GOSSEN METRAWATT

# SECULIFE ESPRO
## ELECTROSURGICAL UNIT ANALYZER

3-349-624-03
1/5.11

## Contents

---

## WARNING - USERS
**The SECULIFE ES**PRO** Analyzer is for use by skilled technical personnel only.**

## WARNING - USE
**The SECULIFE ES**PRO** Analyzer is intended for testing only and he should never be used in diagnostics, treatment or any other capacity where they would come in contact with a patient.**

## WARNING - MODIFICATIONS
**The SECULIFE ES**PRO** Analyzer is intended for use within the published specifications. Any application beyond these specifications or any unauthorized user modifications may result in hazards or improper operation.**

## WARNING - CONNECTIONS
**All connections to patients must be removed before connecting the Device Under Test (DUT) to the Analyzer. A serious hazard may occur if the patient is connected when testing with the Analyzer. Do not connect any leads from the patient directly to the Analyzer or DUT.**

## WARNING - POWER ADAPTOR
**Unplug the Power Adaptor before cleaning the surface of the Analyzer.**

## WARNING - LIQUIDS
**Do not submerge or spill liquids on the Analyzer. Do not operate the Analyzer if internal components not intended for use with fluids may have been exposed to fluid, as the internal leakage may have caused corrosion and be a potential hazard.**

---

---

```
CAUTION - SERVICE
The SECULIFE ESPRO Analyzer is intended to be
serviced only by authorized service personnel.
Troubleshooting and service procedures should
only be performed by
qualified technical personnel.
```

```
CAUTION - ENVIRONMENT
The SECULIFE ESPRO Analyzer is intended to
function between 15 and 30 °C.
Exposure to temperatures outside this range can
adversely affect the performance of the Analyzer.
```

```
CAUTION - CLEANING
Do not immerse. The Analyzer should be cleaned
by wiping gently with a damp, lint-free cloth.
A mild detergent can be used if desired.
```

```
CAUTION - INSPECTION
The SECULIFE ESPRO Analyzer should be
inspected before each use for wear and
the Analyzer should be serviced
if any parts are in question.
```

---

CE

EG - KONFORMITÄTSERKLÄRUNG
DECLARATION OF CONFORMITY

GMC-I ◢ MESSTECHNIK

| | |
|---|---|
| Dokument-Nr./ Document.No.: | 820 / 11-017 |
| Hersteller/ Manufacturer: | GMC-I GOSSEN-METRAWATT GMBH |
| Anschrift / Address: | Südwestpark 15 D - 90449 Nürnberg |
| Produktbezeichnung/ Product name: | Electrosurgical Analyzer Electrosurgical Analyzer |
| Typ / Type: | SECULIFE ES Pro |
| Bestell-Nr / Order No: | M 6 9 5 B |

Das bezeichnete Produkt stimmt mit den Vorschriften folgender Europäischer Richtlinien
überein, nachgewiesen durch die vollständige Einhaltung folgender Normen:

The above mentioned product has been manufactured according to the regulations
of the following European directives proven through complete compliance with the
following standards:

| Nr. / No. | Richtlinie | Directive |
|---|---|---|
| 2006/95/EG 2006/95/EC | Elektrische Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen - Niederspannungsrichtlinie – Anbringung der CE-Kennzeichnung : 2011 | Electrical equipment for use within certain voltage limits - Low Voltage Directive - Attachment of CE mark : 2011 |

| EN/Norm/Standard | IEC/Deutsche Norm | VDE-Klassifikation/Classification |
|---|---|---|
| EN 61010-1 : 2001 | IEC 61010-1 : 2001 | VDE 0411-1 : 2002 |

| Nr. / No. | Richtlinie | Directive |
|---|---|---|
| 2004/108/EG 2004/108/EC | Elektromagnetische Verträglichkeit - EMV Richtlinie - | Electromagnetic compatibility - EMC directive - |

Fachgrundnorm / Generic Standard

EN 61326-1 : 2006

Nürnberg, den 10.02.2011
_____
Ort, Datum / Place, date:

_____
Geschäftsführung / managing director

# NOTICE – SYMBOLS

| Symbol | Description |
|---|---|
|  | **Caution** <br> **(Consult Manual for Further Information)** |
|  | **RF Current Transformer** |
|  | **Per European Council Directive 2002/95/EC, do not dispose of this product as unsorted municipal waste.** |

# NOTICE – ABBREVIATIONS

| | |
|---|---|
| **Amps** | **Ampheres** |
| **c** | **centi- ($10^{-2}$)** |
| **C** | **Celsius** |
| **CF** | **Crest Factor** |
| **°** | **degree** |
| **DFA** | **Digital Fast Acquisition** |
| **DUT** | **Device Under Test** |
| **hrs** | **hours** |
| **Hz** | **hertz** |
| **k** | **kilo- ($10^{3}$)** |
| **kg** | **kilograms** |
| **kHz** | **kilohertz** |
| **lbs** | **pounds** |
| **L1, L2, L3** | **Location 1, 2, 3** |
| **M** | **Mega- ($10^{6}$)** |
| **MHz** | **Megahertz** |
| **µ** | **micro- ($10^{-6}$)** |
| **µA** | **microampere** |
| **m** | **milli- ($10^{-3}$)** |
| **mA** | **milliampere** |
| **mHz** | **millihertz** |
| **mm** | **millimeter** |
| **ms** | **millisecond** |
| **mV** | **millivolts** |
| **Ω** | **ohm** |
| **PC** | **Personal Computer** |
| **Pk** | **peak** |
| **RF** | **Radio Frequency** |
| **RMS** | **Root Mean Square** |
| **US** | **United States** |
| **V** | **volt** |
| **VDC** | **Direct Current Voltage** |

### NOTICE – DISCLAIMER

**USER ASSUMES FULL RESPONISIBILITY FOR UNAUTHORIZED EQUIPMENT MODIFICATIONS OR APPLICATION OF EQUIPMENT OUTSIDE OF THE PUBLISHED INTENDED USE AND SPECIFICATIONS. SUCH MODIFICATIONS OR APPLICATIONS MAY RESULT IN EQUIPMENT DAMAGE OR PERSONAL INJURY.**

### NOTICE – DISCLAIMER

**GMC-I MESSTECHNIK GMBH RESERVES THE RIGHT TO MAKE CHANGES TO ITS PRODUCTS OR SPECIFICATIONS AT ANY TIME, WITHOUT NOTICE, IN ORDER TO IMPROVE THE DESIGN OR PERFORMANCE AND TO SUPPLY THE BEST POSSIBLE PRODUCT. THE INFORMATION IN THIS MANUAL HAS BEEN CAREFULLY CHECKED AND IS BELIEVED TO BE ACCURATE. HOWEVER, NO RESPONSIBILITY IS ASSUMED FOR INACCURACIES.**

### NOTICE – CONTACT INFORMATION

**GMC-I Messtechnik GmbH**
**Südwestpark 15**
**90449 Nürnberg**
**Germany**
**Phone:    +49 911 8602-111**
**Fax:        +49 911 8602-777**

**www.gossenmetrawatt.com**
**e-mail:** **info@gossenmetrawatt.com**

---

## Gossen Metrawatt
## SECULIFE ESpro
## ELECTROSURGICAL UNIT ANALYZER

The SECULIFE ESPRO Electrosurgical Unit Analyzer is a high-accuracy True RMS RF Voltmeter designed to be used in the routine performance verification of Electrosurgical Generators. The SECULIFE ESPRO offers a higher degree of accuracy than previously attainable with conventional Electrosurgical Unit Analyzer designs. The SECULIFE ESPRO has been designed to be used in conjunction with an external RF Current Transformer (Pearson Electronics Model 411 and 4100 recommended) and external precision load resistors (Vishay Dale NH-250 Precision 1% tolerance resistors recommended) to measure various parameters relating to the routine service of Electrosurgical Generators. The SECULIFE ESPRO is microprocessor based and utilizes a combination of unique hardware and software to provide accurate and reliable test results, even from "noisy" ESU Generator waveforms such as "Spray". The DFA™ Technology utilized in the SECULIFE ESPRO allows the system to aggressively digitize the complex RF waveforms produced by Electrosurgical Generators, analyze each individual digital data point, and provide highly accurate measurement results.

---

The following are highlights of some of the main features:

- TRUE RMS READINGS USING DFA™ TECHNOLOGY
- INDUSTRY STANDARD CURRENT SENSING TECHNOLOGY
- MV, MV PEAK, MA, CREST FACTOR AND POWER (WATTAGE) RANGES
- LARGE GRAPHICS DISPLAY WITH CURSOR SELECTION OF OPTIONS AND SETUP OF PARAMETERS
- 1% OF READING MEASUREMENT ACCURACY
- DIGITAL DATA OUTPUT VIA USB AND RS232
- PC BASED INTERFACE AND DATA CAPTURE PROGRAM
- DIGITAL CALIBRATION – NO POTS TO TURN
- SELECTABLE DISPLAY OPTIONS
- DISPLAY CONTRAST IS SOFTWARE ADJUSTABLE
- TACTILE KEYS WITH AUDIO FEEDBACK
- GRAPHICAL ON-SCREEN REPRESENTATION OF MEASURED RF SIGNAL
- STANDARD (1000 MV) AND LOW RANGE (100 MV) WITH AUTOSCALING CAPABILITY
- CAN BE USED WITH 0.1:1 OR 1:1 VOLTAGE:CURRENT CURRENT TRANSFORMERS
- INTERNALLY PROTECTED INPUT CIRCUITRY GUARDS AGAINST INPUT OVERLOAD DAMAGE
- INTERNAL DATA STORAGE FOR 3 FULL DATA SETS
- PULSED RF WAVEFORM MEASUREMENT MODE FOR LOW DUTY CYCLE PULSED OUTPUTS OFFERED BY SOME ELECTROSURGICAL MANUFACTURERS

