Operating Instructions for the *EC* Robot Control and the Robot Desk Top Automation

Edition 2.10 valid for DTA ***EC*** Control Version 2.10 and E-Doku V 2.10

CONTENTS

1. Basic Operation

1.1 Naming Conventions

Following abbreviations are used within the manual:

DTA Desk Top Automation device used to load and unload PCB's to a working device. This manual handles the description of the DTA.

AG Working device. This device gets PCB's loaded and unloaded from the DTA, this could be a Orbotech Paragon™ imaging system.

1.2 Basic Operation Philosophy

Operation of the Desk To Automation – **DTA** is designed to handle the automation with only a few operating controls. The machine is operated by a touch screen. Nearly all operation tasks can be accomplished using the touch screen. Only the Emergency Off button, the main switch and the cartridge unlock keys are separate control elements.

To start the machine switch on the main switch an then reference the machine by pressing the **Reference** button on the touch screen display. Next press the **Start** button. The machine will do some initial motions and the wait for the AG (Paragon) to initialize. After AG initialization is done, PCB loading is started.

1.3 Standard Operation

A full cartridge is entered on the left side of the **DTA**. For each cartridge 2 buttons are available to handle cartridge release and trolley release operation. A cartridge can only be released if the trolley is connected and the green lamp in the release button is on (control is in RESET state).

On the main page of the control display the operator has to select "print single side" or "print both sides" on the Printing Mode field. Then START has to be pressed to start the operation.

Single Side Operation
After initialization motions and measurements (2 seconds), the loading arm waits in front f the left input cartridge for the **AG** (Paragon) to initialize and then for the first panel request of the Paragon.
Then PCB is loaded to the cleaning station and centered and aligned afterwards. After that the next PCB is fetched from the left cartridge, then PCB's are exchanged on the center station and then the cleaned PCB is laid down to the Paragon. Then the next PCB is fetched from the left cartridge, exchange on the center station and moved to the Paragon AG where it is exchanged if the printing process is done. The finished PCB is laid to the right cartridge.

Double Side Operation
Wit setting "Print both sides" the loading sequence is at first the same as for single sided printing. After the first side has been printed and laid down to the right cartridge PCB's are picked from the right cartridge moved to the center

conveyor and then flipped in the flip station. After that the PCB's are printed on the back side and stacked back to the left cartridge. With the back side visible.

2. User Interface

2.1 Touch Screens Layout

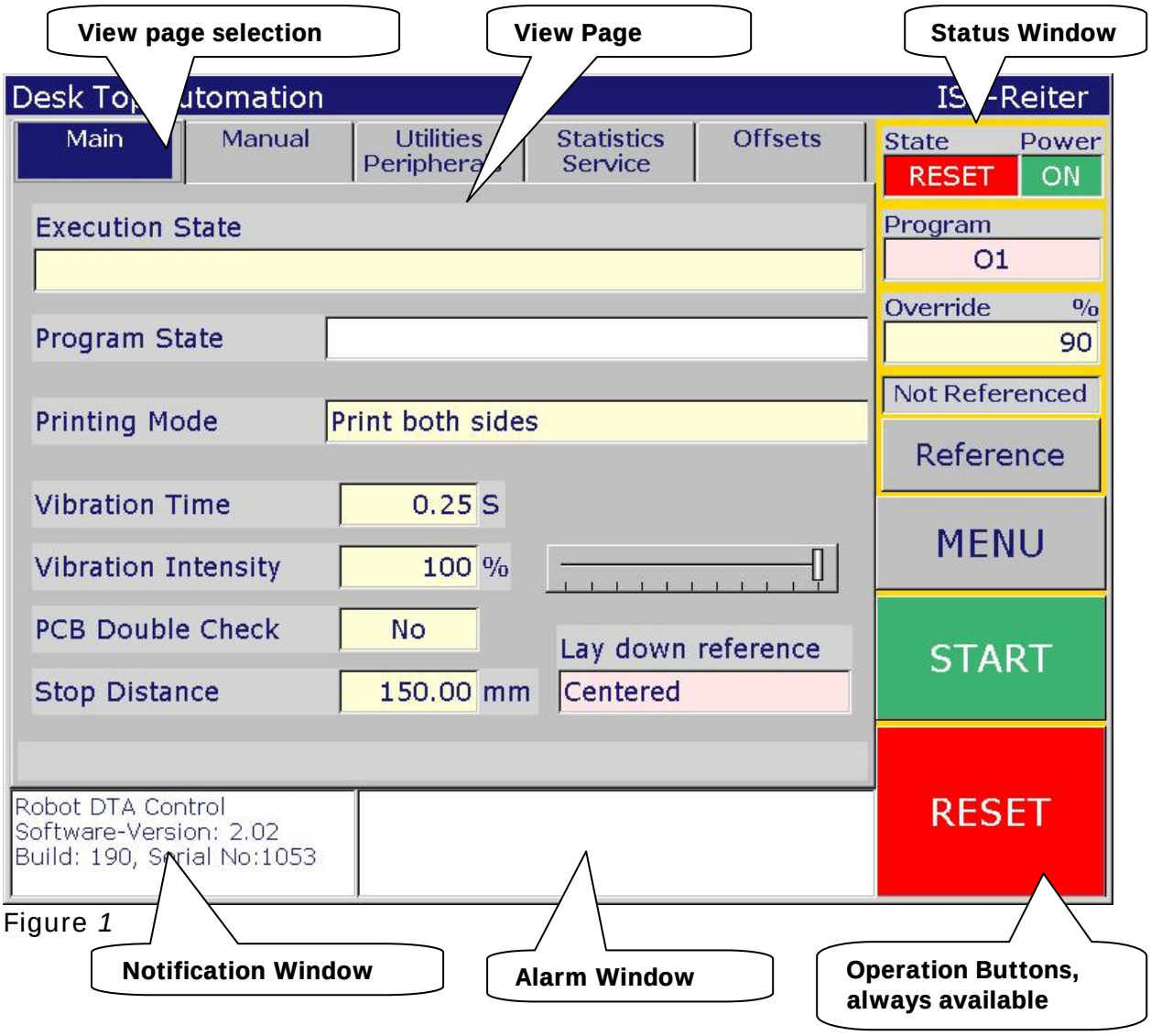

Figure *1*

The touch screen consists of 5 regions.
On the right side the **status window** can be found.
The status window is always visible and contains the main operation command buttons.

On the bottom side, the notification and alarm windows are displayed.
The view page window covers the main part of the display. This window allows showing an unlimited number of views or pages. The 5 main views can be

directly selected by tab controls on top of the view window. The actual selected view tab is marked by a dark background (see Main in figure 1).

2.2 Graphical Interface Elements

The touch screen operation requires some special graphical user interface elements. Those elements are discussed below.

View and Edit elements
Control data is displayed by view or edit elements. Those elements consist of a title, a data field and an optional unit field. The data field can get 3 different background colors with dedicated meaning:

White	Standard data field not editable (see program State Figure 1)
Yellow	Changeable data field. Changes can be made by touching the title or the data field (see Vibration Intensity Figure 1).
Pink	Changeable but password protected data field. Changes can be made after entering a password.

Buttons or Keys
By pressing touch screen buttons or keys, dedicated commands are executed (i.e. START, RESET.. Figure 1). Some buttons also execute commands on releasing the button (i.e. Jog buttons on the manual page).

Slider
A slider can be used to do a quick value setting within a value range by touching the wanted slider position (Figure 1 near Vibration Intensity). On a touch screen it is not feasible to draw the slider like you can do it with a mouse on a PC.

Menus
Menus are used to select one of a list of elements.

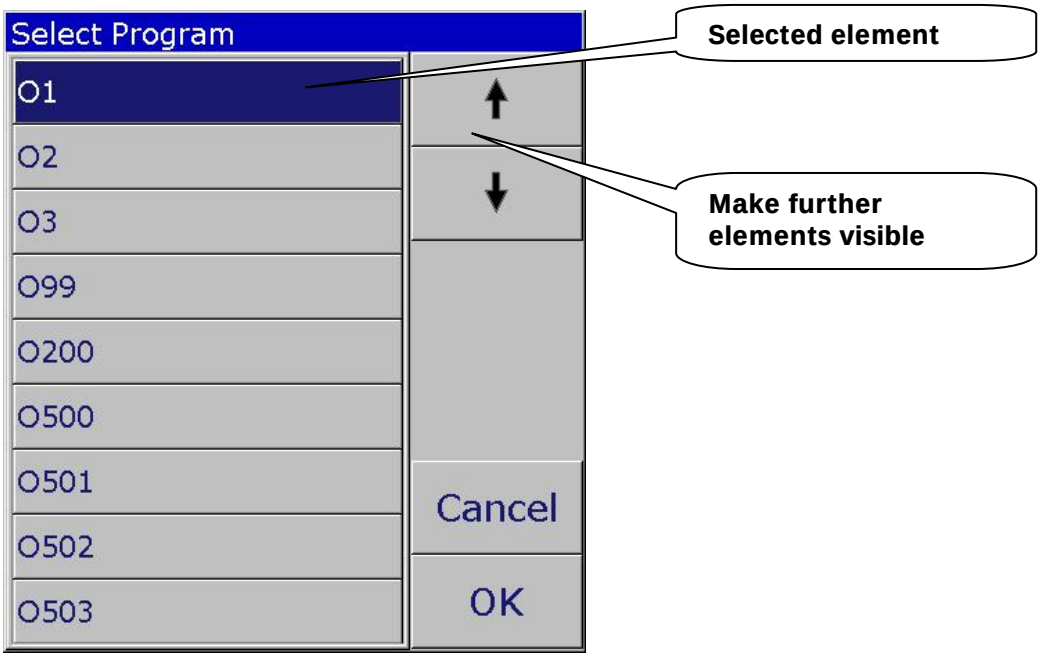

Figure 2 Program selection menu

On the left side the element bars (in Figure 2 a list of programs) appears. Touch an element to select it. the selected element appears inverted (dark background). If not all elements can be displayed, use the arrows in the upper right corner to navigate trough the list. The **Cancel** button discards the selection an the **OK** button confirms the selection.

Number entry:

Touching a editable number field opens the number edit window (Figure 3). There is a standard number key field including the +/- key.
To delete values the **Clear All** button or the back step "←" button can be used.
Cancel cancels the edit operation and **OK** confirms it.
Some edit field also show a slider control below the value field for quick value setting

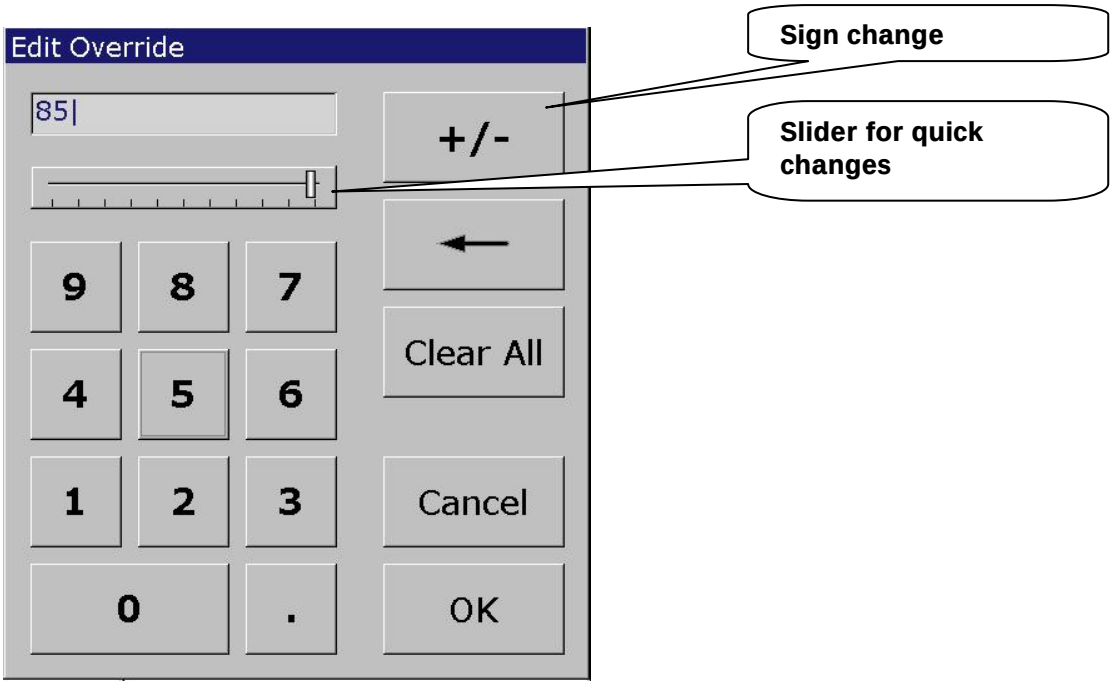

Figure 3 Number entry

Hint:
If values appear unchanged after entering a new value, the valid range for this variable field might be exceeded!

2.3 The Status Window including important Buttons

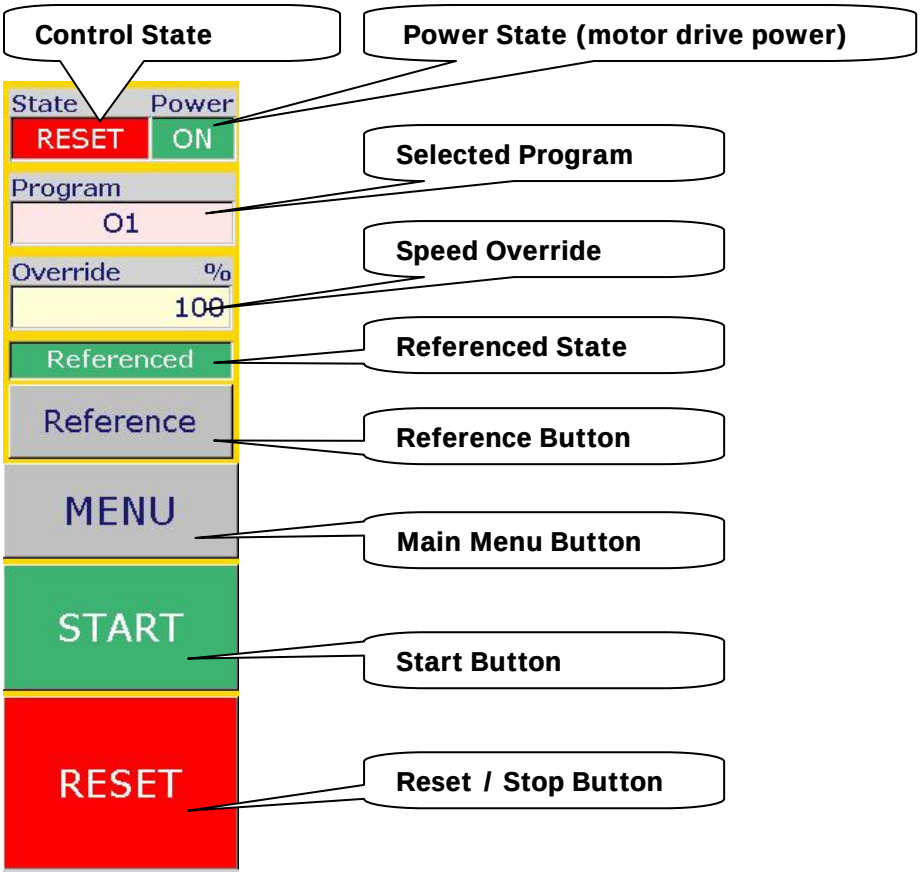

Figure 4 The Status Window

The Status window is the most important command and display window an is always visible (Figure 4).

