RENTAL
ELPA-SINE

ADVANCED AC/DC ELECTRONIC LOAD

ETPS
ELECTRONIC TEST & POWER SYSTEMS

POSITIVE PROBLEM SOLVING ➕ ═

The ELPA-SINE is an advanced series of electronic loads, aimed at both AC and DC test applications. A comprehensive feature set is provided, as well multiple inbuilt tests.

When in constant current operation the user can select between sine, square and DC waveforms. Peak currents can be simulated with the crest factor mode. A power factor can be set with adjustments from unity to 0 lagging or leading. The desired wave can be recalled from the front panel or selected via an optional computer interface. A turbo mode is included as standard. This provides the ability to test currents up to double the maximum current range for up to 1 second, ideal for inrush current testing.

+ **Sine, Step & Squarewave Loading Functions**
+ **Adjustable Leading & Lagging Power Factor**
+ **CC, CV, CP, CR & Crest Factor Mode**
+ **Last Setting Memory Function**
+ **DC to 440Hz Operation**
+ **Inbuilt Battery Tests**

CONTENTS

STANDARD MODELS

SELECTION TABLE

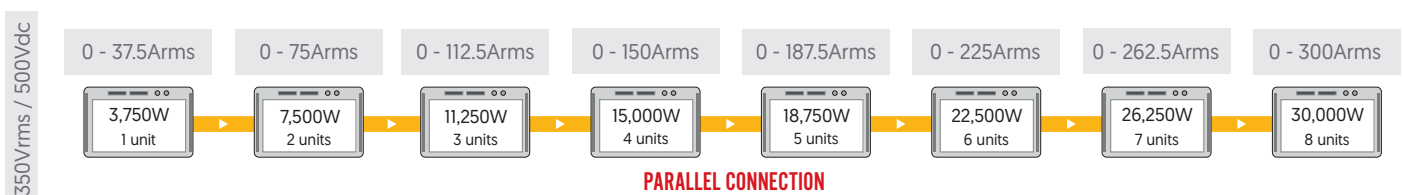| Part Number	Max Power	Maximum Voltage	Current Range
ELPA-SINE 3750-r	3750W	350Vrms / 500Vdc	0 - 37.5Arms

OPERATING RANGE

The ELPA-SINE is able to operate at maximum current across most of its voltage range. This allows one system to test many different types of AC and DC devices. When operating below 50V, the maximum amount of current that the load can sink decreases. Example values for this derating at low voltages are provided below.

3750-r AC Power Curve

3750-r DC Power Curve
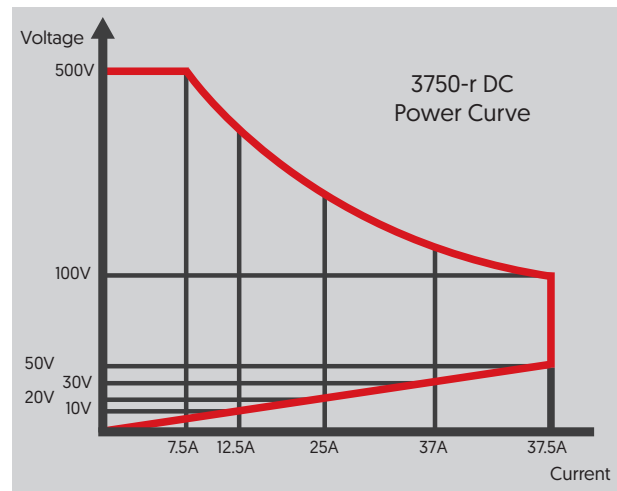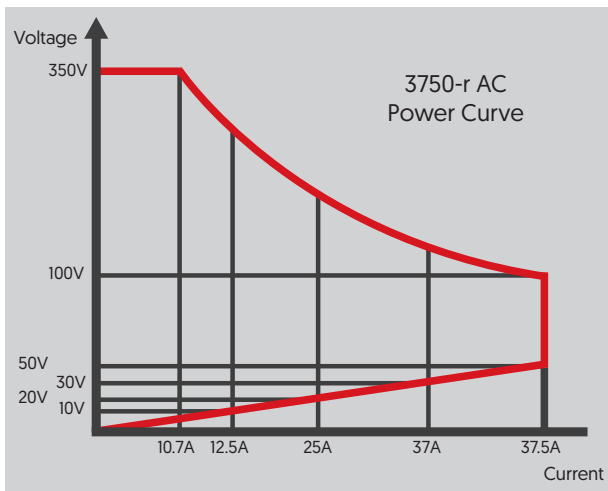
MASTER-SLAVE CAPABILITY