ACCESSORIES:

BC20 – 21104    UNIVERSAL POWER SUPPLY
BC20 – 41352    COMMUNICATIONS CABLE (USB)
BC20 – 41341    COMMUNICATIONS CABLE (RS232)
BC20 – 00232    CT CABLE (BNC)
BC20 – 205XX    STANDARD POWER ADAPTER
                (International Options, see Page 29 for details)
BC20 – 30108    SOFT SIDED CARRYING CASE

## CURRENT TRANSFORMERS:

| | |
|---|---|
| Z697B | PEARSON ELECTRONICS MODEL 411 0.1:1 RATIO CURRENT TRANSFORMER |
| Z697A | PEARSON ELECTRONICS MODEL 4100 1:1 RATIO CURRENT TRANSFORMER |

## VISHAY-DALE NH-250 PRECISION 1% TOLERANCE LOAD RESISTORS:

| | |
|---|---|
| Z696A | 5 $\Omega$, 250 WATT RESISTOR |
| Z696B | 10 $\Omega$, 250 WATT RESISTOR |
| Z696C | 20 $\Omega$, 250 WATT RESISTOR |
| Z696D | 30 $\Omega$, 250 WATT RESISTOR |
| Z696E | 50 $\Omega$, 250 WATT RESISTOR |
| Z696F | 100 $\Omega$, 250 WATT RESISTOR |
| Z696G | 200 $\Omega$, 250 WATT RESISTOR |
| Z696H | 300 $\Omega$, 250 WATT RESISTOR |
| Z696I | 500 $\Omega$, 250 WATT RESISTOR |
| Z696J | 1000 $\Omega$, 250 WATT RESISTOR |
| Z696K | 2000 $\Omega$, 250 WATT RESISTOR |
| Z696L | 3000 $\Omega$, 250 WATT RESISTOR |
| Z696M | 4000 $\Omega$, 250 WATT RESISTOR |
| Z696N | 5000 $\Omega$, 250 WATT RESISTOR |
| Z696O | 1 $\Omega$, 50 WATT RESISTOR |
| Z696P | 125 $\Omega$, 250 WATT RESISTOR |
| Z696Q | 150 $\Omega$, 250 WATT RESISTOR |
| Z696R | 400 $\Omega$, 250 WATT RESISTOR |
| Z696S | 800 $\Omega$, 250 WATT RESISTOR |
| Z696T | 1500 $\Omega$, 250 WATT RESISTOR |
| Z696U | 10 $\Omega$, 50 WATT RESISTOR |

| | |
|---|---|
| BC20-00240 | POWER RESISTOR BANANA JACK ADAPTER |

# TYPICAL TEST SETUP

Unlike all conventional ESU Analyzers with lesser degrees of accuracy, the SECULIFE ESPRO utilizes an external Current Transformer and external precision load resistors (values to be determined by the manufacturer's suggested test load for the generator you are testing or servicing) for typical Electrosurgical Generator testing. Many of the world's leading Electrosurgical generator manufacturers utilize this exact same technique when they test, service and calibrate their generators.
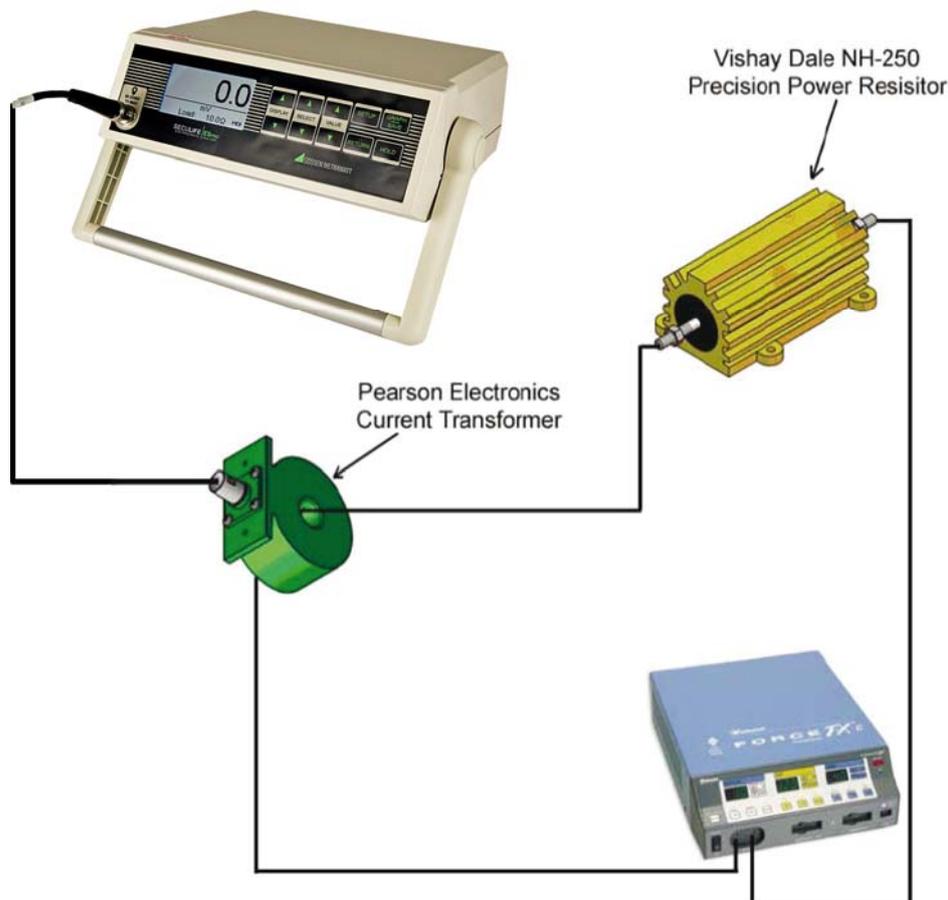


This methodology has several distinct advantages over conventional ESU Analyzers:

- Improved accuracy and resolution capabilities
- 100% manufacturer recommended test load compatibility
- Smaller and lighter weight instrumentation

The current transformer senses the RF current flowing through the external test load and produces a proportional voltage as an input to the SECULIFE ESPRO. This input is either a direct 1 : 1 input (for current transformers with a ratio of 1 : 1 volts : amps) or a 0.1 : 1 input (for current transformers with a ratio of 0.1 : 1 volts : amps). Combining the standard and low ranges of the SECULIFE ESPRO with the use of either a 0.1:1 or 1:1 ratio current transformer, the user has full control over the ability to get high accuracy and high resolution readings from all types of Electrosurgical Generators.

# OVERVIEW

This section looks at the layout of the SECULIFE ESPRO and gives descriptions of the elements that are present.

10 Light Touch Keys for Selecting Parameters and Settings:

High Impact Plastic Case

Swivel and Locking Handle

Backlit LCD Graphical Display

RF Current Transformer (Donut ) Input

Power Kycon 3 pos locking connector

Power Switch Rocker Switch

USB

RS232 DB9
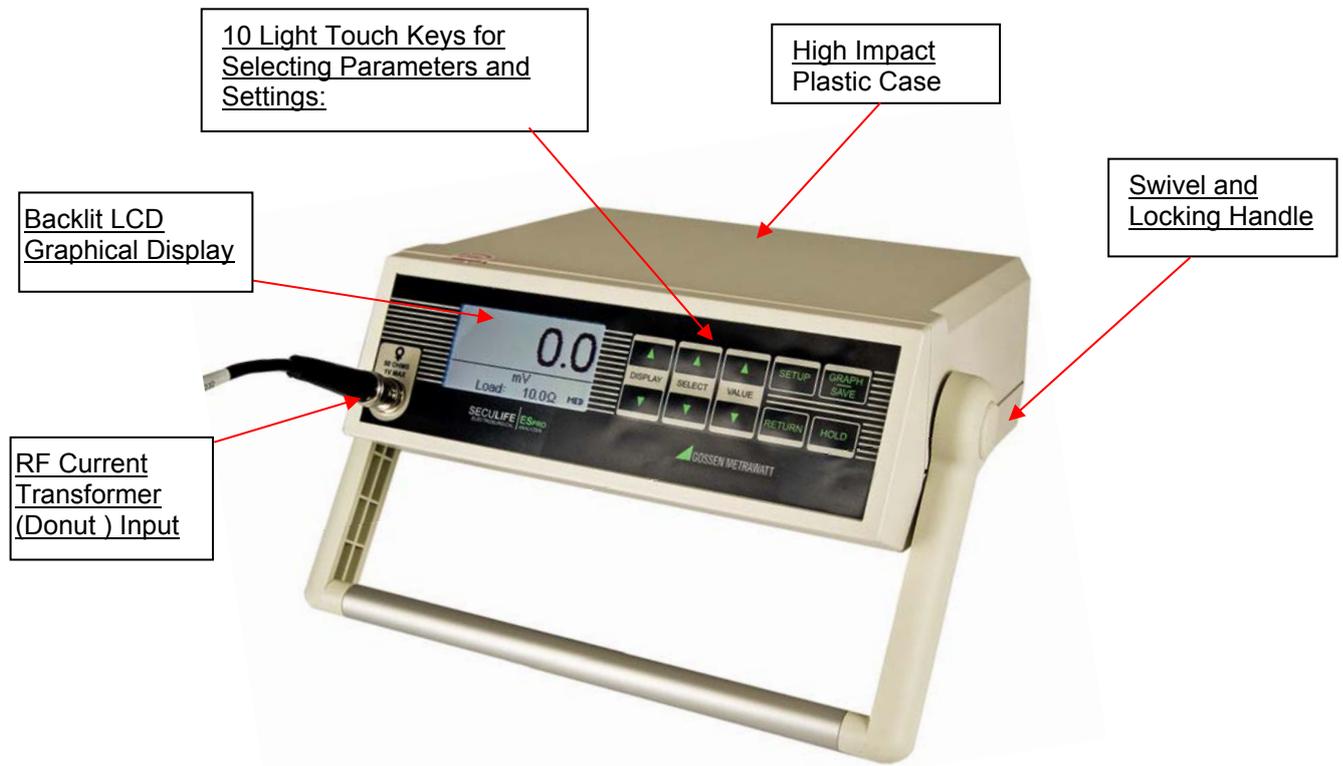
**MAIN SCREENS** – There are 7 main screens, 5 Display Screens which have 1, 2, 3, 4 and 5 display zones respectively, a Measurement List Screen which shows available measurements and the Quick Config Screen which displays the current hardware configuration. In the Display Screens, each Display Zone can be customized to show the desired parameter from the following options:

| Parameter | Abbreviation | Description |
|---|---|---|
| mV RMS | mV | This is the mV measured directly from the RF donut. |
| mA RMS | mA | This is the converted mA measurement based on the RF donut mV to mA attenuation ratio. |
| Power in Watts | Watts | This is the computed power based on load setting and mA measured. |
| mV Peak | mV Pk | This is the maximum mV measured in the buffer. NOTE: This is shown as absolute value. |
| mV Peak - to - Peak | mV P-P | This is the difference between maximum mV measured and min mV measured. |
| mV Peak / Peak - to - Peak | Pk/P-P | This is the ratio of Peak versus Peak to Peak millivolts. |
| mV Positive Peak Only | mV Pk+ | This is the maximum positive mV measured in the buffer. For asymmetric waveforms this can determine if the output polarity is reversed. |
| Crest Factor | CF | This is the ratio of peak to rms of the measured waveform. |
| Time Pulse - On | Ton | This is the duration that the pulsed waveform is on. (See Diagram 1) |
| Time - Pulse Off | Toff | This is the duration that the pulsed waveform is off. (See Diagram 1) |
| Time - Total Cycle | Tcyc | This is the total cycle time of the pulsed waveform (i.e. Ton + Toff). (See Diagram 1) |
| % Duty Cycle | %Duty | This is the ratio of the pulse on time (Ton) versus cycle time (Tcyc). (See Diagram 1) |
| mV Pulse | mV cyc | This represents the RMS mV over one pulsed cycle. (See Diagram 1) |
| mA Pulse | mA cyc | This represents the RMS mA over one pulsed cycle. (See Diagram 1) |
| Watts Pulse | Wcyc | This represents the RMS Watts over one pulsed cycle. (See Diagram 1) |
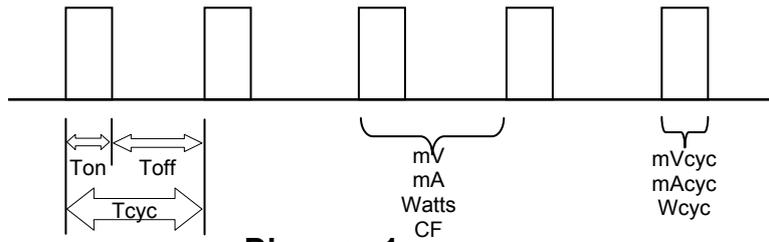
**Diagram 1**

The available screens can be toggled through using [DISPLAY] .
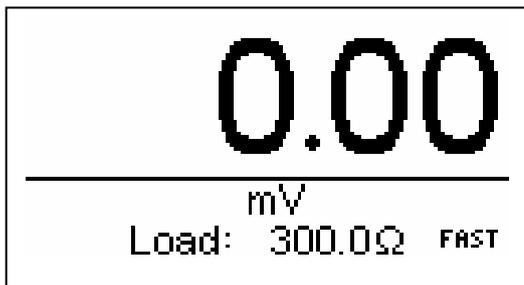
**Display Screens**



One Display Zone Screen

with mV parameter selected
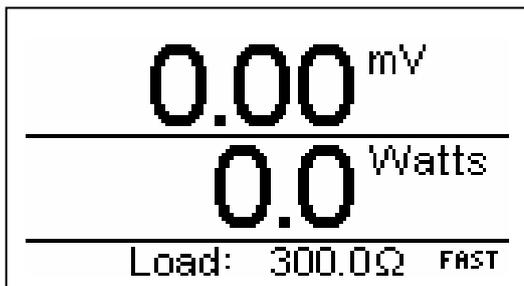


Two Display Zone Screen

with mV and Watts parameters selected
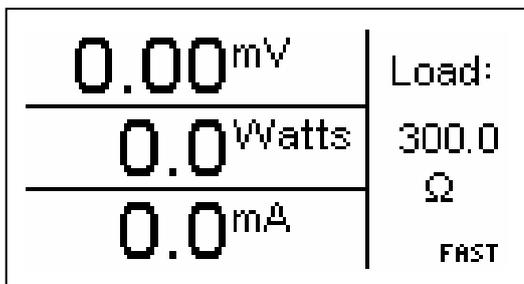


Three Display Zone Screen

with mV, Watts and mA parameters selected
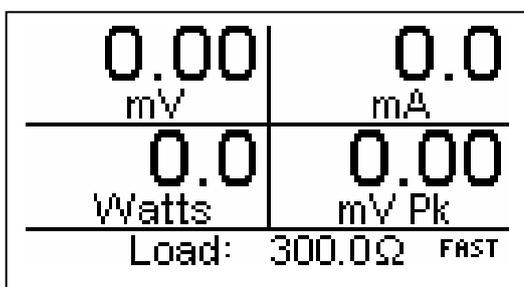


Four Display Zone Screen

with mV, Watts, mA and mV Peak parameters selected
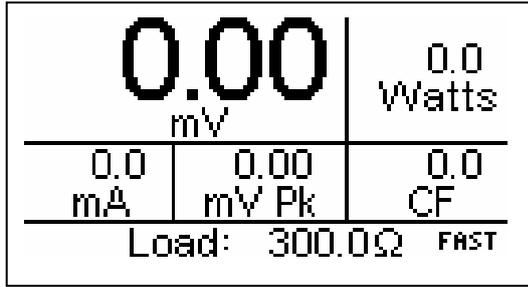
Five Display Zone Screen

with mV, Watts, mA and mV Peak and CF parameters selected

**Measurement List Screen:**



| Measured Parameters | |
|---|---|
| Parameter | Abbreviation |
| mV RMS | mV |
| mA RMS | mA |
| Watts RMS | Watts |
| mV Peak | mV Pk |
| mV Peak - to - Peak | mV P-P |
| mV Peak / Peak - to - Peak | Pk/P-P |
| mV Positive Peak | mV Pk+ |
| Crest Factor | CF |
| Time Pulse – On | Ton |
| Time - Pulse Off | Toff |
| Time - Total Cycle | Tcyc |
| % Duty Cycle | %Duty |
| mV Pulse | mV cyc |
| mA Pulse | mA cyc |
| Watts Pulse | Wcyc |

**Quick Config Screen:**

| Donut Atten |
|---|
| 0.1 : 1 |
| 1 : 1 |

| Input Range |
|---|
| 100 mV |
| 1000 mV |
| Auto |

| Load Resistance |
|---|
| 0 – 6,500.0 ohms |

| Input Mode (ESU-2050P Only) |
|---|
| Continuous |
| Pulsed |

```
        QUICK CONFIG
   ⚲  Donut Atten:   0.1:1
  ⌁⌁⌁Load:           10.0 Ω
   Input Range:      Auto
   Input Mode:       Pulsed
```

NOTE: Load Resistance can be Adjustable or Selected from the table of available resistor combinations.
(See Load Table for more information).
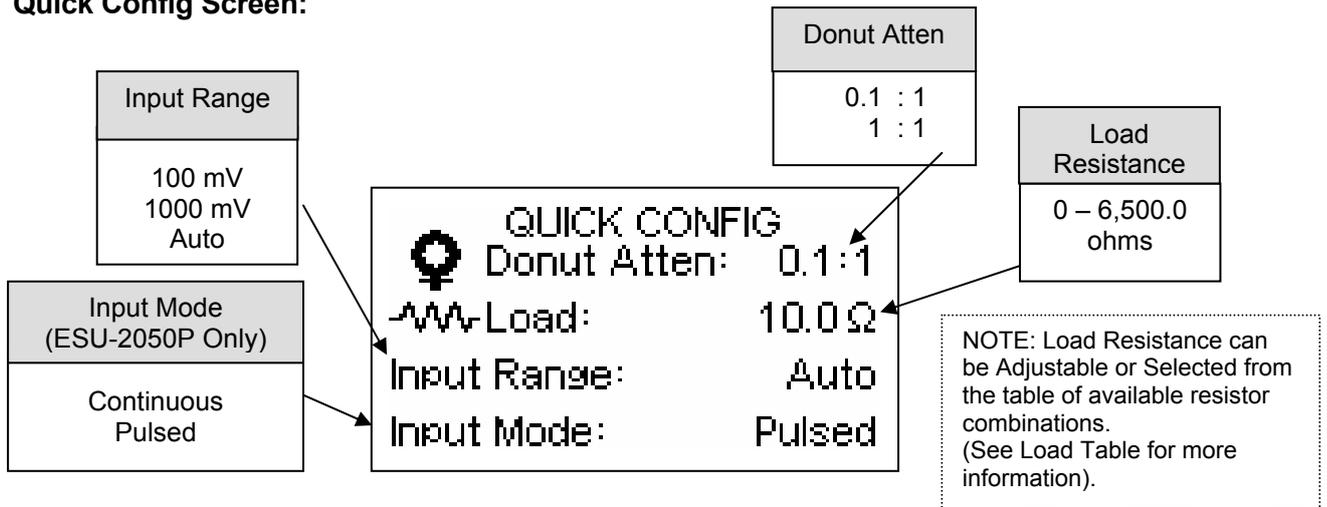
The Quick Config Screen allows the user to see the current configuration and provide a quick method of changing the RF Current Transformer (Donut) Attenuation, Load Resistance , Input Range or Input mode parameters.

