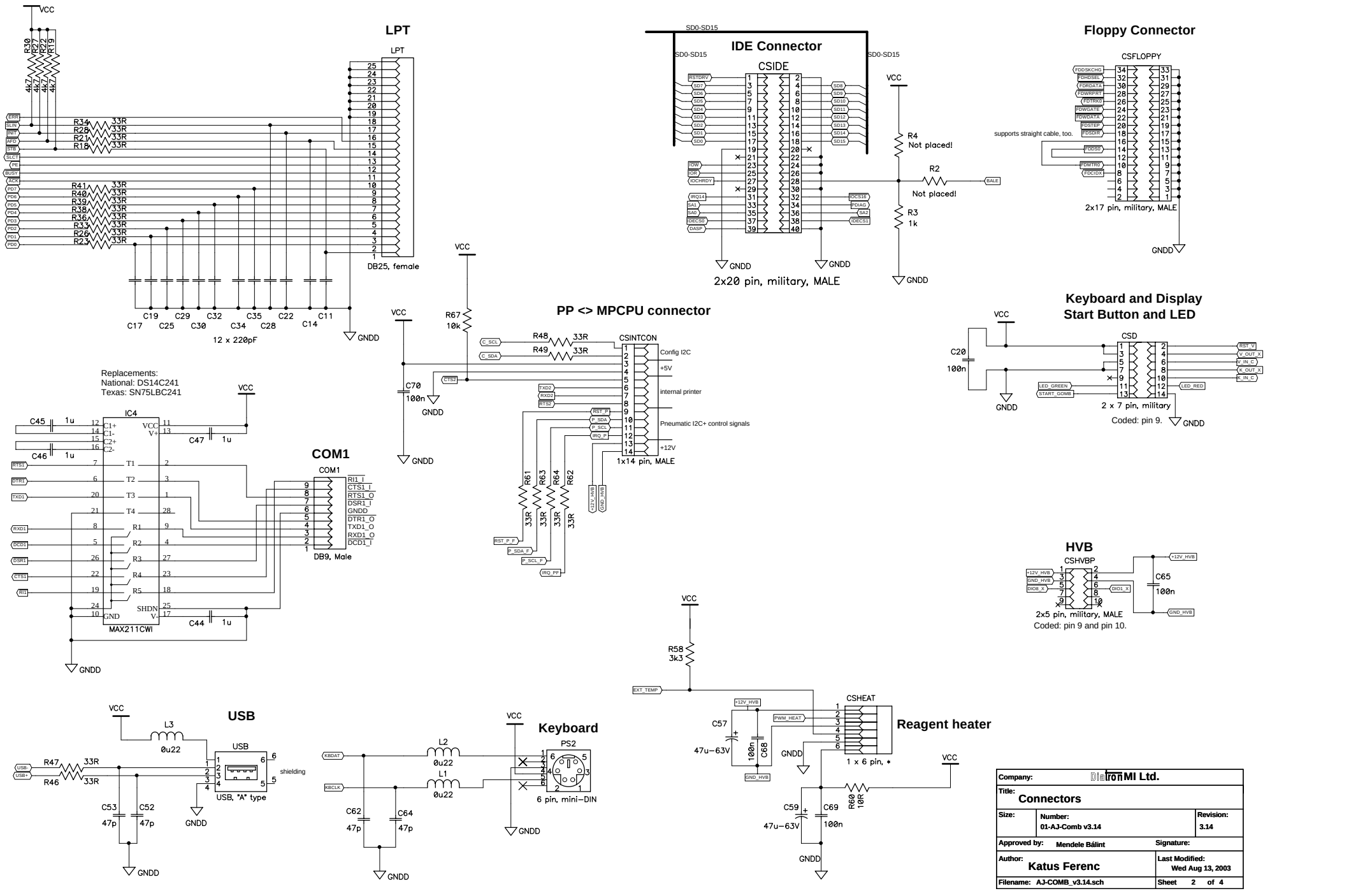


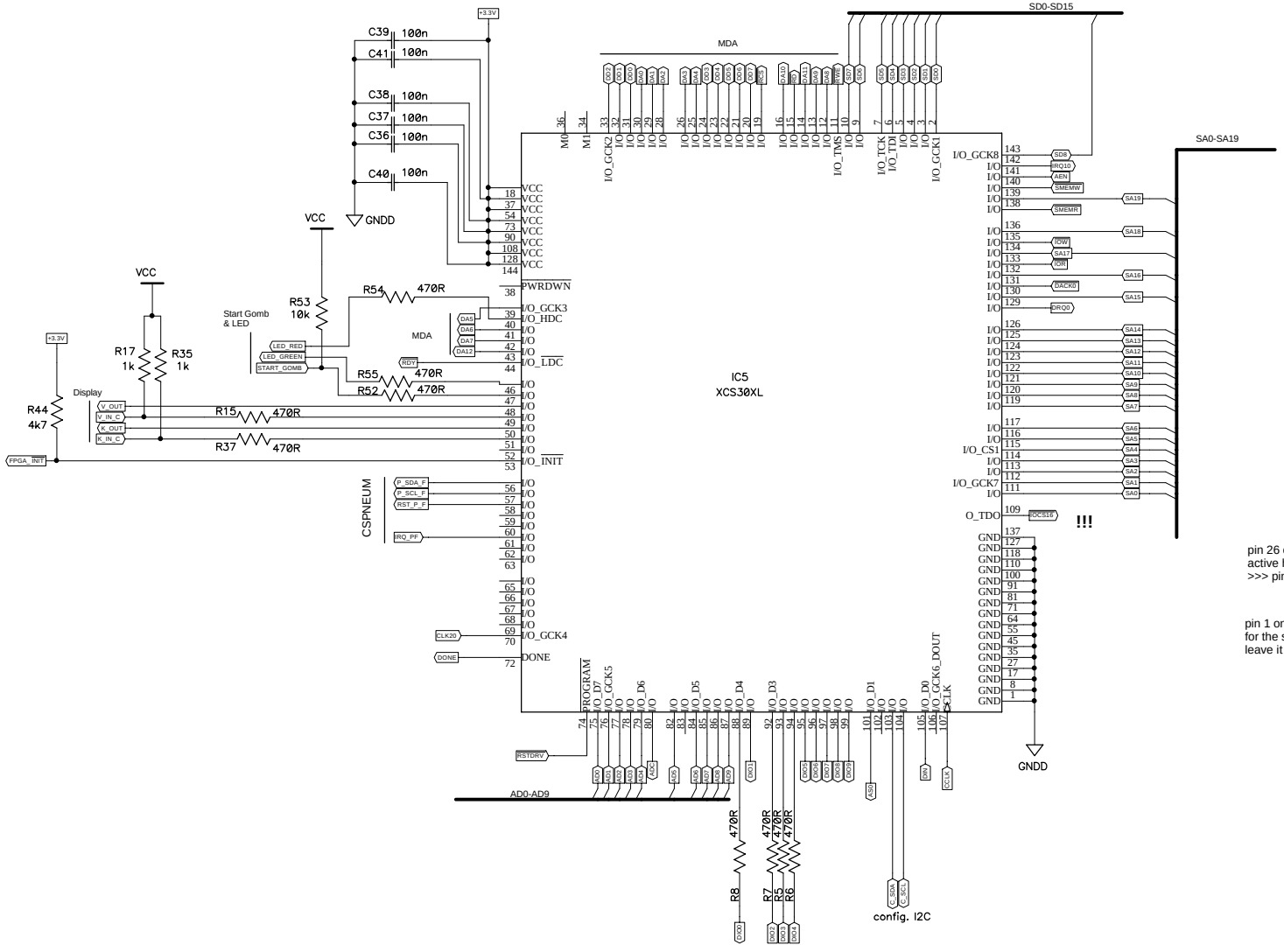




3.13:
R67 added to the #CTS of the INTPRN(COM2)
Some documentational correction
R65 became a pull-down, BEFORE IC7

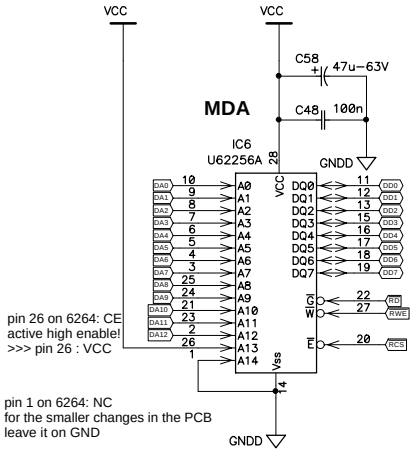
Company:	DigiTron MI Ltd.	
Title:	**Analog section and other circuits**	
Size:	**Number:** 01-AJ-COMB v3.14	**Revision:** 3.14
Approved by:	**Mendele Bálint**	**Signature:**
Author:	**Katus Ferenc**	**Last Modified:** Wed Aug 13, 2003
Filename:	**AJ-COMB_v3.14.sch**	**Sheet** 1 of 4

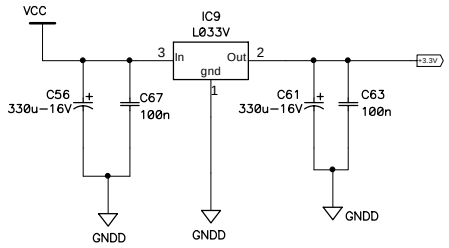

LPT
LPT
DB25, female
12 x 220pF
IDE Connector
CSIDE
2x20 pin, military, MALE
Floppy Connector
CSFLOPPY
supports straight cable, too.
2x17 pin, military, MALE
PP <> MPCPU connector
CSINTCON
Config I2C
+5V
internal printer
Pneumatic I2C+ control signals
+12V
1x14 pin, MALE
Keyboard and Display
Start Button and LED
CSD
2 x 7 pin, military
Coded: pin 9.
Replacements:
National: DS14C241
Texas: SN75LBC241
IC4
MAX211CWI
COM1
DB9, Male
HVB
CSHVBP
2x5 pin, military, MALE
Coded: pin 9 and pin 10.
USB
USB, "A" type
shielding
Keyboard
PS2
6 pin, mini-DIN
Reagent heater
CSHEAT
1 x 6 pin, *
R4
Not placed!
R2
Not placed!
R3
1k
R58
3k3
R67
10k
R60
10R
Company: DigitronMI Ltd.
Title: Connectors
Size:
Number: 01-AJ-Comb v3.14
Revision: 3.14
Approved by: Mendele Bálint
Signature:
Author: Katus Ferenc
Last Modified: Wed Aug 13, 2003
Filename: AJ-COMB_v3.14.sch
Sheet 2 of 4



pin 26 on 6264: CE active high enable!
>>> pin 26 : VCC

pin 1 on 6264: NC
for the smaller changes in the PCB leave it on GND

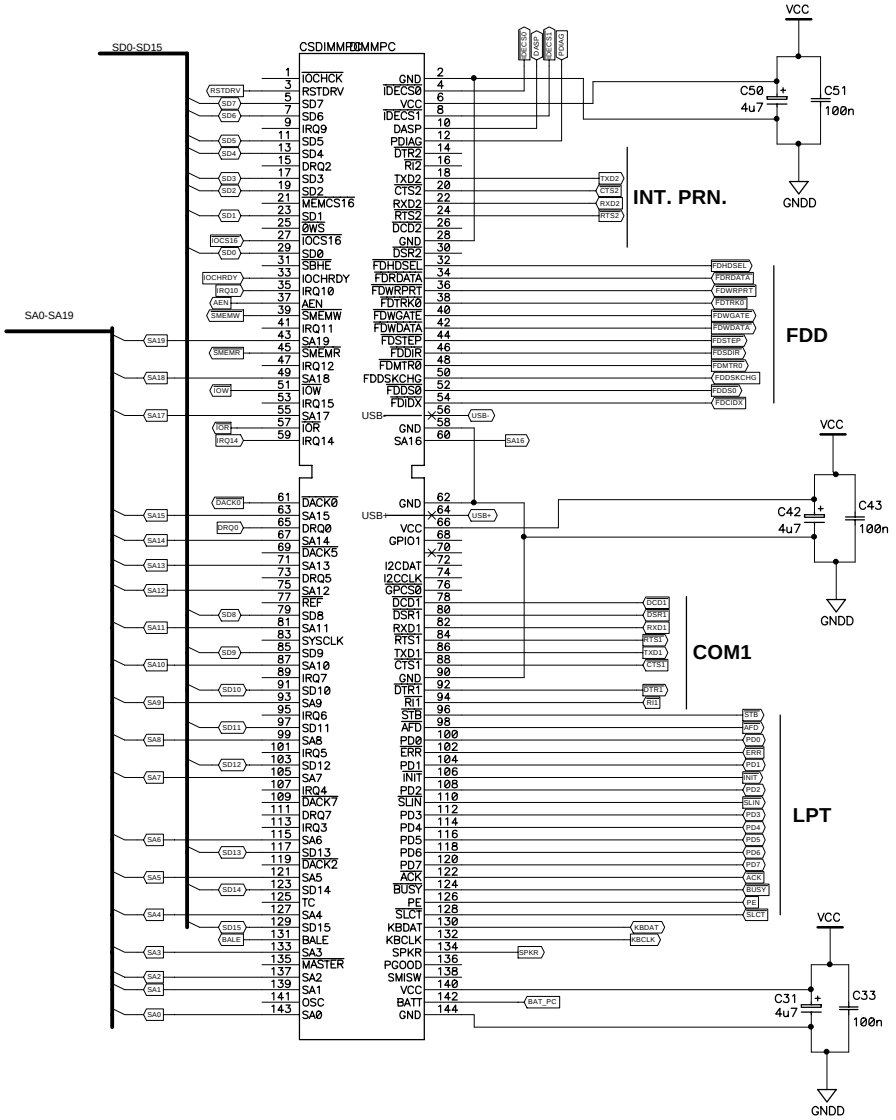




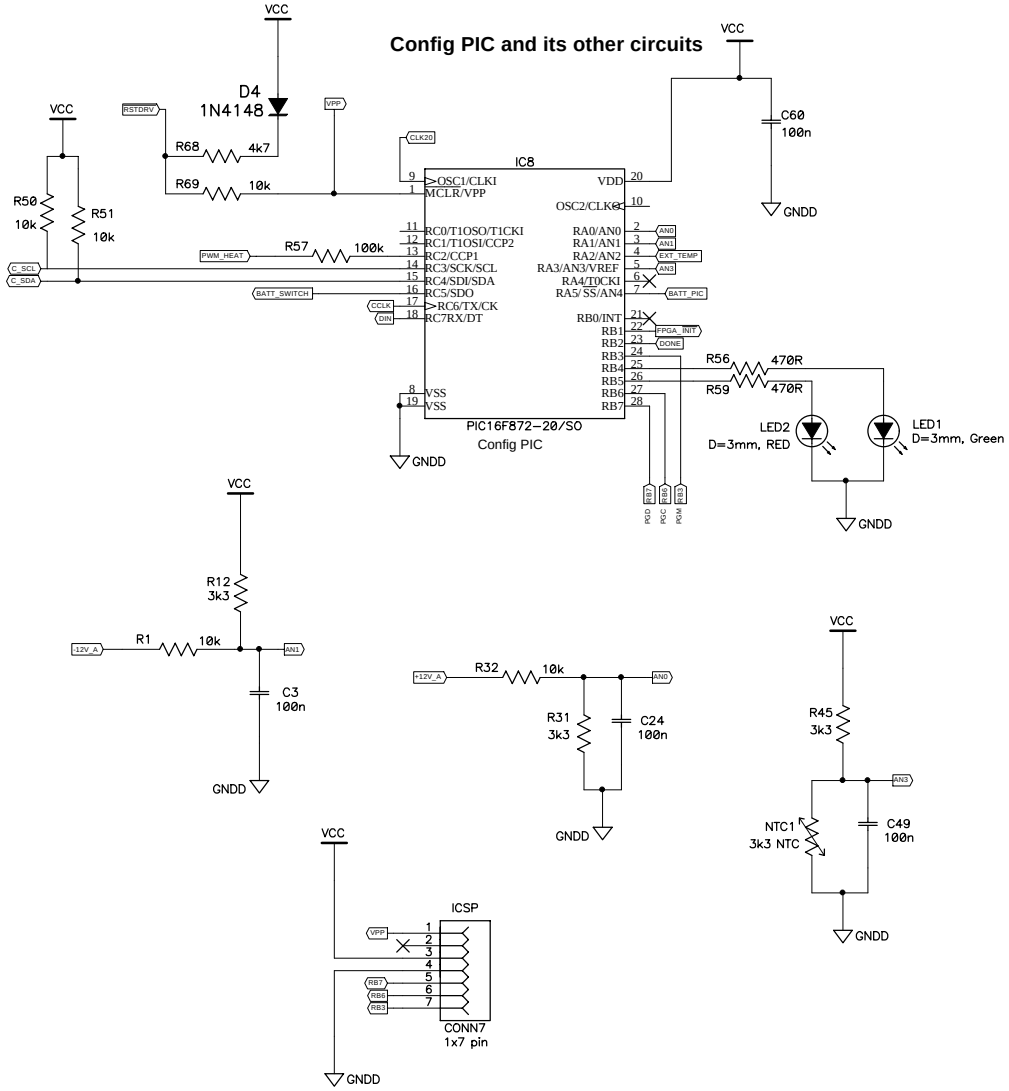
DIO9_X --- HSW
DIO8_X --- CFSW
DIO7_X --- TEST
DIO6_X --- RSW
DIO5_X --- PLS
DIO4 --- DHM
DIO3 --- VMU
DIO2 --- VML
DIO1_X --- MVON
DIO0 --- DHON

Company:	DigitronMI Ltd.	
Title:	**FPGA and MDA chip**	
Size:	**Number:** 01-AJ-Comb v3.14	**Revision:** 3.14
Approved by:	Mendele Bálint	**Signature:**
Author:	**Katus Ferenc**	**Last Modified:** Wed Aug 13, 2003
Filename:	AJ-COMB_v3.14.sch	**Sheet** 3 of 4

Dimm Socket

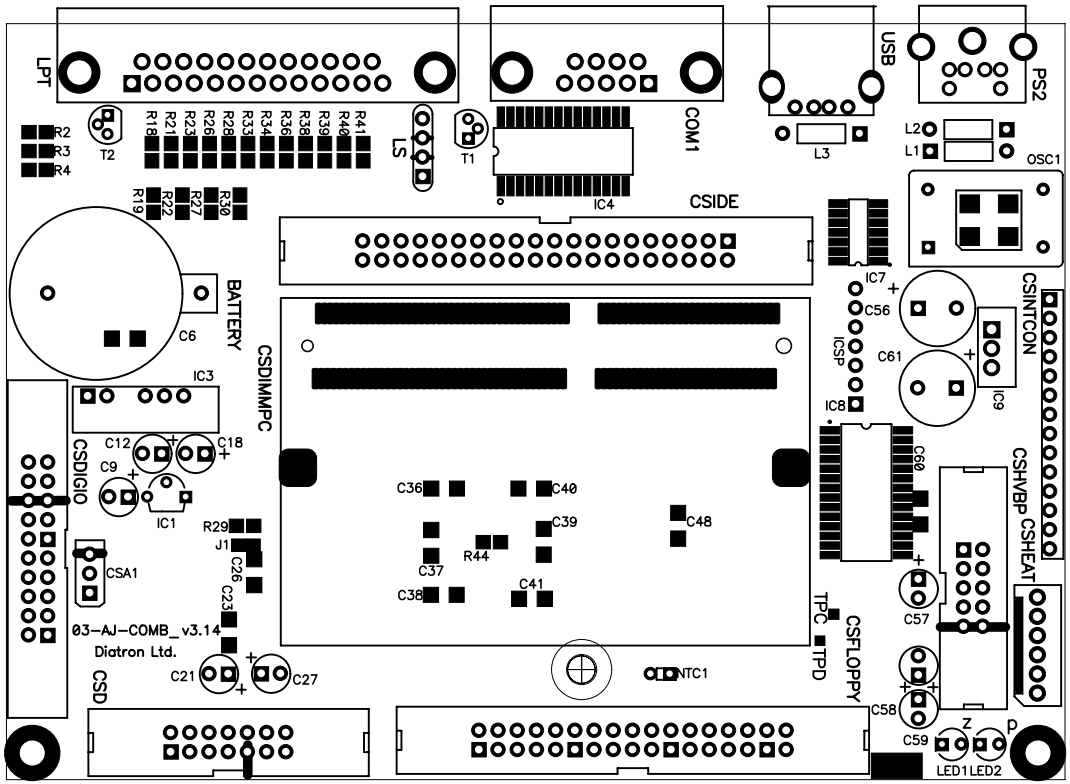


Config PIC and its other circuits

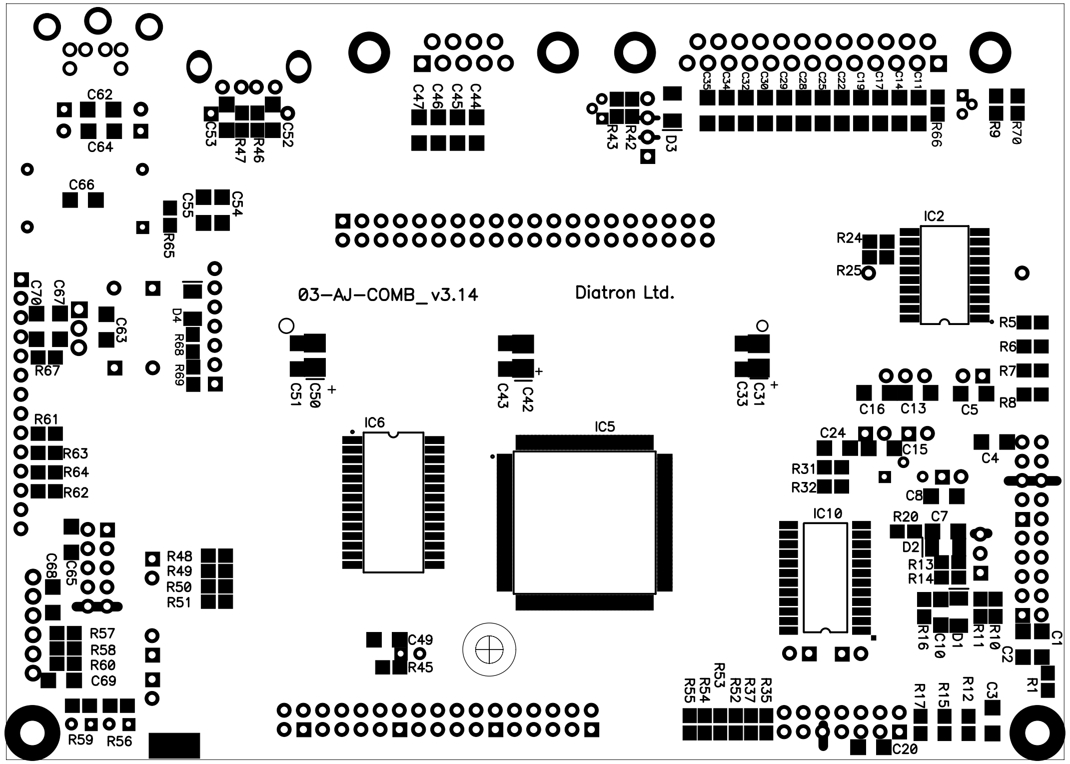


3.13:
ICSP connector and protecting (from VPP) circuit added

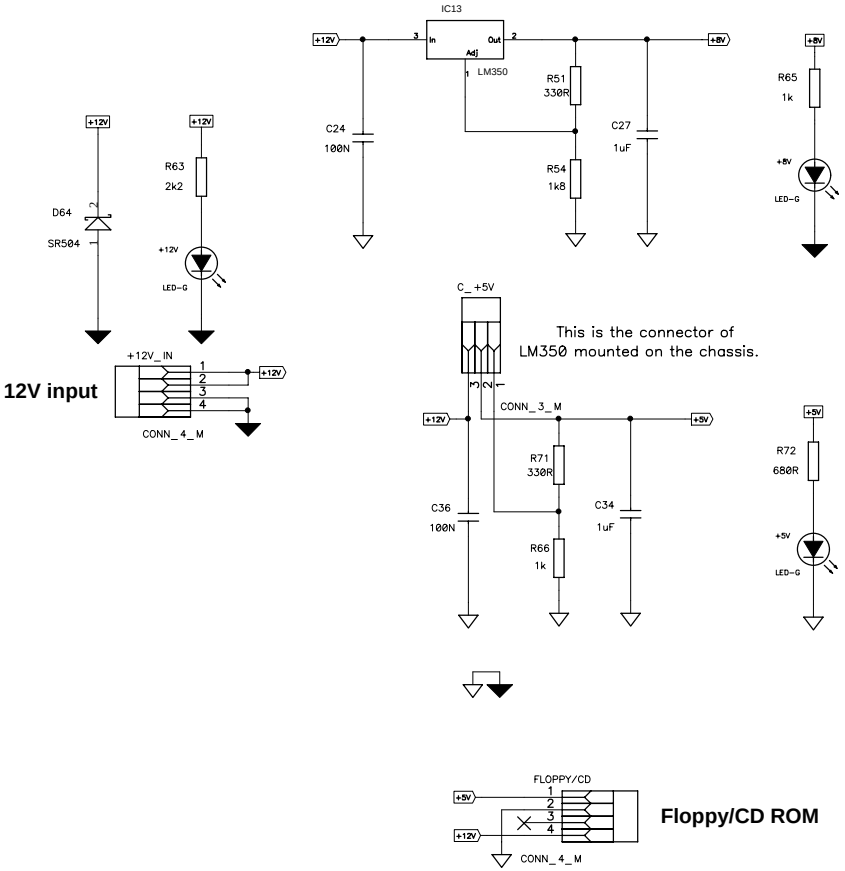
Company:	Dimm MI Ltd.	
Title:	DimmPC and the Config PIC	
Size:	Number: 01-AJ-Comb v3.14	Revision: 3.14
Approved by: Mendele Bálint		Signature:
Author: Katus Ferenc		Last Modified: Wed Aug 13, 2003
Filename: AJ-COMB_v3.14.sch		Sheet 4 of 4



Company:	Diatron MI Ltd.	
Title:	Abacus Jnr. - Control and Measurement Board v3.14	
	Drawing Number: 03-AJ-COMB_v3.14	Revision: 3.14
Approved by: Mendele Bálint	Signature:	
Author: Katus Ferenc		Modified: Wed Aug 13, 2003
File name: AJ-COMB_v3.14.pcb		Layer: Top Silk



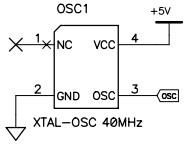
Company: Diatron MI Ltd.		
Title: Abacus Jnr. – Control and Measurement Board v3.14		
	Drawing Number: 03-AJ-COMB_v3.14	Revision: 3.14
Approved by: Mendele Balint	Signature:	
Author: Katus Ferenc	Modified: Wed Aug 13, 2003	
File name: AJ-COMB_v3.14.pcb	Layer: Bot Silk	

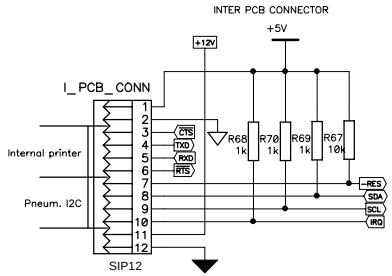


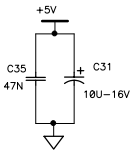
12V input

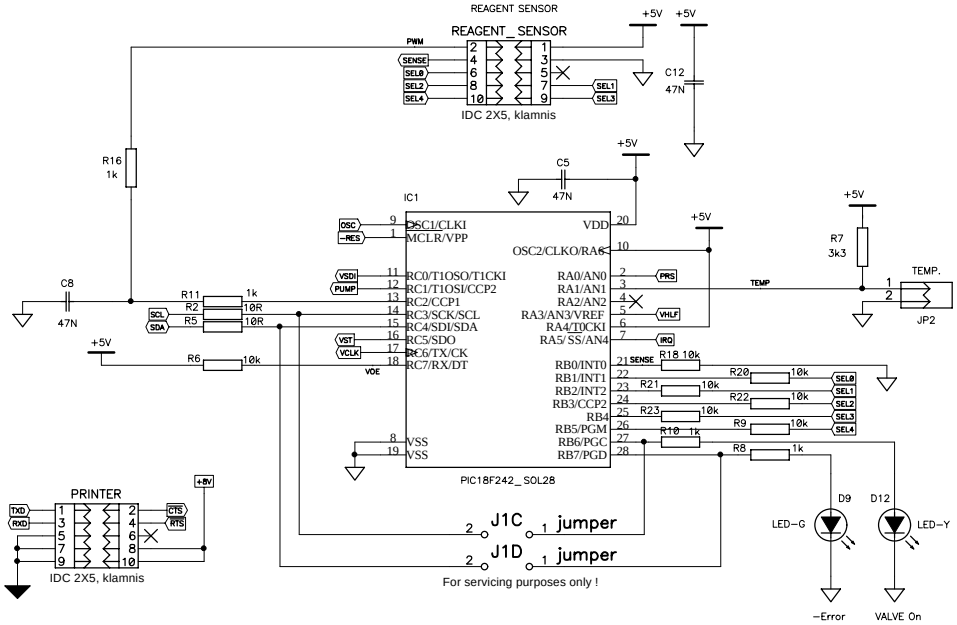
Floppy/CD ROM

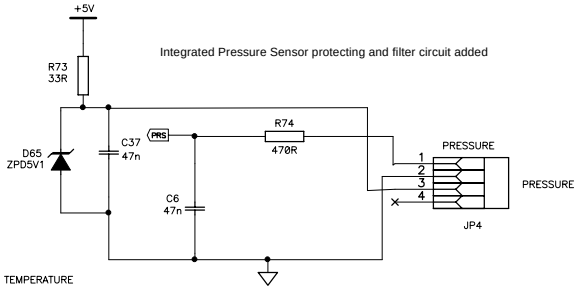
Company: Diatron Ltd.		
Title: Power Supply		
Size:	**Number:** 03-AJ-PPB v3.14	**Revision:** 3.14
Approved by: Gyetvai Árpád		**Signature:**
Author: Nagy István		**Date:** Tue Aug 26, 2003
Filename: PPB v3.14.sch		**Sheet** 1 of 4

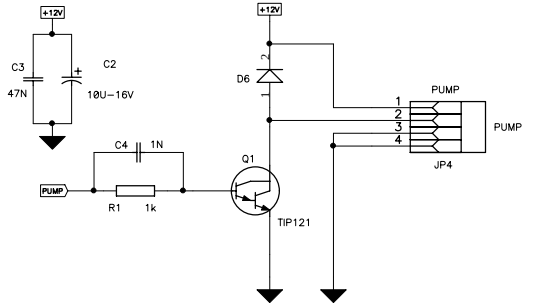




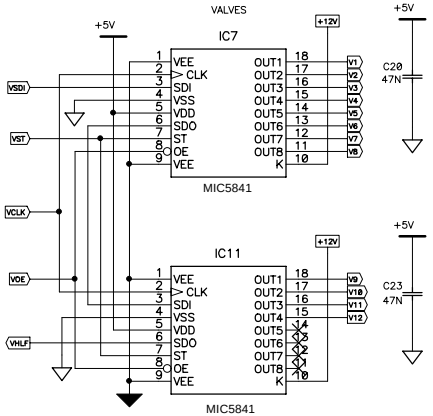


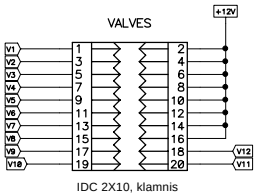


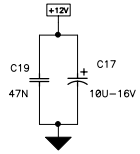




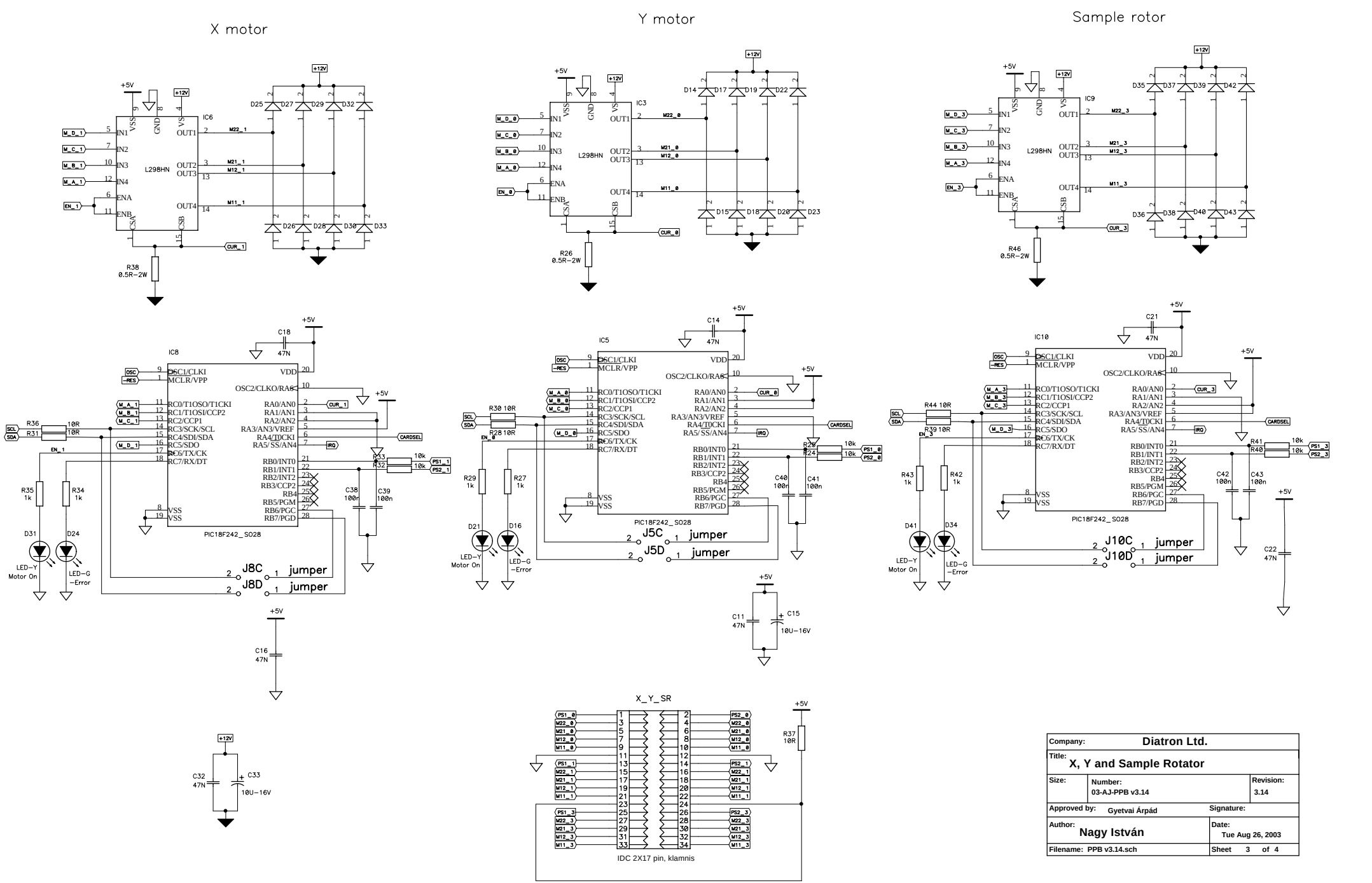
Pin 3 is not used, it is connected to ground for the sake of easier routing on the PCB.