Our rental system can be combined in parallel with any ELPA-SINE 3750 units you have previously purchased, providing they have the same nominal outputs. This allows any short term requirements outside of usual operating ranges to be met. Up to 8 ELPA-SINE systems can be arranged in single phase parallel connection.

The current is actively shared between each load. The ammeter of the master unit shows the total current that is the sum of all ammeters, The voltmeters of the slaves will show SL1 and SL2.

350Vrms / 500Vdc

0 - 37.5Arms	0 - 75Arms	0 - 112.5Arms	0 - 150Arms	0 - 187.5Arms	0 - 225Arms	0 - 262.5Arms	0 - 300Arms
3,750W 1 unit	7,500W 2 units	11,250W 3 units	15,000W 4 units	18,750W 5 units	22,500W 6 units	26,250W 7 units	30,000W 8 units

PARALLEL CONNECTION

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GENERAL SPECIFICATIONS

STANDARD FEATURES

TECHNICAL DATA	
Maximum Power	3750W
Current Range	37.5Arms / 112.5Apeak
Voltage Range	50-350Vrms / 50-500Vdc
Frequency Range	DC, 40-440Hz (CC, CP Mode), DC-440Hz (LIN, CR, CV Mode)
Master/Slave Functionality	Yes, up to eight identical single phase units can be connected in parallel
External Programming Input	F.S. / 10Vdc, Resolution 0.1V (Optional)
External SYNC Input	TTL
Vmonitor (Isolated)	±500V / ±10V
Imonitor (Isolated)	±112.5Apk / ±10Vpk
Interface (Option)	GPIB, RS-232, LAN, USB
Operating Temperature	0 to 40°C (accuracy of the specifications provided are valid at 25°C ±5°C)
Current of Input Impedence	~V*0.6 ; ~V*4.4
Weight	33.5kg
Start Up Loading	Yes, power on loading during inverter / UPS start up
Load ON/OFF Angle	0-359 degree can be programmed for the angle of load ON and load OFF loading
Half Cycle & SCR/TRIAC Loading	Positive or negative half cycle, 90˚ trailing edge or leading edge current waveform can be programmed

