User Manual

attocube systems’ Piezo Motion Controller ANC350

attocube systems AG, Königinstr. 11a (Rgb), D – 80539 Munich Germany
Phone: +49 89-2877 8090 Fax: +49 89-2877 80919
E-Mail: info@attocube.com www.attocube.com

For technical queries, contact:
support@attocube.com

attocube systems office Munich:
Phone: +49 89 2877 8090
Fax: +49 89 2877 80919
Safety Information

For the continuing safety of the operator of this equipment and the protection of the equipment itself, the operator should take note of the **Warnings**, **Cautions**, and **Notes** throughout this handbook and, where visible, on the device itself.

The following safety symbols may be used throughout the handbook:

- **Caution**. An instruction which draws attention to the risk of injury or death.

- **Caution**. An instruction which draws attention to the risks of damage to the device, process, or surroundings.

- **Warning**. Risk of electric shock. High voltages present.

- **Warning**. Laser radiation. Do not stare into beam. Class 1M Laser product.

- **Note**. Clarification of an instruction or additional information.

- Functional (EMC) earth/ground terminal.
Important Warnings – Read this Section First!

The unit must be connected only to grounded and fused supply of 100, 115, or 230V.

**Warning.** The equipment, as described herein, is designed for use by personnel properly trained in the use and handling of mains powered electrical equipment. Only personnel trained in the servicing and maintenance of this equipment should remove its covers or attempt any repairs or adjustments. If malfunction is suspected, return the part to attocube systems immediately for repair or replacement. There are no user-serviceable parts inside the electronics. Take special care if connecting products from other manufacturers. Follow the General Accident Prevention Rules.

**Note.** Modified or opened electronics cannot be covered by the attocube warranty anymore.

**Caution. The piezo translators and controllers are high voltage devices which are capable of generating high output currents.** Do never touch any part of the piezo translators and controllers that might have connection to the high voltage output. They may cause serious or even lethal injuries if used improperly. Working with high voltage devices requires adequately educated operating personnel.

**Warning. Do not operate the instrument outside its dedicated supply voltages or environmental range.** If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired. In particular, excessive moisture may impair safety.

**Warning. Never connect any cabling to the electronics when the outputs are enabled!**
The scan piezo elements at the heart of a positioner unit are high voltage components and can cause serious injuries.

**Caution. Avoid short-cuts.** Be careful not to cause a short-cut between the contacts in the Sub-D-Mix connector or anywhere in the cabling.

**Caution. For laboratory use only.** This unit is intended for operation from a normal, single phase supply, in the temperature range 5°C to 40°C, 20% to 80% RH.
Declarations of Conformity

For Customers in Europe:

This equipment has been tested and found to comply with the EC Directives 89/336/EEC ‘EMC Directive’ and 73/23/EEC ‘Low Voltage Directive’ as amended by 93/68/EEC. Compliance was demonstrated by conformance to the following specifications which have been listed in the Official Journal of the European Communities:

Safety EN61010: 2001
EMC EN61326: 1997

For Customers in the USA:

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. Changes or modifications not expressly approved by attocube systems could void the user’s authority to operate the equipment.
Waste Electrical and Electronic Equipment (WEEE) Directive

Compliance
As required by the Waste Electrical and Electronic Equipment (WEEE) Directive of the European Community and the corresponding national laws, attocube systems offers all end users in the EC the possibility to return “end of life” units without incurring disposal charges. This offer is valid for attocube systems electrical and electronic equipment:

- sold after August 13th 2005,
- marked correspondingly with the crossed out “wheelie bin” logo (see logo to the left),
- sold to a company or institute within the EC,
- currently owned by a company or institute within the EC,
- still complete, not disassembled, and not contaminated.

As the WEEE directive applies to self contained operational electrical and electronic products, this “end of life” take back service does not refer to other attocube products, such as

- pure OEM products, that means assemblies to be built into a unit by the user (e. g. OEM electronic drivers),
- components,
- mechanics and optics,
- left over parts of units disassembled by the user (PCB’s, housings etc.).

If you wish to return an attocube unit for waste recovery, please contact attocube systems or your nearest dealer for further information.

Waste treatment on your own responsibility
If you do not return an “end of life” unit to attocube systems, you must hand it to a company specialized in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site.

Ecological background
It is well known that WEEE pollutes the environment by releasing toxic products during decomposition. The aim of the European RoHS directive is to reduce the content of toxic substances in electronic products in the future.

The intent of the WEEE directive is to enforce the recycling of WEEE. A controlled recycling of end of life products will thereby avoid negative impacts on the environment.
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I. System Overview

The ANC350 electronics is a sophisticated closed and open loop positioning and scanning system allowing the operation of up to six piezo-driven positioners and/or scanners. The ANC350 can be controlled either directly on the front panel or, alternatively, with the “DAISY” software provided by attocube.

In addition, a *.DLL-file is provided for the integration of ANC350 software control in your own programs.

With the ANC350 controller you are able to drive attocube positioners either open-loop or closed-loop (only for positioners with read out system). Either way there two driving modes, stepping mode and fine positioning mode.

Closed-loop positioning could be done either absolute or relative. Both modes allow the most accurate operation and control since the position of the piezo stage is controlled and adjusted by the controller in real-time.

Stepping mode:
In this mode a saw tooth like driving signal is used like in the figures on the left. Where the amplitude and the frequency of the signal can be adjusted to the positioner and the application.

The motion corresponding to this driving signal are several steps, where as the steps size is mainly depending on the amplitude of the signal.

Fine positioning mode:
In this mode a DC-Voltage signal is applied to the positioner which corresponds to an elongation of the piezo build in the positioner. The maximum travel in this mode is limited with the maximum travel of the piezo, typical several micrometers.

For attocube scanners the ANC350 controller could also used as high voltage amplifier where a voltage input 0-10V is amplified to a differential output of 0-140V as well as a DC-Voltage source to position the scanners to a certain position.
II. Setup Procedure

II.1 Mechanical Installation

Setting up
Unpack the controller and the delivered stages carefully and inspect them for any damage. Place all components on a flat and clean surface.

