

## Introduction

At LuminUltra, we are committed to providing high quality test kits to anyone that needs fast and reliable results about the microbiological characteristics of any process! Visit [www.luminultra.com](http://www.luminultra.com) to learn about the exciting opportunities that our solutions can provide.

Whereas traditional microbiological tests require days for feedback and measure only a fraction of the microorganisms, **2<sup>nd</sup> Generation ATP®** (Adenosine Triphosphate) test kits from LuminUltra measure total microorganisms and provide feedback in minutes!

In this test kit instruction guide, you will learn...

- Where this kit can be used;
- How 2<sup>nd</sup> Generation ATP technology works;
- How to handle and store components of this kit;
- How to perform tests;
- How to calculate and interpret results; and
- How to contact us.



QG21S Test Kit (QG21S-50C)

## Choosing the Right Test Kit

LuminUltra provides 6 core test kits for measuring total microbiological concentration via ATP, each tailored to specific applications:

- **Quench-Gone™ Aqueous (QGA™):**  
*For low-solids water-based samples, such as drinking, cooling and process waters with less than 10% free oil and/or salinity.*
- **Quench-Gone Organic Modified (QGO-M™):**  
*For low-solids organic-based samples, such as fuel, bottom waters, metalworking fluids, lubricants, oily brine, and oilfield waters with more than 10% free oil and/or salinity.*
  - QGOM-XLPD is available for difficult-to-filter samples such as polymers.
  - dQGO-M™ is also available for separate determination of large and small cells.
- **Deposit & Surface Analysis (DSA™):**  
*For measuring attached growth such as biofilm, corrosion products, slimes, and biological filter media.*
- **QuenchGone21 Industrial (QG21I™):**  
*For high-solids process fluids, including paper process and other wash waters.*
- **QuenchGone21 Specialty (QG21S™):**  
*For chemical product testing, such as slurries, adhesives, paints, and other coatings.*
- **QuenchGone21 Wastewater (QG21W™):**  
*For wastewater and bioprocessing samples, whether influent, bioreactor or effluent. Also provides the capability to quantify attached growth and floc bulking sedimentation processes.*

## Where to Use This Test Kit

The QuenchGone21 Specialty (**QG21S**) test kit provides a real-time measurement of total microorganism population and stress level in preserved chemical products. Use QG21S to detect total microbiological activity in:

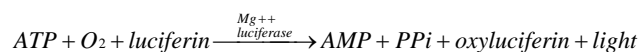
- ✓ Slurries
- ✓ Paints
- ✓ Adhesives
- ✓ Coatings

... and more! QG21S test kits are available in two formats. Choose the best format to suit your needs from the following descriptions:

- QG21S Standard (**QG21S-50**) provides materials to perform 50 analyses each of Total ATP (or **tATP™**: living plus dead biomass) and Dissolved ATP (or **dATP™**: dead biomass only). This provides the most accurate indication of living microorganisms only via Cellular ATP and allows computation of the Biomass Stress Index to assess microbial population health.
- QG21S tATP Only (**QG21St-100**) provides materials to perform only 100 analyses of **tATP**. Use this kit when no differentiation between living and dead microbes is required.

## How Does This Test Kit Work?

LuminUltra's test kits are based on the measurement of ATP, which is a direct and interference-free indicator of total living biomass. ATP is measured using the firefly luciferase assay, where a sample containing ATP is introduced to a solution containing the enzyme Luciferase, which naturally occurs in the tails of fireflies, to produce light. The light is detected in a **luminometer** as Relative Light Units (RLU).



The QG21S Standard test kit uses two parallel 1-minute analyses (tATP and dATP) on each sample to determine two valuable pieces of information:

- **Cellular ATP (cATP™)** – represents ATP from living microorganisms and therefore is a direct indication of total living microorganisms.
- **Biomass Stress Index (BSI™)** – represents the stress level experienced by the microbiological population.

QG21S is capable of detecting ATP levels as low as **20 pg ATP/mL** using standard procedures and equipment.

