

## Arbitrary/Function Waveform Generators 4075B Series



### Point-by-Point Signal Integrity

The 4075B Series Arbitrary/Function Waveform Generators are versatile high-performance single- and dual-channel arbitrary waveform generators with large arbitrary memory depth. The instruments provide variable output voltages from 0 to 10 Vp-p into 50 ohms or up to 20 Vp-p into open circuit and a continuously variable DC offset that allows the output to be injected directly into circuits at the correct bias level.

These generators combine the benefits of DDS (direct digital synthesis) and true AWG (arbitrary waveform generator) architectures without the limitations of either. Standard waveforms such as sine, square, and triangle are generated with a DDS chip, delivering great frequency resolution at a low cost. Custom arbitrary waveform generation is implemented with a true point-by-point design, offering improved signal integrity by producing significantly less jitter and distortion compared to a DDS-only architecture. This point-by-point

generation capability allows these instruments to be used for simulating reliable clock signals, generating triggers, or validating serial data buses.

Additionally, these generators can be used with B&K Precision's waveform editing software WaveXpress to create complex arbitrary waveforms.

Extensive features such as internal or external AM, FM, and FSK modulation along with versatile sweep capabilities and variable edge pulse generation make these generators suitable for a wide range of applications.

### Applications

These generators are suitable for applications such as electronic design, sensor simulation, functional test, or generation of I/Q modulated signals.

### Features

- 14-bit, 200 MSa/s, 16 Mpts arbitrary waveform generator
- Generate sine waveforms up to 80 MHz
- Bright color LCD display
- Linear and logarithmic sweep
- AM/FM/FSK modulation
- Variable DC offset
- Adjustable duty cycle
- Output ON/OFF button
- Internal/external triggering
- Gate and burst mode
- Fully programmable markers
- Store/recall up to 49 instrument settings
- Standard USBTMC interface (all models) and GPIB interface (50 MHz & 80 MHz models only) supporting SCPI commands
- Closed case calibration
- Short circuit protection for resistive and capacitive loads on outputs and overvoltage protection on inputs

### Dual-channel models

- Both channels offer full functionality and all parameters can be set independently
- Synchronize the phase of both channels with the push of a button

| Model                     | 4075B               | 4078B | 4076B               | 4079B | 4077B               | 4080B |
|---------------------------|---------------------|-------|---------------------|-------|---------------------|-------|
| Channels                  | 1                   | 2     | 1                   | 2     | 1                   | 2     |
| Sine frequency range      | 1 $\mu$ Hz – 30 MHz |       | 1 $\mu$ Hz – 50 MHz |       | 1 $\mu$ Hz – 80 MHz |       |
| Square frequency range    | 1 $\mu$ Hz – 30 MHz |       | 1 $\mu$ Hz – 50 MHz |       | 1 $\mu$ Hz – 60 MHz |       |
| Arbitrary waveform length | 1 Mpts              |       | 4 Mpts              |       | 16 Mpts             |       |

