QUANTIFY
truly intelligent buildings

Quantify Technology Overview

White Paper

Version 1.0

WHAT PROBLEM IS QUANTIFY TECHNOLOGY SOLVING?

The next major industrial revolution is underway: the Internet of Things (IoT).

Business processes must change as IoT delivers detailed information from an ever-increasing number of things. With this ability to leverage data, we can now measure and control costs, reduce risks, improve lives and deliver key stakeholders laser focus for future business investment. This transition is what underpins the smart cities revolution. The ability to act on this information, then have the environment interact with citizens, fundamentally alters urban living.

However, as with all powerful innovations, disruption can sometimes polarise. At its core, IoT is made up of sensors (detecting something has happened) and actuators (actioning change on sensor data and business logic). Add into the mix software or AI (artificial intelligence), and we can now deliver value to a business process. The combination of sensors, actuators and processes offers value across many industry verticals including:

a) Sensors and actuators will come from multiple vendors – compatibility, supportability.
b) Every touchpoint (sensor, actuator, network, application, user) is an entry point into the business – security, business process engineering.
c) Removing people from the decision process (automation) reduces risk - security, business continuity.

As far as the consumer is concerned, the IoT transition needs to be simple, invisible and trustworthy. A consumer wants to buy something that delivers an emotional connection, something that provides real human value whilst maintaining trust.

The consumer selects the products for ease of use, to deal with rising energy costs and the ability to interact with the products through voice, mobile or application. The distributed nature, edge compute power, modular upgrade paths and powerful cloud software means the consumer has invested in an extendable architecture that is more than smart-widget power points and light switches.

THE NEXT INDUSTRIAL REVOLUTION?

Sometimes IoT and AI are referred to as the fourth industrial revolution with the previous revolutions being steam, science and the rise of digital technology. Like any previous revolutions, IoT creates opportunity, but also a risk. However, unlike the three previous revolutions, IoT and AI create a velocity challenge because of the exponential growth in software performance. IoT generates vast quantities of data which provide very detailed, and sometimes unexpected insights. These can change processes at a speed where there may be a perception that humans are blocking points. To capture value, we need the means to operate at speed with trust, or in other words, keep traditional checks and balances in place. We do not want consumers to be scared, but rather embrace these benefits.

Humans still need to be involved in defining the desired outcome. Artificial Intelligence (AI) means that although humans may define the original desired state, we will see the process dynamically change. This dynamic change allows operations to become more focused in ways that we may not have originally envisaged. As AI becomes pervasive, the role of humans is to ensure that AI is focusing in the correct places. Remember the "A" in AI means artificial; it still relies on humans to nudge it in a specific desired direction.

THE QUANTIFY TECHNOLOGY VISION

IoT is changing the very fabric of the way people live and Quantify Technology is at the forefront of this change. Quantify provides customers with a value-added entry point into IoT via our intelligent building automation platform. This delivers immediate value through lighting automation and energy management at an affordable cost, designed to adapt to customers' future needs.

THE PLATFORM APPROACH

By themselves, single IoT widgets deliver little value over a disconnected widget. IoT's real value is the entire end-to-end system and associated processes. By viewing IoT as a holistic platform, we can help contain risk and deliver higher value. Moreover, various stakeholders can add value to consumers, actively collaborating to create the most beneficial outcome.

Typically, business owners define the benefits they wish to deliver to consumers through technical outcomes. IoT and AI are turning this on its head. Today, consumers are telling business owners what they want from their devices.