## What Else is Required?

LuminUltra's test kits contain all of the consumable materials required to run their specified number of tests (Defined by the last 2 or 3 digits of the product code). To use our test kits, you will require a luminometer. For optimal functionality, we recommend the PhotonMaster™ Luminometer & Bluetooth Module Equipment Set (**EQP-PBM-PAC**), which includes a Carry Case, Micropipettors, PhotonMaster Luminometer, PhotonMaster Bluetooth Module, and Test Tube Racks.



PhotonMaster & PBM Equipment Set (EQP-PBM-PAC)

**NOTE:** LuminUltra's test kits can be used with the majority of photomultiplier tube-based luminometers, including the Kikkoman Lumitester C-110 or Berthold Junior 9509LB. Contact LuminUltra to confirm compatibility of your luminometer.



We also recommend **LuminUltra Cloud™**, a powerful mobile platform that allows you to calculate, store, and analyze your data with ease via your smartphone, tablet, or personal computer.



Through robust analytics, collaboration, and reporting functions, users and their colleagues can stay on top of their process anytime, anywhere.

Visit [www.luminultra.com](http://www.luminultra.com) for instructions on how to acquire LuminUltra Cloud.

LuminUltra is sensitive to the needs of each individual customer. We can supply you with on-site auditing and training services, web-based training, and one-on-one

consultation to get your process improvement program off the ground. Contact us today to learn more!

## Test Kit Contents and Storage

When you receive your test kit, utilize the following guidelines for material storage. Note that the presence and quantity of each item listed below will depend on test kit size and type. Avoid freezing of all product components except where noted, and avoid usage of expired test kit components.

QG21S Test Kit Contents & Storage Conditions

Component (LuminUltra P/N)	Storage	Shelf Life
<b>Luminase™<sup>XL</sup> Enzyme &amp; Buffer Vials*</b> (LuXL-3mL-FD) <i>Luciferase Enzyme Reagent, 3mL</i>	4 to 25°C	24 mo**
<b>UltraCheck™ 1 Dropper Bottle***</b> (UC1-5mL) <i>1 ng ATP/mL Standard, 5mL</i>	4 to 25°C	24 mo
<b>UltraLyse™ 30<sup>21</sup> (Extraction) Tube, 1mL</b> (UL30(21)-1mL-50R) <i>tATP Extraction Reagent, 1mL</i>	4 to 25°C	24 mo
<b>UltraLute™/Resin (Dilution) Tube, 8mL</b> (ULuR-8mL-50R) <i>tATP Dilution Reagent, 8mL</i>	4 to 25°C	24 mo
<b>LumiSolve™ (Stabilizer) Tube, 9mL</b> (LS-9mL-50R) ****	4 to 25°C	24 mo
<b>UltraLute™ (Dilution) Tube, 9mL</b> (ULu-9mL-50R) <i>Sample Pre-Dilution Reagent, 9mL</i>	4 to 25°C	24 mo
100 to 1000µL Wide-Mouth Pipet Tips, 100/rack (DIS-PT1WM-100R)	-	-
1 to 200µL Yellow Pipet Tips, 96/rack (DIS-PT01-96R)	-	-
12x55mm Test Tubes, 50/pk (DIS-CT1255-50)	-	-

\* Note that the Luminase<sup>XL</sup> supplied in QG21S kits is NOT interchangeable with other forms of Luminase (i.e. Luminase<sup>W</sup>, Luminase Lite, and Luminase).

\*\* Luminase<sup>XL</sup> is manufactured and shipped as a set of vials, one of each freeze-dried pellet and liquid buffer. The stated shelf life reflects the freeze-dried form; store refrigerated for the best possible shelf life. Following rehydration, the reagent will be stable for 3 months when refrigerated and 6 months when frozen.

\*\*\* Sufficient UltraCheck 1 and Luminase<sup>XL</sup> is included to perform 1 standardization (Step 1) for every 2 samples tested.

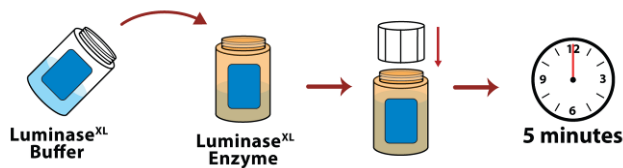
\*\*\*\* Materials are included as part of QG21S Standard (QG21S-50) test kit only.

