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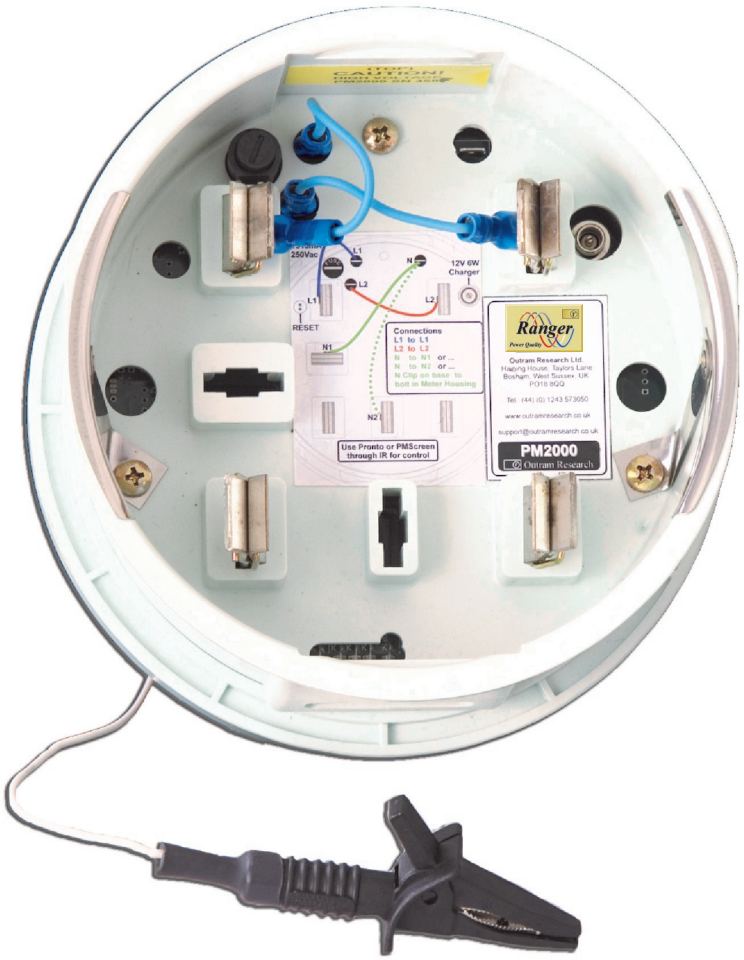
Ranger Power Master 2000 (PM2000) Meter Socket Logger Operation Manual



SYNERGY SYSTEMS INC
4101 Pierce Drive,
Shelby Twp., MI 48316
USA
Tel: 800-338-4505
Email: sales@synergy-mi.com

OUTRAM RESEARCH LTD
Haining House,
Taylors Lane, Bosham,
West Sussex, PO18 8QQ
Tel: 0044 1243 573050
Email: support@outramresearch.co.uk

Safety Warnings

The Symbol ⚠ is about SAFETY and concerns YOU

⚠ You MUST refer to the relevant section of this manual wherever this symbol is displayed on the equipment. In some cases ⚠ draws attention to the fact that the parts or adjustments to which ⚠ refers are not serviceable by the user. In those cases the unit MUST be repaired or serviced by properly qualified personnel. Please note that this is especially important with reference to fuses and batteries.

⚠ Because you will be attaching the PM2000 to a potentially hazardous live circuit, you must be suitably qualified. Before you make any such connection or disconnection you need to understand the dangers associated with doing this and how to eliminate those dangers and control the risks associated with CAT III (Category III) type high fault current electricity supplies

⚠ LETHAL VOLTAGES MAY BE PRESENT whenever the conductor blades are exposed. IF IN DOUBT SEEK ADVICE.

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Introduction

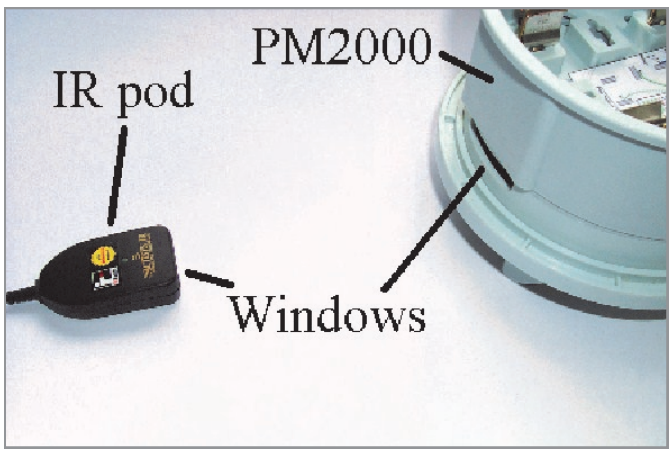
The PM2000 is extremely simple to operate. It is possible that some units may be used through-out their entire lives to deliver all the data required without any user adjustments or configuration changes.

Recordings are made automatically by default; voltage, current and power parameters are recorded for 7 days. If recording at a new site for the best part of a week at a time suits you, and if volts, current and power are what you want to see, don't change anything!

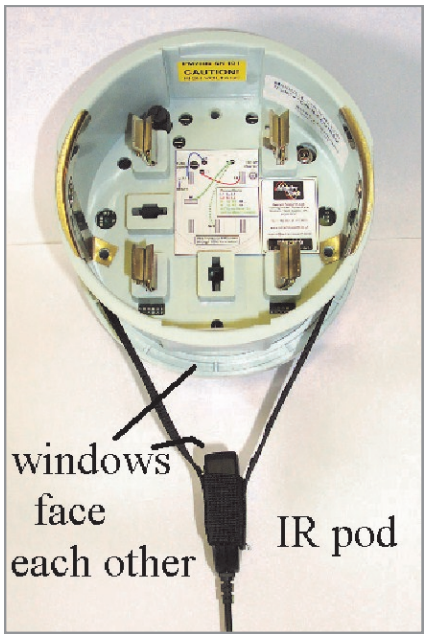
It *is* necessary to understand and use the Pronto Data Recovery software. This provides the essential means of data recovery, presentation and archiving.

