



**Ranger**  
Power Quality



# Ranger PM7000 POWER QUALITY RECORDING ANALYZER



## Each Unit Includes

- FIVE FUSED VOLTAGE PROBES 600V CAT IV POLLUTION LEVEL 2
- FOUR 24" 6000A/400.0A FLEXIBLE CURRENT CLAMPS (MAX CONDUCTOR SIZE 8")
- PRONTO FOR WINDOWS ANALYSIS SOFTWARE
- POCKET PC—COLOR WINDOWS MOBILE
  - 12 VOLT WALL CHARGER
  - OPERATION MANUAL ON CD
    - CARRYING CASE
    - 1 YEAR WARRANTY
- NO COST LIFETIME UPGRADES FOR SOFTWARE & FIRMWARE
- CONFORMS TO IEEE 1453 FLICKER

CONFORMS TO IEEE 1453  
Our Software Displays & Prints  
Instantaneous Flicker Sensation  
For the Entire Length of Recording  
A Ranger / Pronto Exclusive  
Ask our competitors to show you  
IF their software can do this  
Before You Buy!

ASK OUR COMPETITORS TO  
SHOW YOU IF THEY  
CAN DO ALL 10

## TOP 10 REASONS YOU SHOULD ONLY CONSIDER RANGER PM7000 PQ RECORDING ANALYZER

1. Input leads fusing is - **STANDARD**, because for us, **SAFETY is NUMBER 1—EXCLUSIVE**  
Also, Isolation, both between channels AND for Communications
2. **Compliant to IEEE 1453 Flicker Specification** released May 2005. **ONLY** Ranger loggers can provide the required "NEW" **Instantaneous Flicker Output** for the **ENTIRE LENGTH OF RECORDING** with **FLICKER FLAG VALIDATION FOR SHORT & LONG TERM FLICKER**
3. RECORDS **32 Detail Channels** simultaneously with single cycle resolution on changes BECAUSE of our: **EXCLUSIVE PATENTED "SINGLE CYCLE ADAPTIVE STORE"**  
Gives unprecedented detail. TRY IT! **YOU WILL BE AMAZED!**
4. High speed sampling on ALL inputs including CURRENT.
5. Auto-ranking of waveform capture greatest disturbances—Ranger **EXCLUSIVE**
6. 128 Meg on board memory. USB jump drive compatible for extended memory.
7. Wireless communications to remote screen (PDA), allows utility personnel access to PM7000 display, without suiting up as required by NFPA 70. **Check out our ITIC/CBEMA event display.** (see page 5)
8. **Stores over 200 configurations on board.** Just choose a configuration, press load & start.
9. InterHarmonics Option. Ranger PM7000 is the best instrument on the market—we are the experts (see page 14 & 15)
10. **Phasor Diagram Display** of individual harmonics, **NOT** just the fundamental

# Ranger PM7000 SPECIFICATIONS

<b>Input Voltage</b>	<b>FOUR FUSED</b> 0-600 Vac Safety Banana Sockets	<b>Configurations</b>	<b>On Board Storage of over 200 configs—Exclusive</b>
<b>Input Current</b>	<b>Four</b> Sensors 2 ranges 6000A or 400.0A menu selectable.	<b>Data Retention</b>	<b>Flash Memory:</b> During recording sequential data is saved to Flash memory. Waveform capture data is held in RAM and transferred to Flash memory when recording .
<b>Channels</b>	<b>32 Channels Single Cycle Adaptive Store™</b> for detail data and troubleshooting,	<b>User Interface</b>	<b>Via Remote Screen:</b> PC via Bluetooth or USB Running PMScreens or Pronto, Pocket PC provided with each unit via Bluetooth running PMScreens
<b>Accuracy</b>	< 0.25% excluding sensors, +/- 2LSBs	<b>Setup/Configuration:</b>	Via remote screen
<b>Programmable</b>	<b>AC 1 Phase:</b> RMS, Stray Voltage RMS Hi Res < 35V,	<b>Data Review:</b>	Real Time via Bluetooth Pocket PC, laptop or PC
<b>Math Channels</b>	Real power, VARS, Apparent Power, Phase angle,	<b>Displays</b>	<b>PMScreen:</b> Pocket PC over Bluetooth to program and display Power & Energy, Waveforms, Harmonics, Phasors, Harmonic Phasors, Trends, Statistics, list of channels & more
<b>Recorded using</b>	Power Factor (Real & Displacement), Frequency,	<b>Communications</b>	<b>Bluetooth:</b> Wireless interface (isolated)
<b>Adaptive Store</b>	Instantaneous Flicker Sensation, Flicker Flag, (Pst, Plt already recorded)	<b>USB:</b>	Serial interface to PC (isolated > 2.5kV)
<b>For extra detail and/or troubleshooting</b>	<b>AC 2 Phase:</b> Real Power, VARS, Apparent Power, Power Factor <b>AC 3 Phase:</b> Real Power, VARS, Apparent Power, Power Factor, Voltage Unbalance (Conventional & Sequential Components), Current Unbalance <b>Harmonics:</b> Total Harmonic Value, % Total Harmonic Distortion, Odds, Evens, Triplens and individual harmonics with direction, K-Factor <b>Interharmonics, optional</b> <b>Basic Maths:</b> Channel X * Constant, Channel X/Channel Y, Filtered Channel X, Internal Temperature, On Charge, Battery Volts	<b>USB:</b>	Memory module interface (non-isolated). Download to PC & control through PDA or Pronto for Windows, MODBUS Ascii support
<b>Waveform Capture</b>	Sample Rate: 8 channels at up to ~ 1.2288Ms/s (~20,480 samples / cycle)	<b>Power Requirements:</b>	Powered from V1 input (90-660 VRMS, 15W Max) OR from charger input @ 12Vdc, 6W Max.—Auto Switching
<b>Wave Allocation</b>	Waves allocated across trigger functions	<b>Battery Capacity:</b>	1600mAhrs (5 HI-Temp NiMH batteries)
<b>Wave Sets</b>	TBD—but will be in 1000's	<b>Charge Method:</b>	From V1 input or from 12V Wall Charger (auto switching) Battery Ride Through: 10 minutes at a time
<b>Recording</b>	<b>PM7000S —Sample rate per cycle ~ 320</b> <b>PM7000H —Sample rate per cycle ~ 2560</b> <b>PM7000T —Sample rate per cycle ~ 20,480</b>	<b>A/D Converter</b>	<b>Resolution:</b> 24 bit (top 16 bits used normally) for harmonics, power & energy, flicker
<b>Memory</b>	128MB Flash memory for all files 32MB RAM for waveform capture data 64MB working RAM Firmware (program memory) 2MB Flash upgradeable User Preferences - Stored in non-volatile RAM/EEPROM	<b>Resolution</b>	Programmable to 0.1 Vac and 0.1 Aac (0.01V high res mode)
<b>Recording Mode and Rate</b>	<b>Point Store:</b> Selectable from single cycle rate to once every 12 hours <b>Adaptive Store:</b> Extended recording with single cycle (half cycle?) resolution on changes. Statistics closed (at least) every 5 minutes. <b>General Store:</b> Statistics to IEC EN50160 via PC Software <b>Waveforms:</b> Examined <b>RANKED</b> and stored in real time at full speed— <b>Exclusive</b>	<b>Environmental</b>	<b>Operating &amp; Storage Temp:</b> -10° F to 140° F <b>Case Type:</b> Pelican 1150 Box <b>Dimension:</b> 9" x 7.5" x 4.3" <b>Weight:</b> 7.7 LBS <b>IP Rating:</b> IP67 (immersion for limited time)
<b>Flicker</b>	<b>IEEE 1453 INSTANTANEOUS FLICKER FOR ENTIRE LENGTH OF RECORDING</b>	<b>Certification</b>	IEC 61010 (600V Category <b>IV</b> . Pollution level 2, 1000V Cat III if PSU fuses removed), CE Fused voltage leads (lead fuses 500mA, 1000V, 50kA rupture current) GS38 compliant Internal Fusing: PSU (x2), Charger input, Battery stack Internal Thermal Fuse
<b>Fixed Functions</b>	Voltage & Current RMS (8 inputs)	<b>Computer Requirements</b>	For Pronto Software: Windows 9x, ME, NT, XP, Vista
<b>Recorded on (selected)</b>	THD/Harmonic Value (8 inputs) Power (kW, VAR, AP, PF)	<b>PDA Requirements</b>	For PMScreens: Microsoft Pocket PC 2003
<b>Intervals (Max, Min, Avg)</b>	Individual Harmonics 2-51 (8 * 50 signals)	<b>Applicable Patents</b>	6424277, 0230712, 4910692
<b>&gt;492 CHANNELS</b>	General Store avg. adjustable 1 sec— 1 hour		

