

# PQube® Report Writer 3.8.0

User's Guide



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# 1. Introduction to the PQube® Report Writer

• Create Standard-based and Custom Power Quality Reports.

The PQube® Report Writer is a powerful tool that automates writing complete, ready-to-present Microsoft Word® reports based on the data and analysis generated from the Powerside PQube. The report organizes and formats the data collected and provides comparisons to international standards such as EN50160<sup>1</sup> documenting compliance. In addition to the library of standard reports, Report Writer can create custom reports based on user-selected thresholds, limits, coverage, etc. Report customization is made easy and repeatable using information captured in the main Report Writer window and inserted in the report, including photographs, as appropriate. Each report is complete and ready for delivery.

# 2. Available Report Types

• Standards-based reports, including EN50160

The PQube® Report Writer comes with a library of international standards, including all six versions of EN50160. Choose a standard in the main Report Writer window to create a report based on that standard.

• Custom Reports, such as IEC 61000-3-2

Create custom reports and add new standards to the library. Simply select NEW and create a report based on your unique criteria. Use this new standard for future reports. Note that any custom standards report must manually copied to the PQube Report Writer Standards folder with the installation of a new version of the Report Writer program.

• Energy, Harmonics, and PQube Trends

Focused (limited) reports are available for energy usage, power readings or harmonic compliance.



# 3. Installing the Report Writer program

• System Requirements

To install the PQube® Report Writer program, you will need the following:

- Microsoft® Word 2007 or later. Open Office version of Word will not work.
- At least 1 GB of free RAM.
- ADMIN privileges if installing in the C:\Program Files directory.
- Installing the Report Writer program

It is a compressed (zipped) file so you will first need to extract (unzip) it to run the executable. A file called "Install PQube Report Writer.exe" will be created. Double click on this to install the program. You will get the PQube® Report Writer Setup screen.





PQube Report	: Writer 3.8.0.0		2436		×
Select Language	[English] t	PQube Report Writer (Requires Microsoft® Word® 2007 or later)			
Add company: Company: Name: Email: Address 1: Address 2: Address 3: Phone number:	y logo Power Standards Lab. John Smith 980 Atlantic Ave Alameda, CA 510 522 4400	Create Report  1. [EN50160 LV Synchronous Connection [Recommended]  2. Locate PQube data	View	Threshold	ls
Fax number: Website: Customer Inform Company: Name: Job title:	www.powerstandards.com ation Sample Customer George Sample				
Email: Address 1: Address 2: Address 3: Phone number: Website:	I23 Sample Drive Alameda, California 94501 USA www.Sample.com				
Add customer	photos				

PQube Report Writer is now ready for use.

### 4. Using Report Writer

You must have Microsoft® Word® 2007 or later

The PQube® Report Writer Program generates reports in Microsoft® Word®. To use this program, you *must* have Microsoft Word 2007 or later. Note that Open Office version of Word will not work.

Configuring your PQube's Setup.ini for an EN50160 report

To include EN50160 requirements such as harmonics, flicker, voltage unbalance, voltage THD, 10sec frequency in your EN50160 report, it is important to properly configure your PQube's Setup.ini parameters *prior* to measuring and recording data. Below are the parameters which need to be enabled in your Setup.ini file.

PQube 3: Record voltage unbalance, Record 10 second frequency, Record 10 min harmonics and parameter, Record Flicker, Record THD, Record TDD. Note that if "Record 10 second frequency" is enabled in your PQube 3's Setup.ini, only averages for frequency will be reported.
PQube Classic: Trend Harmonics (10 or 15 min. intervals), Voltage THD, Voltage Unbalance, Flicker



Or click on the "EN50160 Settings" button in your PQube Configurator program and it will automatically enable these settings for you.

**Very important.** Use either a comma (,) or semicolon (;) as your CSV separator for the PQube trends output formatting in the Setup.ini file (default is set to comma). *Do not use [tab]*. The Report Writer program does not recognize the use of the [tab] separator and will generate an error message.

• PQube-recorded data

To create a report, import the recordings from your PQube. We recommend that you copy ALL the data from your PQube to your computer. Or simply generate your report directly from your USB Drive or SD card! If you don't have physical access to the PQube, you can download the files via FTP. The Report Writer program uses the Daily/Weekly/Monthly Trends data which can be found in the \<year>\<month>\<day> folders. When downloading the files remotely to your computer, it is important to maintain the same file directory structure found on your PQube.

#### Company Information

Enter information about your company in the main Report Writer window. The PQube® Report Writer uses this information to prepare a Microsoft® Word® report that is correctly formatted with your company as the preparer of the report. The PQube® Report Writer automatically remembers all your company's data, so you only need to enter it once.

Company's Logo

If you want your company's logo to appear on every report, click on **Add Company Logo** and select a file that contains a picture of your logo in JPG, PNG, or GIF format. Don't worry about the size of the picture—the PQube® Report Writer will automatically resize it to fit.