THE QUANTIFY TECHNOLOGY PLATFORM

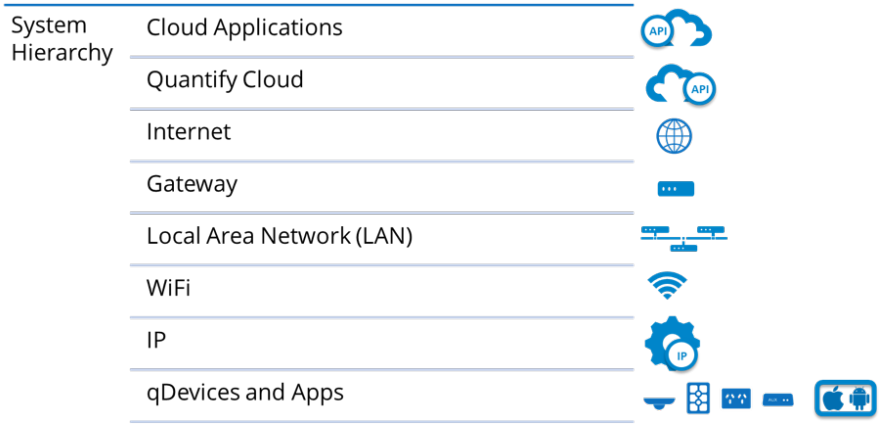

Figure 1: **Quantify Technology Platform Overview**

Figure 1 shows a high-level overview of the Quantify Technology platform. The platform consists of:

- **qDevices and Apps**
  Quantify Technology's custom hardware and mobile applications provide automation and energy management.
- **IP**
  Quantify Technology's qDevices and custom Apps run on industry-standard IP (the internet protocol). Each device much have an IP address to permit communication between qDevices, Apps and the Quantify Cloud.
- **Wi-Fi**
  qDevices and mobile Apps use the local Wi-Fi network to connect to the buildings Local Area network (LAN).
- **LAN**
  A Local Area Network (LAN) connects multiple WiFi access points in a building. The LAN also connects to the internet gateway and DHCP (Dynamic Host Configuration Protocol) server. qDevices obtain their IP addresses from the DHCP server; addresses are NOT hardcoded.
- **Gateway**
  The gateway is where qDevices connect to communicate to the internet. Typically, this will also act as the DHCP server.
- **The Internet**
  To connect qDevices to the Quantify Cloud service.
- **The Quantify Cloud**
  The Quantify Cloud is responsible for the onboarding, configuration and reporting of qDevices. qDevices do not need access to the cloud for day-to-day operation. However, for accurate reporting and the enablement of services, such as voice control, the internet is recommended.
- **Cloud Applications**
  Designed with a secure programming Application Programming Interface (API), the Quantify Cloud connects securely to third-party applications. The API safely enables integration and the reporting and control of qDevices. An example application is Amazon Alexa for voice control of qDevices.

THE QDEVICE

Quantify Technology's qDevices are intelligent power control devices. qDevices consist of:

- **qDimmer**
  This phase dimmable device can support up to three dimming channels of 150 Watt (W) each, or three switched channels up to 275W each. The total power consumption of all three channels must not exceed 450W.
- **qPower+**
  This two-socket device can support up to two 10 Amp (A) 240 Volt (V) switched circuits via a standard plug. The total sustained current draw should not exceed 15A.
- **qBlind**
  This device supports an interlocked blind up/blind down feature. Interlock means only one of the two-channel interlock pair can be active at one time. Designed for blind controllers that take two inputs, one for up and the other for down.
- **qBridge**
  This device supports integration into legacy devices. It supports four dry contact inputs and four dry contact outputs.
- **qData**
  This device supports up to four mech inserts. Mech inserts are for wall plate customisation.

Figure 2: **The qDevices, qDimmer/qBlind, qPower+, qBridge and the qLiving user application**

qDevices are economical and easy to install in new developments or retrofit into existing buildings. The qDevices use standard AC cabling techniques and standard light switch or power outlet wall boxes. There is no need for a dedicated hub or gateway for any qDevice and, subject to load type and suitable wattage, qDimmers do not require a neutral wire.

Intelligent qDevices support a modular architecture. This architecture consists of a Feature Card, AC Controller and Touch Panel.