**Ranger PM7000**  
 BETA: 0.206 Serial No: 1.018.0246.550203

14:16:12 10 Jul 06 Main Menu Help ?

Connections Rogowski Coil 3Ø 4w Wye

← Back Main Menu

Operations  
 Explore Configure Stop Recording Power Dff

Display Graphs & Tables  
 General Parameters Detail Recording Channels  
 Harmonics and Phasors Compare to Standards ENS0160 GS/4 IEEE519  
 Waveforms

14:26:03 10 Jul 06

← Back Information

Ranger PM7000 Power Master Series  
 Serial No: 1.018.0246.550203  
 Date calibrated: 4/Jul/06

← Back PM7000 Help

Help for the PM7000 series products is available primarily by pressing a button and holding it down for a second or more.

Try it here... Contents Index General

Then press briefly for more help.

Press here to skip this introduction in future (re-enabled on next Logger power-up). Skip

← Back Configure

Preferences Utilities Available Configs

Current Configuration Initial Config

Hook Up Record Mode & Times Review  
 Detail Recording Channels Save as...  
 Input Signals Waveform Capture Flicker

← Undo Select Hook-up Accept

3-Phase 4-Wire Wye (Optional)

Some connections may be suspect Details

← Undo Input Signals Accept

VOLTAGE GROUP Secondary PT  
 Set signals individually Ratio 20.0:1

CURRENT GROUP Secondary CT  
 Set signals individually Ratio 200:5

Select Current Sensor (& Range)  
 Rogowski Coil or Voltage Output CT  
 High 3000A Mid 320.0A  
 0-1V rms Ratio 10:1

← Undo Set Waveform Capture parameters Accept

Retain Wave Sets on basis of  
 Greatest Disturbances First Past Threshold

Captured Wave Bracket 100 ms  
 Press within waves to choose start & stop

Signals to be Captured  
 Triggers to be used Set

← Undo Setup Record Mode & Times Accept

General Parameters Record Every 1 min

Detail Recording (Trouble Shooting)  
 Storage Mode Adaptive Store Point Store  
 Record Time 7 days  
 Recycling FIFO On Off

← Undo Detail Recording Channels Accept

Setup the recording channel functions: (press function TWICE to edit or use buttons) Suggest New Functions

10	RMS Ic (I3)	Aac
11	RMS In (I4)	Aac
12	Flicker Sensation Van	Pfs
13	Flicker Sensation Vbn	Pfs
14	Flicker Sensation Vcn	Pfs
15	Flicker PLT Van (V1)	Plt

List by: Channel Name Signal

← Undo Edit Channel Function Accept

+/- % One Harmonic Apply to Channel 16 (Change Channel)

1	2	3	4	5
6	7	8	9	10
11-20	21-30	31-40	41-50	

of Signal Units %

Van Vbn Vcn Vne  
 Ia Ib Ic In

High Alarm +0.0 Off Low Alarm +0.0 Off

Recording Suggestions Return to List

Most recent channel defined: (press to edit, or clear using button)

7 Calculated RMS Vac Vac Clear

No. of next channel to be defined: 8

Suggestions for next channel: (press on a function to select then edit above)

RMS Ia (I1)	Aac
THD Van (V1)	%
Other	

← Back Detail Recording Channels

1: RMS Van (V1)	2: RMS Vbn (V2)
+222.1 Vac	+0.0 Vac
3: RMS Vcn (V3)	4: RMS Vne (V4)
+0.1 Vac	+0.0 Vac
5: Calc RMS Vab	6: Calc RMS Vbc
+222.1 Vac	+0.1 Vac
7: Calc RMS Vac	8: RMS Ia (I1)
+222.2 Vac	+12. Aac

Set Channels to Display

← Back General Parameters - Live Summary

Summary	Volts	Current	Volts Flicker
Signal V-rms [V]		Signal I-rms [A]	
Van	222.0	Ia	12.
Vbn	0.1	Ib	0.
Vcn	0.1	Ic	6.
Vne	0.0	In	7.
Parameter		Parameter	
Unbal %	199.73	kW	+2.
NPS/PPS	100.00	kVar	+0.
PF	+0.94	kVA	2.
Freq. (Hz)	49.89	kWhr	7.

← Back Harmonic Presentation

BarGraph Phasor Trend Table

Signal All  
 Harm. 1-21  
 Remove Fund. Show Direction

← Back Harmonic Presentation

Harm	Rel(%)	Phase	Value
1	100.0	0	222.6
2	0.0		0.0
3	0.9	204	1.9
4	0.0		0.0
5	0.9	114	1.9
6	0.0		0.0
7	1.9	189	4.3
8	0.0		0.0
9	0.3	236	0.7
10	0.0		0.0

← Back Live Waveforms Stored Waveforms

Signal Van  
 Zoom History

← Back Live Waveforms Stored Waveforms

Signal All V  
 Zoom History

← Back Live Waveforms Stored Waveforms

Signal Van  
 Zoom History

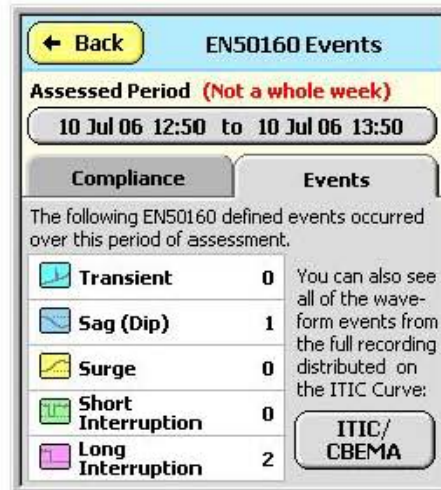
← Back Live Waveforms Stored Waveforms

Signal Van  
 Zoom History

# Ranger PM7000 POCKET PC SCREEN EXAMPLES FOR "REAL TIME" COMPLIANCE & EVENT PRESENTATION



Screen a)



