PQ ONE is a freeware application developed by HIOKI for use with its Power Quality Analyzers, including models PQ3100, PW3198, and PQ3198. The software enables users to analyze measurement data on a computer, view three-phase trend graphs, review event statistics, and generate reports without complex settings. It supports data export in both CSV and PQDIF formats. This manual applies only to PQ ONE and does not cover the operation of the analyzers themselves. For hardware usage, refer to the device’s user manual. All rights to the software and its documentation are reserved by HIOKI E.E. CORPORATION. Unauthorized reproduction, modification, or commercial use is prohibited. The software is provided as-is, with no guarantees against bugs or defects, and HIOKI assumes no responsibility for any damage resulting from its use. Updates may occur without prior notice, and HIOKI does not offer support or respond to inquiries related to this software.

[Page 1]

1. Introduction

PQ ONE is a free application developed by HIOKI for analyzing measurement data from power quality analyzers on a computer. It supports models such as the PQ3100, PW3198, and PQ3198. This software allows users to view and analyze measurement data, including the ability to display three-phase trend data on a single graph. It also simplifies report generation, enabling users to output reports that reflect the screen content without needing to configure complicated settings. In this manual, PQ ONE is often referred to simply as “the software.”

**[Page 1]  
1.1 Precautions concerning reproduction, copyright, and use**

HIOKI E.E. CORPORATION retains full copyright over both the software executable and the documentation. Commercial use—such as bundling with other software or printed material—is prohibited without explicit permission. Users are not allowed to reverse-engineer or modify the software unless authorized. PQ ONE is provided as freeware, and HIOKI assumes no responsibility for any damage, bugs, or defects that may arise from its use. Additionally, HIOKI does not provide customer support or updates for the software. PQ ONE may be updated or changed without prior notice. Microsoft, Microsoft .NET Framework, and Microsoft Word are registered trademarks of Microsoft Corporation.

**[Page 2]  
1.2 System requirements**

To use PQ ONE, a Windows 10 (32-bit or 64-bit) or Windows 11 operating system is required, with the latest service pack as of August 1, 2023. The Microsoft .NET Framework version 4.5.2 or later must be installed, and users in non-English environments should ensure the correct language pack is added. A minimum display resolution of 1024 x 768 is required. In some cases, even if all system requirements are satisfied, the software may not operate correctly. An SD memory card is necessary to load measurement data. To view the generated reports properly, Microsoft Word 2010 or later must be used, as other applications may misrender the layout. If the frequency analysis screen does not display, the user should install the “Visual C++ Redistributable Package for Visual Studio 2015.”

**[Page 3]  
2. Setup**

To install the PQ ONE software from the CD that comes with the PQ3100 or PQ3198 Power Quality Analyzer, users should follow the instructions provided in the user manual for those analyzers. If the software was downloaded from HIOKI’s website, the user must first unzip the downloaded ZIP file and then run the installer program by executing the file named SetUp.exe. This process will launch the installation procedure for PQ ONE on the user’s computer.

**[Page 4]**

3.1 Loading measurement data

To launch PQ ONE, go to the [Start] menu, select [All Programs] → [HIOKI] → [PQONE], and click on [PQONE]. Once the software is open, click the data selection icon to access the data menu. From this menu, the user can choose how to load measurement data. Selecting a menu option will either read the designated data or open a screen related to that menu. While viewing data, users must not delete the files or disconnect the storage device (e.g., HDD or SD card) that contains the measurement data, as doing so may cause the program to crash.

**[Page 6]**

Automatic behavior on drag-and-drop

If a folder is dragged directly onto the Data list screen, the data is automatically added without showing a confirmation message. To read the data, the user can simply select it from the list and click [OK]. This screen not only loads data but also allows users to manage or output data information. For advanced operations, users can refer to Chapter 7, which discusses the Data list in detail.

**[Page 6 continued]**

Read repeated data from [Data list] at once

PQ ONE allows the user to load repeated data in a batch. This is done by checking the target data entries in the Data list and clicking [OK]. Data entries that can be read together are marked with the same background color. Alternatively, users can right-click to select “Selects the check boxes for repeated data,” and the system will automatically highlight compatible data.

**[Page 7]**

Conditions for repeated data\*\*

For data to be recognized as repeated recordings, several conditions must be met: the model, wiring configuration (e.g., CH123/CH4), frequency, nominal voltage (Uref), trend interval, and recorded items must be identical. Folder names should follow a consistent repeated-recording naming format, and measurement periods must not overlap. Even if the background color is not the same, PQ ONE may still judge the data as repeated if all conditions match. When such data is loaded, PQ ONE shows the name as a range from the first folder to the last. Users may choose whether to display the full file path or just the data name in the window title bar.

**[Page 8]**

Read data from [Open Folder] menu\*\*

By selecting the [Open Folder] menu from the data selection menu, the user opens a screen to choose a folder. If the selected folder contains valid measurement data, PQ ONE will automatically begin loading it. If multiple sets of data exist, PQ ONE will instead display the Data list screen so the user can select which to load.

**[Page 9]**

Read data from [Recent the measurement data] menu\*\*

The [Recent the measurement data] menu shows up to 10 of the most recently accessed measurement files. A user can select a file from this list or double-click a file icon on the initial screen to load it. This provides a quick way to re-open frequently accessed data.

**[Page 9 continued]**

Read data imported by GENNECT One\*\*

GENNECT One is a free software application that works over LAN to centralize management of multiple HIOKI devices, enable automatic file transfer, and support remote operation. PQ ONE can load data from PQ3100 or PQ3198 that has been imported through GENNECT One. Note that GENNECT One does not support the PW3198 model.

**[Page 10]**

Open data (Local data via GENNECT One)\*\*

To load data locally imported by GENNECT One, open the [Data] screen within GENNECT One, select “PQA measurement data,” and click [Open]. This launches PQ ONE and begins the data loading process, similar to dragging a folder into the software.

**[Page 10 continued]**

Open data (Cloud data via GENNECT Cloud)\*\*

Users can also open cloud-stored measurement data using GENNECT Cloud in combination with GENNECT One. After logging into the cloud, the “Cloud” section appears on the [Data] screen. From there, the user can select a PQA Data Folder and click [Open], which l

**[Page 11]**

Open repeated data from GENNECT One\*\*

When working with GENNECT One, users may want to load multiple related data files. Although GENNECT One creates a separate folder for each imported file—making them appear unrelated in the PQ ONE list—users can still load them together. After launching PQ ONE, select [No] when prompted to clear the current list, then use the context menu option [Selects all check boxes] to highlight all files and press [OK] to load them as a group.

**[Page 12]**

Batch loading cloud data\*\*

PQ3100 and PQ3198 measurement data that has been uploaded to the GENNECT Cloud can be selected and loaded in batch through the GENNECT One interface. If the data list is not in order, users are advised to sort by folder name or measurement time before proceeding with loading.