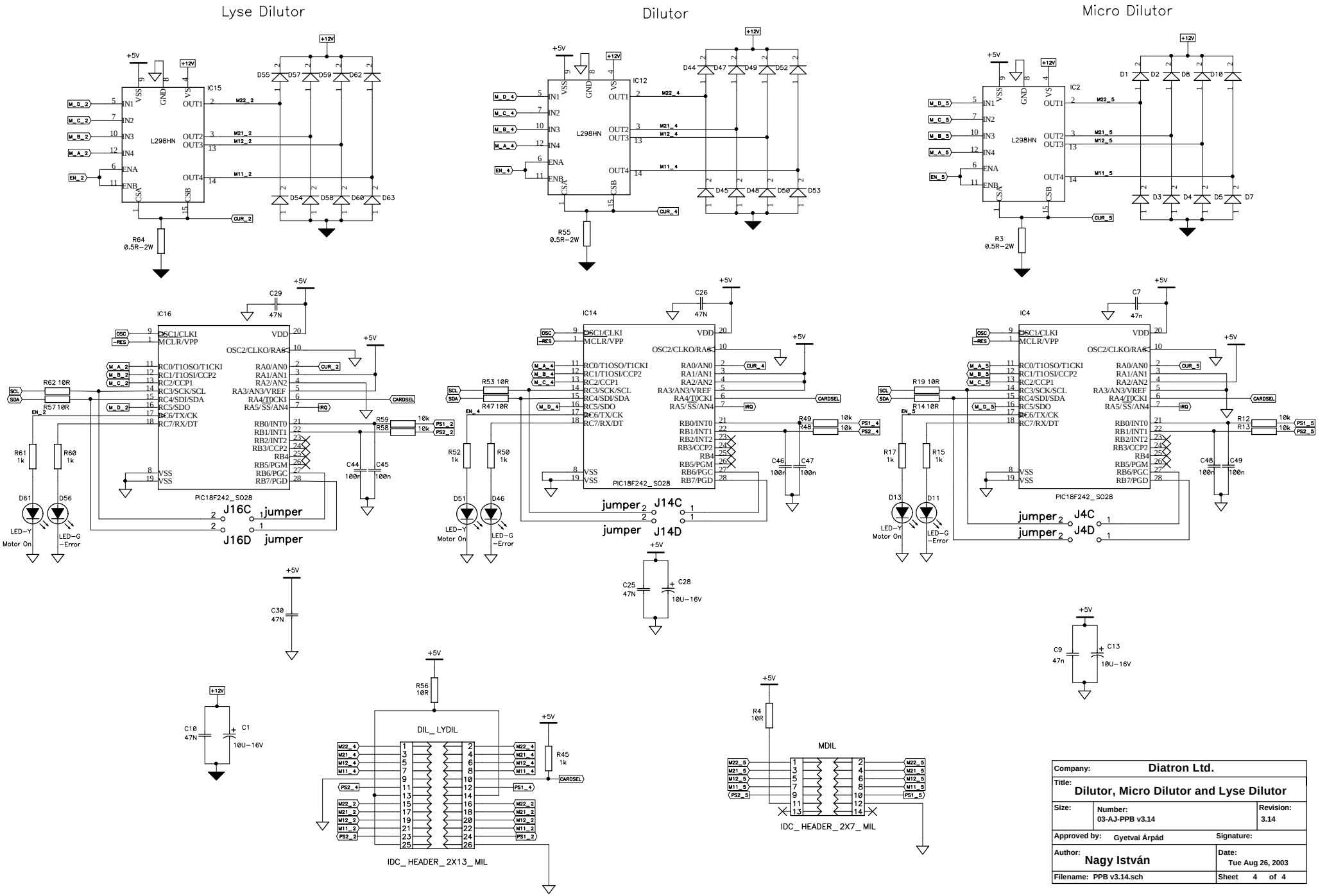


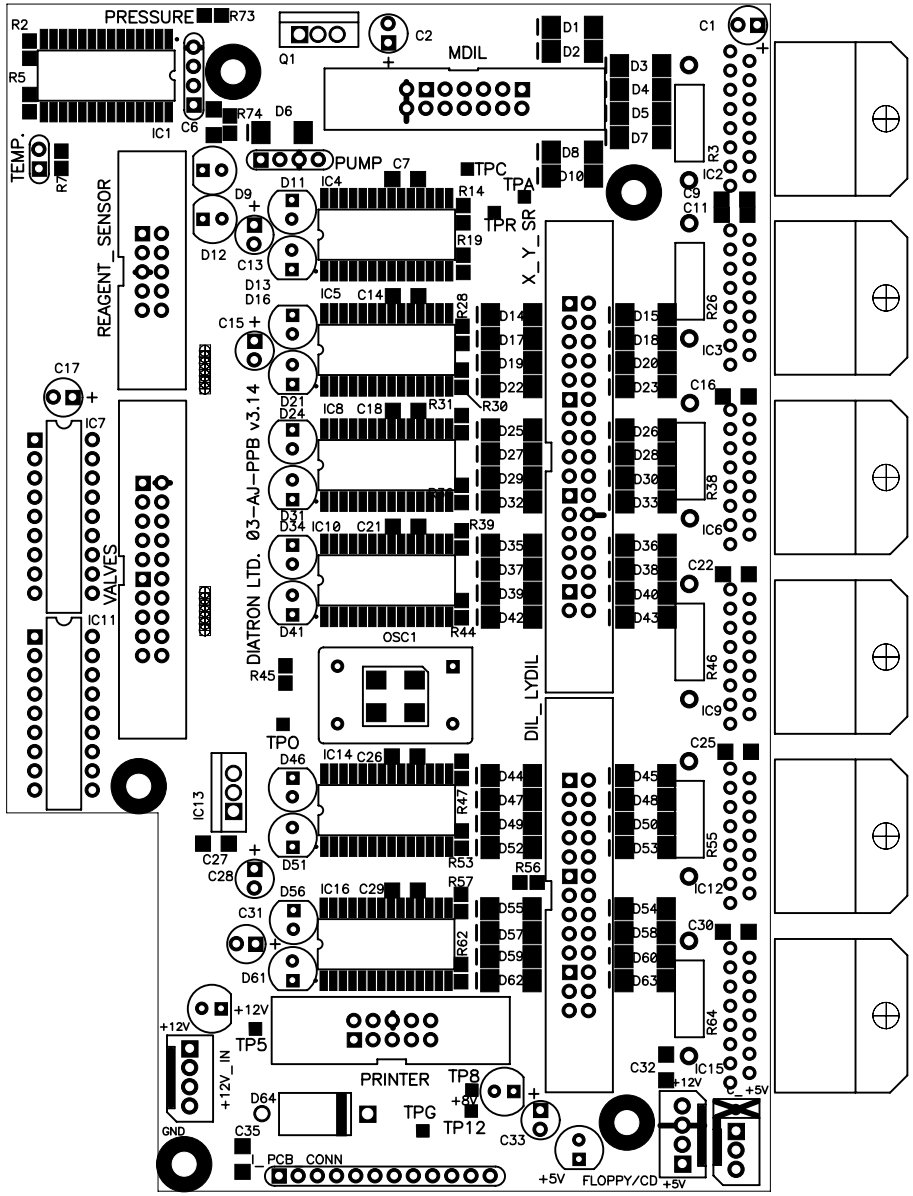




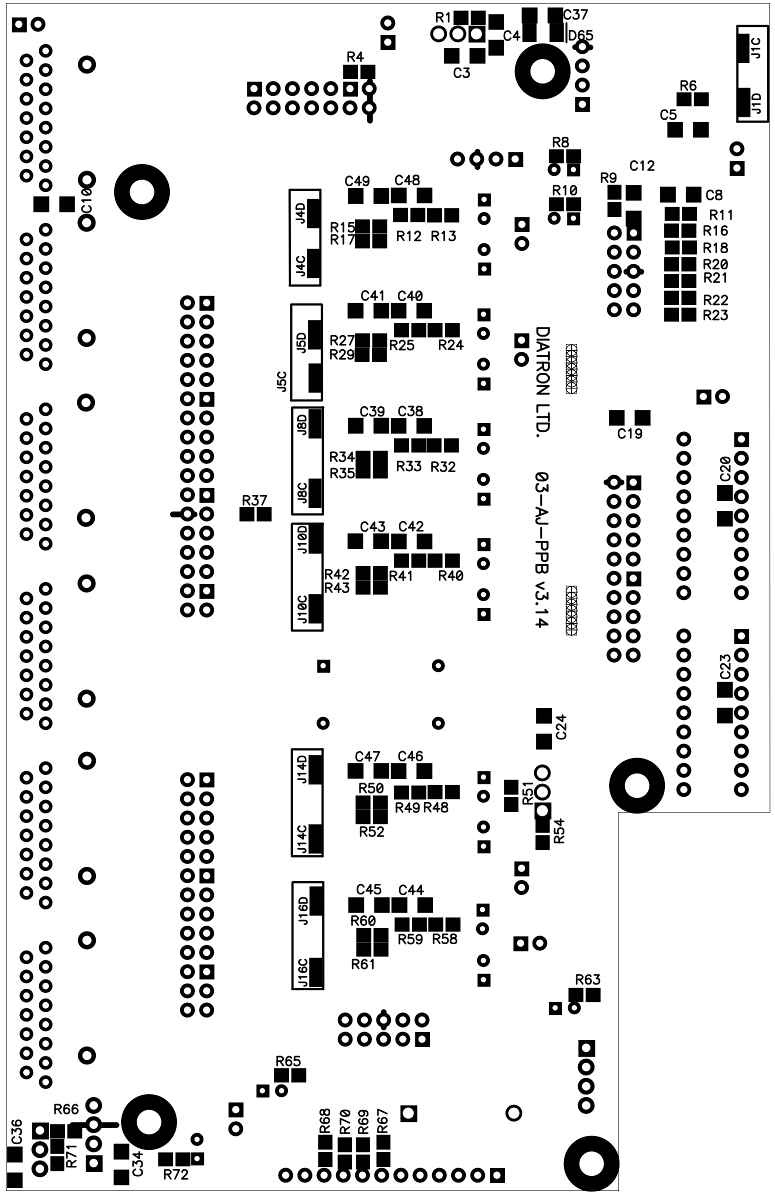
Company: Diatron Ltd.		
Title: Valves, Sensors and Connectors		
Size:	Number: 03-AJ-PPB v3.14	Revision: 3.14
Approved by: Gyetvai Árpád		Signature:
Author: Nagy István		Date: Tue Aug 26, 2003
Filename: PPB v3.14.sch		Sheet 2 of 4


X motor
Y motor
Sample rotor
L298HN
IC6
IC3
IC9
IC8
IC5
IC10
PIC18F242_SO28
J8C jumper
J8D jumper
J5C jumper
J5D jumper
J10C jumper
J10D jumper
X_Y_SR
IDC 2X17 pin, klamnis
LED-Y Motor On
LED-G -Error
Company: Diatron Ltd.
Title: X, Y and Sample Rotator
Size:
Number: 03-AJ-PPB v3.14
Revision: 3.14
Approved by: Gyetvai Árpád
Signature:
Author: Nagy István
Date: Tue Aug 26, 2003
Filename: PPB v3.14.sch
Sheet 3 of 4

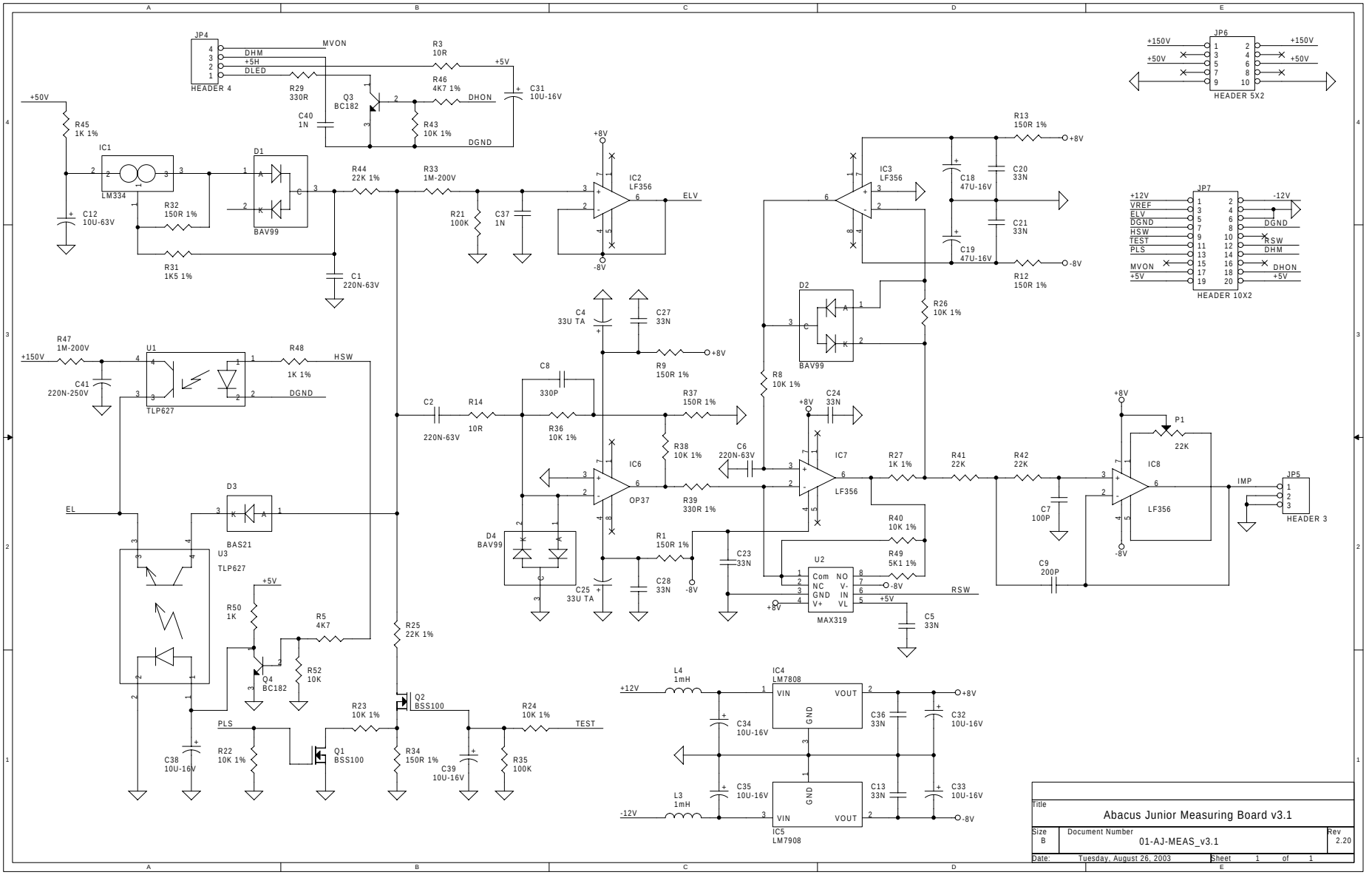

Lyse Dilutor
Dilutor
Micro Dilutor
L298HN
PIC18F242_SO28
IDC_HEADER_2X13_MIL
IDC_HEADER_2X7_MIL
DIL_LYDIL
MDIL
J16C jumper
J16D jumper
J14C jumper
J14D jumper
J4C jumper
J4D jumper
LED-Y Motor On
LED-G -Error
Company: Diatron Ltd.
Title: Dilutor, Micro Dilutor and Lyse Dilutor
Size:
Number: 03-AJ-PPB v3.14
Revision: 3.14
Approved by: Gyetvai Árpád
Signature:
Author: Nagy István
Date: Tue Aug 26, 2003
Filename: PPB v3.14.sch
Sheet 4 of 4

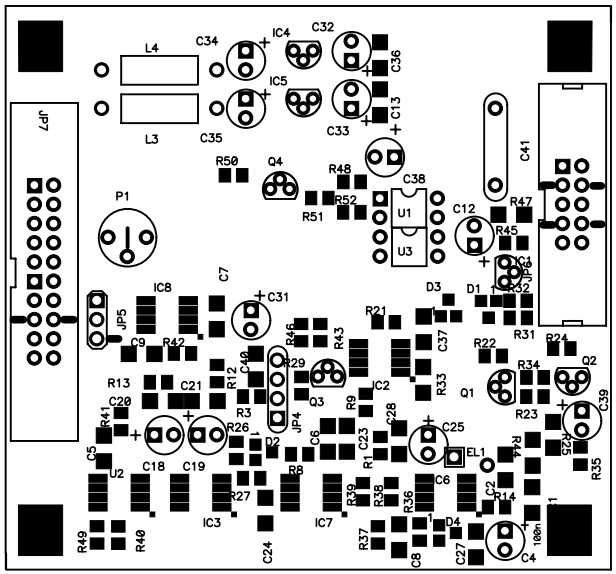


Company:	**Diatron Ltd.**	
Title:	AJ-Pneumatic and Power Board v3.14	
	Drawing Number: 03-AJ-PPB v3.14	Revision: 3.14
Approved by: Mendele Bálint	Signature:	
Author: Nagy István		Modified: Thu Aug 14, 2003
File name: PPB_v3.14.pcb		Layer: Top Silk

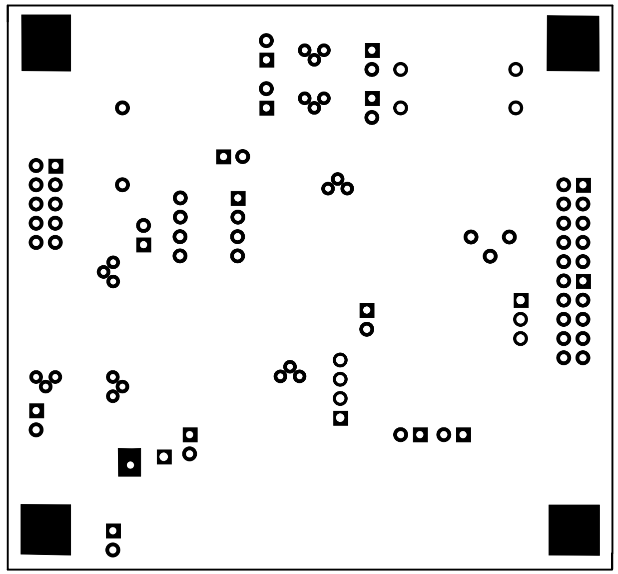


Company:	Diatron Ltd.
Title:	AJ-Pneumatic and Power Board v3.14
Drawing Number:	03-AJ-PPB v3.14
Revision:	3.14
Approved by:	Mendele Balint
Signature:	
Author:	Nagy Istvan
Modified:	Thu Aug 14, 2003
File name:	PPB v3.14.pcb
Layer:	Bot Silk

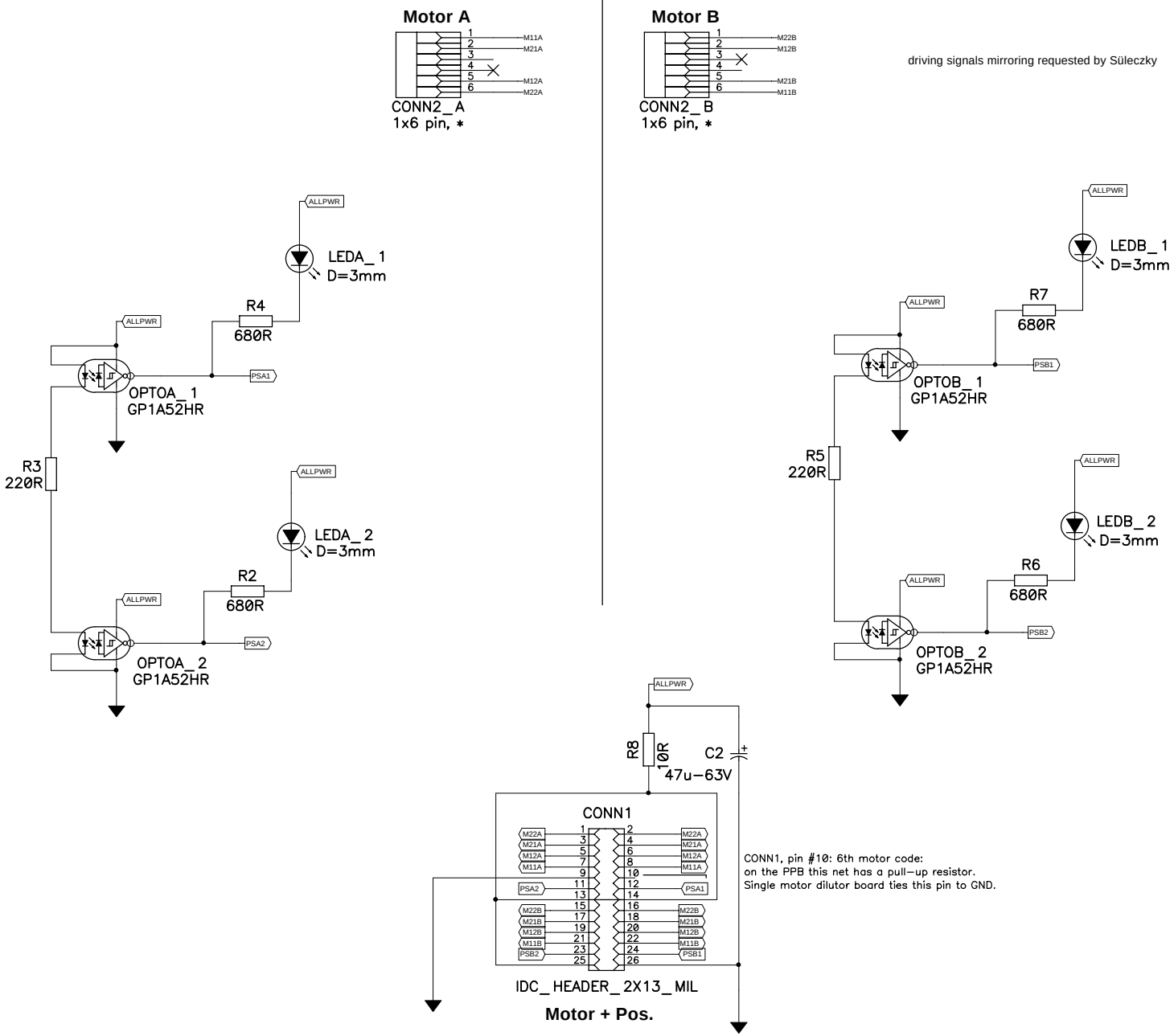

JP4
HEADER 4
DHM
+5H
DLED
MVON
R3 10R
+5V
R46 4K7 1%
DHON
R43 10K 1%
DGND
R29 330R
Q3 BC182
C40 1N
C31 10U-16V
+50V
R45 1K 1%
IC1
LM334
R32 150R 1%
R31 1K5 1%
C12 10U-63V
D1
BAV99
C1 220N-63V
R44 22K 1%
R33 1M-200V
R21 100K
C37 1N
IC2 LF356
+8V
-8V
ELV
JP6
HEADER 5X2
+150V
+50V
IC3 LF356
C18 47U-16V
C19 47U-16V
C20 33N
C21 33N
R13 150R 1%
R12 150R 1%
JP7
HEADER 10X2
+12V
VREF
ELV
DGND
HSW
TEST
PLS
MVON
+5V
-12V
RSW
DHM
DHON
R47 1M-200V
U1
TLP627
R48 1K 1%
HSW
C41 220N-250V
D2
BAV99
R26 10K 1%
R8 10K 1%
C4 33U TA
C27 33N
R9 150R 1%
C8 330P
C2 220N-63V
R14 10R
R36 10K 1%
R37 150R 1%
R38 10K 1%
C6 220N-63V
IC6 OP37
IC7 LF356
C24 33N
R27 1K 1%
R41 22K
R42 22K
P1 22K
IC8 LF356
IMP
JP5
HEADER 3
C7 100P
C9 200P
R40 10K 1%
R49 5K1 1%
U2
MAX319
Com NO
NC V-
GND IN
V+ VL
RSW
C5 33N
D3
BAS21
EL
U3
TLP627
R50 1K
R5 4K7
Q4 BC182
R52 10K
R25 22K 1%
Q2 BSS100
R23 10K 1%
R24 10K 1%
TEST
PLS
R22 10K 1%
Q1 BSS100
R34 150R 1%
C39 10U-16V
R35 100K
C38 10U-16V
D4 BAV99
R1 150R 1%
C23 33N
C25 33U TA
C28 33N
L4 1mH
L3 1mH
IC4 LM7808
IC5 LM7908
VIN
VOUT
GND
C34 10U-16V
C35 10U-16V
C36 33N
C13 33N
C32 10U-16V
C33 10U-16V
+12V
-12V
Title
Abacus Junior Measuring Board v3.1
Size B
Document Number
01-AJ-MEAS_v3.1
Rev 2.20
Date: Tuesday, August 26, 2003
Sheet 1 of 1



Company:	Diatron MI Ltd.	
Title:	Abacus Junior Measuring Board v3.1	
	Drawing Number: 01-AJ-MEAS_V3.1	Revision: 3.1
Approved by: Gyetvai Árpád	Signature:	
Author: Fábián György	Modified: Mon Aug 11, 2003	
File name: AJ-MEAS_v3.1.pcb	Layer: Top Silk	

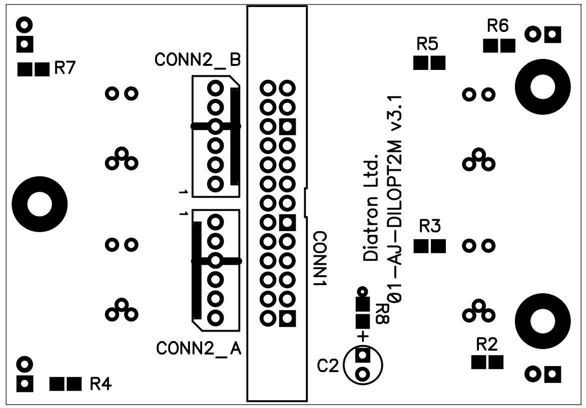


Company: Diatron MI Ltd.		
Title: Abacus Junior Measuring Board v3.1		
	Drawing Number: 01-AJ-MEAS_V3.1	Revision: 3.1
Approved by: Gyetvai ┬rpßd	Signature:	
Author: Fabian Gy÷rgy	Modified: Mon Aug 11, 2003	
File name: AJ-MEAS_v3.1.pcb	Layer: Bot Silk	

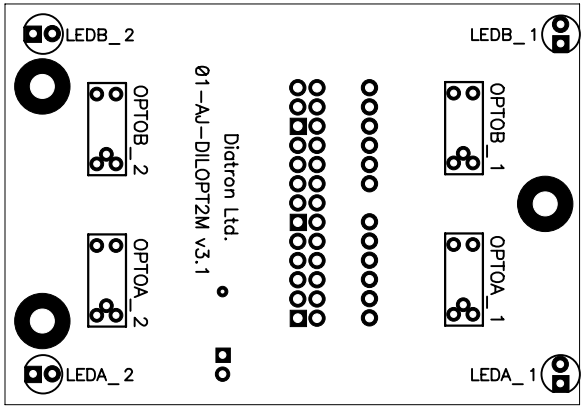


Revision History (GyA)
V1.0 -> V3.1:
1. CONN1-25 was tied to GND, changed now tied to VCC (because of PPB) !
2. LEDB_1 and LEDB_2 name exchange !