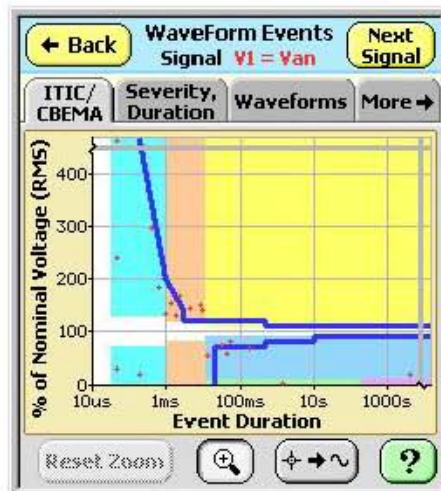
Screen b)

Recorded results may be compared against various Standards, for example EN50160 the European Public Voltage Supply characteristic.

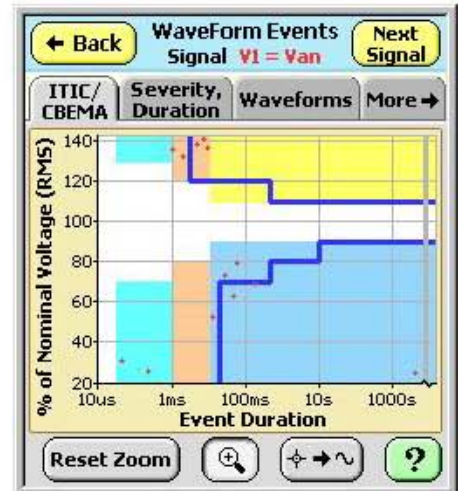
The screens here show examples a) of the summaries for compliance of the supply during the assessed period, and b) the number of specific events.

For both of these screens the assessment period can be adjusted.

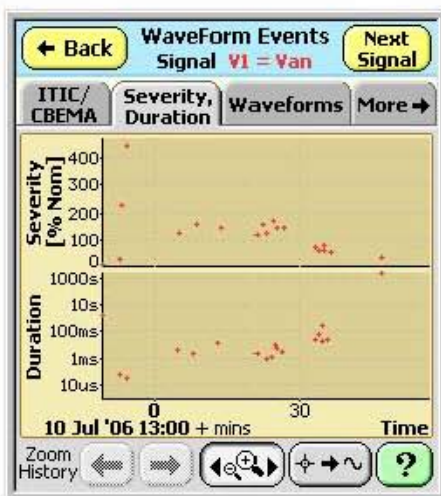
The screens to the right and below show different ways of presenting recorded event data. Screen c) is the conventional ITIC (CBEMA) presentation. This graph can be zoomed (d) to distinguish elements of a cluster, then the relevant waveform can be displayed.



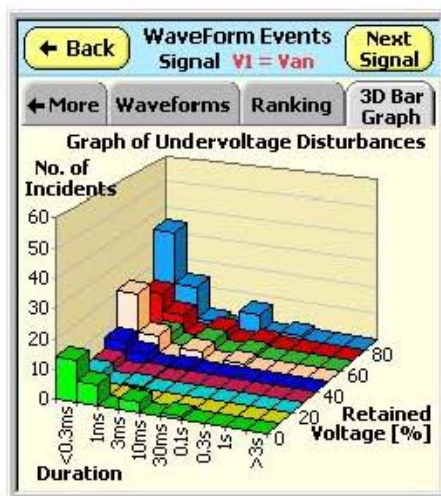
Screen c)



Screen d)



Screen e)



Screen f)

Screen e) shows event severity and duration against time for the recording. This too can be zoomed in.

Screen f), the 3D Undervoltage Disturbance graph, shows how serious the supply disruptions have been in terms of an industrial process being disturbed.

Remember that sags/dips may affect processes more seriously than complete outages.

## FEATURES

- ▶ **Patented Single Cycle Adaptive Storage**  
One Meg memory provides **single cycle** event resolution over recording periods of 30 days with all 16 channels recording - **Standard**
- ▶ Graphical **touchscreen** interface provides straightforward, user-friendly operation
- ▶ Resident on-line HELP guides users through configuration and hook up
- ▶ Records and displays up to 16 channels of voltage, current, power, power factor, VAR's, phase angle, frequency, THD, K Factor - **Standard**
- ▶ **Records & Displays Harmonics: Odd, Even, Triplens and Individual with direction to the 15th**
- ▶ **RECORDS & DISPLAYS Instantaneous Flicker Sensation over the entire recording session, as well as programmable time periods for long & short term flicker—Ranger / Pronto Exclusive**
- ▶ Battery back up provides 10 minutes re settable timed ride-through in case of power outage
- ▶ Powered independently by AC measurement circuits or DC power supply for voltages below 50 volts
- ▶ **15** pre-stored configurations are set for 3 phase, 2 phase, and single phase hook ups with several math channels pre-configured for power, harmonic & **Flicker** measurements
- ▶ Fused voltage leads and internally fused voltage inputs protect expensive equipment - **Standard**
- ▶ **Exclusive** - Capable of storing up to **127** configuration or data files
- ▶ Built in connection wizard ensures correct hook up, provides suggestions upon detecting errors and determines if current sensor is properly orientated
- ▶ Phasor Diagram Display to ensure correct hook up **and show the phase relationship of individual harmonics**
- ▶ RS232, with MODBUS ASCII and modem compatible Data Storage includes an additional internal flash memory for field programmable upgrades
- ▶ **Safety Benefit:** Very small size, will fit in most panels and allow the door to be closed
- ▶ Lowest Cost 3 Phase Power Quality & Harmonic Logger on the market today—rugged, compact, portable case is lockable



### Each Unit Includes

- PM3000HF Power Quality & Harmonic Logger
- Three 24" 3000A/400.0A Flexible Current Clamps (max conductor size 8")
- Four **Fused** Voltage Input Cables
- 9-Pin Serial Download Cable
- Two Neutral Common Jumpers
- 12 Volt Charger
- Pronto for Windows Analysis Software
- Operation Manual on CD
- Training Video
- Carrying Case

**CONFORMS TO IEEE 1453**  
Our Software Displays & Prints  
Instantaneous Flicker Sensation  
For the **Entire Length of Recording**  
A **Ranger / Pronto Exclusive**  
Ask our competitors to show you  
IF their software can do this  
Before You Buy!

## SPECIFICATIONS

**Input Voltage** Four 0-525 Vac In-line shrouded 4mm banana plugs and **fused** crocodile clips

**Input Current** Three 24" 3000A/400.0A (software selectable) Flexible Current Clamps **included**, or with optional conventional 0-5 Vac current clamp voltage output

### Channels 16

**Accuracy** Volts and wide range current < 0.25% True RMS  
Narrow range current < 1% True RMS

**Resolution** Programmable to 0.1 Vac and 0.1 Aac  
0.01V, 0.01A high resolution mode

**Math Channels** AC 1 Phase: RMS, Stray Voltage RMS HI Res < 35V,  
Real power, VARS (fund), Apparent Power,  
Power Factor, Phase angle, Frequency

AC 2 Phase: Real Power, VARS (fund), Apparent Power,  
Power Factor

AC 3 Phase: Real Power, VARS, (fund), Apparent Power,  
Power Factor, Voltage Unbalance, Current Unbalance  
(Conventional & Sequential Components)

**Harmonics:** Value and / or percentage of total harmonic distortion, odd, even, triplens and individual harmonics **with direction** to the 15th.

