BRUKER

Bruker AXS GmbH

LynxEye Detector

User Manual

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We have checked the contents of this manual for agreement with the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee full agreement. However, the data in this manual are reviewed regularly and any necessary corrections are included in subsequent editions. Suggestions for improvement are welcome.

All configurations and specifications are subject to change without notice.

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Bruker AXS GmbH
Östliche Rheinbrückenstr. 49
76187 Karlsruhe, Germany
Tel. +49 (7 21) 5 95-28 88
Fax +49 (7 21) 5 95-45 87
info@bruker-axs.de
www.bruker-axs.com

LynxEye™ Detector User Manual

Table of Contents

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1 Safety Issues

This manual contains notices which you should follow 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.

1.1 Qualified Personnel

The LynxEye™ may only be set up and operated in conjunction with this manual. Only personnel authorized by Bruker AXS is allowed to work on this equipment. All repairs, adjustments and alignments performed on any components of the LynxEye 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.

The LynxEye detector itself is no source generating X-rays, it just senses X-rays.

WARNING

Voltage Danger - Before installing the detector, switch off the system to avoid high voltages.

Bias voltages up to 500 V DC are accessible from the **outside**! They are present on the metal sensor window on the front side of the detector! **Never** operate the detector with Bias voltage switched on **without** having the detector optics mounted!

Inside the LynxEye, Bias voltages up to 500 V DC can occur which are not accessible from the outside. Bias voltages exist inside the detector, the detector controller and in the Detector Power cable connecting the detecting unit and the control rack. After turning off the system, Bias voltages are still present. They discharge over time. Wait a few minutes before removing cables from the controller unit. If one of these Bias-voltage components is damaged, switch off the system immediately and contact your local Bruker AXS Service Department.

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.

CAUTION

Switching ON/OFF the detector Bias will initiate a ramping process for the Bias voltage. This process is indicated by a flashing BIAS READY LED. In all cases wait until the ramping process has finished.

When switching ON the detector Bias this will be indicated by a steadily lit BIAS READY LED.

When switching OFF the detector Bias this will be indicated by the BIAS READY LED turning off.

Any violation of this precaution rule might result in a reduced lifetime or damage of the detector.

CAUTION

Never touch the metal sensor window of the detector entrance window with fingers or tools. Any partial damage on this thin layer might lead to non-repairable malfunctions of the detector, the warranty is not valid any more.

CAUTION

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

WARNING

The mains power for the LynxEye controller commonly connects to X601, located on the left side of the D8 base cabinet.

Pressing the Stop button of the D8 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 labeled 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.

In the event of an emergency, press either Stop button located on the front side columns of the D8 base cabinet to switch off power to the control electronics and high voltage generator. In case that the LynxEye controller is connected to X602 it will also be shut off **violating the precaution** rules for the detector Bias!

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.

1.4 Proper Lifting

Installation of the detector requires lifting of components with heavy weight (e.g. enclosure rear panel). 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 LynxEye detector. The LynxEye is a 1-dimensional detector for X-ray powder diffraction, based on Bruker AXS' compound silicon strip technology. Compared to a simple point detector the LynxEye dramatically increases measured speed – without sacrificing resolution and peak shape. A Diffraction Solution equipped with the LynxEye records a typical powder pattern in approximately 1/200th of the time required using a point detector, with identical data quality.

The LynxEye is based on the silicon strip detector technology. The active area of the detector is 14.4 mm by 16 mm (along the scattering plane respectively perpendicular). The 192 strips of the sensor act as 192 individual detectors. This technology allows operation at count rates much higher than those typically possible with gaseous detectors while maintaining all benefits. Together with the innovative front-end electronics, optimum tuning of the silicon strip sensor to the requirements of the X-ray energy from 6 keV to 15 keV is provided. The factory settings are optimized for Cu-Kα.

The LynxEye fits to all Bruker AXS D4 and D8 Diffraction Solutions. It can be easily exchanged by any other point, linear or 2-dimensional detector. There is no need for counting gas, cooling water or liquid nitrogen, making the LynxEye a compact, robust and maintenance-free detector.

Supplied with a dedicated software the LynxEye can also be operated as a stand alone solution.

3 System Description

Figure 3.1 LynxEye detector

The LynxEye consists of three coponents which are installed in the D8 system: the detector itself, the detector controller, and the optics. This section also contains information on the counterbalance, as the setting may vary depending on your configuration.

3.1 The Detector

3.1.1 Detector Specifications

Table 3.1 Basis specifications of the LynxEye

Detector Specifications	
Suitable systems	All D8 SUPER SPEED SOLUTIONS systems, all D8 systems and the D4 ENDEAVOR
Active area	14.4 mm x 16 mm; (in and perpendicular to the scattering plane)
Max 2-theta range simultaneously covered	4° at 401 mm measurement circle diameter
Usable wavelength range	From Cr-Kα up to Cu-Kα, factory-set default for Cu-Kα
Maximum global count rate	> 100,000,000 cps
Maximum local count rate (per strip)	650,000 cps
Energy resolution	25% with 55Fe radiation at 5.9 keV
Efficiency	> 98% (Cu-radiation)
Spatial resolution (pitch)	75 µm, 192 individual readout channels
Voltage of power supply	100–240 V AC
Frequency of power supply	50/60 Hz
Power rating	100 VA

Detector Specifications	
Detector (overall dimensions and weight)	200 mm D x 120 mm W x 120 mm H, 2.5 kg
Controller (overall dimensions and weight)	420 mm D x 485 mm W x 90 mm H, 8.5 kg
Length of cables between the detector and 19” controller chassis unit	4 m
Disconnect device	IEC 320 connector/plug on power supply cord
Software	DIFFRAC^{plus} Measurement package version 2.4 or higher, for 0-D mode version 2.6 or higher
Included in delivery	LynxEye detector; front-end read-out and supply electronics; mounting and optics assembly, including Kβ-filter, 2.5° Soller slit, 3 mm and 8 mm plug-in slits

3.1.2 Environmental Ratings

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

Table 3.2 Environmental ratings of the detector

Environmental ratings	
Operating temperature	14–34°C (57–93°F)
Maximum temperature gradient	+ 0.5°C (+ 0.9°F) per hour
Relative humidity	Max 80%, non-condensing, for temperatures up to 31°C (88°F) decreasing linearly to 50% at 40°C (104°F)
Location of	Indoor use only
Altitude	All terrestrial locations
Mains supply voltage fluctuations	Up to +10% of the nominal voltage
Over voltage category	IEC 664 II

3.1.3 Detector Components

The detector contains the Silicon Strip Sensor, the signal pre-processing electronics (ASICs) and a non-volatile memory where all detector specific parameters are stored.

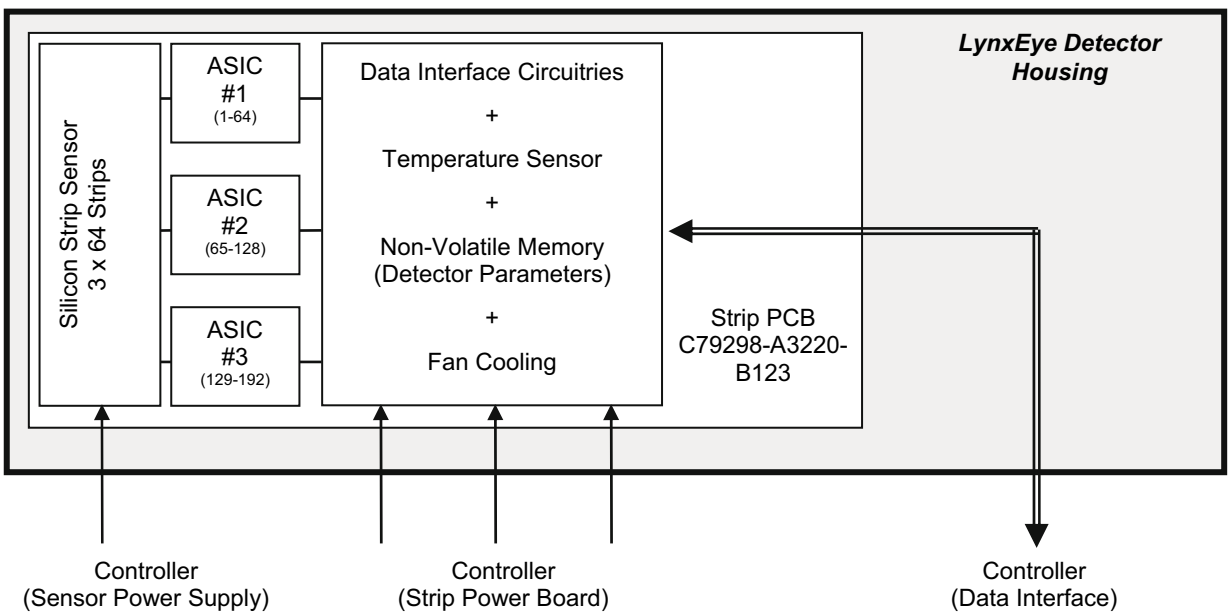

Figure 3.2 Block diagram of the detector electronics

3.1.4 Detector Cables and Connectors

The detector has two cable connectors:

- One connector for the detector power
- One connector for the detector's signal outputs

3.2 The Detector Controller

3.2.1 Detector controller components

The detector controller contains the electronic circuit boards for signal processing, the detector bias voltage power supply (sensor power supply), power supplies for other detector electronics and a CPU running the controller firmware (stored on a flash disk).

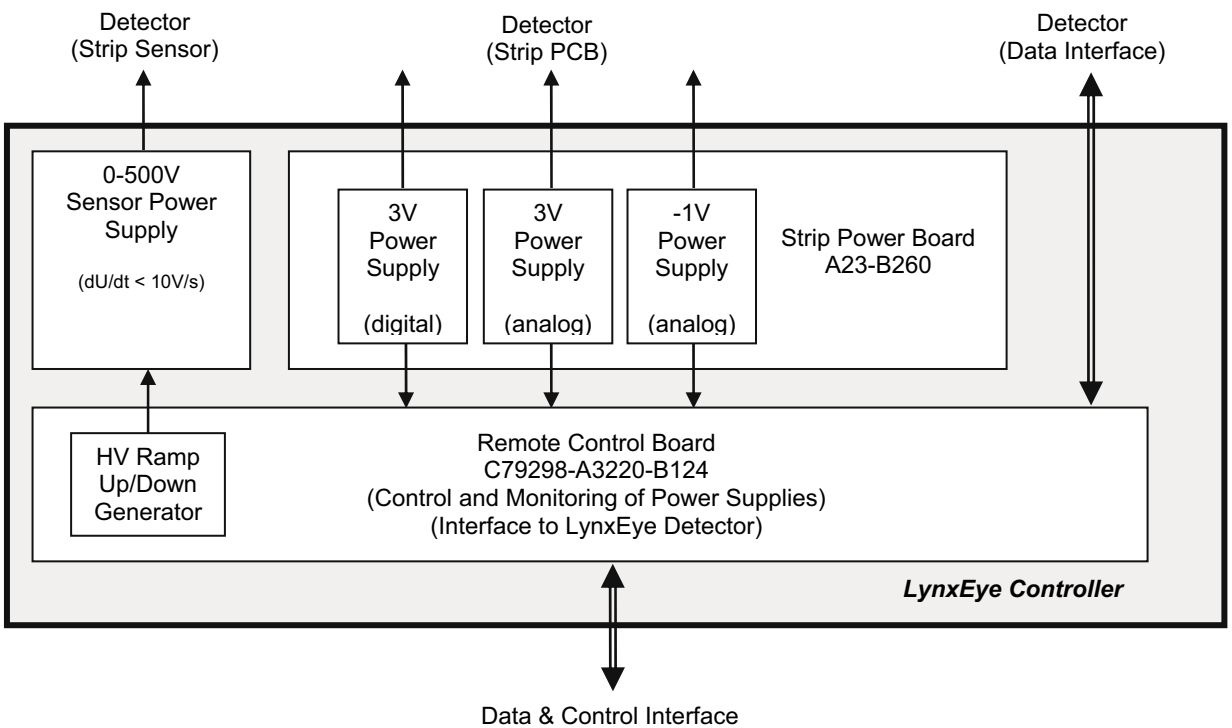

Figure 3.3 Block diagram of the controller electronics (part 1)

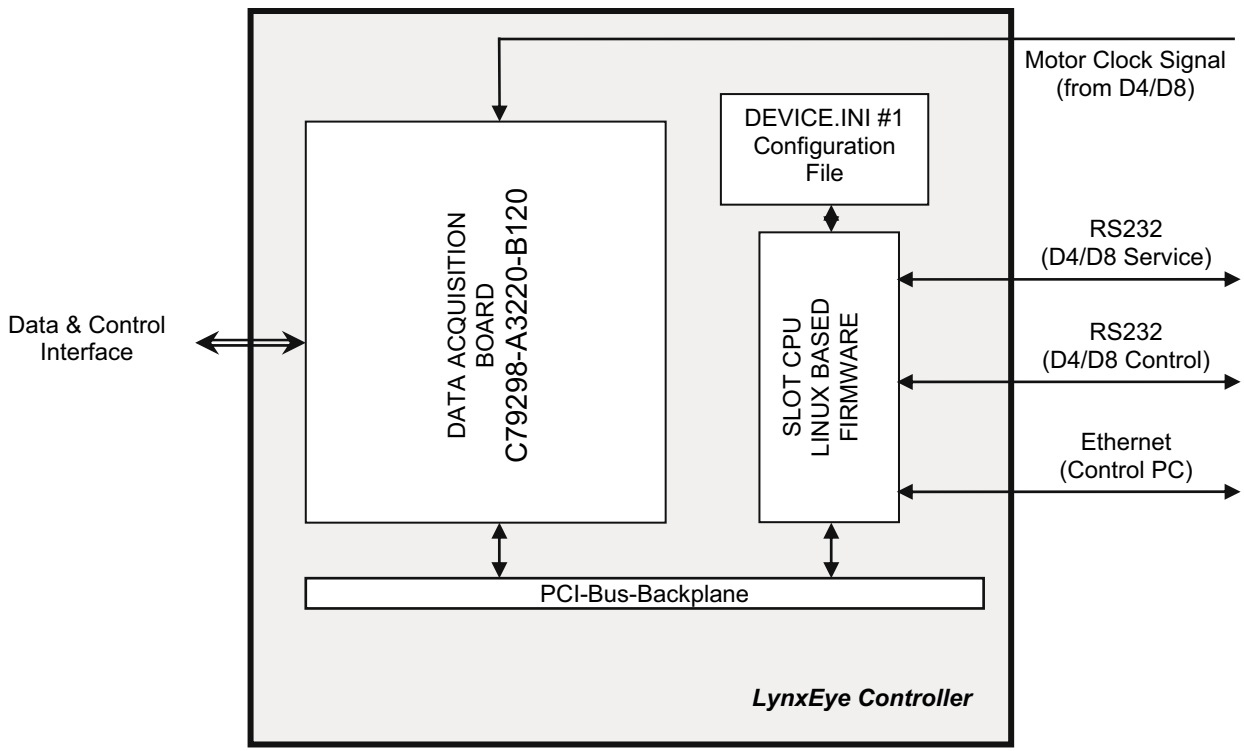

Figure 3.4 Block diagram of the controller electronics (part 2)

All of these units are placed within the same 19" housing.

Figure 3.5 Detector controller (outside, front)

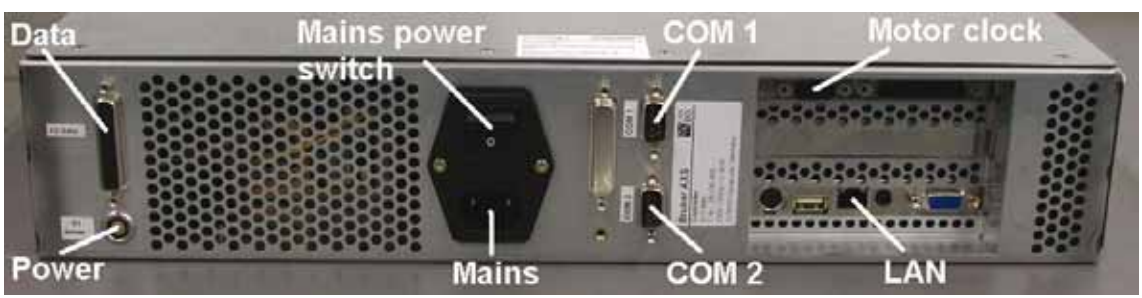

Figure 3.6 Detector controller (outside, back)

3.2.2 Detector Controller Status LEDs

Table 3.3 shows the different states of the controller's status LEDs.

LED	State
ALARM (red)	**Alarm** (lighting permanently) or **Warning** (blinking) pending.
SYSTEM ACTIVITY (green)	Blinking LED indicates that the firmware of the LynxEye controller is running. The LED stays turned on or off if the firmware has not been started or hangs by any reason.
BIAS READY (yellow)	The bias LED displays the status of the high voltage supply which produces the bias voltage for the silicon strip detector. • LED **off**: Bias voltage is turned off. • LED **blinking**: Bias voltage is ramping up or down. • LED **on**: Bias voltage is on and equal to the set value.
LOW VOLTAGE READY (green)	The LED is turned on when all internal power supplies are OK. If one or more supply voltages are not present then the LED will be turned off.

Table 3.3 States of the controller's front side LED's

3.3 Detector Optics

WARNING

Voltage Danger - Bias voltages up to 500 V DC are accessible from the **outside**! They are present on the metal sensor window on the front side of the detector! **Never** operate the detector with Bias voltage switched on **without** having the detector optics mounted!

The optics of the detector consists of four components (see Figure 3.7): Axial Soller slit, Kβ filter, Antiscatter tube and plug-in slits. All filters and slits have notches which fix the slit in position when properly inserted (see Figure 3.8). The Antiscatter tube length used depends on the measurement circle diameter: one for 401 mm (for D4 only), one for 435 mm and one for 500 mm are available (see Figure 3.9). See 12 for part numbers.

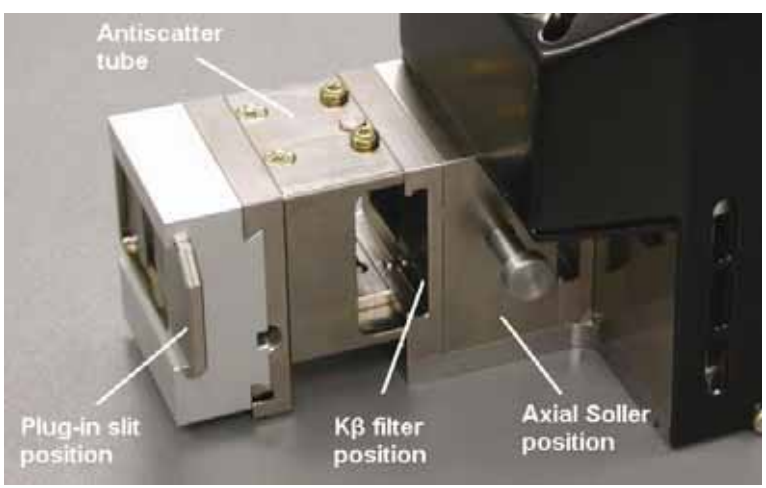

Figure 3.7 LynxEye detector optics

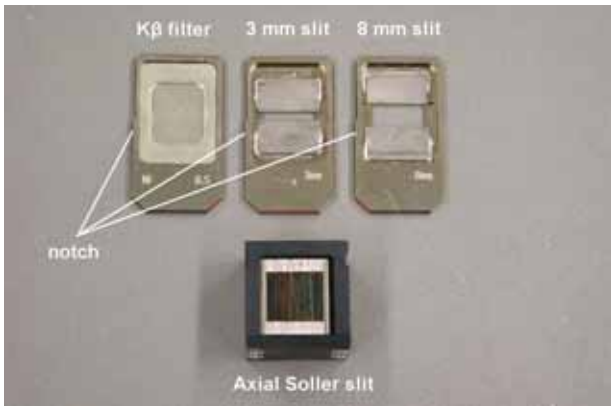

Figure 3.8 Plug-in slits and Axial Soller slit

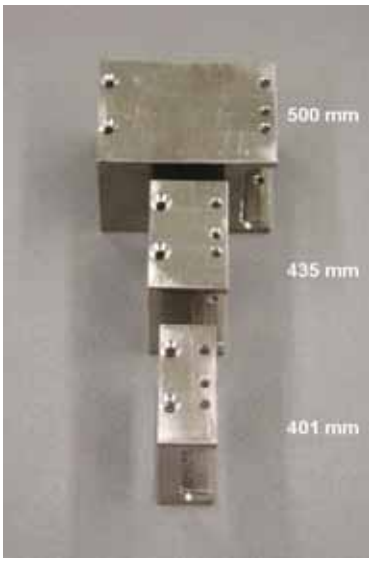

Figure 3.9 Antiscatter tubes options for different measurement circle diameters

3.3.1 Exchanging the Antiscatter tube

To optimize the performance of the LynxEye detector the appropriate Antiscatter tube should be used for the corresponding measurement circle diameter. For D4 systems only one defined measurement circle diameter is used (401 mm). On D8 systems different measurement circle diameters can be used, dependent on the application.

To take this into account Antiscatter tubes for the two most common measurement circle diameters are available (435 mm and 500 mm). The Antiscatter tubes are exchangeable. For part numbers see 12.

1. Remove 2 screws fixing the Antiscatter tube to the detector (see Figure 3.10).
2. Slide the optic block out of the guideway of the detector (see Figure 3.11).
3. Remove 4 screws fixing the plug-in slit holder to the Antiscatter tube (see Figure 3.11). Figure 3.12 shows the disassembled optic
4. Re-assemble the parts using the exchanged Antiscatter tube.

