Operator Manual

MA 1006

Vers 1.1c/1006e

This manual is printed on clean room paper

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1 General description and principles of operation

The **MA1006** TSA, **MA1006** TSA/BSA and **MA1006** TSA/IR mask aligners are designed for high resolution photolithography in a laboratory, development, or pilot production environment. They offer unsurpassed flexibility in the handling of irregularly shaped substrates of differing thickness as well as standard size wafers up to 150mm diameter.
All mask aligner of the **MA1006** series are partly motorised with a very easy-to-use user panel. The adjustment is done by micrometerscrews. Both, screw and user panel are designed for best ergonomic position.
For most accurate alignment, each step of alignment can be viewed on a monitor using a splitfield microscope in combination with a CCD camera for bottom side alignment and a high resolution splitfield microscope for top side alignment.
The **MA1006** is a compact mask aligner in a modular assembly design which allows a very easy maintenance procedure. The functional groups are easily accessible and the subassemblies can be quickly exchanged.

1.1 A brief orientation

The main functional block on the **MA1006** mask aligners are: alignment unit (microscope, video-camera-system, X-Y-θ-alignment stage) and exposure unit (lamp housing and mirror housing with lenses).
To start a run, the main switch on the left side of the user panel has to be pressed. Then the mask has to be loaded and the mask holder has to be clamped. After selecting a exposure program, the machine is ready to work.
On the chuck one can find prealignment pins which are used to position the wafer on the chuck. After depositing the wafer on the chuck, the transport slide has to be pushed towards the machine.
Now the wedge error compensation has to be done. The exposure chuck with the prealigned wafer moves up together with the wedge error compensation head on a air cushion until the wafer is in a parallel position to the mask.
This parallel position of mask and wafer is now locked by a clamping system and the chuck is moving into the selected alignment distance. To avoid complete contact of mask and wafer in order to protect mask and the photoresist on the wafer surface, the **MA1006** exposure chucks can be equipped with three high precision distance balls only three point size contact areas are touched during the wedge error compensation step.
The alignment itself is done by micrometerscrews for X-,Y- and θ-direction and can be viewed by a splitfield camera-monitor system for bottom side alignment respectively by a splitfield microscope for top side alignment. After the final alignment the wafer is moving towards the mask to control the wafer-mask position the last time before exposure.
The exposure step starts with the motorised moving of the microscope to the left side and bringing the mirror housing in the exposure position. The shutter between lamp and mirror housing opens for the selected exposure time. Then the exposed wafer is moving together with the wedge error compensation head into the unloading position.

1.2 Alignment and exposure modes

The **MA1006** mask aligner are equipped with exposure optics for proximity1, proximity2, hard, soft and vacuum contact. These five exposure modes can be selected for the first exposure as well as for exposure rows so that a huge variety of process possibilities are given.

1.2.1 Proximity1 exposure mode

The proximity exposure mode permits to perform a wedge error compensation without contact of mask and wafer. Three high precision distance balls are inserted between wafer and mask. Therefore only three point size areas on the edge of the wafer are in contact. By using the proximity exposure mode every possibility of wafer and mask damage is eliminated.
The exposure- respectively alignment distance can be selected between 0 and 999µm in 1µm steps.

1.2.2 Proximity2 exposure mode

With the proximity2 exposure mode the wedge error compensation between wafer and mask is done in contact. For the exposure the wafer is moving into a selected distance to the mask.

1.2.3 Soft contact exposure mode

In the soft contact exposure mode the vacuum securing the wafer on the exposure chuck remains in "on" mode during the exposure time. The pressure between wafer and mask remains also stable and can be adjusted between 0.03 and 0.07N/cm^2.

1.2.4 Hard contact exposure mode

In the hard contact exposure mode, the vacuum remaining the wafer on the chuck is removed after the wedge error compensation and simultaneous nitrogen is introduced under the wafer to pressing it against the mask. The contact pressure can be easily adjusted by a throttle starting from 0.07N/cm^2 up to 0.16N/cm^2.

1.2.5 Vacuum contact exposure mode

In the vacuum contact exposure mode the chamber between wafer and mask is evacuated after the wedge error compensation: Once the wafer is in contact and totally parallel to the mask, a rubber seal is brought up from the chuck and pressed also on the mask. Then the air in the chamber is evacuated through small holes on the edge of the exposure chuck during a adjustable time step. The vacuum inside the wafer-mask-chamber is fixing the wafer on its position on the chuck.
The highest resolution levels can be achieved in this exposure mode.

1.2.6 Bond mode

With an additional bond kit it is possible to align two wafers to each other. After the alignment a bonding in a bonding oven is possible.

1.2.7 First mask exposure

For the first layer there is no alignment of mask to wafer necessary. During this mode the alignment chuck is always in middle position, so that the following layers can be easily aligned.

1.2.8 Exposure with alignment

For the second or further layer, you have to align the wafer with the first layer structure to the next level mask. With the splitfield microscope for the top side alignment and the splitfield-camera-monitor system for bottom side alignment the fine adjustment can be easily done by using the manipulators. For X- an Y-direction steps in 1µm size are possible and the θ-direction can be adjusted in $4.5x10^{-6}$°steps.
For these alignment steps you can change as often as you want between alignment and exposure level.

1.3 Functional groups of the MA1006

The **MA1006** is divided in different functional blocks. So a maintain-friendly service procedure was achieved. The separate subassemblies can easily exchanged and this guarantees only a short machine down time in case of a service.

1.3.1 Wedge error compensation head and exposure chuck

The **MA1006** has a calotte-chuck system for the wedge error compensation. The wedge error compensation head contains the exposure chuck.
The wedge error compensation is done in four steps:
I) After finishing the loading of the wafer, the wedge error compensation moves towards the mask.
II) Then the wafer is pressed against the mask and the calotte of the wedge error compensation head slides in a parallel position to the mask. Therefore, any unevenness, taper or bow of wafer and mask is compensated during this step.
If you have chosen a proximity mode exposure, the wafer and the mask are only in contact with the three reference balls.
III) The now parallel position is fixed with a pneumatic clamping system.
IV) After finishing the wedge error compensation, the chuck is moving in the selected alignment or exposure distance.
The alignment chuck has prealignment pins as well as some depressions to allow an easy positioning of the wafer by using tweezers.

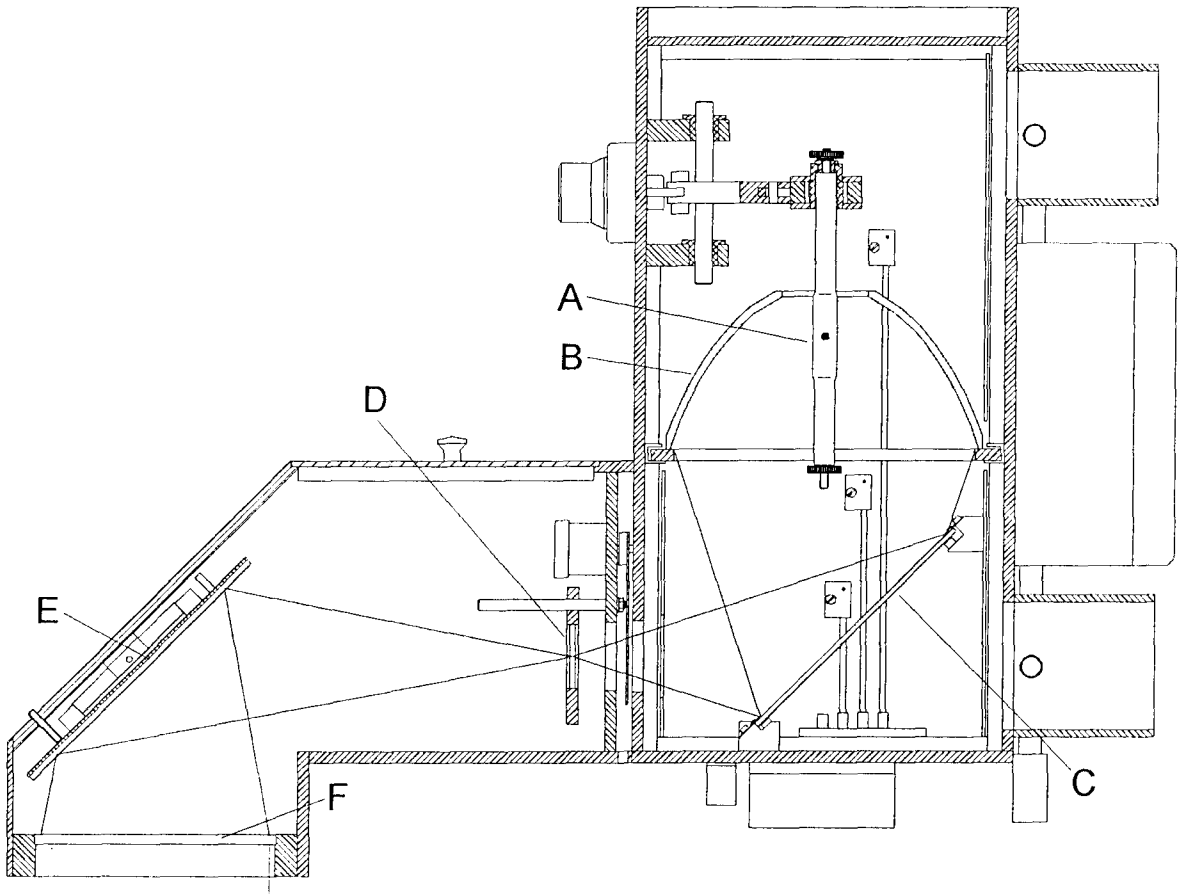
1.3.2 Alignment stage

The alignment stage of the **MA1006** mask aligner can load masks up to 7"x7" size. The stage itself can move in X, Y and θ (rotation) direction. The smallest alignment step is 1µm. The stage moves ± 5mm in X and Y direction and ±3° in θ direction by a smallest movement step of $4.5x10^{-6}$°.
Additionally the Z axis raises and lowers the wedge error compensation head to the exposure the chuck to the selected alignment and exposure gaps. The smallest Z-axis moves is also 1µm.

1.3.3 Lamphouse

The **MA1006** lamphouse can be used for exposure lamps up to 1000W. The lamphouse also contains the exposure optics. So the best results in exposure uniformity are achieved in terms of steep resist edges and small diffraction effects. Normally the exposure uniformity for a 6" wafer is ±5%.
The light is conducted from the exposure lamp via an ellipsoid mirror and then the requested light wavelength is selected by a cold light mirror with a special coated surface. This surface is deflecting the requested "cold" ultraviolet light which is required for the exposure. In addition the light is now directed in a horizontal direction towards the shutter. Behind the shutter there is the so-called exposure optic system which is optimised for lowest diffraction effects.

picture 1: **MA1006** Lamphouse



A: high pressure exposure lamp
B: ellipsoid mirror
C: cold light mirror
D:honey comb condensor lense
E: 45°turning mirror
F: front lense

1.3.4 Mirrorhouse

In the mirrorhouse the horizontal light is directed via the 45° front mirror in a strictly vertical direction. The front lens now separates the light into parallel light beams which are brought onto the wafer surface.

1.3.5 Splitfield camera system

The **MA1006** can be equipped with a splitfield-camera-monitor system, which allows together with a image storage system and two CCD camera tubes the alignment of the wafer to the mask. This opto-electrical alignment system is used by bottom side alignment (BSA) procedures. The system recognises the alignment marks on the mask, saves them and aligns the wafer to these marks.

1.3.6 Splitfield microscope

For top side alignment (TSA) the **MA1006** is equipped with a splitfield microscope. The tubes and objectives can be selected according customers specifications and needs.
With this splitfield microscope the field can be observed either through the right or the left objective or through both at the same time.

1.3.7 Armrest assembly

On the armrests on the left hand and right hand side of the **MA1006**, the logically arranged control buttons for the program steps are located.
Here, the operator can change and control the program steps. In addition a display shows actual program values and in case of a misfunction of the program, the failure with its description.

1.3.8 Underframe unit

The **MA1006** mask aligner is mounted on a vibrationfree aluminium underframe. The whole underframe is build in a modular assembly design and can be easily moved by its castors. In its finally position, the machine is stabilised with position levers.
Between the underframe and the machine functional block, five adjustable vibration dampers are located. This prevents vibration flow from the surrounding of the machine onto the exposure chuck and guarantees best vibration isolation.
The whole machine is designed in a compact style, so smallest clean room area is required.

2 General warnings and safety hazards

In this chapter general warnings are summarised to establish a safe usage for the operator.

2.1 Exposure lamp

The light sources required for photolitographic exposures are high pressure lamps filled with mercury or toxic gases. The lamps are radiating ultra violet light and are needing a very high initial voltage to start.
Special precautions must be taken when working with these lamps.

2.1.1 Electrical hazards

The voltage and current required to run a high pressure lamp constitute a lethal combination. Starting ignition voltage are 30 kV and during usage the required voltage are around +100V_{DC}.

NOTA:
During performing any maintenance on the exposure lamp, the lamphouse and the lamp power supply, it is indispensable to disconnect the power line of the machine and of the lamp power supply.

2.1.2 Lamp explosion

The used high pressure lamps are operating at a extremely high pressure (50-70atm). Explosion is therefore a possibility when these lamps are handled or operated wrongly. In order to avoid lamp explosions, please follow the instructions below:

- **respect the requested lamp cooling**
- **with each lamp changing, control the correct fixing of connection cables from and to the lamp**
- **by handling the lamps, even when they are cold, wear always protective face shields**
- **never touch a lamp without wearing gloves**
- **never run a lamp longer then the guaranteed lifetime (see manufacturer notes)**

The **MA1006** lamphouse is designed to minimise damage of the interior of the mask aligner and prevent possible injury of the operator in case a lamp explosion occurs. For this reason, all assemblies and protective covers must be in place during operation of the machine.

In case of a lamp explosion, please switch of the power and let the machine cool down for at minimum 1 hour.

When opening the lamp house, wear protective face shields and gloves. Never touch the fragments of the lamp an/or breathing the vapour. The lamp fragments must be disposed as high toxic garbage.

2.1.3 Eye and skin safety by working with UV-light

The ultraviolet light of the high pressure exposure lamps can cause erythema of the skin, which is similar to sunburn and conjunctivitis. The high infrared light output of those lamps can also cause retinal burns resulting in blindness.
The **MA1006** mask aligner is designed for opacity on the lightpath during normal operation.
In case of a maintenance procedure it can be necessary to remove covers and shields. For this reason **it is recommended to wear an eye protection during maintenance procedures and during light intensity measurements.**

2.1.4 Exhaust requirements

All high pressure UV lamps are producing ozone during their usage. The ozone is produced due to chemical interactions of the air oxygen and the radiation emitted below a wavelength of 250nm. Ozone is hazard gas because it attacks the muscous membranes of the human respiratory system, producing symptoms similar to pneumonia. These effects are cumulative.
High pressure mercury lamps up to 500W should be operated in well ventilated areas only.

If the machine is running with high pressure mercury lamps above 500W or with Cd-Xe- or Hg-Xe-lamps, a exhausting system must be installed to avoid hazard ozone concentrations in the operating room.

2.2 Electrical equipment

The **MA1006** mask aligner is CE certificated. By using the machine according the required safety rules, no danger can occur from the electrical equipment.

Maintaining and repairing off the MA1006 should be done only by trained persons.

2.3 Broken wafers

Since fragments of broken wafers can be very sharp as well as toxic (in case of GaAs wafers), removing of such fragments should be only done by using proper tools, i.e. tweezers, to minimise the injury risk for the operator.

2.4 Moving parts

The operator should be careful to keep loose clothing or long hair from getting caught in the machine.

2.5 Covers

Never place any parts on top of the machine.
All covers are designed for best safety and follow the general rules.

Never remove any cover during operating the machine!

3 General demands for proper operation

The **MA1006** mask aligner is a high precision photolitographic machine. To obtain best results possible, some general requirements for the used material and the surrounding have to be reached. The **MA1006** mask aligner cannot be expected to function properly unless it is not correctly adjusted, placed and maintained.

3.1 Environment and working conditions

The alignment and resolution which are achievable with the **MA1006** mask aligner are in the submicron range. At this level of precision almost everything in a normal environment, like dust or pollen can be declared as "dirt". To achieve best exposure results on semiconductor devices, it is necessary to operate the **MA1006** mask aligner only in a clean room environment.
In addition it is necessary to avoid any chemical process next to the machine, which can produce an effect on the exposure results. Also the handling of corrosive chemicals next to the machine should be neglected in order to avoid any damage the high precision mechanical parts of the **MA1006**.
It goes without saying that only good wafer and mask material can lead to good exposure results.

3.1.1 Requirements for the mask

A mask aligner like the **MA1006** produces a 1:1 image of the mask structures onto the wafer. Therefore it is very important that the mask is not damaged and totally clean. Each grain of dust or even a fingerprint produces a defective exposure result on the wafer. Especially by using the vacuum exposure mode, where the wafer is always pressed on the mask, the mask should be cleaned before each exposure and should be changed by showing even only small defects.
In addition, the flatness of the mask material is very important for the exposure results and also the thickness of the mask material should be selected according the SEMI specifications.
The maximum size for the mask is 7"x7" and should be always at minimum 1" larger in diameter then the wafer to be exposed. Again, the SEMI specifications prescribing the exact tolerances for diameter, flatness and thickness of wafer and mask.
For easy alignment, the alignment marks on the mask should be in a symmetrical direction to the middle of the mask. So it is ensured that the wafer can be aligned by using only the fine alignment distances.

3.1.2 Requirements for the coated wafer

Like all mask dimensions, also the wafer sizes (like flatness, thickness and diameter) should be within the SEMI specifications.
The coating of the wafer should be done by using a special spinner/coater to ensure best resist coating.

3.2 Machine checks

The **MA1006** mask aligner should be checked on a regular basis to ensure that the machine is still adjusted to optimum performance conditions.

3.2.1 Exposure chuck and mask holder

Mask holder and exposure chuck are manufactured with very fine mechanical tolerances. Before each exposure, check mask holder, the chuck and the induction areas for cleanliness and mechanical integrity. Any evidence of residues, i.e. like photoresist will also result in poor equipment performance.
You should clean the chuck and the mask holder before each exposure by using a cleanroom towel and pure alcohol.

3.2.2 Light intensity

On a regular basis, the lamp conditions and the light intensity has to be recorded to ensure constant quality of the exposure results.
By checking the high pressure lamp the electrical contacts are to be controlled. The glass of the lamp bulb should be clear and without any darkening. If such a effect is visible, the lamp has to be exchanged to avoid lamp explosions. The on-time of the lamp has to be controlled and the lamp has to be exchanged if the manufactures noted lifetime is exceeded.
All optical parts of the lamp- and mirror house should be checked for cleanliness and coatings, because this can cause a leak of light intensity.

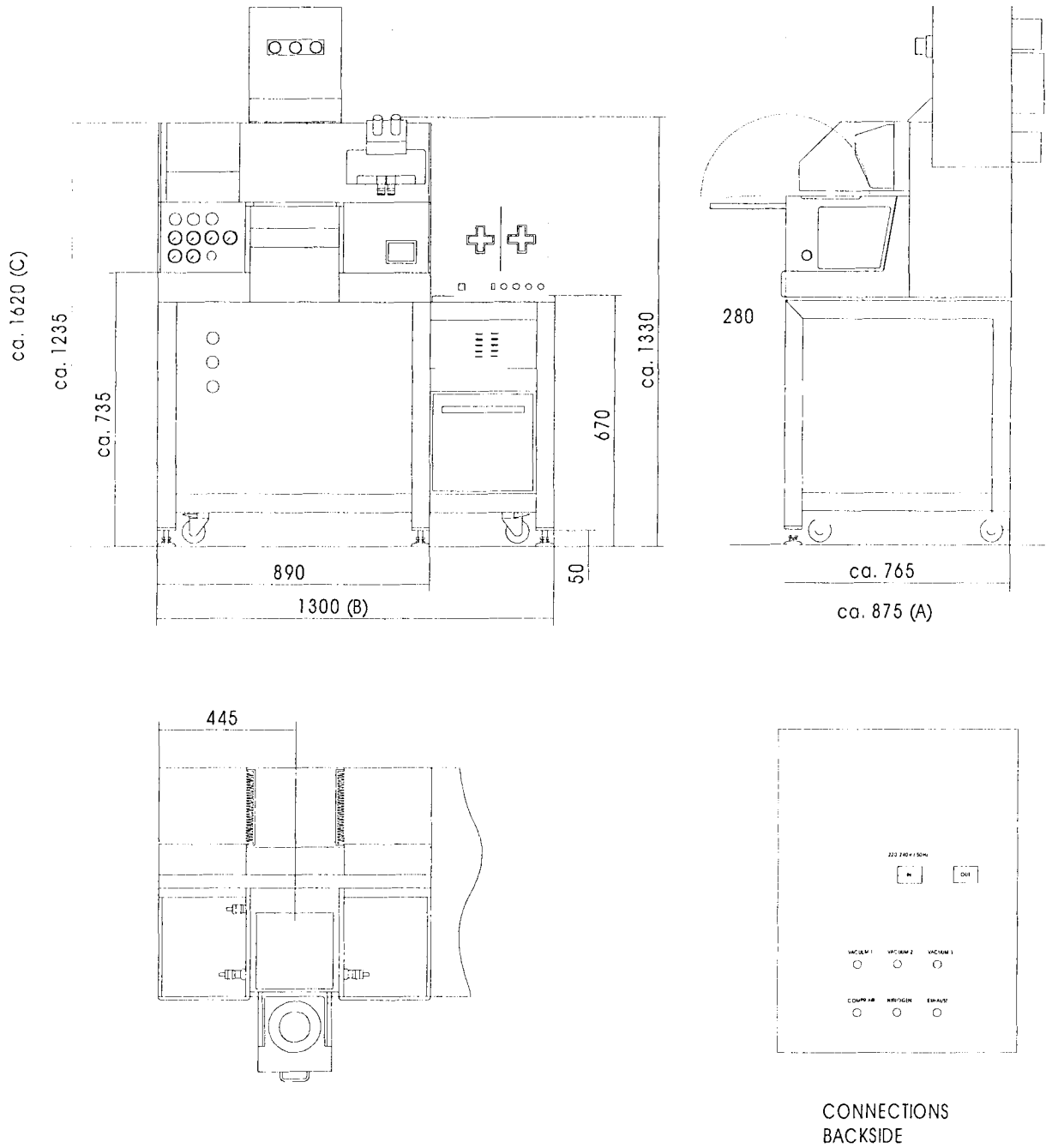
3.2.3 Light uniformity

To measure the light uniformity you should do the following test i.e. on a daily basis: With the SUSS UV1000 lightmeter measure the light intensity on at minimum five positions (12,3,6,9 o'clock and in the centre). With these five measured data's you can calculate and monitor the light uniformity i.e. as the average uniformity (= ((max value - min value)*100)/(2*average value)).
It is also possible to re-adjust the lamp for a better light uniformity result.

4 Installation

To prepare you for your new **MA1006** mask aligner and to make the decision where to install the machine easier for you, here some dimensions and technical requirements of the **MA1006**:

picture 2: Dimensions of the **MA1006**



4.1 Delivery

Some weeks before shipment, SUSS will decide unison with you the exact delivery date.

Upon arrival of the shipment, the container should be inspected for evidence of damage. If any damage is apparent, notify the shipping carrier and SUSS at once.

4.2 Installing and start up

The **MA1006** mask aligner must be installed by a SUSS service engineer. The start up procedure has also to be done by SUSS service engineer to ensure best operating performance. The machine and the subassemblies may be transferred to the installation location, but no container should be opened until the SUSS service engineer arrives. This procedure is necessary in order to avoid any question regarding equipment warranty.

4.3 Machine dimensions

length:	1300mm
depth:	875mm
height:	1620mm
weight:	approx. 300kg

4.4 Power requirements

The unit requires 230V / 50Hz AC. It is also possible to run the machine with 220V / 50Hz or 240V / 50Hz or 110V / 60Hz without any change. SUSS will provide the correct power cord for the country of delivery.
The power consumption by using the machine with a 350W Hg high pressure lamp 1200VA, and for the operation with a 1000W high pressure lamp 2000VA.

4.5 Environmental requirements

The SUSS **MA1006** should be installed in a vibration-free area which is also free from any possible dust and acid fumes. The room temperature should be controlled and around 19°C (66°F) to 24°C. Also the relative humidity in the operating room has to be stable between 45% to 55%.
The distance from the machine to the wall must be at least 10cm (4in) to allow a proper cooling and ventilation.
To avoid any electrical problems due to static electricity the floor where the machine is installed should not generate any static charge.

4.6 Other requirements

For nitrogen, vacuum and compressed air the requirements are as follows:

Vacuum: < -0.8bar gauge (or more than 24" of Hg or less than 200mbar absolute);the flow rate is insignificant
All machine vacuum connections should be separated to the house vacuumsystem to avoid any vacuum interference's

Compressed air: 4 to 6bar (or 60 to 90psi); the consumption can be neglected; any dust, particles, oil or humidity should be avoid in the compressed air lines

Nitrogen: 2 to 3bar (or 30 to 45psi); the consumption is less than 0.1m^3/h only dry nitrogen should be used

With the shipment, SUSS delivers also hoses and connectors to connect nitrogen, vacuum, and compressed air. The hoses have normally a length of about 2m, but can also being ordered in any other length. The connectors provided from SUSS are 1/8" male pipe gas threads. Thus the customer should supply a sufficient number of connections with 1/8" female gas threads.
Optional a SUSS vacuum pump is available and it goes without saying that the pump is supplied with appropriate connectors.

4.7 Basic alignments

4.7.1 Frame unit

The machine has to be installed in a clean room with a vibration-free floor in an absolutely horizontal direction.
First the four adjustable feet which are mounted on the underframe unit should be positioned for best horizontal direction. Then the machine's ground plate has to be adjusted as well for best horizontal direction by the vibration damper. The best adjustment is reached when there is a ca. 10mm gap between the groundplate and the under frame unit. The pressure of the vibration damper should be around 1.5bar. The control knobs for the five vibration dampers are located on the left hand side of the underframe unit.
The pressure of the vibration dampers should not exceed 2.5 bar to avoid any damage.