Pronto may also be used to configure the PM2000, and for those who want direct access to the instrument and to see it working in real time, we have also provided a Virtual Screen Interface program, called "PMScreen". This program, which may be opened with a button from within the Pronto program, can be used to alter any of the PM2000 characteristics. It provides a transparent way for the PM2000 to present its "screen" to the user via a PC, as though it was a touch screen on a physical instrument. The PC Mouse acts as the user's finger or stylus, and a mouse click simulates touching the screen.

The physical interface between PM2000 and a PC is the non-contacting Infra-Red interface supplied. This should be plugged into the USB port on your PC. Older customers will have been supplied with an IR to RS232 cable, use this cable in the same way. It will typically work up to 2 feet (0.5m) range, but it is line-of-sight, so the dark window on the pod at the end of the lead MUST face the corresponding clear window in the PM2000 so that they can see each other. If you put your coffee mug in the way IT WONT WORK!



We supply an elasticated sling to hold the pod close to the PM2000 window when the PM2000 is installed on the side of a house. In the lab. or in the office, you may lay both PM2000 and the Infra-Red pod on a desk. But bear in mind that if you disturb the line of sight between them, THEY WONT COMMUNICATE.



Background

For users who know other Adaptive Store or Ranger products, this system will be very familiar. The Pronto interface is the same, the adaptive store process, parameter selection and other set-up functions are the same, (though restricted to the specific split-phase application for which the PM2000 was designed) and even the virtual screens of the PM2000 are almost identical to those of the PM3000.

The PM2000 is in fact based on the PM3000. Where any questions arise over behaviour or performance, please refer to the PM3000 manual.

Quick Details for Familiar Users

The Baud Rate for the Infra-Red link is 115.2kBd. Pronto should be set for this. The Infra-Red pod does need to be initialised and this occurs automatically when the baud rate is selected by the application program. Try to remember to make the physical arrangements and connections *before* attempting to communicate.

(Beware that if the Infra-Red cable is connected *after* the application program has started trying to communicate, you may have to wait up to a minute for the application program to toggle the baud rate (and initialise the Infra-Red pod for the *first* time) as part of its retry process.)

Recordings start 1 minute after current starts flowing consistently, or 15 minutes after power is applied if current does not start flowing. (It will not start just because the charger is plugged in).

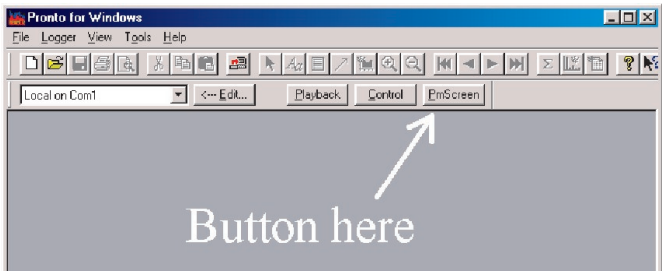
If power is removed in the middle of a recording, recording will cease after 10 minutes, and resume when power is reapplied, provided the original recording time would not have expired while the power was off. (The charger is not considered “power” in this context.)

Note that if you move the unit from one site to another during a recording, recording will restart immediately when power is applied at the new site, since the unit has no way of knowing that it is not still installed at the original site. It will not wait for current to start flowing again.

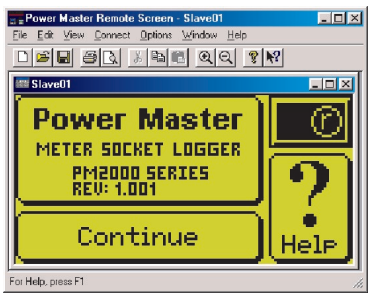
After the original recording time has elapsed, or the unit has been removed from site and re-powered only from charger, recording will have stopped, and the data should be read by Pronto. Once data has been read, even if the memory is not erased, a flag is set in the unit to tell it that this data can be overwritten if necessary. The unit will then restart automatically when power is reapplied. Thus recording and maintenance can be entirely automatic.

The PMScreen Interface

PMScreen is a program which may standalone or be run within Pronto. It is installed with Pronto Rev 5.33 or later, and a “PMScreen” button appears on the Logger tool bar.



Pressing the PMScreen button starts the application, which (if cables are plugged in and line-of-sight to the PM2000 is good) should produce the current screen on the logger:



It will not be this screen every time you access the PM2000 – it will be however you left it. The PMScreen application program ONLY provides a screen space and mouse interface. The screen *content* comes from the logger itself, hence if you close PMScreen and re-open it later, the logger screen is likely to be the same as it was when you last looked at it.

The mouse can be used to click on one of the screen "buttons", for instance "Continue" in the screen above, to bring up the next screen etc.

Power drain on the PM2000

PMScreen has the ability to wake up a PM2000 (or a PM3000 or PM7000) from a dormant condition, as has Pronto. Pronto however only talks to the instrument when the operator requests some kind of service, so if the operator downloads a logger, then examines the graph at length, the logger itself may go to sleep if it is not powered even though Pronto remains open.

PMScreen is different. All the time you are using PMScreen it interrogates the PM2000 to find out if its internal screen has changed, and if so, reads it to reproduce it on the PC screen. Consequently the logger is never given a chance to go to sleep and even if it did, PMScreen will deliberately send a wake-up code whenever a minute has elapsed since the last response. PMScreen can therefore drain the battery in the PM2000 (or PM3000 etc) if it is not powered externally. So unless you anticipate only a short session without power (say a download), it is best to use the charger when communicating to the PM2000.