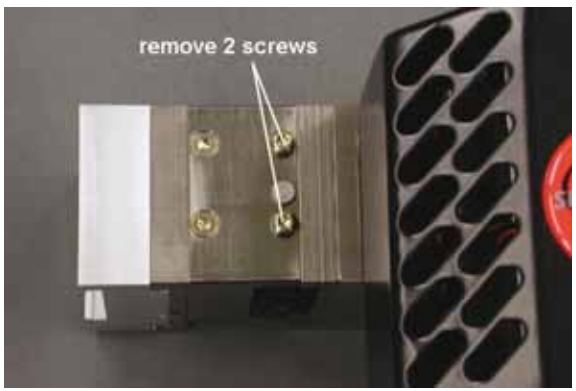

Figure 3.10 Removing the optics from the detector

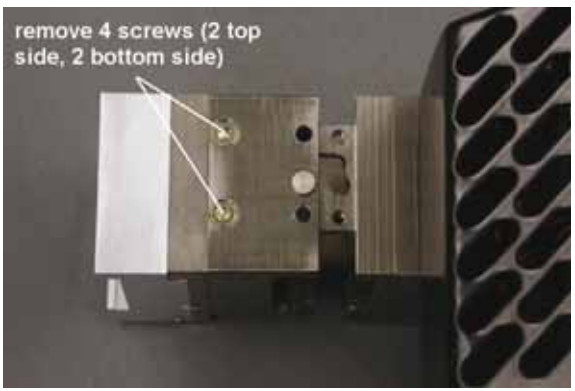

Figure 3.11 Slide out the optics block

Figure 3.12 Disassembled optics

3.4 Counterbalance

There is no special counterbalance setting required for the LynxEye detector. The standard setting for the Scintillation counter should be used.

Please refer to the counterbalance test sheet in the Instrument Supplement folder.

4 Hardware Installation in the D8

This section describes hardware installation for a D8 ADVANCE.

4.1 Servicing Precautions

WARNING

Risk of electric shock!

Some steps of the hardware installation require opening the side panels of the D8 base and accessing parts inside.

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 base cabinet's Power OFF button (O) or the on/off power switch on the LynxEye controller. The mains supplied to the system must be completely switched off externally.

It is highly recommended that any work on components of or inside the D8 base cabinate is performed by Bruker AXS employees only!

CAUTION

Switch off the LynxEye detector Bias before switching off the LynxEye controller mains power. Wait until the BIAS READY LED turned off to make sure that the Bias voltage ramped down completely!

CAUTION

Components attached to the goniometer will move during operation.

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 8.1 or Table 8.2. The data file will be the baseline for comparison of the data collected using the LynxEye detector. The baseline data should be collected with a standard reference material like the NIST SRM 1976 corundum plate (see the Instrument Verification Booklet M88-Zxx041 for additional system parameters).

NOTE

For Systems delivered without secondary slit systems the initial alignment of the system has to be done with the LynxEye detector in 0-D mode with 10 mm opening for theta and 0.075 mm opening for detector to determine the ZI-valus with the glass slit. For additional information about the parameters see section 9.

4.4 Hardware Installation

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

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

The location of the LynxEye controller is critical for proper operation. There must be sufficient airflow around the controllers to prevent the electronics from overheating.

Do not place the LynxEye 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.

4.4.1 Mount the Rails

1. It might become necessary to mount additional rails (part number C79298-A3242-C115), item C in Figure 4.1, to accommodate the LynxEye 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 LynxEye controller and other components.
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.

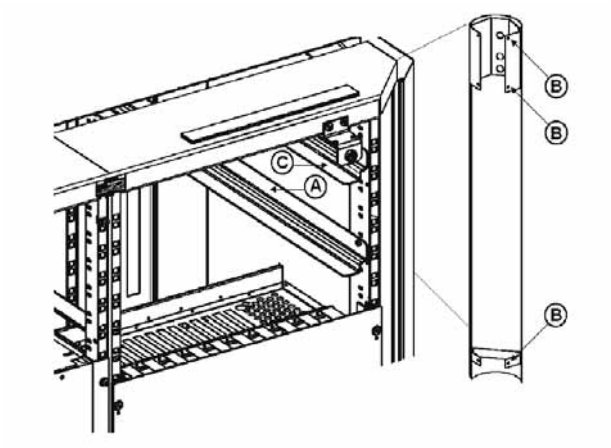

Figure 4.1 Column and rail locations

4.4.2 Install the Controller

Whenever possible, place the LynxEye controller above the D8 controller electronics. 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 controller.

4.4.3 Connect the Cable Wiring

6 cables are delivered with the complete detector system (see 12 for part numbers)

- Detector Power cable
- Detector Data cable
- Ethernet crossover patch cable with RJ-45 connectors
- Motor clock cable A17D42 and adapter A17D43 or Multi Axes Clock cable A17D79
- Mains power cable
- Ground cable

See Figure 3.6 and Figure 6.1 for the connection of the wiring. Guide the Detector Power cable and the Detector Data cable through the safety labyrinth at the back of the D8 enclosure. Make sure that no cables will be pinched when closing the back cover. Connect LynxEye controller, control PC and D8 system like the configuration shown in Figure 6.1.

1. Connect Detector Power cable to detector and to controller.
2. Connect Detector Data cable to detector and to controller.
3. Take the serial cables that are used to connect the PC and COM 1/COM 2 of the LynxEye controller, respectively.
4. The connection of the motor clock cable (A17D42 or A17D79) differs dependent on system and revision of the axes boards:

    4.1. **Series 1 axes indexer boards B104/B105**: The motor clock cable (A17D42, A17D79 is not usable for series 1 boards) **with** adapter (A17D43) has to be connected between the 9-pin STEP/DIR port of the detector controller and either

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

4.2. **2nd generation axes indexer boards (AIB2G) B231/B232**: The motor clock cable (A17D42 or A17D79) **without** adapter (A17D43) has to be connected between the 9-pin STEP/DIR port of the detector controller and either:

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

NOTE

The clock signal cable can be one of two cables, one straight and one Y-shaped (see Figure 4.2 and Figure 4.3). If you are running the system with the AIB2G, NEVER use the Y-shaped adapter cable (A17D43) in any case! For additional information about mounting the A17D79 cable see section 9.

Figure 4.2 Clock signal cable (A17D42)

Figure 4.3 Y-shaped adapter cable (A17D43). **Note: Use only for AIB B104/B105 (series 1).**

5. Attach the grounding strap to the ground plate on the left-side panel of the D8 base cabinet.

6. Use the network cable to connect the LynxEye controller and the 2nd LAN adapter of the PC. For installation and configuration of the 2nd LAN adapter see Sections 6.1 through 6.3.

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 base cabinet.

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 of the instrument.

The mains supply must be switched off externally on the customer's side (wall socket or external switch).

4.4.5 Mount the Detector to the 2-Theta Axis

The detector replaces the scintillation detector or any other previously installed detector.

Follow the steps indicated below for assembling mount and detector. Mounts will be available for three measuring heights (150 mm, 214 mm and 258 mm). Special mounts for 0/90° orientation of the LynxEye are available since 2007 for D8 ADVANCE and D8 DISCOVER diffractometers. See sections 12 for part numbers.

1. Check that the setscrew is in the location shown in Figure 4.4. This ensures that the detector is at the proper measurement circle diameter.
2. Fix the mount with two screws to the detector (see Figure 4.5).

Figure 4.4 Setscrew position

Figure 4.5 Detector mounting plate

3. Move the 2-theta drive to a position where the detector can be placed on the track (approximately 35° 2-theta).

4. Use Figure 4.6 to set the predefined measurement circle diameter on the theta and 2-theta tracks.

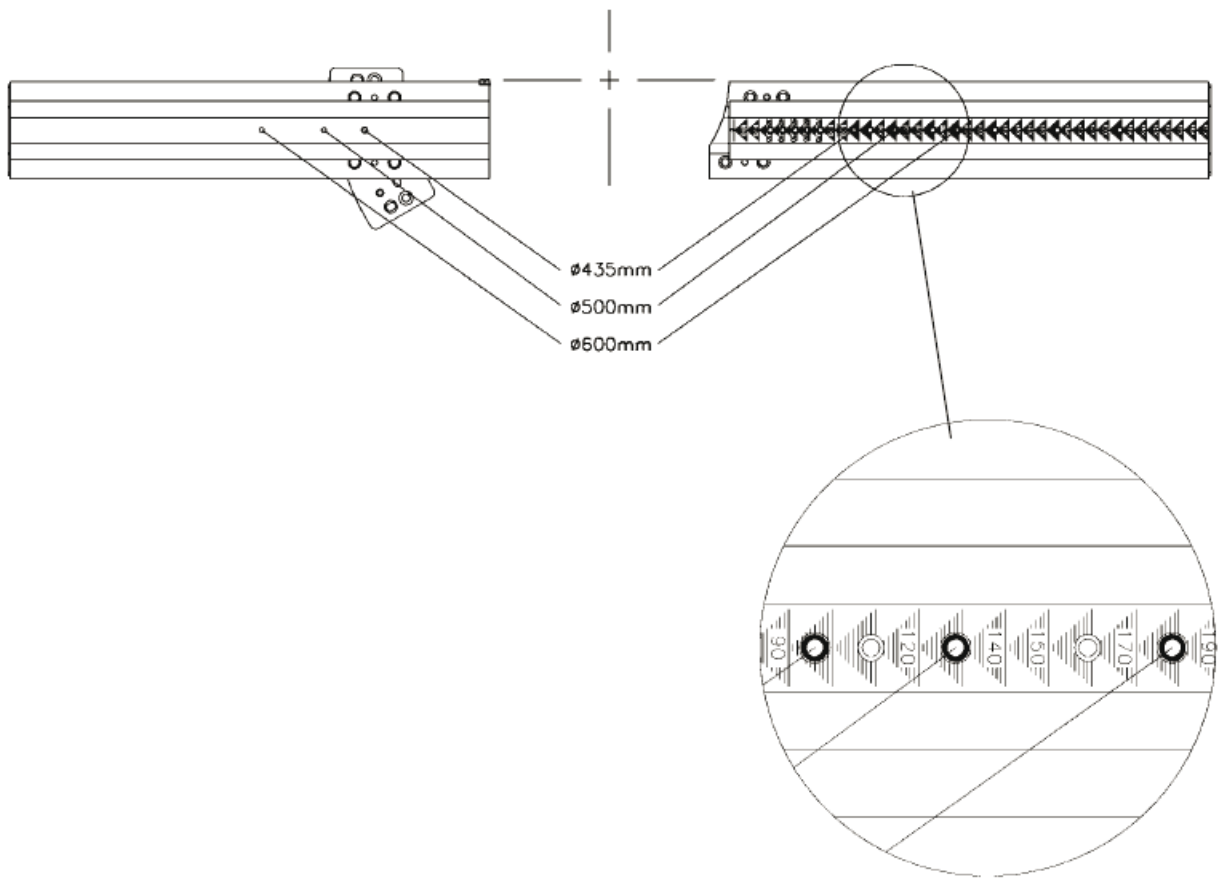

Figure 4.6 Predefined measurement circle diameter pin locations

5. Place the detector on the track. Slide it down to the pinned position and tighten the track mounting screws.

NOTE

To confirm the proper measurement circle radius, measure from a point at the center of the sample stage (goniometer center) to a point approximately 41 mm behind the front side of the detector cover (see Figure 4.7). Use this as a reference when placing the detector on the track.

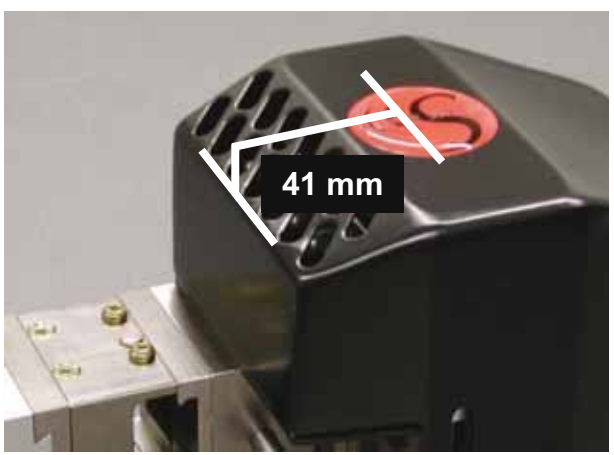

Figure 4.7 Reference for checking the measurement circle radius

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

5 Hardware Installation in the D4

This section describes hardware installation for a D4 ENDEAVOR. The installation of the LynxEye detector in the D4 ENDEAVOR is different to the installation in the D8 ADVANCE. The main differences are the detector mount and the cabling through the enclosure.

5.1 Servicing Precautions

WARNING

Risk of electric shock!

Some steps of the hardware installation require opening the side panels of the D4 and accessing parts inside.

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 D4's Power OFF button (O) or the on/off power switch on the LynxEye controller. The mains supplied to the system must be completely switched off externally.

It is highly recommended that any work on components inside the D4 is performed by Bruker AXS employees only!

CAUTION

Switch off the LynxEye detector Bias before switching off the LynxEye controller mains power. Wait until the BIAS READY LED turned off to make sure that the Bias voltage ramped down completely!

CAUTION

Components attached to the goniometer may move during operation.

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 8.1 or Table 8.2. The data file will be the baseline for comparison of the data collected using the LynxEye detector. The baseline data should be collected with a standard reference material like the NIST SRM 1976 corundum plate (see the Instrument Verification Booklet M88-Zxx041 for additional system parameters).

5.4 Hardware Installation

The additional electronics mounting rack (incl. a set of rails) must be present to accommodate the LynxEye controller in the D4.

The location of the LynxEye controller is critical for proper operation. There must be sufficient airflow around the controller to prevent the electronics from overheating. Do not place the LynxEye 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.

5.4.1 Mount rails and controller

1. Remove the D4's left side panel.
2. Remove the rack for the electronics.
3. Attach the rack nuts at the positions to mount the LynxEye controller as shown in Figure 5.1.

Figure 5.1 Relocate rails and rack nuts

Figure 5.2 Controller inside D4

4. Adjust the height of the rails so that the controller can be fixed to the rack nuts (see Figure 5.1).
5. Take out the controller and mount the rack into the system again.
6. Mount the controller into the rack (see Figure 5.2).

5.4.2 Mounting of detector and cable guide A17B63

1. Fix the detector to the detector mount with 2 screws (see Figure 5.3).
2. Fix the sheet angle to the D4 mount with 2 screws (see Figure 5.4).

Figure 5.3 Mount the detector to the detector mount

Figure 5.4 Mount sheet angle

3. With a piece of tape mark the detector data cable (A17D78) exactly 1 m measured from the connector B60-X2 (see Figure 5.5).

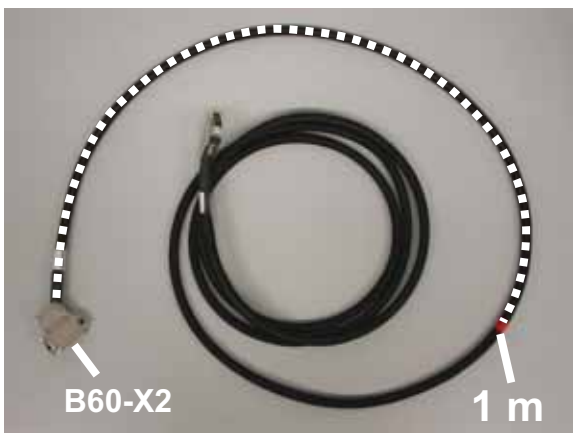

Figure 5.5 Mark detector data cable

4. Remove the transportation lock bar and the rear low cover of the D4.

Figure 5.6 Remove transportation lock bar

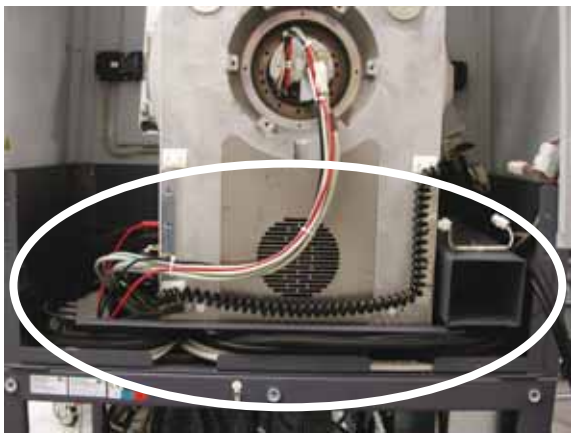

Figure 5.7 Remove rear low cover

5. Mount the goniometer top cover (3 screws only!) and the back side shield.

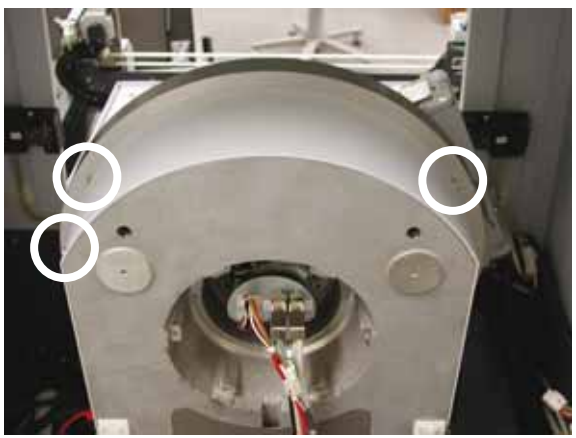

Figure 5.8 Mount top cover

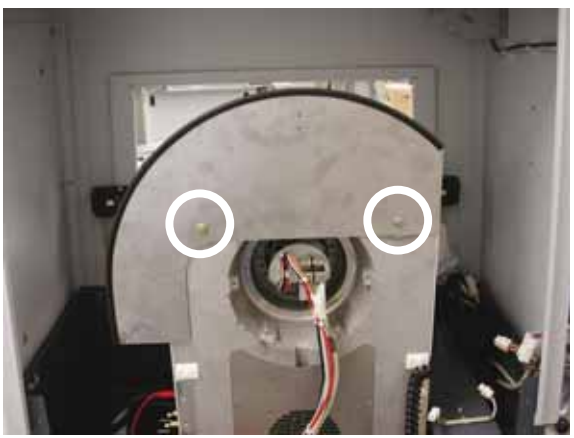

Figure 5.9 Mount back side shield

6. To mount the detector to the goniometer, use two 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 and Figure 5.11).

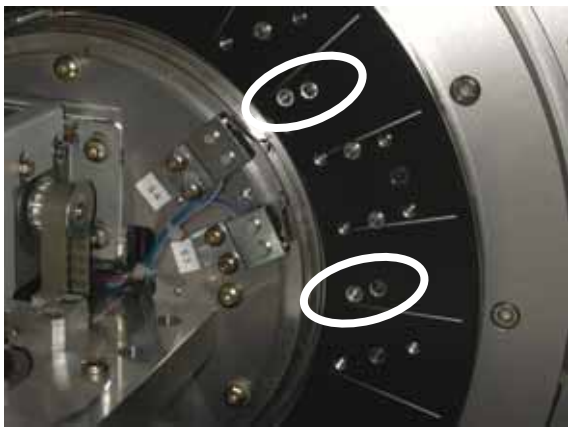

Figure 5.10 Detector mounting positions

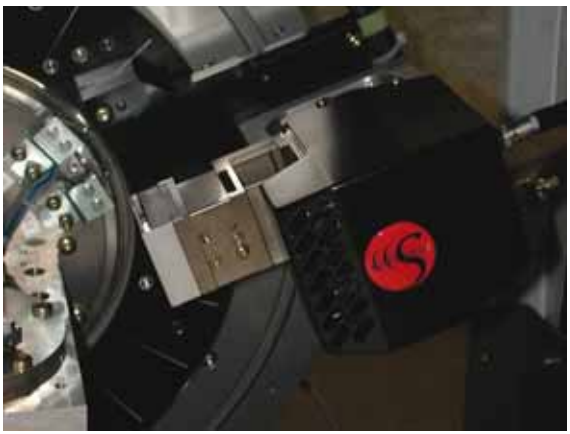

Figure 5.11 Detector mounted

7. Connect data cable and power cable to the detector. Fix the data cable with a binder to the sheet angle and fix the power cable with some binders to the data cable.

Figure 5.12 Fix data cable

Figure 5.13 Fix power cable

8. Route the cables over the top of the goniometer along the back side shield.

Figure 5.14 Route cables (front side view)

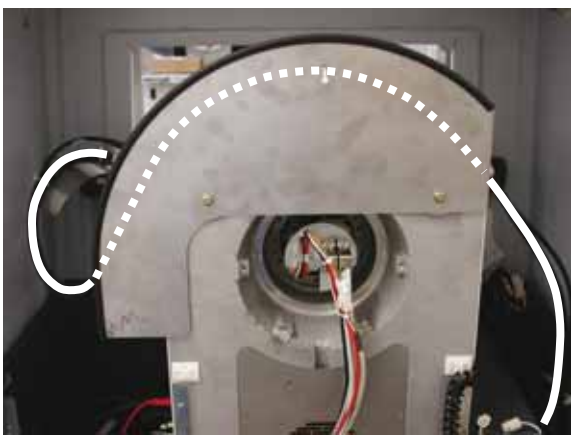

Figure 5.15 Route cables (rear side view

9. Fix the cables with the cable clamp on the goniometer top cover (see Figure 5.16). The correct length for the cables to this mounting position is indicated by the tape mark on the detector data cable (refer to Figure 5.5)

10. Fix the cables with a binder to the back side shield.

Figure 5.16 Fix cables to goniometer

Figure 5.17 Fix cables to back side shield

11.Route the cables in a wide bow through the lower cable channel and down through the labyrinth.

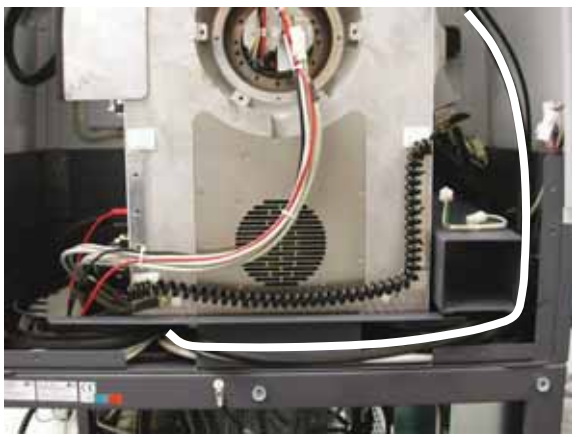

Figure 5.18 Route cables down through labyrinth

12.Connect all components as shown in Figure 3.6 and Figure 6.1.

