Welcome to SQM Reader Pro 3

Thank you for choosing ***SQM Reader Pro***. This product allows you to acquire, store and manage darkness readings from Unihedron's Sky Quality Meter models LE, LU, LU-DL, and LR.

This document describes how to use the software, how to interpret the data that it displays, and it gives some examples of how you might share the data that you collect with other applications, scripts or batch processes.

Installation instructions can be found here.

Please apply the latest software updates if any are available after installing.

Activation instructions can be found here. **Please remember to activate your license within 30 days of installation!**

Brief Overview

The main application window is divided into 2 sliding menus (left & right), a command panel, a center display panel and a reading panel. The left menu ☰ gives you access to the program's configuration settings and data display pages. The right menu ? gives you access to the program's help and online support facilities. The command panel at the top of the main window contains the command buttons that initiate and terminate reading. The panel at the bottom of the window contains data from the latest reading.

Key Features

- displays darkness readings in magnitude per square arcsecond (MPSAS) and theoretical Naked Eye Limiting Magnitude (NELM)
- time-averaging of readings
- calculates and displays elementary statistics per sampling period (minimum, maximum, mean and standard deviation) for MPSAS and NELM
- on-demand or continuous reading is available
- configuration, read, erase and time synchronization is supported for data logger models (SQM-LU-DL)

- continuous reading can be suspended during twilight and/or sun up at your meter (not necessarily at your computer)
- continuous reading can be aligned to the PC clock so that reading occurs on even time boundaries
- graph MPSAS and NELM in real-time
- stores readings data in ***SQM Reader Pro*** native format (comma separated values text file)
- stores readings data in Skyglow Observations standard format
- opens and processes data in ***SQM Reader Pro*** native format or Skyglow Observations format
- stores latest graphed data as a JPEG file
- stores latest readings values as a JPEG file
- sends selected file(s) to program, script, batch file or remote FTP server
- sends latest reading to Knightware's SQM Reading Map web page for public display of contributed readings
- sends latest reading to Globe At Night Monitoring Network (registration required)

Getting help

You are encouraged to read this help document so that you can familiarize yourself with the software. Networking and hardware related questions should be directed to Unihedron.

This **help document** is intended to be a detailed and exhaustive reference describing the product. Open it by visiting **Help** on the Help menu in ***SQM Reader Pro***. You can also press F1 anywhere in the product to open context sensitive help.

The **Readme** file contains installation and other release notes not contained in the help files. Open it by visiting **Release Notes** on the Help menu.

Support information is available in the SQM Reader Pro Support web page. Here you will find links to the knowledgebase, video library, YouTube channel, and Yahoo Group (user discussion forum).

If you have a general question about ***SQM Reader Pro***, you can post it on the sqmreaderpro Yahoo Group or submit it throught the Knightware Contact Us page. If you have a technical problem (bug) to report, please enter a support ticket at the Support Center.

Hardware and Software Requirements

You need the following hardware and operating system software to run the product:

- PC with Intel Pentium CPU or later (or a fully compatible and equivalent CPU) . 1GHz or faster on Windows 7, 8 or 10.
- 32 or 64 bit edition of Windows 7, 8 or 10 including the latest Windows Updates from Microsoft
- Internet Explorer 6 or later
- 1 GB Windows 7, 8 or 10 (32-bit), 2 GB Windows 7, 8 or 10 (64-bit)
- installation requires about 20.6 MB of hard disk space
- XGA (1024 x 768) or better with DirectX 9 graphics device with WDDM 1.0 or higher driver Windows 7, 8 or 10.
- Scaling > 100% on Windows 10; some problems appear on Windows 7 & 8 with scaling > 100%.
- CD drive (if installing from CD)
- a pointing device (mouse) is recommended but not required
- Internet connection is recommended but not required
- 9-pin serial port and cable are required to communicate with SQM-LR
- Ethernet port and cable, or wireless NIC, is required for communication with SQM-LE

- USB port and cable are required to communicate with the SQM-LU and SQM-LU-DL

Installation

Before Installation

Before you install ***SQM Reader Pro 3*** you should:

- Locate your version 3 product key. It is easiest to enter it during installation. Your version 3 product key is in your purchase confirmation e-mail if you received the software by digital delivery (download), or it is printed on a sticker inside the product CD case. **Do not enter you version 2 product key!**
- Decide how you want to install and use the software. There are two available installation strategies available for ***SQM Reader Pro 3.*** **Nearly all users will find that the 'Just for me' option is sufficient and most convenient.** Special circumstances may dictate using the 'Anyone using this computer' method. See Install ' Just for me' or 'Anyone using this computer' below for complete details.
- Copy your settings from SQM Reader Pro 2 if applicable. You can open SQM Reader Pro 2 and copy the settings to version 3 after you install version 3. You do **not** need to uninstall ***SQM Reader Pro 2*** before installing ***SQM Reader Pro 3***. The two versions can reside on the same computer if desired.

A Note about Windows UAC Security

SQM Reader Pro 3 is designed to run under a Windows user account having standard or administrative privileges, and with User Account Control (**UAC**) enabled. Knightware does not recommend installing under the Guest account. Microsoft recommends that users perform everyday tasks running under an account with standard privileges to assure a "more secure user experience." ***SQM Reader Pro 3*** meets that requirement.

Installation

If you received the software by digital delivery (download), run the file SqmPro3Setup.exe. If you received the software on CD, insert the CD into your drive. The Windows AutoRun facility should automatically start the setup; if it doesn't, find SqmPro3Setup.exe in the root folder of the CD and run it.

License Agreement

You must accept the agreement to proceed. If you do not wish to accept it, the setup will terminate. The license agreement allows installation on up to 3 computers if each is used primarily by one person. You may also install for more than one Windows account on each computer (using the Just for Me installation option). You can refer to the License Agreement after installation by clicking **License Agreement** under the help menu.

Choose Users

Select either Just for Me (recommended) or Anyone using this computer. To understand which to choose, please read this. You can refer to the installation mode after installation by clicking About under the help menu.

Customer Information

You may enter a User Name and Organization. These are optional. They appear in the About box

in ***SQM Reader Pro***.

You may enter your product key here, or later in the Software Activator or by clicking Product Key under the help menu in ***SQM Reader Pro***.

Destination Folder

Windows will suggest an installation folder depending on how you are installing (see Install for Just Me or All Users). You may change this if you like.

Choose Start Menu Folder

The installation program suggests the folder name 'SQM Reader Pro 3' for your Start Menu. All product shortcuts are available from this folder in your Windows Start Menu.

Click install to perform the installation.

Install ' Just for me' or 'Anyone using this computer'?

SQM Reader Pro 3 can be installed for single Windows account(s) (**Install just for me**) or for all accounts on the computer (**Install for anyone using this computer**). Knightware recommends that you Install using the 'Just for me' option to avoid maintenance issues associated with the 'Anyone using this computer' option. Please note that regardless of which installation option you choose, ***SQM Reader Pro 3*** can be used in a Windows account with standard or administrative privileges. See installation folders for information about where files are installed for each option.

Install just for me (recommended) installs program files and other user files in folders accessible by the current user as permitted by **UAC**. This installation option provides the smoothest and most secure user experience.

- You must have administrative privileges to install the software.
- You do not need administrative privileges to apply software updates.
- You do not need administrative privileges to activate the software license.

You can also install multiple copies of ***SQM Reader Pro 3*** on a single computer if you want to keep separate data files and settings for multiple users. To install multiple copies on your computer, choose the 'Just for me' type of installation; install the software and activate the license while logged into each user's Windows account . An entire copy of the product (program and documentation) is installed for, and is accessible by, each account for which the product is installed. This method requires that each installation be maintained (installed and updated) separately while logged into each user account.

Do NOT mix one or more 'Just for me' installations on the same computer with an 'Anyone using this computer' installation.

Installing for anyone using this computer places user files in folders accessible by any user of the computer, but one copy of the program is placed in the Program Files folder. Standard Windows accounts cannot modify files in this folder. These important consideration apply:

- You must have administrative privileges to install the software.
- You must have administrative privileges to apply software updates.
- You must have administrative privileges to activate the license.

In Summary

- Installing 'Just for Me' is the default installation option and is best when one user of the computer needs to use the product, OR more than one user needs to use the product and each wants separate data files. Program maintenance (updating) does not require administrative privileges.
- The only reason to Install for 'Anyone using this computer' is so that a single set of settings can be shared among multiple users accounts. Software maintenance and license activation require administrative privileges.

What about?

Knowing how you installed the software is necessary information in troubleshooting some problems. If you have forgotten how you installed ***SQM Reader Pro***, go to About under the help menu.The gray area beneath the image and copyright information shows either **Installed for Single User** ('Just for me' option) or **Installed for All Users**. ('Anyone using this computer' option).

Changes from Version 2

This list is intended for experienced users of ***SQM Reader Pro*** version 2. It lists functionality changes from version 2 to version 3.

- The user interface has been redesigned to fit smaller monitors and high resolution monitors with scaling > 100%.*
- Styling has also been added which allows different skins to be used. This affects the JPEG images produced by the software that can be transferred to an FTP server, thereby allowing images to be color compatible with web page design.
- Data logger (SQM-LU-DL) configuration and reading support have been added. Read All, Erase All and time settings functions are included.
- Continuous reading may be aligned to the PC clock so that readings occur on the top of the hour and integer multiples of the specified reading interval.
- Sampling period capacity has been expanded to 1,048,576 readings.
- Reading file format has been changed slightly. MPSAS, NELM solar and lunar altitude values are now recorded in fixed format to provide easier human-readable presentation. Altitude values are presented as rounded signed integers. Field arrangement has not been changed.
- Multi-threaded and parallel processing have been added to improve various functions.
- A color swatch has been added to the reading display page (and main window) which corresponds to the color scheme used in *The New World Atlas of Artificial Sky Brightnes*s (Falchi et al, 2016).
- An option to activate the software license online has been added. Manual activation via e-mail is still available.

* There is a known problem on a 5k monitor with scaling at 250% on Windows 7. Testing on Windows 7, 8.1 and 10 with a 4k monitor at 200% scaling is satisfactory, as is testing a 4k monitor on Windows 10 at 250% scaling.
Microsoft continues to make changes to Windows to accommodate high DPI monitors at the time of this writing, but mainly to Windows 10.

Software Activator

SQM Reader Pro's software license agreement grants users a license to *use* the software. Users do not *own* the software, and this is normal practice in the software industry.

You may use all features of the product during the 30 day activation grace period, but you are encouraged to activate your license at your earliest convenience so that you may use your software without interruption. ***SQM Reader Pro*** will remind you to activate during the final week of your activation grace period.

The license activation process does not include any personally identifiable information. Please see the privacy statement.

Your license can be activated using either an online service or email. The online service contacts the license server and thus requires an active Internet connection.

Activating Online

- Click **Activate License** under the help menu in ***SQM Reader Pro***, - OR - open the Windows Start menu and find your ***SQM Reader Pro*** product folder. The ***SQM Reader Pro*** product folder is normally called 'SQM Reader Pro 3' unless you changed this during installation. Click **Software Activator**.
- If **Product Key** is missing, enter your product key as it appears inside your original product CD case (if you ordered one), or your purchase confirmation e-mail (if you purchased ***SQM Reader Pro*** by digital download delivery). Product Keys contain numbers 0-9 and letters A-F. Do not confuse capital O for number zero, capital I for number 1 or lower case letter l for number 1.
- Click the **Activate Online** button.You should see a message indicating that your software license has been activated successfully.

If you have difficulty activating your license, please contact Knightware Support. Please be prepared to provide your product key, the type of installation you have (Just for Me or All Users), and the Windows operating system version you have.

Activating by E-mail

You must perform **both** of the following steps while logged into the same computer and Windows account that you installed ***SQM Reader Pro*** under!

Step 1: Request Activation Code

- Click **Activate License** under the help menu in ***SQM Reader Pro***, - OR - open the Windows Start menu and find your ***SQM Reader Pro*** product folder. The ***SQM Reader Pro*** product folder is normally called 'SQM Reader Pro 3' unless you changed this during installation. Click **Software Activator**.
- If Product key is missing, enter the product key as it appears inside your original product CD case (if you ordered one), or your purchase confirmation e-mail (if you purchased ***SQM Reader Pro*** by digital download delivery). Product Keys contain numbers 0-9 and letters A-F. Do not confuse capital O for number zero, capital I for number 1 or lower case letter l for number 1.
- Click the **Request Activation Code by E-Mail** button.
- A web mail form is opened in your browser that resides on the Knightware web site, knightware.biz.. It shows the product key that you entered above, and a Computer Code that identifies your computer hardware. This is not personally identifiable information.
- Enter the e-mail address to which the activation code should be returned. Please be

sure that there are no typographical errors in the e-mail address, or your activation code will not reach you. Also, be sure to enter an e-mail address that can receive e-mail from knightware.biz, adjusting your spam filter if necessary.

- Click **Send Request** to send the request message to Knightware. Once Knightware receives your request, an activation code is created and returned to you by e-mail. If you do not receive this activation code response e-mail within 24 hours, it is very likely that you entered an incorrect e-mail address, or a spam filter at your e-mail server stopped the activation code response message.

  Check your spam filter and/or send another request. Duplicate requests received by Knightware in less than 24 hours are generally ignored; duplicate requests received in more than 24 hours receive an activation code response from a different e-mail server in case the first one was intercepted by a spam filter.

Very Important: Please be sure that your e-mail address is typed correctly, and that your security software and/or spam filters will permit delivery of your activation code message from knightware.biz. These are the leading reasons for not receiving your activation code promptly.

Step 2: Install Activation Code

Once you receive the e-mail response containing your activation code:

- Open the ***Software Activator*** as described above.
- Click the **Activate Manually** button.
- A dialog box is displayed where you can enter the activation code. It must be entered exactly as it appears in your activation response e-mail message. The easiest way to do this is to copy (Ctrl-C) the activation code text from the e-mail message and paste (Ctrl-V) it into the **Activation Code** text box on the dialog.
- Click **Activate**. You should see a message indicating that your software license has been activated successfully.

If you have difficulty activating your license, please contact Knightware Support. Please be prepared to **provide your product key**, the type of installation you have (Just for Me or All Users), and the Windows operating system version you have.

Additional Information:

Product Key

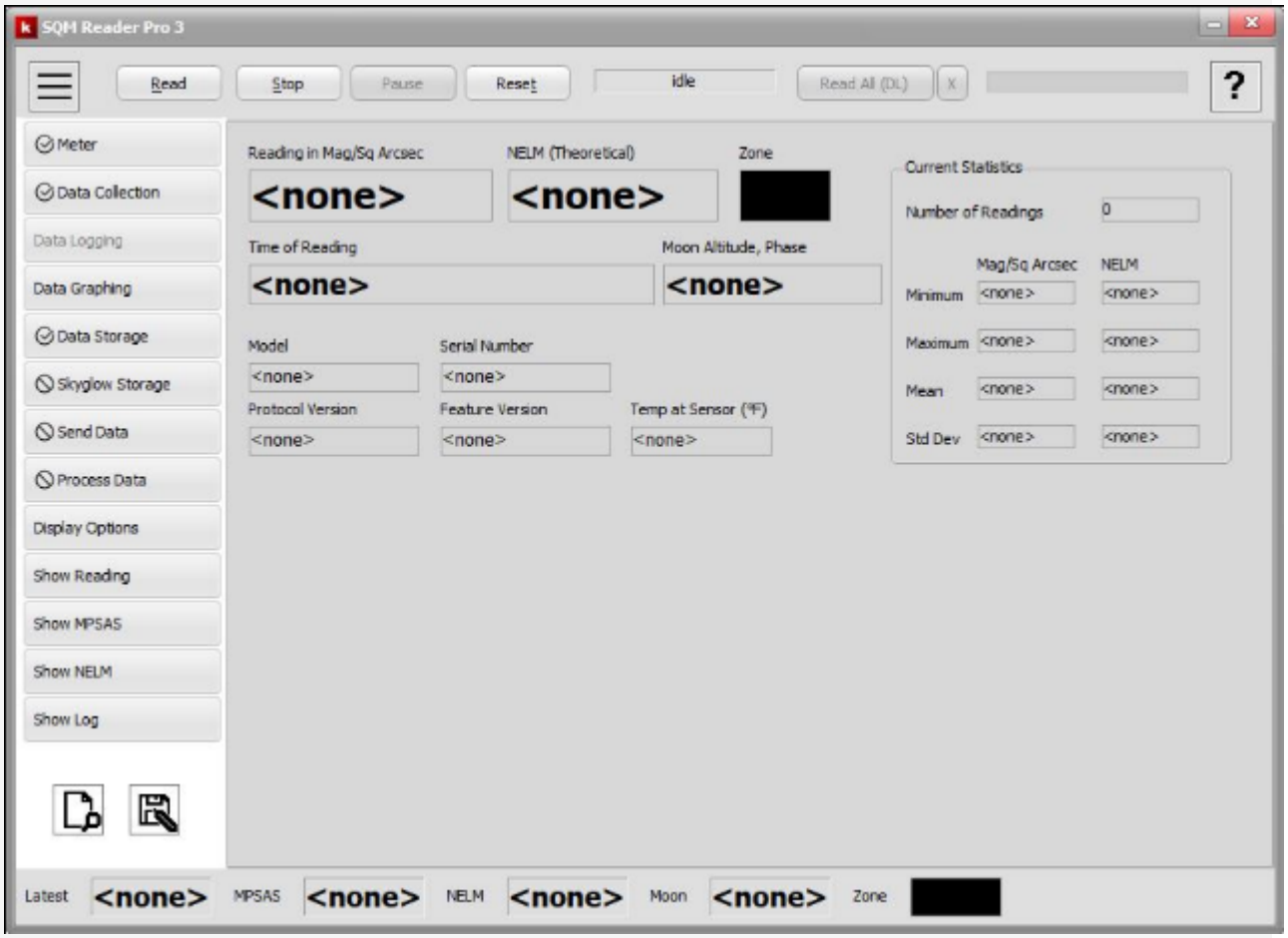
Main Window

The application's main window contains a button that toggles display of the main menu ☰. This menu provides access to most of the application's functions, broadly described as configuration settings and data display pages. It is shown expanded in the figure below. The central pane of the window shows the configuration or display page that is selected in the main menu. By default, the Show Reading page is displayed. When you close ***SQM Reader Pro***, the last page shown is displayed when the program is started the next time.