4.7.2 Central nitrogen, vacuum and compressed air supply

The central compressed air supply should be adjusted at 2 bar, the nitrogen pressure at 2 bar. The vacuum line should have at minimum 0.8 bar.
All control instruments and the control knobs are located on the back side of the machine. There, also the connector for the waste air is located.

4.7.3 Adjustment procedure for the process pressures

In addition to the central pressure supply, there are some process pressures which have to be adjusted before the first use:

Pressure supply for the wedge error compensation head:
An adjustment of 0.25 bar leads to a mask-/wafer contact pressure of 9 N.

Pressure supply for hard and soft contact exposure sequences:
These pressure have to be adjusted according the needed pressures for your system.

All control instruments, knobs and valves are located in one area underneath the left cover. This makes it easy for you to control and adjust all process pressures.

5 Warranty and limitations

In almost every case the **MA1006** mask aligner carries a six month warranty. This warranty is covering labor, material and workmanship. Nevertheless the outlined warranty terms in your quotation are your specific warranty agreement with SUSS.

5.1 Scope

The SUSS warranty is limited to the following points:

I) The machine is unpacked and installed by a SUSS service engineer or a SUSS trained service person.

II) The equipment has to be used and operated in accordance with this reference manual.

III) The machine has to be properly maintained on a regular basis.

The SUSS warranty excludes any damage during shipment or any items that are subject to wear during normal operation of the SUSS **MA1006** mask aligner. Those items are: exposure lamps, mask holders, chucks and rubber lips.

5.2 Exposure lamp explosions

Any damage of the optics or the lamphouse due to a exposure lamp explosion is not covered by the warranty.
In case an exposure lamp explosion occurs, please return the lamp socket and some glass fragments to SUSS. SUSS will contact the lamp manufacturer and try to determine the cause of the explosion. If the failure of the lamp is due to faulty workmanship, SUSS will replace the lamp at no cost.

Because nearly every lamp explosion is caused by improper handling, operating and installing of the lamp, SUSS strongly suggested to follow all lamp starting, adjustment and cooling procedures.

5.3 Warranty terms in case of resell

SUSS offers only a warranty to the original purchaser of the equipment.

6 Operating procedures of the MA1006

6.1 Machine controls and their functions

Language selction:
Press both ***ENTER*** and ***EDIT***. Now you are in the language select menue. Choose your language with ⇐ and ⇒. Confirm your choice with ***ENTER***.

6.1.1 Right armrest assembly

RESET	performs a complete machine reset
F1, F2, F3	no function
FIRST EXP	button to select first mask exposure
INTERV EXP	button to select interval exposure
ALIGN CHECK	offers the opportunity to control the wafer-to-mask alignment before exposure
EDIT	button to edit a program
⇐; ⇒	program enter buttons
ENTER	button to confirm an input
TSA	button to select top side alignment
BSA	button to select bottom side alignment
LIVE	selects the actual view from the BSA camera tubes
STORE	stores the actual view from the BSA camera tubes to the image storage system
IMAGE	shows the stored image of the BSA camera tubes
LOAD MASK	mask holder loading or reloading
VAC	switches on the holding vacuum for the wafer on the chuck
START	starts the program
CONT / SEP	switches between alignment- and exposure gap
EXP	starts the exposure

6.1.2 Left armrest assembly

TSA	switches from camera to microscope
BSA-L	switches to the left BSA camera tube
BSA-R	switches to the right BSA camera tube
BSA-Z	switches to the Z movement for the BSA camera tubes; the camera tube to be moved has to be selected by simultaneous pressing the BSA-L or/and BSA-R button
⇐; ⇑; ⇒; ⇓	controls the movement in X-, Y-direction for the microscope (for camera tubes also in Z-direction)
FAST	fast movement; the movement direction has to be selected by simultaneous pressing an arrow button.

On the left armrest assembly also the main switch and the emergency-power-off switch are located.

6.2 Alignment of camera / microscope to the mask

To align the camera or the microscope to the mask, the button ***LIVE*** on the right hand side has to be pressed.
To move the microscope, the button ***TSA*** on the left armrest assembly has to be pressed. Then a movement direction has to be selected by the arrow buttons: ⇑ and ⇓ for the Y-direction and for the X-direction ⇐ and ⇒. By pressing the button ***BSA-L*** the left camera tube can be moved. For a right camera tube movement you should press ***BSA-R***. By pressing both buttons – ***BSA-R*** and ***BSA-L*** – both tubes can be moved synchronously.
By pressing the ***BSA-Z*** button together with one or both of the tube selection buttons, the selected tube or both tubes are moving in Z direction. Use the arrow buttons : ⇑ and ⇓ for up and down movements. If also the ***FAST*** button is pressed, the movement speed is enlarged.

6.3 Loading and unloading of a mask

To load or unload a mask, first the button ***LOAD MASK*** has to be pressed. Then you should pull the transport slide and fold the mask holder to your direction. Then the cleaned mask has to be positioned on the mask holder frame. A vacuum is pressing the mask on the mask holder. Fold the mask holder back to its normal position and press the button ***LOAD MASK*** once again. The machine is now clamping the mask holder.

6.4 Loading of a stored program sequence

The **MA1006** mask aligner allows you to store 99 program sequences on its hard drive. To recall a already stored program, you have to press the ***EDIT*** button. With the arrow keys the program number has to be selected. When you found the right program number, press ***ENTER*** again to confirm your choice. After loading the wafer, the selected program sequence starts.

6.5 Writing and editing a program sequence

To write a new program sequence or to edit an existing program, you have to press ***EDIT***. The machine's display is now showing you all values and parameters of the selected program sequence. Each value can be selected with the arrow buttons and can be edited after pressing the ***EDIT*** button. The editing is done by changing the values with the up and down arrow keys. When you have selected the right parameter value, press ***ENTER*** to confirm it. After editing all parameters, press ***SAVE*** to save this changing. Now you can choose whether you want to save the changing to a new program number or whether you want to keep the existing program number.

6.5.1 EXPOSURE TIME

By pressing the ***EXPOSURE TIME*** button you can edit the requested exposure time with the arrow keys. Steps starting from 1 to 9999 are possible. **Each step represent a 1/10sec time step**. Again press ***ENTER*** after you have chosen your exposure time.

6.5.2 ALIGNMENT GAP

You can varying the alignment gap between mask and wafer. Distances from 1µm up to 999µm are possible. Select the ***ALIGNMENT GAP*** line by using the arrow buttons ⇦ and ⇨.. Then press ***ENTER*** and select the distance with the arrow keys ⇧ and ⇩. Confirm your choice with ***ENTER***.

6.5.3 EXPOSURE GAP

Like for the alignment, you can also choose your gap between wafer and mask for the exposure step. The exposure gap has to be at minimum in the same size like the alignment gap. If you don't follow this rule, the display will show you an operating failure.
To edit the exposure gap, press ***EXPOSURE GAP***, select the distance with the arrow keys and confirm your choice with ***ENTER***.

6.5.4 PROG. TYPE

After pressing the ***PROG. TYPE*** button, the display shows the whole range of possible program modes Make your choice by selecting the program with the arrow keys and confirm with ***ENTER***.
Possible program modes are: bond, proximity1, proximity2, soft contact, hard contact and vacuum contact. Please be aware that for each mode you need to use a different exposure chuck respective a bond tool.

6.5.5 INTERVAL

By pressing this button you can switch between normal and interval exposure. Interval exposure may be necessary i.e. if your resist is very thick. For a exposure sequence the selected exposure time is divided into several interval steps (see 6.5.6). Between each step there is a pause (see 6.5.7).
After pressing ***INTERVAL*** you can choose the number of intervals and the pause time (see 6.5.7 and 6.5.8).

6.5.6 #INTERVALS

This button allows you to select the number of exposure steps for an interval exposure. Numbers from 1 to 99 are available. Choose the interval count with the arrow keys an confirm with ***ENTER***.

6.5.7 PAUSE

For an interval exposure you also have to select the pause time between each exposure step. This can be done by pressing the ***PAUSE*** button and selecting the pause time between 1 1/10sec and 9999 1/10sec. Confirm your choice with ***ENTER***.

6.5.8 CHECK ALIGNMENT

When you are using the vacuum contact exposure mode, there is the following program sequence: First you align your wafer to the mask. Then you press ***EXPOSURE***. Now the chuck rubber lips are pressed against the mask and the now existing chamber between mask and wafer is evacuated. You can control your alignment now by pressing ***CHECK ALIGNMENT***. If everything is ok, you have to press ***EXPOSURE*** once again to start the exposure step.

6.6 Start of a program sequence

With the **MA1006** it is very simple for the operator to run the machine in the correct way, because each selection to do is shown in the display. As soon as READY, PRESS START appears in the display, the program sequence can be started by simply pressing the ***START*** button.

6.7 Reset of the machine

By pressing the ***RESET*** button, the machine will be put into normal condition.

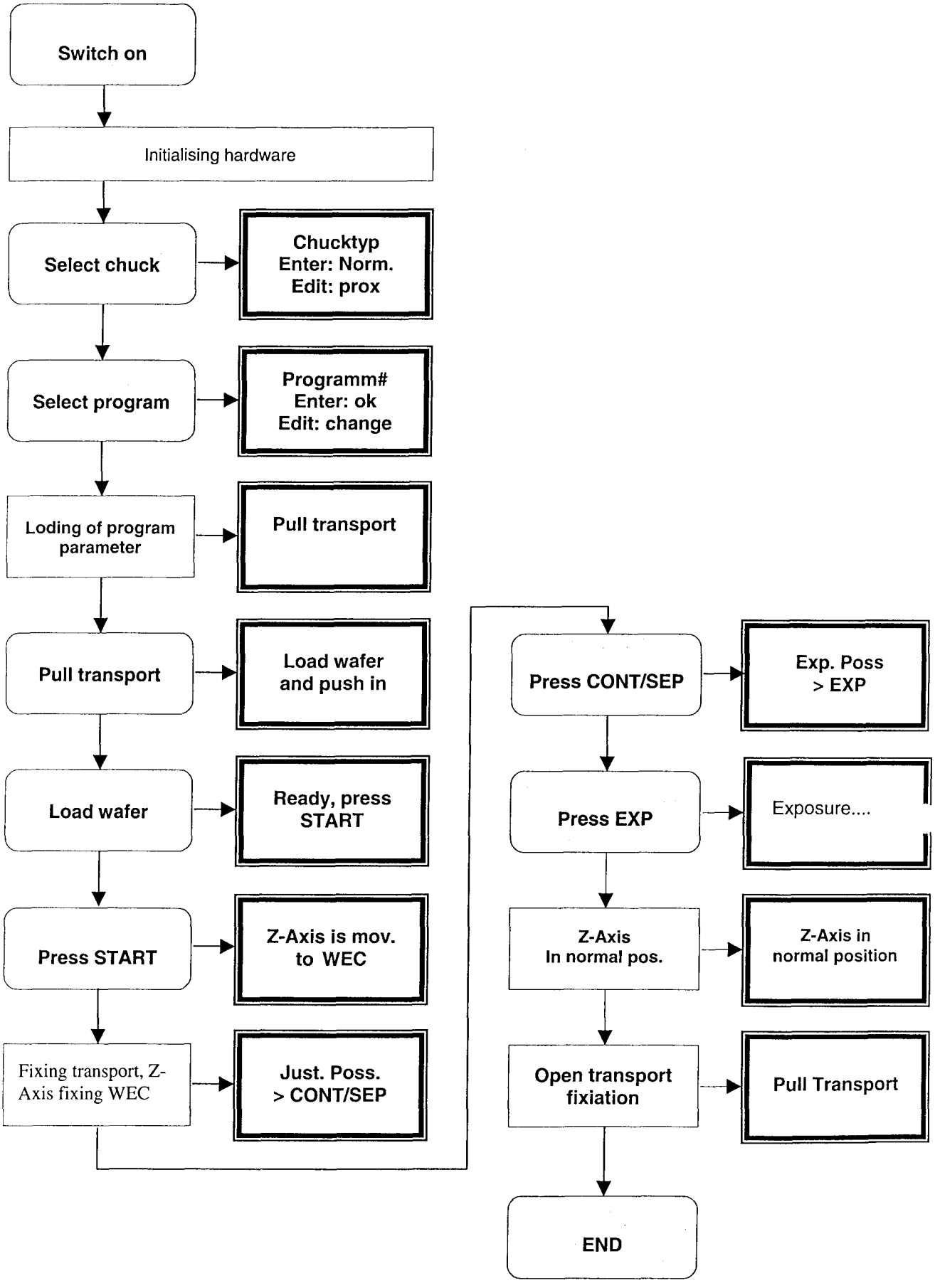
7 Program sequences

7.1 Exposure programs

After switching on the machine the last active program is reloaded. The display shows the program number. Now, by pressing ENTER, the machine is activating this last active program again. By pressing EDIT, the user can go for any other program by choosing the corresponding program number.
Because the high pressure lamp will need some time to reach the operating temperature, it is useful to start directly the lamp power supply. Simply switch on the SUSS LPS1000 power supply, which is mounted in the electronic assembly on the right hand side of the **MA1006** underframe unit. The SUSS LPS1000 power supply starts with its self test and the START button needs to be pressed for the lamp ignition. For a more detailed description of the SUSS LPS1000 power supply, please refer to the operating manual, which is also a part of the machine's manuals.
The next operating step shown in the display is PULL TRANSPORT. Follow this instruction until the transport has reached the end position. The display gives you the information LOAD WAFER. Position the wafer on the chuck by using the prealignment pins. After the right prealignment procedure, press the ***VAC*** button. If this button is not pressed, the machine starts the fixing vacuum for the wafer on the chuck when the transport is pushed back to the exposure position. When the transport is now in it's final position, the display gives you the following information: READY; PRESS START. By activating the ***START*** button, the **MA1006** now starts with the selected exposure program sequence:

After the prealignment of the wafer on the chuck, the wedge error compensation starts. The wedge error compensation head is moving towards the mask until the wafer is fully in contact with the mask, respectively until the three precision distance balls (by proximity exposure) are in contact with the mask. Now wedge error compensation is finished and the chuck / wedge error compensation unit is moving down into the fine alignment distance. Now the camera tubes / microscope is sliding in the alignment position. The display shows now the information ALIGNMENT POSSIBLE.
Now adjust the camera tubes / microscope for a sharp view of the alignment marks. Use the ***BSA-R*** and ***BSA-L*** buttons to control the movements of the camera tubes to left or right direction. For up and down moves, use the ***BSA-Z*** button. An alignment of the camera tubes / microscope is only possible when the ***LIVE*** status is active!
The fine alignment of the wafer is done by the three high precision micrometer screws on the left hand and right hand side of the alignment table unit.
The alignment position can be controlled by the alignment marks on the wafer and on the mask. Either the position can be viewed in the microscope or on the monitor mounted on the right hand side of the machine. (On the screen it seems, that the wafer is moving relatively to the mask, but it is the mask which is moving synchronously with the camera tubes relatively to the wafer. The wafer and the chuck are not moving.)
After the fine alignment is done, the wafer can be moved to the exposure gap position by pressing the button ***CONT/SEP***. With this button it is possible to switch between the alignment gap position and the exposure gap position as often as the operator wants to control the wafer/mask alignment. When the wafer is in the exposure gap position the display shows EXP POSSIBLE. When the ***EXP*** button is now pressed, the machine starts the exposure sequence of the program: First, the camera tubes are moving back and the microscope is sliding to the right. The moving part of the lamp house is moving into the exposure position and the shutter is opening for the selected exposure time. When an interval exposure is activated, the shutter is switching between open and close for the requested times. The display the information EXPOSURE and a bar is showing the remaining exposure time.
After the exposure, the shutter is closing and the display asks you to pull the transport (PULL TRANSPORT). Now you can remove the exposed wafer and start a new exposure sequence for a new wafer.

7.2 Flowchart of a program sequence



7.3 Bond program

If a bond program is selected instead of a exposure program, the sequence is changing substantial.
At the begin of the program the display ask you to PUT BOND TOOL IN. After the bond tool is in its right position and also fixed, the display gives you the information to PRESS START. After pressing the ***START*** button once, the display gives you the information to SEPERATORS AUSSCHWENKEN; PRESS START. Now the separators of the bond tool has to be removed manually and the ***START*** button has to be activated a second time.
The display asks you now to PULL TRANSPORT. If this is done, the bond glass has to be loaded (LOAD BOND GLAS) and the start button has to be pressed again (PRESS START). Now the bond glass is fixed by a vacuum.
In the next step, the wafer has to be loaded (1. LOAD WAFER AND ALIGN, PRESS START). After loading and aligning the wafer and pressing ***START***, a fixing vacuum for the wafer is also activated and the display ask you to PUSH TRANSPORT. Now the display gives you the information READY, PRESS START and with pressing ***START*** again, the wedge error compensation is activated. When the bond glass and the wafer are in parallel position, the wafer remains in contact with the bond glass and the information VACUUM MASK ON appears. Now the mask vacuum has to be activated by the rotary switch on the left side of the machine. The first wafer is now fixed and the display asks you to PULL TRANSPORT again.
The second wafer has to be loaded and aligned (2. WAFER LOAD AND ALIGN, PRESS START). The transport has to be pushed back (PUSH TRANSPORT). Now you have to follow the display instructions: INSERT SEPERATOR; PRESS START. Pull in the separators manually and press ***START*** again. Now the Z-axis is moving into contact. Now the display asks you to INSERT CLAMPS and to PRESS START. The machine is fixing the two wafers to each other and the Z-axis is moving down. After this bonding alignment is done, the display asks you to REMOVE BONDTOOL, PRESS START: Remove the bond tool with the two wafers and start a new bond alignment sequence by pressing ***START***.
This is only a short bond sequence description. By equipping your **MA1006** with the bond alignment option a detailed bond alignment manual will be handed out to you.

7.4 Power down of the MA 1006

To power down the machine, first switch off the lamp power supply SUSS LPS1000 with it's main switch. Now the machine can be also switched off by the main switch.

8 Machine alarms and their repairs

The **MA1006** mask aligner is programmed to stop immediately the program sequences in case a machine alarm occurs.

The reasons for a machine alarm can be different:

8.1 Vacuum leak

The vacuum for the transport and chuck is controlled by vacuum guards. If there is a vacuum leak, the machine stops and shows you an error note in the display.
The most common reason for vacuum leaks are dirty wafers or dirty / corroded chucks. Clean them with pure alcohol and a clean room towel and start the program again.

8.2 Nitrogen supply failure

The nitrogen line is also controlled by a pressure guard. If there is a leak in the nitrogen supply, the cooling for the lamp house is also effected. For this reason, the exposure lamp is powered down in case of a nitrogen supply cut to avoid defects or lamp explosions due to overheating. Of course, in the display an error note is visible. Control the line and check for leaks.

8.3 Compressed air supply failure

If the pressure of the compressed air line falls below 4 bar, the machine stops immediately and an error note appears in the display.
Control the line and check for leaks.

8.4 Basic machine failure

The **MA1006** is equipped with control sensors and micro switches. If one of them shows a failure, read the detailed error description the display is showing you and control the effected positions / parts.

9 Maintenance

9.1 Cleaning of the machine

Maskholder, chuck, transport must be free of dust, dirt, corrosion and mechanical defects to ensure best exposure results.
The best and easiest way of cleaning such parts is done be technical alcohol and a clean room towel on regular basis.
If a wafer has been broken or there a pieces of dirt on the machine, please use a vacuum cleaner to remove the dirt and dust. By using a compressed air flow, dirt and dust can be blowed inside the machine and can cause mechanical defects, so use only a vacuum cleaner!

9.2 Cleaning of optical parts.

Optical parts shouldn't be touched and should only cleaned by a nitrogen air flow. If a lens or mirror is broken, please call SUSS for spare part delivery.

9.3 Lamp replacement and adjustment procedure

9.3.1 Lamp replacement procedure

For any maintenance on the lamp and the lamp house, the machine and the lamp power supply have to be switched off.

In case the machine was running, you have to wait and to let cool down the lamp and the lamp house for at least 45 minutes. Inside the lamp house temperatures above 150°C can be reached during operation.
Before opening the lamp house, please first pull out the power cord. To open the lamp house, please loose the screws on the right side. Then you can open the cover like a door to the right side. Now you can check the cold light mirror, which should be clean and without any damage. The position of the cold light mirror should be exact and not too strong fixed in the holders. If the fixing is too strong, the tension due too heat during operation can cause a mechanical damage of the cold light mirror.
For lamp replacement, the nut on the lower pole of the exposure lamp must be loosened and the connection cable has to be removed. Then the lamp has to be screwed out.

Never touch the bulb with bare finger! Touch the lamp only on the metallic poles!

Some exposure lamps are mounted by the use of an adapter. In this case, remove the adapter and fix it on the new exposure lamp. In case any corrosion is visible on the adapter, replace it in order to avoid a lamp explosion due to bad (because corroded) contacts.
Now open the package of the new exposure lamp. Screw the minus pole of the lamp in the upper connector: Then connect the lower end by using the nut and a nickel plate with the connection cable.
If you use a 1000W lamp, please do not attach a nickel plate between lamp and nut.
The lamp is now replaced and after closing the lamp house, the machine and the lamp power supply can be started again.

If any corrosion is visible on the connectors, screws, nuts or cables, please replace the whole lamp connection kit in order to avoid a lamp explosion!

9.3.2 Lamp adjustment procedure

After the replacement of the exposure lamp an adjustment is necessary to ensure an uniform exposure result. Also the light intensity has to be checked and the exposure times have to be controlled.
On the front of the lamp house three alignment knobs are visible which are used to adjust the lamp position within the ellipsoid mirror.

For all exposure lamp adjustments, wear UV protection for eyes and skin!

After the lamp replacement let the lamp burning-in for at least 20 minutes. Then the optimal operating temperature is reached and the lamp can be adjusted.
Place the maskholder without a mask in the correct position, press ***EDIT*** and select ***service.*** Now you can open the shutter by selecting ***light measurement.***
Place the sensor with the correct light wavelength sensitivity in the middle of the exposure chuck and adjust the lamp position with the Z,X and Y knob for highest intensity.
Now the uniformity of the light has to be adjusted. For that, place the sensor of your light measurement instrument to the 12 o'clock and 6 o'clock position and adjust for equivalent intensity values with the Y knob.
Do the same procedure with the sensor on the 3 o'clock and 9 o'clock position by using the X knob.
Now the lamp power supply has to be calibrated. For this procedure, please refer to the SUSS LPS1000 manual.
When lamp and lamp power supply are adjusted and calibrated, close the shutter of the lamp house by selecting ***light measurement*** again.

9.3.3 Exposure lamp cooling

The cooling of the lamp and the lamp house is realised in different ways:
The lower part of the lamp housed is cooled by compressed air. The shutter and the exposure lamp socket needs a nitrogen flow to be cooled. The valve positions for the lamp house cooling will be adjusted during the machine start-up by a SUSS service engineer.

Be aware

If the cooling of the lamp house is too low, an overheating can cause a lamp explosion.

If the cooling of the lamp house is too high, the lamp can not reach their operating temperature and so the light intensity will be too low.

9.4 Appearing of unknown noise

If unknown noise is audible, check the functional groups of your **MA1006** maskaligner by running some testwafers. If the sound is not locatable, please call SUSS. Do not run the machine in order to avoid a colossal blunder.

9.5 List of consumables for MA1006

9.5.1 Optical parts

Lamps:

High pressure mercury lamp USH200DP	146051
High pressure mercury lamp USH350DP	146049
High pressure mercury lamp USH1005DP	148959
High pressure Xenon lamp UXM501MD	148979

Lamp connector cables

Cable USH200 Positive	186667
Cable USH350 Positive	186669
Cable USH1005 Positive	186670
Cable USH1005 Negative	186671

mirrors

ellipsoid mirror	130416
cold light mirror UV400	169446
cold light mirror UV300	172410
cold light mirror UV250	169724
condensor lens UV300/UV400	185997
condensor lens UV 250	185998
turning mirror 45°	185999

9.5.2 electronic parts

PC-Boards

Input/Output-TTL	185858
Input-24	185859
Output-24	185860

Sensors

inductive quadruple	185833
Inductive round	185826
end position switch micro	185829
end position switch	151276
PEN-M5	151089

9.5.3 Pneumatic parts

valve unit compressed air	186787
valve unit nitrogen	186777
valve unit vacuum	186778
manometer 0-10bar	185950
manometer 0-4bar	185951
manometer -1-0bar	185952
fine adjustment pressure regulator 0-4bar	170759
pressure regulator 0-7bar	186775
pneumatic switch on/off	186776

Lamp Power Supply

SUSS
LPS 1000

Table of contents

1 Introduction

1.1 Power Supply

The power supply for an arc lamp must take into consideration the lamps operating characteristics. Although the supply can drive the lamp over a large latitude of electrical input powers, it is the lamp characteristics alone which will dictate the actual value of voltage and current. A basic supply should have the following specification:

- A low ripple regulated DC output.
- A high voltage starting circuit (25 kV or higher).
- A ballast or active circuit to limit current to the lamp during the warm up period.
- A means to adjust the lamp power output.

1.2 Constant Intensity

The chemistry of a photoresist has a given amount of energy (Joules) be absorbed by the molecular structure over a finite period of time for a successful print.
It is also to deteriorate from the moment it is started, and the decline is accelerated as the lamp ages, one is faced with varying illuminating conditions. As the shutter opens and light is detected in the light path, the controller will electrically drive the lamp to a power which will produce a present level of intensity (mW/cm^2) on the wafer surface.
During the interval while the shutter is closed, the lamp power will be returned to a value at or near its rating (Idle) for optimum life. It should be noted that lamp power in the control mode may be depend on the selected set value of intensity, the efficiency of the lamp on associated optical systems, and also of the runtime of the lamp.
There are limitations, however, as to the range that a lamp can be driven; too low and the arc will extinguish, while too high may result in an explosion of the bulb. These extremes are avoided by circuitry within the controller which set upper and lower values of power that the unit will deliver.