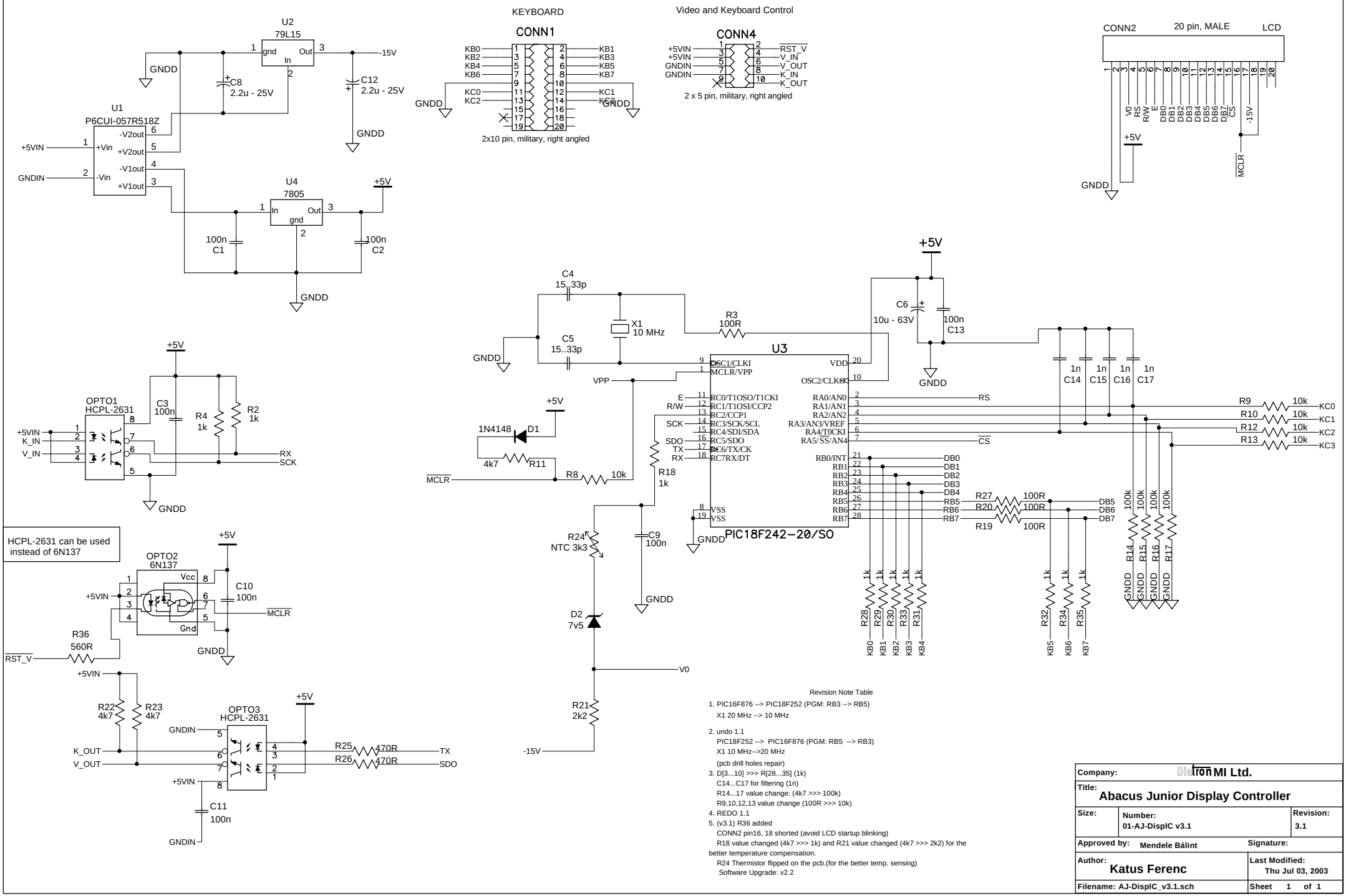
Company:	DistroMI Ltd.	
Title:	AJ Dilutor Opto Board for 2 motors	
Size:	Number: 01-AJ-DILOPT2M v3.1	Revision: 3.1
Approved by: Gyetvai Árpád	Signature:	
Author: Katus Ferenc	Last Modified: Tue Jul 15, 2003	
Filename: AJ-Dilopt2M_v3.1.sch	Sheet 1 of 1	



Company:	Diatron MI Ltd.
Title:	AJ Dilutor Opto Board for 2 motors
Drawing Number:	01-AJ-DILOPT2M v3.1
Revision:	3.1
Approved by:	Gyetvai ┴rpad
Signature:	
Author:	Katus Ferenc
Modified:	Mon Aug 04, 2003
File name:	AJ-Dilopt2M v3.1.pcb
Layer:	Bot Silk



Company: Diatron MI Ltd.		
Title: AJ Dilutor Opto Board for 2 motors		
	Drawing Number: 01-AJ-DILOPT2M v3.1	Revision: 3.1
Approved by: Gyetvai Árpád	Signature:	
Author: Katus Ferenc	Modified: Mon Aug 04, 2003	
File name: AJ-Dilopt2M_v3.1.pcb	Layer: Top Silk	

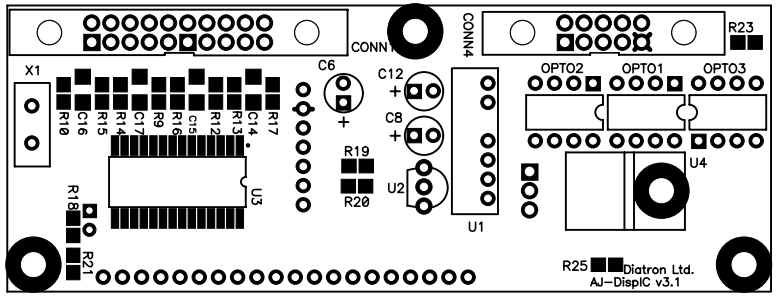


Revision Note Table

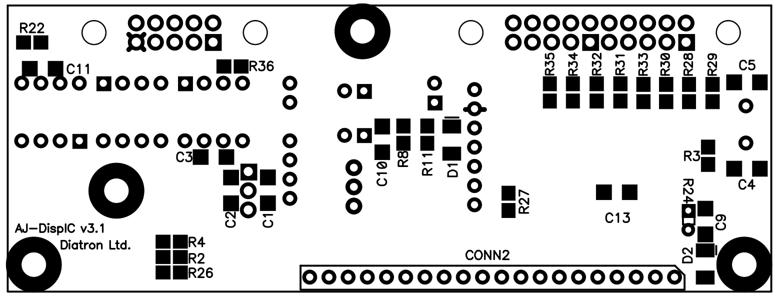
1. PIC16F876 --> PIC18F252 (PGM: RB3 --> RB5)
   X1 20 MHz --> 10 MHz

2. undo 1.1
   PIC18F252 --> PIC16F876 (PGM: RB5 --> RB3)
   X1 10 MHz-->20 MHz
   (pcb drill holes repair)
3. D[3...10] >>> R[28...35] (1k)
   C14...C17 for filtering (1n)
   R14...17 value change: (4k7 >>> 100k)
   R9,10,12,13 value change (100R >>> 10k)
4. REDO 1.1
5. (v3.1) R36 added
   CONN2 pin16, 18 shorted (avoid LCD startup blinking)
   R18 value changed (4k7 >>> 1k) and R21 value changed (4k7 >>> 2k2) for the better temperature compensation.
   R24 Thermistor flipped on the pcb.(for the better temp. sensing)
   Software Upgrade: v2.2

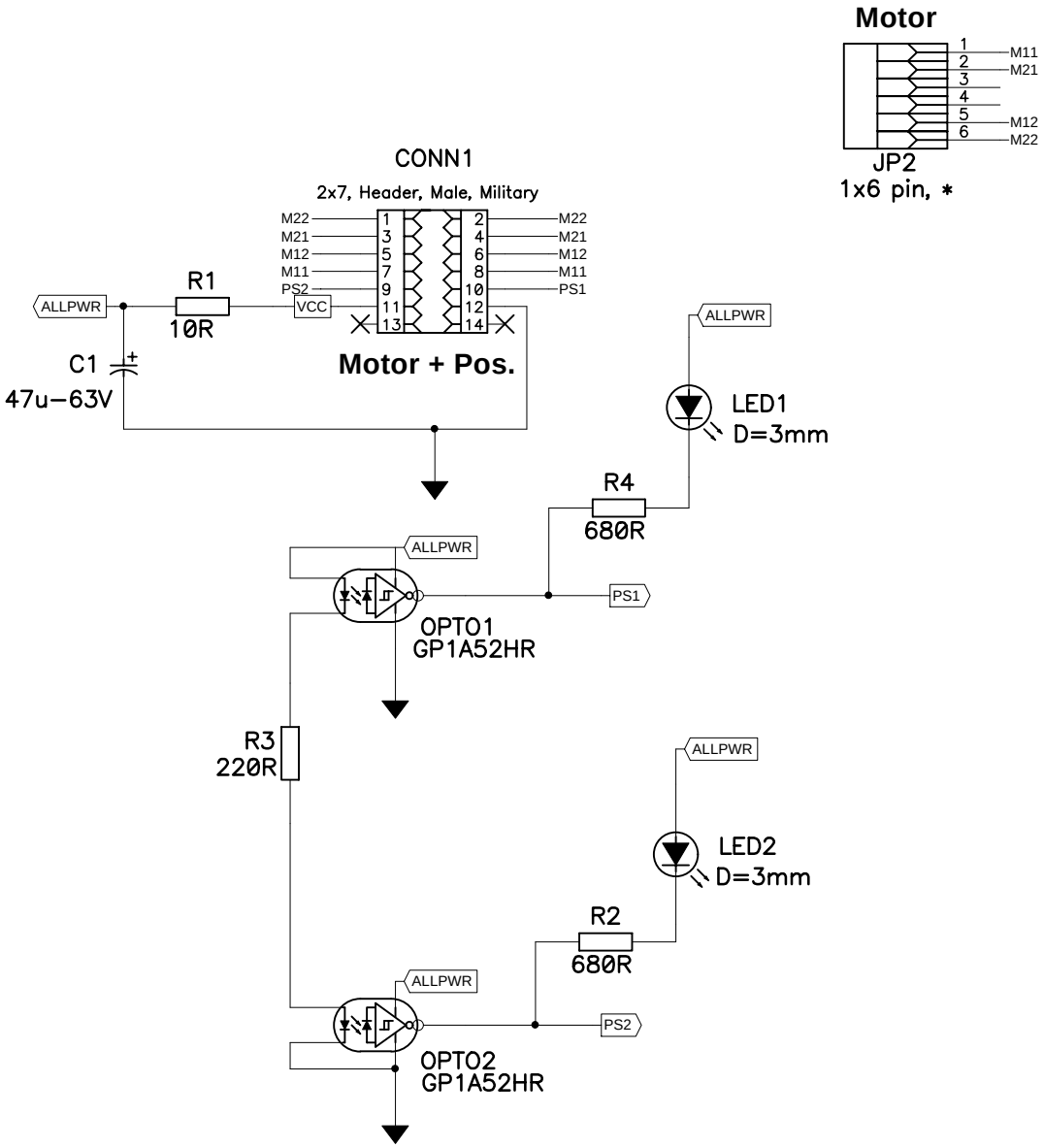
Company:	DigiTronMI Ltd.	
Title:	Abacus Junior Display Controller	
Size:	Number: 01-AJ-DisplC v3.1	Revision: 3.1
Approved by: Mendele Bálint		Signature:
Author: Katus Ferenc		Last Modified: Thu Jul 03, 2003
Filename: AJ-DisplC_v3.1.sch		Sheet 1 of 1



Company:	Diatron MI Ltd.	
Title:	Abacus Junior Display Module	
	Drawing Number: AJ-DisplC v3.1	Revision: 3.1
Approved by: Gyetvai Árpád	Signature:	
Author: Katus Ferenc		Modified: Tue Aug 26, 2003
File name: AJ-DisplC_v3.1.pcb		Layer: Top Silk

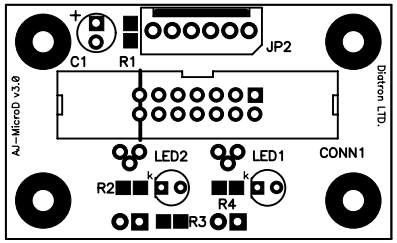


Company: Diatron MI Ltd.		
Title: Abacus Junior Display Module		
	Drawing Number: AJ-DispIC v3.1	Revision: 3.1
Approved by: Gyetvai Árpád	Signature:	
Author: Katus Ferenc	Modified: Tue Aug 26, 2003	
File name: AJ-DispIC v3.1.pcb	Layer: Bot Silk	

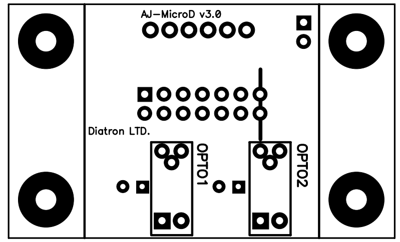


1.1 PCB: changes in placement
MS–MicroD v1.2 >>> AJ–MicroD v3.0

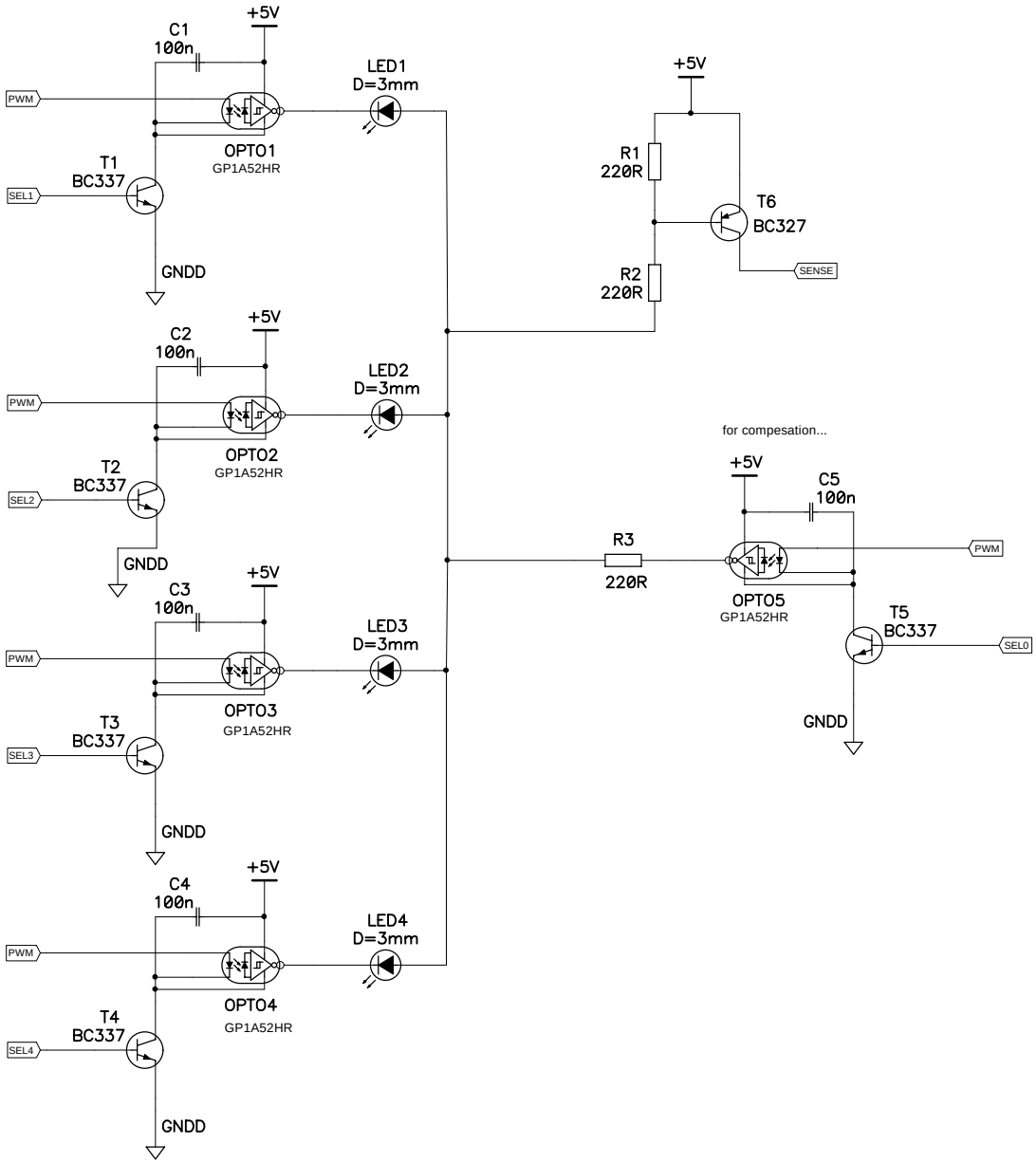
Company:	Diatron MI Ltd.	
Title:	Abacus Junior Micro Dilutor v3.0	
Size:	Number: 01-AJ-MicroD v3.0	Revision: 3.0
Approved by: Mendele Bálint		Signature:
Author: Katus Ferenc		Last Modified: Tue Jul 15, 2003
Filename: AJ-MicroD_v3.0.sch		Sheet 1 of 1

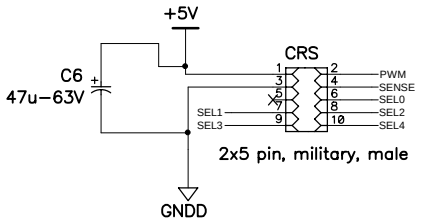


Company: Diatron MI Ltd.		
Title: Abacus Junior Micro Dilutor		
	Drawing Number: AJ-MicroD v3.0	Revision: 3.0
Approved by: Mendele Bálint	Signature:	
Author: Katus Ferenc	Modified: Mon Aug 25, 2003	
File name: AJ-MicroD_v3.0.pcb	Layer: Top Silk	



Company:	Diatron MI Ltd.
Title:	Abacus Junior Micro Dilutor
Drawing Number:	AJ-MicroD v3.0
Revision:	3.0
Approved by:	Mendele Balint
Signature:	
Author:	Katus Ferenc
Modified:	Mon Aug 25, 2003
File name:	AJ-MicroD v3.0.pcb
Layer:	Bot Silk



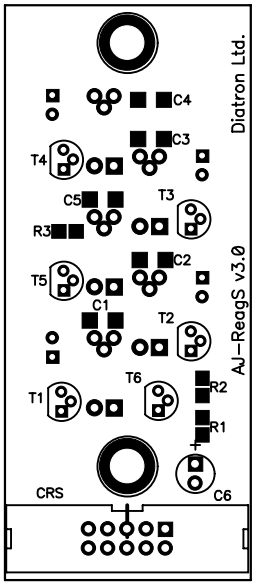


Revision Note Table

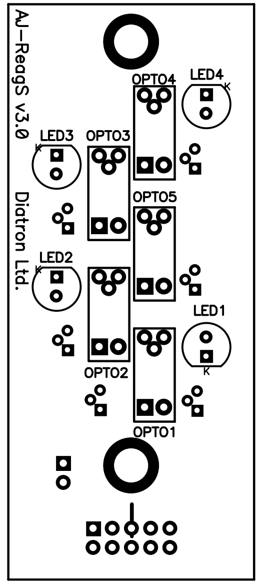
1.1: SCH, PCB connection established,
Smaller PCB changes

3.0 MS-* v1.1 >>> AJ-* v3.0

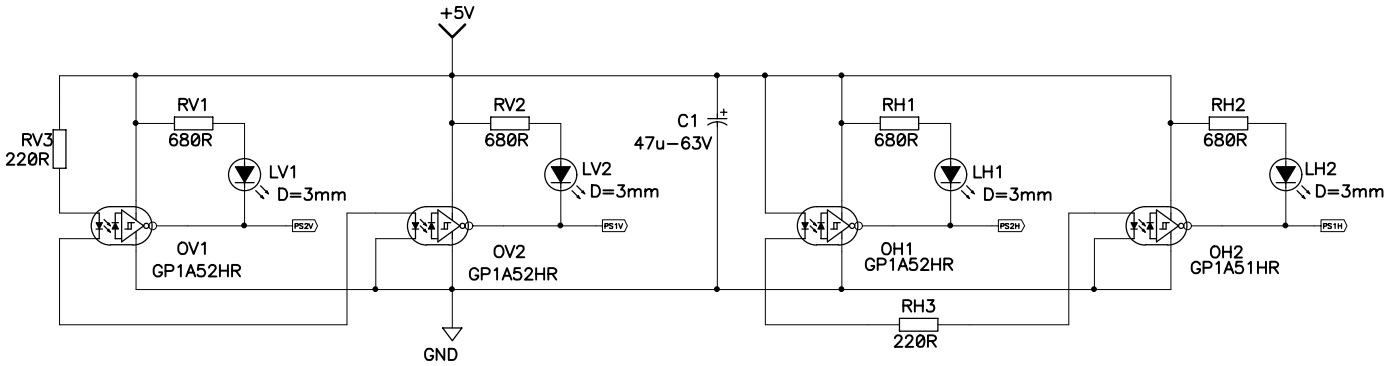
Company: DigiTron MI Ltd.		
Title: **Abacus Junior Reagent Sensors**		
Size:	Number: **01-AJ-ReagS v3.0**	Revision: **3.0**
Approved by: **Mendele Bálint**		Signature:
Author: **Katus Ferenc**		Last Modified: **Wed May 21, 2003**
Filename: **AJ-ReagS_v3.0.sch**		Sheet **1** of **1**



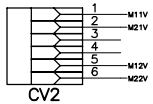
Company:	DiaTron MI Ltd.	
Title:	Abacus Junior Reagent sensors	
	Drawing Number: AJ-ReagS v3.0	Revision: 3.0
Approved by: Mendele Bálint	Signature:	
Author: Katus Ferenc	Modified: Wed May 21, 2003	
File name: AJ-ReagS_v3.0.pcb	Layer: Top Silk	



Company: Diatron MI Ltd.	
Title: Abacus Junior Reagent sensors	
Drawing Number: AJ-ReagS v3.0	Revision: 3.0
Approved by: Mendele Balint	Signature:
Author: Katus Ferenc	Modified: Wed May 21, 2003
File name: AJ-ReagS v3.0.pcb	Layer: Bot Silk

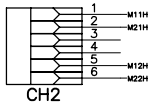


Vertical Motor



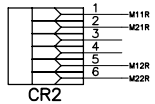
CV2
1x6 pin, *

Horizontal Motor



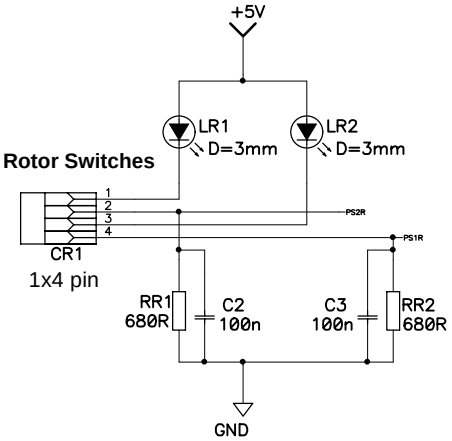
CH2
1x6 pin, *

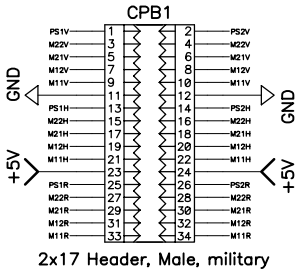
Rotor Motor



CR2
1x6 pin, *

Rotor Switches

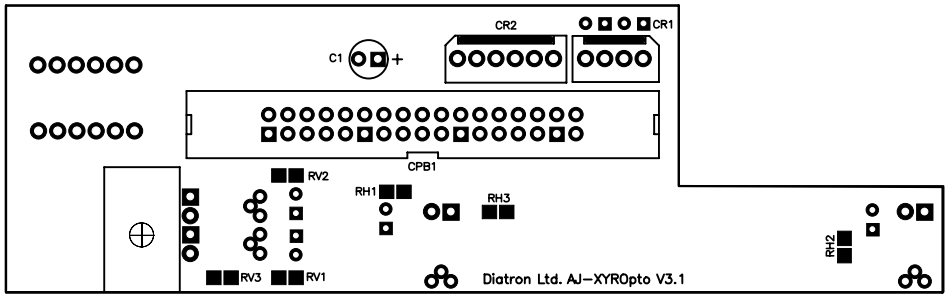




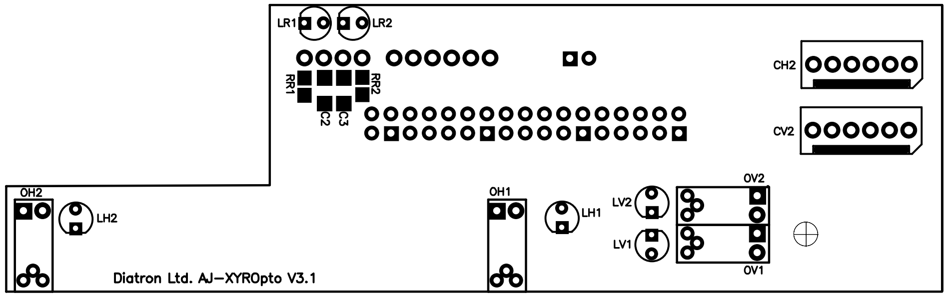
2x17 Header, Male, military

Revision Note Table
1. Abacus Junior specialized design
3.1 : C2 and C3 added, for filtering

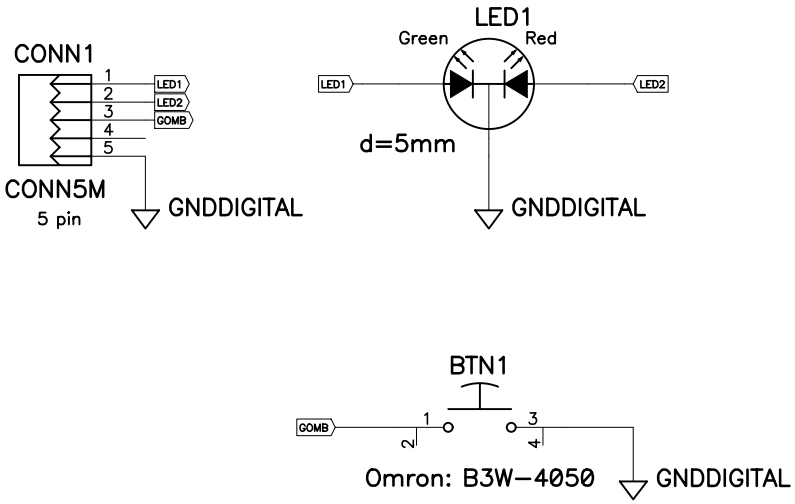
Company:	Dietron MI Ltd.	
Title:	Abacus Junior XYR OPTO Board	
Size:	Number: 01-AJ-XYROpto v3.1	Revision: 3.1
Approved by: Mendele Bálint	Signature:	
Author: Katus Ferenc	Last Modified: Tue Jul 15, 2003	
Filename: XYROpto_v3.1.sch	Sheet 1 of 1	



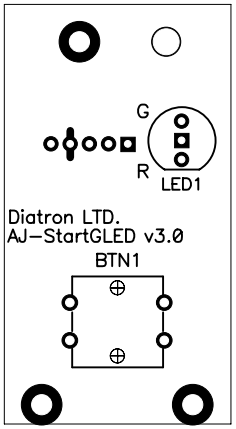
Company: Diatron MI Ltd.		
Title: Abacus Junior XYR OPTO Board		
	Drawing Number: AJ-XYROpto V3.1	Revision: 3.1
Approved by: Katus Ferenc	Signature:	
Author: Gyetvai Árpád	Modified: Thu Aug 07, 2003	
File name: AJ-XYopto V3.1.pcb	Layer: Top Silk	



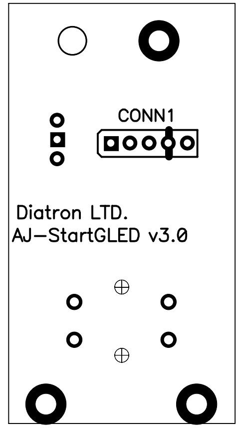
Company: Diatron MI Ltd.		
Title: Abacus Junior XYR OPTO Board		
	Drawing Number: AJ-XYROpto V3.1	Revision: 3.1
Approved by: Katus Ferenc	Signature:	
Author: Gyetvai Árpád	Modified: Thu Aug 07, 2003	
File name: AJ-XYopto V3.1.pcb	Layer: Bot Silk	



Company:	DiaTron MI Ltd.	
Title:	Abacus Junior Start Button and LED	
Size:	Number: 01-AJ-StartGLED v3.0	Revision: v3.0
Approved by: Mendele Bálint	Signature:	
Author: Katus Ferenc	Date: Tue Aug 26, 2003	
Filename: AJ-StartGLED_v3.0.sch	Sheet 1 of 1	



Company: Diatron MI Ltd.		
Title: Abacus Junior Start Button and LED		
	Drawing Number: AJ-StartGLED v3.0	Revision: 3.0
Approved by: Mendele Bálint	Signature:	
Author: Katus Ferenc	Modified: Tue Mar 11, 2003	
File name: AJ-StartGLED_v3.0.pcb	Layer: Top Silk	



Company: Diatron MI Ltd.