Use SELECT ▲▼ to highlight the parameter to change and then VALUE ▲▼ to sequence through the available options.

**NOTE:** On power up, the Quick Config Screen will display for a few seconds to indicate the current configuration and then the default Display Screen will be displayed.

The Quick Config Screen can be accessed using DISPLAY ▲▼ .

**DISPLAY PARAMETERS** – There are five options of parameters that can be selected for each Display Zone on the Main Screens. This allows users to custom configure the displays to best suit their needs.

Use SELECT to highlight the Display Zone to change and then VALUE to sequence through the available parameters.

**NOTE:** To save a custom configuration, see Power Up Settings section.

**SYSTEM CONFIGURATION SCREEN** – The SYSTEM SETUP MODE allows the user to adjust the configuration of the unit. The Setup Screen can be entered using the SETUP key. The parameters can be changed by using SELECT to highlight the line and VALUE to toggle the available options.

The Setup Screen can be exited using the RETURN key.

```
↑MORE System Setup MORE↓
Input Range          Auto
Input Mode         Pulsed
Load Resistance  300.0Ω
Load Selection      Table
Power up with     Custom
```
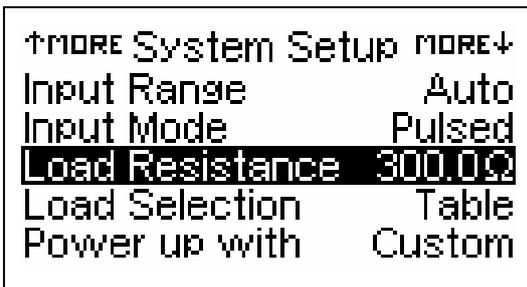
Typical Setup Screen

The following is a breakdown of the parameters available in the configuration of the unit

and their available options:

| System Setup Configuration | | |
|---|---|---|
| **Parameter** | **Description** | **Range** |
| Donut Atten | Selects the RF Current Transformer Attenuation in Volts : Amp for the RF Donut being used. Default = 0.1 : 1 | 0.1 : 1<br>1 : 1<br>Volts : Amps |
| Input Zero | Zeros the input circuitry based on donut being used. Each donut can have a slightly different zero offset. This function will eliminate the offset from the readings. Press the SETUP key while this parameter is selected to perform the auto – zero function. | Press Setup |
| Input Range | Determines the input range. Default = Auto | 100 mV<br>1000 mV<br>Auto |
| Input Mode | Determines whether the unit continuously monitors the Input Signal or looks for a Pulsed Input Signal. Default = Continuous | Continuous<br>Pulsed |
| Load Resistance | Used for Power (Watts) calculation only. Can be adjustable or set by a table of fixed resistors. (See Load Selection and Load Table for more information.) Default = 500 | 0-6,500.0 ohms |
| Load Selection | Determines whether the Load Resistance Parameter is adjustable by tenths of ohms or selected from the Load Table. The Load Table is created from the Load Resistance Values set in the Factory Setup and the Load Sets. (See Load Sets, Load Table and Factory Setup for more information.) Default = Table | Adjustable or Table |
| Power up with | Determines the power up mode of the SECULIFE ESPRO. The default mode shows a single mV parameter display. Set this parameter to custom to display the saved startup mode. Set this parameter to Save current as custom to save the settings for the next time power is cycled. Default = Defaults | Defaults<br>Custom<br>Set Current as Custom |
| Num A/D Samples | Sets the number of A/D converter readings used in each mV RMS computation. A higher setting requires more computation and is slower, but results in a more stable reading. Default = 32,768 | 1024<br>2048<br>4096<br>8192<br>16384<br>32768 |
| Display Averaging | Sets which display averaging parameter is to be used. Three independent averaging modes can be configured for optimum system performance. | Fast<br>Medium<br>Slow |

<table>
<tr><th colspan="3">System Setup Configuration</th></tr>
<tr><th>Parameter</th><th>Description</th><th>Range</th></tr>
<tr>
<td>Slow Averaging</td>
<td>Sets the number of mV RMS readings that are averaged when the Display Averaging parameter is set to Slow. A higher number will cause the display to update slower, but will give a more stable reading<br>Default = 150</td>
<td>1-200 Readings</td>
</tr>
<tr>
<td>Medium Averaging</td>
<td>Sets the number of mV RMS readings that are averaged when the Display Averaging parameter is set to Medium. A higher number will cause the display to update slower, but will give a more stable reading<br>Default = 15</td>
<td>1-200 Readings</td>
</tr>
<tr>
<td>Fast Averaging</td>
<td>Sets the number of mV RMS readings that are averaged when the Display Averaging parameter is set to Fast. A higher number will cause the display to update slower, but will give a more stable reading<br>Default = 4</td>
<td>1-200 Readings</td>
</tr>
<tr>
<td>Averaging Window</td>
<td>Sets the range of input readings that will be averaged. If a new mV reading deviates from the average by less than this amount, it will be averaged with the rest of the readings in the display averaging buffer. Otherwise, the input is considered a step change and the display averaging buffer is flushed.</td>
<td>0.0 to 100.0 mV</td>
</tr>
<tr>
<td>Load Set 1</td>
<td>Assigns a resistance value for Set 1 from a combination of the available loads as determined by the Load Resistance Values set in the Factory Setup. (See Custom Load Sets for more information.)<br>Default = None Selected</td>
<td>0-6,500.0 ohms</td>
</tr>
<tr>
<td>Load Set 2</td>
<td>Assigns a resistance value for Set 2 from a combination of the available loads as determined by the Load Resistance Values set in the Factory Setup. (See Custom Load Sets for more information.)<br>Default = None Selected</td>
<td>0-6,500.0 ohms</td>
</tr>
<tr>
<td>Load Set 3</td>
<td>Assigns a resistance value for Set 3 from a combination of the available loads as determined by the Load Resistance Values set in the Factory Setup. (See Custom Load Sets for more information.)<br>Default = None Selected</td>
<td>0-6,500.0 ohms</td>
</tr>
<tr>
<td>Load Set 4</td>
<td>Assigns a resistance value for Set 4 from a combination of the available loads as determined by the Load Resistance Values set in the Factory Setup. (See Custom Load Sets for more information.)<br>Default = None Selected</td>
<td>0-6,500.0 ohms</td>
</tr>
</table>

| System Setup Configuration | | |
| --- | --- | --- |
| **Parameter** | **Description** | **Range** |
| Load Set 5 | Assigns a resistance value for Set 5 from a combination of the available loads as determined by the Load Resistance Values set in the Factory Setup. (See Custom Load Sets for more information.)<br>Default = None Selected | 0-6,500.0 ohms |
| Load Set 6 | Assigns a resistance value for Set 6 from a combination of the available loads as determined by the Load Resistance Values set in the Factory Setup. (See Custom Load Sets for more information.)<br>Default = None Selected | 0-6,500.0 ohms |
| Load Set 7 | Assigns a resistance value for Set 7 from a combination of the available loads as determined by the Load Resistance Values set in the Factory Setup. (See Custom Load Sets for more information.)<br>Default = None Selected | 0-6,500.0 ohms |
| Load Set 8 | Assigns a resistance value for Set 8 from a combination of the available loads as determined by the Load Resistance Values set in the Factory Setup. (See Custom Load Sets for more information.)<br>Default = None Selected | 0-6,500.0 ohms |
| Load Set 9 | Assigns a resistance value for Set 9 from a combination of the available loads as determined by the Load Resistance Values set in the Factory Setup. (See Custom Load Sets for more information.)<br>Default = None Selected | 0-6,500.0 ohms |
| Load Set 10 | Assigns a resistance value for Set 10 from a combination of the available loads as determined by the Load Resistance Values set in the Factory Setup. (See Custom Load Sets for more information.)<br>Default = None Selected | 0-6,500.0 ohms |
| LCD Contrast | Sets the contrast of the display screen.<br>Default = 10 | 0-20 |
| Access Code | In some cases it may be desirable to restrict access to the System Setup. This sets the number that must be matched in order to gain access to the System Setup. If set to 0, the Access Code feature is disabled. Default = 0 | 0 to 9999 |
| Software | Displays current software program. | (Read Only) |

**INPUT ZERO** – The Input Zero offset can be slightly different between RF donuts. This parameter accesses an auto-zeroing function that eliminates this offset. Independent settings are saved for the 0.1:1 RF donut and 1:1 RF donut. The user can switch between the two donut types without having to re-zero the input. The input needs to be zeroed only when a new donut is introduced.

**INPUT RANGE** – The input range can be scaled to accommodate the signal that is being measured. The input can be set to fixed ranges of 100mV Peak, 1000mV peak or Auto-Ranging. For Auto-Ranging mode, the low range will be used for readings from 0.00 to 30.00 mV RMS. The high range will be used for 20.0 to 700.0 mV RMS.

**INPUT MODE** – There are two input modes to allow for measurement of continuous signals or pulsed signals. In Continuous Mode, the input is updated every 100 mS. This mode should be used for all Electrosurgical Generator waveform outputs in general use generators. A number of Electrosurgical generator manufacturers offer generators with pulsed outputs, where there is a long duty cycle (typically ½-second or more) and the actual RF output of the generator is active for a brief period of time within the duty cycle (typically 1/10th second or less). In Pulsed Mode, the input to the SECULIFE ESPRO is only processed when a signal over 20 mV in amplitude is detected. The SECULIFE ESPRO analyzes the pulsed input waveform and can provide the RMS readings for either the overall input or the pulse only (see Diagram 1, Page 15).
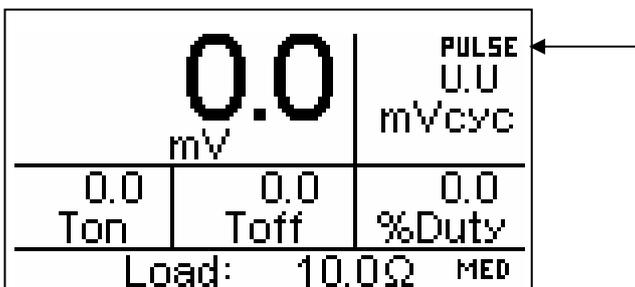


NOTE: When set to Pulsed Mode, a small graphic appears in the upper right corner of the screen to identify to the user that the SECULIFE ESPRO is looking for a pulsed RF input.