User interface behaviour – principal differences from the PM3000

As mentioned above, the PM2000 interface and functionality are identical to those of the PM3000 except where the different applications demand differences. Specifically the areas of difference are in

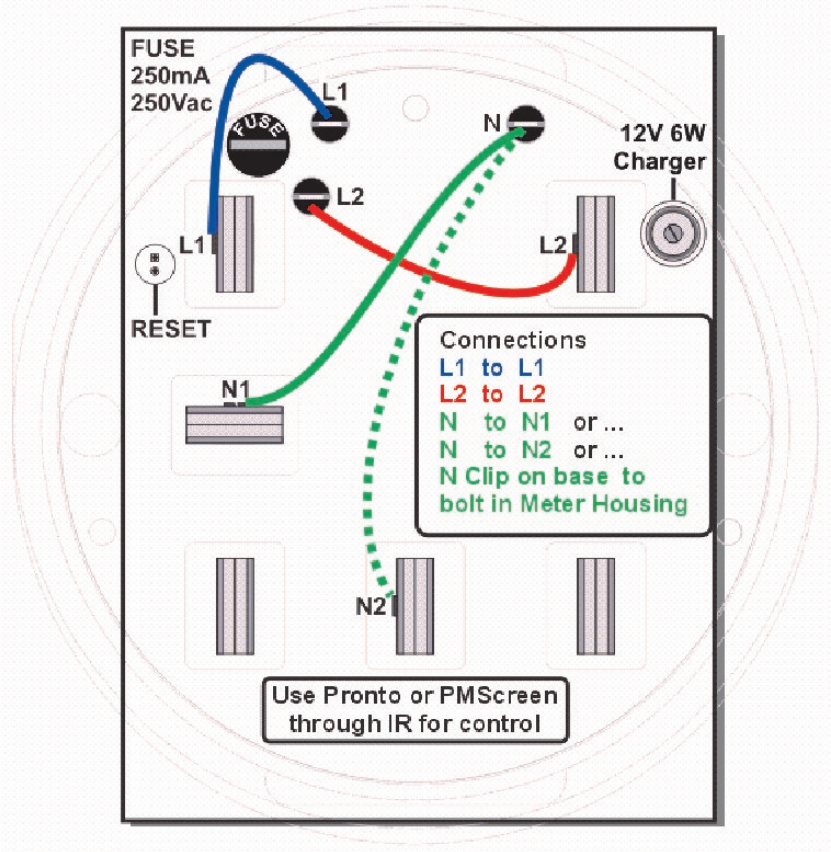
- Serial Interface is via the Infra-Red link instead of conventional RS232.
- There is no display, though internal screens are prepared just as they are for the PM3000. These screens must be expressed on the PC, or netbook/ Mobile phone if using Bluetooth, using PMScreen rather than a built-in display.
- Without a Liquid Crystal Display, status information is made available through an LED interface visible on the PM2000 through its clear polycarbonate window.

In software, differences are

- Hook-Up – the PM2000 is for a prescribed Split-Phase hook-up. Input signals are restricted in range so Hook-up is fixed, and there no choices for current sensors since they too are built-in and consequently fixed.
- Choice of Maths Functions – these are appropriate to the Split-Phase hook-up, so you will not find Three-Phase options present.
- Automatic Start of Recording - this is the main difference. The automatic start process and the relatively well-known application of residential monitoring mean operation can be entirely automated if so desired.

See separate section on Automatic Recording and LED Behaviour for details, and please see the PM3000 manual for an extensive discussion of the user interface.

Connections



This is very much simpler than other products!

The four diagonally placed buss bar blades in the housing act as extensions of the blades present in the house termination box. Connections from VL1 and VL2 in the street are assumed to be from the top pair, and to the house via the bottom pair. The current sensors are already arranged around the lower buss bar blades, and the links from VL1 and VL2 should already be made (Blue and Red as shown in the diagram).

It remains only for the user to select the appropriate connection to the neutral. There are three options. Which one is chosen will depend on the installation.

1. There is a neutral blade in the 6 or 9 o'clock position in the house termination box.

Use the spare blade provided with the spade terminal side connection in the 6 or 9 o'clock position, and secure with the cotter pin at the back. Make the link from the blade to the logger electronics as shown in the diagram with the spare spade-terminal-to-spade-terminal link provided. Ensure the long lead from the back of the housing is detached at the rear spade terminal, and stowed in the bag.

2. There are no extra blade positions in the house termination box, but the house neutral passes through a large screw terminal block at the back of the house termination box.

Remove the spare blade from the PM2000 if installed, and stow in the bag, being careful to save also the cotter pin. Attach the long neutral lead spade female to the spade terminal male fitting on the PM2000 rear housing, and attach the alligator clip to the screw terminal block at the back of the house termination box.

Making certain that nothing is trapped behind the unit and that the neutral lead (if used) will not fall off, offer the PM2000 to the house termination box and secure using the existing fittings.

Fit the Meter onto the front of the PM2000 housing.

Operation from a PC using the Infra-Red Interface or Bluetooth (Optional)

The PM2000 Meter Socket Logger is configured, and downloaded from a PC via the Infra-Red interface (IR) or Bluetooth (optional). For Infra-Red connection a USB to IR lead is provided. (Older customer will have been supplied with a serial RS232 to IR lead.) If the unit has Bluetooth capability, Bluetooth is woken up as the unit is connected and is immediately available for connection. Separate software drivers are not necessary in the PC, since the operating programs contain the necessary protocol and control functions.

The programs to be used with the PM2000 are:

- Pronto for Windows, Rev 5.33 or later
- PMScreen (which can be launched from within Pronto)

Pronto for Windows works with the PM2000 MSL as with other Outram Research products, providing download, data presentation, and many logger control functions.

For those who want the direct screen interface and control over all logger functions, PMScreen provides a virtual screen to the PM2000. The PM2000 is the active partner when used with PMScreen. The PMScreen program is passive, unintelligent, providing only a means of display for the screen information which is prepared and controlled WITHIN the PM2000 instrument itself. (It also passes mouse clicks to the instrument to simulate a touch screen.) Of particular interest to someone demonstrating the PM2000 maybe the STATUS screens, which show the decision making process prior to recording. Otherwise the PM2000 screens (as shown on the PC) are very similar to those of the PM3000, and for a detailed explanation of them see the PM3000 manual.

Both Pronto and PMScreen are able to wake up the PM2000 directly. They are also both “network aware”. Normally this “network awareness” is not used, but if desirable can be invoked to control or interrogate more than one unit at once. Unlike a physical wire lead, the Infra-Red interface is not a “one-to-one” communications path. If two or more PM2000s are in range of the PCs IR or Bluetooth transmissions, then all may legitimately think that they are the intended recipients. Thus the PC programs and the PM2000s must include the means to differentiate units. These facilities are included.

Automatic Recording and Status LED Behaviour

The PM2000 Meter Socket Logger does not have a touch screen, nor any direct user controls. It therefore needs to work automatically and indicate its status somehow so that the user may have confidence in what it is doing. When a PC is present it can be operated just like the PM3000 through the PMScreen program or Pronto For Windows, and this is the way to change its operating characteristics. However an operator may take the PM2000 to site, install it and leave it in complete confidence that house voltages are in specification and it is recording correctly. This is achieved by a combination of Automatic Behaviour, and an LED array showing status.