Title: Abacus Junior Start Button and LED

Drawing Number: AJ-StartGLED v3.0

Revision: 3.0

Approved by: Mendele Balint

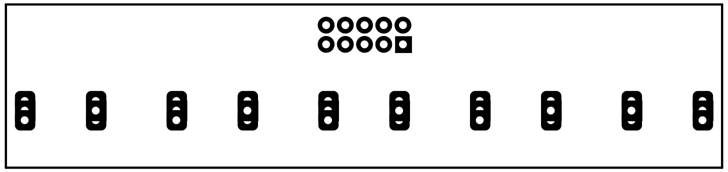
Signature:

Author: Katus Ferenc

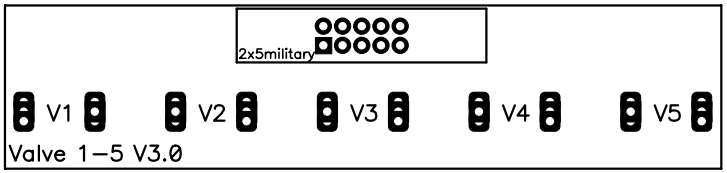
Modified: Tue Mar 11, 2003

File name: AJ-StartGLED v3.0.pcb

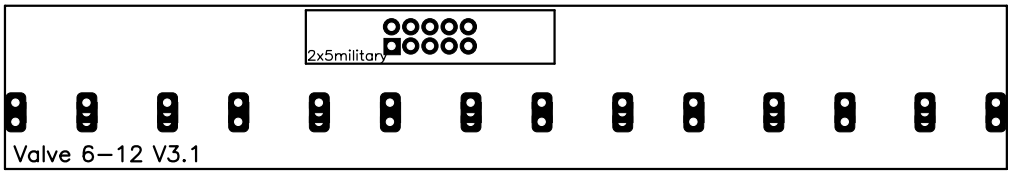
Layer: Bot Silk



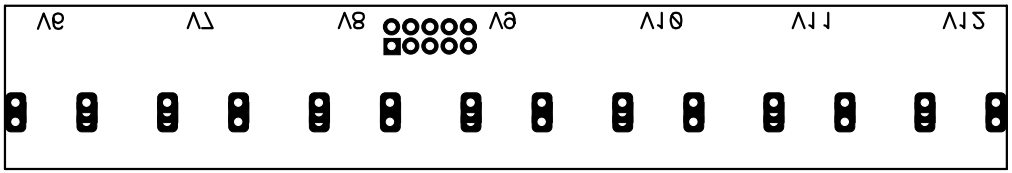
Company:	Diatron MI Ltd.
Title:	Abacus Junior Valve Module 1−5 v3.0
Drawing Number:	01−AJ−Valve_ 1−5 v3.0
Revision:	3.0
Approved by:	Mendele Balint
Signature:	
Author:	Gyetvai Árpád
Modified:	Tue Aug 26, 2003
File name:	Valve 1 5 V3.0.pcb
Layer:	Bot Silk



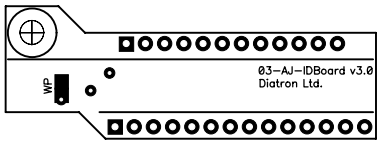
Company: Diatron MI Ltd.		
Title: Abacus Junior Valve Module 1-5 v3.0		
	Drawing Number: 01-AJ-Valve_1-5 v3.0	Revision: 3.0
Approved by: Mendele Bálint	Signature:	
Author: Gyetvai Árpád		Modified: Tue Aug 26, 2003
File name: Valve 1_5 V3.0.pcb		Layer: Top Silk



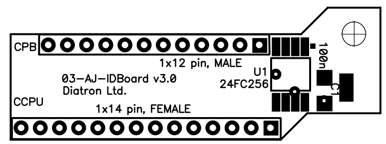
Company: Diatron MI Ltd.		
Title: Abacus Junior Valve Module 6-12		
	Drawing Number: 01-AJ-Valve 6-12 v3.1	Revision: 3.1
Approved by: Mendele Bálint	Signature:	
Author: Gyetvai Árpád	Modified: Tue Aug 26, 2003	
File name: Valve 6_12 V3.1.pcb	Layer: Top Silk	



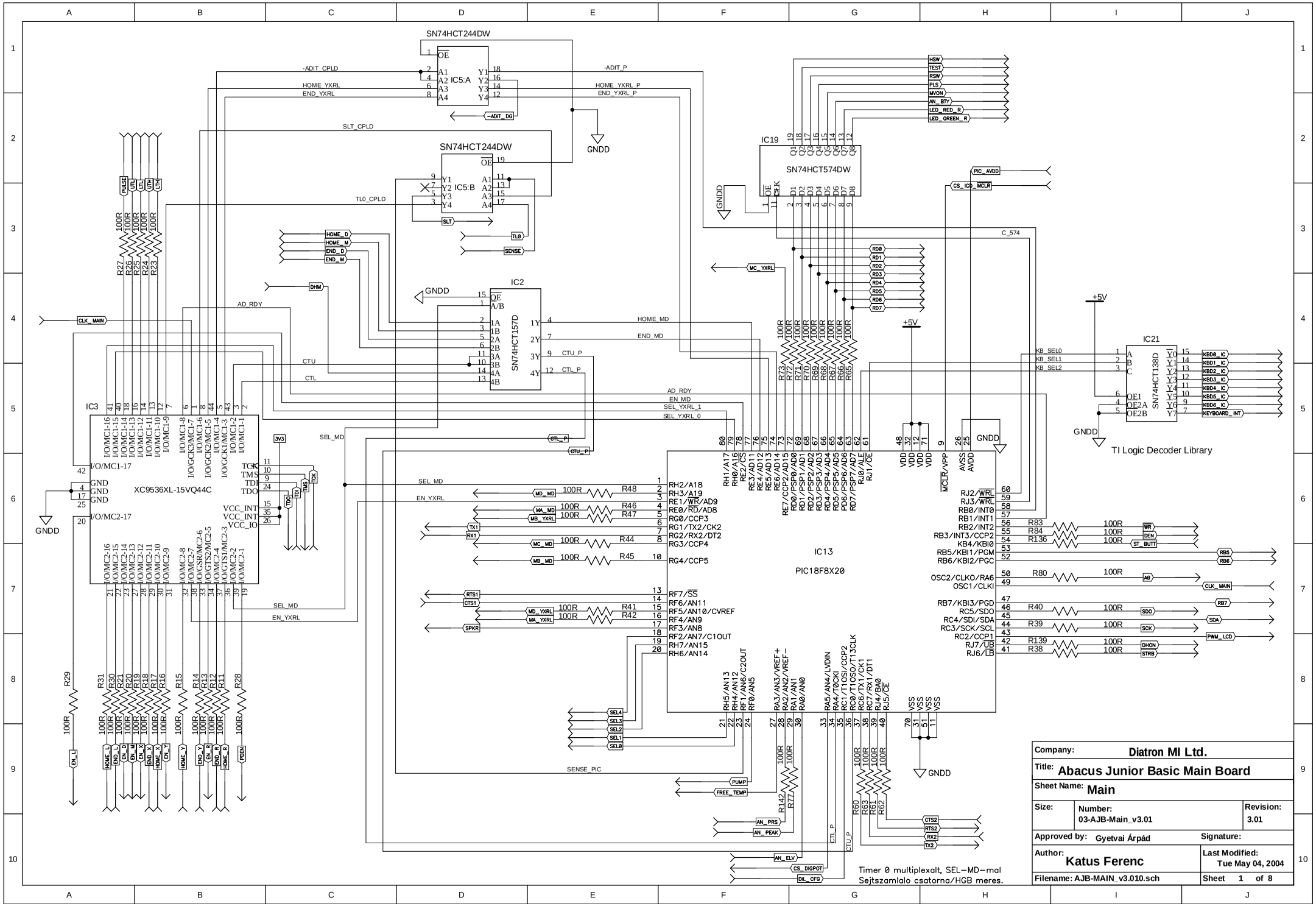
Company:	Diatron MI Ltd.	
Title:	Abacus Junior Valve Module 6-12	
	Drawing Number: 01-AJ-Valve 6-12 v3.1	Revision: 3.1
Approved by: Mendele Bálint	Signature:	
Author: Gyetvai Árpád	Modified: Tue Aug 26, 2003	
File name: Valve 6_12 V3.1.pcb	Layer: Bot Silk	



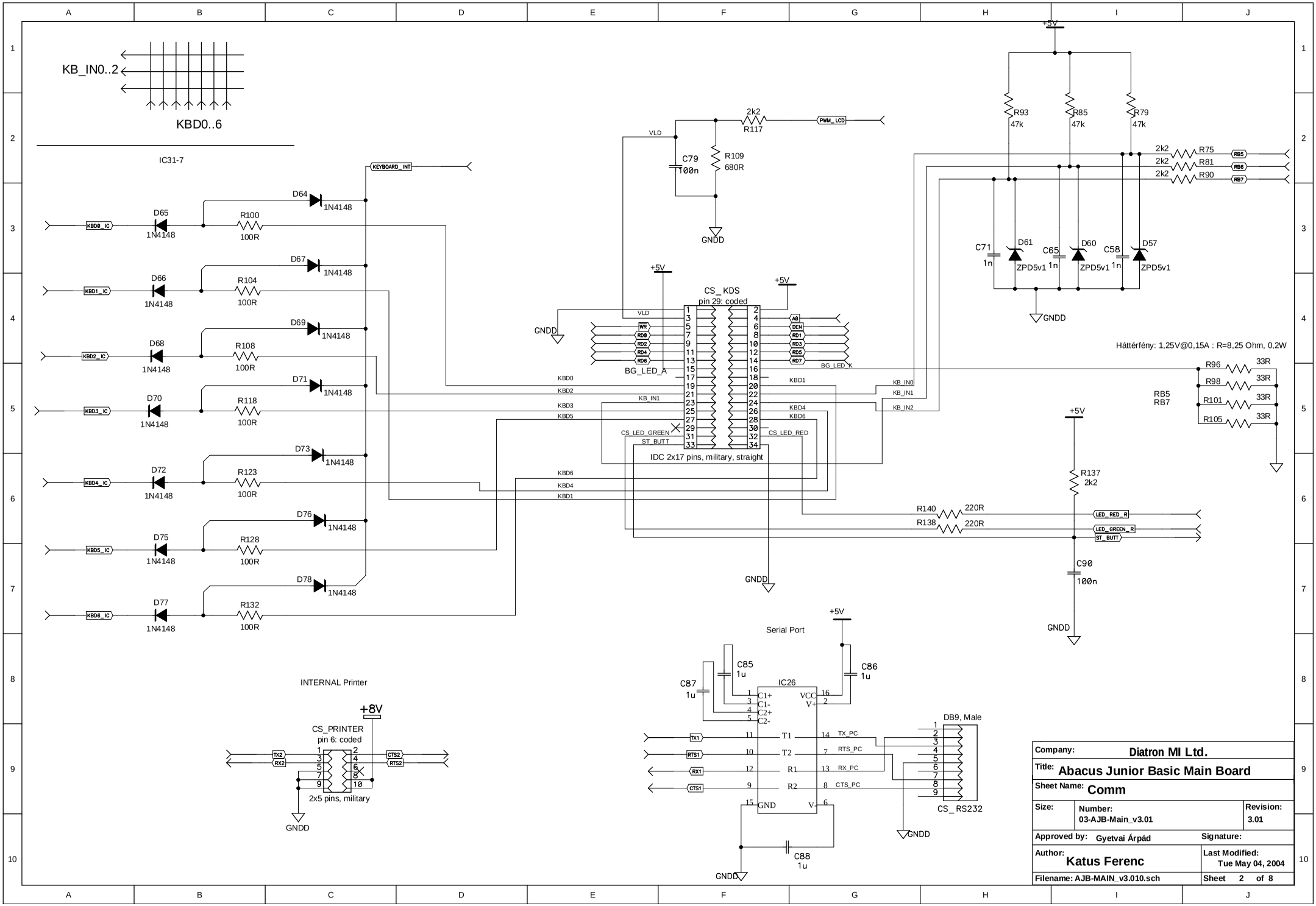
Company: Diatron MI Ltd.		
Title: Abacus Junior ID Board v3.0		
	Drawing Number: 03-AJ-IDBoard v3.0	Revision: 3.0
Approved by: Mendele Bálint	Signature:	
Author: Gyetvai Árpád	Modified: Tue Mar 25, 2003	
File name: AJ-IDBoard_v3.0.pcb	Layer: Top Silk	



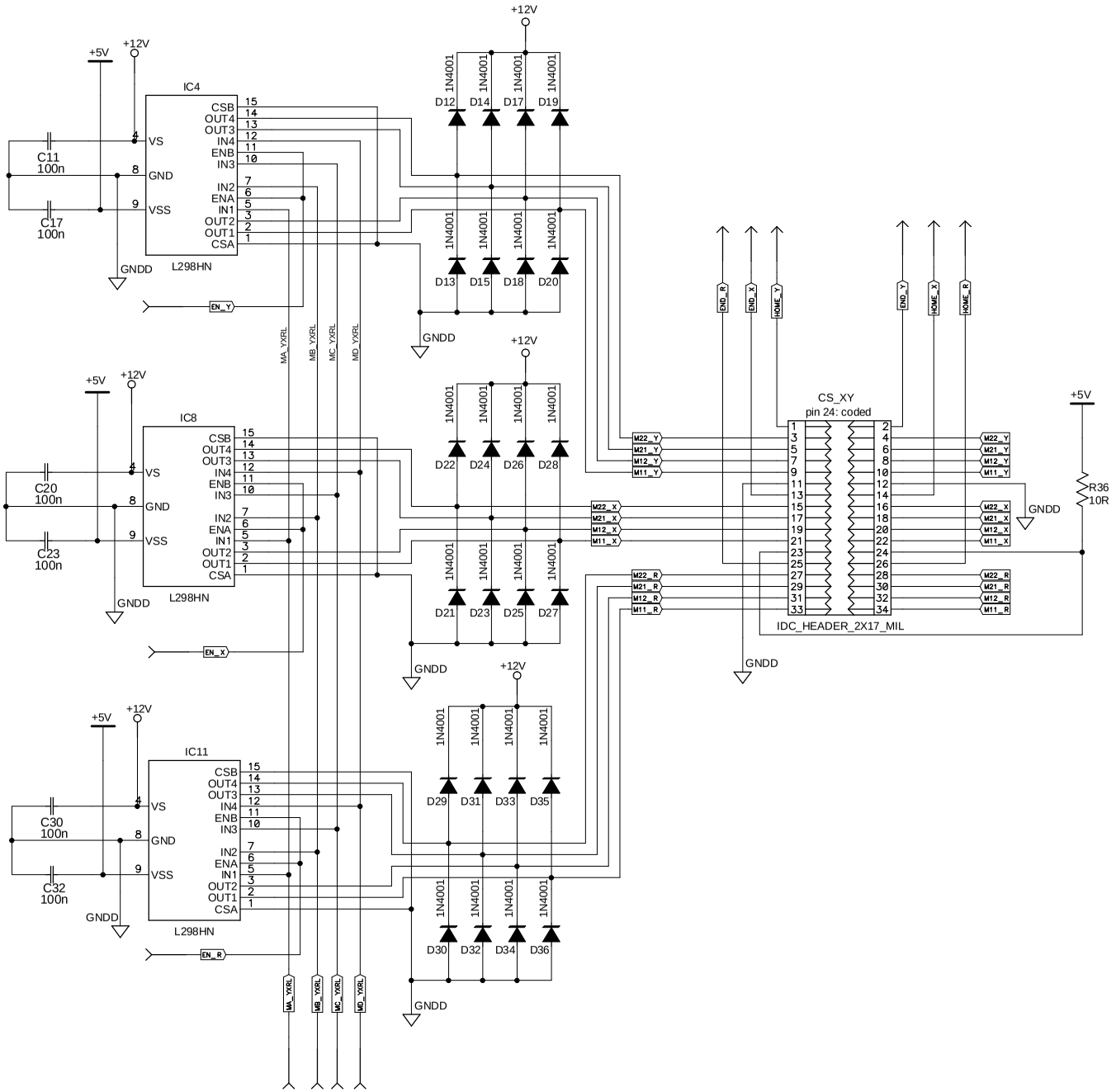
Company: Diatron MI Ltd.		
Title: Abacus Junior ID Board v3.0		
	Drawing Number: 03-AJ-IDBoard v3.0	Revision: 3.0
Approved by: Mendele Bálint	Signature:	
Author: Gyetvai Árpád	Modified: Tue Mar 25, 2003	
File name: AJ-IDBoard v3.0.pcb	Layer: Bot Silk	



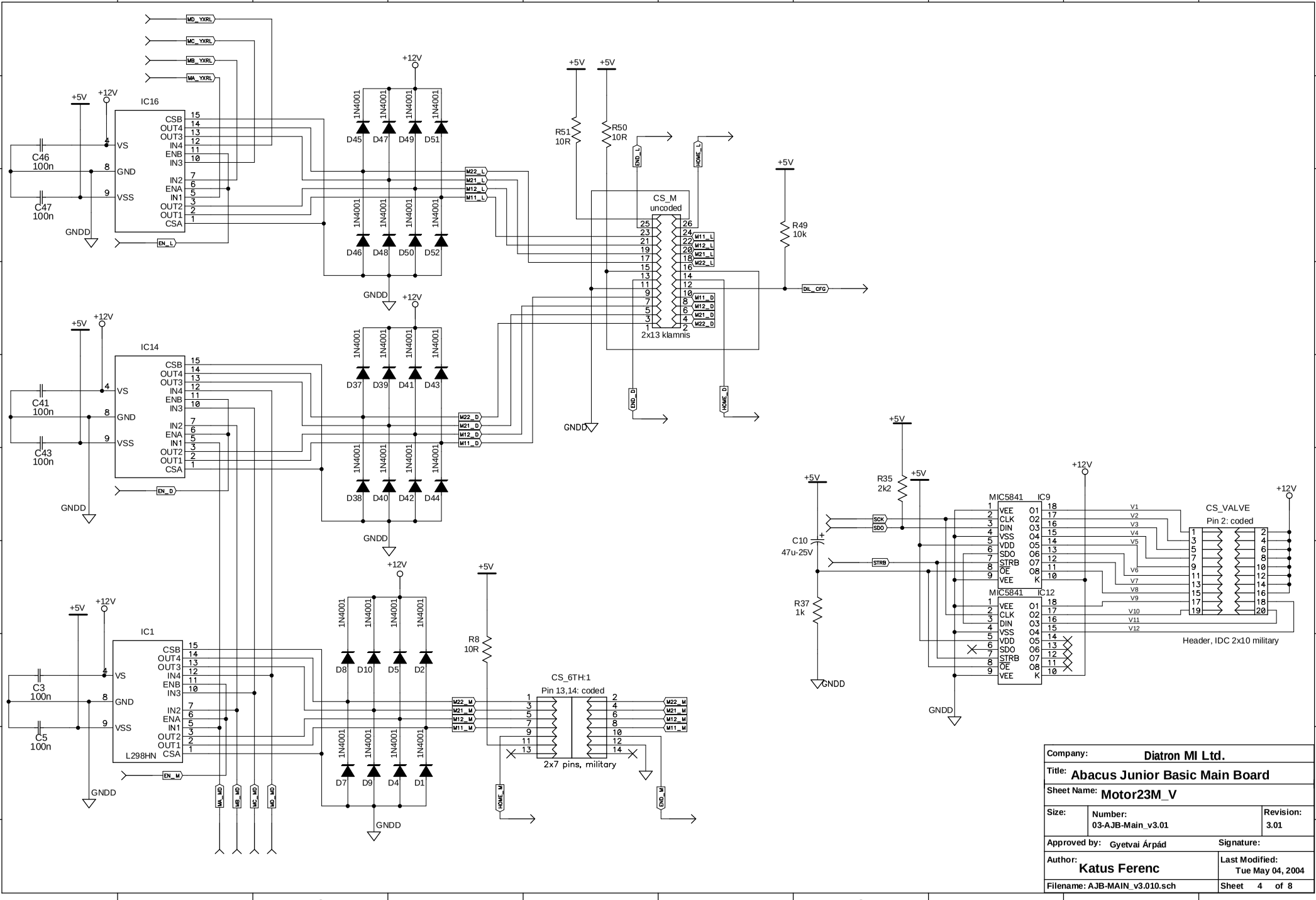
Company:	Diatron MI Ltd.
Title:	Abacus Junior Basic Main Board
Sheet Name:	Main
Size:	
Number:	03-AJB-Main_v3.01
Revision:	3.01
Approved by:	Gyetvai Árpád
Signature:	
Author:	Katus Ferenc
Last Modified:	Tue May 04, 2004
Filename:	AJB-MAIN_v3.010.sch
Sheet	1 of 8



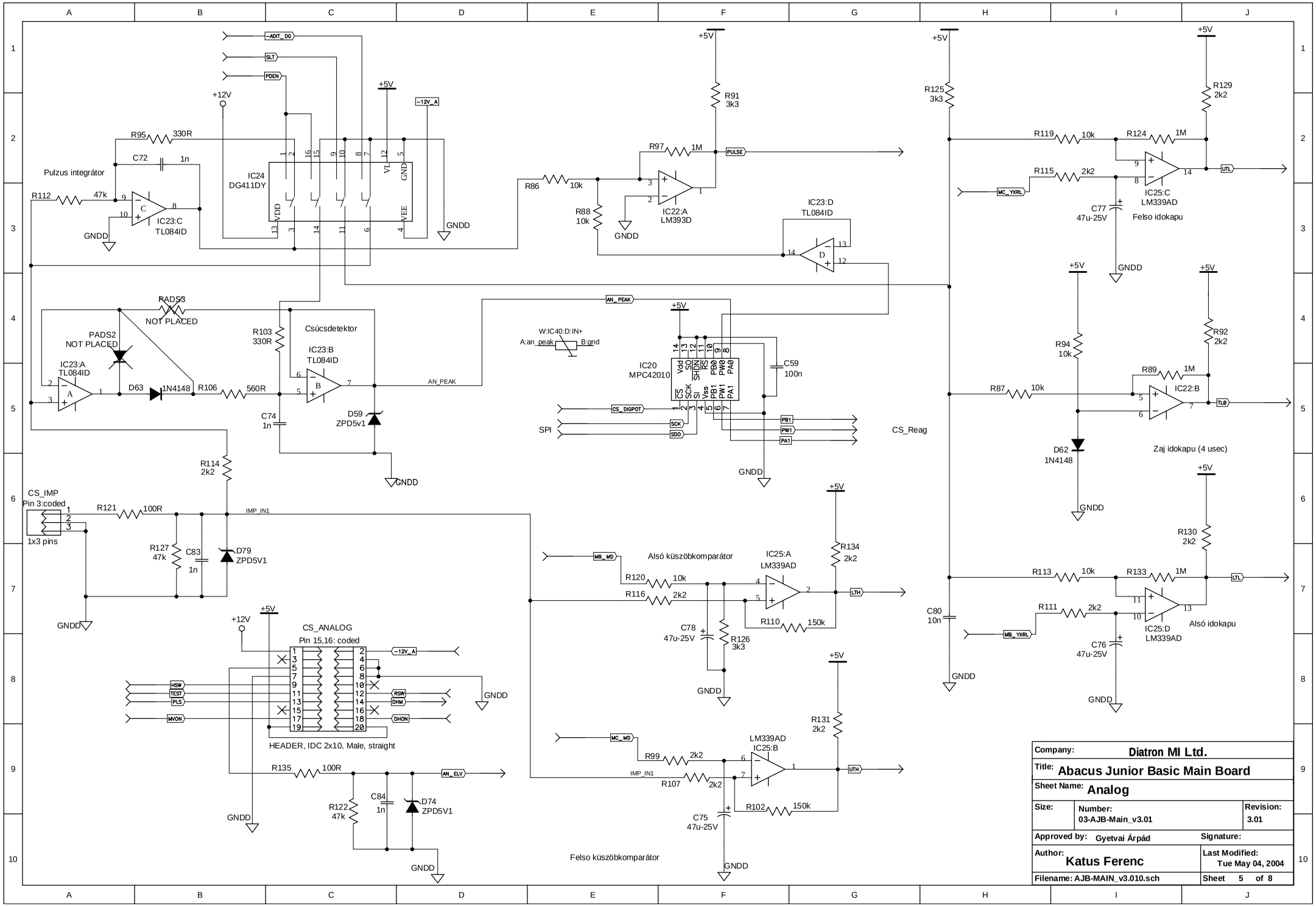
Company:	Diatron MI Ltd.
Title:	Abacus Junior Basic Main Board
Sheet Name:	Comm
Size:	Number: 03-AJB-Main_v3.01 — Revision: 3.01
Approved by:	Gyetvai Árpád — Signature:
Author:	Katus Ferenc — Last Modified: Tue May 04, 2004
Filename:	AJB-MAIN_v3.010.sch — Sheet 2 of 8



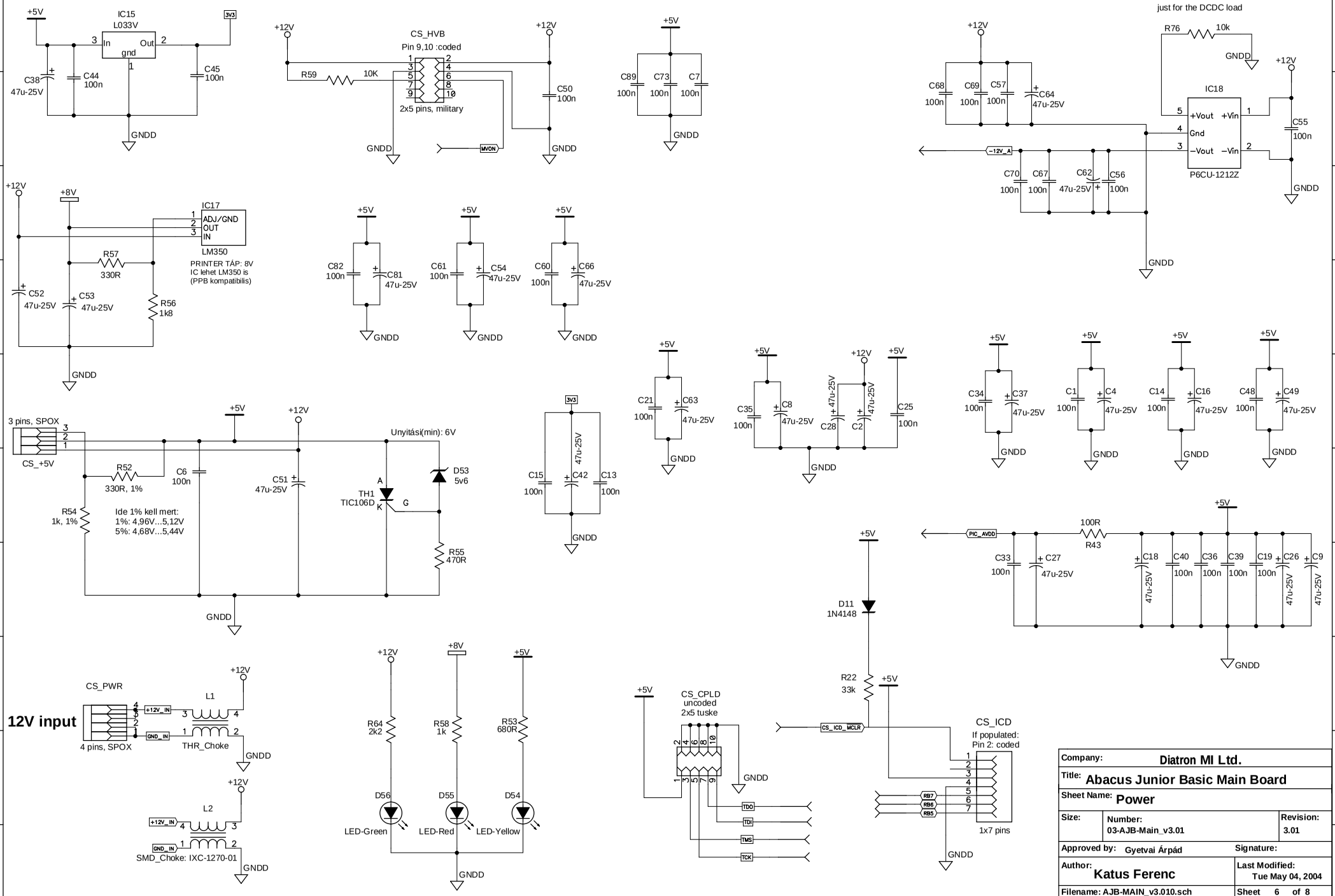
Company:	Diatron MI Ltd.
Title:	Abacus Junior Basic Main Board
Sheet Name:	MotorXYR
Size:	
Number:	03-AJB-Main_v3.01
Revision:	3.01
Approved by:	Gyetvai Árpád
Signature:	
Author:	Katus Ferenc
Last Modified:	Tue May 04, 2004
Filename:	AJB-MAIN_v3.010.sch
Sheet	3 of 8

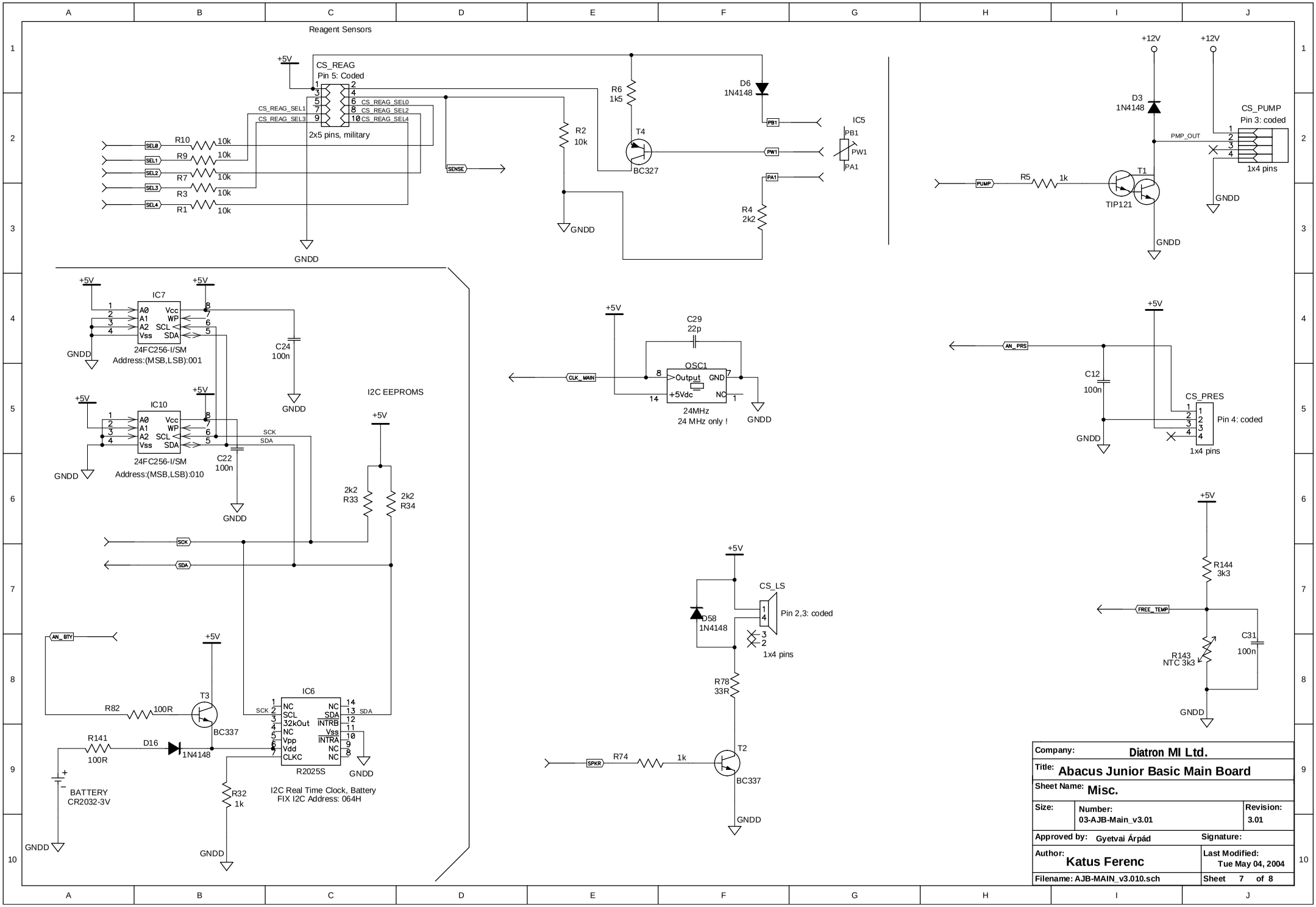


Company:	Diatron MI Ltd.
Title:	Abacus Junior Basic Main Board
Sheet Name:	Motor23M_V
Size:	
Number:	03-AJB-Main_v3.01
Revision:	3.01
Approved by:	Gyetvai Árpád
Signature:	
Author:	Katus Ferenc
Last Modified:	Tue May 04, 2004
Filename:	AJB-MAIN_v3.010.sch
Sheet	4 of 8



