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Hardware Operation Manual

ELPHY *Quantum* and ELPHY *Plus*

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Statement

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Addresses

Raith GmbH	Tel.: +49 231 97 50 00 – 0
Hauert 18	Fax.: +49 231 97 50 00 – 5
44227 Dortmund	WWW: *www.raith.com*
Germany	Email: support@raith.com

Raith USA, Inc.	Tel.: +1 631 738 9500
2805 Veterans Hwy	Fax.: +1 631 738 2005
Suite 23	WWW: *www.raith.com*
Ronkonkoma, New York	Email: support@raithusa.com

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1 Introduction

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1.1 Using this manual

Make sure that you use the system correctly by reading the operation manual before usage carefully.

Keep the operation manual on hand to read it whenever necessary.

Contact directly Raith or your local representative whenever you are uncertain about operating your system.

1.2 Notes, cautions, and warnings

Stickers on the left column provide you with the following messages:



A note emphasizes information requiring special attention.



A caution message appears when special handling is necessary to prevent product damage.



A dedicated warning message appears when special handling is necessary to prevent personal injury or death.

The same stickers are displayed at the instrument. Should any of the stickers be missing please notify Raith. Raith will send a replacement.

1.3 Navigating through the manuals

This manual provides information about

- safety and handling procedure for system and personal safety,
- startup, standby, shutdown, and bakeout procedures

Information on the task-oriented operation of the system as well as the user interface is given in separate documents.

You can read the manual from beginning to end. This is highly recommended but rarely done. Be sure to read the safety remarks.

2 ELPHY *Plus* and ELPHY *Quantum* Hardware Guide

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The following guide describes the basic components of the ELPHY *Plus* and the ELPHY *Quantum* attachment systems.

2.1 Overview

A system consists of the following:

- A high end PC computer system with software;
- PCI pattern generator card or one electronics 19" rack;
- Interface cables.

Options include:

- Beam blanker electronic control unit;
- Beam blanker hardware for the SEM column;
- Universal sample holder;
- Picoammeter;
- Motorized stage controller.

2.1.1 PC System

A high end PC system is supplied with the system. The ELPHY *Plus* will have a PCI SCSI card installed for communication with the pattern generator. The ELPHY *Quantum* will have PCI pattern generator installed. The PC may have a GPIB (IEEE-488) interface card for communication with a Keithley Picoammeter. An additional network card is installed for communication with certain SEM models. An onboard network interface can be used for connection to an in-house LAN.

2.1.2 ELPHY *Quantum*

The ELPHY *Quantum* is a full length PCI multi layer card. The card requires one PCI slot and two access slots at the rear of the PC.

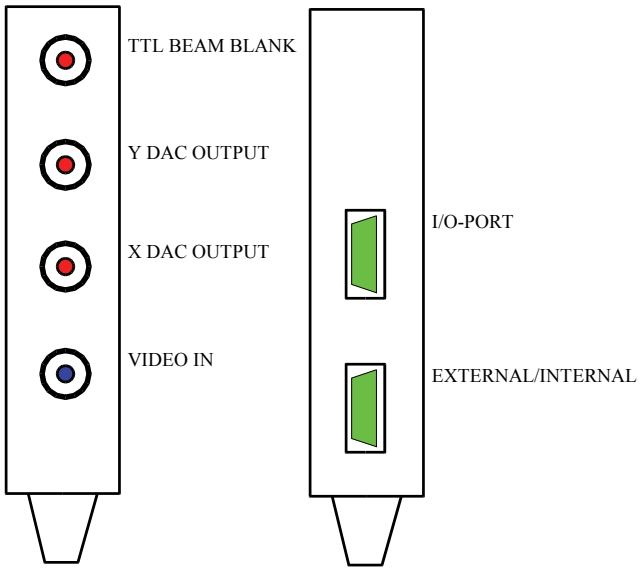
The PCI card provides the following interface:

- X DAC scan output;
- Y DAC scan output;
- TTL level beam blank control signal output;
- Video input from the SEM;
- TTL level SEM external control switching signal;
- IO port for Raith use.

The input and output levels are factory set to match the users SEM.

Figure 1

ELPHY *Quantum* board connections at the rear of the PC.



