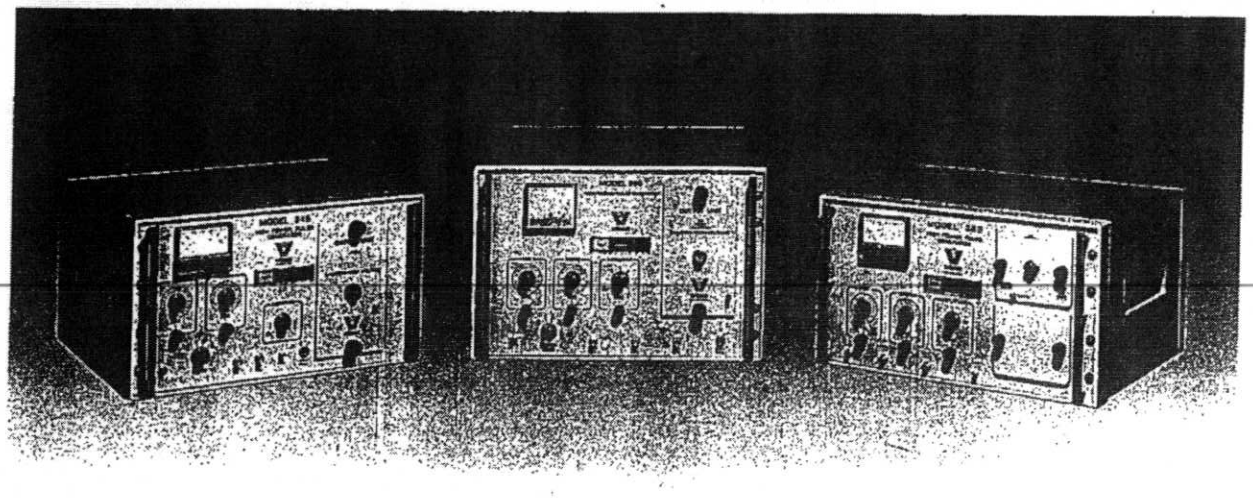
HIGH-POWER PULSE GENERATORS

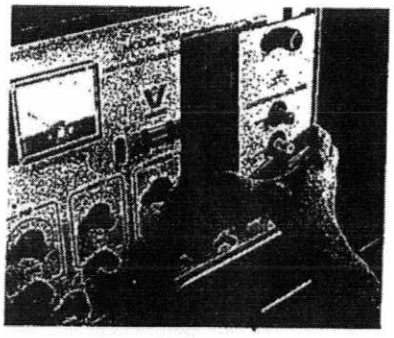


EXTENSIVE HIGH POWER PULSE EXPERIENCE

Velonex has specialized in high-power pulsers (over 1,000 watts, peak), for over twenty-five years, producing general-purpose instruments that meet the specialized requirements of almost any application.

Before Velonex developments, when high power pulses were needed, your only choice was to build a special source for each application. Such generators were usually extremely limited in what they could do. Now, with the Velonex line of standard generators you can have convenient and repetitive clean waveform, high power pulses off-the-shelf.

Velonex high-power pulse generators produce pulses with characteristics you'd normally expect only in more common low power pulses: defined wave shape, precise repeatability, good flat top and minimum ringing.



PLUG-IN VERSATILITY

One of the main reasons for the exceptional versatility of Velonex high-power pulse generators is the availability of a wide range of *fully-recessed* plug-ins. These easily inserted and removed units provide a large selection of output currents and voltages (impedance matching); DC isolation; inversion of output pulse polarity; and varying rise and fall times. Interlocks remove high-voltage if a plug-in is removed while power is on.

Each Velonex generator comes with a direct feed-through output plug-in. Other plug-ins are available as options. In many cases, the same plug-ins can be used in several different generators. Velonex "Plug-In Output Units Brochure" describes the standard plug-in units.

COMPACT, EASILY INSTALLED

Despite their high power outputs, Velonex generators are remarkably compact, and well suited for bench use. Most dimensions are 19¾" wide by 11" to 18¼" high to 21½" deep. Rack mounting is available for all models.

Hookup is a simple matter since the instruments use 115 V, 60 Hz, single phase power (230 V, 50/60 Hz available). This also results in a degree of portability that you normally would not expect in such instruments.