Company:	Diatron MI Ltd.
Title:	Abacus Junior Basic Main Board
Sheet Name:	Analog
Size:	Number: 03-AJB-Main_v3.01 — Revision: 3.01
Approved by:	Gyetvai Árpád — Signature:
Author:	Katus Ferenc — Last Modified: Tue May 04, 2004
Filename:	AJB-MAIN_v3.010.sch — Sheet 5 of 8


just for the DCDC load
IC15
L033V
3V3
In
Out
gnd
C38
47u-25V
C44
100n
C45
100n
GNDD
CS_HVB
Pin 9,10 :coded
2x5 pins, military
R59
10K
C50
100n
MVON
C89
100n
C73
100n
C7
100n
R76
10k
IC18
+Vout
+Vin
Gnd
−Vout
−Vin
P6CU-1212Z
C68
100n
C69
100n
C57
100n
C64
47u-25V
C55
100n
−12V_A
C70
100n
C67
100n
C62
47u-25V
C56
100n
IC17
ADJ/GND
OUT
IN
LM350
PRINTER TÁP: 8V
IC lehet LM350 is
(PPB kompatibilis)
R57
330R
C52
47u-25V
C53
47u-25V
R56
1k8
C82
100n
C81
47u-25V
C61
100n
C54
47u-25V
C60
100n
C66
47u-25V
3 pins, SPOX
CS_+5V
R52
330R, 1%
C6
100n
C51
47u-25V
Unyitási(min): 6V
TH1
TIC106D
D53
5v6
R54
1k, 1%
Ide 1% kell mert:
1%: 4,96V...5,12V
5%: 4,68V...5,44V
R55
470R
C15
100n
C42
47u-25V
C13
100n
C21
100n
C63
47u-25V
C35
100n
C8
47u-25V
C28
47u-25V
C2
47u-25V
C25
100n
C34
100n
C37
47u-25V
C1
100n
C4
47u-25V
C14
100n
C16
47u-25V
C48
100n
C49
47u-25V
PIC_AVDD
100R
R43
C33
100n
C27
47u-25V
C18
47u-25V
C40
100n
C36
100n
C39
100n
C19
100n
C26
47u-25V
C9
47u-25V
D11
1N4148
R22
33k
CS_ICD_MCLR
CS_ICD
If populated:
Pin 2: coded
RB7
RB6
RB5
1x7 pins
CS_CPLD
uncoded
2x5 tuske
TDO
TDI
TMS
TCK
12V input
CS_PWR
4 pins, SPOX
+12V_IN
GND_IN
L1
THR_Choke
L2
SMD_Choke: IXC-1270-01
R64
2k2
R58
1k
R53
680R
D56
D55
D54
LED-Green
LED-Red
LED-Yellow
Company: Diatron MI Ltd.
Title: Abacus Junior Basic Main Board
Sheet Name: Power
Size:
Number: 03-AJB-Main_v3.01
Revision: 3.01
Approved by: Gyetvai Árpád
Signature:
Author: Katus Ferenc
Last Modified: Tue May 04, 2004
Filename: AJB-MAIN_v3.010.sch
Sheet 6 of 8



Company:	Diatron MI Ltd.
Title:	Abacus Junior Basic Main Board
Sheet Name:	Misc.
Size:	
Number:	03-AJB-Main_v3.01
Revision:	3.01
Approved by:	Gyetvai Árpád
Signature:	
Author:	Katus Ferenc
Last Modified:	Tue May 04, 2004
Filename:	AJB-MAIN_v3.010.sch
Sheet	7 of 8

Power Table											
Ref Des	Device(Type)	Package	VDD_RTC	+5V	+12V	MAXV+	GNDD	-12V_A	MAX_V-	+8V	3V3
IC1	L298HN	L298 FEKVO		9	4		8,15,1				
IC2	SN74HCT157D	SO-G16/D10_GLUED		16			15,8				
IC3	XC9536-15VQ44C_ENLAR	QFP10X10-G44/XAE_ENLARGED					4,25,17				35,26,15
IC4	L298HN	L298 FEKVO		9	4		8,15,1				
IC5	SN74HCT244DW	SO-G20/G7.1		20			1,19,10				
IC6	R2025S	SO-G14_ENLARGED	5,6				11				
IC7	24FC256	SO-G8/Y1.7		1,8			3,4,2				
IC8	L298HN	L298 FEKVO		9	4		8,15,1				
IC9	MIC5841	DIP18		5	10		9,1,4				
IC10	24FC256	SO-G8/Y1.7		2,8			1,3,4				
IC11	L298HN	L298 FEKVO		9	4		8,15,1				
IC12	MIC5841	DIP18		5	10		9,1,4				
IC13	PIC18F8520	TQFP80		48,71,12,32			51,31,26,11,70				
IC14	L298HN	L298 FEKVO		9	4		8,15,1				
IC15	L033V_STANDING	TO-220AB-STANDING		3			1				2
IC16	L298HN	L298 FEKVO		9	4		1,15,8				
IC17	LM1084	TO220_FEKVO			3					2	
IC18	P6CU-XXXXZ	SIP7#3#7			1		2,4	3			
IC19	SN74HCT574DW	SO-G20/G7.1		20			1,10				
IC20	MCP42XXX	SO-G14/G3_KF		11,14,12			10,4				
IC21	SN74HCT138D	SO-G16/D10		6,16			5,4,8				
IC22	LM393D	SO-G8					2,4			8	
IC23	TL084ID	SO-G14/G3			4		10	11			
IC24	DG411DY	SO-G16		12	13		7,5,15,10	4			
IC25	LM339AD	SO-G14/G3					12			3	
IC26	MAX232AESE	SO-G16		16		2	15		6		

Net Index Table	
Net Name	Sheets
-12V_A	Analog[D8],Power[H2]
-ADIT_DG	Main[D2],Analog[B1]
A0	Main[I7],Comm[G4]
AN_BTY	Main[H2],Misc.[A8]
AN_ELV	Main[F10],Analog[D9]
AN_PEAK	Main[F10],Analog
AN_PRS	Main[F10],Misc.[H4]
CLK_MAIN	Main[A4][J7],Misc.[E5]
CS_DIGPOT	Main[F10],Analog[E5]
CS_ICD_ MCLR	Main[H3],Power[G8]
CTS1	Main[D7],Comm[F9]
CTS2	Main[H10],Comm[D9]
DEN	Main[I6],Comm[G4]
DHM	Main[C4],Analog[D8]
DHON	Main[I8],Analog[D8]
DIL_CFG	Main[F10],Motor23M_V[G4]
END_D	Main[C3],Motor23M_V[E5]
END_L	Main[A9],Motor23M_V[E2]
END_M	Main[C3],Motor23M_V[F9]
END_R	Main[B9],MotorXYR[F3]
END_X	Main[B9],MotorXYR[F3]
END_Y	Main[B9],MotorXYR[G3]
EN_D	Main[A9],Motor23M_V[B6]
EN_L	Main[A9],Motor23M_V[B3]
EN_M	Main[A9],Motor23M_V[B9]
EN_R	Main[B9],MotorXYR[C9]
EN_X	Main[B9],MotorXYR[C6]
EN_Y	Main[B9],MotorXYR[C3]
FREE_TEMP	Main[F9],Misc.[I7]
HOME_D	Main[C3],Motor23M_V[F5]
HOME_L	Main[A9],Motor23M_V[F2]
HOME_M	Main[C3],Motor23M_V[D9]
HOME_R	Main[B9],MotorXYR[G3]
HOME_X	Main[B9],MotorXYR[G3]
HOME_Y	Main[B9],MotorXYR[F3]
HSW	Main[H1],Analog[B8]
KBD0_IC	Main[J4],Comm[A3]
KBD1_IC	Main[J4],Comm[A4]
KBD2_IC	Main[J5],Comm[A4]
KBD3_IC	Main[J5],Comm[A5]
KBD4_IC	Main[J5],Comm[A6]
KBD5_IC	Main[J5],Comm[A7]
KBD6_IC	Main[J5],Comm[A7]
KEYBOARD_INT	Main[J5],Comm[D2]
LED_GREEN_R	Main[H2],Comm[I6]
LED_RED_R	Main[H2],Comm[I6]
LTH	Main[B2],Analog[G7]
LTL	Main[B2],Analog[J7]
MA_MD	Main[D6],Motor23M_V[B9]
MA_YXRL	Main[D7],MotorXYR[D9],Motor23M_V[B2]
MB_MD	Main[D7],Motor23M_V[B9],Analog[E7]
MB_YXRL	Main[D6],MotorXYR[D9],Motor23M_V[B1],Analog[H8]
MC_MD	Main[D7],Motor23M_V[C9],Analog[E9]
MC_YXRL	Main[F3],MotorXYR[D9],Motor23M_V[B1],Analog[H3]
MD_MD	Main[D6],Motor23M_V[C9]
MD_YXRL	Main[D7],MotorXYR[D9],Motor23M_V[B1]
MVON	Main[H1],Analog[B8],Power[D2]
PA1	Analog[G5],Misc.[F2]
PB1	Analog[G5],Misc.[F2]
PDEN	Main[B9],Analog[B1]
PIC_AVDD	Main[H2],Power[H6]
PLS	Main[H1],Analog[B8]
PULSE	Main[A2],Analog[G2]
PUMP	Main[F9],Misc.[H3]
PW1	Analog[G5],Misc.[F2]
PWM_LCD	Main[J8],Comm[G2]
RB5	Main[J7],Comm[J2],Power[G9]
RB6	Main[J7],Comm[J2],Power[G9]
RB7	Main[J7],Comm[J2],Power[G9]
RD0	Main[G3],Comm[E4]
RD1	Main[G3],Comm[G4]
RD2	Main[G3],Comm[E4]
RD3	Main[G4],Comm[G4]
RD4	Main[G4],Comm[E4]
RD5	Main[G4],Comm[G4]
RD6	Main[G4],Comm[E4]
RD7	Main[G4],Comm[G4]
RSW	Main[H1],Analog[D8]
RTS1	Main[D7],Comm[F9]
RTS2	Main[H10],Comm[D9]
RX1	Main[D6],Comm[F9]
RX2	Main[H10],Comm[B9]
SCK	Main[I7],Motor23M_V[G6],Analog[E5],Misc.[B6]
SDA	Main[J7],Misc.[B7]
SDO	Main[I7],Motor23M_V[G6],Analog[E5]
SEL0	Main[E9],Misc.[B2]
SEL1	Main[E9],Misc.[B2]
SEL2	Main[E9],Misc.[B2]
SEL3	Main[E8],Misc.[B3]
SEL4	Main[E8],Misc.[B3]
SENSE	Main[D3],Misc.[D2]
SLT	Main[D3],Analog[B1]
SPKR	Main[D7],Misc.[E9]
STRB	Main[I8],Motor23M_V[G7]
ST_BUTT	Main[I7],Comm[I6]
TCK	Main[C6],Power[F10]
TDI	Main[C6],Power[F9]
TDO	Main[C6],Power[F9]
TEST	Main[H1],Analog[B8]
TL0	Main[D3],Analog[J5]
TMS	Main[C6],Power[F10]
TX1	Main[D6],Comm[F9]
TX2	Main[H10],Comm[B9]
UTH	Main[B2],Analog[G9]
UTL	Main[A2],Analog[J2]
WR	Main[I6],Comm[E4]

Company: **Diatron MI Ltd.**

Title: **Abacus Junior Basic Main Board**

Sheet Name: **tables**

Size: | Number: **03-AJB-Main_v3.01** | Revision: **3.01**

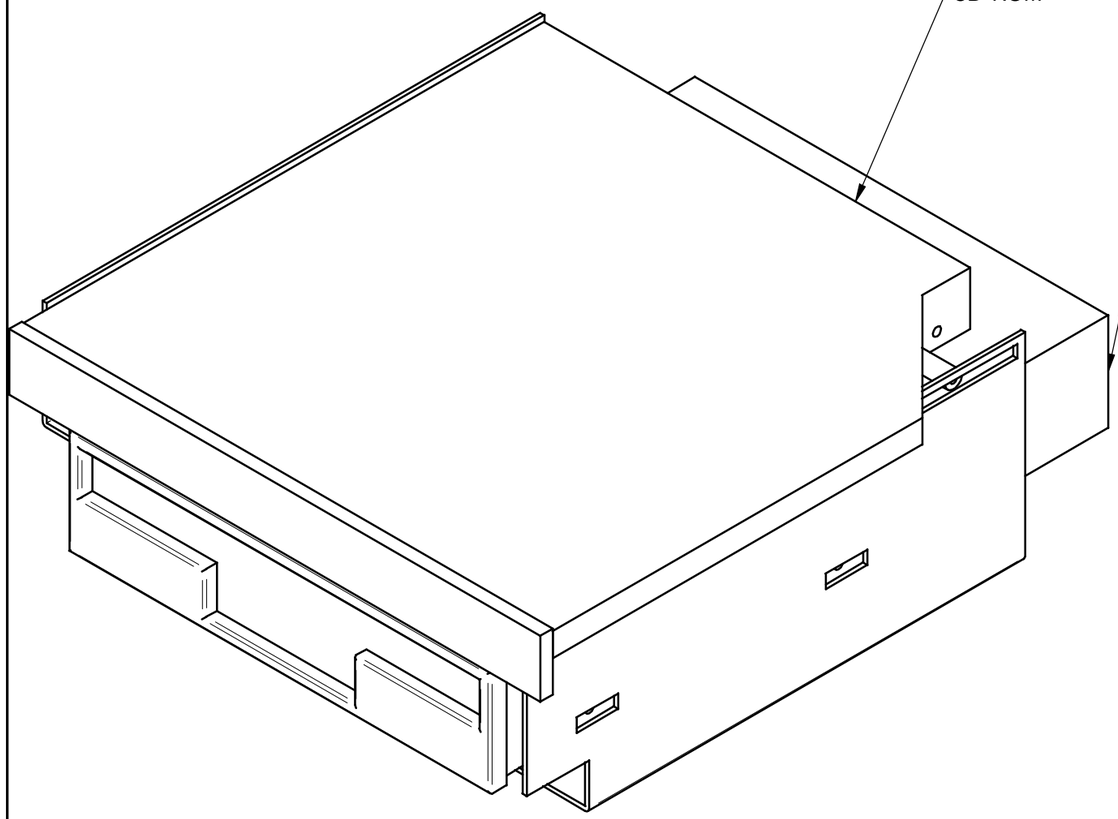
Approved by: **Gyetvai Árpád** Signature:

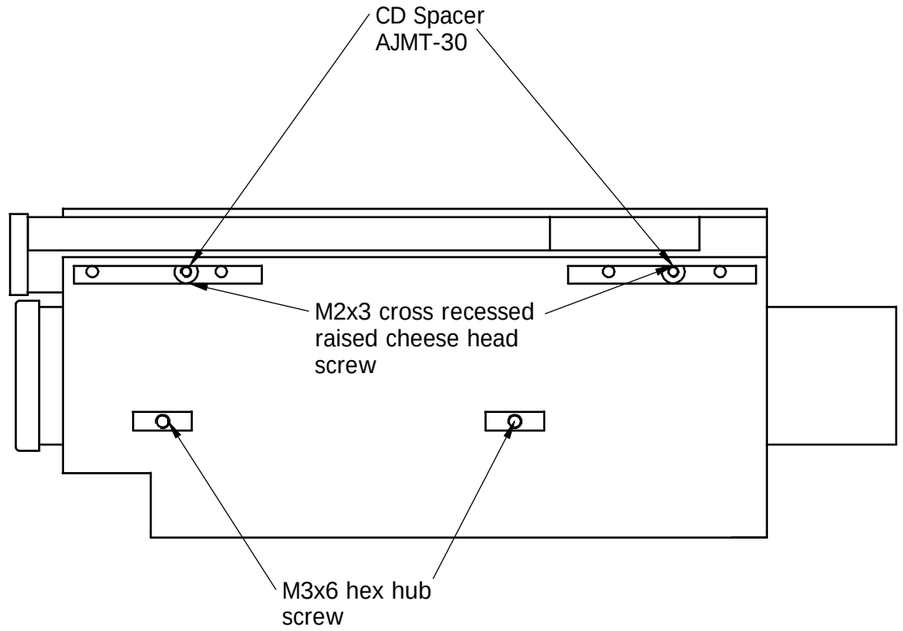
Author: **Katus Ferenc**

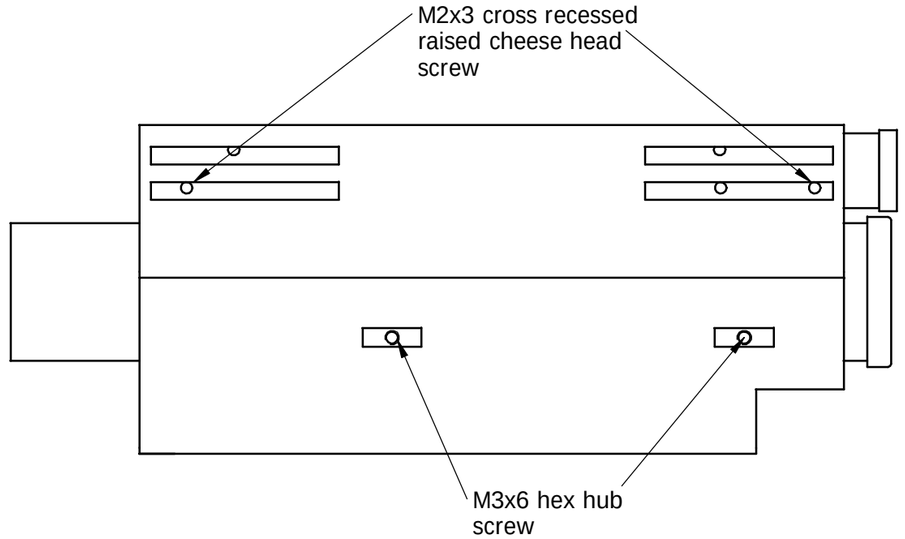
Filename: **AJB-MAIN_v3.010.sch**

Last Modified: **Tue May 04, 2004**

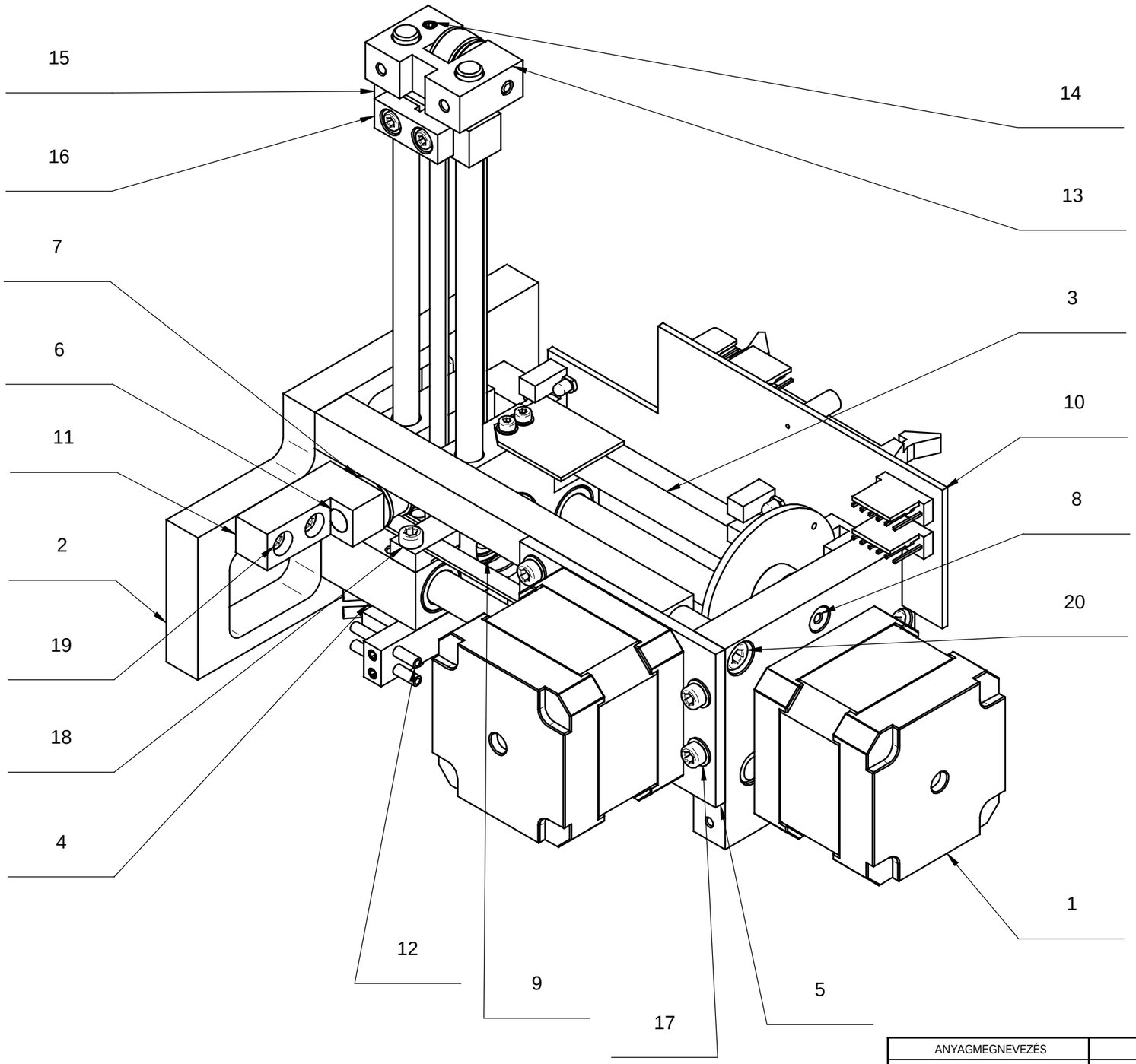
Sheet **8** of **8**







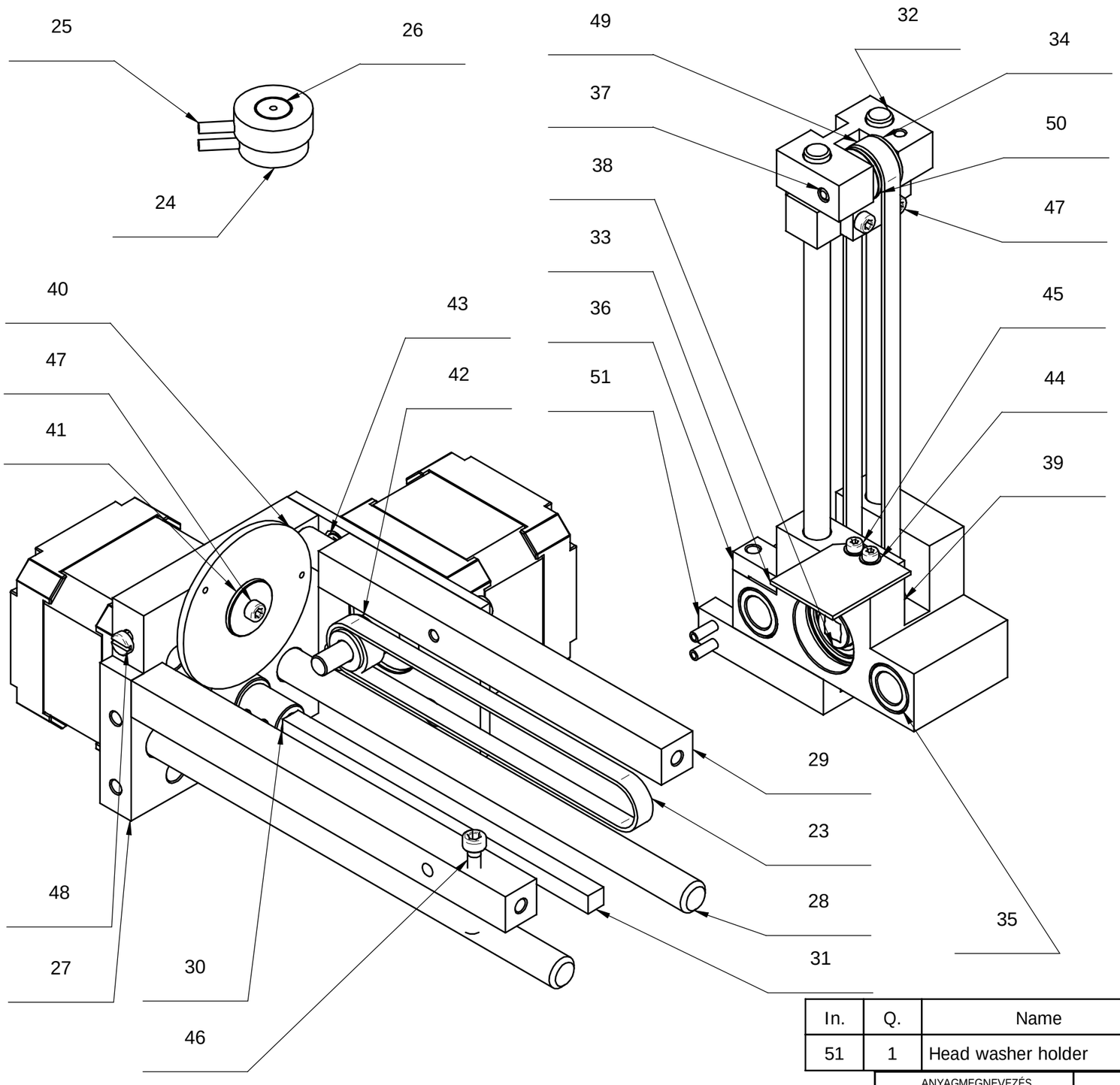
ANYAGMEGNEVEZÉS		FELÜLETKIKÉSZÍTÉS	MEGJEGYZÉS	DARAB	MÉRETARÁNY
					M 1:1
RAJZ.	DÁTUM	MEGNEVEZÉS			Diatron®
		Floppy & CD-ROM assembly			RAJZSZÁM
VÁLTOZÁS JELE	DÁTUM				AJASM-17



In.	Q.	Name	CODE
1	2	Stepmotor	
2	1	Front plate for frame	AJ30024
3	1	Joining bar lower for frame	AJ30008
4	1	Main moving block	AJ30001
5	1	Stepmotor holder for X	AJ30014
6	1	Roller axle for X	AJ30017
7	1	Belt roller for X	AJ30021
8	1	Axle for Y opto cog-wheel	AJ30016
9	2	Bearing	
10	1	Opto board	J307
11	1	Roller holder for X	AJ30019
12	2	Tube	
13	1	Roller holder for Y	AJ30020
14	11	M3x3 hex set screw	
15	1	Moving block for Y	AJ30003
16	1	Aspirator tip fastener	AJ30028
17	3	Washer D3	
18	1	M3x8 hex hub screw	
19	5	M3x10 hex hub screw	
20	4	M4x10 hex hub screw	
21*	1	Bush	AJ30013
22*	2	M2,5x10 hex hub screw	

ANYAGMEGNEVEZÉS	FELÜLETKIKÉSZÍTÉS	MEGJEGYZÉS	DARAB	MÉRETARÁNY
				M 1:1

RAJZ.	DÁTUM	MEGNEVEZÉS	Diatron®
		H&V Moving Unit assmebly I.	RAJZSZÁM
VÁLTOZÁS JELE	DÁTUM		RXY-00