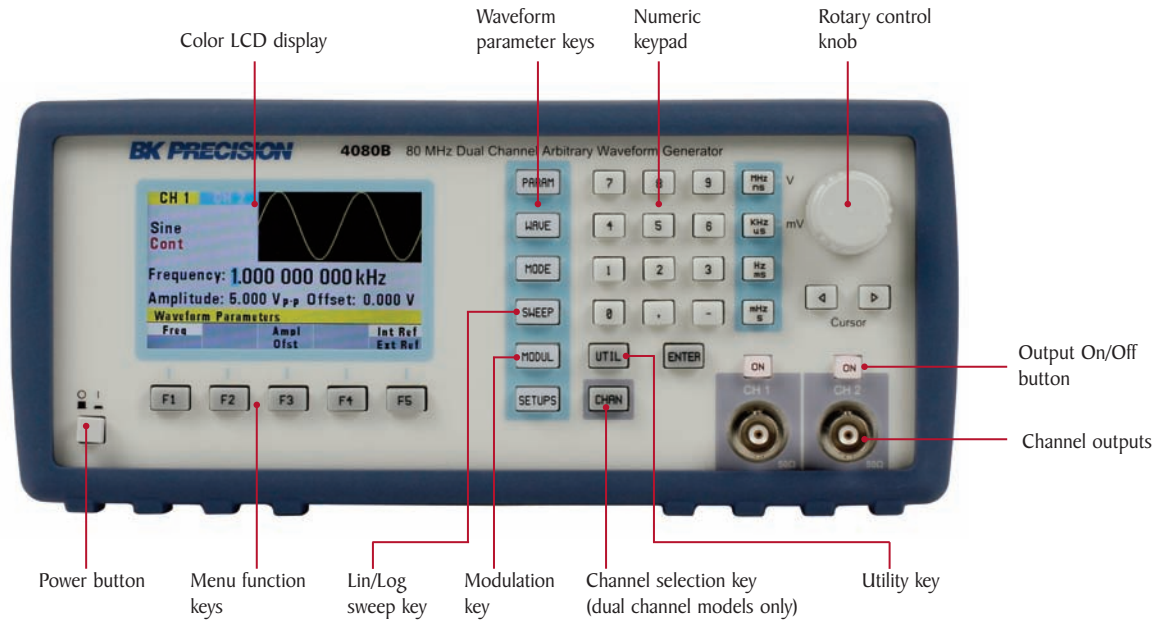


For more information, visit [www.bkprecision.com/WaveXpress](http://www.bkprecision.com/WaveXpress)

## Front panel

### Extensive modulation functions

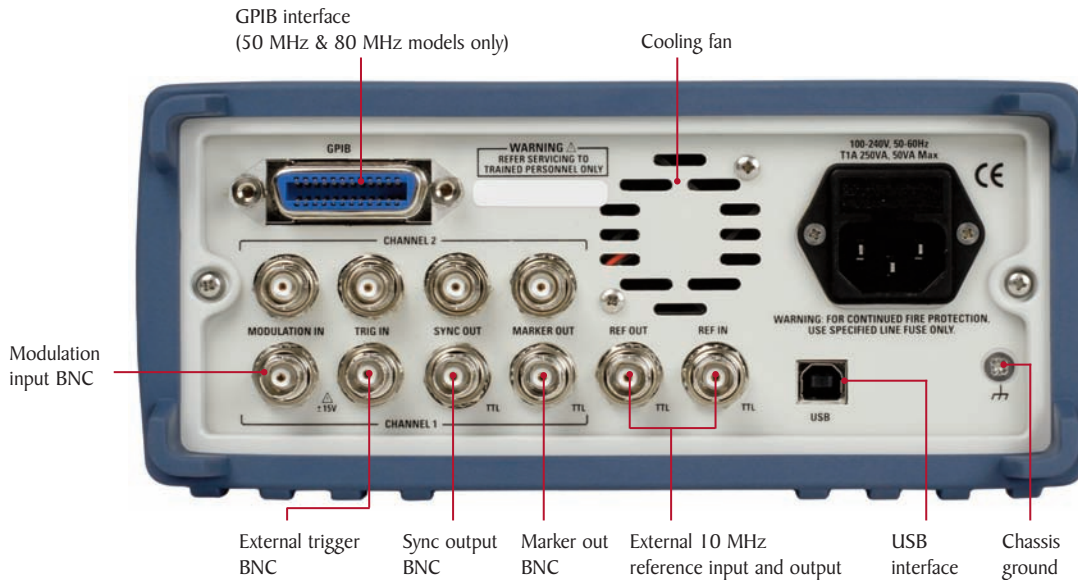
The generators provide AM, FM, and FSK modulation schemes along with combined AM plus FM capabilities. Users can also simulate analog VCOs and VCAs by inputting a voltage to the external modulation input.



### Intuitive user interface

Easily change all waveform parameters using the intuitive menu-driven front panel keypad, control knob, and easy-to-read LCD. Convenient waveform and range selection buttons let users make quick and precise adjustments to the output signal.

## Rear panel



### SCPI-compliant programming

The generators can be programmed remotely via the USB and GPIB interface using SCPI commands.

