

**Pulse Pattern Generator Specifications****1. Basic Modes of Operation**

The 340x generator may be set in one of four available modes, Pulse, Pattern, Burst and External Width.

**Pulse Mode** delivers a single pulse per trigger event to the outputs. The pulse is programmable in delay and duration.

**Burst Mode** results in a 'burst' of  $n$  pulses per trigger event, with pulses configured similarly to single pulses in Pulse mode.

**Pattern Mode** delivers a programmable pattern per trigger event to the outputs. The pattern is programmable, or may be selected from a library of pre-configured patterns. The pattern may be presented in either NRZ or RZ formats. In NRZ mode, the pattern crossing point is programmable. In RZ mode the duration (duty cycle) of the pattern pulse is programmable.

**External Width Mode** makes the pulse level follow the edges of the Ext In input. A rising edge causes the output to go high, while a falling edge causes the output to go low.

**2. Interfaces**

The 340x generator may be controlled via the front panel GUI interface, a GPIB interface, or a USB interface. IEEE 488.2, SCPI compliant.

**3. General Mechanical Characteristics**

Size: 439 mm (17.3 in) wide x 87 mm (3.4 in) high x 393mm (15.5 in) deep

Weight: 6.80 kg (15.0 lbs)

**4. Specifications**

Pulse / Level Parameters	Specification
Pulse Amplitude <sup>1</sup>	100mV to +10V 50 $\Omega$ into 50 $\Omega$ 200mV to +20V 1k $\Omega$ into 50 $\Omega$
Level Window <sup>2</sup>	-10V to +10V 50 $\Omega$ into 50 $\Omega$ -20V to +20V 1k $\Omega$ into 50 $\Omega$
Amplitude Accuracy <sup>3</sup>	$\pm(0.5\% \text{ Amplitude} + 30 \text{ mV})$
Offset Accuracy <sup>4</sup>	$\pm 100 \text{ mV}$
Output Resolution	10mV, 50 $\Omega$ into 50 $\Omega$ 20mV, 1k $\Omega$ into 50 $\Omega$
Overshoot / pre-shoot / ringing <sup>5</sup>	$\pm 5\% \pm 20 \text{ mV}$
Source Impedance <sup>6</sup>	50 $\Omega$ or 1 k $\Omega$ , selectable
Short Circuit Current <sup>7</sup>	$\pm 400 \text{ mA}$

<sup>1</sup> Amplitude may be set in either voltage or current units.

<sup>2</sup> Level may be set in either voltage or current units.

<sup>3</sup> 50 $\Omega$  into 50 $\Omega$

<sup>4</sup> 50 $\Omega$  into 50 $\Omega$

<sup>5</sup>  $\pm 1\%$  at 10V p-p typical /  $\pm 2\%$  at 5V p-p typical

<sup>6</sup>  $\pm 1\%$  typical

<sup>7</sup>  $\pm 800 \text{ mA}$  in Channel Add Mode

**Pulse Pattern Generator Specifications**

<b>Timing and Trigger Parameters</b>	<b>Specification</b>
Frequency Range <sup>8</sup>	1mHz to 165MHz
Period	6.06 ns to 1000 s
Period Accuracy	PLL: $\pm 0.01\%$ VCO: $\pm 0.5\%$ typical with self-cal $\pm 3\%$ without self-calibration
Period Resolution	PLL: 4 digits, 1 ps best case VCO: 3.5 digits, 10 ps best case
Period Jitter, RMS	VCO: 0.015% + 20ps PLL: 0.001% + 15ps
Pulse Width <sup>9</sup>	3.02 ns to (period – 3.02 ns)
Width Accuracy	$\pm 0.5\% \pm 250\text{ps}$ typical with self-cal $\pm 3\% \pm 250\text{ps}$ without self-cal
Delay <sup>10</sup>	0 to (period – 3.02 ns)
Delay Accuracy	$\pm 0.5\% \pm 0.5\text{ns}$ typical with self-cal $\pm 3\% \pm 0.5\text{ns}$ without self-cal
Delay & Width Resolution	3.5 digits, 20 ps best case
Delay & Width Jitter, RMS	0.01% + 15ps
Fixed Delay <sup>11</sup>	22 ns

