BRUKER ADVANCED X-RAY SOLUTIONS

VÅNTEC-1 Detector

USER MANUAL

M88-E01072 5/05

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This manual covers the VÅNTEC-1 detector. To order additional copies of this publication, request the part number shown at the bottom of the page.

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1	Revised and expanded to contain integrated FDC information et al.

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1. Safety Issues

This manual contains notices which you should observe to ensure your own personal safety, as well as to protect the product and connected equipment. These notices are highlighted in the manual by a warning triangle and are marked as follows according to the level of danger:

WARNING

The word “Warning” indicates that death, severe personal injury or substantial property damage can result if proper precautions are not taken.

CAUTION

The word “Caution” indicates that minor personal injury or property damage can result if proper precautions are not taken.

NOTE: The word “Note” draws your attention to particularly important information on the product, handling the product or to a particular part of the documentation.

The symbol shown above is used whenever high voltage is present.

1.1 Qualified Personnel

The VÅNTEC-1 may only be set up and operated in conjunction with this manual. Only personnel authorized by Bruker AXS are allowed to work on this equipment. All repairs, adjustments and alignments performed on any components of the VÅNTEC-1 must be carried out strictly in accordance with the established safety practices and standards of the country where the equipment is installed.

1.2 Correct Usage

This device and its components may only be used for the applications described in this manual and only in connection with devices or components from other manufacturers which have been approved or recommended by Bruker AXS.

This product can only function correctly and safely if it is transported, stored, set up and installed correctly and operated and maintained as recommended by Bruker AXS. Protection provided by this equipment may be impaired if it is used in a manner not specified by Bruker AXS.

1.3 X-ray Equipment

WARNING

X-ray equipment produces potentially harmful radiation and can be dangerous to anyone in the immediate vicinity unless safety precautions are completely understood and implemented. All persons designated to operate or perform maintenance need to be fully trained on the nature of radiation, X-ray generating equipment and radiation safety. All users of the X-ray equipment are required to accurately monitor X-ray exposure by proper use of X-ray dosimeters.

For safety issues related to the operation and maintenance of your particular X-ray generator, diffractometer and shield enclosure, please refer to the manufacturer operation manuals or your Radiation Protection Supervisor. The user is responsible for compliance with local safety regulations.

WARNING

Voltage Danger—Before installing or servicing the detector, switch off the system to avoid high voltage.

Inside the VÅNTEC-1, voltages up to 15 KV DC occur which are not accessible from the outside. High voltages exist inside the detector and in the cables with the label “HV” connecting the detecting unit and the control rack. After turning off the system, high voltages are still present. They discharge over time. Wait a few minutes before removing cables from the controller unit. If one of these high-voltage components is damaged, switch off the system immediately and contact your local Bruker AXS Service Department (in the U.S.A., 1-800-234-XRAY).

WARNING

Sometimes complex D8 systems will be supplied by several power supply lines. The system and its components will be live until all power lines connected to the system are disconnected from the mains power supply.

The following warning symbols are displayed on the detector. Strictly obey all instructions and warning text printed on the labels attached to the various parts of the equipment.

WARNING

Wait 60 seconds after turning off HV power before removing HV connectors!

WARNING

X-ray window is Beryllium.

Any activity that scratches the window surface can generate airborne Beryllium dust which can cause lung disease if inhaled.

Beryllium metal in solid form, and as contained in this product, presents no special health risks.

For additional information, reference MSDS.

The rating plate is also displayed on the detector.

Model #: 672-_____
100-240 VAC
50/60 Hz, 120 W
Fuse Rating: F, 3.15 A, 250 V

1.4 Hazardous Materials

WARNING

The VÅNTEC-1 optic assemblies contain a beryllium window. Beryllium is potentially hazardous if ingested, inhaled or absorbed through the skin. Take care to avoid contact with the VÅNTEC-1 X-ray window. Never drill, grind or sand beryllium unless you are a qualified individual using appropriate respiratory equipment and dust containment and collection apparatus. Disposal of parts containing beryllium must comply with all applicable local and national regulations.

1.5 Proper Lifting

Installation of the detector requires lifting of components that weigh up to 43 lbs (19.5 kg). Whenever possible, two or more people should lift objects together. Use proper lifting techniques at all times. Use the following steps as an overview of proper lifting techniques.

1. Plan: practice the lift. While lifting, bend at the knees, keep your back straight, tighten your stomach and lift with your legs.
2. Position: keep your body close to the object you wish to lift—your stability increases the closer you are to the object. Keep your feet shoulder width apart.
3. Movement: avoid making awkward movements while holding a heavy object. Get help if the object is too heavy or cumbersome.

2. Introduction

This manual covers installation and basic operation of the VÅNTEC-1 detector.

The VÅNTEC-1 detector features the fastest simultaneous recording of X-ray diffraction patterns within a wide 2-theta angular range. When performing XRD experiments, the detector can be used either in fixed PSD mode (snapshot) or in locked coupled mode (similar to using a zero-dimensional scintillation counter). For powder XRD, the VÅNTEC-1 offers a reduction of the overall measurement time up to a factor of 100 in comparison to measurements executed with the commonly used zero-dimensional detector setup, providing a similar angular resolution. Furthermore, the fixed 2-theta mode allows measurement times down to 100 msec with about 12° 2-theta coverage for executing in-situ investigations like recording an “X-ray movie” of kinetic processes.

The active area of the detector is 50 mm by 16 mm (along the scattering plane respectively perpendicular). The simultaneously-recorded angular range, as well as the achievable angular resolution, are influenced by the sample properties, the selected measurement circle diameter, the used slit openings and the applied X-ray wavelength. Generally, the para-focusing Bragg-Brentano geometry and a larger measurement circle diameter result in a better angular resolution.

The VÅNTEC-1 detector is based on the patented Mikrogap™ technology. It offers all the benefits common with gaseous detectors, such as high signal amplification resulting in high peak-to-background ratio, high sensitivity for a wide range of X-ray wavelengths, and a good energy resolution. The Mikrogap™ technology allows operation at count rates much higher than those typically possible with gaseous detectors while maintaining all benefits. The

VÅNTEC-1 detector has energy resolution for all common characteristic X-ray emission lines from Cr through Mo; the default is Cu.

The factory settings are optimized for Cu-Kα. The electronic energy window allows the operator to set a discriminator window optimized for the X-ray wavelength used in the experiment, minimizing the background scattering or fluorescence impact on the recorded diffractogram.

3. System Description

Figure 3.1 - VÅNTEC-1 detector

The VÅNTEC-1 consists of four parts that are installed in the D8 system: the detector, the detector controller, the fast diffraction controller (FDC) and the optics. This section also contains information on the counterbalance and both integrated and external FDCs, as these components may vary depending on your configuration.

The newest VÅNTEC-1 configuration has the FDC integrated into the detector controller housing. Only three parts need to be installed in the D8 system: the detector, the detector controller, and the optics.

3.1 The Detector

The detector consists of a pressure vessel at 3.04 bar (3040 hPa, 3 ATM) with a back cover (see Figure 3.1). The VÅNTEC-1 is a single photon counting detector which converts the X-ray photons to electrical signals. The signals are amplified by three preamplifiers attached to the detector. The high-voltage filter and preamps are mounted into the back cover of the detector.

3.1.1 Detector Cables and Connectors

The back cover has six cable connectors:

- One connector for the preamplifiers' low voltage power supply
- Two cables for the detector's high-voltage supply
- Three signal outputs for the preamplifiers

Ten cables are delivered with the detector (see Table B.1 for part numbers):

- Ethernet crossover patch cable with RJ-45 connectors
- Power cable
- Motor clock cable
- Serial cable
- Three 15 ft (5 m) preamp cables (Ch 1, Ch 2, Ch 5)
- Low-voltage (detector) cable
- Power cable

For configurations with an external FDC, an additional power cord, serial cable, and TDC to FDC data cable are included.

Table 3.1 summarizes the detector specifications.

Detector Specifications	
Suitable systems	All D8 SUPER SPEED SOLUTIONS™ systems, all D8 systems, and the D4 ENDEAVOR
Active area	50 mm x 16 mm; 1,600 pixels (in the scattering plane x perpendicular)
Max 2-theta range simultaneously covered	12° at 435 mm measurement circle diameter, 11° at 500 mm
Usable wavelength range	From Cr-Kα up to Mo-Kα, factory-set default for Cu-Kα
Gas fill	3.04 bar (3040 hPa, 3 ATM) non-polymerizing Xe-CO_2 gas, no external gas supply required
Radiation hardness	> 10^{12} counts/mm^2
Readout dead time	None
Internal dead areas	None
Maximum local count rate	400,000 cps
Energy resolution	10% with ^{55}Fe radiation at 5.9 keV
Spatial resolution	< 50 μm, > 1,600 individual readout channels
Window type	Be
Voltage of power supply	100–240 V AC
Frequency of power supply	50/60 Hz
Power rating	120 W

Table 3.1 – Basic specifications of the VÅNTEC-1

Detector Specifications	
Detector overall dimensions and weight	3.5 in H x 3.1 in W x 7.5 in D, 4.4 lbs (90 mm H x 80 mm W x 190 mm D, 2 kg)
Controller chassis unit	5.25 in H x 19 in W x 16 in D, 35 lbs (133 mm H x 483 mm W x 406 mm D, 15.9 kg)
External FDC unit (if present)	3.5 in H x 19 in W x 16.25 in D, 10 lbs (90 mm H x 480 mm W x 410 mm D, 4.5 kg)
Length of cables between the detector and the controller chassis unit	16.4 ft (5 m)
Disconnect device	IEC 320 connector/plug on power supply cord
Software	DIFFRAC*plus* Measurement package version 2.4 or higher
Included in delivery	VÅNTEC-1 detector; front-end read-out and supply electronics; mounting and optics assembly, including Kβ-filter, 2.5° Soller slit and primary beam stop

Table 3.1 – Basic specifications of the VÅNTEC-1

3.1.2 Environmental Ratings

Table 3.2 shows the range of environmental conditions for which the equipment is designed.

Ambient temperature	41–104°F (5–40°C)
Operating temperature	57–93°F (14–34°C)
Maximum temperature gradient	± 0.9°F (± 0.5°C) per hour
Relative humidity	Max 80%, non-condensing, for temperatures up to 88°F (31°C) decreasing linearly to 50% at 104°F (40°C)
Location of use	Indoor
Altitude	Up to 1.2 miles (2000 m)
Mains supply voltage fluctuations	Up to ±10% of the nominal voltage
Overvoltage category	IEC 664 II
CE certification	See Appendix D
Pollution degree	2

Table 3.2 – Environmental ratings of the detector

3.2 The Detector Controller

The detector controller currently has the FDC integrated within the detector controller. Previous configurations have an external FDC unit. Both configurations are discussed in this manual.

3.2.1 Identifying Integrated and External FDC configurations

Older detector controllers contain the electronic circuit boards for signal processing, the detector (high-voltage) power supply, a power supply for the detector preamplifiers, the Constant Fraction Discriminator (CFD) boards, the Time to Digital Converter (TDC) boards, and all electronic assemblies. All of these units are placed within the same 19" housing as shown in Figure 3.4.

In these older configurations, the FDC is an external unit.

Newer detector controllers have FDC controller integrated within the detector controller chassis.

To determine which type of detector controller you have, simply examine the rear panel of the detector controller.

External FDC: The uppermost slot on the right-hand side of the detector controller's rear panel contains both a DB9 male connector and a DB25 male connector (Figure 3.2).

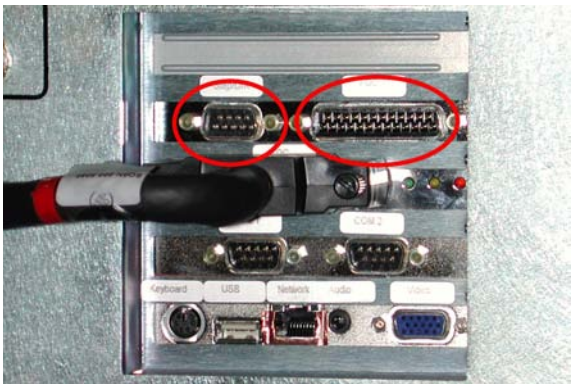

Figure 3.2 - External FDC identification

Integrated FDC: The uppermost slot on the right-hand side of the detector controller's rear panel contains only a DB9 male connector. The DB25 male connector is missing (Figure 3.3).

Figure 3.3 - Integrated FDC identification

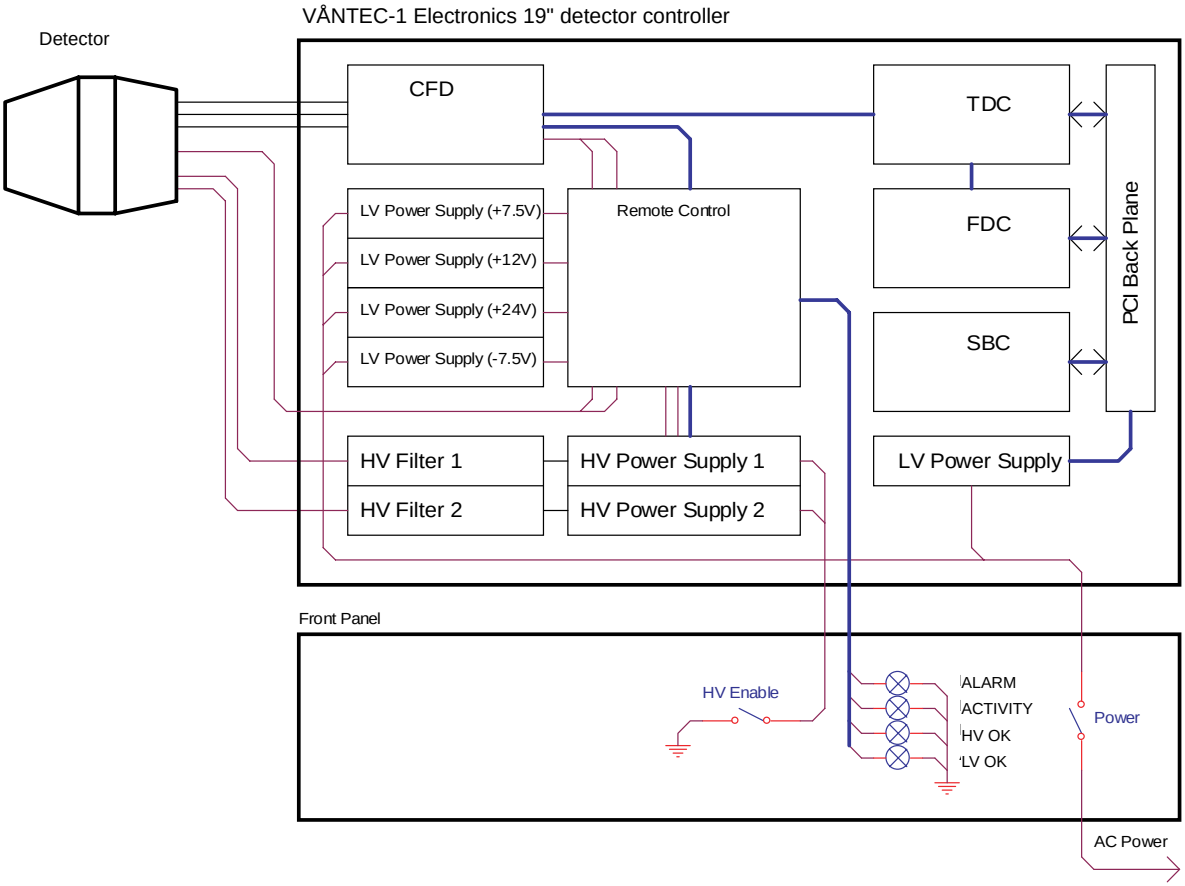

Figure 3.4 - Block diagram of the detector controller

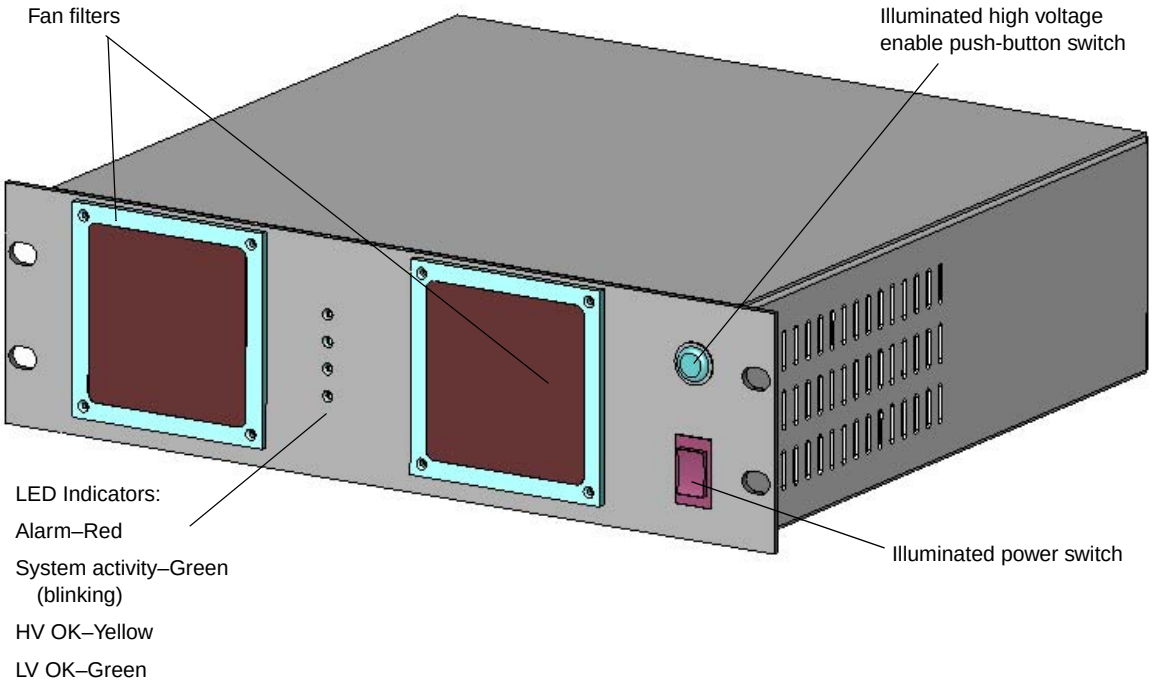

Figure 3.5 - Detector controller (outside, front)

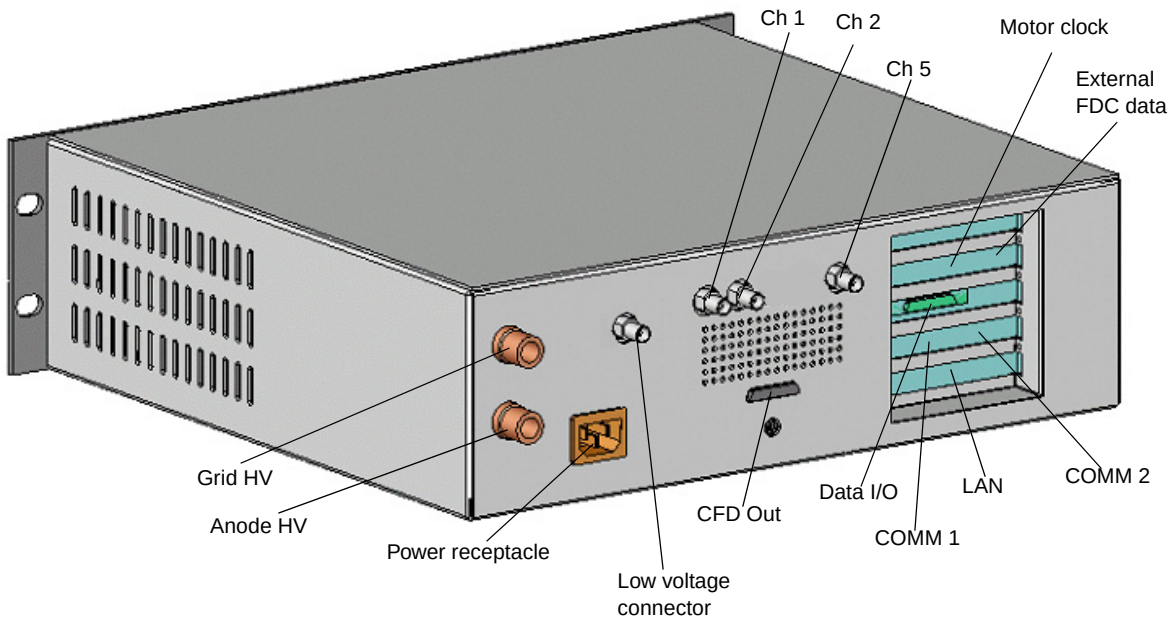

Figure 3.6 - Detector controller (outside, back)

3.3 The External Fast Diffraction Controller (FDC)

The FDC is a microprocessor unit for control and data readout of the VÅNTEC-1 detector. It is wired to the computer's diffractometer control data connection chain.

Features:

- LCD display (132 x 39 mm)
- Two serial interfaces
- Integrated multi-channel analyzer
- 19" unit
- Online display of the measured 2-theta diagram on the LCD display

NOTE: FDCs for the D5000 and D500 may need to have minor hardware modifications. Contact Bruker Service—have the serial number of the FDC available.

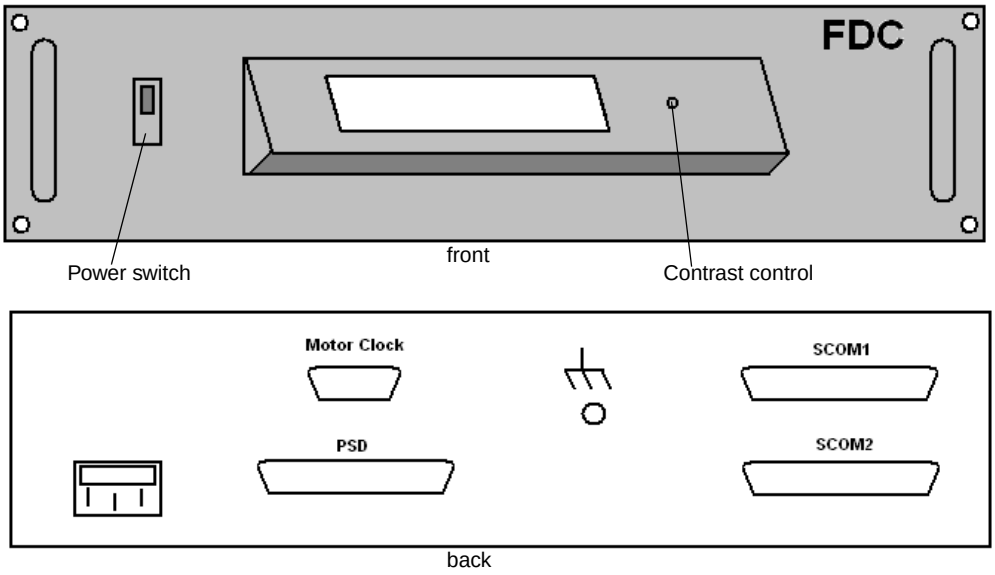

Figure 3.7 - FDC

The front display of the FDC will graphically show a selected subset of the measuring channels and three values.

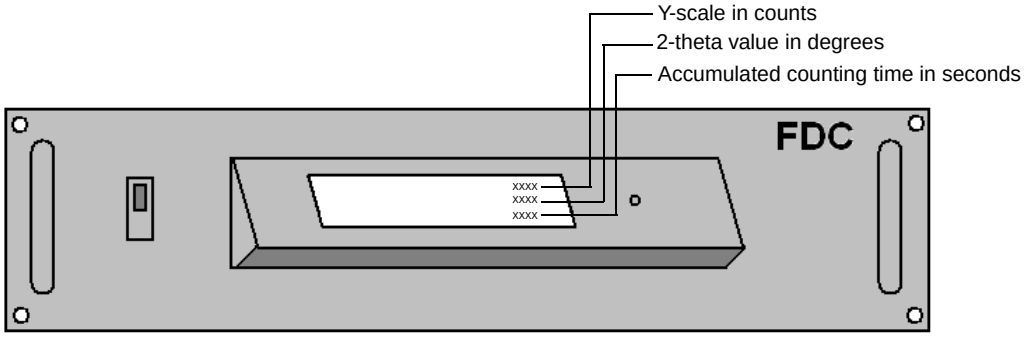

Figure 3.8 - FDC display for fast diffraction (locked-coupled) mode

3.4 Detector Optics

The optic of the detector consists of six components: detector window slits, Debye slits (optional), Kβ filter, anti-scatter slits, Soller slits (default 2.5°, 4.0° optional) and window opening scales.