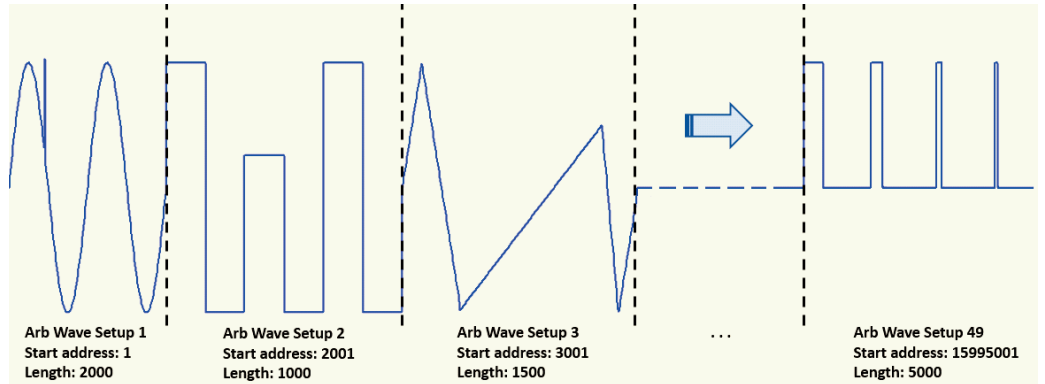
### Multi-unit/channel synchronization and external triggering

Use the built-in 10 MHz external reference input and output, external trigger input, and programmable marker output to synchronize multiple units or channels. The generator can be connected with another generator or to an external 10 MHz clock for precise phase adjustment. The Sync output connector can be used to generate a positive TTL pulse output on each waveform cycle. An external trigger input connector is also available to trigger the instrument via an external TTL signal.

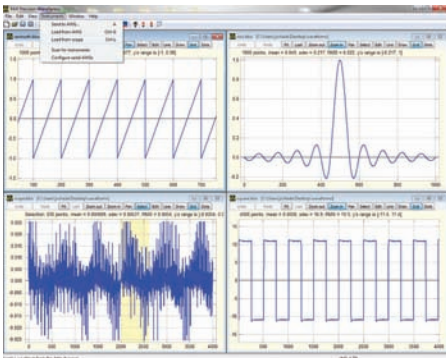
## Versatile arbitrary waveform generation

### Flexible memory management

The 4075B Series gives users more freedom by allowing the flash memory to be allocated via start address and length parameter setups. For instance, a model 4080B user could generate one large 16M-point waveform or up to 49 different waveform setups totaling 16 Mpts in one memory bank. Up to eight non-volatile memory banks are available to store arbitrary waveforms with 14-bit vertical resolution.