The application's main window also contains a button that toggles display of the help menu ?. The help menu provides access to online help file (this document), other documents and services that support your usage of ***SQM Reader Pro***. It is also shown expanded below.

The other areas of the main windows are the command panel (top of window) and the latest reading panel (bottom of window).

Note: The screenshots included in this document are made using the 'Slate Classico' style. Appearance varies according to the style that you select on the Display Options page

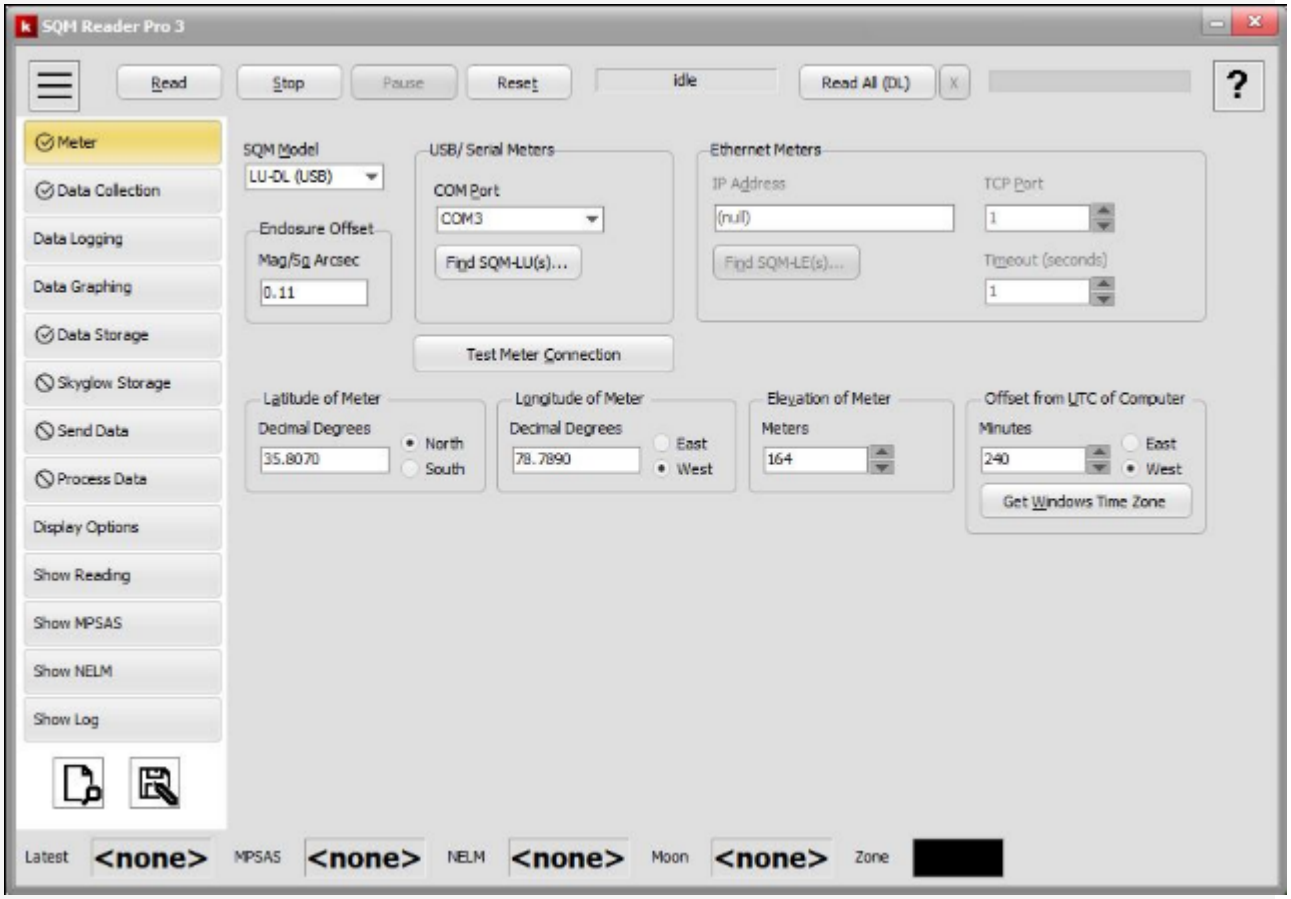


Main window with main menu (left) and help menu (right) displayed.

Meter

The **Meter** page allows you to configure settings necessary for communicating with your SQM.

Menu Icon Synopsis: the **Meter** menu item shows if any meter communication parameters are set, or if not.



Meter confguration page

SQM Model allows you to select the model of Sky Quality Meter that you will read. Communication settings required by the model you select are enabled, others are disabled.

Enclosure Offset allows you to enter the amount of light loss, in unsigned magnitudes per square arcsecond, that occurs when light passes through glass to reach the meter. Light loss produces darker (higher number) raw readings, so the value is subtracted from raw readings to adjust for absorption in the glass.

The offset is applied to both Mag/Sq Arcsec and NELM displayed readings, stored readings and graphed readings. It is not applied to readings stored in Skyglow Observations files per the standard. This value should be set to 0 if your meter is not in an enclosure, or you are already applying an offset in your post processing procedures.

USB/ Serial Meters

COM Port allows you to select the port to which your SQM-LU, SQM-LU-DL or SQM-LR is attached. In the case of the SQM-LU and SQM-LU-DL, this is a virtual COM port name assigned

by the FTDI Virtual COM port driver. You can use **Find SQM-LU(s)** to determine what COM port assignment(s) have been made by the driver.

Find SQM-LU(s) reports any virtual COM port assignments made by the FTDI Virtual COM port driver, and collects meter identification data. The driver creates a virtual COM port for the USB connection. The driver must be installed to report the assignment. Please see your SQM-LU or SQM-LU-DL documentation for more information on obtaining and installing this driver.

Ethernet Meters

IP Address allows you to set a fully qualified URL (if you have made DNS assignments), or an IPv4 address for your SQM-LE. This must match the static IP address stored in the meter or the IP address assigned by a router.

TCP Port is the port number of the device, assigned by the manufacturer to 10001. Change this only if you have changed the port assignment in your SQM-LE.

Find SQM-LE(s) attempts to identify any SQM-LE devices on the local network. ***SQM Reader Pro*** broadcasts a command via UDP to all devices. Most routers do not permit the UDP packet to cross over to the outside world, so the search is usually limited to inside your local network. Each SQM-LE device should respond with its MAC address and IP address, allowing you to determine the correct value for **IP Address** above. Each meter's MAC address is included with the meter so that you can identify a particular device.

If any SQM-LE devices respond, a dialog box is displayed showing the MAC address and IP address of each device that responded. You can use copy and paste to place the address information on the Windows clipboard for transfer to the **IP Address** box mentioned above or to another Windows program.

Note: Please see the appendix for more information regarding Security Warnings.

Timeout is the amount of time that ***SQM Reader Pro*** will wait for the SQM-LE to respond to a read request. You should change this value only if you are familiar with the speed of the network between your computer and the meter.

Test Meter Connection allows you to attempt to connect with the meter defined by the settings described above - either Ethernet or serial models. The connection selected in **SQM Model** is tested. Meter identification data is transferred and validated. If the connection fails, or the meter identification is not valid, the test fails.

The following values are necessary for computing the position of the sun which is required if you want to use the **Suspend Collection** feature on the Data Collection page. They are also required for calculating the moon's phase and altitude, and for storing data in Skyglow Observation format.

Latitude of Meter is the latitude of the meter, not the computer on which ***SQM Reader Pro*** is running.

Longitude of Meter is the longitude of the meter, not the computer on which ***SQM Reader Pro*** is running.

Elevation is the elevation in meters of the meter, not the computer on which ***SQM Reader Pro*** is running.

Offset from UTC of Computer indicates the time zone separation in minutes of the computer running ***SQM Reader Pro*** from UTC, not the meter. For example, the offset for US Eastern Standard Time is 300 minutes west and the offset for Central European Standard Time is 60

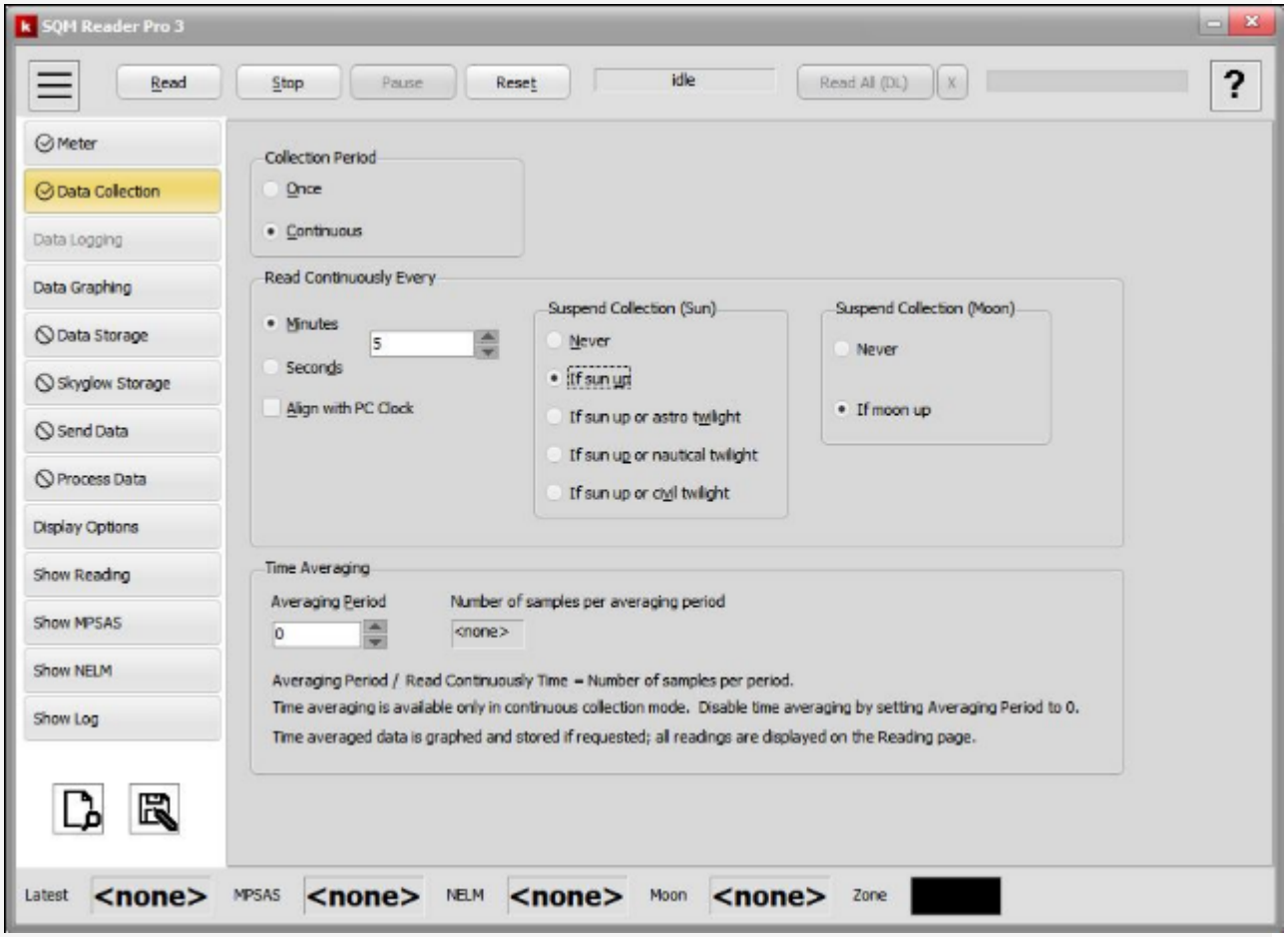
minutes east.

Get Windows Time Zone fetches the time zone information from Windows Regional Settings and updates the minutes and direction offset from UTC.

Data Collection

The **Data Collection** page allows you to configure how often the meter is read.

Menu Icon Synopsis: the **Data Collection** menu item shows  if the collection period is **Continuous**, or  if it is **Once**.



Data Collection configuration page

Collection Period

Collection Period determines whether you want to read your meter on demand (a manual button click), or continuously.

Once: a reading is acquired each time you click the Read button.

Continuous: readings are acquired until you click the Stop button.

Read Continuously Every

Read Continuously Every defines how often the meter is read in continuous reading mode only. The value may be from 1 to 60, inclusively.

Minutes/Seconds allows you to specify whether the Read Continuously value shall be in seconds or minutes. The Send Data and Process Data functions are not available when reading

occurs faster than once per minute.

Align with PC Clock allows you to begin continuous reading at a second or minute boundary as specified by Minutes/Seconds. For example, if you specify continuous reading every 5 minutes and aligned to the clock, reading will begin at the next 5 minute boundary of the PC clock on or following the top of the hour (1:00, 1:05, 1:10 etc). If you choose continuous reading every 15 seconds and aligned to the clock, reading will begin at the next 15 second boundary of the PC clock on or following the top of the minute (1:00:00, 1:00:15, 1:00:30 etc). After the first reading is acquired on a clock boundary, reading continues on a normal schedule which will be aligned to the clock. The Pause/Resume function is not available if reading is aligned to the clock because alignment is lost when reading is paused.

You must specify a reading interval that divides evenly into 60 when aligning to the clock. Thus, reading every 7 seconds is not valid because 7 doesn't divide evenly into 60.

Suspend Collection (Sun) is enforced for the second and subsequent readings during continuous data collection. The first reading is always acquired. If reading is suspended due to a restriction for the sun's position, the Reading Status box on the Command Panel shows 'suspended - sun'.

Never means that data collection proceeds without regard to the position of the sun at the location of the meter.

If sun up means data collection is suspended when the sun is above the horizon at the location of the meter. Note that the location of the meter and the time zone offset of the data collection computer must be accurate for this to function correctly.

If sun up or astro twilight extends the 'sun up' suspension period described above to include astronomical twilight. Data is collected only when the sun is below -18° altitude at the location of the meter.

If sun up or nautical twilight extends the 'sun up' suspension period described above to include nautical twilight. Data is collected only when the sun is below -12° altitude at the location of the meter.

If sun up or civil twilight extends the 'sun up' suspension period described above to include civil twilight. Data is collected only when the sun is below -6° altitude at the location of the meter.

Suspend Collection (Moon) is enforced for the second and subsequent readings during continuous data collection. The first reading is always acquired. If reading is suspended due to a restriction for the moon's position, the Reading Status box on the Command Panel shows 'suspended - moon'. Note that suspension of reading due to the position of the sun takes precedence over that of the moon, so if both restrictions are in effect, the Reading Status box shows 'suspended - sun'

Never means that data collection proceeds without regard to the position of the moon at the location of the meter.

If moon up means data collection is suspended when the moon is above the horizon at the location of the meter. Note that the location of the meter and the time zone offset of the data collection computer must be accurate for this to function correctly.

Time Averaging

Time Averaging: some applications may wish to store and graph time-averaged data. In this mode, readings are acquired each **Read Continuously Every** sampling time, and they are accumulated and averaged over a number of readings. The Reading display page shows **every**

reading sample; readings text files, graphs and Skyglow data files all contain **time-averaged data** if time averaging is enabled.

Important: the Skyglow Observations standard data format does not identify time-averaged readings as such and may not be acceptable to every repository. Please check with your repository administrator before submitting time-averaged Skyglow Observations.

