

# SEM5000A Series Electronic Calibration(ESal) Modules

Datasheet

DS60050\_E01A



01189 786911 TELONIC.CO.UK



SIGLENT TECHNOLOGIES CO.,LTD

## SEM5000A: 5002A、5012A、5022A、5032A、 5004A、5014A、5024A、5034A

### 1. General Description

SEM5000A series electronic calibrators include 5002A / 5012A / 5022A / 5032A / 5004A / 5014A / 5024A / 5034A, covering the frequency bands of 9kHz to 4.5GHz / 9kHz to 9GHz / 100kHz to 13.5GHz / 100kHz to 26.5GHz, with USB interface for communication and power supply, and the RF connectors come in three forms: SMA, 3.5mm, and Type-N. They are suitable for calibration and error correction of SHA800A series, SVA1000X series, SNA5000X series, SNA5000A series, and SNA6000A series vector network analyzers of Siglent Technology Co., Ltd.



Figure 1-1

As shown in Figure 1-1 above, the SEM5000A series of ECal module are simple, fast, efficient, accurate, and widely applicable, as follows:

**Simple and quick:** Connect the USB cable and calibrate when the indicator light shows green. The system automatically recognises it, making it easy and convenient to operate.

**Efficient and accurate:** Traditional mechanical calibration methods require the operator to connect and disconnect the instrument to be measured several times using calibration devices. This not only increases the calibration time, but also the frequency of operation and the probability of human error. When calibrating with electronic calibrators, the operator only needs to make one connection - at the very beginning, the port of the electronic calibrator is connected to the test port - which significantly reduces the number of connections made during the calibration process, making the process much simpler and more efficient. As the number of connections decreases, the probability of operator error is reduced, as is the probability of connector wear and tear, which in turn reduces the cost of port connector maintenance.

**Wide applicability:** Siglent offers a wide range of electronic calibrator models - you can choose from different series in terms of maximum operating frequency, number of ports, connector type, etc. (Details can be found in the ordering information)

### 2. Features

- Frequency range: 9kHz- 26.5 GHz
- Maximum input power level: +20 dBm
- Maximum protection DC voltage:  $\pm 35$  V
- RF connector types: SMA female, SMA male, 3.5mm female, 3.5mm male, Type-N 50 $\Omega$  female, Type-N 50 $\Omega$  male
- Number of supported ports: 2,4
- Power supply control: USB 2.0

### 3. Description of models

It mainly describes the number of ports, the types of connectors, the operating band and the option number corresponding to connectors for the different models in the SEM5000A series. [Table 3-1](#) mainly describes the standard types, the mixed types are described in [Table 3-2](#).

Table 3-1

| Series   | Specific model | Number of ports | Connector Type    | Operating Frequency | Connector Options |
|----------|----------------|-----------------|-------------------|---------------------|-------------------|
| SEM5000A | SEM5002A       | 2               | Type-N 50Ω female | 9 kHz-4.5 GHz       | 020               |
|          |                |                 | SMA female        | 9 kHz-4.5 GHz       | 030               |
|          | SEM5012A       |                 | Type-N 50Ω female | 9 kHz-9 GHz         | 020               |
|          |                |                 | SMA female        | 9 kHz-9 GHz         | 030               |
|          | SEM5022A       |                 | 3.5mm female      | 100 kHz-13.5 GHz    | 010               |
|          | SEM5032A       |                 | 3.5mm female      | 100 kHz-26.5 GHz    | 010               |
|          | SEM5004A       | 4               | Type-N 50Ω female | 9 kHz-4.5 GHz       | 020               |
|          |                |                 | SMA female        | 9 kHz-4.5 GHz       | 030               |
|          | SEM5014A       |                 | Type-N 50Ω female | 9 kHz-9 GHz         | 020               |
|          |                |                 | SMA female        | 9 kHz-9 GHz         | 030               |
|          | SEM5024A       |                 | 3.5mm female      | 100 kHz-13.5 GHz    | 010               |
|          | SEM5034A       |                 | 3.5mm female      | 100 kHz-26.5 GHz    | 010               |

