

High Speed Comprehensive Power Quality Analyser

Ranger Power Master 7000 (PM7000)

Three Phase, High Speed Power Quality Recording Analyser with Flicker and Harmonics available in Turbo, High Speed and Standard models



All your P.Q. needs in a single unit

A comprehensive high performance tool for all your P.Q. measurement requirements.

Set up your first recording in just 15 mins!

Wireless Communication

Use behind closed doors!



Optional Ethernet allows remote communication via your network.

Correct Data 1st Time

Our patented **Single Cycle Adaptive Store™** recording process provides single cycle measurements over long recording periods.

All the measurements you need first time out, without setting any thresholds!

Disturbances Ranked

Our **Auto-Ranking Waveform Capture** technique retains and ranks the waveforms of the 'worst' disturbances throughout the recording.

We take you straight to the core of your P.Q. problem.

Automatic measurements

No need to set thresholds! Our intelligent data handling technique, the patented **Adaptive Store**, and our **Auto-Ranking Waveform Capture** selectively retain detail when the 'worst' disturbances occur during your recording. The PM7000 will save you time and money when you solve your P.Q. problems more quickly than ever before.

Do not miss anything during your first recording

- > 470 channels reporting to the Standards
- 32 troubleshooting channels with single cycle detail
- 8 channels for Waveform Capture, at High Speed over 1 Ms/sec (24576 samples per cycle at 50Hz per channel, Turbo model).
- All channels recorded simultaneously

Highly accurate data (0.1% on V and I measured)

- **Individual Harmonics** to the 127th, %THD to the 50th and Interharmonics.
- Instantaneous **Flicker** sensation, short term and long term Flicker to IEC61000-4-15
- **Power parameters, unbalance, phase angle, frequency** and much more.

Expect safety as standard

The PM7000 is a Cat IV 600V Power Quality Analyser, powered off the voltage being measured.

Multiple modes of direct & remote comms

Great choice of communication methods to suit any situation. Choose from USB, Bluetooth, Ethernet and USB memory stick connectivity.

The PM7000 is easy to use

Our Hook-up Checklist, Configuration Guide and Step-by step Quick Start Guide all make setting up and using your PM7000 quick and simple.

Water resistance to IP65

Technical help: support@technical-sys.com
Sales enquiries: sales@technical-sys.com

techniCAL

Ranger PRODUCTS

designed and manufactured in the UK by



High Speed Comprehensive Power Quality Analyser

PM7000 Interharmonics option available



In short, we are very happy with the [Outram PM7000], and glad we found each other. Really because it does things and finds things which other kit doesn't touch! The "detailed recording" channels, and the ability to relate different channels, makes it ideal for answering questions like "what happened and why?"

R. Ball, National Grid UK, 2011.

Records 32 channels simultaneously with single cycle resolution on disturbances due to our exclusive, patented Single Cycle Adaptive Store™. Records for up to a year at this rate.

Records > 470 channels of general parameters in 10 minute (or user specified) increments.

Routine measurements, troubleshooting & high speed waveform capture all recorded simultaneously.

Auto-ranking Waveform Capture means time taken to analyse data is greatly reduced.

Waveforms recorded include transients, sags, surges, notches, rings, THD and TH current.

Extended Waveform Capture can record disturbance waveforms for up to 60 secs.

Gives unprecedented detail due to superior sampling speeds.

Reports to the Standards.

Virtually unlimited memory and zero download time! The unit can automatically download data after each recording session to USB stick. Record for weeks at a time.



The first analyser to include the required Instantaneous Flicker Sensation output. Provides authoritative Flicker measurements to IEC61000-4-15.

Harmonic Direction shows if Harmonics are upstream or downstream of the point of measurement. Also measures individual Harmonics and THD to the 50th. Interharmonics and individual harmonics to the 127th are optional.

Over 200 MB of on-board data storage plus USB Flash.

Comes with 12 pre-stored configurations. Just choose one using your portable device or PC, or program your own with the included software, PMScreen.