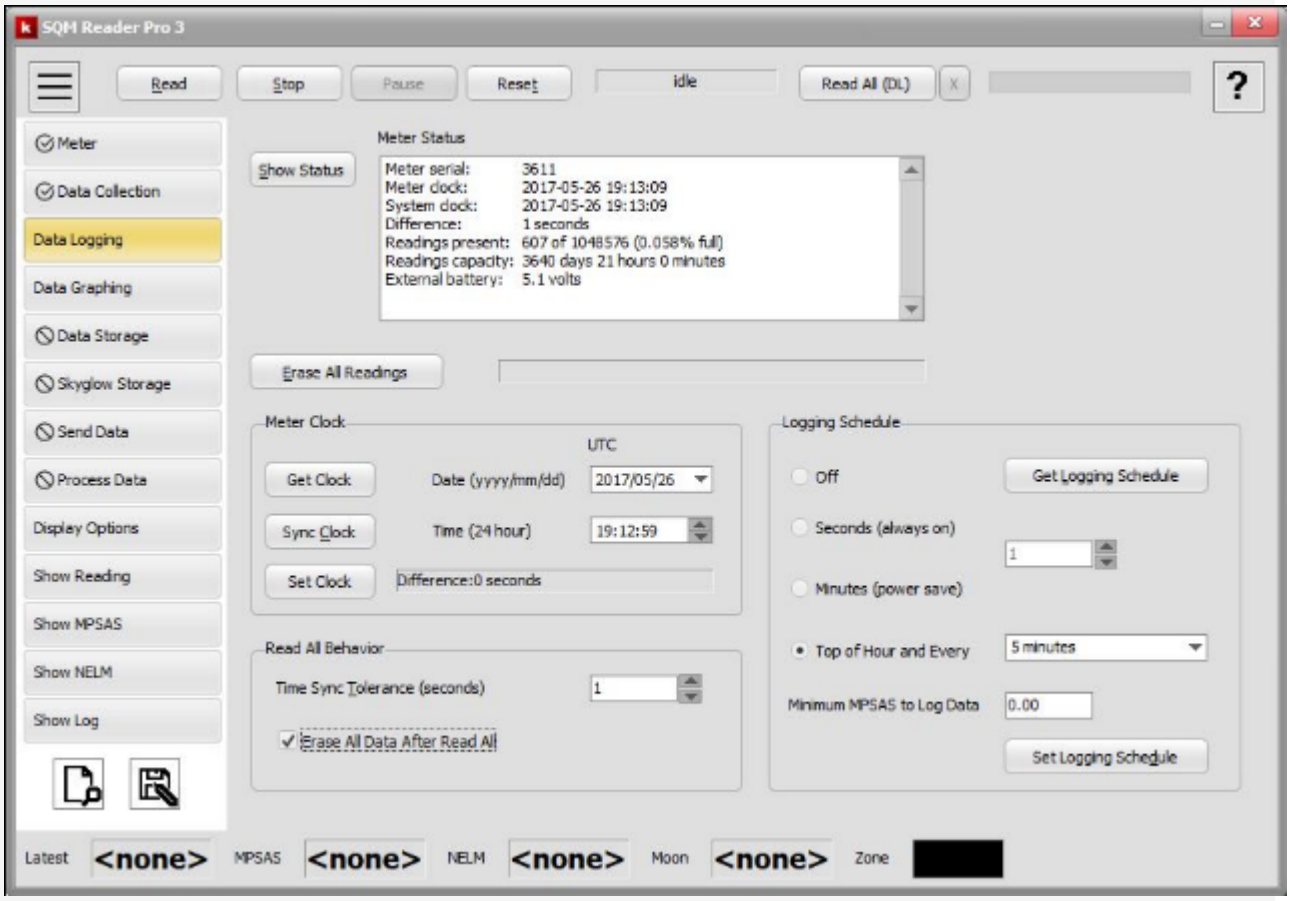
Important: The Pause/Resume reading function will skew the timing of time-averaged reading. Time averaging accumulates successive readings into a time-averaged value whether the readings occur on schedule or are interrupted by the **Pause/Resume** function.

Averaging Period determines how much time is represented in a time-averaged reading. Readings are stored if necessary and graphed only at these points in time. All readings are displayed on the Reading page.

Number of Samples per Averaging Period shows how many sub-interval readings are accumulated into a time-averaged reading.

Data Logging

The **Data Logging** page allows you to configure data logging parameters in SQM-LU-DL meters. This page is enabled only when the **SQM Model** selected on the Meter page is SQM-LU-DL.



Data Logging configuration page

Show Status allows you to read and display logging status information from the meter.

Erase All Readings erases all logged readings from the FLASH memory of the meter. You are asked to confirm the erasure before it starts. Click **No** to cancel the erase request (all records are left unchanged), or click **Yes** to proceed with the erasure.

Meter Clock

Get Clock reads the real time clock in the meter and displays it in **Date** and **Time**. The meter keeps universal time (UTC). The difference between your local PC time and UTC should be set correctly on the Meter page.

Sync Clock reads the current PC date & time, applies the time zone offset recorded on the Meter page, and sets the real time clock (date & time) in the meter. Note that there can be a difference of 1 second after Sync Clock due to the resolution of timekeeping in the PC. This is a normal artifact.

Set Clock reads the date and time from **Date** and **Time** and sets the real time clock in the meter. **Date** and **Time** should be in universal time (UTC).

Logging Schedule

The logging feature in the meter must be configured to record readings on a specified time schedule while the meter is operating on external battery power. Note that the meter must power up to acquire a reading. Please see the Operator's Manual for more information.

Get Logging Schedule allows you to read the logging schedule from the meter and display it. The schedule in the meter is not altered. This is useful if you wish to check the configuration or make a minor change.

Off disables the logging of readings to FLASH memory.

Seconds enables logging of readings to FLASH memory on a time period of seconds, and the meter is powered up continuously. Specify the number of seconds in the edit box beside **Seconds**. Note that this selection does not align logging to the clock in the meter.

Minutes enables logging of readings to FLASH memory on a time period of minutes, and the meter is powered down between readings. Specify the number of minutes in the edit box beside **Minutes**. Note that this selection does not align logging to the clock in the meter.

Top of Hour and Every enables logging of readings to FLASH memory on a time period of minutes, and the meter is powered down between readings. Specify the number of minutes in the drop down box beside **Top of Hour and Every**. Note that this selectionaligns logging to the clock in the meter. For example, if you choose **Top of Hour and Every 5 minutes**, readings are recorded at the top of the hour and every 5 minutes thereafter.

Minimum MPSAS to Log Data allows you to set a minimum reading value in MPSAS for recording readings in FLASH memory. The meter must power up to acquire a reading, but if the reading value is lower (brighter) than the threshold value, it is not recorded into FLASH memory. Set the threshold value to 0 to record all readings to FLASH memory.

Set Logging Schedule sets the logging threshold and schedule in the meter. It does not erase any readings.

Read All Behavior

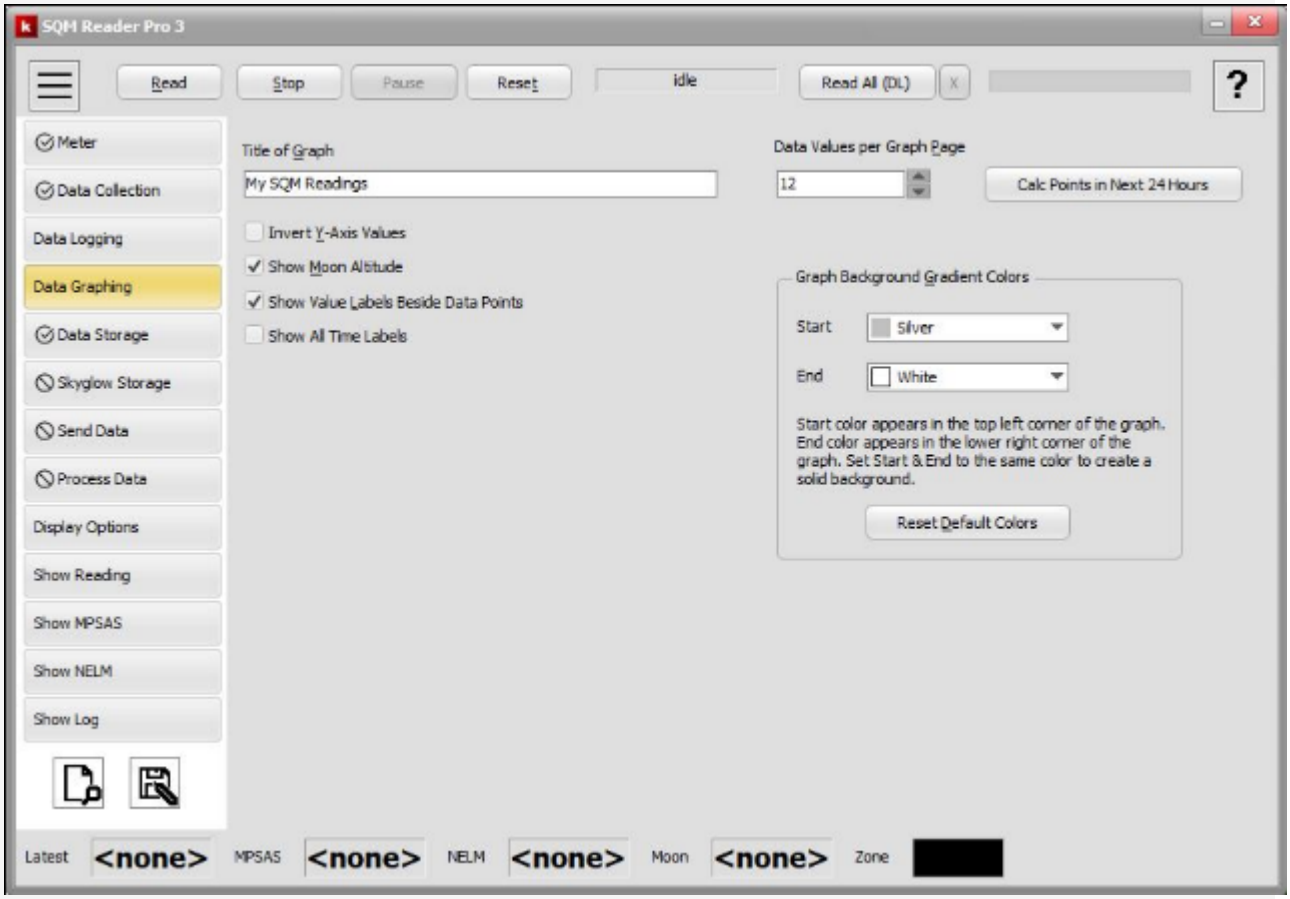
The Read All function on the command panel is a general maintenance function. It is designed to perform a standard set of tasks on a meter when it is visited for maintenance. When **Read All** is clicked, logged readings are read, readings are erased (optional) and time in the meter is synchronized with the PC clock if the difference exceeds a tolerance value.

Time Sync Tolerance specifies the number of seconds difference between meter time and PC time before clock sync is performed during the **Read All** function. Set this value to 1 to always perform time sync during **Read All**.

Erase All Data After Read All allows you to specify whether all logged readings are erased during the **Read All** function. If this option is unchecked, data is not erased and you ar not prompted to confirm erasure. If it is checked, you must confirm that you want data erased during **Read All** before it is actually erased. You can cancel the erase operation during **Read All** even if this option is checked. Also, data is **not** erased if an error occurs during reading.

Data Graphing

The **Data Graphing** page allows you to set various parameters that control the display of the MPSAS and NELM graphs.



Data Graphing configuration page

Title of Graph appears on the MPSAS and NELM graph displays and is limited to 50 characters. It can be used to describe the location of the meter or any other useful text.

Data Values per Graph Page allows you to control how many data points are displayed on the graph before it begins scrolling as new readings are acquired. Text can become crowded on the graph if a large number of data points are displayed on a graph page so some labels may be omitted. You can mouse-over any data point to see the data value and the time it was acquired. Note that the Store Latest MPSAS Graph as JPEG and Store Latest NELM Graph as JPEG functions depict the last graph page - readings plotted furthest to the right on the graphs.

Calc Points in Next 24 Hours is enabled when continuous reading is configured. It is intended to estimate the number of data points that will be recorded in the next 24 hours given the Read Continuously settings (excluding Align with PC Clock). The actual time period over which readings are acquired may differ by 1 or 2 data points due to rounding, the actual time at which reading is initiated and communication retries. Note that this value is calculated only when the button is pressed. It is not recalculated automatically at runtime. Thus, it is accurate given the sampling interval and sun circumstances on the date when the calculation is made.

Invert Y-Axis Values allows you to plot data on both the MPSAS and NELM graphs with an inverted Y-axis; that is, lower (darker) readings appear at the top of the graph.

Show Moon Altitude allows you to toggle the display of lunar altitude at each reading sample

time on the MPSAS and NELM graphs. Moon symbols are plotted on graphs only when the moon is above or at the horizon at the sampling time.

Show Values and Labels Beside Data Points allows you to show or hide the labels beside MPSAS or NELM values on their respective graphs. You might wish to hide these labels if you are showing a large number of data values per graph page so that they overlap.

Show All Time Labels allows you to force all labels to be shown on the Time axis of graphs. If this option is unchecked (default), labels are shown on the graph if the system determines there is adequate space for the label along with a small amount of padding around the label. You may force the labels to be shown if you want to override the default.

Important: Lunar altitude data is not available in either Skyglow Observations format or Unihedron Device Manager data files so no lunar altitude symbols are displayed when viewing these files using Open Reading File.

Graph Background Gradient Colors

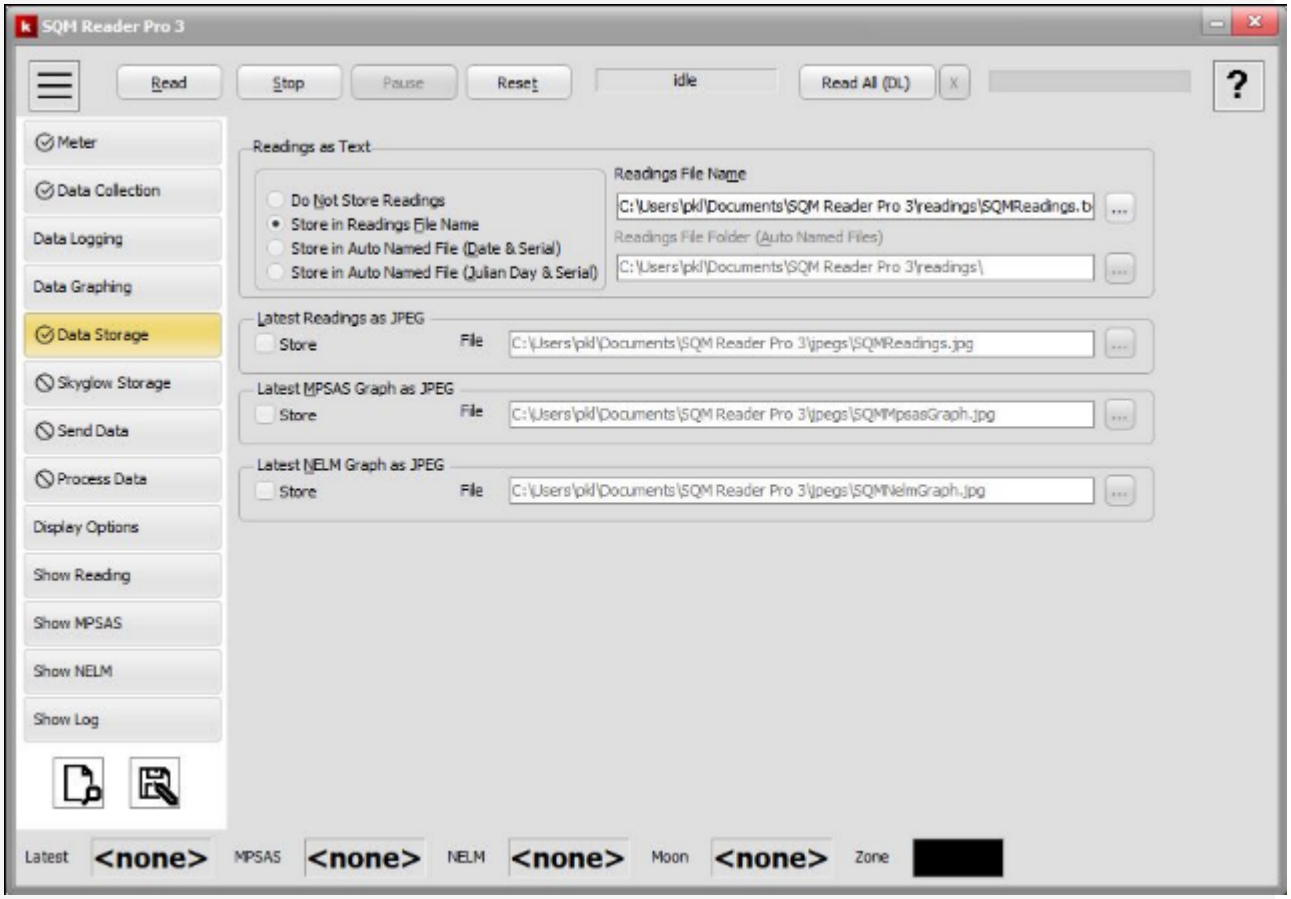
The background of the graph is drawn as a color gradient by default. The **Start** color defines the color that appears in the top left corner of the graph. The **End** color defines the color that appears in the lower right corner. The background is drawn in a smooth transition from **Start** color to **End** color. If you want the background to be a solid color, set the **Start** and **End** colors to the same value.

Click **Reset Default Colors** to set **Start** and **End** colors to their factory default settings.

Data Storage

The **Data Storage** page allows you to control whether readings or graphs are stored in files.

Menu Icon Synopsis: the **Data Storage** menu item shows  if any data or image storage is enabled, or  if no storage is enabled.



Data Storage configuration page

Readings as Text

Readings are stored in SQM Reader Pro native format (comma separated values in a text file). The format of the data file is shown in the appendix.

Storage Modes

Do Not Store Readings: no readings are stored in a text data file.

Store in Readings File Name: You specify the file name into which readings are appended.

Store in Auto Named File (Date & Serial): the readings file name is generated automatically based on the computer's date and the serial number of the meter from which readings are acquired. This option is useful if you wish to organize data collection in midnight to midnight files. Readings are appended to this file.

Store in Auto Named File (Julian Day & Serial): the readings file name is generated

automatically based on the computer's Julian day number and the serial number of the meter from which readings are acquired. This option is useful if you wish to organize data collection in noon to noon files. Readings are appended to this file.

Readings File Name: is a complete file path and name used when the storage mode is **Store in Readings File Name**. By default, this file is created in ...\Documents\SQM Reader Pro 3\SQMReadings.txt, but you can choose a different file name and path. If the folder does not exist when a reading is ready to be stored, the program tries to create it. If that fails (usually due to lack of Windows user privileges) an error message is displayed and reading is stopped if the program is in continuous reading mode. If the folder exists but the file does not exist when a reading is ready to be stored, the program attempts to create the file. If the file cannot be created or is opened exclusively by another process, a message is added to the status log and processing continues.