Company's Contact information

Fill in your company's contact information. The PQube® Report Writer will automatically put it in the correct locations in your report.

Company's Website

Add your company's website. It will appear on every page of the report. Your customer will know exactly who prepared the report!

Customer Information

Enter information about your customer right below your company's information. This information will change based on the specific customer for whom the report was generated. Click the **Save Customer Information** button to save the customer information for future use.

Once a customer profile has been saved, this customer's information will be automatically available on the customer drop-down list.



To enter a new customer, choose **New** from the Customer drop-down list, choose a new name for this customer, and enter the data for this customer.

Customer name, address and website

The PQube® Report Writer will automatically insert the customer's name, address and website at the correct locations in your report.

Customer photographs

Photographs can also be imported into Report Writer. Click on **Add customer photos** to add photos and captions for the photos.

The photo files can be multiple formats with JPG being standard. The photos must be in the correct orientation—the PQube® Report Writer will not rotate them. Report Writer will automatically resize the photos to fit the report.

• Standards-Based Reports

The PQube® Report Writer prepares a report based on your PQube's recorded data and the requirements of an international standard or your custom limits/threshold settings. Choose a standard from the drop-down list on the right side of the Report Writer window.

Custom Reports

Create custom reports based on new standards or your unique requirements. From the Standard dropdown list, choose **New**, and name the new standard. Thresholds, comments, and all the parameters of the new standard can now be edited and saved for future use.

• Standard Reports English, French or German

PQube® Report Writer comes ready to write reports in English, French and German.

Other Languages

Add any language is as easy as updating a text file. Copy and rename a text file (in the "Languages" folder) and translate the phrases in the text file. The new language will be available in the Languages menu of your PQube® Report Writer.



### 5. Write the report

Once the data has been loaded and prepared, click on the Create Report button, and the PQube® Report Writer will automatically launch Microsoft® Word® and start writing the report!

	PQube Report	t Writer 3.8.0.0								1	5.	×
	Select Language	(Eng	lish]									
		t		P( (R	Qube Repo equires Microso	<b>rt Wri</b> ft® Wo	<b>ter</b> rd® 2007 or later	)		mm	2	
	Add compa	ny logo	<b>↑</b> ⊷	Cr	eate Report						e	-
	Company:	Power Standards	Lab	1.	EN50160 LV 5	Synchro	onous Connectio	n [Rec	commended]	•	/iew Thre	esholds
	Name:	John Smith		2.	Locate PQ	ube da	ta					
	Email:						SD card,	USB	or computer	_		
	Address 1:	980 Atlantic Ave		3.	C Daily		C Weekly	(	C Monthly	<ul> <li>Date</li> </ul>	e Range	
	Address 2:	Alameda, CA			5/31/2020	-		-	2020-05 -	From	5/30/2	020 -
	Address 3:							,		to	E/21/2	020 -
	Phone number:	510 522 4400								LO	15/31/2	020 1
	Fax number:				D	10				-		
	Website:	www.powerstand	ards.com		Prepare		Date Rang	je	Trends covera	age ()	larmonik	s coverage
	Customer Inform	nation	_/		1		5/30/2020	j	100.0%		10	.0%
	Company	Samela Customer	-	5	Site Inform	nation						-
	Nomo:	Sample Customer	<u> </u>		Poube ID:				PQube 3 - Powe	er Quality	& Power	Flow
	Joh title:	George Sample			Location:				PSL - Alameda,	California		
	Email:	1			Fower Con	figura	tion:		Wye/Star			
	Address 1:	123 Sample Driv			Nominal Vo	oltage:			277V			
	Address 2:	Alameda, Califo ni	ia 94501 USA		Nominal Fre	equen	cy: chor:		60Hz 03004210			
	Address 3:			Ш.,	Firmware r	evision			3.7.9.20.02.1	1		
	Phone number:				124		1					
	Website:	www.Sam le.com	1	0	Other ins	strumer	nts used					
	Add custome	rphotos		1	Crea	te Re	port					
		Save Cus	stomer Information				K.					
	C:\Users\jma\Des	top\_Juliana\Repo	ortWriter\P3004210	ata	ServiceEntran	ce\P30	004210\2020\M	onth_	_05			
		1										
e an EN50160 s	tandard or create yo	our own!	Click Prepare	to ca	alculate		Click Crea	te Re	port to start			
n customize yo	our report by clicking	g on the	vour Trends a	and H	armonics		uniting the				Choos	e Daily, W
esholds butto	n. Note that you can	only View	covorago for		roport		writing the	repo	DIT IN MIS		Month	ly or Date
Ide for ENEON	FO reports	-	coverage for	your	iepoit.		Word.				forvo	ır renort

# 6. How to choose a pre-defined standard

Thresholds for EN50160 reports.

