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587 and 587-*PLUS*® Surge Generators, Options and Surge Networks

Equipment Supplied

Model 587-PLUS®
ANSI/IEEE

Consists of the Model 587-PLUS® mainframe, and Surge Network S1/S3. The combination has the advantages of modular, plug-in Surge Network design.

The Model 587-PLUS® (ANSI/IEEE) is designed for testing to ANSI/IEEE C62.41 (IEEE 587) Cat. A and B, including the KeyTek Bi-Wave™ *; parts of IEC 664; IEC 1000-4-5/D (IEC 801-5), etc.*†

Standard model provides plug-in waveform circuits, integral coupler/filter with normal/common mode switching, switching for wave selection and polarity, integral surge coupler/filter with 10A rms, 277V power line capability. It also includes remote control of charge and pulse functions (previously option RC-587), four-mode power line coupling (previously option M-587), and a precision surge current monitor (previously option I-587).

Unit further includes selection of line phase at which surge is applied, digital display of peak open-circuit voltage, BNC port for scope monitoring surge current wave, and BNC ports for differential, four-wire scope monitoring of actual, delivered surge voltage wave.

NOTE: The internal back-filter is automatically disconnected from the surge generator when the surge wave is not specified for coupling to an ac power line.
Also disconnects when the surge line circuit breaker is off for all surge networks (except the S3/S21, which is now available only for replacement purposes).

The benefits of plug-in Surge Network design allow testing to UL, FCC, CCITT and other test specifications via additional Surge Networks; and to other existing standards as well as to new standards as Surge Networks are introduced to meet them.

Requires Option 801-587 to accept either the M801-5 Network, or to accept the S1/S3 Network with Option 801-S1/S3.

Model 587-PLUS® Mainframe, with Surge Net S1/S3

	U.S. (ANSI/IEEE C62.41)		IEC 1000-4-5/D (IEC 801-5)		
Network[1]	Mains 1.2/50, 8/20μs Comb Wave	Mains 100 kHz Ring Wave	Mains 1.2/50 μs Comb Wave, alone and with series 10Ω	I/O 1.2/50μs Impulse[2]	Telecom 10/700 Impulse[2]
M801-5	•		•	•	•
S1[3]		•			
S1/S3	•	•		•	
S1/S3 w/Opt. 801-S1/S3	•	•	•	•	
S21					•

Notes:
1. The 801-PLUS Mainframe (and the 587-PLUS Mainframe with Option 801-587), both accept *all* the Networks.
   The 587-PLUS Mainframe *without* Option 801-587 accepts the S1, S1/S3, and S21; it does *not* accept either the M801-5 or the S1/S3 with Option 801-S1/S3.
2. For surging I/O lines and lines connected to Telecom equipment, external, multi-line couplers and protection circuits are required in many applications.
3. The S1/S3 can also be used to supply the 100 kHz Ring Wave, but the S3 impulse portion is redundant with part of the M801-5; so the S1 alone is the more cost-effective addition to the M801-5 to do the full ANSI/IEEE and IEC job.

Option PLUS-587

Conversion of basic Model 587 to Model 587-PLUS® (ANSI/IEEE). Factory recalibration required, independent of date of initial shipment; included in conversion price.

Option 801-587/PIO
Total power mains and I/O line surge generation upgrade for IEC 801-5††

Options 801-587 and 801-S1/S3

Option 801-587/PIOT1
Further upgrade to add surge generation capability for lines connected to Telecom equipment.

Options 801-587 and 801-S1/S3 S21

Option 801-587/PIOT2
Total power mains, I/O line and Telecom line upgrade for IEC 801-5††
Alternative upgrade for power mains, I/O lines and Telecom lines, if all done at the same time.

Option 801-587 and M801-5

* The KeyTek Bi-Wave™ has now been introduced into various international and national standards, in which it is referred to as the Combination Wave. Examples include IEC 1000-4-5/D (IEC 801-5), ANSI/IEEE C62.41, UL 1449, etc.