On top the Control **State** and the motor drive **Power** state are displayed. The states do have different background colors:

Control-**State**:

RESET	The control is in RESET state no axis is moving, the conveyor is stopped.
RUN	The control execution is running, PCB's are transported if available etc.
STOP	Robot motions are stopped. The conveyor might continue transporting PCB to the next stop position.

Motor driver **Power**:

ON	Motor driver power is on.
OFF	Motor driver power is off. Motor breaks are fixing the axes.

The motor driver power is usually only switched off if power on is pressed or for maintenance tasks.

Note!
If motor driver power is switched off, the reference value is lost and referencing is required.

Next the selected **Program** field is displayed. This program will be started if the START button is pressed. Normally the selected program will not be changed, it will always be program 1 for standard operation. Different programs are used only for maintenance purposes i.e. cartridge calibration
Program selection is password protected (pink background).

Next the speed **Override** field can be found. This field allows a percentage change for the speed of the robot arm motions. Usually this value will be 80 to 100%.
The override setting does not change the speed of the conveyor or flip staton!

Next the **Reference** state and the **Reference** button are displayed.
After power on the loader has t be referenced by pressing the reference button. The axis will move to the reference position, the referenced state field will get a green background. Referencing ca be done at any time if the machine is in the RESET state.

The next 2 buttons **START** and **RESET** are used to start and reset the control operation, see chapter 2.5 for further details.

2.4 The Main Menu

There are 2 ways to select different views. One is to press the tabs for the 5 main views (see 1.3). The second way is to open the view selection menu with the **MENU** button. Pressing the MENU button opens the main menu with the available view pages.

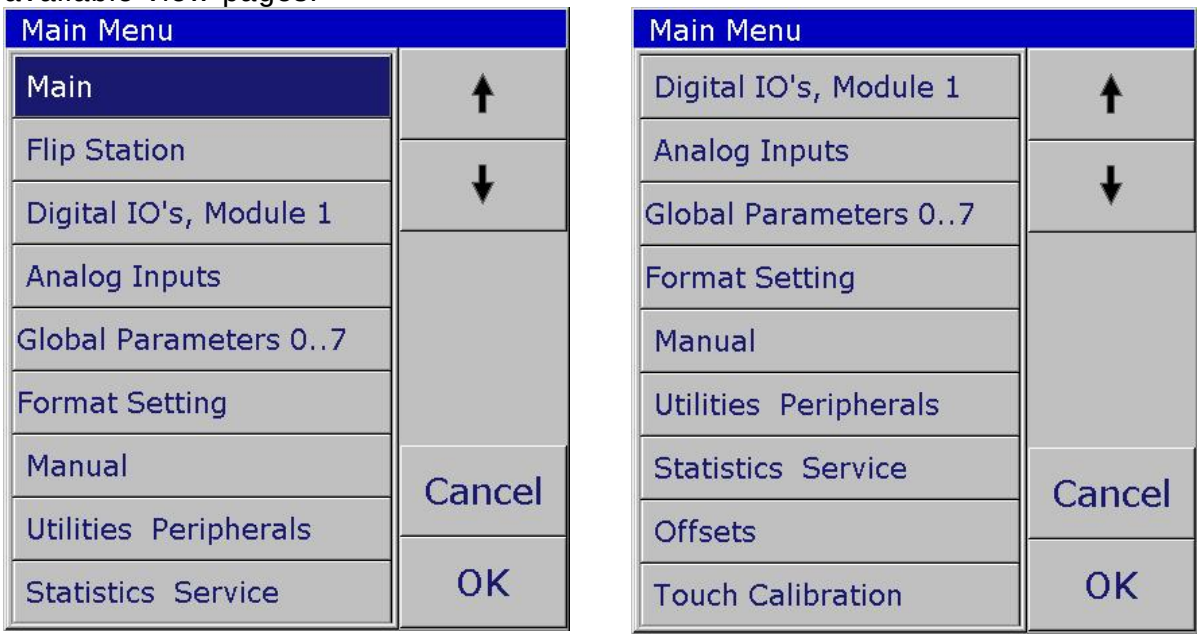

Figure 5 *The main menu*

View pages that do not belong to he 5 main view pages cover the complete view area and have to be closed with the EXIT button on the upper right corner.

2.5 Starting and Stopping the Control Function

Pressing the **START** key starts the Loading Program if the control is in RESET state or continues the program if it's stopped (control STOP state). The Program state changes from RESET or STOP to RUN.

If a program is started and the initialization tasks are done, the **RESET** button changes to a **STOP** button.
If the **STOP** button is pressed, then all axes will stop after the actual motion is finished (but not the center and flip station axes). Then the control goes into STOP state and the reset button changes back to RESET. From the STOP state the **START** button can be used to continue the operation. The **RESET** button can be used to reset the automation procedure completely; PCB's on the robot arm or on the center conveyor have to be removed manually.

!Note!
If an immediate axes stop is required, the RESET/STOP button must be pressed twice, the first activation of the Stop button continues motion to the programmed endpoint! Alternatively the Emergency Off button can be pressed or the Safety fence can be interrupted.

2.6 Error and Message Display

If an error occurs it will be displayed in the lower right alarm window. Additionally it will be displayed on the dynamic message bar, which is visible on the bottom of most view pages.

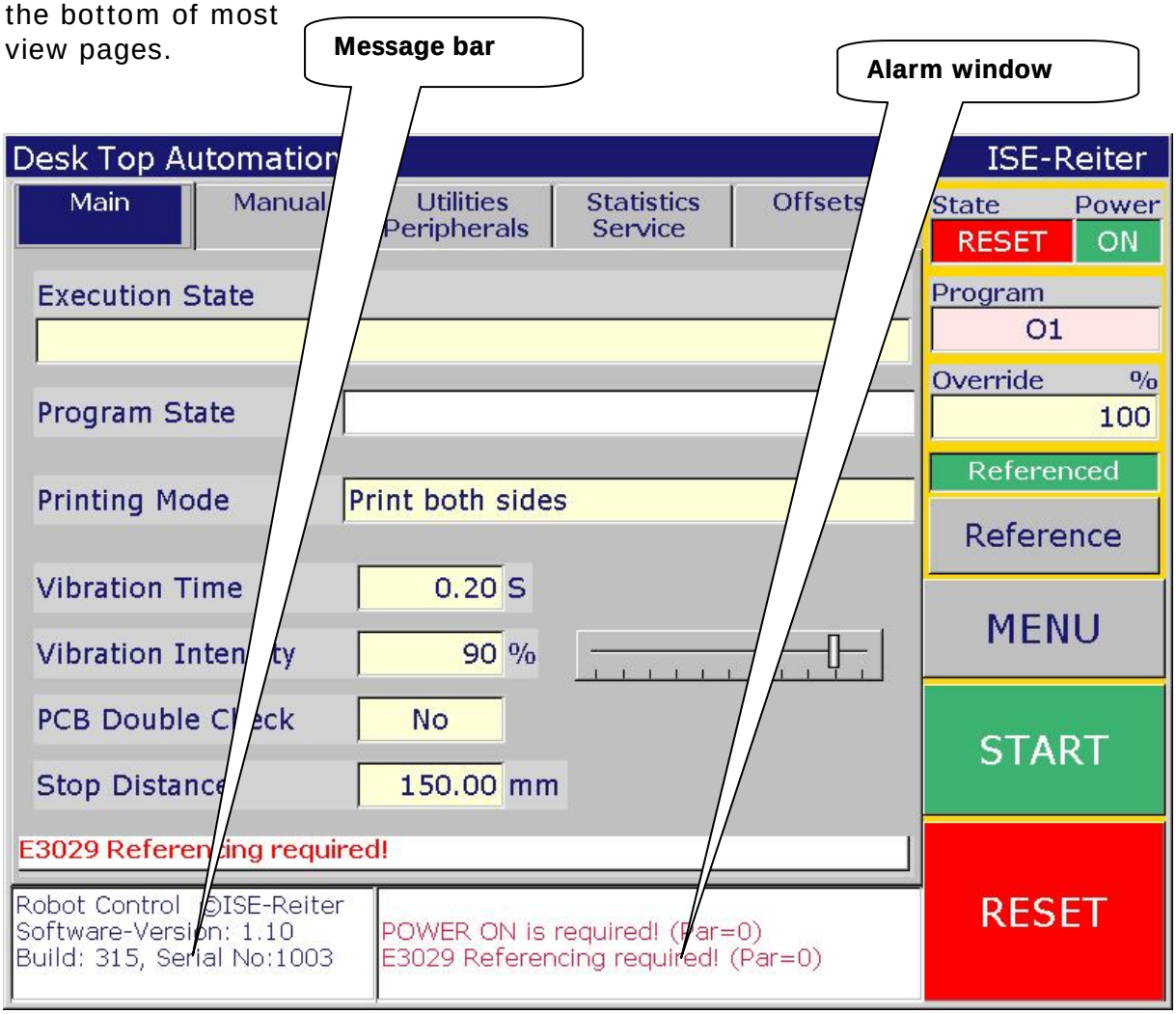

Figure 6a *Error and Message Display*

Messages are displayed in the message window, which is left of the alarm window.
The message is dynamically shown if a new generated by the control. If errors and messages are active, errors will be shown.

To get a detailed view of messages or alarms, just touch the alarm or message window. Then a extended view will be displayed in the page view area (see figure 6b).

By pressing the **Clear All** button all alarms or all messages can be cleared.
Use Page Up or Page Down if many alarms are available to see the older ones.
The **Exit** key is used to close the window again.
The ***EC*** control saves the latest 2000 alarms in an alarm history memory with detailed in formations like time and date of occurrence. The Error History can be displayed by pressings the **Error History** button (see 2.9 for details).

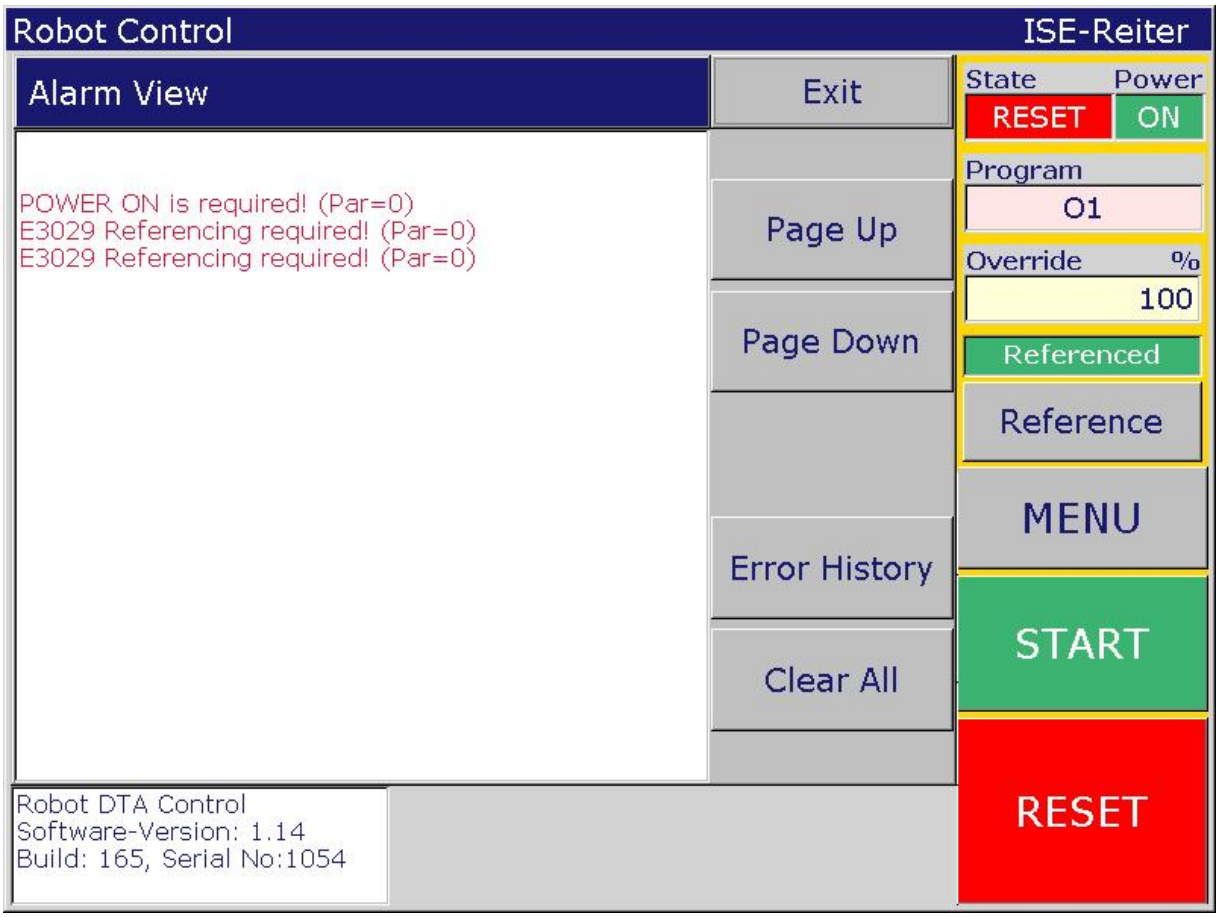

Figure 6b *Expanded error window*

2.7 How to acknowledge Errors and acoustic Alarms

Errors and acoustic alarms can be acknowledged touching the display on any position.