**CUSTOM LOAD SETS**. To simplify the selection of commonly used load configurations, 10 custom resistor sets are available. Each resistor set can consist of any combination of the available calibrated loads. The number of loads and load calibration is performed in the Factory Setup Screen.

A custom load set can be configured in the Setup Screen by either using SELECT to highlight the line and VALUE to toggle the available custom set resistance,

or by using the SETUP key to access the Custom Resistor Set Menu.

This menu shows the current values of the loads as set in the Factory Setup Screen. The value of a Load Set can be changed by using SELECT to highlight the load line and VALUE to include or remove the resistor from the custom set. The total series resistance of the selected resistors is shown to aid in customizing the custom resistor set.

NOTE: If individual selected load values are changed in the Factory Setup Screen, the resistance value of the sets will change accordingly.

```
Select Series   ☐    50.0 ↑
Resistors to    ☑   100.0
Make Set 01     ☐   200.0
  SELECTED      ☑   300.0
  RESISTANCE    ☐   500.0
  430.0 Ω       ☐  1000.0 ↓
```

The Setup Screen can be exited using the RETURN key.

**LOAD TABLE** – Up to twelve Load Resistance Values (each with a range from 0.0 to 6,500.0 ohms) may be set in the FACTORY SETUP Configuration. These values are used in combination with the Custom Load Sets to determine the Load Configuration Table. These options are available if the Load Selection parameter is set to "Table". The settings will be the individual calibrated loads followed by the Load Sets. Since these values can be set to the actual values of the real resistors, this allows for maximum accuracy in the wattage calculations. By default, the following values are loaded into this table when the SECULIFE ESPRO instruments ships from the factory:

Load #1:     10 $\Omega$

Load #2:     20 $\Omega$

Load #3:     30 $\Omega$

Load #4:     50 $\Omega$

Load #5:     100 $\Omega$

Load #6:     200 $\Omega$

Load #7:     300 $\Omega$

Load #8:     500 $\Omega$

Load #9:     1000 $\Omega$

Load #10:     2000 $\Omega$

Load #11:     3000 $\Omega$

Load #12:     4000 $\Omega$

**LOAD CALIBRATION SCREEN** – The LOAD SETUP MODE allows the user to adjust the calibration of the loads. The Load Setup Screen can be entered using the SETUP key while in the SYSTEM SETUP MODE.

The parameters can be changed by using SELECT to highlight the line and VALUE to toggle the available options.

The Load Setup Screen can be exited using the RETURN key.

Typical Load Setup Screen

The following is a breakdown of the parameters available in the LOAD SETUP MODE
and their available options:

<table>
<tr><th colspan="3">Load Setup Configuration</th></tr>
<tr><th>Parameter</th><th>Description</th><th>Range</th></tr>
<tr><td>Number Of Loads</td><td>Sets the number of load resistors present in the system. This determines the maximum combination of resistors available when the Load Selection is set to Table.</td><td>1-12</td></tr>
<tr><td>Load 1</td><td>Calibrates the Load 1 Resistance Value. This should be set to the actual resistance of the smallest resistor in the system.</td><td>0.0-6500.0 ohms</td></tr>
<tr><td>Load 2</td><td>Calibrates the Load 2 Resistance Value. This should be set to the actual resistance of the next higher resistor in the system.</td><td>0.0-6500.0 ohms</td></tr>
<tr><td>Load 3</td><td>Calibrates the Load 3 Resistance Value. This should be set to the actual resistance of the next higher resistor in the system.</td><td>0.0-6500.0 ohms</td></tr>
<tr><td>Load 4</td><td>Calibrates the Load 4 Resistance Value. This should be set to the actual resistance of the next higher resistor in the system.</td><td>0.0-6500.0 ohms</td></tr>
<tr><td>Load 5</td><td>Calibrates the Load 5 Resistance Value. This should be set to the actual resistance of the next higher resistor in the system.</td><td>0.0-6500.0 ohms</td></tr>
<tr><td>Load 6</td><td>Calibrates the Load 6 Resistance Value. This should be set to the actual resistance of the next higher resistor in the system.</td><td>0.0-6500.0 ohms</td></tr>
<tr><td>Load 7</td><td>Calibrates the Load 7 Resistance Value. This should be set to the actual resistance of the next higher resistor in the system.</td><td>0.0-6500.0 ohms</td></tr>
<tr><td>Load 8</td><td>Calibrates the Load 8 Resistance Value. This should be set to the actual resistance of the next higher resistor in the system.</td><td>0.0-6500.0 ohms</td></tr>
<tr><td>Load 9</td><td>Calibrates the Load 9 Resistance Value. This should be set to the actual resistance of the next higher resistor in the system.</td><td>0.0-6500.0 ohms</td></tr>
<tr><td>Load 10</td><td>Calibrates the Load 10 Resistance Value. This should be set to the actual resistance of the next higher resistor in the system.</td><td>0.0-6500.0 ohms</td></tr>
<tr><td>Load 11</td><td>Calibrates the Load 11 Resistance Value. This should be set to the actual resistance of the next higher resistor in the system.</td><td>0.0-6500.0 ohms</td></tr>
<tr><td>Load 12</td><td>Calibrates the Load 12 Resistance Value. This should be set to the actual resistance of the next higher resistor in the system.</td><td>0.0-6500.0 ohms</td></tr>
</table>

**FACTORY SETUP SCREEN** – The FACTORY SETUP MODE allows for the configuration of system parameters that the standard user should not access. This setup allows for Calibration of the system. The Factory Setup Screen can be entered by pressing and holding the [SETUP] key for five seconds while in the SYSTEM SETUP MODE. This will open an Access Code Window.

```
       System Setup MORE↓
  Donut                  0.1:1
  Input F Enter Code     Auto
  Input N       0        Pulsed
  Load R                 300.0Ω
  Load Selection         Table
```
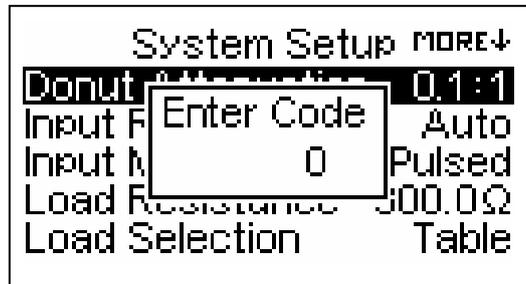
Use [▲ VALUE ▼] to change the displayed code to 135. Then [SETUP] is used to access the

FACTORY SETUP MODE.

The parameters can be changed by using [▲ SELECT ▼] to highlight the line and [▲ VALUE ▼] to

toggle the available options. The Setup Screen can be exited using the [RETURN] key.

```
     Factory Setup MORE↓
 ▌Input Range      Auto▐
  Donut Attenuation 0.1:1
  Counts Zero Offset    0
  Input Gain         2000
  mVRMS Reading       0.0
```

Typical Setup Screen

The following is a breakdown of the parameters available in the configuration of the unit and their available options:

| Factory Setup Configuration | | |
|---|---|---|
| **Parameter** | **Description** | **Range** |
| Input Range | Used to select the input range that is to be calibrated. | 100 mV<br>1000 mV |
| Donut Attenuation | Selects the Attenuation in Volts : Amp for the RF Current Transformer being used. Each setting has an independent gain setting. | 0.1 : 1<br>1 : 1<br>Volts : Amps |
| Counts Zero Offset | Used to adjust the A/D converter output to zero counts when zero input is applied. This should be adjusted to get the smallest mVRMS reading when the input is zero. | ± 1000 Counts |
| Input Gain | Used to calibrate the mV reading for when the 0.1 : 1 RF Current Transformer (Donut) attenuation is selected. | 0 to 5000 |
| mV RMS Reading | Shows the latest measurement by the system. This is for display only to help in calibrating the system. | 0.0 to 700.0 mV |
| Input Zero | Zeros the input circuitry based on donut being used. Each donut can have a slightly different zero offset. This function will eliminate the offset from the readings. Press the SETUP key while this parameter is selected to perform the auto – zero function. This will also remove any offsets created by the User in the System Setup screen. | Press Setup |

**LINE POWER** – A Kycon 3 pos locking connector is provided for the 6 VDC Universal Power Supply input.

The Universal Power Supply takes a Standard Power Adapter Cable with Small Standard Product Plug and Required International Connector (See Options Below).

BC20-20500
North America
Hospital Grade

BC20-20501
Japan

BC20-20502
United Kingdom

BC20-20503
Schuko-
Continental
Europe

BC20-20509
India/
South Africa

BC20-20510
Switzerland

BC20-20512
Italy

BC20-20516
Australia

Pick Your Country's
Connector from Above

to Connect to the
Universal Power Supply

Standard Power Cord

Standard Product Plug
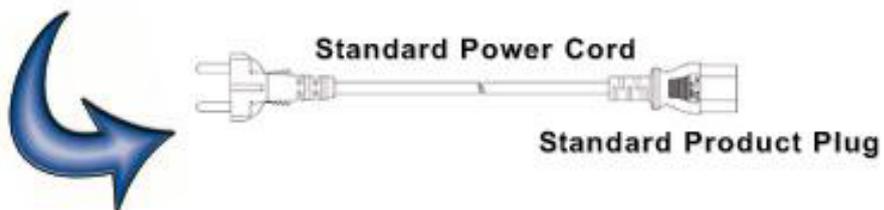
**SERIAL COMMUNICATION** – There is a serial port on the rear panel. The RS-232 Port is used for Firmware upgrades

**USB COMMUNICATION** – There is a USB port on the rear panel. The USB Port is used to interface with a PC.

**POWER SWITCH** - The main power switch for the Analyzer is located on the left side on the rear panel.

GMC-I Messtechnik GmbH

```
KEYS
```

Ten tactile-touch keys are provided for system operation:

– In the Main Screen, these keys will scroll through the available display screens.