† Fully meets Combination Wave (i.e., 2Ω source impedance) requirements of IEC 1000-4-5/D (IEC 801-5); but does not include 12Ω portions of IEC 801-5, or VDE 0878 part 200. (See Model 801-PLUS™ with M801-5 network, pages 20-22.)
Internationally, also meets IEC 255-4, 255-5, 255-6, 255-10, SEV 3313, SEN 361503 and BEAMA 219.
In the U.S., meets UL1449 (TVSS), UL943 (GFCIs), UL217 and UL268 (Smoke Detectors), plus SAMA specifications.

†† Requires recalibration if done more than a year after initial purchase.

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587 and 587-*PLUS*® Surge Generators, Options and Surge Networks (continued)

Required Units and Options

Model 587 Same as Model 587-PLUS, except without plug-in Surge Network capability; i.e., S1/S3 Network internal and not interchangeable. Cannot be optioned for 480V ac surge line capability.

MODEL 587-PLUS®
MAINFRAME ONLY

Accepts plug-in Surge Networks: S1/S3, S3B, S21, S3/S21, S3/S21(IEC), S4/5/6, S9, S9 A/B and others as they are developed to meet new or changing surge standards. Requires Option 801-587 to accept M801-5 Network, or S1/S3 Network with Option 801-S1/S3.

MODEL 587-PLUS®
PLUG-IN SURGE NETWORKS

NOTE: Option 801-587 upgrades the Model 587-PLUS® Mainframe to accept the M801-5 SURGE Network for EC92 (see page 33).

Abbreviated Summary of Surge Networks for Combination Waves (1.2/50μs open-circuit voltage, 8/20μs short-circuit current). See individual Surge Network specifications for details.

Network	Maximum Peak Current	Maximum Peak Voltage	Power-Line Coupling Modes
M801-5	3KA; also 500A with ~ 1.2/50μs waveshape	6kV	All
S1/S3	3kA	6kV	All
S3B	5kA	6kV	All
S3HV	5kA	10kV	All
S4/5/6	750A, 500A, 125A	6kV	All
S7	10kA	6kV	Line-to-line

See appropriate Network descriptions

M801-5■ Meets IEC 801-5, BiWave™ 1.2 × 50 μs peak open-circuit voltage, 0-6 kV; 8 × 20 μs peak short-circuit current, to ~ 3 kA, plus additional series 10Ω resistor as per IEC 1000-4-5/D (IEC 801-5) and VDE 0878 part 200. CCITT Rec K. 17 telecom surge waves: 0-6 kV; selectable damping R of 0 and 25 ohms. (Also includes an additional, .5 × 700 μs wave, 0-6 kV.) **CCITT Rec K.20 and K.21 surges with built-in, true three-terminal coupling network: 10/700 μs, 0-6kV, 2 × 25 ohm outputs.**

CCITT REC	Application	Wave	Damping (ohms)	Three Terminal	M801-5 Does It
K.17	Repeaters	10/700	0/2.5/25	No	Yes, but no 2.5Ω
		100/700	0/2.5/25	No	No
K.20	Central-Office	10/700	25	Yes	Yes
K.21	Station	10/700	25	Yes	Yes
K.22	Within-Building	10/700	25	Yes	Yes

Model 587-PLUS Mainframe with Option 801-587, or Model 801-PLUS Mainframe

S1 0-6 kV, 100 kHz ring wave, at both 200 A and 500 A.

S1/S3• 0-6 kV, 100 kHz ring wave, at both 200A and 500A; plus Bi-Wave™ 1.2 × 50 μs peak open-circuit voltage, 0-6 kV; 8 × 20 μs peak short-circuit current, to ~3kA. This Surge Network is included in the Model 587-PLUS (ANSI/IEEE). (The same waves are generated by the basic Model 587, but without the plug-in network capability.)