13.Move 2Theta through its whole range and check that the detector cables can move free, are not squeezed, are not bent too much or are not rubbing against sharp edges.

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 or with 2Theta at low angles.

14.Mount the D4 rear low cover.

6 Software Configuration

This section describes the basic software configuration.

6.1 Communication Line

Communications between the D8 controller, LynxEye detector are made via RS232 lines. Communications between the Control PC and the LynxEye detector controller are made via a network connection.

The parameters for communication need to be defined by the user and are stored in the device.ini file. The DIFFRAC*plus* Configuration program is used to set the parameters. Perform the following steps to configure the system (see Figure 6.1 for the cabling scheme).

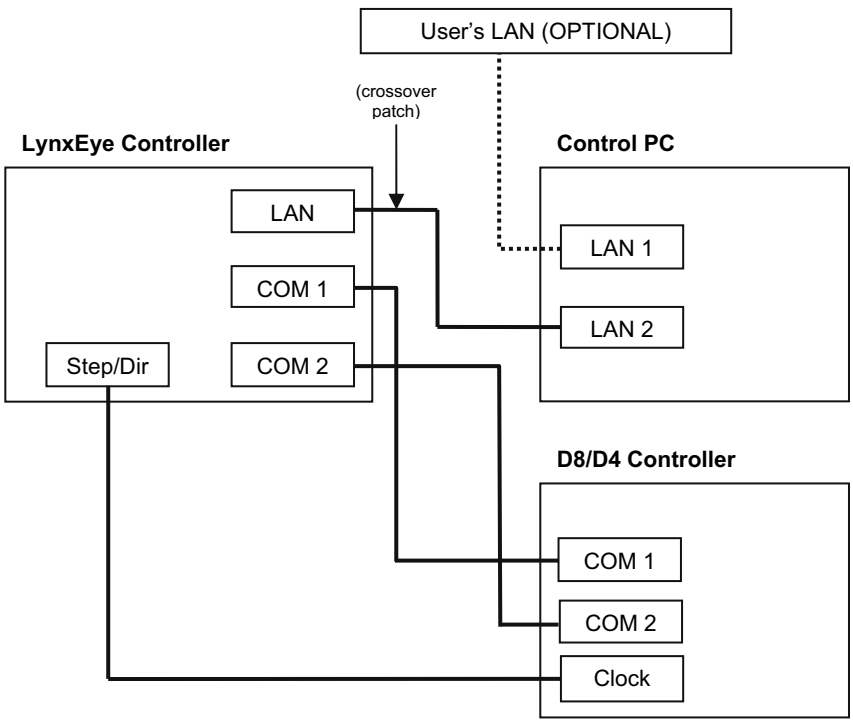

Figure 6.1 Wiring of the LynxEye detector controller

6.2 Install the 2nd Network Adapter "LAN 2" in the PC

An additional network card is required if the PC will be connecting to the customer's network. The second LAN connection is then used to communicate with the LynxEye controller.

1. Prepare the 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 person should discharge themselves by touching an earthed, grounded object.

6. Replace the case. Secure any screws.
7. Turn on your computer and allow it to boot up normally.

6.3 Configuration of the 2nd Network Adapter “LAN 2”

1. Mount the additional PCI network adapter into a free PCI slot in the PC. To install the network card, see Section 6.2
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 6.2).

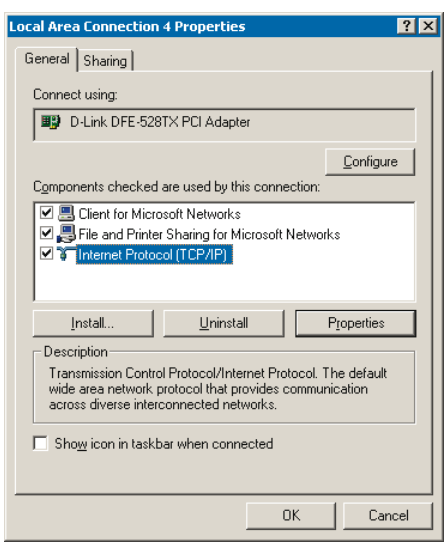

Figure 6.2 Local Area Connection Properties

4.4. Select the **Internet Protocol (TCP/IP)** item and click the **Properties** button. Another dialog box will appear (see Figure 6.3).

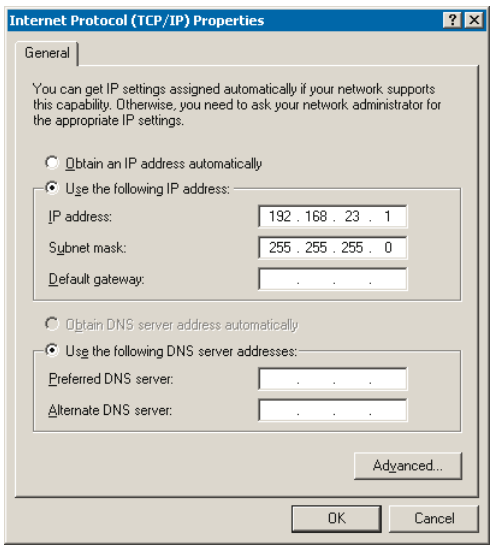

Figure 6.3 Internet Protocol (TCP/IP) Properties

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 control PC’s network adapter is now configured.

6.4 Detector Configuration

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

1. From the main Config menu, select the **Detectors** menu (Figure 6.4).
2. Check the **Position Sensitive Detector** checkbox.
3. Set the PSD type to **LynxEye**.
4. Click **OK**.

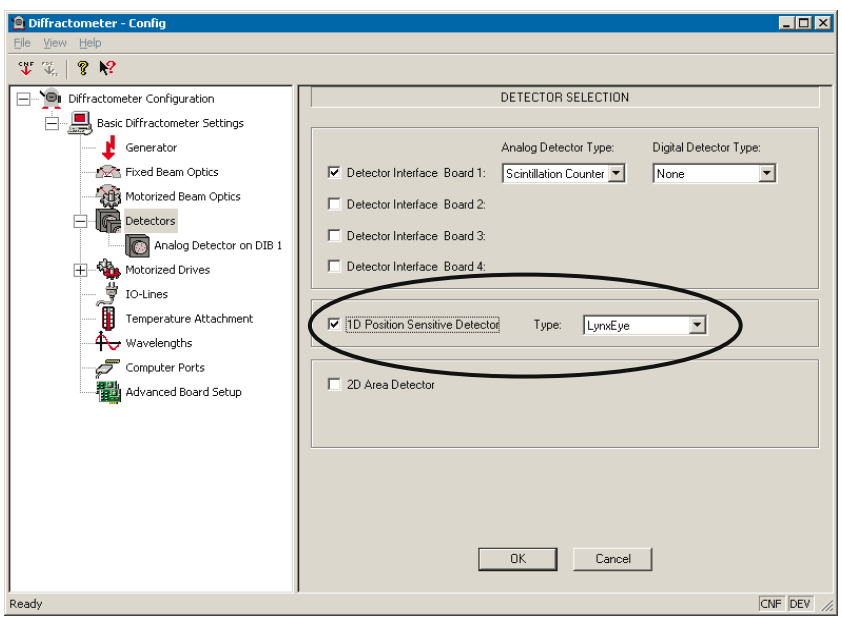

Figure 6.4 Detector menu in Configuration program

5. Select **LynxEye** (see Figure 6.5)

6. Click **Default** and confirm the following warning. This will set parameters useable for any detector and standard applications.

NOTE

All relevant detector specific parameters are factory set and stored in the detector's permanent memory.

7. Select the correct distances for Detector Slit (18.8 mm) and Antiscattering Slit (91.1 mm or 98.2 mm or 130.6 mm dependent on the measurement circle diameter (see Figure 6.5)

8. Click **OK**.

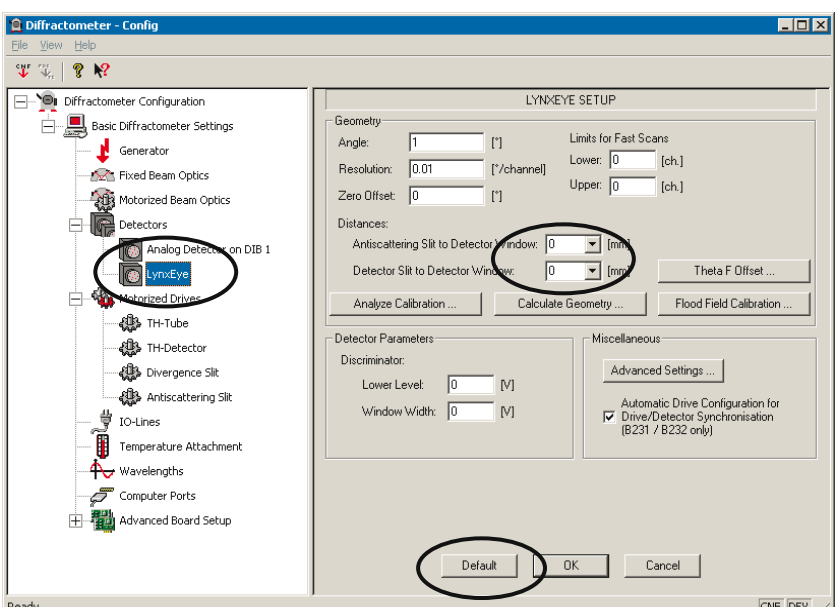

Figure 6.5 LynxEye menu

6.5 2nd Generation Axes Indexer Boards (AIB2G) Configuration

NOTE

In case that series 1 axes indexer boards (B104/B105) are in use only basic functions of the LynxEye detector will be available. To get unlimited access to all functions of the LynxEye detector the system needs to be upgraded with the 2nd Generation Axes Indexer Boards (AIB2G) B231/B232.

Please proceed with Section 6.6 in case that still old axes indexer boards are in use.

Under **Motorized Drives**, select **B231/232** from the “AIB Type” drop-down menu (Figure 6.6). This is standard for Theta-Theta or Theta-2Theta configurations.

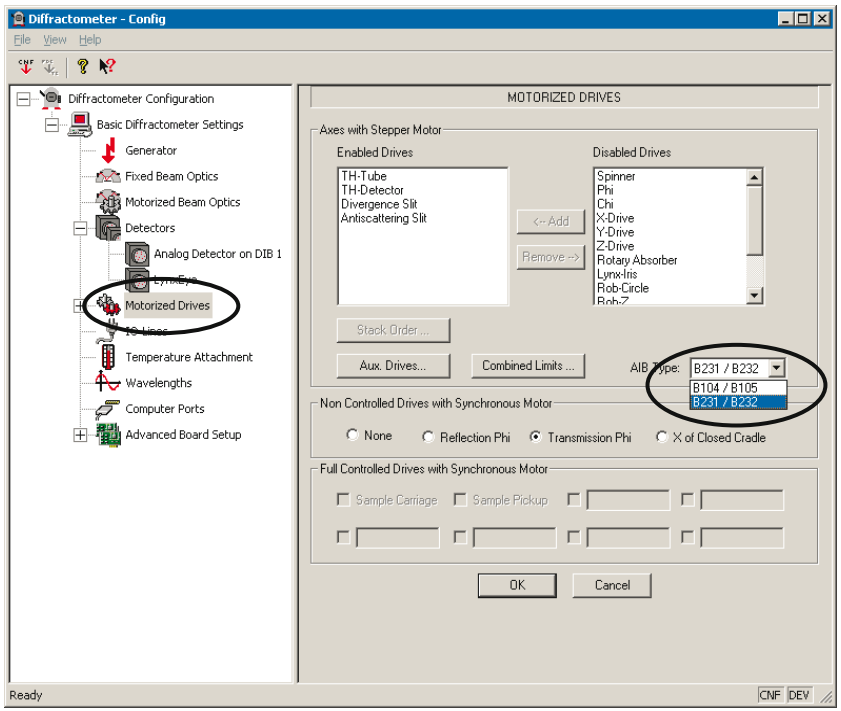

Figure 6.6 Motorized Drives section

6.5.1 Automated installation for AIB2G

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 **LynxEye** window (Figure 6.7).
2. Check the **Automatic Drive Configuration for Drive/Detector Synchronization (B231/232 only)** checkbox.

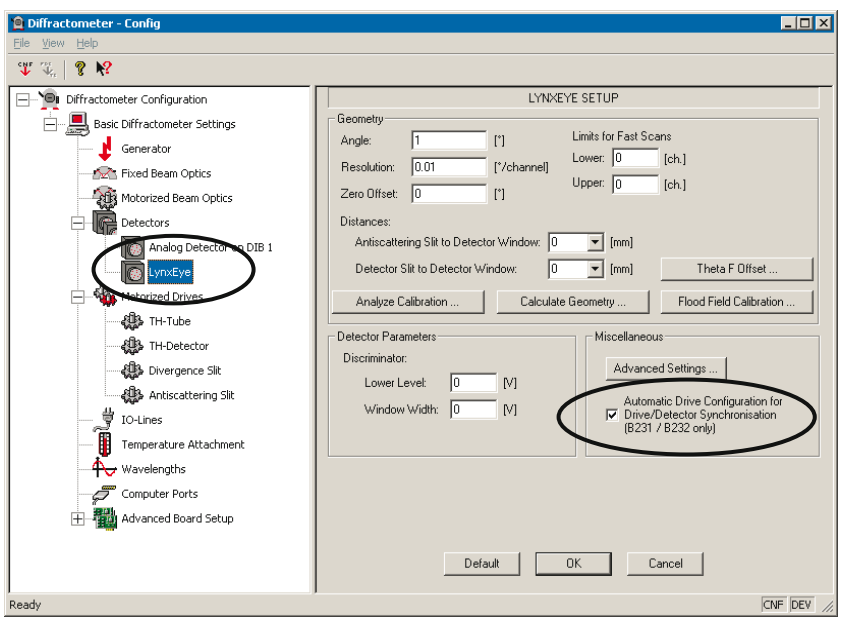

Figure 6.7 Activation of the Automatic Drive Configuration

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.

6.5.2 Manual Installation for Theta-Theta Configuration

The following sections will describe the settings for different goniometer configurations in case that a manual configuration will be done. Anyhow, the use of automated installation for the Clock Signal is recommended (see Section 6.5.1).

1. Make sure that the Automatic Drive Configuration is disabled by unchecking the checkbox in Figure 6.7.
2. Select **Advanced Board Setup > OK, Show Dialogs > Two Axes 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 6.8).

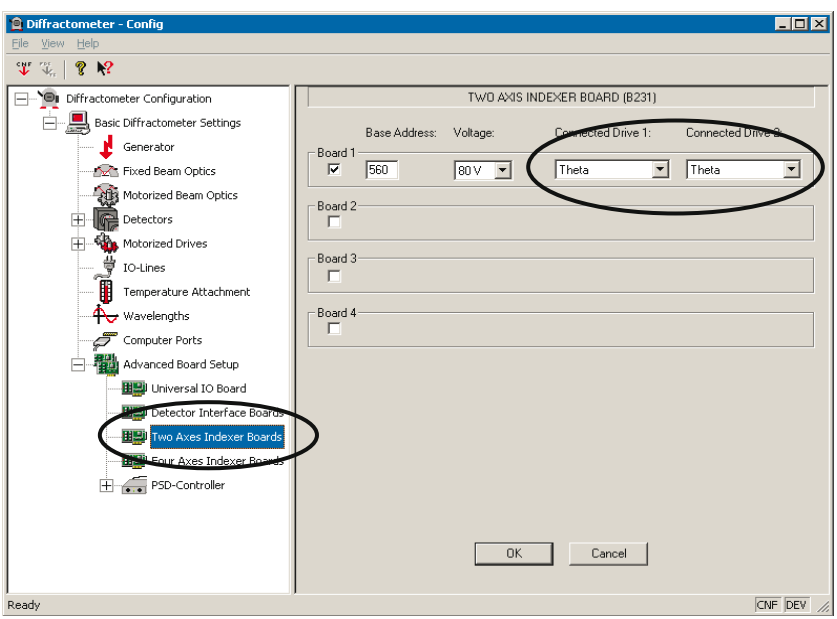

Figure 6.8 Manual settings for TH-TH

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

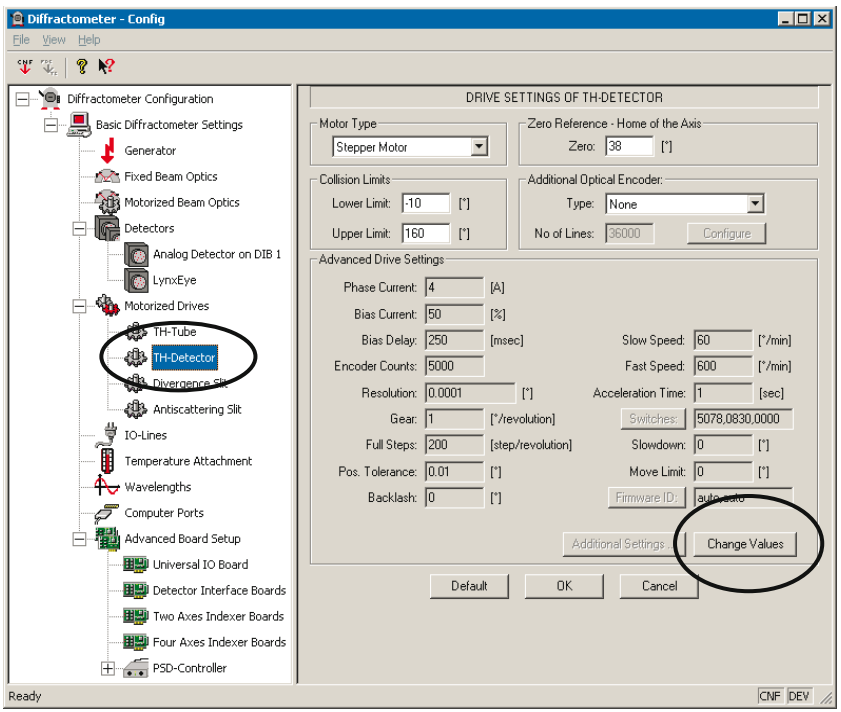

Figure 6.9 TH-Detector - change values

4. Answer **Yes** to the confirmation message and click **Additional Settings**. The following box appears (Figure 6.10). 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 6.8, the “Axis” must be **Driver 1**. Set “Register” to **Signal Status Register** and “Bit” to **(bit 11) Motor Clock – Bit 3**.

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 6.11.

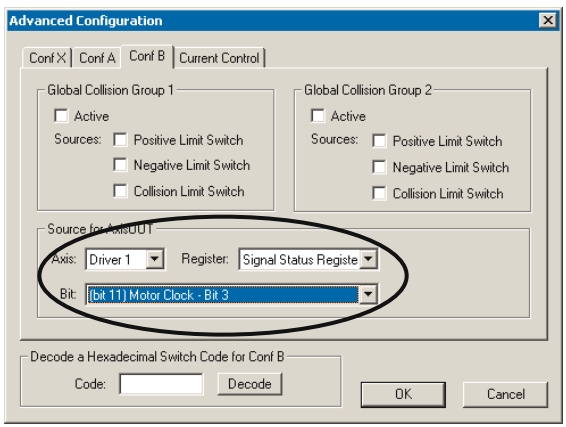

Figure 6.10 Motorized Drives section TH-Detector -Advanced Configuration

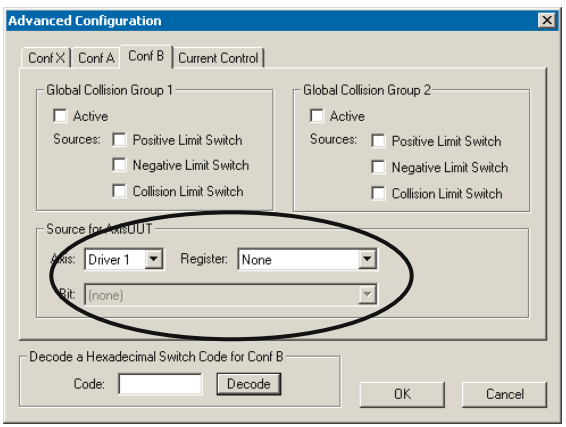

Figure 6.11 Motorized Drives section TH-Tube - Advanced Configuration

6. Save and download the configuration.

6.5.3 Manual Installation for Theta-2Theta Configuration

The following sections will describe the settings for different goniometer configurations in case that a manual configuration will be done. Anyhow, the use of automated installation for the Clock Signal is recommended (see Section 6.5.1).

1. Make sure that the Automatic Drive Configuration is disabled by unchecking the checkbox in Figure 6.7.
2. Select **Advanced Board Setup > Two Axes 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 6.12).

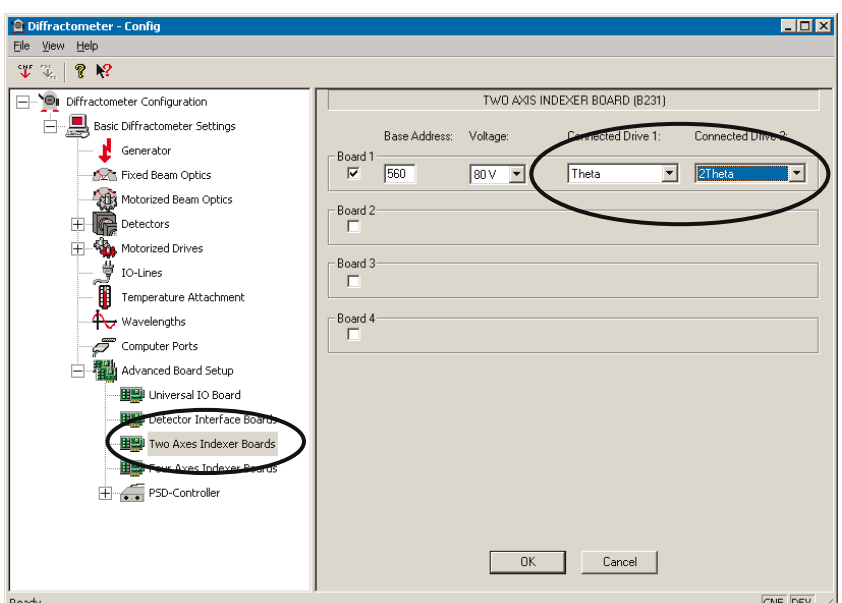

Figure 6.12 Advanced Board Settings - Two Axes Indexer Board. Settings for Theta-2Theta

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 6.13). The “Axis” must be set to **Driver 2**. Set “Register” to **Signal Status Register** and “Bit” to **(bit 11) Motor Clock - Bit 3**.
5. Check the settings for “2Theta”. The parameters for “Sources for AxisOUT” have to look like Figure 6.14.