  In the GRAPH MODE, these keys will scroll through the horizontal zoom level

  for the graph.

– In the Main Screen, these keys will toggle through the available Display Zones.

  In the SETUP MODE, these keys will scroll through the available parameters.

  In the GRAPH MODE, these keys will select the waveform to be displayed.

– In the Main Screen, these keys will scroll through the available parameters.

  In the SETUP MODE, these keys will scroll through the available settings

  for the parameters.

  In the GRAPH MODE, these keys will Scroll through the selected data set.

– This key is used to toggle between the entering the SETUP MODE and the

  LOAD SETUP MODE, where the calibration can be viewed and adjusted.

**RETURN** – In the SETUP MODE, this key is used to exit and return to the previously viewed Main Screen. This will also save any changes to the internal EEPROM memory so they will be retained even with the power turned off.

In the GRAPH MODE, this key is used to exit and return to the previously viewed Main Screen.

In the SAVE MODE, this key is used to exit without saving.

**GRAPH SAVE** – In the Main Screen, this key is used to enter the GRAPH MODE.

In the GRAPH MODE, this key is used to enter the SAVE MODE.

In the SAVE MODE, this key is used to save the data set.

**HOLD** – This key is used to toggle the HOLD MODE on and off. The HOLD MODE will lock the latest reading into the display and the current waveform in the register.

In HOLD MODE, a small "HOLD" alpha will be displayed in the upper right corner of the screen.

# POWER UP SETTINGS

The SECULIFE ESPRO allows the user to customize the settings that the unit will have on Power Up. The "Power up with" parameter in the System Setup Menu allows for the selection of either Default or Custom selections.

Use **SETUP** to enter the SETUP MODE. Use **SELECT** to select the "Power up with" parameter.

Use **VALUE** to change the parameters to Default, Custom or Set Current as Custom.

The Setup screen can be exited using the **RETURN** key.

### Default

If this option is selected, the unit will Power Up to the One Display Zone screen, showing the mV reading. The default parameters shown in the other Main Screens will be the same as shown in the Main Screens Section.

### Custom

If this option is selected, the unit will Power Up using the unique sets of parameters that were last customized and saved by the user. Each Main Screen will use the parameters in the Display Zones that were last configured and saved by the user.

**Set Current as Custom**

This choice is provided to create the set of custom startup screen parameters. The user simply configures each of the five display screens to show the desired parameters in each Display Zone, selects this option and presses RETURN. The current configuration is then saved as the Custom Power Up values and will be used when the "Power up with" parameter is set to Custom. This configuration will remain the Custom configuration until it is written over using the Set Current as Custom option in the "Power up with" parameter.

## GRAPH MODE

The GRAPH MODE allows the user to view the measured waveform in the display. The horizontal axis can be zoomed in to display higher frequency waveform components. The vertical axis is auto-scaling and cannot be adjusted. Any of the stored waveforms can be graphed. Additionally, if the unit is placed in the HOLD MODE, the user can adjust which portion of the waveform is being displayed.

NOTE: Due to the limited number of pixels in the display, this should not be used as a calibrated reference, rather as a quick check of the waveform being measured.

Use **GRAPH SAVE** to enter the GRAPH MODE.

Use **RETURN** to exit the GRAPH MODE.

### Selecting a Waveform

Use **▲ SELECT ▼** to select the waveform to be graphed, Ram or Location 1-3.
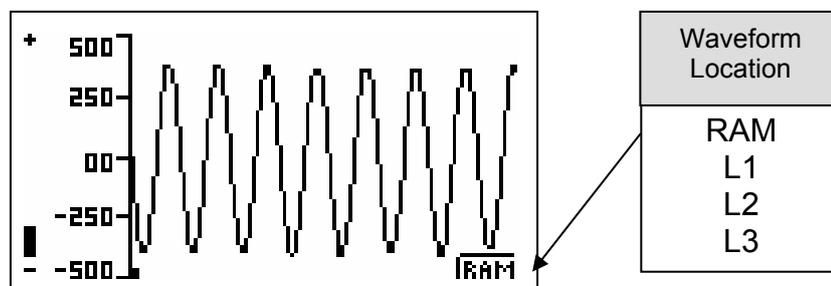
## Location Indicator

Use ▲ VALUE ▼ to select a specific portion of the waveform buffer to be graphed.

The Location Indicator is a small square that moves along the bottom of the Graph Screen to indicate where the current viewing window portion of the waveform is from within the overall data set.



Location Indicator
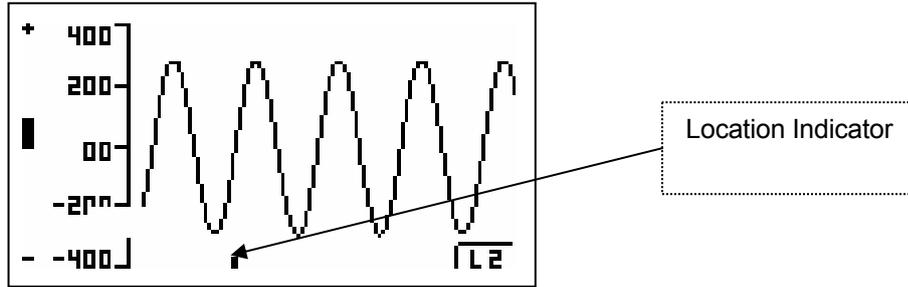
## Zooming

Use ▲ DISPLAY ▼ to zoom the graph in and out.

The Zoom Indicator is a bar that moves along the left side of the Graph Screen to indicate the Zoom level shown in the current viewing window. It adjusts from Fully Out (-) to Fully In (+).

Zoom Indicator



Fully Zoomed Out

Fully Zoomed In
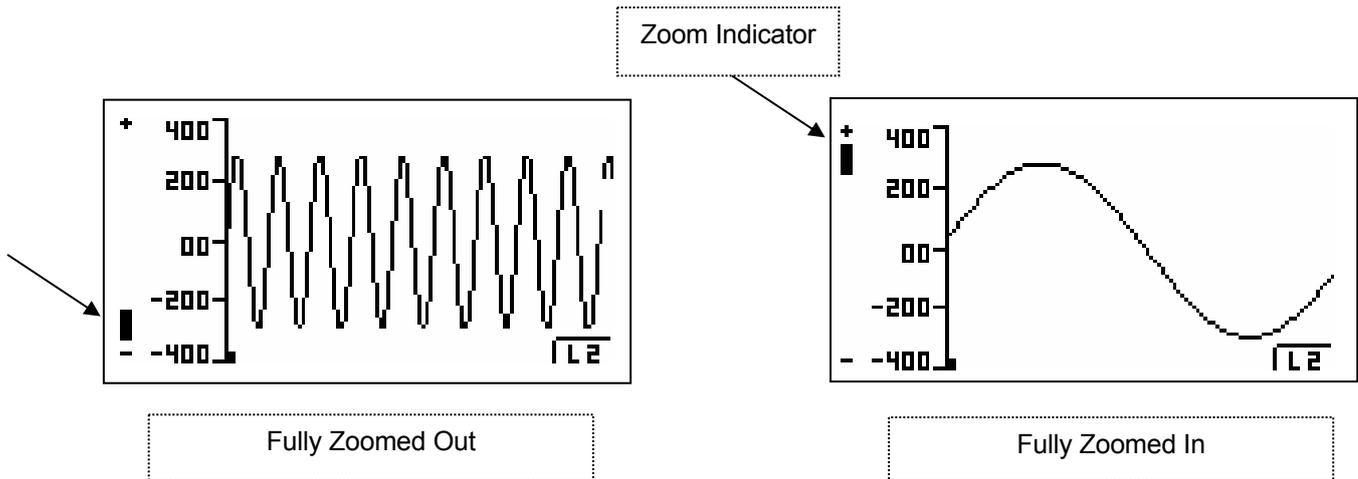
**Saving**

To save the displayed waveform, use GRAPH SAVE to enter the SAVE MODE.
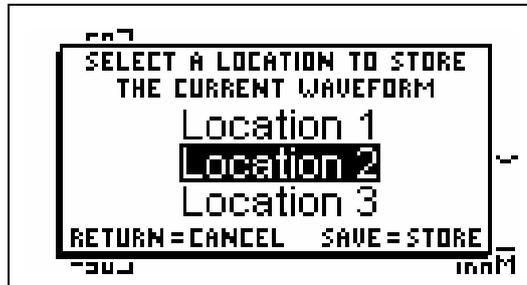


Use VALUE to select the desired storage location, then GRAPH SAVE to save the waveform, or RETURN can be

pressed to cancel the save function. Once the save is complete, the newly saved waveform will be

displayed.

---

<div style="border:1px solid">

# ERROR MESSAGES

</div>

Several error messages are provided to indicate invalid operating conditions. Any values that are over range will be displayed as dashes.



| 205.3 mV | - - - - Watts |
|---|---|
| 2053 mA | 315.1 mV Pk | 1.5 CF |
| Load: 300.0Ω | | |

Watts Calculation out of range



| 256.8 mV | 329.7 Watts |
|---|---|
| 2568 mA | - - - . - mV Pk | 4.6 CF |
| Load: 50.0Ω | | |

Peak Voltage Input Out of range

When the input voltage rises above the range that is measurable by the system, the "WARNING Input Overload" message will be shown.