Caution. When setting up the unit, it should be positioned in a way that the operation of the power supply plug and switch on the rear panel is not impeded. Ensure that proper airflow is maintained to the unit. Do not obscure the ventilation holes.

Warning. Operation outside the following environmental limits may adversely affect the safety of the operator:

- Indoor use only
- Maximum altitude 2000 m
- Temperature range 5°C to 40°C
- Maximum humidity less than 80% RH (non-condensing) at about 30°C

To ensure reliable operation, the unit should not be exposed to corrosive agents or excessive moisture, heat or dust. If the unit has been stored at a low temperature or in an environment of high humidity, it must be allowed to reach ambient conditions before being powered up.

Caution. In applications requiring the highest level of accuracy and repeatability, it is recommended that the controller unit is powered up approximately 30 minutes before useage in order to allow the internal temperature to stabilize.

Caution. Do not connect any cabling longer than 5m. Longer cabling may increase the sensitivity of the device to external influences.

Caution. Use only control cables which are supplied by attocube systems. Other cabling may affect the sensitivity of the device to external influences or may cause errors.
II.2 Electrical Installation

Connect the controller to the voltage supply:

**Warning.** The unit must be connected to a grounded and fused supply of 100 V, 115V, or 230 V. The voltage selector on the rear panel has to be adjusted to match the voltage value of the power supply line.

**Warning.** Use only power supply cables which are supplied by attocube systems, other cables may not be rated to the same current. The unit is shipped with appropriate power cables for usage in the UK, Europe, and the USA. When shipped to other territories, the appropriate power plug must be provided by the user.

Start the controller:

**Note.** When the unit’s main power switch is turned on, the system will boot. This may take several seconds. The blinking of the green LED on the master module will indicate the booting process.

III. Front Panel Controls and Indicators

The front panel of the ANC350 consists of a single panel for the master module (ANC350 Motion Controller), and up to seven individual panels. Each corresponding to one output axis. In the following chapter these panels are described in detail.
01 Display

02 lock / unlock switch with lock / unlock LED [on / off]
   only main module

03 resolution indicator LEDs [1; 0.1; 0.01]

04 value dial [change value | change resolution by pressing]
   scan axis: affirm mode
   dither axis: affirm mode

05 mode indicator LEDs
   main: amplitude | frequency | capacitance
   step axis: forward | backward | output off
   scan axis: DC-IN | Internal | output off
   dither axis: DC-IN | AC-IN | Internal | output off

06 mode switch
   main: amplitude | frequency | capacitance

07 mode switch / button
   step axis: reset | output off | offset/distance

08 mode switch / button
   scan axis: DC-IN | Internal | output off
   dither axis: DC-IN | AC-IN | Internal | output off

09 focus LED
   only step axis / scan axis / dither axis: indicates active axis

10 activation button
   main: check capacitance

11 stepping switch
   step axis: single step [up / down]

12 stepping switch LED
   step axis: continuous [up / down]

13 DC-IN input BNC plug
   only scan axis / dither axis

14 AC-IN input BNC plug
   only dither axis
IV. Rear Panel Connections

On the back panel, there are:

01 main power switch
    main fuse
    main power supply connector,
    (110V/115V/220V, 50 Hz – 60 Hz, max. 20VA)
02 voltage selector (100V/115V/220V)
03 GND socket
04 Ethernet port (optional)
05 RJ-12 port (for internal use only)
06 USB port for connection to a computer
07 trigger connector (Sub-D, 15-pin)
08 BNC connector for the Test-Output (for internal use only)
09 positioner connectors: Sub-D mix connectors
    (max. 70V/140V, 4.5A), up to seven axis

Axes arrangement on rear panel:

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A4</td>
<td>A5</td>
<td>A6</td>
<td>A7</td>
</tr>
<tr>
<td>A1</td>
<td>A2</td>
<td>A3</td>
<td></td>
</tr>
</tbody>
</table>
How to connect a positioner:

For more information on the specific types of positioners and connectors please see chapter V.2.

Optional vacuum feedthrough:
Additional to an attocube positioning system a specific vacuum feedthrough could be ordered. The figure below shows a feedthrough for on single /NUM-positioner. More axis feedthroughs are also available. With such a feedthrough a alternative-adapter is delivered which allows testing the whole system without dismounting the feedthrough.

Vacuum feedthrough /NUM-positioner
alternative-adapter
V. Pin Assignment

V.1 TTL Trigger Connector

The ANC350 allows to output LVTTL trigger signals depending on the actual position of a connected piezo positioning stage. For further details regarding this feature please see chapter VIII.6. In addition, modules and stages can be controlled/operated by external trigger inputs, such as frequently used for the coarse approach of scanning probe microscopes (see chapter VIII.7). The pin assignment of the female 15-pin Sub-D connector at the rear side of the ANC350 for the trigger output and input signals is given in the table below:

<table>
<thead>
<tr>
<th>PIN #</th>
<th>Interpolation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Output trigger 1</td>
</tr>
<tr>
<td>2</td>
<td>Output trigger 2</td>
</tr>
<tr>
<td>3</td>
<td>Output trigger 3</td>
</tr>
<tr>
<td>4</td>
<td>Output trigger 4</td>
</tr>
<tr>
<td>5</td>
<td>Output trigger 5</td>
</tr>
<tr>
<td>6</td>
<td>Output trigger 6</td>
</tr>
<tr>
<td>7</td>
<td>GND</td>
</tr>
<tr>
<td>9</td>
<td>Input trigger 1</td>
</tr>
<tr>
<td>10</td>
<td>Input trigger 2</td>
</tr>
<tr>
<td>11</td>
<td>Input trigger 3</td>
</tr>
<tr>
<td>12</td>
<td>Input trigger 4</td>
</tr>
<tr>
<td>13</td>
<td>Input trigger 5</td>
</tr>
<tr>
<td>14</td>
<td>Input trigger 6</td>
</tr>
<tr>
<td>15</td>
<td>GND</td>
</tr>
<tr>
<td>8</td>
<td>+3,3V</td>
</tr>
</tbody>
</table>

The pin assignment of the female 15-pin Sub-D connector at the rear side of the ANC350 for the trigger output and input signals is given in the table below:
The ANC350 uses LVTTL logic which works with a maximum Voltage of 3,3V. In the table below you see all treshold values of the LVTTL logic which are equal to the 5V-TTL logic.

