



electron microscope
stage automation

SPRITE

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SPRITE

electron microscope stage

Deben Research are a leading manufacturer of accessories for electron microscopes. Since 1987 we have supplied motorisation systems for SEM and TEM stages from all electron microscope manufacturers. Deben Research stage motorisation is recommended by electron microscope and EDX companies around the world.

SPRITE stage motorisation systems, available for all makes and models of electron microscope, comprise joystick controller, microprocessor controlled electronics and two or more SPRITE motor drive units.

The key to SPRITE system performance is our micro-stepping drive unit, specially designed for driving electron microscope stages. Resolution is 50,000 steps per revolution, giving smooth movement at stage speeds from 10nm per second to 2.5mm per second. You can use the SPRITE motor drive at magnifications from x10 to x100,000 and beyond.

Most SPRITE drive units have handwheels so the user can move the stage manually if needed. Optical encoders ensure that you never lose position and integral limit switches mean that installation is quick, simple and virtually foolproof.

SPRITE motorisation not only gives you easy movement of all stage axes, but also the ability to store and recall coordinates, set up scan patterns, sequence moves and montages. An RS-232 interface enables stage movement to be controlled from any computer, allowing your stage to be driven by all leading EDX systems.

- large handwheel
- stepping motor
- optical encoder
- electronic limits
- microscope drive shaft



• Drive Unit



• Typical 2 Axis Drive package



- speed range indication
- bright coordinate display angled for ease of viewing
- rotate, Z, tilt controls
- axis display & speed selection keys
- stage move function keys
- stage stop, setup keys
- joystick for XY stage movement

• Joystick Controller

The stylish new SPRITE stagecontroller offers simple, fast and accurate control of up to five axes on all SEM stages and two axes on TEM stages. Analogue joystick for XY stage movement, a bright vacuum-fluorescent display for coordinate readout, and function buttons for mode selection and parameter input are combined in one ergonomic unit. As an option, a trackerball can be fitted for XY control in place of the joystick.

The joystick is fully proportional, giving speed variation greater than 50:1. Three speed ranges are selectable, FAST is typically 50 μ m/sec to 2.5mm/sec, MEDIUM; 1 μ m/sec to 100 μ m/sec, and SLOW; 0.1 μ m/sec to 5 μ m/sec. (Actual speeds vary slightly with microscope model.) Dedicated buttons provide for movement of Z, rotate (R) and tilt (T), with three fixed speeds available.

The bright vacuum-fluorescent display, angled for ease of viewing, is visible at all levels of room lighting. The display indicates current stage position, typically X, Y and Z. For four or five axis systems, pressing the DISP key will display rotate and or tilt positions.

An important feature of the new SPRITE stagecontroller is the comprehensive range of built-in routines aimed at making the work of electron microscopists more efficient and productive. Dedicated keys are provided for all commonly used functions, such as STORE, RECALL, SEQUENCE, SCAN, BACKLASH and EXCHANGE. In addition, move parameters (coordinates, speed, etc) can be entered directly from the keypad.

STORE allows the user to store the coordinates of up to 100 points in memory; RECALL will drive the stage to any of these stored positions within a few seconds. A sequence of moves between stored points can be programmed. The SCAN function will set up a variety of automatic move patterns so you can survey large areas of your sample systematically and quickly. A stage offset can be programmed so the displayed coordinates are relative to a point on the sample. Software limits can be set to restrict the stage movement in any axis. A backlash correction move, essential for accurate re-positioning, requires just one key stroke. An exchange button will drive the stage to a pre-programmed specimen exchange or home position.

STORE the coordinates of up to 100 points in non-volatile controller memory. The store number automatically increments after each operation, making it easy to save a sequence of positions.

```
Store 15  
25.000 25.000
```

RECALL will drive the stage to any of the stored locations. For multi-axis systems, the user can set whether the additional axes (Z, R, T) also move. Auto-incrementing makes it simple to recall a series of points.

```
Recall 5  
20.042 11.233
```

SEQUENCE automatically drives the stage through a series of stored points. Simply select the start point, end point, delay between each point (or wait until a key is pressed) and number of cycles.

```
SEQUENCE : Start  
66_
```

SCAN sets up a wide range of scan patterns to facilitate the rapid survey of samples. Select one of four available patterns, enter magnification and the stage will then automatically scan the specimen.

```
SCAN PATTERN SETUP  
Snake<1> Raster<2>_
```

BACKLASH in the stage must be corrected to ensure best repositioning accuracy. A backlash move distance of 0.5mm gives an accuracy of 1 μ m to 2 μ m on most SEM stages.

```
XY backlash : 0.500  
New value ? 1.000_
```