PROGRAMMABLE UNITS

Velonex Programmable High Power Pulse Generators may be operated with BCD inputs to set pulse width, prf, and amplitude. Alternately, the amplitude may be continuously programmed by low-level analog input. These units are ideal for testing surge protection devices, semiconductors, discharge devices, or other components requiring a High Power Pulse Generator with a computer interfaced programmed test sequence. Inputs are TTL compatible and separate grounding is maintained to allow interconnection to computer systems without introducing problems of common ground return impedances. Programmable units may also be employed in a manually operated mode.

VELONEX: UNLIMITED APPLICATIONS VERSATILITY

Listed below are a few of the many applications where Velonex high-power pulse generators can make your job easier, faster and more precise:

- Surge Protection Device Testing (Spark-Gaps, VDR's)
- Nuclear Pulse Simulation
- Electric Arc Studies
- Lightning Simulation
- Electro Optics (Pockel & Kerr Cell pulsing)
- Exploding-Wire Phenomena
- Magnetic Field Studies
- Electromagnetic Interference Testing
- Ultrasonics
- Gaseous Discharge Device Pulsing
- Solid State Component Testing

EXTENSIVE APPLICATIONS ASSISTANCE

An extra benefit of dealing with Velonex is access to applications experience gained by Velonex engineers in over twenty-five years of solving high-power pulse problems: from one-of-a-kind specials to production-line testing instruments. This saves you substantial time and money, and can often make your "special requirement" routine.

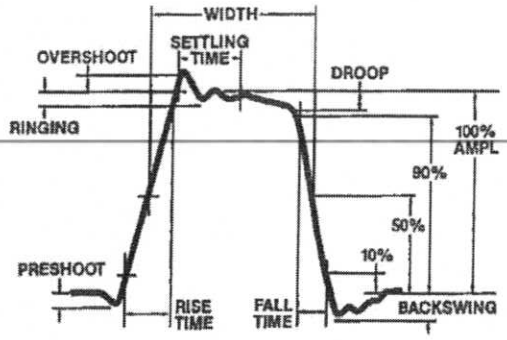
VELONEX

HIGH-POWER PULSE GENERATORS

HIGH POWER PULSE TERMS

High-power pulse terminology is the same as for any pulse. Unless otherwise indicated, the following definitions and/or measuring techniques are used:

- Parameters are specified for operation into a non-reactive (resistive) load of a specified value.
- Pulse rise-time is measured from the 10% to the 90% pulse amplitude points.
- Pulse fall-time is measured from 90% to the 10% pulse amplitude points.
- Pulse width is measured from the 50% response points on the rising and falling edges of the waveform.
- Duty factor is the ratio of pulse "on-time" to pulse period. This equals the product of pulse width and pulse repetition rate.
- Average output power is the product of peak power and duty factor.



SAFETY AND RELIABILITY

INSTRUMENT SAFETY

Velonex designs-in numerous instrument and customer load safety features.

For example, each generator is completely protected against short-circuits and duty cycle overloads. If there's any momentary loss of power, the instrument comes back on in a standby mode instead of at high voltage. The operator must take an intentional action to get the high voltage back on. Inicuded on the front panel are an overload indicator light and a reset pushbutton.

There are also several overload sensors in the instrument. Any one of these can trip the power off when necessary. Fuses are also used to protect the instrument and load if there is a malfunction.

On some models where heat might become a problem, there's also a sensor that automatically turns the power off if the temperature gets too high. This might be caused, for example, by blockage of the forced air flow.

OPERATOR SAFETY

Operator safety is provided by making all plug-ins *fully-recessed* (flush with the front panel)—a Velonex exclusive. This is especially important when semi-skilled operators are using the instrument. Even where there's very high output voltage, the fully recessed plug-in eliminates any possible interconnection contact.

The plug-ins are also interlocked: the high voltage automatically shuts off if they are removed.

Another operator safety feature, in all Velonex generators that produce over 500 volts, is "High Voltage Reset" on the amplitude control. Once power has been turned off, the operator must turn the amplitude control all the way back to zero before they can again get high voltage output. Where exact reproducibility is critical, Velonex furnishes a keylock that overrides the High Voltage Reset. A positive operator action is required: they must insert and turn the key.