Readings File Folder (Auto Named Files): is the folder used to store readings when file names are automatically generated in storage modes **Store in Auto Named File (Date & Serial) or Store in Auto Named File (Julian Day & Serial)**. If the folder does not exist when a reading is ready to be stored, the program tries to create it. If that fails (usually due to lack of Windows user privileges) an error message is displayed and reading is stopped if the program is in continuous reading mode. If the folder exists but the file does not exist when a reading is ready to be stored, the program attempts to create the file. If the file cannot be created or is opened exclusively by another process, a message is added to the status log and processing continues.

Latest Reading as JPEG

Store: determines whether a JPEG image file of the Show Reading page is created each time a reading is acquired.

File: is a complete path and file name to which the JPEG image is stored. If the folder does not exist when an image is ready to be stored, the program tries to create it. If that fails (usually due to lack of Windows user privileges) an error message is displayed and reading is stopped if the program is in continuous reading mode. If the file cannot be created or written (usually due to being opened exclusively by another process) a message is added to the status log and processing continues.

You can use the ... button to browse to a path and name for this file.

Latest MPSAS Graph as JPEG

Store: determines whether a JPEG image of the latest MPSAS graph is created each time a reading is acquired.

File: is a complete file path and name to which the JPEG image is stored. If the folder does not exist when an image is ready to be stored, the program tries to create it. If that fails (usually due to lack of Windows user privileges) an error message is displayed and reading is stopped if the program is in continuous reading mode. If the file cannot be created or written (usually due to being opened exclusively by another process) a message is added to the status log and processing continues. Note that the graph is scrolled automatically to the right to show the latest readings acquired.

You can use the ... button to browse to a path and name for this file.

Latest NELM Graph as JPEG

Store: determines whether a JPEG image of the latest NELM graph is created each time a

reading is acquired.

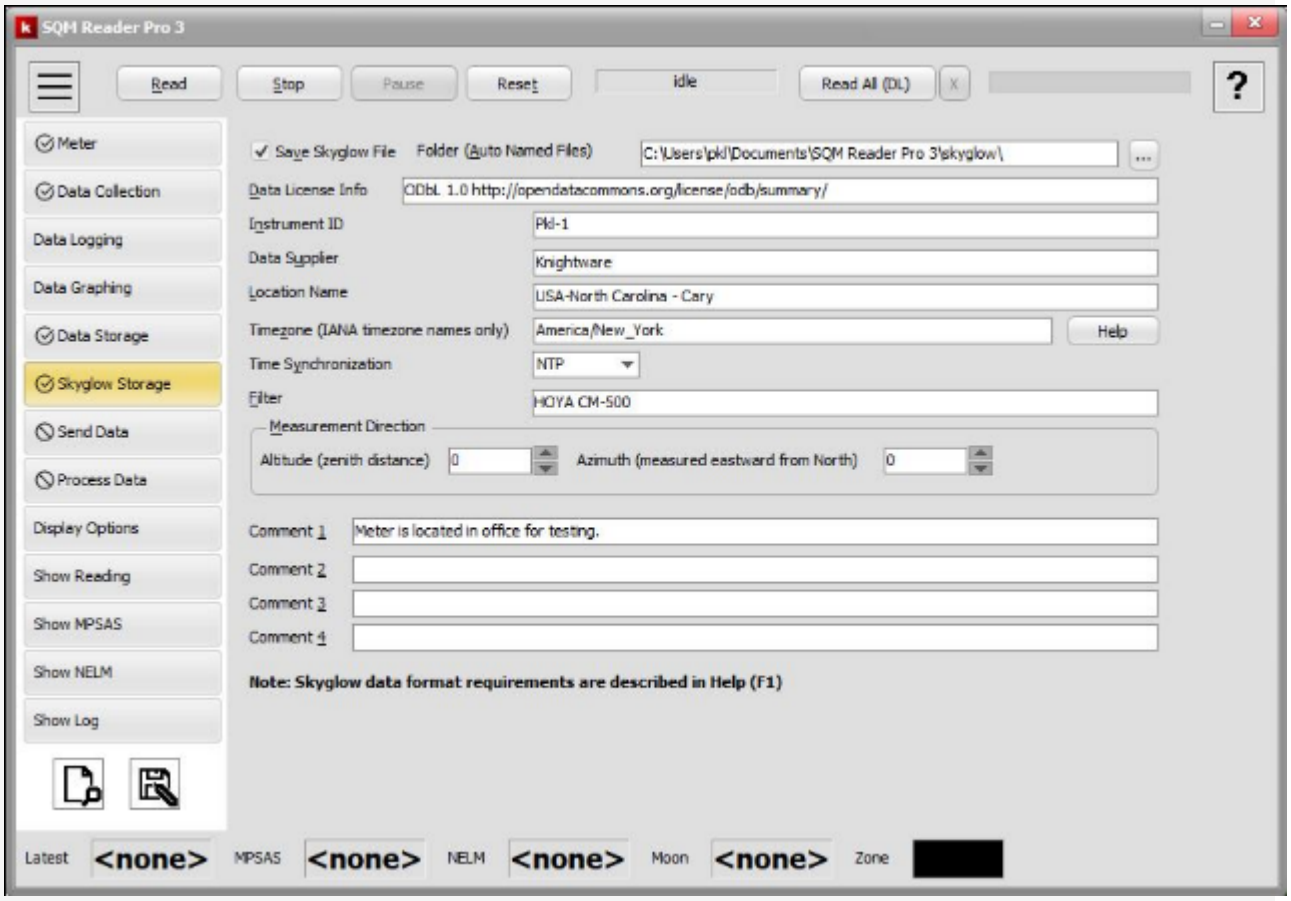
File: is a complete file path and name to which the JPEG image is stored. If the folder does not exist when an image is ready to be stored, the program tries to create it. If that fails (usually due to lack of Windows user privileges) an error message is displayed and reading is stopped if the program is in continuous reading mode. If the file cannot be created or written (usually due to being opened exclusively by another process) a message is added to the status log and processing continues. Note that the graph is scrolled automatically to the right to show the latest readings acquired.

You can use the ... button to browse to a path and name for this file.

Skyglow Storage

The **Skyglow Storage** page allows you to configure the settings necessary for storing your readings in a Skyglow Observations format file. This file format can be shared with researchers worldwide. Read about the standard at the IDA website; read the standard definition document here.

Menu Icon Synopsis: the **Skyglow Storage** menu item shows if Skyglow data storage is enabled, or if no storage is enabled.



Skyglow Storage configuration page

Save Skyglow File determines whether data is recorded in a Skyglow Observations format file. If storage is enabled, a new skyglow file is created each time Read is selected. Readings are appended to the file in continuous reading mode.

Folder (AutoNames Files) defines the folder in which Skyglow Observations files are stored. Note that the Skyglow Observations standard requires that files be auto-named at file creation.

Data License Info defines the license under which Skyglow observations data is released (if any). The Skyglow Observations standard recommends that data be released under a shared license such as the Open Data Commons Open Database License (ODbL 1.0 http://opendatacommons.org/license/odb/summary/). You can read about this license at https://opendatacommons.org/licenses/odbl/summary/. Only ASCII characters are permitted in this field.

Instrument ID is a unique identifier assigned to the meter. The Skyglow Observations standard

requires that **Instrument_ID** be used to form Skyglow Observations file names, so it must contain only ASCII characters among the character set [A-Za-z0-9_-].

Data Supplier is individual or institution name that is contributing the Skyglow Observations data file. Contact information may be recorded in the Comments section. Only ASCII characters are permitted.

Location Name is a unique name that identifies the location where the meter is installed. Location should be formatted as **Country-State-City-Location** where State (or Province) and City are optional. Only ASCII characters are permitted.

Timezone (IANA timezone names only) identifies the timezone identifier in which the meter is installed. Please refer to http://en.wikipedia.org/wiki/List_of_tz_database_time_zones for the latest listing of timezone names in the IANA time zone database, also called the Olson time zone database.

Time Synchronization method by which the computer/meter installation receives time sychronization updates. Windows computers generally receive daily time synchronization updates via NTP. Choose GPS if your installation includes an automatic time update through a GPS receiver, or None if your installation has no time synchronization capability.

Filter is the optical filter placed over the optical sensor in the SQM. At the time of this writing, Sky Quality Meters ship with the **HOYA CM-500** filter installed. Only ASCII characters are permitted.

Altitude (zenith distance) defines the angle at which the meter is aimed in degrees from the **zenith**. Do not enter the altitude in degrees from the **horizon**.

Azimuth (measured from North) defines the angle at which the meter is aimed in degrees measured eastwards from North.

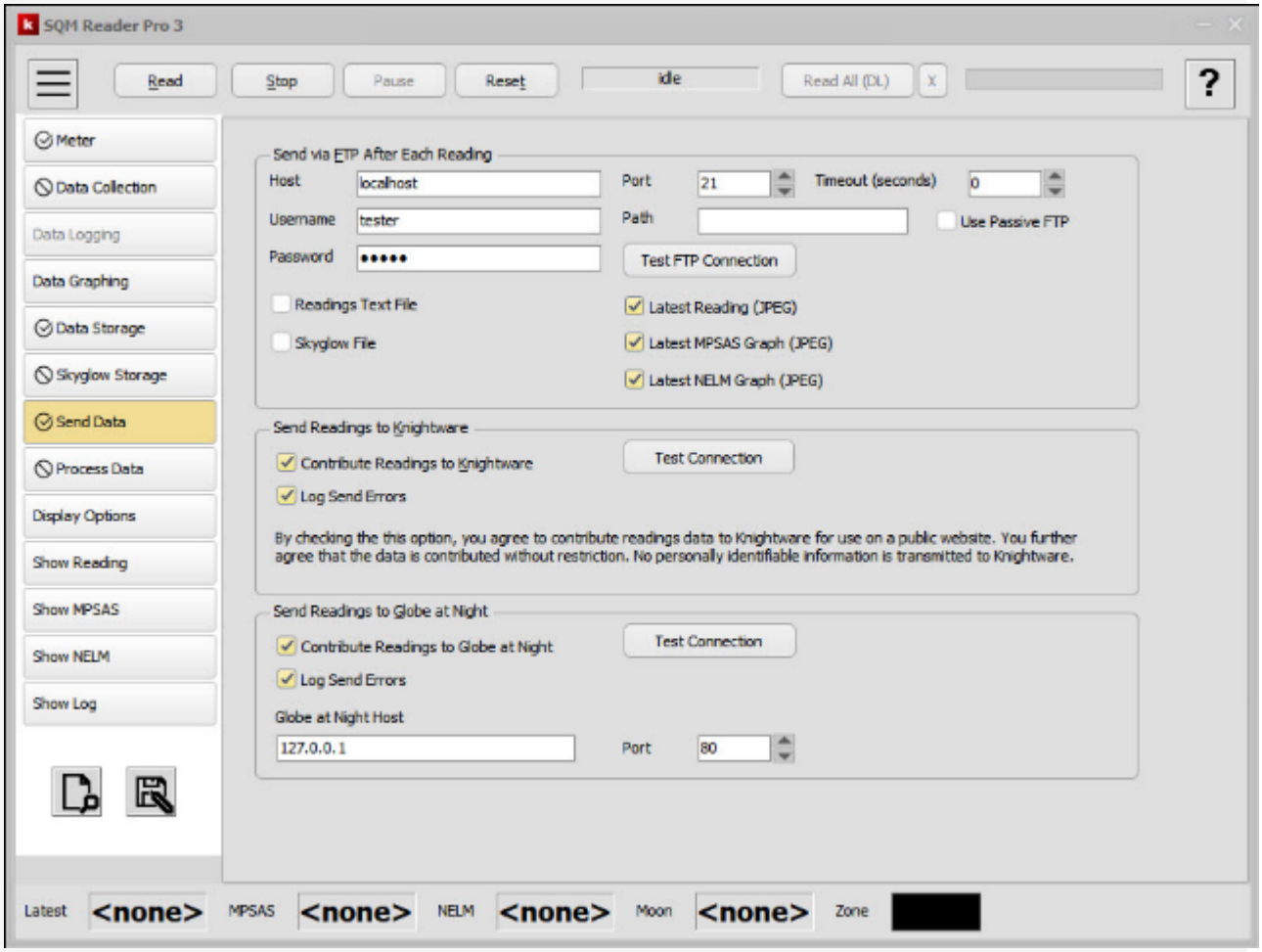
Comment 1-4 allows the user to enter 4 free-format comment lines of ASCII text. Comments may describe helpful information not otherwise presented in the header area of the Skyglow Observations file, such as placement of the meter or the last date that the meter enclosure was cleaned.

Note that one comment line in the Skyglow Observations file is automatically filled with the producer of the data, ***SQM Reader Pro***, along with the product build number.

Send Data

The **Send Data** page allows you to configure the transfer of data to your FTP server, the Knightware SQM Readings Map and the Globe at Night Monitoring Network (GaN MN).

Menu Icon Synopsis: the **Send Data** menu item shows if any file will be sent to an FTP server or the GaN MN server, or if no sending is enabled.



Send Data configuration page

Send via FTP After Each Reading: allows you to send the selected file(s) to a remote FTP server using the built-in FTP capability[1]. This is a little more efficient than sending data to an FTP program using the Process Data method because there is no overhead incurred in loading a separate program, command processor or script processor. All selected files are sent in a single FTP session. FTP errors are treated as non-fatal errors: a message is added to the status log and processing continues.

Host is the FTP server name, such as ftp.mydomain.com or perhaps localhost if the server resides on the same computer where ***SQM Reader Pro*** is running.

Username is the FTP account log-in username.

Password is the FTP account password. Please note that this value is encrypted in the ***SQM Reader Pro*** storage file. Please contact Knightware support if you need to know more about

password security.

Port is the FTP service port number on the FTP server. This is usually 21.

Timeout (seconds) is the connection timeout value in seconds. A value of zero (0) allows Windows to use its default timeout value and retry strategy. A value greater than zero overrides the Windows defaults and instructs the FTP connection request to timeout after a specified number of seconds. A connection timeout override value should be used only if you are getting a large number of FTP connection timeout errors in the status log.

Use Passive FTP allows you to select either an active or passive FTP connection. By default, ***SQM Reader Pro*** uses an active connection to transfer data to your FTP server. If your FTP server configuration requires a passive connection, check **Use Passive FTP**.

Test FTP Connection allows you to attempt to connect to the remote FTP server described by the settings above. No data is transferred, only a connection is attempted so that you can confirm that your FTP account log in is correct. Please see the appendix for more information regarding Security Warnings.

Path is the path on the FTP server where files are to be stored. If this is left blank, files are stored on the current working directory for the FTP account. **Path** should include a **trailing slash** if it is non-blank. For example, you should specify either ./mysqm/ or mysqm/ to store files in the folder named mysqm immediately beneath the current working directory of your FTP account. Please note that your FTP account must have Write and Delete privileges for the folder that you specify.

Readings Text File: check this option to send the readings text (***SQM Reader Pro*** native CSV format) file named on the Data Storage page to the FTP server.

Skyglow File: check this option to send the Skyglow Observations Standard format file named on the Skyglow Storage page to the FTP server.

Latest Reading (JPEG): check this option to send the most recently stored readings JPEG file named on the Data Storage page to the FTP server.

Latest MPSAS Graph (JPEG): check this option to send the most recently stored MPSAS graph JPEG file named on the Data Storage page to the FTP server.

Latest NELM Graph (JPEG): check this option to send the most recently stored NELM graph JPEG file named on the Data Storage page to the FTP server.

Send Readings to Knightware

Contribute Readings to Knightware allows you to send readings to the Knightware website. The data contains no personally identifiable information, and is used on the public SQM Readings Map display page. The location of your meter installation is modified by a small random amount in latitude & longitude so that the true location of the meter is not displayed. Please see the Knightware website for further information about the data display page(s).

Readings are not sent to the Knightware website if any of the following conditions are true:

- a reading is taken while the sun is above the horizon
- readings are taken faster than once per minute as selected on the Data Collection page
- product key is missing or incorrect

Test Upload Connection allows you to verify that your readings can be uploaded to the Knightware website. It verifies that your configuration is reasonable and that the connection is available. No reading is transmitted.

Log Send Reading Errors allows you to add error messages that occur while sending readings to the Knightware website to the status log. Program execution is not interrupted when an error occurs while sending data to Knightware.

Send Readings to Globe at Night

Contribute Readings to Globe at Night allows you to send readings to the Globe at Night Monitoring Network (GaN MN). The data contains no personally identifiable information. Uncheck **Contribute Readings to Globe at Night** to ***stop*** sending readings to GaN MN.

Log Send Errors allows you to add error messages that occur while sending readings to the GaN network to the status log. Program execution is not interrupted when an error occurs while sending data to GaN MN.

Host is the Globe at Night Monitoring Network service host address. Please get this setting by registering with the Globe at Night Monitoring Network.

Port is the Globe at Night Monitoring Network service port number. This is usually 80.

Test Connection allows you to verify that your readings can be uploaded to the Globe at Night Monitoring Network. It verifies that your configuration is reasonable and that the connection is available. No reading is transmitted.