Stores up to 200 configurations on board. Eliminates the need to program on site. Just choose a configuration, press Load and Start.

Phasor Diagram Display ensures correct hook up and shows the phase relationship of individual harmonics, NOT just the fundamental.

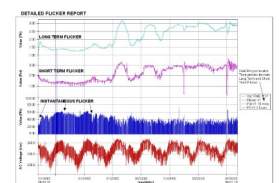
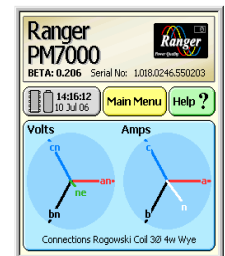
On-screen HELP guides users through configuration and hook up.

Memory Expansion Port.

Sampling rate:
PM7000 384 samples / cycle @ 50 Hz
PM7000H 3072 samples / cycle @ 50 Hz
PM7000T 24576 samples / cycle @ 50 Hz.

Records automatically at 50 or 60Hz.

The Cat IV 600V Phase A powered unit comes with our comprehensive, straight forward, analysis software, Pronto for Windows, at no extra cost.



Tablet or mobile phone included with every unit, showing via PMScreen:

- Analyser status,
- Live screens for waveforms,
- Harmonics,
- Interharmonics,
- Trends,
- Disturbance Incidents
3D Bar Graph,
ITIC (CBEMA),
Severity Duration v Time,
- Phasor diagrams
- & many more.

High Speed Comprehensive Power Quality Analyser

PM7000 Kit

- Ranger PM7000 Power Quality Analyser
- Four 24" 6000 Amp Flexible Current Clamps (max conductor size 8"), braided
- Five Voltage Probes 600V Cat IV (1000V Cat III), Braided
- Three Neutral Common Leads
- Mains Lead
- USB Lead
- Pronto for Windows Analysis Software
- Customer CD with Operation Manual
- Android Tablet /Mobile Phone or Netbook
- Customised Bag with Tool Roll



Single Cycle Adaptive Store™

"Starting from scratch we would have spent weeks zeroing in on something like this on a conventional recorder, but the PM7000 caught it on the first try, with no special setup"

Pat Coleman, Southern Company, USA, 2010

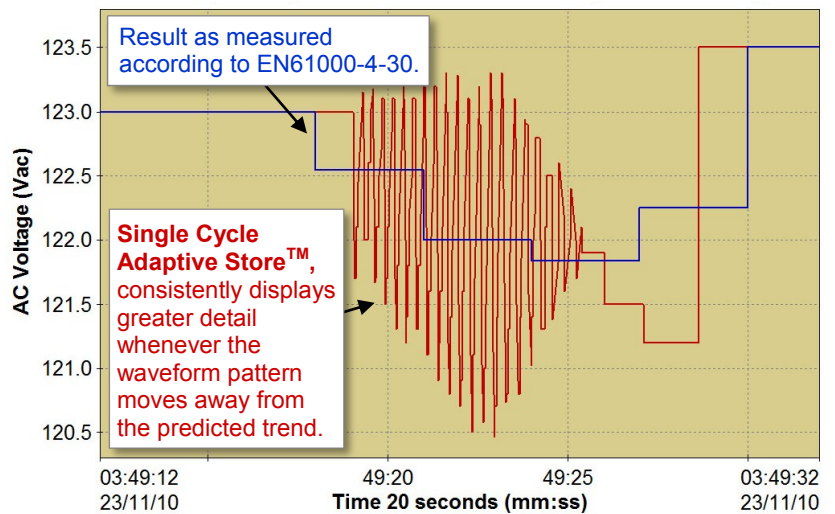
Adaptive Store is our patented compression technology available in all PM Series Analysers. It automatically records the chosen parameters in great detail and at high sampling rates when anomalies and deviations from the predicted trend occur.