Choose an EN50160 standard •

> There are six versions of the EN50160 standard built into the Report Writer program: Low Voltage, Medium Voltage, High Voltage, and, each in a-Synchronous Connection (interconnected grid i.e., European grid, western U.S. grid, etc.)

-Non-synchronous Connection mode (islanded grid i.e., Azores Islands, Hawaii, Puerto Rico grid, etc.). You have the option of excluding or including flagged data<sup>2</sup> in your EN50160 report by clicking on the "View Thresholds..." button.



Exclude flagged data	This is the default setting. Dips, swells, interruptions will be "flagged,"
	excluded in the report and not calculated in the measurement period.
	However, if there was a continuous event and 100% of your data are flagged
	or your frequency was flagged more than 20% of the measurement period,
	the result will be INCOMPLETE.
Exclude flagged data	Dips, swells, interruptions will NOT be "flagged" and included in the report. By
Exclude flagged data	Dips, swells, interruptions will NOT be "flagged" and included in the report. By doing so, your results may yield as FAILED if the flagged data measurements
Exclude flagged data	Dips, swells, interruptions will NOT be "flagged" and included in the report. By doing so, your results may yield as FAILED if the flagged data measurements fall outside of the EN50160 limits and thresholds for frequency, voltage,
Exclude flagged data	Dips, swells, interruptions will NOT be "flagged" and included in the report. By doing so, your results may yield as FAILED if the flagged data measurements fall outside of the EN50160 limits and thresholds for frequency, voltage, flicker, unbalance, THD.

<sup>2</sup>Flagged data is defined as IEC 61000-4-30 events such as voltage sags, swells, interruptions.

The description of the EN50160 standard is based on the characteristics of voltage at a network user's supply terminals: Limits and Values

- EN50160 LV Synchronous Connection Low Voltage Systems (<1 kV) limits</li>
- EN50160 LV Non-Synchronous Connection (Island) Low Voltage Systems (<1 kV) limits</li>
- EN50160 MV Synchronous Connection Medium Voltage Systems (1 kV — 36 kV) limits
- EN50160 MV Non-Synchronous Connection (Island) Medium Voltage Systems (1 kV — 36 kV) limits
- EN50160 HV Synchronous Connection High-Voltage Systems (36 kV — 150 kV) limits
- EN50160 HV Non-Synchronous Connection (Island)
   High-Voltage Systems (36 kV 150 kV) limits

Click on the drop-down list to select from one of the EN50160 standards.

Thresholds, limits, parameters are pre-defined and cannot be edited (grayed out). To view the thresholds, click on the **View Thresholds** button.



	[English]					
Author of Repor	nt ny logo 🛛 🌴 🚋	P( (Re	Qube Report Writer aquires Microsoft® Word® 2007 or later) eate Report			J
Company: Name: Email: Address 1: Address 2: Address 3: Phone number: Fax number: Website: <b>Customer Infom</b> Company: Name: Job title:	Power Standards Lab. John Smith 980 Atlantic Ave Alameda. CA 510 522 4400 www.powerstandards.com Ation Sample Customer	1. 2.	EN50160 LV Synchronous Connection [Recommended] EN50160 LV Synchronous Connection [Recommended] EN50160 MV Synchronous Connection EN50160 MV Non-Synchronous Connection EN50160 HV Synchronous Connection EN50160 HV Synchro	▼ ~	View T	hresholds

The first screen that appears is your "General" settings for the **EN50160 standard**. Here you'll select what parameters are included in your report. To get more details, click on each tab to display the EN50160 defined limits and thresholds for each individual parameter. Note that the limits and thresholds are pre-defined per EN50160 standards and cannot be edited.

You have the option to EXCLUDE or INCLUDE flagged data<sup>2</sup> in your report.

- Exclude flagged data may lower the coverage and result in INCOMPLETE. Check the box.
- Include flagged data may result in FAILED when there are many events. Uncheck the box.

# 7. Choose a non-EN50160 standard

In addition to EN50160 compliance report, the PQube® Report Writer program comes preloaded with other types of reports to help you understand and analyze your power.