## General Tips

- New to 2<sup>nd</sup> Generation ATP technology? Before getting started, consult [www.luminultra.com](http://www.luminultra.com) for links to video demonstrations, use guidelines, validation guidelines, other product documentation, and more!
- Microbiological characteristics of most samples will begin to change immediately upon collection. If samples cannot be tested within 2 hours of collection, store refrigerated (2 to 8°C) and test within 24 hours of collection. Allow samples to reach ambient temperature prior to testing, and perform ATP analyses on the same sample used for measuring other parameters for reliable interpretation.
- Waste reagent can be discarded as general waste. Consult MSDS for more information. Contact LuminUltra for copies of MSDS.
- All materials in this test kit including pipet tips and test tubes are single-use only. Because ATP and microorganisms are present on skin, do not touch the surface of pipet tips. Ensure that all pipet tips and test tubes are clean inside and outside prior to use. Do not mark on assay tubes as this may impact light detection by the luminometer.
- Note that the fixed-volume pipets included in the PhotonMaster & PBM Equipment Set cannot be recalibrated and should be replaced annually.
- Avoid taking multiple luminometer readings on the same assay. The light output from ATP assays is relatively constant and at a maximum for the first 15-30 seconds after mixing, after which the output will decline.
- When testing samples that yield low RLU values (i.e.  $RLU_{ATP} \leq 50$ ), it is recommended to account for background noise. Simply follow the procedure without adding any of the ATP-containing sample into the analysis and record this value as  $RLU_{bg}$ . Typical  $RLU_{bg}$  values when using a PhotonMaster or Lumitester C-110 are  $\leq 10$ . If high  $RLU_{bg}$  are consistently observed, repeat assays in an area out of direct sunlight or intense lighting. A single  $RLU_{bg}$  may be used for multiple analyses much like a single UltraCheck 1 RLU ( $RLU_{ATP1}$ ).

## Handling Luminase

- **Luminase<sup>XL</sup>** is manufactured using a process called freeze-drying. This maximizes product stability prior to use. Before using this product, it must first be rehydrated by mixing freeze-dried pellet with liquid buffer and then allowed to incubate for at least 5 minutes. Take care to avoid contamination when removing the glass vial stopper.



Luminase<sup>XL</sup> Rehydration Process

- Rehydrated **Luminase<sup>XL</sup>** can be stored in the refrigerator for up to 3 months (or freezer for up to 6 months with unlimited freeze-thaw cycles) following rehydration. Always bring cold rehydrated **Luminase<sup>XL</sup>** to ambient temperature prior to use, because reaction kinetics will change with temperature. 1 hour is generally sufficient for this purpose.
- Never expose rehydrated **Luminase<sup>XL</sup>** to  $\geq 30^{\circ}\text{C}$  for longer than 1-2 hours.
- In general, it is recommended that **Luminase<sup>XL</sup>** only be rehydrated as required. In other words, rehydrate on the day of testing rather than in advance.
- Never attempt to partition portions of freeze-dried **Luminase<sup>XL</sup>** enzyme and/or the supplied buffer into smaller quantities.
- If you begin utilizing a new bottle of **Luminase<sup>XL</sup>** during your testing, make sure to collect a new calibration result for that bottle. Alternatively, mix multiple bottles of **Luminase<sup>XL</sup>** for all testing at one time.

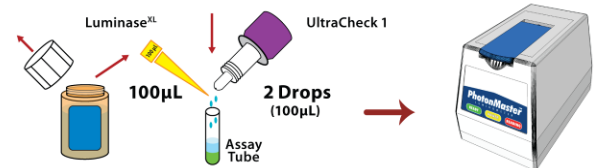
## Step 1 – Calibration

**Included in QG21S and QG21St test kits.**

The ATP Standard Calibration (**ATP1**) converts luminometer RLU values into actual ATP concentrations. Perform one calibration per day or for each set of samples analyzed at the same time. Be

sure that all reagents (especially rehydrated **Luminase<sup>XL</sup>**) are allowed to reach ambient temperature prior to use.

**PROCEDURE:** Holding the bottle vertical, add 2 drops (100 $\mu\text{L}$ ) of **UltraCheck 1** to a new 12x55mm test tube (the Assay Tube). Use a new pipet tip to dispense 100 $\mu\text{L}$  of **Luminase<sup>XL</sup>**, swirl gently five times, immediately insert into the luminometer and measure. Record  $\text{RLU}_{\text{ATP1}}$ .