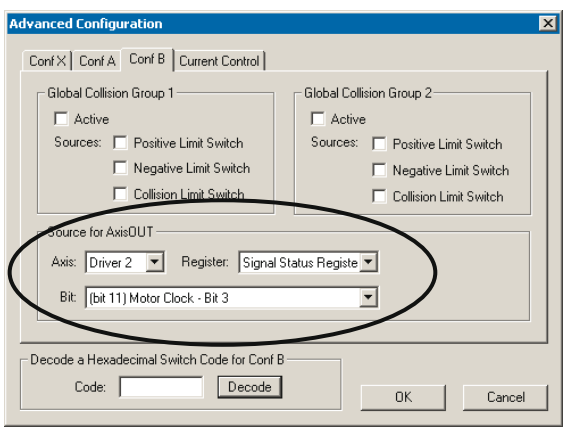

Figure 6.13 Motorized Drives section Theta - Advanced Configuration

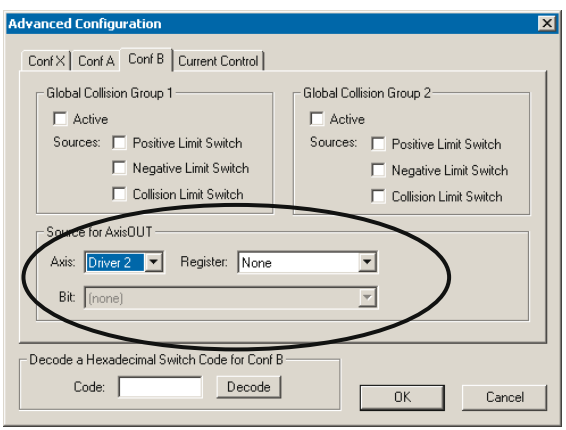

Figure 6.14 Motorized Drives section 2Theta - Advanced Configuration

NOTE

Don’t worry about the fact that the settings for “2Theta” don’t show values for “Register” and “Bit”.

6. Save and download the configuration.

6.6 Network Configuration

1. The Advanced Board Setup menu, located in the Configuration program, must be completed prior to saving and downloading the configuration file.
2. Go to **Advanced Board Setup > PSD-Controller**.
   2.1. In Communication Topology, select **Network** and press the button **Default Network Settings**.
   2.2. In Serial Communication Parameters, ensure that **Determine Automatically** is selected.
   2.3. Click **OK**.

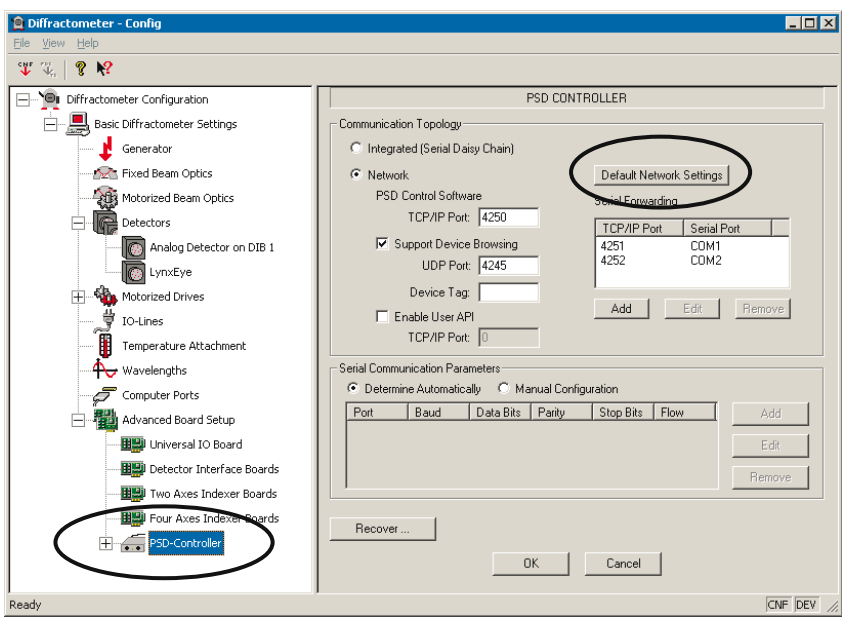

Figure 6.15 PSD Controller menu

3. Go to **IP Setup and Services** (see Figure 6.16).

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

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

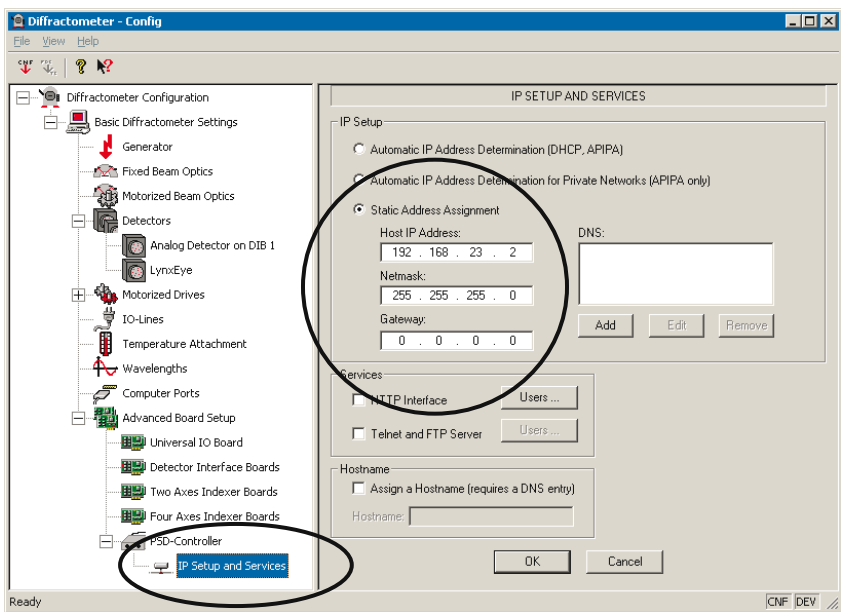

Figure 6.16 IP setup

   3.3. For upgrade or troubleshooting purposes the HTTP Interface has to be enabled and users have to be defined. Refer to Appendix A.1.

   3.4. Click **OK**.

6.7 Computer Port Configuration

1. In Config, go to Computer Ports (see Figure 6.17).

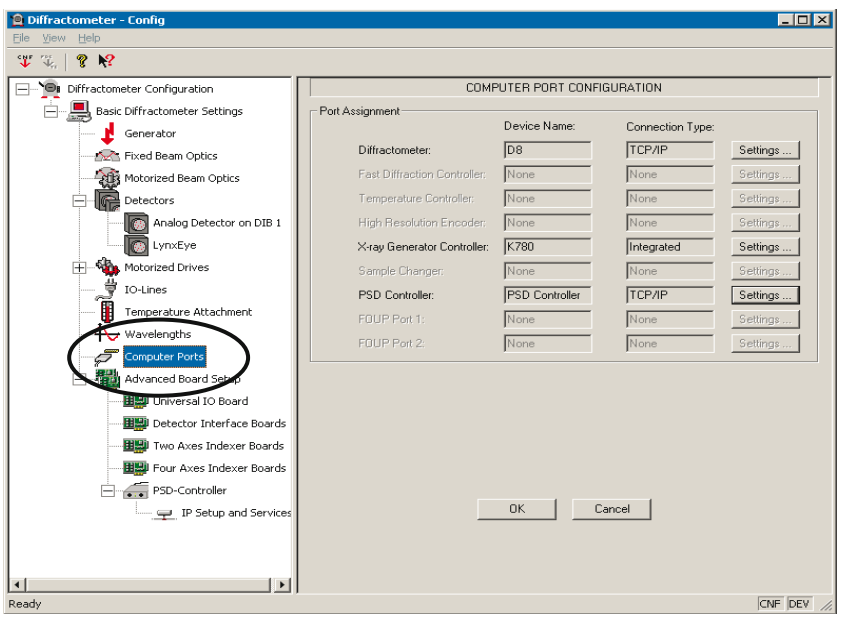

Figure 6.17 Computer port configuration

2. In Computer Ports, select **Settings** under Diffractometer.
   2.1. In the pop-up window, select **TCP/IP** as the connection type.
   2.2. Enter the IP address **192.168.23.2** and the port **4251** (see Figure 6.18)
   2.3. Click **OK** and close the window.

3. In Computer Ports, select **Settings** under PSD Controller.
   3.1. In the pop-up window, select **TCP/IP** as the connection type.
   3.2. Enter the IP address **192.168.23.2** and the port **4250** (see Figure 6.19).
   3.3. Click **OK** and close the window.

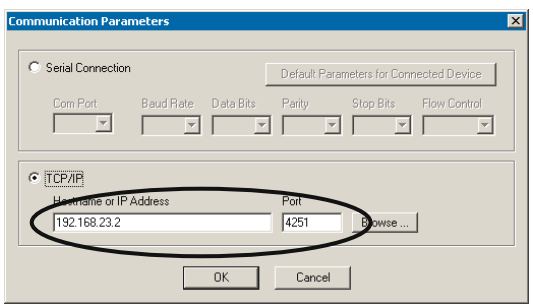

Figure 6.18 Diffractometer > Settings pop-up window

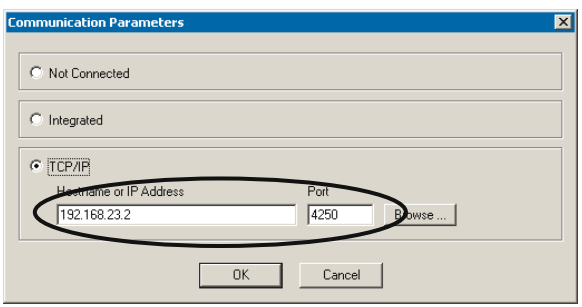

Figure 6.19 PSD controller > Settings pop-up window

4. In Computer Port Configuration, click **OK** to accept the changes (see Figure 6.17).
5. To activate the configuration, go to **File > Save and Download** or click the CNF icon.
6. In the Save and Download pop-up window, ensure that all boxes are checked.

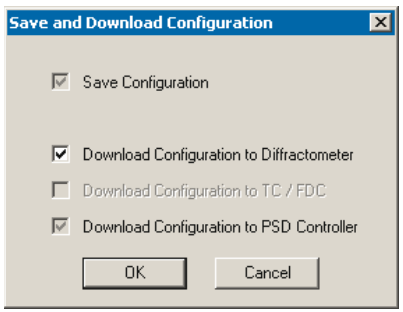

Figure 6.20 Save and Download pop-up window

7. Check that the LynxEye controller and the diffractometer are switched on and connected according to Figure 6.1.
8. Click **OK** to download.

7 Motorized Antiscatter slit (Lynx Iris)

Figure 7.1 Motorized Antiscatter slit (Lynx Iris)

The Lynx Iris (A17B70) for the LynxEye detector is a device to control the opening of the 1-dimensional detector in the diffraction plane via software. It replaces the Fixed Slit assembly and allows full flexibility for the detector aperture. The opening of the Lynx Iris can be selected under computer control with respect to the measurement range.

7.1 Hardware Installation

1. Switch off the D8/D4.
2. Switch off the LynxEye BIAS. After the BIAS has ramped down switch off the LynxEye controller.
3. Disconnect the cables from the LynxEye detector. Remove the LynxEye detector from the detector track/goniometer.
4. Remove the front side slit holder from the Antiscatter tube (see Figure 7.2 and Figure 7.3).

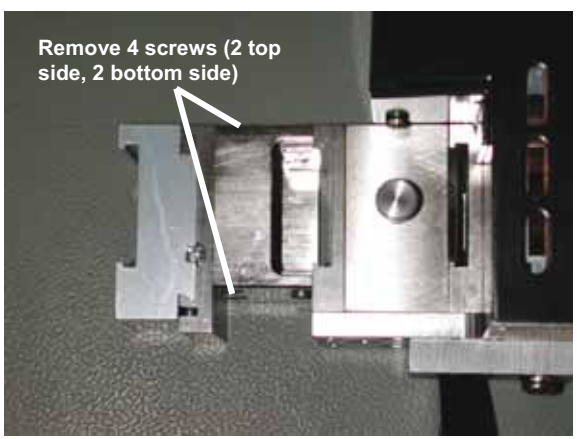

Figure 7.2 Removing the slit holder from the Antiscatter tube

Figure 7.3 Slit holder removed

5. Note the values for the reference position and the upper limit from the label on the Lynx Iris (see Figure 7.4).
6. Mount the Lynx Iris to the Antiscatter tube (see Figure 7.5).

Figure 7.4 Note zero position values and upper limit values

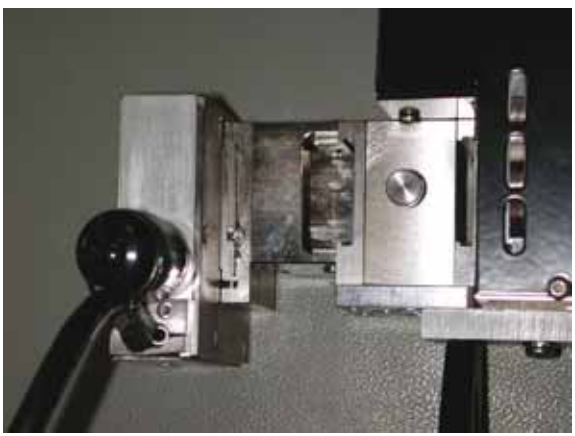

Figure 7.5 Lynx Iris mounted

7. Mount the LynxEye detector back on the detector track/goniometer.
8. Connect the power cable and the data cable to the LynxEye detector.
9. Route the Lynx Iris cable in a proper way down to the D8/D4 controller.
10. Connect the Lynx Iris cable to a free driver output of a 4 Axes Indexer Boards.
11. Restart the D8/D4 and the LynxEye controller.

12. Move the detector circle through its whole range and check that the detector cables and the Lynx Iris cable can move free, are not squeezed, are not bent too much or are not rubbing against sharp edges.
    In case of collision risks please adjust the software limits using the DIFFRAC^{plus} configation program.

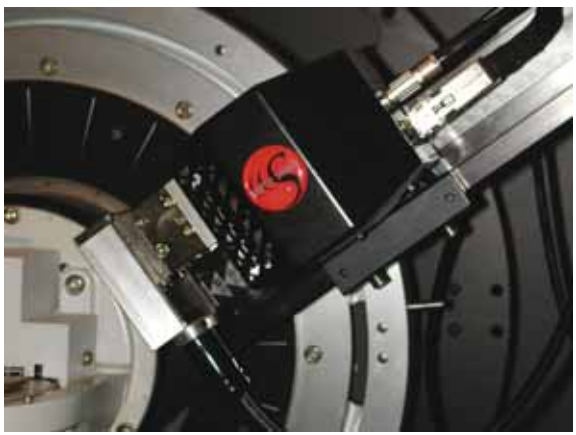

Figure 7.6 LynxEye detector with Lynx Iris mounted in a D8

7.2 Software Configuration

7.2.1 Series 1 4 Axes Indexer Boards (4AIB)

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

1. Within the **Motorized Drives** section select **Lynx Iris** in the **Disabled Drives** box. **Click** on **Add** to move the device to the **Enabled Drives** box (see Figure 7.7).

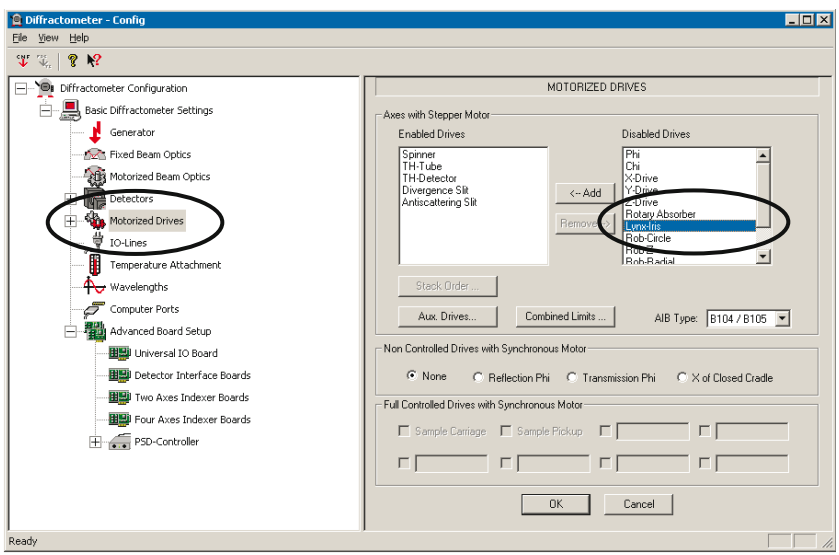

Figure 7.7 Motorized Drives > Define AUX Drive

2. Click **OK** to apply the changes in this section.
3. Activate the new defined Lynx Iris and press **Default** to preset all motor parameters **(A)** (see Figure 7.8).
4. For **Zero Reference (B)** and **Upper Limit (C)** refer to the values named **Index Mark Off** noted in Section 7.1 (see also Figure 7.4).

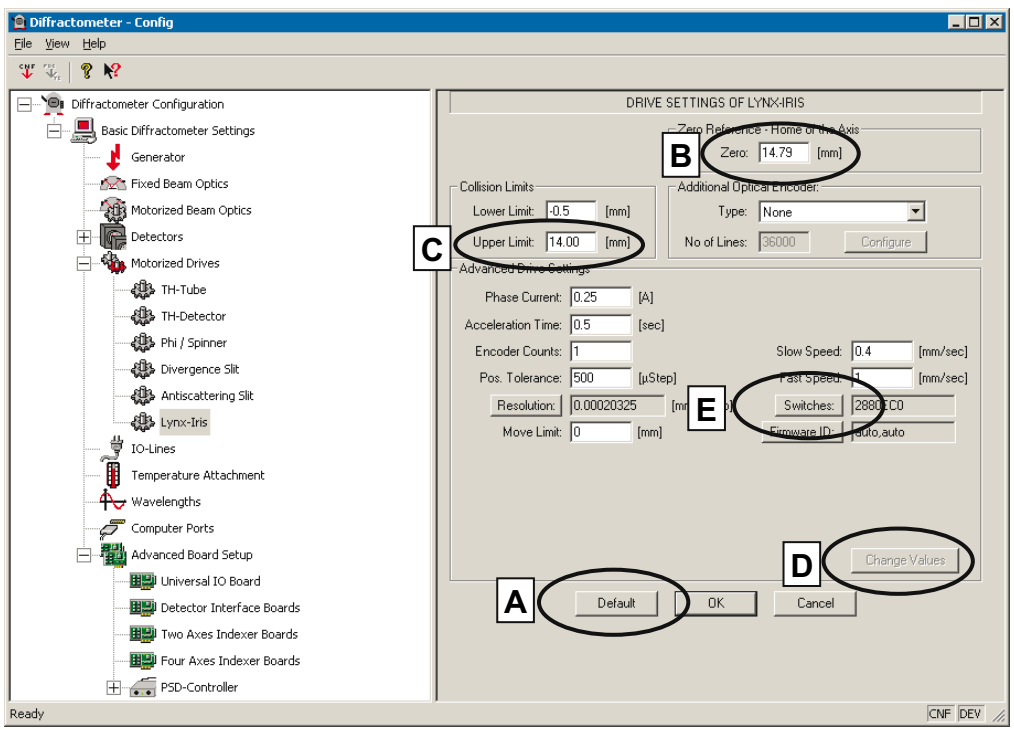

Figure 7.8 Lynx Iris Parameters

5. Click on **Change Values (D)** to get access to advanced parameters.
6. Click on **Switches (E)** and check the parameters as shown in Figure 7.9.

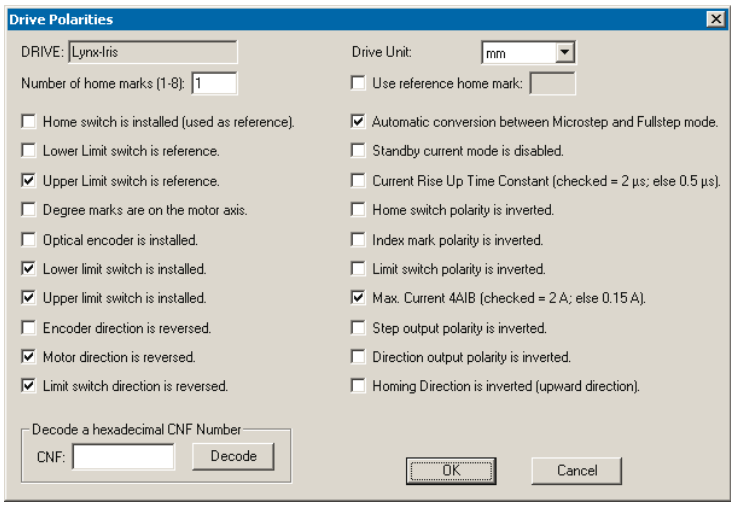

Figure 7.9 Switches

7. Check that the resulting switch code is: **2880EC0**.
8. Close all windows by clicking **OK**.
9. Click **OK** to apply the changes in this section.

10. Within the **Advanced Board Setup>Four Axes Indexer Boards** section assign the physical connection of the Lynx Iris established in Section 7.1 item 10 (see Figure 7.10).