**[Page 13]**

3.2 Main screen layout\*\*

The main screen of PQ ONE consists of several distinct areas, each designed to facilitate a different aspect of measurement analysis. At the top of the screen is the toolbar, which allows users to select and load measurement data, adjust option settings, load saved configuration files, create reports, convert binary data to CSV format, open the Statistics or Standards screens, and access the instruction manual. Below the toolbar is the Period setting area, where users can define the display period for the trend graphs shown below. The central portion of the screen displays the trend graph, which visualizes the measured data over time.

On the right side of the screen is the Event list, which presents a summary of events that occurred, along with a bar graph showing how frequently each event type happened. Below the Event list is the Event data section, which shows detailed data for a selected event. Each area is designed to interact with the others, allowing for a streamlined workflow from data selection to event review and reporting.

**[Page 14]**

Change display size and reset layout\*\*

Users can change the size of each panel on the main screen by dragging the split bars that separate them. This allows flexible resizing of the trend graph, event list, and event data areas depending on the user’s focus. If the user wishes to restore the original layout, they can right-click on the toolbar area to open the context menu and select the option [Initialize the display]. This resets the display position and panel sizes to the default configuration.

**[Page 15]**

3.3 Viewing the trend graph\*\*

**Selecting the period**

The trend graph screen in PQ ONE displays time-series measurement data such as voltage, current, and frequency over time. The graph uses the horizontal axis to represent time and the vertical axis to show the measured value. Each waveform line corresponds to a measurement channel, and arrow icons are placed along the graph to indicate where power quality events (such as dips or interruptions) occurred. These arrows are color-coded and labeled with event types (e.g., DIP1, INT1).

The top of the screen contains menu buttons for operations like data selection, settings, CSV export, and report generation. The central area shows the trend graph, and below it is a scrollbar for time navigation. A typical screenshot on this page illustrates a trend graph with red, green, and blue waveform lines, and several downward-pointing arrows labeled “DIP1”, “DIP2”, and “INT1”, indicating when those events happened.

**[Page 16]**

Zooming in on the trend graph\*\*

To zoom in on the trend graph, users can click and drag the mouse over the section of interest. A shaded box appears while dragging, and upon release, the graph zooms into the selected region. This action works both horizontally and vertically, depending on the direction of the drag.

Dragging the mouse diagonally enables simultaneous zooming on both the Y-axis (value) and the X-axis (time). The graph adjusts its scale to tightly focus on the boxed area. If the mouse is dragged vertically, only the Y-axis is zoomed, allowing for closer inspection of value fluctuations without changing the time scale. Conversely, dragging horizontally zooms only the time axis (X-axis), useful for inspecting timing patterns while keeping value ranges intact.

The images show three examples: zooming diagonally to isolate a spike in voltage, zooming vertically to examine amplitude changes, and zooming horizontally to focus on a particular time window.

**[Page 17]**

Adjusting the range of the X-axis on the trend graph\*\*

PQ ONE allows users to fine-tune the time axis (X-axis) scale using zoom control buttons. Clicking the magnifying glass icon labeled "Axis X ZoomIn" zooms into the time axis, compressing the visible time span. Clicking the "Axis X ZoomOut" icon does the opposite, expanding the visible time range.

Users can hover the mouse over the zoom icons to highlight the area that will be affected. When the zoom cursor is displayed, the graph will adjust around the cursor’s current position, making that the center of the zooming operation.

In the screenshots, clicking ZoomIn repeatedly reduces the visible time window from an entire day to just a few hours, while ZoomOut restores the full view. The gray-shaded region indicates the newly focused range. The maximum zoom-in level is limited to 12 points on the X-axis, ensuring that extreme magnification still retains readability.

**[Page 18]**

Adjusting the range of the Y-axis on the trend graph\*\*

Users can automatically adjust the Y-axis scale to better fit the values displayed in the trend graph. This is done by clicking the Y-axis auto-scaling button located beside the graph. The first click sets the Y-axis to cover the data range plus a margin of approximately 10% above and below the highest and lowest values. If the lower limit is 0, the margin is applied only to the upper side.

Clicking the button a second time changes the Y-axis range to the data range plus a 100% margin. This provides more space around extreme values, making them easier to view. A third click resets the scale to use 0 as the lower bound, ignoring the fluctuation range. The scaling then cycles back to the first stage upon the next click.

An illustration on this page shows how each level of scaling changes the vertical axis. For example, a graph showing current fluctuations from 0 to 50 A will expand its range up to 55 A in the 10% mode, to 100 A in the 100% mode, or down to 0 in the zero-reference mode.

**[Page 19]**

Y-axis display range specification\*\*

In addition to automatic scaling, users can manually specify the Y-axis display range. This is useful for comparing data across multiple graphs with the same axis settings. To do this, the user can either double-click directly on the Y-axis, or open the pop-up menu and select the [Vertical Axis Setting] option. This opens a configuration dialog where minimum and maximum values can be entered.

The minimum and maximum limits available depend on the voltage or current range of the measurement channel. For example, if the channel measures up to 300 V, the user may set the axis from 0 to 300 V or narrow it to focus on a specific range such as 100–200 V. This feature ensures consistent and meaningful visual scaling when analyzing multiple parameters or measurement sessions.

The screenshot on this page shows a graph with a Y-axis range manually set from 0 to 250, with the axis value edited via the settings dialog. This kind of adjustment is helpful for generating standardized reports or side-by-side comparisons.

**[Page 20]**

Displaying the entire trend graph\*\*

When the user has zoomed into a specific portion of the trend graph, they can return to the full view by clicking the [All] button. This command resets both the X-axis (time) and Y-axis (value) scales to their initial state, allowing the entire measurement period and full data range to be shown again. The feature is especially useful after analyzing a specific event or narrowed section, as it eliminates the need for manual scroll and axis adjustments.

The image shows a zoomed-in trend graph that becomes fully expanded after pressing the [All] button. This action clears any zoom box or custom scaling previously applied.

**[Page 21]**

Displaying measured values\*\*

When the user clicks within the trend graph area, a vertical cursor line appears along with numerical information for that exact time point. This includes the timestamp and the corresponding measured value (e.g., voltage or current). The cursor can be moved by clicking another point on the graph, and it disappears when the user clicks outside the graph area.

In the illustration, the cursor is displayed as a vertical dashed line intersecting multiple trend lines, and a small tooltip box shows the timestamp and measurement value at the intersection point. This feature enables precise value inspection for data interpretation or troubleshooting.

**[Page 22]**

Selecting display parameters\*\*

Users can select which parameters to visualize on the trend graph using dropdown menus and checkboxes. Parameters are grouped into tabs such as "Detail Trend," "U/I," "Frequency," "Unbalance," "Harmonics," "Power," "Energy," and others. Within each tab, specific channels and values can be enabled or disabled using checkboxes.

For example, under the “Detail Trend” tab, users can select RMS voltage refreshed every half-cycle (Urms1/2), inrush current, or frequency (Freq\_wav). Selecting a parameter adds it to the graph, while choosing [–] removes it. Up to three trend graphs can be displayed simultaneously, each configurable independently.