<table>
<thead>
<tr>
<th>Technology</th>
<th>Input ( V_{\text{IH}} )</th>
<th>Output ( V_{\text{IH}} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>LVTTL 3,3V</td>
<td>( \leq 0,8 )</td>
<td>( \geq 2,0 )</td>
</tr>
<tr>
<td>TTL 5V</td>
<td>( \leq 0,8 )</td>
<td>( \geq 2,0 )</td>
</tr>
</tbody>
</table>

**Warning.** Do not under any circumstances attempt to connect the digital I/O to any external equipment that is not galvanically isolated from the mains. In addition to the damage that may occur to the controller there is the risk of serious injuries and fire hazard.
### V.2 Positioner Control Cables

A positioner control cable connects the ANC350 electronics with a positioner. attocube provides this cable along with each delivered axis by default. Nevertheless, for self-construction or customization purposes, the cabling specifications as well as the pin assignment are described as follows.

**Cable Layout for /NUM Connectors and Cabling:** (figures illustrates front view of connectors)

<table>
<thead>
<tr>
<th>ANC350</th>
<th>D-SUB Mix</th>
<th>Control Cable</th>
<th>Application dependent connector</th>
<th>POS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>D-SUB MIX connector, male, 11-pin Connector: FM11W1P-K120 High power contact (A1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Circular plug-in connector, female Type Binder 678, 14-pin ➔ <strong>Used for room temperature applications</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Standard D-SUB connector, female, 15-pin ➔ <strong>Used for vacuum applications</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Control Cable Type e.g. LiY-LiY(CB)-Y, 12-pin, 6x2x0.14, twisted in pairs, one pair extra shielded (driving signal)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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### Pin Assignment:

<table>
<thead>
<tr>
<th>SUB-D MIX, 11-pin</th>
<th>Sensor I/O (1Vss)</th>
<th>Piezo voltage</th>
<th>RT</th>
<th>HV/UHV</th>
<th>SUB-D 15-pin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Circ. plug-in connector 14-pin</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>U0+</td>
<td>N</td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Pos-Con</td>
<td>G</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>- OUT</td>
<td>U</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>+ OUT</td>
<td>T</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>U1+</td>
<td>L</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>U2+</td>
<td>R</td>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>U0-</td>
<td>O</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>UB=5V</td>
<td>S</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>U1-</td>
<td>J</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>U2-</td>
<td>P</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1</td>
<td>GND</td>
<td>E</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>A,C,M not connected</td>
<td>2,7,8,9 not connected</td>
</tr>
</tbody>
</table>

**Caution.**

- The pin-numbers of the feed through will be different from the numbers of the vacuum cable [Sub-D 15-pin]. 1⇒8; 2⇒7;3⇒6;4⇒5; 9⇒15; 10⇒14; 11⇒13
- Make sure not to connect cabling with a wire resistance >5Ω.
- Use EMV-housings as enclosure for the SUB-D connectors
- Use the extra shielded twisted pair wires for the piezo voltage supply to avoid interference with the sensor signal.
**Cable Layout for /RES**  

<table>
<thead>
<tr>
<th>ANC350</th>
<th>Control Cable</th>
<th>Application dependent connector</th>
<th>POS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>D-SUB Mix</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| D-SUB MIX connector, male, with 2x coaxial contacts  
Connector: FM-7W2P-K120  
Coaxial contacts (A1, A2) | | | |
| Circular plug-in connector, female  
Type Binder 678, 5-pin  
⇒ Used for room temperature (RT) applications | | | |
| Socket board connector, 5 pin, female,  
raster 2.0mm  
⇒ Used for low temperature (LT) and vacuum (HV/UHV) applications | | | |
| Control Cable Type  
e.g. LiY-LiY(CB)-Y,  
6-pin, 3x2x0.14/12,  
twisted in pairs,  
one pair extra shielded (driving signal) | | | |

**Connecting scheme for non-vacuum positioners**

**Connecting scheme for vacuum positioners**
### Pin Assignment:

<table>
<thead>
<tr>
<th>SUB-D MIX, 9-pin</th>
<th>Sensor I/O</th>
<th>Piezo voltage</th>
<th>RT</th>
<th>LT/HV/UHV</th>
<th>HV/ UHV</th>
<th>LT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Circ. plug-in con. 5-pin</td>
<td>Socket board con. 5-pin</td>
<td>Positioner pin plug</td>
</tr>
<tr>
<td>1</td>
<td>Sens -</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>not beveled 3-pin</td>
<td>black 3-pin</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Sens +</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>middle</td>
<td>yellow</td>
</tr>
<tr>
<td>4</td>
<td>RES-CON</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Uo</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>beveled 3-pin</td>
<td>red 3-pin</td>
</tr>
<tr>
<td>I-A1</td>
<td>-OUT</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>not beveled 2-pin</td>
<td>black 2-pin</td>
</tr>
<tr>
<td>S-A1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-A2</td>
<td>+OUT</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>beveled 2-pin</td>
<td>red 2-pin</td>
</tr>
<tr>
<td>S-A2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jumper 4 to 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R=1MΩ between 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Caution.**

- Make sure not to connect cabling with a wire resistance >5Ω.
- Use EMV-housings as enclosure for the SUB-D connectors.
- Use the extra shielded twisted pair wires for the piezo voltage supply to avoid interference with the sensor signal.
Cable Layout for SCN

Connectors and Cabling: (figures illustrates front view of connectors)

D-SUB MIX connector, with 2x coaxial contacts and 1x high power contact
Connector: FM-3W3P-K120
Coaxial contacts (A1, A3)
High power contact (A2)

Socket board connector, 2 pin, female, raster 2.0mm
➤ Used for low temperature (LT) and vacuum (HV/UHV) applications

Control Cable Type
e.g. LIF1CY,
2-pin, 1x2x0.14/14, twisted pair

Pin Assignment:

<table>
<thead>
<tr>
<th>SUB-D MIX, 5-pin</th>
<th>Piezo voltage</th>
<th>Socket board connector, 2-pin</th>
<th>Positioner pin plug</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>LT</td>
</tr>
<tr>
<td>I-A1</td>
<td>-OUT</td>
<td>2</td>
<td>black</td>
</tr>
<tr>
<td>S-A1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-A3</td>
<td>+OUT</td>
<td>1</td>
<td>red</td>
</tr>
<tr>
<td>S-A3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(*) In case of an HV/UHV application a SUB-D 9-pin connector is used. To minimize the amount of necessary feed-troughs, up to three axes can be connected to one SUB-D 9pin vacuum feed-through.
Caution.
- Make sure not to connect cabling with a wire resistance >5Ω.
- Use EMV-housings as enclosure for the SUB-D connectors.
VI. Manual Use of Front Panel

The front panel consists of four different types of modules, one master module (ANC350 Motion Controller, see figure below) and three types of individual modules: a step module, a scan module, and a dither module. All three modules can be arbitrarily combined to best match the application of the customer.

VI.1 ANC350 Motion Controller (Master Module)

With the master module, you can control both amplitude and frequency for each individual module, measure the capacitance of connected piezoelectric elements, and lock the control panel.

LOCK/UNLOCK: After turning on the ANC350, the front panel interface is locked by default. To unlock, simply turn the “LOCK/UNLOCK”-switch to the UNLOCK position. By switching to the “LOCK”-position, the front panel can be locked at any time if so desired. If locked, the red LED is illuminated.

The settings displayed by the master module always refer to the axis module being in “FOCUS”. Whether or not an individual module is focussed on is indicated by a green LED on the corresponding module, labelled “FOCUS”. In order to lift a certain axis module into the “FOCUS”-state, simply press any knob/switch of this specific module. This action will activate the axis module, but not alter its individual setting. Note: It is not possible to modify the settings of modules not in “FOCUS”.

MODE: Using the “MODE”-switch, amplitude (AMP) and frequency (FRQ) values for each axis module can be set. The display of the master module will automatically show the current parameters for the axis module in focus. Simply adjust this value by rotating the turning knob. The adjustment step size can be varied in three steps from “x0.01” to “x1.0” by pressing the knob. A yellow LED indicates a “x0.1” and “x0.01” setting; without any LED illuminated, the step size is “x1.0”.

By selecting the “MODE”-function capacitance (CAP), the capacitance of the piezo element connected to the axis in “FOCUS” is measured. In order to start or refresh this measurement, press the “ACTIVATION”-button.

By pressing the “ACTIVATION”-button in amplitude mode, the “Automatic Amplitude Control” is activated (green LED) for the axis in “FOCUS”. “Automatic Amplitude Control” adjusts the amplitude of the piezo drive voltage in order to achieve a constant step size. This step size corresponds to the amplitude value selected on the master module.
VI.2 ANC350 Stepper Driver (Step Module)

With the step module, one can control the motion of a positioner by either defining a certain target position (closed-loop) or by manually performing several steps (open-loop).

Prior to operation, make sure that the positioner is connected correctly to the control unit. Afterwards, enable the output of the step module by putting it into “FOCUS” (press any button) and by pressing and holding the “START” button for approx. two seconds. Once the module is turned on, the yellow “ON”-LED in the lower part of the module is illuminated. Using the same method, the output can also be disabled. In this status (“ON”-LED off), the axis is set to GND level.

The step module can be operated in either positioning or fine-positioning mode. Use the “START”-button to toggle between these two modes.

Note: The module can only be turned on and off in Fine positioning mode, i.e. whenever the display shows “x.xxxV”.

Positioning mode: The module shows “x.xxx:xx” on its display, corresponding to the positioner’s absolute position. By turning the “VALUE” knob, the set-position can be adjusted, causing the positioner to follow the input value instantly (closed loop).

In contrast to the closed-loop functionality of the “VALUE” knob, the switches “STEP” and “CONT” allow open loop positioning. By pressing the “STEP”-switch, the positioner makes a single step, whereas pressing the “CONT”-switch causes the positioner to make continuous steps as long as the switch is held. If the “CONT” and the “STEP” switches are pressed simultaneously, the continuous stepping mode is enabled until one of these switches is operated again. The travel direction of the positioner depends on the direction these switches are pressed and will be indicated by respective yellow LEDs (up-arrow: forward (FORW); down-arrow: backward (BCKW)).

Note: If “Automatic Amplitude Control” of the corresponding axis is turned off, the “VALUE”-knob of the master module can be used to select the desired driving voltage for the “STEP” as well as the “CONT”-positioning.

Fine positioning mode: The display shows “x.xxxV”, corresponding to the DC voltage applied to the piezo element. By varying this voltage (turning the “Value”-knob), the position of the translation stage can be varied with nanometer resolution. The standard positioning functions of both “STEP” and “CONT” switches are also accessible in this mode.
VI.3   ANC350 Scan Driver (Scan Amplifier and Module)

With the Scan module, a dedicated scanner (providing a linear movement proportional to an applied voltage) can be operated. The scan module has different modes of operation and can be driven by both an internal and external voltage source, working either as voltage supply or as voltage amplifier.

To turn on the scan module, put it in “FOCUS” first by either pressing the “MODE” button or turning the “Value” knob. Next, enable the output by pressing and holding the “MODE” button for approx. two seconds. An operational Scan module is indicated by yellow illuminated LEDs (DC-IN / INT), located in the lower section of the front panel. The module can also be disabled by pressing and holding the “MODE” button; in this case, the LEDs are switched off and the output is set to GND.

After turning on the unit, the display shows “x.xxxV” by default, corresponding to the DC voltage being applied to the piezo element. Simply adjust this voltage by turning the “VALUE” knob for manual operation. The adjustment step size can be varied in three steps from “x0.01” to “x1.0” by pressing the knob. A yellow LED indicates a “x0.1” and “x0.01” setting; without any LED illuminated, the step size is “x1.0”.