The Kβ filter and Debye slits have notches which fix the slit in position when properly inserted. The anti-scatter slit assembly length used depends on the measuring circle, one for 435 mm and one for 500 mm (see Figure 3.9).

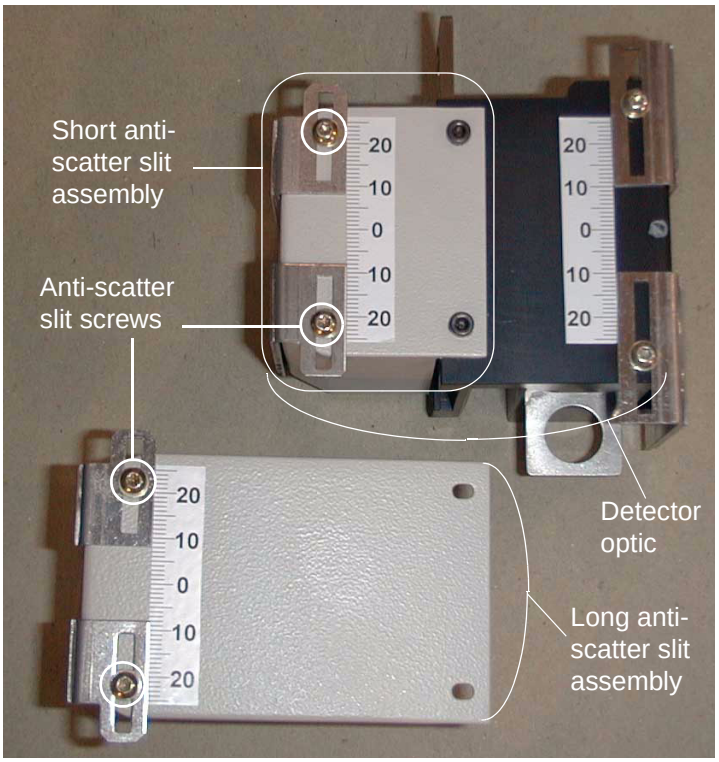

Figure 3.9 - Anti-scatter slit assembly options (short and long)

The optic of the detector consists of six components (see Appendix B for part numbers):

1. Detector window slits
2. Debye slits (optional)
3. Kβ filter
4. Anti-scatter slits (near sample window slits)
5. Soller slits
6. Window opening scales

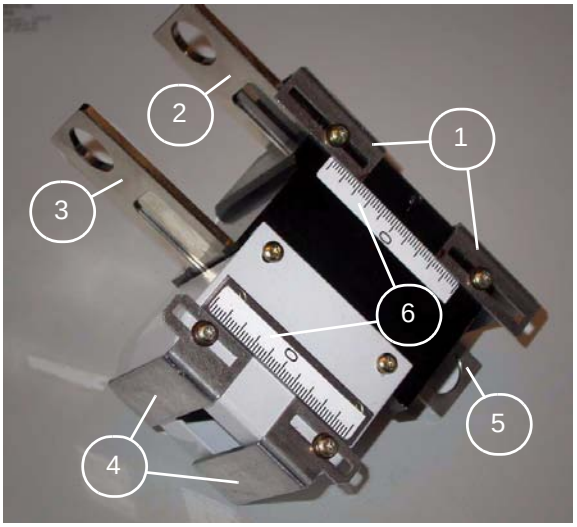

Figure 3.10 - Detector optic

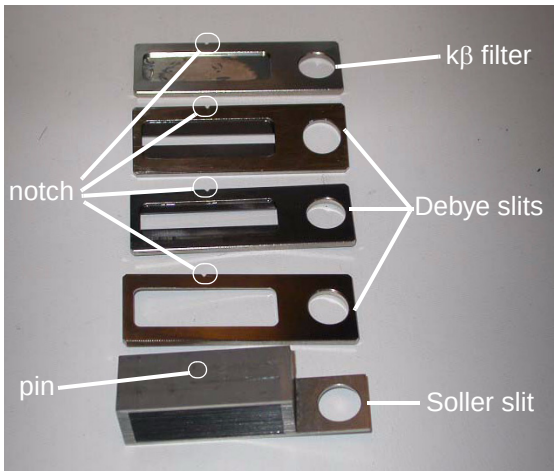

Figure 3.11 - Close-up view of slits/filter

3.4.1 Beam Stop

The beam stop blocks any X-rays from striking the face of the detector at low incident angles. The beam stop has three directions of movement.

1. Selects an adapter for the beam height (default height is 150 mm).
2. Adjusts beam stop for 401, 435 and 500 mm circles.
3. Adjusts beam stop up and down (height).
4. Adjusts beam stop tilt.

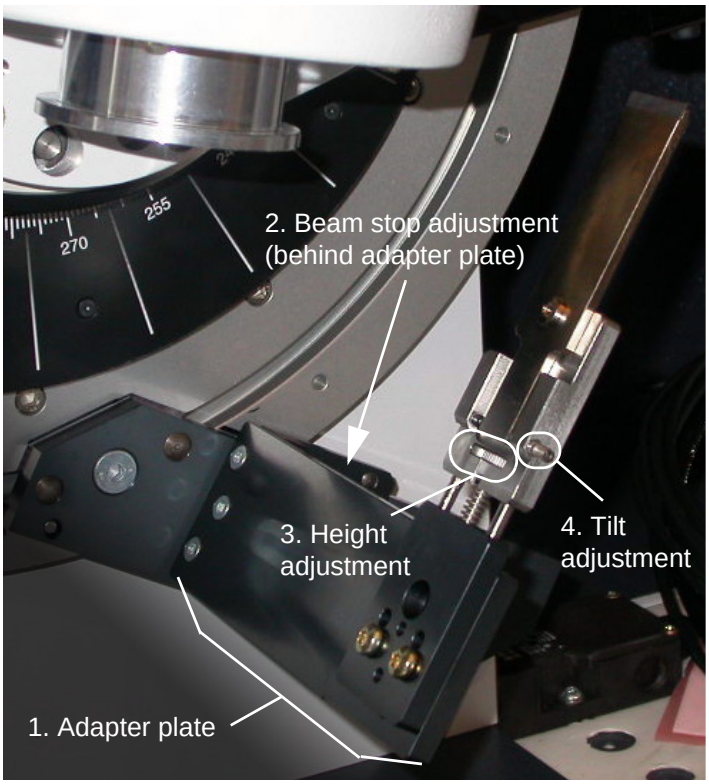

Figure 3.12 - Beam stop

3.4.2 Air Scatter Screen

The purpose of the air scatter screen is to reduce primary air scatter which influences the background of the diffraction pattern, usually at lower angles. The air scatter screen can be attached to the primary optics. The air scatter screen will mount to either the motorized or fixed primary optics or to the Göbel mirrors.

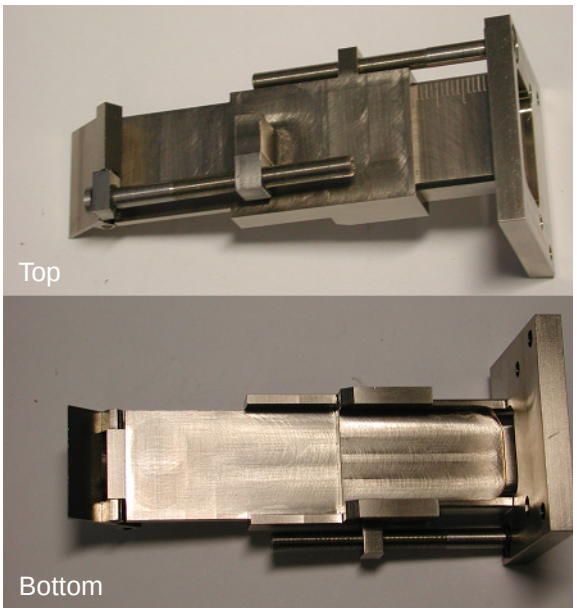

Figure 3.13 - Air scatter screen

3.4.3 Radial Soller Slit

The purpose of the radial Soller slit is to reduce both primary and secondary air scatter which influences the background of the diffraction pattern. The peak intensity phases, with small sample amounts, are determined more easily and can be detected earlier. The radial Soller slit is needed for the linear detector VÅNTEC-1, Göbel mirrors (Parallel beam geometry) or primary focusing monochromators in transmission mode. The final settings have to be tested with an intensity standard like NIST SRM1976 Corundum plate or NIST SRM640c Silicon powder filled in capillaries.

NOTE: The radial Soller slit cannot be used with Bragg-Brentano focusing geometry due to difference in the beam path. When using Göbel mirrors or primary monochromators, no Kβ filter is needed. Fixed mode measurements will also fail because only the center of the detector will show useful signals.

The radial Soller slit has two degrees of freedom (DOFs). Position the DOFs using dovetails and fine adjustment screws (see Figure 3.14). The first DOF is the translation movement along the tangent of the measuring circle (tangent axis) and the second is the radial movement along the radius (radial axis).

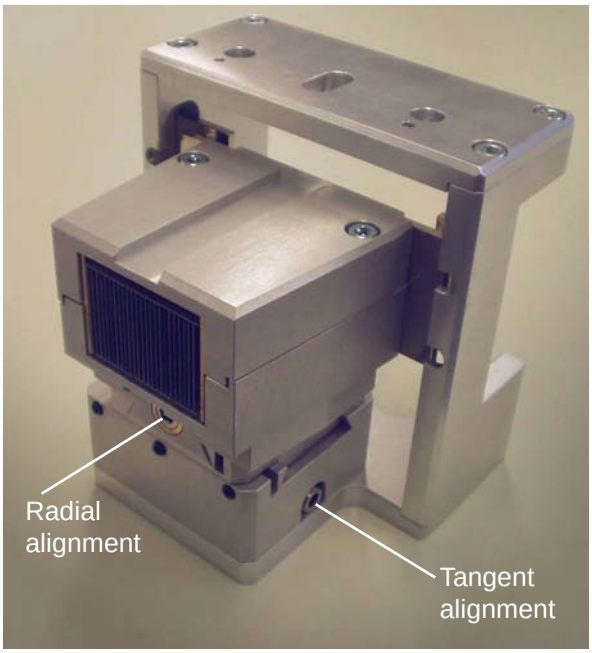

Figure 3.14 - Radial Soller slit

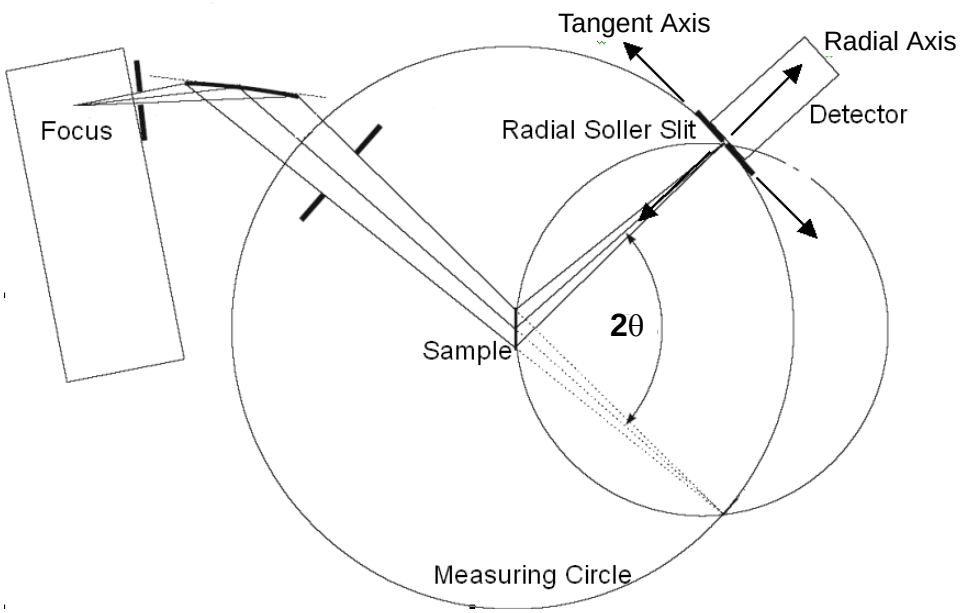

Figure 3.15 - Transmission ray tracing

3.5 Counterbalance

The counterbalance is located on the back of the goniometer. Figure 3.16 shows an example of a counterbalance on a θ/θ goniometer. The addition of a counterbalance provides smooth and flawless movement of the goniometer. The position of the counterbalance is based on the weight of the detector and optics, the measuring circle diameter, and the height of the sample stage. In order to ensure proper weight distribution, please use the tables below to select the correct position of the counterbalance for the detector system. Table 3.3 refers to the positions shown in Figure 3.17.

Stage Height (mm)	150	214	258
Circle Diameter (mm)	435	500	600
Handle	-4	-1	1
Weight	B	B	B

Table 3.3 – Position of the handle and weight for the counterbalance

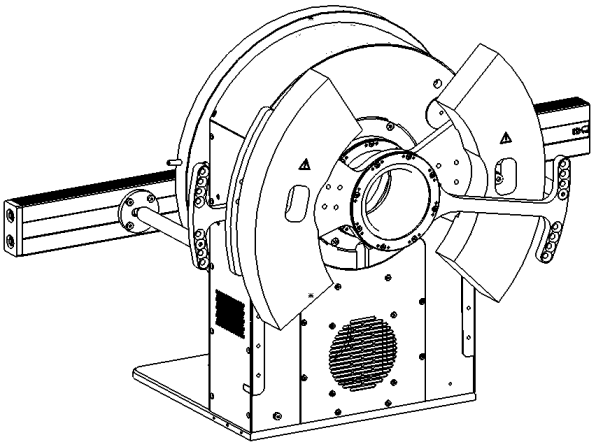

Figure 3.16 - Counterbalance on the goniometer

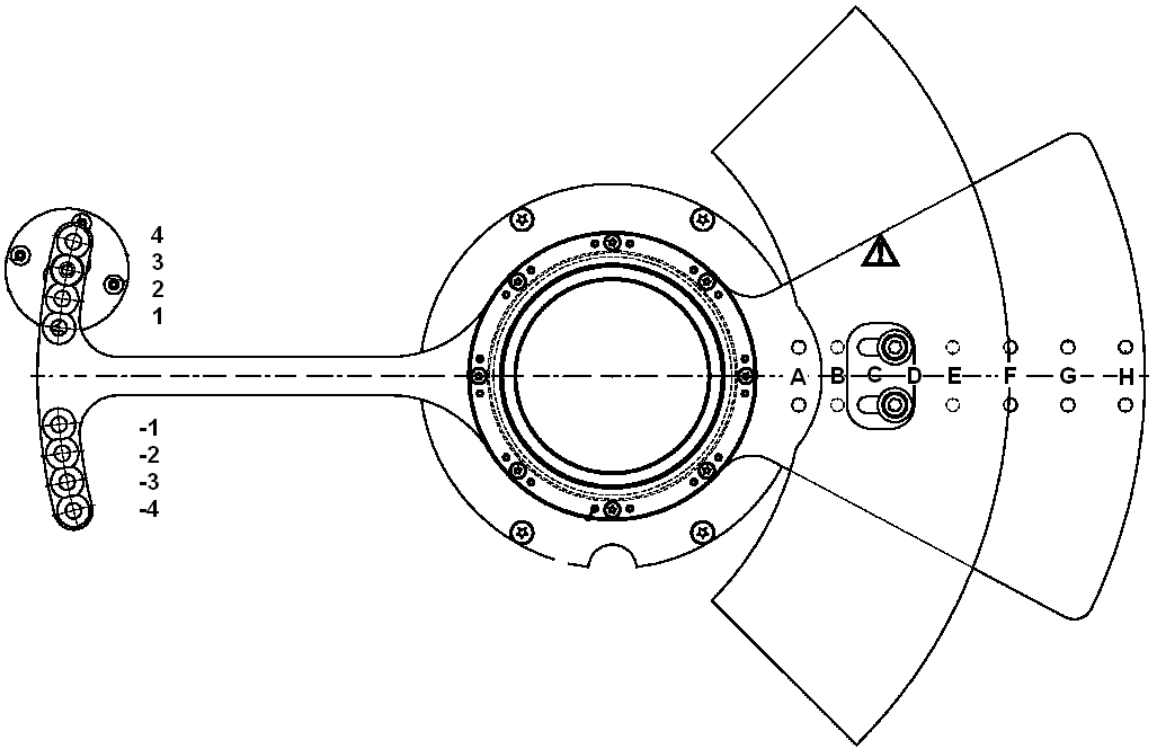

Figure 3.17 - Counterbalance positions

4. Hardware Installation for the D8 ADVANCE

This section describes hardware installation for a D8 ADVANCE.

4.1 Servicing Precautions

WARNING

When the equipment is connected to the mains supply, some terminals, components, and multiple power supply lines may be live. It is not sufficient to just press the D8 enclosure's Power OFF button (O) or the on/off power switch on the VÅNTEC-1 controller. The mains supplied to the system must be switched off externally.

CAUTION

Components attached to the goniometer will move during operation. Use proper lifting methods for the detector controller and the detector components.

4.2 Shipping and Unpacking

1. Check for external shipping damage to the packages.
2. Open the boxes containing the detector and its components.
3. Check for any damage to the components.
4. Inventory all items for completeness.
5. Save the packaging when practical for return shipping.

4.3 Baseline Data

Before making any installation or calibrations to the diffractometer, run and save a standard Bragg-Brentano scintillation scan using the settings in Table 7.1 or Table 7.2. The data file will be the baseline for comparison of the data collected using the VÅNTEC-1 controller. The baseline data should be collected with a standard reference material (SRM) like the NIST 1976 corundum plate (see the Instrument Verification Booklet M88-Zxx041 for additional system parameters).

4.4 Hardware Installation (for detector controllers with an external FDC)

The following sections discuss the integration of the detector in D4 and D8 systems in response to developments in the area of integrating the FDC with the second-generation D8 axis indexer board (AIB2G).

Beginning March 2005, the D8 FOCUS, D8 ADVANCE and D8 DISCOVER systems will be equipped with the AIB2G (C79298-A3220-B231 and C79298-A3220-B232).

- See Section 4.4.1 for detector controllers with external FDC (see Section 3.2.1 for identification).
- See Section 4.5 for detector controllers with internal FDC (see Section 3.2.1 for identification).
- See Section 4.6 for detector installation with A1B2G index board (D8 controllers installed after March 2005).

Use the following tools for this procedure:

- Torx screwdriver
- Allen screwdriver

Additional rails and hardware must be mounted to accommodate the VÅNTEC-1 controller and FDC in the D8. The location of the FDC and PSD controllers is critical for proper operation. There must be sufficient airflow around the controllers to prevent the electronics from overheating. Do not place the VÅNTEC-1 controller in close proximity to the generator. This may induce electronic noise in the detector electronics.

CAUTION

Use care when moving the detector head to avoid mechanical shock to the assembly.

See Table A.3 in Appendix A for the configuration scheme.

4.4.1 Mount the Rails

1. Additional rails (part number C79298-A3242-C115), item C in Figure 4.1, must be added to accommodate the FDC controller.
2. Relocate the existing rails, A in Figure 4.1, for adequate airflow.
3. Mount the rails so there is a minimum space of 1" between the detector and FDC controllers.
4. Mounting the rails requires removing the front and rear columns of the system. Remove the screws located at position B in Figure 4.1 to detach the columns.

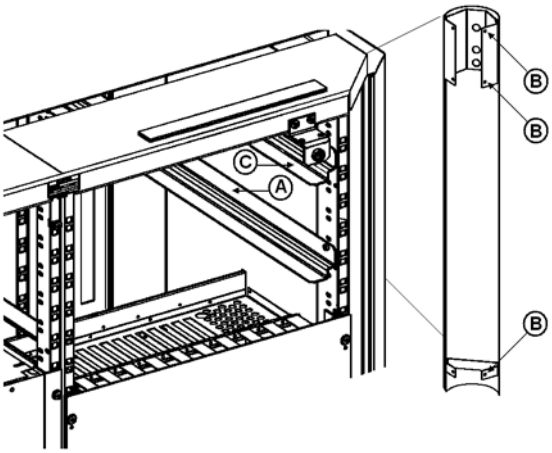

Figure 4.1 - Column and rail locations

4.4.2 Install the Controllers

Location of the FDC and PSD controllers is critical for proper operation. Whenever possible, place the VÅNTEC-1 controller above the D8 controller electronics (see Figure 4.2 for proper location in the D8). Allow at least 1" of open area around the top, bottom, and back of the units for adequate airflow. Remove the D8 front and side access panels and blank panels for the installation of the controllers.

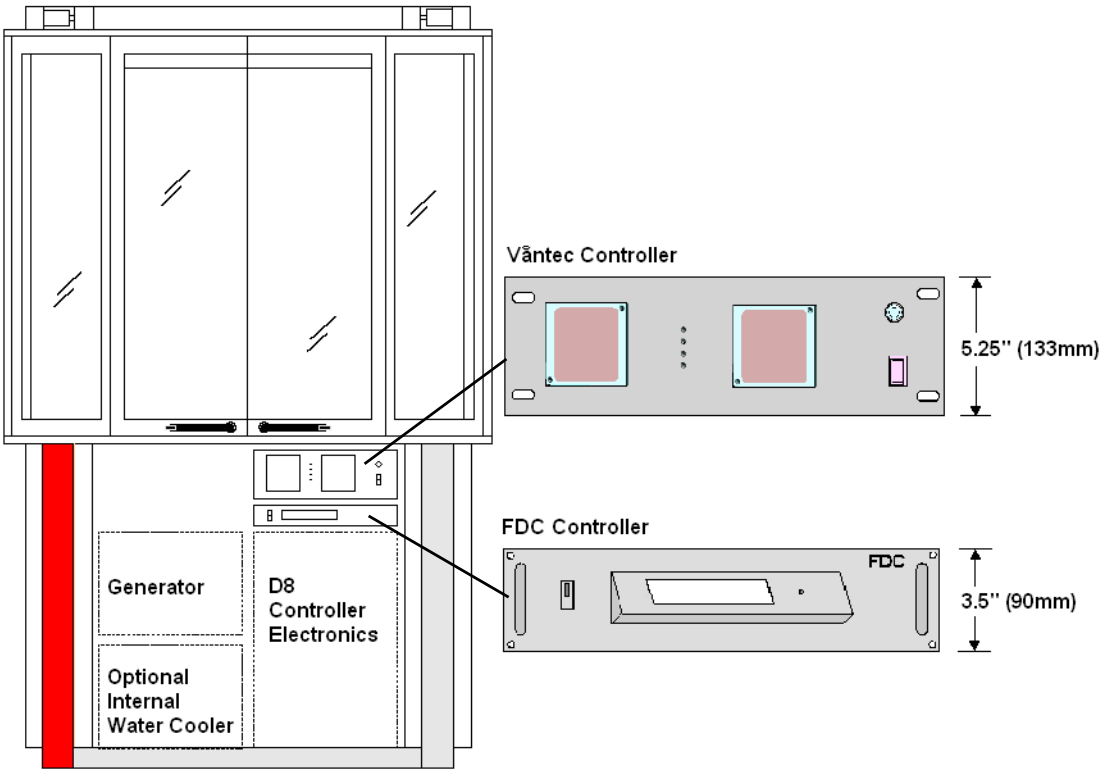

Figure 4.2 - Location of FDC and PSD controller within the D8 ADVANCE

4.4.3 Connect the Cable Wiring

See Figure 3.6 and Figure 4.3 for the connection of the wiring. Guide the (3) preamp, and (2) high voltage and low voltage wires through the safety labyrinth at the back of the D8 enclosure. Make sure that no cables will be pinched when closing the back cover. Use a serial cable initially to configure the VÅNTEC-1 controller for the final network connection.

Connect the following cables:

1. Connect the FDC controller, detector controller, control PC and D8 system like the configuration shown in Figure 4.3.

   1.1 Take the serial cables that are normally connected to the PC and connect them to COM 1/COM 2 of the VÅNTEC-1 controller, respectively.

   1.2 Disconnect the COM 1 cable on top of the D8 controller and connect it to the additional cable that is connected to SCOM 1 of the FDC controller.

   1.3 Connect the cable coming from SCOM 2 of the FDC controller to COM 1 on top of the D8 controller.

All connectors have a positive lock to ensure proper connection.

2. Connect the BNC type connector from CH 1 of the VÅNTEC-1 controller to the CH 1 connector on the detector head.
3. Connect the BNC type connector from CH 2 of the VÅNTEC-1 controller to the CH 2 connector on the detector head.
4. Connect the BNC type connector from CH 5 of the VÅNTEC-1 controller to the CH 5 connector on the detector head.
5. Connect the low voltage of the VÅNTEC-1 controller to the low voltage connector on the detector head.