HIGHLIGHTED FEATURES

FRONT PANEL MEMORY

150-state memory allows quick initialisation and limit setting of the unit. Common test routines can be saved and executed at the touch of a button.
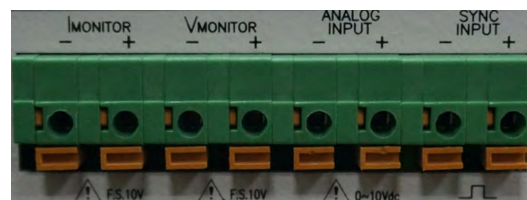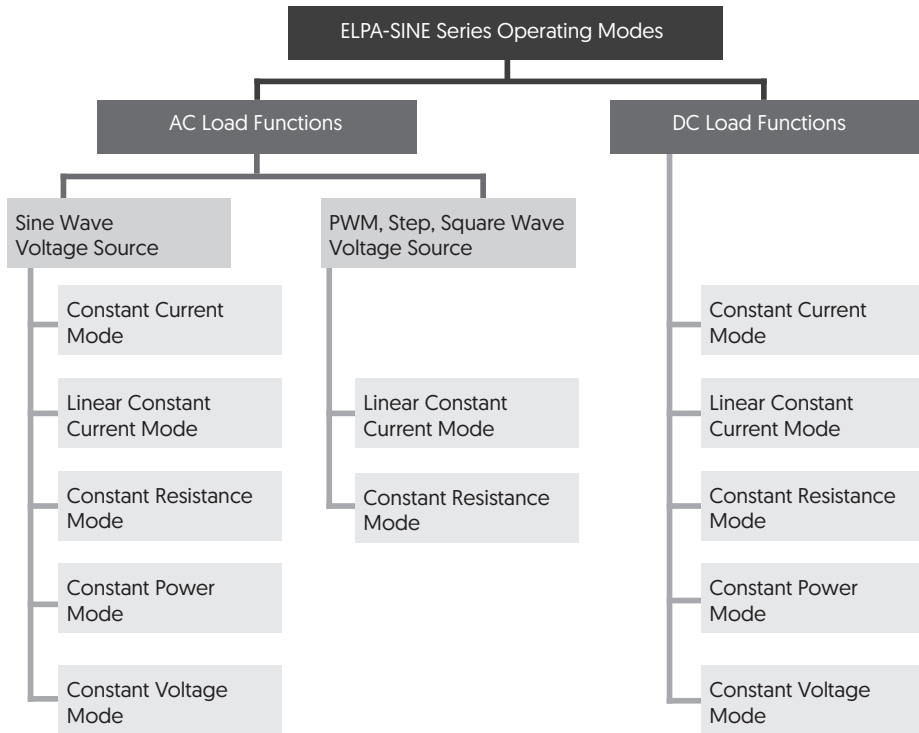
SEQUENCING FUNCTION

A sequencing function means that stored settings can be implemented against time, enabling the unit to carry out complex test routines without the need for a computer interface.

LAN INTERFACE

A remote control LAN interface is provided on the rear panel. Commands are detailed in the manual. Other interfaces such as RS-232, GPIB and USB may be available on request. Please contact ETPS if you have a particular preference.

ANALOGUE INTERFACE

The ELPA-SINE has an analogue programming input available on the rear panel of the load. The analogue programming input enables the load module to track and load according to an external 0-10V signal applied to the analogue terminal. The ELPA-SINE will attempt to load proportionally according to the signal and the load's maximum current or power range.
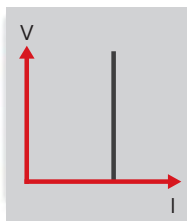
OPERATING MODES