Option 801-S1/S3 Adds selectable 10Ω resistor in series with basic Bi-Wave™ to permit independent, line-to-ground and neutral-to-ground surging of power mains as per IEC 801-5.

Model 587-PLUS with Option 801-587, or Model 801-PLUS

S3B Bi-Wave™ 1.2 x 50 μs peak open-circuit voltage, 0-6 kV; 8 x 20 μs peak short-circuit current, to 5 kA. (Undershoot in two-line-to-ground common mode ~ 50%.)

S3HV Bi-Wave™ 1.2 × 50 μs peak open-circuit voltage, 0-10 kV; 8 × 20 μs peak short-circuit current, to 5 kA.

HV-587

■ Meets MIL-S-19500/500A, MIL-S-19500/552 and MIL-STD 1399. As per IEC 1000-4-5/D (IEC 801-5), the 1.2/50 wave duration is reduced when the output impedance is raised to 12Ω and the wave is coupled to the ac line. Also as per IEC 1000-4-5/D (IEC 801-5), with the 12Ω impedance, short-circuit current is no longer 8/20 but starts to approach the 1.2/50 open-circuit voltage wave.

The KeyTek Bi-Wave™ has now been introduced into various international and national standards, in which it is referred to as the Combination Wave. Examples include IEC Pub 1000-4-5/D (IEC 801-5), ANSI/IEEE C62.41, UL 1449, etc.

• Also meets UL943 (GFCI's), UL217 and UL268 (Smoke Detectors). SAMA specifications, UL1449, IEC 255-4, 255-5, 255-6, 255-10, SEV 3313, SEN361503 and BEAMA 219.

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587 and 587-*PLUS*® Surge Generators, Options and Surge Networks (continued)

		Required Units and Options
MODEL 587-PLUS®		
PLUG-IN SURGE NETWORKS (continued)		
S4/5/6*	Provides the three new surge waves described in UL1449. All three are BiWaves.™† with peak open circuit voltage waves 1.2 x 50μs, 0-6 kV: peak short circuit current waves are 8 × 20μs, with Mode 1 to 750A, Mode 2 to 500A, and Mode 3 to 125A.	S4/5/6-587
S7	BiWave™ 1.2 × 50 μs peak open-circuit voltage, 0-6 kV; 8 × 20 μs peak short-circuit current, to 10 kA.	
S8	Provides a 4 × 10 μs short-circuit wave, with max peak of 10 kA; peak open-circuit voltage is 0-6 kV. Tolerances on short-circuit current front time and duration are both -0, +50%. Impulse is coupled to AC power line in line-to-line mode.	
S9†	FCC Docket 19528 Part 68 surges: < 10 × >160μs, 0-1500 V, 200 A max < 10 × >560μs, 0-800 V, 100 A max < 2 × > 10μs, 0-2500 V, 1 kA max (coupled to AC powerline)	S9-587
S9 A/B (LSSGR)†**	Three-terminal output, 0-2500V peak. ≤ 2 x ≥ 10 μs short-circuit current waveform. 500A per side. For telecom surging. (Not coupled to AC power line.)	
	Three-terminal output, 0-5kV peak, ≤ 2 × ≥ 10 μs short-circuit current waveform, 500 A per side. For telecom surging. (Not coupled to AC power line.)	
S21	CCITT Rec K.17 telecom surges: 10 × 700 μs, 0-6 kV; 100 × 700 μs, 0-5 kV; plus an additional .5 × 700 μs wave, 0-6 kV; with selectable damping R of 0, 2.5, and 25 ohms. CCITT Rec K.20 and Rec K.21 surges with optional, external coupling network: 10/700 μs, 0-6 kV, 2 × 25 ohms.	
S21H	Same as S21, except with a voltage capability of 0-7 kV for the .5 × 700 and 10 × 700 μs waves, 0-6 kV for the 100 × 700 μs wave.	S21H-587
Option H-S21	Conversion of existing S21 to S21H.	S21H-587
S21HV	Same as S21 for the 10/700μs wave only, with a voltage capability of 0-10kV.	HV-587
S29 (LSSGR)†**	True three-terminal network to produce a 10 × 1000 μs short-circuit current wave, 100A peak/side. (Not coupled to AC power line.) Peak open-circuit voltage is 1 kV max or 1.5 kV max, switch-selectable (100A peak/side applicable at 1 kV or 1.5 kV, respectively). Open-circuit voltage wave is ~ 8 × ~ 1200 for the 1 kV max selection, and ~ 7 × ~ 1300 for the 1.5 kV max selection.	See ■
S29C	Two terminal network for maximum energy testing of clamping protectors with energies to 400 Joules and clamping voltages to 3kV. Device current is ~ 10 × ~ 1000μs with peaks to 100A, short-circuit current is up to 200A max. Open-circuit voltage duration is > 10ms up to >5kV maximum. Maximum surge repetition rate is approximately one surge per 25 seconds.	See ■
Replacement only††		
S3/S21	Bi-Wave™ 1.2 × 50 μs peak open-circuit voltage, 0-6 kV; 8 × 20 μs peak short-circuit current, to ~3 kA. (For this wave, the mainframe back-filter is **not** disconnected automatically when the mainframe powerline circuit breaker is turned off; so voltage wave under-shoot may be 30-35%, usually of minor importance.) Also supplies CCITT Rec K.17 telecom surge waves: 10 × 700 μs, 0-6 kV; 100 × 700 μs, 0-5 kV; plus an additional .5 × 700 μs, 0-6 kV; with selectable damping R of 0, 2.5 and 25 ohms.	