NOTE: Use caution with the connectors and cables for the high voltage.

CAUTION

The connectors are made of a Teflon material, which can be damaged if not properly installed.

6. Connect the high voltage grid of the detector head to the high voltage grid connector on the VÅNTEC-1 controller.
7. Connect the high voltage anode of the detector head to the high voltage anode connector on the VÅNTEC-1 controller.

NOTE: The HV connector has to be properly aligned. This should be done at the factory.

8. Attach the grounding strap to the ground plate on the left-side panel.

Figure 4.3 is a system block diagram that illustrates the major detector system components and the cabling for communication.

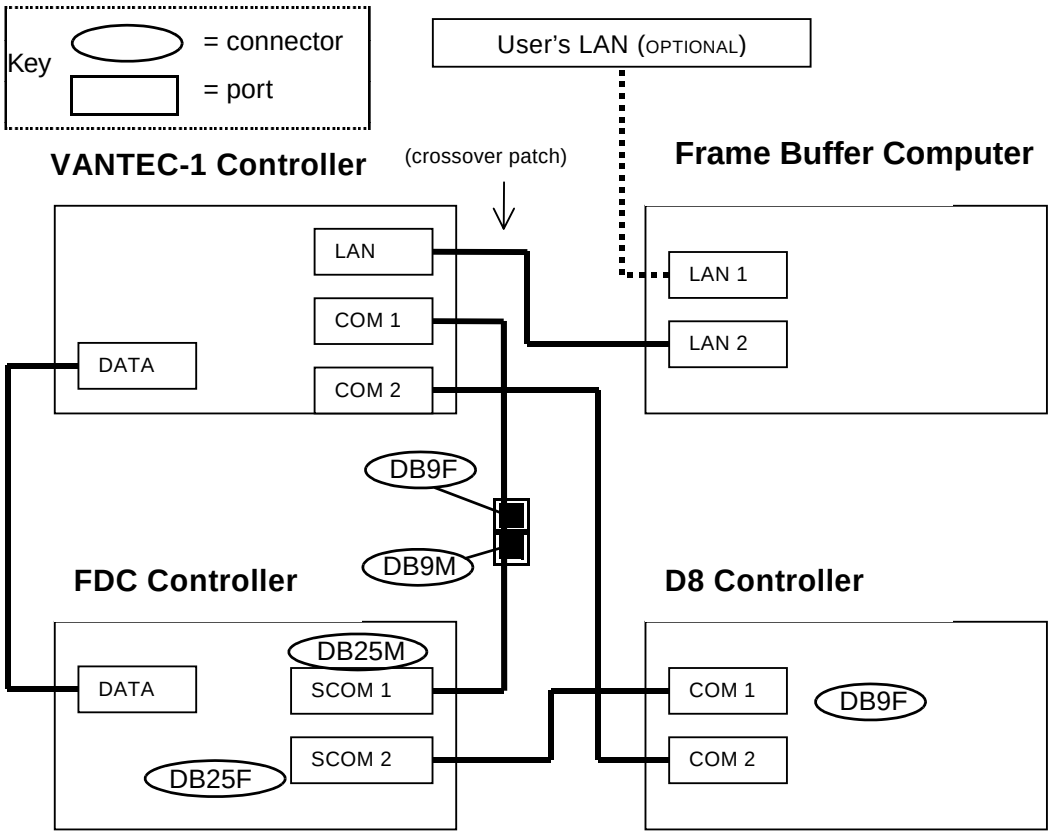

Figure 4.3 - Configuration setup

4.4.4 Connect the Power Supply

Check that the detector controller power cord is connected to X601 on the left side of the D8 enclosure. The FDC controller must also be connected to the mains power.

WARNING

Servicing Precautions—When the equipment is connected to the mains supply, some terminals of the mains distribution unit may be live. Therefore, it is absolutely necessary to switch off the external mains supply before opening the housings. It is not sufficient to just press the on/off power switch on the VÅNTEC-1 controller. The mains supply must be switched off externally on the customer's side (wall socket or external switch).

4.5 Hardware Installation (for detector controllers with an integrated FDC)

4.5.1 Mount the Rails.

1. Relocate the existing rails, A in Figure 4.4, for adequate airflow.
2. Mounting the rails requires removing the front and rear columns of the system. Remove the screws located at position B in Figure 4.4 to detach the columns.

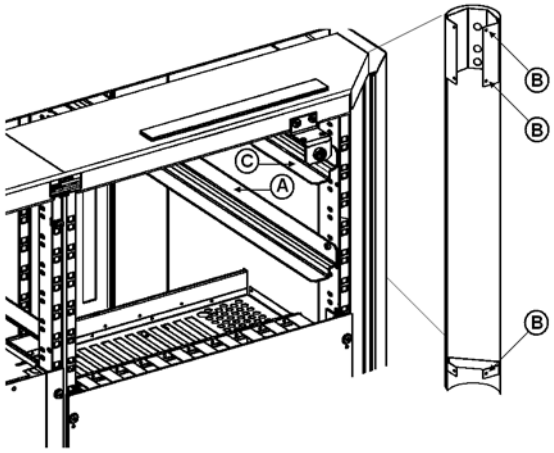

Figure 4.4 - Column and rail locations

4.5.2 Connections and Cable Wiring

The latest version of the VÅNTEC-1 runs with an integrated FDC located inside the detector controller. Cabling (see Figure 4.6) differs in 2 ways compared with Figure 4.3:

1. The serial cables, used for measuring and service, are connected directly between the COM ports of the detector controller and the D8 Electronics Rack. COM1 is for Measuring, COM2 is for Service.
2. The motor clock cable (A17-D42) must be connected between the 9-pin STEP/DIR port on the rear of the detector controller (see Figure 4.5) and either:

- For **D8 systems**, the X5 9-pin port on the B104 2-axis indexer board, or
- For **D4 systems**, the socket on the bracket of the B105 4-axis indexer board.

Figure 4.5 - Back panel of the VÅNTEC-1 detector controller. The circle shows the connection STEP/DIR for the motor clock signal.

Important: When replacing the clock signal cable for an external FDC, there is an additional adapter with two 9-pin plugs labeled either: “T-T” for D8 Theta-Theta goniometer, or “T-2T” for D4 or D8 Theta-2Theta goniometer (A17-D43).

After connecting the cables, switch on the detector controller and D8/D4 system.

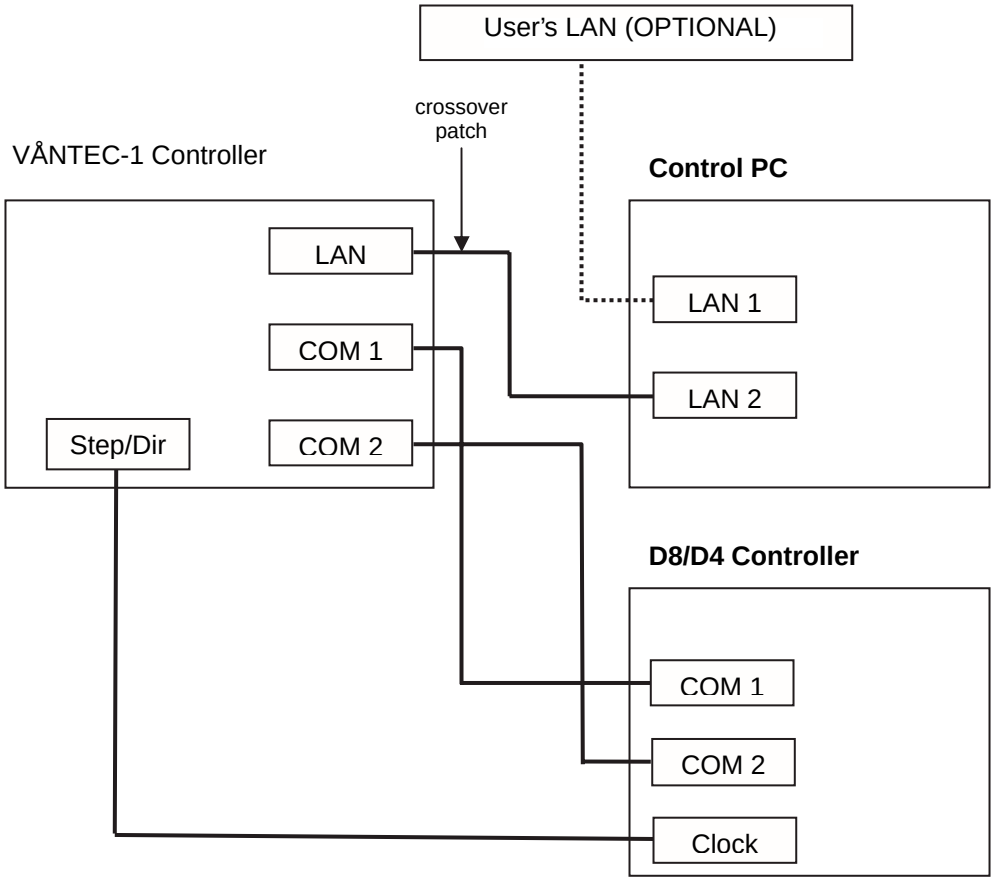

Figure 4.6 - Wiring of VÅNTEC-1 detector controller with integrated FDC

4.6 Install the Network Card

1. Prepare your computer and work area.
2. Turn off the power and unplug your computer.
   - 2.1 Do not attempt to open the computer case while it is on.
   - 2.2 Do not work on components inside of the computer while it is on.

WARNING

Risk of electric shock. Do not attempt the installation with power applied to the computer.

3. Open the computer case. Computer cases are held together in different ways—consult your computer's manufacturer for details.

   Removal of retaining screws may be required.

   Some models have plastic snaps at the corners or edges of the case. Release the cover with a squeeze or pull.

4. Select an open expansion slot on the computer's system board.
   - 4.1 Remove the cover plate (i.e., blank plate covering the opening). In most cases, the cover plate is held in place with a screw.
   - 4.2 The network card must fit into an appropriate and available expansion slot.
5. Insert and secure the card.
   - 5.1 The card should fit fully and squarely into the slot. The card may need to be rocked gently in order to get it to seat.
   - 5.2 Secure the card to the computer case with a screw.
   - 5.3 Check to make sure you have not dislocated other wiring or components.

CAUTION

Take care not to damage components of the card or touch the connector edge. The network card and its components contain electrostatically sensitive devices. Before touching the network card, the servicing people should discharge themselves by touching an earthed, grounded object.

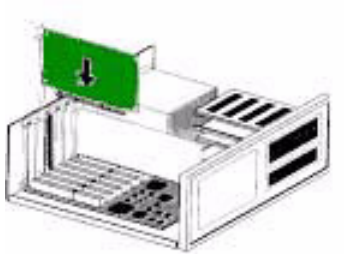

Figure 4.7 - Insert the network card

6. Replace the case. Secure any screws.
7. Turn on your computer and allow it to boot-up normally.
8. To complete the installation, go to Section 6.

4.7 Installation of the detector controller using second-generation indexer boards (AIB2G)

The cabling and configuration of a VÅNTEC-1 running with the second generation of Axis Indexer Boards (AIB2G) is different than that mentioned in Section 4.4.3. This section describes cabling and configuration of a VÅNTEC-1 with AIB2G.

4.7.1 Requirements

- 2 Axes Indexer Boards C79298-A3220-B231 for D8 systems
- 4 Axes Indexer Boards C79298-A3220-B232 for D4 and D8 systems
- DIFFRAC*plus* Measuring Package Release 2.4.1
- D8 Controller Firmware 3.0
- D4 Controller Firmware 2.0

4.7.2 Connection and Cable Wiring

The cabling differs in one way compared to that in Figure 4.6:

1. The motor clock cable (A17-D42) has to be connected between the 9-pin socket STEP/ DIR of the Detector Controller or external FDC and either:

- For **D8 systems**, the X5 9-pin socket on the B231 2-axis indexer board, or
- For **D4 systems**, the socket on the bracket (X11) of the B232 4-axis indexer board.

Figure 4.8 - Clock signal cable (A17-D42)

NOTE: The clock signal cable can be one of two cables, one straight and one Y-shaped. If you are running the system with the AIB2G, NEVER use the Y-shaped adapter cable (A17-D43) in any case!

After connecting the cables, switch on the detector controller and D8/D4 system.

Figure 4.9 - Y-shaped adapter cable (A17-D43).
NOTE: Use only for first-generation indexer boards (AIB) B104/B105.

4.7.3 Hardware Installation

Configure the VÅNTEC-1 detector as shown in Figure 4.6. Connect the AIB2G to the system.

CAUTION

NOTE: Power down the complete D8 system before changing circuit boards on the D8 Controller Rack. Changing boards in the D8 Controller Rack without powering down the system can damage both the boards and the Controller Rack.

CAUTION

NOTE: Never mix old and new Axis Indexer Boards! The boards may be rendered inoperable as a result.

When using the B104 or B105 Axis Indexer Boards, connect the motor clock cable and indexer cables as described in Section 4.5.2.

When using the 2-axis version of the AIB2G (B231), the motor clock cable must be attached to X5.

When using the 4-axis version of the AIB2G (B232), the motor clock cable must be attached to X11. The connection X11 is located on the bracket of the board (see Figure 4.10).

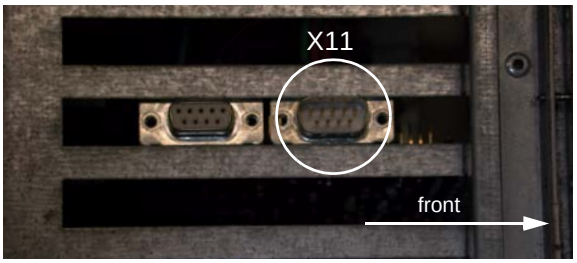

Figure 4.10 - Top view of the 4-axis AIB2G (B232). The X11 socket is used for the Motor Clock Signal.

For a D8 system, connect the motor and encoder cables as shown in Table 4.1:

Source (Theta-Theta / Theta-2Theta)	Cable	Connection on B231
Th-Tube / 2Theta	Encoder 2	X4
Th-Detector / Theta	Encoder 1	X3
Th-Tube / 2Theta	Driver 2	X2
Th-Detector / Theta	Driver 1	X1

Table 4.1 – Motor and encoder cable connection for a D8 system

Switch on the D8/D4 system.

4.7.4 Software Configuration

1. Open the Configuration software from within the DIFFRACplus folder.
2. Under **Motorized Drives**, select **B231/232** from the “AIB Type” drop-down menu (Figure 4.11). This is standard for Theta-Theta or Theta-2Theta configurations.

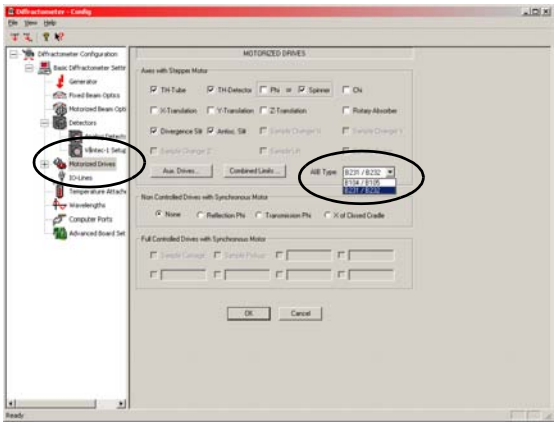

Figure 4.11 - Motorized Drives section

4.7.5 Automated installation for AIB2G

For systems without 21 CFR Part 11 software, the system can be set to configure itself automatically with regard to the source for the Clock Signal.

1. Open the Configuration software and select the **Våntec-1 Setup** window (Figure 4.12).
2. Check the **Automatic Drive Configuration for Drive/Detector Synchronisation (B231/232 only)** checkbox.

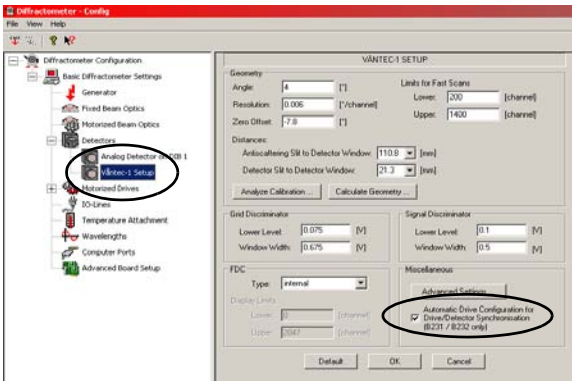

Figure 4.12 - Activation of the Automatic Drive Configuration

After the next download, the source of the Clock Signal is set automatically for Theta-Theta or Theta-2Theta configurations.

If automatic installation was successful, you can skip the following steps regarding manual installation.

4.7.6 Manual Installation for Theta-Theta Configuration

The following sections will show settings for different goniometer configurations. In 21 CFR Part 11 situations, manual setup is mandatory. Otherwise, the use of automated installation for the Clock Signal is recommended (see Section 4.7.5).

1. Make sure that the Automatic Drive Configuration is disabled by unchecking the checkbox in Figure 4.12.
2. Select **Advanced Board Setup > Two Axis Indexer Boards**. Ensure that physical drive 1 is connected to logical axis **TH-Detector**, and physical drive 2 is connected to logical axis **TH-Tube** (see Figure 4.13).

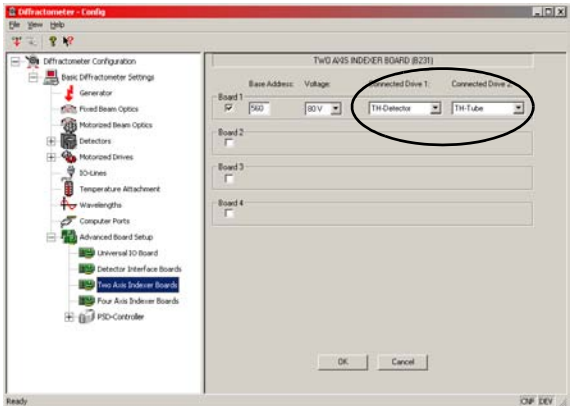

Figure 4.13 - Manual settings for TH-TH

3. Select **Motorized Drives > TH-Detector**. Click **Change Values**.

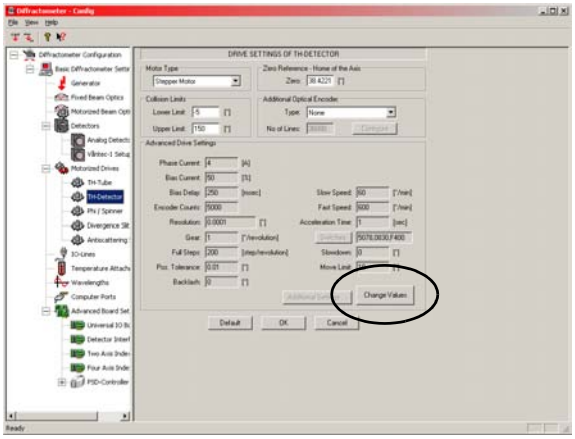

Figure 4.14 - TH-Detector - change values

4. Answer **Yes** to the confirmation message and click **Additional Settings**. The following box appears (Figure 4.15). Select the axis that should deliver the Clock signal. Because the logical axis TH-Detector is sending the clock signals, this motor axis has to be chosen. From Figure 4.13, the “Axis” must be **Driver 1**. Set “Register” to **Signal Status Register** and “Bit” to **(bit 11) Motor Clock - Bit 3**.

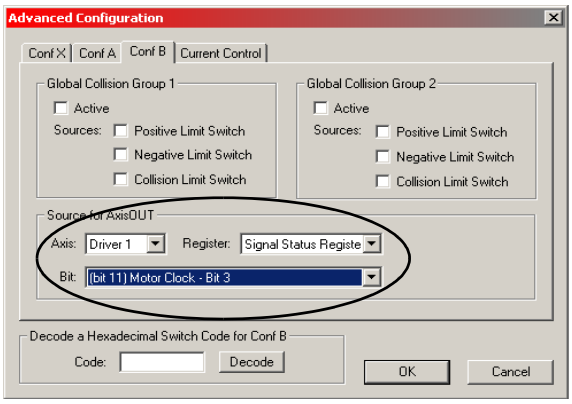

Figure 4.15 - Motorized Drives section – TH-Detector – Advanced Configuration

5. Also check the settings of the logical axis TH-Tube in the same way. The parameters for “Sources for AxisOUT” must look like Figure 4.16.

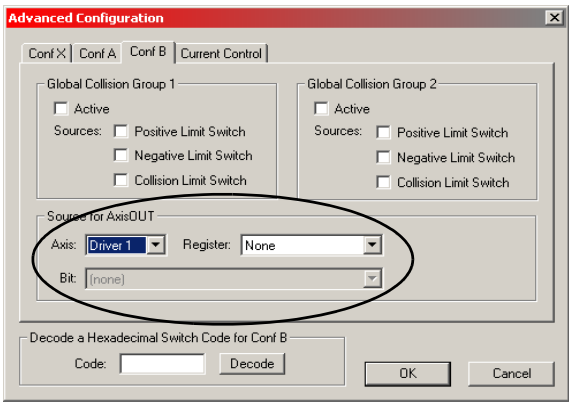

Figure 4.16 - Motorized Drives section – TH-Tube – Advanced Configuration

6. Save and download the configuration.

4.7.7 Manual Installation for Theta-2Theta Configuration

In 21 CFR Part 11 situations, manual setup is mandatory. Otherwise, the use of automated installation for the Clock Signal is recommended (see Section 4.7.5).

1. Make sure that the Automatic Drive Configuration is disabled by unchecking the checkbox in Figure 4.12.
2. Select **Advanced Board Setup > Two Axis Indexer Boards**. Ensure that physical drive 1 is connected to logical axis **THETA**, and physical drive 2 is connected to logical axis **2THETA** (see Figure 4.17).

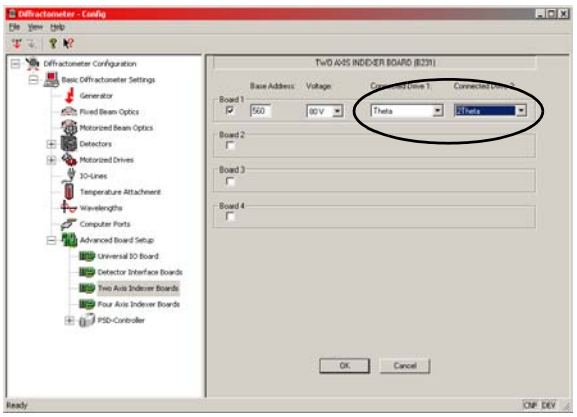

Figure 4.17 - Advanced Board Settings – Two Axis Indexer Board. Settings for Theta-2Theta.

3. Select **Motorized Drives > Theta**. Click **Change Values**.
4. Answer **Yes** to the confirmation message and click **Additional Settings**. The following box appears (see Figure 4.18). The “Axis” must be set to **Driver 2**. Set “Register” to **Signal Status Register** and “Bit” to **(bit 11) Motor Clock - Bit 3**.

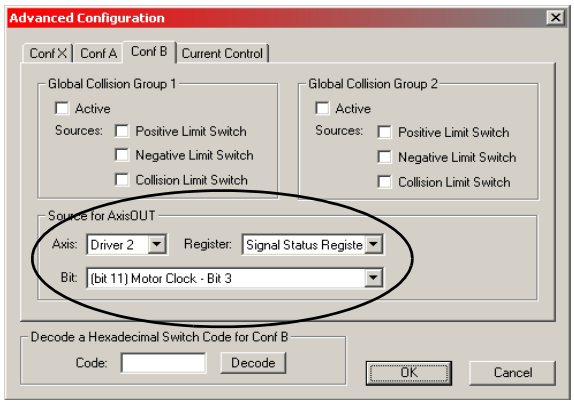

Figure 4.18 - Motorized Drives section – Theta – Advanced Configuration

5. Check the settings for “2Theta”. The parameters for “Sources for AxisOUT” have to look like Figure 4.19.

NOTE: Do not worry about the fact that the settings for “2Theta” show no settings for “Register” and “Bit”.