Table 3-2

| Connector Type     | Port A Option | Port B Option | Port C Option | Port D Option |
|--------------------|---------------|---------------|---------------|---------------|
| All 3.5mm -f-      | 010           |               |               |               |
| All Type-N 50Ω -f- | 020           |               |               |               |
| All SMA -f-        | 030           |               |               |               |
| 3.5mm -f-          | 101           | 201           | 301           | 401           |
| 3.5mm -m-          | 102           | 202           | 302           | 402           |
| Type-N 50Ω -f-     | 103           | 203           | 303           | 403           |
| Type-N 50Ω -m-     | 104           | 204           | 304           | 404           |
| SMA -f-            | 105           | 205           | 305           | 405           |
| SMA -m-            | 106           | 206           | 306           | 406           |

## 4. Front panel

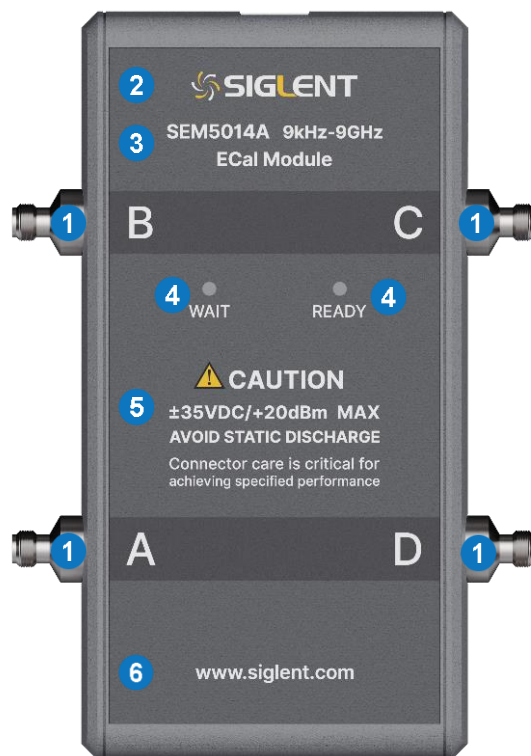


Figure 4–1

The information on the front panel of ECal module is laid out as shown in Figure 4–1 above:

- ① RF connectors as shown in Table 3-1 and Table 3-2 above.
- ② Logo.
- ③ Series of models and operating frequency bandwidths.
- ④ Indicator lights, respectively WAIT indicator (red), READY indicator (green).
- ⑤ Cautions.
- ⑥ Officials website.

## 5. Rear panel

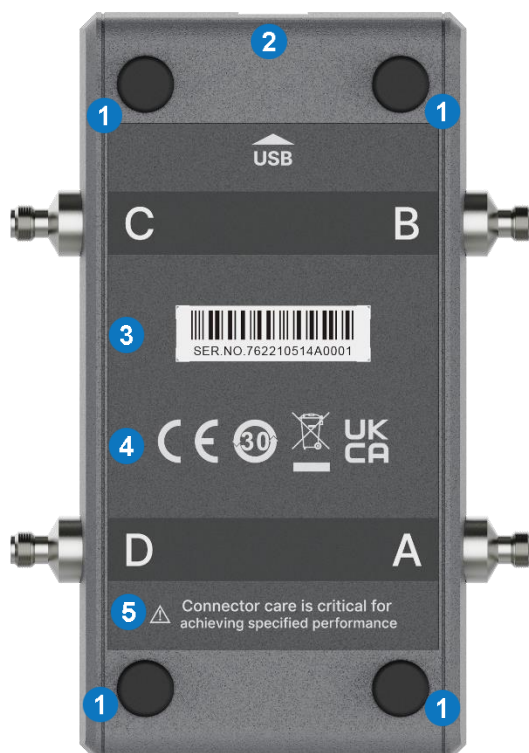


Figure 5–1

The information on the rear panel of the ECal module is laid out as shown in Figure 5–1 above:

- ① Pad
- ② USB port
- ③ Barcode
- ④ Safety terminology and labelling
- ⑤ Cautions

## 6. Definition of conditions

**Technical specification:** Indicates guaranteed product performance for ambient temperature range, unless otherwise stated.

**Typical value:** Indicates typical performance at room temperature (approx. 25°C) for 80% of the test results with a 95% confidence level. The data is not guaranteed and does not include measurement uncertainty.

**Nominal value:** Indicates the expected average performance or the performance characteristics of the design, e.g. 50  $\Omega$  connector. The data is not guaranteed and is obtained from measurements at room temperature (approx. 25°C) and does not include measurement uncertainty.

## 7. Operating temperature

The temperature of the electronic calibrator must be within the following temperature range in order to meet the operating specifications.

SEM5000A series: +15°C to +35°C and relative humidity must not exceed 75%.