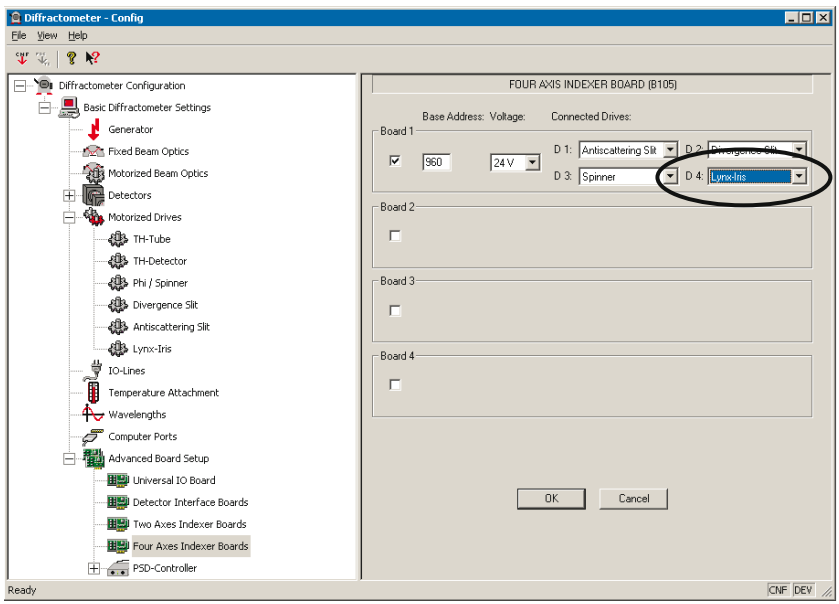

Figure 7.10 Assign the connection of the Lynx Iris

11. Click **OK** to apply the changes in this section.

12. Save and Download to Diffractometer and LynxEye controller.

7.2.2 2nd Generation 4 Axes Indexer Boards (4AIB2G)

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

1. Within the **Motorized Drives** section select **Lynx Iris** in the **Disabled Drives** box. **Click** on **Add** to move the device to the **Enabled Drives** box (see Figure 7.11).

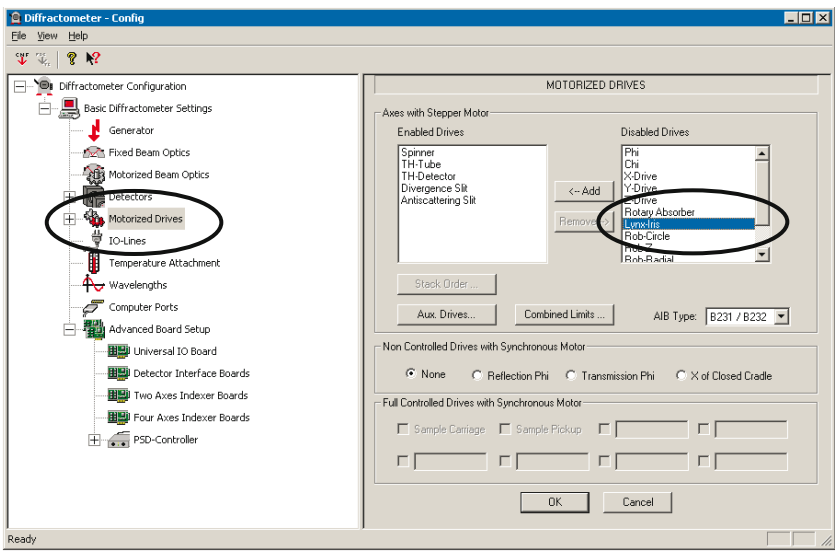

Figure 7.11 Motorized Drives > Define Lynx Iris

2. Click **OK** to apply the changes in this section.

3. Activate the new defined Lynx Iris and press **Default** to preset all motor parameters **(A)** (see Figure 7.12)

4. For **Zero Reference (B)** and **Upper Limit (C)** refer to the values named **Index Mark Off** noted in Section 7.1 (see also Figure 7.4).

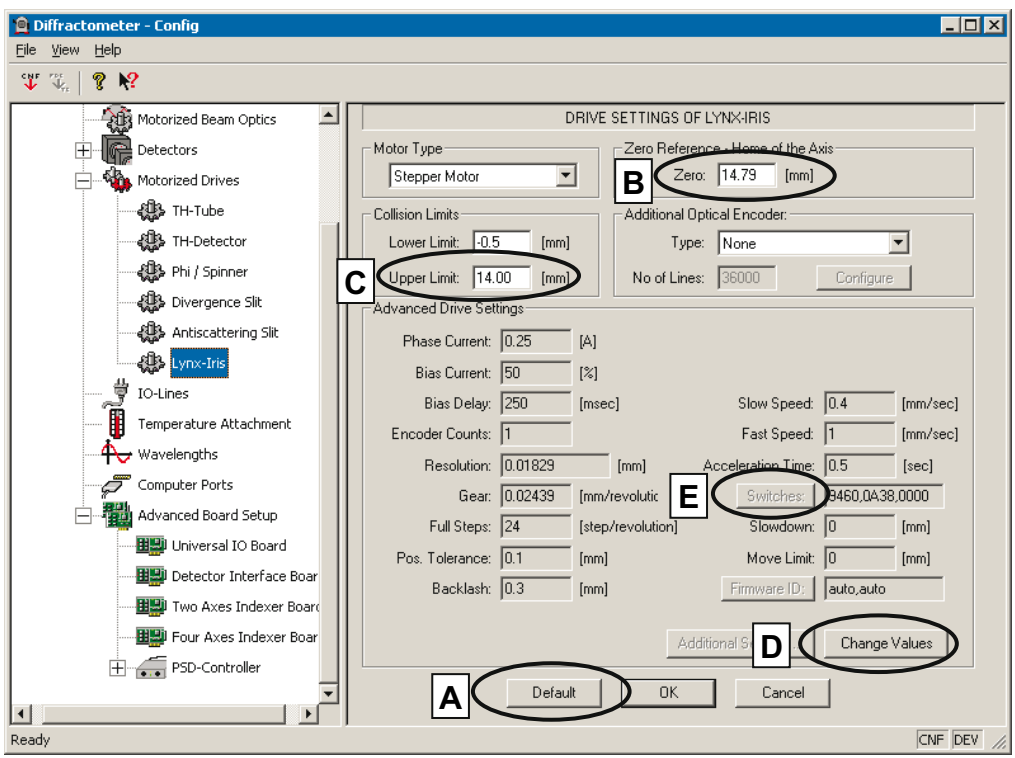

Figure 7.12 Lynx Iris Parameters

5. Click on **Change Values (D)** to get access to advanced parameters.

6. Click on **Switches (E)** and check the parameters in the four tabs as shown in Figure 7.13 to Figure 7.16.

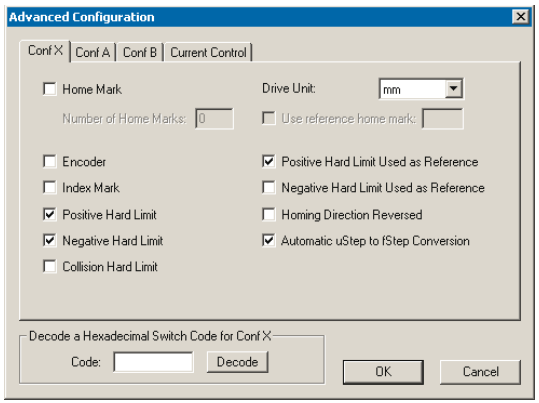

Figure 7.13 **Conf X** Settings

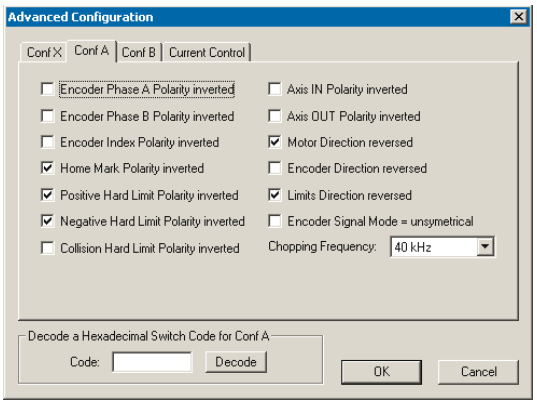

Figure 7.14 **Conf A** Settings

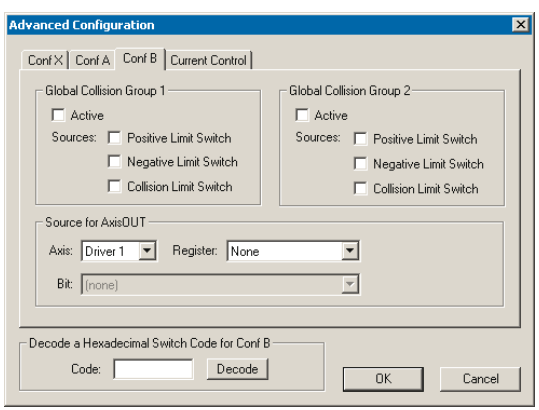

Figure 7.15 **Conf B** Settings

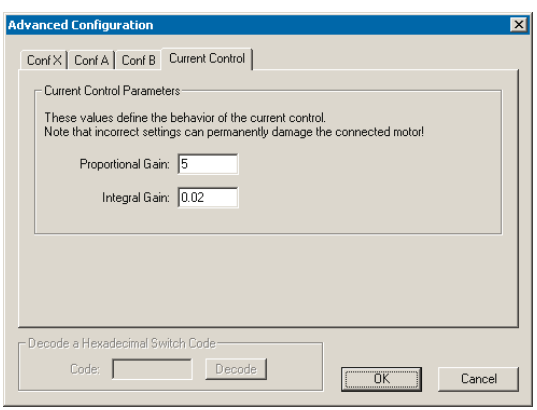

Figure 7.16 **Current Control** Settings

7. Check that the resulting switch code is: **9460,0A38,0000**.
8. Within the **Advanced Board Setup>Four Axes Indexer Boards** section assign the physical connection of the Lynx Iris established in Section 7.1 item 10 (see Figure 7.17).

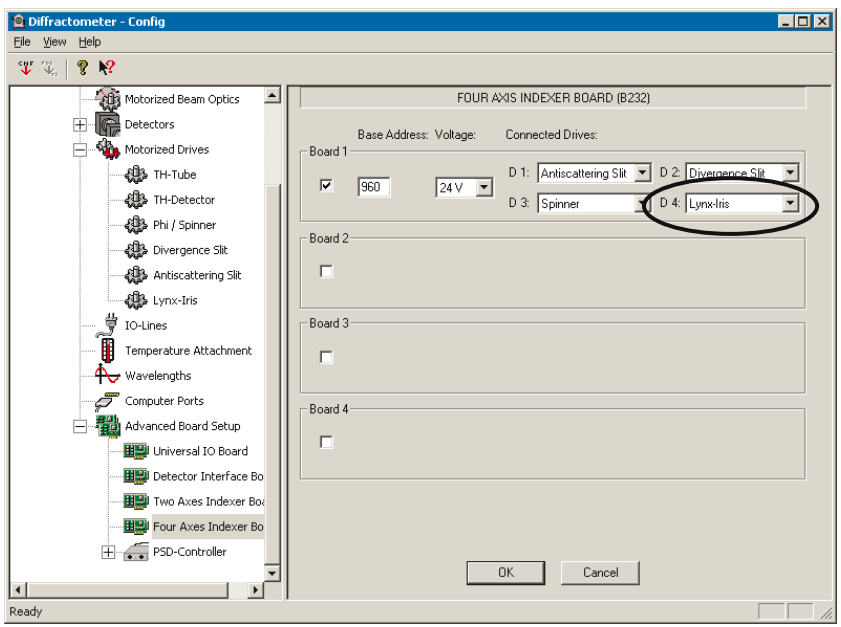

Figure 7.17 Assign the connection of the Lynx Iris

9. Click **OK** to apply the changes in this section.
10. Save and Download to Diffractometer and LynxEye controller.

7.3 Alignment

NOTE

Following alignment procedure for the Motorized Antiscatter Slit (Lynx Iris) assumes a proper aligned D8/D4.

1. Run a **PSD Calibration** (see Section 8.2).

NOTE

Within the **Drive** section of the XRD Wizard set the Lynx Iris drive to **14 mm**.

2. Mount the glass slit.
3. Move Theta and 2Theta to **0°**.
4. Set generator to **20 kV** and **5 mA**.
5. Close the Lynx Iris to **5 mm**.
6. Measure the intensity using the XRD Commander ratemeter (Diffractometer>Ratemeter or )
7. With one millimeter at a time step down to the final measurement of 1 mm and measure the intensity until you find an intensity decrease.
8. Using the alignment screw of the Lynx Iris **(B)** (see Figure 7.18) optimize to a position where you get maximum intensity.

WARNING

Do **NOT** touch the dove tail screws **(A)** of the Lynx Iris. Any try of turning the screws might lead to damage.

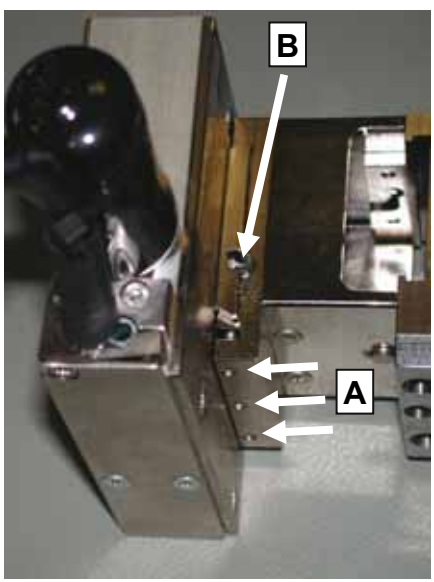

Figure 7.18 Dove tail screws (A) and alignment screw (B)

9. Continue closing the Lynx Iris in steps of 0.1 mm down to 0.2 mm and align the Lynx Iris to maximum intensity.

7.4 Basic Operations

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* XRD Commander User Manual (M88-Exx060). This section will just give an overview of operating the Lynx Iris.

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.
3. Within the XRD Commander window click on **Aux** to get access to the additionally defined drives (see Figure 7.19).

The Lynx Iris can be handled similar to all other standard drives (Init Drives, Move Drives). The base unit is **[mm]**.

NOTE

When using series 1 4 Axes Indexer Boards (4AIB) it is recommended to move the Lynx Iris first to 0.3 mm, then to a position below the measurement position, and then to the measuremnt poisition finally. This is useful to compensate backlash effects.

When using 2nd generation 4 Axes Indexer Boards (4AIB2G) this is automatically controlled by the D8 firmware.

To determine optimized positions for the Lynx Iris dependent on detector geometry angle, divergence, measurement diameter, … refer to Section 10.7.

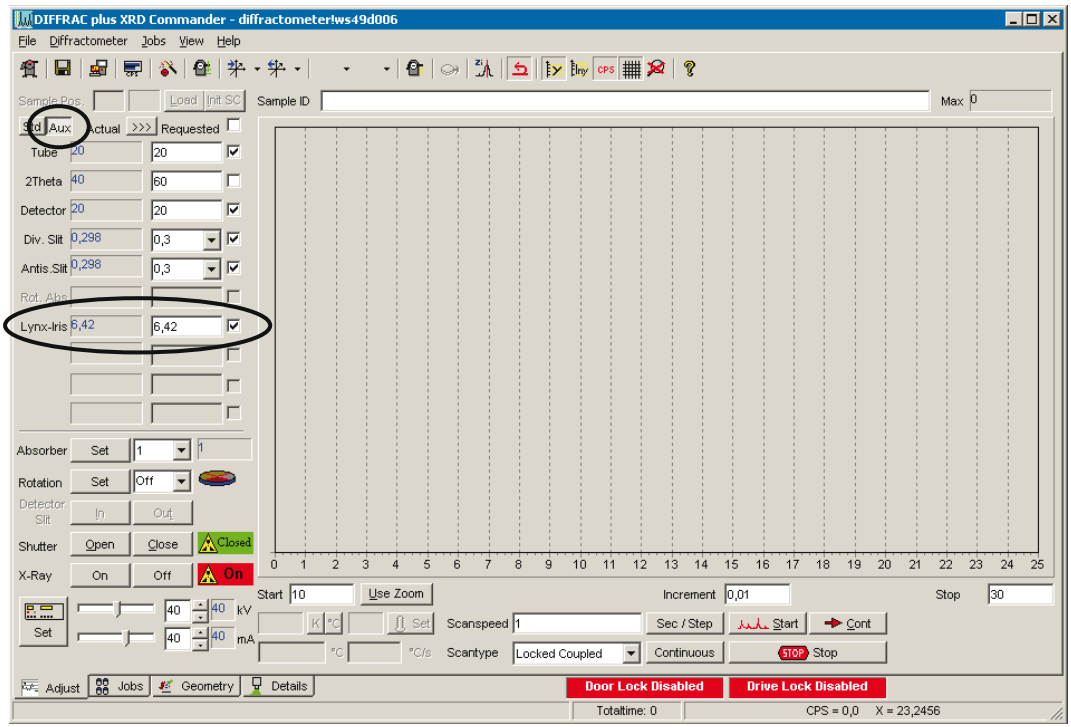

Figure 7.19 XRD Commander>Auxiliary Drives

8 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.

8.1 Check Positional Calibration

1. Remove all plug-in slits from the detector optic.
2. Ensure that the proper Kβ filter and the 2.5° Soller slit are in place.
3. Ensure that the reference material is mounted (Quartz or NIST 1976) in the sample stage.
4. Set the goniometer to the parameters in Table 8.1 or Table 8.2 using DIFFRAC*plus* XRD Commander.

NOTE

Do not close DIFFRAC*plus* XRD Commander. Instead, minimize the window.

Goniometer					Divergence slit			Generator settings		Scan parameters	Scan speed	
Radiation	Theta/Theta		Theta/2-Theta		Variable	Fixed (mm)	Kβ filter	kV	mA	Increment	PSD fixed (sec)	Scinti (s/step)
Cr	20.03	20.03	20.03	40.06	0.3°	0.6	V	35	45	0.006	10	0.002
Co	15.52	15.52	15.52	31.04	0.3°	0.6	Fe	35	45	0.006	10	0.002
Cu	13.32	13.32	13.32	26.64	0.3°	0.6	Ni	40	40	0.006	10	0.002

Table 8.1 Parameters for Quartz standard reference

Goniometer					Divergence slit			Generator settings		Scan parameters	Scan speed	
Radiation	Theta/Theta		Theta/2-Theta		Variable	Fixed (mm)	Kβ filter	kV	mA	Increment	PSD fixed (sec)	Scinti (s/step)
Cr	26.67	26.67	26.67	53.34	0.3°	0.6	V	35	45	0.006	10	0.002
Co	20.52	20.52	20.52	41.05	0.3°	0.6	Fe	35	45	0.006	10	0.002
Cu	17.57	17.57	17.57	35.15	0.3°	0.6	Ni	40	40	0.006	10	0.002

Table 8.2 Parameters for NIST 1976 standard reference

8.2 PSD Calibration

8.2.1 Create Files

1. Open XRD Wizard from **C:\Diffplus\XRDWizard.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 8.1).

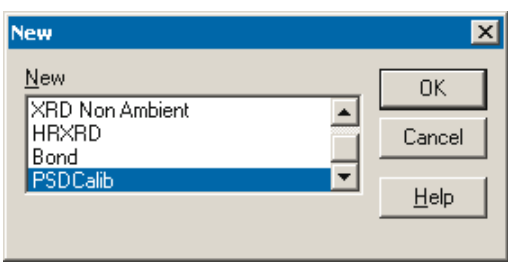

Figure 8.1 XRD Wizard > File > New

4. To create the DQL file, input the calibration parameters and click **OK**. The number of positions may be nine or larger. Whenever possible, select rotation ON and set the speed at 15 rpm.
5. Determine the theoretical 2-theta values using Table 8.1 or Table 8.2. Input the values into the Calibration Parameters screen (see Figure 8.2).
6. Input a step size of **0.3**.

NOTE

For measurements circles larger than 500 mm use 2-theta range 2° and a step size of 0.2°.

NOTE

When using the Motorized Antiscatter Slit (Lynx Iris) set the position to **maximum** (≈ 14 mm) in the **Drive** section of the XRD Wizard.

7. Save the DQL file as **Calib.DQL** and exit XRD Wizard.

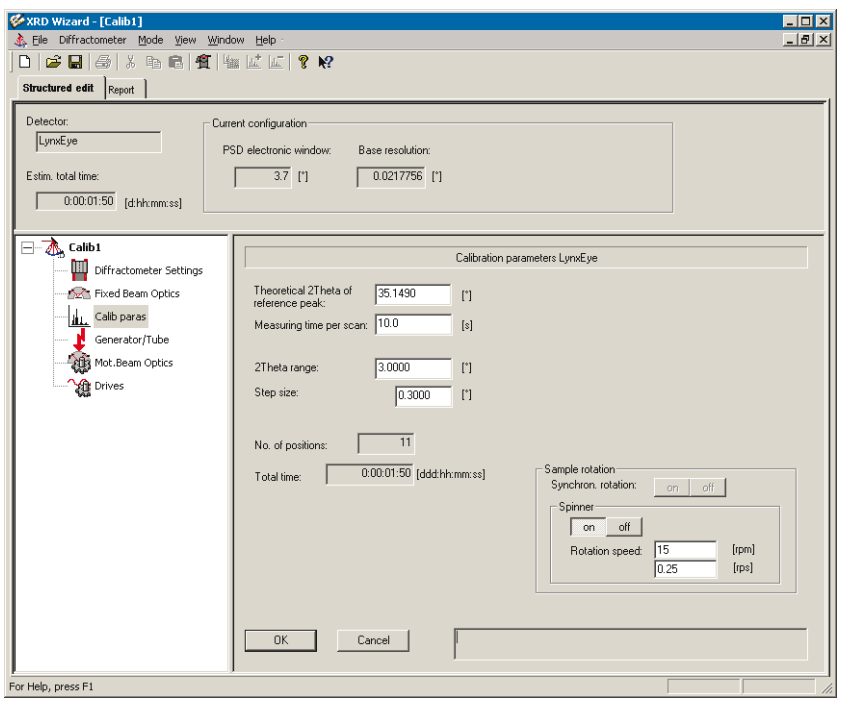

Figure 8.2 Create the DQL file. Example shown is for Corundum sample and Cu radiation

8.2.2 Collect Data

1. Open DIFFRAC^{plus} XRD Commander.
2. Select the **Jobs** tab and create a job using the Calib.DQL file.
3. Name the RAW file **Calib.raw**.
4. Make sure that **MeasureV4.VBS** is selected as the script to be used.
5. Press **Start Job** and wait for the job to finish.