Errors will be preserved in the error history memory and can be shown with the Monitor program ***EcMonitor*** (see Service CD).
To delete an Emergency Off error it is required to unlock the Emergency off button first.

2.8 Password Entry

For several input fields a password is required. Those fields can be recognized by a rosy red background color. To activate the **password** the numbers "**1221**" must be entered and the OK button must be pressed (figure 8).

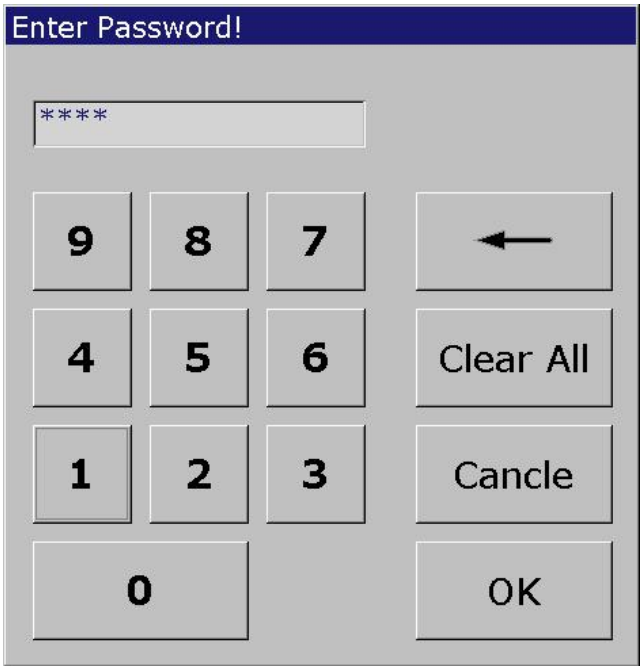

Figure 8 Password entry

After successful entry, the protected variable can be edited.

The password will stay active for 5 minutes so subsequent editing of protected variables will require no further password entry.

2.9 Error History

The Error History page (Figure 8a) can be displayed by pressing the **Error History** button of the Alarm page (see chapter 2.4).
The latest 2000 errors can be inspected here. See chapter 5.13 for details.

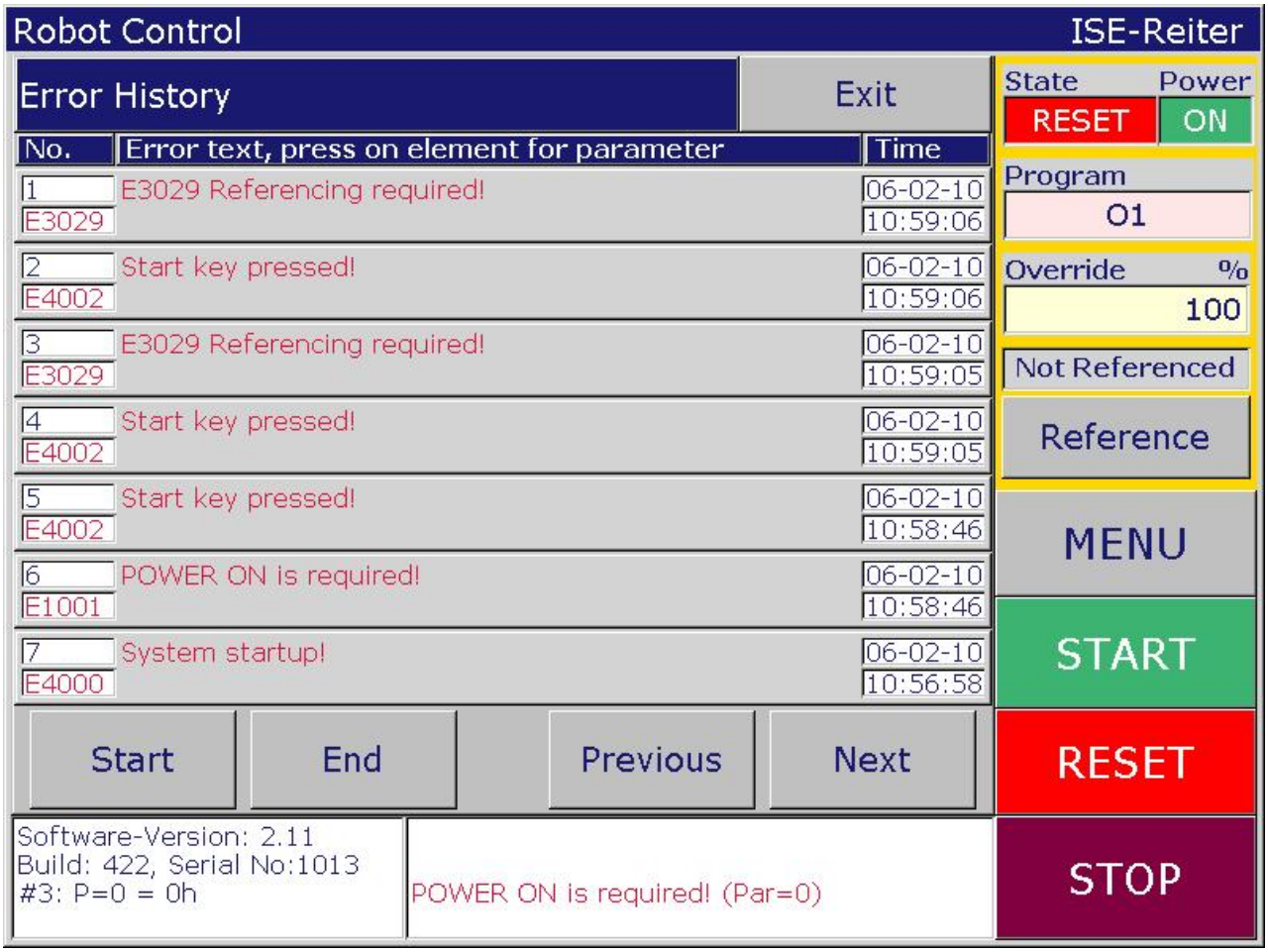

Figure 8a *Error History*

3. Standard Operation

3.1 Power Up Operations

If the power is switch on, the DTA is unreferenced. In this state only axes jog is possible, but no program can be started. To reference the machine press the **Reference** button on the status window.
During referencing, the axes are moved to the reverence position (vertical) and the referenced field will change to **Referenced** with green background.
The ZP (long linear axis) axis will be referenced at last, together with the format with axis (axis H) of the robot hand.

For rare situations, if previous axes positions are in extreme positions, there might be a collision when axes are moved to reference positions directly. So watch the axes and press RESET if such a situation occurs. You have to move the axes manually in a different position (see chapter 3.6).
When referencing is done, you can press the **START** key to start loading or unloading.

3.2 Entering the Safety Region

The DTA is freely accessible at the cartridge area and on the operation side of the Paragon. These accessible areas protected by a safety light fence.
If you enter this region, the robot will stop all axes immediately and safety breaks will fix the axes. After leaving the region the robot continues its operation automatically.
It is recommended to enter the safety region only if axes are stopped to avoid stressing motor drives and mechanics.

3.3 Stop and Continue Loading

The Automation process can be stopped at any time by pressing the **RESET / STOP** key. The axes motion will stop after the actual programmed motion has been finished, the conveyor and the flip station will finish their actual task.
After that the machine is in STOP mode (see the state field on top of the status window).
The machine can be started again by pressing the **START** key.

PCB's can be removed manually in STOP or RESET state. To switch off vacuum press the "Toggle Vacuum A" or "Toggle Vacuum B" buttons in the "Utilities" Page (see Figure 12).
If a PCB is removed, and the control is started the errors will occur!

3.4 Cartridge Change

Cartridges can be changed in Reset state. If changing is allowed, the green light of the cartridge release button will be on.
To change the cartridge, the trolley has to be connected. The cartridge release button ca be pressed an the cartridge be removed to the trolley.

3.5 Tuning the Separation Process (Loader)

The DTA uses a vibration feature on the robot arm after lifting the PCB to do a separation.
The vibration intensity can be set on the main page as a percentage value. Additionally a slider can be used to set the value. Vibration time can also be set. Separation consists of several bursts of vibration; the vibration time is the time of a single burst, so the value should be in the range of about 0.01 to 2 seconds. If the time is very long and the intensity is high, the thermal vibration motor protection might switch off the vibration.
In such a case check the thermal protection device F5 in the electrical cabinet, push the button to switch on again. Additional adjustments can be set on the global parameter page (see 5.8, 4.6).

3.6 Axes Conventions and Manual Axis Moving.

There are several ways to manually move axes.
To basic modes are available:
In **Jog** mode axes are moved as long as an axis direction button is pressed.
In **Increment** mode an axis is moved a specific distance for each press event of the key.
To switch between modes, use the Jog/Inc mode button (Figure 11).
There are 2 different coordinate systems available to move axis:
A: The Cartesian system (Figure 9) and
B: the rotation or angle system (Figure 10).
In **Cartesian** system axis can be moved along Cartesian axes **X**, **Y** and the rotation axis **Wh** and along the endpoint **E** directions **N** and **NR**,**NL**.
In angle or **rotational** system axes can be moved round axis center of **U0**, **U1** and **U2**.
To move the format axis manually got to the Format setting page (use menue button).

Axis conventions are as follows:

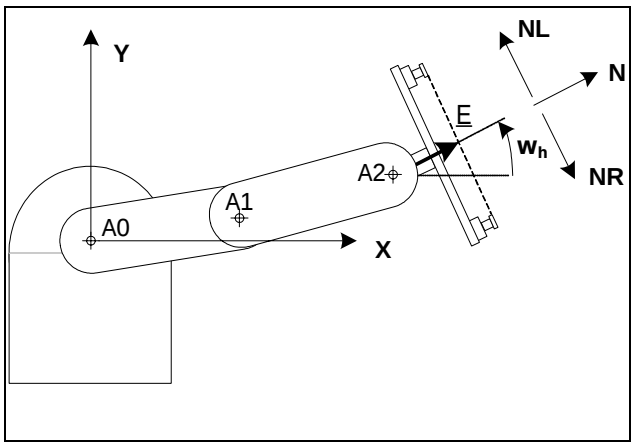

Figure 9 Cartesian Axes

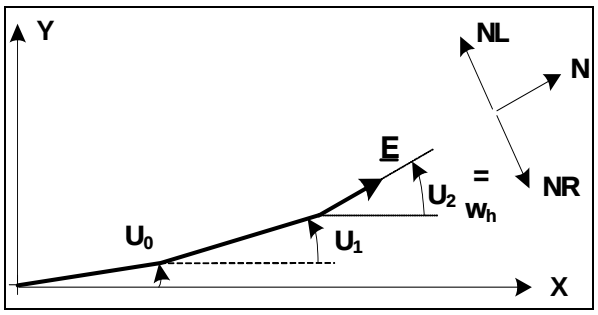

Figure 10 Rotation Axes

To move axes manually the control state has to be RESET or STOP.

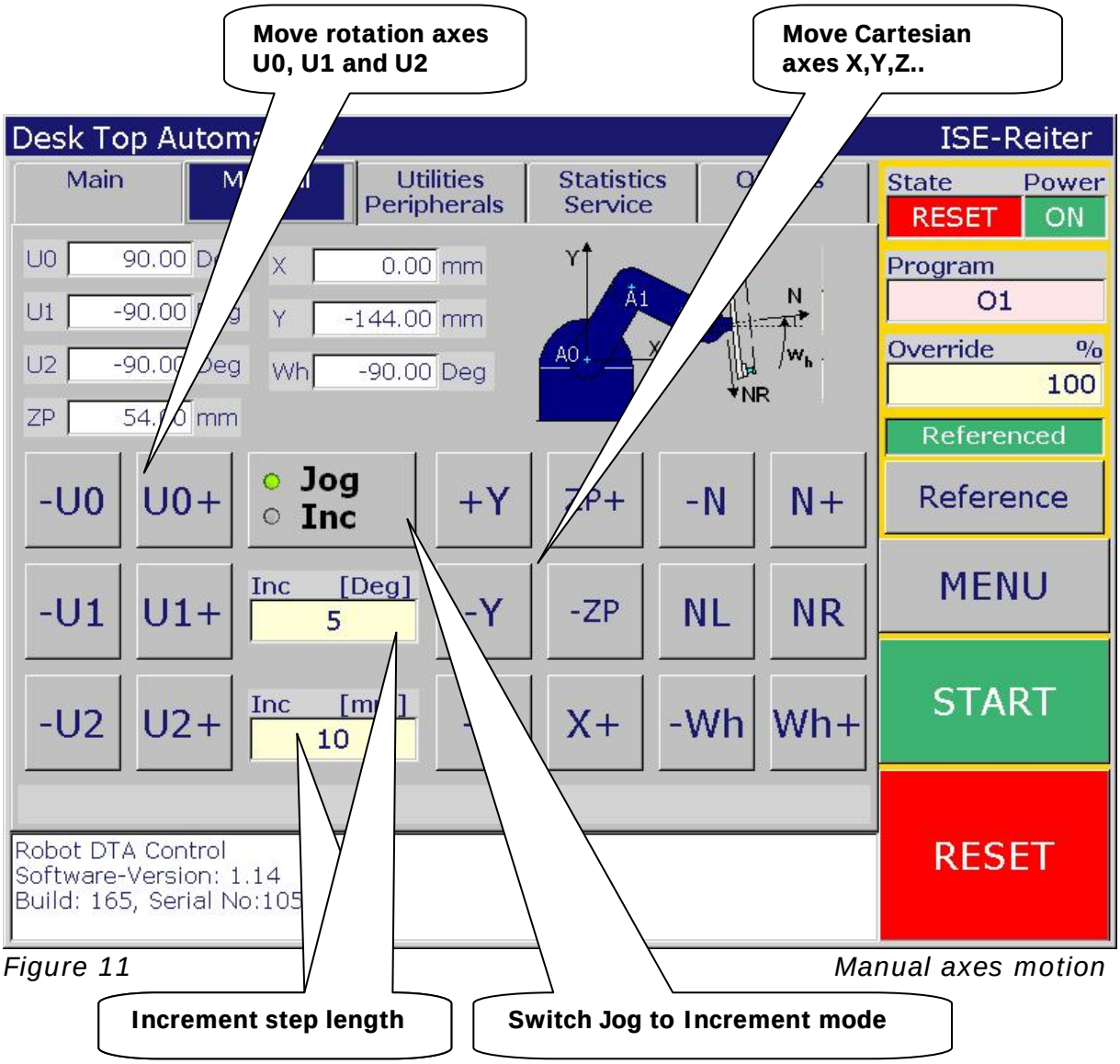

Figure 11 Manual axes motion

For Increment mode there are 2 fields to set the increment step with (Figure 11). One is for the rotation axes in degrees the other one for linear Cartesian axes in mm.