**NOTE:** If  $\text{RLU}_{\text{ATP1}} \leq 50,000$  using a PhotonMaster or Lumitester C-110 rehydrate a new bottle of Luminase for maximum sensitivity.

**NOTE:**  $\text{RLU}_{\text{ATP1}}$  will fall over time for the same batch of Luminase<sup>XL</sup>. This is due to decreased luciferase enzyme activity. When followed, the guideline above ensures that there is sufficient activity to meet the specified detection limit.

## Step 2 – tATP™ Analysis

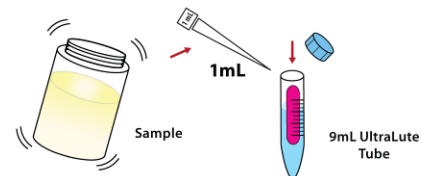
**Included in QG21S and QG21St test kits.**

The Total ATP (**tATP**) analysis measures ATP from both living and dead cells. Perform one tATP analysis on each sample you wish to test.

### 2.1 – PRE-DILUTION

Chemical products that are highly turbid are recommended to be pre-diluted prior to carrying out the tATP analysis. Because it is important to ensure that the dilution medium used is free of ATP and other microbial contaminants, LuminUltra provides pre-dispensed pre-dilution tubes.

Use a new wide-mouth pipet tip to transfer 1mL of sample into a new **9mL UltraLute (Dilution) Tube**. Mix and immediately proceed to Step 2.2.



**NOTE:** When using the bulk-format version, you must dispense your own reagent into a clean test tube.



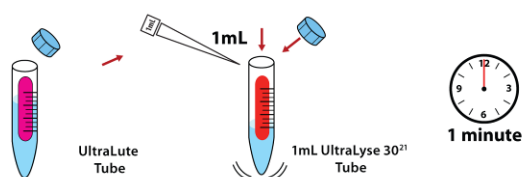
**NOTE:** If a Dissolved ATP (dATP) analyses will also be done on the sample, retain the Pre-Diluted sample until later when the dATP test can be done.

**NOTE:** Wide-mouth pipet tips are those that have sufficiently large openings to prevent tip plugging by sample particles. In general, wide-mouth 100-1000µL pipet tips are sufficient for most samples. If required, increase the bore size of a tip using a clean pair of scissors.

**TIP:** If a different dilution is desired, increase or decrease the proportion of sample to dilution medium used in this step and adjust the dilution factor in the final calculations accordingly. For example, a 1:9 dilution as shown above provides a dilution factor of 10, whereas a 1:19 dilution provides a dilution factor of 20. Be aware however that too much dilution will compromise test method sensitivity.

## 2.2 – EXTRACTION

Using a new wide-bore pipet tip, add 1mL of well-mixed, pre-diluted sample from the **UltraLute (Dilution) Tube** to a new **1mL UltraLyse 30<sup>21</sup> (Extraction) Tube**. Cap and invert three times to mix. Allow at least 1 minute for incubation.



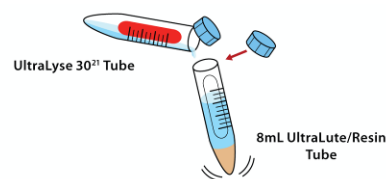
**NOTE:** When using the bulk-format version, you must dispense your own reagent into a clean test tube.

**NOTE:** At this point, the contents of the Extraction Tube can be capped and stored refrigerated between 2-8°C for up to 1 week prior to 2.3.

**TIP:** Wide-bore pipet tips are those that have sufficiently large openings to prevent tip plugging by sample particles. In general, wide-mouth 100-1000µL pipet tips are sufficient for most samples. If required, increase the bore size of a tip using a clean pair of scissors.

## 2.3 – DILUTION

Pour the **UltraLyse 30<sup>21</sup> (Extraction) Tube** contents into a new **8mL UltraLute/Resin (Dilution) Tube**. Transfer the mixture back and forth between the two tubes at least three times for best mixing accuracy. Cap and invert three times to mix. Allow beads to settle.