The ANC350 Scan module has three working modes: “INT”, “DC-IN” and “INT & DC-IN”. To toggle between these modes, simply press the “MODE” button and confirm your selection by pressing the “VALUE” knob.

**INT:** In this mode, an internally generated DC-voltage of up to 140V is supplied to the respective axis. The voltage magnitude can be adjusted by turning the “VALUE” knob, as described above. The INT mode is indicated by a yellow illuminated “INT” LED.

**DC-IN:** Here, an external DC-voltage of 0…10V is amplified by a factor 14 and supplied to the scanner. If this mode is activated, the yellow “DC-IN” LED is lit. The external DC-voltage needs to be connected to the “DC-IN” BNC connector on the Scan Driver’s front panel.

**INT & DC-IN:** In the third mode, an internal offset is added to the externally supplied and amplified voltage. This mode is activated when both LEDs are illuminated. The magnitude of the internal offset can be adjusted by turning the “VALUE” knob.

**Note:** Unless a mode selection is confirmed by pressing the “VALUE” knob, the scan module is still in its previously confirmed mode. This safety feature is meant to avoid unintentional mode changes.

**Caution:** The output of the Scan Driver is differential, so in case of the maximum voltage the negative output is set to -70V. Be careful with using BNC connectors in your setup.
VI.4  ANC350 Scan Driver+ (Dither Module)

The ANC350 Scan Driver+ differs from the standard scan module by having four additional working modes. To toggle between these modes, simply press the “MODE” button and confirm your selection by pressing the “VALUE” knob.

**AC-IN:** In this mode, an external AC-voltage of 0...10V amplitude is amplified by a factor 14. A yellow “AC-IN” LED indicates operation of this mode. The external AC-voltage needs to be connected to the “AC-IN” BNC connector on the module’s front panel (located in the lower left corner).

**AC-IN & DC-IN:** The external AC-voltage is added to the external DC-voltage and then amplified by a factor of 14. The “AC-IN” LED together with the “DC-IN” LED indicate this mode.

**AC-IN & INT:** The external AC-voltage is added to the internal DC-voltage and then amplified. The “AC-IN” LED together with the “INT” LED indicate this mode.

**AC-IN & DC-IN & INT:** In this mode, the external AC-voltage, the external DC-Voltage, and the internal voltage are added and afterwards amplified by a factor of 14. The “AC-IN” LED in combination with the “DC-IN” LED and the “INT” LED indicate this mode.

The additional “AC-IN” option makes the Scan Driver+ the module of choice for atomic force microscopy.

**Note.** Unless a mode selection is confirmed by pressing the “VALUE” knob, the dither module is still in its previously confirmed mode. This safety feature is meant to avoid unintentional mode changes.

**Note.** In contrast to the step and scan module, only one dither module can be integrated into the ANC350 controller.
VII. Software

VII.1 Hardware Requirements

A standard x86-PC with a USB 2.0 port is required to operate the system the ANC350 Motion Controller.

VII.2 Operating System

The current version of the ANC350 software is compatible with Microsoft Windows 2000 ® and Microsoft Windows XP ®. Corresponding drivers are included on the installation CD.

Note. In order to control the ANC350 Motion Controller, both hardware driver and DAISY software need to be installed. Driver and software are installed separately, see sections VII.3 and VII.4.

VII.3 Hardware Driver Installation

Connect the USB cable to both computer and ANC350 Motion Controller. Once connected, the new hardware wizards (shown to the left) will pop up. Do not let the wizard search for drivers automatically; instead choose: ‘No, not this time’ as indicated in the screenshot to the left. Choose “Next” to get to the next window.

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In the subsequent window, choose “Install from a list or specific location (Advanced)”. Click “Next”.

In the next window, cause the wizard to search for the driver at a defined location. Check: “Include this location in the search” and choose either the CD-ROM path if the driver is installed from CD or the path where you copied the folder ANC350 Driver to.

If installing from CD, choose the following path:
\Software\Hardware_Driver\ANC350_Driver\.
Click “Next”.
In some cases, another window may pop up claiming that the driver didn’t pass the Windows®® Logo testing. Select ‘Continue Anyway’.

Finish the installation by pressing the ‘Finish’ button.
VII.4 DAISY Software Installation

For the installation of the DAISY software, please copy the folder \\Software\\ANC350\Software\\ANC350_GUI on the enclosed CD and all of its content to a new folder on your hard drive. In order to launch the software, simply execute the file daisy.exe within the new folder (no installation program is required). If desired, a shortcut to the program can be created on the desktop.

![daisy.exe]

When initially executing the file “daisy.exe”, an error message may appear in case the Microsoft Windows XP® firewall is activated. Choose “Do not block again” to go ahead.

Other firewalls may show slightly different warnings.
VIII. Starting the System

The ANC350 positioning system can be fully controlled with the DAISY software. In the following, a detailed description on how to operate this software is given.

VIII.1 Starting the System – Main Window (DAISY)

After launching the software [Daisy.exe], the ANC350 hardware is automatically booted, causing the following window to appear.

First of all, check if the (left) status LED in the lower right is illuminated, verifying a proper connection between ANC350 and the host PC. The are three LEDs in this software window, having the following functionalities:

left LED: “Connection to Server” → green if connection to the ANC350 is established, otherwise red.

middle LED: “Receiving Data” → always grey when using an ANC350

right LED: “Data Overflow” → always grey when using an ANC350

If the left LED is illuminated red, check all connections and driver installation.

The ANC350 can be connected to the host PC via USB or Ethernet. By starting up the system, the software will look for connected ANC350s. Any motion controller connected via USB will be linked first. Note: Only one ANC350 can be connected at one time with the DASiY.
The following symbols, located below the menu bar, allow fast access to several important functions as described below. The same commands are, however, also accessible from the menu bar itself.