<b>Rise/Fall Parameters</b>	<b>Specification</b>
Rise / Fall Time	<2.5ns to 200ms, adjustable
Minimum Rise / Fall Time <sup>12</sup>	2.5ns maximum at 10V p-p 2.3ns typical at 5V p-p 2.1ns typical at 2 V p-p
Rise / Fall Time Accuracy	$\pm 10\% \pm 200\text{ps}$
Rise / Fall Ranges	2ns - 20ns, 10ns - 200ns, 100ns – 2us, 1us – 20us, 10us – 200us, 100us – 2ms, 1ms – 20ms, 10ms – 200ms

<b>Burst Mode Parameters</b>	<b>Specification</b>
Number of pulses	2 – 65,536

<sup>8</sup> Range reduced for 1 k $\Omega$  source impedance.

<sup>9</sup> At 50% level. Specified at fastest rise/fall, and for amplitudes < 5 Vpp.

<sup>10</sup> Delay is measured from Trigger Out to Pulse Out, and is the sum of the user defined Delay plus the Fixed Delay.

<sup>11</sup> Nominal.

<sup>12</sup> 10% to 90%, 50  $\Omega$  source and load, at 25°C. Higher for 1k $\Omega$  source impedance, rising and falling edges independent within selected ranges.

**Pulse Pattern Generator Specifications**

Pattern Mode Parameters	Specification
<b>Pattern</b>	
Data Pattern length <sup>13</sup>	2 – 16384 bits
PRBS	2 <sup>n</sup> -1 with n = 5-14
<b>Data Formats</b>	NRZ, RZ

CLK IN and EXT IN Parameters	Specification
Input Impedance	50 Ω or 10 kΩ
Threshold	-3 V to +3 V
Maximum Input Voltage	± 6 V
Coupling	DC

TRIG OUT and STROBE OUT Parameters	Specification
Output Impedance	50 Ω
Levels	TTL (0V / 2.4V)
Maximum External Voltage	-2V to 5 V
Coupling	DC

REF OSC IN and REF OSC OUT Parameters	Specification
Impedance	50 Ω, AC coupled
Ref Osc In Signal	10 MHz, 0 dBm typical, 20 dBm max
Output Amplitude	10 MHz, 1 V <sub>pp</sub> typical

General Specifications	
Power	100V to 240V; Single phase; 50 / 60 Hz; universal voltage input; 165 VA max.
Compliance	EMC: Conforms to European Union Directive 89/336/EEC, EN 61326-1. SAFETY: Conforms to European Directive 73/23/EEC, EN 61010-1.
Operating Temperature	0°C to 50°C
Operating Humidity	80% R.H. up to 35°C. De-rate 3% R.H./°C, 35° to 50°C
Storage Temperature	-25°C to 65°C
Altitude	Maximum 2000 meters above sea level.
Environmental	For indoor use only.

<sup>13</sup> Pattern for each channel is independent, must be same length.

## 5. Additional Information

### Inputs/Outputs

- OUTPUT1- channel 1 signal output, front panel
- OUTPUT2 - channel 2 signal output (optional), front panel
- TRIG OUT - generates trigger pulse on each period, front panel
- STROBE OUT – programmable NRZ in pattern mode, marks burst width in burst mode, front panel
- CLK IN - accepts external clk , front panel
- EXT IN - accepts external signal for arming, front panel
- REF OSC IN - accepts external 10 MHz signal for PLL reference, back panel
- REF OSC OUT - generates 10 MHz signal phase locked to PLL, back panel

### Trigger Modes

- Continuous - trigger circuitry is always armed
- Started - trigger arming is edge sensitive, needs selected edge prior to allowing trigger event
- Gated - trigger arming circuitry is level sensitive, always armed when selected level is present

**Pulse Period Source** (this is period of pulses in continuous mode, or period of pulses within a burst or pattern in burst or pattern modes)

- PLL oscillator
- startable oscillator
- CLK IN

**Arming Source** (this sets period of entire burst/pattern in burst/pattern mode)

- EXT IN
- PLL oscillator (in started mode, if not used as pulse period source)
- MANUAL (in started mode)