1.3 Principles of Operation

The basic circuit of a constant intensity controller is a switching power regulator which is controlled by a lamp voltage-ampere servo loop. The reference for this loop may either be a fixed value (idle or constant power) or a value derived from the optical control loop (constant intensity). Switching semiconductors are MOS transistors which are operating at a rate of 40 kHz. The output transistors are isolated from the low level drive and control circuitry by means of a high speed opto-isolator device.

2 Technical Specification

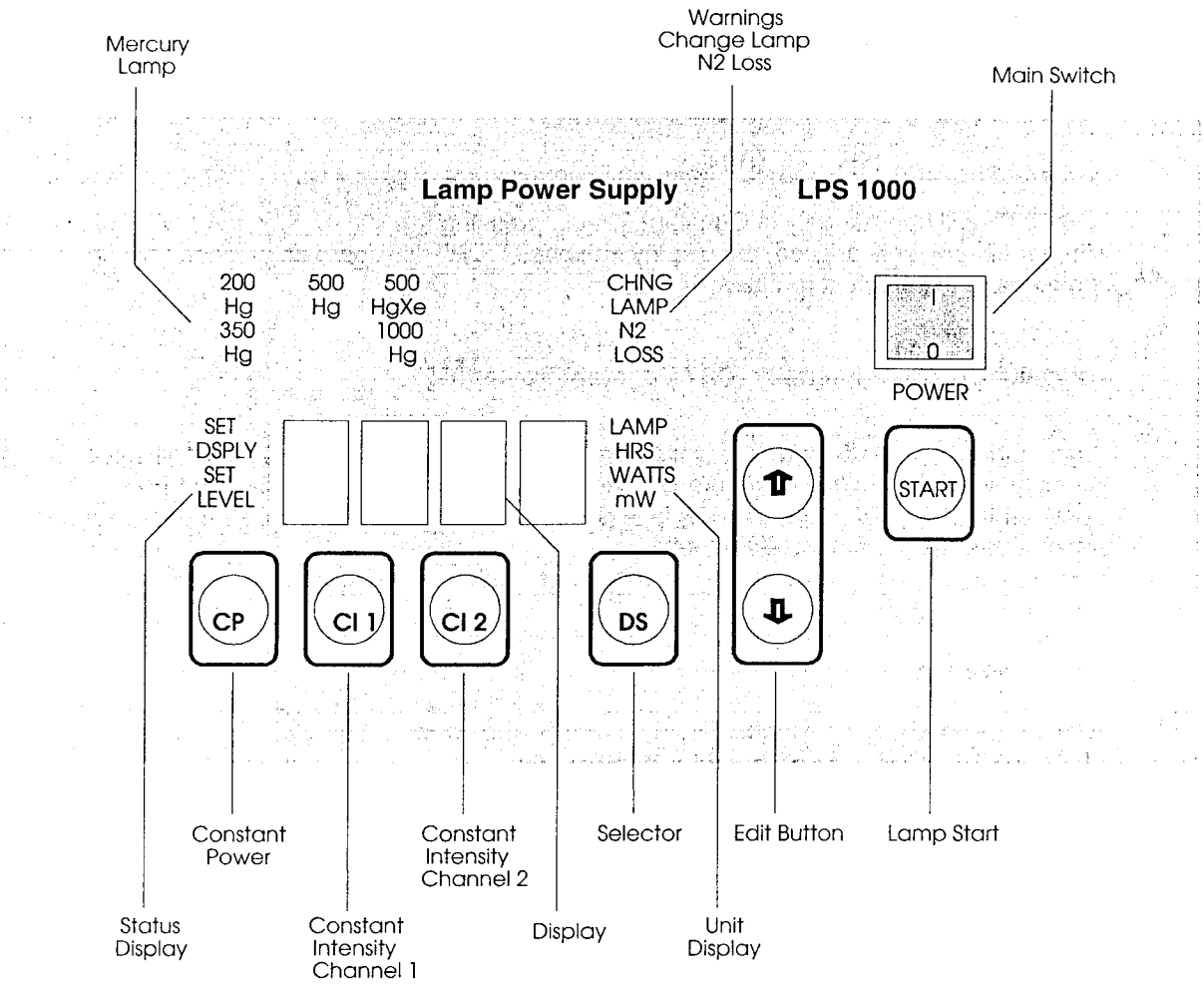
Operating Mode:	Single channel constant power Independent dual channel constant intensity
Output:	1000 watts maximum continuous 180 volts DC open circuit 30 amperes active current limit
Output Regulation:	± 1 % over selected mains input range
Lamp Ignition:	- 25 kV start with automatic shutdown following ignition - active current limit during warm up; Remote start unit

Lamp Options:	1000 W Hg	500 W HgXe	500 W Hg	350 W Hg	200 W Hg
Idle Power (W)	900 W	425 W	425 W	275 W	190 W
Max. Power (W)	1200 W	600 W	600 W	400 W	240 W
Min. Power (W)	700 W	350 W	350 W	200 W	160 W
Max. Voltage (V)	50 V	45 V	85 V	80 V	75 V
Voltage	38 V	25 V	67-85 V	65-75 V	65 V
Current	28 A	20 A	5.9-7.4A	4.6-5.9 A	3.1-4.2 A

Mains Input Options:	230 VAC - 50/60Hz
Size: (without remote start unit)	Depth: 400 mm (15,75 in) Width: 260 (10.25 in) Height: 152 mm (6.0 in)
Weight: (without remote start unit)	8,0 kg (17.5 lbs)

3 Operating Procedures

3.1 Front Panel Controls and Functions



front view

3.2 Basic Adjustments

3.2.1 Selecting the Operating Configuration

The **LPS 1000** Intensity Controller is capable of operating in constant power only, or in operator selectable constant power or constant intensity. For proper operation in constant intensity, a optical sensor must be situated in the light path of the exposure optics of the mask aligner and attached to the rear of the controller.

To select Constant Power (CP) only:

Press and hold the ⇧ and (CP) keys while applying main power with [POWER]. In this mode, the **LPS 1000** will operate only in Constant Power; pressing the (CI1) or (CI2) keys will have no effect. When main power is applied, the display indicates **„CP“** for approximately one second and then commences the self test routine.

To select Constant Intensity (CI) / Constant Power (CP):

Press and hold the ⇧ and (CI1) while applying main power with [POWER]; this will select Constant Intensity operation. In this configuration, the unit will operate in either Constant Power or Constant Intensity. After main power is applied, the display indicates **„CI“** for approximately one second and then commences the self test.

3.2.2 Self Test

With the self-test appears in the display one after the other:
C01 > **PASS** > **C02** > **PASS** > **C03** > **PASS** > **rdy**.

3.2.3 Lamp Selection

Pressing and holding the ⇩ and (CI2) keys while applying main power with [POWER]. In the display appears **BULB**. By pressing the ⇩ or ⇧ keys, the unit will toggle among all applicable lamps, and the corresponding front panel LED will illuminate. When the desired lamp is indicated, pressing the (CI2) key again will start the self test procedure.

In the field exposure-lamp either appears:

200 Hg	for 200 W mercury-steam-maximum-pressure-lamps or
350 Hg	for 350 W mercury-steam-maximum-pressure-lamps or
500 Hg	for 500 W mercury-steam-maximum-pressure-lamps or
500 HgXe	for 500 W mercury-xenon-maximum-pressure-lamps or
1000 Hg	for 1000 W mercury-steam-maximum-pressure-lamps.

3.2.4 Display Test

Pressing and holding the ⏻ and the DS keys while applying main power with POWER activates the **Display Test** subprogram. For ten seconds, all applicable LED and display signals will illuminate and the alarm will pulsate. After ten seconds, the self test routine will commence automatically.

3.2.5 Standby

Pressing and holding the ⏻ key for more than three seconds while operating in the **CP** mode will cause the unit to revert to the standby mode. The lamp will be operated at Idle power ant the **CP LED** will flash. To exit from the standby mode, press the CP, CI1, or CI2 to select that particular operating mode.

Exposure-mode	IDLE-Mode
200 W lights	190 W
350 W lights	275 W
500 W lights	425 W
1000 W lights	900 W

3.2.6 Alarm

The **LPS 1000** is equipped with an audible alarm to indicate abnormal operating conditions. The alarm operates in two separate modes – either a continuous or a pulsating tone. The continuous tone is heard when either minimum or maximum lamp wattage is reached, or when an over temperature condition has occurred. The pulsating tone is heard when an over voltage condition has occurred and the power supply has automatically extinguished the exposure lamp; it also signals that the lamp cooling interface has been activated.

3.3 Front panel Controls and Functions

3.3.1 In - / turn off of the appliance

POWER switch – The POWER switch applies main power to the **LPS 1000.**

3.3.2 Start the Lamp

START membrane key pad – Momentarily pressing the START key when the display indicates „**rdy**“ will commence the lamp ignition sequence. During the ignition the display indicates **"FIRE"**. After the ignition the display shows for approx. 5 min **"COLD"** during warming up the lamp.

Pressing the START key at any other time has no effect.

3.3.3 CP Mode

pressing DS key for less than 3 seconds
- The **CI1** key **LED** will flash.
- The display will indicate mW/cm^2 of channel 1.

If the DS key is pressed again, the same sequence will take place in **CI2**. If the DS key is pressed for a third time ,the display will revert to the original **CP** indication of watts.

3.3.4 CI1 or CI2 Mode

pressing (DS) key for less than 3 seconds
Display will alternate between an indication of watts or mW/cm^2 for the channel (**CI1** or **CI2**) in which the controller is operating.

3.3.5 Lamp Hours

In all modes, including pre-ignition **„rdy"** state, pressing (DS) key for more than 3 but less than 5 seconds.
Pressing and holding the (DS) key for more than 3 but less than 5 seconds will cause the display to indicate total lamp hours. When lamp hours are being displayed, pressing the key will zero the lamp time counter. To exit from the lamp hour mode, press the (DS) key again to revert to the previous operating mode; if lamp is on, pressing (CP), (CI1), or (CI2) keys will select that mode.

3.3.6 Operating Hours

In all modes, including pre-ignition **„rdy"** state, pressing (DS) key for more than 5 seconds.
Pressing and holding the (DS) key for more than 5 seconds will cause the display to indicate controller operating hours. The number which is shown on the display must be multiplied by ten (X10) to determine the total number of operating hours; this number can not be reset. To exit from the total unit hours mode, press the (DS) key again to revert to the previous operating mode; if lamp is on, pressing (CP), (CI1), or (CI2) keys will select that mode.

3.3.7 CP (Constant Power) Membrane Key Pad

Pressing (CP) key for less than 3 seconds:

Pressing and holding (CP) key for less than 3 seconds will cause the unit to go to the **CP** operating mode, and indicate watts on the display.

Pressing (CP) key for more than 3 seconds:

Pressing and holding the (CP) key for more than 3 seconds will cause the **SET LEVEL** indicator to illuminate, and the arrow keys will be activated.
By using the and keys at this point, the operator can adjust the power supplied to the lamp to any value desired within the operating range of the lamp (specified in Section 2). When the desired value is reached, press the (CP) key again to store the information.

3.3.8 CI1 or CI2 (Constant Intensity) Membrane Key Pads

There are two independent constant intensity channels in the **LPS 1000** with keys labelled **CI1** and **CI2**. The functional description applies to either channel.

Pressing (CI1) or (CI2) key for less than 3 seconds:

Pressing and holding the (CI1) or (CI2) key for less than 3 seconds will cause the **LPS 1000** to operate in the **CI** mode. The display will first indicate in mW/cm^2; power in watts can be displayed by pressing the (DS) key.

Pressing (CI1) or (CI2) key for more than 3 but less than 5 seconds:
Pressing and holding the (CI1) or (CI2) key for more than 3 but less than 5 seconds will cause the **SET LEVEL** indicator to illuminate. The arrow keys will be activated, and the display will indicate in mW/cm^2.
By using the (↑) and (↓) keys at this point, the operator can select the desired exposure intensity. When desired value is reached, press the (CI1) or (CI2) key again to store the information.

Pressing (CI1) or (CI2) key for more than 5 seconds:
Pressing and holding the (CI1) or (CI2) key for more than 5 seconds will cause the **SET DSPLY** indicator to illuminate. The arrow keys will be activated, and the display will indicate in mW/cm^2.
At this point, the controller can be calibrated to an external power meter. Use the (↑) and (↓) keys to change the **LPS 1000** display to match the display of the power meter; when the readings on the two meters are the same, press (CI1) or (CI2) key again to store the information.

3.4 Optical Sensor Calibration

The optical sensor is typically located somewhere off axis in the exposure energy path. The sensor is designed to operate properly when it is exposed to only a portion of the energy level of the main beam. The following steps should be performed whenever a lamp is changed or lamp uniformity is adjusted:

3.4.1 Sensor Calibration

Set the electrical power level by pressing (CP) key for more than 3 sec. (i.e. 300 W for Lamp Hg350).

Press and hold the (↑) arrow key for more then 3 sec. to activate the frequency display. The **CI1** key **LED** will be flashing and the measured frequency for **channel 1** is displayed.

Turn the sensor light restrictor screw closest to the sensor cable until the displayed value is between **4500** and **5500**.

Press the (DS) key once. The **CI1** key **LED** will cease flashing, and the **CI2** key **LED** will begin to flash and the measured frequency for **channel 2** is displayed.

Repeat the steps above using the opposite sensor light restrictor screw.

Press the (CP) key to store and exit the calibration subprogram.

3.4.2 Optical Calibration

For this procedure, we assume that the lamp has started and has warmed at least twenty minutes to its **"Idle"** running temperature.

In order to obtain valid and repeatable results, it is necessary to use a calibrated UV power meter whose optical band pass filters are identical (within the range of ± 5nm) to those of the optical sensor used with your controller.

Optical calibration of the **LPS 1000** is performed for both Constant Intensity 1 (CI1) and Constant Intensity 2 (CI2) channels. No optical calibration is required for Constant Power Operation.

- Perform the procedures as before (3.4.1 Sensor Calibration) to check for sensor saturation. This must be done whenever the exposure lamp position is changed or any optical component has moved or exchanged.

- To select channel 1 press (DS) once, to select channel 2 press (DS) twice.
  ⇒ **note the displayed value (mW/cm²)**

- Press and hold (CI1) for channel 1 or (CI2) for channel 2 for more than 3 sec.:
  - **SET LEVEL** is illuminated.

- Adjust with (↑) or (↓) the value you noticed before.

- Store with (CI1) for channel 1 or (CI2) for channel 2.

Adjust the display as followed:

- Press and hold (CI1) for channel 1 or (CI2) for channel 2 for more then 5 sec.:
  - **SET DISPLAY** is illuminated.

- Place the probe of the UV power meter which corresponds to the channel you are calibrating on the exposure chuck or mask holder of the mask aligner.

- Open the light housing shutter so that light is incident on the probe. Note the value indicated on the power meter.

- Using the (↑) or (↓) keys, adjust the display on the **LPS 1000** so that it matches with the display on the power meter.
- Store with (CI1) for channel 1 or (CI2) for channel 2.

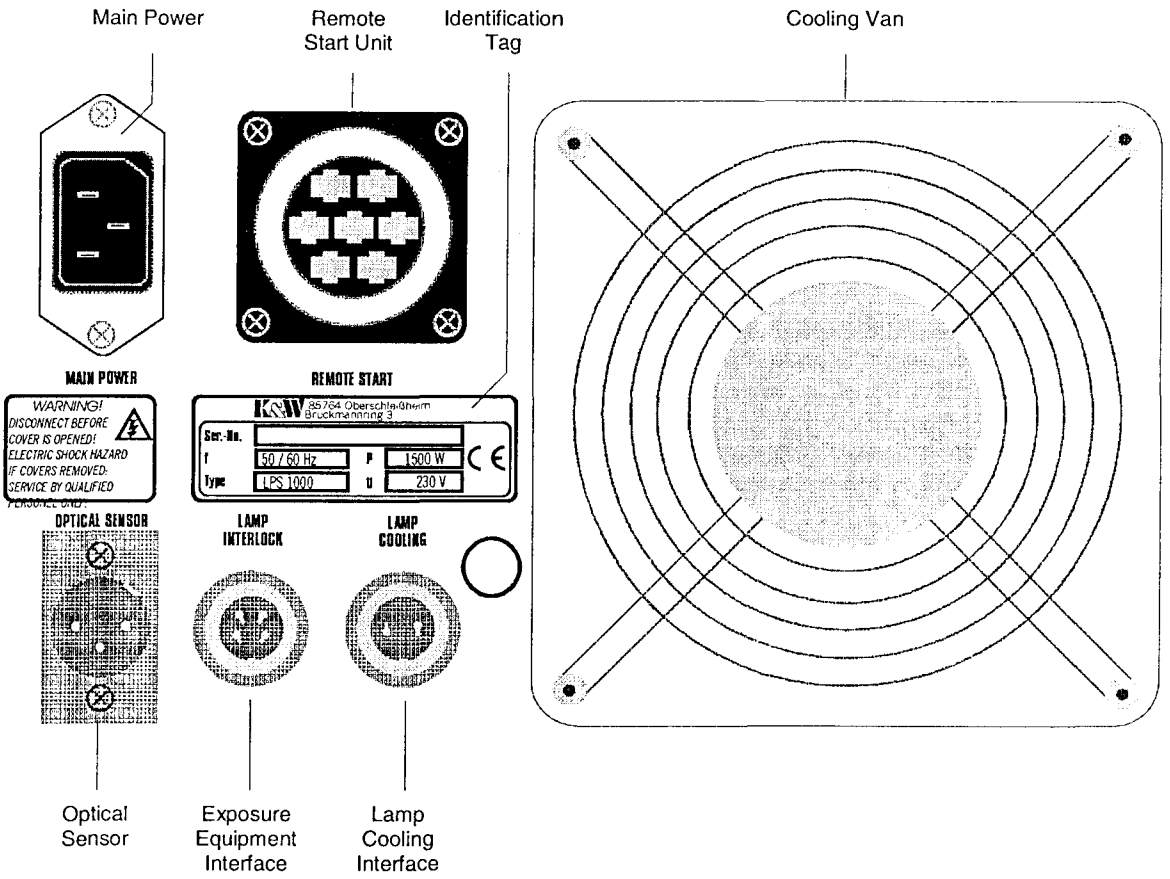
- You have now calibrated the display section of the unit so that it correctly indicates exposure lamp intensity at the exposure point.
-

Adjusting the desired light intensity:

- Press (CI1) for channel 1 or (CI2) for channel 2: - **SET LEVEL** is illuminated.
- Now the desired intensity can be adjusted with (↑) or (↓) keys.

  Pressing (DS) shows the corresponding power in Watt.

3.5 Rear Panel



Following connections are on the rear of the lamp power supply:

Main Power:	230 V AC - 50/60 Hz.
Remote Start Unit:	Ignition box - Lamphouse
Lamp Interlock:	Ignition only possibly with turned off electronics of the exposure-appliance. At business without Interlock, pin 3 must be connected to pin 4 with one of the enclosed bridges.
Lamp cooling Interlock:	with cancellation of the lamp-refrigeration is switched off the exposure after 7 minutes. At business without Interlock, pin 1 must be connected to pin 2 with one of the enclosed bridges.
Optical sensor:	Light sensor for CI 1 and CI 2

4. Warnings and Safety Hazards

4.1 Electrical

Caution!

Lethal voltages are present within the controller chassis. It is strongly suggested that you do not open the case and attempt repair.

Make sure that the lamp in the machine matches the lamp selected on the front panel.

The electrical requirements of voltage and current required to run a short arc lamp constitute a lethal combination. Starting ignition voltages are 30 kV, and open circuit potentials range up to 150 V DC at currents between 8 and 50 amps. When performing any maintenance on the Constant Intensity Controller, lamp housing, or lamps, make certain that the power switch is in the Off position, the mask aligner is turned Off, and the **LPS 1000** power cord is removed either from the wall outlet or the controller.

4.2 Exhaust Requirements

All short arc lamps produce toxic ozone due to the radiation emitted below 200 nm. Ozone attacks the mucous membranes of the respiratory system, producing symptoms similar to pneumonia. The effects are cumulative. The small wattage lamps (xenon to 200 watts, and mercury to 500 watts) should be operated only in a well ventilated area. Large wattage lamps should be vented out of the room.

4.3 Lamp Explosion

The lamps operate at extremely high pressure (50-70 atm) and are therefore subject to explosion. They must be operated within a protective housing. Additionally, even cold mercury-xenon-lamps are still above atmospheric pressure and should be handled with protective face shields and gloves.

4.4 Eye and Skin Safety

The short wave ultraviolet light produced by these lamps can cause erythema of the skin (similar to sunburn) and conjunctivitis. In addition, the large infrared output can cause retinal burn resulting in blindness. UV and IR absorbing goggles and protective clothing should be worn when working in the vicinity of these emissions.

5. Maintenance

This chapter describes the self test features, present a comprehensive troubleshooting guide, gives step by step instructions on how to replace fuses and change main power, and provides guidance on how to receive further technical assistance.

5.1 Self Test

The **LPS 1000** performs a series of tests of the major functional sections of the unit every time the main power is applied. These are designated Test 1, Test 2, and Test 3.

Test 1 writes a sequence of test data to the unit RAM and then reads that information back. If the read data does not correlate with the written data, the test sequence terminates and the lamp ignition is inhibited. The display will alternate between „**FAIL**" and „**C 01**".

Test 2 checks the unit´s EPROM where the following operational parameters have been stored: lamp type, previous operating mode, set point, display scaling, unit hours, and lamp hours. Test 2 is broken into four individual tests. (Please refer to section 5.2 for specific details.) If the unit fails Test 2, lamp ignition is inhibited and the display alternates between „**FAIL**" and „**C 02**".

Test 3 performs a check of the power section. Soft start of the power components is initiated and the detection circuitry for the voltage and current inputs is checked. If this test fails, lamp ignition is inhibited and the display alternates between „**FAIL**" and „**C 03**". If the **LPS 1000** passes all three tests, the display indicates „**rdy**" (Ready), and the START key is enabled.

5.2 Troubleshooting Guide

Symptom	Corrective Action
Display indicates **OH** and Lamp is extinguished	Internal overheating; to receive technical assistance call SUSS Microtec.
Display alternates between **FAIL** and **C 01**	RAM failure; to receive technical assistance call SUSS Microtec.
Display alternates between **FAIL** and **C 2.1**	Press ⏻ to continue test. Re-enter either **CP** or **CI** exposure mode after lamp ignition.
Display alternates between **FAIL** and **C2.2**	Press ⏻ to continue test. Re-enter either **CP** or **CI** operating mode; re-enter SET LEVEL Parameters after lamp ignition. (See Section 3.4.2)
Display alternates between **FAIL** and **C 2.3**	Press ⏻ to continue test. Re-enter either **CP** or **CI** operating mode; re-enter SET LEVEL and SET DSPLY parameters after lamp ignition. (See Section 3.4.2)
Display alternates between **FAIL** and **C 02**	EPROM failure; to receive technical assistance call SUSS Microtec.
Display alternates between **FAIL** and **C 03**	Power section failure; to receive technical assistance call SUSS Microtec.
No display	Bad fuse(s). Refer to section 5.3.

Lamp will not start	- Connections between start box and lamp are loose shorted, or have developed high resistance contacts; check all connections, especially within the lamp housing. - Connections between controller and start box are loose, shorted, or have developed ohmic contacts, check all connections at the rear of the controller. - Start interlock activated; see section 6.3.
Chgn Lamp annunciator illuminates	Aged lamp causes over voltage trip.
Lamp starts but controller shuts down after short time	- Lamp has been installed in reverse which results in in rapid gap erosion; replace with new lamp and install correctly. - Bad contacts in lamp housing; clean and check all connections. - Defective lamp; replace. - No cooling; N2 loss.
Lamp intensity is low; step changes in power proceed slowly	- Lamp is overcooled; reduce air flow past lamp. - Lamp has developed a leak; - Defective lamp; replace. - Reflective band on lamp has deteriorated due to age; replace.
Lamp intensity is low; but not over-cooled	- Improper alignment in lamp housing. - Aged lamp with metal deposits on inside of bulb; replace. - Optical coatings on surface. - Optical coatings on surface deteriorated; replace.
Lamp display on control does not agree with that of external power meter	- Measurement with external power meter made at two different points in light beam. - Measurement with external power meter was made with a probe where spectral response differs from that of the controller. - Change in optical properties or alignment of optical elements; recalibrate system. - Incorrect calibration during original settings. - Control settings of controller have been changed since original calibration. - Insufficient light incident on optical sensor.
Intensity will not maintain present level in control	- Optical sensor not installed. - Defective optical sensor assembly. - No light on optical sensor.
mW/cm^2 display Indicates no response	- Optical sensor not installed. - Defective sensor assembly. - No light on optical sensor.
Will not maintain correct Idle power	- Lamp is overcooled; reduce N2 flow past lamp. - Defective lamp; replace. - Bad contacts in lamp housing; clean and check all connections.
N2 Loss annuniciator	- Lamp cooling interface connector/connection missing. - Low/no lamp cooling.

5.3 Breaker Reset

In the event of a power line surge, the breaker may trip even though the unit is still functional. If this occurs, switch the unit back on and restart the lamp after allowing it to cool for 5-10 minutes. If the breaker trips again, refer to ther instructions on how to receive technical assistance.

6 Installation

6.1 Inspection

After removing the packing material check to make sure that you have received the following items and that your packing list agrees with the material which you have received.

- **LPS 1000**
- Dual Optical Sensor Assembly (used in CI configuration only) – may be installed on aligner.
- Lamp cable and start box – may be installed on aligner.
- Lamp cooling interface connector
- Operator Reference Manual

Upon application of main power to the **LPS 1000**, the lamp selection which was set at the factory will be displayed on the front panel. A label on the mounting plate of the optical sensor specifies wavelength for which the sensor is set.