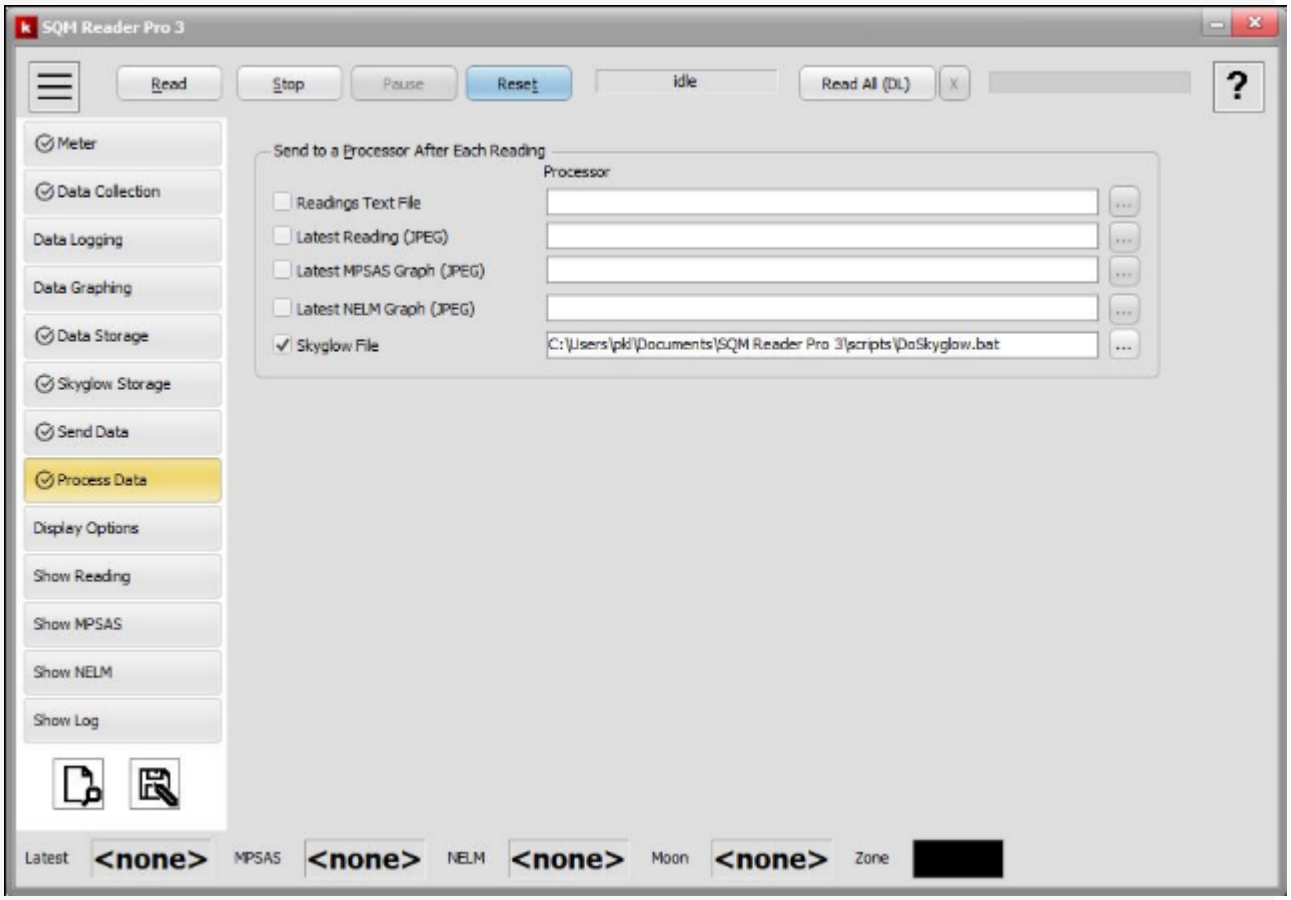
Important: You must be registered with the Globe at Night Monitoring Network for your readings to be used. Registration will contain information about your meter installation as directed by GaN MN. Please see http://globeatnight-network.org/ for further information or contact globeatnight.network@gmail.com or gan-mn@qq.com

[1] The built-in FTP service is not capable of SFTP or FTPS. If you require secure upload, you must use the Send to a Processor method.

Process Data

The **Process Data** page allows you to pass a data or image file to a batch file, program or script after each reading is acquired. This allows extensive flexibility in your data acquistion post-processing.

Menu Icon Synopsis: the **Send Data** menu item shows if any file will be sent to a post-processor, or if no post-processing is enabled.



Process Data Configuration page

Send to a Processor After Each Reading: allows you to send selected data to a target program, script or batch file for further processing. When you choose to send a file to a program (.exe), the program is run using the name of the file to be processed as the program's only argument. For scripts (.js, .vbs), the Windows script host (Wscript) is loaded and the script is passed to the script processor with the data file name as its only argument. For batch files (.bat), the command interpreter is loaded and the batch file is passed to the batch file processor with the data file as the only argument. Please see the appendix for examples.

Readings Text File: check this option to send the readings text (***SQM Reader Pro*** native CSV format) file named on the Data Storage page to the program (exe), script (vbs or js), or batch (bat) file named beside the checkbox. Use the ... button to navigate to the program, script or batch file that you want to process your data.

Latest Reading (JPEG): check this option to send the most recently stored readings JPEG file named on the Data Storage page to the selected processor.

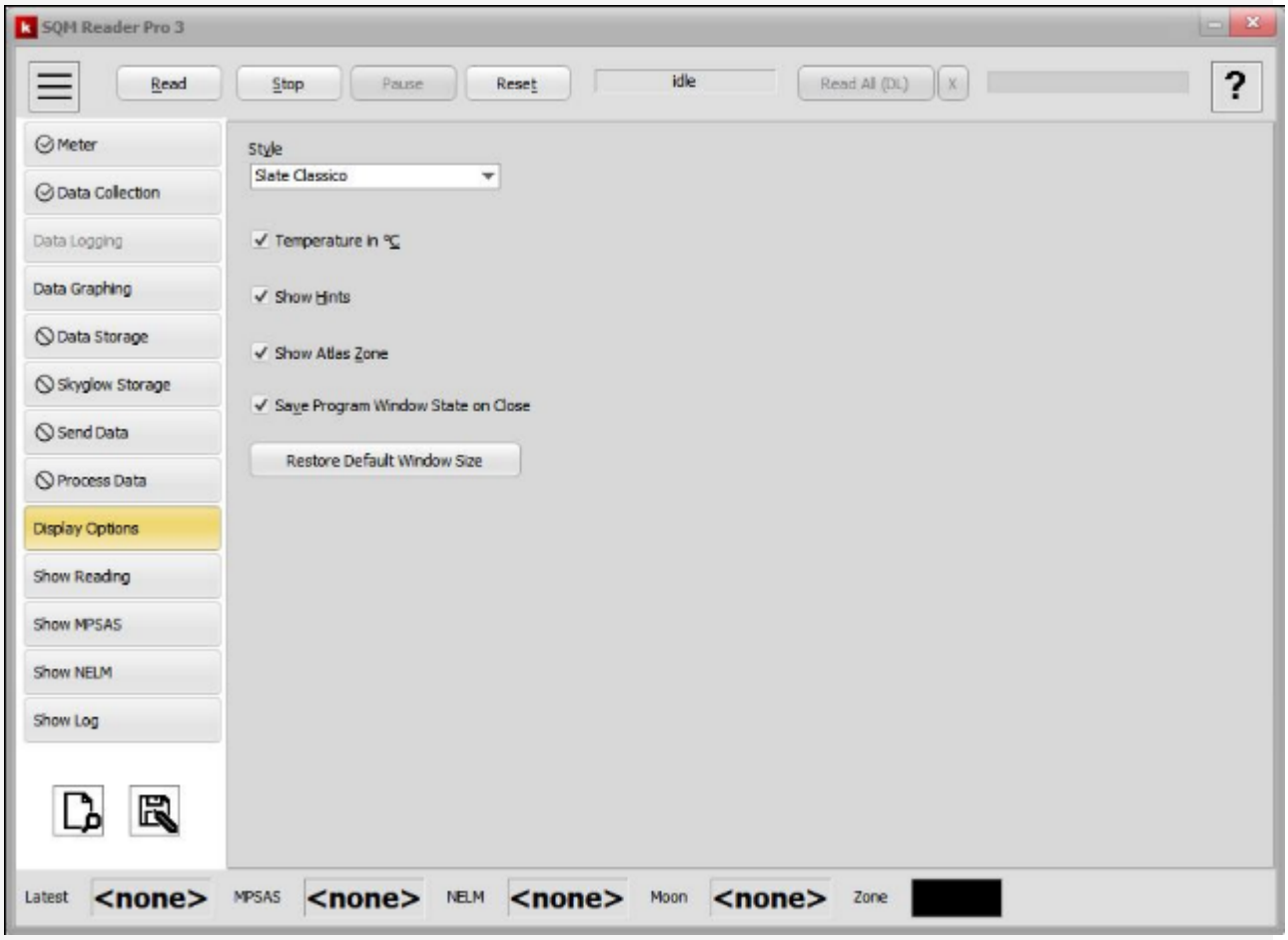
Latest MPSAS Graph (JPEG): check this option to send the most recently stored MPSAS graph JPEG file named on the Data Storage page to the selected processor.

Latest NELM Graph (JPEG): check this option to send the most recently stored NELM graph JPEG file named on the Data Storage page to the selected processor.

Skyglow File: check this option to send the Skyglow Observations Standard format file named on the Skyglow Storage page to the program (exe), script (vbs or js), or batch (bat) file named beside the checkbox. Use the ... button to navigate to the program, script or batch file that you want to process your data.

Display Options

The **Display Options** page contains various settings that control the appearance of ***SQM Reader Pro***. Please note that the appearance of graphs is configured on the Data Graphing page.



Display Options configuration page

Style allows you to select a color theme for the application. Note that the style affects the JPEG images stored in files and to an FTP server if so configured.

Temperature in °C controls whether **Temp at Sensor** on the Show Reading page is displayed in Celsius or Fahrenheit. This menu item acts as a toggle switch. Click it when checked to display sensor temperature in Fahrenheit; click it when unchecked to display sensor temperature in Celsius.

Show Hints controls whether tool-tip hints are displayed when the mouse cursor hovers over a control such as a button or an edit box. It also controls the display of data value popup windows on the MPSAS Graph or NELM Graph pages when the mouse cursor hovers over a data point. This menu item acts as a toggle switch. Click it when checked to disable help hints; click it when unchecked to enable display of help hints.

Show Atlas Zone controls whether **Zone** is shown on the Show Reading page and the Latest Reading panel of the main window. Atlas Zone refers to the luminance color definitions in *The New World Atlas of Artificial Sky Brightness* (Falchi et al., Sci. Adv., Jakob Grothe/NPS contractor, Matthew Price/CIRES, 2016). See http://cires.colorado.edu/Artificial-light.

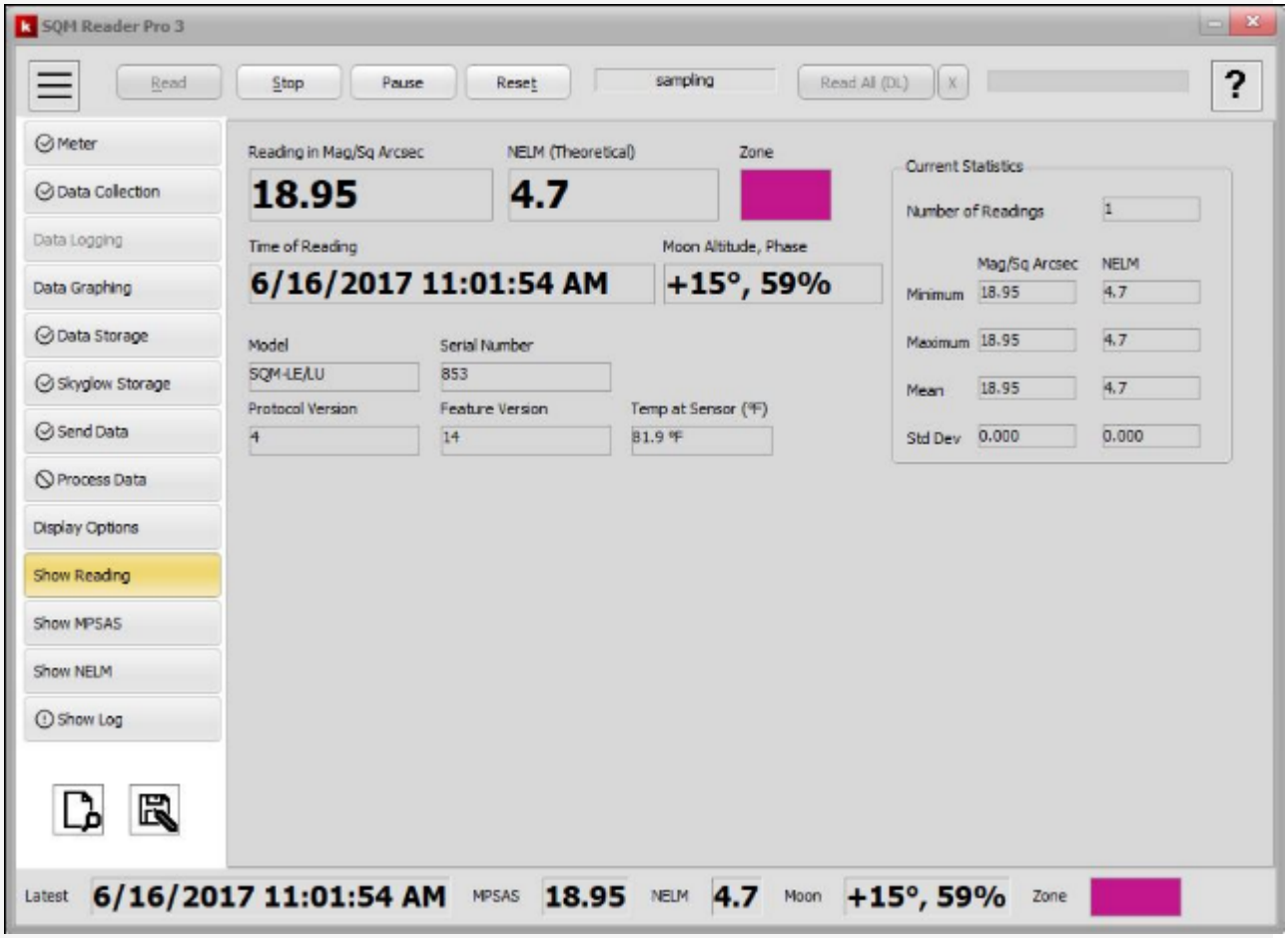
Save Program Window State on Close controls whether the size and position of the program window is saved when the program is closed. This option is enabled by default. If you have difficulty with window state becoming corrupted when the program is moved among monitors with

differing resolutions on a multi-monitor system, you can disable this option and close the program to clear the window state.

Restore Default Window Size allows you to change the size of the program window to its default size. This may be useful if you have resized the program window and want to restore it to it factory default size.

Show Reading

The **Reading page** displays the most recently acquired data from the meter along with some elementary statistics calculated during the present sampling period.



Show Reading display page

Reading in Mag/Sq Arcsec is the raw reading provided by the meter. This value is not time-averaged. This value is also referred to as MPSAS.

NELM (Theoretical) is a calculated value that represents the Naked Eye Limiting Magnitude that corresponds to the meter's Mag/Sq Arcsec value. See NELM for more information.

Zone is a color swatch that represents the darkness zone of the reading as used in *The New World Atlas of Artificial Sky Brightnes*s (Falchi et al, 2016). In this example, the MPSAS value 18.57 corresponds to the pink zone.

Time of Reading is the computer's date and time when the latest reading was acquired. The format of date and time are dictated by Windows Regional Settings.

Moon Altitude, Phase is calculated for the time of the reading and the location of the meter specified on the Meter page. Phase is the percent of the total lunar disk that is illuminated.

Model a model name assigned by the manufacturer.

Serial Number a device identification number assigned by the manufacturer. This may be required when submitting readings for statistical analysis in various darkness data collection projects.

Protocol Version identifies the communication protocol version used my the meter.

Feature Version identifies the feature set in use by the meter.

Temp at Sensor the actual temperature inside the meter case at the light sensor (**not the ambient temperature** outside the meter case.) This value may be displayed in either Celsius or Fahrenheit.

Current Sampling Period Statistics

Number of Readings is the number of readings[1] acquired successfully during this sampling period.