**NOTE:** At this point, the contents of the Dilution Tube are stable at room temperature for up to 4 hours.

**TIP:** If beads do not settle or settle slowly, tap the Dilution Tube gently to assist settling.

**TIP:** If the Extraction Tube cannot be poured into the Dilution Tube, simply pour the Dilution Tube contents into the Extraction Tube to liquefy its contents.

## 2.4 – ASSAY

Using a new pipet tip, add 100µL of the **UltraLute/Resin (Dilution) Tube** contents to a new 12x55mm test tube (the **Assay Tube**), and use another new pipet tip to add 100µL of **Luminase<sup>XL</sup>**, swirl gently five times, immediately insert into the luminometer and measure. Record  $RLU_{tATP}$ .



**NOTE:** If  $RLU_{tATP} \leq 10$  on a PhotonMaster or Lumitester C-110, you are below the low-detection limit. Report  $tATP$  (pg ATP/mL) = 0 in calculations.

**NOTE:** When  $RLU_{tATP} \leq 50$  on a PhotonMaster or Lumitester C-110, it is recommended that you measure and subtract  $RLU_{bg}$  from your measurement.

**TIP:** If “Scale Over” is returned, repeat the  $tATP$  analysis using 100µL of pre-diluted sample in 2.2 (EXTRACTION) and modify the dilution factor in the calculations as noted.

## 2.5 – CALCULATIONS

Following completion of  $tATP$  analyses, RLU values must be converted to ATP concentrations using the following calculations. For easy calculations, utilize **LuminUltra Cloud**.

$$tATP (pg\ ATP/mL) = \frac{RLU_{tATP}}{RLU_{ATP1}} \times 100,000 (pg\ ATP / mL)$$

**NOTE:** When applicable, subtract  $RLU_{bg}$  from  $RLU_{tATP}$  prior to executing the above calculation.

**NOTE:** If 100µL of sample was used in 2.2 of the tATP analysis, replace the dilution factor “100,000” with “1,000,000”.

### Step 3 – dATP™ Analysis

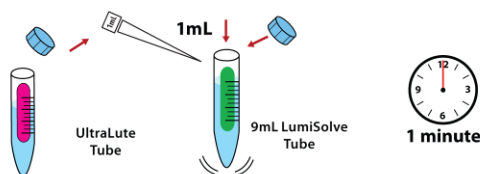
**Included in QG21S Standard test kit only.**

The Dissolved ATP (**dATP**) analysis measures ATP from only dead cells. Perform one dATP analysis on each sample you wish to test.

**NOTE:** Use the same pre-diluted sample as prepared in Step 2.1 for the tATP analysis when using the dATP analysis.

#### 3.1 – DILUTION

Using a new wide-mouth pipet tip, add 1mL of well-mixed, pre-diluted sample from the **UltraLute (Dilution) Tube** to a **9mL LumiSolve (Stabilizer) Tube**. Cap and invert three times to mix. Allow at least 1 minute for incubation.



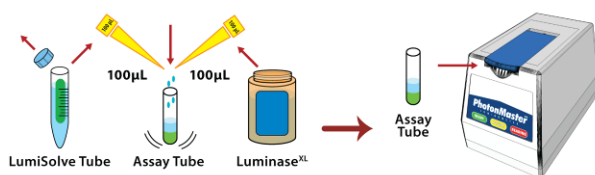
**NOTE:** When using the bulk-format version, you must dispense your own reagent into a clean test tube.

**NOTE:** The LumiSolve Tube can be capped and stored between 2 to 8°C for up to 1 week prior to 3.2.

**TIP:** Wide-mouth pipet tips are those that have sufficiently large openings to prevent tip plugging by sample particles. In general, wide-mouth 100-1000µL pipet tips are sufficient for most samples. If required, increase the bore size of a tip using a clean pair of scissors.

#### 3.2 – ASSAY

Using a new pipet tip, add 100µL of the **LumiSolve (Stabilizer) Tube** contents to a new 12x55mm test tube (the **Assay Tube**), and use another new pipet tip to add 100µL of **Luminase<sup>XL</sup>**, swirl gently five times, immediately insert into the luminometer and measure. Record RLU<sub>dATP</sub>.