Additional operator safety features include a flashing red light on the front panel, to indicate the presence of high voltage, and a meter that shows relative pulse level. All external parts of the generator, including all controls, are always at ground potential.

FIELD PROVEN RELIABILITY

Velonex high-power pulse generators have earned an *unequaled* reputation for in-the-field reliability. The number needing factory repair has been virtually insignificant over the last twenty-five years.

The reasons? For one thing, all components are substantially derated. In addition, all units are forced-air cooled to provide long life for all parts. There is no marginal performance anywhere. Furthermore, all Velonex generators are burned-in before final testing, to detect any possible sources of trouble.

Specifications subject to change without notice.

Your Local Velonex Rep. is:

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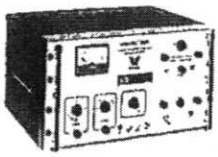
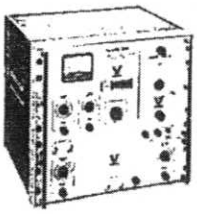
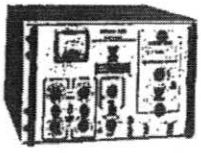
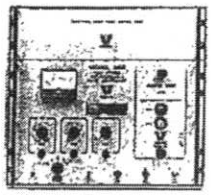
 380 ULTRA FAST t_R & t_F	 570(3) MODEL 350 WITH BURST CAPABILITY	 580(3) MODEL 360 WITH BURST CAPABILITY	 660 VERY HIGH POWER PROGRAMMABLE
500V 1000V	2100V 24000V	2500V 30000V	2500V 30000V
10.0 A 100 A	10.5 A 600 A	12.5 A 750 A	12.5 A 750 A
5000 W 5000 W 50 W	26000 W 22000 W 220 W	31000 W 31000 W 460 W	31000 W 31000 W 460 W
1.0% 1.0%	to 50%(3) to 50%	to 50%(3) to 50%	1.5% 1.5%
15 ns 25 μs	100 ns 300 μs	50 ns 3 ms	75 ns 1 ms
One Shot 400K pps 0 to 400K pps	3KHz(3) 2MHz 0 to 100K pps	3KHz(3) 2MHz 0 to 1M pps	One Shot 300K pps 0 to 300K pps
7 ns 7 ns	30 ns 50 ns	20 ns 30 ns	20 ns 30 ns
0.1%/μs	0.04%/μs	0.003%/μs	0.009%/μs
50Ω	200Ω	200Ω	200Ω
F, J, L, R	F, J, M, R	C, D, F, H, J, M, R(6)	F, H, J, M, R
YES YES NO YES NO YES	NO YES YES YES NO NO	YES YES YES YES NO YES	YES YES YES YES YES(5) YES

(4) To 10% with option E.
(5) PRF, Width and Amplitude. Accessory unit allows GPIB Interface.
(6) Options "C" & "D" are not available simultaneously.

OPTIONS

A. Allows operation with either 115 V (±5%) 400 Hz or 60 Hz.

B. Adds line regulation. Output amplitude change <0.9% for ±10.0% input line change. Input line 115 V 60 Hz.

C. Extends pulse width range to 10 milliseconds.

D. Extends pulse repetition rate to 1 megahertz. Maximum power out reduced to ≤ 3.2 KW.

E. Allows generator to be operated at 10% duty factor at 10% of rated output power with modified specifications.

F. Input power requirements changed from 115 V 50/60 Hz to 230 V 50/60 Hz.

G. Reduced Rise and Fall Times to 30 ns and min PW to 50 ns.

H. T^2L input logic on External Drive.

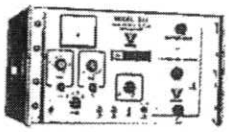
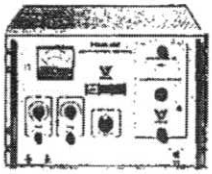
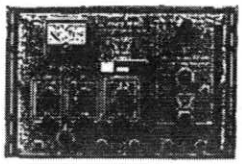
J. Input power requirements changed to 100 V 50/60 Hz.