Adaptive Store is designed to make the best use of available memory, whilst meeting two conflicting requirements:

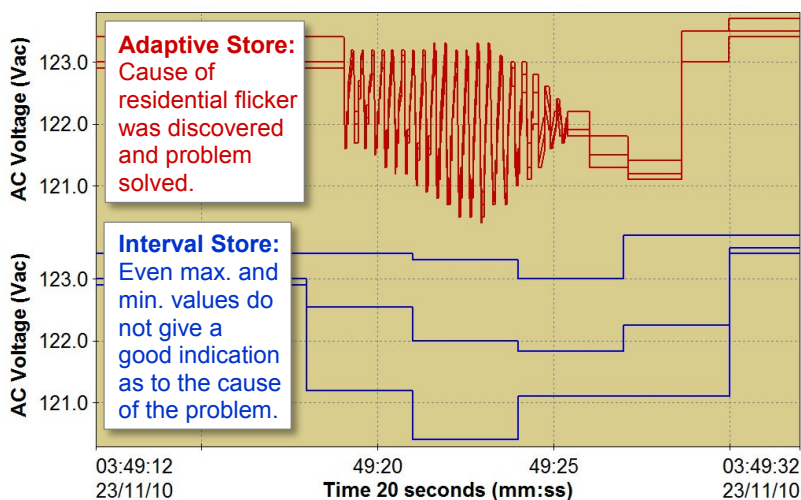
- to provide long-term trend data, observing the worst extremes of max and min values, and;
- to provide detail where new activity occurs, i.e., detecting and capturing sudden changes.

Adaptive Store assesses signal conditions in real time without having to set thresholds. The only required user parameter is the total time of the recording.

Outram's Adaptive Store vs. Interval Store (3 sec averages) of Van



Max, Min and Average of Van: Adaptive Store vs. Interval Store



Adaptive Store recognises the unpredictability of future signal activity

This unique method of *anticipating* the possible signal path has many advantages. For example:

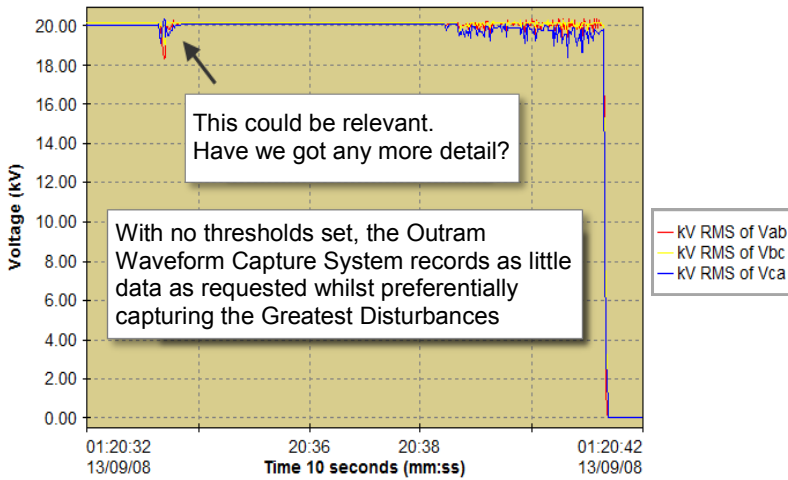
- it allows for immediate reaction to transients capturing the entire duration of the disturbance, and;
- it works with extremely long recording periods.

By automatically adjusting the thresholds distinguishing the anomalies from the trend as signal dynamics change or the available memory becomes full, Adaptive Store ensures that less significant phenomena can be summarised and greater detail recorded for abnormal behaviour.

The Single Cycle Adaptive Store™ recording mode is the most powerful automatic data compression system available in any data logger on the market.

Auto-Ranking Waveform Capture

Voltage transient occurs 8 secs before voltage collapse



Outram's Autoranking Waveform Capture is designed to manage the high speed waveform data measured by the PM7000.

It tracks and ranks multiple categories of sub-cycle transient and other problem event types, such as sags, surges, notches and rings. It then discards smaller events when larger ones occur.