## 8. Characteristic performance

The characteristic properties of ECal modules in Table 8-1 below, which mainly describes the residual errors in the different operating bands of the electronic calibrators.<sup>1</sup>

Table 8-1

| SEM5000A                                       | 9kHz to 2.5GHz | 2.5 to 4GHz | 4 to 6GHz | 6 to 9GHz |
|------------------------------------------------|----------------|-------------|-----------|-----------|
| Directivity (dB)                               | 44             | 40          | 38        | 35        |
| Source match (dB)                              | 40             | 34          | 32        | 30        |
| Reflection tracking ( $\pm$ dB)                | 0.14           | 0.25        | 0.3       | 0.4       |
| Transmission tracking ( $\pm$ dB) <sup>2</sup> | 0.12           | 0.17        | 0.20      | 0.23      |
| Load match (dB) <sup>2</sup>                   | 33             | 32          | 33        | 30        |

1. When the input power is greater than 10dBm, the calibration will be worse compared to the data shown in Table 8-1 above.

2. The model number of the vector network analyser used for this measurement data is SNA5014A.

## 9. Connecting and disconnecting ECal module

The ECal module is connected to the vector network analyser via a USB cable (supplied as an accessory) and the vector network analyser then provides control and power via the USB cable. When connecting the electronic calibrator to the vector network analyser, the vector network analyser will automatically recognise the calibrator type, frequency range and connector type.

The specific connections are shown in Figure 9–1 below.

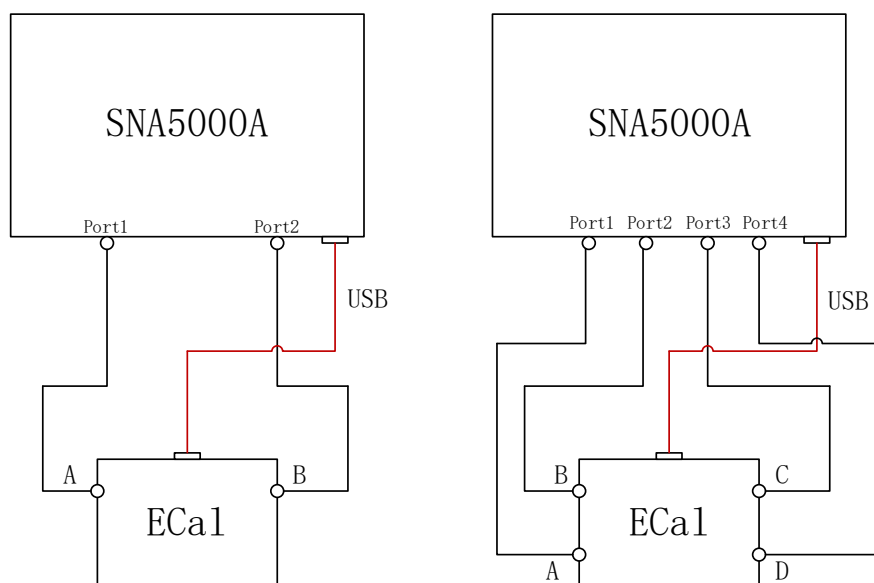


Figure 9–1

When the connection is completed if the WAIT indicator (red) lights on, it means that the ECal module has not reached the normal operating temperature and needs to wait until the ECal reaches the normal operating temperature before it can be used; if the READY indicator (green) lights on, it means that the ECal module has reached the normal operating temperature and can be used normally.

Disconnect: Simply disconnect the USB cable to stop the ECal module from working. Then simply disconnect the RF connector at ports A, B, C and D.

## 10. Compatible List of ECal Modules

Table 10-1

| VNA models            | ECal models             |             | Interface |
|-----------------------|-------------------------|-------------|-----------|
|                       | 5002A/5012A/5022A/5032A | 5004A/5014A |           |
| SNA5000A <sup>1</sup> | YES                     | YES         | USB       |
| SVA1000X <sup>2</sup> | YES                     | YES         | USB       |
| SHA850A <sup>3</sup>  | YES                     | YES         | USB       |