3.7 Manual Removal of Sucked PCB's .

If you stop the DTA while a PCB is suck on the robot hand you can remove the PCB by manually switch off the vacuum.
This can be accomplished at the Utilities/Peripherals page by pressing the "**Toggle Vacuum A**" or "**Toggle Vacuum B**" button.

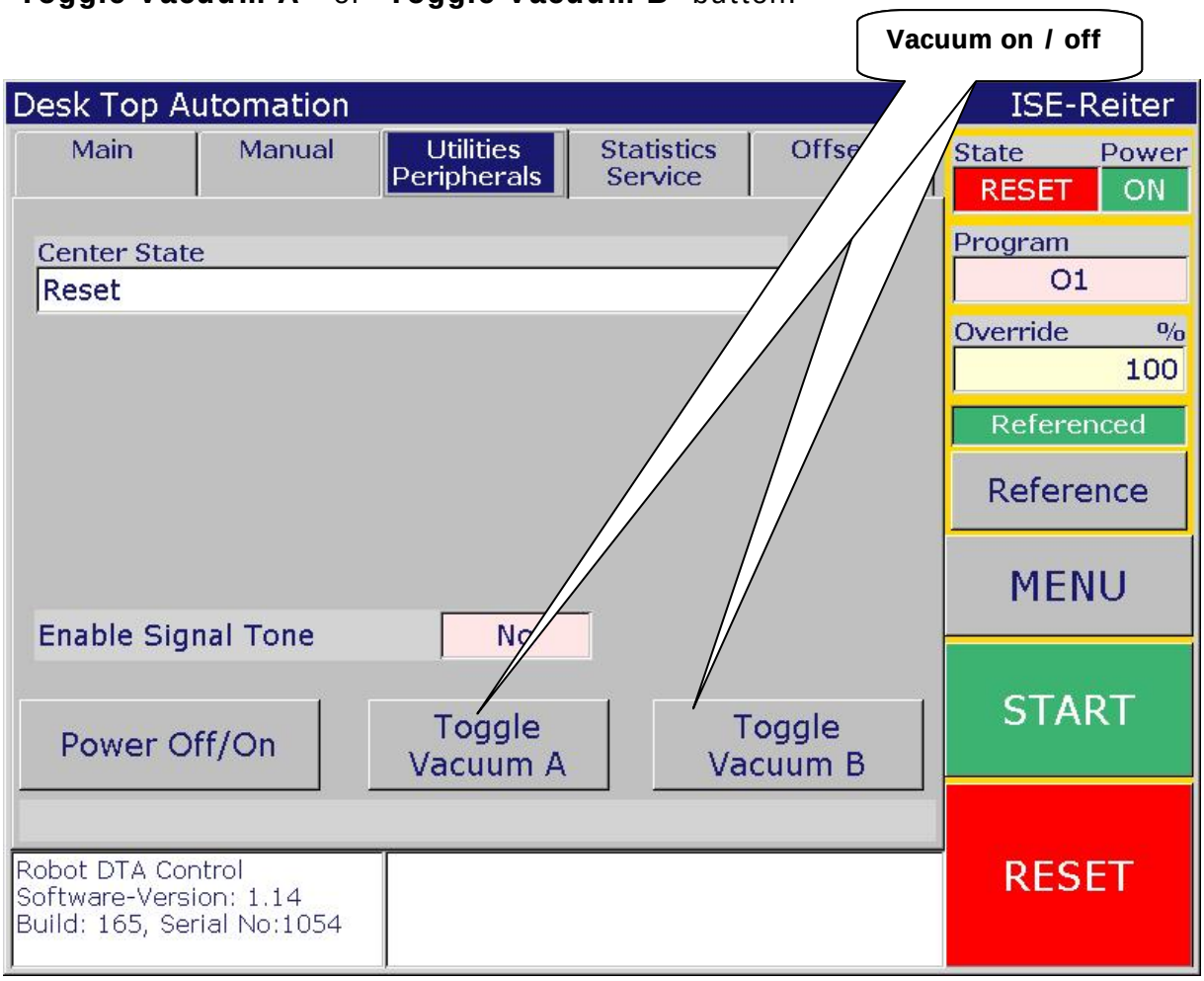

Figure 12 *Utilities and Peripherals*

If the DTA is started with a PCB on either side an error is generated – the PCB must be removed manually

3.8 Restart after Reference is Lost

In rare conditions the reference of the machine may be lost. This i.e. can happen after a collision, the axis synchronization error is generated. If you try to start the operation after this error you will be notified that referencing is required.

The referenced state can be verified in the status window above the Referenced button.
To reference the machine press the **Reference** button.

3.9 PCB Double Check.

For the DTA there is a software option to check for double or multiple PCB takeoff from the cartridge. Therefore an additional sensor is placed on the loader hand. After PCB take off and vibration the robot control checks if only one or multiple PCB's are taken. For multiple PCB takeoff the vibration is repeated up to about 15 times (depending on parameters on the global parameters page) to separate the PCB's. If separation is successful, the loading process continues normally, otherwise the loader stops, showing the message "ER1: DOUBLE PCB'S DETECTED". The double check option can be switched on and off at the Main page (figure 1). The double PCB verification operates automatically with no additional user operation required.
After a program restart (**RESET** button) or after a slip sheet is fetched, the first loaded PCB is used as a reference. The next PCB's will be compared to this reference PCB. If the double check operation is switched off and on (figure 18), the next PCB will again be handled as reference PCB.
It is also required that the PCB is touching the sensor at least at on side, while the other side must not be off more then about 1mm from the sensor. Optimal results are generated if the sensor touches the PCB completely. For thin PCB's it might be useful to add an additional sucking head.
For PCB double check there are several parameters to align the process in chapter 5.

3.10 Mute the Acoustic Signal

Some errors can generate an acoustic warning signal. This signal can be muted by setting the "Enable Signal Tone" to Off on the Utilities/Peripherals page (figure 12). The password has to be entered to change this setting!

3.11 Cartridge and Conveyor Offsets

Robot programs are aligned for specific cartridge positions from Advanced Engineering. Sometimes it might be useful to align these positions at the customer's site. For such alignments there are Offsets available to align the cartridge position and the conveyor positions (Figure 13).
Note that for the Loader the cartridge position is measured by a ultrasonic sensor. So eventually a cartridge calibration is the right way to align positions.
If cartridges are geometrically very different, it's better to use longer spring travel to compensate these differences.
For the DTA offset 0 and offset 1 are used. Further offsets are used if additional cartridges (geometrically different) are used (see additional documentation).
Offset changes are password protected!

Bedienung Stapler

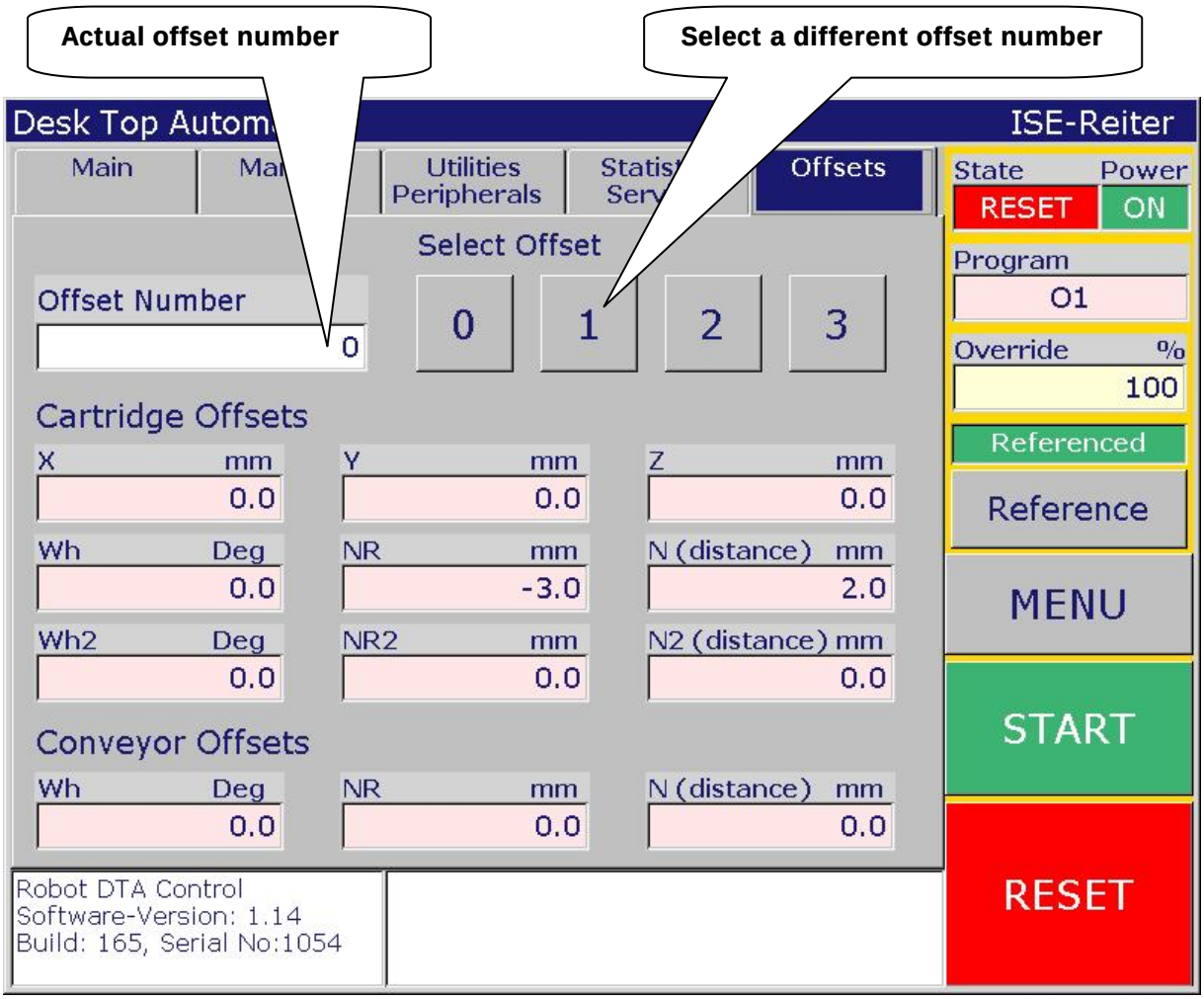

Figure 13 *Offset page*

Offsets are stored in persistent memory and will be available even if the machine is switched off!
Values are limited to ±30mm or ±5 degrees.

There are 2 Offset categories (Figure 14). To the left, the cartridge offsets and to the right the conveyor offset can be seen, arrows show the direction for positive values.

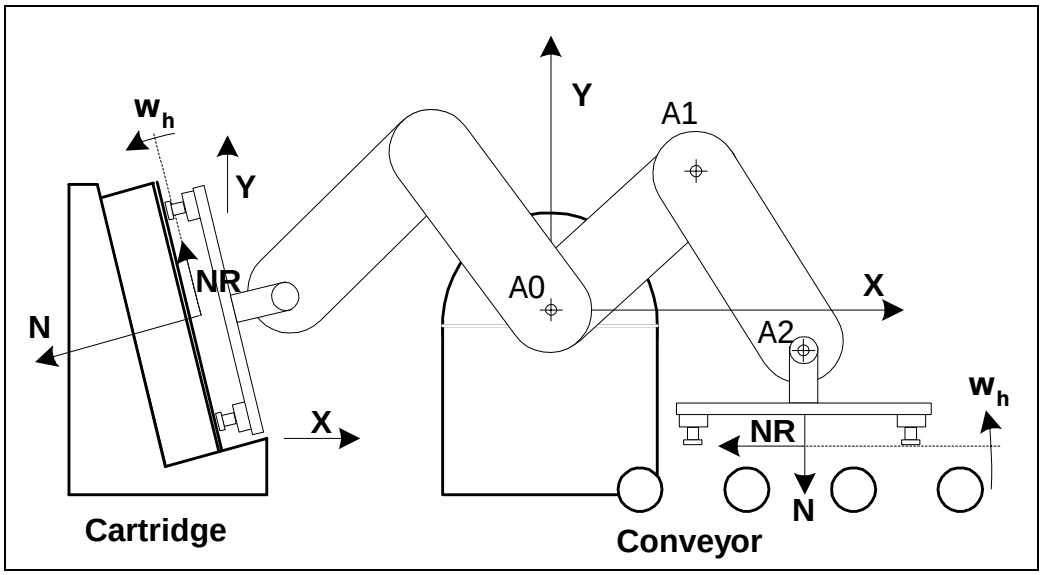

Figure 14 *Offset Conventions*

The cartridge offsets Wh2, NR2 and N2 are only used for specific machine configurations. For example loading slip sheets from an opposite positioned cartridge is changing the leading edge for the robot hand. So slip sheet lay down uses separate offsets NR2, N2 align slip sheets for set down!

Actually used offsets for the DTA:
Offset 0 for cartridge 0 (right cartridge)
Offset 1 for cartridge 1 (left cartridge = input cartridge)

Conveyor offsets on center device:
On the center devoice the N values of the conveyor offset can change the height position (lay down / pick up):
N offset 0: Y-Position of side A (vibration motor and double check sensor side) can be modified: **+ values move arm lower**!
N offset 1: Y-Position of side B (opposite side of vibration motor and double check sensor) can be modified: **+ values move arm higher**!

Further information's how offsets are used for a specific machine can be found in the OffsetsUsage.doc document on the Service CD.

Hint!
Further offsets, especially ZP position offsets can be set using global parameters! Some offsets are identical to those on the offset page; in such cases the offsets will be added to calculate the final axis position.

3.12 Format Setting, Robot Hand Axis

Starting from version 2.0, the Robot software can handle automatic format setting. Therefore all available formats are set in machine data files. Up to 16 formats can be handled. The format number or index is supplied by the Orbotch paragon via the digital interface between the 2 machines.

The format axis (H-axis) can be set manually in reset mode. You need the brig up the format setting page (menu button – Format Setting entry) – see figure 14b.