NOTE

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

8.2.3 Analyze Data

1. After creating Calib.raw, select **Analyze Calibration** in the Configuration program under the LynxEye menu (see Figure 8.3).
2. Use the **Browse** button to locate the RAW file saved during the measurement of the CALIB.DQL.
3. Press **Apply** to analyze the calibration and set the resolution and offset of the detector (see Figure 8.4).

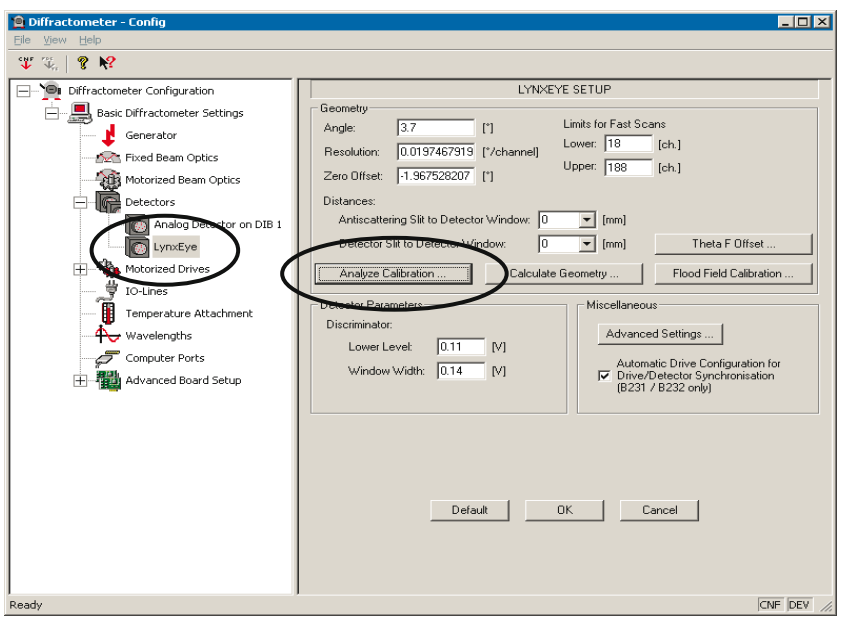

Figure 8.3 Analyze the calibration

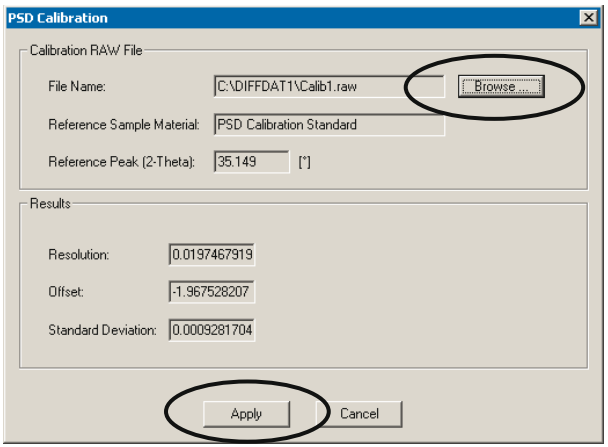

Figure 8.4 Locate the RAW file and apply new calculated values

4. Ensure that the mode zero offset value is approximately -3 to -1. Resolution should be approximately 0.020.
5. Recalibrate if the standard deviation is larger 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 -3 to -1 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 **LynxEye** menu (see Section 10.7).

NOTE

Whenever changes have been made in the configuration, remember to restart the Measurement server!

9 0D-Mode

This section describes the operation and parts of the 0D-Mode which are available since end of 2007. Additional hard- and software is required to fully support this modus. Full support is only achieved with new Axes Indexer Boards (C79298A3220-B231 and –B232) , combined with the Multi Axes Clock Cable (A17D79) and the 0/90° Mounts for 150mm (A17B81), 214mm (A17B82) and 258 mm (A17B83, consisting of A17B82 plus a spacer of 44 mm).

In 0D-mode a variable block of strips can be defined by software. All events collected by these strips are counted as one single rate at a specific angular position – similar to a scintillation counter.The most benefit can be achieved with the aid of a special detector holder (0/90° mount) by using the 90° rotated position (around the diffracted beam) in combination with a standard 0-dimensional optics. In this case, the line intensity is distributed to up to 192 strips of 75 µm width which results in detectable count rates of some 100 kcps. This will give the option to measure some 10 million cps. Even if in most cases not needed, the LynxEye in 0-D Mode can be combined with the Automatic or Rotary Absorber in Auto Mode.

Continuous and Step Scans are supported for all motors configured in combination with up to 3 Axes Indexer Boards. With Series 1 Axes Indexer Boards only Continuous Scan is available for either the Tube or Detector axis, depending on where the motor clock events are generated from.

9.1 Premises for 0-D mode

Full support of the 0-D for Step and Continuous Scan for motors connected to up to 3 Axes Indexer Boards requires a D8 Series 2 with:

1. D8 Firmware version 3.06 or 5.02 Release 11/2006, D4 Firmware version 2.02
2. MeasPart Version 2.6 Release 2007
3. LynxEye Firmware Version 0.86
4. Eva Version 13 Release 2007
5. Multi Axes Clock Cable A17D79

NOTE

Clock pulses of 2nd generation Axes Indexer Board are only generated, if a drive is assigned to driver 1 of this board, even if this drive is not intended for the 0-D mode scans with the LynxEye detector!

With the standard clock cable A17D42, only Continuous Scans with tube and detector are possible which allows a complete alignment of the diffractometer (without Scintillation counter). Locked coupled scans and some others with the these two drives will work in Continuous Mode only. This is important for D4 and D8 Focus diffractometers where only the standard clock cable A17D42 will be delivered.

9.2 Detector Components for 0-D mode

In addition to the standard configuration some more parts are available for use with the 0-D Mode:

- Plug-in Absorber (A17B53, Figure 9.1)

Figure 9.1 Plug-in Absorber 0.1mm Cu

- Multi Axes Clock cable (A17D79, Figure 9.2)

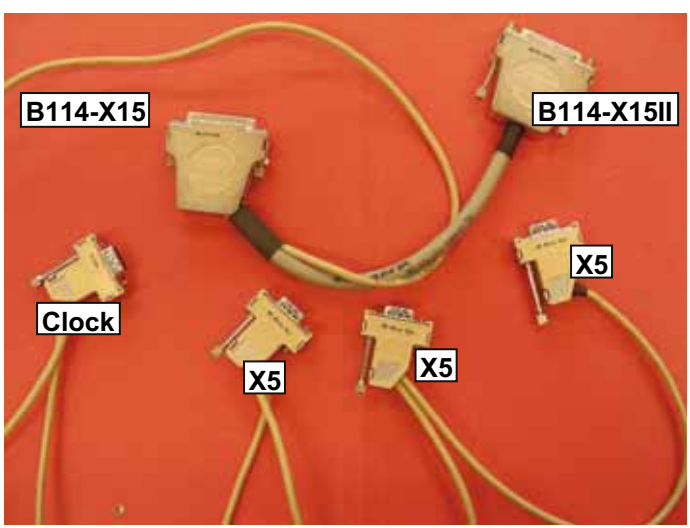

Figure 9.2 Multi Axes Clock Cable A17D79

All three X5 plugs are identical, unused plugs can be left free. Plug B114-X15 is required for step scans. The free length B114-X15II can be used for additional parts like video microscope or additional X-ray shutter open display. The clock plug has to be connected to the Motor clock socket (see Figure 3.6). Connections to the Axes Indexer Boards and the I/O Board B114 are shown in Figure 9.3.

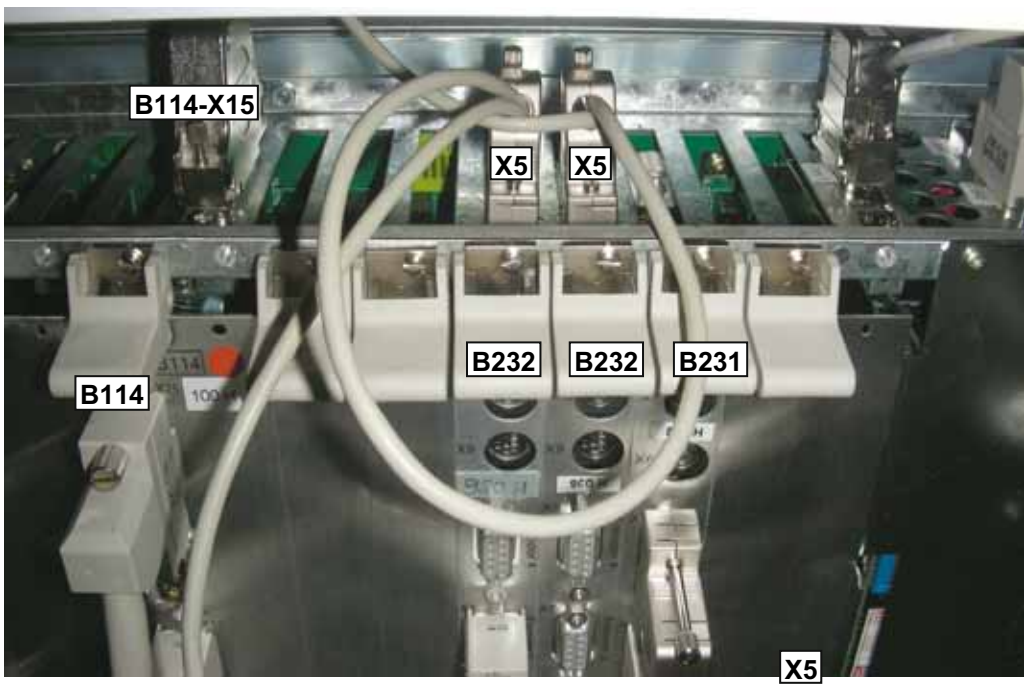

Figure 9.3 Connection of the Multi Axes Clock cable to the D8 Controller boards.

- 0/90° Mount with adapters for different measurement heights, Figure 9.4

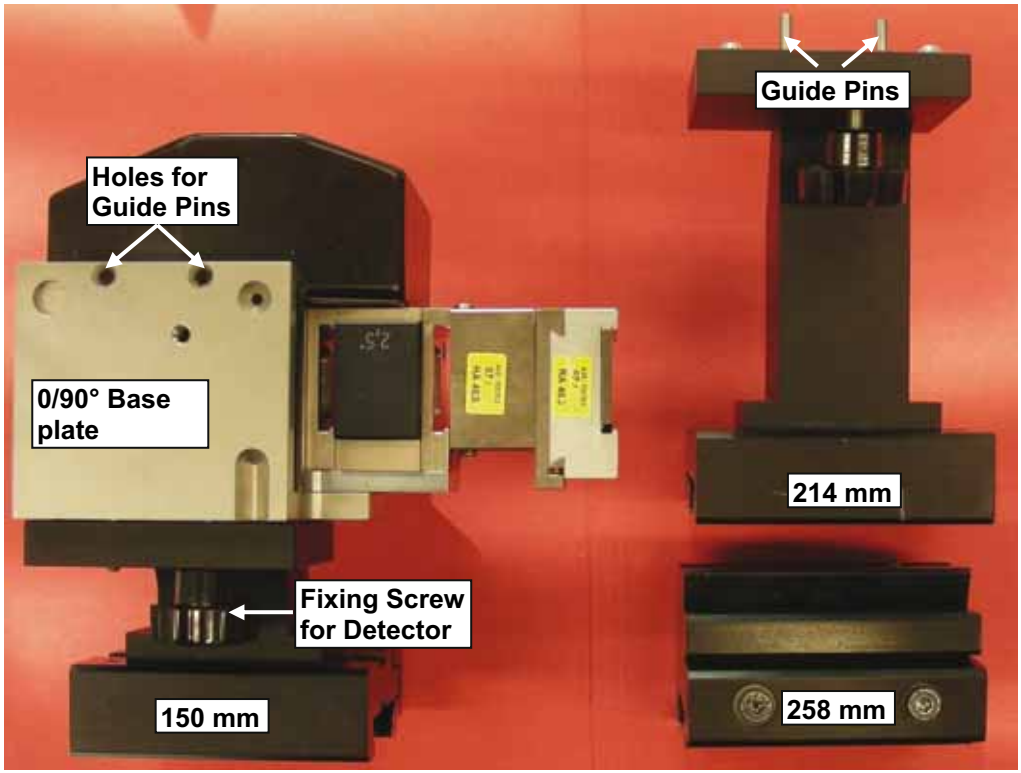

Figure 9.4 Mounts for different measurement heights.

These mounts allow a reproducible switching between 0 to 90°. In 90° position high count rates are possible but without a defined angular resolution in 2theta. To compensate this additional secondary optics might be required.

9.2.1 Mounting the detector using the 0/90° Mount

1. Fix the 0/90° Base plate to the LynxEye detector. See Figure 9.5

Figure 9.5 Fixing the LynxEye detector to the 0/90° Base plate.

2. Fix the detector unit (detector + 0/90° base plate) to the spacer either in 0° or in 90°. The pair of guide pins of the spacer will fit to the appropriate holes of the 0/90° Base plate. See Figure 9.6.

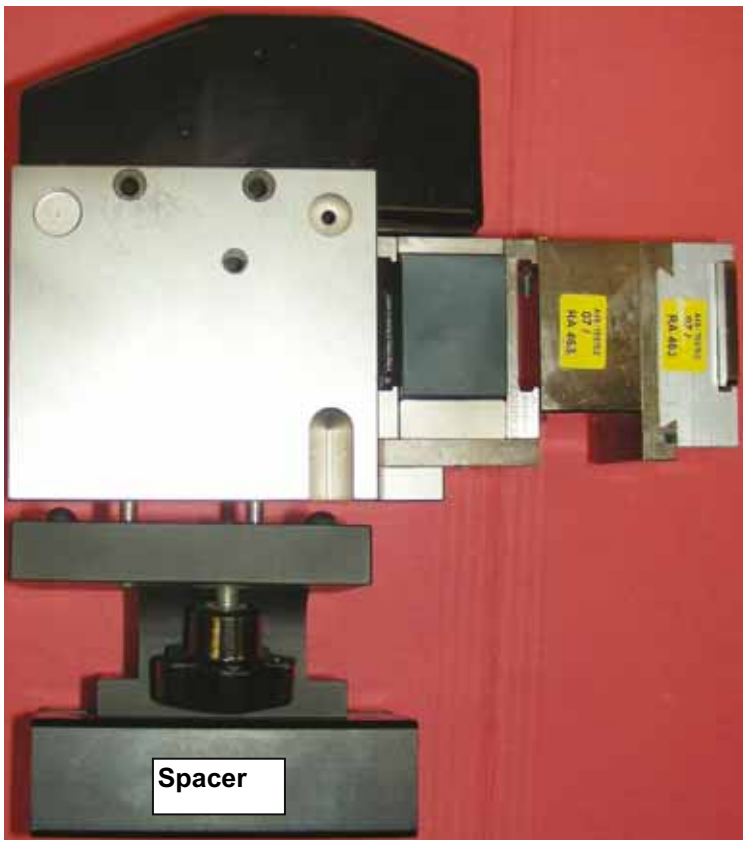

Figure 9.6 Mounting the detector with 0/90° Base plate to the detector spacer.

The mounting position shown in Figure 9.6 is the standard one for e.g. powder diffraction. The detector angle is resting on three balls, which allow a precise and reproducible mounting for 0° and 90° position.

The setup for e.g. Reflectometry Measurements requires a standard secondary optics system in addition to the 0/90° holder (to make use of the high count rate mode). A setup with the fixed slit optics (diffracted beam slit assembly) for high count rate mode with 90° mounted LynxEye is shown in Figure 9.7. No Soller should be inserted for the LynxEye because one is used in the Slit assembly.

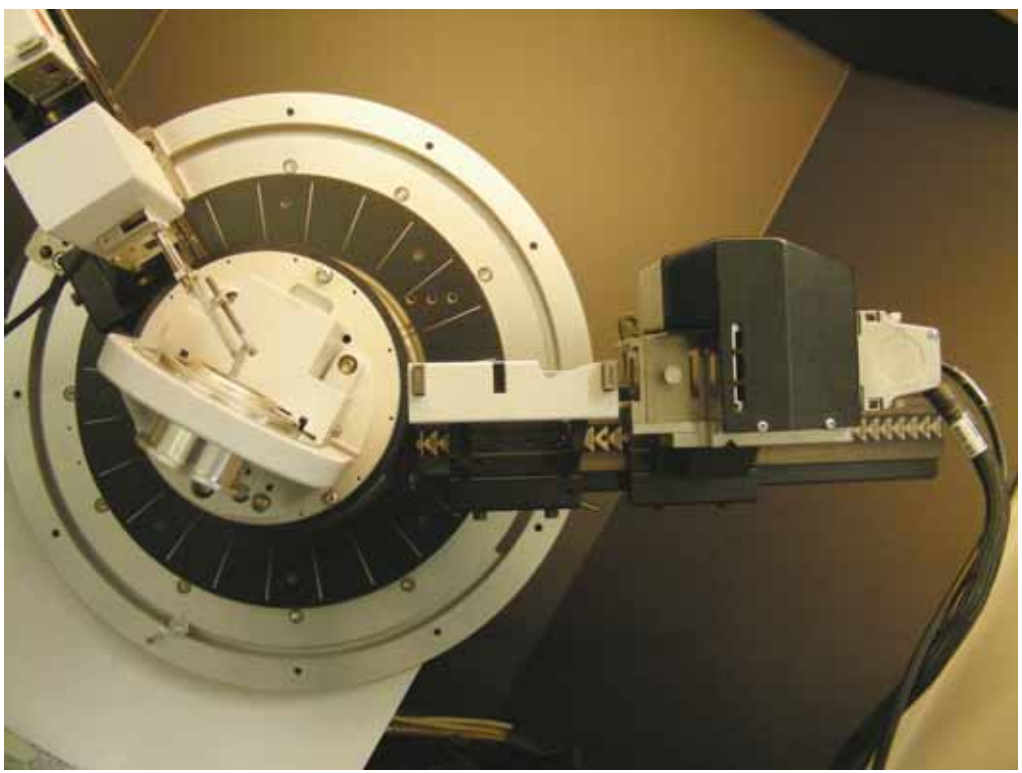

Figure 9.7 Detector setup for high count rates with Slit assembly and LynxEye in 90° mode.

9.3 Performing scans in 0-D Mode using XRD Commander and XRD Wizard

9.3.1 Standard operation

0-D Mode does not require a special setting for the LynxEye in the configuration of the diffractometer. Since release 2.6 of the Measurement Part this mode is supported by the XRD Commander and the XRD Wizard. When selecting the **Details** button in the XRD Commander two buttons are available for the PSD under **Scanning Mode** (see Figure 9.8**)**.

The default mode is '1D'. After clicking the **0D** button a value for **Opening** has to be defined,(unit is **mm**). See Figure 9.8. The smallest possible value is 0.075 mm, corresponding to one strip. Odd multiples of 0.075 mm can be selected up to a complete opening of approximately 14 mm (depending slightly on the centre position of the LynxEye detector).

All Scan types as for the Scintillation counter or the Sol-X detector are available, see Figure 9.9. Also both scan modi (Step scan and Continuous) are possible.

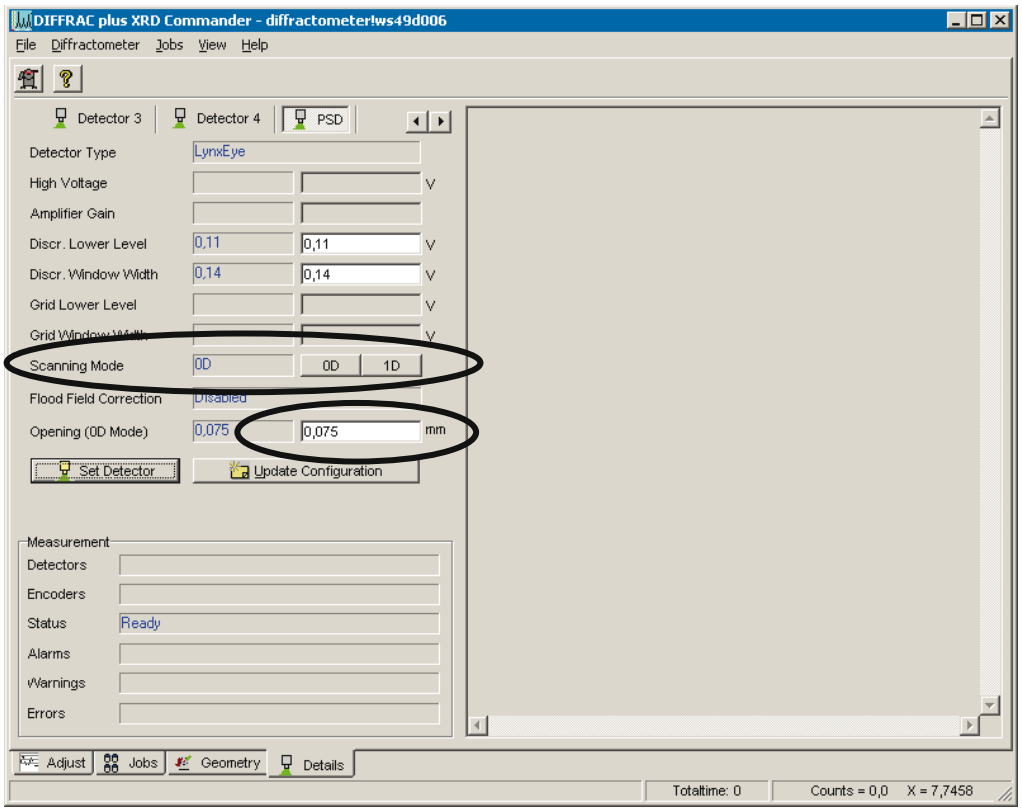

Figure 9.8 Detector Opening selection for 0-D Mode.