Title:	EN50160		🔽 Ex	clude flagge	d data	^
Coverage:	80					
Description of Standard:	Characteristics of Vo	oltage at a Network U	ser's Supply Ter	minals: Limits	and Values	<u> </u>
Note 1:	Low Voltage System	ns (< 1 kV) limits were i	used.			
Note 2	Flagged data was e	xcluded from this repo	t.			
lote 3:						
Vote 4:						
Dual voltage mode						
onow graphs perioay 1						
	Include in Report	Use Thresholds	Min Av	g Max	Graph	
Frequency	<u>I</u>	12		Г	R	
/oltage RMS	<u>Iv</u>	17			N	
/oltage N-E RMS		Г	ГГ		Г	
Main Currents	Г	Г	ГГ		Г	
Neutral Current	Г	Г	ГГ	Г	Г	
Ground Current	Г	Г	ГГ	Г	Г	
6 Current	Г	Г	ГГ	- Γ	Г	
17 Current	Г	Г	ГГ		Г	
8 Current	Г	Г	ГГ	Г	Г	
9 Gurrent	Г	Г	ГГ	Г	Г	
10 Current	Г	Г	ГГ	Г	Г	
I11 Current	Г	Г	ГГ	Г	Г	
112 Current	Г	Г	ГГ	Г	Г	
13 Current	Г	Г	ГГ	Ē	Г	
114 Current	Ē		ГГ	Г	Г	
Ricker Pst	Ē	Г	ГГ		Г	
Ricker Pit	V	R		Г	V	
Voltage Unhalance		12		Ē	R	
Supert Unbalance	Г.		ГГ	- F	Г	
MITE also and		<b>_</b>		- F		
	-	-		-	-	¥

EN50160 reports which have fixed pre-defined parameters and limits, you can choose which parameters to include/exclude in your report and whether to use thresholds by clicking on the "Edit Thresholds..." button. Graphs are optional.

Use Thresholds	To generate a DATA only report without a PASS/FAIL result, uncheck the
	"Use Thresholds" box for each parameter included in your report.
Use Thresholds	To generate a PASS/FAIL compliance report and customize your limits and
	threshold settings, check the "Use Thresholds" box for each parameter
	included in your report. By default, you will also get min., avg., and max.
	values.



• Energy

This report has preselected parameters for Power and Energy.

• Energy Billing

In this report, you can load account-specific tariff rates, edit an existing tariff, and select a currency.

Note: The power\_energy.CSV files needed for the Energy Billing report are generated in the Daily trends only. Therefore, you can only run the report by selecting "Daily" or "Date range."

fonthly C Date Range
D-05 From 5/30/2020
A DE CONTRACTOR OF A DE CONTRACT

"Record energy metering" must be enabled in your PQube's Setup.ini prior to recording data.

Peak demand interval in minutes:	15	× 0	Current computation			
VAR calculations:	FUN	IDAMENTAL 🗸 🥑	Calculate remaining current channel	OFF	~	0
Record energy metering		0				
Energy metering interval in minutes:	15	Set this tag ON to reco	ord daily power/energy			
KYZ relay in Whiper pulse.		of individual current of	hannels l6 thru l14.			
MV7 raise Which append a shadoot	0	Also required for Ener	gy Billing report in Report Writer.			



# 8. Important information for all Harmonics and IEEE 519 reports

Harmonic recording must be enabled in the PQube's Setup.ini prior to recording data.

Record 10 min harmonics and param. (parameter) = ON (for PQube 3)—CLASS A Compliant

PQube 3 Configurator 3.8.0.3		- 🗆 X
File Help	● PQube 3   ● PQube 3e   ● PQube 3v   ● PQu	be 3r Firmware version 3.8.x 🗸
Global Default Settings EN50160 Settings PQube general info Load(s) definition Reveals AC voltage	Restore Defaults         Power configuration         Power configuration:         Power configuration:         Fixed Sampling (No Mai v)         Nominal phase to phase voltage:         AUTO       V         Nominal phase to neutral voltage:         AUTO       V	Flicker Record Flicker Flicker frequency filter: 60Hz v
Woltage triggering     Woltage triggering     Woltage mode     Oual voltage mode     Oual voltage mode     Ourrents (11-18)     Ourrent triggering (11-18)	Nominal frequency: AUTO VItz V Voltage recordings Record phase to phase channels: AUTO V Record phase to neutral channels: AUTO V	Fix connections errors         Channel L1 from connector:         L1 (17)         Channel L2 from connector:         L2 (18)         Channel L3 from connector:         L3 (19)         Channel N from connector:
<ul> <li>⊕ → ↔ Analog/Digital triggering</li> <li>⊕ → ↔ Envirosensor probe</li> <li>⊕ → ↔ Accelerometer</li> </ul>	Voltage connections Potential transformer ratio: 1:1	
Arelay output     Arelay output     Arelay output     Arelay output     Arelay output     Arelay output     Additional Protocols     Additional Protocols     Arelay output	Advanced Record voltage unbalance Unbalance calculation method: Record 10 second frequency Record 10 min harmonics and param. Record 2-150kHz conducted emissions Rotation convention on vectors screen: COUNTER_CLOCKWISE COUNTER COUNT	Voltage Current

#### Trend Harmonic Interval in Minutes = 10 or 15 (for PQube Classic)-NOT CLASS A Compliant





#### 10 Min Class A CSV

The Report Writer uses the 10-Min Class A.CSV files for all Harmonics and IEEE 519 report. These files are generated as part of the daily trends (not weekly or monthly). However, you can still run a Weekly and Monthly report that will include your harmonics data. To do so, when clicking on "Locate PQube data..." button, select the <year> folder.