6.2 Environmental Requirements

Network-connection		230 V - 50/60 Hz
Temperature	with storage and transportation	4°C - 60°C
	at business	4°C - 30°C
Refrigeration	Minimum-spacing the casing-rear of the wall 150 mm	

A minimum clearance of 15 cm between the rear panel and any obstruction should be maintained.

6.3 Lamp Connections

The Constant Intensity Controllers incorporate remote starting units which can either be mounted to the back of the lamp house or placed close to the exposure lamp house. The remote starter has a cable which connects to the rear of the **LPS 1000** and has connectors to attach the lamp cables. The cathode cable and connector are rated at 30 kV; the cable insulation meets MIL-W-16878 and UL62 specifications. The white cable with the large black connector must go to the lamp cathode, and the cable with the red connector must go to the lamp anode.

6.3.1 Ignition-box at lamp-house

If the remote start unit is attached to the back of the lamp house , the connections are internal and connected at the factory.

6.3.2 Separated ignition-box

The „stand alone" remote start unit should be placed as close as possible to the exposure lamphouse. Insert the 6-pin plug into the connector on the rear panel of the unit and secure with the locking lever.

6.4 Lamp ignition Inhibit Interface

Provisions for two methods of inhibiting lamp start are made on the rear panel.

The lamp ignition inhibit is used to prevent damage to connected equipment by the high voltage RF pulse used in starting the lamp. The usual requirement is that the associated equipment be powered down during the starting sequence. This is easily accomplished by connecting Pin 2 to the positive rail of the 24 V DC power supply in the associated equipment and Pin 1 to the ground rail. Whenever the aligner is activated, the internal start circuitry of the controller will be inhibited. Note that no other functions of the controller are modified by this condition.

6.5 Lamp Cooling Interface (N2 Loss)

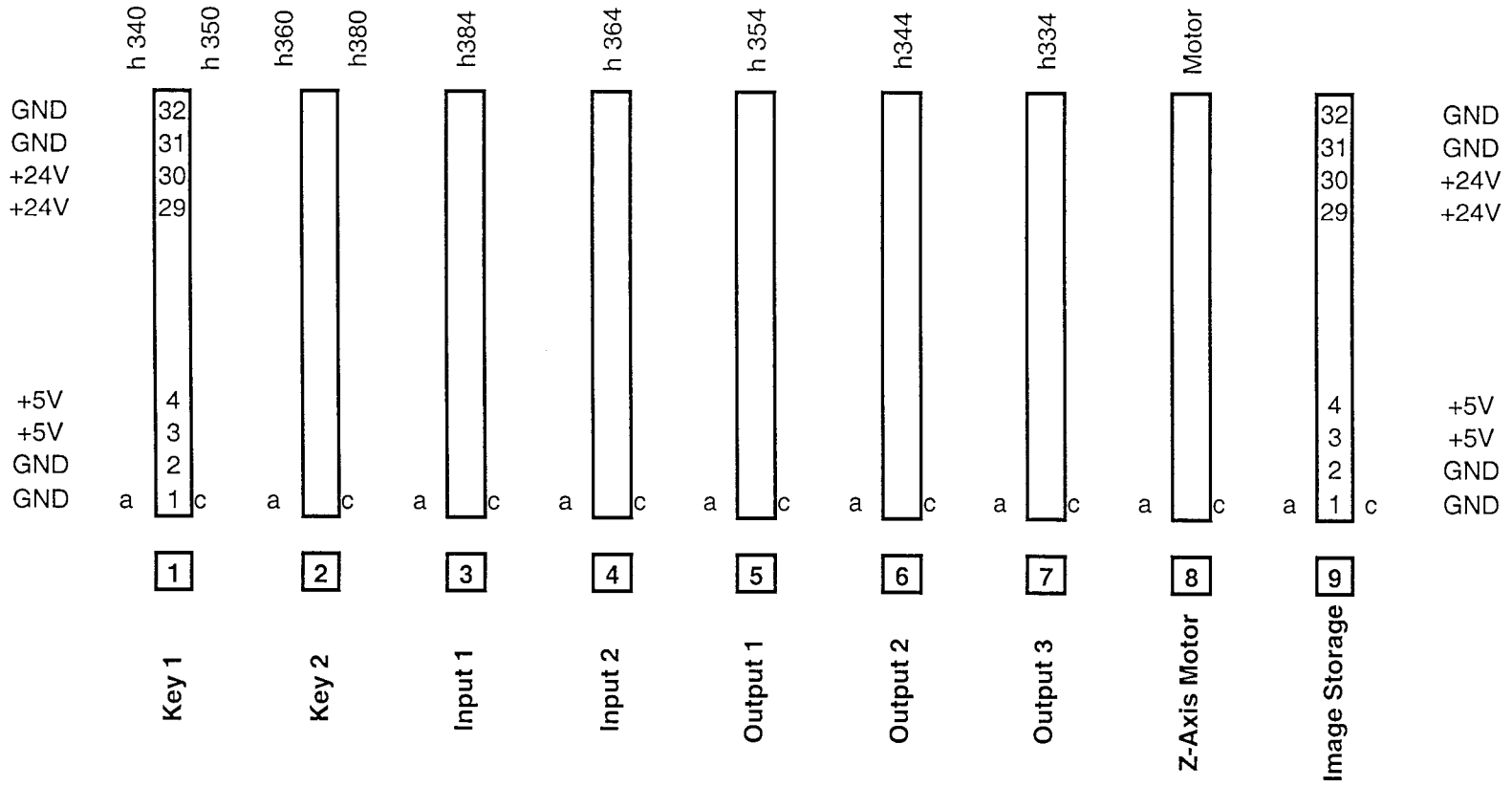
A sensor which detects proper lamp cooling can be connected to the controller through a standard 2-pin connector on the rear of the unit. If lamp cooling is provided by a flow of air or nitrogen, a flow sensor may be installed in the cooling line. If this flow falls below a pre-set level, contact closure is broken.

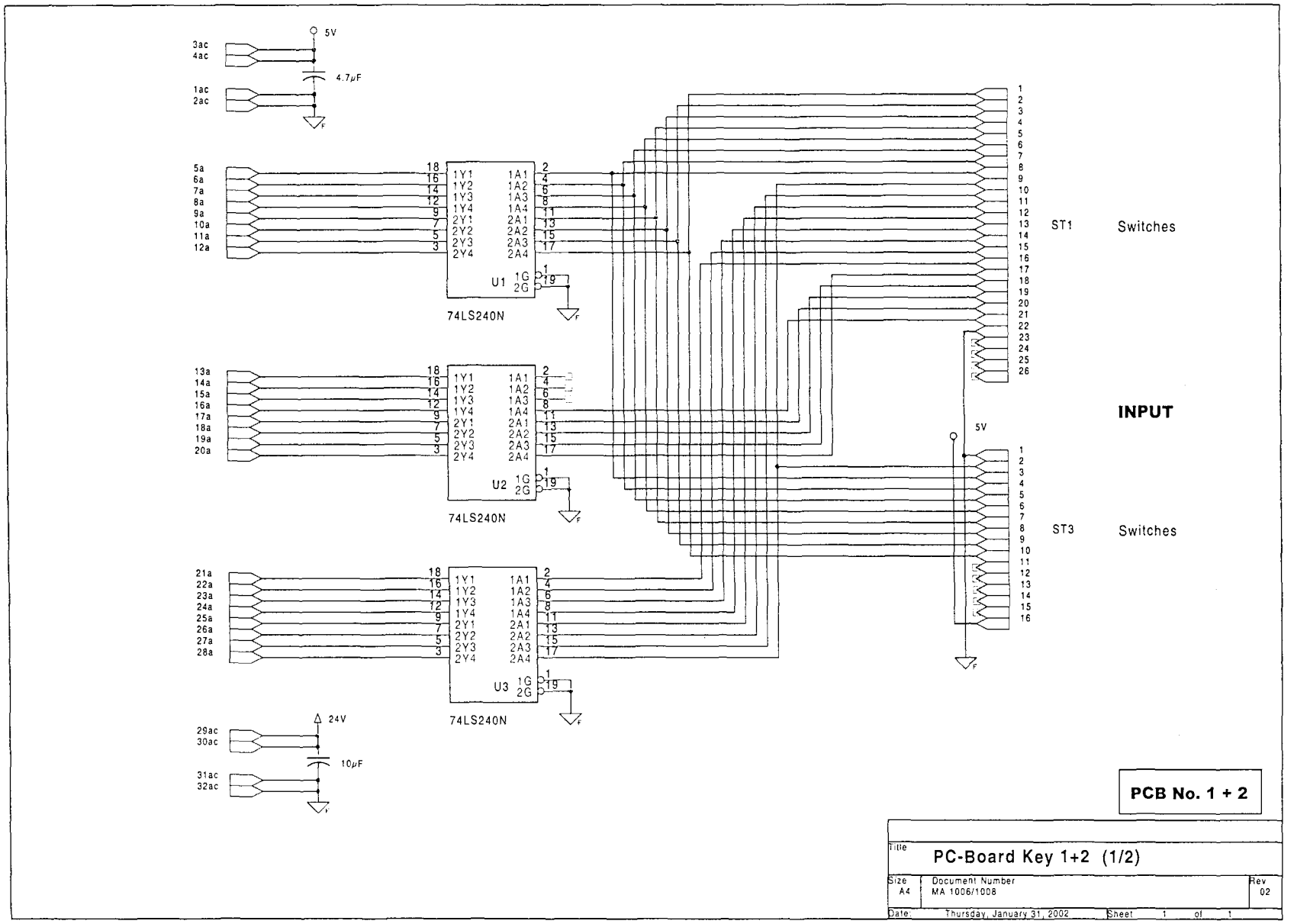
Upon detection of loss of electrical contact at the Lamp Cooling Interface, the **N2 loss** LED on the front panel will be illuminated, and the alarm will pulsate. If the connection is restored within approximately three minutes, the **N2 loss** LED and alarm will be deactivated and no further will be taken.

If the connection is not restored, the controller will extinguish the lamp, the alarm will pulsate, and the **N2 Loss** LED will flash. Once the lamp has been extinguished and the Lamp Cooling Interface connection has been restored, the alarm will cease, the **N2 Loss** LED will got out, and the display will indicate „**rdy**". Lamp ignition can now be performed. If no flow sensor is used, the connector enclosed with the shipment must be used.

MA1006 electrical circuit diagrams

PCB - Location

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4ac
4.7µF
1ac
2ac
5a
6a
7a
8a
9a
10a
11a
12a
U1
74LS240N
13a
14a
15a
16a
17a
18a
19a
20a
U2
74LS240N
21a
22a
23a
24a
25a
26a
27a
28a
U3
74LS240N
24V
29ac
30ac
10µF
31ac
32ac
ST1
Switches
INPUT
5V
ST3
Switches
PCB No. 1 + 2
Title
PC-Board Key 1+2 (1/2)
Size
A4
Document Number
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Date:
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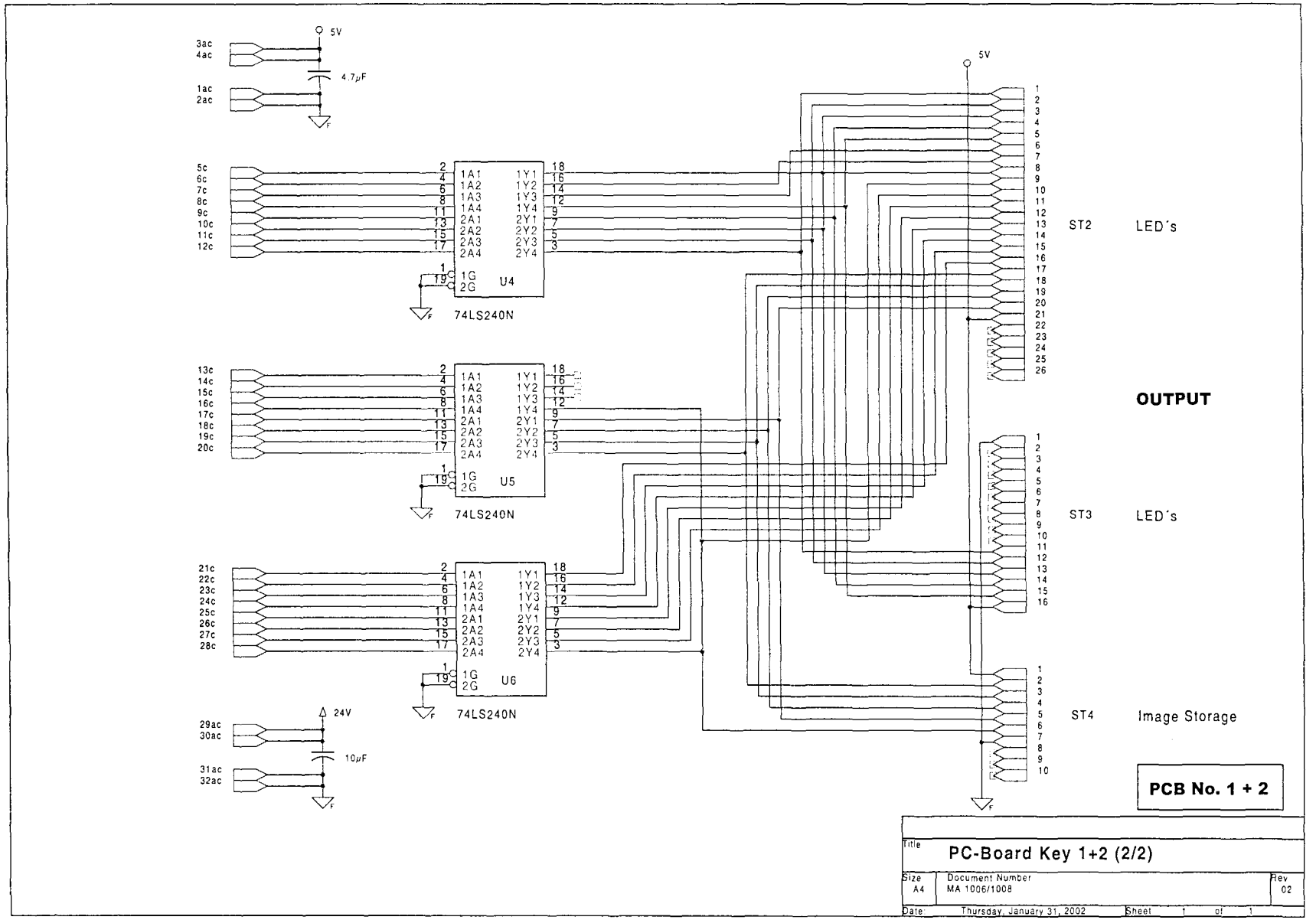
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4ac
4.7µF
1ac
2ac
5c
6c
7c
8c
9c
10c
11c
12c
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1A2
1A3
1A4
2A1
2A2
2A3
2A4
1Y1
1Y2
1Y3
1Y4
2Y1
2Y2
2Y3
2Y4
1G
2G
U4
74LS240N
13c
14c
15c
16c
17c
18c
19c
20c
U5
74LS240N
21c
22c
23c
24c
25c
26c
27c
28c
U6
74LS240N
24V
29ac
30ac
10µF
31ac
32ac
ST2
LED´s
OUTPUT
ST3
LED´s
ST4
Image Storage
PCB No. 1 + 2
Title
PC-Board Key 1+2 (2/2)
Size
A4
Document Number
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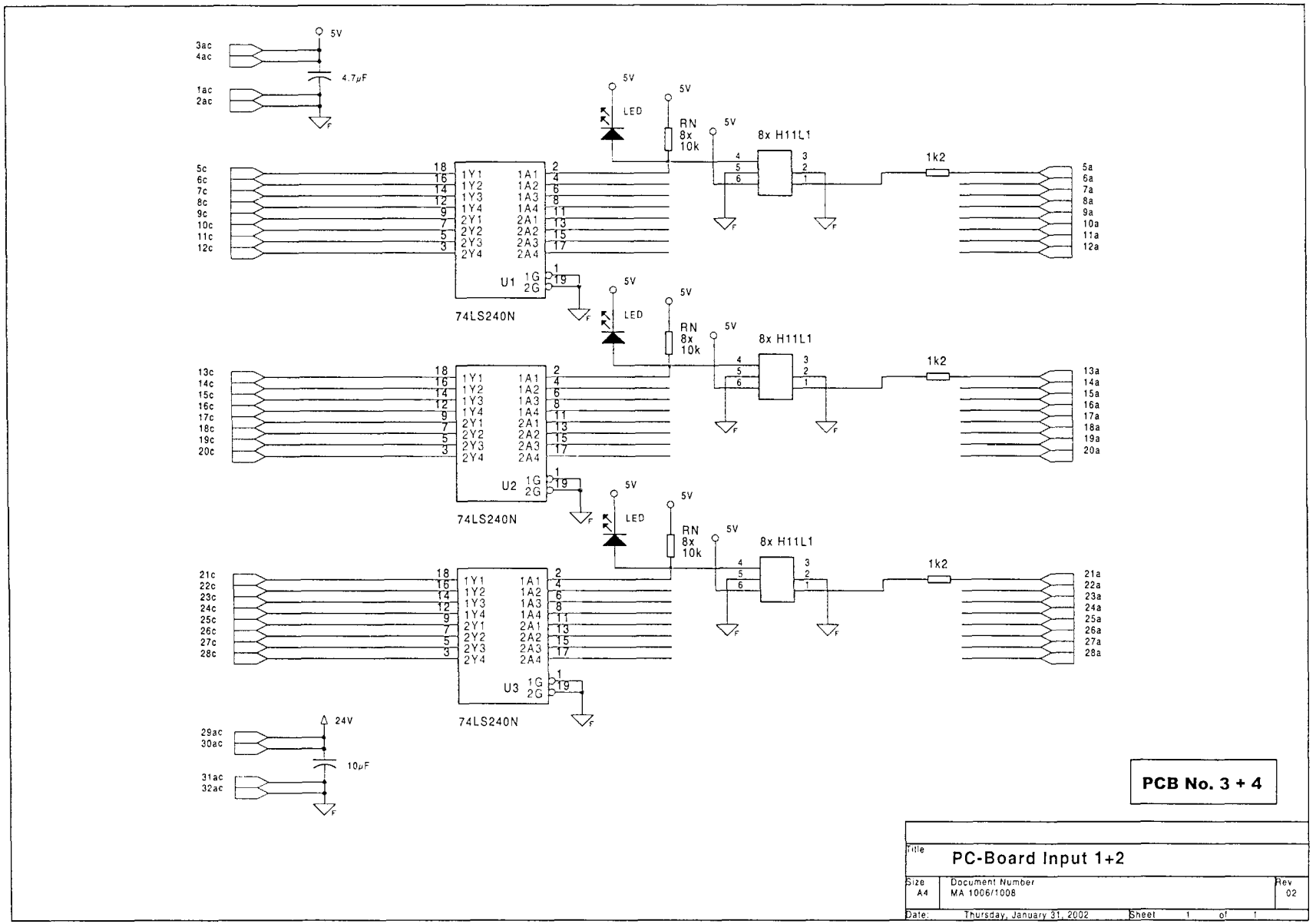
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2ac
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4.7µF
LED
RN
8x
10k
8x H11L1
1k2
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6c
7c
8c
9c
10c
11c
12c
5a
6a
7a
8a
9a
10a
11a
12a
U1
74LS240N
13c
14c
15c
16c
17c
18c
19c
20c
13a
14a
15a
16a
17a
18a
19a
20a
U2
74LS240N
21c
22c
23c
24c
25c
26c
27c
28c
21a
22a
23a
24a
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27a
28a
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32ac
24V
10µF
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Size
A4
Document Number
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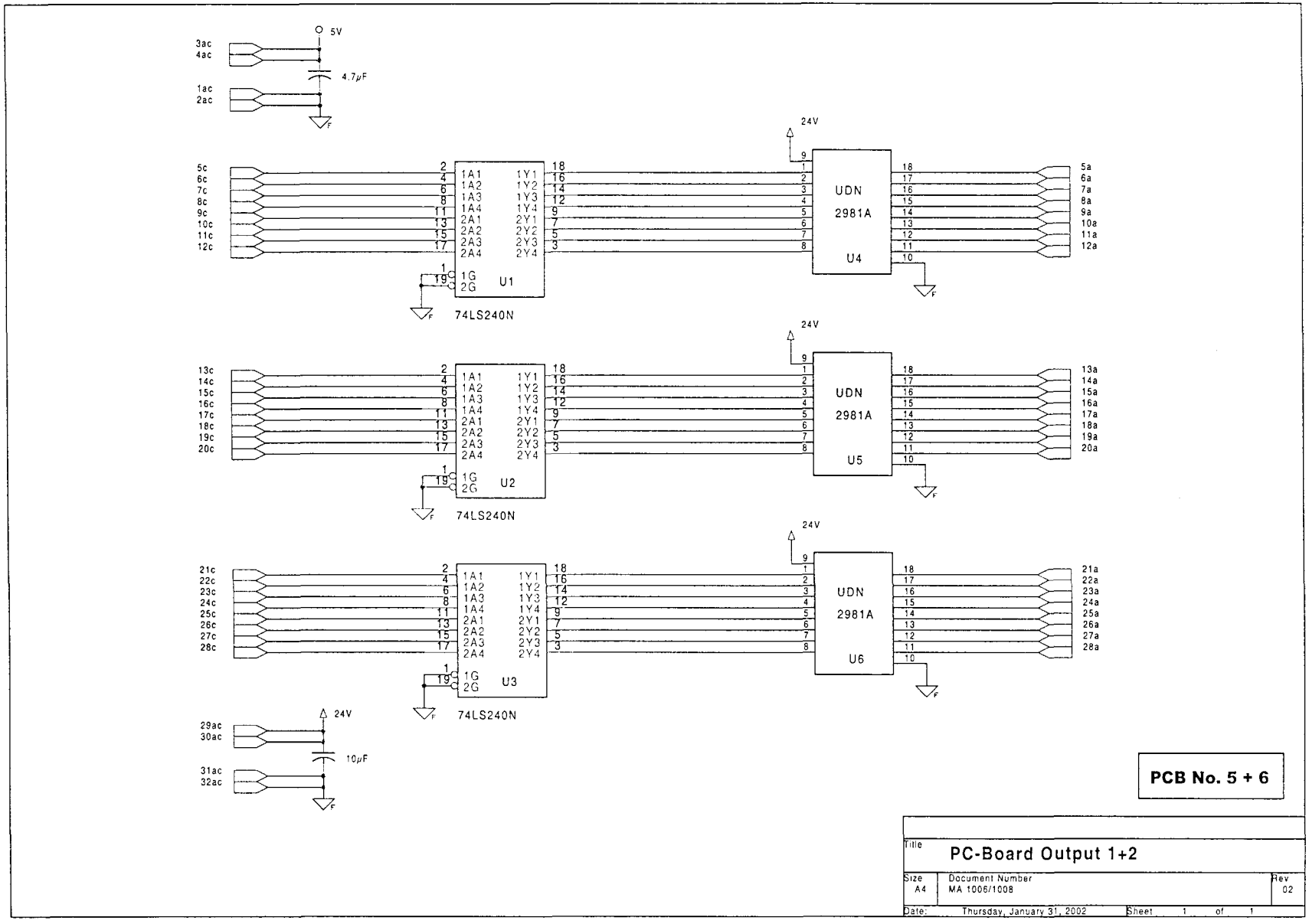
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2ac
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10c
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1A2
1A3
1A4
2A1
2A2
2A3
2A4
1Y1
1Y2
1Y3
1Y4
2Y1
2Y2
2Y3
2Y4
1G
2G
U1
74LS240N
UDN
2981A
U4
5a
6a
7a
8a
9a
10a
11a
12a
13c
14c
15c
16c
17c
18c
19c
20c
U2
U5
13a
14a
15a
16a
17a
18a
19a
20a
21c
22c
23c
24c
25c
26c
27c
28c
U3
U6
21a
22a
23a
24a
25a
26a
27a
28a
29ac
30ac
31ac
32ac
10µF
PCB No. 5 + 6
Title
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Size
A4
Document Number
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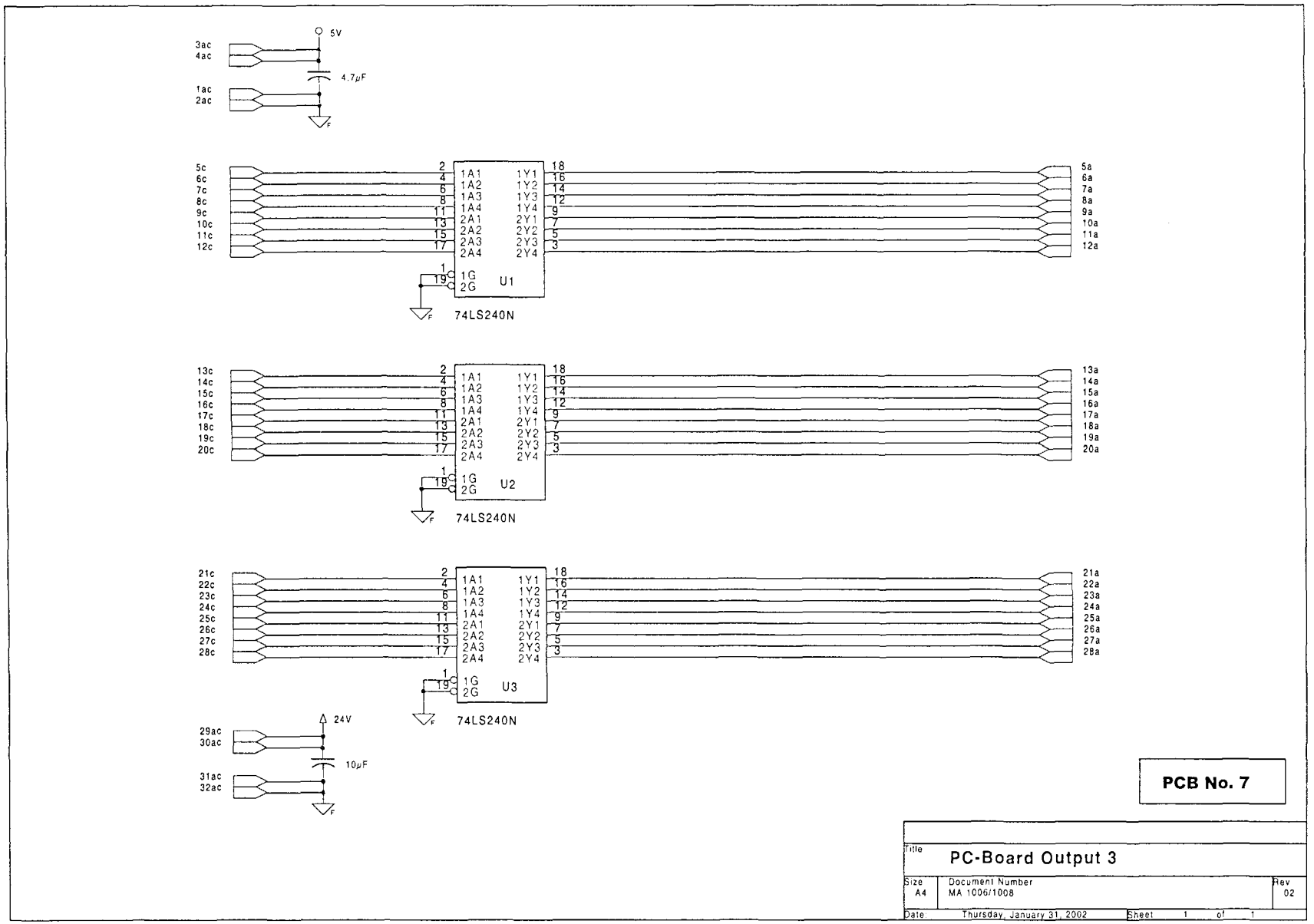
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4.7µF
3ac
4ac
1ac
2ac
5c
6c
7c
8c
9c
10c
11c
12c
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1A2
1A3
1A4
2A1
2A2
2A3
2A4
1Y1
1Y2
1Y3
1Y4
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2Y4
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2G
U1
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U2
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22c
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25c
26c
27c
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21a
22a
23a
24a
25a
26a
27a
28a
24V
10µF
29ac
30ac
31ac
32ac
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Size
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Document Number
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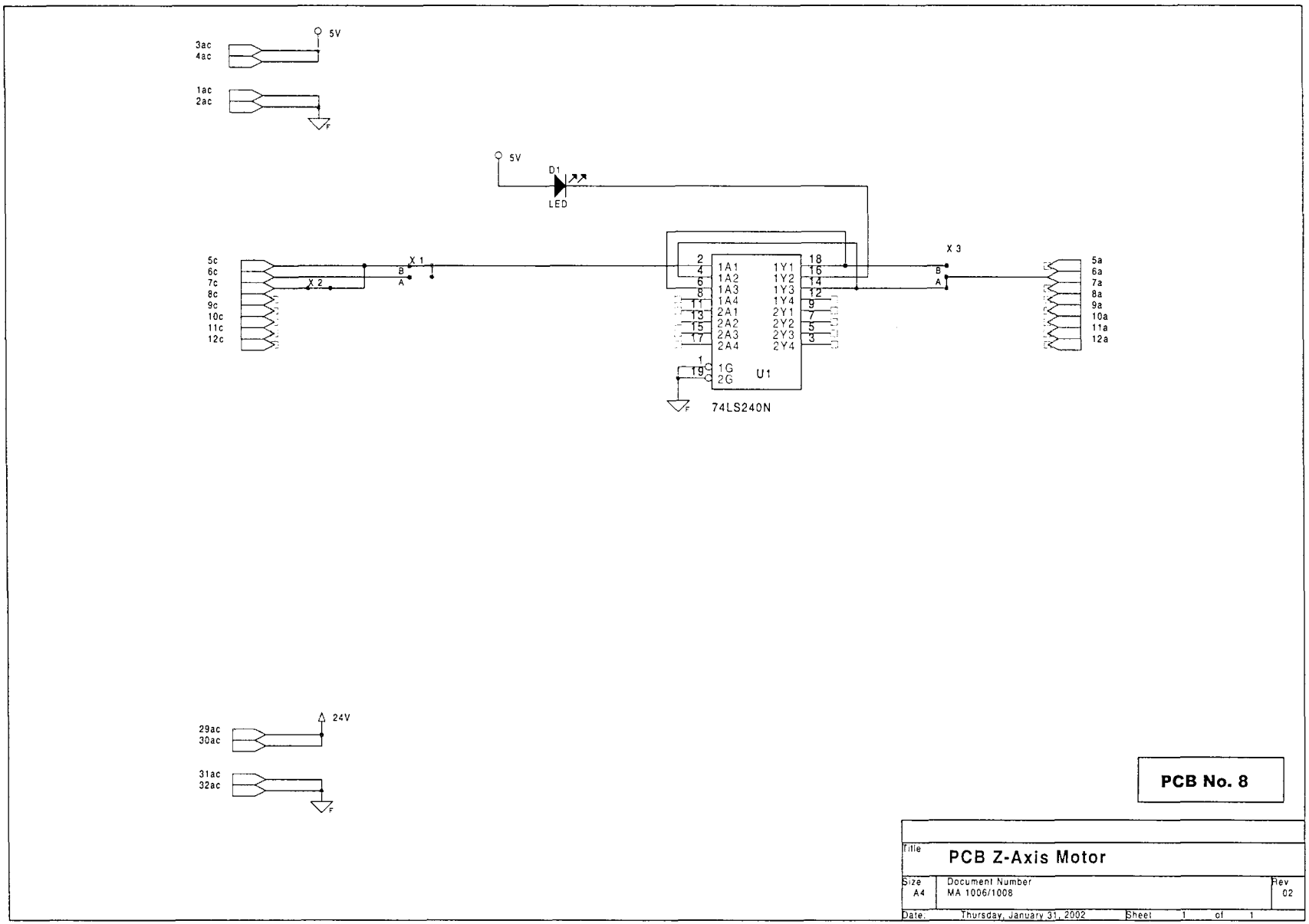
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4ac
1ac
2ac
5V
D1
LED
5c
6c
7c
8c
9c
10c
11c
12c
X 1
X 2
B
A
2
4
6
8
11
13
15
17
1A1
1A2
1A3
1A4
2A1
2A2
2A3
2A4
1Y1
1Y2
1Y3
1Y4
2Y1
2Y2
2Y3
2Y4
18
16
14
12
9
7
5
3
1
19
1G
2G
U1
74LS240N
X 3
B
A
5a
6a
7a
8a
9a
10a
11a
12a
24V
29ac
30ac
31ac
32ac
PCB No. 8
Title
PCB Z-Axis Motor
Size
A4
Document Number
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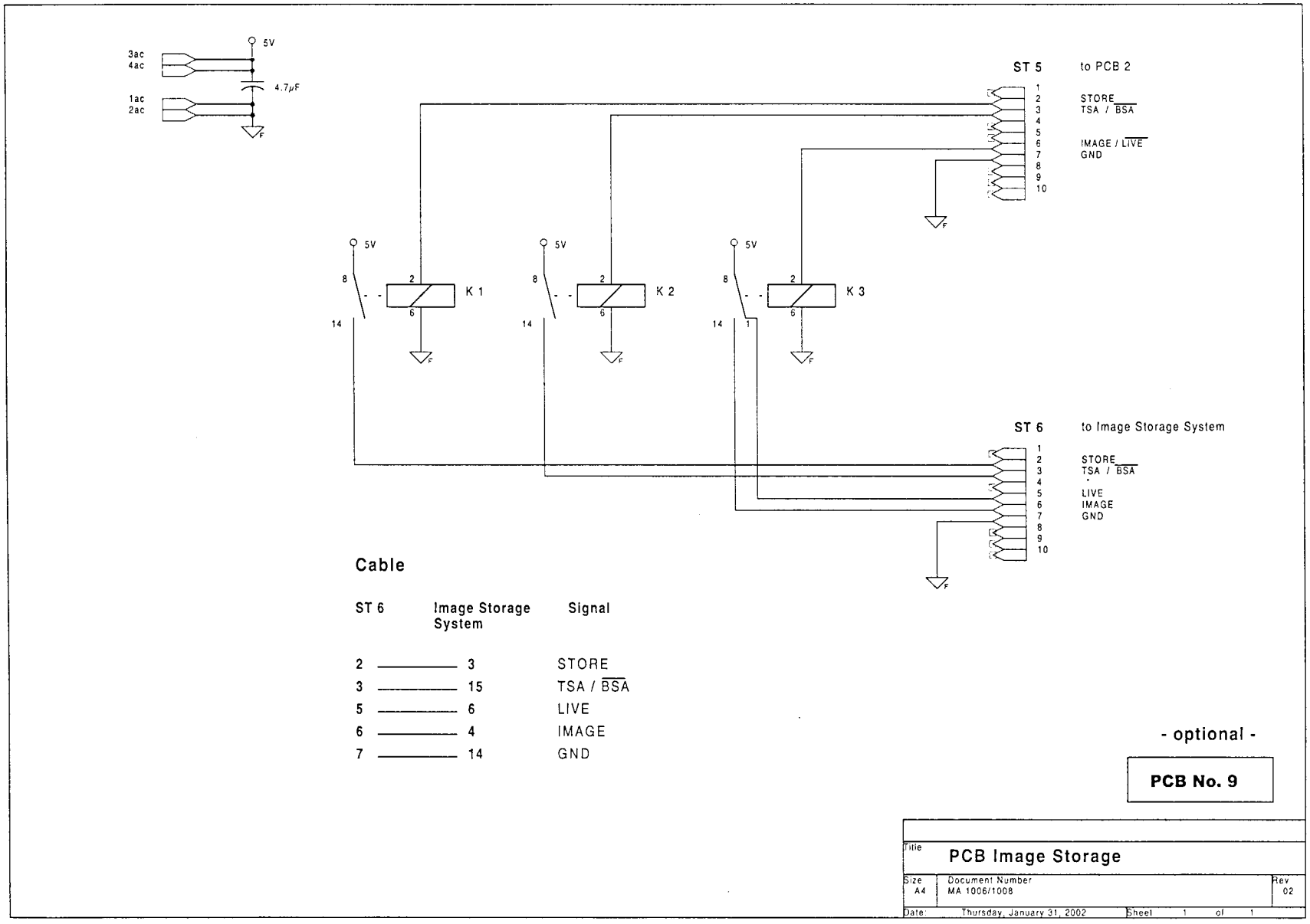
1