Automatic Recording

The PM2000 uses several conditions to control behaviour such as when:

- AC voltage is present
- Current is flowing in the house
- Charger voltage is present (i.e. it is on charge even though there is no AC volts)
- Memory is empty
- Memory contains recording(s), which may or may not have been downloaded
- the unit has been switched off since the last recording was completed.

The default condition for the PM2000 is to TRY to record (if not already recording). (The recording period to be used and number of channels to be recorded are whatever has been set by the user (using PMScreen or Pronto).)

Typically the unit WILL record if given a chance, provided it has NOT got UNREAD data from a previous recording. It may still contain data from a previous recording but, so long as it has been downloaded at least once, this will not prevent a new recording being started.

Recording starts (or can be started) by:

- Direct user action through PMScreen or Pronto

Or automatically

- 15 minutes after AC power is applied consistently, or
- 1 minute after AC current begins to flow.

The automatic recordings erase any previously recorded data before they start (unless that data has not been read/downloaded, in which case the new recording does NOT start).

Thus the normal situation for an operator is to install the unit on a socket base, re-attach the meter, wait 1 minute, and leave. By this time the unit should have begun recording and will be indicating voltage quality and recording status, as discussed below.

The 1 minute delay after current flow starts is added to give the operator a chance to remove or re-position the meter before starting the recording. Current must flow consistently for the whole minute, so if the meter is removed and reinstalled, the minute delay restarts. Similarly the 15 minute voltage only delay is restarted if voltage is removed and reapplied. These two conditions are intended to give the operator the freedom to test the installation voltages, and make satisfactory physical arrangements before recording starts.

Once recording is complete (or has been stopped by the user) the data remains in the unit, and since this is a normal benign condition, the unit knows it should not attempt a new recording. It knows this because although conditions may be right for recording, the unit has not been switched off since the recording ended. In all probability it is still installed on the same meter base.

Once the unit has been turned off (or turned itself off), that "continuation" information is lost. When power is reapplied it could well be on a new meter base, so this time it will try to start a recording when power conditions are right. As discussed above, the only thing preventing a recording is the UNREAD recording still in memory. Once the recording HAS been read, that restriction has been removed, and recording can start when power conditions are again right.

Status LEDs

There are 5 LEDs recessed in the bottom of the unit (as it would be when mounted on a wall). Looking from underneath, these are from left to right:

Power Volts L1 Volts L2 Volts L3 Memory/Recording

The LEDs are in a line, slightly disposed to the left of the slot in the housing. On the right of the same slot is the IR interface, comprising transmit and receive sensors. As far as the IR is concerned, the important thing to remember is that it can't see round corners, and if you put a unit on the bench to download it, it's the easiest thing in the world to put your coffee cup in the line-of-sight between the IR lead from the PC and the unit. We have done this many times, and you blame the fault on the wrong hardware (Its not even the coffee cup's fault – who put it there?). There is another danger which is that the PC can talk to more than one MSL at the same time, plus it can wake them up. So if you have several on a bench, or a nearby shelf, beware that their IR ports are NOT visible from the PC interface. You may wake them up, not realise it, and run down their batteries; since if they are being interrogated or continually woken by the PC, they can't stay off!

Use of the LED Legend Card as a reflector

Note that the LED Legend card provided (and reproduced in Appendix D) will reflect the LEDs nicely. The black area at the top is placed deliberately to provide a good contrast when used as a reflector. When the PM2000 is installed hold the card at 45 degrees to the wall right underneath the back of the unit. You should be able both to see the LEDs and to read the interpretation.

LED Interpretation

Power LED

This is RED and only comes on when either the charger is applied or input mains is present and is greater than about 100V on L1-L2. (Voltage on L1 or L2 by itself is no good. The PSU runs from *between* L1 and L2. Normally this is 240V, so 100V is way below the level it should ever see.)

The Power LED is on all the time the unit is powered, even if it has been switched off, EXCEPT when power has been newly applied, and the batteries have too little charge to support operation. Then it will flash every 2 secs to indicate that it is in the process of waking up. Just be patient for up to 64 secs. Its not driven by the processor and has only this simple function.

Power LED	Meaning
Off	There is no external power on the unit, either from the charger or input mains
Flashing Red	External power has been applied, but the internal Charge Accumulator wants up to a minute (64 secs) of full charge before switching the processor on. Be patient, it will come on soon!
Red all the time	Power is present. The unit might be either on or off.

Voltage LEDs

These three all work the same way, though the voltage tolerance levels reflect the function and its nominal voltage. These are bi-colour **red** and **green.** These LEDs show the condition of the relevant voltage, ranging from Off (< 50V) to badly out of tolerance, just out of tolerance, just in tolerance, and comfortably inside tolerance. Simply, if it is **red**, its **out of tolerance**, if **green**, its **in tolerance**. Note that if it is not being measured AND evaluated (i.e. for which no tolerancing is available), the LED stays off permanently.

Voltage tolerance levels and setting

The tolerance levels used are those set for the Alarm conditions on the RMS voltages being measured. It is not necessary to turn the Channel Alarms on: The Alarm thresholds are used anyway. All eight of the Factory Configurations call for Voltage Measurements on Channels 1, 2 and 3, (VL1, VL2, and VL1 to L2 respectively), and all have the same set of Alarm Threshold settings: 114 and 126V for L1, and L2, and 228 and 252V for L1 to L2. The operator may define his own configurations based on any of the Factory versions, and change the settings to suit his particular requirements. Note that if an RMS voltage is NOT specified as one of the channel functions to be recorded, that Voltage is NOT evaluated against the threshold settings, so its LED remains OFF. If it is specified twice (its possible, but why???) the thresholds specified for the higher channel number are used for evaluation of tolerance.

All Factory Configurations specify voltages in channels 1, 2 and 3, as shown below.

The LEDs now reflect the state of each independent voltage evaluation.