**Records & Displays Instantaneous Flicker Sensation over the entire recording session, as well as programmable time periods for long & short term flicker—Ranger / Pronto Exclusive**

**Recording** 3840 samples per second; **Single Cycle** True RMS response time; 16 bit simultaneously sampling all channels

**Memory** 1MB Ram - **Standard / Approximately 4MB uncompressed**

**Recording Mode and Rate** **Adaptive Store: Unique** store management enables extended recording & **Single Cycle** resolution on significant signal changes  
**Point Store:** Selectable from **Single Cycle** rate to once every 12 hours

**Data Retention** Back-up battery provides 3 month's retention @ 77°F (25°C)

**Power** Requires 50-525 Vac off of Phase A voltage measurement or separate power supply  
Battery: 4 AA Ni-Cad battery pack & 1 Lithium battery

**Communications** **Serial Ports:** RS232, (up to 230.4K baud); Isolation > 2.5kV  
Protocol: MODBUS ASCII

**Computer Requirements for Pronto Software:** Windows 9x, ME, NT, XP; 486DX66 or higher; 250MB hard drive; 16MB RAM

**Display** Backlit LCD graphic **touchscreen** display 2.5" x 1.35"

**Case** Pelican 1120 Guard Box: Dimensions 8" x 6.5" x 3.5"

**Weight** 2.5lbs. without leads and clamps

**Operating Temp** -4°F (-20°C) to 140°F (60°C)

**Certification** IEC 61010, Cat. III, Pollution Degree 2; CE

ASK OUR COMPETITORS TO SHOW YOU IF THEY CAN DO ALL 6

# TOP 6 REASONS YOU SHOULD ONLY CONSIDER RANGER PM3000HF HARMONIC LOGGER

1. Input lead fusing is - **STANDARD**, because for us, **SAFETY is NUMBER 1—EXCLUSIVE**
2. **Compliant to IEEE 1453 Flicker Specification** released May 2005. **ONLY** Ranger Loggers can provide the required "NEW" **Instantaneous Flicker** Output for the ENTIRE LENGTH OF RECORDING UP TO 14 DAYS while RECORDING ALL 16 CHANNELS available
3. RECORDS **16 Channels** simultaneously for **2 WEEKS** with single cycle resolution on changes BECAUSE of our: **EXCLUSIVE PATENTED "SINGLE CYCLE ADAPTIVE STORE"**  
Gives unprecedented detail. TRY IT! **YOU WILL BE AMAZED!**
4. **Harmonic Direction** shows if Harmonics are **upstream** or **downstream** from the point of measurement
5. Stores up to **127 Configurations on board**  
Eliminates the need to program on site  
– Just choose a configuration, press Load & Start
6. **Phasor Diagram Display** to ensure correct hook up and show the phase relationship of individual harmonics, NOT just the fundamental

Comes with 15 Pre-Stored Configurations. Just choose through the communication port OR program your own, with the Included PMScreen Software  
Graphical LCD Touchscreen (backlit) Display Interface  
PRONTO Software is included with all PM Products, AND **LIFETIME UPGRADES** for software & firmware at **NO COST**

## Ranger PM3000HF DISPLAY SCREEN EXAMPLES



24 -7 Technical Assistance @ 248-408-7852



## FEATURES

- **Patented Single Cycle Adaptive Storage**  
One Meg memory provides single cycle event resolution over recording periods of 30 days with all 16 channels recording— **Standard**
- FIVE externally visible status LEDs (4-bi-color)
- Rogowski coil technology ensures the most accurate current readings in a low current measurement situation  
*Accurate current readings to zero amps*
- **RECORDS & DISPLAYS Instantaneous Flicker Sensation over the entire recording session**, as well as programmable time periods for long & short term flicker— **Ranger / Pronto Exclusive**
- Data storage includes an additional internal flash memory for field programmable upgrades
- Battery back up provides 10 minutes re-settable timed ride-through in case of power outage
- **Works with 1S, 2S, & 12S Meter Sockets**
- **Twelve** pre-stored configurations are set for split phase hook ups with several math channels pre-configured for power, harmonic, and Flicker measurements
- **Infrared Optically Isolated Noncontacting RS232**, with MODBUS ASCII
- Records and displays up to **16 channels** of voltage, current, power, power factor, VAR's, phase angle, frequency, THD Harmonic Readouts on all voltage and current channels - **Standard**
- **PM Meter Software** to show digital display of all 16 channels— **Standard**
- **PM Wave Software** shows waveform of all input channels— **Standard**
- **PM Screen Software** for virtual screen display, configuration, and operation (launched through Pronto for Windows) - **Standard**
- Measures voltage **L1 to L2** (we don't calculate it), L1 to neutral, L2 to neutral, Measures current in L1 and in L2— **Standard**
- Compact size Marwell socket case



### Each Unit Includes

- PM2000F Power Quality Meter Socket Logger
  - Pronto for Windows Analysis Software
    - Infrared Serial Download Cable
    - Neutral Blade & Neutral Clip Lead
      - LED Legend Card
    - 12 Volt Charger & Carrying Case
      - Operation Manual on CD
      - Training Video

**CONFORMS TO IEEE 1453**  
 Our Software Displays & Prints  
 Instantaneous Flicker Sensation  
 For the **Entire Length of Recording**  
*A Ranger / Pronto Exclusive*  
 Ask our competitors to show you  
 IF their software can do this  
 Before You Buy!