### Waveform creation tools



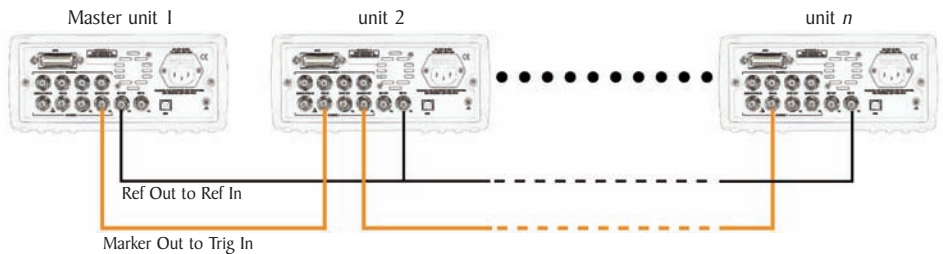
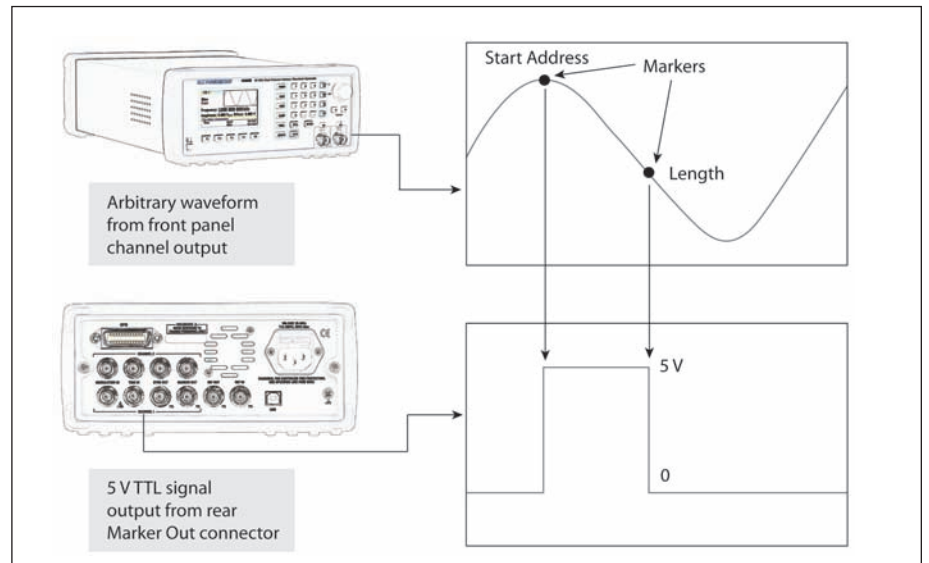
WaveXpress software

From the front panel, waveforms can be defined from scratch by entering data point-by-point or by loading and modifying predefined waveforms. The WaveXpress waveform editing software is also provided for users to easily generate, edit, and upload custom arbitrary waveforms to the generator via the remote interface. Create waveforms in the software by importing a text file or define via freehand, point draw, and waveform math functions.

### Easy noise generation

Conveniently add noise to your waveform directly from the front panel and precisely adjust the scale of the noise amplitude. This feature allows you to choose between generating a noise waveform and adding noise to an existing waveform.

### Programmable markers



### Multi-unit/channel synchronization

The 4075B Series provides fully programmable markers that allow you to generate a positive TTL level output signal at the points specified by address and length up to 4000 points. It could be used for applications requiring triggering at specific points in the arbitrary waveform for precise synchronization between two signals, e.g. simulation of a real world 3-phase AC network where one of the phases is degraded.