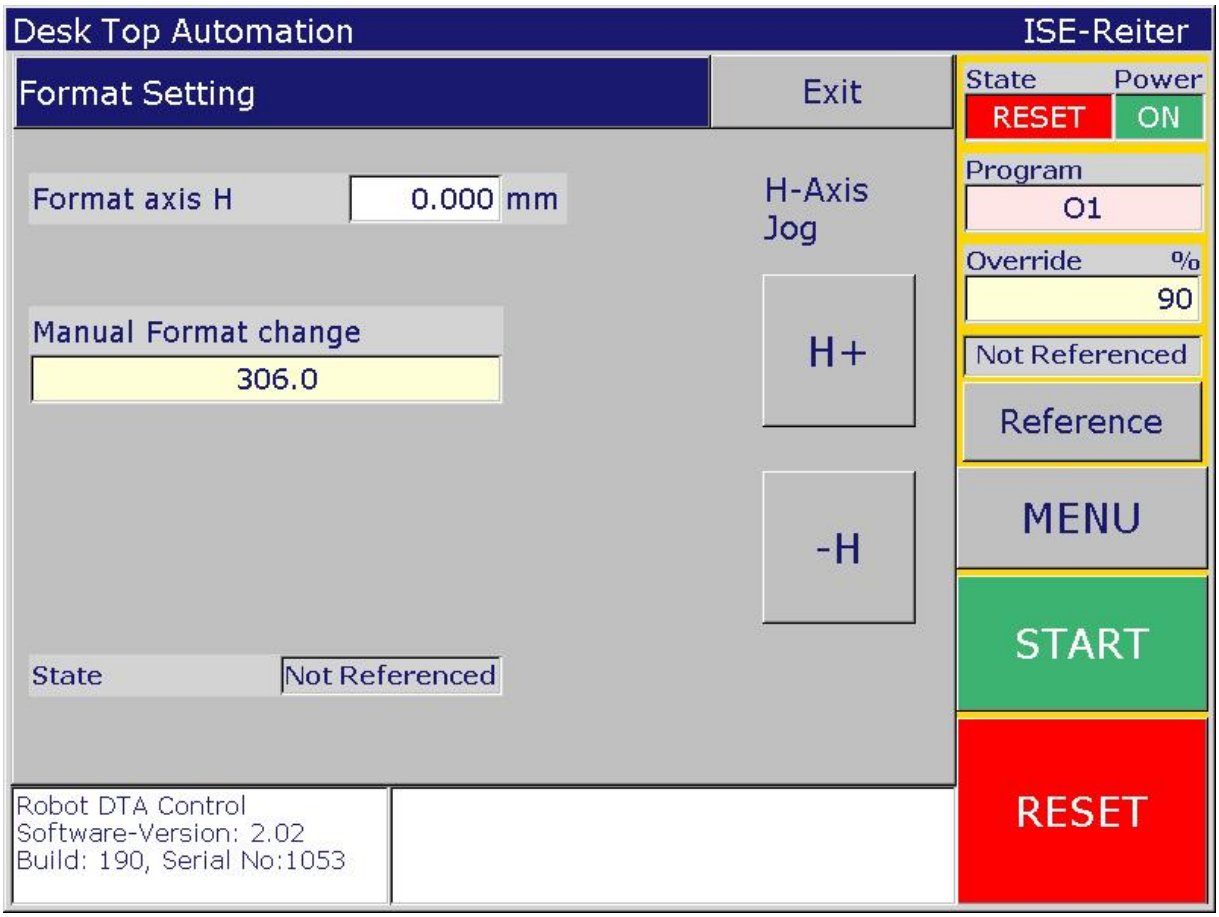

Figure 14b *Offset Conventions*

Use the H+ and –H buttons to move the axis continuously. This can also be done if the axis are nor referenced, but axis can be moved to manual block on both limits!
If the machine is referenced, the format with can be set by the menue “manual Format change”, by selecting he specific width.
The position window “format axis H” shows the specific robot hand width (format) in mm, which is usually a little smaller then the specific PCB width (i.e. 8mm).

4. Extended Information

4.1 Program Selection.

If the **START** key is press the robot control starts the selected program. This program is visible on top of the status page. For the DTA this will always be program O1.
For service purposes some other programs might be useful.
The robot control must be in RESET mode to allow program selection. The program selection is password protected so the password has to be entered before a selection change is possible!

!Note!
Standard operation doesn't require starting other programs than Program O1. Only authorized personnel should select different programs to avoid collisions!

Additional system programs are available in each control; here is a list of available programs:

O1 ... Standard DTA automation program

A. Standard programs:
Standard programs for Offset **number 0**
- O10... Cartridge calibration for offset 0
- O20... Cartridge measurement for offset 0
- O30... Move to measure position of cartridge 0

Standard programs for Offset **number 1**
- O110... Cartridge calibration for offset 1
- O120... Cartridge measurement for offset 1
- O130... Move to measure position of cartridge 1

Standard programs for Offset **number 2** (**actually not used**)
- O210... Cartridge calibration for offset 2
- O220... Cartridge measurement for offset 2

Standard programs for Offset **number 3** (**actually not used**)
- O310... Cartridge calibration for offset 3
- O320... Cartridge measurement for offset 3

See also chapter 4.4 and 3.11 concerning O10, O20, O110, O120 operation!

B. System programs starting from Number O9000

Program numbers above O9000 are special system programs. Only advised personal should use them!
Available system programs:

O9995	Format axis referencing. Required to mesure and set the reference position of the format axis in the machine data (MDF).
O9998	This program is used to do a new reference point measurement and alignment. This is required if mechanical connections from motors to robot arms are opened (like for a belt change).
O9999	The referencing program. This program is started if the Reference button is pressed.

Note!
The selected program will stay active even if power is switched off. So remember to select the standard program.

4.2 Control States.

The control state can be see on top of the status window (see **State** , figure 1). The basic states are **RESET**, **STOP** and **RUN**. But there are some more intermediate states that arise out of following circumstances:
The EC control internally consists of 2 main units. A Programmable Logic Control PLC and a Robot Control RC. The PLC handles conveyor, centering and interfacing to the neighbor machines while the RC executes the robot program, which moves the axes and handles robot arm sensors.
When the **START** button is pressed, both controls units are started and when **RESET** is pressed both units are reset. But there might occur some intermediate states when on control already is in reset, while the other one is not. I.e. the PLC will transport a PCB completely out of the loader while the RC already is in reset state (see also chapter 2.2).

Following states are possible:

Number	**PLC**	**RC**	**Text in *State* control**
1	Reset	Reset	RESET
2	Run	Run	RUN
3	Reset-Request	Run	run
4	Run-Request	Run	Run
5	x	STOP	STOP

Reset-Request: Reset was requested by the PLC, but is not completely executed, i.e. a PCB has to be transported out off the loader..
Run-Request: Start was executed, but initializing procedure is not yet done.
x any state

4.3 Measurement of the Reference Position.

If axes connections or mechanical motor connections are opened (i.e. for changing belts), the reference position has to be measured. Therefore the program 9998 and a water-level is required.

Execute following procedure:

1. Verify the horizontal level of the conveyor using the water lvel. Adjust it if required with the adjustable shoes of the robot.
2. Select program O9998 and start it. All 3 axes will move to the reference switches. After that the control will change to STOP mode. Do not press RESET, because program O9998 has to continue from that point!
3. Change to the Manual page. Stet the Increment Value for degrees to 0.1 deg.
4. Use the JOG/INC button to switch to INC mode (green lap near INC must be active).
5. Use the +U0 or U0- buttons to align the first axis vertically, verify this with the water-level.
6. Use the +U1 or U1- buttons to align the second axis vertically, verify this with the water-level.
7. Use the +U2 or U2- buttons to align the third axis horizontally, verify this with the water-level.
8. Press the START button to continue program O9998
9. The Program executes referencing, after that verify the vertical (U0, U1) and horizontal (U2) positions of the axes again.
10. Change the selected program back to O1

!Caution!
It is mandatory to execute the alignment exactly in the sequence axis U0, axis U1 and axis U2!

Referencing ZP Axis:
If the mechanical connection from motor to the sledge is disconnected, the ZP axes reference point has to be measured. After referencing the sledge position must be measured (from the back side) an the value be entered into machine date. The value has to be set in the machine data file, call for service assistance if this is required.

Referencing Flip station axis:
The flip station axis is automatically referenced within the first program start. On the Flip station page referencing can be done after startup by pressing the “Flip once” button.

4.4 Cartridge Calibration.

A cartridge calibration recalibrates the distance of the ultrasonic sensor to the empty cartridge background. This has usually to be done if an ultrasonic sensor is changed. For a new sensor the analog input value has to be set manually (yellow screw9 to about 9.2V manually before calibration is executed.
The calibration requires the calibration block, a 150mm thick cuboid block that comes with each machine. The thickness of this block is set in the global parameter 15!

Do following steps to do a cartridge calibration:

1. Enter an empty cartridge; it will be used as a geometrical reference.
2. Select program O10 for offset number 0 (or O20 for cartridge 1, see 4.1).
3. Start program O10 and wait for the control to get into STOP state.
4. Continue the program by pressing the **START** button, the ZP axis will move to the appropriate position for cartridge 0. Robot arms are set vertically (reference position).
   !CAUTON!
   For cartridge 0 measurement the robot arms moves outside the machine above the Paragon desk!
   Next the control changes to STOP state.
5. Now you are asked to set the calibration block into the cartridge (in the middle of the ultrasonic sensor).
6. After that press START again.
7. Calibration is done if the program is finished (RESET state).

Usually cartridge calibration is not required. If it is required eventually a clamping set might be loose, check the reference position with the water level first before you do calibration.

4.5 Cartridge Measurement.

Cartridge measurement (program O20 for cartridge 0 and O120 for cartridge 1) is only required if the measure position or the vertical cartridge angle changes. For large geometric changes it's recommended to adapt the robot program.

Actually cartridge measurement is only possible with assistance of **Advanced Engineering**, **SAT** or **ISE-Reiter** employees.

4.6 Separation Fine-tuning.

Loader separation can be fine-tuned by adapting several global parameters:

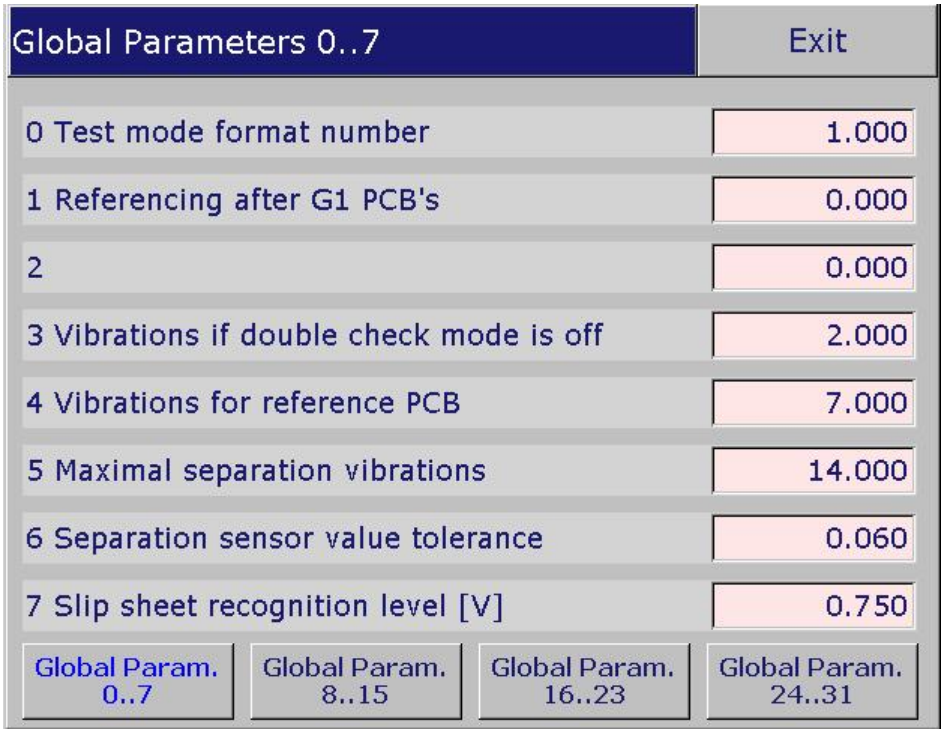

Figure 14a *Loader Global Parameter*

The main page includes a control to select loading operation with or without separation (double check mode on or off). Thick PCB's usually don't require separation. Following fine tuning parameters are available for separation:

3 Vibrations if double check mode is off.

The number of vibrations if double check mode is off is set here. Tgere is a minimum of 4 vibration, but a value of 0 switches off separation completely.

4 Vibrations for reference PCB's.

The first PCB on a cartridge is used as a reference PCB. The following PCB's are compared to this PCB. So the PCB has to be a single PCB. With this value the vibrations for the reference PCB can be set.

5 Maximum number of separations.

Here the maximum number of separation packets can be set. On separation packet consists of 3 short vibrations. After the maximum vibration packet number is reached a double check error is generated.

6 Separation sensor value tolerance.

This value sets the tolerance of a PCB to the reference PCB that is allowed to accept a single PCB. If PCB's with few copper mass below the sensor are loaded, the value has usually to be higher.
A Value of 0.1 means 10% tolerance 0.05 = 5% tolerance.

7 Slip sheet recognition value.

Slip sheets are used to separate Jobs (set of PCB'S comprising a set of

identical PCB images) for multi batch operation. Slip sheets are recognized by missing copper layer. Here the separation sensor level is set to differentiate slip sheets from normal PCB'S (normally 0.3 to 1.0V).

4.7 Multi Batch Mode.

The **Multi Batch Mode** is available for multiple sets of PCB's placed on one cartridge. Each set of PCB's is called a Job. Within a job all PCB's have identical images. Jobs are separated by slip sheets.
Jobs must be prepared on the Paragon as a processing queue. Slip sheets are used to switch between the job images.
Multi batch mode can be used for single or double sided operation.

Multi batch mode is recognized automatically if slip sheets are found. Just the appropriate queue on the Paragon has to be selected.

For single sided operation the jobs are in the reverse order on the output cartridge 0, for double sided operation the jobs are in the original position after the batch is done.

Rules for Multi Batch Mode:

- Slip sheets only must be places between jobs and not at the beginning or at the end of a batch on the cartridge.
- Slip sheets must be single, 2 or more consecutively slip sheets are not allowed!
- The number of PCB's for each job's should match the number set on the Paragon queue preparation.
- Firm slip sheets have to be applied, which size has to be at least the size of the largest PCB.

If PCB number for jobs is different on the cartridge and on the Paragon queue:

The preparation of the queue might be wrong, and too many or too few PCB may be set on the cartridge.
In such a case the operation will not be stopped, but the wrong PCB number will be recorded on the Paragon an noted after the batch is done.
Interrupting the process would be too complex for a restart, so this behavior was chosen.