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                    ┌─────────────────────────────────┐
                    │  ELPA-SINE Series Operating Modes │
                    └─────────────────────────────────┘
                ┌──────────────┴──────────────┐
     ┌──────────────────┐           ┌──────────────────┐
     │ AC Load Functions │           │ DC Load Functions │
     └──────────────────┘           └──────────────────┘
```

Sine Wave Voltage Source	PWM, Step, Square Wave Voltage Source	DC Load Functions
Constant Current Mode		Constant Current Mode
Linear Constant Current Mode	Linear Constant Current Mode	Linear Constant Current Mode
Constant Resistance Mode	Constant Resistance Mode	Constant Resistance Mode
Constant Power Mode		Constant Power Mode
Constant Voltage Mode		Constant Voltage Mode

CONSTANT CURRENT MODE FOR SINE-WAVE
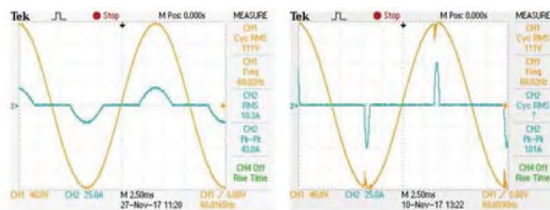
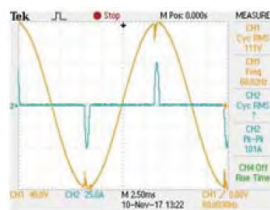| TECHNICAL DATA	
Range	0-37.5A
Resolution	0.625mA/16bits
Accuracy	±(0.1% of setting + 0.2% of range) at 50/60Hz

In constant current mode, crest factor and power factor tests can be performed on sine wave voltage sources.
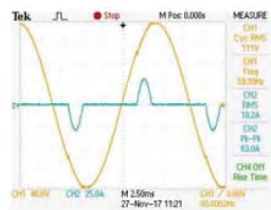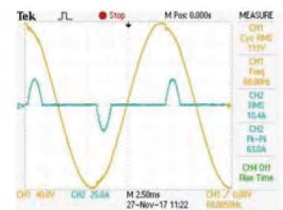

CC Mode

CC mode, Crest Factor = 2

CC mode, Crest Factor = 5

CC mode, Power Factor = +0.5

CC mode, Power Factor = -0.5

This is the most commonly used mode of operating when testing a voltage source. In this mode of operation, the load will sink a constant level of current as set by the user regardless of any voltage variations. A real time feedback loop ensures a stable current under any voltage variation of the DUT. This mode is recommended for load regulation testing, loop stability testing, battery discharge testing and any other form of voltage regulation loop testing.

OPERATING MODES

## LINEAR CC MODE FOR SINE-WAVE, SQUARE-WAVE OR QUASI-SQUARE WAVE, PWM WAVE

LINEAR CC MODE FOR SINE-WAVE, SQUARE-WAVE OR QUASI-SQUARE WAVE, PWM WAVE	
Range	0-37.5A
Resolution	0.625mA/16bits
Accuracy	±(0.1% of setting + 0.2% of range) at 50/60Hz

In linear constant current mode, both sine wave and non-sine wave voltage sources can be tested. The examples below show the testing of a PWM inverter driver step voltage source, as well as an offline UPS sine wave switch to square wave and a square wave switch to a sine wave waveform.
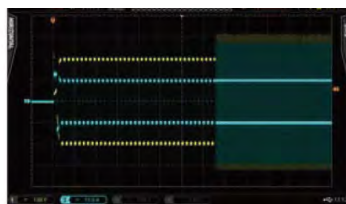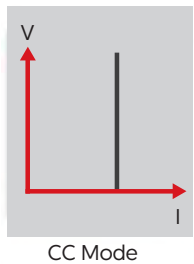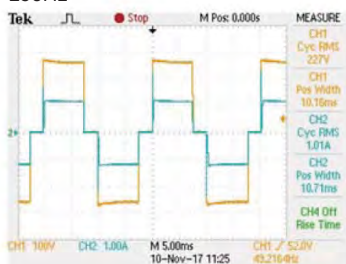

CC Mode

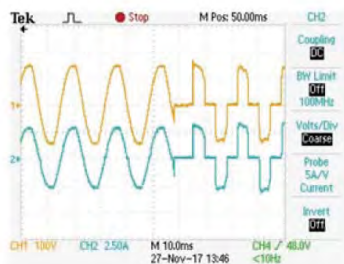Linear CC Mode, PWM 10A 2.5Hz to 250Hz
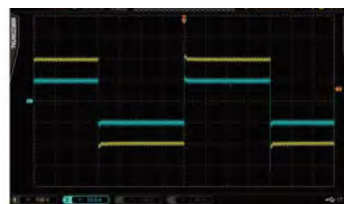
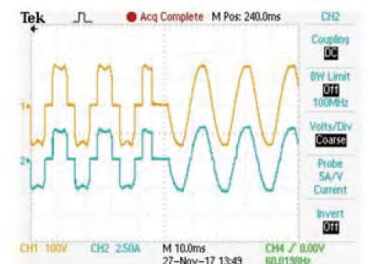Linear CC Mode, PWM 10A 2.5Hz

Linear CC Mode, PWM 10A 250Hz

Linear CC Mode, Step 10A