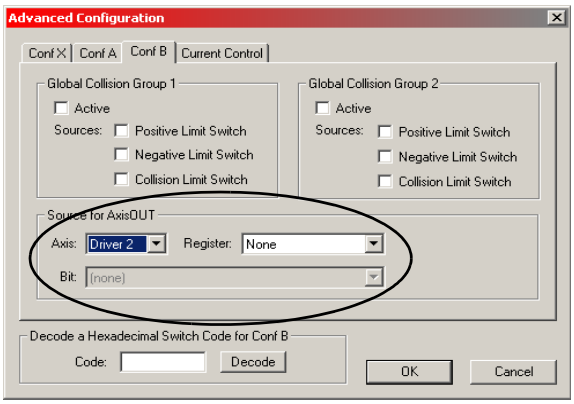

Figure 4.19 - Motorized Drives section – 2Theta – Advanced Configuration

6. Save and download the configuration.

4.8 Optic Components

4.8.1 Mount the Detector Head to the 2-Theta Axis

Mount the detector head in place of the scintillation detector or the previously installed detector. The detector will be shipped mounted and pre-aligned to the two degrees of freedom (2 DOF). If this is not the case, follow the steps indicated below. Move the detector to different measuring circles to suit the installation.

1. Move the 2-theta drive to a position where the detector can be placed on the track (approximately 35° 2-theta).
2. Check that the setscrew is in the location shown in Figure 4.21. This ensures that the detector is at the proper measuring circle.

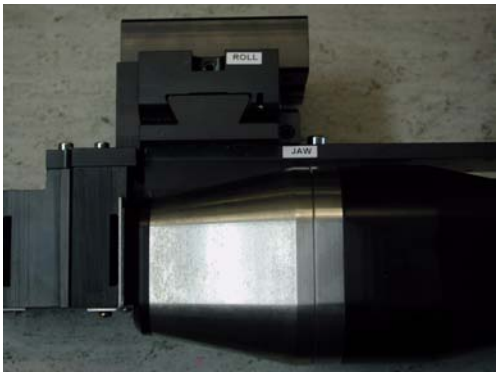

Figure 4.20 - New detector mount

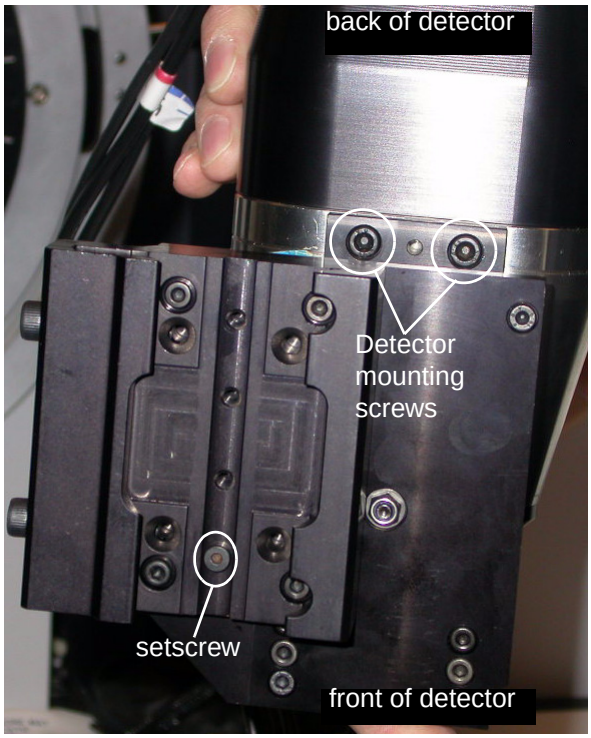

Figure 4.21 - Detector mounting plate

3. Use Figure 4.22 to set the predefined measuring circle on the theta and 2-theta tracks.

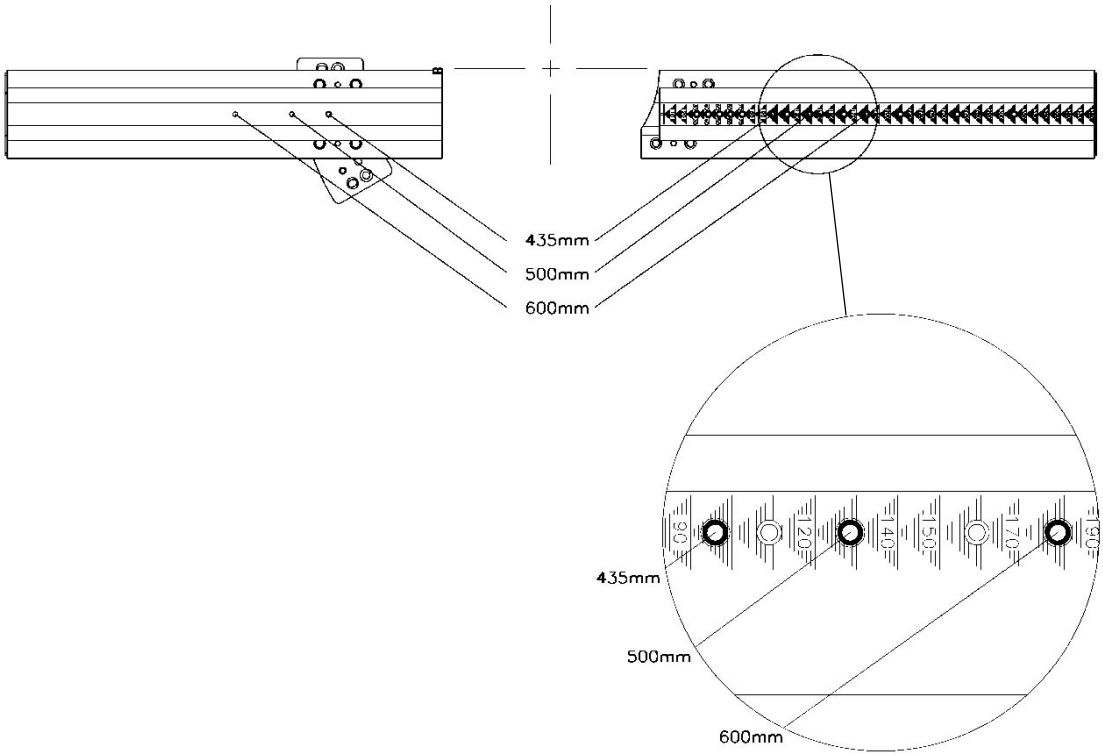

Figure 4.22 - Predefined measuring circle diameter pin locations

4. To confirm the proper measuring circle radius, measure from a point at the center of the sample stage (goniometer center) to a point approximately 17 mm behind the detector faceplate. This spot should be marked on the detector head (see Figure 4.23). Use this as a reference when placing the detector on the track.

Figure 4.23 - Connect and mount the detector

4.1 If not already attached, attach the detector to the 2 DOF mount with the detector mounting screws shown in Figure 4.21 and Figure 4.24.

4.2 Place the detector on the track. Slide it down to the pinned position and tighten the track mounting screws shown in Figure 4.24.

5. Connect the preamplifier, HV and low voltage cables to the detector.

6. Adjust the cable strain relief on the detector mount (see Figure 4.24).

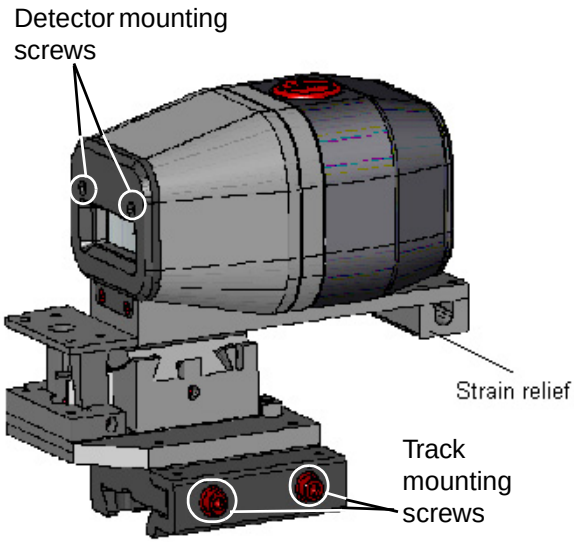

Figure 4.24 - Strain relief

7. Move the 2-theta drive through the complete range to make sure the detector moves freely and is not restricted by the cables.

4.8.2 Mount and Align the Beam Stop

The beam stop is mounted to restrict the main beam's path (divergence).

CAUTION

An un-attenuated beam path may saturate the detector and prolonged exposure to main beam intensities may damage the detector.

To Mount the beam stop:

1. Move the 2-theta drive to 60°.
2. Insert the locking T-nut into the goniometer track (see Figure 4.25).

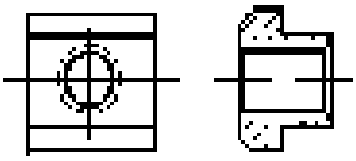

Figure 4.25 - Locking T-nut

3. Fasten the beam stop assembly to the goniometer (see Figure 4.26).
   3.1 Use the mounting pin to position the beam stop assembly.
   3.2 Insert and tighten the mounting screw.
4. Mount the beam stop in one of the following positions using the "D" screws in Figure 4.26.

   A = 435 mm diameter measuring circle

   B = 500 mm diameter measuring circle

   C = 600 mm diameter measuring circle

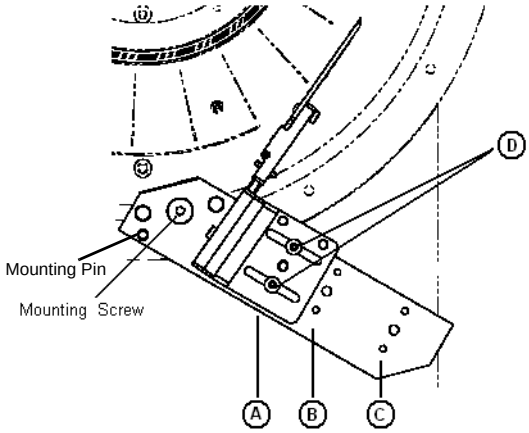

Figure 4.26 - Beam stop (front view)

5. Slowly move 2-theta to 0°, checking that the beam stop does not collide with the anti-scatter optics of the detector.
6. Adjust the beam stop as necessary to avoid a collision with the detector optics.
7. Raise 2-theta back to 60°.
8. Check that collision limits are set in the software.

To align the beam stop:

1. Attach fluorescent paper to the upper edge of the beam stop knife edge (item C in Figure 4.27).
2. Raise the beam stop using the thumb wheel (item A in Figure 4.27) until the edge is above 0° 2-theta.

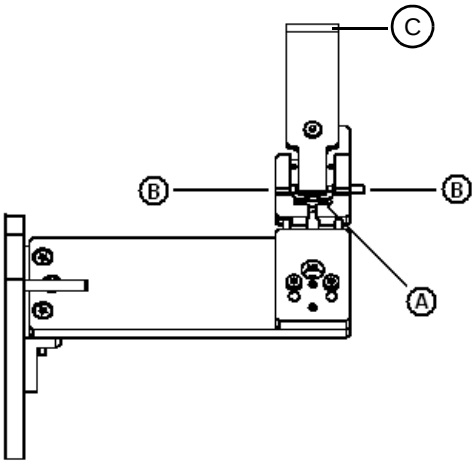

Figure 4.27 - Beam stop (side view)

3. Open the shutter.
4. Observe the flux on the fluorescent paper.
   4.1 Lower the room lights or cabinet lamps to make the beam visible.
   4.2 If necessary, raise the kV/mA to make the beam clearer.
5. Lower the knife edge until the flux is clearly distinguished on the fluorescent screen.
6. Adjust the tilt, item B in Figure 4.27, of the knife edge until the beam appears homogeneous and has uniform intensity. The tilt adjustment is comprised of opposing set-screws. When making an adjustment, also loosen the opposing screw.
7. Lower θ or the tube to 0°.
8. Raise the beam stop using the thumb wheel to cut off the beam.
9. Remove the fluorescent paper from the beam stop.

4.8.3 Mount and Align the Air Scatter Screen

The air scatter screen will provide a greater noise-to-signal ratio, enabling better phase identification with smaller sample amounts. The air scatter screen is beneficial with linear detectors like the MBraun PSD or VÅNTEC-1. Do not move θ or the tube lower than 0° with the air scatter screen attached in order to avoid collision with the stage. The air scatter screen should be retracted during system alignment and when the scan range for theta is less than 0°.

Complete the following steps for proper installation, alignment and use of the air scatter screen. Test the final settings with an intensity standard like the NIST SRM1976 Corundum plate. Use a procedure similar to that in the Instrument Verification Booklet M88-Zxx041 for final documentation of the instrument results.

To mount the air scatter screen:

1. Attach the air scatter screen to the primary divergence slit devices.
2. Remove the flange plate by removing the two screws labeled “3” in Figure 4.28.
3. Mount the air scatter screen to the divergence assembly by aligning the two holes to the matching alignment pin (item 4 in Figure 4.28) located on the plates of the primary optics. See Figure 4.28 as an example of mounting for a variable divergence slit assembly.
4. The plates of the primary optics have two screw holes (item 3 in Figure 4.28) used for securing the air scatter screen to the divergence assembly. Secure the air scatter screen using two Torx M3x10mm screws (item 2 in Figure 4.28).

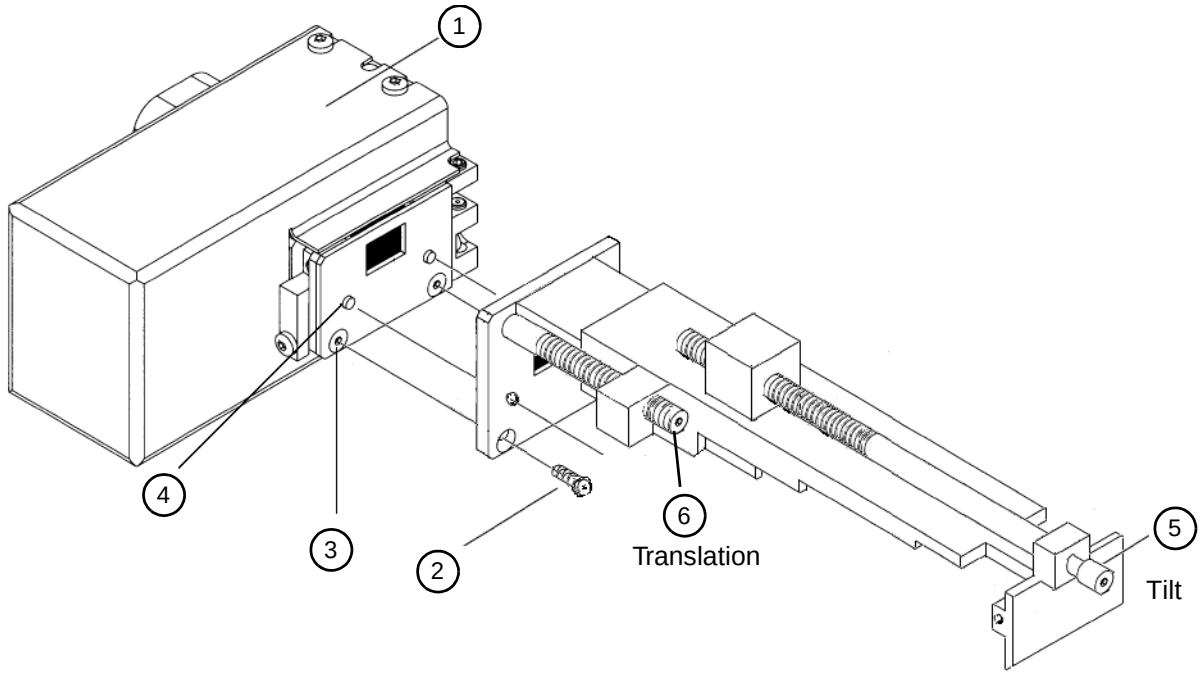

Figure 4.28 - Air scatter screen, exploded view

Align the air scatter screen:

The alignment of the air scatter screen is dependant upon the beam path of the system and the type of optics used. The alignment consists of two parts: the height of the paddle above the sample surface and centering the paddle to the center of the measuring circle. Because the sample holder is mounted onto the stage in the center of the goniometer, a fluorescent screen is used as a reference to the center line. The beam path of a Bragg-Brentano, para-focusing or parallel beam (Göbel mirror) condition will influence the gap between the paddle and the sample surface.

1. Before any alignment is made to the air scatter screen, run a measurement scan using the settings in Table 7.1 or Table 7.2. This data file will be the baseline for comparison to the data collected using the air scatter screen. The baseline data should be collected with a standard reference material (SRM) like the NIST 1976 corundum plate. See the Instrument Verification Booklet M88-Zxx041 for additional system parameters.
2. For the tilt and translation adjustments, use a 2 mm Allen tool.

Perform manual alignment:

1. Run a measurement with predefined optical settings with SRM1976 or another similar reference material to define the intensity distribution (see M88-Zxx041).
2. Move the primary (theta or tube) drive to 0° theta.
3. Mount the fluorescent screen (P/N A13-B71) onto the sample stage.
   - 3.1 Set tilt to a reasonable value (see item 5 in Figure 4.28).
   - 3.2 Align the height of the gap between the paddle and the sample surface using tilt.
   - 3.3 For a 0.6 mm (0.3°) divergence slit, use a gap of 2 mm as a starting point.
4. Align the translation of the screen so the paddle will be exactly centered to the sample (see Figure 4.29).
5. Repeat the measurement in step 1 and check the intensity distribution.
6. Close the height of the gap and realign the translation to keep the paddle centered.
   - 6.1 Repeat steps 5 and 6 until the desired intensity distribution is met. Do not forget to compensate the translation movement of the air scatter screen.

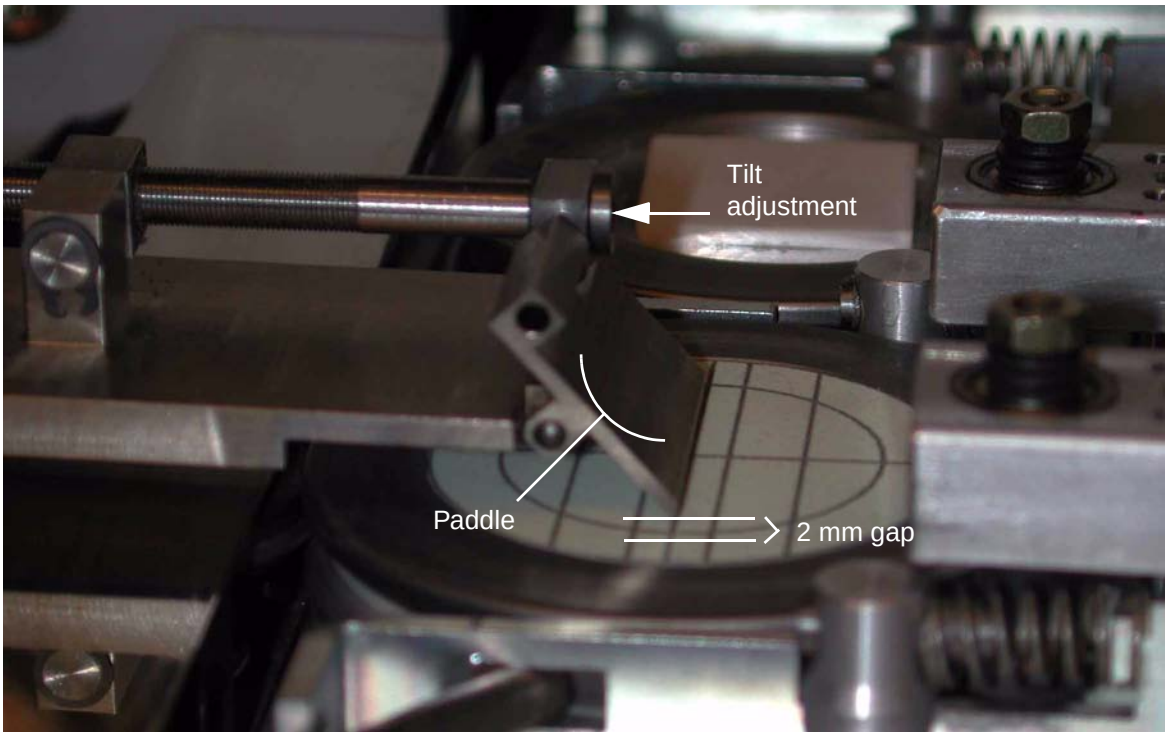

Figure 4.29 - Alignment of the paddle using the fluorescent screen

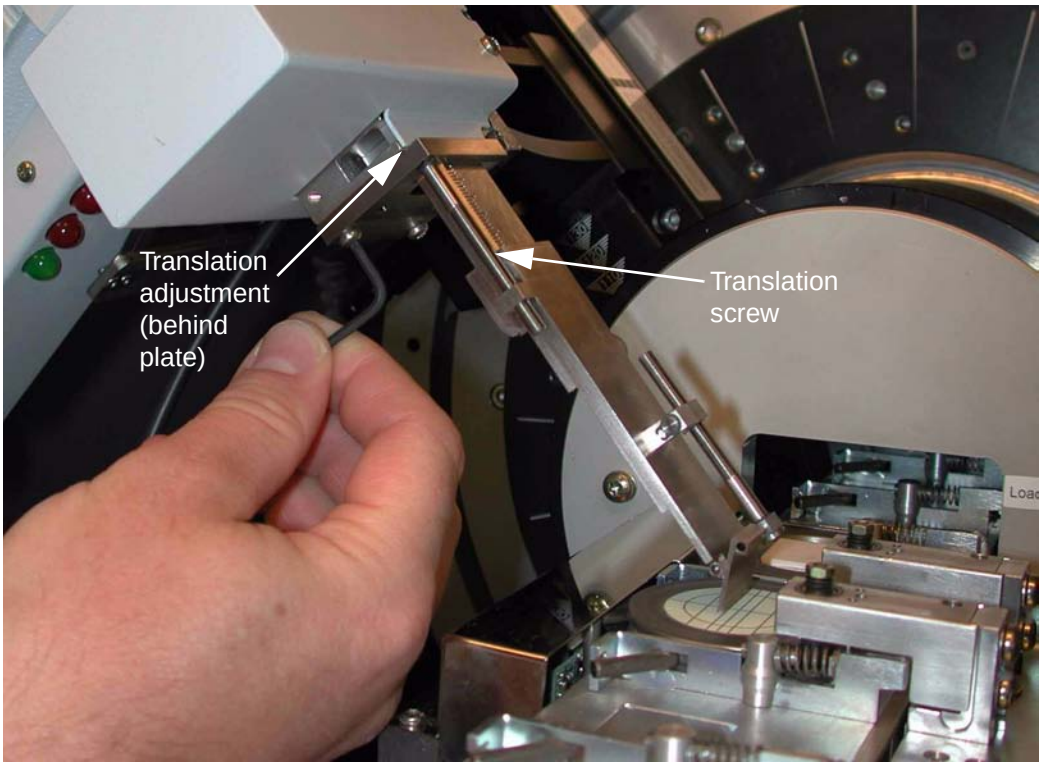

Figure 4.30 - Translation adjustment

CAUTION

Do not use smaller primary angles (tube angle or sample) than 0° theta in order to avoid a collision between the air scatter screen and sample holder.

4.8.4 Mount and Align the Radial Soller Slit

Use the following tools for this procedure:

- NIST SRM 1976 Corundum plate (for reflection) or NIST SRM 640c Silicon powder (for transmission)
- Torx key set
- Allen key set

Mount the radial Soller slit:

1. Take off the kβ filter.
2. Attach the radial Soller slit onto the VÅNTEC-1 optics block using the two anti-scatter slit screw holes shown in Figure 3.9.
3. Remove the anti-scatter slit assembly of the detector optics and mount the radial Soller slits with the two M3 screws. The alignment pin of the detector optics block has to be visible.

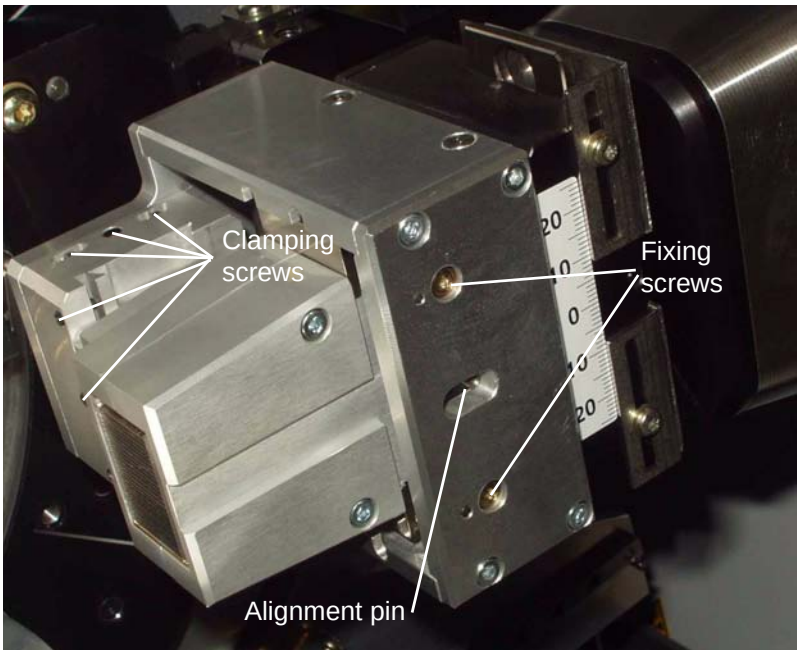

Figure 4.31 - Installation of the radial Soller slit

Align the radial Soller slit:

The radial Soller slit can not be used with Bragg-Brentano geometry. The beam path of a primary focusing monochromator or parallel beam condition (Göbel mirror) will influence two DOFs: tangent and radial axis. Perform the manual alignment as follows:

1. Run a baseline scan using the scan parameters listed in Table 8.1 with SRM1976 or powder in capillaries to define the intensity distribution (also see the Instrument Verification Booklet M88-Zxx041).
2. Install the radial Soller slit (see Figure 4.31).
3. Run a lock coupled scan on the main peak and record the intensity.
4. Align the tangent axis and then the radial axis to maximize intensity. Make sure that the movements along the axis are smooth. Loosen the clamping screws as needed. The peak positions should not vary.
5. Repeat the measurement like in step 1 and compare the intensity distribution. There should be no intensity loss.
6. Tighten the clamping screws on both dovetails.