Channel	Function	Low (Alarm) Threshold (V)	High (Alarm) Threshold (V)
1	RMS Voltage Line 1	114.0	126.0
2	RMS Voltage Line 2	114.0	126.0
3	RMS Voltage Line 1 to Line 2	228.0	252.0

Note that the “All is well” sequence is quiet **green**, a short pulse every four seconds. This is the same pattern used in the PM3000 to indicate recording is under way, and it applies in the PM2000 Meter Socket Logger too, as discussed next. So if all the LEDs (except the power one) flash in a quiet **green** way, it means the voltages are all comfortably in spec and the unit is recording.

Voltage LED	Meaning
Off	This signal is not being evaluated against tolerance.
Quiet flashing red (short pulse every four secs.)	Input signal is < 50V. This is typical when the unit is operated from the charger on the bench at playback time. Its just showing that the signal IS being evaluated, but it is clearly not plugged to an AC voltage source, so its nothing to be concerned about.
Angry red (on all the time except for short gap every four secs.)	Signal is a volt or more out of tolerance. For tolerance level 114.0 to 126.0V, this signifies signal is 50 to 113.0V OR ≥ 127V.
Alert red (short pulse every sec.)	Signal is just OUT OF tolerance, by up to a volt. For tolerance level 114.0 to 126.0V, this signifies signal is 113.1 to 114.0V OR 126.0 to 126.9V.
Alert green (short pulse every sec.)	Signal is just IN tolerance, by up to a volt. For tolerance level 114.0 to 126.0V, this signifies signal is 114.1 to 115.0V OR 125.0 to 125.9V.
Quiet green (short pulse every four secs.)	Signal is IN tolerance, by better than a volt. For tolerance level 114.0 to 126.0V, this signifies signal is 115.1 to 124.9V.

LED Interpretation

Memory / Recording LED

This too is bi-colour, and again the ANGRY RED flashing condition is to be avoided. This LED gives more information than the voltage LEDs, as it shows when data is in memory, whether it has been downloaded, and whether the unit would like to start recording automatically! It indicates that recording is under way, and when it has finished, that new data is in memory which has not been downloaded.

In addition to showing whether data is in memory, this LED operates rather like the "Timed Exposure" function on a camera – it flashes at one rate to show it is switched on, and at a more urgent rate to show that recording start is imminent. When recording has started, the flash rate backs off to the "quiet" regime exactly in synchronism with the "comfortably in tolerance" rate on the voltage LEDs. So if all LEDs (except power) are doing the same thing, slowly and quietly, and are **GREEN**, then all is well, the meterman can tiptoe away so as not to disturb it, and go to the next site.

Memory/ Recording LED	Meaning
Off	No power present, therefore it cannot start recording automatically. Or there IS power present, but there is no data in memory BECAUSE its just been downloaded and erased. It's the normal state after playback and erasure on charger.
Alert green, (short pulse every sec.)	Power is present but no current is flowing yet. Memory is empty. If nothing else happens, recording will start in 15 minutes. This is the condition after the PM2000 is fitted into the wall socket, but before the meter is replaced to close the circuit
Urgent green, (short pulse every $^1/_2$ sec.)	Current is now flowing. Memory is empty. Recording will start automatically in the next minute. This condition occurs once the meter is replaced. Any current 0.1A or more lasting for a minute or more is sufficient to enable the recording process.
Quiet green, (short pulse every 4 secs.)	Recording is under way. Once started, the ride-through function will allow recording to continue for ten minutes after power loss, so this does not depend on power being present, though it will not start automatically without power. If power is off for more than ten minutes, recording will stop and the unit will shut off. When power is restored, the unit will start recording again within a few seconds.
Angry green, (on all the time except short gap every 4 secs.)	Recording has stopped, data is in memory, it hasn't been downloaded, so THAT'S THE PRIORITY! This also applies if the unit is woken up on charger or without power.
IF the unit is turned off or allowed to turn itself off, without downloading (normal condition when the unit is removed from a house installation), then EITHER the unit will be woken without AC power, in which case the Angry Green LED applies, OR the operator forgets to download, goes to another installation and plugs it in...	
Angry red, (on all the time except for short gap every 4 secs.)	Now AC power IS present, there is data in memory, AND it hasn't been downloaded. Yet the operator has reinstated the unit ready to record again. IN THIS CASE, the unit WILL NOT RECORD. **Angry red** is a warning that something must be done to empty this unit, or at least to download it.
Quiet flashing red (short pulse every 4 secs.)	If it is downloaded but not erased – a common condition – the LED will flash quiet red to indicate that data is present, it has been downloaded so situation is not critical, and recording could start if the conditions are right (though while flashing quiet **red**, something is not yet ready).
Alert red, (short pulse every sec..)	AC Power is present, data is still in memory though it has been downloaded, however current is not yet flowing. This is the condition arising when the unit has been downloaded but not erased, then the unit is installed on another installation, but the meter has yet to be reinstalled. Recording will start in 15 minutes on the basis that AC voltage is present, and the data WILL BE ERASED just before the recording starts.
Urgent red/green, (short alternating pulse every $^1/_2$ sec.)	AC Power is present, data is still in memory though it has been downloaded, current is now flowing. All the conditions are right to begin recording. This is the condition arising when the unit has been downloaded but not erased, then the unit is installed on another installation, and the meter has been reinstalled. Recording will start in 1 minute and the data WILL BE ERASED just before the recording starts. Now it changes to **quiet green**.

Normal sequence examples:

Installation on site
If previously downloaded and now empty:

- Sitting on the bench or in a car: OFF
- Arrive on site, and install. Before the meter is installed, ALERT **GREEN** (voltage now present, recording starts in 15 minutes if nothing else is done)
- Install the meter, URGENT **GREEN** (current now flowing, recording brought forward to start in 1 minute)
- Recording starts, QUIET **GREEN**
- Recording Ends (automatically or by user operation) ANGRY **GREEN**. (The unit detects that it has not lost power since the recording was completed so it does not need to try starting another)
- Unit removed from site. Turns itself off.

Data recovery
Arrival in car, or back at office.

- If unit is put on charger, ANGRY **GREEN** shows that data is present and not downloaded (although power HAS been lost since recording was completed, there is no AC volts, so restarting recording is not attempted). However the unit may be downloaded without power if necessary. If so, Pronto is used to wake it up and perform the download. After download, QUIET **RED** applies to show data is still present, though it has been downloaded. If memory is erased too, LED goes off altogether.