This automatic real time data management process has these advantages:

- It fills the allocated memory at the start of a recording with anything the analyser sees, then discards the least interesting disturbances, as more 'exciting' ones come along.
- It captures the best, most revealing events without any prior knowledge of what might happen. **Setting thresholds is not necessary.**

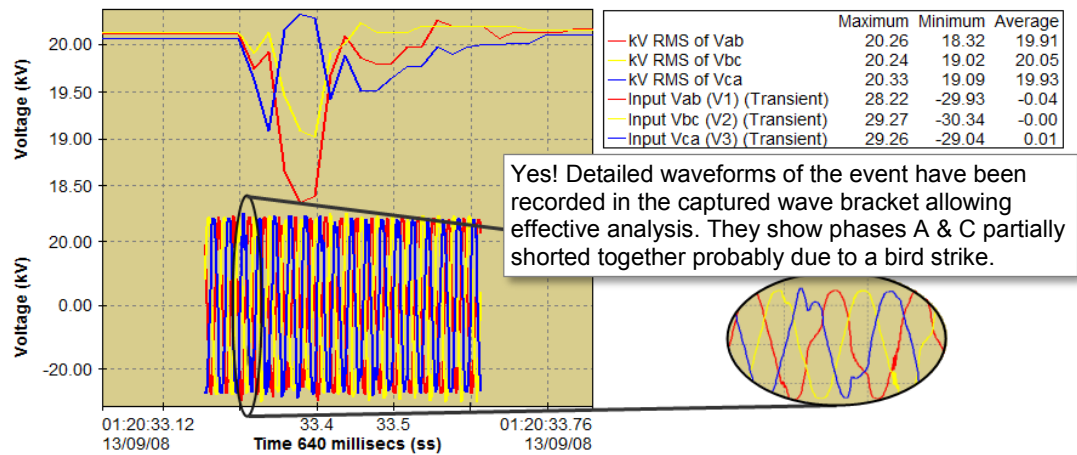
• It increases the quality of data at the same time as reducing volume, consequently speeding up download time as well as making data review easier.

• It works equally well over short and long recording periods.

• It is continuously re-triggerable and does not require re-arming.

The waveforms captured are normally up to 2 cycles before the event and up to 5 cycles after. However, captures may be extended up to 60 seconds after the event with different extensions for individual triggers.

Voltage transient occurs 8 secs before voltage collapse



Use the PM7000 to measure any **LOW VOLTAGE** supply, including the mains supply...



...or **HIGH VOLTAGE**, up to 400kV, through secondary transformers.

High Speed Comprehensive Power Quality Analyser

Example Screens of the Ranger PM7000

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 Off

Display Graphs & Tables
 General Parameters Volt Current Power Detail Recording Channels
 Harmonics and Phasors Compare to Standards EN50160 G5/4 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
 Then press briefly for more help. Index
 General

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

← Back Configure

Preferences Utilities Available Configs

Current Configuration is 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)

V-Line V-Return Current

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 High 3000A Mid 320.0A
 or Voltage Output CT 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
 V or I V & I All V All I

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)

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
 Van Vbn Vcn Vne
 Ia Ib Ic In

High Alarm Low Alarm
 +0.0 Off +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

222.4V 100.0% Voltage
 12.A 100.0% Current

Remove Fund. Show Direction

← Back Harmonic Presentation

BarGraph Phasor Trend Table

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

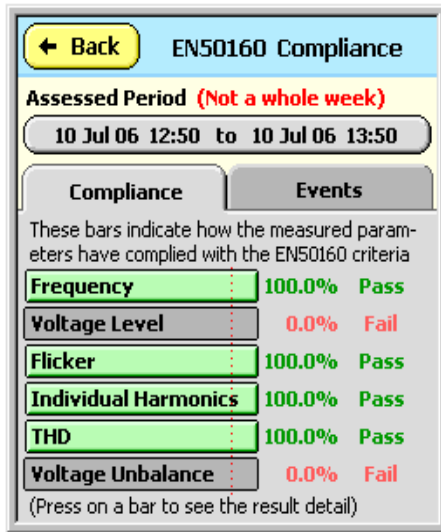
Zoom History

← Back Live Waveforms Stored Waveforms

Signal Van

Zoom History

PMScreen example screens cont.