3ac
4ac
1ac
2ac
5V
4.7µF
ST 5
to PCB 2
STORE
TSA / BSA
IMAGE / LIVE
GND
K 1
K 2
K 3
ST 6
to Image Storage System
STORE
TSA / BSA
LIVE
IMAGE
GND
Cable
ST 6
Image Storage System
Signal
2 — 3 STORE
3 — 15 TSA / BSA
5 — 6 LIVE
6 — 4 IMAGE
7 — 14 GND
- optional -
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Title
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Size A4
Document Number MA 1006/1008
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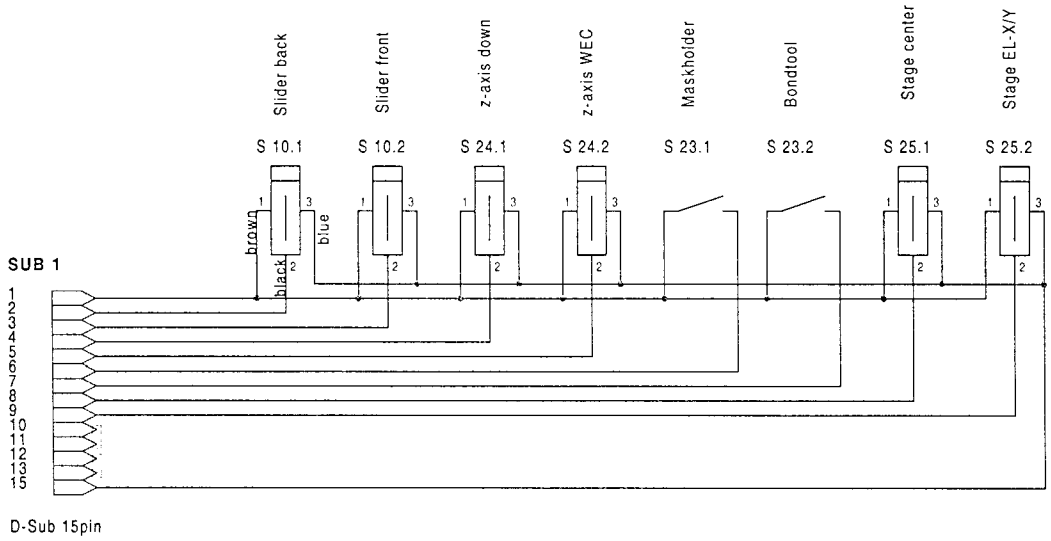

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Size A4	Document Number MA 1006/1008	Rev 02
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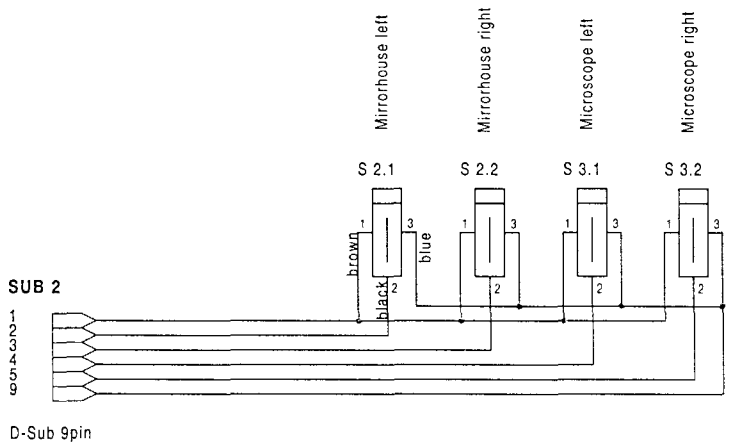

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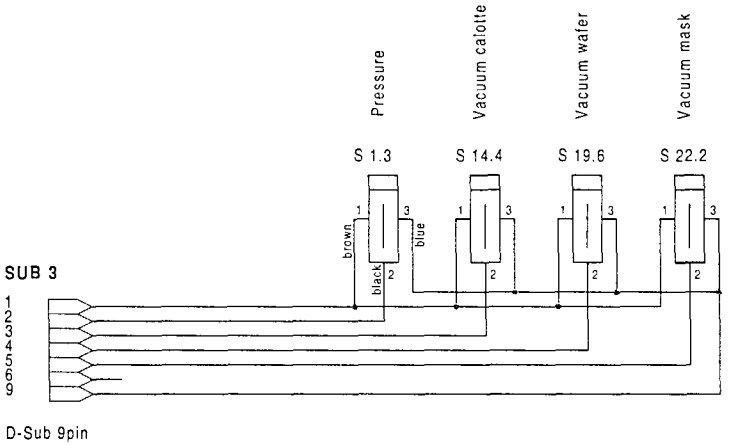

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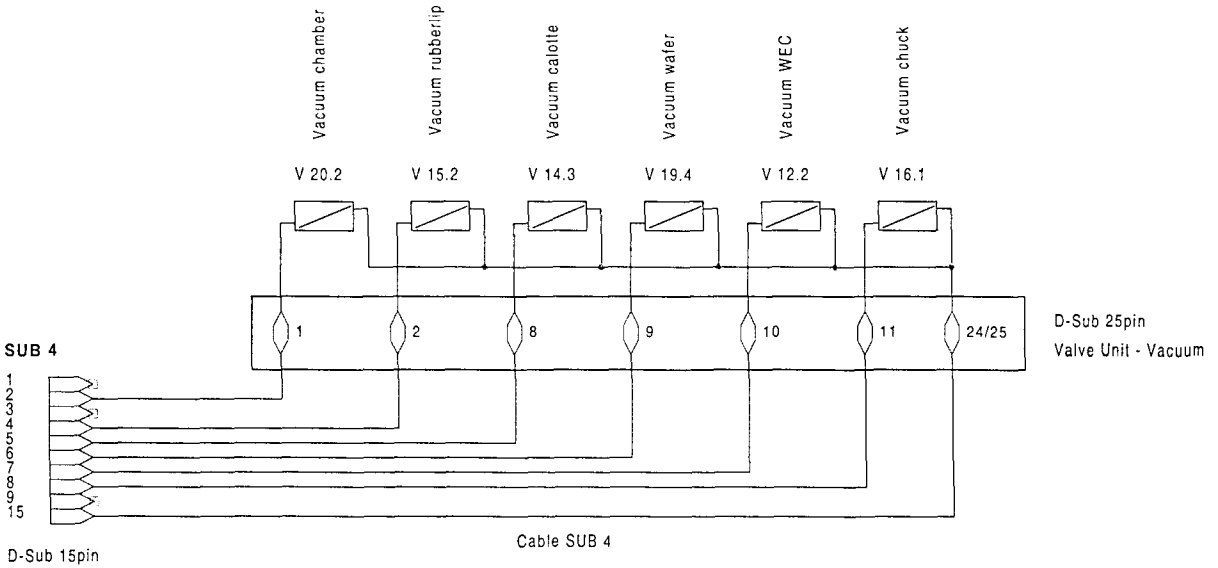
Size A4	Document Number MA 1006/1008	Rev 02
Date: Thursday, January 31, 2002	Sheet 1 of 1	



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Size A4	Document Number MA 1006/1008	Rev 02
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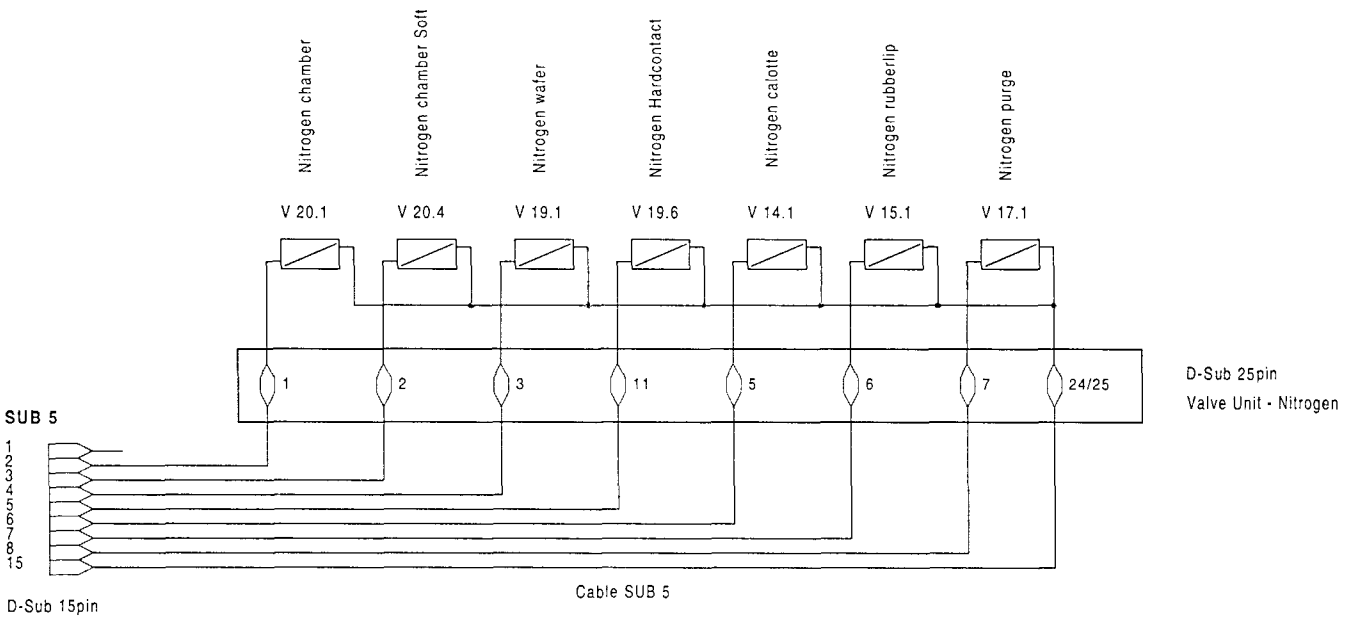