Alternative Installation on site
If previously downloaded but NOT erased:

- Sitting on the bench or in a car: OFF
- Arrive on site, and install. Before the meter is installed, ALERT **RED** (recording starts in 15 minutes if nothing else is done)
- Install the meter, URGENT **RED/GREEN** (recording brought forward to start in 1 minute)
- Recording starts, QUIET **GREEN**. Note previous data is erased when recording starts.

As for a) above

Second Alternative Installation on site
Recording present but NOT DOWNLOADED:

- Sitting on the bench or in a car: OFF
- Arrive on site, and install. ANGRY **RED**. Even though meter may be installed and conditions for recording present, RECORDING IS DISABLED until data is downloaded.

Troubleshooting

Below are troubleshooting charts. We hope you will find these useful should you have any difficulty getting your PM2000 to perform in the way you would wish and expect.

Lack of communications

This may be because the unit has not woken up, or there may be a communications block. We deal with failure to wake up first:

LED Interpretation

Failure to wake up

Symptom	Checkpoint	Yes/No	Explanation / Remedy
No response to computer when Pronto or PMScreen running	Is power applied? (either through the normal house connections or through the charger)		
If yes	Is the little red power LED flashing (extreme left viewed from underneath)	Yes	Low battery charge It hasn't yet woken up properly. Wait till after 64 seconds when the unit will power up. Then leave it on charge for 24 hours. You can still use the unit.
		No its off	Power is not being received. Check charger or mains connections.
		No its on	Power is being received. See Communications problems below
If no	Is there any LED activity?	Yes	Unit is awake. See Communications problems below.
		No	Battery charge level may be too low to permit waking up, or see Communications problems below.

Communications problems

This is probably the easiest and most likely source of frustration. Many things under the *User's* control have to be right to ensure proper operation. Here is a list of things to consider.

Note that the serial interface is not switched on all the time, as when on the side of a house it is not necessary. Therefore there is a preliminary "wake-up serial interface" process which must precede normal communications.

Both Pronto and PMScreen automatically invoke this process so the user is normally unaware that it occurs. However it is not sent continuously once normal communications are established, so if communications are *interrupted*, there may be a delay of up to one minute before the retry processes try again.

Assuming the unit has adequate power and could, if physical arrangements and set up were all correct, talk to the computer, reasons for failure are:

Reason	Remedy
No cable, or cable not connected at PC end	Connect sound cable
No line-of-sight between Infra-Red window on the IR pod and the PM2000 clear window, or angle too acute at either end	If on the bench remove coffee cups etc, position the IR pod about 1 ft (30cms) from the PM2000 window and have each face the other squarely
IR range too great	Stay below 2 feet (0.5m)
Wrong Baud Rate	Choose 115.2KBd at the PC and leave the PM2000 baud rate set to 115.2kBd Pronto: Under Logger/Playback/Edit set Baud rate and de-select "Use Network Address". PMScreen: Under Connect/Configure/ set Baud rate
Wrong .COM port on the PC	Select correct .COM port Pronto: Under Logger/Playback/Edit set COM port. PMScreen: Under Connect/Configure/ set COM port. If the option is "greyed out", close the port first (Connect/Close)
Wrong PM2000 slave address	The PM2000 is MODBUS compatible, and hence "network" aware. It is not normally necessary to change network addresses, since this is done automatically by the PC. If you close and restart Pronto and/or PMScreen, either will use a "Discovery" procedure to find new units to talk to.

Will not record

Symptom (Will not record)	Checkpoint		
The Record/Memory LED flashes anything EXCEPT one short green flash every four seconds (which would indicate recording).	If LEDs are on (or flashing), and this still applies after 15 minutes, it means there is a specific reason for NOT recording. Has Delayed Start recording been cancelled through Pronto or PMScreen?	Yes	Start recording in either Pronto or PMScreen, or remove power completely, and power up again. (The act of re-powering re-sets the default "I will try to record", so when voltage is consistently present, it will start after 15 mins, or 1 minute if current is flowing.
	Is power present?	No, or only through Charger	Recording won't start unless told to through Pronto or PMScreen.
		Yes	Recording SHOULD start as described above in no more than 15 mins, BUT
	Has previously recorded data been downloaded?	No	This is the one condition which prevents recording. Previously recorded data MUST be either read or deleted from the PM2000 in order to release it to record.
	?	Yes	It is likely that either the input voltage is not consistent, or the "User is in control". Start recording in either Pronto or PMScreen, or remove power completely, and power up again.

Flashing angry red LEDs

"Flashing Angry" is used to describe the state of the LEDs when they are on for 3 seconds out of 4. Only when they are Angry **RED** is there a real problem.

If it's a Voltage LED flashing – one of the middle three – it means the voltage is more than 1 volt *outside* the threshold.

If it's the Recording/Memory LED, this indicates that the unit is TRYING to record, but previously recorded data is present and has not been downloaded. Data must be downloaded or deleted.

Miscellaneous

Symptom (Miscellaneous)	Checkpoint		Explanation /Remedy
Your logger measures the voltage present but does not charge the batteries. (There is no flashing C). It shuts down after a few minutes.	Will it run happily on the charger?	Yes	One of the fuses has gone. Check the mains input fuse.
		No	Contact your distributor or representative.
	The fuse is intact	Yes	Contact your distributor or representative.
The screen is not displaying correct data.	Is the neutral properly connected?	No	Connect up using the lead on the base of the unit, or use one of the extra blade connections.
		Yes	Check your Set Ups particularly Maths Functions.