The figure shows dropdown menus for parameter selection and a matrix of checkboxes for each channel and statistic. Additionally, clicking a legend entry in the graph highlights that parameter’s line in bold, helping to visually distinguish it.

**Supported Parameters by Device Model**

For \*\*PQ3100\*\*, the selectable parameters are:

- `U rms1/2`: RMS voltage per half-cycle

- `I rms1/2`: RMS current per half-cycle

- `Inrush`: Inrush current

- `Freq\_wav`: Frequency per waveform

- `Pinst`: Instantaneous flicker

For \*\*PW3198 / PQ3198\*\*, the selectable parameters are:

- `U rms1/2`: RMS voltage per half-cycle

- `I rms1/2`: RMS current per half-cycle

- `Inrush`: Inrush current

- `Pinst`: Instantaneous flicker

**\*\*[Page 23]**

Detailed Trend, U/I, Frequency, and Unbalance Tabs\*\*

The “Detailed Trend” tab shows vertical bars connecting the minimum and maximum values during the recording interval, allowing users to view value fluctuations over time. The “U/I” tab focuses on voltage and current measurements, offering options like RMS, peak, DC, crest factor, and average values. The “Frequency” tab provides frequency data recorded at 200 ms intervals or as 10-second averages. The “Unbalance” tab displays voltage and current unbalance factors, as well as zero, negative, and positive phase components.

The diagrams on this page show trend graphs for each of these tabs, where users can observe variations across channels and quickly detect abnormalities like phase imbalances or frequency drifts.

**\*\*[Page 24]**

Harmonics, Flicker, Power, and Energy Tabs\*\*

The “Harmonics” tab includes both a “Trend” sub-tab and a “Peak Level” sub-tab. In “Trend,” users can track THD (Total Harmonic Distortion), individual harmonic levels, and interharmonic values. In “Peak Level,” harmonic data is presented as bar graphs, with options to toggle AVG or MAX peak level over a selected time window.

The “Flicker” tab shows values like Pst (short-term), Plt (long-term), and ΔV10-related statistics. The “Power” tab displays active power (P), apparent power (S), reactive power (Q), and power factor (PF). The “Energy” tab reports accumulated electric energy and cost-related values. These tabs allow users to correlate power quality metrics with events and overall system performance.

The figure shows examples of bar graphs, cursor markers, and dropdowns for selecting harmonic order and trend types.

**\*\*[Page 25]**

Demand and Mains Signaling Tabs\*\*

The “Demand” tab presents demand values and quantities over fixed intervals like 15 minutes, 30 minutes, 1 hour, or 2 hours. Demand bars are color-coded to distinguish intervals. If recording doesn't align perfectly with the demand window, demand values are shifted accordingly.

The “Mains Signaling” tab shows the strength and content percentage of signal voltages used to control industrial equipment over power lines, as defined by IEC 61000-4-30. Parameters include Msv1, Msv2, Msv1%, and Msv2%, and are available only for PQ3198 version 2.00 or later.

In the illustrations, time-distributed bar graphs show demand trends, while the signaling graphs depict voltage signal levels across time with peak markers.

**[Page 26]**

[ U / I ] Tab\*\*

The [U / I] tab in PQ ONE displays trend graphs related to voltage (U) and current (I). Users can use checkboxes to enable the display of maximum (MAX), minimum (MIN), and average (AVG) values during the recording interval. The available parameters depend on the analyzer model. For the PQ3100, selectable parameters include Urms, Upk+, Upk−, Udc, Ucf, Irms, Ipk+, Ipk−, Idc, Icf, Uavg, and Iavg. For the PW3198 and PQ3198, the list is mostly the same, but with some limitations—for example, Udc and Idc are available only for CH4 in DC measurement mode. These trend graphs allow detailed analysis of voltage and current waveforms during power quality evaluations.

**\*\*[Page 27]**

[ Frequency ] Tab\*\*

The [Frequency] tab shows trend graphs for parameters related to system frequency. The PQ3100 offers two options: Freq and Freq10s, while the PW3198 and PQ3198 show “Freq” and “f10s.” These graphs allow users to track fast and slow fluctuations in frequency over time. Notably, for firmware version 9.00 and above, the 10-second frequency data appears as “f10s.” This tab is particularly useful for identifying long-term instability in the power grid.

**\*\*[Page 28]**

[ Unbalance ] Tab\*\*

The [Unbalance] tab provides visualizations of voltage and current unbalance factors. Selectable parameters include Uunb0, Uunb, Iunb0, Iunb, and symmetrical component factors such as U zero, U neg, U pos, I zero, I neg, and I pos. These measurements help users identify asymmetry in three-phase systems, which may be caused by uneven loads or wiring issues. The graphs in this tab allow users to detect and assess unbalanced conditions in real time.

**\*\*[Page 29]**

[ Harmonics ] Tab – [Trend] Sub-tab\*\*

The [Trend] sub-tab under [Harmonics] displays graphs for harmonic-related parameters such as total harmonic distortion (THD), individual harmonics, interharmonics, and derived metrics. PQ3100 devices support Uthd-f/r, Ithd-f/r, Uharm, Iharm, Pharm, KF, Uiharm, Iiharm, and TDD. PW3198 and PQ3198 models add more options like UharmH and IharmH. Users can toggle between “level,” “%fnd” (fundamental content percentage), and “phase” for display. For [U harm] and [I harm] phase data, only average values are shown, even if MIN or MAX is selected. Clicking the [Order] button opens a dialog box to select harmonic order or interharmonic display. For more details on TDD (Total Demand Distortion), see Chapter 4, page 65.

**\*\*[Page 30]**

[ Harmonics ] Tab – [Peak Level] Sub-tab\*\*

The [Peak Level] sub-tab displays bar graphs for voltage or current harmonics, showing their peak levels during the selected display interval. The [Period] setting defines this detection interval. Users can enable [AVG Peak] to see average peak values or [MAX Peak] to display the highest recorded values during that time. A cursor can be placed on the bar graph to examine individual harmonic orders, and the value will be reflected in a list on the right. The [Order] button allows sorting or selecting which harmonics are displayed. This view is useful for identifying the most significant harmonic distortions in the measurement window.

**\*\*[Page 31]**

Zoom and auto Y-axis in harmonic graphs\*\*

Users can zoom into a portion of the harmonic bar graph by clicking and dragging the mouse over a selected area. This enables detailed inspection of harmonic content. A zoomed area is visually highlighted. Clicking the “Auto scale Y-axis” button automatically adjusts the graph to fit all bars within the display window. Clicking the “Reset zoom” button restores the display to show harmonic orders from 0 to 50, undoing any previous zoom.

**\*\*[Page 32]**

[ Flicker ] Tab\*\*

The [Flicker] tab displays time-based graphs of flicker parameters, including short-term flicker (Pst), long-term flicker (Plt), and ΔV10. For PQ3100, PW3198, and PQ3198, parameters include Pst, Plt10min, Plt, and ΔV10 values like 1min, 1hMAX, 1h4th, and 1hAVG. These graphs allow users to assess flicker severity and compliance with flicker standards, helping identify voltage fluctuation issues caused by variable loads.