* Waveforms specified for surging with surge line circuit breaker off (line to line). With the line breaker on, using the line coupler/filter, 125A waveforms will have significantly reduced peak and duration in common modes. Consult factory. Factory retrofit of 587-PLUS mainframe, and all plug-in units is required for units shipped prior to November 1, 1987 (serial numbers less than 8711000). Order option S4/5/6-587.

** Factory retrofit of 587-PLUS mainframe and all plug-in units is required for units shipped prior to October 1, 1988 (serial numbers less than 8810000). Order option S9-587.

† Note that for LSSGR waveforms, front time for both voltage and current is defined as 1.25 x risetime (or 1.25 x time from 10% to 90% of peak).

†† Preferred to the S3/S21 is a combination of S1/S3 and an S21; since the powerline back filter is automatically turned off for both the S1 and S3 waves when the breaker is off, and isn't connected at all for the S21 since it generates a telecom wave. An alternate is to use the M801-5 Network from the 801 Series. It contains all of the wave and circuit alternatives from the S3/S21, except the 2.5 ohm damping resistor selection and the 100/700 wave, both of which are no longer in significant use. Note: requires Option 801-587 for the Mainframe.

■ For Model 587s with serial numbers lower than 8711000, consult factory.

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587 and 587-*PLUS*® Surge Generators, Options and Surge Networks (continued)

CONVERSION OPTION

Option 801-587†

Modifications to 587-PLUS® Mainframe required in order to use the M801-5 Surge Network from the 801 Series of EFT and SURGE generators. This option in effect provides the same capabilities for the 587-PLUS® Mainframe that are built into the 801-PLUS™ Mainframe.

Option 801-587 is useful to permit procurement of a generator with the 587 model number, which can still meet the new international 801 standards, and to permit upgrading existing systems that are based on 587-PLUS® Mainframes.

NOTE: 587-PLUS Mainframes which do not have all four ac power line coupling modes (Option M before it was incorporated into the basic 587-PLUS Mainframe), should be upgraded to include them via adding Option M, in order to meet the IEC 1000-4-5/D (IEC 801-5) standard. In addition, upgrade to 20A AC rms via Option F1-587 may also be desirable; it is not included in Option 801-587.