**WARNING**
Input Overload

Load: 50.0Ω

Input Voltage Overload

**NOTE:** Although the input is protected from damage at these voltages, the user should immediately remove any input voltage when this message is shown.

---

# DFA™ TECHNOLOGY

DFA™ Digital Fast Acquisition Technology is a revolutionary new method of measuring ESU generator output power. A high-speed analog to digital converter is used to digitize the high frequency, high power output of the ESU generator. An RF Current Transformer is used to convert the current signal to a voltage signal, which is read by the a/d converter. By digitizing the signal a more accurate, frequency independent measurement can be made.

# COMMUNICATION PROTOCOL

The communication protocol provides a means to completely configure and use the SECULIFE ESPRO from a PC. All of the functions available through the front panel can be performed through the communication ports. All of the measurements made by the SECULIFE ESPRO are accessible as well. This provides for hands free or automated operation of the SECULIFE ESPRO.

## Communication Ports

The SECULIFE ESPRO has two communication ports. Both ports use the same command format. The Serial port is configured as 115,200 Baud Rate, 8 Data Bits, 1 Stop Bit, and No Parity. The USB port appears to a PC as a serial port and is configured for 748,800 Baud Rate, 8 Data Bits, 1 Stop Bit, and No Parity.

## Command Syntax

The command description is broken into 3 columns; the KEYWORD, the PARAMETER FORM and COMMENTS.

### Keyword

The KEYWORD column provides the name of the command. The actual name of the command consists of one or more keywords since SCPI commands are based on a hierarchical structure, also known as a **tree system**.

In such a system, associated commands are grouped together under a common node in the hierarchy, analogous to the way leaves at a same level are connected at a common branch. This and similar branches are connected to fewer and thicker branches, until they meet at the root of the tree. The closer to the root, the higher a node is considered in the hierarchy. To activate a particular command, the full path to it must be specified.

This path is represented in the following tables by placing the highest node in the left-most position. Further nodes are indented one position to the right, below the parent node.

The highest level node of a command is called the Keyword, followed by the Node, Subnode, and then the value.

Not all commands require the complexity of the full command path. For example, the Status? command doesn't have a Node or Subnode.

Some commands allow for reading and writing data and some commands are Read Only. To indicate a read function, a question mark (?) is placed at the end of the command path. For example, a write command to change the load resistance to 100.5 ohms would be "CONFigure:LOAD:VALue 100.5<cr>", where <cr> indicates a carriage-return. For example, a mArms read command would be "READ:MArms?<cr>", which would return a value of "xxx.x<cr><lf>" where <cr> is a carriage-return and <lf> is a linefeed.

Lowercase letters indicate the **long-form** of the command (for example, **CONFigure:INPut:RANGe?**) and can be omitted for simplification. Uppercase letters indicate the abbreviated, or **short-form,** of the commands and must be included (for example, **CONF:INP:RANG?**).

All commands sent to the unit are terminated with a Carriage Return.

**NOTE:** Commands can be entered in either upper or lowercase or a mixture of the two, uppercase and lowercase. Commands sent to the SECULIFE ESPRO are not case sensitive. Upper and lower cases are only used when documenting the commands.

**Parameter Form**

The PARAMETER FORM column indicates the number and order of parameters in a command and their legal values. Parameter formats are listed in angle brackets (<>) while string parameters are simply listed.

Square brackets ([]) are used to enclose one or more parameters that are optional.

The vertical bar (|) can be read as "or" and is used to separate alternative parameter options.

The query form of a command is generated by appending a question mark (?) to the last keyword. However, not all commands have a query form, and some commands exist only in the query form. The COMMENTS column is used to indicate this.

**Comments**

The COMMENTS column indicates any notes.

## CONFigure Subsystem

This group allows the user to setup the display and operational settings for the unit.

| KEYWORD | PARAMETER FORM | COMMENTS |
|---|---|---|

CONFigure

    :DISPlay   :SxZy  S<display_screen_number> Z<zone_number> nn

| display_screen_number = 1-7 |
|---|
| 1 = One Parameter |
| 2 = Two Parameters |
| 3 = Three Parameters |
| 4 = Four Parameters |
| 5 = Five Parameters |
| 6 = Measurement List Display (Non-editable) |
| 7 = Quick Configuration Screen (Non-editable) |
| |

| nn = Parameter for selected Zone | |
|---|---|
| 0 = mV RMS | 7 = Creast Factor |
| 1 = mA RMS | 8 = Time-Pulse On |
| 2 = Watts RMS | 9 = Time-Pulse Off |
| 3 = mV Peak | 10 = Time-Total Cycle |
| 4 = mV Pk-Pk | 11 = % Duty Cycle |
| 5 = mV Pk / mV Pk-Pk | 12 = mV Pulse Cycle |
| 6 = mV Pk+ | 13 = mA Pulse Cycle |
| | 14 = Watts Pulse Cycle |

| | | |
|---|---|---|
| :SCReen | < numeric_value > | Range 1-7<br>1-5 = # display zones<br>6=Measurement List Display<br>7=Quick Config Screen |
| :AVERaging | FAST \| SLOW \| MEDium | |
| :HOLD  ON \| OFF | | |
| :LOAD | | |
|  :MODE | TABle \| ADJustable | |
|  :VALue | < numeric_value > | Table Mode: 1-12 for individual resistors, 13-22 for resistor sets 1-10<br>Adjustable Mode: 0-6500.0 |
|  :SETn | < numeric_value > | n = Resistor set to configure (1-10)<br>< numeric_value > = 16 bit binary value of resistors to include in set 'n' where bit 0 = Load 1, Bit 1 = load 2… Bit 11 = Load 12 each bit selects whether the load is included in the set. Bit = 1 includes the load Bit = 0 excludes the load. |
|  :NUMber | < numeric_value > | set of valid numeric values |
|  :Ln | < numeric_value > | n = Load to configure<br>< numeric_value > = Actual value of load 'n'; 0-6500.0 ohms |
| INPut: | | |
|  Atten: | 0.1 \| 1 | |
|  RANGe: | 100 \| 1000 \| AUTo | |
|  NUMsamples: | 1024 \| 2048 \| 4096 \| 8192 \| 16384 \| 54768 | |
|  MODE: | CONTinous \| PULs | |

## SYSTem Subsystem

This group allows the user to setup the startup mode for the unit, as well as directly control the unit, as if pressing the keys on the front panel.

| KEYWORD | PARAMETER FORM | COMMENTS |
|---|---|---|
| SYSTem: | | |
| POWer | DEFaults \| CUStom \| SETCurrent | |
| CONtrast | < numeric_value > | Numbers 1-20 |
| KEY | DUP \| DDN \| SUP \| SDN \| VUP \| VDN \| SETup \| RETurn \| GSAVe \| HOLD | |
| VER? | | Read only |

## READ Subsystem

This group allows the user to get measurements from the unit.

| KEYWORD | PARAMETER FORM | COMMENTS |
|---|---|---|
| READ: | | |
| | MVrms \| MArms \| Warms \| MVPeak \| MVPP \| MVP-PP \| MVPK+ \| CF \| TON \| TOFF \| TCYC \| DCYC \| MVCyc \| MACyc \| WCyc | Read only |
| | DATA | Read only |
| | LOCn | Read only, 'n' = stored waveform location to read (1-3) |

## STATus Sub-system

This subsystem provides status on the operating mode of the unit including messages that would normally be seen on the display.

| KEYWORD | PARAMETER FORM | | | COMMENTS |
|---|---|---|---|---|
| STATus? | Bit | Value | Definition | Read Only |
| | 0 | 1 | Hold Mode | |
| | 1 | 2 | Graph Mode | |
| | 2 | 4 | Calibration Mode | |
| | 3 | 8 | | |
| | 4 | 16 | | |
| | 5 | 32 | | |
| | 6 | 64 | | |
| | 7 | 128 | | |
| | 8 | 256 | Error Present | |
| | 9 | 512 | mV Out of Range | |
| | 10 | 1024 | mA Out of Range | |
| | 11 | 2048 | Watts Out of Range | |
| | 12 | 4096 | mV Peak Out of Range | |
| | 13 | 8192 | Crest Factor Out of Range | |
| | 14 | 16384 | | |
| | 15 | 32768 | | |

# SECULIFE ESPRO **Communication Command Summary**

| Keywords | Nodes | Subnodes | Values |
|---|---|---|---|
| CONFigure | DISPlay | SxZy nn | x is the Screen # (1-5) and y is the Zone # (1-5). <br> nn=0 to 13: <br> 0=mV RMS <br> 1=mA RMS <br> 2=Watts RMS <br> 3=mV Peak <br> 4=mV Pk-Pk <br> 5=mV Pk / mV Pk-Pk <br> 6=mV Pk+ <br> 7=Crest Factor <br> 8=Time-Pulse On <br> 9=Time-Pulse Off <br> 10=Time-Total Cycle <br> 11=% Duty Cycle <br> 12=mV Pulse Cycle <br> 13=mA Pulse Cycle <br> 14=Watts Pulse Cycle |
| | | SCReen | Range: 1-7 <br> 1-5 = # display zones <br> 6=Measurement List Display <br> 7=Quick Config Screen |
| | | AVERaging | FAST, SLOW, MEDium |
| | HOLD | ON,OFF | |
| | LOAD | MODE | TABle, ADJustable |
| | | VALue | Table Mode: 1-12 for individual Resistors, 13-22 for resistor sets 1-10 <br> Adjustable Mode: 0-6500.0 Ohms |
| | | SETn xxxx | n = Resistor set to configure, 1-10 <br> XXXX = 16 bit Binary value of resistors to include in set 'n' <br> Where Bit 0 = Load 1, Bit 1 =Load 2… Bit 11 = Load 12 <br> Each bit selects whether the load is included in the set. <br> Bit = 1 includes the load,  Bit = 0 excludes the load. <br><br> Example: a value of 9 would select loads 4 and 1 and exclude everything else |
| | | NUMber | 1-12 (determines the number of loads present in system) |
| | | Ln xxxx | n = Load to configure <br> xxxx = Actual value of load 'n', 0-6500.0 ohms. |
| | INPut | ATTen | 0.1, 1 (donut attenuation) |
| | | RANGe | 100, 1000, AUTo |
| | | NUMsamples | 1024, 2048, 4096, 8192, 16384, 32768 |
| | | MODE | CONTinuous, PULsed |
| SYSTem | POWerup | DEFaults, CUStom, SETCurrent | |
| | CONtrast | 0-20 | |
| | KEY | DUP, DDN, SUP, SDN, VUP, VDN, SETup, RETurn, GSAVe, HOLD | |
| | VERsion? | [read only] | |