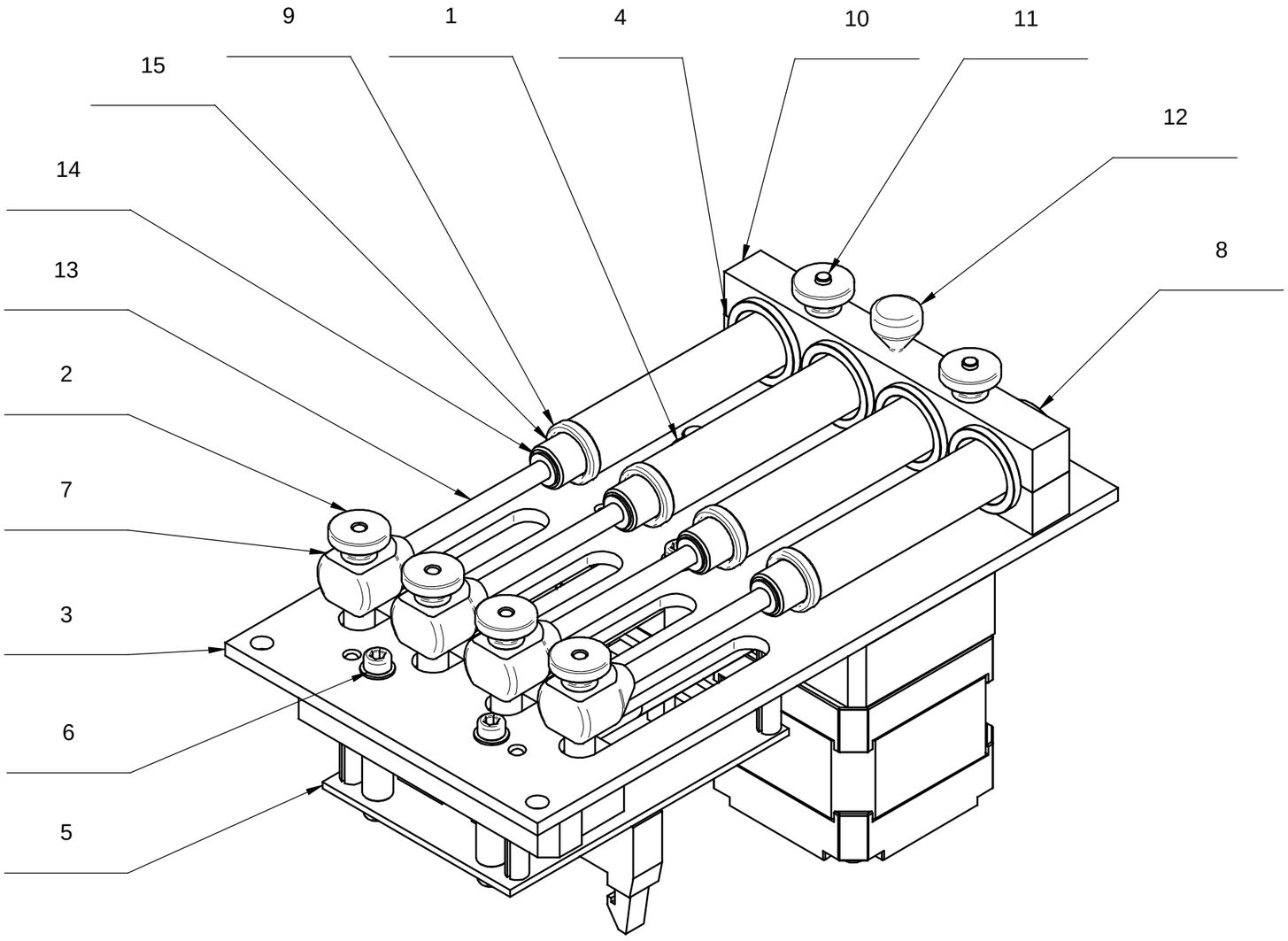


In.	Q.	Name	CODE
51	1	Head washer holder	AJ30026

In.	Q.	Name	CODE
23	1	Timing belt MXL-105	
24	1	Head washer	AJ31001
25	2	Head washer tube	
26	1	Sealing for head washer	AJ31002
27	1	Stepmotor holder for Y	AJ30015
28	2	Axle for X	AJ30005
29	1	Joining bar upper for frame	AJ30007
30	1	Shaft coupling for Y	AJ30010
31	1	Drive stick for Y	AJ30009
32	2	Axle for Y	AJ30006
33	1	Opto flag	AJ30023
34	1	Belt roller for Y	AJ30022
35	2	Sliding tube for main moving block	AJ30002
36	1	Timing belt fastener for X	AJ30011
37	1	Roller axle for Y	AJ30018
38	1	Timing pulley	AJ30501
39	2	Border ring for Y timing p.	AJ30502
40	1	Opto cog-wheel	AJ30600
41	1	Bed-plate for Y opto c-w.	AJ30025
42	1	Timing pulley for X	AJ30401
43	4	M3x6 countersunk screw	
44	2	Washer D2	
45	2	M2x6 hex hub screw	
46	1	M3x6 hex hub screw	
47	5	M2,5x8 hex hub screw	
48	1	M3x6 slotted screw	
49	1	Timing belt MXL-140	
50	1	Timing belt fastener for Y	RXY-11

ANYAGMEGNEVEZÉS	FELÜLETKIKÉSZÍTÉS	MEGJEGYZÉS	DARAB	MÉRETARÁNY
				M 1:1

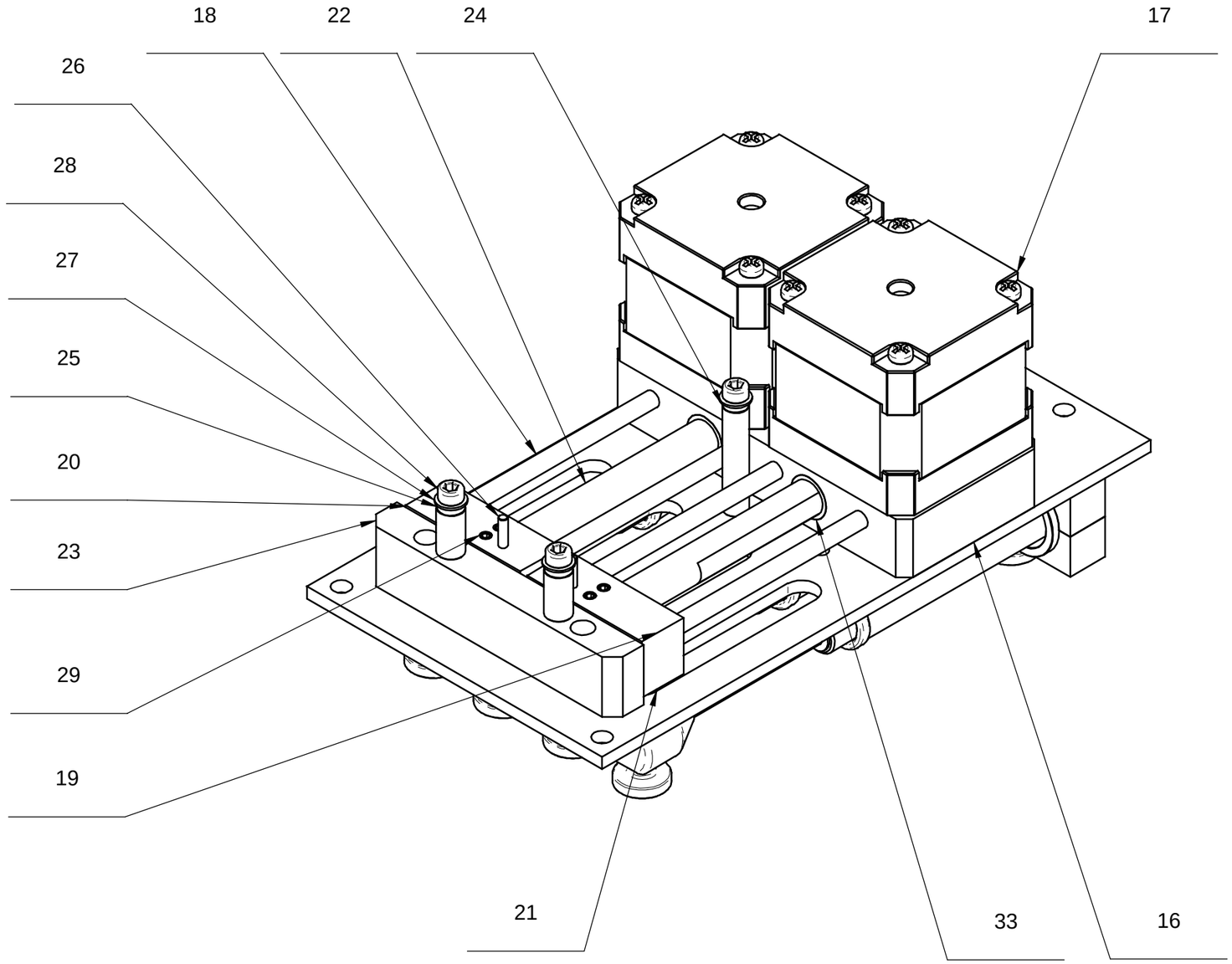
RAJZ.	DÁTUM	MEGNEVEZÉS	Diatron®
		H&V Moving Unit assembly II.	RAJZSZÁM
VÁLTOZÁS JELE	DÁTUM		RXY-00.1



In.	Q.	Name	CODE
1	2	Gear	AJ2D10016
2	6	Fixing nut	
3	1	Dilutor panel	AJ2D10001
4	1	Lower syringe holder	AJ2D10002
5	1	Opto board	J214
6	3	M3x10 hex hub screw	
7	4	Actuator	AJ2D10204
8	4	Lyse glass cover	AJ2D10102
9	4	Lyse glass	
10	1	Upper syringe holder	AJ2D10005
11	2	M3x25 double end bolt	
12	1	Handle	AJ2D10013
13	4	Leadin rod	AJ2D10203
14	4	Piston washer D3	
15	4	Lyse piston	AJ2D10201

ANYAGMEGNEVEZÉS	FELÜLETKIKÉSZÍTÉS	MEGJEGYZÉS	DARAB	MÉRETARÁNY
				M 1:1

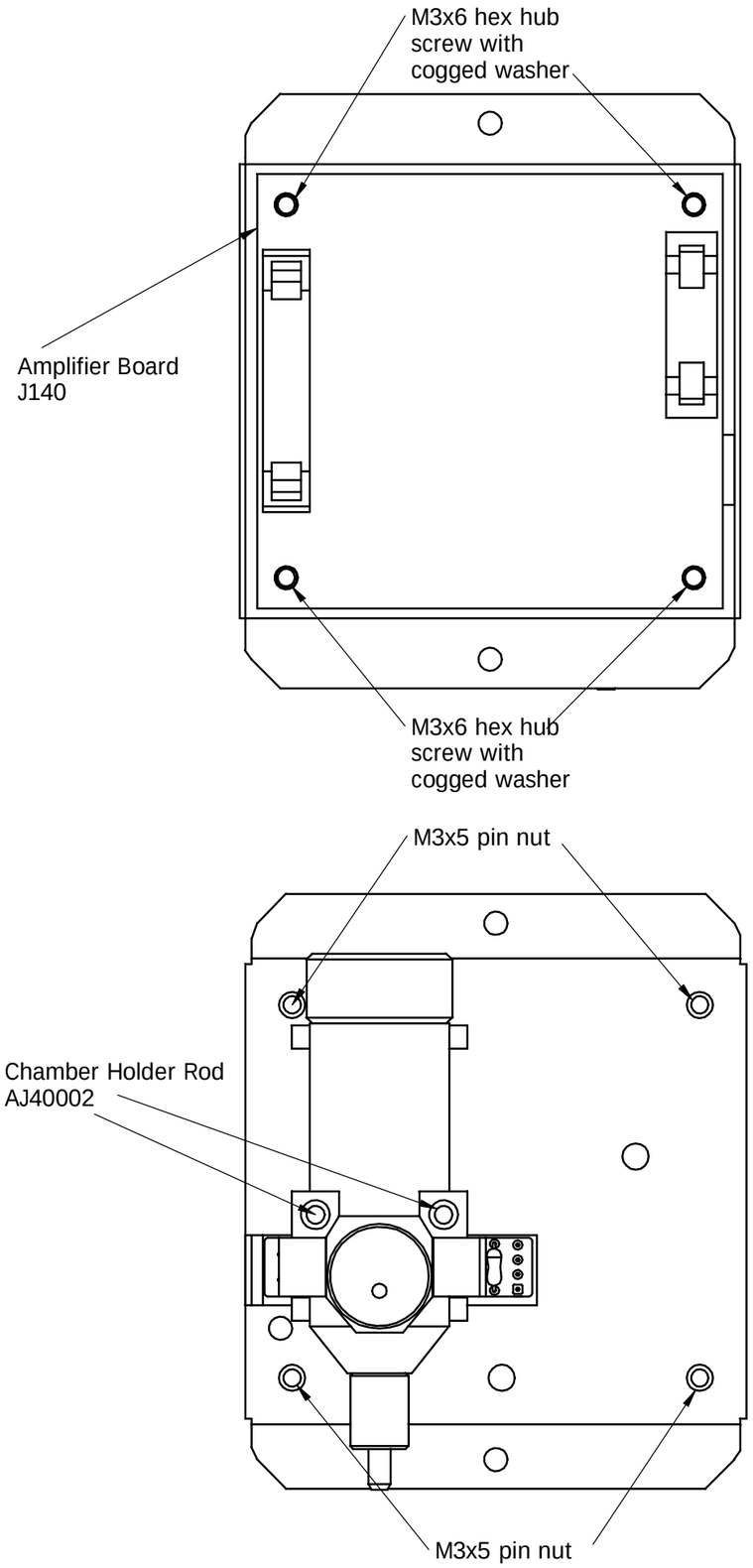
RAJZ.	DÁTUM	MEGNEVEZÉS	Diatron®
		Main Dilutor assembly I.	RAJZSZÁM
VÁLTOZÁS JELE	DÁTUM		2MD-00

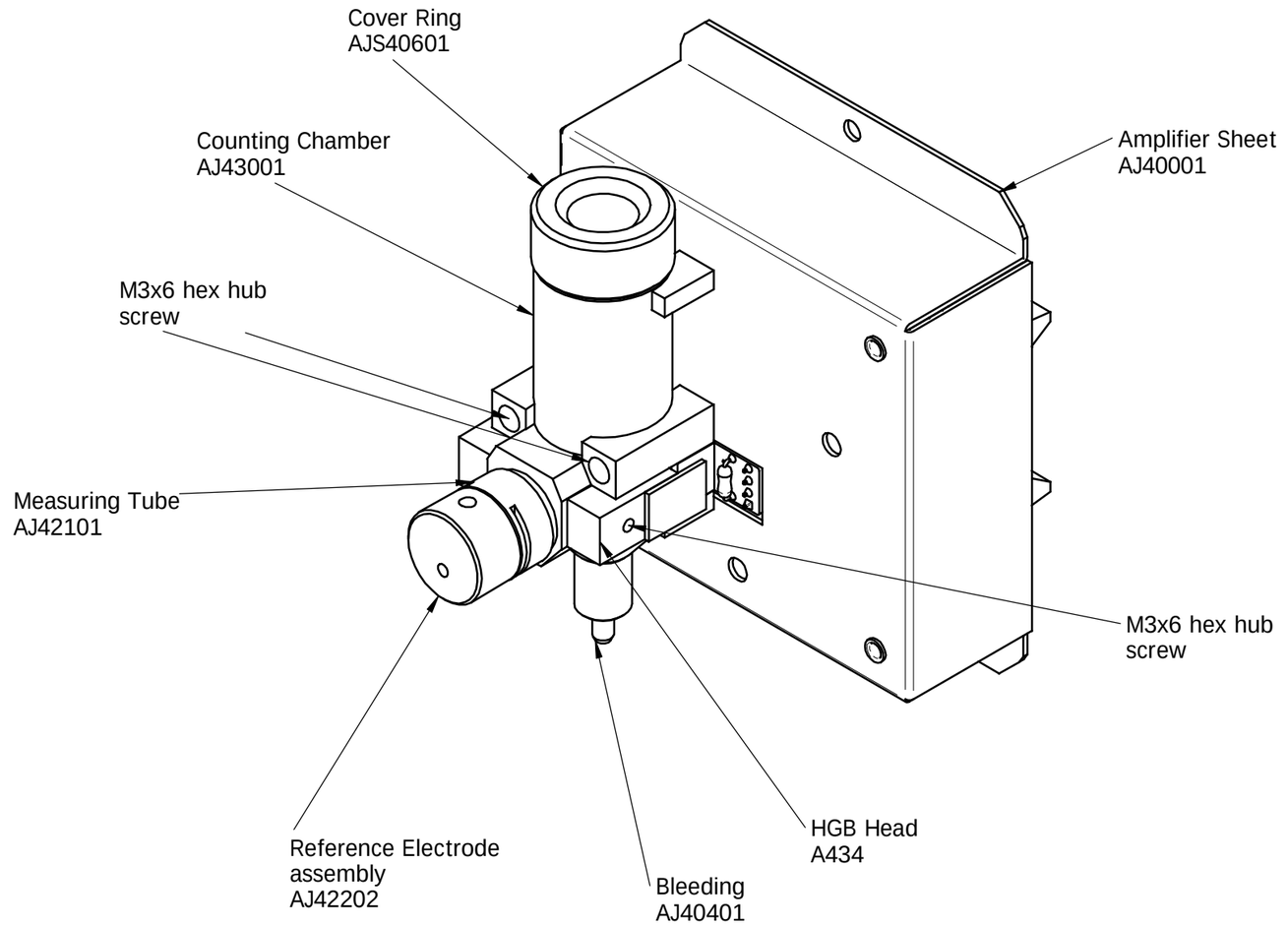


In.	Q.	Name	CODE
16	1	Motor holder	AJ2D10003
17	2	Stepmotor	
18	4	Leading rod	AJ2D10012
19	1	Left sliding block	AJ2D10007
20	1	Right sliding block	AJ2D10008
21	4	Threaded pin	AJ2D10004
22	2	Gear stick	AJ2D10006
23	1	Adjuster	AJ2D10014
24	1	Spacer 26	AJ2D10011
25	2	Spacer 11	AJ2D10010
26	2	Opto flag	AJ2D10015
27	9	Washer D3	
28	6	M3x6 hex hub screw	
29	8	M3x3 hex set screw	
30*	4	Bush	AJ2D10009
31*	4	M4x10 countersunk screw	
32*	8	M3x12 hex hub screw	
33	2	Leading bush	AJ2D10017
34*	4	Sealing ring	

ANYAGMEGNEVEZÉS	FELÜLETKIKÉSZÍTÉS	MEGJEGYZÉS	DARAB	MÉRETARÁNY
				M 1:1

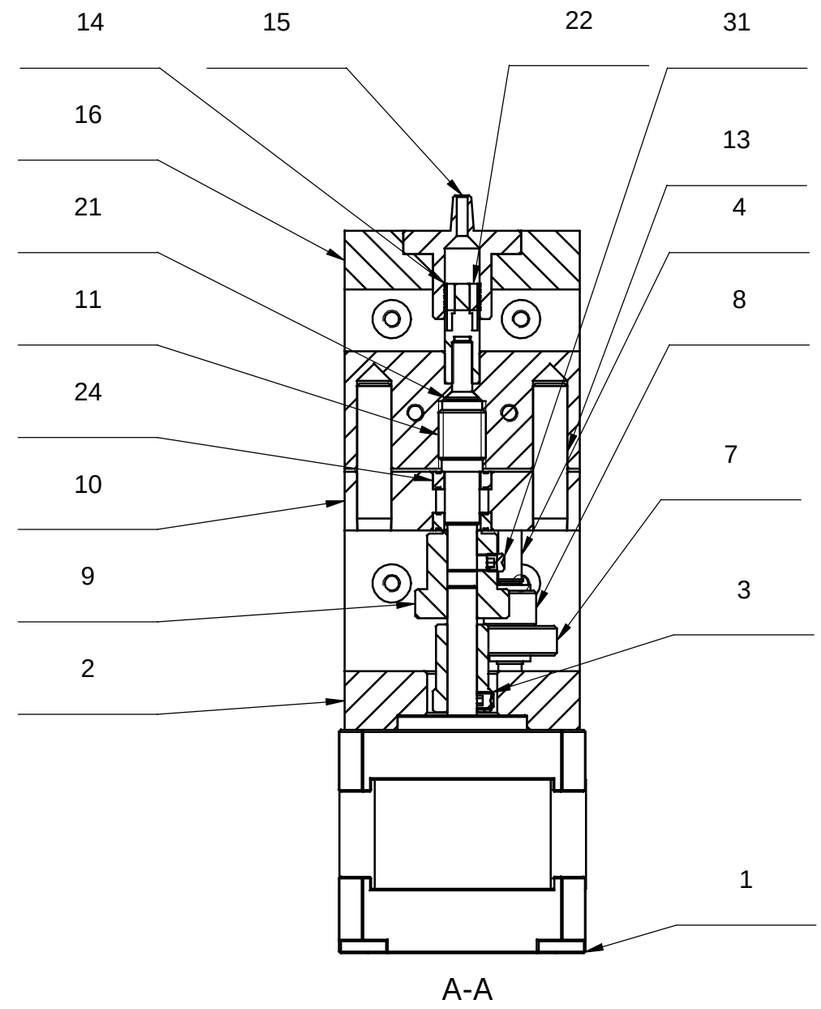
RAJZ.	DÁTUM	MEGNEVEZÉS	Diatron®
		Main Dilutor assembly	
VÁLTOZÁS JELE	DÁTUM		RAJZSZÁM
			2MD-00-1

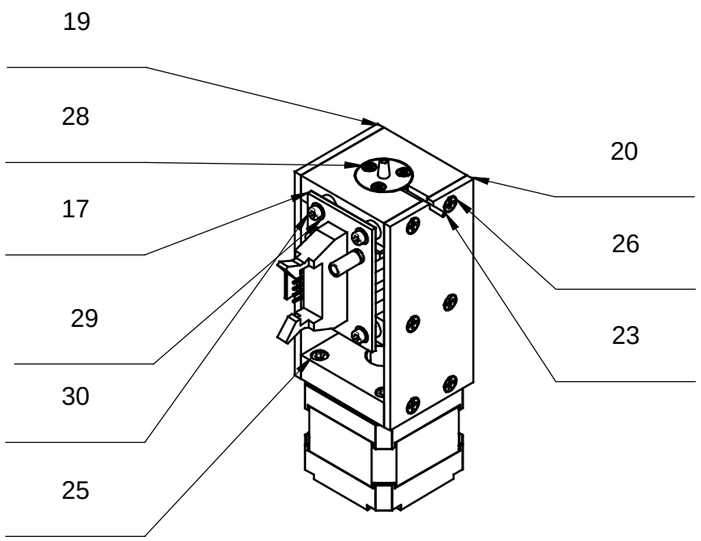




Code for Chamber & Aperture without Amplifier Board: C400

ANYAGMEGNEVEZÉS		FELÜLETKIKÉSZÍTÉS	MEGJEGYZÉS	DARAB	MÉRETARÁNY
					M 1:1
RAJZ.	DÁTUM	MEGNEVEZÉS			Diatron®
		Chamber, Aperture and Amplifier assembly			
VÁLTOZÁS JELE	DÁTUM				RAJZSZÁM
					AJASM-16

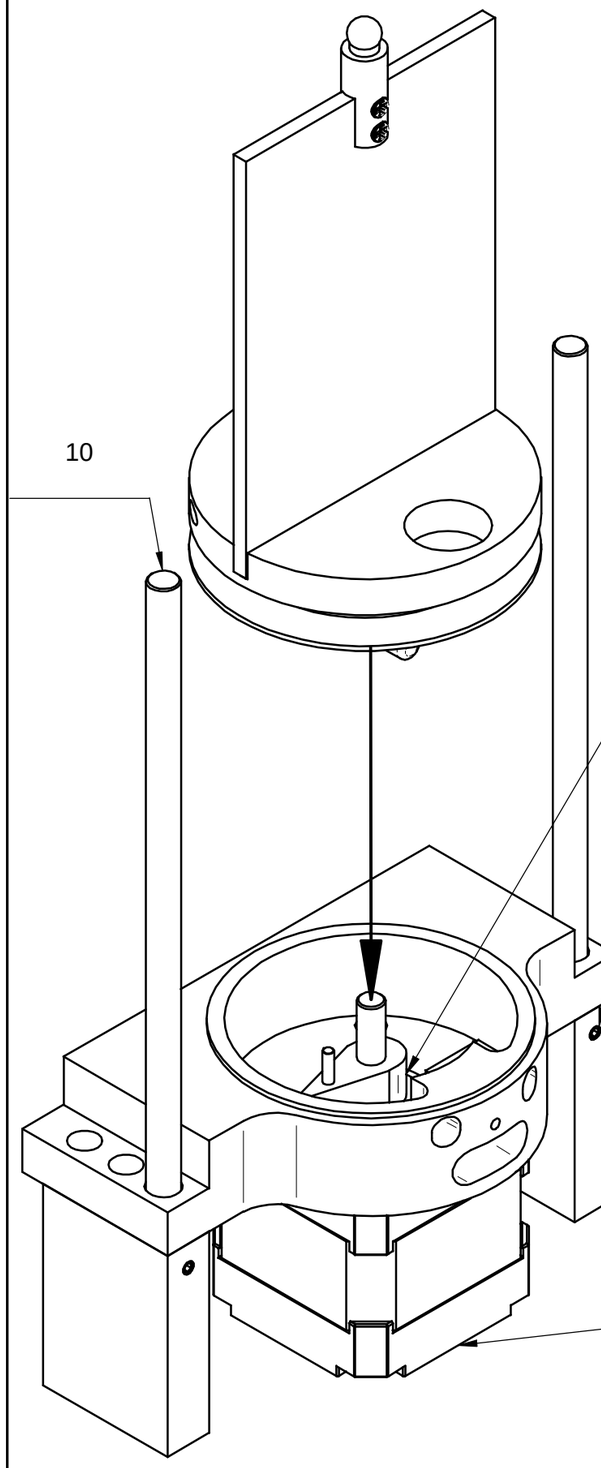


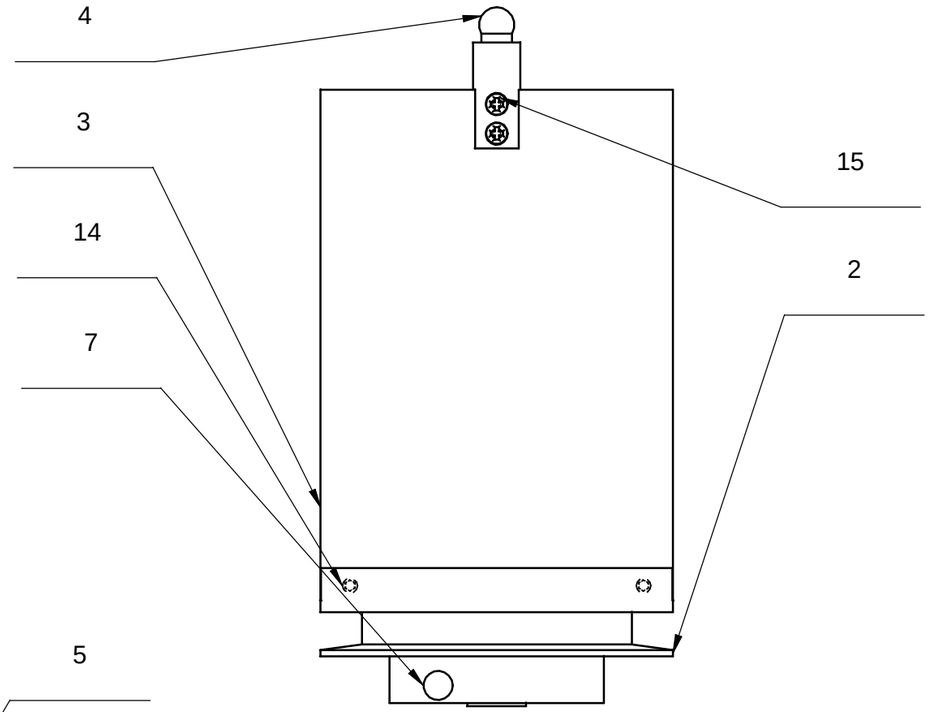


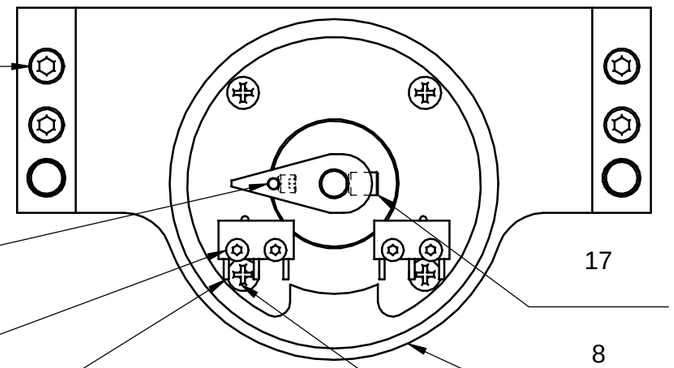
In.	Q.	Name	CODE
1	1	Stepmotor	
2	1	Motor holder	AJM10008
3	1	Gear 16.1	AJM10003
4	1	Gear axle	AJM10012
5	2	Seeger-ring	
6	2	Sliding ring	AJM10011
7	1	Gear 30.1	AJM10006
8	1	Gear 16.2	AJM10004
9	1	Gear 30.2	AJM10005
10	1	Central panel	AJM10010
11	1	Spindle	AJM10009
12	1	Leading billet	AJM10014
13	2	Leading rod	AJM10013
14	1	Piston	AJM10101
15	1	Piston cover	AJM10201
16	1	Cover panel	AJM10203
17	1	Opto board	J224
18	1	Opto flag	AJMVOL150
19	1	Fixing cover sheet	AJM10002
20	1	Cover sheet	AJM10001
21	1	M3x10 countersunk screw	
22	1	Sealing ring	
23	1	1,6/1,2 tube	
24	2	Bearing	
25	4	M3x8 hex hub screw	
26	14	M3x6 countersunk screw	
27	4	M3 PEM fastener	
28	3	M25x8 countersunk screw	
29	4	Washer D2,5	
30	4	M2,5x10 hex hub screw	
31	6	M3x3 hex set screw	

ANYAGMEGNEVEZÉS	FELÜLETKIKÉSZÍTÉS	MEGJEGYZÉS	DARAB	MÉRETARÁNY
				M 1:1

RAJZ.	DÁTUM	MEGNEVEZÉS	Diatron®
		Micro Dilutor assembly	RAJZSZÁM
VÁLTOZÁS JELE	DÁTUM		M2.1-00