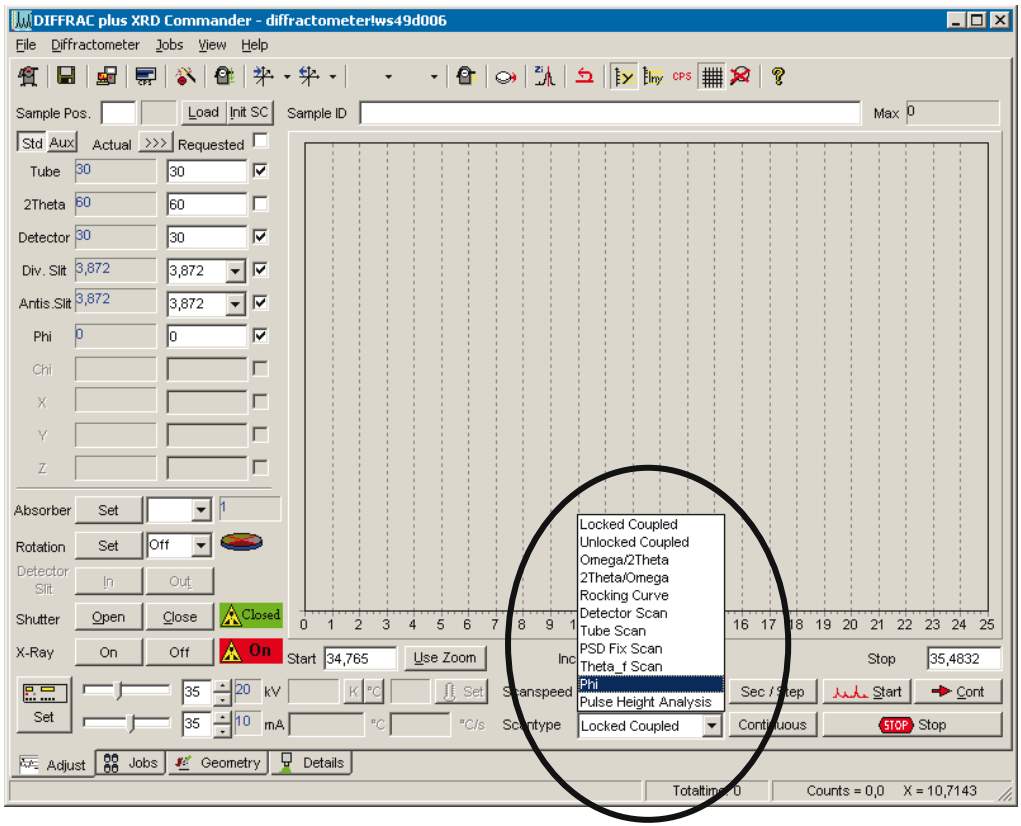

Figure 9.9 Scan Type selection for 0-D Mode in Commander.

In the XRD Wizard the 0-D mode can be selected under **Detector selection**. The detector opening can be chosen in the same way as in the XRD Commander. Afterwards all scans known for the Scintillation counter are available in **Scan Types** under **Scan Parameters** (Figure 9.10).

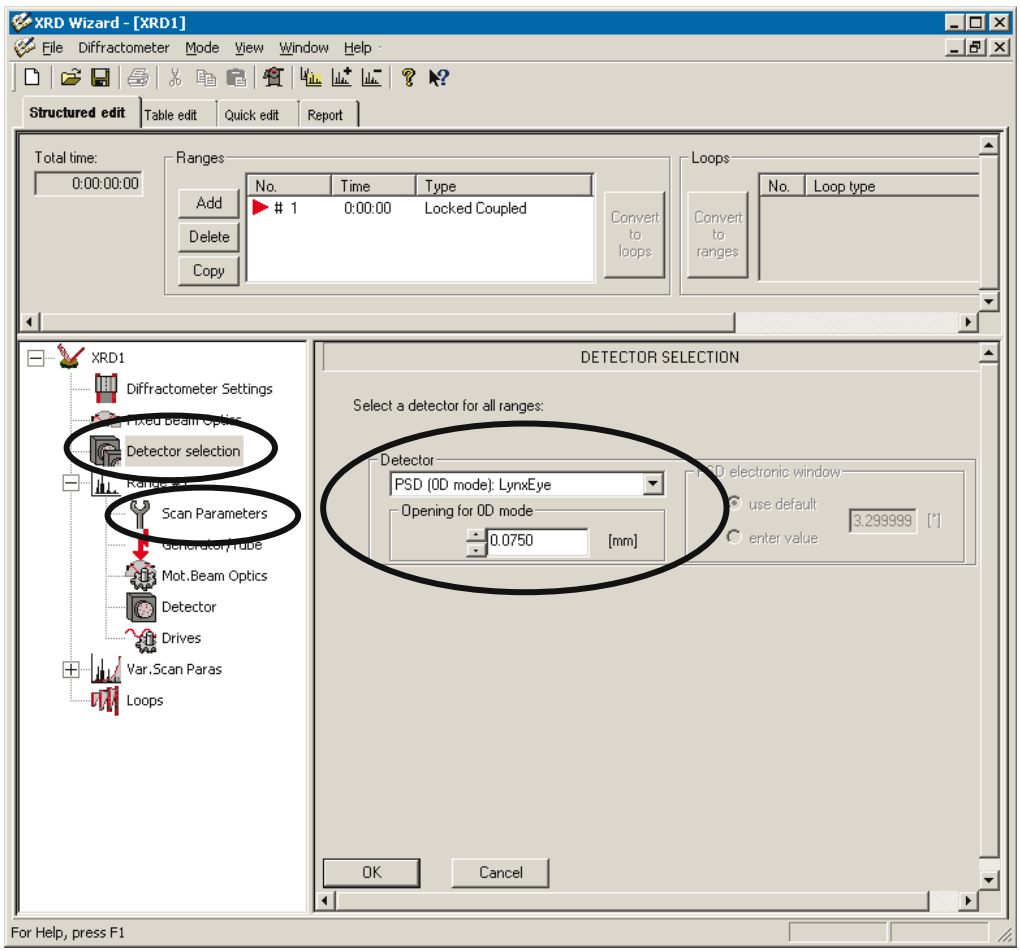

Figure 9.10 Detector and Opening Selection for O-D mode in Wizard.

9.3.2 Systems without Scintillation counter

The additional 0D functionality now allows to align the diffractometer without a scintillation counter and without the additional secondary optics:

- For Tube Scans the large opening of the scintillation counter has to be simulated by setting the LynxEye opening to 10mm.
- For Detector Scans the smallest LynxEye opening of 0.075 mm should be used to simulate a small detector slit.
- Under these conditions, the ZI values for the Tube and Detector can be determined as known for scintillations counters for Th/Th diffractometers. Refer to the ‘User’s Manual for D8 ADVANCE and D8 DISCOVER’.

NOTE

It is recommended to start the alignment of the diffractometer with the default values set for the LynxEye detector in the Configuration program (Config.exe). See section 6.4.

10 Basic Operation

This section covers the power-up, power-down, and basic operation procedures for the LynxEye 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 instrument 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 labeled F600 or the external power switch that is installed on the user's side close to the diffractometer.

10.1 LynxEye Power-Up Procedure

1. Press the I/O switch on the **rear** of the LynxEye controller to apply mains power. Low Voltage Ready LED illuminates when power is present. If the Low Voltage Ready LED 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 base cabinet.
2. Turn on the Bias for the detector by pressing the Bias enable button on the front of the LynxEye controller.

CAUTION

After switching on the detector Bias wait until the BIAS READY LED stays lit to make sure that the Bias voltage ramped up completely!

3. If power and communications for the controller are properly applied, there should be no warning LED illuminated. The System activity LED will flash green, indicating communication and control. The Bias ready LED will be yellow and illuminated. The Low voltage ready LED will be green and illuminated.

10.2 LynxEye Power-Down Procedure

CAUTION

Switch off the LynxEye detector Bias before switching off the LynxEye controller mains power. Wait until the BIAS READY LED turned off to make sure that the Bias voltage ramped down completely!

1. 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).
2. 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.
3. Press the Bias enable button on the front of the LynxEye controller. If the Bias enable button is not illuminated, this indicates that bias for the detector is OFF.
4. Press the I/O switch on the **rear** of the LynxEye controller to switch off the mains power.
5. Press the Power OFF button (O) on the D8 base cabinet’s right-hand column to stop power to the control electronics, high voltage generator, and the LynxEye controller, when the controller is connected to X602.
6. Switch off the instrument by pressing the D8 base cabinet’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.

10.3 Emergency Power-Down Procedure

The mains power for the LynxEye controller normally is connected to X601, located on the left side of the D8 base cabinet.

WARNING

The instrument 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 labeled 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.

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 and high voltage generator. In case that the LynxEye controller is connected to X602 it will also be shut off violating the precaution rules for the detector Bias!

   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.

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 base cabinet.

10.4 Disconnecting the Power Plug

To remove, relocate or service the LynxEye 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 base cabinet 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 base cabinet. Pull the plug from this outlet strip.

10.5 Lock Out

Use the key located on the left side column of the D8 base cabinet 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 base cabinet. 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 and some other distribution panels. Electric shock can result if proper safety precautions are not observed.

10.6 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* XRD 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.

10.6.1 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 10.10.1).
2. Select detector type PSD (LynxEye) in the Details tab.

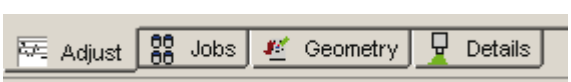

Figure 10.10.1 Tab selection

10.6.2 Select the Scan Parameters

The following parameters must be selected prior to running a measurement: scan type, start, stop, speed, and increment (see Figure 10.2 and Figure 10.3). Additional settings may include divergence slit size, rotation of the stage, and generator settings for KV and mA.

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

To perform a measurement:

1. Turn the X-ray generator on.
2. Figure 10.2 and Figure 10.3 show the location of the parameters for different immediate measurements. The fields show the actual settings for the current measurement.

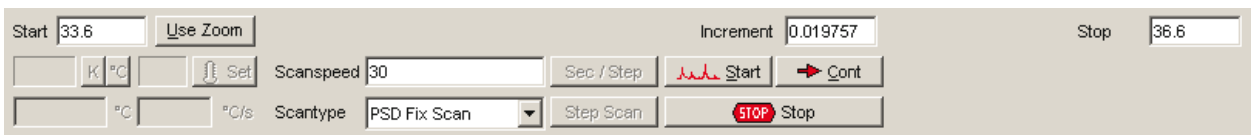

Figure 10.2 Example of measurement parameters for fixed scan

Figure 10.3 Example of measurement parameters for locked coupled scan

3. **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.
4. **Scan speed**: Enter the scan speed here. LynxEye 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.
5. **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 is used to reduce wear on the goniometer.
6. **Start, Stop**: Use these buttons to begin or end an immediate measurement.

10.6.3 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 10.1 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 LynxEye accessories. For part numbers of different filters (material, thickness) see 12

NOTE

Do not use Kβ filters in combination with Goebel mirrors or Primary monochromators!

Table 10.1 Filter selection and angular position [deg] of $K\beta_1$ peak

Settings					
Quartz sample					
Anode	**E (KeV)**	**$K\alpha_1$**	**$K\alpha_2$**	**$K\beta_1$**	**Beta filter**
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
NIST 1976 Corundum Standard					
Cu	8.048	35.15	35.21	31.673	Ni
Co	6.92	41.05	41.11	37.047	Fe

10.7 Calculate the Optimum Detector Optics Settings

This section describes how to calculate the optimum setting for the PSD angle or the secondary slits using **LynxEye > Calculate Geometry** in the Configuration program CONFIG.EXE.

1. In the LynxEye Setup menu, click the **Calculate Geometry** button. The PSD Calculator menu will appear (see Figure 10.4).

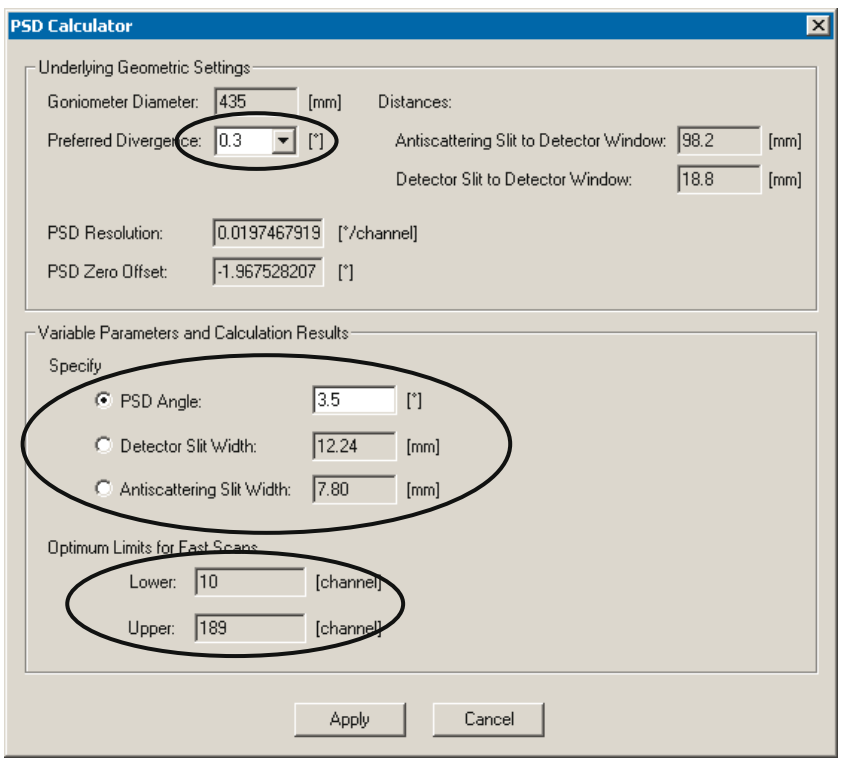

Figure 10.4 PSD Calculator

The values shown in the PSD calculator window are taken from different menus:

- The measurement diameter is set in the Basic Diffractometer Settings menu
- The PSD angle is set in the LynxEye menu
- The PSD resolution and offset were determined during the calibration of the detector
- The distances of the Antiscatter slit and the Detector slit to the detector window are set in the LynxEye menu. The distances are measured from the slit to the focus circle (equal to the sensor plane). There is only one value for the Detector slit distance. Three different distances can be set for the Antiscatter slit distance related to the length of the antiscatter tube used (for 401 mm, 435 mm or 500 mm measurement circle diameter).

2. Set the **Preferred Divergence** (see Figure 10.4).
3. Specify either the **PSD angle** or the **Antiscattering Slit Width** (e.g. 8 mm in case of using the 8 mm plug-in slit or any other value when using the Lynx Iris). See Figure 10.4.

NOTE

PSD angle, Antiscattering Slit Width and Detector Slit Width depend on each other. Changing one of these values will automatically update the others based on the rest of the parameters.

NOTE

Optimize the setting in that manner that following conditions are met: **Lower Channel > 0 AND Upper Channel < 191 !** Due to mechanical tolerances and alignment it might happen that the best usable set of channels is not perfectly centered in relation to the sensor.

NOTE

When using the Motorized Antiscatter Slit (Lynx Iris) write down the value of the **Antiscatter Slit Width**. This value can be used as the optimized target position of the Lynx Iris in XRD Commander. This value is currently (end 2007) NOT set automatically.

4. To implement the settings, press the **Apply** button.
5. Download the changes to the LynxEye 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} XRD Commander User Manual (M88-Exx060).

10.8 Instrument Performance Test

For a quick performance test of the instrument use the NIST SRM 1976 standard sample and determine the resolution of the main peak. The system should match the specifications in Table 10.2

Perform a 2 degree locked coupled (continuous) scan with the main peak centered (e.g. 2Theta = 34.15 to 36.15 for Cu radiation). Refer to Table 8.2 for instrument parameters.

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).

Table 10.2 FWHM specifications for Cu radiation

Cu	Bragg	Göbel Mirror*
401 mm	≤ 0.060°	≤ 0.130°
435 mm	≤ 0.055°	≤ 0.120°
500 mm	≤ 0.050°	≤ 0.110°
600 mm	< 0.050°	< 0.110°

* parallel beam type

Start EVA and load the RAW data to evaluate.

1. 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 artefacts and a 0.5 intensity ratio. Select the **Append** button to create a new phase.
2. Use the Area function in the EVA toolbox to create an area measurement using the complete measured range (see Figure 10.5). Use the mouse to select the range.
3. Review the data displayed in Toolbox (see Figure 10.6).

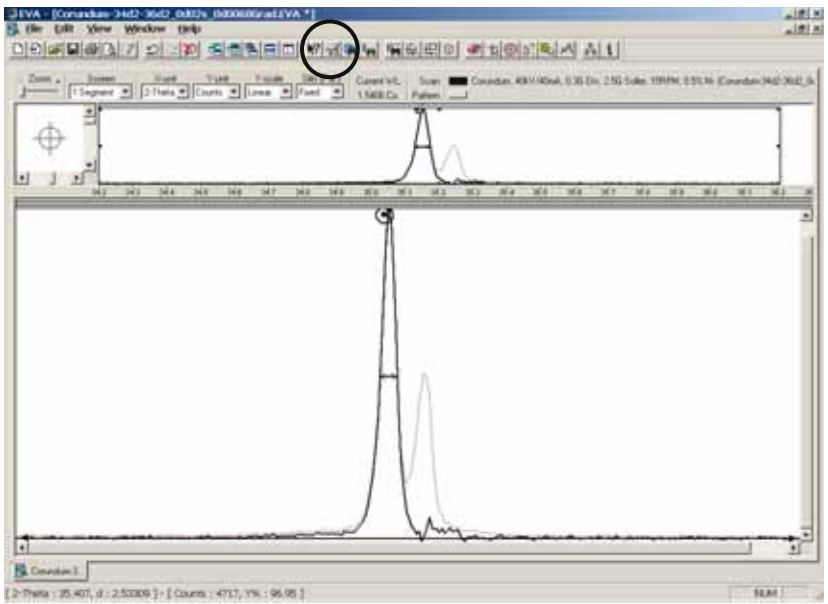

Figure 10.5 EVA Main window

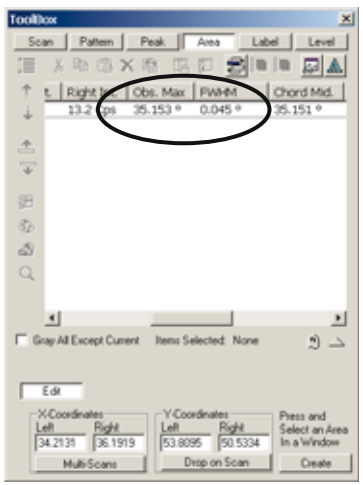

Figure 10.6 EVA Toolbox

NOTE

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

10.9 Pulse Height Analysis (PHA)

Photons are converted to electronic pulses proportional to their photon energy. PHA scans allow to check the correct setting of the discriminators with respect to the noise level, the used radiation and the inherent resolution of the x-ray tube.

10.9.1 Perform a measurement

1. Turn on the X-ray generator.
2. Choose **Pulse Height Analysis** from the Scantype drop-down menu.
3. Preposition the goniometer circles to get a representative reflection of the sample centered on the detector.
4. Figure 10.7 shows an example of a measurement parameter set suitable for a PHA scan using Cu radiation and the NIST SRM 1976 standard sample. The fields show the selected settings for the measurement.

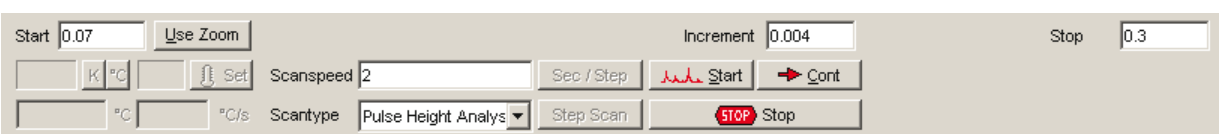

Figure 10.7 Example of measurement parameters for PHA scan

5. **Start value, Stop value**: when doing a PHA scan the measuring unit is V. The default settings for the LynxEye discriminator are:
   - Lower level: 0.11 V
   - Width: 0.14 V
   - High level: 0.25 V (calculated from Lower level + Width)

   The values for the lower level and the window width can be checked and modified in the **Details** tab.
6. **Scan speed**: Enter the scan speed here. LynxEye operation uses seconds per step.

7. **Start, Stop**: Use these buttons to begin or end an immediate measurement.

10.9.2 Determine optimized discriminator settings

Figure 10.8 shows an example of a PHA scan on a corundum sample using Cu radiation.

To determine the different discriminator levels move with the cursor along the scan. The x value of the cursor position (in V) is shown close to the right bottom of the XRD Commander window.

The values for the lower level and the window width can be checked and modified in the Details tab.