The following pertain to both Mag/Sq Arcsec and NELM values:

Minimum, Maximum smallest and largest values acquired during this sampling period

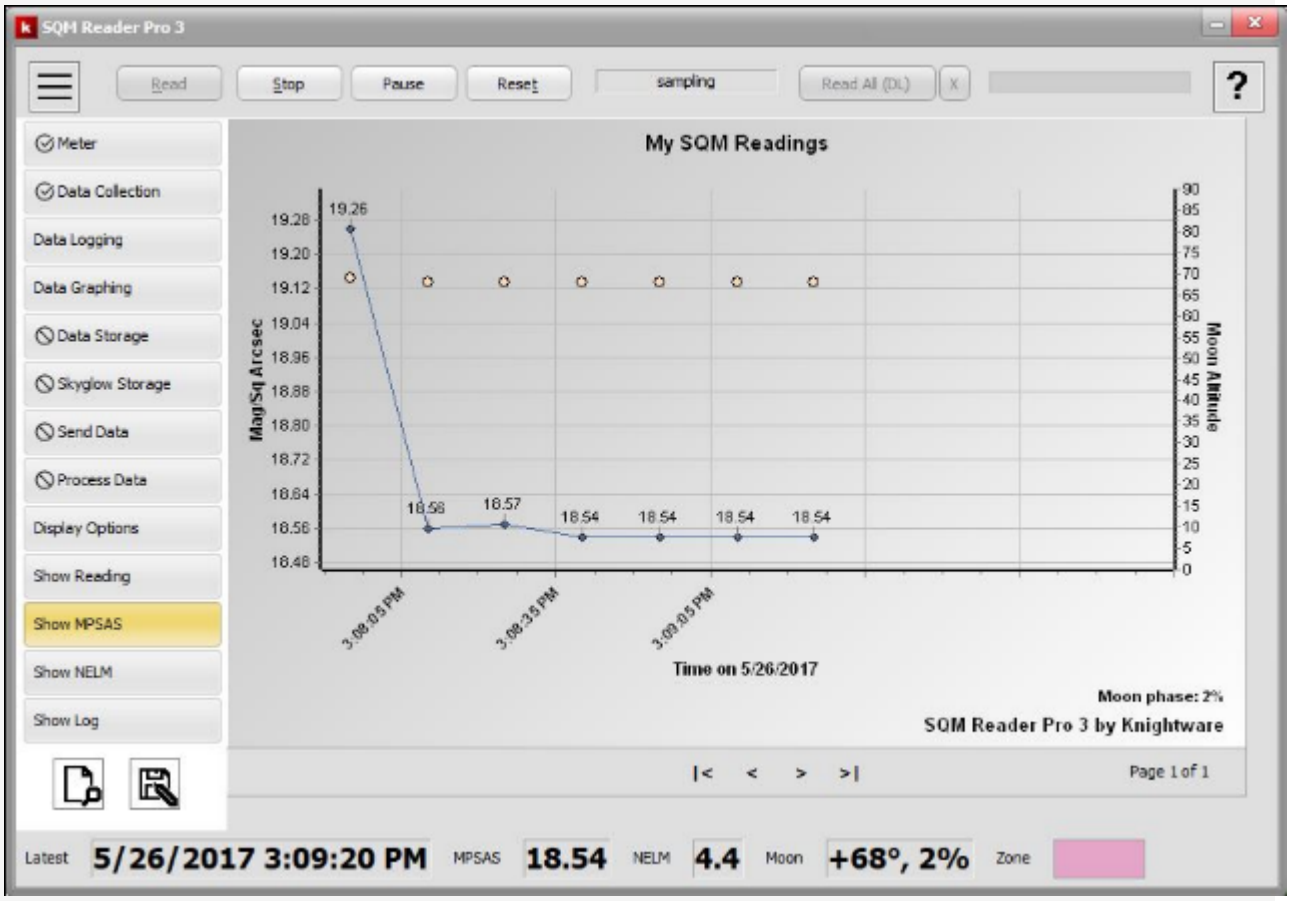
Mean the average of all values acquired during this sampling period

Std Dev the standard deviation of the values acquired during this sampling period. This is the sample standard deviation, not the total standard deviation.

[1] In the case of time-averaged readings, **Number of Readings** indicates the number of time-averaged intervals, not the raw reading sub-intervals.

Show MPSAS

Show MPSAS page shows a graph of readings in magnitude per square arcsecond.



Show MPSAS display page

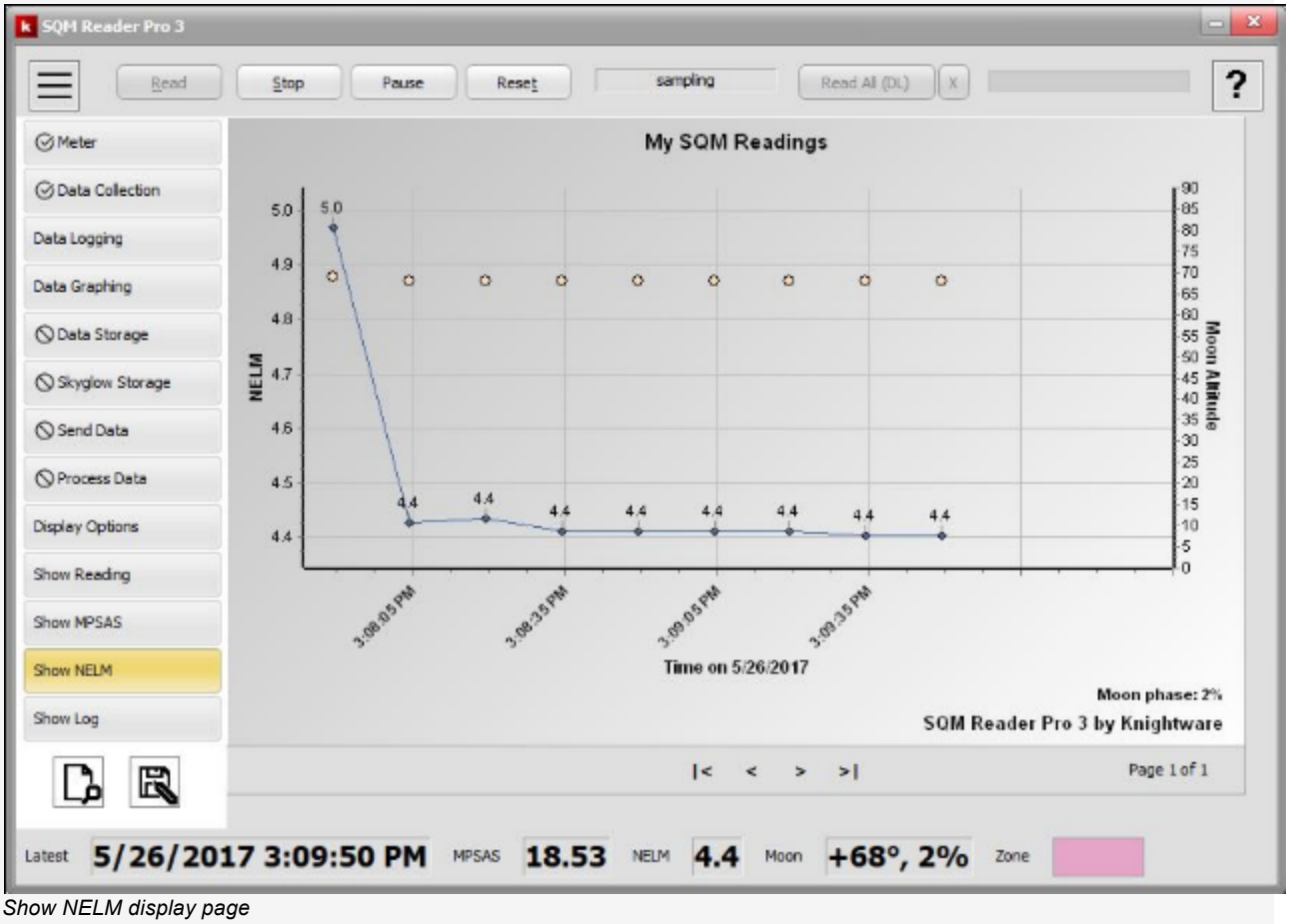
MPSAS values are graphed automatically, and they appear as navy blue diamonds on the graph. The small yellow circles indicates the altitude of the moon at the reading time. This can be turned on or off on the Data Graphing page. The graph is capable of showing up to 1,048,576 values[1]. You can scroll the graph horizontally (across time) using the navigation buttons beneath the graph, but the graph scrolls automatically to the latest reading when data is acquired so that the latest data is always easy to see. You can also adjust the number of readings displayed per graph page before scrolling occurs. The number of values displayed can cause crowding along the x-axis, so some labels may be skipped. You can turn off the display of value labels if the graph page is overcrowded. You can hover your mouse cursor over a plotted data value (either MPSAS or moon altitude) to have a small popup window display the value and time beside the plotted value. Hints and popup value display can be toggled on and off using **Show Hints** on the Display Options page.

Note: if you Open Readings File and view the MPSAS graph generated for the file, the interval resolution specified on the Data Collection page controls the format of the reading time labels. To view time labels in hh:mm format, set the interval resolution to **Minutes** and open the readings file. If you want to view labels in hh:mm:ss format, set the interval resolution to **Seconds** and open the readings file.

[1] When a total of 1,048,576 values have been graphed, the sampling period is restarted. Statistics and graphs are cleared automatically.

Show NELM

Show NELM page shows a graph of readings in Naked-eye limiting magnitude.

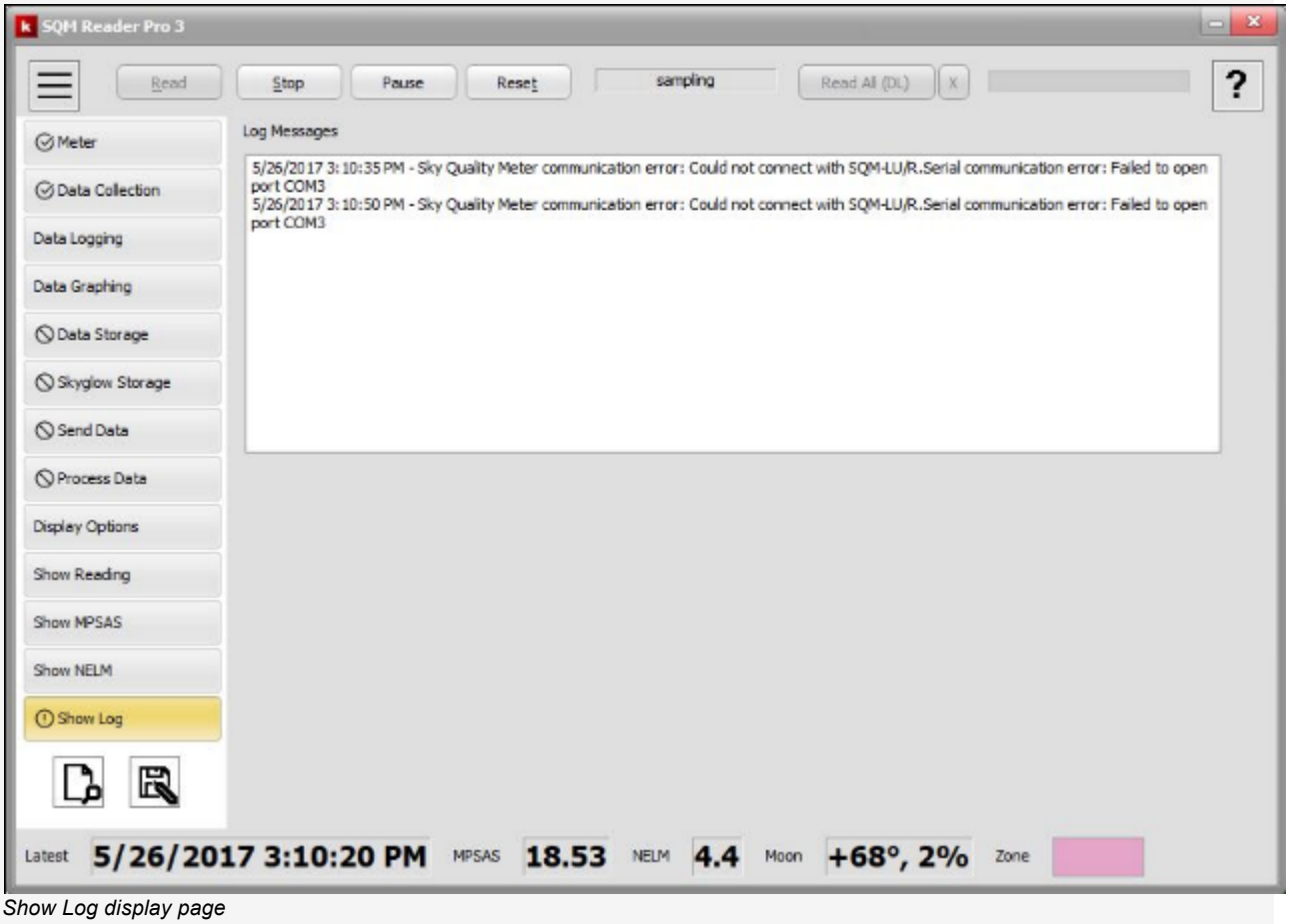


Show NELM display page

NELM values are graphed automatically, and they appear as navy blue diamonds on the graph. The small yellow circle indicates the altitude of the moon at the reading time. This can be turned on or off on the Data Graphing page. The graph is capable of showing up to 1,048,576 values[1]. You can scroll the graph horizontally (across time) using the navigation buttons beneath the graph, but the graph scrolls automatically to the latest reading when data is acquired so that the latest data is always easy to see. You can also adjust the number of readings displayed per graph page before scrolling occurs. The number of values displayed can cause crowding along the x-axis, so some labels may be skipped. You can turn off the display of value labels if there are too many values displayed per graph page. You can hover your mouse cursor over a plotted data value (either NELM or moon altitude) to have a small popup window display the value and time beside the plotted value. Hints and popup value display can be toggled on and off using **Show Hints** on the Display Options page.

[1] When a total of 1,048,576 values have been graphed, the sampling period is restarted. Statistics and graphs are cleared automatically.

Show Log



Show Log display page

Any status notification or non-fatal processing errors that occur during continuous reading are reported on this page. The ⓘ icon is displayed on the Log tab if there are any messages in the log. Please note that fatal errors terminate data collection.

Error messages that may appear here include:

- Failure to load planetary terms that are necessary for calculating the position of the sun
- Failure to complete processing of a reading before another reading is scheduled to occur. In this case, the scheduled reading is skipped in order to allow processing of the previous reading time to complete. This message indicates that you may be attempting to read and process too quickly. You should examine the speed of your network and any file storage problems that may be slowing processing. See the appendix for processing intensive information.
- Data file storage failure due to file sharing conflict. Please see File Sharing Conflicts in the appendix for more information.
- FTP transfer failure

Status messages are displayed when a readings file is opened for processing using Open Readings File. Status messages help to identify data that is excluded in various reading file formats. For example, lunar altitude data is not present in Skyglow or UDM format files so a warning message is posted to the log when **Show Moon Altitude** is checked on the Data Graphing page.

Open Readings File

Open Readings File  allows you to open, process and display data in an existing readings data file. **Open Readings File** is not enabled during continuous reading mode.

The **Open Readings File** common dialog box shows the folders on your system. Select the folder where the desired data file resides.

A list of data file types supported by ***SQM Reader Pro*** is shown. Supported types are described below. You must select the correct file type for the file to be processed correctly; otherwise, an error message will be displayed in the status log.

Supported File Types

- **SQM Reader Pro data file** specifies the native format produced by ***SQM Reader Pro*** . When **Readings as Text** is enabled on the Data Storage tab, ***SQM Reader Pro*** records readings in this file format. The format is defined in the appendix.
- **Skyglow Observations data file** specifies an international standard format for readings data. The format is described further in the glossary.
- **Unihedron Device Manager** (UDM) file specifies the file format output by Unihedron's utility software. The UDM utility is useful for downloading data from the SQM-LU-DL and storing it in a file. ***SQM Reader Pro*** can process these files using this file type selection.

File name allows you to type the name of the file that you want to open and process.

Special Considerations when using Open

1. Settings on the Data Graphing page are used to form graphs. These settings are not stored in readings data files; instead, they are taken directly from the Data Graphing page when the readings data are processed.
2. Moon altitude and phase data are not stored in Skyglow or UDM data format files; thus, moon data are not shown on graphs generated when processing either of these file types.

Save Config File

Save Config File allows you to save the program configuration settings without closing the program. (Configuration settings are always saved when the program is closed.) **Save Config File** is not enabled during continuous reading mode.

Command Panel

The command panel contains the main menu button ☰ and the help menu button ? . It also contains buttons that start and stop data collection, reset a statistical data sampling period and indicate reading status.

Reading all data from SQM-LU-DL data logging meters can be started and stopped, and the progress of reading is indicated on the progress bar.

Command Panel

Read

The behavior of the **Read** button depends on the setting of **Collection Period** on the Data Collection page.

If **Collection Period** is **Once**, a reading is acquired immediately, the reading display, sampling period statistics, latest reading panel and graphs are updated, data is stored to files as specified on the Data Storage and Skyglow Storage pages, and files are sent to an FTP server as specified on the Send Data page and a processor as specified on the Process Data page.

If **Collection Period** is **Continuous**, sampling period statistics are reset, graphs are reset, and the status log is reset. If **Align to Clock** is enabled, the system waits until the alignment time occurs. Next, a reading[1] is acquired and displayed, the sampling period statistics and graphs are updated, data is stored to files as specified on the Data Storage and Skyglow Storage pages, and files are sent to an FTP server and a processor.

In short, **Read Once** initiates an instantaneous collection period and appends the reading to the current sampling period. **Suspend Collection** and **Align to Clock** are ignored. **Read Continuous** initiates an on-going collection period and starts a new sampling period. The first reading is obtained after optional **Align to Clock**, and subsequent readings are subject to the **Suspend Collection** setting.

Please see the appendix for more information if you receive Security Warnings.

Stop

Stop terminates continuous data collection. **Stop** does not reset the latest reading, statistics, graphs or status log.

Pause/Resume

The **Pause / Resume** button acts as a toggle switch. When the **Pause** button is shown, clicking it temporarily stops continuous reading and the **Resume** button is displayed.

When the **Resume** button is shown, clicking it resumes continuous reading and the Pause button is displayed.

The **Pause** and **Resume** functions are only available in continuous reading mode and when

reading is NOT aligned to the PC clock. Pausing or resuming continuous reading does not reset statistics, graphs or begin a new Skyglow Observations file (if used).

Reset

Reset sets reading values and statistics to <none>, clears data from graphs, and starts a new sampling period. It does not terminate continuous data collection.