**\*\*[Page 33]**

[ Power ] Tab\*\*

This tab provides trend graphs for electrical power parameters. For all models, the parameters include active power (P), apparent power (S), reactive power (Q), and power factor or displacement power factor (PF/DPF). The PQ3198 additionally supports "Efficiency" (Eff). These graphs enable energy engineers to monitor power consumption patterns and system behavior over time.

**\*\*[Page 34]**

[ Energy ] Tab\*\*

The [Energy] tab shows trend graphs for accumulated energy measurements. PQ3100 supports WP+, WP−, WQlag, WQlead, WS, and Ecost (electric cost). PW3198 and PQ3198 support the same except for Ecost, which may not be available. This tab helps users monitor long-term energy usage and estimate energy-related costs.

**\*\*[Page 35]**

[ Demand ] Tab\*\*

The [Demand] tab displays bar graphs for demand values and demand quantities. Parameters include Dem P+, Dem P−, Dem Qlag, Dem Qlead, Dem S, Dem PF, Dem WP+, Dem WP−, Dem WQlag, Dem WQlead, and Dem WS. Different colors are used to represent each demand period. Users can select the demand interval—15 minutes, 30 minutes, 1 hour, or 2 hours—via a dropdown at the top right. If the recording interval and demand period do not align perfectly, demand values are calculated based on shifted time periods. For example, if recording starts at 00:10 with a 30-minute interval, the demand periods will also shift by 10 minutes.

**\*\*[Page 36]**

[ Mains signaling ] Tab\*\*

The [mains signaling] tab displays trend graphs for voltage signals used in power line communication (mains signaling), as defined by IEC 61000-4-30. This feature is available only on PQ3198 (version 2.00 or later). Selectable parameters include Msv1, Msv2 (signal levels) and Msv1%, Msv2% (content percentages). These measurements help evaluate the signal quality and reliability of power line control systems.

**[Page 37]**

Reviewing events\*\*

Using the event list located on the left side of the window, users can check the time and characteristics of any events that occurred. The event statistics graph displays the number of events as a bar chart, while the event list provides key information including the time of occurrence, event type, IN and OUT timestamps, the channel where the event occurred, duration from IN to OUT, and the worst value recorded during that duration. The detailed event list expands this view with additional information. When viewing repeated data, event numbers are reassigned in the order the data was measured.

**\*\*[Page 38]**

Event statistics graph\*\*

The event statistics graph provides a visual summary of event occurrence. Users can select which event types to include. Selecting [All] includes every event, while choosing a specific type filters the results accordingly. A [Custom] mode allows users to manually select multiple event types from a menu. The graph type can be toggled among [View by date], [View by hour], [ITIC Curve], and [User-defined Curve]. Users can also specify a statistics period with a defined start and end date. Below the graph, event markers (▽) indicate the start time of each event, and the currently selected event is shown with ▼. The bar chart adapts accordingly, and selected events can also be highlighted on the trend graph.

**\*\*[Page 39]**

Event list\*\*

Clicking a bar on the statistics graph sets a cursor, which filters the event list to show only those corresponding to that time period. If the cursor is hidden, all events within the statistics period are displayed. Events included in the statistics filter are shown in bold. The detailed event list offers IN time, OUT time, worst value, and level for each selected event. Note that in some analyzer models (e.g., PW3198), certain event names differ from those used in PQ3100. For instance, Irms1/2 appears as "Inrush" and "Cont" becomes "After". When event waveforms do not connect continuously, After (Cont) may not be shown. Clicking [+] reveals all grouped events.

**\*\*[Page 40]**

ITIC Curve\*\*

Voltage swell, dip, and interruption events are plotted against an ITIC curve, which is a standard tolerance graph. The vertical axis shows the percentage of nominal voltage, while the horizontal axis shows time in seconds. The graph includes markers for continuous duration and maximum or minimum values. Swell events show duration and maximum voltage, dip events show duration and residual voltage, and interruptions show residual voltage. Transients are represented by width and peak value. Events with duration less than 1 µs are not plotted. Marker symbols differ by channel: CH1 uses red, CH2 green, CH3 blue, with ◆ for selected and ◇ for unselected. The graph also shows how many events exceed the upper or fall below the lower limit curve.

**\*\*[Page 41]**

User-defined Curve\*\*

In addition to the standard ITIC curve, users can define custom tolerance curves with specific upper and lower bounds. From the context menu, selecting [Tolerance curve setting] opens a dialog box for configuration. The default values are based on the ITIC curve but can be freely edited. Target event types can also be selected from the menu. The Y-axis (voltage) and T-axis (time) scales can be adjusted, with YDiv up to 2000% and TDiv down to 1 µs, offering precise control over how events are evaluated visually against custom standards.

**\*\*[Page 42]**

Viewing event data\*\*

Detailed information for each selected event is available under four tabs: [Event Waveform], [Harmonics], [Vector], and [DMM]. Each tab provides a different perspective. [Event Waveform] shows voltage and current waveforms across CH1 to CH4. [Harmonics] displays bar graphs and tables of harmonic voltage, current, and power. [Vector] shows the phase relationship as a vector diagram. [DMM] presents a table of measured values for voltage, current, and power during the event. Event data is aggregated in ~200 ms intervals.

**\*\*[Page 43]**

[ Event Waveform ] Tab\*\*

Within the [Event Waveform] tab, users select channels on the right side and waveforms on the left. ▼ indicates the currently selected event, and ▽ marks event occurrence. Special icons appear if transient, harmonic, or trend data are available. Clicking these icons opens detailed sub-windows. Time is displayed along two axes: elapsed time from the 200 ms reference and absolute time. The graph provides an example showing both trend waveform and icons for high-order harmonics or inrush data.

**\*\*[Page 44]**

High-order harmonics and frequency analysis\*\*

PW3198 and PQ3198 devices support high-order harmonics visualization. These graphs are shown only if corresponding HHC files are present. A frequency analysis can also be displayed in conjunction with the harmonic waveform. If this analysis does not appear, the user is advised to install the Visual C++ Redistributable Package for Visual Studio 2015. Both X and Y axes support switching between linear and logarithmic scales for better data interpretation.

**\*\*[Page 45]**

Zooming in on waveform graph\*\*

Users can zoom into waveform graphs by dragging the mouse. Dragging diagonally zooms both axes. Vertical dragging zooms the Y-axis (amplitude), while horizontal dragging zooms the X-axis (time). This interaction enables users to inspect detailed waveform behavior around events.

**\*\*[Page 46]**

Automatically adjusting the X-axis on waveform graphs\*\*

Clicking the zoom-in or zoom-out buttons near the X-axis enables users to adjust the time range. Hovering over the zoom icon displays the portion of the graph that will be affected. The zoom operation centers around the current cursor location for precise control.