## Specifications

| Model  | 4075B  | 4078B                          | 4076B                           | 4079B | 4077B  | 4080B |
|--|--|--------------------------------|---------------------------------|-------|--------|-------|
| Channels   | 1  | 2                              | 1                               | 2     | 1      | 2     |
| Maximum frequency                                  | 30 MHz   |                                | 50 MHz                          |       | 80 MHz |       |
| <b>Waveforms</b>                                   |  |                                |                                 |       |        |       |
| Standard   | Sine, Square, Triangle/Ramp, Pulse   |                                |                                 |       |        |       |
| Built-in arbitrary                                 | Sine, Triangle, Square, Noise, Ramp Up, Ramp Down, Sine(X)/X, Exponential Up, Exponential Down, Gaussian |                                |                                 |       |        |       |
| User-defined arbitrary                             | 1 Mpts x 8 memory banks per ch   | 4 Mpts x 8 memory banks per ch | 16 Mpts x 8 memory banks per ch |       |        |       |
| <b>Operating Modes &amp; Modulation Types</b>      |  |                                |                                 |       |        |       |
| Operating modes                                    | Continuous, Triggered, Burst, Gated  |                                |                                 |       |        |       |
| Modulation types                                   | AM, FM, FSK  |                                |                                 |       |        |       |
| <b>Sine</b>  |  |                                |                                 |       |        |       |
| Frequency range                                    | 1 $\mu$ Hz to 30 MHz   | 1 $\mu$ Hz to 50 MHz           | 1 $\mu$ Hz to 80 MHz            |       |        |       |
| Resolution   | 1 $\mu$ Hz, up to 12 digits  |                                |                                 |       |        |       |
| <b>Amplitude flatness (relative to 1 kHz)</b>      |  |                                |                                 |       |        |       |
| $f_{OUT} \leq 1$ MHz                               | $\pm 0.2$ dB   |                                |                                 |       |        |       |
| $f_{OUT} \leq 50$ MHz                              | $\pm 1.0$ dB   |                                |                                 |       |        |       |
| $f_{OUT} \leq 80$ MHz                              | $\pm 2.0$ dB   |                                |                                 |       |        |       |
| <b>Harmonic distortion (typical)</b>               |  |                                |                                 |       |        |       |
| $f_{OUT} \leq 100$ kHz (10 Hz - 100 kHz)           | -65 dBc  |                                |                                 |       |        |       |
| $f_{OUT} \leq 5$ MHz (100 kHz - 5 MHz)             | -45 dBc  |                                |                                 |       |        |       |
| $f_{OUT} \leq 80$ MHz (5 MHz - 80 MHz)             | -35 dBc  |                                |                                 |       |        |       |
| <b>Spurious</b>                                    |  |                                |                                 |       |        |       |
| $f_{OUT} \leq 1$ MHz (DC - 1 MHz)                  | -60 dBc  |                                |                                 |       |        |       |
| $f_{OUT} < 20$ MHz (1 MHz - 20 MHz)                | -50 dBc  |                                |                                 |       |        |       |
| <b>Phase noise (<math>f_{OUT} = 10</math> MHz)</b> |  |                                |                                 |       |        |       |
| 10 kHz offset                                      | -110 dBc/Hz  |                                |                                 |       |        |       |
| <b>Square</b>                                      |  |                                |                                 |       |        |       |
| Frequency range (Square)                           | 1 $\mu$ Hz to 30 MHz   | 1 $\mu$ Hz to 50 MHz           | 1 $\mu$ Hz to 60 MHz            |       |        |       |
| Rise & Fall time                                   | < 5 ns (10% to 90%) at full amplitude into 50 $\Omega$   |                                |                                 |       |        |       |
| Duty Cycle   | 20% to 80% to 10 MHz,<br>40% to 60% to 30 MHz,<br>50% > 30 MHz   |                                |                                 |       |        |       |
| Asymmetry (50% duty cycle)                         | 1% of period $\pm 5$ ns  |                                |                                 |       |        |       |
| Aberrations  | < 5% + 50 mV   |                                |                                 |       |        |       |
| Jitter   | < 70 ps rms (typical)  |                                |                                 |       |        |       |
| <b>Ramp &amp; Triangle</b>                         |  |                                |                                 |       |        |       |
| Frequency range                                    | 1 $\mu$ Hz to 5 MHz  |                                |                                 |       |        |       |
| Resolution   | 1 $\mu$ Hz, up to 12 digits  |                                |                                 |       |        |       |
| Symmetry   | 1 $\mu$ Hz to 500 kHz: 0%-100%,<br>500 kHz to 2 MHz: 10%-90%,<br>50% > 2 MHz                             |                                |                                 |       |        |       |
| Linearity  | <0.1% of peak output (1 $\mu$ Hz to 250 kHz)   |                                |                                 |       |        |       |
| <b>Pulse</b>                                       |  |                                |                                 |       |        |       |
| Frequency range                                    | 1 MHz to 25 MHz  |                                |                                 |       |        |       |
| Resolution   | 1 $\mu$ Hz   |                                |                                 |       |        |       |
| Pulse width  | 20 ns minimum, 10 ns resolution, 999 s max   |                                |                                 |       |        |       |
| Variable edge time                                 | <5 ns (Fast setting) to pulse period <sup>(1)</sup>  |                                |                                 |       |        |       |
| Jitter   | < 50 ps rms (typical)  |                                |                                 |       |        |       |