## SPECIFICATIONS

<p><b>Input Voltage</b> Three 0-300 Vac True RMS</p> <p><b>Input Current</b> Two 0-220 Amp Rogowski Type Rigid Coil Sensors <b>Industry Exclusive feature:</b> Allows extremely low level accurate current sensing down to 0 Amps</p> <p><b>Channels</b> 16</p> <p><b>Accuracy</b> Voltage &lt; 0.25% True RMS of Reading Current &lt; 0.5% True RMS of Reading</p> <p><b>Resolution</b> Fixed to 0.1 Vac and 0.1 Aac</p> <p><b>Math Channels</b> AC 1 Phase: RMS, Real Power, VARS (fund), Apparent Power, Power Factor, Phase angle, Frequency AC Split Phase: Real Power, VARS (fund), Apparent Power, Power Factor</p> <p><b>Records &amp; Displays Instantaneous Flicker Sensation over the entire recording session</b>, as well as programmable time periods for long &amp; short term flicker— <b>Ranger / Pronto Exclusive</b></p> <p><b>Harmonics:</b> Total Harmonic Value, % Total Harmonic Distortion</p> <p><b>Other Math Option:</b> Channel X * Constant, Channel X / Channel Y, Filtered Channel X, Internal Temperature, On Charge, Battery Volts</p> <p><b>Recording</b> 3840 samples per second; <b>Single Cycle</b> True RMS response time; 16 bit simultaneously sampling all channels</p>	<p><b>Memory</b> 1MB Ram - <b>Standard / Approximately 4MB uncompressed</b></p> <p><b>Recording Mode and Rate</b> <b>Adaptive Store:</b> Unique store management enables extended recording &amp; <b>Single Cycle</b> resolution on significant signal changes <b>Point Store:</b> Selectable from <b>Single Cycle</b> rate to once every 12 hours</p> <p><b>Data Retention</b> Back-up battery provides 2 month's retention @ 77°F (25°C)</p> <p><b>Power</b> Requires 100-300 Vac from L1 to L2 voltage measurement or separate power supply <b>Battery: 4 AA Ni-Cad rechargeable battery pack Customer Replaceable</b></p> <p><b>Communications</b> Serial Ports: Infrared Optically Isolated, non-contacting RS232, (up to 115.2K baud) Protocol: MODBUS ASCII <b>Computer Requirements for Pronto Software:</b> Windows 9x, ME, NT, XP: 486DX66 or higher; 250MB hard drive: 16MB RAM</p> <p><b>Case</b> Marwell Socket</p> <p><b>Weight</b> 2.6 lbs.</p> <p><b>Operating Temp</b> -22° F (-30° C) to 149° F (65° C)</p>
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ASK OUR COMPETITORS TO SHOW YOU IF THEY CAN DO ALL 5

# TOP 5 REASONS YOU SHOULD ONLY CONSIDER RANGER PM2000HF METER SOCKET LOGGER

**ONLY Meter Socket Logger Compliant to IEEE 1453 Flicker specification released May 2005**

- ONLY** Ranger Loggers can provide the required **"NEW" Instantaneous Flicker Output** for the **ENTIRE LENGTH OF RECORDING UP TO 14 DAYS** while **RECORDING ALL 16 CHANNELS** available
- We **DO NOT** Compute L1 to L2, we **MEASURE IT!** AND give you **3 Voltages & 2 Currents**
- We use Aircore Rogowski Coil CT's in the socket and can actually **READ DOWN TO 0 AMPS** and up to 220 Amps
- Recording **Automatically** Starts after 1 minute –No room for Human Error
- RECORDS **16 Channels** simultaneously for **2 WEEKS** with **single cycle resolution** on changes BECAUSE of our **EXCLUSIVE PATENTED "SINGLE CYCLE ADAPTIVE STORE"** Gives unprecedented detail.

**TRY IT! YOU WILL BE AMAZED!**

**12 Pre-Stored Configurations.** Just choose through the infrared communication port OR program your own, with the included PMScreen Software

PRONTO Software is included with all PM Products, AND **LIFETIME UPGRADES** for software & firmware at **NO COST**

## Ranger PM2000HF VIRTUAL DISPLAY SCREEN EXAMPLES

The virtual display screens include:

- Main Menu:** Hook Up, Configure, Display, Explore, START RECORDING, Power Off
- List Channels:** Shows a table of channels with RMS, VL, and Aac values. Example: CH 4 RMS VL (C1) +13.2 Aac.
- Status-Recording:** Shows 98% AVAILABLE, 5.71U CHARGING, and recording time: ELAPSED 0:00:00, REMAINING 6:23:59:52.
- Phasor Diagram:** Shows two phasor diagrams for VOLTAGE (L2, L1, L3) and CURRENT (I1, I2, I3).
- Review "CURRENT CONFIG":** Shows a table of current configurations. Example: CH 1 RMS VL1 (C1) 125.0 114.0 UAC.
- Edit Configuration "F1 STANDARD":** I/P Signals, Record Mode & Time, Recordings Channels.
- Hook-Up in use METER SOCKET:** Shows a diagram of the meter socket with line and load connections.
- Sessions Explorer:** Shows a list of recording sessions with dates and times. Example: Session 19 9 JUN 9:11:18 - 9:17:31.
- Utilities:** Baud Rate 115200, Manage Battery, NETWORK ADDRESS: 1, SER NO: 1.018.0246.290201.

# SYNERGY SYSTEMS PM SERIES LONG LIFE FLEXIBLE CURRENT SENSORS



Model Shawn  
Part# PLLAF1

## Applications

- Will work where a standard CT won't fit
- Flexible AC Probes offer excellent linearity and a True RMS output that is insensitive to any DC components.

## Features

- Two AA batteries (included) will power these units for a minimum of 2000 hours in continuous operation
  - No-clip connector
  - Internal electrostatic shield
  - No core saturation or damage if overloaded
  - EN 61010, 1000V Cat. III (sensor); EN 61010, 600V Cat. III (module)
  - Standard waterproof sensor lengths 12", 24" and 36".
  - Standard unit has two ranges 5000Aac:1Vac, and 400Aac:1Vac.
  - Safety BNC Connector
- \* Contact us for special range & length availability

# PM SERIES PRECISION CURRENT CLAMPS

## Applications

- 5A secondary current transformers (CTs) monitoring
- Measuring in breaker panels
- Industrial loads
- HVAC
- Residential and commercial sites
- Data logging and recording

## Features

- Small, compact size
- Measurement range of 100mA to 240AAC
- Large jaw opening accommodated conductors up to 250MCM
- Designed for DMMs, loggers, recorders and oscilloscopes
- Available with mA or mV output signals
- Conforms to EN 61010, 600V Cat. III



Model Shawn  
Part# PIM243

# SYNERGY SYSTEMS METER SOCKET INTERFACE SERIES

The MSI series of meter socket interfaces are designed to allow safe and simple connection of recorder products to commercial and industrial revenue meter sockets.

The unit incorporates integrated current transformers for direct current sensing, as well as voltage readings for 3 and 4 wire configurations on a wide variety of meter bases.

### Features

- 3 voltages and neutral available
- Current outputs mV/A or mA/A
- Compatible with 200/320 amp services
- Direct connect to 12S and 15S meters compatible with both ringed or ringless bases
- Custom configurations available upon request

### Safety

- Water Resistant
- Voltages fuse protected
- CTs are open circuit protected

**TWO PIECE DESIGN ALLOWS ONE DATA LOGGER INTERFACE TO CONNECT TO A VARIETY OF METER SOCKETS**



**Meter Socket Adapter  
12S or 15S**

Socket Adapter				
Model	SA212	SA312	SA215	SA315
Configurations	3 Phase 3 Wire		3 Phase 4 Wire	
Meter Form	12S		15S	
Voltage Rating	600 VAC			
Max Current	200 AAC	320 AAC	200 AAC	320 AAC
Current Range	0.5 to 200 AAC	0.5 to 280 AAC	0.5 to 200 AAC	0.5 to 280 AAC
CT Ratio	1000:1			
Accuracy	1% of Reading			

\* Contact us for custom configurations

Data Logger Interface		
Model	DL3	DL6
Interfaces to	PM3000, PM7000	PM6000
Output Type	Banana/BNC	Fixed Cables
Cable Length	10ft *	10ft

Note: \* units come with 4 banana to banana for voltage connections and 3 BNC to BNC for current connection



**DL3—For use with a  
Ranger PM3000/PM7000**

**DL6—For use with a  
Ranger PM6000**

# PRONTO—THE SOFTWARE FOR *Rangers*

However clever the *Ranger* instrument is, however much information it collects, however accurate is the data, of most interest to you the user is the answer to 'how easy is it to make use of my data?'