Harmonics			Edit Thresholds
Locate PQube da	ata		
C Daily	C Weekly	Monthly	C Date Range
5/31/2020 💌	2020-CW22 <u>-</u>	2020-05	From 5/30/2020
Browse For Fold	ler		× to
Select location	of PQube data		
	P3004210		~
-	P3004210		^

Harmonics

This report includes THD, TDD and all individual harmonic measurements based on user-defined harmonic limits.

IEEE 519 THD\_1.5% High Voltage

IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems. Bus voltage V at PCC (point of common coupling): 161 kV <V.

IEEE 519 THD\_2.5% Medium Voltage

IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems. Bus voltage V at PCC: 69 kV <V ≤ 161 kV

• IEEE519 THD\_5% Low Voltage

IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems. Bus voltage V at PCC: 1 kV <V ≤ 69 kV

IEEE519 THD\_8% Low Voltage

IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems. Bus voltage V at PCC: V ≤ 1 kV



• PQube Trend

This report takes all the parameters and combines it into one convenient report!

• EIFS 2013—LV

Swedish standard: voltage systems (<36 kV) limits

EIFS 2013—MV

Swedish standard: voltage systems (> 36 kV) limits

• IEC 61000-2-2

Electromagnetic compatibility (EMC)

Costa Rica—LV Synchronous Connection

Low Voltage Systems (<1 kV) limits were used

• PRODIST - 1 kV

Baixa tensão (<1 kV) limites usados



# 9. How to create a new standard

Report Writer allows for the creation of a new report. Customization includes everything from defining your own limits, percent coverage, choosing which power parameters to include/exclude in your report and choose whether to "Use Thresholds."

Click on the drop-down list, select NEW, and choose from one of the following options:

- "Create a brand-new report."
- "Create a report from an existing one."

<ul> <li>PQube Report</li> </ul>	t Writer 3.8.0.0		
Select Language	[English]		
Author of Repor	n	PQube Report Writer (Requires Microsoft® Word® 2007 or later)	
Add compar	ny logo 🔷 🏞 🖳	Create Report	
Company: Name: Email: Address 1: Address 2: Address 3: Phone number: Fax number:	Power Standards Lab. John Smith 980 Atlantic Ave Alameda, CA 510 522 4400	1. NEW         2       Locate PQube data         Standard Name       >         Standard:       [Solar Panel Installation]	View Thresholds  Enter a name for your standard
Website: Customer Inform	www.powerstandards.com	Create a brand new report     Create a report from an existing one	Select brand new repo from an existing report
Name: Job title: Email:	George Sample	OK Cancel	1
Address 1: Address 2:	123 Sample Drive Alameda, California 94501 USA		
Address 3: Phone number: Website:	www.Sample.com		
Add customer	photos		
	Save Customer Information		



10. Sample EN50160 Report

# EN50160 Compliance Report PASS

Day 5/31/2020 "Characteristics of Voltage at a Network User's Supply Terminals: Limits and Values"

# PQube 3—Power Quality & Power Flow

Sample Customer

3-phase 4-wire Wye/Star Um=277V/60 Hz



# Summary of Results EN50160 5/31/2020 00:00-5/31/2020 23:59

#### **EN50160 Pass-Fail Requirements Table**

EN50160 Section	Power Quality Parameter	EN50160 Compliance	Remarks
4.2.1	Power Frequency	PASS	
4.2.2	Supply Voltage Variations	PASS	
4.2.3	Flicker Severity	PASS	
4.2.4	Voltage Unbalance	PASS	
4.2.5	Voltage THD	PASS	
4.2.5	Voltage Harmonics	PASS	

# **EN50160 Additional Information Table**

	EN50160 Section	Power Quality Parameter	Remarks
	4.2.6	Voltage Interharmonics	Limits thresholds not set
	4.3.1	Interruptions	
	4.3.2	Dips	
	4.3.3	Swells	
	4.3.6	Rapid Voltage Changes	
	4.3.4	Transient Overvoltages	
	4.3.5	Waveshape Changes	
1	: During 5/31/202	20 measurements were made 100.00% of the time	

Note

Note 2:

Low Voltage Systems (<1 kV) limits were used. Flagged data was excluded from this report. Note 3:



Instrument used: Manufacturer: PQube ID: Location: Serial number: Firmware revision: Report Software: Author of Report: Name:

# **Customer Information**

Name: Company: Address 1: Address 2: Address 3: Phone: Website:

Sample Customer

Powerside

P3004210

3.7.9.20.02.11

PQube 3<sup>®</sup> (www.powerside.com)