## Specifications (cont.)

| Model                                     | 4075B  | 4078B | 4076B                        | 4079B | 4077B                         | 4080B |
|---|--|-------|------------------------------|-------|-------------------------------|-------|
| <b>Arbitrary Waveform Characteristics</b> |  |       |                              |       |                               |       |
| Waveform Length                           | 2 points to 1,048,576 points   |       | 2 points to 4,194,304 points |       | 2 points to 16,777,216 points |       |
| Sampling Rate                             | 200 MSa/s, point execution rate adjustable from 5 ns – 100 s   |       |                              |       |                               |       |
| Vertical Resolution                       | 14 bits (16,384 levels)  |       |                              |       |                               |       |
| Noise                                     | Add 1% to 100% to output arbitrary waveform  |       |                              |       |                               |       |
| Bandwidth                                 | 100 MHz max (2-point waveform length)  |       |                              |       |                               |       |
| Frequency                                 | Accuracy: $\pm 0.002\%$ , Resolution: 4 digits or 1 ps   |       |                              |       |                               |       |
| Rise and Fall Time                        | < 5 ns (typical)   |       |                              |       |                               |       |
| Jitter                                    | < 50 ps rms (typical)  |       |                              |       |                               |       |
| <b>Output Characteristics</b>             |  |       |                              |       |                               |       |
| <b>Signal Output</b>                      |  |       |                              |       |                               |       |
| Output Impedance                          | 50 $\Omega$ (typical)  |       |                              |       |                               |       |
| Output Protection                         | Protected against short circuit or accidental voltage applied to the main output connector <sup>(2)</sup>                                    |       |                              |       |                               |       |
| <b>Amplitude</b>                          |  |       |                              |       |                               |       |
| Range                                     | 10 mV to 10 V <sub>p-p</sub> into 50 $\Omega$  |       |                              |       |                               |       |
| Resolution                                | 4 digits (9,999 counts)  |       |                              |       |                               |       |
| Units                                     | V <sub>pp</sub> , V <sub>rms</sub> , or dBm  |       |                              |       |                               |       |
| Accuracy                                  | $\pm 1\% \pm 20$ mV of the programmed output value from 1 V – 10 V,<br>$\pm 1\% \pm 1$ mV of the programmed output value from 50 mV – 999 mV |       |                              |       |                               |       |
| <b>DC Offset</b>                          |  |       |                              |       |                               |       |
| Range                                     | $\pm 4.99$ V <sub>pk</sub> into 50 $\Omega$  |       |                              |       |                               |       |
| Resolution                                | 1 mV with 4 digits resolution  |       |                              |       |                               |       |
| Units                                     | VDC  |       |                              |       |                               |       |
| Accuracy                                  | $\pm 1\% \pm 10$ mV into 50 $\Omega$   |       |                              |       |                               |       |
| <b>Frequency</b>                          |  |       |                              |       |                               |       |
| Accuracy                                  | $\pm 10$ ppm for DDS waveform, $\pm 20$ ppm for arbitrary mode   |       |                              |       |                               |       |
| Phase                                     | -180 to +180 degrees with 0.1 degree resolution  |       |                              |       |                               |       |
| <b>Modulation Characteristics</b>         |  |       |                              |       |                               |       |
| <b>Amplitude Modulation (AM)</b>          |  |       |                              |       |                               |       |
| Carrier                                   | Sine, Square, or Triangle  |       |                              |       |                               |       |
| Source                                    | Internal, External   |       |                              |       |                               |       |
| Internal Modulation                       | 0.01 Hz - 20 kHz   |       |                              |       |                               |       |
| Depth                                     | 0% to 100%   |       |                              |       |                               |       |
| <b>Frequency Modulation (FM)</b>          |  |       |                              |       |                               |       |
| Carrier                                   | Sine, Square, or Triangle  |       |                              |       |                               |       |
| Source                                    | Internal, External   |       |                              |       |                               |       |
| Internal Modulation                       | 0.01 Hz - 20 kHz   |       |                              |       |                               |       |
| Deviation                                 | 1 $\mu$ Hz to max frequency / 2  |       |                              |       |                               |       |
| <b>Frequency-shift Keying (FSK)</b>       |  |       |                              |       |                               |       |
| Carrier                                   | Sine, Square, or Triangle  |       |                              |       |                               |       |
| Source                                    | Internal, External   |       |                              |       |                               |       |
| Rate                                      | $\leq 1$ MHz   |       |                              |       |                               |       |