- **open** a user interface
- **save current data** (settings, etc.) into a user interface (.ngp data). Choose “ANC350.ngp” when using the ANC350 or create your own file.
- **close** an user interface
- **detach** the user interface window from the DAISY environment
- **move** detached user interface back to the DAISY environment
- **immediate snapshot** of all displays
- **snapshot of all displays** when completed next time
- **start** application server, only active (yellow) when there is no connection, otherwise grey
- **shut down** application server, only active (blue) when there is a connection, otherwise grey
- **open the settings** dialog of the DAISY software
VIII.2 Starting the GUI

To open up the ANC350 user interface window, select “File/Load File” from the menu or press the open button ➤, respectively. Now, select an ANC350 profile (*.ngp-file). This can either be the attocube preset “ANC350_x.ngp” (where “x” represents the number and types of modules integrated in the controller) or an individually created file. Press “Enter” after selecting a profile. The ANC350 graphical user interface (GUI) will appear (see figure on the next page).

**Note:** Generally, an ANC350 GUI profile (*.ngp-file) is built from individual panels (*.ngc-files). In simple words, these panels are input arrays for axis controls, trigger settings, global settings, and update procedures. In addition, the panels include all parameters necessary for the positioning or scanning process.

The user has the possibility to open, close, or alter panels and save the created individual profile with the command “File/Save as …”.

The main window of the attocube profile “ANC350_x.ngp”, for example, combines the axis control panels for x axes and the global settings panel. To switch between the individual panels, simply choose the corresponding flag on top of the window. It is also possible to place several axis control windows next to each other by detaching them from the DAISY environment (double click on control window or using the ➤ button).
VIII.3  Software – Axis Control

The following figure shows the features available for each axis:
The software allows entering values of some parameters such as (among others) the position, amplitude and frequency of a positioning stage into specific fields.

Note: All values typed into respective input fields need to be within a certain range allowed by the software. Entered values need to be confirmed by hitting the “Enter”-button. Unless a value is confirmed, the ANC350 is using the last confirmed value.

With respect to input confirmation, three different display modes may appear:

A green box indicates an allowed value which needs to be confirmed
A red box indicates a value not inside the allowed range
A white box indicates an allowed and confirmed value

Note: Before operating an axis the “Actor Profile” of the connected positioner needs to be loaded into the software. The specific command to perform this action is located in the “Manual Positioning” array and will be described in detail later. This procedure will import positioner-characteristic parameters into the GUI and guarantees an accurate positioning.

In the following, the different features available for each axis will be explained in detail:

**Position** This indicator displays the current position of the positioner connected to the respective axis. The unit corresponding to the indicated number is given in the brackets after the number. If a rotary positioner (ANR) is used, an additional counter indicates the number of revolutions.

**Linear positioner:**

```
  Position
      2701.980  [ um ]
```

**Rotary positioner:**

```
  Position
      20.000  [ deg ]
  Rot. Count  1
```
Reference

This display refers to the /NUM system only. In contrast to the /RES system, reading out an absolute position, the /NUM system uses an incremental encoding method. Each /NUM positioner has its individual reference position, given by a physical marker on an optical grating mounted to the inside of the positioning stage. This reference is a physical mark on the sensor and does exist even after closing the DAISY software or shutting down the ANC350. The value indicated in the ‘Reference’-field corresponds to the distance between the position of the reference mark and the current zero-position. If the computer read-out is restarted, the positioner needs to be moved across the mark once in order to initialize its reference position.

Only after this process, the read-out provided by the software is accurate, indicated by a green LED “VALID”. If no referencing has been performed, the LED is lit red.

Reset

Pressing this button resets the current position to “0”. The reference value is updated automatically. This feature is only valid for the /NUM system.

Graphical Position Indicator

As an additional useful feature, the current position of a /RES or /NUM positioning stage is displayed by means of a graphical indicator. Depending on the positioner type (determined by the uploaded actor profile), either as a linear or a rotary progress bar is displayed. The marginal values are updated automatically as soon the positioner detects a mechanical end stop.

Automatic Positioning

The following controls determine the closed loop functions of the ANC350.

Linear positioning stage:

<table>
<thead>
<tr>
<th>Position</th>
<th>Absolute</th>
<th>Relative</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Hump detected | Moving | Target END | Single Cycle Mode |
Rotary positioning stage:

```
<table>
<thead>
<tr>
<th></th>
<th>Position</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rot Count</td>
<td>0</td>
<td>10 deg</td>
<td></td>
</tr>
<tr>
<td>Hump detected</td>
<td></td>
<td>Moving</td>
<td></td>
</tr>
<tr>
<td>Hump detection</td>
<td></td>
<td>Single Circle Mode</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Target END</td>
<td></td>
</tr>
</tbody>
</table>
```

**Position:** In this (input) box, the desired target position needs to be entered. This position may either be an **absolute value** or a **relative distance** which the positioner should travel. No movement of the positioner is caused unless either “Absolute” or “Relative” button has been pressed.

**Note:** You can enter the position in “µm” or “mm” simply by appending the respective unit after the input value. (In case of µm, “um” has to be entered into the input field).

**Rot. Count:** This box is used only in case of a rotator. In addition to the target position in degrees, an arbitrary number of additional full revolutions can be defined. (Single Circle Mode must be disabled)

**Absolute/Relative:** If an absolute positioning is selected by pressing the “Absolute”-button, the positioner travels from its current position to the target position entered in the “Position” field. If relative positioning is selected, the positioner travels a distance according to the entered value. In this case the, entered value is **added** to the current position.

**Note.** During controlled positioning, no other functionality of the software is available. However, the controlled positioning can be stopped at any time by re-pressing either the “Absolute” or “Relative”-button.

**Reference:** By pressing this button, the positioner travels to the **absolute reference position**, presuming a referencing motion has already been executed (**green** “Valid”-LED is illuminated).

In case of the /RES system, there is no reference position. Therefore, the “Reference” button is available only when using a /NUM positioner.

**Target GND:** The positioner will be grounded, if the target position is hit. There will be no correction of the actual position by applying a constant voltage to the positioner.
**Hump Detected:** This LED is illuminated red if the positioner reaches a mechanical end stop or if its movement is stopped by any other influence. Once a hump is detected the system either stops the positioning operation or continues running depending on whether the “Hump detection” is activated or not.

**Hump Detection:** By activating this box the positioner will automatically stop as soon as a mechanical stop of the positioning stage is reached.