Screen a)



Screen b)

Compare vs. the standards

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

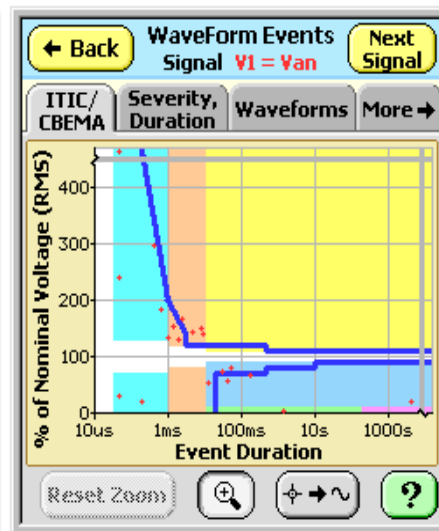
The screens here show examples of Screen a) the summaries for compliance of the supply during the assessed period, and Screen b) the number of specific events.

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

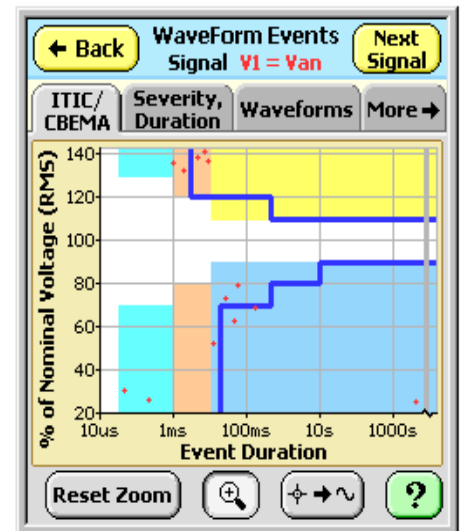
View data in multiple forms

ITIC (CBEMA) Curve

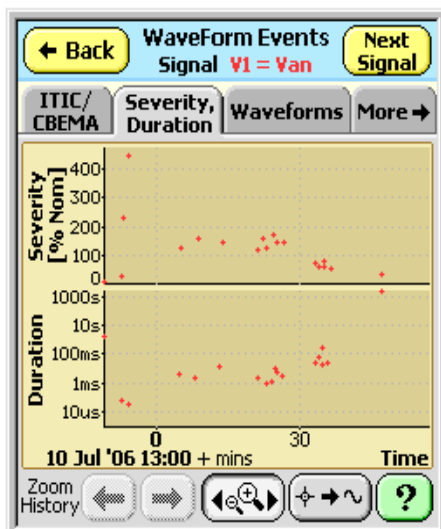
The screens to the right and below show different ways of presenting recorded event data, Screen c) is the conventional ITIC (CBEMA) presentation. This graph can be zoomed (d) to distinguish elements of a cluster, then the relevant waveform can be displayed.



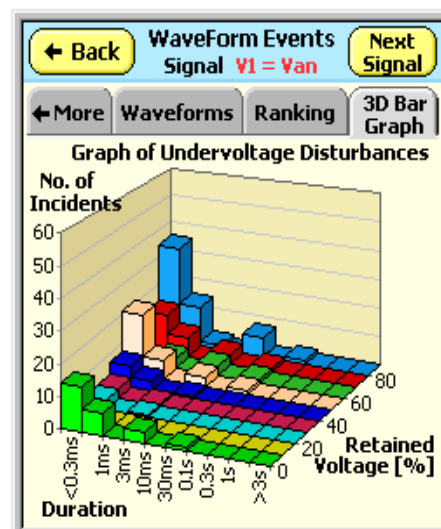
Screen c)



Screen d)



Screen e)



Screen f)

Severity / Duration Curve

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

3D Undervoltage Disturbance Graph

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 effect processes more seriously than complete outages.