**\*\*[Page 47]**

Automatically adjusting the Y-axis on waveform graphs\*\*

Clicking the Y-axis auto-adjust button scales the waveform vertically. The first click adds a 10% margin above and below the amplitude range. A second click expands the margin to 100%. A third click cycles back to the original 10% margin. This toggling allows users to dynamically control graph compression and legibility.

**\*\*[Page 48]**

Manually adjusting the Y-axis\*\*

Users can manually configure the Y-axis range by double-clicking on the Y-axis itself. This opens a dialog where min and max values can be set directly, offering consistent scaling across different event views.

**\*\*[Page 49]**

Displaying the entire waveform graph\*\*

To reset all zoom settings, clicking the [All] button restores both X and Y axes to their initial scale, allowing the full waveform to be viewed again. This is useful after detailed inspection when the user wants to return to the full event context.

**\*\*[Page 50]**

Displaying measured values\*\*

Clicking anywhere on the waveform graph adds a cursor line and displays the measured value at that time. Clicking a new point moves the cursor, and clicking outside the graph area hides it. Users can also highlight specific parameters by clicking them in the legend, which thickens the corresponding waveform line.

**\*\*[Page 51]**

Displaying A and B cursor\*\*

In addition to the main cursor, users can enable two additional cursors labeled A and B. These can be dragged across the waveform to compare specific moments. The system displays the values at each cursor and computes the time and value differences (ΔT, ΔV), assisting in quantifying events like dips and swells.

**\*\*[Page 52]**

[ Harmonics ] Tab\*\*

The [Harmonics] tab shows bar graphs for voltage and current harmonics based on 200 ms aggregation. Clicking a bar places a cursor, which shows the selected harmonic order’s value in a table on the right. Users can drag to zoom into the graph and use auto-adjust buttons to fit the bars within view. X-axis zoom buttons allow finer control of the harmonic range, and double-clicking the Y-axis allows manual scale entry.

**\*\*[Page 53]**

[ Vector ] Tab\*\*

The [Vector] tab displays phase relationships between voltage and current harmonics using vector diagrams. These diagrams are shown for the harmonic order selected via the bar graph. The Y-axis range from the bar graph is used as the vector radius, keeping both views synchronized. Dragging to zoom the bar graph simultaneously updates the vector view. Vector diagrams only reflect channels visible on the bar graph.

**\*\*[Page 54]**

[ DMM ] Tab\*\*

The [DMM] tab shows numerical readings for power, voltage, and current at the time of the event. Data is presented in three sub-tabs: [Power], [Voltage], and [Current], each listing key metrics in table format. These readings come from the same ~200 ms aggregation as waveform and harmonic data, offering a comprehensive snapshot of the system at the moment of event occurrence.

**[Page 55]**

Displaying statistics screen\*\*

The statistics screen allows users to view statistical summaries of trend data. By clicking the designated icon, the [PQ ONE Statistic] screen opens, displaying a summary of measured items and trend graph parameters. Users can configure the display content via the option settings menu. The statistics include measured parameters such as Urms and Irms for voltage and current, frequency, unbalance (Uunb, Iunb, Uunb0, Iunb0), total harmonic distortion (THD), flicker (Pst, Plt), and power-related values (P, S, Q, PF).

Displayed statistics for each item include count, the time range of measurement, average value, standard deviation, and percent values. Only the parameters that were measured are shown. Users can toggle between displaying the maximum (MAX), average (AVG), or minimum (MIN) value of each parameter. If the user changes the trend graph display period, they must click the refresh button to update the statistics. Note that the display period cannot be changed directly within the statistics screen.

**\*\*[Page 56]**

Displaying statistics screen\*\*

For data recorded by PQ3198 or PW3198, enabling the option to show the total duration of power factor (PF) events will display both the number of occurrences and total duration of such events in the [Power] tab of the statistics screen. For each channel (CH1, CH2, CH3), individual values are shown alongside the total. If the worst PF value is positive, it is categorized as a LAG-type event. If negative, it is categorized as a LEAD-type event.

**\*\*[Page 57]**

Displaying standards screen\*\*

The [PQ Check (Standards)] tab within the statistics screen allows users to evaluate measurements against defined power quality standards. When this tab is selected, relevant standard limits and thresholds are shown alongside the measured results for comparison.

In EN50160 display mode, analysis is performed based on EN50160 guidelines. The view configuration section includes several components: users can select the standards to apply, such as [EN50160(U ≤ 1kV)], [EN50160(1kV < U ≤ 36kV)], or [Custom]; the total evaluation period, which is identical to the trend graph display period; the nominal voltage (Uref), which if out of range triggers a warning; and the RMS averaging interval, which is expected to be 10 minutes under EN50160. A warning is also displayed if this averaging interval is invalid.

**\*\*[Page 58]**

Displaying standards screen\*\*

Further configuration options include the evaluation statistics period (typically one week under EN50160), the number of periods to display at once (up to four), and a flag to exclude data during flagged events like voltage swell, dip, or interruption. Users can collapse or expand the display of standard values for clarity. The list of evaluation items under EN50160 includes: Power Frequency, Supply Voltage Variations, Flicker, Voltage Unbalance, Harmonic Voltage (THD, 2nd–25th), Supply Voltage Dip/Swell (additional info), and Rapid Voltage Change (used especially in Norway).

**\*\*[Page 59]**

Displaying standards screen\*\*

In Custom mode, users can define their own evaluation standards by specifying items, ranges, and thresholds. These settings can be saved or loaded as .std files. In the configuration area, users select the evaluation period (e.g., per day, per week, per month, or for the entire duration), modify custom parameters, and calculate results based on current settings. Additional options allow saving/loading settings and configuring warning messages when the nominal voltage (Uref) or RMS averaging interval is outside acceptable bounds.

Users can also add or remove items to be evaluated. A maximum of 20 items can be selected, and each item may appear up to twice. Parameters can be evaluated using user-defined threshold ranges.

**\*\*[Page 60]**

Displaying standards screen\*\*

In Custom mode, selectable evaluation items include a wide array of power quality parameters, such as: Power Frequency, Supply Voltage Variations, Rapid Voltage Change, Flicker, Voltage Unbalance, Harmonic Voltage (2nd–25th and 26th–50th), Interharmonic Voltage (0.5th–24.5th and 25.5th–49.5th), Supply Voltage Dip/Swell, Current RMS, Current Unbalance, Harmonic Current (2nd–25th and 26th–50th), Interharmonic Current (0.5th–24.5th and 25.5th–49.5th), High Frequency Harmonic Voltage/Current, Power (sum or individual), and Power Factor (sum or individual). These items can be selected for detailed analysis in accordance with custom rules.

**\*\*[Page 61]**

[ GB Standards ] tab\*\*

The [GB Standards] tab evaluates data according to China's Guobiao (GB) standards. This tab is visible only when the corresponding option is enabled. The configuration menu allows users to set measurement header information and measurement status that will be included in the report. When the "Display both" harmonics option is selected, both harmonics and interharmonics are shown, including both level and content data.