L. Remote "one shot" trigger.

M. Remote safety feature (see Application Note 121).

R. Rack mounting.

SPECIFICATIONS

CHARACTERISTICS	 345 LOW COST	 350 HIGH POWER	 360 REGULATED VERY HIGH POWER
VOLTAGE PEAK, Max			
Direct Out	1000 V(2)	2100 V	2500 V
With Standard Plug-in	11400 V	24000 V	30000 V
CURRENT PEAK, Max			
Direct Out	5.0 A	10.5 A	12.5 A
With Standard Plug-in	290 A	600 A	750 A
POWER OUTPUT			
Peak One Shot	6000 W	26000 W	31000 W
Full Duty Factor	5000 W	22000 W	31000 W
Average	50 W	220 W	460 W
DUTY FACTOR			
Full Output Power	1.0%	1.0%	1.5%
(1)Reduced Output Power	10%	1.0%(4)	1.5%
PULSE WIDTH			
Internal Minimum	80 ns	100 ns	50 ns
Internal Maximum	10 ms	300 μs	3 ms
PULSE REPETITION			
Internal Minimum	1 pps	3 pps	One Shot
Internal Maximum	100 K pps	100 K pps	300 K pps
External	0 to 100 K pps	0 to 100 K pps	0 to 300 K pps
TRANSITION TIME			
Rise	35 ns	30 ns	20 ns
Fall	35 ns	50 ns	30 ns
DROOP			
Maximum	0.004% / μs	0.04% / μs	0.003% / μs
IMPEDANCE			
Load for above data	200 Ω	200 Ω	200 Ω
AVAILABLE OPTIONS			
	A, B, F, G, H, J, L, M, R	E, F, J, M, R	C, D, F, H, J, L, M, R(6)
MODES OF OPERATION			
One Shot Button	YES	NO	YES
Internal PRF	YES	YES	YES
External Drive	YES	YES	YES
External Trigger	YES	YES	YES
Programmable	NO	NO	NO
Line & Duty Factor Reg.	NO	NO	YES

(1) Increased duty factor may degrade some specifications.
(2) Can be increased to >1500 V, with R_L >400 Ω; other specifications may be altered.
(3) Data shown for burst mode, specifications in non-burst are same as generator indicated in heading.

Power input 115 V ± 10%, 50/60 Hz unless otherwise indicated.

Specifications Subject to Change Without Notice

Plug-Ins and Accessories

Peak voltages and currents listed are the highest possible values, maximum peak values are less for some generators. Pulse widths are applicable for peak values shown. May be greater at lower output voltages.

Model	Polarity	Volts Peak	Amperes Peak	Pulse Width Range (µS)
V-1097	Output Unit, Straight Through, Var. Gen.			
V-1102	DC Blocking Network			
V-1121	Negative	2.5k	---	0.1 - 300
V-1260	Negative	50	100	0.05 - 0.5
V-1261	Positive	50	100	0.05 - 0.5
V-1262	Negative	50	100	0.5 - 5
V-1263	Positive	50	100	0.5 - 5
V-1264	Positive	500	10	0.05 - 1.0
V-1265	Positive	500	10	0.2 - 20
V-1266	Negative	1k	5	0.05 - 0.5
V-1267	Positive	1k	5	0.05 - 0.5
V-1268	Negative	1k	5	0.5 - 20
V-1269	Positive	1k	5	0.5 - 20
V-1270	Rise/Fall Time Range: 25-295ns			
V-1276	Rise/Fall Time Range: 50-345ns			
V-1337	Output Unit, Straight Through, Model 380			
V-1506	Negative	1k	1	0.45 - 25
V-1720	Positive	30k	1	20 - 100
V-1721	Negative	30k	1	20 - 100
V-1723	Positive	20k	1.5	3 - 10
V-1724	Negative	20k	1.5	3 - 10
V-1725	Positive	20k	1.5	10 - 100
V-1726	Negative	20k	1.5	10 - 100
V-1727	Positive	10k	3	1 - 10
V-1728	Negative	10k	3	1 - 10
V-1729	Positive	10k	3	10 - 100
V-1730	Negative	10k	3	10 - 100
V-1731	Positive	9k	3	100 - 300
V-1732	Negative	9k	3	100 - 300
V-1733	Positive	5k	6	0.2 - 1.0
V-1734	Negative	5k	6	0.2 - 1.0
V-1735	Positive	5k	6	1 - 10

Specifications Subject to Change Without Notice

Plug-Ins and Accessories

Peak voltages and currents listed are the highest possible values, maximum peak values are less for some generators. Pulse widths are applicable for peak values shown. May be greater at lower output voltages.