5. Hardware Installation for the D4 ENDEAVOR

This section describes hardware installation for a D4 ENDEAVOR. The installation of the VÅNTEC-1 detector in the D4 ENDEAVOR is different from installation in the D8 ADVANCE in several ways. The main difference is related to the primary beam stop, which has to slide away in case of high-angle measurements. The detector mount and the cabling through the enclosure are also different.

5.1 Servicing Precautions

WARNING

When the equipment is connected to the mains supply, some terminals, components, and multiple power supply lines may be live. It is not sufficient to press the D4 enclosure's Power OFF button (O) or the On/Off power switch on the VÅNTEC-1 controller. The mains supplied to the system must be switched off externally.

CAUTION

Components attached to the goniometer will move during operation. Use proper lifting methods for the detector controller and the detector components.

5.2 Shipping and Unpacking

1. Check for external shipping damage to the packages.
2. Open the boxes containing the detector and its components.
3. Check for any damage to the components.
4. Inventory all items for completeness.
5. Where possible, save the packaging for return shipping.

5.3 Baseline Data

Before doing any installations or calibrations on the diffractometer, run and save a standard Bragg-Brentano scintillation scan using the settings in Table 7.1 or Table 7.2. The data file will be the baseline for comparison of the data collected using the VÅNTEC-1 controller. The baseline data should be collected with a standard reference material (SRM) like the NIST 1976 corundum plate (see the Instrument Verification Booklet M88-Zxx041 for additional system parameters).

5.4 Hardware Installation

Use the following tools for this procedure:

- Loctite 422
- Torx screwdriver
- Allen screwdriver

Additional rails and hardware must be mounted to accommodate the VÅNTEC-1 controller and FDC (if present) in the D4. The location of the FDC (if present) and PSD controllers is critical for proper operation. There must be sufficient airflow around the controllers to prevent the electronics from overheating. Do not place the VÅNTEC-1 controller in close proximity to the generator. This may induce electronic noise in the detector electronics.

CAUTION

Use care when moving the detector head to avoid mechanical shock to the assembly.

See Table A.3 in Appendix A for the configuration scheme.

5.4.1 Mount the Rails and Detector

1. Remove the D4's left side panel.
2. Remove the rack for the electronics.
3. Mount the rails and attach the rack nuts at the positions shown in Figure 5.1. The FDC (if present) must be mounted below the detector controller. Otherwise, the airflow inside the detector controller is restricted.

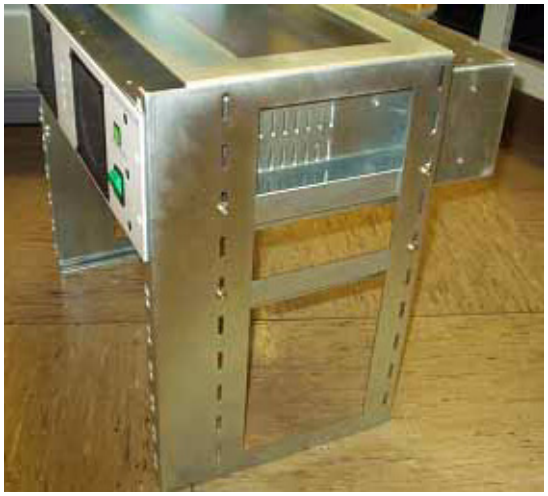

Figure 5.1 - Mount the controllers in the electronics rack

4. Adjust the height of the rails so that the controller can be fixed to the rack nuts.
5. Take out the controllers and mount the rack into the system again.

6. Mount the controllers into the rack and connect the components as shown in Figure 4.3.

The cabling of the VÅNTEC-1 inside the radiation safety box is shown in Figure 5.2 through Figure 5.4.

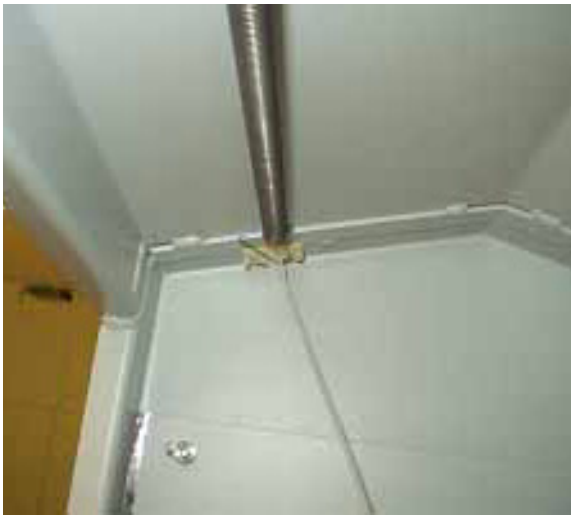

Figure 5.2 - Fix the spring to the ceiling with Loctite 422

Figure 5.3 - Fix the cables as shown

Figure 5.4 - Fix the cables as shown

7. Fix the detector to the detector mount with two M3 countersunk screws and two M5 Allen screws (see Figure 5.5).
8. Mount the high voltage cables to the strain relief (see Figure 5.6). Attach the other cables to the strain relief with cable ties.

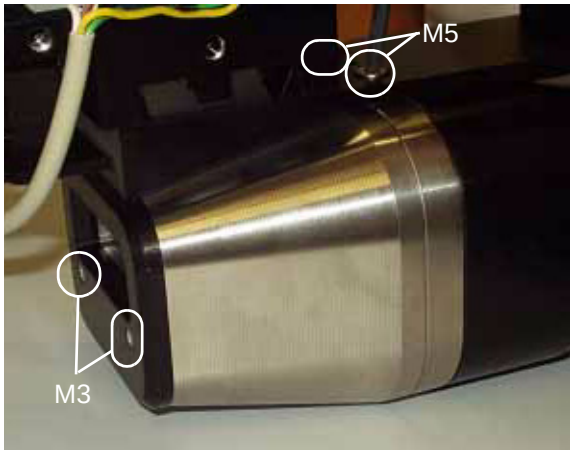

Figure 5.5 - Mount the detector to the detector mount

Figure 5.6 - Strain relief

9. To mount the detector, use M5 30 mm Torx screws and place the detector onto the goniometer. Use the same position as used with the secondary slit system with the scintillation counter (see Figure 5.10).

WARNING

Position additional components, such as the scintillation counter and slit systems, so that no cables or components can collide or jam with the sample lift.

5.4.2 Install the Primary Beam Stop

1. Remove the cover of the sample magazine and all side and back panels.
2. Mount the special handles for the front panel. Turn the safety key to position 1. Open the front panel.
3. Remove the scintillation counter, proportional counter (Ca channel) or SOL-X detector and position the components so that they will not collide with other components.
4. Using Service Support mode, drive the sample lift to 200 mm.
5. Using Service Support mode, drive the detector to 100° 2-theta and the sample holder to 70° theta.
6. Mount the bracket for the magnet of the beam stop. Secure the slide for the beam stop using the screws and cable clamps as shown in Figure 5.7.

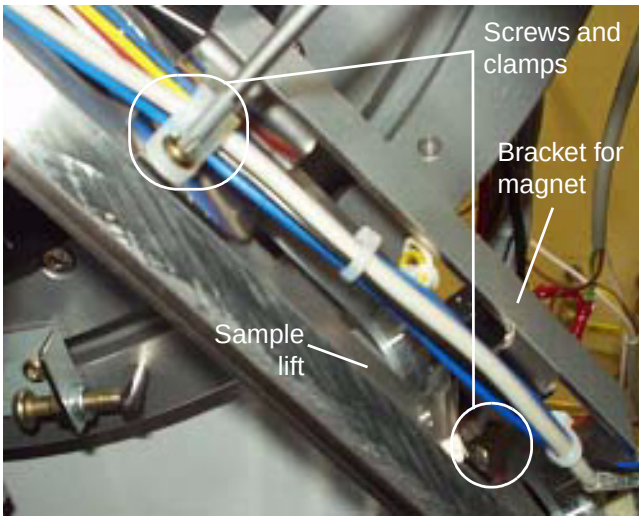

Figure 5.7 - Mount the bracket for the magnet of the beam stop

7. Drive the sample holder to 30° and mount the beam stop for the D4 (see Figure 5.8). Place a T-nut into the groove ring of the goniometer and tighten the fixing screw. Ensure that the two additional pins also fit into the groove ring.

NOTE: Do not lose the T-nut in the groove—put a tissue into the groove to prevent this.

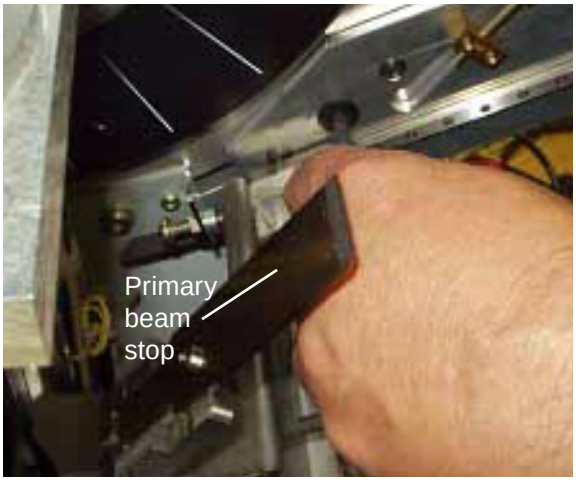

Figure 5.8 - Mount the primary beam stop

8. Screw the alignment screw completely out (see Figure 5.9). Put the alignment pin into the goniometer ring and place the beam stop so the alignment screw hits the alignment pin.

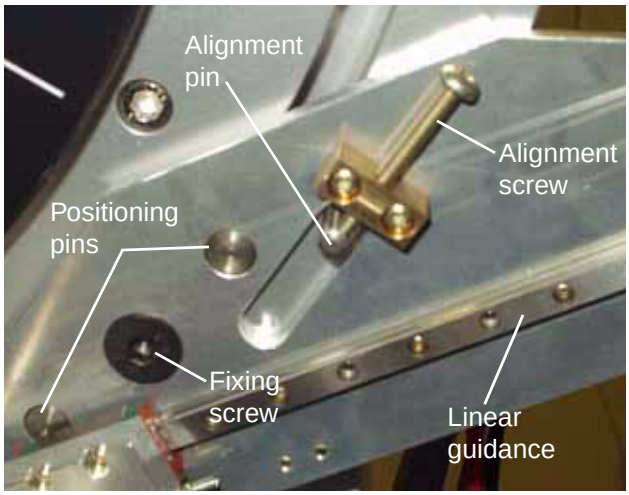

Figure 5.9 - Details of the primary beam stop—showing the extreme low position of the beam stop

9. Mount the actuator for the beam stop collision switch using a T-nut in the groove ring (see Figure 5.10). The position of the actuator is defined by the extreme low position of the alignment screw and shows the highest position of the primary beam stop (about 6° 2-theta).

   Figure 5.9 shows the actuator in the extreme high position of the alignment screw.

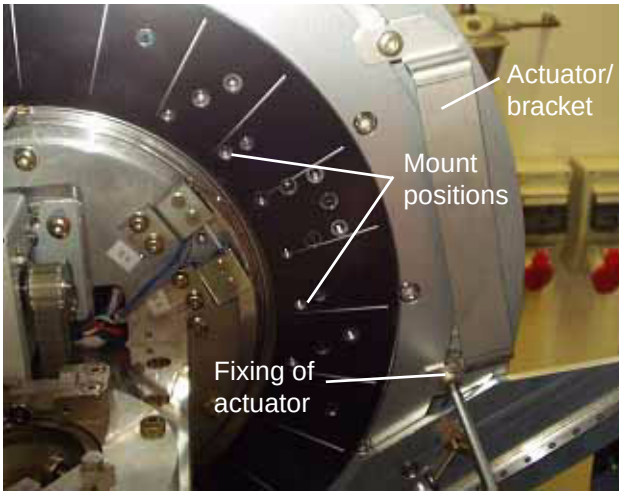

Figure 5.10 - Mounting of the actuator bracket for beam stop collision switch

10. Mount the collision switch to the detector mount. Place the color-coded banana plugs into the sockets on the goniometer side panel labeled “Collision switch.” Do not switch the colored plugs and sockets (see Figure 5.11).

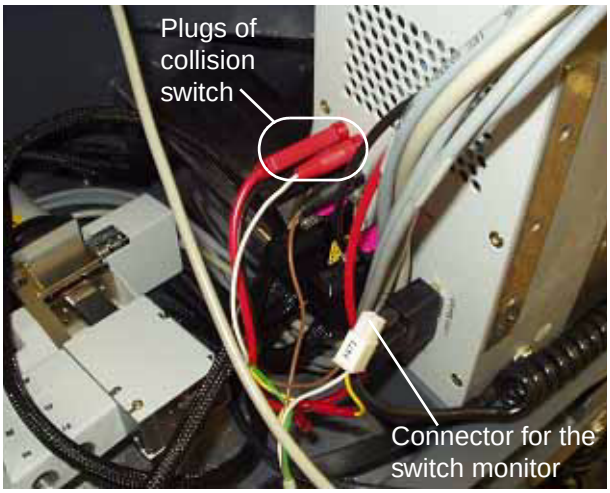

Figure 5.11 - Cabling of the collision switch

11. Connect the plug X672 to the cable for the switch monitoring in D4TOOLS.

12. Mount the collision switch to the detector mount (see Figure 5.12). Use the top position for mounting. Align the final position after attaching the detector to the goniometer to make the switch contacts.

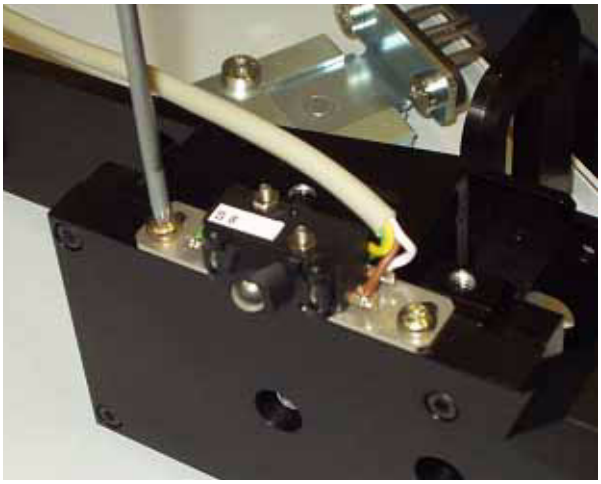

Figure 5.12 - Mount the collision switch to the detector mount

13. Test the collision switch by holding up the beam stop while moving down the detector (2-theta). The instrument must stop moving and display the error “theta and 2-theta in collision” after the collision switch hits the actuator bracket.
14. Connect the cable wiring as described in Section 4.4.3.
15. Follow Section 4.4.4, Section 4.8 and Section 4.8.3 through Section 4.6.
16. Replace the left side panel on the controller rack.
17. To complete the installation, proceed to Section 6.

6. Software Configuration

This section describes basic software configuration.

Communications between the D8 controller, FDC (if present) and the detector are made via RS232 communication ports. Communications between the frame buffer computer and the detector controller are made via a network connection. The parameters for communications must be defined by the user and are stored in the device.ini file. The Configuration program is used to set the parameters. Perform the following steps to configure the system (see Figure 4.3 for the cabling scheme for an internal FDC, Figure 4.6 for the cabling scheme for an integrated FDC).

6.1 Recommendations

Software versions listed are minimum recommended versions.

- D8 Controller Firmware 2.03
- D4 Controller Firmware 1.05
- PSDWare 0.51
- FPGA v1.01 AK (for external FDC)
- FPGA v1.02 AN (for internal FDC)
- DIFFRAC*plus* Measuring Package
- VÅNTEC-1 Update Package
- Clock Signal Cable A17-D42
- Adapter for Clock Signal Cable A17-D43

NOTE: Never mix software packages/versions from VÅNTEC update CDs containing different releases!

6.2 Configuration of the Second Network Adapter “LAN 2” in the PC

An additional network card is required if the customer will be connecting to their LAN network. The second LAN connection is used to control the components needed by the detector.

1. Mount the additional PCI network adapter into a free PCI slot in the PC.

   1.1 To install the network card, see Section 4.6.

2. Restart the computer.

3. Windows should recognize the new hardware. If it asks for a diskette that contains the network adapter driver, insert the installation CD.

4. Configure the network adapter.

   4.1 Click **Start > Settings > Control Panel > Network and Dial-up Connections**.

   4.2 The new network adapter is listed as “Local Area Connection 2.”

   4.3 Right-click on the new adapter and select **Properties**. A new dialog box will appear (see Figure 6.1).

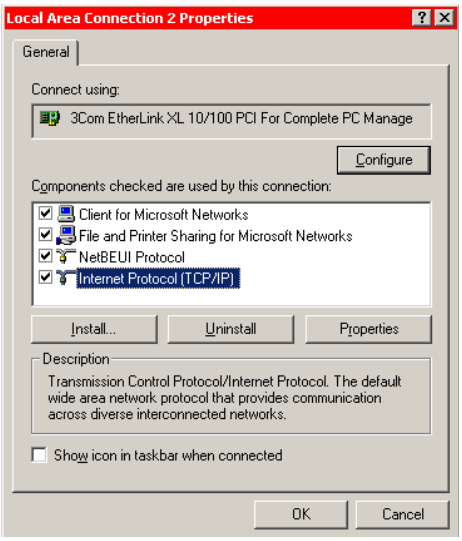

Figure 6.1 - Local Area Connection Properties

4.4 Select the **Internet Protocol (TCP/IP)** item and click the **Properties** button. Another dialog box will appear (see Figure 6.2).

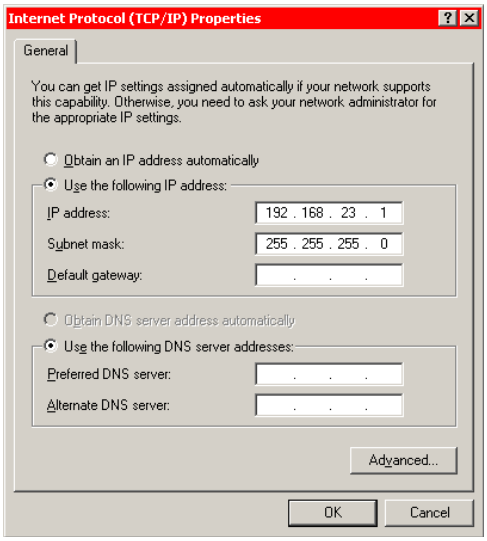

Figure 6.2 - Internet Protocol (TCP/IP) Properties

4.5 Select the “Use the following IP address” radio button and enter **192.168.23.1** for the IP address and **255.255.255.0** for the Subnet mask. Leave all other fields blank.

4.6 Confirm and close both dialog boxes by clicking **OK** in each box.

The frame buffer computer’s network adapter is now configured.

6.3 Detector Software Configuration

1. Open the Configuration program (Config.exe) located in the C:\Diffplus directory.

   1.1 From the main Config menu, select the **Detectors** menu (see Figure 6.3).

   1.2 Check the **Position Sensitive Detector** checkbox.

   1.3 Set the PSD type to **VÅNTEC-1**.

   1.4 Select **OK**.

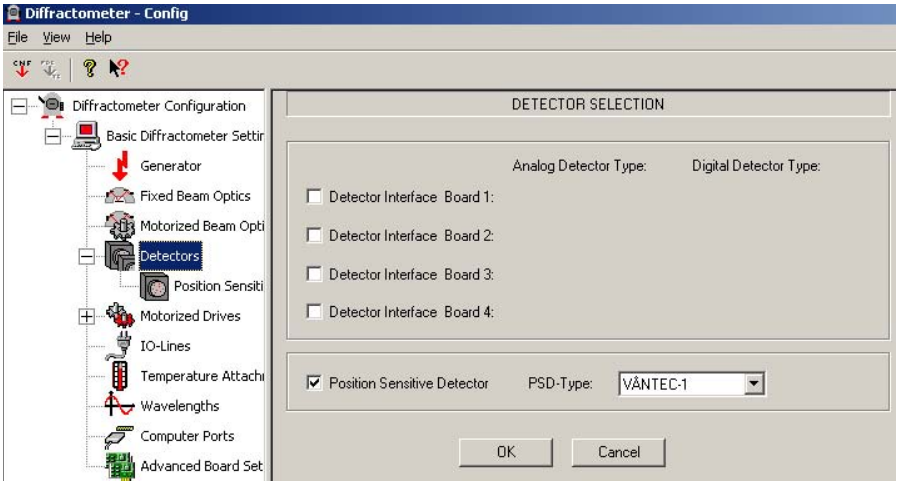

Figure 6.3 - Detector menu in Configuration program

6.3.1 Software Configuration

From Config:

1. The FDC type has to be set to “internal”. In fact, the settings of the “Fast Diffraction Controller” at the subfolder “Computer Ports” will be inaccessible (see Figure 6.9).
2. Check whether the FDC entry at the “Computer Ports” section is inactive.

3. Select **VÅNTEC-1 Setup** (see Figure 6.4).
   - 3.1 Select **Default**.
   - 3.2 Set the Geometry Angle to **12°**.
   - 3.3 Set FDC type to **Internal** for detector controllers with an internal FDC (See Section 3.2.1 for identification).
   - 3.4 Select FDC type to **Socabim** for detector controllers with an external FDC (See Section 3.2.1 for identification).
   - 3.5 Click **OK**.

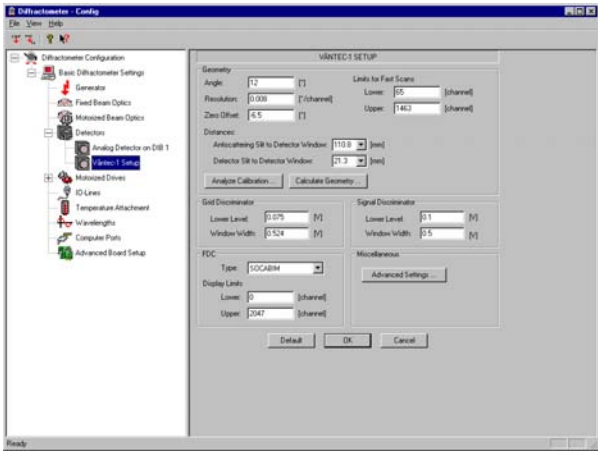

Figure 6.4 - Position Sensitive Detector menu

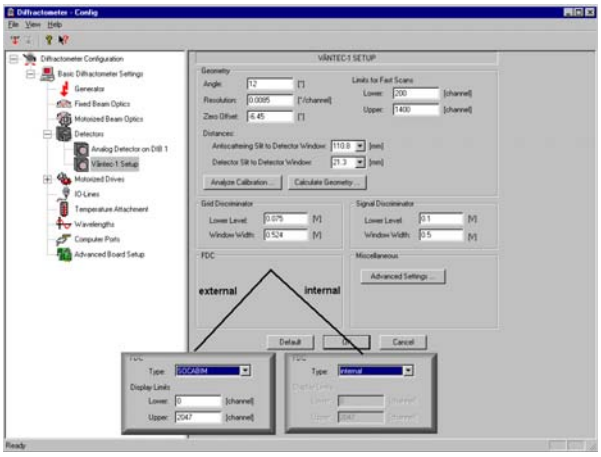

Figure 6.5 - Settings for FDC type

6.4 Network Configuration

The Advanced Board Setup menu, located in the Configuration program, must be completed prior to saving and downloading the configuration file.