The answer lies with **Prono**. Our software **Prono** first came out in 1985. From the start emphasis was placed on making **Prono** easy to use, useful and reliable. By the year 2000 **Prono** had reached its fifth generation. **Prono for Windows** has benefited particularly all users who wish to make full use of the Microsoft® Windows Operating System.

**Prono** and **Adaptive Store** make a strong partnership. Here's a scenario.

'Start a *Ranger* recording. (That's easy as well). We make sure the factory default set up is a most useful one and in this case the logger will record for 7 days. At the end of the recording download to **Prono** and see the data take form in the graphs or reports you choose. Clear instructions guide you the first time. Note the detail you are getting, down to a single cycle. Zoom in and out. Label points. Note the many parameters that have been recorded for you by the *Ranger*. There are fewer cries of "I wish I had remembered to set up to record..."

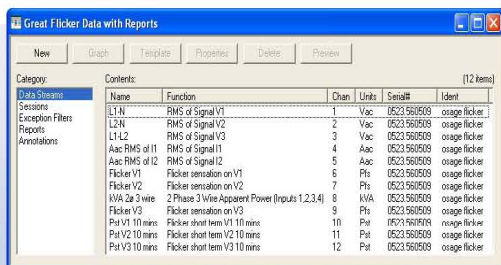
Look at your data values, perhaps the maximums or minimums are not what you expected. Now, even after your recording is finished, you may choose to produce out of limit (exception) reports. They can now depend upon the results your *Ranger* has just given you.'

*Rangers* with **Prono** and **Adaptive Store** will look after you.

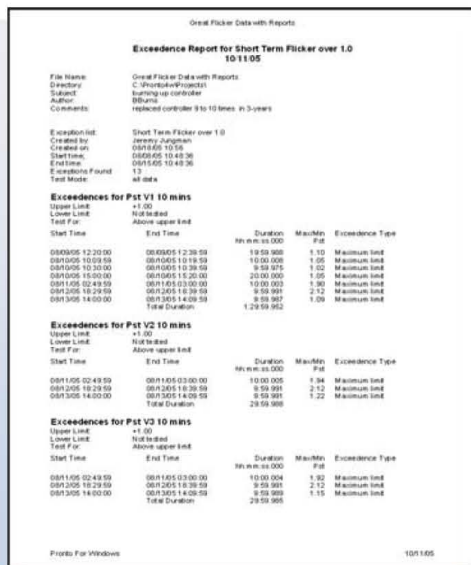
For the final answer to your question, 'how easy is it to make use of my data?' watch our 54 minute video on 'How to use **Prono**'. It comes with your *Ranger* kit.

You will find the world of Power Quality opening up in an exciting way.

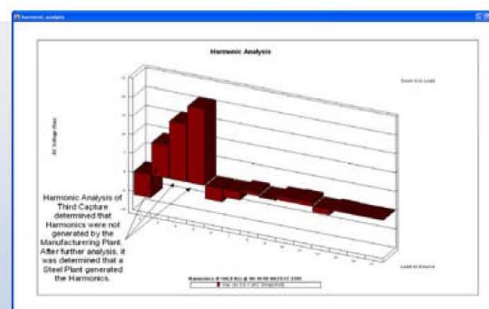
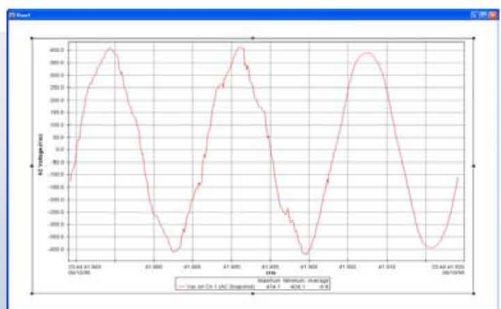
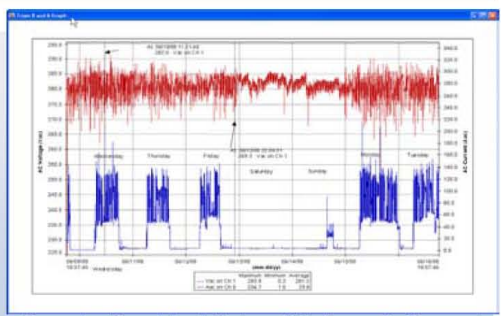
## PRONTO FOR WINDOWS DATA ANALYSIS & REPORTING SOFTWARE



Prono for Windows Explorer



Exceedance Report - Multiple Reports Generated after recording is concluded



### FEATURES

- ⇒ File Management Tools
- ⇒ **Logger Configuration Saved with Data for Retrieval at any time**
- ⇒ Templates for Viewing Data
- ⇒ Unlimited Traces on Screen
- ⇒ Titles, Subtitles & Legends for Text & Data
- ⇒ Text Annotation
- ⇒ Arrow Pointer for Text
- ⇒ **Cut & Paste Graphs to emails and any Word Processing Program**
- ⇒ Font Selection of Size & Type, Color Selection for Text & Graphs
- ⇒ User Information Screen
- ⇒ Local Data Logger Network Support
- ⇒ Remote Data Logger Network Support
- ⇒ Notebook
- ⇒ Export data to spreadsheets
- ⇒ **38.4 K Baud up to 921 K Baud**
- ⇒ Configure Logger
- ⇒ **Zooming Tools**
  - Frame
  - Pan
  - Exception Zooming
  - Limits (value or %)
- ⇒ **Reporting Tools**
  - Exceedance Reports
  - Customer Statistics
  - Tabular Listings
  - Custom Reports
- ⇒ Context-Sensitive, On-Line Help System
- ⇒ **Used with all Ranger & Adaptive Store Products**

# FLICKER IN THE *Ranger* PM SERIES

## What is Flicker?

Flicker is the name given to changing light intensity caused by fluctuations in the voltage. It is the second most common power quality problem, causing both irritation and possible medical consequences to users exposed to its effects.

## Why are the Ranger Power Masters the best analyzers for measuring and analyzing Flicker?

Rangers calculate and record the Instantaneous Flicker Sensation, Short Term Perceptibility, and Long Term Perceptibility. (These are known as Pfs, Pst and Plt respectively.)