Appendix A
PM2000 Specification (REV 3)

Inputs	
Voltage	3: 0-300 Vac Line 1 to Neutral, Line 2 to Neutral, Line 1 to Line 2
Current (PM2000)	2: 0-200A RMS on Line 1 & Line 2
Current (PM2000-300)	2: 0-300A RMS on Line 1 & Line 2
Accuracy	< 0.25%, +/- 2LSBs (voltage channels) < 0.5%, +/- 2LSBs (current channels)
Resolution	Vac and 0.1 Aac
A/D Converter	
Resolution	16 bit
Sample Rate	64 samples per cycle (input Frequency Tracking)
Operating Frequency	56 to 64 Hz
Maths Channels	
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
Harmonics	Total Harmonic Value, % Total Harmonic Distortion
Basic Maths 1	Channel X * Constant
Basic Maths 2	Channel X / Channel Y
Basic Maths 3	Filtered Channel X, Internal Temperature, On Charge, Battery Volts
Recording	
Sample rate	64 samples per cycle; Single cycle true RMS response time; 16 bit simultaneously sampling all channels
Channels	16
Memory	
Storage capacity	1 MB
Firmware (Program Memory)	Flash upgradeable 1 MB
User Preferences	Stored in non-volatile RAM/EEPROM
Recording Mode and Rate	Point Store: Selectable from single cycle rate to once every 12 hours
Single Cycle Adaptive store:	Extended recording with single cycle resolution on changes Statistics closed (at least) every 5 mins. Statistics to EN50160 via PC Software
Data Retention	
Back-up battery	Provides 1 month's retention at 77'F (25'C) from full charge System detects remaining charge on battery while in storage, and if necessary writes recently used configurations to internal flash memory for permanent retention.
User Interface	
On Unit	5 status LEDs. (Power on, Voltages in spec, Recording/Memory)
Setup / Configuration	Achieved on unit through a PC running Virtual Screen software (PMScreen) or through Pronto for Windows
Data Review	Summary on Virtual Screen (PMScreen) & full data analysis using Pronto for Windows

Communications	
Serial IR Port	Max 115.2 kBd Isolation > 2.5kV Download to PC & control through Pronto for Windows MODBUS Ascii support
Bluetooth	
Computer requirements	
For Pronto Software	Windows 7, Vista, XP: 486DX66 or higher: 250 MB hard drive: 16 MB RAM
Power	
Requirements	Powered from L1-L2 input (75 – 300 VRMS, 3W Max) OR from charger input @ 12Vdc, 3W Max.
Battery capacity	1000 mAhrs (4*AA NiMH batteries)
Charge method	From L1-L2 input or from 12 V Wall Cube
Battery ride through	10 mins at a time, Operation from Fully Charged Battery > 5 hrs at 25 ^{o}C
Environmental	
Operating & Storage Temp.	-22 ° F (-30 ° C) to 140 ° F (60 ° C)
Case type	Consumer meter adaptor
Case Dimensions	175mm diameter, overall length 130mm, installed length 91mm.
Weight	1.2kg
IP Rating	Determined by seals to Meter Socket Adaptor.
Safety & Standards	
Approvals:	IEC 61010 (240V Category III, Pollution level 2), CE
Internal Fusing:	PSU , Charger input, Battery stack, IEC61326 (EMC)
Applicable Patents	
	6424277, 0230712, 4910692
Features	
	Automatic or Manual Recording Start, Up to >100 Set-ups (Factory or User created) saved for easy reference.

Appendix B
PM2000 Maths Functions

The functions available in the PM2000 are arranged in groups. There are six groups and an “Unspecified” assignment. These are listed below:

Groups

- Unspecified
- AC 1 Phase
- Split Phase
- Harmonics
- Basic Maths 1
- Basic Maths 2
- Basic Maths 3

The “Unspecified” category is used to “deselect” a Channel. When a Channel is “Unspecified”, it does not appear in the Display functions, and it is not recorded. In fact it is not processed at all.

AC 1 Phase Group

Options available in the 1 phase group are

- RMS
- RMS High Resolution
- Real Power
- Volts Amps Reactive (VAR)
- Apparent Power
- Displacement Power Factor
- Real Power Factor
- Phase Angle
- Frequency
- Real Impedance
- Reactive Impedance

Split Phase Group

Options available in the Split phase group are

- Real Power
- Volts Amps Reactive (VAR)
- Apparent Power
- Power Factor

Harmonics

- Total Harmonic Distortion (w.r.t Fundamental)
- Total Harmonic Value

Basic Maths 1

- Channel X * Constant

Basic Maths 2

- Channel X / Channel Y

Basic Maths 3

- Filtered version of Channel X
- Internal Temperature
- On Charge Indication
- Internal Battery Voltage

Appendix C
Factory Configurations 1-4

Configurations 1 - 11 are for recordings in Adaptive store for 7 days, FIFO Off.

NAME	2ø I Hmncs 7day	2ø I only 7day	2ø V Hmncs 7day	2ø V I 7day
Signal (Name and Full Scale)				
V1	VL1 300.0V	VL1 300.0V	VL1 300.0V	VL1 300.0V
I1	I1 200.0A	I1 200.0A	I1 200.0A	I1 200.0A
V2	VL2 300.0V	VL2 300.0V	VL2 300.0V	VL2 300.0V
I2	I2 200.0A	I2 200.0A	I2 200.0A	I2 200.0A
V3	VLL 300.0V	VLL 300.0V	VLL 300.0V	VLL 300.0V
Channel				
1	RMS VL1 [1]	RMS VL1 [1]	RMS VL1	RMS VL1
2	RMS VL2 [1]	RMS VL2 [1]	RMS VL2	RMS VL2
3	RMS VLL [1]	RMS VLL [1]	RMS VLL	RMS VLL
4	RMS I1	RMS I1	THD VL1 (Harmonics %)	RMS I1
5	RMS I2	RMS I2	THD VL2	RMS I2
6	HMNCS I1 (Harmonics Value)		THD VLL	
7	HMNCS I2			
8-16				

Note [1]: Voltage measurements are not recorded (i.e. the Channel is turned off for recording), although the measurements are left in the configuration so that the voltage threshold tests are processed to drive the status LEDs.

Note: Voltage Channels

The LED Status thresholds are derived from the High and Low alarm settings of the voltage measurement channels. The default threshold settings are:

Low	High	Applied to
114.0	126.0	V Line 1, V Line 2
228.0	252.0	V Line 1 – Line 2

These values are programmed into all the Factory Settings so that the user may see where to make changes to the threshold settings if desired. However if the Alarm Levels are left at the default level of 0.0 (as for instance when specifying a new Maths Channel to be recorded), the above threshold settings are applied automatically. The rule used by the PM2000 is:

“If an Alarm level is specified, use that for the threshold setting.”

“If the Alarm level is 0, use the default values (in the above table) for the threshold settings.”