1. Go to **Advanced Board Setup > PSD-Controller**.

1.1 In Communication Topology, select **Network** and press the button **Default Network Settings**.

1.2 In Serial Communication Parameters, ensure that **Determine Automatically** is selected.

1.3 Click **OK**.

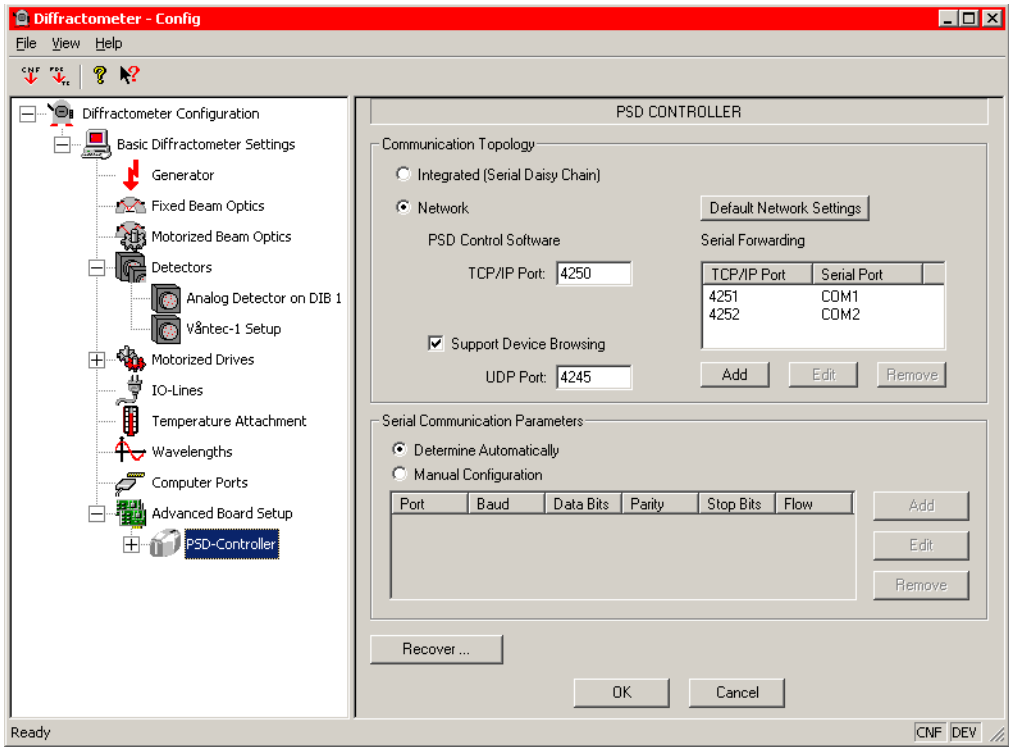

Figure 6.6 - PSD Controller menu

2. Go to **IP Setup and Services** (see Figure 6.7).

   2.1 In IP Setup, select the **Static Address Assignment** radio button.

   2.2 Enter the Host IP Address **192.168.23.2** and the Netmask **255.255.255.0**. Do not change any other values.

   2.3 Under Services, check the **HTTP Interface** checkbox.

   2.4 Click **OK**.

   2.5 If no Users are available, refer to Appendix C.1.

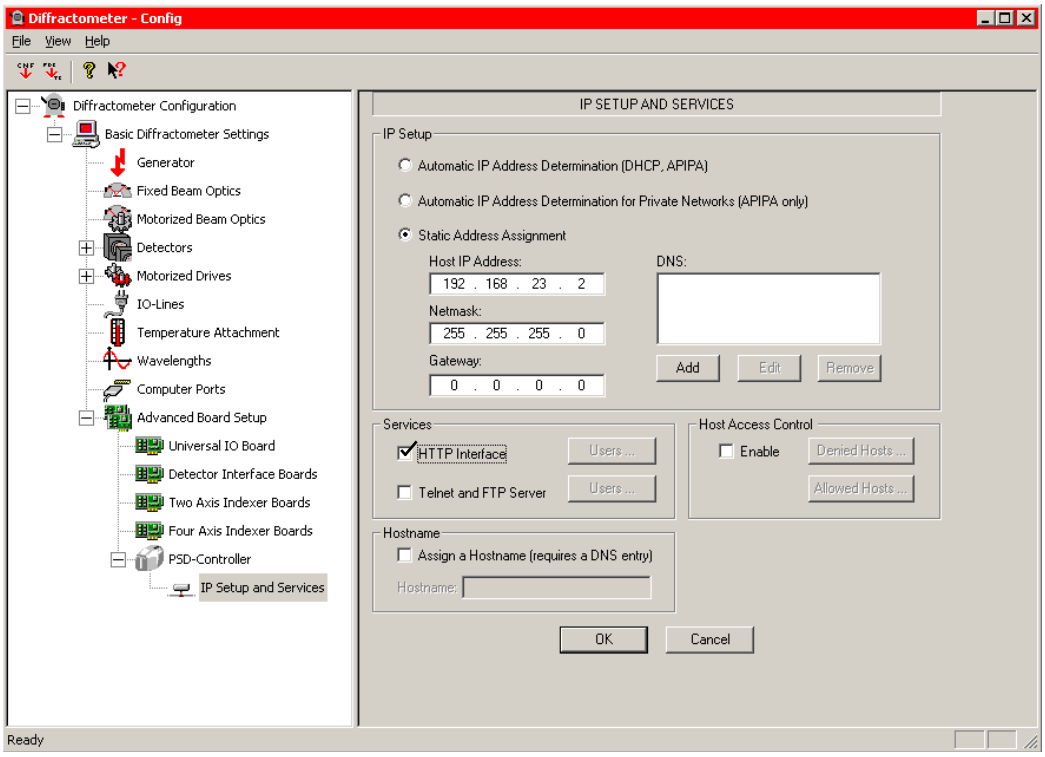

Figure 6.7 - IP setup

6.5 Computer Port Configuration

6.5.1 For detector controllers with external FDC

1. In Config, go to Computer Ports (see Figure 6.8).

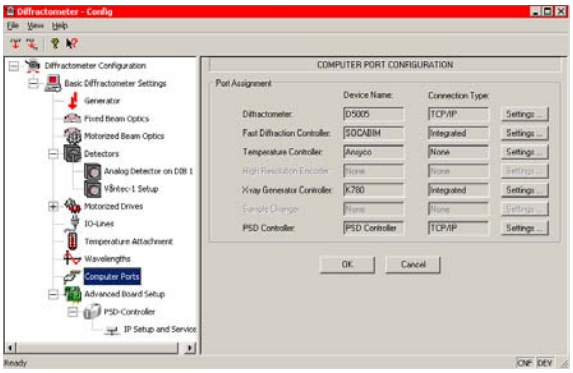

Figure 6.8 - Computer port configuration

6.5.2 For detector controllers with integrated FDC

1. In Config, go to Computer Ports (see Figure 6.9).

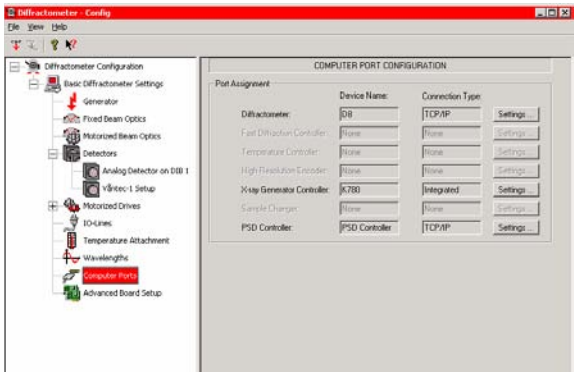

Figure 6.9 - Settings for computer ports

6.5.3 Set Up Communication Parameters (both FDC types)

Under Diffractometer, select **Settings**.

1.1 In the pop-up window, select **TCP/IP** as the connection type.

1.2 Enter the IP address **192.168.23.2** and the port **4251**.

1.3 Click **OK** and close the window.

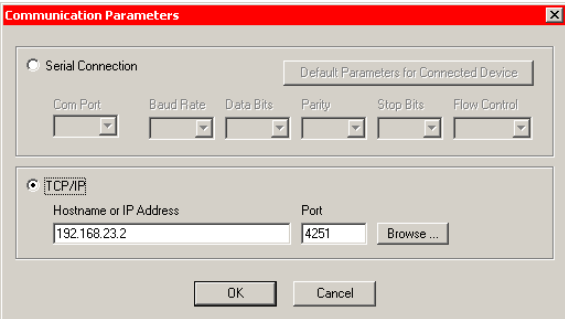

Figure 6.10 - Diffractometer > Settings pop-up window

2. In Computer Ports, select **Settings** under PSD Controller.

2.1 In the pop-up window, under TCP/IP, enter the IP address **192.168.23.2** and the port **4250**.

2.2 Click **OK** and close the window.

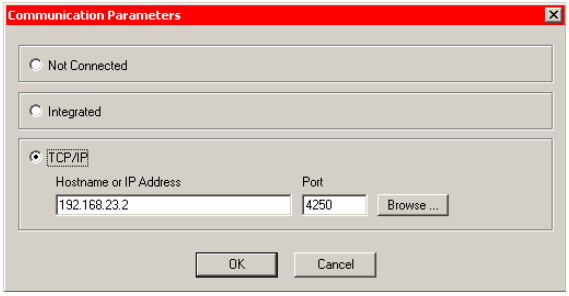

Figure 6.11 - PSD Controller > Settings pop-up window

3. In Computer Port Configuration, click **OK** to accept the changes (see Figure 6.8).

4. To activate the configuration, go to **File > Save and Download** or click the CNF icon.

5. In the Save and Download pop-up window, ensure that all boxes are checked.

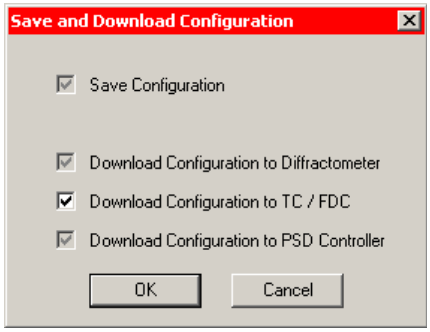

Figure 6.12 - Save and Download pop-up window

6. Check that the VÅNTEC-1 controller, the FDC (if present) and the diffractometer are switched on and connected according to Figure 4.3. If your VÅNTEC-1 has an integrated FDC, refer to Figure 4.6.
7. Click **OK** to download.

6.6 Factory Default Settings

1. Import the default detector settings (see Figure 6.13).
   1.1 In the Configuration menu, select **File > Section(s) > Import ...** .
   1.2 Import the Advanced Settings from the floppy disk sent with the controller. The floppy will be marked “Advanced Settings” with the system serial and control numbers. Advanced settings imports all of the factory-determined specifications into the configuration file.

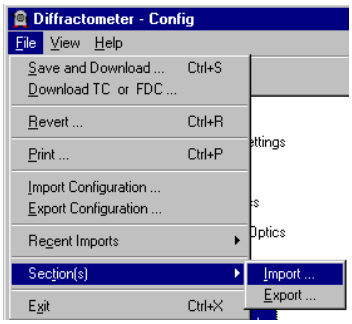

Figure 6.13 - Import detector settings

2. Select **VÅNTEC-1 Setup** (see Figure 6.14).
   2.1 Set the Geometry Angle to **12°**.
   2.2 The starting values for Resolution and Zero Offset should be **0.008** and **-6.5**, respectively.
   2.3 Click **OK**.

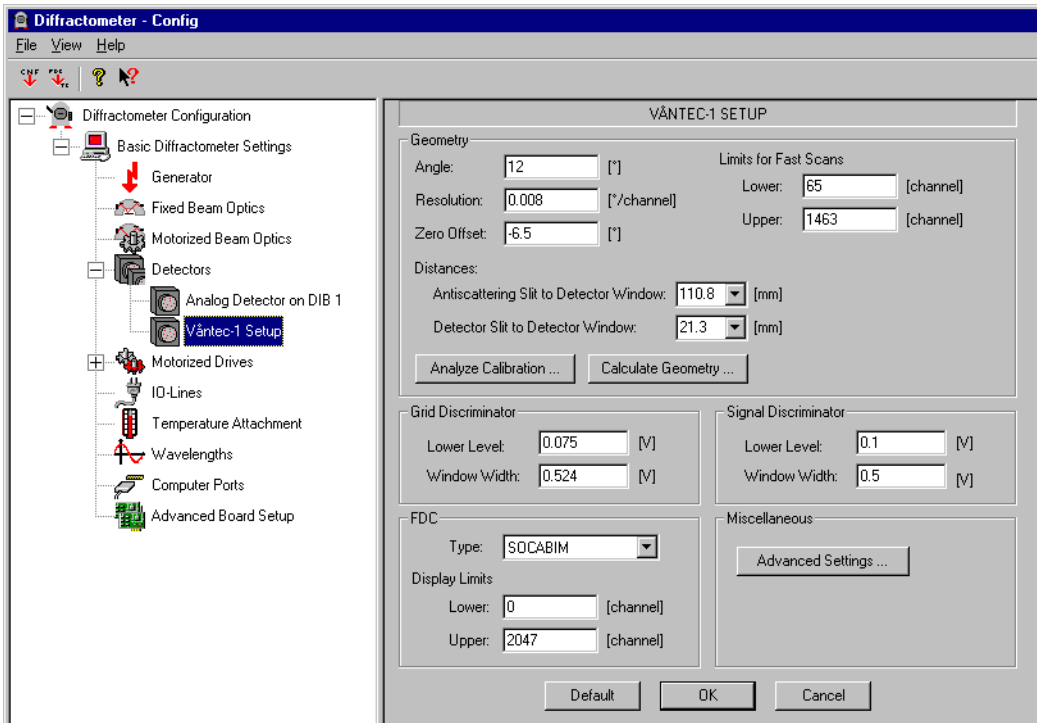

Figure 6.14 - VÅNTEC-1 Setup menu

7. Calibration

Prior to calibration, the system must be aligned using the scintillation detector.

Each detector and the associated electronics are unique. A calibration process is used in conjunction with standard reference materials to determine a zero offset for the resolution in degrees. This value represents the angular difference between the zero angle of 2-theta and the zero channel of the PSD. The calibration program will refine the values and record them in the Configuration program.

7.1 Positional Calibration

1. Manually open all window slits as wide as possible.
2. Ensure that the proper Kβ filter is in place.
3. Make sure that no Debye slit is in place.
4. Ensure that the reference material is mounted (quartz or NIST 1976) in the sample stage.
5. Set the goniometer to the parameters in Table 7.1 or Table 7.2 using DIFFRAC*plus* COMMANDER.

NOTE: Do not close DIFFRAC*plus* COMMANDER. Instead, minimize the window.

Goniometer					Divergent slit			Generator settings		Scan parameters	Scan speed	
Radiation	Theta/Theta		Theta/2-theta		Variable	Fixed (mm)	Kβ filter	kV	mA	Increment	PSD (sec)	Scintillation (step/sec)
Cr	20.03	20.03	20.03	40.06	0.3°	0.6	V	35	45	.006	30	.002
Co	15.52	15.52	15.52	31.04	0.3°	0.6	Fe	35	45	.006	30	.002
Cu	13.32	13.32	13.32	26.64	0.3°	0.6	Ni	40	40	.006	30	.002

Table 7.1 – Parameters for Quartz standard reference

Goniometer					Divergent slit			Generator settings		Scan parameters	Scan speed	
Radiation	Theta/Theta		Theta/2-theta		Variable	Fixed (mm)	Kβ filter	kV	mA	Increment	PSD (sec)	Scintillation (step/sec)
Cr	26.67	26.67	26.67	53.34	0.3°	0.6	V	35	45	.006	30	.002
Co	20.52	20.52	20.52	41.05	0.3°	0.6	Fe	35	45	.006	30	.002
Cu	17.57	17.57	17.57	35.15	0.3°	0.6	Ni	40	40	.006	30	.002

Table 7.2 – Parameters for NIST 1976 standard reference

7.2 PSD Calibration

7.2.1 Create Files

1. Open XRD Wizard from **C:\Diffplus\XRD-Wizard.exe**.
2. Select **File** and **New** to display the file types available. This window creates the DQL used for calibration.
3. Select **PSDCalib** from the new menu files. Click **OK** (see Figure 7.1).

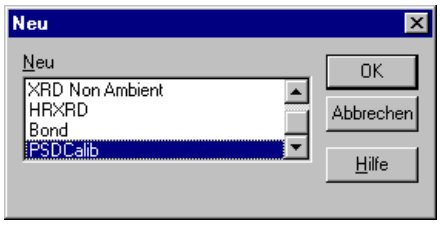

Figure 7.1 - Wizard > File > New

4. To create the DQL file, input the calibration parameters and click **OK**. The number of positions must be nine or greater. Whenever possible, select rotation ON and set the speed at 15 rpm.
5. Determine the theoretical 2-theta values using Table 7.1 and Table 7.2. Input the values into the Calibration Parameters screen (see Figure 7.2).
6. Input a step size of **1**.
7. Save the DQL file as **Calib.DQL** and exit XRD Wizard.

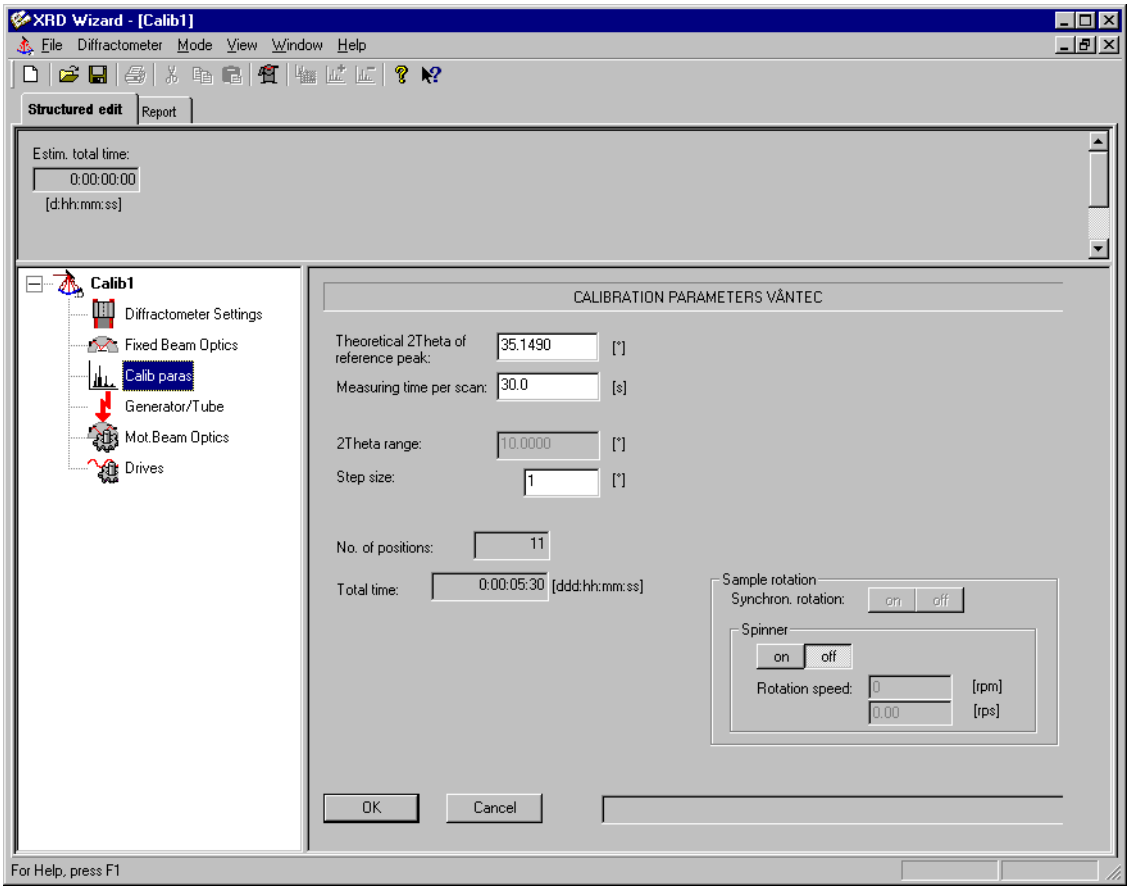

Figure 7.2 - Create the DQL file. Example shown is for Corundum sample and Cu radiation.

7.2.2 Collect Data

1. Open DIFFRAC*plus* COMMANDER.
2. Select the **Jobs** tab and create a job using the Calib.DQL file.
3. Name the RAW file **Calib.raw**.
4. Press **Start Job** and wait for the job to finish.

NOTE: If desired, you can save this job for future calibrations.

7.2.3 Analyze Data

1. After creating Calib.raw, select **Analyze Calibration** in the Configuration program under the VÅNTEC-1 Setup menu (see Figure 7.3).

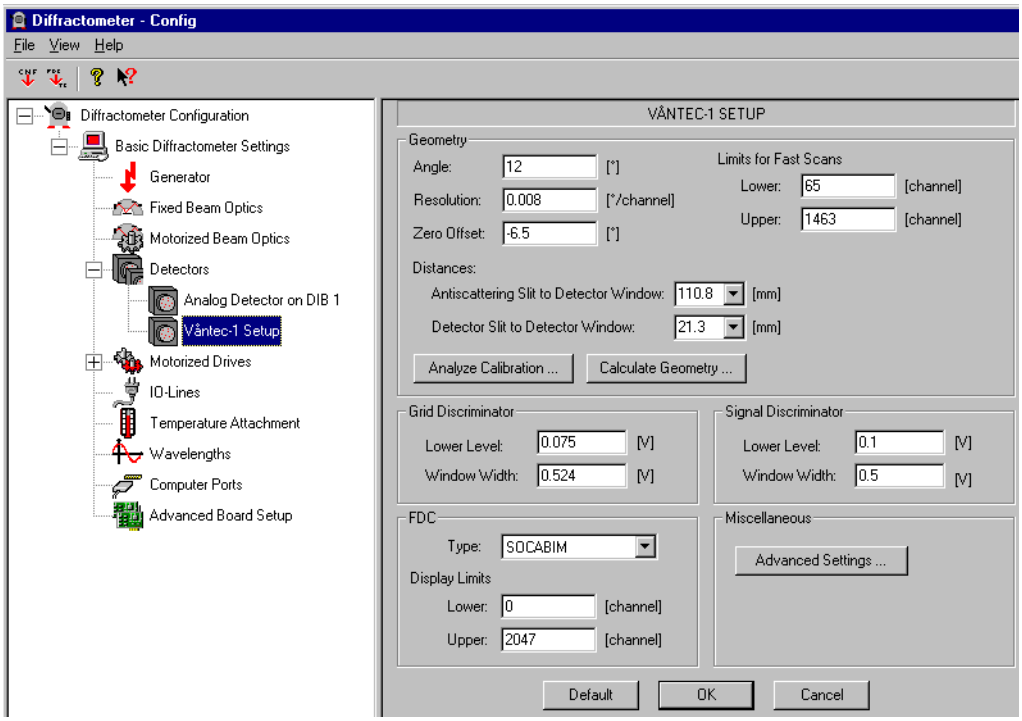

Figure 7.3 - Analyze the calibration

2. Use the **Browse** button to locate the RAW file saved during the calib.job measurement (see Figure 7.4).

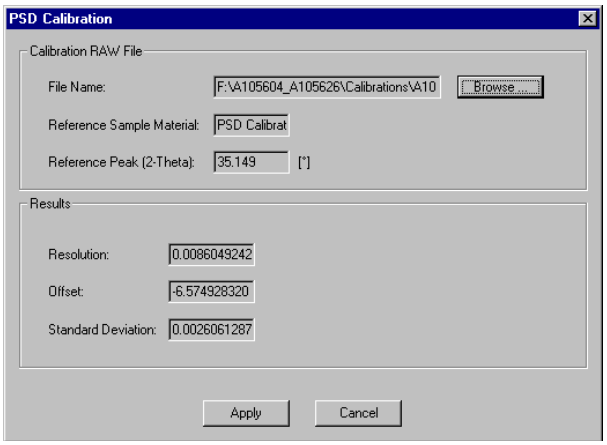

Figure 7.4 - Locate the RAW file

3. Press **Apply** to analyze the calibration and set the resolution and offset of the detector.
4. Ensure that the mode zero offset value is approximately -5 to -8. Resolution should be approximately .007.
5. Recalibrate if the standard deviation is greater than 0.05°. Continue on to the next step when you have reached a standard deviation of less than 0.05° (i.e., zero offset is approximately -5 to -8 and standard deviation is less than 0.05).
6. After changing the detector parameters, save and download the new configuration.

The calibration is now complete.