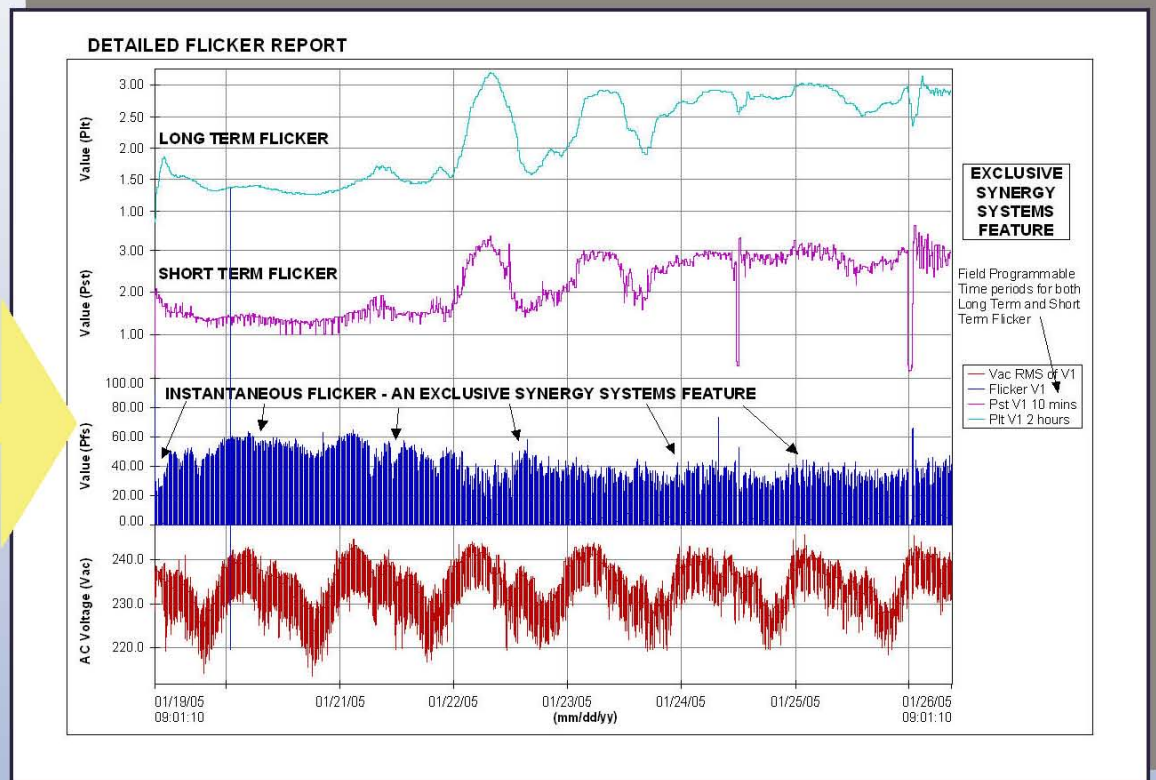
A Pfs measurement of 1 is the point at which 50% of the human population becomes aware of the flicker.

A Pst of 1 describes the point at which 50% of the population actually becomes irritated by the flicker while Plt indicates the irritation caused by irregular flicker effects over a longer period.

In Ranger PM Products all three parameters are derived using the IEEE 1453 and IEC 61000-4-15 model for human behavior.

The measurement process meets all the Flicker Tests specified in both Standards, and in addition meets the linearity tests being proposed by CIGRE for the highest class of instruments.

**CONFORMS TO  
IEEE 1453  
Our Software  
Displays & Prints  
Instantaneous Flicker  
Sensation  
For the Entire Length of  
Recording  
A Ranger / Pronto  
Exclusive  
Ask out  
competitors to show  
you if they can do this  
for 7 days with 16  
channels recording  
simultaneously**



**Detailed Flicker Report—For a complete 7 day recording period**

The bottom Graph is the True RMS value of the Voltage Channel being tested for FLICKER.

### The Instantaneous FLICKER

(or Flicker Sensation, a Ranger Exclusive) Graph, shows there is continuous Flicker present on the voltage being tested for 7 days.

The Short Term Flicker Graph is based on a 10 minute time period  
(Programmable time period, with PM Products Only)

The Long Term Flicker Graph is based on a 2 hour time period  
(Programmable time period, with PM Products Only)

# RECORDING INTERHARMONICS IN THE *Ranger PM7000*

Interharmonics are available to be recorded as individuals (specified by Harmonic if an integer number or by frequency), and/or as Interharmonic or Harmonic Groups and Sub-groups. They may be referenced to the appropriate fundamental grouping if desired. In all there are 12 selection methods:

RMS Value	% of Fundamental (or Fundamental Group/Sub-group)	
Harmonic	Interharmonic	
Individual	Sub-Group	Group
Gives 12 possibilities (any combination) from 30Hz to 3kHz		

Interharmonics are recorded in the PM7000 as Detail Troubleshooting Channels using the Adaptive Store or Point Store methods. The Interharmonics Function Group selection screen is populated with the twelve selection possibilities. Choosing any of these functions leads to a choice of relevant parameters, signal and harmonic etc., thus complete flexibility is available.

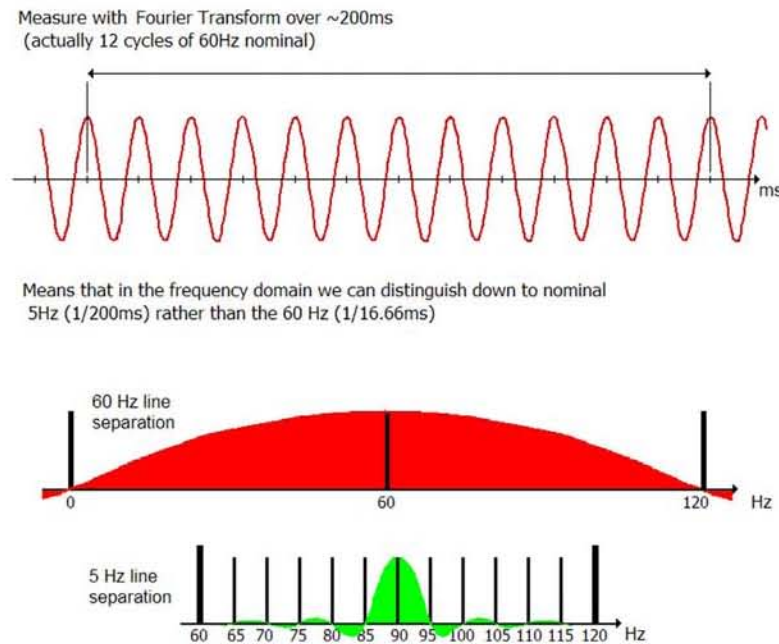
Today more and more companies are concerned with interharmonics. Interharmonic frequencies are not integer multiples of the fundamental frequency (i.e.- 120hz = 2nd harmonic on a 60hz system), but are all other frequencies that are between the multiples (i.e.- 122hz, 75hz).

Interharmonics exist alongside the fundamental and other harmonics. They cause irregular distortion and can cause strange effects in sensitive equipment .

## InterHarmonics Calculations

Harmonics, Harmonics Groups and Sub-groups; InterHarmonics, InterHarmonics Groups and Sub-groups are all available and calculated according to IEC61000-4-30 (which calls IEC 61000-4-7).