OTHER OPTIONS

F1-F5

Basic Model 587 maximum surge line current is 10A rms, and maximum surge line voltage, both line-to-line and line-to-ground, is 277V rms. Options F1-587 through F5-587 increase maximum surge line current and/or line-to-line voltage capabilities to the indicated values. (Note: Line-to-ground voltage remains 277V rms.)

	Maximum line-to-line surge line rms voltage	Maximum surge line rms current
F1-587	277 V	20 A
F3-587	277 V	30 A
F2-587*	480 V*	10 A
F4-587*	480 V*	20 A
F5-587*	480 V*	30 A

G33-587** Wiring and signal cable connector required in the Model 587-PLUS for use with three phase coupler/filter Model G33-(277/480)-20 or G33-(277/480)-30.

HV-587** Factory modifications to Model 587-PLUS mainframe required for use with waveforms having open circuit voltage peaks to 10 kV.

I-587** Surge Current Monitor: provides output surge current monitoring via front-panel BNC for connection to oscilloscope. (10 V/kA) Now standard with any 587 mainframe.

*F2, F4 and F5, 480 V options, are only available with Model 587-PLUS; not available with Model 587.

** Includes recalibration.

† If retrofit is ordered more than one year after initial shipment, must include Model 587-PLUS recalibration.

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587 and 587-*PLUS*® Surge Generators, Options and Surge Networks (continued)

OTHER OPTIONS (continued)

M-587*	High/ground and low/ground coupling modes. Now standard with any 587.
RC-587*	Provides external connections to remotely control charge and pulse functions of any 587 mainframe (now standard with any 587 mainframe).
R-587	Rackmount handles and appropriate holes in side covers through which the handles mount, when ordered with initial shipment of a Model 587 or 587-PLUS. Four holes must be drilled by user in each side cover (using existing pilot positions) to add rack-mount handles after initial shipment. Feet must be removed before rack mounting. (Cabinet angle brackets etc. to be user-supplied.)
R-G33	Same as R-587, except for any G33 coupler/filter.
S4/5/6-587*	Factory retrofit of 587-PLUS mainframe for compatibility with S4/5/6 plug-in surge network. Required only for 587 mainframes with serial numbers less than 8711000. Includes modification to all existing customer plug-ins, and recalibration.
S9-587**	Factory retrofit of 587-PLUS mainframe for compatibility with S9 plug-in surge network. Required only for 587 mainframes with serial numbers less than 8810285. Includes modification to all existing customer plug-ins.
S21H-587**	Factory retrofit of 587-PLUS Mainframe for compatibility with S21H, 7 kV plug-in Surge Network.

OUTPUT TERMINAL COVERS WITH BUILT-IN AC OUTPUT SOCKETS

C1-587	Removable interlocked output terminal cover, with opening for (user-supplied) output wires. Included with initial shipment of all Model 587 generators.
C-SCHUKO†	Removable interlocked output terminal conversion cover, with built-in, 16A SCHUKO European output socket, for Model 587 and Model 587-PLUS® with AC surge line currents up to and including 16A, up to 240 V.
C-UK†	Removable interlocked output terminal conversion cover, with built-in, 16A United Kingdom output socket, for Model 587 and Model 587-PLUS® with AC surge line currents up to and including 16A, up to 240 V.
C277-20†	Removable interlocked output terminal conversion cover, with built-in, 20A AC output socket, for any Model 587 generator with AC surge line currents up to and including 20A, up to 277V. (Was C2-587.)
C277-30†	Same as C277-20 except for 30A. Includes NEMA L7-30P plug for user termination.
C480-30†	Removable interlocked output terminal conversion cover, with built-in 480V AC output socket, for Model 587-PLUS with ac surge line voltage to 480V line-to-line, and with ac surge line currents up to and including 30A. Includes unwired, mating NEMA L8-30P plug for user termination. (Was C3-587.)