1. Currently, only versions after V1.0.0.2.6 are supported.

2. Currently, only versions after V3.2.2.6.0 are supported.

3. Currently, only versions later than V1.1.2.1.3 are supported.

## 11. General technical specifications

Table 11-1

| Description                | Characteristics                |
|----------------------------|--------------------------------|
| <b>Working environment</b> |                                |
| Temperature                | +15℃ to 35℃                    |
| Humidity                   | 75 %: 40℃ , 24 hours           |
| Altitude                   | 0 to 3000 m                    |
| <b>Storage environment</b> |                                |
| Temperature                | -20℃ to 60℃                    |
| Humidity                   | 85 %: 65℃ , 24 hours           |
| Altitude                   | 0 to 15000 m                   |
| dimension                  | W×H×D=135.4 mm×97.5 mm×31.0 mm |
| Weight                     | 259g <sup>1</sup>              |

1. This weight information is based on test data from an electronic calibrator with 4-port female SMA connectors.

## 12. Ordering Information

Table 12-1

| Items                       | Description                                                                     | Order number |
|-----------------------------|---------------------------------------------------------------------------------|--------------|
| <b>Products</b>             | 2 ports, 4.5G ECal module, SMA -f-                                              | SEM5002A     |
|                             | 2 ports, 9G ECal module, SMA -f-                                                | SEM5012A     |
|                             | 2 ports, 13.5G ECal module, 3.5 mm -f-                                          | SEM5022A     |
|                             | 2 ports, 26.5G ECal module, 3.5 mm -f-                                          | SEM5032A     |
|                             | 4 ports, 4.5G ECal module, SMA -f-                                              | SEM5004A     |
|                             | 4 ports, 9G ECal module, SMA -f-                                                | SEM5014A     |
|                             | 4 ports, 13.5G ECal module, 3.5 mm -f-                                          | SEM5024A     |
|                             | 4 ports, 26.5G ECal module, 3.5 mm -f-                                          | SEM5034A     |
| <b>Standard Accessories</b> | 1 x Quick-start, 1 x USB 2.0-cable                                              |              |
|                             | Torque wrench: 8.1 mm, for SMA, 3.5 mm -m-, Torque standard: $0.9 \pm 0.04$ N.M |              |
| <b>Optional Accessories</b> | Torque wrench: 19.1 mm, for type-N, Torque standard: $1.36 \pm 0.05$ N.M        |              |
|                             | Torque wrench: 20.1 mm, for type-N, Torque standard: $1.36 \pm 0.05$ N.M        |              |
|                             | RF connector: SMA -m-                                                           |              |
|                             | RF connector: 3.5 mm -m-                                                        |              |
|                             | RF connector: Type-N 50 $\Omega$ -f-                                            |              |
|                             | RF connector: Type-N 50 $\Omega$ -m-                                            |              |

For specific RF connector selection, please refer to [Table 3-1](#) and [Table 3-2](#) above.



## About SIGLENT

SIGLENT is an international high-tech company, concentrating on R&D, sales, production and services of electronic test & measurement instruments.

SIGLENT first began developing digital oscilloscopes independently in 2002. After more than a decade of continuous development, SIGLENT has extended its product line to include digital oscilloscopes, isolated handheld oscilloscopes, function/arbitrary waveform generators, RF/MW signal generators, spectrum analyzers, vector network analyzers, digital multimeters, DC power supplies, electronic loads and other general purpose test instrumentation. Since its first oscilloscope was launched in 2005, SIGLENT has become the fastest growing manufacturer of digital oscilloscopes. We firmly believe that today SIGLENT is the best value in electronic test & measurement.

### Headquarters:

SIGLENT Technologies Co., Ltd  
Add: Bldg No.4 & No.5, Antongda Industrial  
Zone, 3rd Liuxian Road, Bao'an District,  
Shenzhen, 518101, China  
Tel: + 86 755 3688 7876  
Fax: + 86 755 3359 1582  
Email: [sales@siglent.com](mailto:sales@siglent.com)  
Website: [int.siglent.com](http://int.siglent.com)

### North America:

SIGLENT Technologies America, Inc  
6557 Cochran Rd Solon, Ohio 44139  
Tel: 440-398-5800  
Toll Free: 877-515-5551  
Fax: 440-399-1211  
Email: [info@siglentna.com](mailto:info@siglentna.com)  
Website: [www.siglentna.com](http://www.siglentna.com)

### Europe:

SIGLENT Technologies Germany GmbH  
Add: Staetzlinger Str. 70  
86165 Augsburg, Germany  
Tel: +49(0)-821-666 0 111 0  
Fax: +49(0)-821-666 0 111 22  
Email: [info-eu@siglent.com](mailto:info-eu@siglent.com)

Follow us on  
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