**Moving:** Whenever the axis is operating, i.e. the positioning stage moving, this LED is illuminated green until the positioner stops its motion.

**Single Circle Mode:** This setting is only relevant in case of a rotary positioner (ANR). If the “Single Circle Mode” is activated, the rounds of rotation are not counted and absolute or relative positioning is only allowed up to a full circle. In absolute positioning the rotator also takes the shorter way. Deactivating this box allows a positioning of targets more than 360deg away from the current position and the rounds of rotation are relevant for the position.
**Manual Positioning**

By operating the controls within the “Manual Positioning” window, a positioner connected to the ANC350 can be driven manually via the software interface.

<table>
<thead>
<tr>
<th>Manual Positioning</th>
<th>Amplitude</th>
<th>DC Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Step</td>
<td>30 V</td>
<td>0 V</td>
</tr>
<tr>
<td>Continuous</td>
<td>300 Hz</td>
<td>1000 Hz</td>
</tr>
<tr>
<td>Endless</td>
<td>0.3 µm</td>
<td></td>
</tr>
</tbody>
</table>

**Single Step:** The positioner travels one step in the selected direction with each actuation. The step size is determined by the “Amplitude” value.

**Continuous:** The positioner travels in the selected direction as long as the button remains actuated or a stop is detected [if hump detection is enabled]. The step repetition frequency is given by the field “Frequency”.

**Endless:** This button latches when pressed causing the positioner to move until the button is unlatched (pressed again) or a stop is detected [if hump detection is enabled].

**Amplitude:** Value for the drive voltage of the piezo drive. By changing this value the step size of the positioner can be varied. The allowed voltage values range from 0V to 70V.

**DC Level:** The “DC Level” box is both indicator and input for the applied DC-voltage to the piezo.

**Frequency:** Here, the desired frequency of the voltage signal applied to the piezo translation stage can be entered. The frequency is proportional to the travel speed of the positioner. The allowed frequency value range from 1Hz to 2kHz.

**Speed:** Indicates the positioner’s current speed of travel, either in “µm/s” in case of a linear positioner or in “deg/s” in case of a rotary positioner/goniometer.

**Step Width:** Indicates the positioner’s current step size, either in “µm” in case of a linear positioner or in “deg” in case of a rotary positioner/goniometer.

**Note.** In general, piezo elements change their properties due to different environmental conditions such as heavy loads or low temperatures etc. In order to maintain a constant travel speed or step width, however, it is possible to activate a specific “Amplitude Control” mode.
**Amplitude Control:** There are three different kinds of controlling the motion of a piezo drive:

- **Amplitude:** The properties of individual steps of the piezo translation stage are only defined by the amplitude entered in the “Manual Positioning” dialog above. The positioner is driven in an open-loop mode with the indicated amplitude. Travel speed and step width may vary in this mode.

- **Speed:** This feedback control enables a constant travel speed by a closed-loop control of the amplitude and frequency values applied to the piezo. The designated speed (displayed in the speed indicator) is set by adjusting the amplitude and/or the frequency value.

- **Step Width:** In this case the step size is regulated to a constant value. Here only the amplitude is closed-loop controlled and the travel speed may vary depending on the frequency value. The designated step width (displayed in the step width indicator) is set by adjusting the amplitude value.

**Output Enable:** By checking the “Output Enable” box the respective axis output is enabled. Deactivating this box sets the axis to GND.

**Load Actor Profile:** Pressing this button opens the browser window for the calibration/parameter files (*.apsz-files). To each attocube positioner, there is a corresponding parameter file (e.g. “ANPx101num.aps”,...).

By opening a parameter file, all parameters necessary for the operation of a positioner will be imported into the GUI. For convenience, an identification tag of the currently loaded parameter file is displayed next to the “Load Actor Profile” button. For stand alone use these parameter could also be saved to the controller (see VIII.8).

- Load Actor Profile
- LoadANPx101num.aps

**Ext. Coarse:** This will open a separate window which allows assigning the input trigger to the corresponding axis.

- Ext Coarse
- See Chapter VIII.7
**Sensor Status**  
This area gives information on the sensor status. After dis- and reconnecting a positioner, any button must be pressed to activate / update the values indicated in the sensor status environment.

**Error**: Indicates an error signal of the sensor. Normally, when a positioner is connected to the ANC350, this LED is in switched-off state (grey). If this LED indicates an error (red), please check the connection between positioner, ANC350, and the computer. If the error signal persists, the sensor may be contaminated or even damaged. In this case, please contact our attocube support team.

**Connected**: Indicates if a positioner is connected to the respective axis. A properly connected positioner will cause the LED to be illuminated green.

**Enable**: A green LED displays an activated axis. In the case of an ANC350/1 controller this means that only axis 1 is enabled, whereas in the case of an ANC350/6, all six axes are activated.

### Capacity Measurement
Pressing the Start button measures the actual capacitance of a connected positioner.

| Capacity Measurement | Start | Capacity: 0.372μF |
VIII.4 Software – Scanner Control

If the ANC350 is equipped with a scanner module, there is a Scanner Control interface available. This panel is either already loaded into your profile or needs to be opened manually. If already loaded, it can be found among the panel flags on top of the main window. If it needs to be opened, select the menu “File/Open” or press the open button and open the panel file (*.ngc) named “ANC350_scanner_axisx.ngc”.

![ANC350 Scanner Axis 6 - Daisy](image)

**Amplitude**  
In this box, the maximum amplitude allowed for the respective axis needs to be entered. This value represents the voltage limit of the DC Level defined in the subsequent input box. The maximum voltage generated by the ANC350 is 140V.

**DC Level**  
Defines the DC voltage generated for scanner operation. The voltage is limited by the value entered into the “Amplitude” input box.

**Output Enable**  
Indicates whether or not the output is enabled. An enabled output is signalized by a illuminated LED. To enable an output DC-In or INT have to be checked.

**Bandwidth Limit**  
Determines the status of the bandwidth limiter of the corresponding axis. Only applicable for scanner axes.