After analyzing the calibration file and prior to executing a measurement, optimize the detector optics using the Calculate Geometry menu in the VÅNTEC-1 Setup menu (see “Calculate the Optimum Secondary Slit Openings” in Section 9.7).

NOTE: Whenever changes have been made in Config, remember to restart the Measurement server!

8. Alignment

Peak position is determined during calibration (see Section 7), not during alignment. The alignment optimizes the resolution of the detector. The resolution is determined by finding the best possible FWHM (Full Width Half Maximum). The resolution is dependent on the measuring circle and the alignment of the detector mount.

8.1 Alignment of the VÅNTEC-1 Detector and Mount

Complete a coarse alignment of the 2 DOF mount by running repeated PSD fixed scans of NIST SRM 1976 or Quartz. For a quick assessment of the alignment, compare the intensities of the main (104) peak to the valley between $K\alpha_1$ and $K\alpha_2$ (see the example in Figure 8.1). [Example: The first scan's intensity of the valley is 4,000 cps. The main peak's intensity is 8,000 cps. This represents a ratio of 2 (4,000:8,000 = 1:2)]. A ratio of 3.0 to 4.0 is desired. Once the max ratio is achieved, proceed to Section 8.2.

1. Run a PSD fixed scan. Use a standard reference material of the NIST SRM 1976 Corundum plate (104) or Quartz (101) reflection. Use the parameters in Table 8.1 for SRM 1976.

Start	33.6°
Stop	36.6°
Increment	0.006°
Scan type	Fixed PSD
Near window slits	Open
Detector window slits	Open
Soller slit	2.5°
Ni filter	In
Debye slit	Out
Scan speed	30 sec. per step

Table 8.1 – Scan parameters for SRM 1976

For additional information on running a measurement, see Section 9.

NOTE: The detector must be set in the Details tab of DIFFRAC*plus* COMMANDER before selecting fixed PSD scan.

2. After running the baseline scan, measure the ratio of the intensity of the main peak to the valley between the $K\alpha_1$ and $K\alpha_2$ peaks (see Figure 8.1).

NOTE: The increment is dependent on PSD-Calib and the measuring diameter.

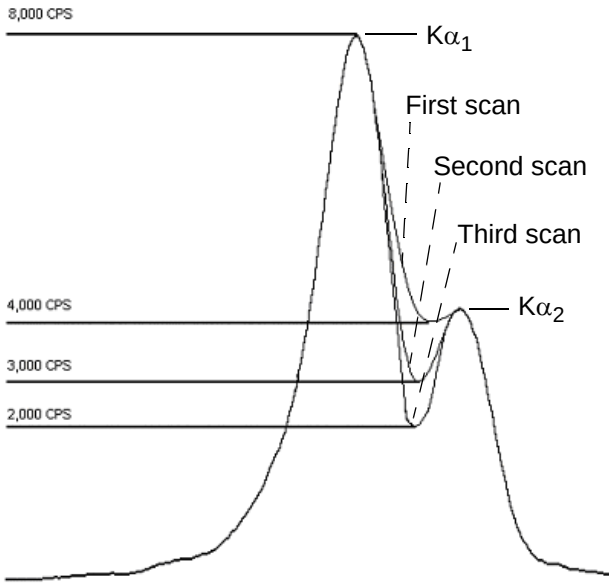

Figure 8.1 - Measure the intensity ratio

3. Adjust the yaw “Y” of the 2 DOF. The yaw adjustment uses opposing screws. To make an adjustment, first loosen the opposing screw and then tighten the adjusting screw (see Figure 8.2).

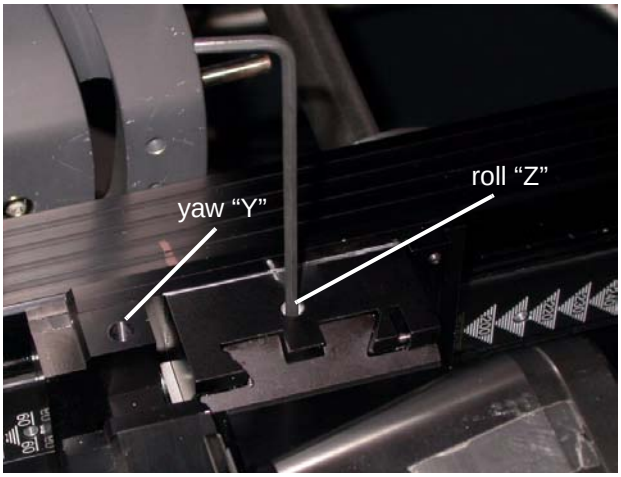

Figure 8.2 - Yaw “Y” and roll “Z” adjustments

4. Re-run the scan and compare the ratio to the baseline scan. If the ratio increases, continue to adjust in the direction first attempted. If the ratio decreases, reverse the direction of movement and repeat step 3 until the maximum ratio is achieved. Use the ratio to check the alignment. Intensity of the valley alone may vary.
5. Repeat step 3 and step 4 for the roll “Z” of the 2 DOF until a ratio of 3.5 to 4.0 is achieved. Noticeable separation can be seen between the $K\alpha_1$ and $K\alpha_2$ peaks when alignment is correct. Save the final scan for future reference.

8.2 Evaluation and Data Interpretation

Alignment is complete when FWHM matches the specifications in Table 8.2. The FWHM (resolution) is determined using the AREA feature of the program DIFFRAC*plus* EVA, which is part of the DIFFRAC*plus* Basic package supplied with the diffraction system. To learn how to use EVA and its AREA function, refer to the DIFFRAC*plus* EVA User Manual (M85-Exx002). Check the alignment if the detector is removed or moved to another measuring circle. If specifications are not met, repeat Section 8.1.

Cu	Bragg	Göbel Mirror
401 mm	≤ 0.065°	≤ 0.130°
435 mm	≤ 0.060°	≤ 0.120°
500 mm	≤ 0.055°	≤ 0.110°
600 mm	< 0.055°	< 0.110°

Table 8.2 – FWHM specifications for Cu radiation

1. Start EVA and load the RAW data to evaluate.
2. Open the EVA toolbox (press F2 or the hammer icon) to perform background subtraction and a $K\alpha_2$ stripping, ensuring a properly adjusted $K\alpha_1/K\alpha_2$ ratio to minimize artifacts and a 0.5 intensity ratio. Select the Append button to create a new phase.
3. Use the Area function in the EVA toolbox to create an area measurement using the complete measured range (see Figure 8.3). Use the mouse to select the range.

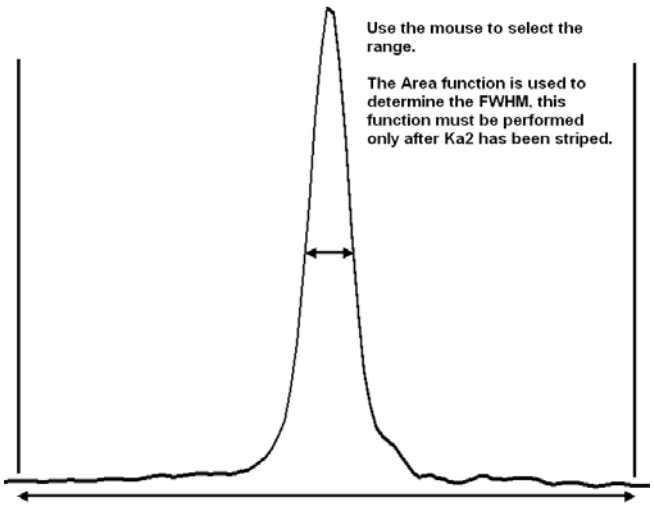

Figure 8.3 - Complete measured range

4. Review the data displayed in Toolbox (see Figure 8.4). Alignment is complete when FWHM matches the specifications in Table 8.2.

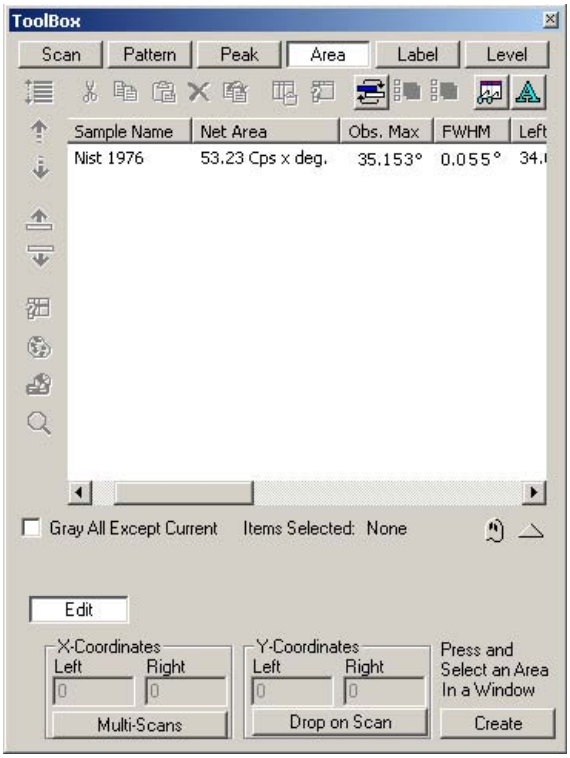

Figure 8.4 - EVA toolbox

5. After completing the alignment of the mount, repeat the calibration described in Section 7.

NOTE: The primary installation and IQ OQ PQ (part number M88-Exx068) may require additional testing instrument verification.

9. Basic Operation

This section covers the power-up, power-down, and basic operation procedures for the VÅNTEC-1 detector system and gives an overview of system operation and collection of data. Operation details for XRD COMMANDER are described in the document M88-Exx060.

WARNING

The Stop button will not turn off the three AC outlets (X601) that are located on the mains distribution panel! Devices connected to these AC outlets can only be switched off by the internal automatic circuit breaker labelled F600 or the external power switch that is installed on the user's side close to the diffractometer.

The VÅNTEC-1 controller requires one hour to warm up for optimal results.

9.1 VÅNTEC-1 Power-Up Procedure

1. Press the I/O button on the front of the VÅNTEC-1 controller to apply mains power. The I/O button illuminates when power is present. If the I/O button doesn't illuminate, ensure that there is power applied to the D8 system by pressing the Power ON (I) button located on the right side column of the D8 enclosure.
2. Turn on the high voltage for the detector by pressing the high voltage enable button on the front of the VÅNTEC-1 controller. If power and communications for the controller are properly applied, there should be no warning LED illuminated. The system LED will flash, indicating communication and control. The high voltage LED will be yellow and illuminated. The low voltage LED will be green and illuminated.

9.2 VÅNTEC-1 Power-Down Procedure

1. Press the high voltage enable button on the front of the VÅNTEC-1 controller. If the high voltage button is not illuminated, this indicates that high voltage for the detector is OFF.
2. Press the I/O button on the front of the VÅNTEC-1 controller to switch off the mains power.

WARNING

Wait 60 seconds after turning off HV power before removing the HV connectors!

3. Press the Power OFF button (O) on the D8 enclosure's right-hand column to stop power to the control electronics, high voltage generator, and the VÅNTEC-1 controller and FDC (if present), when the controllers are connected to X602.
4. Before switching off the diffraction system, reduce the high voltage and current of the generator to the lowest values (e.g., 20 kV/ 5 mA) using the control software (e.g., XRD COMMANDER).
5. Turn off the high voltage generator by turning the rotary switch "High Voltage" to the left side. The X-RAY ON displays will turn off.
6. Switch off the instrument by pressing the enclosure's Power OFF button.

CAUTION

Failure to reduce the generator high voltage and current prior to shutting off the D8 could significantly reduce the lifetime of the X-ray tube and the high voltage generator.

9.3 Emergency Power-Down Procedure

The mains power for the VÅNTEC-1 controller is connected to X601, located on the left side of the D8 lower enclosure.

1. In the event of an emergency, press either Stop button located on the front side columns to switch off power to the control electronics, high voltage generator, and the VÅNTEC-1 controller and FDC (if present), when the controllers are connected to X602.

   Use the Stop button to immediately shut off power to the X-ray source and stop all moving drives instantly. The Stop button should only be used in emergency situations and not for normal shutdown of the diffractometer system.

WARNING

The Stop button will not turn off the three AC outlets (X601) that are located on the mains distribution panel! Devices connected to these AC outlets can only be switched off by the internal automatic circuit breaker labelled F600 or the external power switch that is installed on the user's side close to the diffractometer. The control panels of the D8 diffraction system are located on the front side of the system. X602 is supplied power as long as the D8 On/Off switch (on the right-hand column of the D8 cabinet) is enabled and the two emergency Stop switches are not engaged.

2. To disengage the Stop button, turn the button clockwise and release. Re-apply power with the Power On button that is on the right side column of the D8 enclosure.

9.4 Disconnecting the Power Plug

To remove, relocate or service the detector controller, it may be necessary to disconnect the power cord from the rear of the controller.

1. Ensure that all power is off to the enclosure prior to removing the power cord.
2. Remove the rear access panel of the D8 enclosure. Use caution when removing the panel as the ventilation fans are connected to it.
3. Visually inspect the power cord for frayed or exposed wiring prior to removal. If the power cord appears defective, contact Bruker AXS Service for replacement by qualified service personnel.
4. With the access panel removed, firmly grasp the power cord of the detector controller at the strain relief and pull the cord from the controller.
5. The power cord is connected to X601 on the left side of the D8 enclosure. Pull the plug from this outlet strip.

9.5 Lock Out

1. Use the key located on the left side column of the D8 enclosure to lock and unlock the system.

During normal operation, the key must be switched to the unlocked position. In the unlocked position, power may be applied with the ON button located on the right-hand column of the D8 enclosure. In the locked position, no power will be available for the control electronics, generator or X602 connectors. The key can only be removed in the locked position.

CAUTION

Power will still be present at the X601 connectors. Electric shock can result if proper safety precautions are not observed.

9.6 Performing a Measurement

XRD COMMANDER is the main measurement program in the DIFFRAC*plus* suite. It can be used to perform immediate measurements to get a quick overview of a sample, as well as to perform batch measurements using jobs. Operation details for XRD COMMANDER are described in the DIFFRAC*plus* COMMANDER User Manual (M88-Exx060). This section gives an overview of the system operation and collection of data.

To open the XRD COMMANDER program:

1. Locate the C:\diffplus directory.
2. Double-click on the **XRDCMD** icon. There may be icons set up on the desktop to open the XRD COMMANDER program, as well as in the DIFFRAC*plus* Measurement folder in the Windows Programs menu.

9.6.1 Select the Detector Type

The XRD COMMANDER program window is separated into five pages.

1. Use the tabs on the bottom of the screen to change the active page (see Figure 9.1).
2. Select detector type PSD (VÅNTEC-1) in the Details tab.

Figure 9.1 - Tab selection

9.6.2 Select the Scan Parameters

The following parameters must be selected prior to running a measurement: scan type, start, stop, speed, and increment (see Figure 9.2). Additional settings may include divergence slit size, rotation of the stage, and generator settings for KV and mA.

When using a Fixed PSD scan, max length may vary and is dependent upon the Config geometry angle.

To perform a measurement:

1. Turn the X-ray generator on.

Figure 9.2 shows the location of the parameters for immediate measurement. The fields show the actual settings for the current measurement.

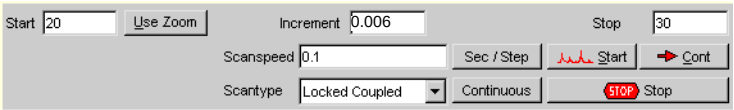

Figure 9.2 - The scan control area

2. Scan type: Choose the scan type from the drop-down menu. You must select PSD as a detector type in the Details tab before PSD Fixed scan is available.
3. Scan speed: Enter the scan speed here. VÅNTEC-1 operation uses seconds per step. Click the button to the right of the input field to switch between seconds per step and degrees per minute. The actual setting will be displayed on the button.
4. Continuous/Step scan: Click this button to change between continuous or step scan mode. The actual setting will be displayed on the button. It is recommended that continuous scan be used to reduce wear on the goniometer.
5. Start, Stop: Use these buttons to begin or end an immediate measurement.

9.6.3 Suppression of Kβ

During typical operation, suppression of Kβ is necessary. For this reason, it is important to make sure that you are using the proper filter. See Table 9.1 for proper filter selection and the location of the $K\beta_1$ peak. In the case of Cu radiation, a Ni filter is included with the VÅNTEC-1 accessories.

Settings:

Anode	E (KeV)	$K\alpha_1$	$K\alpha_2$	$K\beta_1$	Beta Filter
Quartz Standard					
Cu	8.048	26.64°	26.70°	24.033°	Ni
Cr	5.412	40.06°	40.13°	36.333°	V
Co	6.92	31.04°	31.11°	28.054°	Fe
Mo	17.44	12.17°	12.24°	10.852°	Zr
Fe	6.40	33.67°		30.46°	Mn
NIST 1976 Corundum Standard					
Cu	8.048	35.15°	35.21°	31.673°	Ni
Co	6.92	41.05°	41.11°	37.047°	Fe

Table 9.1 – Filter selection and location of $K\beta_1$ peak

9.6.4 Secondary Optics Settings

In addition to selecting the proper filter, it is necessary to fix the secondary slits of the VÅNTEC-1 optics.

1. During the calibration of the detector, open both secondary slits to the maximum setting. The position of the secondary slits is calculated for optimum performance under normal data collection operations (see Section 9.7). An 8 mm Debye slit and 2.5° Soller slit will provide sufficient resolution for most measurements.
2. Manually close the anti-scatter slits to eight ticks up and eight ticks down for a total opening of 16 mm.
3. Manually close the detector window slits to ten ticks up and ten ticks down for a total opening of 20 mm.

9.6.5 Execute an Immediate Measurement

1. After selecting the correct scan parameters, click the **Start** button to begin the scan.

For more detailed information on the operation and use of the XRD COMMANDER measurement software package, refer to the DIFFRAC*plus* COMMANDER User Manual (M88-Exx060).

9.7 Calculate the Optimum Secondary Slit Openings

This section describes how to calculate the optimum setting for the secondary slits using **VÅNTEC-1 Setup > Calculate Geometry** in the Configuration program.

1. In the VÅNTEC-1 Setup menu, click the **Calculate Geometry** button. The PSD Calculator menu will appear (see Figure 9.4).
2. Enter the goniometer diameter, divergence slit size, and the PSD angle from other menus in the configuration program to calculate the optimum secondary slit and limits for the FDC fast scans. The values cannot be changed in this menu. They must be changed in their respective menus:

- The measurement diameter is set in the Basic Diffractometer Settings menu;
- The divergence slit size is set in the Fixed Beam Optics menu (see Figure); and
- The PSD angle is set in the VÅNTEC-1 Setup menu.

The calculation is made based on the diameter of the measuring circle (mm), size of the divergence slit (mm), and the distance of the anti-scatter and detector slits.

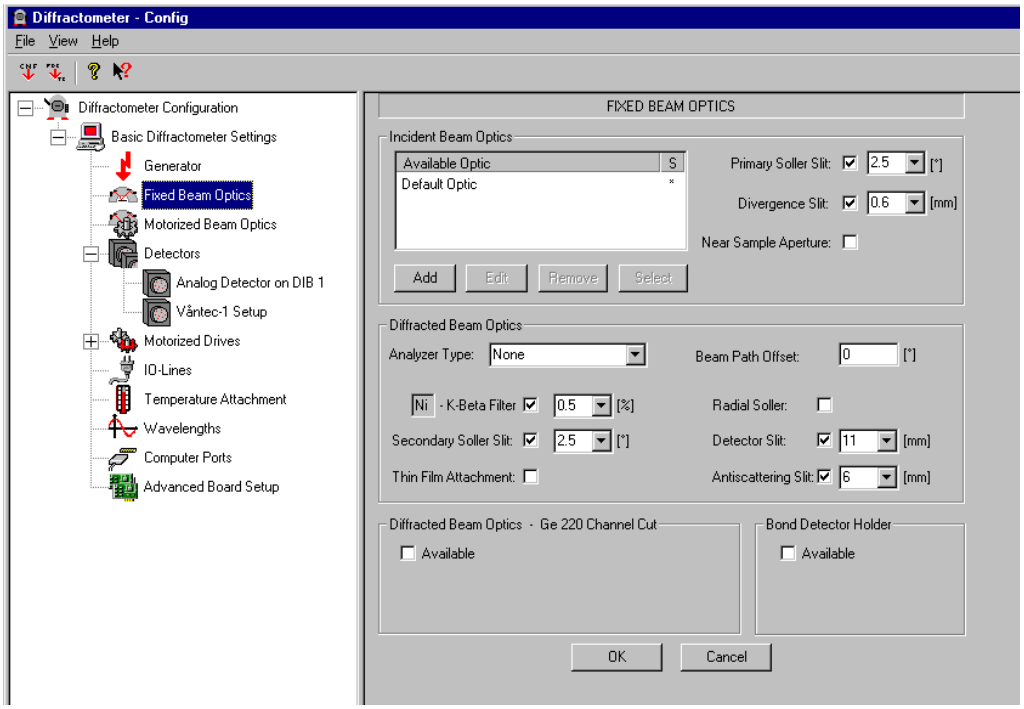

Figure 9.3 - Fixed beam optics

The distance of the anti-scatter slit is measured from the center of the goniometer to the edge of the slits.

The distance for the detector slit is measured from the reference mark on the detector to the edge of the detector slits (see Figure 4.23).

The PSD resolution and offset were determined during the calibration of the detector.

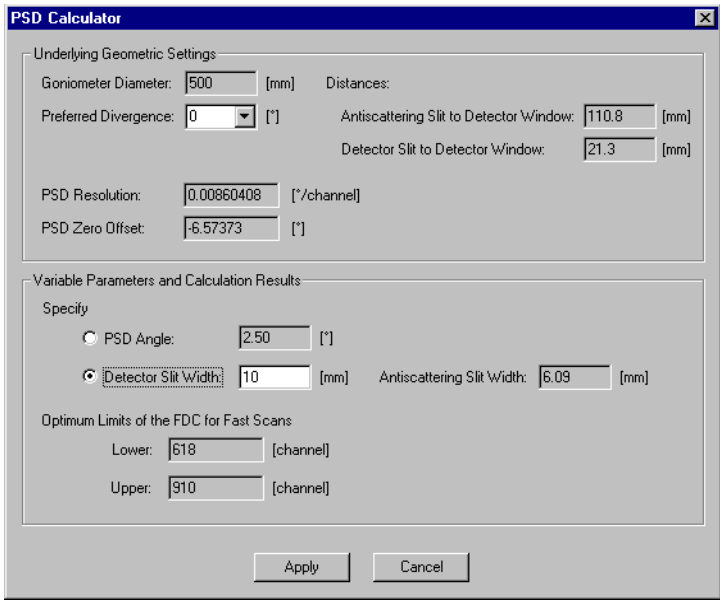

Figure 9.4 - PSD Calculator

3. Specify the optimum settings of the PSD angle or the detector slit width.
4. Physically set the slit settings to the values determined in step 3.
5. To implement the settings, press the **Apply** button.
6. Download the changes to the VÅNTEC-1 controller to make them effective.

For more detailed information on the operation and use of the XRD COMMANDER measurement software, refer to the DIFFRAC*plus* COMMANDER User Manual (M88-Exx060).

10. Preventive Maintenance and Troubleshooting

The components of the diffractometer measuring equipment are maintenance-free for the user. However, Bruker AXS recommends a yearly preventive maintenance inspection. To schedule this inspection or for technical support, contact your local Bruker AXS Service Department (for the U.S.A., call 1-800-234-XRAY).

10.1 Cleaning the Diffraction System and Measuring Equipment

CAUTION

Before cleaning the equipment, turn off power to the complete diffraction system (i.e., all control electronics, accessory components, and the high voltage generator).

WARNING

Do not touch the front window of the X-ray detector and the X-ray tube as they contain beryllium. Beryllium is potentially hazardous if ingested, inhaled or absorbed through the skin. Take care to avoid contact with the VÅNTEC-1 X-ray window. Never drill, grind or sand beryllium unless you are a qualified individual using appropriate respiratory equipment and dust containment and collection apparatus. Disposal of parts containing beryllium must comply with all applicable national regulations.

To clean the interior of the enclosure and exterior of the detector components, use dry cleaning utensils only. Do not use water or aggressive cleaning agents. Clean laboratory conditions are recommended.

Airflow is critical for maintaining proper operation of the detector control electronics. Do not place anything on the controllers that may restrict the flow of air. Regular cleaning of the detector components includes removal of any airflow restrictions, including dust.