PSL— Alameda, California

PQube Report Writer 3.8.0.0

PQube 3—Power Quality & Power Flow

#### Equipment Settings (Event thresholds)

Dips	90.00%
Swells	105%
Interruptions	10.00%
RVC	6%
Transients	300V



# Section 4.2.1: Power Frequency

Nominal Frequency:	<b>60.00Hz</b>
Parameter definition:	Mean value of the fundamental frequency measured over 10 seconds
Limitation:	For systems with a synchronous connection to an interconnected system Measured values based on coverage

Requirement	Measured Frequency	Result
99.5% of day: 59.40Hz ~ 60.60Hz	59.96Hz~60.04Hz	PASS
100% of day: 56.40Hz ~ 62.40Hz	59.96Hz~60.05Hz	PASS





# Section 4.2.2: Supply Voltage Variations

Nominal Voltage L-N: Parameter definition: Limitation: **277.00V L-N** 10 minute mean RMS value of the supply voltage (Avg) For systems with a synchronous connection to an interconnected system Measured values based on coverage

Requirement	Measured L1 Voltage	Measured L2 Voltage	Measured L3 Voltage	Result	
95% of day: 249.3V ~ 304.7V	281.60V ~ 284.66V	280.63V ~ 283.35V	281.76V ~ 284.69V	PASS	
100% of day: 235.45V ~ 304.7V	281.22V ~ 285.19V	280.07V ~ 283.92V	281.26V ~ 285.22V	PASS	





# Section 4.2.3: Flicker Severity

Parameter definition: Limitation: Long term flicker severity Plt (2 hour intervals) (Avg) Under normal operating conditions Measured values based on coverage





# Section 4.2.4: Voltage Unbalance

Parameter definition: Limitation: 10 minute mean RMS values of the negative sequence ratio u2 (Avg) Under normal operating conditions Measured values based on coverage





# Section 4.2.5: Voltage THD

Parameter definition: Limitation: 10 minute mean RMS value of THD. (Avg) Under normal operating conditions Measured values based on coverage

Requirement	Measured L1 THD	Measured L2 THD	Measured L3 THD	Result
95% of day: THD ≤ 8%	1.17% ~ 1.29%	1.06% ~ 1.16%	1.01% ~ 1.19%	PASS





# Section 4.2.5: Voltage Harmonics

Parameter definition: Limitation: 10 minute mean RMS values of each individual harmonic voltage. Under normal operating conditions Measured values based on coverage

			Odd Ha	rmonics							
	Not m	ultiples of 3	3		Mul	tiples of 3			Even	Harmonics	
Orde r h	EN5016 0 limit	95% value	Result	Orde r h	EN5016 0 limit	95% value	Result	Orde r h	EN5016 0 limit	95% value	Result
H5	6.0%	0.608%	PASS	HЗ	5.0%	0.380%	PASS	H2	2.0%	0.008%	PASS
H7	5.0%	1.120%	PASS	H9	1.5%	0.114%	PASS	H4	1.0%	0.058%	PASS
H11	3.5%	0.391%	PASS	H15	0.5%	0.067%	PASS	H6	0.5%	0.052%	PASS
H13	3.0%	0.113%	PASS	H21	0.5%	0.010%	PASS	H8	0.5%	0.038%	PASS
H17	2.0%	0.119%	PASS	H27	None	0.025%		H10	0.5%	0.015%	PASS
H19	1.5%	0.046%	PASS	H33	None	0.015%		H12	0.5%	0.016%	PASS
H23	1.5%	0.024%	PASS	H39	None	0.012%		H14	0.5%	0.018%	PASS
H25	1.5%	0.031%	PASS					H16	0.5%	0.005%	PASS
H29	None	0.028%						H18	0.5%	0.003%	PASS
H31	None	0.016%						H20	0.5%	0.006%	PASS
H35	None	0.012%						H22	0.5%	0.004%	PASS
H37	None	0.017%						H24	0.5%	0.002%	PASS
								H26	None	0.003%	
								H28	None	0.002%	
								H30	None	0.002%	
								H32	None	0.002%	
								H34	None	0.002%	
								H36	None	0.002%	
								H38	None	0.002%	
								H40	None	0.002%	