## Specifications (cont.)

| Model                         | 4075B  | 4078B | 4076B                           | 4079B | 4077B | 4080B |
|-------------------------------|--|-------|---------------------------------|-------|-------|-------|
| <b>Sweep Characteristics</b>  |  |       |                                 |       |       |       |
| Sweep Shape                   | Linear and Logarithmic, up or down   |       |                                 |       |       |       |
| Sweep Time                    | 10 ms to 500 s   |       |                                 |       |       |       |
| Sweep Trigger                 | Internal, External, Continuous, or Burst   |       |                                 |       |       |       |
| <b>Burst Characteristics</b>  |  |       |                                 |       |       |       |
| Waveforms                     | Sine, Square, Triangle, Pulse, Arb   |       |                                 |       |       |       |
| Count                         | 1-999,999 cycles   |       |                                 |       |       |       |
| Trigger Source                | Manual, Internal, External   |       |                                 |       |       |       |
| <b>Inputs and Outputs</b>     |  |       |                                 |       |       |       |
| Trigger IN                    | TTL Compatible<br>Maximum rate: 20 MHz<br>Minimum width: 20 ns<br>Input impedance: 10 k $\Omega$ nominal |       |                                 |       |       |       |
| Sync OUT                      | TTL pulse at programmed frequency, 50 $\Omega$ impedance   |       |                                 |       |       |       |
| Modulation IN                 | 5 Vp-p for 100% modulation<br>10 k $\Omega$ input impedance<br>DC to 50 kHz bandwidth                    |       |                                 |       |       |       |
| Marker OUT                    | Positive TTL pulse, user programmable in arbitrary waveform, 50 $\Omega$ impedance                       |       |                                 |       |       |       |
| External Reference OUT        | 10 MHz clock for synchronization, TTL, 50 $\Omega$ impedance   |       |                                 |       |       |       |
| External Reference IN         | 10 MHz from an external source, > 1 k $\Omega$ impedance   |       |                                 |       |       |       |
| <b>Internal Trigger</b>       |  |       |                                 |       |       |       |
| Repetition                    | 1 $\mu$ s to 100 s (0.01 Hz – 1 MHz)   |       |                                 |       |       |       |
| Resolution                    | 4 digits   |       |                                 |       |       |       |
| Accuracy                      | $\pm$ 0.002%   |       |                                 |       |       |       |
| <b>General</b>                |  |       |                                 |       |       |       |
| Display Resolution            | 400 x 240 dots   |       |                                 |       |       |       |
| Remote Interface              | USB (USBTMC-compliant)   |       | USB (USBTMC-compliant) and GPIB |       |       |       |
| Storage Memory                | 50 full panel settings at power-off, including last working setup  |       |                                 |       |       |       |
| Dimensions (W x H x D)        | 213 mm x 88 mm x 300 mm (8.4" x 3.5" x 12")  |       |                                 |       |       |       |
| Weight                        | 3 kg (6.6 lbs)   |       |                                 |       |       |       |
| AC Input                      | 100 - 240 V $\pm$ 10%, 50 - 60 Hz $\pm$ 5% (< 40 VA)   |       |                                 |       |       |       |
| Temperature                   | 0° C to +50° C (operating)<br>-20° C to +70° C (non-operating)   |       |                                 |       |       |       |
| Humidity                      | 95% RH, 0° C to 30° C<br>75% RH to 40° C<br>45% RH to 50° C  |       |                                 |       |       |       |
| EMC                           | According to EN55011 for radiated and conducted emissions  |       |                                 |       |       |       |
| Electrical Discharge Immunity | According to EN55082   |       |                                 |       |       |       |
| Safety Specifications         | According to EN61010, CE approved  |       |                                 |       |       |       |
| <b>Three-Year Warranty</b>    |  |       |                                 |       |       |       |
| Included Accessories          | Power Cord, Manual on CD, USB Type A to Type B Cable, Certificate of Calibration                         |       |                                 |       |       |       |

(1) Depending on pulse width.

(2) Output turns off automatically when an overload is applied. The instrument can tolerate shorts to ground indefinitely.