If "Custom" is enabled, users can set nominal voltage, reference short-circuit capacity, thresholds, and results freely. These settings can be saved or loaded using .limit files. Display can be collapsed or expanded, and the evaluation result section shows maximum, average, and minimum values based on the displayed parameters.

Additional metrics include percent value, threshold, result, and passing rate. The result field compares the measured passing rate to the expected target. The passing rate shows how much of the measured data falls within the defined threshold. For example, if the threshold is 95%, the tool checks whether the average value complies with that margin.

**\*\*[Page 62]**

[ GB Standards ] tab\*\*

The voltage deviation value is calculated using the formula:  
**Voltage deviation (%) = (Urms − Uref) ÷ Uref × 100%**,  
where Urms is the measured RMS voltage and Uref is the nominal voltage.

If the voltage deviation is positive, it is treated as an upper-limit deviation; if negative, it is treated as a lower-limit deviation. The judgment result is based on the greater absolute value between the two. A visual example on this page demonstrates how voltage deviation is evaluated and presented based on the difference between measured and nominal values.

**[Page 63]**

Displaying measurement data settings\*\*

In PQ ONE, users can view the configuration details of a recorded measurement by clicking the status icon to open the [Status] window. This screen provides a full overview of the settings used when the data was collected. Depending on the analyzer model, different tabs are shown. For PQ3100, only [Measure] and [Event] tabs appear, while PW3198 and PQ3198 also include [Voltage], [Current / Power / Other], and [Harmonics] tabs. Within each tab, information such as the wiring method, voltage and current range, sampling interval, and filter settings is displayed. This feature enables users to clearly verify the conditions under which measurements were taken, which is especially helpful for reviewing setup consistency or diagnosing unexpected data trends.

**\*\*[Page 64]**

Screen copy\*\*

PQ ONE allows users to copy the visual contents of any currently displayed screen, including trend graphs and event data views. This is done by right-clicking on the graph area and selecting the [Screen copy] option from the context menu. The image is copied to the clipboard and can then be pasted into Word documents or emails. In addition to graphical screen captures, PQ ONE also provides the ability to copy text-based data from lists, such as event harmonics or statistical summaries, using the [List copy] option. This text output can be pasted as plain text into other applications, making it easy to share or document measured results.

**\*\*[Page 65]**

Setting options\*\*

By clicking the options icon, users can access the [Option] window, where various display and behavior settings can be customized. In the [Δ⇔Y/PF/THD] tab, users can configure how certain measurements appear in the trend graph. For example, voltage values labeled “Urms” can be displayed as line-to-neutral or line-to-line depending on the wiring configuration. Power factor values can be shown either as PF or as DPF (displacement power factor), though only one of these can be selected at a time. For harmonic distortion, users can choose between THD-F and THD-R views. Total Demand Distortion (TDD) can also be enabled and is calculated based on IEEE519 standards, using a formula that involves THD-F and first-order harmonic current. These display settings affect only the trend graph and do not influence any judgment thresholds or internal computations.

**[Page 66]**

Display tab\*\*

The [Display] tab in the Option window lets users choose the user interface language from a list that includes Japanese, English, Simplified and Traditional Chinese, Korean, German, French, Italian, Spanish, and Turkish. When set to “Auto,” the software attempts to match the language with the Windows system language, defaulting to English if the selected language is unavailable. This tab also provides checkboxes to control visual elements such as whether milliseconds are shown in trend graphs, whether timestamps in exported CSV files include milliseconds, and whether event markers should be shown on trend graphs. Additionally, users can choose to connect waveform graphs for continuous events, which makes it easier to visually track changes during extended or repeated conditions.

**\*\*[Page 67]**

Display unit settings\*\*

Additional controls in the [Display] tab allow users to enable OVER range background shading, choose whether the title bar shows the full file path or only the data file name, and select between a 3-channel or 4-channel layout for harmonics list displays. In the [Display Unit] tab, users can define how units and decimal places are handled throughout the software. They can apply “Auto” mode, which sets units and precision dynamically, or manually configure specific settings for voltage, current, frequency, power, and other values. These choices affect not only what is seen in the user interface but also how values appear in reports, exported CSV files, trend graphs, transient graphs, and high-order harmonic graphs. However, logarithmic graphs are not influenced by these unit settings.

**\*\*[Page 68]**

Statistics and PQ Check options\*\*

Within the [Statistics] tab, users can enable or disable features such as displaying total duration of power factor events, useful for PW3198 and PQ3198 analyzers. They can also specify which percentiles to use when viewing statistical distributions—for example, 5th, 50th, and 95th percentiles—and whether to synchronize the statistics period with the current trend graph. There is also an option to enable the [GB Standard] tab if applicable. The [PQ Check] tab allows configuration of automatic data evaluations. When PQ Check is used, results are saved in a file named pqone.dat within the data folder. If this file cannot be created due to write restrictions, the PQ Check will not run. Users can choose whether PQ Check should run automatically when data is loaded or added to the data list.

**\*\*[Page 69]**

Other settings and restoring defaults\*\*

In addition to automatic execution settings, users can specify whether PQ Check should be canceled altogether if its history file cannot be generated. The [Other] tab includes an option to disable caching behavior. By default, PQ ONE creates temporary cache files to speed up trend graph rendering, but enabling this option will prevent cache files from being saved or retained. Finally, at the bottom of the [Option] window is the [Restore Defaults] button, which resets all option tabs to their factory settings. Language preferences, however, only take effect after restarting PQ ONE.

**\*\*[Page 70]**

Creating reports\*\*

Users can generate Word-format reports summarizing PQ ONE measurement data by clicking the report icon. This opens the [Report Settings] dialog, where users specify the contents of the report and its format. They can choose whether to include repeated event data or only the first occurrence, and the report will only contain the data visible within the current trend graph period. The measurement period itself must be adjusted from the main screen, not within the report dialog. The generated document includes content from selected tabs, event lists, and the event statistics graph, all depending on the user’s configuration of display parameters.

**[Page 71]**

Selecting the graph format\*\*

In the report settings, users can choose how graphs are formatted in the output. The [Integrated] layout groups data from each tab into a combined graph, aligning all parameters along a shared X-axis. For example, all voltage and current trend lines are shown in one unified chart, followed by waveform graphs that represent all detected events together. This layout results in more compact reports and makes it easier to see parameter interactions. Sample images in the manual show what such integrated graphs look like in the final report.

**\*\*[Page 72]**

Using divided graph format\*\*

Alternatively, users can choose the [Divided] format, where each parameter is output in a separate chart. Instead of grouping data by tab, each measurement—such as Urms, Irms, Pst, or THD—is shown in its own trend graph. Similarly, waveform graphs for each event are displayed separately. This format is ideal for analyzing parameters individually and is helpful when detailed documentation is required. Example illustrations in the manual show how divided graphs occupy more space but provide clearer focus on each specific metric.