# SECULIFE ESPRO Communication Command Summary

| Keywords | Nodes | Subnodes | Values |
|---|---|---|---|
| READ | MVrms? | Returns: mV RMS [read only] | |
| | MArms? | Returns: mA RMS [read only] | |
| | WArms? | Returns: Watts RMS [read only] | |
| | MVPeak? | Returns: mV Peak [read only] | |
| | MVPP? | Returns: mV Peak to Peak [read only] | |
| | MVP-PP? | Returns: mV Peak/Peak to Peak [read only] | |
| | MVPK+? | Returns: mV Positive Peak [read only] | |
| | CF? | Returns: Crest Factor [read only] | |
| | TON? | Returns: Time - Pulse On [read only] | |
| | TOFF? | Returns: Time - Pulse Off [read only] | |
| | TCYC? | Returns: Time - Total Cycle [read only] | |
| | DCYC? | Returns: % Duty Cycle [read only] | |
| | MVCyc? | Returns: mV Pulse Cycle [read only] | |
| | MACyc? | Returns: mA Pulse Cycle [read only] | |
| | WCyc? | Returns: Watts Pulse Cycle [read only] | |
| | DATA? | Returns: Entire Data Buffer [read only] Length = NUMSamples * 2 Data Format is mV in signed double byte format, Decimal place is assumed based on Input Range (Low Range = 2DP, High Range = 1DP) | |
| | LOCn? | Returns: Saved Data Buffer at Location 'n' , n= 1-3 [read only] Length = NUMSamples * 2 Data Format is mV in signed double byte format, Decimal place is assumed based on Input Range (Low Range = 2DP, High Range = 1DP) | |

| Keywords | Bit | Value | Definition |
|---|---|---|---|
| STATus? | 0 | 1 | Hold Mode |
| | 1 | 2 | Graph Mode |
| | 2 | 4 | Calibration Mode |
| | 3 | 8 | |
| | 4 | 16 | |
| | 5 | 32 | |
| | 6 | 64 | |
| | 7 | 128 | |
| | 8 | 256 | Error Present |
| | 9 | 512 | mV Out of Range |
| | 10 | 1024 | mA Out of Range |
| | 11 | 2048 | Watts Out of Range |
| | 12 | 4096 | mV Peak Out of Range |
| | 13 | 8192 | Crest Factor Out of Range |
| | 14 | 16384 | |
| | 15 | 32768 | |

# LIMITED WARRANTY

**WARRANTY:** **GMC-I MESSTECHNIK GMBH** WARRANTS ITS NEW PRODUCTS TO BE FREE FROM DEFECTS IN MATERIALS AND WORKMANSHIP UNDER THE SERVICE FOR WHICH THEY ARE INTENDED. THIS WARRANTY IS EFFECTIVE FOR TWELVE MONTHS FROM THE DATE OF SHIPMENT.

**EXCLUSIONS:** THIS WARRANTY IS **IN LIEU OF** ANY OTHER WARRANTY EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF **MERCHANTABILITY** OR FITNESS FOR A PARTICULAR PURPOSE.

**GMC-I MESSTECHNIK GMBH** IS NOT LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.

NO PERSON OTHER THAN AN OFFICER IS AUTHORIZED TO GIVE ANY OTHER WARRANTY OR ASSUME ANY LIABILITY.

**REMEDIES:** THE PURCHASER'S SOLE AND EXCLUSIVE REMEDY SHALL BE: (1) THE REPAIR OR REPLACEMENT OF DEFECTIVE PARTS OR PRODUCTS, WITHOUT CHARGE. (2) AT THE OPTION OF **GMC-I MESSTECHNIK GMBH**, THE REFUND OF THE PURCHASE PRICE.

# SPECIFICATIONS

| 100 mV INPUT RANGE | |
|---|---|
| Voltage (RMS) | 20 – 70.00 mV RMS |
| Input Resolution | 0.01 mV RMS |
| Voltage (Peak, Peak - to - Peak) | 100.0 mV |
| Resolution | 0.01 mV |
| Frequency | 10 kHz – 10 MHz |
| Accuracy | 0.5 mV, $\leq$ 50 mV,    up to 1 MHz<br>1.0 mV, $\leq$ 50 mV,   1 to 10  MHz<br>1% reading, > 50 mV, up to   1 MHz<br>3% reading, > 50 mV,   1 to   5 MHz<br>12% reading, > 50 mV,   5 to 10 MHz |
| Maximum Input Voltage | 3.3 V p-p<br>Internally Protected |
| **CALCULATED RANGES** | |
| Current (with 0.1:1 CT) | 700.0 mA RMS |
| Resolution | 0.1 mA |
| Current (with 1:1 CT) | 70.00 mA RMS |
| Resolution | 0.01 mA |
| mV Peak / Peak - to - Peak | 0.0 to 1.0 |
| Resolution | 0.1 |
| Wattage | 999.9 Watts |
| Resolution | 0.1 Watt |
| Crest Factor | 1.4 to 500 |
| Resolution | 0.1 |
| **INPUT IMPEDANCE** | |
| 50 ohms | |
| **INPUT COMPATIBILITY** | |
| RF Current Transformer (50ohm) | Pearson (Typical) |
| RF Current Transformer Attenuation | 0.1:1 (Pearson Model 411)<br>1:1 (Pearson Model 4100)<br>User Selectable |

| 1000 mV INPUT RANGE | |
|---|---|
| Voltage (RMS) | 2.0 – 700.0 mV RMS |
| Input Resolution | 0.1 mV RMS |
| Voltage (Peak, Peak - to - Peak) | 1000.0 mV |
| Resolution | 0.1 mV |
| Frequency | 10 kHz – 10 MHz |
| Accuracy | 0.5 mV, $\leq$ 50 mV<br>1% reading, > 50 mV, up to 1 MHz<br>3% reading, > 50 mV, 1 to 10 MHz |
| Maximum Input Voltage | 3.3 V p-p<br>Internally Protected |
| **CALCULATED RANGES** | |
| Current (with 0.1:1 CT) | 7000 mA RMS |
| Resolution | 1 mA |
| Current (with 1:1 CT) | 700.0 mA RMS |
| Resolution | 0.1 mA |
| mV Peak / Peak - to - Peak | 0.0 to 1.0 |
| Resolution | 0.1 |
| Wattage | 999.9 Watts |
| Resolution | 0.1 Watt |
| Crest Factor | 1.4 to 500 |
| Resolution | 0.1 |
| **INPUT IMPEDANCE** | |
| 50 ohms | |
| **INPUT COMPATIBILITY** | |
| RF Current Transformer (50ohm) | Pearson Electronics (Typical) |
| RF Current Transformer Attenuation | 0.1:1 (Pearson Model 411)<br>1:1 (Pearson Model 4100)<br>User Selectable |

| TIMING MEASUREMENTS FOR Ton, Toff, Tcyc and % Duty Cycle | |
| --- | --- |
| Resolution | 0.1 ms |
| Accuracy | $\pm$ 0.2 ms |

| | |
| --- | --- |
| **DISPLAY** | LCD Graphical 128 X 64 Pixels |
| **SETUP MEMORY** | EEPROM, All Parameters |
| **MEMORY RETENTION** | 10 Years w/o Power |
| **OPERATING RANGE** | 15 to 30 Degrees C |
| **STORAGE RANGE** | -40 to 60 Degrees C |
| **CONSTRUCTION** | Enclosure – ABS Plastic Face – Lexan, Back Printed |
| **SIZE** | 3.4 x 9.1 x 8.0 inches 86.36 x 231.4 x 203.2 mm (HxWxD) |
| **WEIGHT** | $\leq$ 3 lbs. (1.36 kg) |
| **CONNECTIONS** | Input:  BNC Output:  Serial DB-9 or USB |
| **POWER SUPPLY ADAPTER** | 6 VDC 500 mA |
| **POWER CONSUMPTION** | ON:  less than 150 mA OFF:  less than 40 µA |
| **DATA STORAGE (Internal)** | 3 Sets of 32768 Data Points |

| NOTES |
|:---:|

**Product Support**

If required please contact:

GMC-I Messtechnik GmbH
Product Support Hotline
Phone +49 911 8602-0
Fax    +49 911 8602-709
E-Mail support@gossenmetrawatt.com

**Service Center**

**Repair and Replacement Parts Service**
**Calibration Center \***
**and Rental Instrument Service**
When you need service, please contact:
GMC-I Service GmbH
    **Service Center**
    Thomas-Mann-Strasse 20
    90471 Nürnberg • Germany
    Phone      +49 911 817718-0
    Fax          +49 911 817718-253
    E-Mail      service@gossenmetrawatt.com
    www.gmci-service.com
This address is only valid in Germany.
Please contact our representatives or subsidiaries for service in other countries.

\***DKD** Calibration Laboratory
    for Electrical Quantities DKD – K – 19701
    accredited per DIN EN ISO/IEC 17025:2005

Accredited measured quantities: direct voltage, direct current -values, DC -resistance, -alternating voltage, -alternating current -values, AC active power, AC apparent power, DC power, -capacitance, -frequency and temperature