**NOTE:** If RLU<sub>dATP</sub> ≤ 10 on a PhotonMaster or Lumitester C-110, you are below the low-detection limit. Report dATP (pg ATP/mL) = 0 in calculations.

**NOTE:** When RLU<sub>dATP</sub> ≤ 50 on a PhotonMaster or Lumitester C-110, it is recommended that you measure and subtract RLU<sub>bg</sub> from your measurement.

**TIP:** If “Scale Over” is returned, repeat the dATP analysis using 100µL of pre-diluted sample in 3.1 (DILUTION) and modify the dilution factor in the calculations as noted.

#### 3.3 – CALCULATIONS

Following completion of dATP analyses, RLU values must be converted to ATP concentrations using the following calculations. For easy calculations, utilize **LuminUltra Cloud**.

$$dATP (pg\ ATP/mL) = \frac{RLU_{dATP}}{RLU_{ATP1}} \times 100,000 (pg\ ATP / mL)$$

**NOTE:** When applicable, subtract RLU<sub>bg</sub> from RLU<sub>dATP</sub> prior to executing the above calculation.

**NOTE:** If 100µL of sample was used in 3.1 of the dATP analysis, replace the dilution factor “100,000” with “1,000,000”.

### Key Process Indicators

**NOTE:** When using the QG21St kit, skip the final calculations and interpret tATP results as you would cATP results in the Interpretation Guidelines.

For monitoring basic biomass concentration and health at any process location, the following 2 parameters are used. For easy calculations, utilize **LuminUltra Cloud**.

1. Cellular ATP (**cATP**) represents the amount of ATP contained within living cells and is a direct indication of total living biomass (quantity).

$$cATP (pg\ ATP/mL) = tATP (pg\ ATP/mL) - dATP (pg\ ATP/mL)$$

**NOTE:** When the computed dATP (pg/mL) is greater than tATP (pg/mL), first confirm that the result is not due to inhibition by re-testing tATP and dATP using 0.1mL of sample rather than 1mL. If the result persists, report dATP (pg/mL) = tATP (pg/mL). Occurrences of dATP > tATP are most often the result of a combination of test method and instrumentation sensitivity and are to be considered normal.

**NOTE:** It is important to stress that in situations of dATP (pg/mL) = tATP (pg/mL), it does not mean that the entire microbiological population is **dead**. What it does mean is that in their current state, the microorganisms are

severely compromised to the degree that their weakened cell membranes are lysed and their ATP is released even when exposed to a mild buffer such as LumiSolve. Occurrences of dATP (pg/mL) = tATP (pg/mL) should be taken as an indication of a highly-suppressed and thus successfully controlled microbiological population, provided that the magnitude of the tATP (pg/mL) result is low.

To communicate results on the same basis as traditional culture tests, cATP results are converted into Microbial Equivalents (**ME's**). This is based on the established conversion that 1 E. coli-sized bacteria contains 0.001 pg (1 fg) of ATP.

$$cATP (ME/mL) = cATP (pg\ ATP/mL) \times \frac{1ME}{0.001\ pg\ ATP}$$

**NOTE:** For more discussion on the quantity of ATP per cell, visit [www.luminultra.com](http://www.luminultra.com).

Because many of the traditional culture-based methods report results in a similar fashion, it is sometimes convenient to report cATP results in ME/mL using Scientific Notation (i.e. **## x 10<sup>#</sup>**) or on a **Log<sub>10</sub>** format for comparison purposes.

2. Biomass Stress Index (**BSI**) – provides a measure of the stress level (quality) of the microbiological community.

$$BSI (\%) = \frac{dATP (pg\ ATP/mL)}{tATP (pg\ ATP/mL)} \times 100\%$$

**NOTE:** If dATP (ng/mL) > tATP (ng/mL) as discussed above, the BSI value will exceed 100%. If these values persist after re-testing, report BSI = 100%.

## Interpretation Guidelines

Once QG21S cATP and BSI results are calculated, microbial control can be evaluated. ATP-based measurements are extremely sensitive to changes in total microbial quantity. In general, processes will have the best microbial control when **cATP is minimized** and **BSI is maximized**. For the easiest interpretation, utilize **LuminUltra Cloud**.

LuminUltra's ATP test kits can be used to audit microbial quantity to reveal differences at different process locations in an effort to quickly assess the 'hot spots' within a process that require more immediate attention.