2.1.3 ELPHY *Plus*

The ELPHY *Plus* is a 19in. advance rack-based system to reduce electronic noise. Apart from the interface signals the ELPHY *Quantum* provides, the ELPHY *Plus* also has:

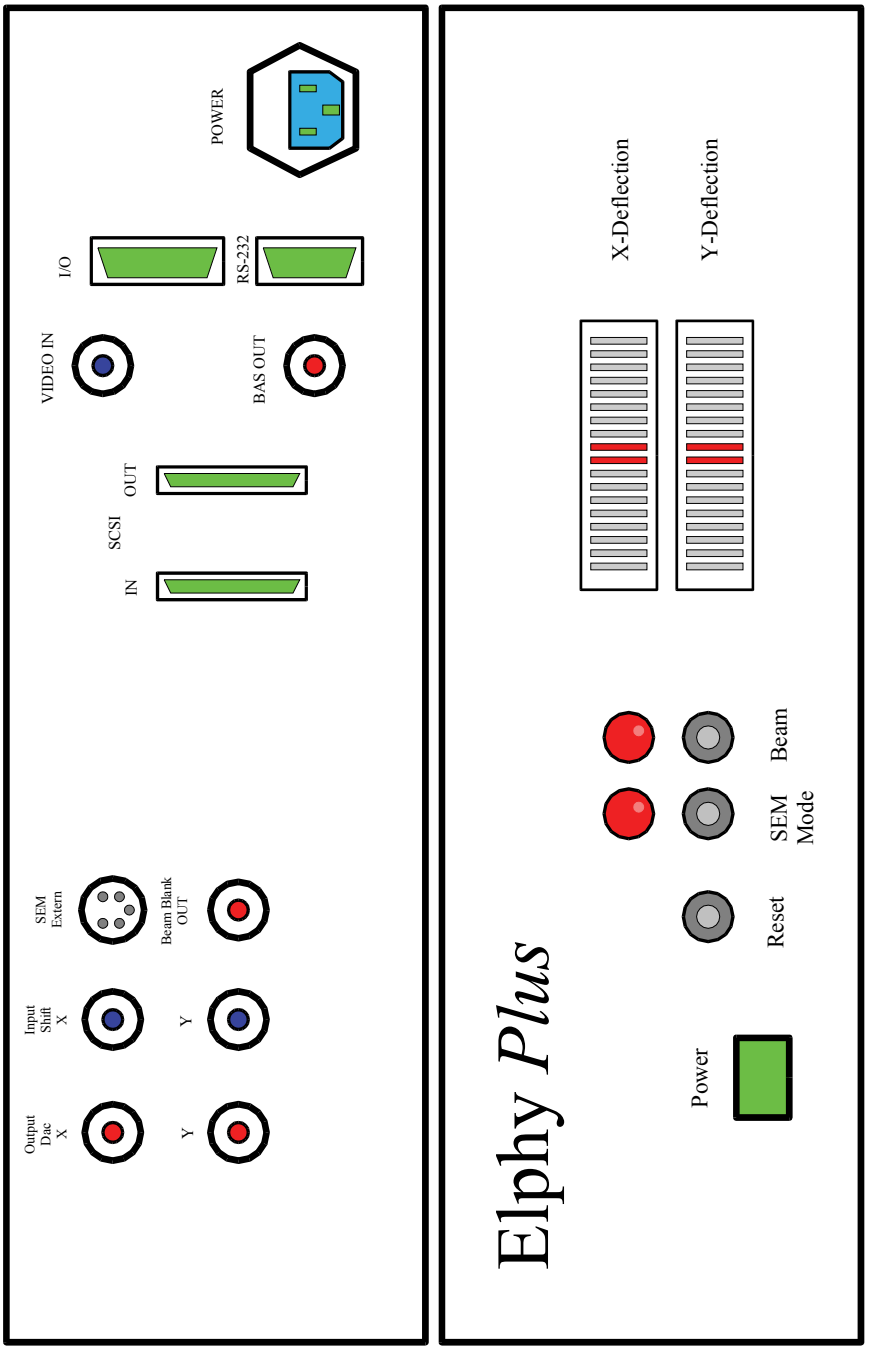
- A SCSI interface to the PC;
- X Y beam shift inputs;
- Video out to a monitor (BAS out);

There are also additional manual controls and visual indicators:

- A switch for inverting the SEM external control signal;
- A switch for inverting the beam blank control signal;
- A toggle switch to reset the hardware;
- Two LED bar displays to indicate the beam position;
- LED to indicate beam blank signal;
- LED to indicate SEM external control signal;
- Power button and indicator.

Figure 2

Front and rear panels of the ELPHY *Plus*.



2.1.4 Electronic Beam Blanker Control Unit

The beam blanker control unit consists of a high voltage power supply and associated control electronics. It accepts a TTL signal from the ELPHY *Quantum* or ELPHY *Plus* to switch the high voltage on or off. Typical output of the high voltage is 200 volts. The high voltage is applied to the beam blanker hardware plates to deflect the electron beam.