4.8 Erroneously printed PCB's:

Sometimes printing can't be done correctly. In such cased the PCB is laid down shifted (with a ZP offset) on the batch. The length of this shift can be set with global parameter 16 (see 5.10).

5 Page Reference

Fields with yellow background can be edited by touching the field or the label.
Fields with pink background are password protected and can be edited after entering the password.
Fields with white background are not user changeable.

5.1 The DTA Main Page

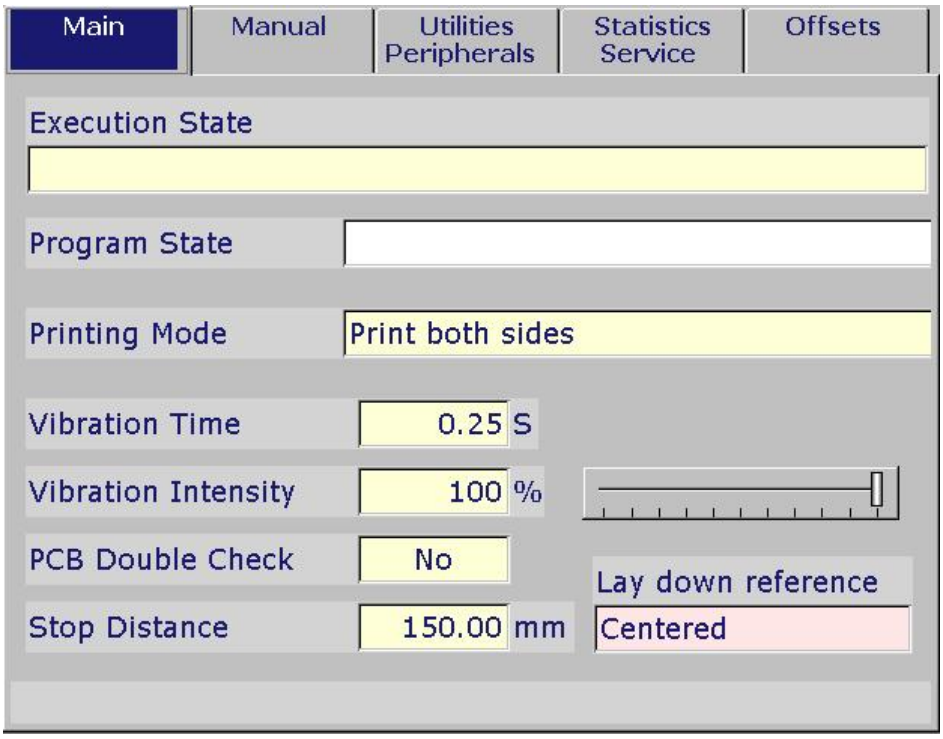

Figure 15 *Main Page Loader*

Execution State
shows the actual state of the DTA process sequencer.

Program State
shows the state of the motion control process.

Printing mode
Allows to set single sided or double sided (default) printing operation. In single sided operation the PCB's are placed on the right cartridge 0 in reverse order. For double sided operation PCB'S will be placed batch to the left cartridge 1 in original order after processing is done.

Vibration Time
Time in seconds for a single vibration for loader PCB separation. Usually this value is within the range of 0.05S to 1S.

Vibrations Intensity
Vibration intensity as percentage value. The slider on the right side can be used for quick settings.

Double Check

Activate or deactivate the double check feature to verify single PCB pickup.

Stop distance

Maximum PCB stack thickness on the output cartridge.

Lay down reference

This menu allows to set the PCB lay down alignment on the Paragon desk centered (default) or left side referenced. If the setting is changed eventually the lay down position for ZA axis (global parameter G13) has to be aligned.

5.2 Manual Operation Page

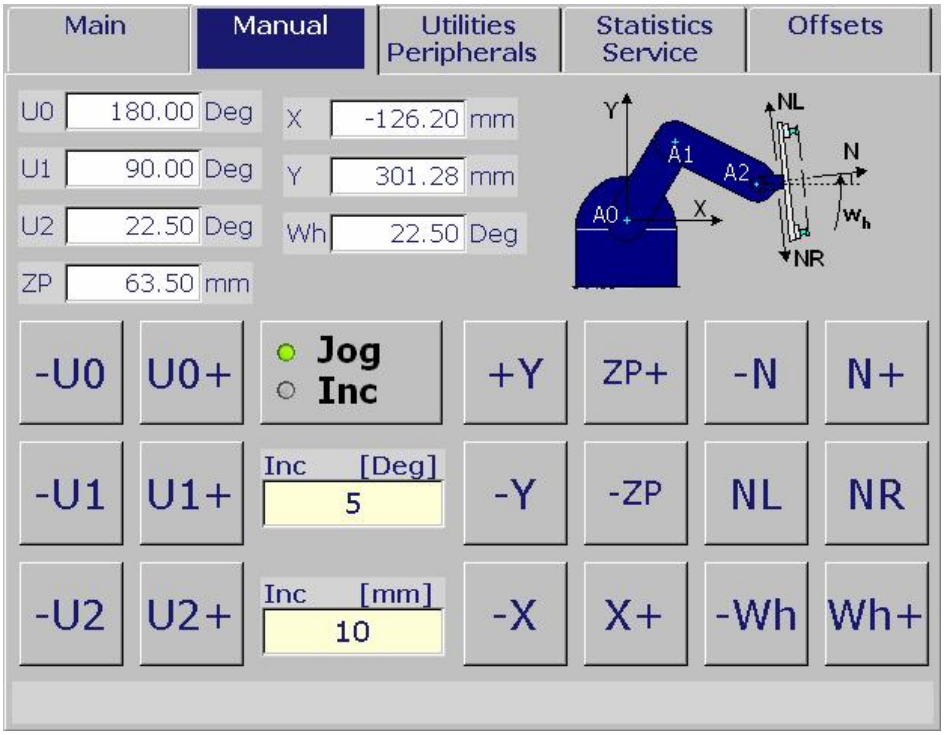

Figure 17 *Manual Operation*

Buttons ±U0 to ±U2 are used to move rotation axes U0, U1, U2 (Figure 17) to the specified direction.
Use buttons ±X, ±Y, ±ZP (if available) ±Wg (if available), ±Wh, ±N, NR and NL to move axes in Cartesian directions (figure 9).
For Cartesian Axes movement a referenced machine is required.
The ZP axis is available only for double cartridge devices and moves the complete robot tower in Z direction

Hint!

If axle leg of axis A0 and axis A1will cover within a motion, (point A0 and point A2 are identical), then in many cases this can only be achieved with axis U1 motion and not with Cartesian axes X and Y due to mathematical singularities for this situation.

There are 2 motion types:
Jog: Axes are moved as long as the button is pressed.
Increment: Axes move a predefined length or angle .for each button press event.

The Jog/Inc button is used to change the 2 basic modes, the green lamp in the button shows the actual state.

The motion length for Increment mode can be set in 2 different variable fields. For axes X, Y, Z, N, Nr in mm and for axes U0,U,U2, Wg, Wh in degrees.

5.3 Utilities and Peripherals

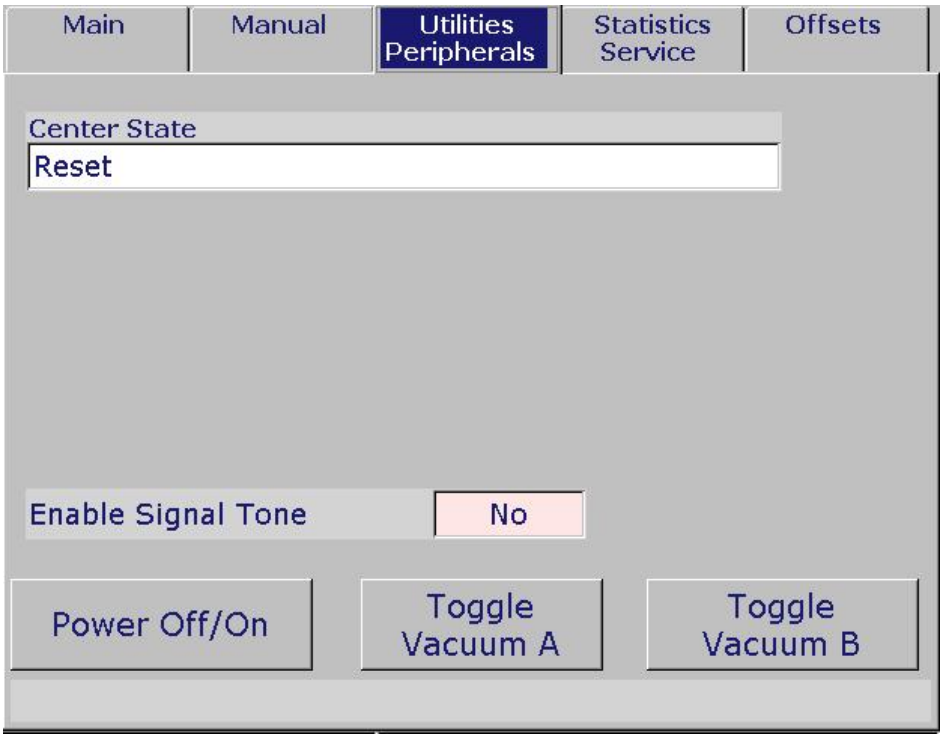

Figure 18 *Utilities and Peripherals*

Field Function

Center State
Actual state of the center control.

Enable Signal Tone
Password protected field to completely enable or disable output of

acoustic alarms.

Power On / Off

Motor driver power is switched off or on. After power is switched off, the reference of the machine is invalid! Reset mode is required to switch power off!

Toggle Vacuum A, Toggle Vacuum B

Used to switch vacuum on the robot hands A or B side on or off. Side A is the pick up side with vibration motor and double detection sensor mounted (on bottom side after referencing).

5.4 Statistics and Services

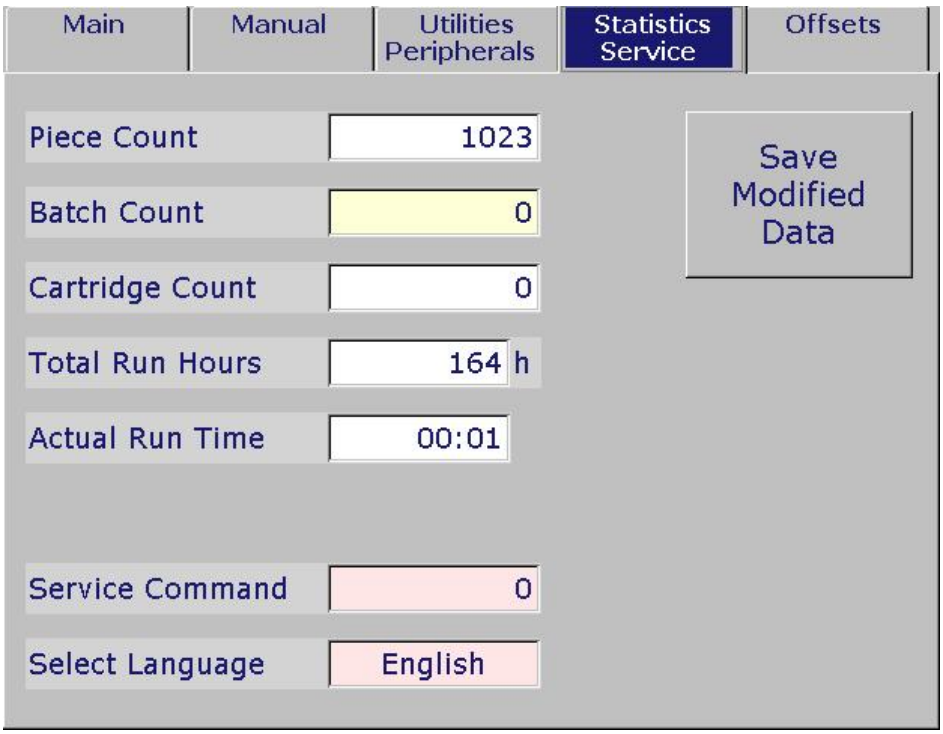

Figure 19 *Statistics und Services*

Field Function

Piece Count

Shows the total number of transported PCB's. It can't be erased..

Batch Count (No function for DTA!)

Preset piece count for loading PCB's. Is this value is not 0, The loader loads the specified number of PCB's and the stops loading with an error message "PCB batch done!". After that the Batch Count is again 0..

Cartridge Count

Counts the number of changed cartridges.

Total Run Hours

Shows the operation number of hours. This time is measured if the machine is not in RESET state.

Actual Runtime

This is the actual run time since the last program start.

Service Command

This is a protected command entry only for service personal.
Do not enter values, this could generate severe problems!

Select Language

After entering the password a different language can be selected. The selection can only be changed in RESET sate, after that the control will reboot.
Actually English and German are available.

5.5 Offsets

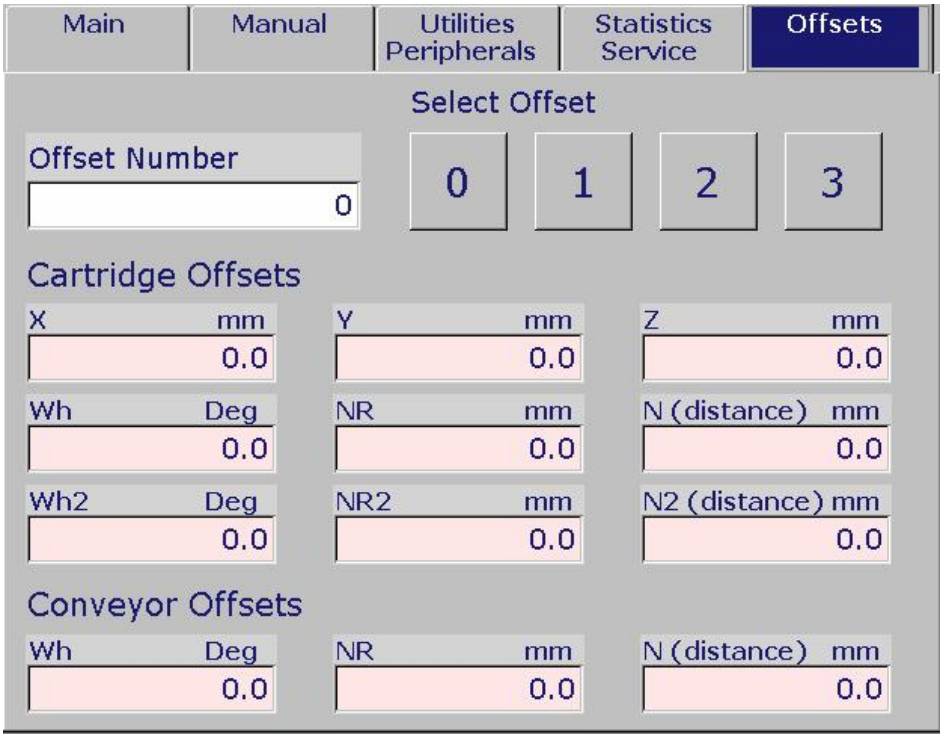

Figure 20 *Offsets*

The Control actually manages 4 offsets, each of them dedicated to a specific cartridge.