#### L1-N Harmonics Table

#### L2-N Harmonics Table

			Odd Ha									
	Not m	ultiples of 3	5		Mul	Itiples of 3		Even Harmonics				
Orde r h	EN5016 0 limit	95% value	Result	Orde r h	EN5016 0 limit	95% value	Result	Orde r h	EN5016 0 limit	95% value	Result	
H5	6.0%	0.741%	PASS	H3	5.0%	0.217%	PASS	H2	2.0%	0.017%	PASS	
H7	5.0%	0.837%	PASS	H9	1.5%	0.139%	PASS	H4	1.0%	0.049%	PASS	
H11	3.5%	0.447%	PASS	H15	0.5%	0.100%	PASS	H6	0.5%	0.118%	PASS	
H13	3.0%	0.168%	PASS	H21	0.5%	0.016%	PASS	H8	0.5%	0.042%	PASS	
H17	2.0%	0.109%	PASS	H27	None	0.011%		H10	0.5%	0.013%	PASS	
H19	1.5%	0.037%	PASS	H33	None	0.007%		H12	0.5%	0.031%	PASS	
H23	1.5%	0.021%	PASS	H39	None	0.008%		H14	0.5%	0.021%	PASS	
H25	1.5%	0.022%	PASS					H16	0.5%	0.006%	PASS	
H29	None	0.016%						H18	0.5%	0.005%	PASS	
H31	None	0.004%						H20	0.5%	0.004%	PASS	
H35	None	0.009%						H22	0.5%	0.002%	PASS	
H37	None	0.008%						H24	0.5%	0.002%	PASS	
								H26	None	0.002%		
								H28	None	0.002%		
								H30	None	0.002%		
								H32	None	0.002%		
								H34	None	0.002%		
								H36	None	0.002%		
								H38	None	0.003%		
								H40	None	0.002%		



			Odd Ha	rmonics							
	Not m	ultiples of 3	1		Mul	Itiples of 3			Even	Harmonics	
Orde	EN5016	95%	Rosult	Orde	EN5016	95%	Result	Orde	EN5016	95%	Result
r h	0 limit	value	Result	rh	0 limit	value	Result	rh	0 limit	value	Result
H5	6.0%	0.633%	PASS	НЗ	5.0%	0.234%	PASS	H2	2.0%	0.013%	PASS
H7	5.0%	1.020%	PASS	H9	1.5%	0.118%	PASS	H4	1.0%	0.046%	PASS
H11	3.5%	0.350%	PASS	H15	0.5%	0.044%	PASS	H6	0.5%	0.067%	PASS
H13	3.0%	0.115%	PASS	H21	0.5%	0.009%	PASS	H8	0.5%	0.046%	PASS
H17	2.0%	0.105%	PASS	H27	None	0.010%		H10	0.5%	0.013%	PASS
H19	1.5%	0.062%	PASS	H33	None	0.012%		H12	0.5%	0.017%	PASS
H23	1.5%	0.017%	PASS	H39	None	0.006%		H14	0.5%	0.015%	PASS
H25	1.5%	0.030%	PASS					H16	0.5%	0.005%	PASS
H29	None	0.010%						H18	0.5%	0.003%	PASS
H31	None	0.013%						H20	0.5%	0.005%	PASS
H35	None	0.008%						H22	0.5%	0.002%	PASS
H37	None	0.008%						H24	0.5%	0.002%	PASS
								H26	None	0.002%	
								H28	None	0.002%	
								H30	None	0.002%	
								H32	None	0.002%	
								H34	None	0.001%	
								H36	None	0.002%	
								H38	None	0.002%	
								H40	None	0.002%	

#### L3-N Harmonics Table



# Section 4.2.6: Voltage Interharmonics

Parameter definition:

Limitation:

The level of interharmonics is increasing due to the development of frequency converters and similar control equipment. Levels are under consideration in EN50160, but there are no limits at present.

Measured values based on coverage

	Odd Interharmonics										
	Not mul	tiples of 3			Multip	oles of 3		Even Interharmonics			
Order h	Min value	Average value	Max value	Order h	Min value	Average value	Max value	Order h	Min value	Average value	Max value
IH5	0.004%	0.005%	0.005%	IH3	0.004%	0.005%	0.006%	IH2	0.005%	0.006%	0.006%
IH7	0.004%	0.005%	0.006%	IH9	0.003%	0.003%	0.004%	IH4	0.005%	0.005%	0.006%
IH11	0.005%	0.006%	0.007%	IH15	0.007%	0.008%	0.010%	IH6	0.004%	0.005%	0.006%
IH13	0.009%	0.011%	0.013%	IH21	0.002%	0.002%	0.002%	IH8	0.003%	0.004%	0.005%
IH17	0.003%	0.004%	0.004%					IH10	0.004%	0.005%	0.006%
IH19	0.002%	0.002%	0.002%					IH12	0.007%	0.009%	0.010%
IH23	0.001%	0.002%	0.002%					IH14	0.009%	0.010%	0.013%
IH25	0.001%	0.002%	0.003%					IH16	0.005%	0.006%	0.007%
								IH18	0.003%	0.004%	0.004%
								IH20	0.002%	0.002%	0.003%
								IH22	0.003%	0.006%	0.011%
								IH24	0.002%	0.010%	0.020%