Model	Polarity	Volts Peak	Amperes Peak	Pulse Width Range (µS)
V-1736	Negative	5k	6	1 - 10
V-1737	Positive	5k	6	10 - 100
V-1738	Negative	5k	6	10 - 100
V-1739	Positive	4.7k	6	100 - 300
V-1740	Negative	4.7k	6	100 - 300
V-1741	Positive	2.4k	12	0.1 - 1.0
V-1742	Positive	2.4k	12	1 - 10
V-1743	Positive	2.4k	12	10 - 100
V-1744	Positive	2.4k	12	100 - 300
V-1745-1	Positive	1.2k	25	0.1 - 1.0
V-1745-1U	Positive	1.2k	25	0.1 - 1.0
V-1746-1	Negative	1.2k	25	0.1 - 1.0
V-1746-1U	Negative	1.2k	25	0.1 - 1.0
V-1747-1	Positive	1.2k	25	1 - 10
V-1747-1U	Positive	1.2k	25	1 - 10
V-1748-1	Negative	1.2k	25	1 - 10
V-1748-1U	Negative	1.2k	25	1 - 10
V-1749-1	Positive	1.2k	25	10 - 100
V-1749-1U	Positive	1.2k	25	10 - 100
V-1750-1	Negative	1.2k	25	10 - 100
V-1750-1U	Negative	1.2k	25	10 - 100
V-1751-1	Positive	1.2k	25	100 - 300
V-1751-1U	Positive	1.2k	25	100 - 300
V-1752-1	Negative	1.2k	25	100 - 300
V-1752-1U	Negative	1.2k	25	100 - 300
V-1753	Positive	600	50	0.1 - 1.0
V-1754	Negative	600	50	0.1 - 1.0
V-1755	Positive	600	50	1 - 10
V-1756	Negative	600	50	1 - 10
V-1757	Positive	600	50	10 - 100
V-1758	Negative	600	50	10 - 100
V-1759	Positive/Negative	570	50	100 - 300
V-1761	Positive/Negative	300	100	0.1 - 1.0

Specifications Subject to Change Without Notice

Plug-Ins and Accessories

Peak voltages and currents listed are the highest possible values, maximum peak values are less for some generators. Pulse widths are applicable for peak values shown. May be greater at lower output voltages.

Model	Polarity	Volts Peak	Amperes Peak	Pulse Width Range (μS)
V-1762	Positive/Negative	300	100	1 - 10
V-1763	Positive/Negative	300	100	10 - 100
V-1764	Positive/Negative	280	100	100 - 300
V-1765	Positive/Negative	120	250	0.1 - 1.0
V-1766	Positive/Negative	120	250	1 - 10
V-1767	Positive/Negative	120	250	10 - 100
V-1768	Positive/Negative	115	250	100 - 300
V-1769	Positive/Negative	60	500	1 - 10
V-1770	Positive/Negative	60	500	10 - 100
V-1771	Positive/Negative	56	500	100 - 300
V-1772	Positive/Negative	40	750	1 - 10
V-1773	Positive/Negative	40	750	10 - 100
V-1777	Positive/Negative	38	750	100 - 300
V-1786	Negative	2.5k	200 ohm load	0.05 - 3000
V-1883	Rise/Fall Time Range 50-345ns			
V-1911	Positive	10k	3	0.3 - 1.0
V-1912	Negative	10	3	0.3 - 1.0
V-1913	Positive/Negative	60	500	0.3 - 1.0
V-1918-1	Output Unit, Straight Through, for V-1883 and V-3535			
V-2100	Output Unit, Straight Through, Model 660, Ground Isolated			
V-2475	Negative	2.4k	12	0.1 - 1.0
V-2476	Negative	2.4k	12	1 - 10
V-2477	Negative	2.4k	12	10 - 100
V-2478	Negative	2.4k	12	100 - 300
V-2627	IEEE 488 GPIB Interface Adaptor			
V-2761	Voltage Phase Shifter			
V-3535	Rise/Fall time range 50-1500ns			