Zeiss FEG SEM systems will be supplied with a 19in. rack system. This unit has 8kV input and output and requires installation by Zeiss.

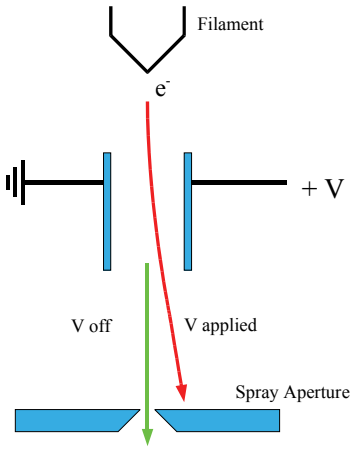
2.1.5 Beam Blanker Hardware

The beam blanker hardware is install on the SEM column by either Raith or the SEM manufacture. Further information should be obtained from the SEM manufacture if installed by them.

Basic hardware consists of two parallel plates, one connected to ground and the other to the high voltage. Some systems have mechanical adjustment for positioning the plates concentric to the electron beam.

Figure 3

Beam blanker schematic.



Electrons entering the beam blanker will be deflected when a voltage +V is applied. A spray aperture further down the column prevents the electrons from reaching the surface of the sample.

When V=0 the electrons are allowed to pass through the spray aperture and therefore to reach the sample surface.

2.1.6 Universal Sample Holder

The universal sample holder is a convenient way to mount small chip size samples. A simple clamping system holds the sample in place. There is room to have several samples and a calibration sample, e.g. Chessy. An inbuilt Faraday cup enables the user to measure the total

beam current at the specimen surface. The holder is provided with a base to match the users SEM stub mount.

Figure 4

Universal Sample Holder.

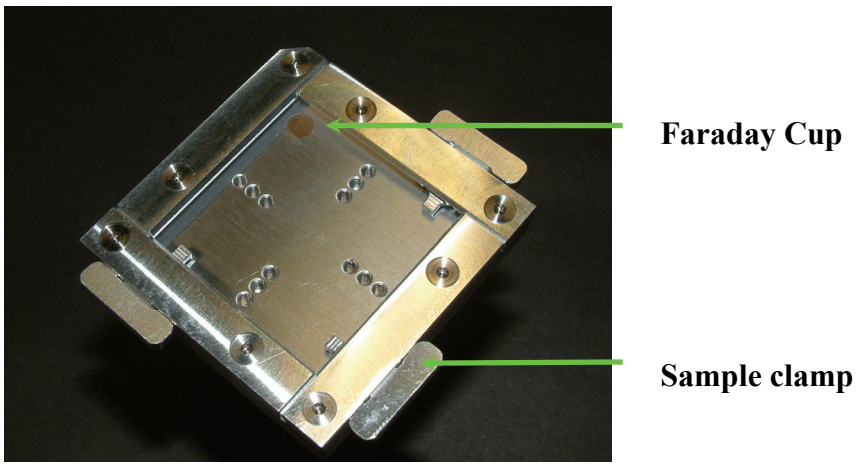
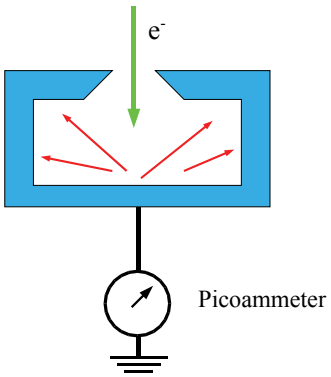


Figure 5

Principle of the Faraday Cup.



Electrons entering the Faraday cup strike the internal surface. Some are absorbed; some will cause secondary emission. The secondary emission electrons will be absorbed when they do not have sufficient energy to cause further secondary emission events.

The cup is sufficiently deep to prevent lose of electrons from the small aperture.

A Picoammeter measures the absorbed current.

2.1.7 Picoammeter

Either a portable battery powered meter, or a high end Keithley meter can be supplied. A BNC cable is provided to connect to the SEM absorbed current output on the stage. If a Keithley has been supplied, then a GPIB interface board may also be present in the PC. The GPIB board is an option.

2.1.8 Motorized Stage Control

Most modern SEM's will have a motorized stage. Control can be via RS-232, TCP/IP, or sometimes GPIB. Some SEM stages can be retro fitted with motors and a suitable control unit, e.g. from Deben.

2.2 Connection Overview

The following section illustrates the basic connections needed for an attachment system.