Actually used offsets for the DTA:
Offset 0 for cartridge 0 (right cartridge)
Offset 1 for cartridge 1 (left cartridge = input cartridge)

If cartridges are geometrically very different, then a longer spring travel for suck heads is required, this can't be compensated with offset!

Use button 0 to 3 to select the offset you want to view or change, the Offset Number field shows the actual selected offset.
See chapter 3.11 and Globale Parameters (chapter 5.9) for field details

Conveyor offsets are used to align lay down and take-up positions on the center conveyor.

Note:
Conveyor offset 0 is used for lay down (vibration motor points down)
Conveyor offset 1 is used for pick up (vibration motor points up)
Offset 0 works different to offset 1. A positive N value moves the robot arm down for offset 0, while for offset 1 (pick up) the arm is moving higher.

5.6 The Digital IO Page

This page is only available within the main menu (menu button). Here you can see all digital inputs (24) and outputs (24) for a dedicated IO module (EMIO). The digital I/O states can be 1 (+24V) or 0 (0V).
Use the Control IO Map in the electrical documentation of the Service CD.

The buttons on the right can be used to change to a different EMIO module, to view analog inputs or to exit the page.

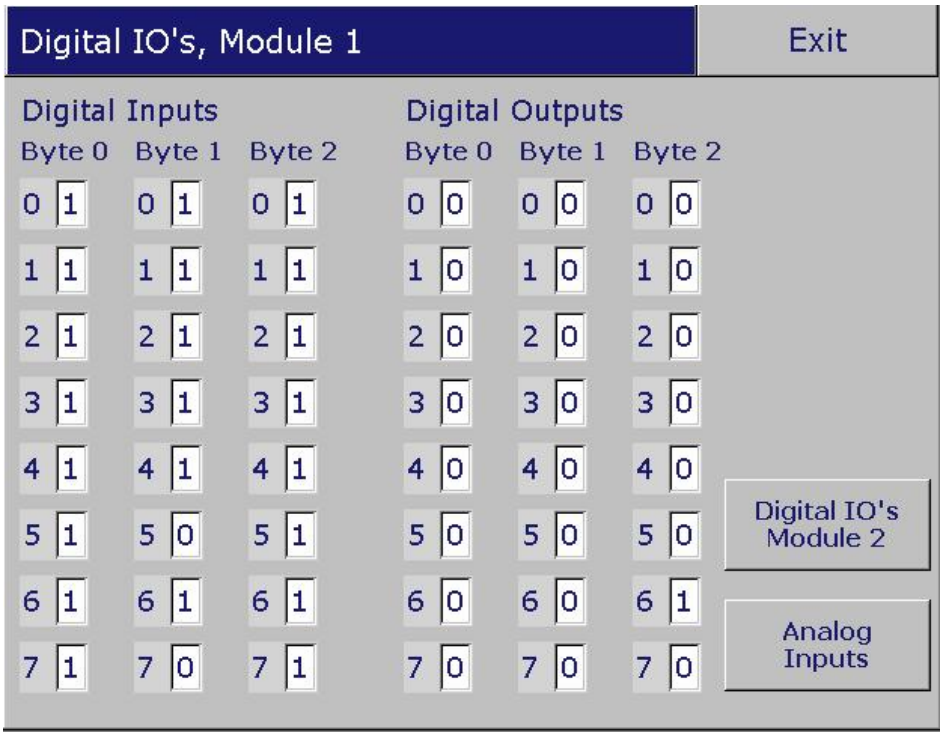

Figure 21 *Digital IO's*

5.7 The Analog IO Page

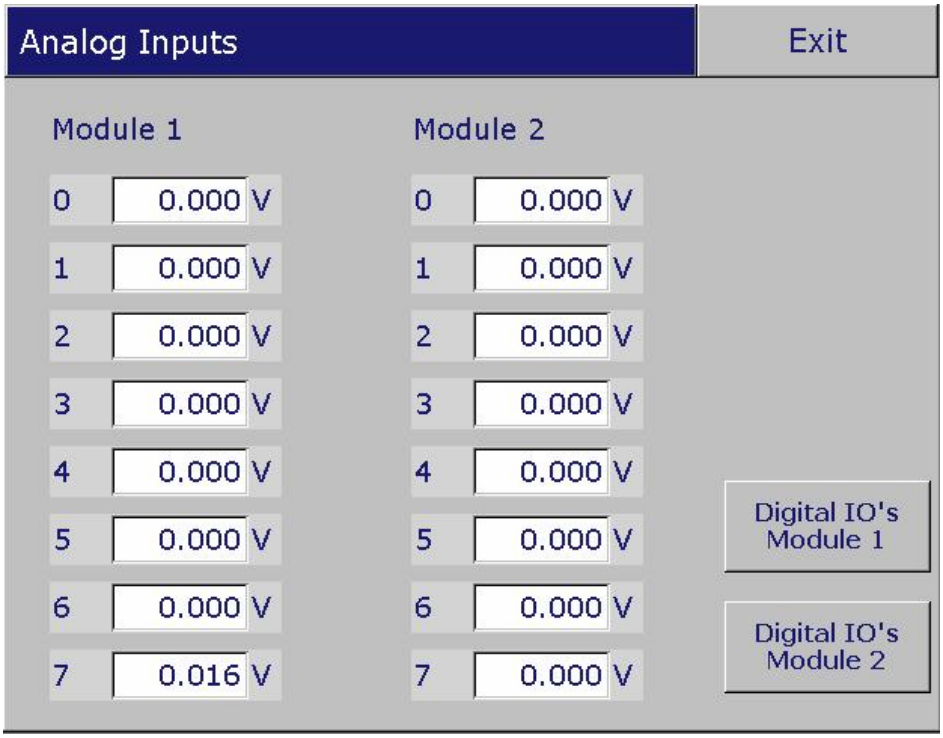

Figure 22 *Analog IO'S*

Analog inputs are displayed for both EMIO modules. Values can be in the range of 0 to 10V. For details see Control IO Map in the electrical documentation of the Service CD.

Default sensor mapping:

AI0: PCB distance sensor
AI1: Double PCB check sensor

5.8 The Global Parameter Page G0..G7

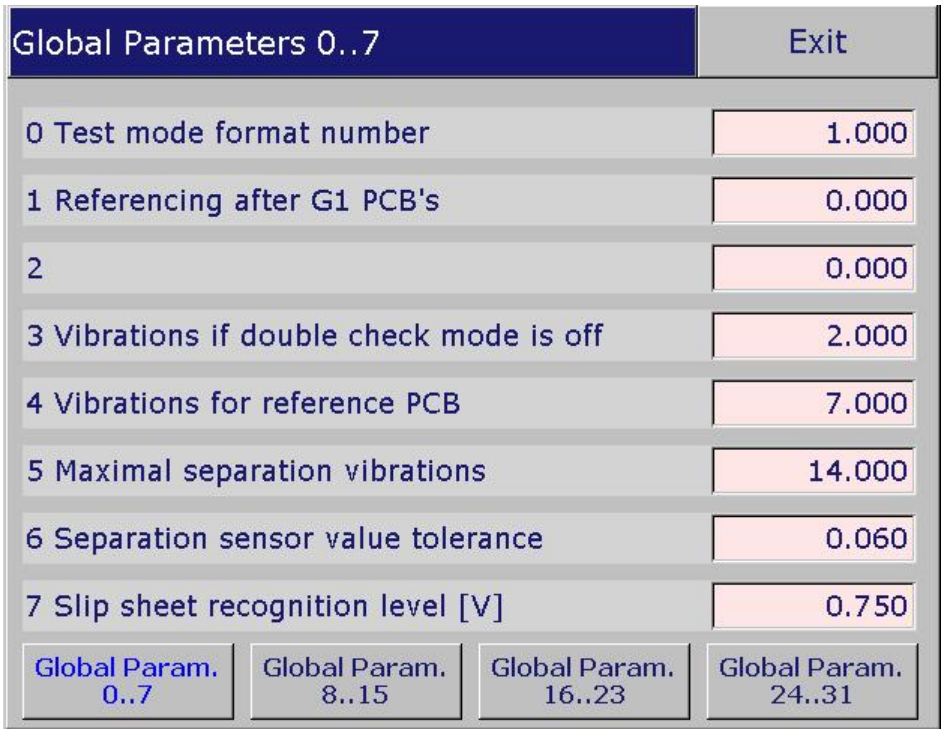

Figure 23 *Global Parameters 0..7*

0 Test mode format number

In test mode operation without Paragon interface handling this value sets the format number for the format axis.

1 Referencing after G1 PCB'S

If this value is not 0, the specified number sets the number of loaded PCB's after which the robot arms A0, A1 and A2 are referenced automatically.

3..6 Vibration settings G3..G6 see chapter 4.6

7 Slip sheet recognition level [V]

Sets the limit value for the separation sensor (analog input 1). Values beyond this limit will differentiate jobs in for multi batch mode.

5.9 The Global Parameter Page G8..G15

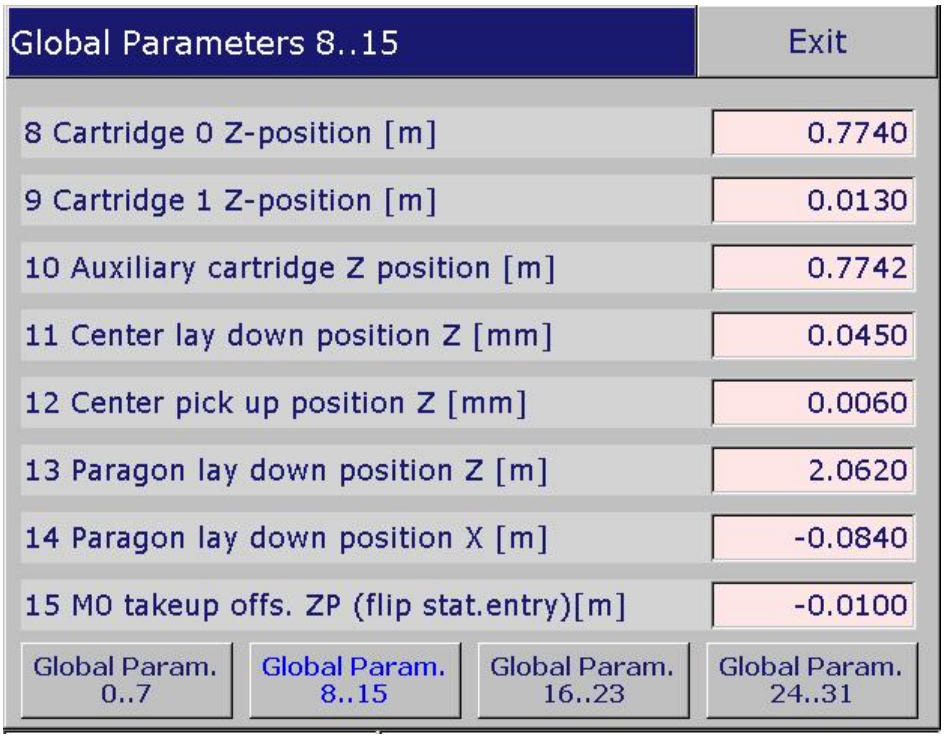

Figure 24 *Global Parameters 8..15*

8 Cartridge 0 Z-position

This parameter sets the ZP Position in meter units to get or lay down PCB's on cartridge 0 (right cartridge).
!CAUTION! For erroneous values collisions may occur!

9 Cartridge 1 Z-position

This parameter sets the ZP Position in meter units to get or lay down PCB's on cartridge 1 (left cartridge).
!CAUTION! For erroneous values collisions may occur!

10 Auxiliary Cartridge Z-position

This parameter sets the ZP Position for an auxiliary cartridge 2. This value is actually not used!

11 Center lay down position Z

Sets the ZP position to lay down the PCB's on the center device.
!CAUTION! For erroneous values collisions may occur!

12 Center pick up position Z

Sets the ZP position to pick up PCB's from the center device. Usually G15 has also to be aligned if this value changes!
!CAUTION! For erroneous values collisions may occur!

13 Paragon lay down position Z

Sets the ZP position to lay down the PCB on the Paragon. ZP axis direction is positive from DTA to Paragon (see also G31)!.
!CAUTION! For erroneous values collisions may occur!

14 Paragon lay down position X

Sets the X position to lay down the PCB on the Paragon. X axis direction is positive to the paragon back side if you are in front of the Paragon.
!CAUTION! For erroneous values collisions may occur!

15 M0 Take-up offset ZP (flip stat. entry) [m]

This offset is a ZP shift offset for takeup panels from cartridge 0 (B-Side). For B-side operation the panel is turned on the flip station, so after turning it could lay too much on the left side. If so centering is not working properly. A positive value in the offset register will lead to make the panel to be shifted right on the center conveyor after turning.
!CAUTION! For erroneous values collisions may occur!