For process control, daily monitoring using ATP test kits will give you true total microbial quantity

parameters to trend over time against process characteristics and performance.

When utilizing ATP test kits it is important to remember that every process is different. During **audits**, relative comparisons from point to point are a reliable means to assess your process, while for **daily monitoring** it is important to establish a baseline trend before making control decisions. To get started, LuminUltra provides the following cATP guidelines in units of **pg cATP per mL**:

QG21S cATP Interpretation Guidelines

Application	Good Control (pg cATP/mL)	Preventive Action (pg cATP/mL)	Corrective Action (pg cATP/mL)
Product Quality Control (Paints, Coatings, Slurries)*	<100	100 to 1,000	>1,000

For BSI (when applicable), it can generally be interpreted that good control is achieved at levels of **75% or above**. Preventive action should be taken at levels **between 50% and 75%**, and corrective action should be taken at levels **below 50%**.

\* Oxidizing biocides include chlorine, bromine, ozone, and others. Given their different mechanism of kill, non-oxidizing biocides and non-chemical treatments will typically have a higher residual cATP when processes are well controlled. Allow at least 1 hour to assess the true efficacy of an oxidizing biocide and 24 hours for non-oxidizers.

**NOTE:** These interpretation guidelines are designed for generic risk management guidance only. Users are encouraged to establish their own control ranges on which to base process decisions. LuminUltra and its affiliates do not accept any liability for any decision or assessment taken or made as a consequence of using this test kit.

## Ordering Information

- New to 2<sup>nd</sup> Generation ATP technology? Start by ordering the PhotonMaster & PBM Equipment Set (Product # **EQP-PBM-PAC**) and the test kit(s) of your choice.
- When reordering materials for testing, it is preferred to order complete kits. QG21S is available in eight formats:

Description	Part #
QG21S Standard, 50 Tests, Complete *	QG21S-50C
QG21S Standard, 50 Tests, Reagents Only	QG21S-50
QG21S Standard, 50 Tests, Bulk Format **	QG21S-50B
QG21S tATP Only, 100 Tests, Complete *	QG21St-100C
QG21S tATP Only, 100 Tests, Reagents Only	QG21St-100
QG21S tATP Only, 100 Tests, Bulk Format **	QG21S-100B
QG21S tATP Only, 25 Tests, Complete *	QG21St-25C
QG21S tATP Only, 25 Tests, Reagents Only	QG21St-25

\* Complete kits include LuminUltra-manufactured reagents plus all consumables (tips, tubes, filters, syringes) required to run analysis. If you supply your own consumables, reagent only kits are available.

\*\* Bulk test kits contain all reagents supplied in bulk format and require the user to dispense individual quantities as required.

- To obtain pricing information, inquire about other products and services, or to place an order, contact LuminUltra or your authorized representative.

### LuminUltra Technologies Ltd.

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 Fax: +1-506-453-9860  
[www.luminultra.com](http://www.luminultra.com)

To order: [orders@luminultra.com](mailto:orders@luminultra.com)

For all other inquiries: [sales@luminultra.com](mailto:sales@luminultra.com)

- Major credit cards (Visa, MasterCard, AMEX) are accepted. Contact LuminUltra by phone to place credit card orders.



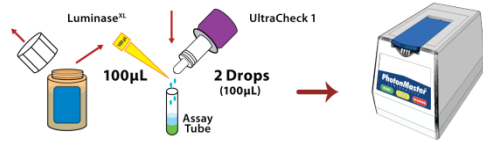
- Orders generally ship within 3 business days. You will receive order confirmation via Email.

*Lumitester is a trademark of Kikkoman Corporation. All other trademarks are the property of LuminUltra Technologies Ltd.*



**Step 1 - UltraCheck™ 1 Calibration**

Perform one UltraCheck 1 calibration per day or per each set of samples analyzed.



**NOTE: If  $RLU_{ATP1} \leq 50,000$  using a PhotonMaster or Lumitester C-110, rehydrate a new bottle of Luminase<sup>XL</sup> for maximum sensitivity.**

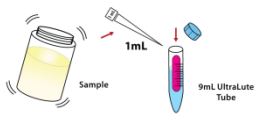
**Please refer to Test Kit Instructions for calculations and interpretation advice, or use LuminUltra Cloud.**

**Step 2 – Total ATP (tATP™) Analysis (1 per sample)**

Included in QG21S™ and QG21St test kits.