OFFSET allows the user to define a new origin with respect to a reference point on the sample. You can then swap between stage coordinates and sample coordinates.

```
Offset XY  
5.000 12.000_
```

GOTO drives the stage to absolute coordinates entered from the keypad. GO Rel moves the stage a defined distance relative to the current position.

```
GoTo XY  
51.761 25.739_
```

EXCHANGE allows you to drive the stage automatically to a preset home or specimen exchange position. A prompt is displayed before the move starts.

```
Move to sample  
EXCHANGE position ?
```

LIMITS can be set up in software (soft limits) to restrict the movement of the stage, reducing the possibility of damage to parts of the SEM, valuable samples or detectors.

```
Z Limit Min 5.0  
New value ? 12.0_
```

CAL provides routines for configuring stage axes, speed, scale factor, direction, exchange position and RS-232 protocol. All parameters are stored in non-volatile memory.

```
← STAGE CONFIGURE →  
Exchange<7> RS232<8>
```

applications

Motorising your SEM or TEM stage brings benefits in all electron microscopy applications, saving time, increasing productivity and reducing operator fatigue. Any electron microscope can be upgraded with SPRITE stage motorisation. Move the stage in any direction (X, Y, Z, tilt or rotate) with our new compact joystick controller and when you find a feature of interest, simply press the STORE button and select a location number. Finding the same feature again is just as easy - simply press RECALL, select the location and go.

Surveying large samples in a systematic manner is now child's play with the new SCAN functions. For example you can define the corners of the field you wish to survey, or a point in the centre. Either a snake scan (direction reversing at the end of each scan line) or raster scan can be selected. The scan can be continuous at a pre-set speed linked to the magnification, or move from field to field with a delay or pause between fields. The distance from one scan line to the next, and the scan speed, are linked to the magnification, ensuring that no areas of the sample are missed. At any time during a scan, the stage can be paused for a manual survey using the joystick, points of interest stored, and the scan resumed.

Computer control of the microscope stage is easy using the built-in RS-232 interface. Simple commands allow the user to incorporate stage control into any application program. Data transfer speed is normally 9600 baud, but different rates can be selected. Deben Research can supply Windows software for controlling the stage, also the source code for those programmers developing their own software.

Microelectronics characterisation and failure analysis uses electron microscopy extensively. Wafer inspection and defect location, voltage contrast, electron beam-induced conductivity and electron beam lithography all require the examination or analysis of many sites on the sample. Stage motorisation helps to improve efficiency in these and many other applications.

X-ray analysis (EDX or WDX) can be fully automated using the SPRITE motorised stage. We have RS-232 software protocols for virtually all manufacturers' systems, enabling analysis of a wide range of samples to be performed totally unattended. The operator examines the sample as normal to locate points of interest, these are then stored as a point file in the EDX (or WDX) system, to be recalled as part of the analysis program. Often the EDX system allows more complex stage manipulation as part of the system software, for example, defining regions of interest, scan patterns, etc.

Image analysis and archiving can also be automated using the SPRITE stage control system. While the montage capability allows some automation in image recording, many image analysis programs have facilities for stage control, and can be set to first store the images from a number of areas of the sample, then to perform a wide range of counting, sizing and measurement functions automatically.

S P E C I F I C A T I O N

The specification given is for a typical SPRITE SEM installation. Note that details of step size, speed, re-positioning accuracy and limits vary somewhat from one microscope model to another. Indeed for some instruments we can offer additional facilities, such as linking stage speed to magnification, and controlling the photo camera. Deben Research can supply more information for specific SEMs and TEMs on request.

- two, three, four and five axis drives
- compact high resolution stepping motors
- 50,000 micro-steps per revolution
- step size typically 10nm (1nm for TEM)
- drive speeds from 20nm/sec to 2.5mm/sec
- 2000 count per revolution optical encoders
- position resolution 0.25 μ m
- integral electronic limits
- handwheels for manual operation
- repeatability typically 1 μ m - 2 μ m
- ergonomic joystick controller (trackerball optional)
- bright vacuum-fluorescent display
- store and recall 100 sets of coordinates
- alpha-numeric labels for coordinates
- program sequences and scan patterns
- automatic montage capability with adjustable overlap
- programmable backlash correction
- stage origin offset function
- integral RS-232 interface for EDX/computer control
- set-up routines for speed, RS232, montage, etc.
- dimensions - motor drive unit: 90mm long x 56mm \varnothing
- dimensions - electronics: 320 x 240 x 97mm (two axes)
- dimensions - controller: 132 x 132 x 30mm
- power consumption (two axis) - 90VA
- supply voltage - 100-120V or 220-240V 50-60Hz

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