Exclusive Software, Pronto for Windows



How to make the most of all your recorded data:

Use our **Pronto for Windows Software**, the best graphing software on the market for use with all PM Analysers



STANDARD REPORTS

Generate graphs and tables suitable for EN50160 reports.

UPSTREAM OR DOWNSTREAM?

Our Adaptive Store recording regime can deliver enough detail to indicate whether a disturbance is coming from upstream or downstream from where the measurement was taken. Work it out by looking at the relationship between the voltage and current data streams.

COMPARE LIKE WITH LIKE?

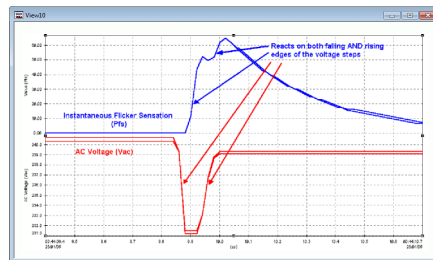
From your own recorded data in Pronto you can load the same configuration back into the analyser to record the same measurements again and again.

TECHNICAL SUPPORT

Technical support is available from those who either designed the unit or have over 20 yrs experience with the Ranger and PM series.

Who better to instruct you how to make the most of your analyser?

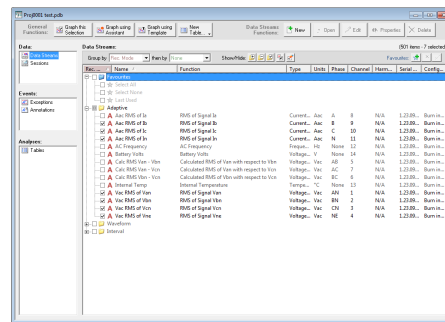
Pronto for Windows is a full-featured, Windows based program designed to extract data from the Power Master series and present it either graphically or in tables for straightforward analysis.



Analyse detailed data that Single Cycle Adaptive Store™ has captured automatically

Pronto for Windows is the only program you will need to communicate, analyse, report, and manage your data (as well as configure the analyser itself).

Through the use of easy to follow 'assistants' and pre-loaded templates, create graphs and tables for emails and hard copy reports simply and quickly. Manage and save your favourites to create the same graphs recording after recording.



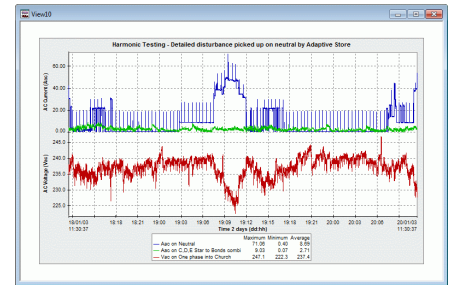
Pronto for Windows Project Browser

The selection of icons on the toolbar makes all commonly used instructions such as zooming, statistical analysis, annotation, downloading, and printing as easy as pointing and clicking the mouse.

Simply 'copy & paste' graphs into any word processing program and export tables straight to Excel or PQDIF for further analysis.

Sales enquiries: sales@outramresearch.co.uk
+44 (0)1243 573050

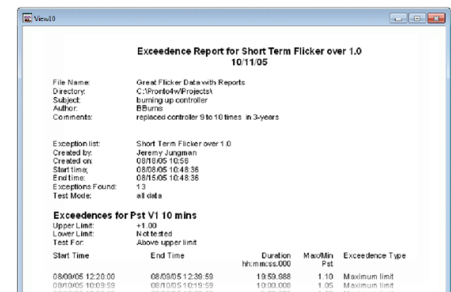
Technical help: support@outramresearch.co.uk
+44 (0)1243 573050



Sample Graphical Data of Voltage & Current

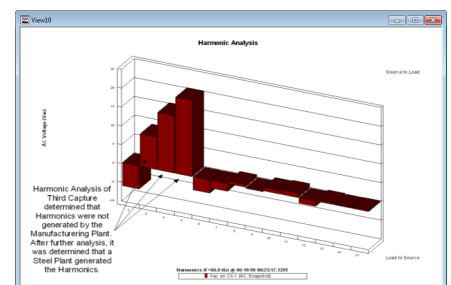
More Pronto Features:

- Analyser configuration is saved with data for retrieval any time
- Easy file management tools
- Watch our New video tutorials on-line
- Reporting Tools:
Exceedence reports
Summary statistics
Tabular Listings
Custom Reports saved as templates



Exceedence Report - Multiple reports generated after recording is concluded

- Unlimited traces on a screen
- Arrange traces on any axis, full freedom of editing on all aspects of a graph
- A comprehensive, context-sensitive help system



Harmonic Analysis of Waveform Events (PM7000 only)

Ranger PM7000S, PM7000H, PM7000T Specification

Input Voltage: 4 input channels. 0-600Vac or 0-1000Vac (if internal AC power supply disconnected). Sensors: In-line shrouded 4mm banana sockets. Fused voltage leads, crocodile clip.

Input Current: 4 input channels. Sensors: Two ranges on two types. Menu Selectable Rogowski coil 0-6000A, 0-400A, or Voltage Type 0-1 Vac. Safety BNC Socket. Phase reversal in software.

Three distinct simultaneous Recording Systems:

Waveform capture: High Speed sampling on all inputs.

Troubleshooting/Trends: Utilising the patented single cycle Adaptive Store™ to capture comprehensive detail over long recording periods on up to 32 selected parameters.

General Parameter Analysis/ Trends: > 470 parameters recorded automatically including reporting to Standards.

Configurations: Space for over 200 files. These may be used for configuration or recording sessions.

Accuracy: 0.1% (excluding sensors), +/- 2LSBs (in target ranges).

Resolution: Programmable to 0.1 Vac and 0.1 Aac, 0.01V high resolution mode.

General Parameter measurement: Records automatically. Fixed functions recorded on (selected) intervals. (1 sec to 2 hours). Voltage & Current RMS (Max, Min, Avg). THD / Harmonic Value (8 inputs), Flicker (3 Voltage inputs). Power (kW, VAR, AP, PF), Individual Harmonics 2-50 (8*50 signals). Unbalance.

Troubleshooting Maths Functions:

AC Single Phase Installation: RMS, Stray Voltage RMS Hi Res < 35V, (line-neutral, line-line where appropriate). Real power W, Reactive Power VARS, Apparent Power VA, Power Factor PF, Displacement Power Factor, Phase Angle, Frequency, Instantaneous Flicker Sensation, Short Term & Long Term Perceptibility, Flicker Flag, Distortion Power.

AC 2 (split) Phase Installation: Real Power, Reactive Power VARS, Apparent Power, Power Factor.

AC 3 Phase Installation (Delta, Wye and variants): Real Power, Reactive Power VARS, Apparent Power, Power Factor, Voltage Unbalance, (Conventional & Sequential Components), Current Unbalance. Distortion Power, Positive Sequence Fundamental Real & Reactive Power (IEEE1459).

Harmonics: Odds, Evens, Triplens, Individual Harmonics value and % and Harmonic Direction to

the 50th, K Factor, % Total Harmonic Distortion, Total Harmonic Value. Individual Harmonics to the 127th and Interharmonics are optional.

Other Maths Options: Channel X * Constant, Channel X / Channel Y, Filtered Channel X, Internal Temperature, On Charge, Battery Volts.

Waveform Capture: Sample rate - up to 1.2288 Ms/s in the PM7000T (~ 24,576 samples/cycle at 50 Hz) on 8 channels. Events examined, Ranked & stored in real time.

Selectable waveform parameters:

Wave Retention Basis: Greatest disturbances (automatic ranking and low rank discard) and first past a threshold.

Capture wave bracket: Wave Sets: from 20ms up to 60secs. Can be contiguous; no re-arming.

Signals to be captured: offending wave / complementary current or voltage, All Voltages, All Currents.

Triggers to be used: Transient, Ring, Notch, Sag, Surge, THD Volts, THD Current.

Wave Allocation: Waves allocated across trigger functions.