**\*\*[Page 73]**

Example report\*\*

A sample report is shown with the following contents: voltage and current trends, harmonic peak levels, an event list, event waveform graphs, and trend data associated with specific events. The report begins with a cover page and includes a table of contents that mirrors the structure of the PQ ONE instruction manual. Sections include system introduction, copyright and terms of use, software setup, data analysis functions, report generation, CSV export procedures, and format conversion. The document also covers how to view event lists, store data as PQDIF files, open PQDIF files, check system specifications, and more. This structured format ensures that the final report is both technically comprehensive and easy to navigate.

**[Page 74]**

Creating reports of statistics / standards\*\*

Within the statistics screen of PQ ONE, users can also generate reports that summarize either statistical data or evaluations against power quality standards. By clicking the report icon while viewing the statistics screen, a dialog box appears allowing users to configure the report settings. The report includes the contents of any tab currently selected or checked within the screen. This makes it easy to produce Word-formatted summaries that incorporate parameters such as voltage levels, THD, flicker, and the outcome of PQ standard evaluations such as EN50160. Users can quickly compile this data into documents for documentation or sharing with clients or teams.

**\*\*[Page 75]**

Example report\*\*

An example report generated from the statistics and standards screen shows multiple sections clearly labeled and structured. These include voltage statistics, U-THD statistics, flicker statistics, and PQ Check results under standards compliance. The report opens with a cover sheet and presents each of these datasets in tables or graphs depending on the nature of the information. As with other PQ ONE reports, layout quality may vary slightly when opened in non-Microsoft Word environments due to format compatibility issues.

**\*\*[Page 76]**

Converting measurement data to CSV format\*\*

PQ ONE allows users to convert binary measurement data into CSV format for use in spreadsheet applications like Excel. Users begin by clicking the export icon and selecting the specific type of data they wish to convert. For trend data, the [Export CSV file – Trend Graph] interface lets users configure which parameters to include. Other export options include displayed event waveforms, all event waveforms, displayed DMM values, and the DMM values of all events listed. The report period used during export is determined by the [Period] setting in the main interface and must be adjusted there prior to exporting. Users can choose to export only currently displayed parameters or include all available items, regardless of whether they are visible on screen.

**\*\*[Page 77]**

Exporting from independent views\*\*

Users can also export data directly from specialized displays, such as event trend data, transient waveform, or high-order harmonics, by clicking the export icon located in those specific windows. Each display supports CSV output for its own data type. The exported CSV file includes timestamps formatted as follows: the date is shown in YYYY/MM/DD format, and time is displayed as hh:mm:ss.000, including millisecond precision. This consistent timestamp format allows seamless alignment of PQ ONE data with external systems or tools.

**\*\*[Page 78]**

Displaying data list\*\*

PQ ONE includes a data list screen where users can manage, preview, and compare measurement datasets. This screen can be accessed as explained in section 3.1. The list displays the folder name, number of recorded events, and the worst value detected during measurement. Users can toggle between showing the number of events or the worst value, depending on their analysis needs. A [Check] button allows users to select entries for generating quick reports or for removal. If event statistics are not available in the folder, "N/A" will appear in the list. The screen also includes controls to open the data folder in the system file browser, generate quick reports, delete selected entries, clear the entire list, and load the selected dataset into the main window. At the bottom, a PQ Check result area displays the evaluation status based on selected standards. Buttons for stopping or resuming PQ Check processing are also included.

**\*\*[Page 79]**

Execute the PQ Check\*\*

By clicking the PQ Check start button, users can analyze the selected datasets in the list against the specified standard conditions. These settings may be pre-defined templates such as EN50160 or user-defined rules loaded from a .std file. The PQ Check engine reviews each parameter and compiles a summary of results, identifying whether the dataset meets the criteria. Each evaluation returns a result of PASSED, FAILED, N/A, or CHECK. "PASSED" means all items complied; "FAILED" indicates at least one item was non-compliant; "N/A" means the data was unavailable or excluded; and "CHECK" flags cases where special conditions occurred, such as event types not supported or voltage reference (Uref) values falling outside acceptable limits. The results are grouped and displayed per evaluation period, for instance, weekly for EN50160 evaluations.

**\*\*[Page 80]**

Create the quick report\*\*

In addition to formal report generation, PQ ONE allows users to create quick reports from selected items in the data list. These quick reports are output in Microsoft Word format and are especially useful for previewing trends, reviewing repeated measurements, or conducting fast multi-record comparisons. After selecting the desired datasets, users open the [Report Settings] dialog and choose the trend items and graph format. The quick report focuses on essential information and omits extended formatting, offering a lightweight way to review multiple files at once. For more in-depth analysis, users are advised to use the full report generation feature discussed earlier.

**[Page 81]**

Saving the quick report\*\*

After configuring report contents, users finalize the quick report by clicking the generate button and choosing a filename in the “Save As” dialog. The report is then created and saved as a .docx file. An example of a quick report created from five datasets is shown, each containing U/I (voltage and current) data. Again, layout compatibility is optimized for Microsoft Word, and display irregularities may occur in third-party word processors. Quick reports serve as efficient summaries that are especially helpful during routine inspections or when rapidly reviewing logs from multiple devices.

**\*\*[Page 82]**

Storing Measurement Data in a PQDIF file\*\*

Measurement data recorded by PQ ONE can be exported in PQDIF format, which carries the .PQD file extension. PQDIF (Power Quality Data Interchange Format) is a standardized data exchange format defined by IEEE 1159.3 and is supported by various compatible applications. To save a PQDIF file, users select [Save as PQDIF format] from the menu. A dialog box opens, and its contents vary depending on the displayed data type. Users can then check the items they wish to include, such as trend data, integral power (Wh), harmonics, interharmonics, event data, transient waveforms, high-order harmonics, flicker, or WDU (voltage fluctuation). Once confirmed, the software saves the selected data into a single compressed PQDIF file. Any invalid or missing values are stored as zeroes ("0.0") by default.

**\*\*[Page 83]**

Open a PQDIF file\*\*

To view existing PQDIF files in PQ ONE, users can select [Open PQDIF File] from the menu. After selecting a file with a .pqd extension and clicking [Open], PQ ONE loads the contents into its viewer. The Status display also extracts part of the PQDIF header and shows it, allowing users to confirm key file information before analysis. This feature ensures that users can work with externally generated data or historical files, provided they conform to the PQDIF standard.

**\*\*[Page 84]**

Specifications\*\*

PQ ONE supports a range of analyzers, including the PQ3100, PW3198, and PQ3198 models. It is compatible with Windows 10 (both 32-bit and 64-bit) and Windows 11, as long as the most recent service pack as of August 1, 2023 is installed. The Microsoft .NET Framework 4.5.2 or later must be present on the system, and non-English systems require the corresponding language pack. The minimum supported screen resolution is 1024 by 768 pixels. PQ ONE is available either on a CD or as a download from the HIOKI website.