Linear CC Mode, UPS Sine to Square Waveform

Linear CC Mode, UPS Square to Sine Waveform

In this mode the load current input depends on the current setting, regardless of the input voltage (i.e. the current setting remains unchanged). The load input current signal will follow the input voltage signal which is useful for step or square waveform devices. The automatic gain control circuit responds almost instantly to adjust for a sudden increase in input voltage. This fast voltage transient response makes is especially suitable for non-sinusoidal AC voltage inputs such as step waveforms, square waveforms and any AC input voltage with a highly distorted waveform.

OPERATING MODES

| CONSTANT RESISTANCE MODE	
Range	1.6Ω - 32kΩ
Resolution [1]	0.010416mS/16bits
Accuracy	±0.2% of (setting + range) at 50/60Hz
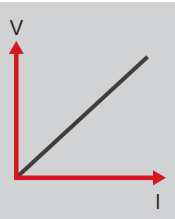
In this mode the ELPA-SINE will sink a current linearly proportional to the load input voltage in accordance with the programmed resistance setting. This mode is useful for discharge testing of battery systems used to power constant impedance loads, as the voltage decreases over time as the battery discharges resulting in reduced current sinking.
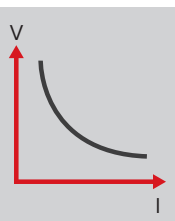
CONSTANT VOLTAGE MODE	
Range	50-350Vrms / 500Vdc
Resolution	0.1V
Accuracy	±(0.1% of setting + 0.1% of range) @ 50/60Hz
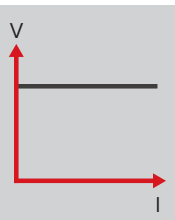
The ELPA-SINE will attempt to sink enough current until the load input voltage reaches the programmed value. Most power sources are voltage controlled (i.e. they regulate the output voltage to a predefined voltage level). Such voltage supplies should not be tested using CV mode, as the supply voltage regulation loop will conflict with the load control loop.

CONSTANT POWER MODE	
Range	3750W
Resolution	0.1W
Accuracy	±(0.1% of setting + 0.1% of range) @ 50/60Hz

The ELPA-SINE will attempt to sink load power (load voltage × load current) in accordance with the programmed power. Constant power mode is useful for battery discharge testing as it simulates constant power drain on the battery, regardless of battery charge state.

CREST FACTOR (CC & CP MODE ONLY)	
Range	√2 - 5
Resolution	0.1
Accuracy	(0.5% / Irms) + 1%F.S.

POWER FACTOR (CC & CP MODE ONLY)	
Range	0 to 1 Lagging or Leading
Resolution	0.01
Accuracy	1% F.S.

[1] 1 mS (millisiemens) is the unit of conductance (G). One siemens is equal to 1kΩ.

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TEST MODES

AC TESTS

- UPS Efficiency
- UPS Back-up Time
- UPS Transfer Time
- Rectifier Load
  - Non-linear Mode
  - Non-linear Mode + Constant Resistance
- PV Inverter Efficiency
- Fuse / Breaker Trip / Non-trip Time
- Turbo Mode [Current / Power × 2]
  - Fuse / Breaker Trip / Non-trip Time