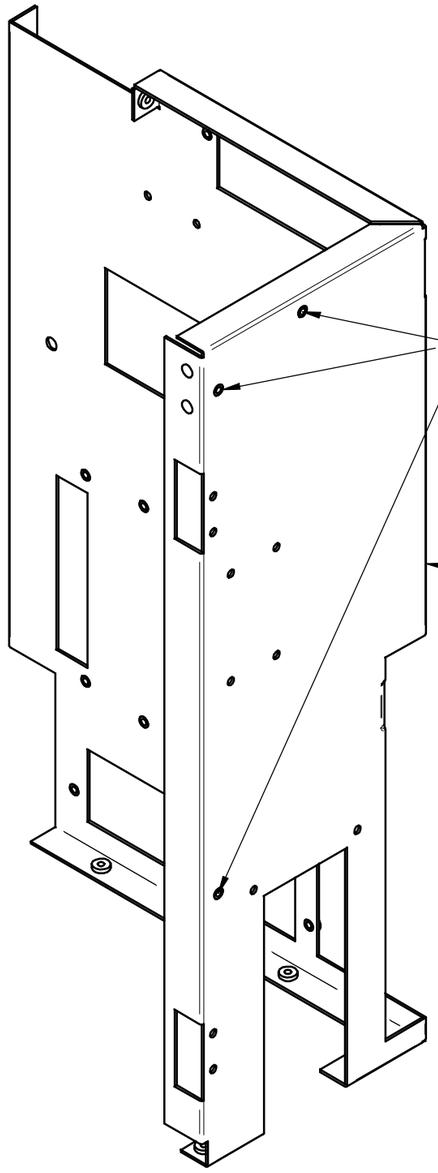


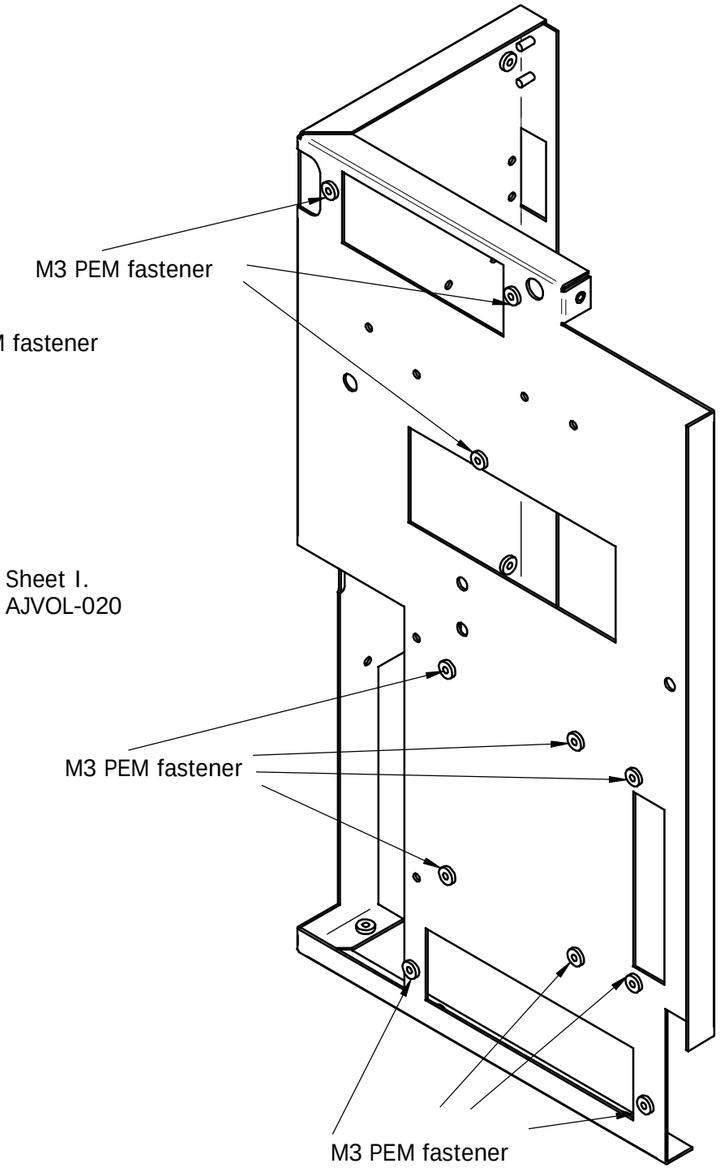


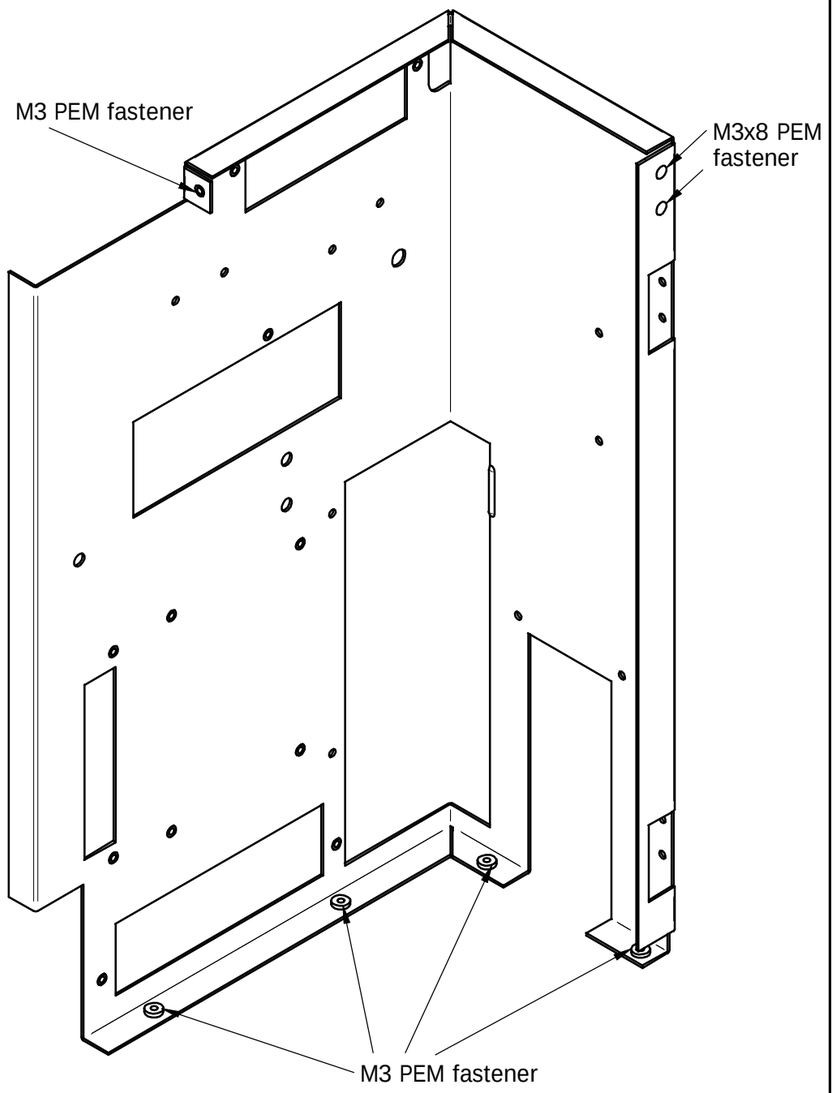
In.	Q.	Name	CODE
1	1	Stepmotor	
2	1	Rotor	MB-06
3	1	Door sheet	VOL-160
4	1	Ball axle	MB-02
5	1	Crank	MB-03
6	1	Actuator	MB-04/1
7	1	Shaft	MB-04/2
8	1	Bob	MB-05
9	2	Abutment	MB-01
10	2	Spacer	MB-07
11	2	Microswitch	AJMB10100
12	3	M3x3 hex set screw	
13	4	M3x10 hex hub screw	
14	2	M3x6 hex hub screw with flat end	
15	2	M2x8 countersunk screw	
16	4	M2x8 hex hub screw	
17	1	M4x5 hex set screw	
18	4	M3x6 countersunk screw	

ANYAGMEGNEVEZÉS	FELÜLETKIKÉSZÍTÉS	MEGJEGYZÉS	DARAB	MÉRETARÁNY
			1 DB	M 1:1

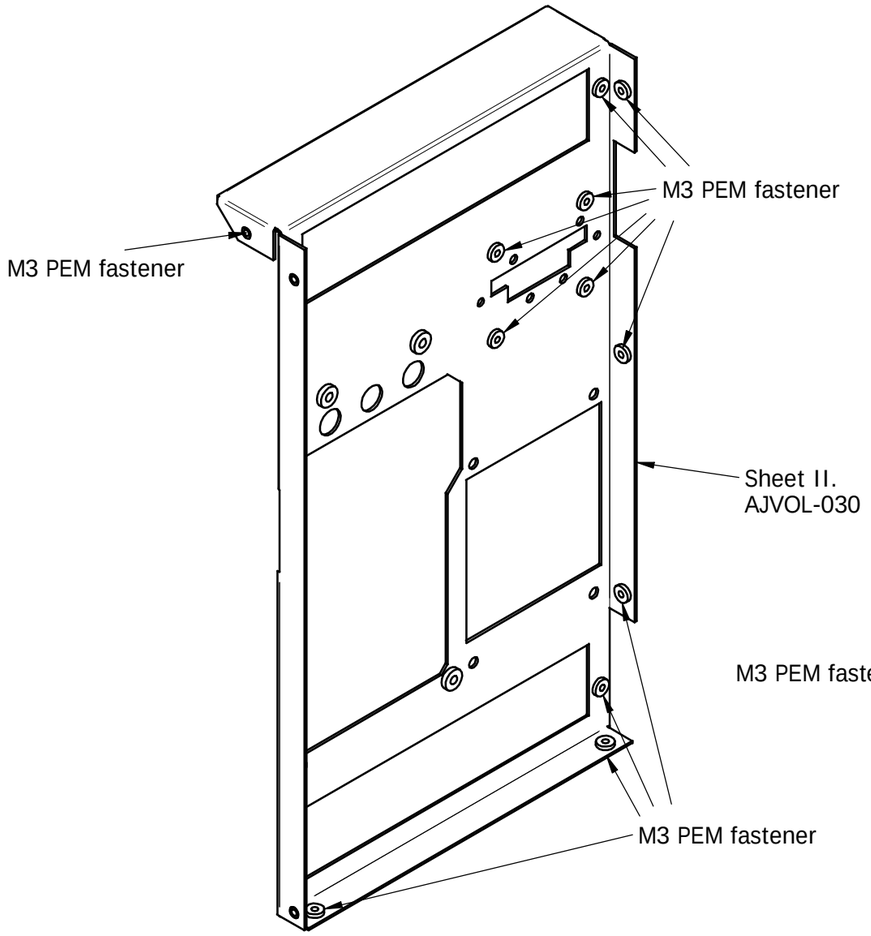
RAJZ.	DÁTUM	MEGNEVEZÉS	Diatron®
		Sample Rotor assembly	RAJZSZÁM
VÁLTOZÁS JELE	DÁTUM		MB-01

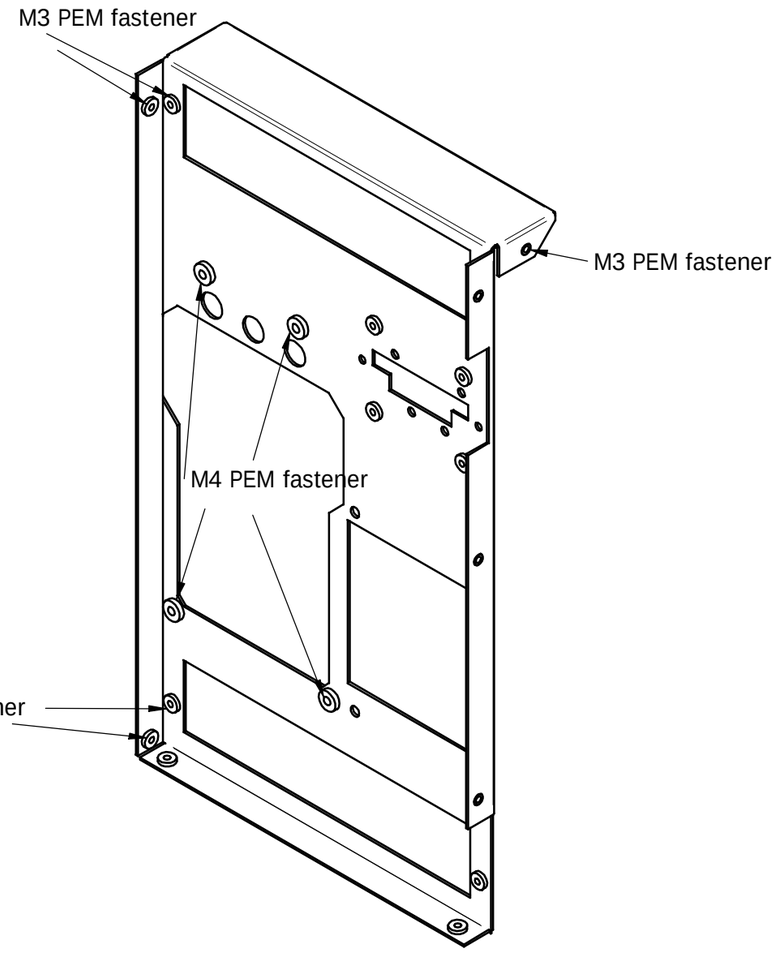






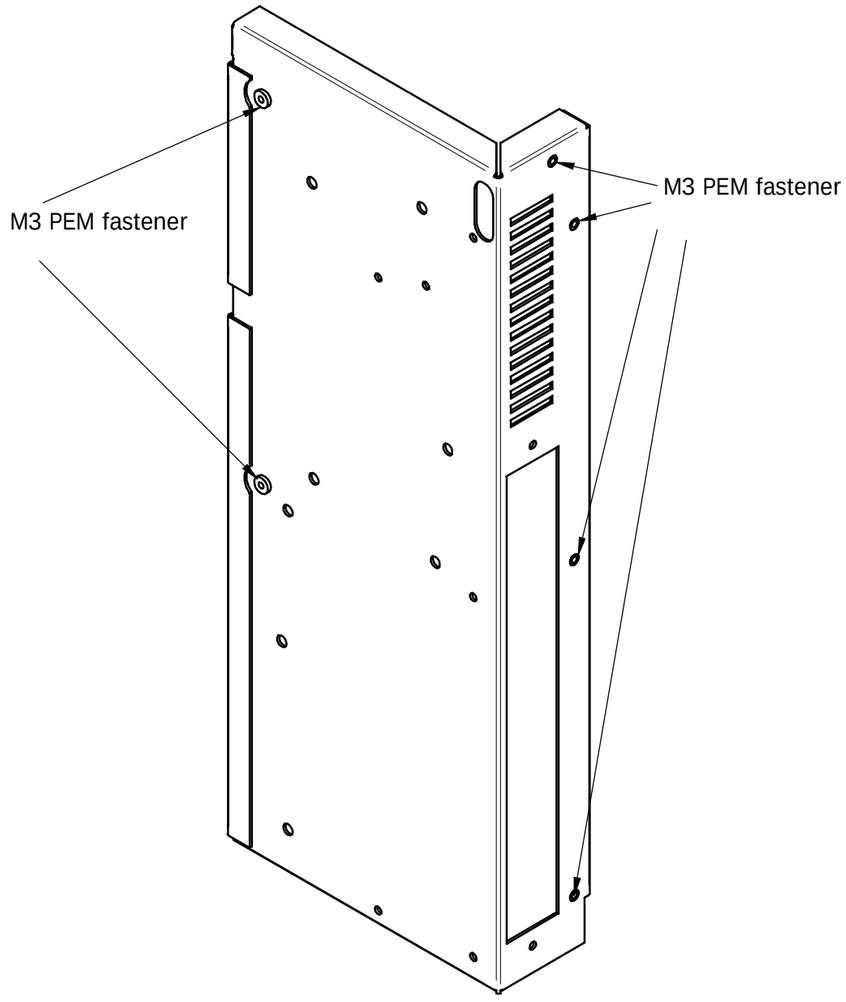
ANYAGMEGNEVEZÉS		FELÜLETKIKÉSZÍTÉS	MEGJEGYZÉS	DARAB	MÉRETARÁNY
					M 1:2
RAJZ.	DÁTUM	MEGNEVEZÉS		Diatron®	
		Sheet I. assembly			
VÁLTOZÁS JELE	DÁTUM			RAJZSZÁM	
				AJASM-02	

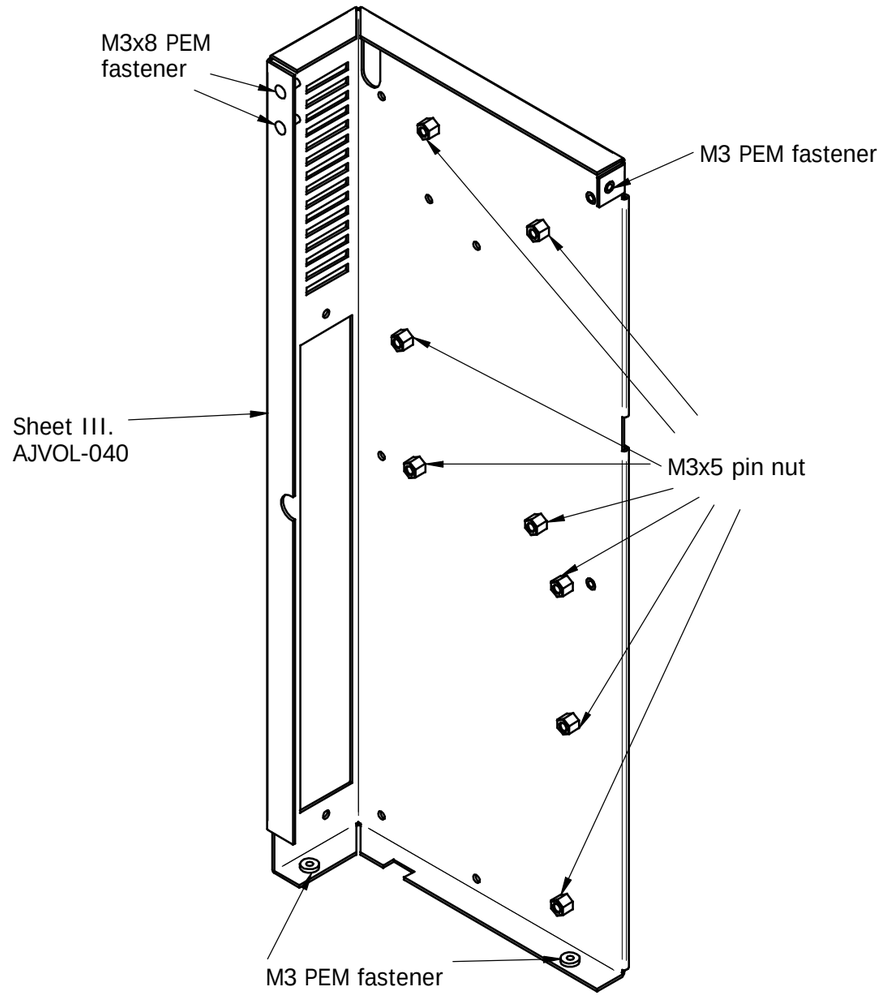




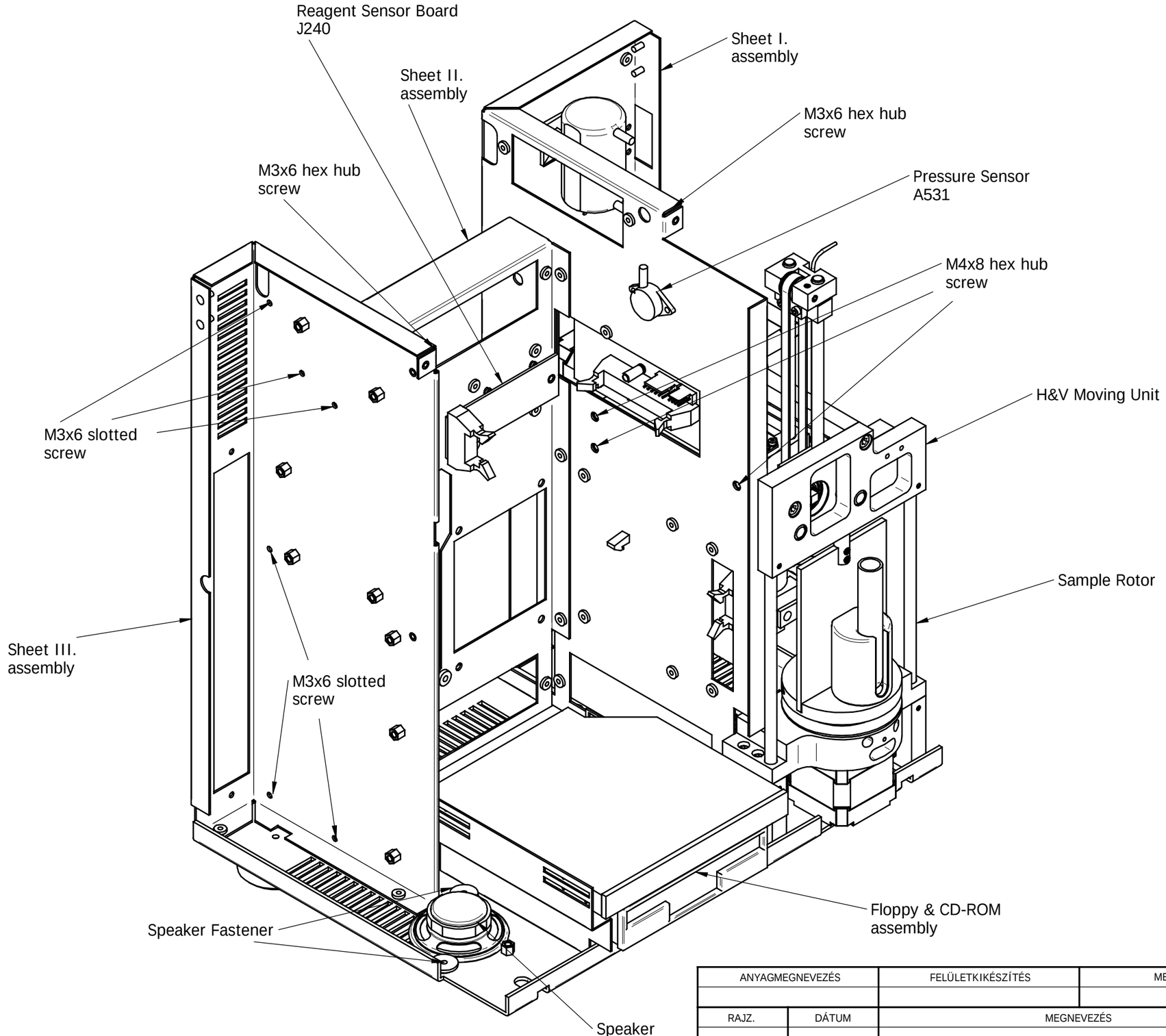
ANYAGMEGNEVEZÉS	FELÜLETKIKÉSZÍTÉS	MEGJEGYZÉS	DARAB	MÉRETARÁNY
				M 1:2

RAJZ.	DÁTUM	MEGNEVEZÉS	Diatron®
		Sheet II. assembly	RAJZSZÁM
VÁLTOZÁS JELE	DÁTUM		AJASM-03

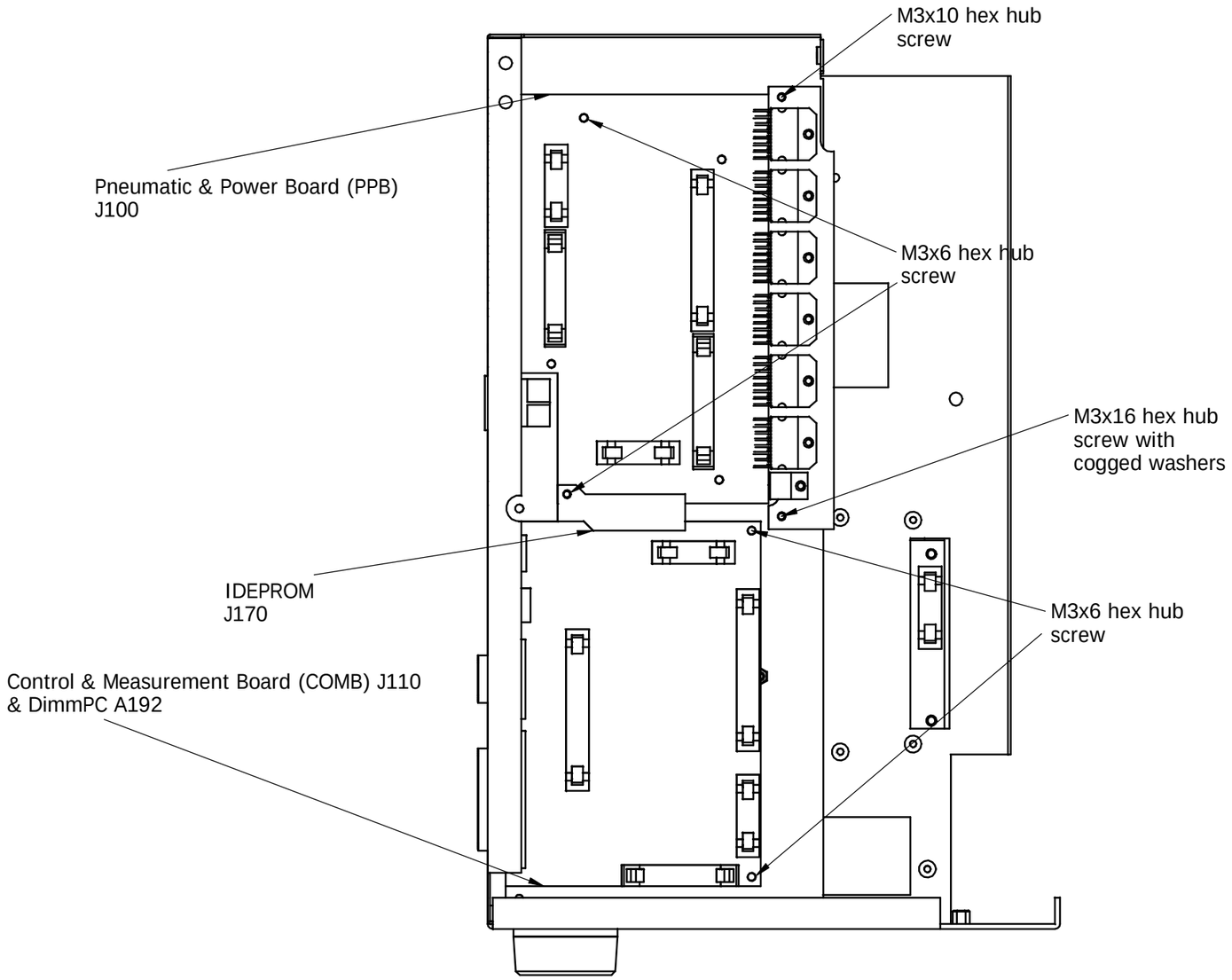




ANYAGMEGNEVEZÉS		FELÜLETKIKÉSZÍTÉS	MEGJEGYZÉS	DARAB	MÉRETARÁNY
					M 1:2
RAJZ.	DÁTUM	MEGNEVEZÉS		Diatron®	
		Sheet III. assembly			
VÁLTOZÁS JELE	DÁTUM			RAJZSZÁM	
				AJASM-04	

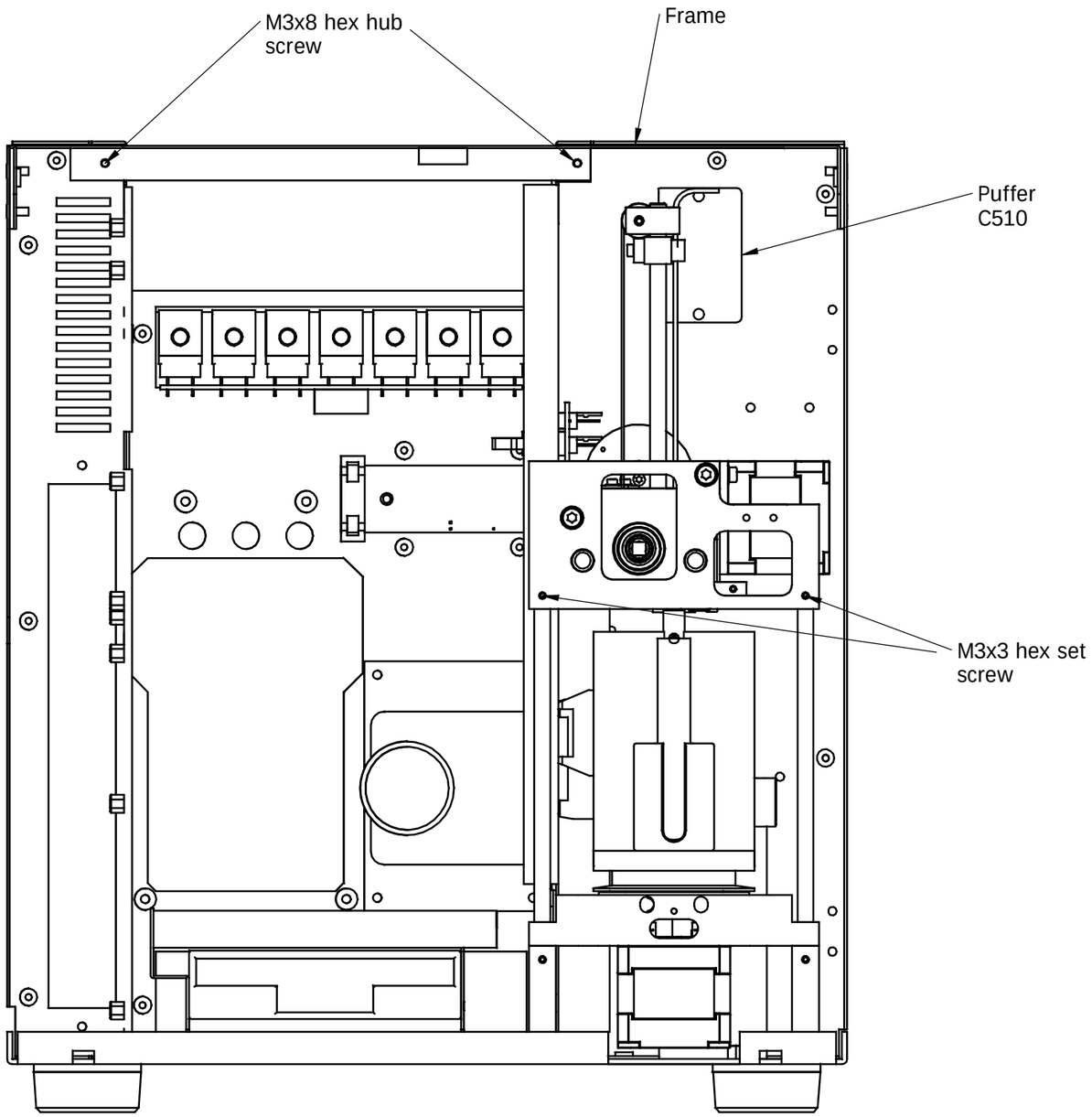


ANYAGMEGNEVEZÉS		FELÜLETKIKÉSZÍTÉS	MEGJEGYZÉS	DARAB	MÉRETARÁNY
					M 1:2
RAJZ.	DÁTUM	MEGNEVEZÉS		Diatron®	
		Structure 00.		RAJZSZÁM	
VÁLTOZÁS JELE	DÁTUM			AJASM-05	