MODELS 350, 570(3) (at 1.0% Duty Factor)(4)			MODELS 345 (at 1.0% Duty Factor)				MODELS 570, 580 (DF max = 50% In Burst)		
E_O Peak Volts Max	I_O Peak Amps Max	Pulse Width Range µs	E_O Peak Volts Max	I_O Peak Amps Max	PW Range µs	Over-shoot %	Max PRF In Burst Mode Hz +	Max PRF In Burst Mode Hz −	Output Connections
24K	0.8	20–120	11.4K	0.4	20–250	5	33K	33K	See Note(7)
16K 16K	1.2	3–12 10–125	7.6K 7.6K	0.6	3–25 10–250	5 10	165K 65K	165K 65K	
8.0K		0.3–1.2	3.8K		0.3–2.5	10	1.0M	500K	
8.0K 8.0K 7.7K	2.4	1–12 10–125 100–300	3.8K 3.8K 3.7K	1.2	1–25 10–250 100–750	5 10 10	330K 165K 500K	280K 165K 65K	
4.0K 4.0K 4.0K 3.8K	4.8	0.2–1.2 1–12 10–125 100–300	1.9K 1.9K 1.9K 1.8K	2.3	0.2–2.5 1–25 10–250 100–750	10 10 10 10	2.0M 2.0M 1.0M 500K	2.0M 2.0M 1.0M 500K	Two 5-Way Binding Posts See Figure 1b
2.0K 2.0K 2.0K 1.9K	10	0.1–1.2 1–12 10–125 100–300	950 950 950 920	4.8	0.1–2.5 1–25 10–250 100–750	10 10 10 10	2.0M 2.0M 2.0M 500K	2.0M 2.0M 2.0M 500K	
1000 1000 1000 960	20	0.1–1.2 1–12 10–125 100–300	480 480 480 460	9.6	0.1–2.5 1–25 10–250 100–750	15 10 12 8	2.0M 2.0M 1.0M 500K	2.0M 2.0M 500K 250K	Gen Rad Type 874 See Figure 1c
490 490 490 480	40	0.1–1.2 1–12 10–125 100–300	240 240 240 230	20	0.1–2.5 1–25 10–250 100–750	20 17 20 15	2.0M 2.0M 500K 500K	2.0M 1.0M 500K 500K	Two 5-Way Binding Posts See Figure 1b
250 250 250 240	83	0.1–1.2 1–12 10–125 100–300	120 120 120 115	40	0.1–2.5 1–25 10–250 100–750	12 11 15 10	2.0M 2.0M 500K 250K	2.0M 2.0M 500K 250K	
100 100 100 96	200	0.1–1.2 1–12 10–125 100–300	48 48 48 46	96	0.1–2.5 1–25 10–250 100–750	12 5 15 15	2.0M 2.0M 300K 300K	2.0M 2.0M 300K 300K	Strip-Line L = 1.70″ with two 1/4″ lugs See Figure 1d
50 50 50 48	415	0.3–1.2 1–12 10–125 100–300	24 24 24 23	200	0.3–2.5 1–25 10–250 100–750	10 5 5 10	1.0M 1.0M 330K 200K	1.0M 1.0M 330K 200K	
33 33 32	600	1–12 10–125 100–300	16 16 15	290	1-25 10–250 100–750	5 5 5	670K 330K 200K	670K 330K 200K	
2.1K	10.5	0.1–200	1.0K	5.0	0.1–300	3	2.0M	2.0M	One 5-Way Post; One GND Terminal
2.1K & 2.1	N/A	0.1–300	1.0K & 1.0	N/A	0.1–1000		2.0M	2.0M	One 5-Way Post; BNC, GND Terminal
N/A			N/A				2.0M	2.0M	Same as Generator
15% max.(6) 30% max.			20% max.(6) 35% max.						
·2476, and V-2477 which are 15% max.			See Listing Above						

(4) Useable to 1.5% on Model 350-E.
(5) These generators contain built in 1000:1 voltage dividers.
(6) At full rated pulse width. Droop is significantly less at shorter pulse widths.
(7) HV Receptacle (AMP LGH-3) with mating 18″ HV lead; 5-Way Binding Post. See Figure 1a.

SPECIFICATIONS

Figure 1a.