Sampling:

PM7000S (Standard) 19.2k Samples per sec
PM7000H (High speed) 153.6k Samples per sec
PM7000T (Turbo) 1,228.8k Samples per sec
Also records automatically at 60Hz.

Memory: 128MB Flash memory for all files. 32MB RAM for high speed waveform capture data, 64MB working RAM. Expansion with USB Memory Device.
Firmware (program memory) - Flash upgradeable 2MB

User Preferences - Stored in non-volatile Flash Memory.

Portable Device Requirements for PMScreen:

Android or Windows compatible.

Data Retention: During recording sequential data is saved to Flash memory. Waveform capture data is held in RAM and transferred to Flash memory when recording ends. Configurations etc. stored in Flash memory.

User Interface via remote screen: PC via Bluetooth or USB running PMScreen, or tablet/mobile phone/netbook (provided) via Bluetooth running PMScreen. Setup/Configuration and Data Review via remote screen. Data analysis using Pronto for Windows. Automatic download to USB stick.

Ranger PM7000S, PM7000H, PM7000T Specification cont.

Displays On PMScreen: Power & Energy, Waveforms, Harmonics, Phasors, Harmonic Phasors, Trends, Statistics, List of Channels. Comparison to Standards. Interharmonics (optional).

Communications:

Bluetooth: Wireless interface (isolated).

USB: Memory module interface (non-isolated).

USB: Serial interface to PC (isolated > 2.5kV) download to PC & control through Pronto for Windows.

Protocol: MODBUS ASCII.

Power: Requires 100-600 VRMS, 15 W Max from Phase A voltage measurement (40 - 64Hz Rated power consumption 11Watts) or separate power supply @12Vdc, 6 W.

Burden: Normally <10 VA from Phase A. If a charger is used the Power Supply is automatically disconnected from Phase A (input impedance per phase 32MOhms).

Battery Capacity: 2100mAh (5 HI-Temp NiMH batteries).

Battery Ride Through: Ten minutes at a time.

Charge Method: From V1 input or from 12V Wall Charger (auto switching).

A/D Converters, 2 sets : (i) 24 bit at 19.2 kSps, top 16 bits used normally for harmonics, power & energy, Flicker. (ii) 12 bits for High Speed and Turbo only.

Measurement & Reporting Standards:

IEC 61000-4-15, IEC 61000-4-7, IEC 61000-4-30, IEEE1453 (Flicker), IEEE1459, IEEE100, Report to EN50160.

Safety Standards: IEC 61010, (600v Cat. IV, pollution level 2, 1000V CAT III if PSU fuses removed), CE Fused voltage leads (lead fuses 500mA, 700V, 50kA rupture current), IEC 61326 (EMC).

Internal fusing: PSU (x2), Charger input, Battery stack, Internal Thermal Switch (x2).

Computer Requirements for Pronto Software:

Windows 2000, XP, Vista, 7; 250MB hard drive space.

Case: Pelican 1150 Guard Box: Dimensions. 22.9 x 19.1 x 11.0cm.

Weight: 3.5 kg. without leads and clamps.

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

Environmental: IP65. Main unit will tolerate momentary emersion when lid sealed. Leads and their connections are not watertight and for safety reasons we strongly recommend that the operator does not connect and disconnect the unit in wet environments.

Applicable Patents: 6424277, 0230712, 4910692.

DELVING INTO THE DETAIL

Single Cycle Adaptive Store™ records more detail when the measurement deviates from the predicted trend.

This PM series EXCLUSIVE storage technique means only the necessary information is captured in detail making the most of the unit memory and reducing analysis time.

FIND THE SOLUTION

You think troubleshooting Power Quality is like looking for a needle in a haystack?

Do you need to find solutions quickly?

Do not leave it to chance.

Use an **Outram PM7000.**



CONTACT techniCAL

techniCAL

For more information on any of our products or services please contact us:

Toll Free: 866-327-8731

by email:

sales@technical-sys.com

or visit us on the web at

www.technical-sys.com