The application supports loading both native binary files and PQDIF files, up to a maximum file size of 8 GB. Its layout consists of four main windows: the event statistics graph, the event list, the trend graph, and the event data viewer. The event statistics graph shows the count of events over time, with X-axis options for date or hour. The event list provides timestamps, durations, and worst-case values. The trend graph displays measurements for selected parameters, while the event data viewer shows waveforms, harmonics, and power readings for selected events. ITIC and user-defined curves can also be plotted for specific event types such as swells, dips, interruptions, and transients. Reports are saved in Word format and include all selected content and settings.

**\*\*[Page 85]**

Specifications (continued)\*\*

PQ ONE also supports conversion of data to CSV format across various views, including trend graphs, waveform windows, event trends, DMM values, transients, high-order harmonics, and the standards/statistics screen. Exported CSV files can include either just the visible data or all available data. Screenshots can also be copied directly to the clipboard using the copy function, allowing users to paste images into documents or presentations. This combination of data export and reporting capabilities makes PQ ONE a comprehensive tool for power quality data analysis and documentation.

**[Page 86]**

Appendix 1: Header Information of CSV Format\*\*

The CSV export function in PQ ONE includes a wide variety of headers depending on the type of measurement. For trend data other than flicker, the exported file includes timestamps with date and time, along with corresponding measurement values. The recorded parameters range from voltage and current RMS updated every half cycle to inrush current, waveform peaks, DC values, crest factors, frequency, power, harmonics, energy, unbalance, flicker, and more. The headers also reflect the measurement type, such as Urms for voltage RMS or Ucf for voltage crest factor, and include suffixes like AVG, MAX, or MIN to indicate average, maximum, or minimum values. For harmonics, each order is labeled by number and includes not only amplitude but also phase angles. Similarly, unbalance is recorded as Uunb, Iunb, and their zero-phase components. Flicker data includes short-term (Pst), long-term (Plt), and ΔV10 flicker indicators. Energy and demand data include total consumption, power factors, and cost indicators. Each header shown in the CSV matches the labeling used in PQ ONE’s on-screen legends, with placeholders like [c] used for channels and [k] for harmonic order.

**\*\*[Page 87]**

Appendix 1: Header Information of CSV Format (continued)\*\*

For flicker-specific CSV exports, the headers include both time-based measurements like 1-minute Pst and 2-hour Plt as well as threshold evaluations based on standards. Flags are also present to indicate whether values are affected by disturbances such as voltage dips. For ΔV10 analysis, the file lists flicker voltage fluctuations averaged over different periods such as one minute, one hour maximum, one hour fourth highest, and one hour average. For event waveform exports, each CSV file contains waveform values per channel (Uc or Ic) along with time stamps, event type, IN and OUT timing, and corresponding power quality data such as harmonics, flicker, and vector parameters. Each measurement is aligned with PQ ONE’s naming conventions, and exported waveforms include several hundred data points captured during the event window.

**\*\*[Page 88]**

Appendix 1: Header Information of CSV Format (continued)\*\*

The event waveform CSV files also contain data captured during transient and harmonic disturbances, stored using consistent labels that reflect the displayed values in PQ ONE. Each event includes identifiers such as the event number, time of occurrence, worst value, and whether the measurement exceeded a threshold. Users analyzing these files externally can match the event information with trend graphs or ITIC curve plots within the software. Each CSV export is organized by fixed column structures, enabling automated parsing and external integration with other analysis software or compliance reporting tools.

**\*\*[Page 89]**

Status Information (PQ3100)\*\*

In PQ ONE, each data record includes status information stored in hexadecimal format, which reflects the state of measurement conditions and abnormalities during acquisition. For PQ3100, two separate 32-bit hexadecimal values are used as Status Information 1 and Status Information 2. These values include bit flags that indicate whether synchronization was lost, if the voltage or current exceeded allowable ranges, whether crest factor limits were surpassed, or if the waveform contained interruptions. Each bit in the 32-bit structure represents a specific condition, and users can decode the values by converting hexadecimal to binary. For example, one bit might indicate that voltage channel CH1 is out of range, while another might show that current channel CH4 is unsynchronized. This binary decoding allows power quality engineers to reconstruct the internal state of the device during recording without opening the visual software.

**\*\*[Page 90]**

Status Information (PW3198 / PQ3198)\*\*

For the PW3198 and PQ3198 analyzers, the same status encoding method applies, but the bit definitions differ slightly due to expanded functionality. Bits in Status Information 1 and 2 reflect additional flags such as harmonic measurement status, zero adjustment status, and whether voltage or current sensors were connected properly. Additional bits may also indicate measurement errors during flicker or harmonics evaluation, or reflect user-defined scaling and averaging settings. Just like with the PQ3100, these hexadecimal values must be manually decoded into binary for interpretation. While most users rely on PQ ONE’s built-in displays to assess status, the hexadecimal flags offer a machine-readable alternative for automated validation or regulatory reporting.

**\*\*[Page 91]**

Status Information and PQ Check Judgement Logic\*\*

The appendix explains that status flags affect certain parts of trend data interpretation, particularly during PQ Check evaluations or CSV export. If a data point is flagged as invalid or out of range, it may be excluded from statistical calculations or standard compliance checks. For PQ Check, each evaluation item references specific trend parameters—such as Urms for supply voltage variation or Freq10 for power frequency—and compares them against defined thresholds. The system counts how many values exceed the range and what percentage of data remains within compliance. If the voltage deviation or frequency fluctuation occurs too often, the evaluation may be marked as FAIL. If the data is unavailable, the system marks it as N/A. These logic rules are summarized and tied directly to trend graph items for transparency.

**\*\*[Page 92]**

Appendix 2: Standard Items\*\*

Each item listed in the PQ Check function corresponds to a specific trend graph parameter and is judged using a defined rule. For example, power frequency is evaluated based on the percentage of 10-second average values (Freq10) that fall outside the specified tolerance. Supply voltage variation is judged by checking whether Urms remains within an acceptable range across the selected period. Voltage flicker items such as Pst and Plt are evaluated by comparing measured values against limits like 1.0 or 0.8 depending on the standard. Harmonic distortion is assessed using THD, harmonic levels by order, or phase angles. Interharmonics, voltage unbalance, current unbalance, power factors, and total energy are also evaluated using custom rules. Some items like rapid voltage change or voltage dips are judged by counting the number of violations. The appendix confirms that each item used for standard evaluation matches the parameter names shown in the trend graphs, which allows users to connect PQ Check results with visual graphs and exported CSV data.

**\*\*[Page 93]**

Appendix 2: Standard Items (continued)\*\*

In addition to standard items, users can define custom rules using item names identical to those displayed in PQ ONE, including optional suffixes like AVG, MAX, or MIN. This ensures that even user-defined standards are applied consistently across different datasets. The appendix concludes by emphasizing that understanding the parameter naming conventions and the judgment logic for each standard item is essential for correctly interpreting PQ Check results. Whether users are analyzing voltage sags, harmonic pollution, or power factor trends, the combination of trend data, status flags, and standard rule mappings provides a comprehensive evaluation framework within PQ ONE.