Reading Status

Reading status is shown in the small box beside the **Reset** button. Status is one of:

- **idle:** No read operation is pending. To begin a read operation, click the **Read** button.
- **aligning:** the system is waiting for the PC time to reach a clock alignment boundary.
- **sampling:** A read operation is currently in progress, or ***SQM Reader Pro*** is waiting for the next continuous read operation to occur.
- **suspended - sun:** Read operation is suspended. ***SQM Reader Pro*** is in continuous read mode and is waiting for the sun to either set or reach the end of twilight to resume reading. Note that suspension of reading due to the position of the sun takes precedence over that of the moon, so if both restrictions are in effect, the Reading Status box shows 'suspended - sun'
- **suspended - moon:** Read operation is suspended. ***SQM Reader Pro*** is in continuous read mode and is waiting for the moon to either set.

Read All (DL)

Read All performs one or more functions on data logging (SQM-LU-DL) meters. It is enabled only when the **SQM Model** selected on the Meter page is SQM-LU-DL.

First, all records are read from FLASH memory in the meter. The progress bar (shown in green above) indicates the running percentage of records that have been read of those recorded. Reading a large number of records is time consuming, but you can cancel the function by clicking the **X** button beside **Read All**.

When reading is complete, the Show Readings page, latest reading panel, Show MPSAS and Show NELM pages are updated with the data read from FLASH memory. These data may be saved in SQM Reader and/ or Skyglow format files if the system is configured to do so.

Next, all records are erased from FLASH memory if Erase All Data After Reading is enabled. (You are prompted to confirm the erase before it is performed.)

Lastly, the real time clock in the meter is synchronized with system time if meter time is out of tolerance. You are asked to confirm the time sync.

Read All is designed to be a general maintenance function. More detailed maintenance can be performed on the Data Logging page.

[1] A reading in this context means the end of a time-averaged interval if time-averaged continuous reading is selected.

Release Notes

Release Notes opens a short document containing late-breaking information about the currently installed version of ***SQM Reader Pro***.

Product Key

Product Key allows you to save your product key code so that you can log into ***SQM Reader Pro***'s online services - Check for Updates and Community Page (both located on the **Help** menu.) Once you have entered your product key in this dialog, the online services are enabled for you to use directly from ***SQM Reader Pro***. Also, after you enter your product key code here, it will be used by Activate License (also on the **Help** menu) so that you do not have to re-enter it there. Thus, **entering your product key code here is highly recommended**.

If you purchased ***SQM Reader Pro*** by digital download, your product key is in your purchase confirmation e-mail. Knightware recommends that you copy and paste the product key without alteration from the e-mail message.

If you purchased ***SQM Reader Pro*** on CD, your product key code is located on a printed sticker on your original product CD case. Please type the code in exactly as it appears on the sticker. The code should look like this:
1234-1234-1234-1234-1234-1234 (6 groups of 4 characters separated by hyphens.

If you receive an invalid product key error message, the most like problem is one of:

- Not enough characters were entered. There should be 29 characters, including the hyphens.
- An illegal character was entered. Legal characters are 0-9 and A-F. Note that there are no letters 'O' or 'I'; these are sometimes confused for numbers 0 and 1.

This dialog box will appear at program startup until you enter a product key. You can always access this dialog box from the **Help** menu.

Press **OK** to accept the changes, or **Cancel** to leave **Product Key**.

Activate License

Activate License starts the ***Software Activator*** program. Please click here to see help for the ***Software Activator***.

This function is supplied simply as a convenience; you can still access the ***Software Activator*** from the Windows Start menu.

Check for Updates

Check for Updates allows you to connect to the ***SQM Reader Pro*** community web site and find out whether there are any software updates available for you. Since checking for updates accesses the Internet:

- an active Internet connection must be established before this function can succeed.
- this function may trigger a warning from your security software (firewall) if you have any running. If your security software asks you whether to permit ***SQM Reader Pro*** to access the Internet, you must answer yes before this function can succeed. If you answer no, you will not be able to use this function successfully, but you will be able to use all other functions that do not require an active Internet connection.

A status box is displayed showing 'Checking for updates', and a message indicating whether an update is available or your software is already up to date.

You can select **Get Update** to download the update, or click **Close** to quit. If you select **Get Update**, your default web browser is launched with the proper instructions to download the update. Don't forget to **save the update file** to your hard drive. You should run the update after it has been saved to your hard drive.

The most recent date & time that you **successfully** connected with the update server is shown in the About box.

What about?

If you receive the message "Error sending data: (12029) A connection with the server could not be established", then you have not established a connection to the Internet or your firewall software is preventing ***SQM Reader Pro*** from connecting to the Internet. You must establish a connection before attempting this function. If you fail to connect to the update server, the date and time of last updates in the About box is not changed.

Check for Updates is disabled (grayed out) on the Help menu ? if no Product Key has been entered because the Product Key is required when logging into the web site. Enter your product key and then check for updates.

Additional Information:

- Product Key
- Community Page

Community Page

The **Community Page** has resources for licensed ***SQM Reader Pro*** users such as software updates.

You can log into the **Community Page** with a web browser, but you must provide your product key number and password to enter. Using **Community Page** on the help menu in ***SQM Reader Pro*** allows you to log into the community web page directly using your default web browser. Your product key and password are automatically supplied to the community page log-in process. If you attempt to log into the Community Page and receive the message "Community log in failed", you probably have mistyped your product key. See Product Key to correct the problem.

Note: Your product key must be entered correctly and saved using Product Key on the Help menu before attempting to use the **Community Page** feature. You must also have an active Internet connection established before this function can succeed.

Community Page is disabled on the **Help** menu if no Product Key has been entered because the Product Key is required when logging into the web site.

Readings Map

Readings Map allows you to connect to the ***SQM Reader Pro*** web site and view a map showing the latest readings uploaded to the website by other owners of ***SQM Reader Pro***.

Upgrade

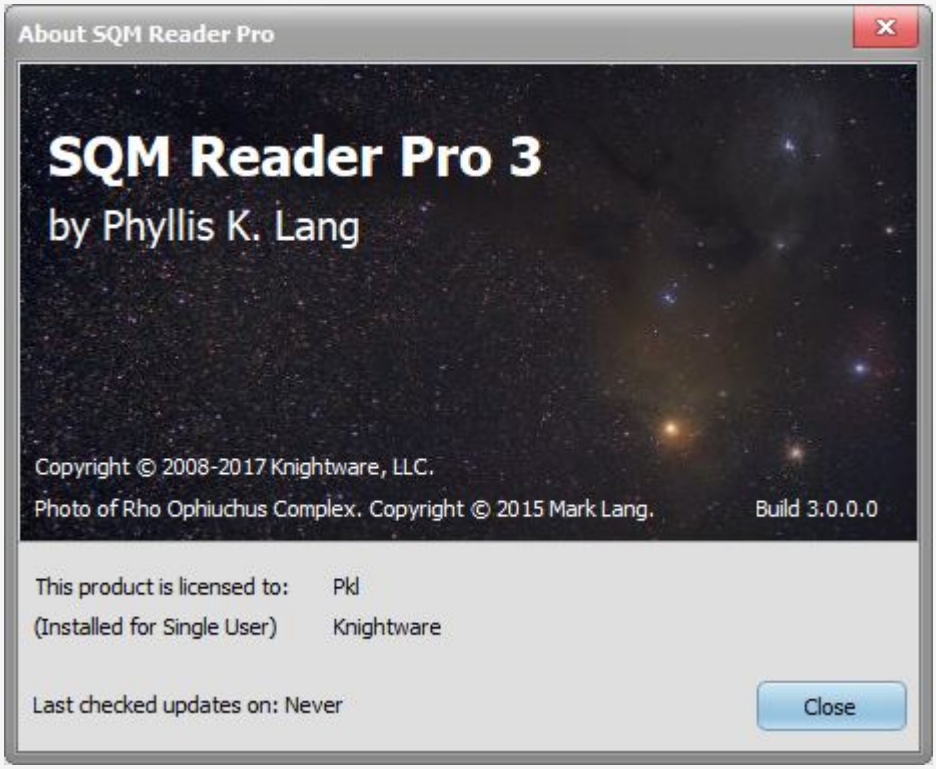
Upgrade allows you to connect to the ***SQM Reader Pro*** web site and find out whether there is a product upgrade available for you. An upgrade is a major new release of the product that is available to licensed users of an earlier version at a discounted price. Since checking for upgrades accesses the Internet:

- an active Internet connection must be established before this function can succeed.
- this function opens your default web browser to the proper web page on the ***SQM Reader Pro*** web site.

Note that product **updates** include bug fixes and new features which are free to licensed users. **Upgrades** usually include major new features that require new or upgraded software development tools to produce.

About

About SQM Reader Pro contains various information about the product, your license and update status.



About box

This product is licensed to shows the User Name and Organization entered at installation time.

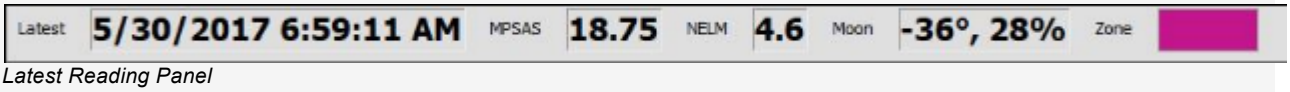
(Installed for Single User) or **(Installed for All Users)** indicates whether the product was installed using the 'Just for me' option or the 'Anyone using this computer' option. The installation mode determines where files are installed and how the product can be used. Please see Installation for more information.

Last checked updates on shows the last time that ***SQM Reader Pro*** checked for an update to the software.

Latest Reading Panel

Latest Reading Panel

The latest reading panel shows the results of the latest reading.



Latest Reading Panel

Latest is the computer's date and time when the latest reading was acquired. The format of date and time are dictated by Windows Regional Settings.

MPSAS is the raw reading provided by the meter. This value is not time-averaged and is expressed in magnitudes per square arcsecond.

NELM is a calculated value that represents the Naked Eye Limiting Magnitude that corresponds to the meter's Mag/Sq Arcsec value. See NELM for more information.

Moon is the altitude and phase calculated for the time of the reading and the location of the meter specified on the Meter page.

Zone is a color swatch that represents the darkness zone of the reading as used in *The New World Atlas of Artificial Sky Brightnes*s (Falchi et al, 2016). In this example, the MPSAS value 18.75 corresponds to the magenta zone.

Glossary

collection period is a period of time over which data is read from the meter. Collection period can be either a single reading that is manually initiated by button press, or it can be a timed-interval continuous reading that is manually initiated by button press

installation folders are standardized locations for your product's files. ***SQM Reader Pro*** installs files into folders as recommended by Microsoft. The location of installed files depends on whether you chose to install 'Just for me' or 'Anyone using this computer'. You can tell which option you chose by visiting About under the help menu.

Some of the folders listed are typically hidden from view by Windows Explorer. If you want to see these folders in Windows Explorer, open Explorer and navigate to Organize > Folder and search options > View tab and select 'Show hidden files, folders and drives'.

Type of files	Standard location	Comments
Documents means the Documents folder for your Windows user account	C:\Users\<useraccount>\Documents\SQM Reader Pro 3	
Program Data means the Application Data folder for your Windows user account	C:\Users\<useraccount>\AppData\Roaming\Knightware\SQM Reader Pro 3	This folder may be hidden.
Program Files means the Program Files folder for your Windows user account	C:\Users\<useraccount>\AppData\Local\Knightware\SQM Reader Pro 3	This folder may be hidden.

Just for Me *folder locations*

Type of files	Standard location	Comments
Documents means the Documents folder for the Public Windows account.	C:\Users\Public\Public Documents\SQM Reader Pro 3	
Program Data means the Application Data folder for the Public Windows account.	C:\ProgramData\Knightware\SQM Reader Pro 3	This folder may be hidden from view for user accounts with standard privileges. You can access this path from a user account with Administrative privileges or by 'showing hidden files' as described above.
Program Files means the Program Files folder for the Public Windows account.	C:\Program Files (x86)\Knightware\SQM Reader Pro 3	This folder may be hidden.

Anyone Using this Computer *folder locations*

moving average is a simple method of smoothing data in the graph. The when a reading is acquired, it is averaged together with a number of immediately preceding readings and plotted on the graph. This has the effect of showing a moving trend in the data while eliminating spikes and

dips.

MPSAS is an abbreviation for magnitude per square arcsecond.

NELM is an abbreviation for naked eye limiting magnitude. This is a calculated estimate of the faintest star visible to the naked eye. Your actual results depend on local weather and sky conditions, your observing experience, and your eye physiology. For these reasons Theoretical NELM is only an estimate.

sampling period is the period of time over which collected data participate in statistical calculations on the Reading display page and are shown on the Graph display pages. A sample starts when the Read button is pressed; it is terminated when the Stop button is pressed. Restarting the sampling period means that statistics and graphs are cleared.

In continuous reading mode, the sampling period is restarted when the Read & Stop button are pressed, or:

- the first reading is acquired following suspension due to the sun.
- the maximum sample size is reached (1,048,576).

Skyglow Observations standard data format defines a common file format for the storage of sky darkness measurements. The standard is housed at the IDA website; you can read the standard definition document here. ***SQM Reader Pro*** does not currently support these features in the standard:

- moving observing platforms
- scanning observing platforms
- multiple sensor (channel) meters

Also, part of the data file name is generated from a date/time stamp that includes time accurate to the millisecond. Since Windows provides timekeeping accurate to the hundredth of a second, the file name is reported in milliseconds but is actually accurate to hundredths of seconds.

time-averaged reading is a single data value that represents a number of sub-interval values. ***SQM Reader Pro*** accumulates sub-interval readings as they are acquired from the meter and calculates an average reading value at the end of the time-averaging interval. This value is subsequently treated as a single reading value for the purposes of sampling statistics, graph display, data storage and data transfer.

Unihedron Device Manager format is the readings output format produced by Unihedron's Device Manager software. Please see Unihedron documentation for details.

Appendix

Examples (Use Cases)

Example 1: Visual or imaging observing

Set up ***SQM Reader Pro*** to read continuously while you observe. Connect your SQM directly to your laptop, or connect to SQM-LE via a router or wifi Internet.

The meter can be read periodically throughout your observing session so that you can monitor sky conditions, log SQM readings as you observe, or review the data at a later time by storing readings to a CSV data file. The CSV data file can be imported into most spreadsheet software and is easily interpreted with most script languages.

1) Setup the meter connection on the Meter page:

For SQM-LE:

Use **Find SQM-LE(s)** to discover the MAC address and IP address of any meters attached on the local network. This includes a meter attached directly to the computer by Ethernet crossover cable.

Enter the **IP Address** and click **Test Meter Connection**. Verify that the meter connection is setup correctly.

For SQM-LU, LR, LU-DL:

Use **Find SQM-LU(s)** to discover the COM port of any meters attached to the computer.

Click **Test Meter Connection**. Verify that the meter connection is setup correctly.

If your meter is in an enclosure, enter the **Enclosure Offset** value associated with your enclosure.

Set up the location of the meter and local time at the computer on the Meter page so that the position of Sun and Moon can be calculated:

Enter **Latitude**, **Longitude** and **Elevation** of the meter installation.

Enter **Offset from UTC of Computer** in minutes.You can get the value directly from the Windows Regional Settings by clicking **Get Windows Time Zone**.

2) Setup continuous reading on the Data Collection page:

Click **Continuous** in Collection Period, enter 15 in **Read Continuously Every,** and click **Minutes**. This causes a reading to be acquired every 15 minutes from the time you click **Read** until you click **Stop**.

Leave **Suspend Reading** = Never and **Time-Averaging** = 0 (off) for this example.

3) Setup the reading graphs on the Data Graphing page:

Enter a **Title** to be displayed on MPSAS and NELM graphs, then select the number of data points that you want to appear on a single page of the graph. Set **Data Values per Graph Page** = 20 for this example.

Uncheck Invert **Y-Axis Values** and **Show All Time Labels**; check **Show Moon Altitude** and **Show Value Labels Beside Data Points.**.

4) Setup storage of readings to a CSV file on the Data Storage page:

In the **Readings as Text** box, select **Store in Readings File Name**.

Click the browse button ... to the right of the **Readings File Name** text box to open a Windows dialog that allows you to navigate to a folder and select a file name for your readings data. Click **Save** to set the folder and name of the file to which CSV readings data are stored.

5) Click **Read** on the command panel to start reading. You can click the **Show** menu items under the main menu to view readings as text or real-time graphs.

Example 2: Imaging remotely

To the example above, we add the ability to display data acquired from an SQM-LE on a web site, and the ability to stop reading when the sun rises at the meter.

1) Setup reading only when the sun is down by setting **Suspend Collection** = If sun up on the Data Collection page.

2) Setup storage of reading and graph as JPEG files on the Data Storage page:

In the **Latest Readings as JPEG** box, check **Store**.

Continuing in the Latest Readings as JPEG box, click the browse button ... to the right of the **File** text box to open a Windows dialog that allows you to navigate to a folder and select a file name for your JPEG file. Click **Save** to set the folder and name of the file.

Repeat for the **Latest MPSAS Graph as JPEG** box.

3) Setup FTP transfer of the JPEG files to your web site on the Send Data page:

In the **Send via FTP After Each Reading** box,

- check **Latest Reading (JPEG)** and **Latest MPSAS Graph (JPEG)**
- enter the FTP **Host** for your web site, e.g., ftp.mydomain.com
- enter the **Port** on which the FTP service is running on Host, usually port 21
- enter the **Username** and **Password** for your FTP account
- Click **Test FTP Connection** to verify that you have set up the Host, Port, Username and Password correctly

4) Click **Read** on the command panel. When each reading is acquired, ***SQM Reader Pro*** stores the JPEG files locally, then connects to the FTP server and transfers the two JPEG files to the server. Each subsequent reading sample is stored, then both JPEG files are transferred.

Once you create a web page on your web site that includes the JPEG files as images, any visitor to your web page can monitor sky darkness by viewing the latest reading and graphs acquired by your SQM. Images taken remotely can be matched with the SQM reading acquired and graphed at the time the image was taken.