5.10 The Global Parameter Page G16..G23

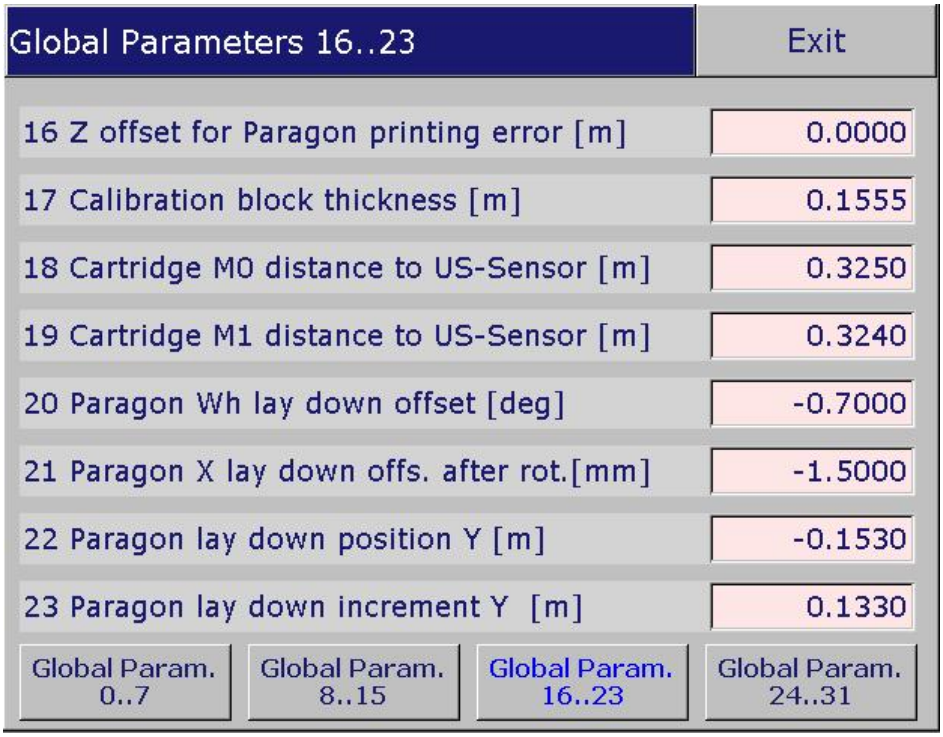

Figure 25 *Global Parameters 16..23*

16 Z offset for Paragon printing error

If a printing error occurs on Paragon the erroneous PCB will be shifted by tis value in ZP direction on the output cartridge.

17 Calibration block thickness

Sets the thickness of the calibration block used for cartridge calibration (see chapter 4.4).

18 Cartridge M0 distance to US Sensor

Sets the distance from the Ultra sonic sensor head to the empty cartridge 0. This value is used for distance measurements! Wrong values

can generate collisions!

19 Cartridge M1 distance to US Sensor

Sets the distance from the Ultra sonic sensor head to the empty cartridge 1. This value is used for distance measurements! Wrong values can generate collisions!

20 Paragon Wh lay down offset [deg]

This value specifies a Wh angle correction value for lay down of PCB's on the Paragon. If this value is set to an non zero value, probably X offset G21 has to be aligned !

21 Paragon X lay down ofs. after rot [mm]

This value shifts the lay down position in X and should be used to align X lay down position on Paragon if G20 value has been changed!

22 Paragon lay down position Y

Is the basic Y-value for lay down operation o the Paragon. The Y axis points up vertically! The position is about 150mm above the paragon lay down area. If Y-alignments are required use G23 if possible !

23 Paragon lay down increment Y

This is an absolute value the robot arm moves down from the G22 Y position (only use positive values)! Use this value to align paragon Pickup and lay down height. Higher values will place the PCB lower on the Paragon desk!

5.11 The Global Parameter Page G24..G31

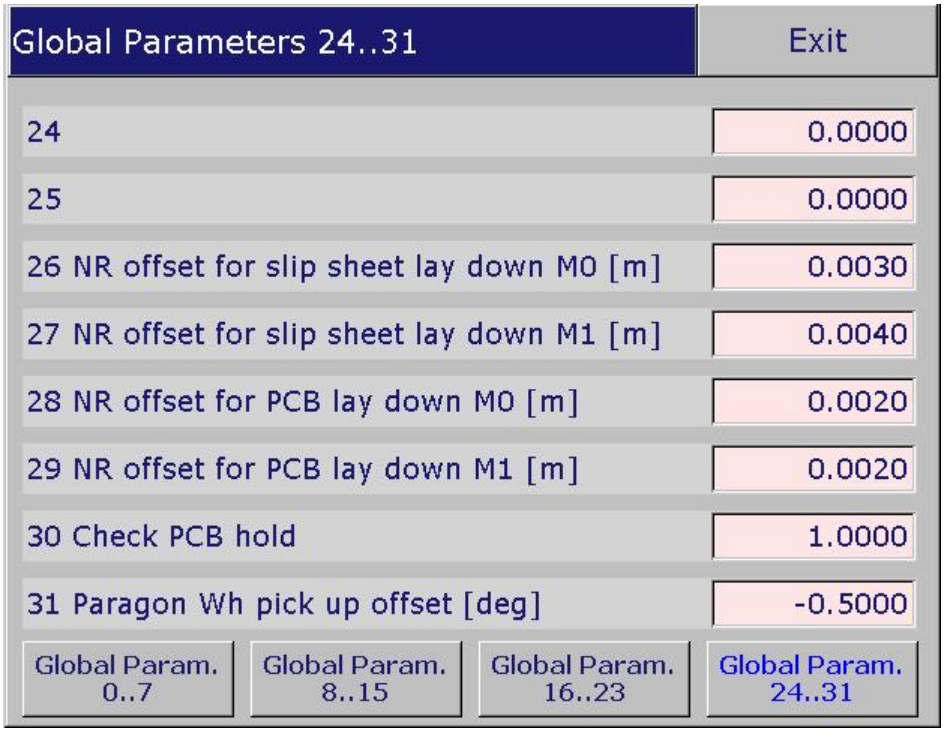

Figure 26 *Global Parameters 24..31*

26 NR-offset for slip sheet lay down M0

Sets a NR offset for lay down of slip sheets on cartridge M0! This value moves the slip sheet lay down position parallel to the cartridge background. This value is added to the NR offset value for cartridge 0, but only is valid for lay down of slip sheets! Positive values will generate higher lay down positions.

27 NR-offset for slip sheet lay down M1

Sets a NR offset for lay down of slip sheets on cartridge M1! This value moves the slip sheet lay down position parallel to the cartridge background. This value is added to the NR offset value for cartridge 1, but only is valid for lay down of slip sheets! Positive values will generate higher lay down positions.

28 NR-offset for PCB lay down M0

Sets a NR offset for lay down of PCB's on cartridge M0! This value moves the PCB lay down position parallel to the cartridge background. This value is added to the NR offset value for cartridge 0, but only is valid for lay down of PCB'S! Positive values will generate higher lay down positions (see chapter 5.5).

29 NR-offset for PCB lay down M1

Sets a NR offset for lay down of PCB's on cartridge M1! This value moves the PCB lay down position parallel to the cartridge background. This value is added to the NR offset value for cartridge 1, but only is valid for lay down of PCB'S! Positive values will generate higher lay down positions (see chapter 5.5).

30 Check PCB hold.

If set to 1, it is verified if PCB's will be lost during transportation. This is done with optical sensor on each side of the robot arm. For very thin PCB's this might not work well due to sagging of thin PCB's so this check can be switched off by setting this value to 0!

31 Paragon Wh pick up offset [deg].

This value can be used to align the pick up angle of the robot arm for Paragon PCB pick up. First lay down offsets G20/G21 should be changed if required.

5.12 Touch Screen Calibration

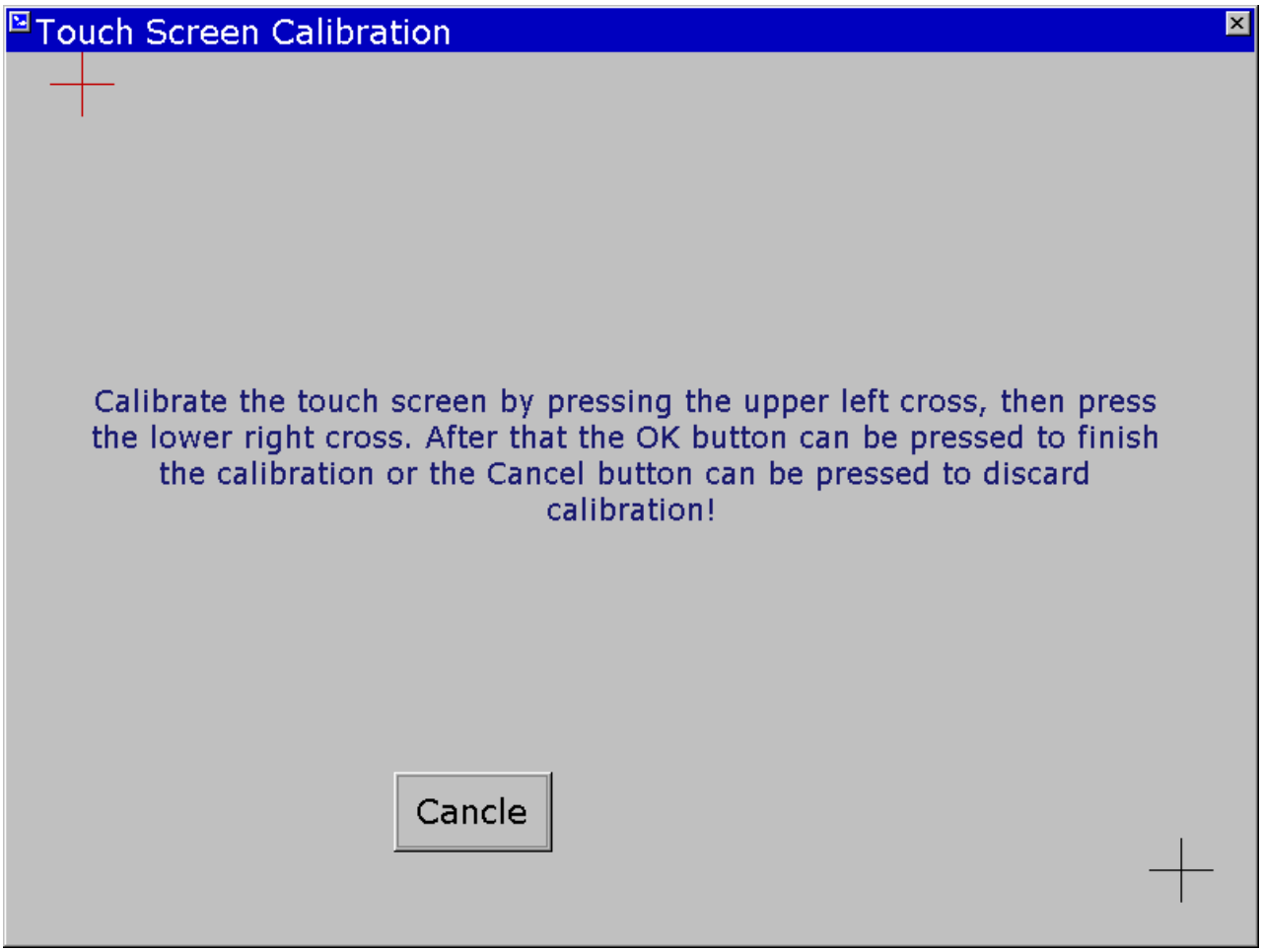

Figure 25 *Touch Screen Calibration*

If a touch screen has to be change a new calibration might be required if control elements are not aligned well with touch events.
Opening the main menu and select the Touch Calibration can do this.
After entering the password you will get the supper screen (figure 23).
Next press the red cross top left and then bottom right once and after that the OK button.

Caution!
If calibration is done badly, the machine can't eventually be operated anymore. This has eventually to be corrected by assistance of Advanced Engineering service personal.

Hint!
Do not use sharp metallic devices to press the touch screen. This might hurt the touch foil!

5.13 The Error History Page

The Error History page can be used to inspect the latest 2000 errors. This list can't be deleted!

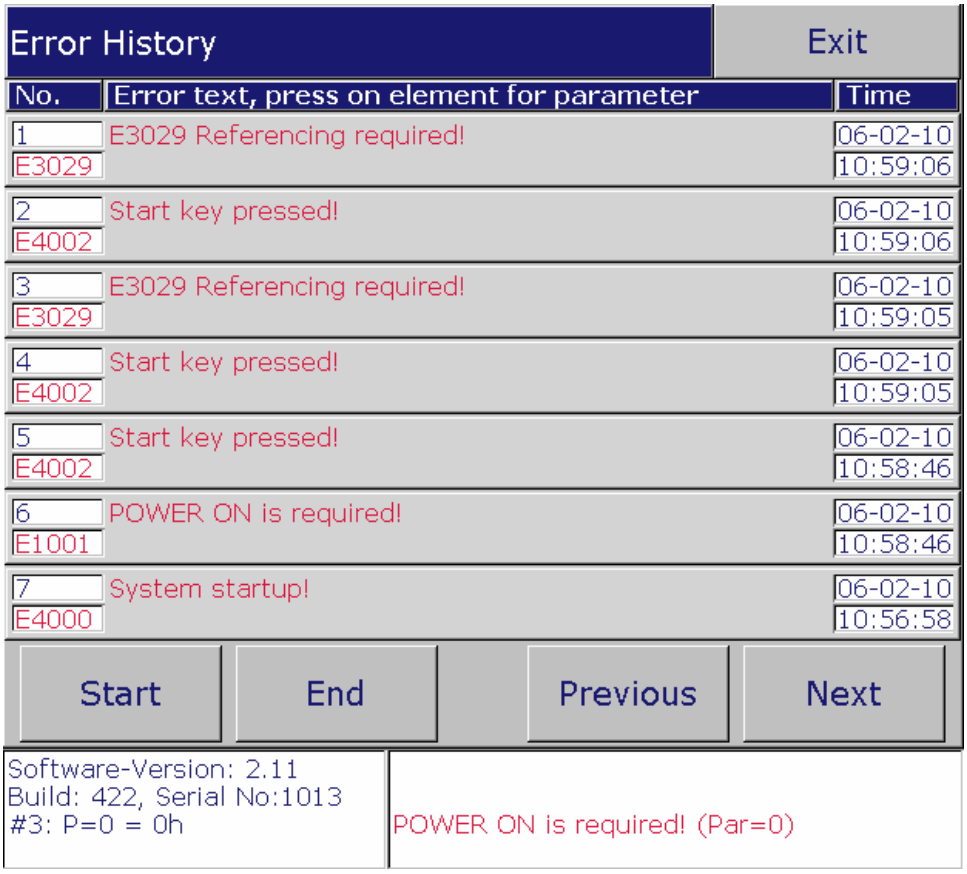

Figure 24 *Error History*

Errors are displayed on bars, including sequential numbers (top left in the error bar) starting with the latest error. Below the sequence number the error number (E..) is shown. The middle part of the bar the error text is visible in red. On the left side the date and time of occurrence is available.

Use the **Next** and **Previous** buttons to navigate page by page trough the list. The **Start** button can be used to move to the beginning of the list (latest errors) and the **End** button to move to the end of the list (oldest error).
Each error has an additional error parameter. This parameter is shown in the message window (bottom left) if the error bar is touched.