**DC In**  
By checking the “DC In” box, the DC-In BNC receptacle on the front panel is activated. Deactivating this box sets the input BNC to GND.
**Int**  By checking the “Int” box, the internal voltage source is switched on.

**Load Actor Profile**  Here, a scanner profile can be loaded into the GUI. This profile simply sets the maximum specified voltage applicable to the scanning device.

Pressing the “LoadActuatorProfile”-button opens the browser window in which the calibration/parameter files (*.aps-files) to be loaded can be specified. Open the corresponding file for the scanner in use.
VIII.5 Software – Dither Control

If the ANC350 is equipped with a Dither module, there is a Dither Control interface available. This panel is either already loaded into your profile or needs to be opened manually. If already loaded, it can be found among the panel flags on top of the main window. If it needs to be opened, select the menu “File/Open” or press the open button and open the panel file (*.ngc) named “ANC350_dither_axis7.ngc”.

![Dither Control Panel]

- **Amplitude**: In this box, the maximum amplitude allowed for the respective axis needs to be entered. This value represents the voltage limit of the DC Level defined in the subsequent input box. The maximum voltage generated by the ANC350 is 140V.
- **DC Level**: Defines the DC voltage generated for scanner operation. The voltage is limited by the value entered into the “Amplitude” input box.
- **Output Enable**: Indicates whether or not the output is enabled. An enabled output is signalized by a illuminated LED. To enable an output DC-In, AC-In or INT have to be checked.
- **DC In**: By checking the “DC In” box, the DC-In BNC receptacle on the front panel is activated. Deactivating this box sets the input BNC to GND.
- **AC In**: By checking the “AC In” box, the AC-In BNC receptacle on the front panel is activated. Deactivating this box sets the input BNC to GND.
**Int**  By checking the “Int” box, the internal voltage source is switched on.

**Load Actor Profile**  Here, a scanner profile can be loaded into the GUI. This profile simply sets the maximum specified voltage applicable to the scanning device.

Pressing the “LoadActuatorProfile”-button opens the browser window in which the calibration/parameter files (*.aps-files) to be loaded can be specified. Open the corresponding file for the scanner in use.
VIII.6 Software – Output Trigger Settings

The trigger settings module creates the possibility to generate position-dependent output/trigger signals which can be accessed at the 15-pin sub-D trigger connector of the ANC350. [see chapter V.1]

All Trigger signals are LVITL compatible, i.e. the high-signal value is 3.8V and the low-signal value 0V. [see chapter V.1]

To access the trigger settings module, select the menu “File/Open” or press the open button , respectively, and open the panel file (*.ngc) named “ANC350_trigger.ngc”.

All together, there are six trigger arrays available (see figure above), allowing to generate six position-dependent TTL signals.

A table with the pin configuration of the 15-pin Sub-D trigger output,
located at the backside of the ANC350, is shown in chapter V.1.
The trigger input parameters are as follows:

**Position low**  Position value at which the trigger signal is initialized.

**Position high**  Position value at which the trigger signal is aborted.

*Note.* The trigger low position needs to be smaller than its respective high value.

**Polarity**  The polarity indicates whether the signal is high or low in between the two trigger positions “low” and “high”.

**Axis**  Number of Axis controlling the trigger signal.

**Epsilon**  Threshold at which the trigger signal is initiated and aborted, respectively, relative to its actual boundaries. Recommended values are:

ANR rotary positioners: Epsilon = 5mdeg

ANP linear positioners: Epsilon = 1μm
VIII.7 Software – Input Trigger Settings

The external coarse settings module creates the possibility to respond to input trigger signals which can be accessed at the 15-pin sub-D trigger connector of the ANC350. [see chapter V.I]

All Trigger signals must be LVTTL compatible, i.e. the high-signal value is 3.8V and the low-signal value 0V. [see chapter V.I]

**Ext. Coarse:** This will open a separate window which allows assigning input triggers to the corresponding axis:

**Trigger No.:** There are 7 options available:
- Set no trigger
- Set trigger number 1
- Set trigger number 2
- Set trigger number 3
- Set trigger number 4
- Set trigger number 5
- Set trigger number 6

**Trigger Edge:** The trigger edge can be switched between raising edge and falling edge

**Coarse Dir:** The direction of the initiated step can be chosen.
VIII.8 Software – ANC350 Global Settings

Select the menu “File/Open” or press the open button , respectively, and open the panel file (*.ngc) named “ANC350_Global.ngc”.

**Static Voltage**  This control sets the voltage applied to the resistive readout system. The voltage can be set from 0.001 to 2.000V. Typically, a very small voltage (marginal heat generation) is used for low temperature applications, whereas higher voltages are used at elevated temperature (increased
resolution).

**Note.** Adjusting the reference voltage of the resistive readout system gives the user the opportunity to optimize his system according to his specific application.

Higher voltages enhance the sensitivity of the positioning and provide a better signal to noise ratio. Low voltages, however, minimize the heat dissipation making the system advantageous for low temperature applications.

**Save Settings** Press this button to save all axis parameters and global settings to your ANC350. This avoids reentering the parameters for subsequent usage and allows stand-alone operation of the ANC350.

**Clear Settings** Sets all parameters in your ANC350 to “0”.

**Flash Status** This LED displays whether or not the saving or clearing process is executed and properly finished. A yellow LED illustrates a working process still in operation.

**Temperature Status** This LED indicates the internal temperature status of the controller. When the internal temperature gets too high the LED will be illuminated and the outputs will be disabled.
IX. Closing the GUI and switching off the ANC350

To avoid malfunctions, always shut down the software connection between ANC350 and PC and exit the DAICY software before switching off the ANC350.

In order to shut down the user interface, select the “Close”-button . Now, the connection between the DAICY software and the ANC350 can be closed by selecting the button. Afterwards, please terminate DAICY by pressing the the cross in the upper right corner of the DAICY window.

X. DLL

To control the ANC350 without the attocube DAICY software, a *.DLL library including a detailed documentation is available. The library is found on the installation CD.

XI. LabView Driver

In addition to the DLL library, the installation CD also includes LabView™ drivers for all commands generated with LabView™.

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