The basic connection requirement are: X Y DAC output of the pattern generator to the SEM external scan interface; and the video input from a detector on the SEM, usually the SEI signal. Optional connections include:

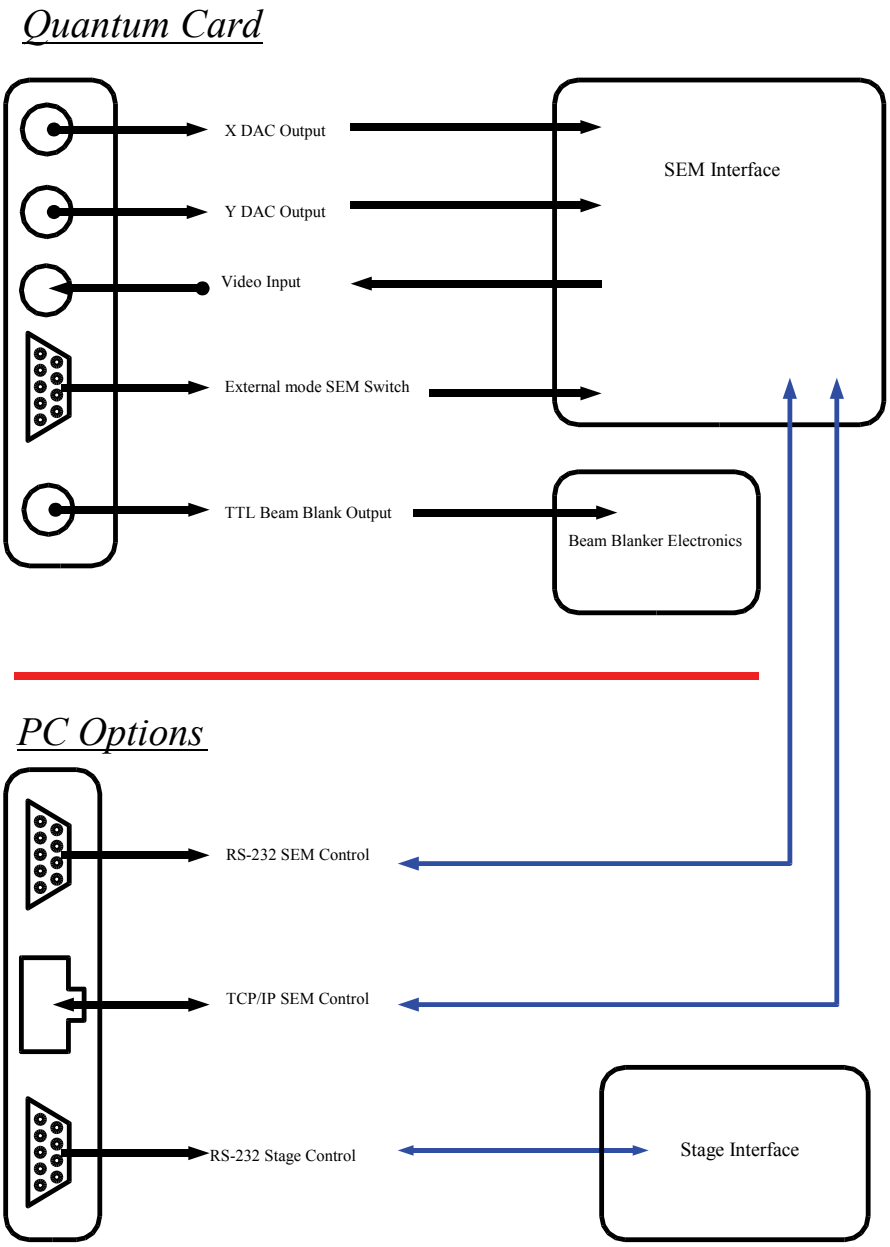
- Control to switch the SEM to external scan mode;
- TTL signal to the beam blanker electronics;
- RS-232 for SEM computer control;
- TCP/IP for SEM computer control;
- RS-232 for Stage control.



The ELPHY *Plus* must have a SCSI terminator installed if no other devices are connected to the SCSI chain.