  - AC Power Source Short Circuit / OPP / OCP
- AC Power Source Short Circuit / OPP / OCP

DC TESTS

- Battery Discharge Time
- Battery Discharge Capacity
- Rectifier Load
  - Non-linear Mode
  - Non-linear Mode + Constant Resistance
- Fuse / Breaker Trip / Non-trip Time
- DC Power Source Short Circuit / OPP / OCP
- Turbo Mode [Current / Power × 2]
  - Fuse / Breaker Trip / Non-trip Time
 - DC Power Source Short Circuit / OPP / OCP

## RECTIFIED LOAD SIMULATION FOR IEC62040-3 AND IEC61683 TEST SPECIFICATIONS

The rectifier load mode is fully compliant with IEC test specification requirements for the UPS, IEC 62040-3 UPS Efficiency Measurement Non-Linear and IEC 61683. The rectifier load mode uses CC + CR load mode and maintains current THD at 80%, to simulate the actual PV Inverter connected to the electronic device.
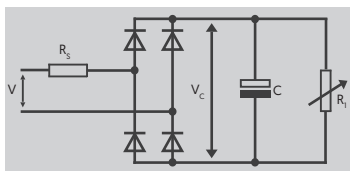
Rectifier Load Mode
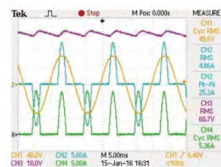
The actual V / A waveform
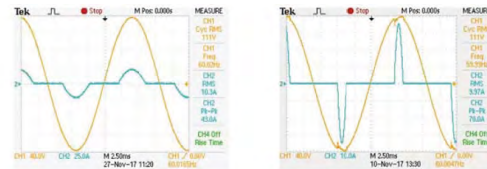
Non-Linear CC mode for UPS test
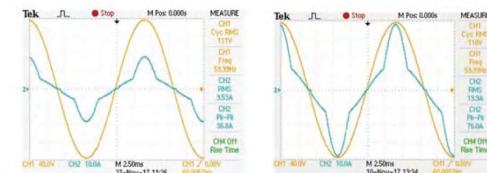
110V, 5A + 22ohm Test

110V, 10A + 11ohm Test

PV Inverter test Non-Linear CC + Resistive mode (CC+CR)

## MEASURING EFFICIENCY FOR PV SYSTEMS, POWER CONDITIONERS FOR THD 80%

TECHNICAL DATA	
Mode Type	Resistive + non-linear mode
Operating Frequency	Auto ; 40-440Hz
Current Range	0 - 37.5A
Resistive Range	1.6Ω - 32kΩ

TEST MODES

## BATTERY DISCHARGE FUNCTION (CC,LIN,CR,CP)

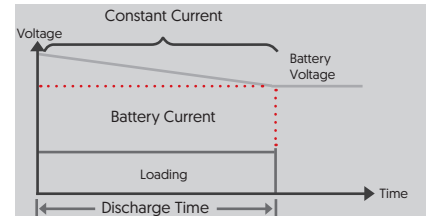| TECHNICAL DATA	
UVP (VTH)	50 - 350Vrms/500Vdc
Battery Discharge Time	1-99999 Sec. (>27H)

The ELPA-SINE has three inbuilt battery discharge tests The test results can be directly displayed on the LCD display for battery AH capacity, the voltage value after discharge and the cumulative discharge time.
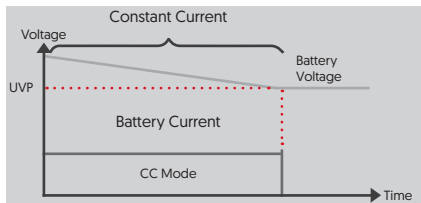
CC + UVP Battery Discharge Mode
(Test 1)
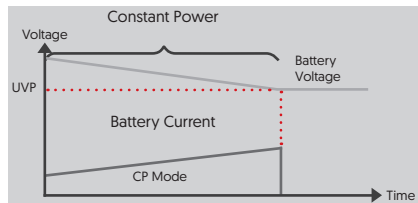
CP + UVP Battery Discharge Mode
(Test 2)

Programmed Battery Discharge Time
(Test 3)

TURBO MODE

TECHNICAL DATA	
Maximum Current (for up to 1 second)	75Arms (ON) (×2)[2], 37.5Arms (OFF)

FUSE TEST MODE

TECHNICAL DATA	
Trip / Non-Trip Time	0.1s - 1s (ON) / 0.1s - 9999.9s (OFF)
Meas. Accuracy	±0.003 seconds
Repeat Time	0-255

SHORT/OPP/OCP TEST FUNCTION

TECHNICAL DATA	
Short Time (TURBO ON/OFF)	0.1s-1s / 0.1s-10s or cont.
OPP/OCP Step Time (TURBO ON/OFF)	100ms, up to 10 steps / 100ms
OCP Istop (TURBO ON/OFF)	75Arms (ON)[2], 37.5Arms (OFF)
OPP Pstop (TURBO ON/OFF)	7500W (ON), 3750W (OFF)

[2] Turbo mode for up to 2 × the Current and Power rating support Fuse, Short/OCP/OPP test function

HIGHLIGHTED FEATURE

CURRENT PROTECTION COMPONENT TEST