**2.1 – PRE-DILUTION**

Pre-dilute sample.



**2.4 – ASSAY**

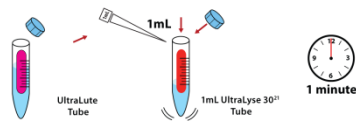
Measure ATP concentration.



**NOTE: If  $RLU_{tATP} \leq 10$  using a PhotonMaster or Lumitester C-110, you are below the low- detection limit.**

**2.2 – EXTRACTION**

Add pre-diluted sample to extract ATP.



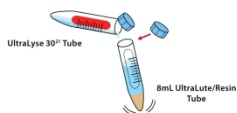
**NOTE: If  $RLU_{tATP} \leq 50$  using a PhotonMaster or Lumitester C-110, consider accounting for background ( $RLU_{bg}$ ). See Test Kit Instructions for guidance.**

**Total ATP (tATP) Calculation:**

$$tATP (pg\ ATP/mL) = \frac{RLU_{tATP}}{RLU_{ATP1}} \times 100,000 (pg\ ATP / mL)$$

**2.3 – DILUTION**

Dilute out interferences.

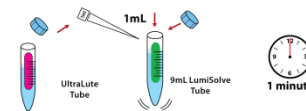


**Step 3 – Dissolved ATP (dATP™) Analysis (1 per sample)**

Included in QG21S test kit only.

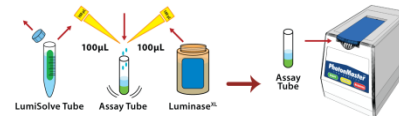
**3.1 – DILUTION**

Add pre-diluted sample to recover ATP.



**3.2 – ASSAY**

Measure ATP concentration.



**NOTE: If  $RLU_{dATP} \leq 10$  using a PhotonMaster or Lumitester C-110, you are below the low-detection limit.**

**NOTE: If  $RLU_{dATP} \leq 50$  using a PhotonMaster or Lumitester C-110, consider accounting for background ( $RLU_{bg}$ ). See Test Kit Instructions for guidance.**

**Dissolved ATP (dATP) Calculation:**

$$dATP (pg\ ATP/mL) = \frac{RLU_{dATP}}{RLU_{ATP1}} \times 100,000 (pg\ ATP / mL)$$

**Calculations:**

**NOTE: When using the QG21S tATP – only kit, skip final calculations and interpret tATP results as you would cATP results using the Interpretation Guidelines.**

**NOTE: If the results show for a given sample that  $dATP (ng/mL) > tATP (ng/mL)$ , report  $cATP^{TM} = 0$  and  $BSI^{TM} = 100\%$**

**Cellular ATP (cATP) Calculation:**

$$cATP \left( \frac{pg\ ATP}{mL} \right) = tATP (pg\ ATP / mL) - dATP (pg\ ATP / mL)$$

**Microbial Equivalent (ME/mL) Calculation:**

$$cATP \left( \frac{ME}{mL} \right) = cATP (pg\ ATP / mL) \times \frac{1\ ME}{0.001\ pg\ ATP}$$

**Biomass Stress Index (BSI) Calculation:**

$$BSI (\%) = \frac{dATP (pg\ ATP / mL)}{tATP (pg\ ATP / mL)} \times 100\%$$

**NOTE: 1 ME (Microbial Equivalent) assumes 0.001 pg (1 fg) ATP per cell.**

**Interpretation Guidelines**

Application	Good Control (pg cATP/mL)	Preventative Action (pg cATP/mL)	Corrective Action (pg cATP/mL)
<b>Product Quality Control</b> (Paint, Coating, Slurries)	< 100	100 to 1,000	> 1,000

**For BSI (when applicable), it can generally be interpreted that good control is achieved at levels of 75% or above. Preventive action should be taken at levels between 50% and 75%, and corrective action should be taken at levels below 50%.**

**NOTE: Interpretation Guidelines provided for general guidance. For best results, establish your own baseline and control levels.**