ACCESSORIES

L-587	Front-panel output links to connect V Monitor high and low to Output high and low terminals, respectively. Included with all 587 and 587-PLUS mainframes.
T1-587	Telephone plug for mating with front-panel external interlock jack (gold plated for signal currents).
T2-587	Telephone plug terminated into shielded 6-foot cable with identical terminating plug, for use with front-panel external interlock jack (both plugs gold plated for signal currents).
T3-587	Telephone jack for mounting in user test fixture, for external interlock use. Mates with remote end of cable in Option T2-587.
TC-587-1	Transit case for Model 587 or Model 587-PLUS, including places for standard accessories: C1-587, ac power cord, surge-line power cord.
TC-587-2	Transit case for one Model 587-PLUS Surge Network.
PK1001D	Differential, 6kV, 10 ns risetime surge and transient probe (10K input impedance each input.) Not for EFT measurements.
PK1002D	Same as PK1001D, except 10kV, and risetime < 15 ns.

* Includes recalibration

** If retrofit is ordered more than one year after initial shipment, must include Model 587-PLUS recalibration.

† Appropriate cover is highly recommended. C480-30 not available for units with serial numbers prior to 8901001.

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587 and 587-*PLUS*® Surge Generators, Options and Surge Networks (continued)

		Required Options
ACCESSORIES (continued)		
Model 455 Component Test Fixture	The Model 455 is a test fixture which extends both the front panel output and monitor terminals of the 587, 587-PLUS® or 801-PLUS™ mainframes to 5-way binding posts under a hinged and fully interlocked cover. The test fixture connects to the mainframe with a special low inductance cable (approximately 1 ft. long). The cable is terminated with a plug that mates directly with the mainframe output terminals. The Model 455 provides optimum waveform and measurement performance for component surge testing. The interlocked cover is clear lexan and features safe and convenient access for making connections to the components under test. Components may be powered during test, from the surge line AC (or DC) power input voltage of the mainframe's coupler/filter. Opening the cover of the test fixture operates the mainframe's interlock system, removing line voltage from the test fixture terminals and preventing any high voltage surges from reaching the terminals of the test fixture. The Model 455 also features built-in differential voltage monitor capability via the internal voltage monitors in the surge generator mainframe. The voltage monitor inputs are brought to 5-way binding posts under the test fixture's cover in addition to the surge/filter outputs. They can be connected to the component's leads with short jumpers or to the output binding posts using the connecting links provided.	
THREE-PHASE COUPLER/FILTERS		
G33-(277/480)-20 Three-Phase Line Coupler/Filter	The Model G33 is designed for coupling voltage surges to 6 kV peak, with durations up to 50 μs, to equipment powered by a three-phase, five wire ac source, to 277 VAC (65 VDC) line-to-ground, 480 VAC line-to-line. Maximum continuous ac surge line current is 20A. Surge coupling modes include all significant normal and common modes, including all three phases with respect to neutral and all three phases plus neutral with respect to ground. Couples AC powerline surges from Models S1/S3, S4/5/6, etc. The G33 includes a back-filter to prevent surging the line itself, plus a complete interlock system and the cables required to connect to the Model 587-PLUS or the Model 801-PLUS Surge Generator. The Model G33-(277/480)-20 includes an EUT power cable (surge line input) terminated with a NEMA L22-20P, 277/480 20A 3-phase plug. (Other connectors are also available; consult factory.) As specified in IEC 1000-4-5/D (IEC 801-5) and other related specifications, there will be some reduction in voltage durations and amplitudes when surging multiple line combinations.	G33-587 (or G33-801)
G33-(277/480)-30 Three-Phase Line Coupler/Filter	Same as Model G33-(277/480)-20, except maximum continuous ac surge line current is 30A; terminated in NEMA L22-30P, 277/480 30A 3-phase plug.	G33-587 (or G33-801)
Option 30-G33	Conversion of Model G33-(277/480)-20 to Model G33-(277/480)-30.	

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