IEC 61000-4-7 calls for a Transform input time of ~200ms (10 cycles at 50Hz or 12 cycles at 60Hz) and hence the bandwidth is nominally 5Hz. The diagram below shows the 60Hz case:

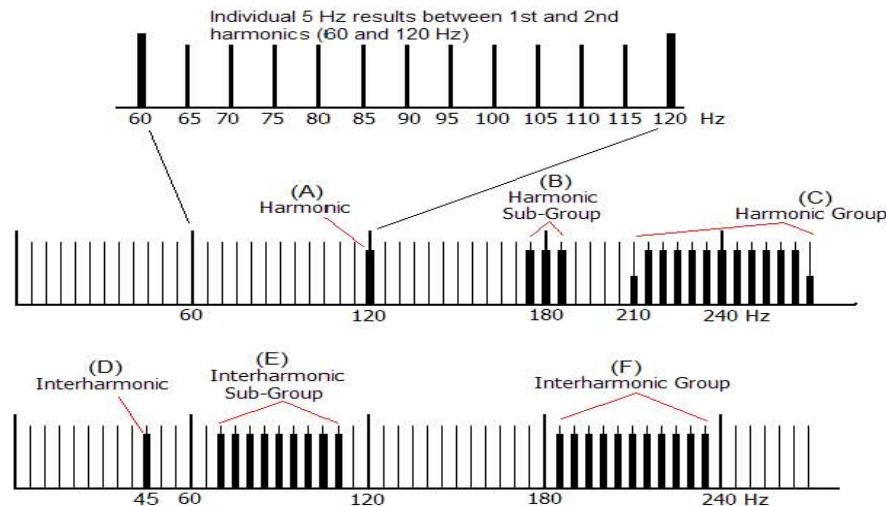


Note that as shown in the diagram the spectrum is in fact continuous, and not just a series of lines. However the transform methods usually used for computational convenience only yield results at the above line intervals (50Hz, 60Hz or 5Hz), so the spectrum is often represented as a line spectrum.

Having resolved the spectrum into 5Hz elements, the authors of the Standards defined various groupings of 5Hz elements to describe harmonic energy in the chunks appropriate to different applications. (See the IEC 61000-4-7 Standard for further application information).

# RECORDING INTERHARMONICS-CONTINUED

The groupings are of six types (A) to (F), as shown below:



These are:

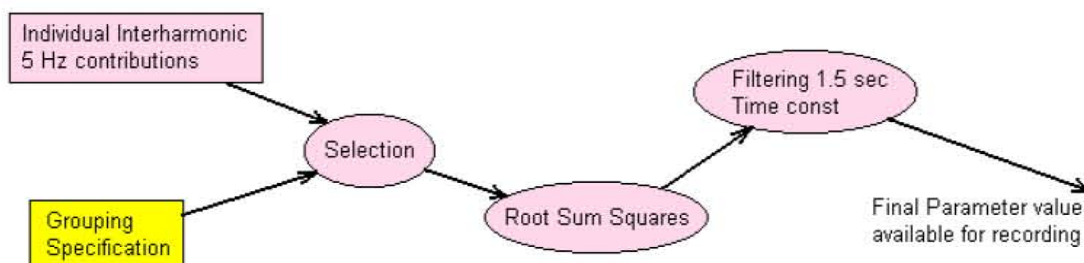
- (A) Individual Harmonics. This grouping is just the single line at an integer harmonic frequency. (In this case the 2<sup>nd</sup> Harmonic, 120Hz.)
- (B) Harmonic Sub-groups comprising integer harmonics plus the two adjacent interharmonics. This grouping shows the 3<sup>rd</sup> Harmonic Sub-group around 180Hz.
- (C) Harmonic groups. These Groups comprise all the energy from half-way between the harmonic below the nominal to half-way above. The components at 210 and 270Hz are halved so that between them, the Groups centered on (e.g.) the 3<sup>rd</sup> and 4<sup>th</sup> harmonics (which both have contributions from the interharmonic line at 210Hz) use 100% of all the available components.

The above three groupings are centered on actual harmonics. In addition to individual Interharmonics ((D) below) there are also two groupings centered halfway between harmonics to deliberately exclude harmonics themselves:

- (D) Individual Interharmonics. This grouping is just the single line at a non-integer harmonic frequency. (In this case at 45Hz.). [Individual Interharmonics are sometimes indexed as the Nth interharmonic of the Mth harmonic group, in this case 0:9 (9<sup>th</sup> interharmonic of the Zeroth harmonic =  $0 * 60 \text{ Hz} + 9 * 5 \text{ Hz} = 45 \text{ Hz}$ ). Because of the need to accommodate 50 and 60 Hz in the PM7000 and the possibility of this indexing being ambiguous, the frequency itself is used.]
- (E) Interharmonic Sub-groups. These Sub-groups contain the lines not included in the Harmonic Sub-groups. The Sub-group shown (E) comprises the 70 Hz to 110 Hz contributions, and for the PM7000 this is described as the Sub-group below the 2<sup>nd</sup> Harmonic.
- (F) Interharmonic Groups. These Groups contain all the lines between integer harmonics. The Group shown (F) has contributions from 185 to 235 Hz, and in the PM7000 nomenclature is described as the Group below the 4<sup>th</sup> Harmonic.

Notice how the Interharmonic Sub-group and Group contributions complement the Harmonic Sub-group and Individual Harmonics respectively.

Parameter values for group and sub-groups combinations are calculated from the Root Sum Squares of the relevant individual Interharmonics, and each final result is filtered with 1.5sec time constant first order filter.



## *The Story of the Ranger*

*Ranger* data loggers began life in Southern England 21 years ago. A small, handheld, 4 channel, data logger, was licensed to Gulton Inc of Rhode Island, owners of the Rustrak paper chart recorders. The name **Ranger** (from the much loved character, The Lone Ranger) was chosen for the logger and the accompanying software was called **Pronto** (nearly the same as Tonto, the Lone Ranger's trusty Indian companion). Early advertisements encouraged customers to buy by declaring, "save a lot of silver too." (The Lone Ranger's horse was Silver).

The (Rustrak) **Ranger 1** was one of the first electronic, graphing, logging devices and replaced the paper chart recorders which recorded temperature primarily, but also 4-20 mA and 0-2 Volts. Much thought went into the design of the user interface, culminating in a very simple, two button, selection operation. The DOS based software **Pronto** managed the data and was appreciated by customers for its ease of use, clarity and reliability (no bugs!). A Hercules Graphics card enabled the computer to show the **Pronto** graphs on screen.

A unique feature of the firmware in the logger, incorporated from the start, was the patented **Adaptive Store** storage technique. Customers haven't always understood how it works but even then they enjoyed the relatively detailed results they saw on their **Pronto** graphs and in their reports.

After **Ranger 1** came **Ranger 2**, retaining the same essence as this first **Ranger**. In addition it had more channels, a memory card and was very versatile, offering a range of pods for different applications.

Gradually power quality measurement capability appeared and indeed started to take over. The 1200 series measured power parameters. It soon became clear that this was a market on which to concentrate as it requires a high level of expertise. The **Ranger** technical team thrive on difficult challenges.

The first instrument dedicated to power quality measurement was the Power Logger, then came the Harmonic Analyser the HA5000 and finally, still under license, the PM6000. **Adaptive Store** delighted customers with the increasing detail it provided as its techniques and the instruments evolved. **Pronto** became **Pronto for Windows**.

However all was not 'easy riding' for **Rangers** and their customers as the product line was transferred between companies and geographic locations a number of times and joint development ventures came under a licensee axe.

In 2003 Outram Research Ltd (ORL), the **Ranger** design house, negotiated back the sole rights to the Intellectual Property for the brand and is now able to focus fully on **Ranger's** destiny. The culmination of its years of experience in the data logger market is a state of the art, extended family of **Ranger** Power Quality Analysers. Each member of the family is described in this catalogue.

*See for yourself how **Rangers** look after you.*

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