

All axes are driven with special dc motors with continuously variable slew speeds. This guarantees motion without vibrations even at the highest possible slew speeds.

In going to the next reflection, all axes are driven simultaneously at their maximum speed. The final correct position is always reached with a low speed from the same direction to avoid even the smallest errors due to unavoidable backlash.

Absolute encoders are used. Two encoders are mounted on each axis, a coarse and a fine. This eliminates the difficulties caused by counting encoder revolutions and the dependence upon the computer.

The encoders are of the voltage resolver type. The resolution and electrical angle read out of these encoders is 0.0007° . Their life is nearly unlimited. The encoders not only achieve this high accuracy but maintain it for a very long time.

A pre-aligned extension piece for the scintillation detector holder to lengthen the crystal-detector distance for protein work is provided with the instrument. The two standard distances are: 173 mm and 368 mm. Other distances are available on request. An extended diffracted beam tunnel which can be flushed by a low absorbing gas is available too.

The counter aperture unit has a continuously variable horizontal receiving aperture, a horizontal slit, two diagonal slits and two beam

splitters. The apertures are computer controlled but manual control is also possible. The reproducibility of the positions of the different apertures is $10\ \mu$. The height of the aperture is determined by slits that can be inserted manually (1 mm, 2 mm, 3 mm, 4 mm, 6 mm).

An incident beam balanced filter unit is provided as standard with the instrument and is simply fitted to the tube stand.

One of the filter holders can be positioned and locked in order to balance the two absorption filters. The balanced filters are also programmable or under manual control. In the Enraf Nonius incident beam graphite monochromator system, which is also delivered as a standard with the CAD 4, the monochromator omega axis is transverse to the omega/2 theta axis of the goniometer. Thus the spectral dispersion of the monochromator is parallel to the omega/2 theta axis, resulting in a symmetric geometry for same reflections at positive and negative 2 theta values. A long experience precedes this monochromator arrangement. The tube shield can be tilted from the equatorial plane to a maximum of 30° while the tube focus adjustments and the take-off angle keep their positions, which is very important for easy adjustment of the total monochromator system. A block containing the omega motion and the graphite monochromator crystal is simply attached to the tube stand and fits in the same way as the balanced filter block. The monochromator crystal can be moved parallel to its omega axis.

The tubeshield is designed to accept fine focus, as well as normal focus tubes. (Philips, AEG, Elliott etc.) It is mounted parallel to the equatorial plane and is an integral part of the goniometer. This assures a rugged construction and makes the goniometer alignment independent of table top movements. x-z translations provide the user with a very accurate focus adjustment device which is easy to handle.

The take-off angle can be adjusted between $0^\circ - 8^\circ$ with a scale reading for the take-off angle of 0.05° . The tube filter disk has four positions: Mn, Ni, Zr filters and open. The status of the fail-safe computer controlled X-ray shutter is indicated by two control lights. If both these lights should burn out, the shutter cannot be opened.

The pre-aligned collimator support is mounted on the tube stand.

Collimators rather than inserts are provided. They are available for both fine focus and normal focus tubes. Standard are:

3 collimators for fine focus tubes and 2 collimators for normal focus tubes. An extra safety shutter has been built to assure that uncollimated X-rays cannot escape from the system. A secondary beam tunnel serves to collimate the diffracted beam and to minimize the background. Two different diffracted beam collimators are provided with the instrument.

The primary beam catcher is placed to give optimal security and at the same time to allow measurements even at very low 2 theta angles. Two differently sized beam catchers are provided with the instrument.