Example 3: Processing a CSV file in real-time with a program, script or batch file

To the examples above, we add the ability to send the latest readings data file to a script that operates on the data.

1) Make sure that the readings data file is being stored as described in Example 1, step 4.

2) Setup a script to process the readings data file on the Process Data page:

In the **Send to a Processor After Each Reading** box, check **Reading Text File** and enter the complete path and filename for the script that you want to process the readings data. You can use the browse button ... to navigate to the processor - in this case a Jscript or Visual Basic script file. An example of each is included below if you wish to experiment. The name of the readings file is passed as the only argument to the script.

test.js

```
objArgs = WScript.Arguments;
message = "I am a Jscript run by SQM Reader Pro.";
if (WScript.Arguments.Count() > 0)
{
  message = message + "\n";
  for (i=0; i<objArgs.length; i++)
  {
    message = message + objArgs(i);
  }
}
WScript.Echo(message);
```

test.vbs

```
Option Explicit
Dim iCount, message
message = "I am a VB script run by SQM Reader
Pro."
If WScript.Arguments.Count > 0 Then
  message = message & Vbcrlf
  For iCount = 0 To WScript.Arguments.Count - 1
    message = message &
WScript.Arguments(iCount)
  Next
End If
WScript.Echo message
```

3) Click **Read** on the command panel. When the reading is acquired, the Windows Script Host opens and the script runs.

If you select the name of a batch file (.bat) to process the readings data file, the command processor (cmd.exe) opens and the batch file runs. If you select a program (.exe) to process the readings data file, it runs as a separate process.

Your program, script or batch file should expect the name of the reading data file as the first argument. Each subsequent reading sends the file to the processor.

Readings as Text File Format

Readings as Text files are stored in comma separated value (CSV) format. This format is acceptable to most speadsheet programs and is easily parsed by scripting languages.

Produced by SQM Reader Pro 3.0.0.0
Year/Month/Day,Hour/Minute/Second,MPSAS,NELM,SerialNo,Protocol,Model,Feature,Temp(C),EncOffset,SolarAlt(deg),LunarAlt(deg),LunarPhase
2017/05/26,10:58:48,18.26,4.2,853,4,3,14,26.4,0.11,+57,+45,0.01
2017/05/26,10:59:49,18.23,4.2,853,4,3,14,26.4,0.11,+57,+45,0.01
2017/05/26,14:39:44,18.64,4.5,853,4,3,14,27.0,0.11,+65,+71,0.02
2017/05/26,14:39:59,19.79,5.4,853,4,3,14,27.0,0.11,+65,+71,0.02

Fields:

- Year/Month/Day,Hour/Minute/Second is PC (local) time when the reading was acquired.
- MPSAS is magnitudes per square arc second as acquired from the meter.
- NELM is calculated from the MPSAS value acquired from the meter.
- SerialNo is the serial number acquired from the meter. The value is zero suppressed.

- Protocol,Model,Feature are firmware version numbers acquired from the meter. They are zero suppressed.
- Temp(C) is the temperature at the light sensor in the meter when the reading was acquired. The value is expressed in degrees Celsius. It is *not* ambient air temperature.
- EncOffset is the amount of light absorbed by the meter enclosure, if any. It is expressed in magnitudes per square arc second and is applied to the MPSAS and NELM values in the file.
- SolarAlt(deg) is the altitude of the sun when the reading was acquired, expressed in rounded integer degrees.
- LunarAlt(deg) is the altitude of the moon when the reading was acquired, expressed in rounded integer degrees.
- LunarPhase is the illuminated fraction of the moon's disk when the reading was acquired.

Important: The readings file format has changed slightly since version 2. If you have automated your backend processing, you should be aware of these changes:

- MPSAS (mm.mm), NELM (n.n) and TempC (tt.t) values are shown in fixed decimal format.
- The first header line shows the new version of SQM Reader Pro

File Sharing Conflicts

SQM Reader Pro opens readings as text files and Skyglow Observations standard format files when storing the latest data sample, and when transmitting these files to an FTP server. Files are expected to be writable when they are opened for storing a data sample, and they are closed immediately. Files that are transmitted to an FTP server are opened with shared, non-exclusive access. This file handling means that if you are experiencing a file conflict problem, you should investigate other processes that access these files. They should not open data files with exclusive access.

Processing Time Problems

SQM Reader Pro has been time-tested with the most processing intensive options enabled. If you are having problems acquiring and processing readings, you should check for these potential bottlenecks:

- network speed - Is the network connection to your meter causing delays? A wireless network between the data collection computer and meter can result in slowed reading.
- graphing a moving average - a number of readings are summed and averaged for each reading when you plot moving averaged data on the graph. This may slow processing if you are averaging a large number of readings to produce the moving average.
- storing files - If you are storing files to a slow device or over a network, you may notice delays in this portion of processing. Storing files locally gives best performance.
- sending files - Connecting to your FTP server may take some time, depending on network latency and how busy the server is. Note that built-in FTP capability does not incur program startup overhead that would occur if you are sending a file to ftp.exe for example.
- processing files - there is some overhead in startup processing of a program, script or batch file. You should be certain that any program, script or batch file exits before another reading needs to be processed.

Menu Icons

The following icons can be used to give a quick synopsis of the configuration options currently set on main menu pages.

⃠ Meter	The meter's connection parameters are not specified. Model SQM-LE is selected but IP address (or domain name) is blank.
⃝ Meter	The meter's connection parameters are specified. A serial connection meter is selected or the ethernet model is selected and the IP address (or domain name) is set (but not necessarily valid.)
⃠ Data Collection	Reading is on-demand (manually triggered.)
⃝ Data Collection	Reading is continuous (automatically triggered.)
⃠ Data Storage	No files will be stored when readings are acquired.
⃝ Data Storage	At least one file will be updated when readings are acquired.
⃠ Send Data	No files will be transferred to a remote FTP server or to the Knightware web site.
⃝ Send Data	At least one file will be sent to a remote FTP server, or readings will be sent to the Knightware web site.
⃠ Process Data	No files will be transferred to a processor.
⃝ Process Data	At least one file will be sent to a processing program, script, batch file.
⃝ Show Log	One or more status messages appear in the log.

Security Warnings

Your security software, such as Windows Firewall, may warn you that ***SQM Reader Pro*** is trying to access the Internet. ***SQM Reader Pro*** contains several features that must be granted access to the Internet in order to function. These features and the networking services that they require are:

Read	requires TCP/IP access to the meter
Test Meter Connection	requires TCP/IP access to the meter
Find Meter(s)	requires UDP access inside your local network
Send via FTP After Each	requires FTP access to a selected FTP server

Reading	
Test FTP	requires FTP access to a selected FTP server
Check for Updates	requires HTTPS access to knightware.biz
Activation Help (Web)	requires HTTP access to knightware.biz
Contribute Readings to Knightware	requires HTTPS access to knightware.biz

Examples (Use Cases)

Example 1: Visual or imaging observing

Set up ***SQM Reader Pro*** to read continuously while you observe. Connect your SQM directly to your laptop, or connect to SQM-LE via a router or wifi Internet.

The meter can be read periodically throughout your observing session so that you can monitor sky conditions, log SQM readings as you observe, or review the data at a later time by storing readings to a CSV data file. The CSV data file can be imported into most spreadsheet software and is easily interpreted with most script languages.

1) Setup the meter connection on the Meter page:

For SQM-LE:

Use **Find SQM-LE(s)** to discover the MAC address and IP address of any meters attached on the local network. This includes a meter attached directly to the computer by Ethernet crossover cable.

Enter the **IP Address** and click **Test Meter Connection**. Verify that the meter connection is setup correctly.

For SQM-LU, LR, LU-DL:

Use **Find SQM-LU(s)** to discover the COM port of any meters attached to the computer.

Click **Test Meter Connection**. Verify that the meter connection is setup correctly.

If your meter is in an enclosure, enter the **Enclosure Offset** value associated with your enclosure.

Set up the location of the meter and local time at the computer on the Meter page so that the position of Sun and Moon can be calculated:

Enter **Latitude**, **Longitude** and **Elevation** of the meter installation.

Enter **Offset from UTC of Computer** in minutes.You can get the value directly from the Windows Regional Settings by clicking **Get Windows Time Zone**.

2) Setup continuous reading on the Data Collection page:

Click **Continuous** in Collection Period, enter 15 in **Read Continuously Every,** and click **Minutes**. This causes a reading to be acquired every 15 minutes from the time you click **Read** until you click **Stop**.

Leave **Suspend Reading** = Never and **Time-Averaging** = 0 (off) for this example.

3) Setup the reading graphs on the Data Graphing page:

Enter a **Title** to be displayed on MPSAS and NELM graphs, then select the number of data points that you want to appear on a single page of the graph. Set **Data Values per Graph Page** = 20 for this example.

Uncheck Invert **Y-Axis Values** and **Show All Time Labels**; check **Show Moon Altitude** and **Show Value Labels Beside Data Points.**.

4) Setup storage of readings to a CSV file on the Data Storage page:

In the **Readings as Text** box, select **Store in Readings File Name**.

Click the browse button … to the right of the **Readings File Name** text box to open a Windows dialog that allows you to navigate to a folder and select a file name for your readings data. Click **Save** to set the folder and name of the file to which CSV readings data are stored.

5) Click **Read** on the command panel to start reading. You can click the **Show** menu items under the main menu to view readings as text or real-time graphs.

Example 2: Imaging remotely

To the example above, we add the ability to display data acquired from an SQM-LE on a web site, and the ability to stop reading when the sun rises at the meter.

1) Setup reading only when the sun is down by setting **Suspend Collection** = If sun up on the Data Collection page.

2) Setup storage of reading and graph as JPEG files on the Data Storage page:

In the **Latest Readings as JPEG** box, check **Store**.

Continuing in the Latest Readings as JPEG box, click the browse button … to the right of the **File** text box to open a Windows dialog that allows you to navigate to a folder and select a file name for your JPEG file. Click **Save** to set the folder and name of the file.

Repeat for the **Latest MPSAS Graph as JPEG** box.

3) Setup FTP transfer of the JPEG files to your web site on the Send Data page:

In the **Send via FTP After Each Reading** box,

- check **Latest Reading (JPEG)** and **Latest MPSAS Graph (JPEG)**
- enter the FTP **Host** for your web site, e.g., ftp.mydomain.com
- enter the **Port** on which the FTP service is running on Host, usually port 21
- enter the **Username** and **Password** for your FTP account
- Click **Test FTP Connection** to verify that you have set up the Host, Port, Username and Password correctly

4) Click **Read** on the command panel. When each reading is acquired, ***SQM Reader Pro*** stores the JPEG files locally, then connects to the FTP server and transfers the two JPEG files to the server. Each subsequent reading sample is stored, then both JPEG files are transferred.

Once you create a web page on your web site that includes the JPEG files as images, any visitor to your web page can monitor sky darkness by viewing the latest reading and graphs acquired by your SQM. Images taken remotely can be matched with the SQM reading acquired and graphed at the time the image was taken.

Example 3: Processing a CSV file in real-time with a program, script or batch file

To the examples above, we add the ability to send the latest readings data file to a script that operates on the data.

1) Make sure that the readings data file is being stored as described in Example 1, step 4.

2) Setup a script to process the readings data file on the Process Data page:

In the **Send to a Processor After Each Reading** box, check **Reading Text File** and enter the complete path and filename for the script that you want to process the readings data. You can use the browse button ... to navigate to the processor - in this case a Jscript or Visual Basic script file. An example of each is included below if you wish to experiment. The name of the readings file is passed as the only argument to the script.

test.js

```
objArgs = WScript.Arguments;
message = "I am a Jscript run by SQM Reader Pro.";
if (WScript.Arguments.Count() > 0)
{
  message = message + "\n";
  for (i=0; i<objArgs.length; i++)
  {
    message = message + objArgs(i);
  }
}
WScript.Echo(message);
```

test.vbs

```
Option Explicit
Dim iCount, message
message = "I am a VB script run by SQM Reader
Pro."
If WScript.Arguments.Count > 0 Then
  message = message & Vbcrlf
  For iCount = 0 To WScript.Arguments.Count - 1
    message = message &
WScript.Arguments(iCount)
  Next
End If
WScript.Echo message
```

3) Click **Read** on the command panel. When the reading is acquired, the Windows Script Host opens and the script runs.

If you select the name of a batch file (.bat) to process the readings data file, the command processor (cmd.exe) opens and the batch file runs. If you select a program (.exe) to process the readings data file, it runs as a separate process.

Your program, script or batch file should expect the name of the reading data file as the first argument. Each subsequent reading sends the file to the processor.

Readings as Text File Format

Readings as Text files are stored in comma separated value (CSV) format. This format is acceptable to most speadsheet programs and is easily parsed by scripting languages.

Produced by SQM Reader Pro 3.0.0.0
Year/Month/Day,Hour/Minute/Second,MPSAS,NELM,SerialNo,Protocol,Model,Feature,Temp(C),EncOffset,SolarAlt(deg),LunarAlt(deg),LunarPhase
2017/05/26,10:58:48,18.26,4.2,853,4,3,14,26.4,0.11,+57,+45,0.01
2017/05/26,10:59:49,18.23,4.2,853,4,3,14,26.4,0.11,+57,+45,0.01
2017/05/26,14:39:44,18.64,4.5,853,4,3,14,27.0,0.11,+65,+71,0.02
2017/05/26,14:39:59,19.79,5.4,853,4,3,14,27.0,0.11,+65,+71,0.02

Fields:

- Year/Month/Day,Hour/Minute/Second is PC (local) time when the reading was acquired.
- MPSAS is magnitudes per square arc second as acquired from the meter.
- NELM is calculated from the MPSAS value acquired from the meter.
- SerialNo is the serial number acquired from the meter. The value is zero suppressed.
- Protocol,Model,Feature are firmware version numbers acquired from the meter. They are zero suppressed.
- Temp(C) is the temperature at the light sensor in the meter when the reading was acquired. The value is expressed in degrees Celsius. It is *not* ambient air temperature.
- EncOffset is the amount of light absorbed by the meter enclosure, if any. It is expressed in magnitudes per square arc second and is applied to the MPSAS and NELM values in the file.
- SolarAlt(deg) is the altitude of the sun when the reading was acquired, expressed in rounded integer degrees.
- LunarAlt(deg) is the altitude of the moon when the reading was acquired, expressed in rounded integer degrees.
- LunarPhase is the illuminated fraction of the moon's disk when the reading was acquired.

Important: The readings file format has changed slightly since version 2. If you have automated your backend processing, you should be aware of these changes:

- MPSAS (mm.mm), NELM (n.n) and TempC (tt.t) values are shown in fixed decimal format.
- The first header line shows the new version of SQM Reader Pro

File Sharing Conflicts

SQM Reader Pro opens readings as text files and Skyglow Observations standard format files when storing the latest data sample, and when transmitting these files to an FTP server. Files are expected to be writable when they are opened for storing a data sample, and they are closed immediately. Files that are transmitted to an FTP server are opened with shared, non-exclusive access. This file handling means that if you are experiencing a file conflict problem, you should investigate other processes that access these files. They should not open data files with exclusive access.

Processing Time Problems

SQM Reader Pro has been time-tested with the most processing intensive options enabled. If you are having problems acquiring and processing readings, you should check for these potential bottlenecks:

- network speed - Is the network connection to your meter causing delays? A wireless network between the data collection computer and meter can result in slowed reading.
- graphing a moving average - a number of readings are summed and averaged for each reading when you plot moving averaged data on the graph. This may slow processing if you are averaging a large number of readings to produce the moving average.
- storing files - If you are storing files to a slow device or over a network, you may notice delays in this portion of processing. Storing files locally gives best performance.
- sending files - Connecting to your FTP server may take some time, depending on network latency and how busy the server is. Note that built-in FTP capability does not incur program startup overhead that would occur if you are sending a file to ftp.exe for example.
- processing files - there is some overhead in startup processing of a program, script or batch file. You should be certain that any program, script or batch file exits before another reading needs to be processed.

Menu Icons

The following icons can be used to give a quick synopsis of the configuration options currently set on main menu pages.

Meter	The meter's connection parameters are not specified. Model SQM-LE is selected but IP address (or domain name) is blank.
Meter	The meter's connection parameters are specified. A serial connection meter is selected or the ethernet model is selected and the IP address (or domain name) is set (but not necessarily valid.)
Data Collection	Reading is on-demand (manually triggered.)
Data Collection	Reading is continuous (automatically triggered.)
Data Storage	No files will be stored when readings are acquired.
Data Storage	At least one file will be updated when readings are acquired.
Send Data	No files will be transferred to a remote FTP server or to the Knightware web site.
Send Data	At least one file will be sent to a remote FTP server, or readings will be sent to the Knightware web site.
Process Data	No files will be transferred to a processor.
Process Data	At least one file will be sent to a processing program, script, batch file.
Show Log	One or more status messages appear in the log.

Security Warnings

Your security software, such as Windows Firewall, may warn you that ***SQM Reader Pro*** is trying to access the Internet. ***SQM Reader Pro*** contains several features that must be granted access to the Internet in order to function. These features and the networking services that they require are:

Read	requires TCP/IP access to the meter
Test Meter Connection	requires TCP/IP access to the meter
Find Meter(s)	requires UDP access inside your local network
Send via FTP After Each Reading	requires FTP access to a selected FTP server
Test FTP	requires FTP access to a selected FTP server
Check for Updates	requires HTTPS access to knightware.biz
Activation Help (Web)	requires HTTP access to knightware.biz
Contribute Readings to Knightware	requires HTTPS access to knightware.biz