The ELPA-SINE provides a special fuse test function for the verification of current protection components (e.g. fuses, circuit breakers, PTC resettable fuses). This can test and verify protection devices using the rated current and power of the device under test. There are 2 types of fuse test, Trip (fuse) and Non-Trip (no fuse). Fuse test setting parameters include test current, test time and number of test repeats.

Turbo OFF, Fuse Mode

Turbo OFF, Fuse ON,
CC Pulse 75A, 2s

Turbo OFF, Fuse ON,
CC Pulse 75A, 2s

Turbo ON, Fuse Mode

Turbo ON, Fuse ON,
CC Pulse 150A, 1s

Turbo ON, Fuse ON,
CC Pulse 150A, 1s

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TEST MODES

UPS EFFICIENCY MEASUREMENT

TECHNICAL DATA	
Mode Type	Non-linear mode
Operating Frequency	Auto ; 40-440Hz
Current Range	0 - 37.5A
PF Range	0 to 1

UPS BACK-UP FUNCTION (CC,LIN,CR,CP)

TECHNICAL DATA	
UVP (VTH)	50 - 350Vrms / 500Vdc
UPS Back-Up Time	1 - 99999 seconds (>27H)

UPS TRANSFER TIME

TECHNICAL DATA	
Current Range	0 - 37.5A
UVP (VTH)	2.5V
Time Range	0.15ms-999.99ms

HIGHLIGHTED FEATURE

∿ SPECIAL UPS WAVEFORM APPLICATIONS

Many UPSs feature a modified sinewave which is designed to alternate load current on and off in order to simulate a sinewave. This is designed to create a waveform of 1ms on and 1ms off at 50Hz or 60Hz. This is typically a lower cost approach than producing a pure sinewave. The ELPA-SINE can be used to demand this type of waveform from the DUT. The plot shows a 110V/60Hz waveform in constant current mode set at 5A (Yellow CH1=Voltage; Blue CH2 = Current).

PROGRAMMABLE INRUSH CURRENT SIMULATION: ISTART - ISTOP / TSEP

TECHNICAL DATA	
Istart, Inrush Start Current	0 - 75A
Inrush Step Time	0.1ms - 100ms
Istop, Inrush Stop Current	0 - 37.5A

PROGRAMMABLE SURGE CURRENT SIMULATION: S1/T1 - S2/T2 - S3/T3

TECHNICAL DATA	
S1 and S2 Current	0 - 75A
T1 and T2 Time	0.01s - 0.5s
S3 Current	0 - 37.5A
T3 Time	0.01s - 9.99s or continuous

TEST MODES

PROGRAMMABLE INRUSH CURRENT SIMULATION: ISTART - ISTOP / TSEP

TECHNICAL DATA	
Istart, Inrush Start Current	0 - 75A
Inrush Step Time	0.1ms - 100ms
Istop, Inrush Stop Current	0 - 37.5A

PROGRAMMABLE SURGE CURRENT SIMULATION: S1/T1 - S2/T2 - S3/T3

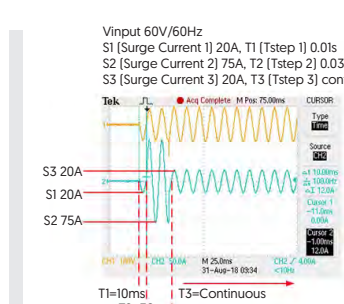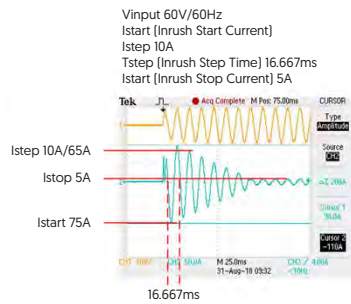| TECHNICAL DATA	
S1 and S2 Current	0 - 75A
T1 and T2 Time	0.01s - 0.5s
S3 Current	0 - 37.5A
T3 Time	0.01s - 9.99s or continuous

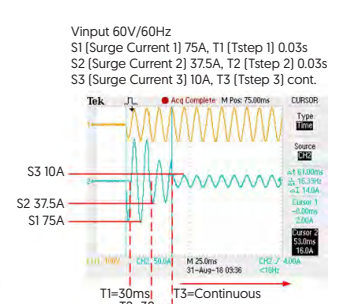# HIGHLIGHTED FEATURE

INRUSH AND SURGE CURRENT TESTING

When applying AC power to a rectifier capacitor input circuit of a load, there is an inrush of current which decays. The ELPA-SINE's inrush mode is unique in that the load does not need to sync up to the AC input voltage before applying current. A typical decaying inrush current when applying AC power to a rectifier capacitor input circuit of a load is shown below.