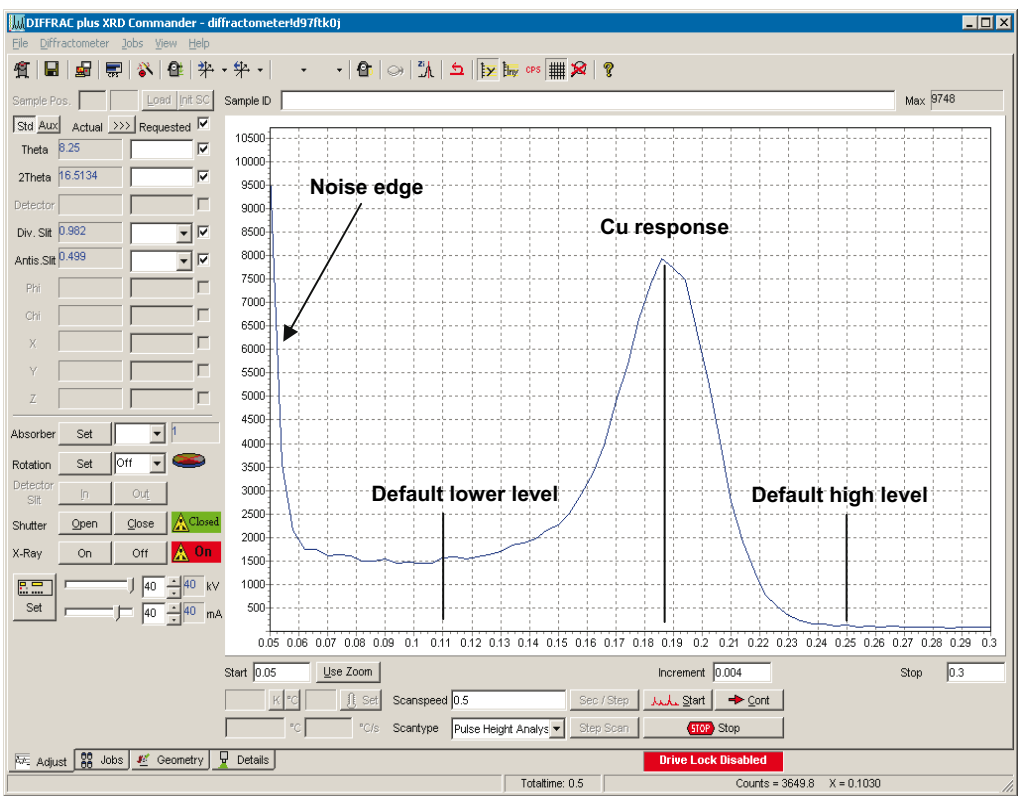

Figure 10.8 Example of a PHA scan (corundum sample, Cu radiation)

NOTE

To ensure the correct allocation of intensities to the detector channels do NOT set the discriminator lower level lower than 1/2 of the level determined for the signal peak maximum!

10.10 Detector flood field correction

The flood field correction is a special feature to improve the LynxEye detector performance for **PSD Fixed Scans**. It might be usable only for some special kind of applications.

It does NOT influence or alter the characteristics of continuous scans.

CAUTION

An improper performed flood field calibration might influence PSD Fixed Scan data!

NOTE

Enabling/disabling the flood field correction is only possible in CONFIG! As long as the flood field correction is enabled in CONFIG it will automatically be applied to all PSD fixed scans. You can check the status (enabled/disabled) in the XRD Commander DETAILS tab).

Please remember that the flood field correction depends on any measurement condition which will influence intensity distributions, especially:

- Alignment
- PSD Calibration
- detector HV and discriminator settings
- measurement circle
- soller slits
- …

You have to perform and analyse a new flood field file whenever measurement conditions have been changed.

1. Optimize the Detector Optics Settings (see Section 10.7). Note the resulting PSD Angle.
2. Make sure that the flood field correction is disabled (see Figure 10.9and Figure 10.10)

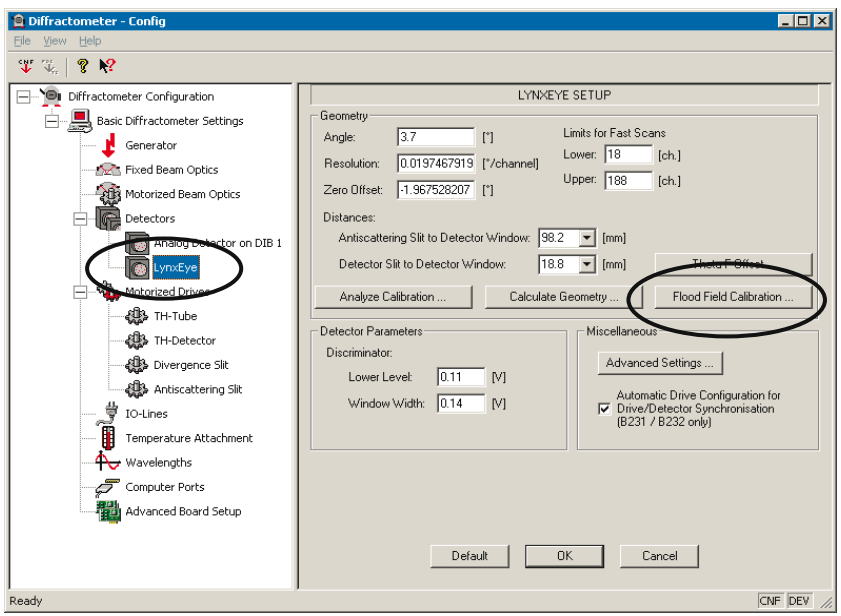

Figure 10.9 Access the flood field option in Config

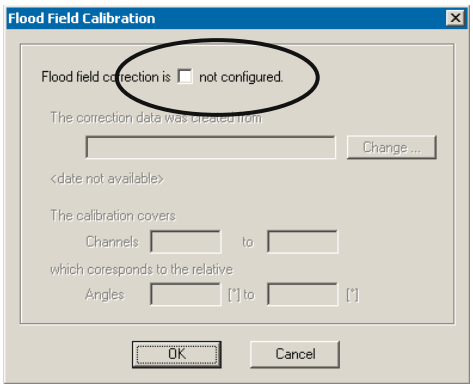

Figure 10.10 Flood field correction disabled

3. Save/download the configuration and quit/restart all other measurement programs.
4. In XRD Wizard create a DQL-file using following measurement conditions:

- Geometry angle: PSD Angle as noted before (see 1.)
- Divergence slit: 1° / 2 mm
- Primary soller: 2.5°
- Secondary soller: 2.5°
- Kβ Filter: removed
- Generator: 40 kV / 50 mA
- Scan type: PSD fixed scan
- Speed/Time: 300 sec
- Resolution: 0.006
- Range: see note
- Rotation (if possible): 15 rpm

NOTE

The range depends on the sample you are using for getting a homogeneous background radiation. When using a standard steel sample holder (mounted upside down) a fixed scan from 100° to (100 + PSD Angle)° 2Theta may be a recommended selection for Cu radiation.

5. Save the DQL file as “floodfield.dql” and exit XRD Wizard.
6. Open XRD Commander and create a job using the “floodfield.dql” file.

NOTE

Make sure that **MeasureV4.VBS** is selected as the script to be used.

7. Name the Raw file “floodfield.raw” and start the job.
8. After finishing the job go to the flood field correction option in CONFIG (see Figure 10.9), enable the flood field correction and import the “floodfield.raw” file (see Figure 10.11).

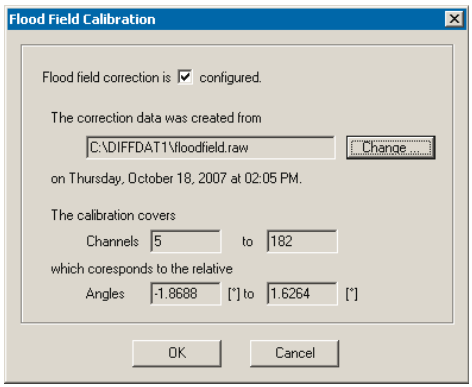

Figure 10.11 Enable correction and import RAW-file

9. Confirm with **OK**, Save/Download the configuration and quit/restart all other measurement programs.

NOTE

As long as the flood field correction is enabled access to the discriminator levels is disabled. To change these detector parameters the flood field correction has to be disabled in CONFIG.

11 Preventive Maintenance and Troubleshooting

The components of the diffractometer are basically 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.

NOTE

For standard maintenance and troubleshooting there is no need to open any of the LynxEye components. Especially breaking the seal of the detector cover and/or removing the detector cover will lead to a complete loss of warranty!

11.1 Cleaning the Diffraction System and Measuring Equipment

CAUTION

In preparation of a cleaning of the instrument please shut down 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 tube as it contains beryllium. Beryllium is potentially hazardous if ingested, inhaled or absorbed through the skin. 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.

11.2 Replacing Fuses

1. Unplug the power cord before replacing the fuse.
2. Locate the fuse at the rear side of the controller.
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 11.1**)**.

NOTE

Replace the fuse only with the specified replacement (see 12). 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.

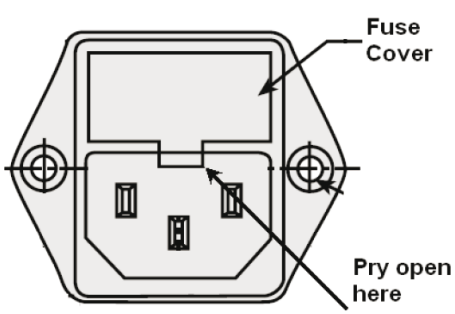

Figure 11.1 Fuse close-up

11.3 Troubleshooting

11.3.1 Display data in the XRD Commander window has flatlined or is nonexistent.

- Ensure that the detector type PSD is selected in the Details tab of the XRD Commander program.
- Check if the BIAS button is illuminated.
- Check if the motor clock cable is properly installed (see Figure 3.6 and Figure 6.1).

11.3.2 System Activity LED not flashing

- Reset the LynxEye controller. If the system activity LED still remains off switch off the LynxEye controller, check the cable connections to the detector and restart the controller.
- Connect a serial cable and attempt to recover communications from the Config program (see Section 11.4).

11.3.3 Alarm LED lights red, Low Voltage Ready LED remains off

- Check the cables and the cable connections to the detector and restart the controller.

11.3.4 The BIAS button is not illuminated.

- Press the BIAS button. If the switch lights, the Bias is enabled. If the switch is still not lit, check the Power ON switch on the LynxEye controller or D8 base cabinet.
- 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 (see Section 11.2).

11.3.5 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 settings in the Config program file.
- Check the configuration of the 2nd network adapter “LAN 2” in the PC.
- Connect a serial cable and attempt to recover communications from the Config program (see Section 11.4).

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

- Repeat the calibration of the LynxEye detector (see Section 8.2).

11.4 Manual Configuration of the Controller

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

1. In the Config software, go to PSD-Controller. Check for correct settings as described in Section 6.6. Press the "**Recover…**" button located in the lower left corner of the window (see Figure 6.15). A new window will pop up (see Figure 11.2).
2. Follow the steps in the screen shown in Figure 11.2.
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.

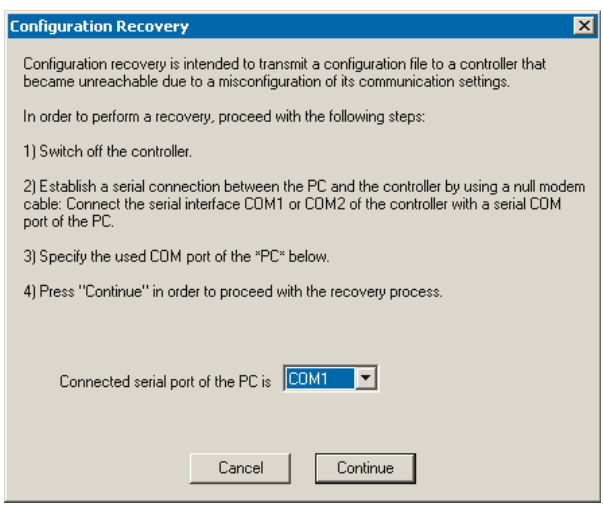

Figure 11.2 Recover pop-up window

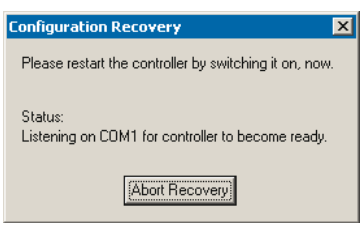

Figure 11.3 Boot-up window

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 LynxEye controller.
6. Replace the cables as they were prior to this recovery procedure (see Figure 6.1).
7. Switch on the LynxEye controller.

Communication is now back via the LAN line.

12 Spare Parts List

Table 12.1 Spare parts

Part Number	Description
A17D60	LynxEye detector for D8 ADVANCE/D8 DISCOVER, incl. controller, mount required
A17D61	LynxEye detector for D8 FOCUS/D4 ENDEAVOR, incl. controller and mount
A17B60	LynxEye detector only
A17B80	Controller for LynxEye detector
C79298A3244B122	Spacer/long for 150 mm (used as the mount for the LynxEye)
C79298A3244B123	Spacer/long for 214 mm (used as the mount for the LynxEye)
C79298A3244B127	Spacer/long for 258 mm (used as the mount for the LynxEye)
A17B81	0/90° Mount and spacer for 150 mm LynxEye (D8 ADVANCE and Discover only)
A17B82	0/90° Mount and spacer for 214 mm LynxEye (D8 ADVANCE and Discover only)
A17B83	0/90° Mount and spacer for 258 mm LynxEye (D8 ADVANCE and Discover only)
A17D62	set of plug-in slits (3.0, 8.0 mm) for LynxEye detector (included in delivery)
A17B85	plug-in slit for LynxEye, 8 mm
A17B86	plug-in slit for LynxEye, 3 mm
A17B61	Axial Soller slit 2.5° for LynxEye detector (included in delivery)

Part Number	Description
A17B67	Axial Soller slit 1.5° for LynxEye detector
A17B68	Axial Soller slit 4° for LynxEye detector
A17B70	Motorized Antiscatter Slit (Lynx Iris)
A17B72	Ni-filter for Cu-Kß-radiation, 2.5%, for LynxEye detector
A17B73	Fe-filter for Co-Kß-radiation, 2.5%, for LynxEye detector
A17B74	V-filter for Cr- Kß-radiation, 2.5%, for LynxEye detector
A17B76	Ni-filter for Cu-Kß-radiation, 0.5%, for LynxEye detector (included in delivery)
A17B77	Fe-filter for Co-Kß-radiation, 0.5%, for LynxEye detector
A17B78	V-filter for Cr- Kß-radiation, 0.5%, for LynxEye detector
A17B53	Cu-Absorber 0.1 mm, for LynxEye detector
A17B88	Antiscatter tube 500mm
A17B89	Antiscatter tube 401mm
A17B90	Antiscatter tube 435mm (included in delivery)
A17B63	Cable Guide LynxEye D4
A17D77	Detector Power cable
A17D78	Detector Data cable
A17D42	Clock cable
A17D43	Y-cable for clock cable A17D42 (only required for AIB 104/105)

Part Number	Description
A17D79	Multi axes clock cable for D8 ADVANCE and D8 DISCOVER, or Super Speed Solutions
C72298A251B39	Ground Cable for FC (S3K)
K340C9	Ethernet Crosslink cable 50 Ft (15 m)
K360C2	Network card
W79054L1011T400	Fuse T 4,0A / 250V

13 Updating the Detector Controller Firmware

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

CAUTION

An improper software installation might result in a loss of functionality or performance of the LynxEye detector. In case of any doubts about usable software versions or the installation process please contact your local Bruker AXS Service Department

A.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 > PSDController > IP Setup and Services**. Check the **HTTP Interface** checkbox and press the **Users button**.

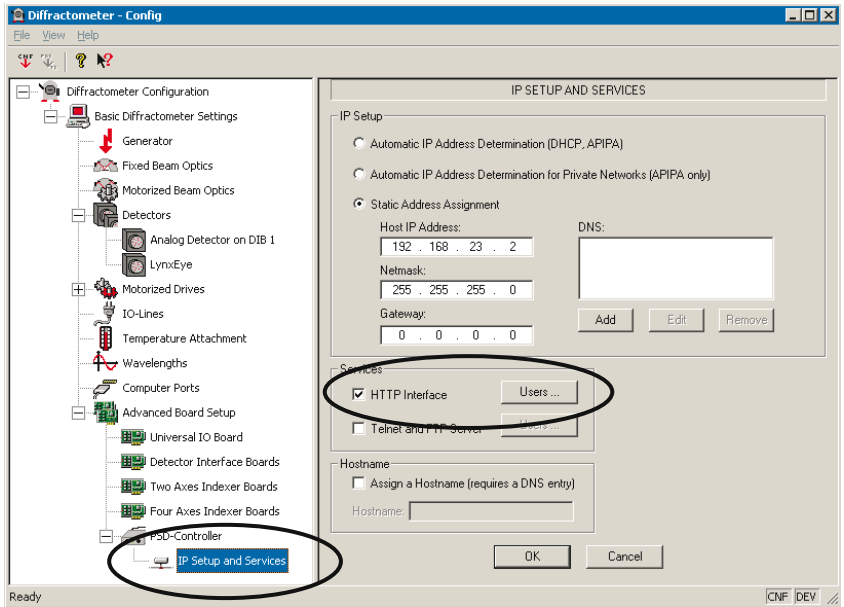

Figure 13.1 Set up login and password

2. Click **Add User** (see Figure 13.2).
3. Fill in the fields in the Add User window as follows:

   User: customer (for example)
   New Password: DIFFRAC (for example)
   Type your new password again in the “Confirm Password” field.

   Check the **Status** and **Service** checkboxes (see Figure 13.3).

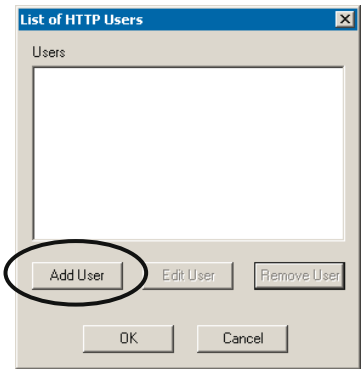

Figure 13.2 List of HTTP Users menu

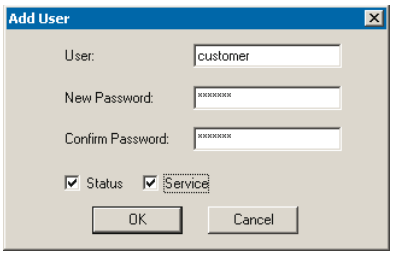

Figure 13.3 User and password setup under Add User

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 13.4). Click **Yes**.

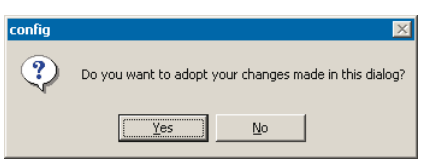

Figure 13.4 Save changes confirmation window

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 13.5, the configuration will not download). Accept the default and click **OK**.

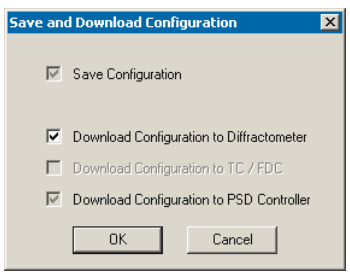

Figure 13.5 Download configuration window

A.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 13.6.

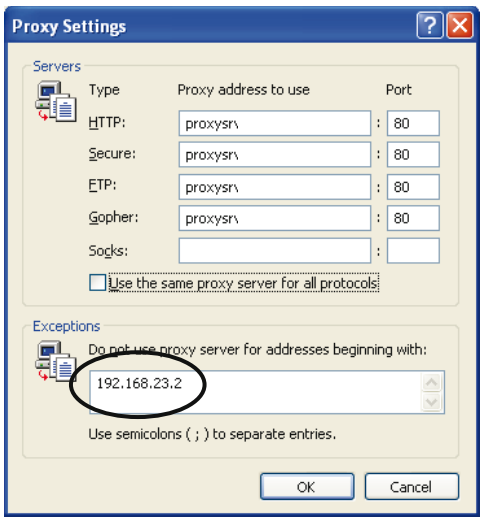

Figure 13.6 Entering the detector controller's IP address as a Proxy server exception

3. After typing the detector controller's IP address, hit **Enter**. The detector controller prompts you for a user name and password.
4. Enter user name and password that have been defined in Section A.1 and click **OK** (see Figure 13.7).
5. The detector controller menu appears in the browser window (see Figure 13.8).

Figure 13.7 Enter Password

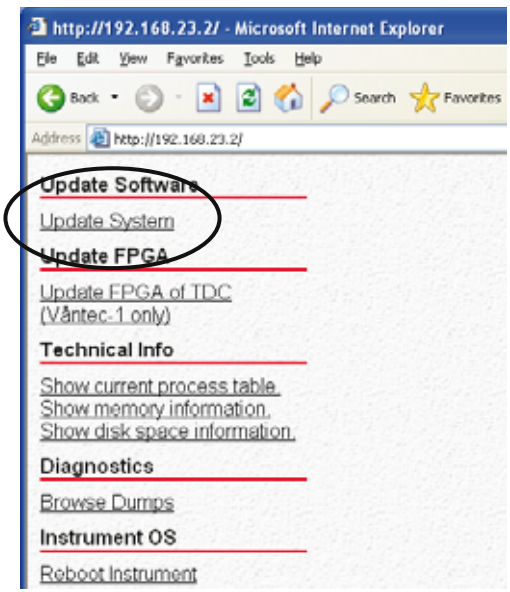

Figure 13.8 Browsing the x86-based CPU board or PC

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

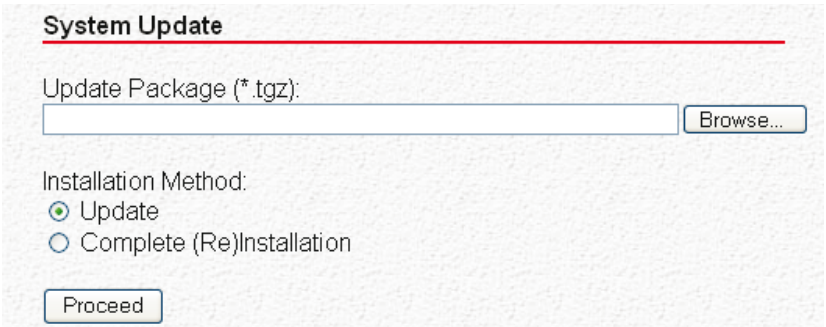

Figure 13.9 System update package dialog

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.