10.2 Replacing Fuses

1. Unplug the power cord before replacing the fuse.
2. Locate the fuse.
3. Carefully remove the fuse from its holder. You may need a small screwdriver or needle-nose pliers to pry open the fuse cover (see Figure 10.1).

NOTE: Replace the fuse only with the specified replacement (see Appendix B). Do not substitute a fuse with a different rating.

4. Insert the new fuse into the holder. Verify complete seating of the new fuse.
5. Replace the fuse cover.
6. Plug in the power cord.

If the controller continues to blow fuses or if any function does not work correctly after replacing the fuse, contact Bruker AXS Service for repair assistance. Discontinue use of the controller if it is not functioning properly.

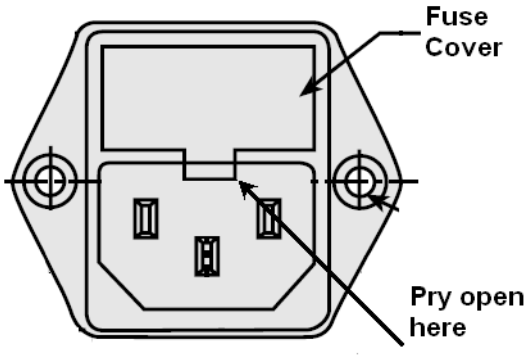

Figure 10.1 - Fuse close-up

10.3 Troubleshooting

1. Display data in the XRD COMMANDER window has flatlined or is nonexistent.

- Ensure that the detector type VÅNTEC-1 PSD is selected in the Details tab of the COMMANDER program.
- Ensure that the detector setting matches the factory setting and the setting in the Config program.

  Set the detector to the factory setting using the Set Detector button.

  Update the config file.

  1.1 If external FDC is used, is data now present on the FDC controller display?

  If the FDC displays data, check the interconnect cables.

  If the FDC does not display data, check if the HV Enable button is illuminated.

2. The High Voltage Enable button is not illuminated.

- Press the High Voltage Enable button.

  If the switch lights, the high voltage is enabled.

  If the switch is still not lit, check the Power ON switch on the VÅNTEC-1 controller or D8 enclosure.
- Use a continuity checker or ohmmeter to verify the condition of the fuse. Visual inspection is not a reliable method for determining the fuse condition. If you do not have access to one of the above instruments, replace the suspect fuse with a new fuse.

3. There is no communication to the system and the following error appears: “Time Out Reading from Socket.”

- Check the network cable connections and network card.
- Check the network setting in the Config program file.
- Connect a serial cable and attempt to recover communications from the Config program (see Section 6.5).

4. The angular accuracy peak position data is greater than +0.01° of the expected value.

- Repeat the calibration of the VÅNTEC-1 detector (see Section 7).

5. There is poor instrument resolution (FWHM is greater than 0.065° of the 104 reflection of NIST 1976).

- Repeat the alignment of the 2 DOF mount for the VÅNTEC-1 detector (see Section 8).

6. The following error appears: “Scan Outside Software Limits.”

- Using Fixed Scan mode, the start-to-stop range is determined by the configuration and cannot exceed the geometry angle set in Config (max 12°).

10.4 Manual Configuration of the Controller

If there is no communication to the D8 controller, power-up the VÅNTEC-1 controller using the following procedure.

1. In the Config software, go to PSD-Controller. Press the "**Recover…**" button located in the lower left corner of the window (see Figure 6.6). A new window will pop up (see Figure 10.2).

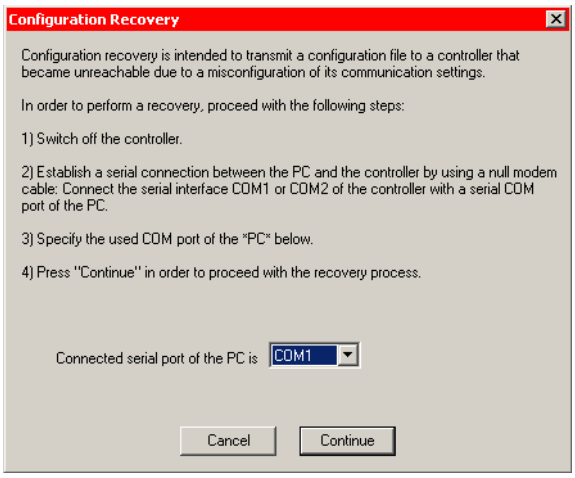

Figure 10.2 - Recover... pop-up window

2. Follow the steps in the screen shown in Figure 10.2.

3. Select **COM1** in the drop-down list and press **Continue**. Another window appears indicating that Config is now waiting for the controller to boot up.

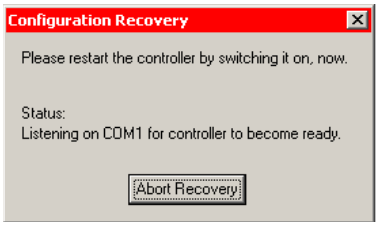

Figure 10.3 - Boot-up window

4. Switch on the controller and wait a few minutes. As soon as the controller becomes ready, Config transmits the configuration file.

5. A message will pop up stating that transmission is successful. Switch off the VÅNTEC-1 controller.

6. Replace the cables as they were prior to this recovery procedure (see Figure 4.3 for external FDC configurations, Figure 4.6 for integrated FDC configurations).

7. Switch on the VÅNTEC-1 controller.

Communication is now via the LAN line.

Appendix A. Configuration Tables

Measurement Diameter (mm)	Standard Sample Stage	Rotation Sample Stages	Non-Ambient Chambers	Reflectometry Sample Stage	Flip Stick	Centric Eulerian Cradle	D4 Sample Stages
401	–	–	–	–	–	–	A17-D16
435	A17-D15	A17-D15	A17-D15	A17-D15	–	–	–
500	A17-D17	A17-D17	A17-D17	A17-D17	–	–	–
500	A17-D18	A17-D18	A17-D18	A17-D18	A17-D18	A17-D18	–

Table A.1 – Part number configuration for the radial Soller slit assembly

Part Number	A17-D15	A17-D16	A17-D17	A17-D18
Name	Radial Soller VÅNTEC-1 435 mm	Radial Soller VÅNTEC-1 401 mm	Radial Soller VÅNTEC-1 500 mm	Radial Soller VÅNTEC-1 Push-Plug
Available Space to Sample Center	82.5 mm	82.5 mm	82.5 mm	132 mm

Table A.2 – Part number breakdown for the radial Soller slit

The air scatter screen is available only for the following components and configurations. If your Göbel mirror housings are older than August 2004, they have to be upgraded with part number A18-C201. Contact Bruker AXS Technical Support for more information.

Measuring Diameter (mm)	Primary Optics	Fixed Sample Stage Reflection	Rotation Sample Stage Transmission (Reflection mode)	Rotation Sample Stage Transmission (Transmission mode)	Flip Stick (9 position)	D4 Sample Stage
401	Fixed or variable slits	–	–	–	–	A17-B27
435	Fixed or variable slits	A17-B28	A17-B28	A17-B28	A17-B28	–
435	Göbel mirror 40 mm	A17-B27	A17-B27	A17-B27	A17-B27	–
500	Fixed or variable slits	A17-B29	A17-B29	A17-B29	A17-B29	–
500	Göbel mirror 60 mm	A17-B28	A17-B28	A17-B28	A17-B28	–
500	Push-Plug (slits and Göbel mirror)	A17-D1	A17-D1	A17-D1	A17-D1	–

Table A.3 – Configuration scheme for the air scatter screen

Appendix B. Spare Parts List

Part Number	Description
033-007300	House Dress Cover 1D
070-003200	Fuse: F, 3.15 A, 250 V, 5 x 20 mm
072-000400	Fan, 12 V Rotron
085-000200	Coaxial thin wire cable
085-006100	3 cond. 8'2" cable
085-013500	Push button 0/1 switch
085-013800	Cable control to FDC
113-002400	Power supply ATX ACE-81
222-224300	Flash drive
222-244100	PCI backplane
222-244200	Comp PCI single board (SBC)

Table B.1 – Spare parts

Part Number	Description
419-308900	PCB TDC
419-309601	PCB CFD
419-309701	PCB preamp 1DDL
419-309901	PCB preamp grid
472-051600	Pressure vessel 1D
472-052500	Filter assembly 1D
472-053000	HV filter chassis
472-053600	Mount Assy/D4 106mm/ PXC, 1D
472-053700	LV Power Supply/Chassis
672-012200	Detector assembly
672-012600	Controller 1D
7KP2912-8BA	Fast Diffraction Controller
842-082100	VÅNTEC-1 Detector, 1D
A17B10	Optic for VÅNTEC-1
A17B13	Set of Kβ radiation (Cr, Co, Mo radiation)
A17B14	Short anti-scatter slit assembly (401 mm measurement circle)
A17B15	Long anti-scatter slit assembly (435 mm measurement circle)
A17B16	Debye slit 8 mm

Table B.1 – Spare parts

Part Number	Description
A17B17	Debye slit 4 mm
A17B18	Ni filter for Cu-Kβ radiation for VÅNTEC-1 (high overall intensity), 2.5%
A17B19	Debye slit 1 mm
A17B20	Fe filter for Co-Kβ radiation for VÅNTEC-1
A17B21	V filter for Cr-Kβ radiation for VÅNTEC-1
A17B22	Zr filter for Mo-Kβ radiation for VÅNTEC-1
A17B23	Ni filter for low Cu-Kβ radiation for VÅNTEC-1 (default), 0.5%
A17B25	Soller slit 2.5° for VÅNTEC-1
A17B26	Soller slit 4° for VÅNTEC-1
A17B27	Air scatter screen, 401 mm diameter
A17B28	Air scatter screen, 435 mm diameter
A17B29	Air scatter screen, 500 mm diameter
A17B30	Beam Stop for D8 (150 mm goniometer height)
A17B31	Long anti-scatter slit assembly (500 mm measurement circle)
A17B32	Beam Stop for D4
A17B35	Mount for VÅNTEC-1, measurement height 150 mm
A17B36	Mount for VÅNTEC-1, measurement height 214 mm
A17B37	Mount for VÅNTEC-1, measurement height 258 mm

Table B.1 – Spare parts

Part Number	Description
A17B71	Fluorescent screen
A17C84	Beam Stop adapter for VÅNTEC-1 Mount
A17C89	Beam Stop extension D8 to 214/258 mm goniometer height
A17D1	Air Scatter screen, Push-plug
A17D10	VÅNTEC-1 Detector for D8 ADVANCE/D8 DISCOVER, Including Beam Stop for External FDC
A17D11	VÅNTEC-1 Detector for D4 ENDEAVOR, Including Beam Stop and Mount for External FDC
A17D12	Set of Debye Slits For VÅNTEC-1 Detector (1 mm, 4 mm And 8 mm)
A17D13	Set of Kβ-filters for VÅNTEC-1 (Cr, Co and Mo radiation)
A17D15	Radial Soller Slit for VÅNTEC-1 (435 mm measurement circle)
A17D16	Radial Soller Slit for VÅNTEC-1 (401 mm measurement circle)
A17D17	Radial Soller Slit for VÅNTEC-1 (500 mm measurement circle)
A17D18	Radial Soller Slit for VÅNTEC-1 (Push-plug)
A17D40	VÅNTEC-1 Detector with Internal FDC For D8, Including Beam Stop
A17D41	VÅNTEC-1 Detector with Internal FDC for D4 ENDEAVOR, including Beam Stop and Mount
A17-D42	Clock Signal cable
A17-D43	Y-shaped Adapter Cable for first-generation indexer boards
A18-C201	Soller holder for Göbel mirror

Table B.1 – Spare parts

Part Number	Description
C71121Z253F41	Nut/cage M6
C72195Z122K2	Socket
C72195Z122K3	Cable Fixer
C72298A251B39	Ground Cable for FC (S3K)
C79298A3130A76	Cable Serial Communication Control PC to Detector Controller
C79298A3220B240	TDC Signal Conditioning board
C79298A3320B124	Remote Control board
K340C9	Ethernet Crosslink cable 50 Ft (15 M)
K360C2	Network card
N120C47	ISO 14583 M5x30 8.8
N120C51	Screw head M6x16 ISO 14583
N301C14	EN 27090 A5
N301C15	EN 27090 A6

Table B.1 – Spare parts

Appendix C. Updating the Detector Controller Firmware

The Bruker AXS VÅNTEC-1 detector controller is running Linux as its embedded operating system. The operating system itself and all associated control software is stored on a Flash drive inside the controller. This section describes how to update the firmware on the detector controller's Flash drive.

C.1 Setting up the HTTP connection

To access the detector controller with a Web browser, the user needs a login name and password.

To set up the login and password:

1. Open the Diffractometer Configuration program and go to **Basic Diffractometer Settings > Advanced Board Setup > PSD-Controller > IP Setup and Services**. Check the **HTTP Interface** checkbox and press the **Users** button.

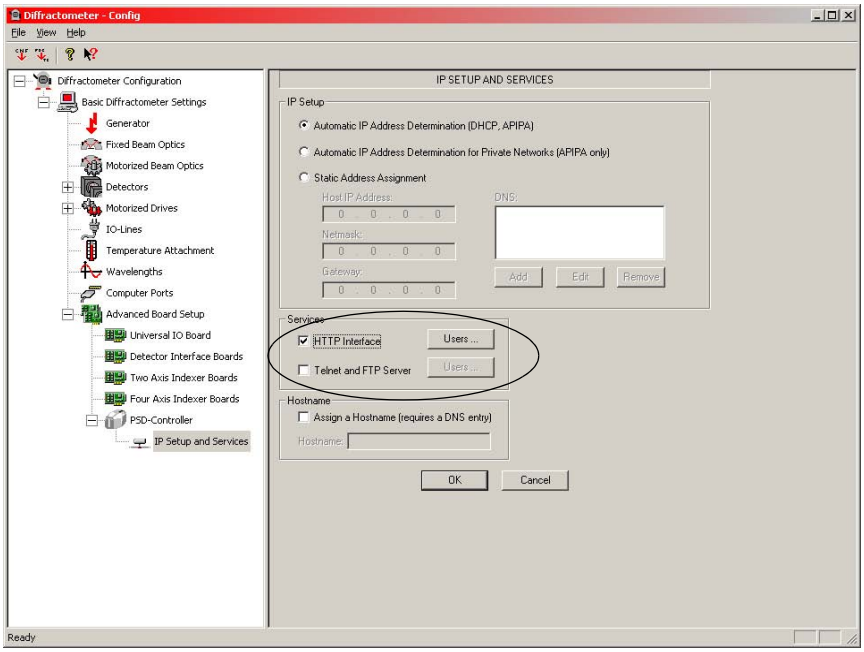

Figure C.1 - Set up login and password

2. Click **Add User**.

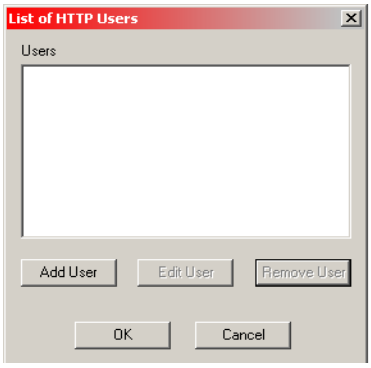

Figure C.2 - List of HTTP Users menu

3. Fill in the fields in the Add User window as follows:

User: user

New Password: DIFFRAC (for example)

Type your new password again in the “Confirm Password” field.

Check the **Status** and **Service** checkboxes.

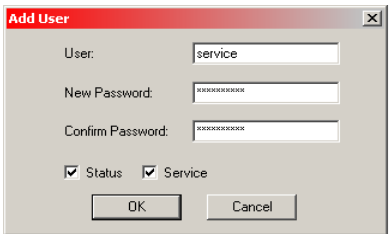

Figure C.3 - User and password setup under Add User menu

4. Click **OK**.
5. Save and download the configuration.

From the menu bar at the top of the Diffractometer Configuration window, go to **File > Save and Download**.

6. A confirmation window appears (Figure C.4). Click **Yes**.

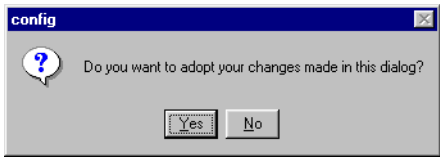

Figure C.4 - Save changes confirmation window

7. Upon saving, the software intelligently decides whether it needs to download the configuration information to the diffractometer. A window appears showing whether the software will do this or not (in Figure C.5, the configuration will not download). Accept the default and click **OK**.

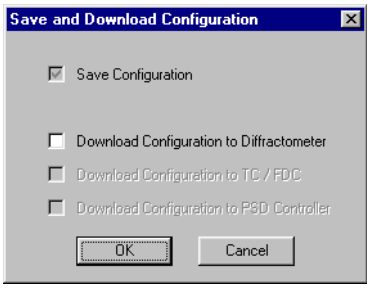

Figure C.5 - Download configuration window

C.2 Performing the Flash Disk Installation

In order to update the embedded Linux system on the Flash drive, do the following:

1. Open your preferred Web browser.
2. Browse the x86 based CPU-Board or PC by typing the detector controller's IP address into the address field of your browser:

http://192.168.23.2

NOTE: If you are using a local proxy server, make sure the detector controller's IP address is excluded by entering it as an exception in your Web browser's Proxy Settings menu. For Internet Explorer, go to **Internet Explorer > Tools > Internet Options > Connections > LAN Settings > Advanced**. See Figure C.6.

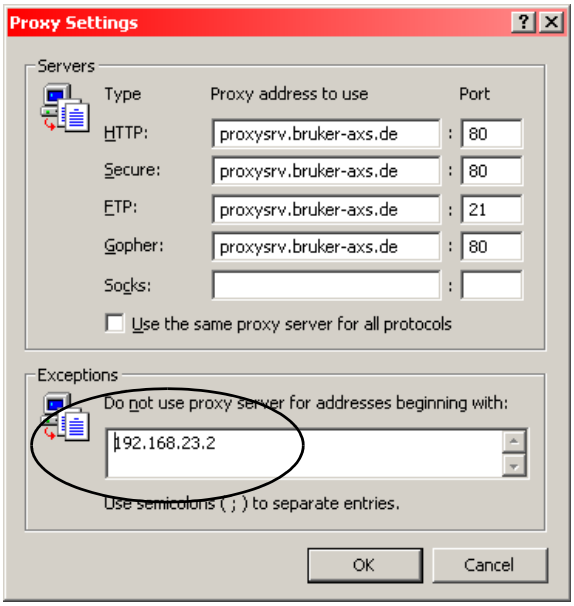

Figure C.6 - Entering the detector controller's IP address as a Proxy server exception

3. After typing the detector controller's IP address, hit **Enter**. The detector controller prompts you for a user name and password.

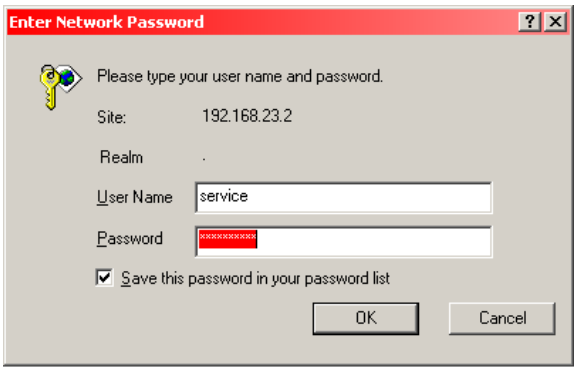

Figure C.7 - Enter Password

4. Initially, the user name is **user** and the password is the corresponding password that was chosen in Section C.1. Enter the username and password and click **OK**.

5. The detector controller menu appears in the browser window.

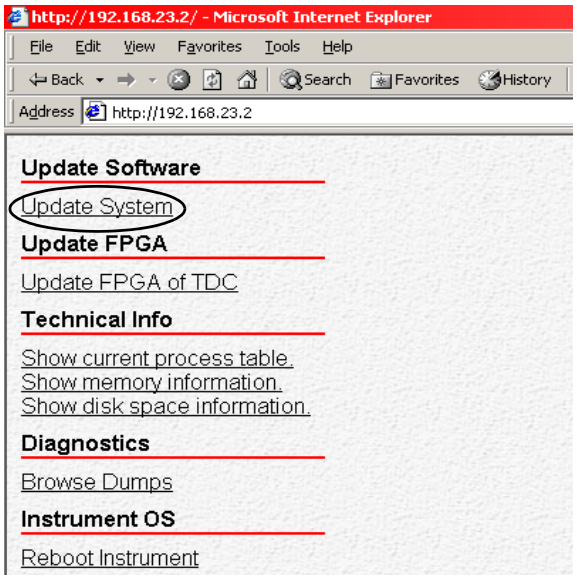

Figure C.8 - Browsing the x86-based CPU board or PC

6. Select the **Update System** link from the menu. The System Update page will appear on the right side of the window.

Figure C.9 - System update package dialog

7. Choose the **Browse** button and select the update package with the extension *.tgz .

NOTE: Update vs. Complete (Re)Installation: The “Update” variant (recommended) leaves intact all configuration files stored on the Flash drive, whereas “Complete (Re)Installation” formats the Flash drive before installing, discarding all configuration files.

---

8. Press the **Proceed** button to begin the update process. It should take about one minute.
9. When finished, a report about the installation process will be displayed.
10. The update of the PSDWARE is now complete.
11. To activate the update, reboot the detector controller by switching it off, waiting 5 seconds, and switching it on again. After rebooting, the detector controller should be reachable with your Web browser at the same IP address.

C.3 Updating the FPGA Firmware

1. To update the FPGA firmware, access the detector controller with a Web browser as in the first part of Section C.2. At the detector controller menu, select the **Update FPGA of TDC** link. The Update page will appear on the right side of the window.

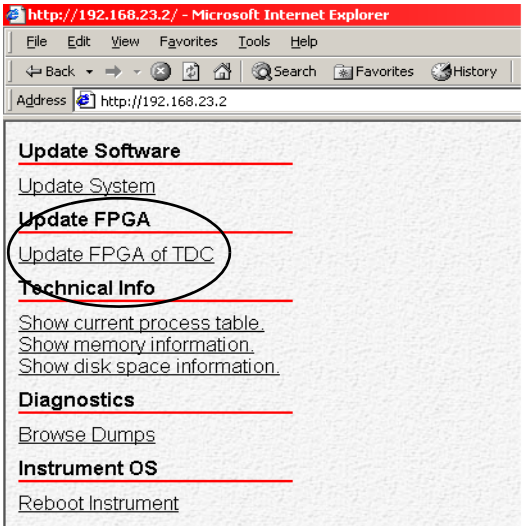

Figure C.10 - Updating FPGA firmware

2. Choose the **Browse** button and select the update package with the extension *.jbc .
3. Press the **Proceed** button to begin the update process. It should take several minutes.
4. When finished, a report about the installation process will be displayed.
5. The update of the FPGA is now complete.
6. To activate the update, reboot the detector controller by switching it off, waiting 5 seconds, and switching it on again. After rebooting, the detector controller should be reachable with your Web browser at the same IP address.
7. There are various services running on the system (e.g., http, telnet, ftp service, and the instrument control software itself). The use and settings of all services can be adjusted with the DIFFRAC*plus* software package's Config program. Consult the Config manual for details.

NOTE: Please do not mix FPGA and PSDWARE versions from different sources. The firmware of the VÅNTEC-1 detector controller MUST fit with the corresponding DIFFRAC*plus* software. The firmware will be delivered either with the Measurement Package or with update CDs.

Appendix D. EC Declaration of Conformity

See the figure on the next page.

BRUKER AXS

EC DECLARATION OF CONFORMITY

Name of Manufacturer: Bruker AXS Inc.
5465 East Cheryl Parkway
Madison, WI 53711
USA

Product Name: Vantec-1 X-ray Detector and Controller

Product type: 672-012200 (detector), 672-012600 (controller)

The designated product conforms to the provisions of the following European Council Directives on the approximation of the laws of the member states.

The conformity of the designated product to the provisions of the directive is attested by full compliance with the following harmonized European standards:

89/336/EEC: Directive relating to electromagnetic compatibility
EN 61326:1997, +A1:1998 to EN 61326:1997, +A2:2001 to EN 61326:1997
EN 55011:1998, +A1:1999 to EN 55011:1998, +A2:2002 to EN 55011:1998
EN 61000-3-2:2000
EN 61000-3-3:1995, +A1:2001 to EN 61000-3-3:1995

73/23/EEC: European Low Voltage Directive
EN 61010-1:2001

Affixing of the CE mark: 2004

Bruker AXS Inc.
Madison, 25 May 2004

Kline Wilkins, Senior Vice President

This declaration certifies compliance with the specified directives but does not warrant any features covered by product liability legislation.

The safety guidelines supplied with the product documentation must be observed.

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