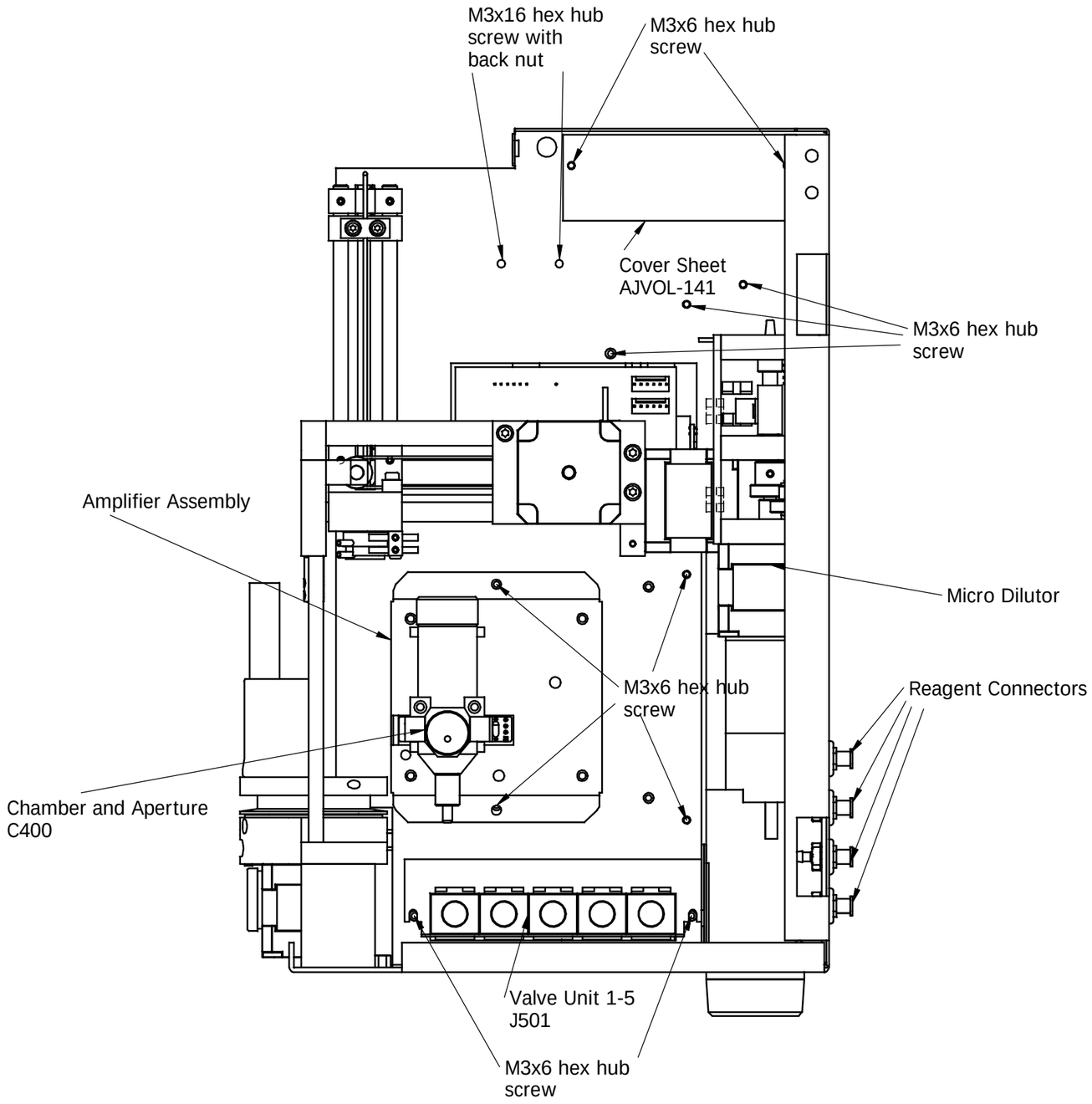
Code for COMB with DimmPC: J111

ANYAGMEGNEVEZÉS		FELÜLETKIKÉSZÍTÉS	MEGJEGYZÉS	DARAB	MÉRETARÁNY
					M 1:2
RAJZ.	DÁTUM	MEGNEVEZÉS			Diatron®
		Structure 01.			RAJZSZÁM
VÁLTOZÁS JELE	DÁTUM				AJASM-06



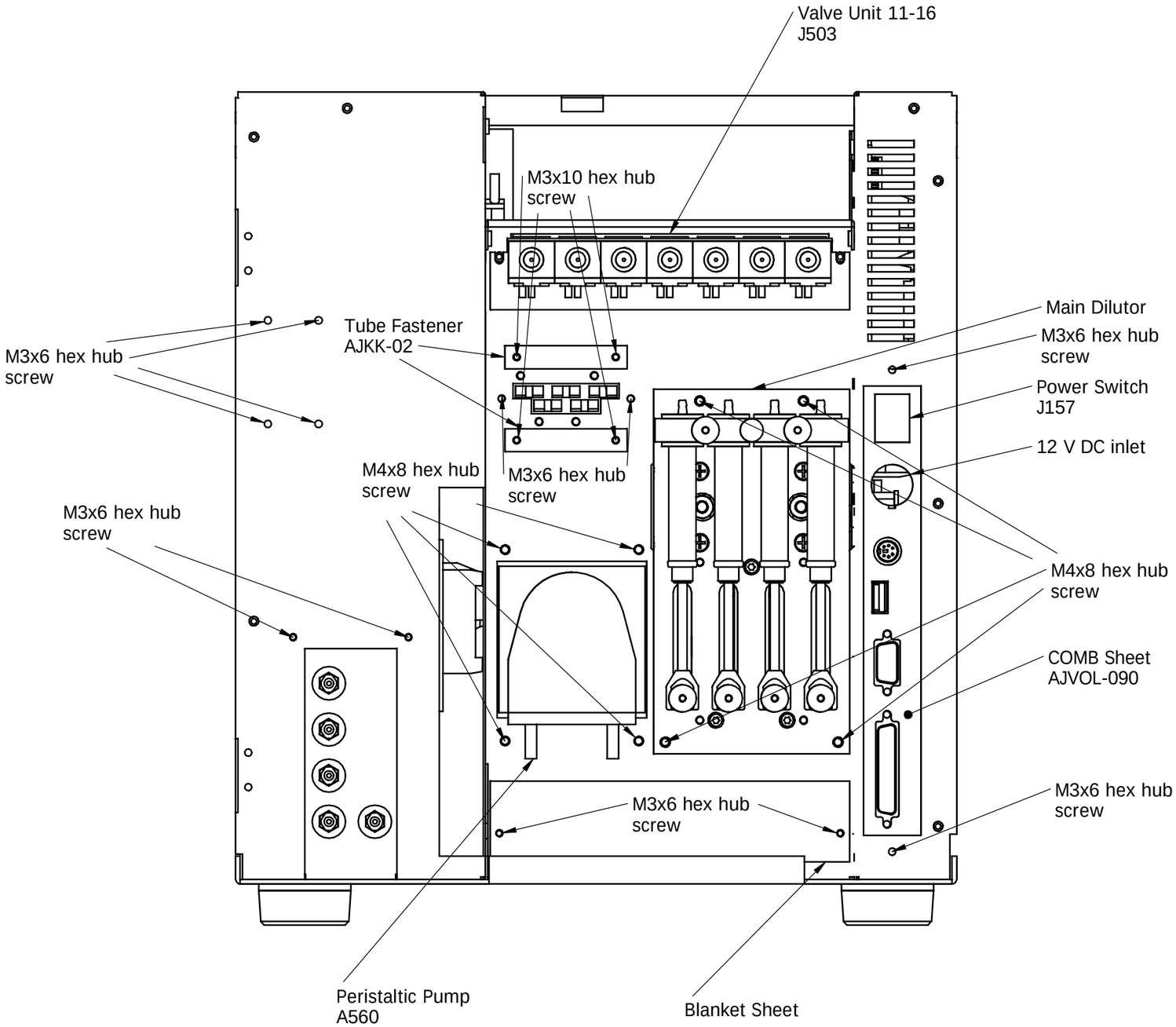
ANYAGMEGNEVEZÉS	FELÜLETKIKÉSZÍTÉS	MEGJEGYZÉS	DARAB	MÉRETARÁNY
				M 1:2

RAJZ.	DÁTUM	MEGNEVEZÉS	Diatron®
VÁLTOZÁS JELE	DÁTUM	Structure 02.	RAJZSZÁM
			AJASM-07



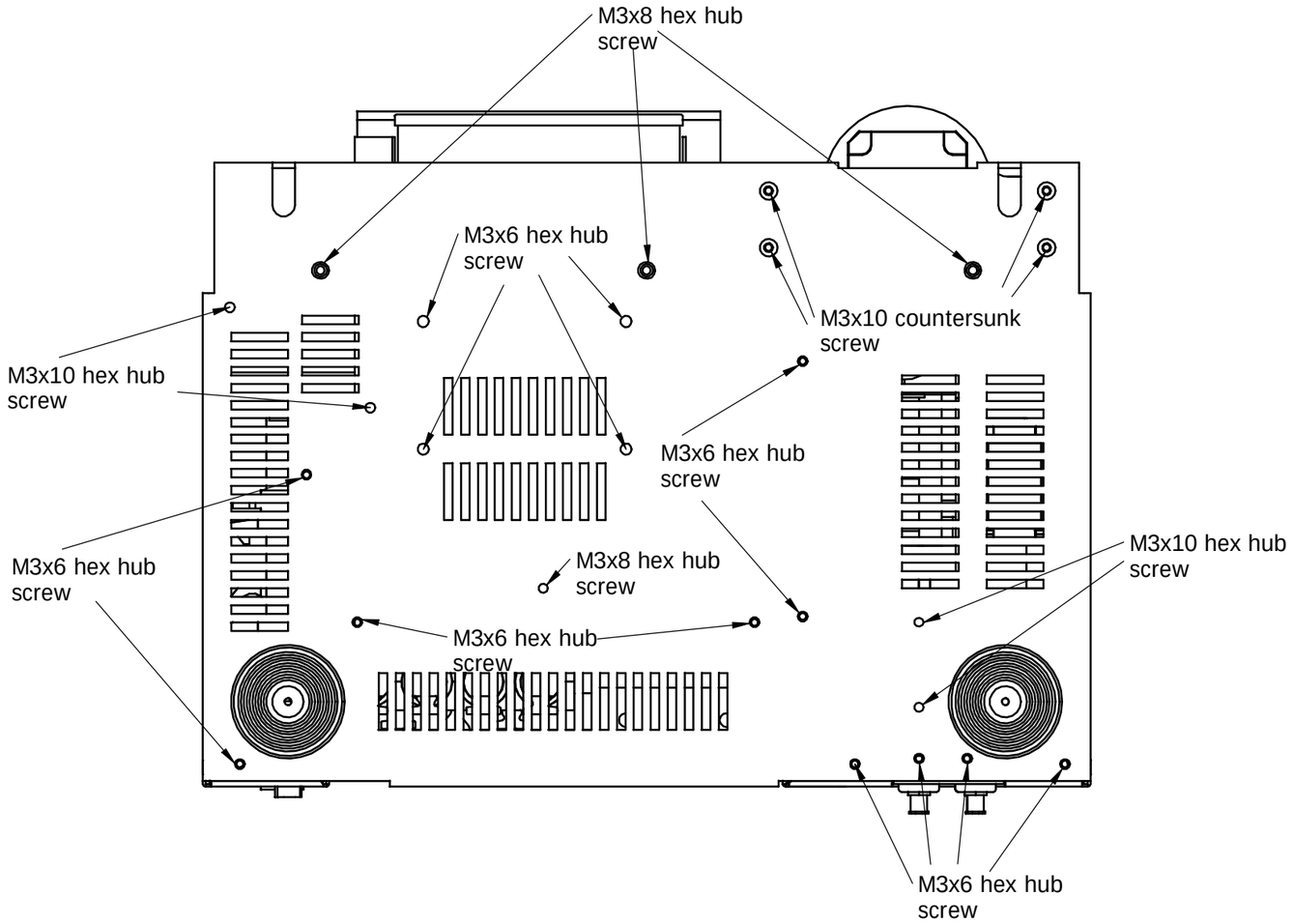
ANYAGMEGNEVEZÉS	FELÜLETKIKÉSZÍTÉS	MEGJEGYZÉS	DARAB	MÉRETARÁNY
				M 1:2

RAJZ.	DÁTUM	MEGNEVEZÉS	Diatron®
		Structure 03.	RAJZSZÁM
VÁLTOZÁS JELE	DÁTUM		AJASM-08

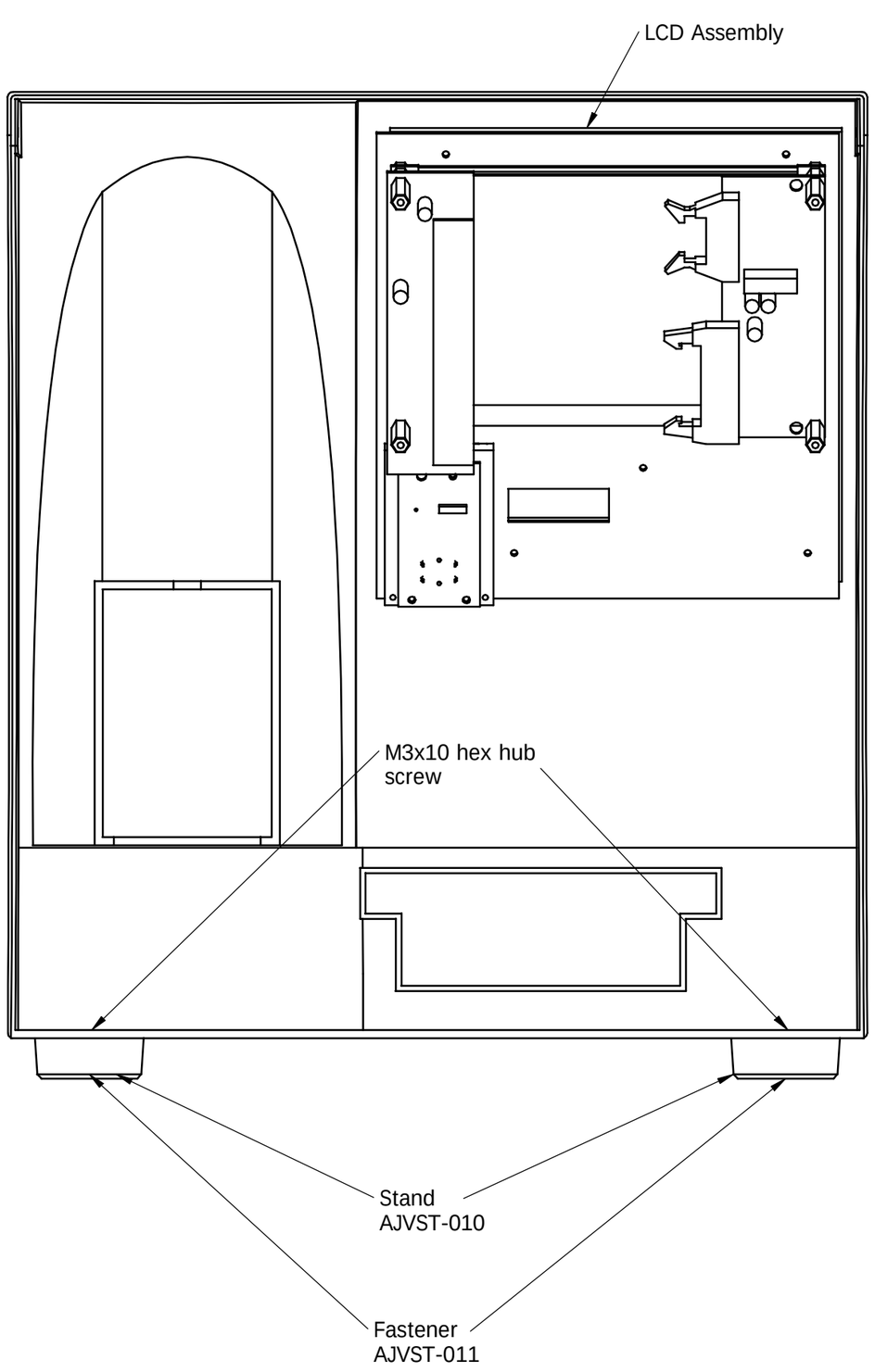


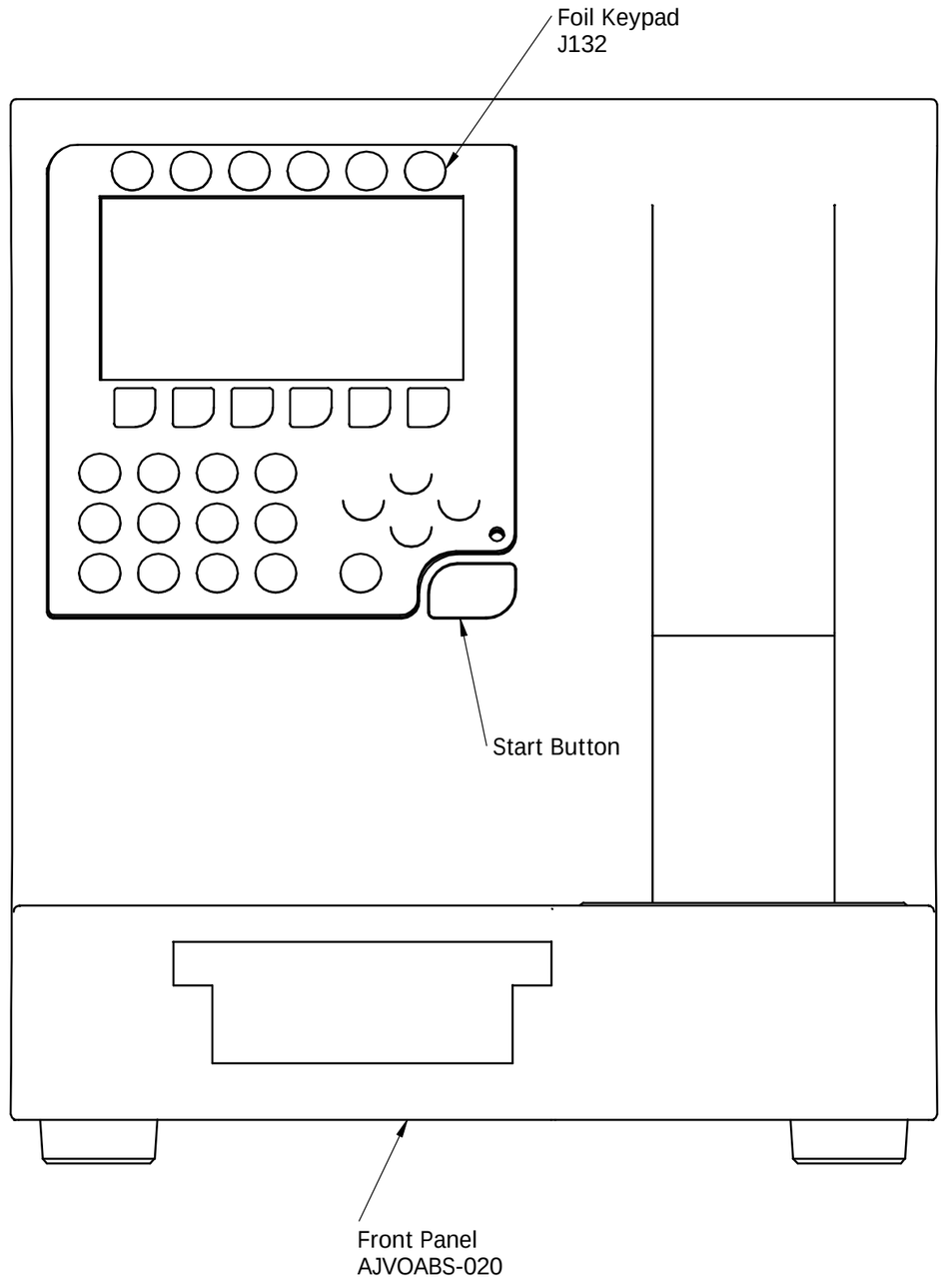
ANYAGMEGNEVEZÉS	FELÜLETKIKÉSZÍTÉS	MEGJEGYZÉS	DARAB	MÉRETARÁNY
				M 1:2

RAJZ.	DÁTUM	MEGNEVEZÉS	Diatron®
VÁLTOZÁS JELE	DÁTUM	Structure 04.	RAJZSZÁM
			AJASM-09



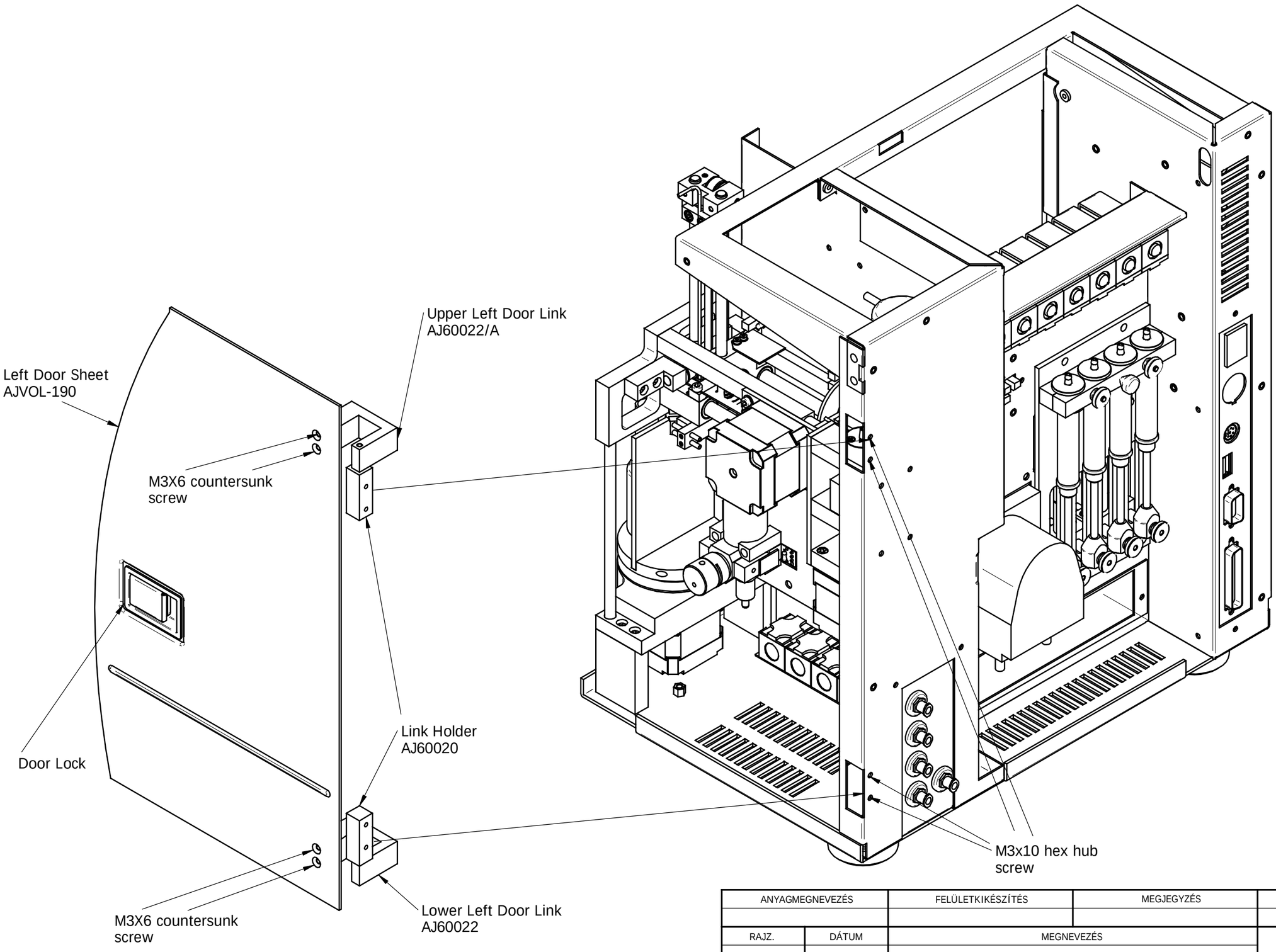
ANYAGMEGNEVEZÉS		FELÜLETKIKÉSZÍTÉS	MEGJEGYZÉS	DARAB	MÉRETARÁNY
					M 1:2
RAJZ.	DÁTUM	MEGNEVEZÉS		Diatron®	
		Structure 05.		RAJZSZÁM	
VÁLTOZÁS JELE	DÁTUM			AJASM-10	





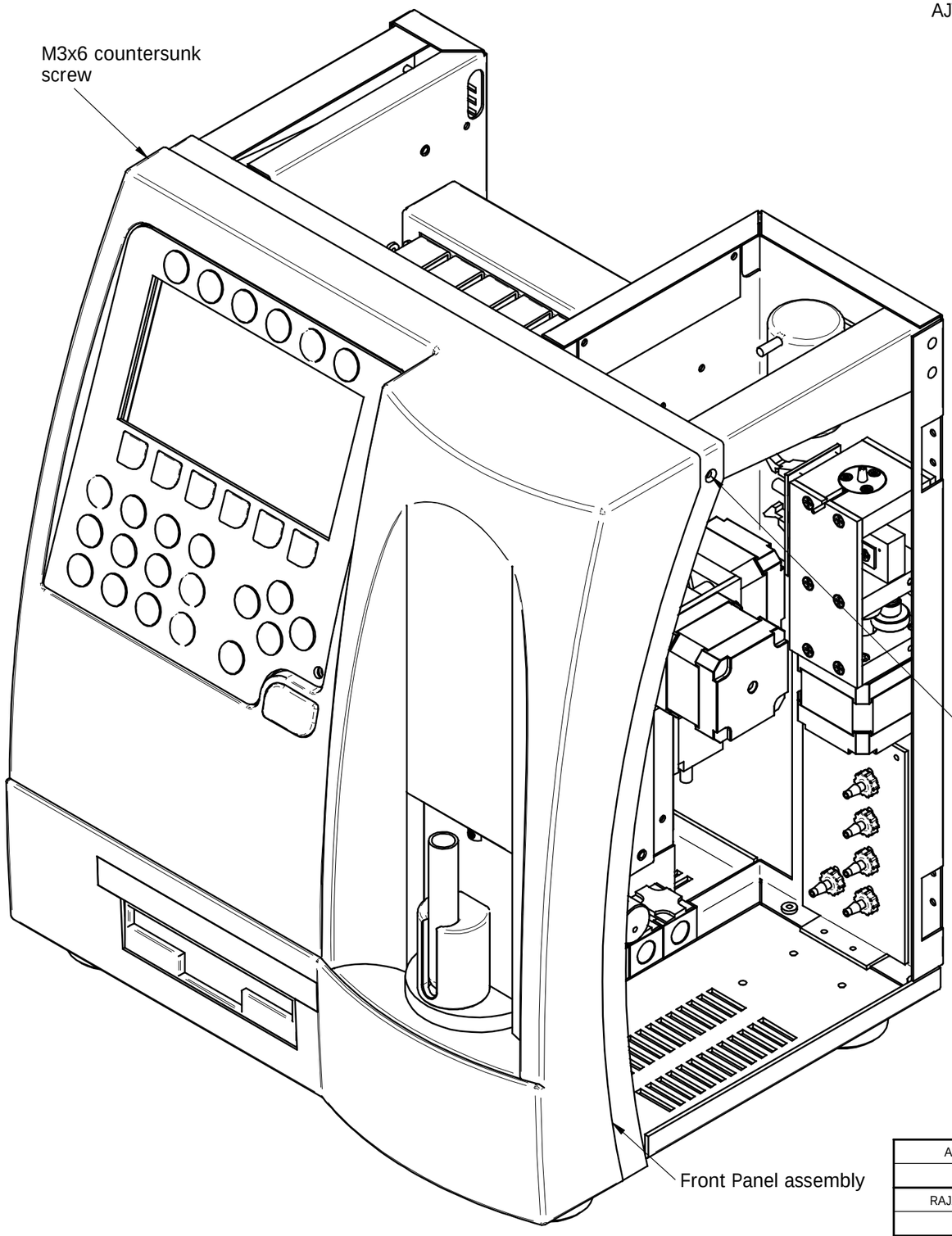
ANYAGMEGNEVEZÉS	FELÜLETKIKÉSZÍTÉS	MEGJEGYZÉS	DARAB	MÉRETARÁNY
				M 1:2

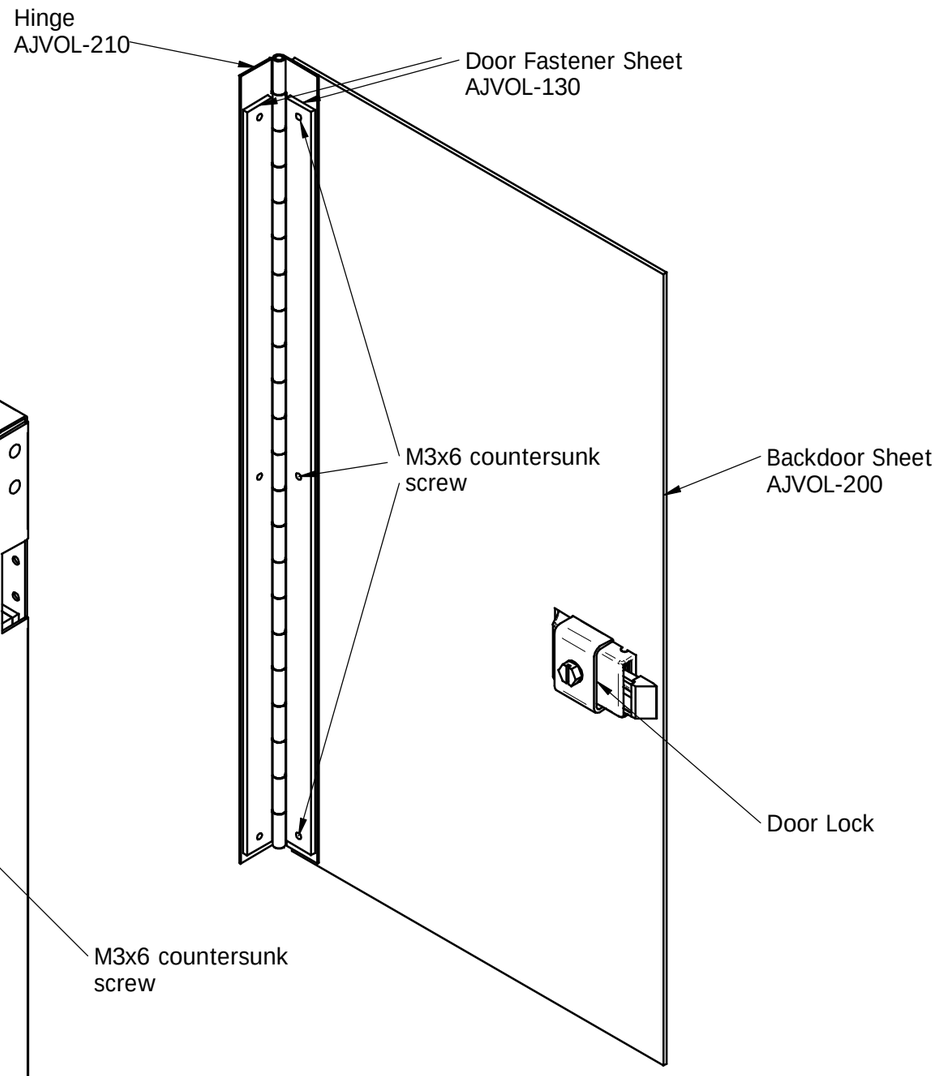
RAJZ.	DÁTUM	MEGNEVEZÉS	Diatron®
		Front Panel assembly	RAJZSZÁM
VÁLTOZÁS JELE	DÁTUM		AJASM-11



ANYAGMEGNEVEZÉS	FELÜLETKIKÉSZÍTÉS	MEGJEGYZÉS	DARAB	MÉRETARÁNY
				M 1:2

RAJZ.	DÁTUM	MEGNEVEZÉS	Diatron®
		Structure 07.	RAJZSZÁM
VÁLTOZÁS JELE	DÁTUM		AJASM-12





ANYAGMEGNEVEZÉS		FELÜLETKIKÉSZÍTÉS	MEGJEGYZÉS	DARAB	MÉRETARÁNY
					M 1:2
RAJZ.	DÁTUM	MEGNEVEZÉS		Diatron®	
		Structure 08.		RAJZSZÁM	
VÁLTOZÁS JELE	DÁTUM			AJASM-13	