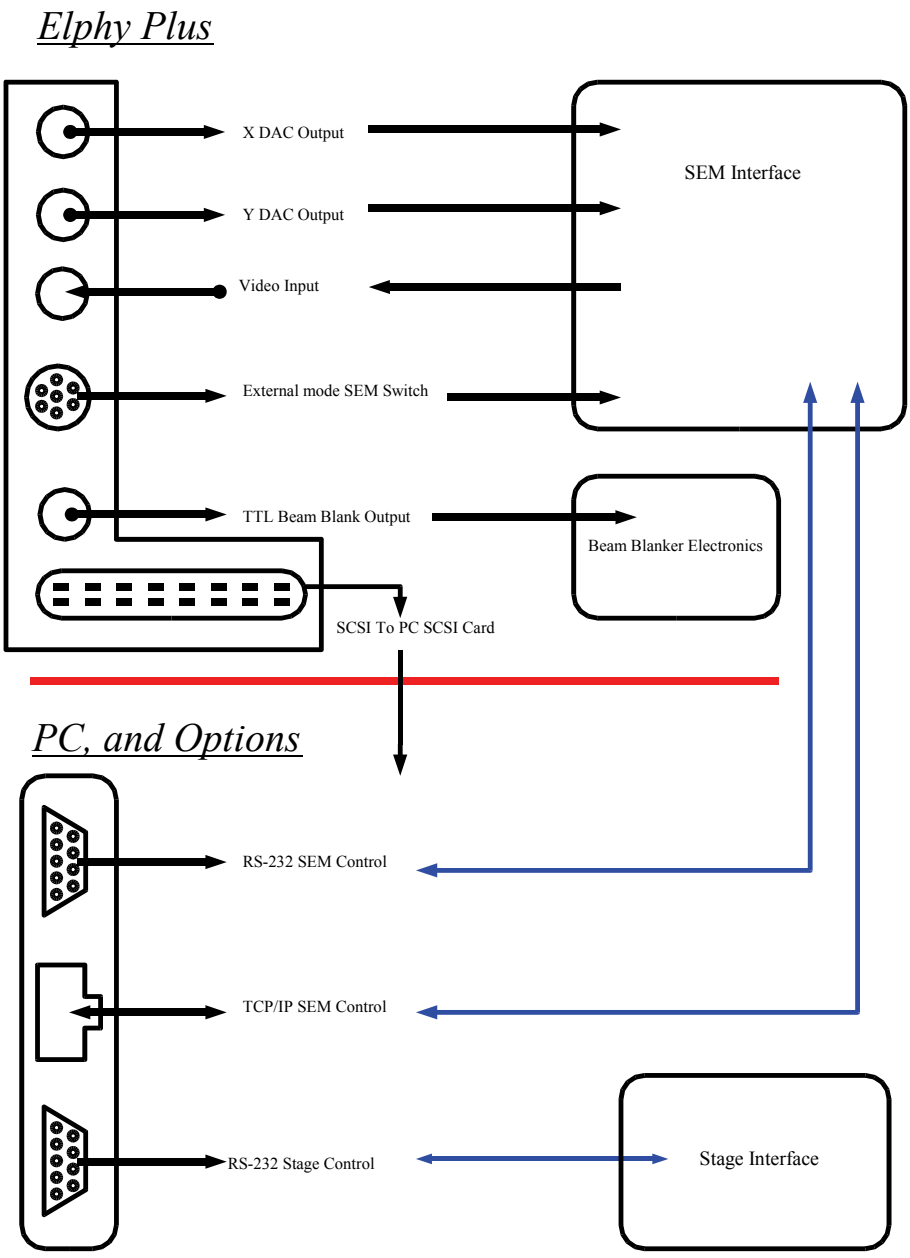
2.2.1 ELPHY *Quantum*

Figure 6
Typical ELPHY *Quantum* connection diagram.



2.2.2 ELPHY *Plus*

Figure 7
Typical ELPHY *Plus* connection diagram.



2.3 General Installation Considerations

2.3.1 Power Supply

All systems are supplied with a power distribution board. The PC, monitor, ELPHY *Plus*, Beam Blanker Electronics, Stage controller, Picoammeter, when supplied should all be plugged into the distribution board. The power for the board should be taken from the

same line supply as the SEM to ensure the same earth ground. If necessary, a second ground wire to the SEM ground point may be installed.

Taking power from a separate supply may result in earth ground loops. If possible, take the supply from the SEM utility power output.



Check the line power supply voltage matches before connecting to the SEM utility output and switching on.

2.3.2 Cables

The cables should be tidy and routed away from any mains or heavy current carrying cables.

2.3.3 Electronic equipment

Electronic equipment can sometimes interfere with the SEM column. Therefore, if a Keithley Picoammeter for example has been supplied, position the meter away from the SEM column.

2.3.4 Systems with EDX Option

Some SEM installations will have an EDX option installed. In such a case there may be a switch box, which will switch between the X Y output of the ELPHY *Quantum* or ELPHY *Plus* and the X Y output of EDX system. The video signal may also be switched.

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