Factory Configurations 5 - 8

Configurations 1 - 11 are for recordings in Adaptive store for 7 days, FIFO Off.

NAME	2ø V I Flkr 7day	2ø V I Full Flkr 7day	2ø V I Hmncs 7day	2ø V I Pwr 7day
Signal (Name and Full Scale)				
V1	VL1 300.0V	VL1 300.0V	VL1 300.0V	VL1 300.0V
I1	I1 200.0A	I1 200.0A	I1 200.0A	I1 200.0A
V2	VL2 300.0V	VL2 300.0V	VL2 300.0V	VL2 300.0V
I2	I2 200.0A	I2 200.0A	I2 200.0A	I2 200.0A
V3	VLL 300.0V	VLL 300.0V	VLL 300.0V	VLL 300.0V
Channel				
1	RMS VL1	RMS VL1	RMS VL1	RMS VL1
2	RMS VL2	RMS VL2	RMS VL2	RMS VL2
3	RMS VLL	RMS VLL	RMS VLL	RMS VLL
4	RMS I1	RMS I1	RMS I1	RMS I1
5	RMS I2	RMS I2	RMS I2	RMS I2
6	FLKR st VL1 (10 mins)	FLKR sensation VL1	THD VL1 (Harmonics %)	Split Phase Real Power
7	FLKR st VL2 (10 mins)	FLKR sensation VL2	THD VL2	Split Phase VARs
8	FLKR st VLL (10 mins)	FLKR sensation VLL	THD VLL	Split Phase Apparent Power
9		FLKR st VL1 (10 mins)	HMNCS I1 (Harmonics Value)	Split Phase Power Factor
10		FLKR st VL2 (10 mins)	HMNCS I2	
11		FLKR st VLL (10 mins)		
12		FLKR lt VL1 (2 hrs)		
13		FLKR lt VL2 (2 hrs)		
14		FLKR lt VLL (2 hrs)		
15		FLKR flag on VL1		
16		FLKR flag on VL2		

Factory Configuration 9 - 11

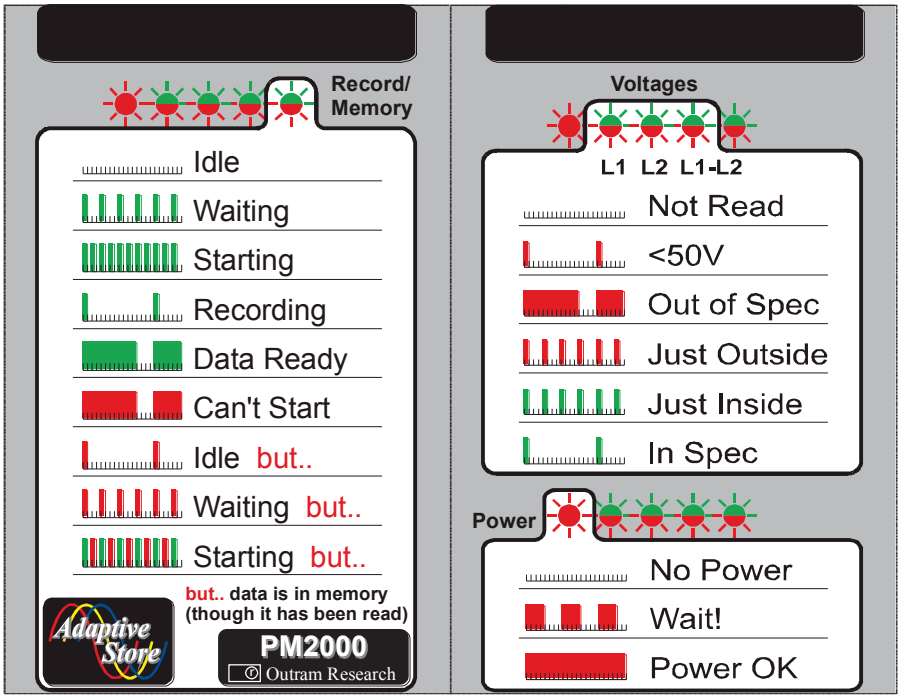
Configurations 1 - 11 are for recordings in Adaptive store for 7 days, FIFO Off.

NAME	2ø V I Pwr Flkr 7day	2ø V I Pwr Hmncs 7day	2ø V only 7day
Signal (Name and Full Scale)			
V1	VL1 300.0V	VL1 300.0V	VL1 300.0V
I1	I1 200.0A	I1 200.0A	I1 200.0A
V2	VL2 300.0V	VL2 300.0V	VL2 300.0V
I2	I2 200.0A	I2 200.0A	I2 200.0A
V3	VLL 300.0V	VLL 300.0V	VLL 300.0V
Channel			
1	RMS VL1	RMS VL1	RMS VL1
2	RMS VL2	RMS VL2	RMS VL2
3	RMS VLL	RMS VLL	RMS VLL
4	RMS I1	RMS I1	
5	RMS I2	RMS I2	
6	Split Phase Real Power	Split Phase Real Power	
7	Split Phase VARs	Split Phase VARs	
8	Split Phase Apparent Power	Split Phase Apparent Power	
9	Split Phase Power Factor	Split Phase Power Factor	
10	FLKR st VL1 (10 mins)	THD VL1 (Harmonics %)	
11	FLKR st VL2 (10 mins)	THD VL2	
12	FLKR st VLL (10 mins)	THD VLL	
13		HMNCS I1 (Harmonics Value)	
14		HMNCS I2	
15			
16			

Factory Configuration 12

Special configuration for Test purposes. Recording in Adaptive Store for 3 days, FIFO Off.

NAME	FC 2ø Test Config #1
Signal (Name and Full Scale)	
V1	VL1 300.0V
I1	I1 200.0A
V2	VL2 300.0V
I2	I2 200.0A
V3	VLL 300.0V
Channel	
1	RMS VL1
2	RMS VL2
3	RMS VLL
4	RMS I1
5	RMS I2
6	
7	Frequency
8	HRMS V1 (Harmonics Value)
9	HMNCS V2
10	HMNCS VLL
11	HMNCS I1
12	HMNCS I2
13	
14	Internal Temperature
15	On Charge
16	Battery Volts

Appendix D
LED Legend Card

– print this off, cut, fold and laminate it if you lose the one provided!