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Size A4	Document Number MA 1006/1008	Rev 02
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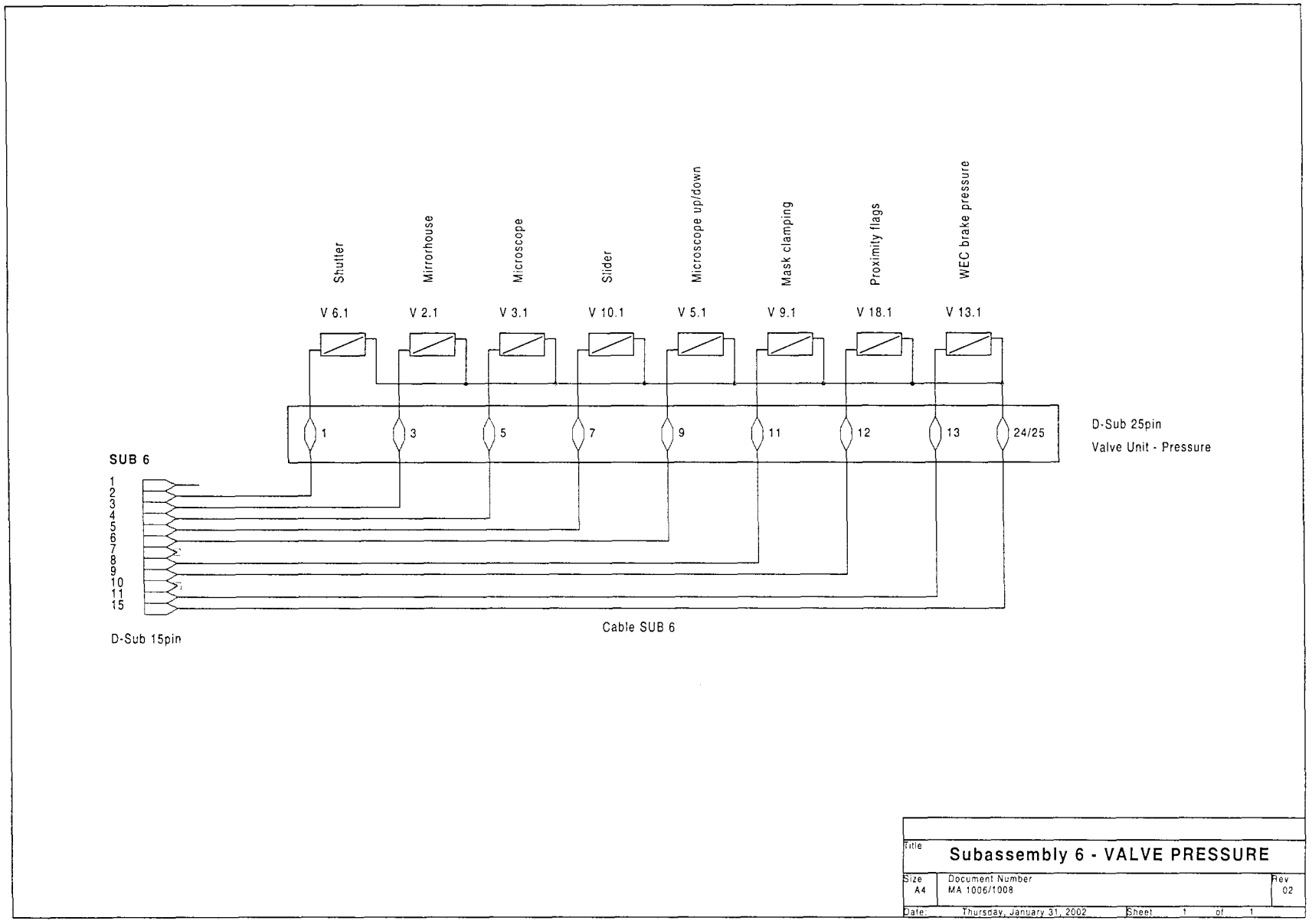
Shutter
Mirrorhouse
Microscope
Slider
Microscope up/down
Mask clamping
Proximity flags
WEC brake pressure
V 6.1
V 2.1
V 3.1
V 10.1
V 5.1
V 9.1
V 18.1
V 13.1
1
3
5
7
9
11
12
13
24/25
D-Sub 25pin
Valve Unit - Pressure
SUB 6
1
2
3
4
5
6
7
8
9
10
11
15
D-Sub 15pin
Cable SUB 6
Title
Subassembly 6 - VALVE PRESSURE
Size A4
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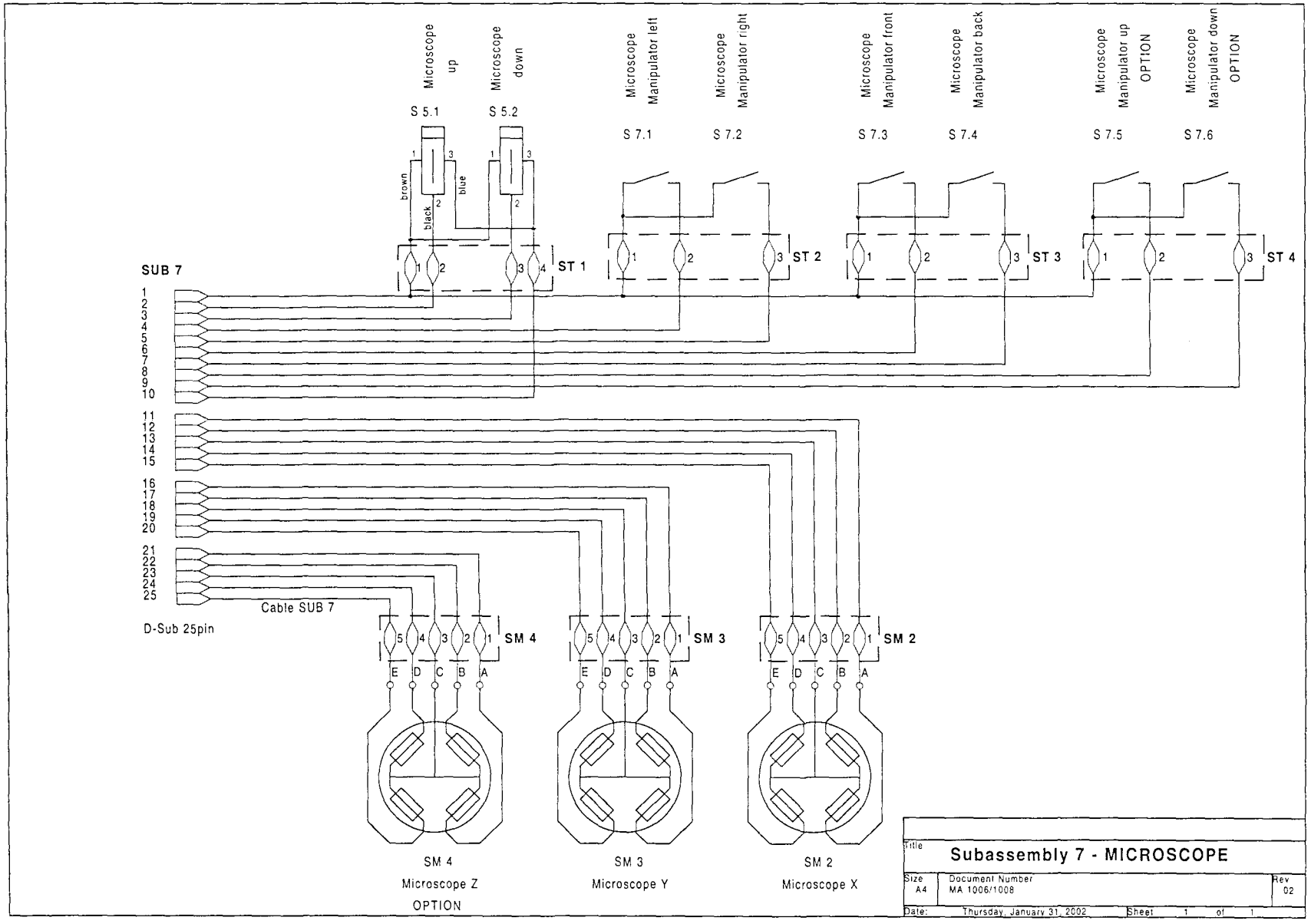
Microscope up
Microscope down
Microscope Manipulator left
Microscope Manipulator right
Microscope Manipulator front
Microscope Manipulator back
Microscope Manipulator up OPTION
Microscope Manipulator down OPTION
S 5.1
S 5.2
S 7.1
S 7.2
S 7.3
S 7.4
S 7.5
S 7.6
brown
blue
black
ST 1
ST 2
ST 3
ST 4
SUB 7
Cable SUB 7
D-Sub 25pin
SM 4
SM 3
SM 2
SM 4
Microscope Z
OPTION
SM 3
Microscope Y
SM 2
Microscope X
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Subassembly 7 - MICROSCOPE
Size A4
Document Number MA 1006/1008
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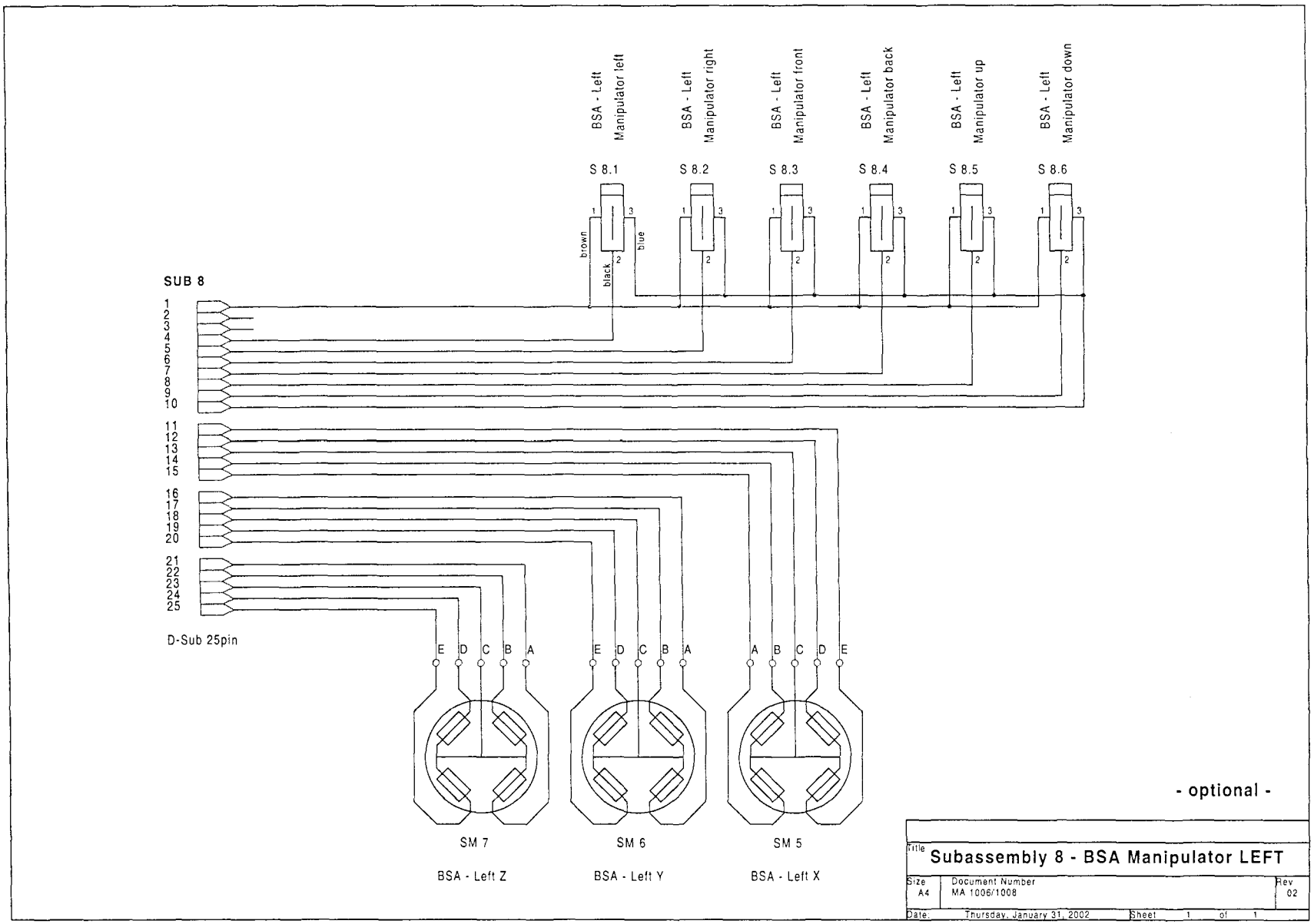
BSA - Left Manipulator left
BSA - Left Manipulator right
BSA - Left Manipulator front
BSA - Left Manipulator back
BSA - Left Manipulator up
BSA - Left Manipulator down
S 8.1
S 8.2
S 8.3
S 8.4
S 8.5
S 8.6
brown
black
blue
SUB 8
1 2 3 4 5 6 7 8 9 10
11 12 13 14 15
16 17 18 19 20
21 22 23 24 25
D-Sub 25pin
E D C B A
E D C B A
A B C D E
SM 7
SM 6
SM 5
BSA - Left Z
BSA - Left Y
BSA - Left X
- optional -
Title
Subassembly 8 - BSA Manipulator LEFT
Size A4
Document Number MA 1006/1008
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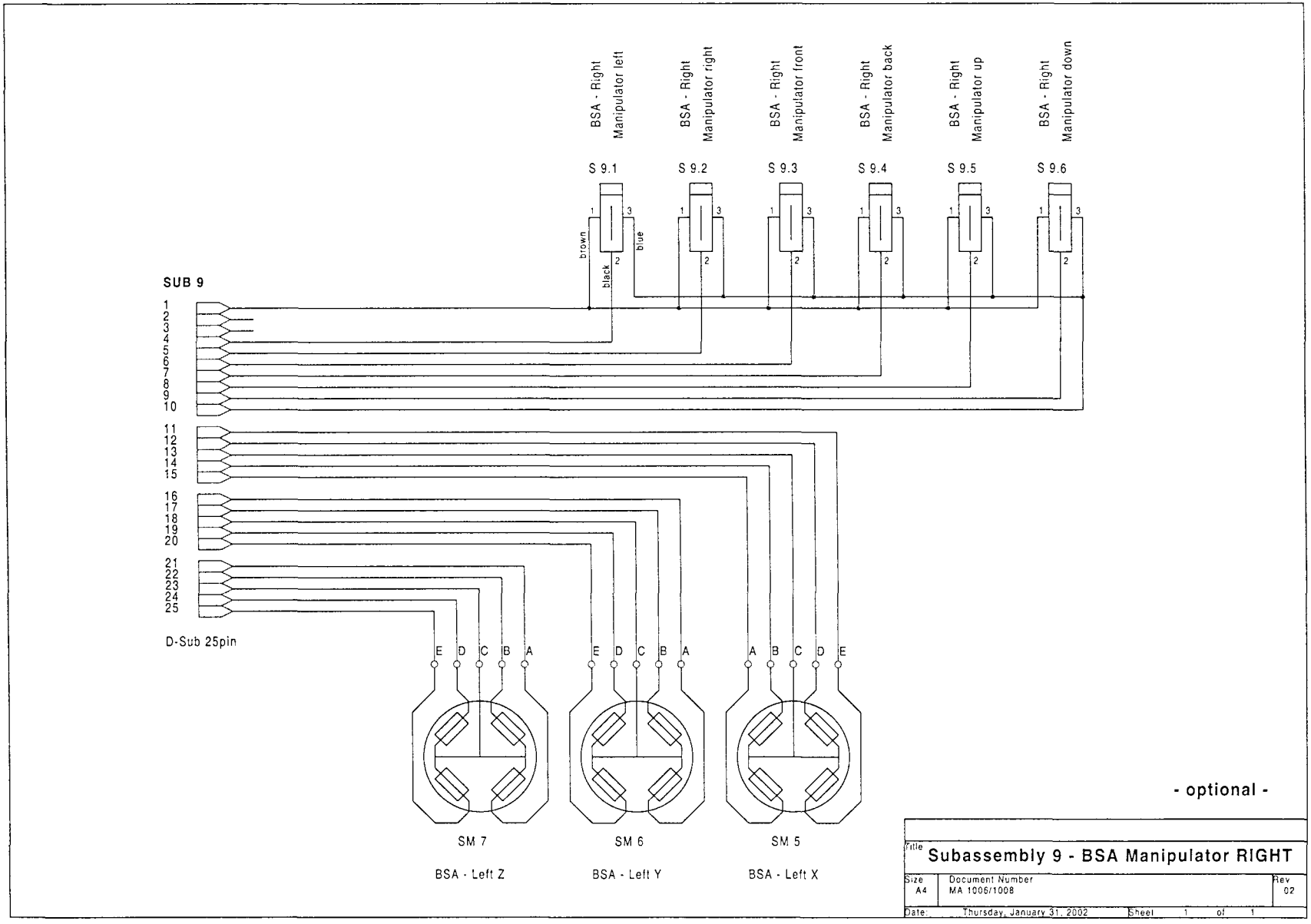
BSA - Right Manipulator left
BSA - Right Manipulator right
BSA - Right Manipulator front
BSA - Right Manipulator back
BSA - Right Manipulator up
BSA - Right Manipulator down
S 9.1
S 9.2
S 9.3
S 9.4
S 9.5
S 9.6
brown
black
blue
SUB 9
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
D-Sub 25pin
E D C B A
E D C B A
A B C D E
SM 7
SM 6
SM 5
BSA - Left Z
BSA - Left Y
BSA - Left X
- optional -
Title
Subassembly 9 - BSA Manipulator RIGHT
Size
A4
Document Number
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02
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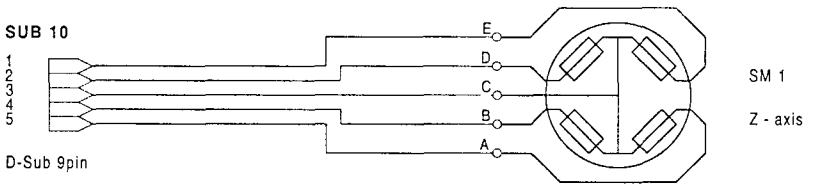

Title	Subassembly 10 - Z-AXIS	
Size A4	Document Number MA 1006/1008	Rev 02
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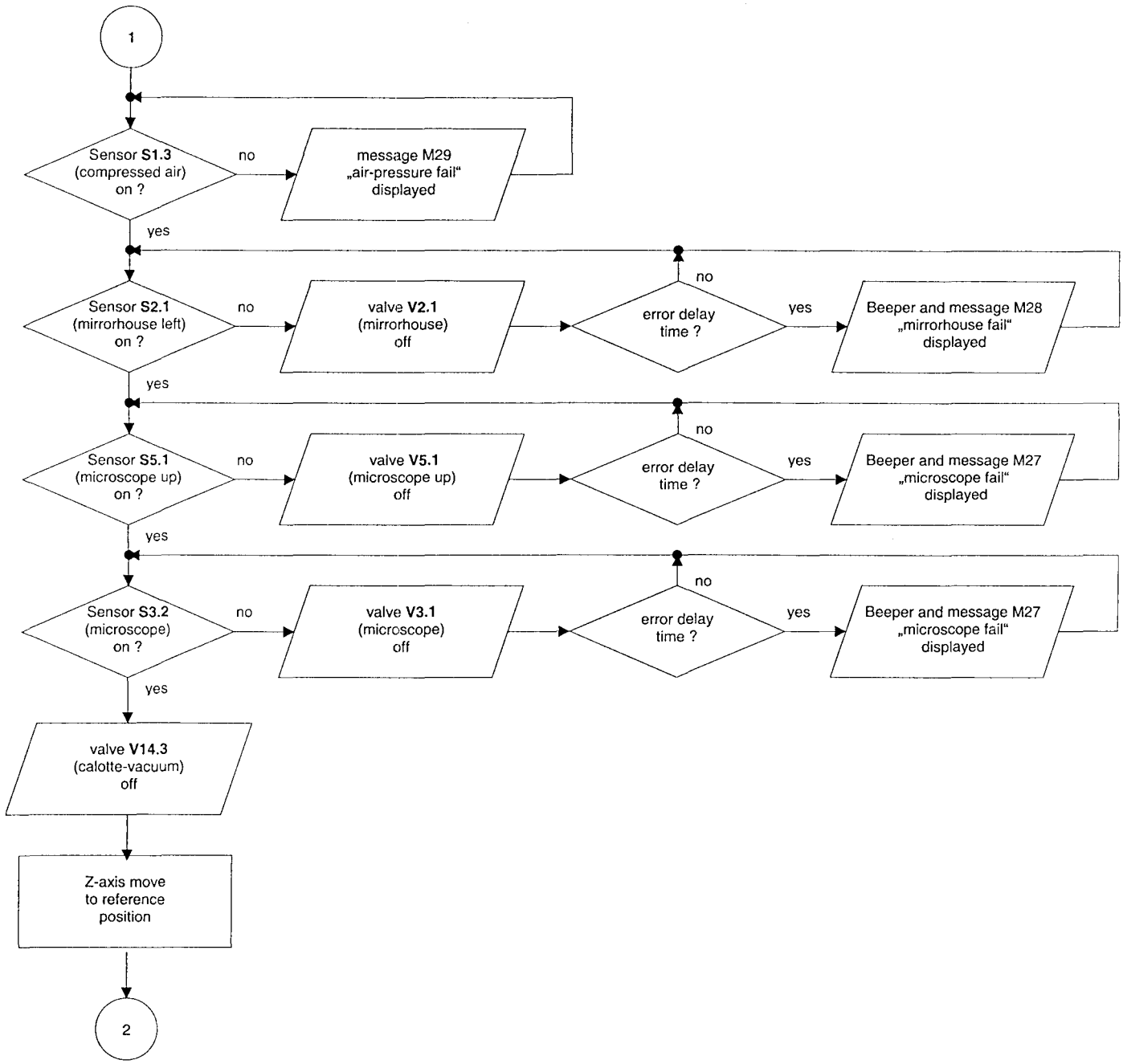
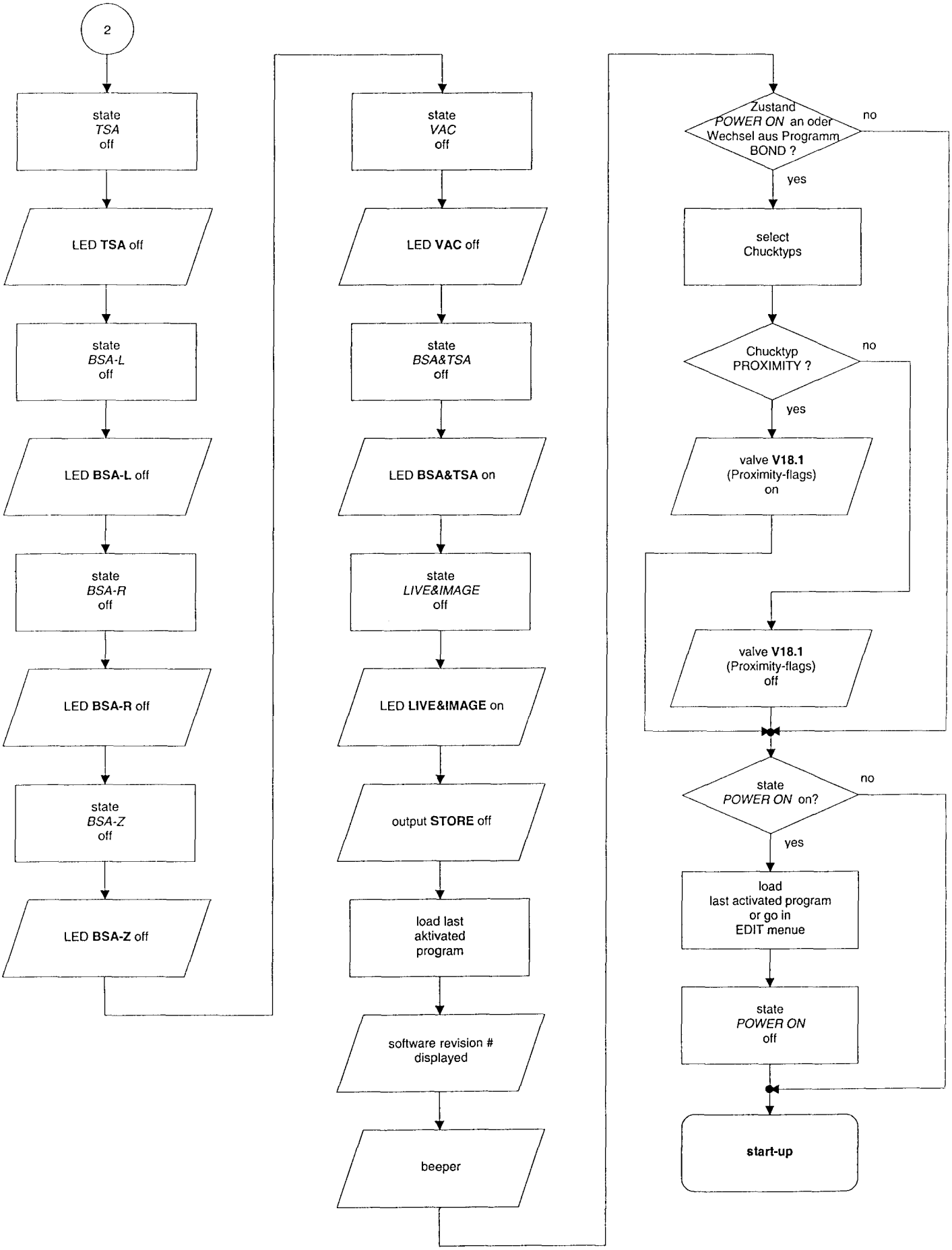
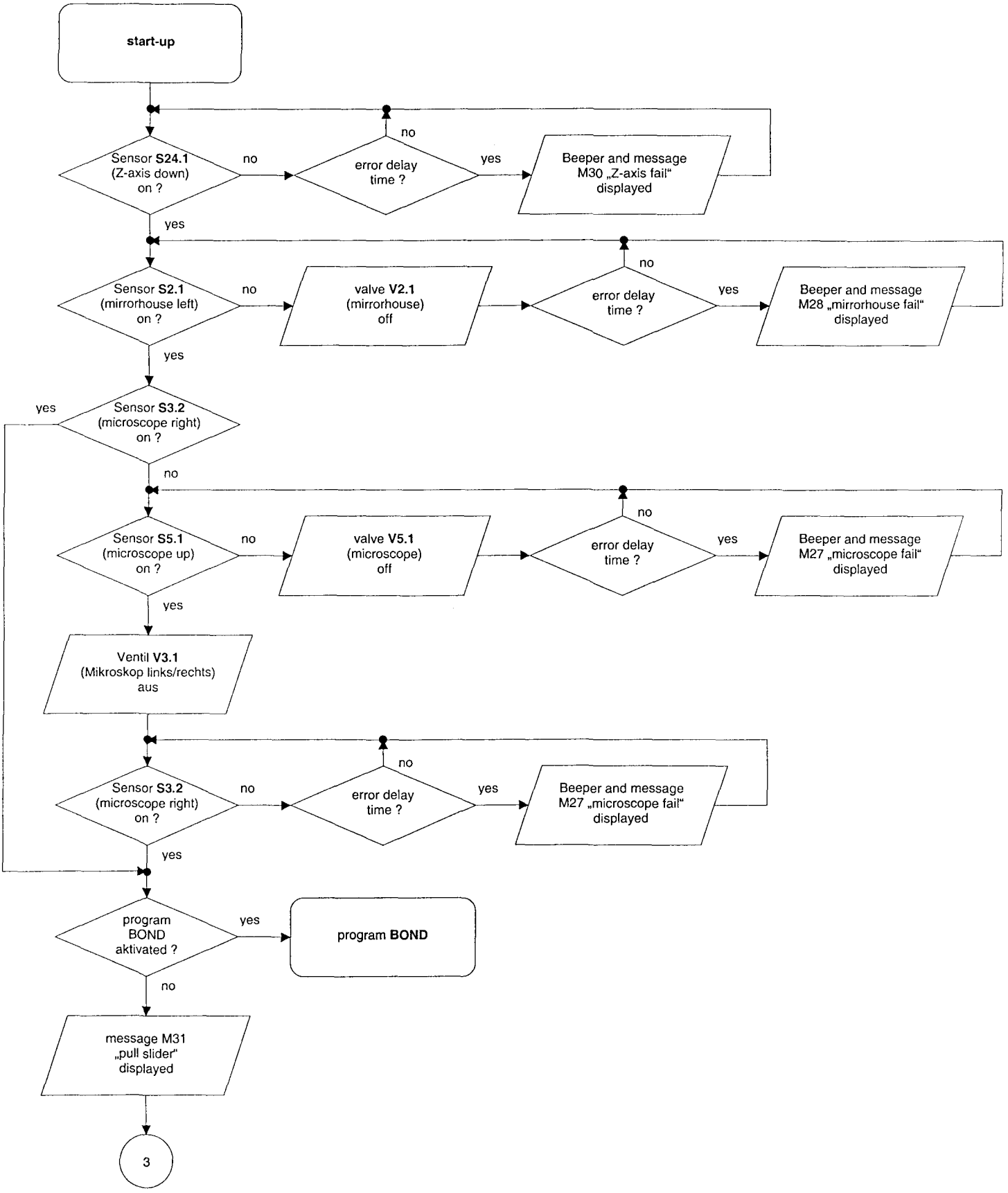
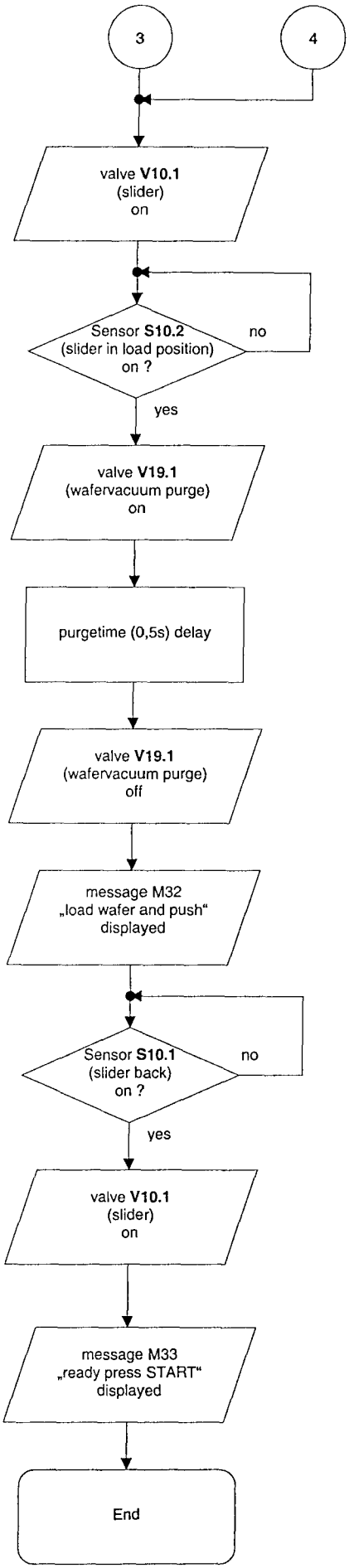
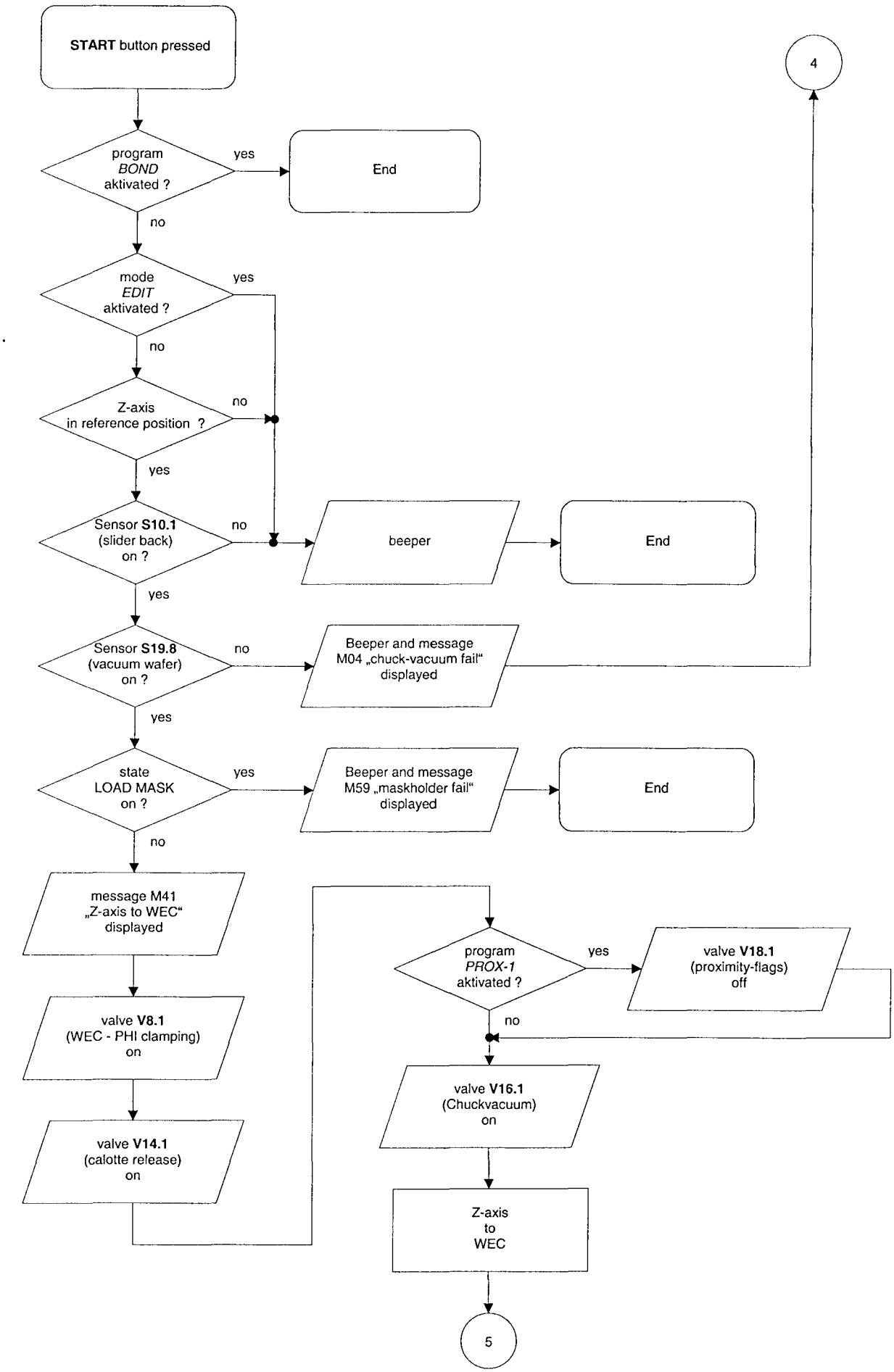
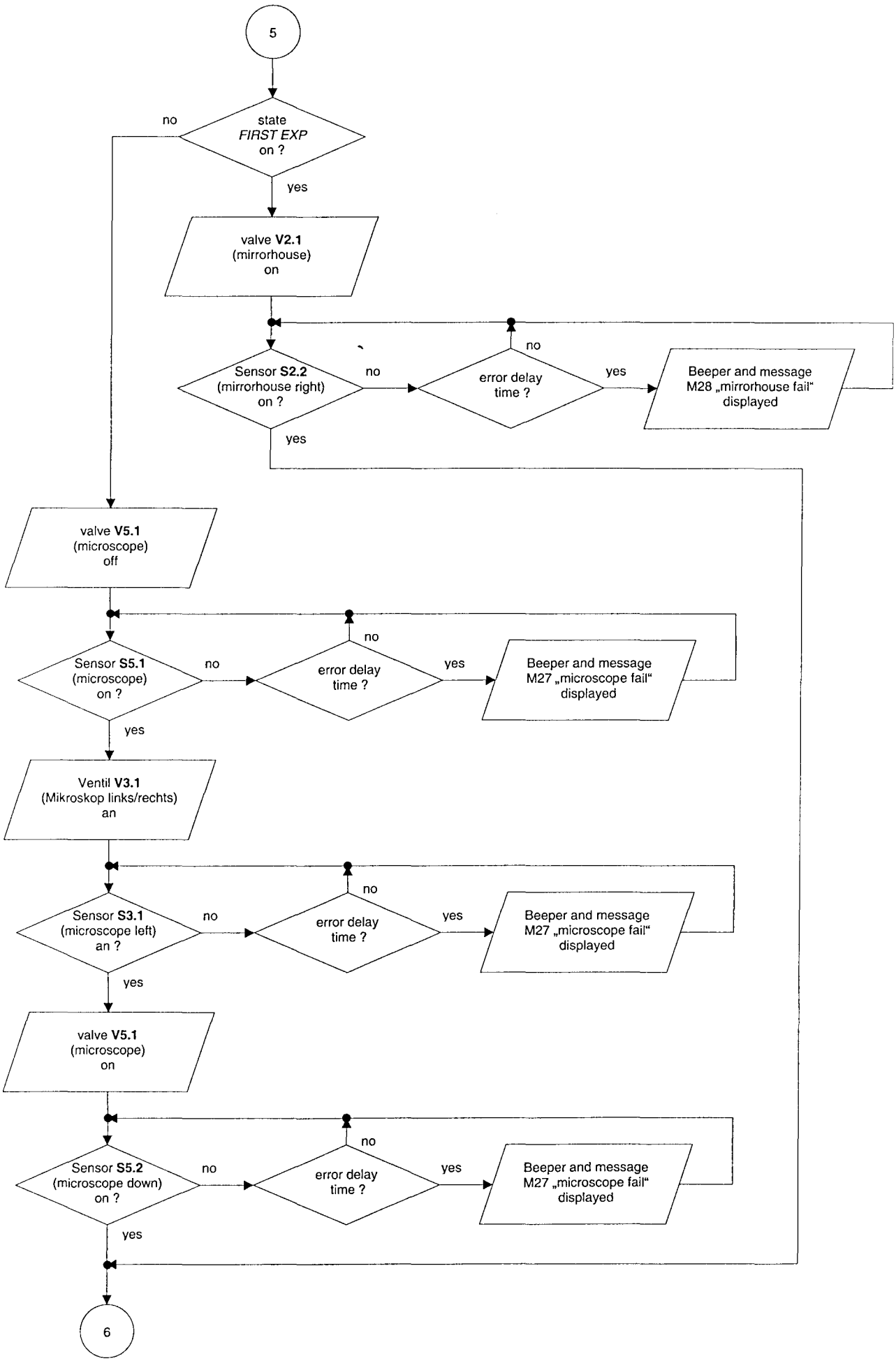