Vinput 60V/60Hz
Istart (Inrush Start Current)
Istep 10A
Tstep (Inrush Step Time) 8.333ms
Istart (Inrush Stop Current) 5A

Istep 10A/65A
Istop 5A
Istart 75A

8.33ms

Vinput 60V/60Hz
Istart (Inrush Start Current)
Istep 10A
Tstep (Inrush Step Time) 16.667ms
Istart (Inrush Stop Current) 5A

Istep 10A/65A
Istop 5A
Istart 75A

16.667ms

Vinput 60V/60Hz
S1 (Surge Current 1) 20A, T1 (Tstep 1) 0.01s
S2 (Surge Current 2) 75A, T2 (Tstep 2) 0.03s
S3 (Surge Current 3) 20A, T3 (Tstep 3) cont.

S3 20A
S1 20A
S2 75A

T1=10ms
T2=30ms
T3=Continuous

Vinput 60V/60Hz
S1 (Surge Current 1) 75A, T1 (Tstep 1) 0.03s
S2 (Surge Current 2) 37.5A, T2 (Tstep 2) 0.03s
S3 (Surge Current 3) 10A, T3 (Tstep 3) cont.

S3 10A
S2 37.5A
S1 75A

T1=30ms
T2=30ms
T3=Continuous

INRUSH CURRENT TEST AT POWER ON

SURGE CURRENT TEST WHEN THE APPLIANCE IS CONNECTED

PROTECTION

STANDARD FEATURES

TECHNICAL DATA	
Over Power Protection	≈3937.5Wrms or programmable
Over Current Protection	≈39.375Arms or programmable
Over Voltage Protection	≈367.5Vrms / 525Vdc
Over Temperature Protection	Yes

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MEASUREMENTS

VOLTAGE READBACK VOLTMETER

TECHNICAL DATA	
Range	500V
Resolution	0.01V
Accuracy	±0.05% of (reading + range)
Parameter	Vrms,V Max/Min,+/-Vpk

CURRENT READBACK AMMETER

TECHNICAL DATA	
Range	18.75Arms / 37.5Arms
Resolution	0.4mA / 0.8mA
Accuracy	±0.05% of (reading + range) at 50/60Hz, ±0.2% of (reading + range)
Parameter	Irms,IMax, IMin,+/-Ipk

POWER READBACK WATTMETER

TECHNICAL DATA	
Range	3750W
Resolution	0.0625W
Accuracy	±0.1% of (reading + range)
VA Meter	Vrms × Arms Correspond To Vrms and Arms

MISCELLANEOUS

POWER FACTOR METER	
Range	±0.000-1.000
Accuracy	±{0.002 ± (0.001/PF) × F}

FREQUENCY METER	
Range	DC, 40-440Hz
Accuracy	0.1%

METERS FOR OTHER PARAMETERS	
Values	VA , VAR , CF_I , Ipeak , Imax. , Imin. , Vmax. , Vmin. , I_{HD} , V_{HD} , I_{THD} , V_{THD}

Every effort is made to ensure that the information provided within this technical summary is accurate. However, ETPS Ltd must reserve the right to make changes to the published specifications without prior notice. Where certain operating parameters are critical for your application we advise that they be confirmed at the time of order. ETPS Ltd specialises in modifying its proven platforms to suit your needs. Please contact our office if your requirement is non-standard. Please note that your actual unit may differ from those shown.

> # "WE ARE POSITIVE PEOPLE"

ETPS engineer electronic power supply and testing systems. Our problem solving skills provide the spark of innovation to some of the world's leading technology brands.

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POSITIVE **PROBLEM SOLVING**