#### L1-N Interharmonics Table

			Odd Interl	harmonics									
Not multiples of 3				Multiples of 3				Even Interharmonics					
Order h	Min value	Average value	Max value	Order h	Min value	Average value	Max value	Order h	Min value	Average value	Max value		
IH5	0.004%	0.005%	0.005%	IH3	0.004%	0.005%	0.006%	IH2	0.005%	0.005%	0.006%		
IH7	0.005%	0.006%	0.006%	IH9	0.003%	0.004%	0.004%	IH4	0.004%	0.005%	0.006%		
IH11	0.005%	0.006%	0.007%	IH15	0.008%	0.009%	0.011%	IH6	0.005%	0.006%	0.007%		
IH13	0.010%	0.012%	0.015%	IH21	0.001%	0.002%	0.002%	IH8	0.004%	0.005%	0.006%		
IH17	0.003%	0.004%	0.004%					IH10	0.005%	0.005%	0.006%		
IH19	0.002%	0.002%	0.002%					IH12	0.008%	0.009%	0.011%		
IH23	0.001%	0.002%	0.003%					IH14	0.010%	0.012%	0.015%		
IH25	0.001%	0.002%	0.003%					IH16	0.005%	0.006%	0.008%		
								IH18	0.003%	0.003%	0.004%		
								IH20	0.002%	0.002%	0.003%		
								IH22	0.003%	0.005%	0.009%		
								IH24	0.002%	0.010%	0.018%		

#### L2-N Interharmonics Table

#### L3-N Interharmonics Table

			Odd Interl	harmonics							
Not multiples of 3			Multiples of 3				Even Interharmonics				
Order h	Min value	Average value	Max value	Order h	Min value	Average value	Max value	Order h	Min value	Average value	Max value
IH5	0.004%	0.005%	0.005%	IH3	0.004%	0.005%	0.006%	IH2	0.005%	0.005%	0.006%
IH7	0.004%	0.005%	0.006%	IH9	0.003%	0.003%	0.004%	IH4	0.004%	0.005%	0.006%
IH11	0.004%	0.005%	0.006%	IH15	0.007%	0.008%	0.010%	IH6	0.005%	0.006%	0.007%
IH13	0.009%	0.011%	0.013%	IH21	0.002%	0.002%	0.002%	IH8	0.004%	0.005%	0.006%
IH17	0.003%	0.003%	0.004%					IH10	0.004%	0.005%	0.006%
IH19	0.002%	0.002%	0.002%					IH12	0.007%	0.008%	0.009%
IH23	0.001%	0.002%	0.002%					IH14	0.009%	0.011%	0.013%
IH25	0.001%	0.002%	0.002%					IH16	0.005%	0.006%	0.007%
								IH18	0.003%	0.003%	0.004%
								IH20	0.002%	0.002%	0.003%
								IH22	0.004%	0.007%	0.010%
								IH24	0.002%	0.010%	0.019%



# Section 4.3.1: Interruptions

No interruptions during 5/31/2020 00:00-5/31/2020 23:59

# Section 4.3.2: Dips

No dips during 5/31/2020 00:00-5/31/2020 23:59

# Section 4.3.3: Swells

No swells during 5/31/2020 00:00-5/31/2020 23:59



# Section 4.3.4: Transient Overvoltages

No transients during 5/31/2020 00:00-5/31/2020 23:59

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# Section 4.3.5: Waveshape Changes

No waveshape changes during 5/31/2020 00:00-5/31/2020 23:59

# Section 4.3.6: Rapid Voltage Changes

No rapid voltage changes during 5/31/2020 00:00-5/31/2020 23:59



### <u>Conclusions</u> EN50160 5/31/2020 00:00 – 5/31/2020 23:59

# EN50160 Pass-Fail Requirements Table

EN50160 Section	Power Quality Parameter	EN50160 Compliance	Remarks
4.2.1	Power Frequency	PASS	
4.2.2	Supply Voltage Variations	PASS	
4.2.3	Flicker Severity	PASS	
4.2.4	Voltage Unbalance	PASS	
4.2.5	Voltage THD	PASS	
4.2.5	Voltage Harmonics	PASS	

### EN50160 Additional Information Table

EN50160 Section	Power Quality Parameter	Remarks
4.2.6	Voltage Interharmonics	Limits thresholds not set
4.3.1	Interruptions	
4.3.2	Dips	
4.3.3	Swells	
4.3.6	Rapid Voltage Changes	
4.3.4	Transient Overvoltages	
4.3.5	Waveshape Changes	

Note 1: During 5/31/2020 measurements were made 100.00% of the time

Note 2: Note 3: Low Voltage Systems (<1 kV) limits were used. Flagged data was excluded from this report.



Instrument used: Manufacturer: PQube ID: Location: Serial number: Firmware revision: Report Software: Author of Report: Name:

### PQube 3<sup>®</sup> (www.powerside.com)

Powerside PQube 3—Power Quality & Power Flow PSL— Alameda, California P3004210 3.7.9.20.02.11 PQube Report Writer 3.8.0.0

#### **Customer Information**

Name: Company: Address 1: Address 2: Address 3: Phone: Website:

Sample Customer

#### Equipment Settings (Event thresholds)

Dips	90.00%
Swells	105%
Interruptions	10.00%
RVC	6%
Transients	300V

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