1
Sensor S1.3 (compressed air) on ?
no
message M29 „air-pressure fail“ displayed
yes
Sensor S2.1 (mirrorhouse left) on ?
no
valve V2.1 (mirrorhouse) off
error delay time ?
no
yes
Beeper and message M28 „mirrorhouse fail“ displayed
yes
Sensor S5.1 (microscope up) on ?
no
valve V5.1 (microscope up) off
error delay time ?
no
yes
Beeper and message M27 „microscope fail“ displayed
yes
Sensor S3.2 (microscope) on ?
no
valve V3.1 (microscope) off
error delay time ?
no
yes
Beeper and message M27 „microscope fail“ displayed
yes
valve V14.3 (calotte-vacuum) off
Z-axis move to reference position
2

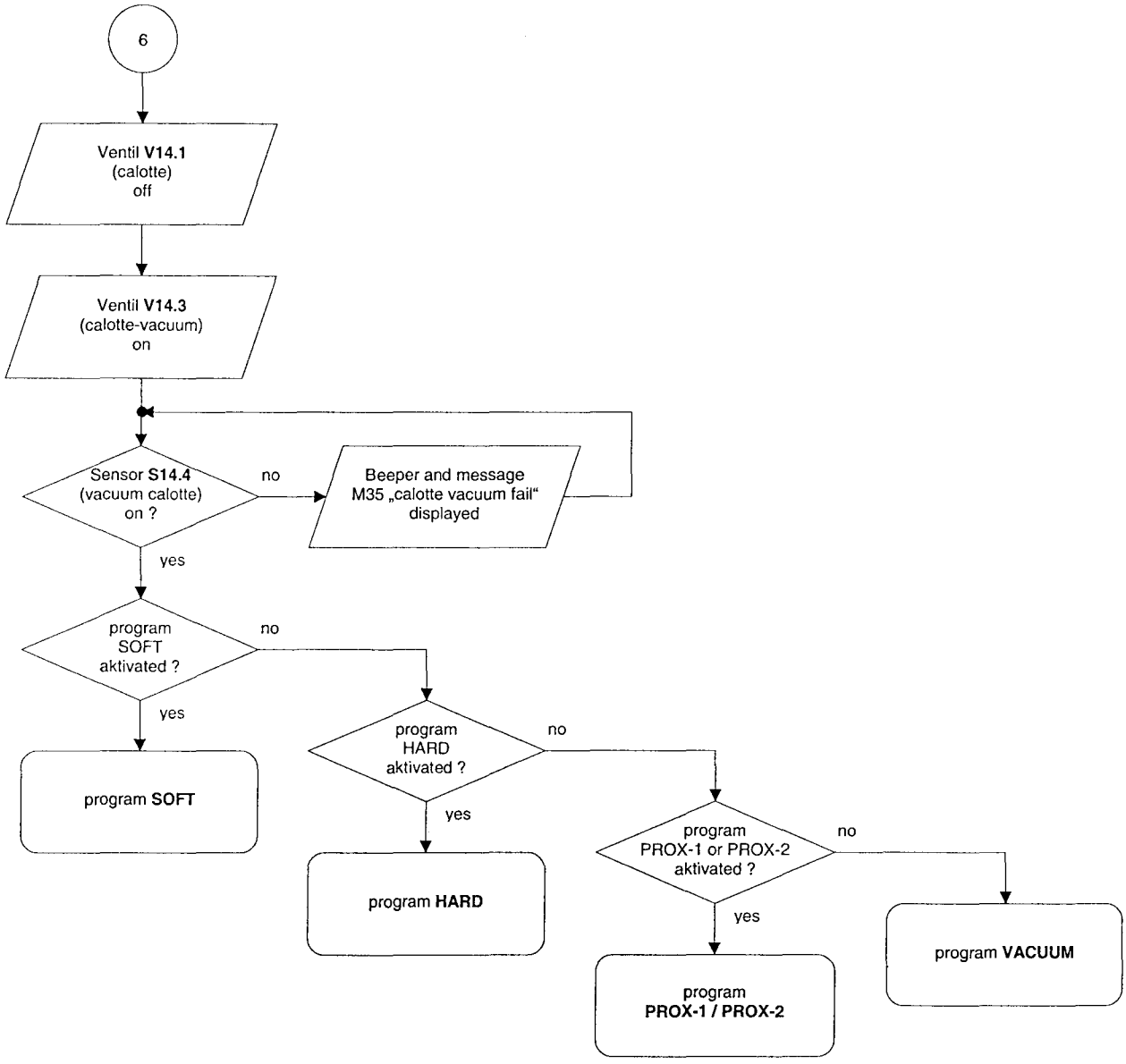

2
state TSA off
LED TSA off
state BSA-L off
LED BSA-L off
state BSA-R off
LED BSA-R off
state BSA-Z off
LED BSA-Z off
state VAC off
LED VAC off
state BSA&TSA off
LED BSA&TSA on
state LIVE&IMAGE off
LED LIVE&IMAGE on
output STORE off
load last aktivated program
software revision # displayed
beeper
Zustand POWER ON an oder Wechsel aus Programm BOND ?
no
yes
select Chucktyps
Chucktyp PROXIMITY ?
no
yes
valve V18.1 (Proximity-flags) on
valve V18.1 (Proximity-flags) off
state POWER ON on?
no
yes
load last activated program or go in EDIT menue
state POWER ON off
start-up

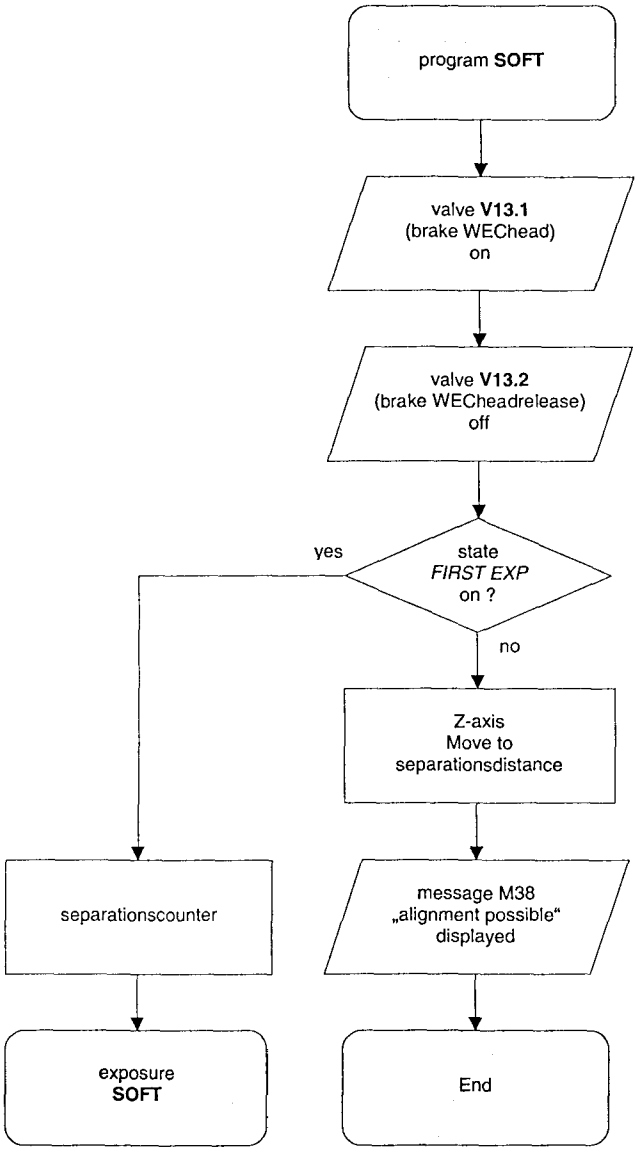

start-up
Sensor S24.1 (Z-axis down) on ?
no
error delay time ?
no
yes
Beeper and message M30 „Z-axis fail" displayed
yes
Sensor S2.1 (mirrorhouse left) on ?
no
valve V2.1 (mirrorhouse) off
error delay time ?
no
yes
Beeper and message M28 „mirrorhouse fail" displayed
yes
Sensor S3.2 (microscope right) on ?
yes
no
Sensor S5.1 (microscope up) on ?
no
valve V5.1 (microscope) off
error delay time ?
no
yes
Beeper and message M27 „microscope fail" displayed
yes
Ventil V3.1 (Mikroskop links/rechts) aus
Sensor S3.2 (microscope right) on ?
no
error delay time ?
no
yes
Beeper and message M27 „microscope fail" displayed
yes
program BOND aktivated ?
yes
program BOND
no
message M31 „pull slider" displayed
3

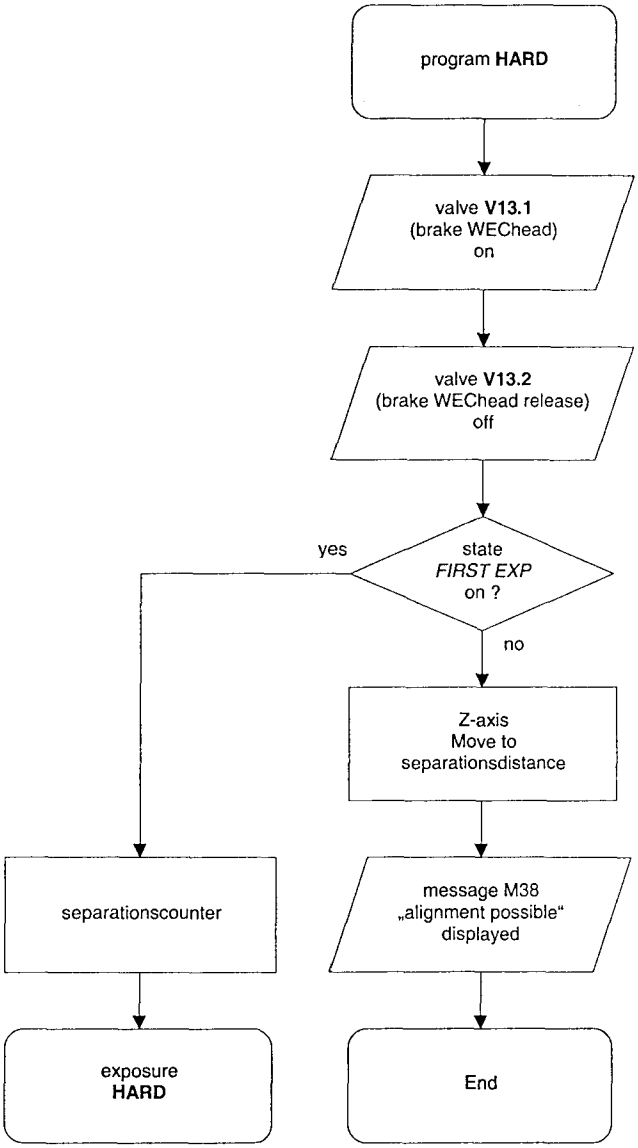

3
4
valve **V10.1**
(slider)
on
Sensor **S10.2**
(slider in load position)
on ?
no
yes
valve **V19.1**
(wafervacuum purge)
on
purgetime (0,5s) delay
valve **V19.1**
(wafervacuum purge)
off
message M32
„load wafer and push"
displayed
Sensor **S10.1**
(slider back)
on ?
no
yes
valve **V10.1**
(slider)
on
message M33
„ready press START"
displayed
End

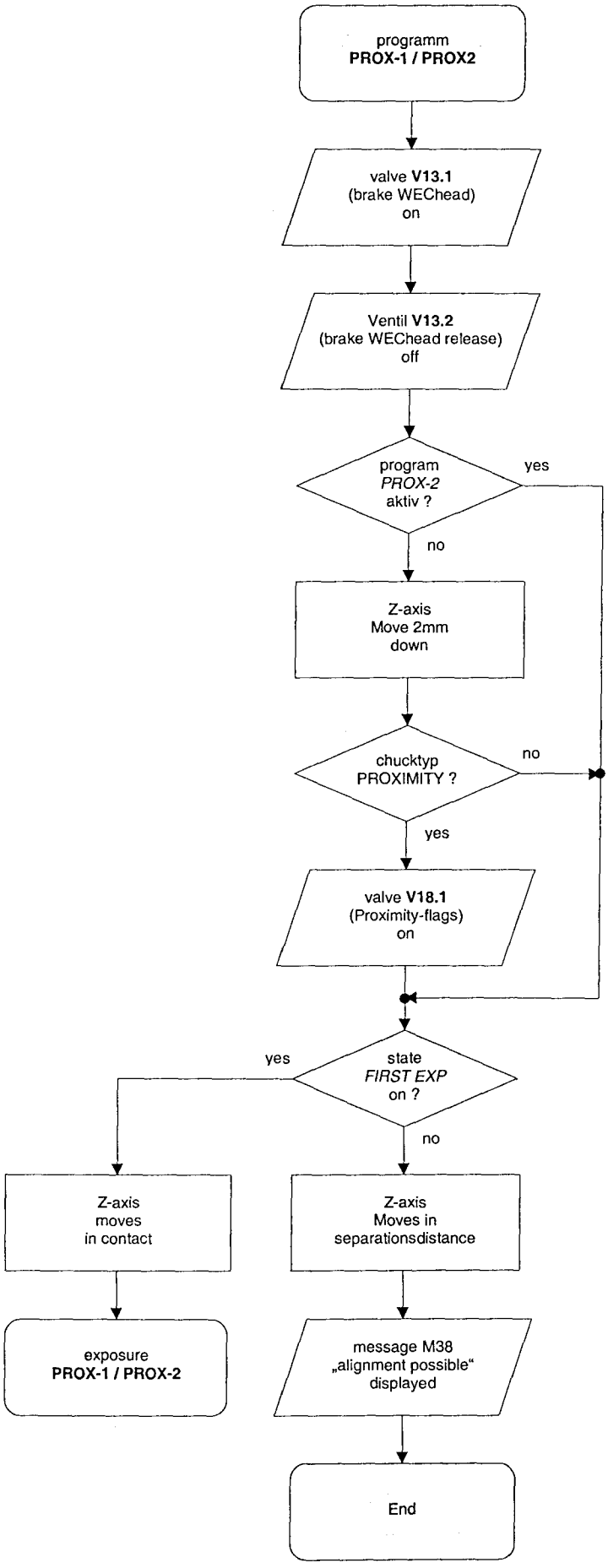

START button pressed
program BOND aktivated ?
yes
End
no
mode EDIT aktivated ?
yes
no
Z-axis in reference position ?
no
yes
Sensor S10.1 (slider back) on ?
no
beeper
End
yes
Sensor S19.8 (vacuum wafer) on ?
no
Beeper and message M04 „chuck-vacuum fail" displayed
yes
state LOAD MASK on ?
yes
Beeper and message M59 „maskholder fail" displayed
End
no
4
message M41 „Z-axis to WEC" displayed
valve V8.1 (WEC - PHI clamping) on
valve V14.1 (calotte release) on
program PROX-1 aktivated ?
yes
valve V18.1 (proximity-flags) off
no
valve V16.1 (Chuckvacuum) on
Z-axis to WEC
5

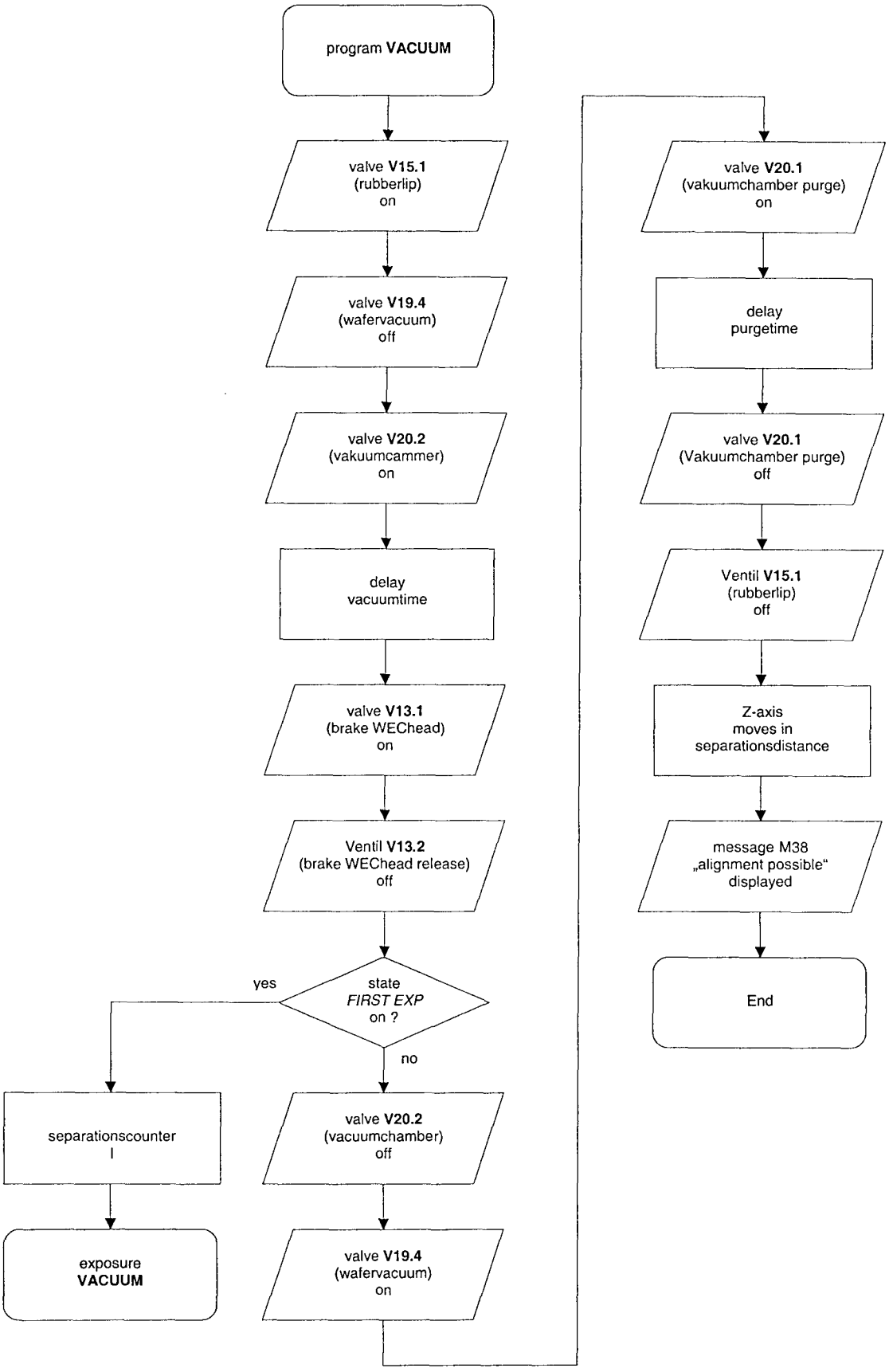

5
state
FIRST EXP
on ?
no
yes
valve V2.1
(mirrorhouse)
on
Sensor S2.2
(mirrorhouse right)
on ?
no
error delay
time ?
no
yes
Beeper and message
M28 „mirrorhouse fail"
displayed
yes
valve V5.1
(microscope)
off
Sensor S5.1
(microscope)
on ?
no
error delay
time ?
no
yes
Beeper and message
M27 „microscope fail"
displayed
yes
Ventil V3.1
(Mikroskop links/rechts)
an
Sensor S3.1
(microscope left)
an ?
no
error delay
time ?
no
yes
Beeper and message
M27 „microscope fail"
displayed
yes
valve V5.1
(microscope)
on
Sensor S5.2
(microscope down)
on ?
no
error delay
time ?
no
yes
Beeper and message
M27 „microscope fail"
displayed
yes
6