Figure 1b.

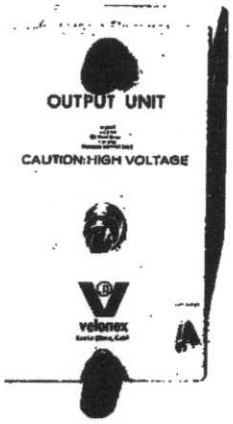


Figure 1c.

Figure 1d.

Table I

Model Number		Rise Time µs Max	Fall Time µs Max	R_L Nominal Resistive Ω	MODELS 360, 580(3), 660 (at 1.5% Duty Factor) (5)		
Output Polarity +	Output Polarity −				E_O Peak Volts Max	I_O Peak Amps Max	Pulse Width Range µs
V-1720	V-1721	11.0	12.0	30K	30K	1.0	20-100
V-1723	V-1724	2.0	2.3	13.3K	20K	1.5	3-10
V-1725	V-1726	4.5	5.5		20K	1.5	10-100
V-1911	V-1912	0.3	0.3		10K	3.0	0.3-1.0
V-1727	V-1728	0.5	0.6	3.3K	10K	3.0	1-10
V-1729	V-1730	2.0	2.0		10K	3.0	10-100
V-1731	V-1732	4.5	4.5		9K	3.0	100-300
V-1733	V-1734	0.09	0.08	830	5.0K	6.0	0.2-1.0
V-1735	V-1736	0.2	0.2		5.0K	6.0	1-10
V-1737	V-1738	1.2	0.8		5.0K	6.0	10-100
V-1739	V-1740	4.5	2.0		4.7K	6.0	100-300
V-1741	V-2475	0.07	0.07	200	2.4K	12	0.1-1.0
V-1742	V-2476	0.15	0.13		2.4K	12	1-10
V-1743	V-2477	0.8	0.8		2.4K	12	10-100
V-1744	V-2478	2.0	1.0		2.4K	12	100-300
V-1745(1)	V-1746(1)	0.06	0.06	50	1.2K	25	0.1-1.0
V-1747(1)	V-1748(1)	0.15	0.12		1.2K	25	1-10
V-1749(1)	V-1750(1)	0.9	0.7		1.2K	25	10-100
V-1751(1)	V-1752(1)	2.0	2.0		1.2K	25	100-300
V-1753	V-1754	0.07	0.07	12	600	50	0.1-1.0
V-1755	V-1756	0.2	0.2		600	50	1-10
V-1757	V-1758	0.8	0.6		600	50	10-100
V-1759(2)		2.0	2.0		570	50	100-300
V-1761(2)		0.08	0.08	3.0	300	100	0.1-1.0
V-1762(2)		0.2	0.15		300	100	1-10
V-1763(2)		1.0	1.0		300	100	10-100
V-1764(2)		2.0	2.0		280	100	100-300
V-1765(2)		0.07	0.08	0.5	120	250	0.1-1.0
V-1766(2)		0.3	0.2		120	250	1-10
V-1767(2)		1.2	1.2		120	250	10-100
V-1768(2)		2.5	1.5		115	250	100-300
V-1913(2)		0.16	0.11	0.12	60	500	0.3-1.0
V-1769(2)		0.4	0.3		60	500	1-10
V-1770(2)		2.0	1.5		60	500	10-100
V-1771(2)		3.0	2.0		56	500	100-300
V-1772(2)		0.5	0.3	0.055	40	750	1-10
V-1773(2)		2.5	2.0		40	750	10-100
V-1777(2)		3.0	2.0		38	750	100-300
N/A	V-1102	DC Blocking Network		200	N/A		
N/A	V-1121	Same as Generator Load for Calibration		200 (internal)	N/A		
N/A	V-1786	Same as Generator Load for Calibration		200 (internal)	2.5K	N/A	0.05-3000
All above units		Total Droop (including Generator)			5% max.(6)		
		Backswing			30% max.		
		Overshoot			6% max. except V-1732, V-1734, V-2475,		

(1) Add "U" suffix for isolated (floating) output, per Fig. 1b; see Applications Bulletin No. 115.
(2) Where one No. spans both + and − columns, unit may be used for either polarity by grounding one terminal.
(3) In non-burst mode.