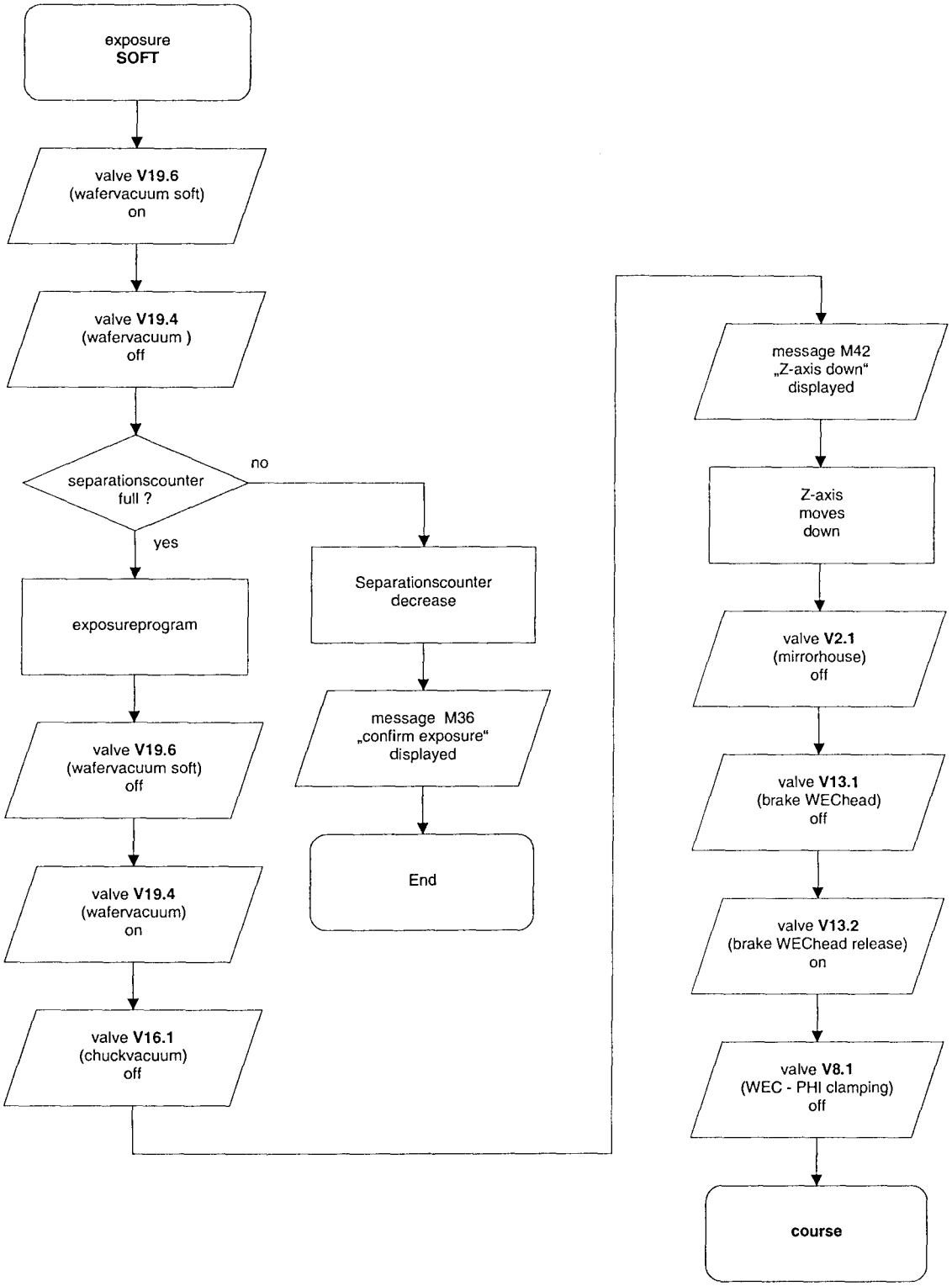

6
Ventil **V14.1** (calotte) off
Ventil **V14.3** (calotte-vacuum) on
Sensor **S14.4** (vacuum calotte) on ?
no
Beeper and message M35 „calotte vacuum fail" displayed
yes
program SOFT aktivated ?
no
yes
program **SOFT**
program HARD aktivated ?
no
yes
program **HARD**
program PROX-1 or PROX-2 aktivated ?
no
yes
program **PROX-1 / PROX-2**
program **VACUUM**

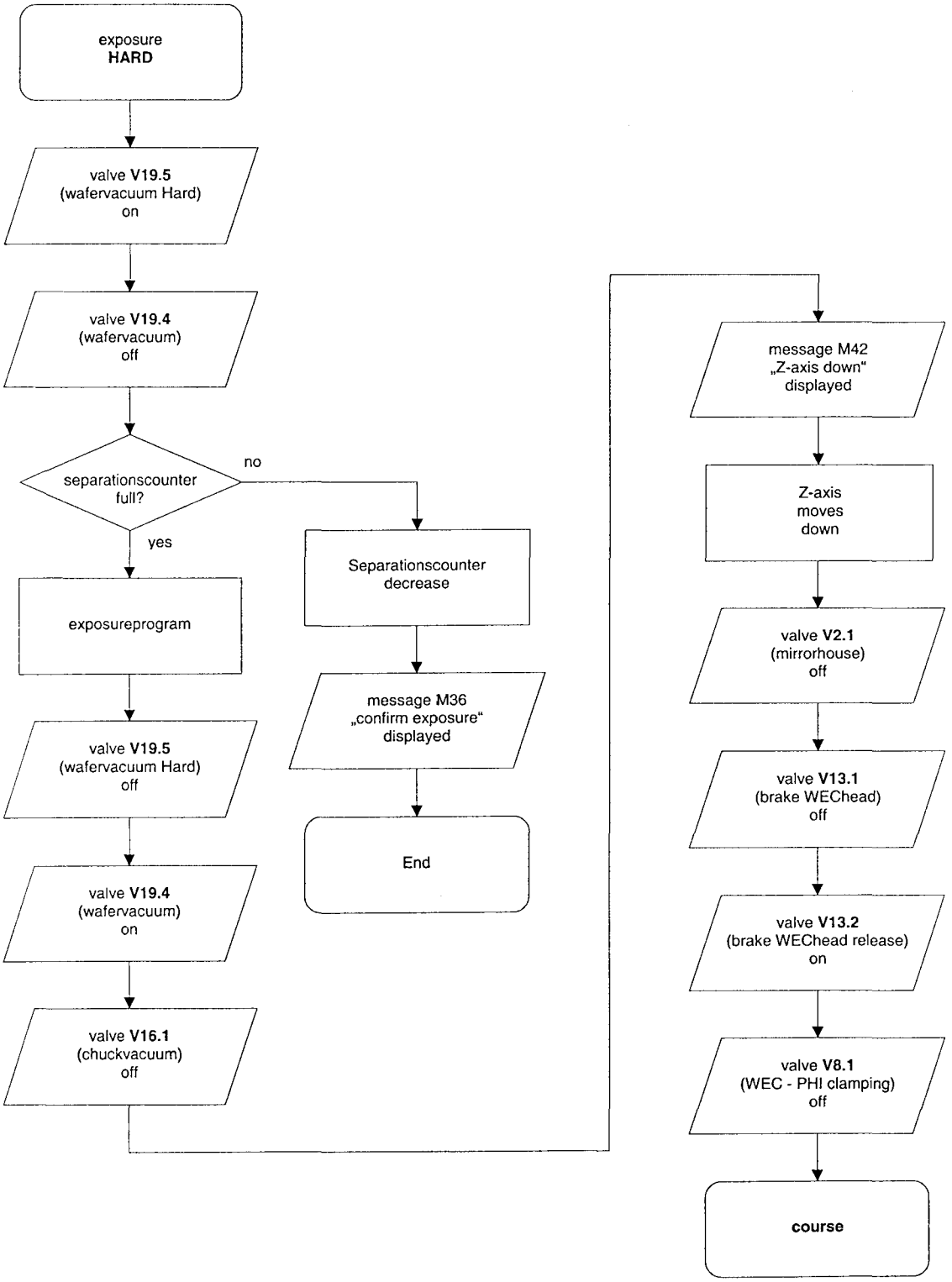

program **SOFT**
valve **V13.1**
(brake WEChead)
on
valve **V13.2**
(brake WECheadrelease)
off
state
FIRST EXP
on ?
yes
no
Z-axis
Move to
separationsdistance
separationscounter
message M38
„alignment possible"
displayed
exposure
SOFT
End

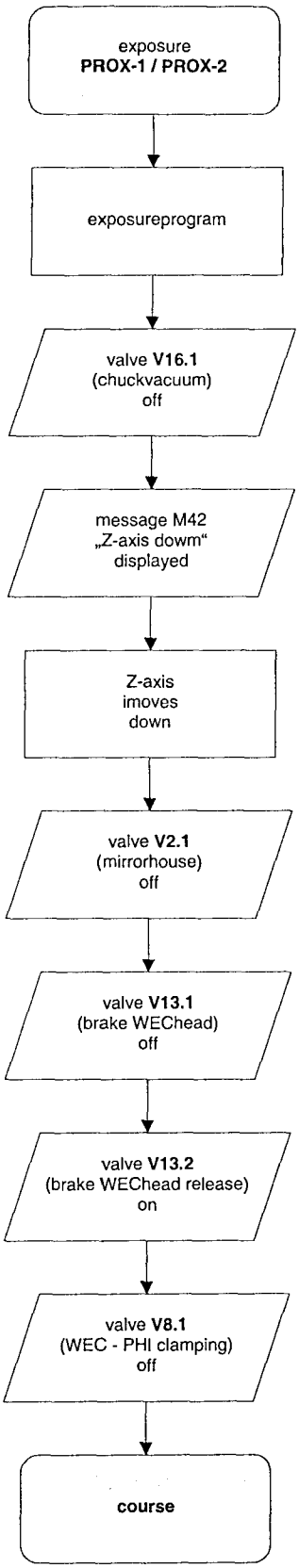

program **HARD**
valve **V13.1**
(brake WEChead)
on
valve **V13.2**
(brake WEChead release)
off
yes
state
FIRST EXP
on ?
no
Z-axis
Move to
separationsdistance
separationscounter
message M38
„alignment possible"
displayed
exposure
HARD
End

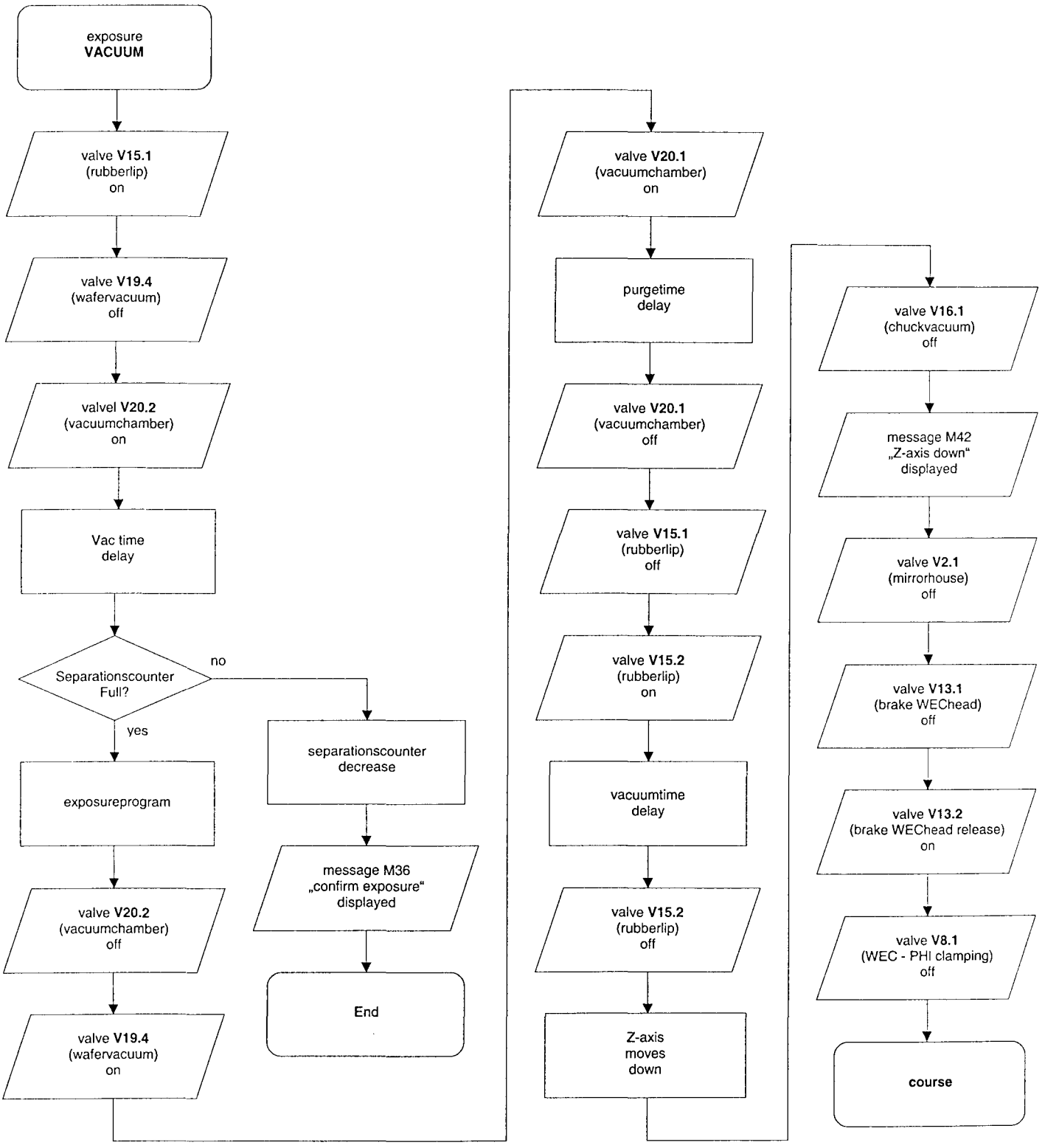

programm
PROX-1 / PROX2
valve **V13.1**
(brake WEChead)
on
Ventil **V13.2**
(brake WEChead release)
off
program
PROX-2
aktiv ?
yes
no
Z-axis
Move 2mm
down
chucktyp
PROXIMITY ?
no
yes
valve **V18.1**
(Proximity-flags)
on
yes
state
FIRST EXP
on ?
no
Z-axis
moves
in contact
Z-axis
Moves in
separationsdistance
exposure
PROX-1 / PROX-2
message M38
„alignment possible"
displayed
End

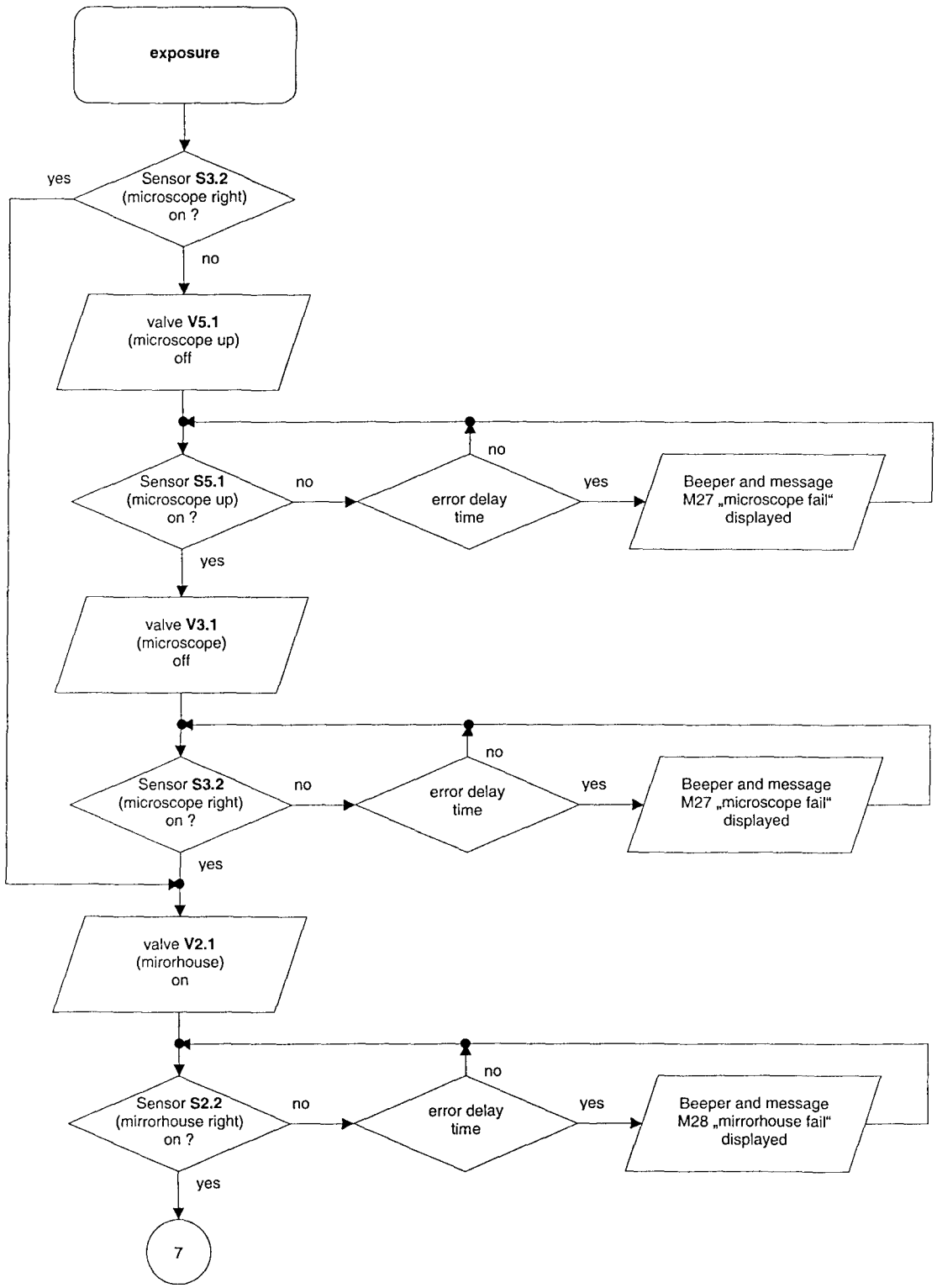

program **VACUUM**
valve **V15.1** (rubberlip) on
valve **V19.4** (wafervacuum) off
valve **V20.2** (vakuumcammer) on
delay vacuumtime
valve **V13.1** (brake WEChead) on
Ventil **V13.2** (brake WEChead release) off
state *FIRST EXP* on ?
yes
no
separationscounter I
exposure **VACUUM**
valve **V20.2** (vacuumchamber) off
valve **V19.4** (wafervacuum) on
valve **V20.1** (vakuumchamber purge) on
delay purgetime
valve **V20.1** (Vakuumchamber purge) off
Ventil **V15.1** (rubberlip) off
Z-axis moves in separationsdistance
message M38 „alignment possible" displayed
End

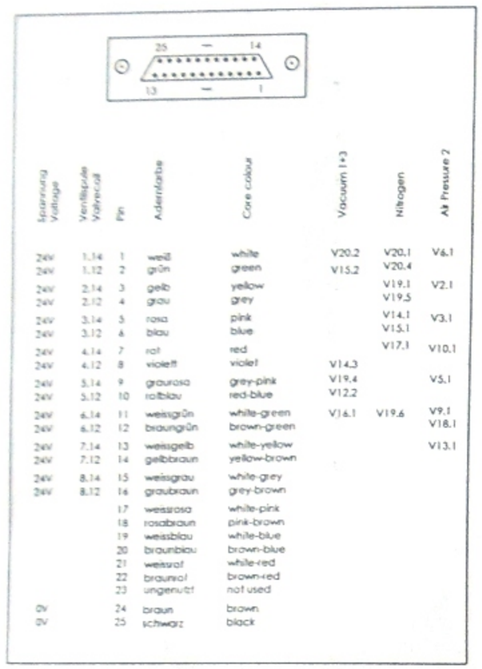

exposure
SOFT
valve V19.6
(wafervacuum soft)
on
valve V19.4
(wafervacuum)
off
separationscounter
full ?
no
yes
Separationscounter
decrease
message M36
„confirm exposure"
displayed
End
exposureprogram
valve V19.6
(wafervacuum soft)
off
valve V19.4
(wafervacuum)
on
valve V16.1
(chuckvacuum)
off
message M42
„Z-axis down"
displayed
Z-axis
moves
down
valve V2.1
(mirrorhouse)
off
valve V13.1
(brake WEChead)
off
valve V13.2
(brake WEChead release)
on
valve V8.1
(WEC - PHI clamping)
off
course


exposure
HARD
valve V19.5
(wafervacuum Hard)
on
valve V19.4
(wafervacuum)
off
separationscounter
full?
no
yes
Separationscounter
decrease
exposureprogram
message M36
„confirm exposure"
displayed
valve V19.5
(wafervacuum Hard)
off
End
valve V19.4
(wafervacuum)
on
valve V16.1
(chuckvacuum)
off
message M42
„Z-axis down"
displayed
Z-axis
moves
down
valve V2.1
(mirrorhouse)
off
valve V13.1
(brake WEChead)
off
valve V13.2
(brake WEChead release)
on
valve V8.1
(WEC - PHI clamping)
off
course


exposure
PROX-1 / PROX-2
exposureprogram
valve **V16.1**
(chuckvacuum)
off
message M42
„Z-axis dowm"
displayed
Z-axis
imoves
down
valve **V2.1**
(mirrorhouse)
off
valve **V13.1**
(brake WEChead)
off
valve **V13.2**
(brake WEChead release)
on
valve **V8.1**
(WEC - PHI clamping)
off
course


exposure
VACUUM
valve V15.1
(rubberlip)
on
valve V19.4
(wafervacuum)
off
valvel V20.2
(vacuumchamber)
on
Vac time
delay
Separationscounter
Full?
no
yes
separationscounter
decrease
exposureprogram
message M36
„confirm exposure"
displayed
valve V20.2
(vacuumchamber)
off
End
valve V19.4
(wafervacuum)
on
valve V20.1
(vacuumchamber)
on
purgetime
delay
valve V20.1
(vacuumchamber)
off
valve V15.1
(rubberlip)
off
valve V15.2
(rubberlip)
on
vacuumtime
delay
valve V15.2
(rubberlip)
off
Z-axis
moves
down
valve V16.1
(chuckvacuum)
off
message M42
„Z-axis down"
displayed
valve V2.1
(mirrorhouse)
off
valve V13.1
(brake WEChead)
off
valve V13.2
(brake WEChead release)
on
valve V8.1
(WEC - PHI clamping)
off
course


exposure
yes
Sensor S3.2
(microscope right)
on ?
no
valve V5.1
(microscope up)
off
Sensor S5.1
(microscope up)
on ?
no
error delay
time
no
yes
Beeper and message
M27 „microscope fail"
displayed
yes
valve V3.1
(microscope)
off
Sensor S3.2
(microscope right)
on ?
no
error delay
time
no
yes
Beeper and message
M27 „microscope fail"
displayed
yes
valve V2.1
(mirorhouse)
on
Sensor S2.2
(mirrorhouse right)
on ?
no
error delay
time
no
yes
Beeper and message
M28 „mirrorhouse fail"
displayed
yes
7



Spannung Voltage	Ventilspule Valve coil	Pin	Adernfarbe	Core colour	Vacuum 1+3	Nitrogen	Air Pressure 2
24V	1.14	1	weiß	white	V20.2	V20.1	V6.1
24V	1.12	2	grün	green	V15.2	V20.4	
24V	2.14	3	gelb	yellow		V19.1	V2.1
24V	2.12	4	grau	grey		V19.5	
24V	3.14	5	rosa	pink		V14.1	V3.1
24V	3.12	6	blau	blue		V15.1	
24V	4.14	7	rot	red		V17.1	V10.1
24V	4.12	8	violett	violet	V14.3		
24V	5.14	9	graurosa	grey-pink	V19.4		V5.1
24V	5.12	10	rotblau	red-blue	V12.2		
24V	6.14	11	weissgrün	white-green	V16.1	V19.6	V9.1
24V	6.12	12	braungrün	brown-green			V18.1
24V	7.14	13	weissgelb	white-yellow			V13.1
24V	7.12	14	gelbbraun	yellow-brown			
24V	8.14	15	weissgrau	white-grey			
24V	8.12	16	graubraun	grey-brown			
		17	weissrosa	white-pink			
		18	rosabraun	pink-brown			
		19	weissblau	white-blue			
		20	braunblau	brown-blue			
		21	weissrot	white-red			
		22	braunrot	brown-red			
		23	ungenutzt	not used			
0V		24	braun	brown			
0V		25	schwarz	black