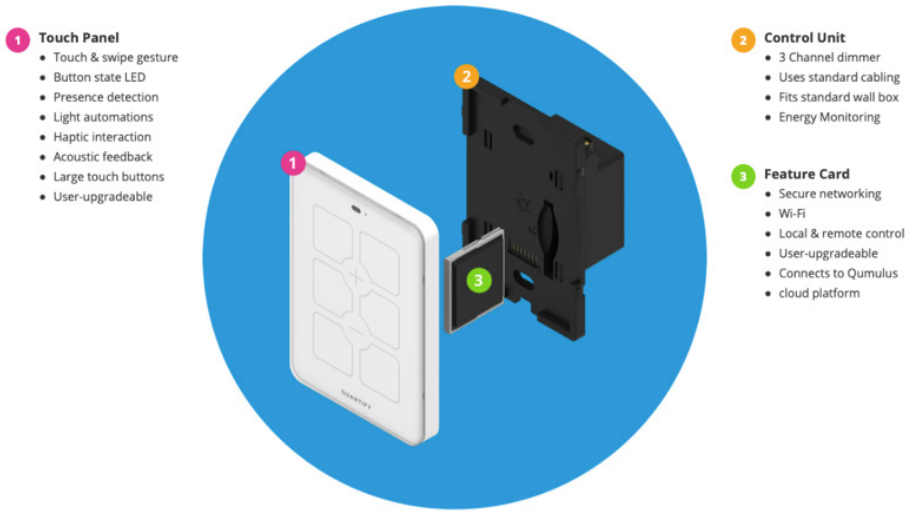

Figure 3: **The qDimmer's three components: the Touch Panel, Feature Card and Controller.**

The table in Figure 4 shows the individual components in differing qDevices:

DEVICE	AC CONTROLLER	FEATURE CARD	TOUCH PANEL
qDimmer	Yes	Yes	Yes
qPower	Yes (switched only)	Yes	Yes
qBlind	Yes	Yes	Yes
qBridge	No	Yes	No
qData	No	No	No

Figure 4: **Component dependencies of qDevices**

THE MODULAR ARCHITECTURE

The AC Controller (Dimmer)

The AC Controller Dimmer is responsible for the control of up to three 240V channels totaling 450W. The configuration of individual channels is supported by up to 275W (switched) 150W (dimmed), but the total device must not exceed 450W.

The AC Controller Dimmer supports both leading and trailing edge dimming with the Quantify Cloud, or the user app setting the dimming mode. Support for automatic channel shutdown and notification, before circuit board breaker, is provided for loads that exceed policy.

In real-time, the AC Controller Dimmer can provide accurate information on the behaviour of any attached load. The Feature Card receives this load information for processing. Once processed, the data can be sent to the Quantify Cloud or possibly trigger a local event.

Consuming this information gives customers unprecedented load reporting and, leveraging the API, the AC Controller Dimmer delivers a Truly Intelligent Building.

GPO AC Controller

The GPO AC Controller is responsible for the control of two 240V 10A channels. Appliances are connected via two standard outlets permitting control via the on-off button. The GPO AC Controller also logs the power consumption of the attached devices.

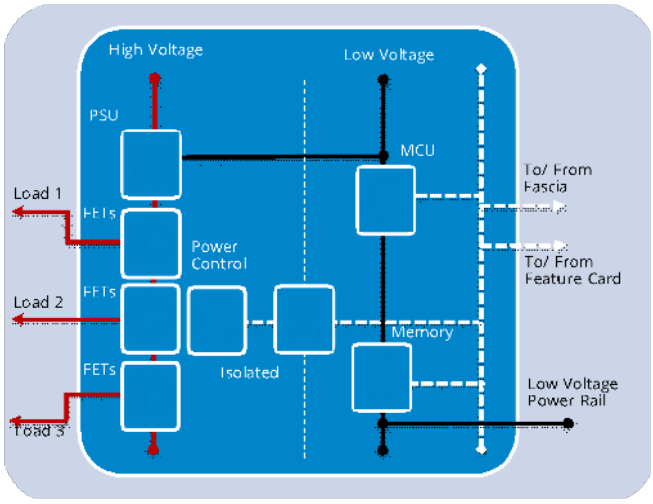

Figure 5: **Block Diagram of A/C Controller (dimmer)**

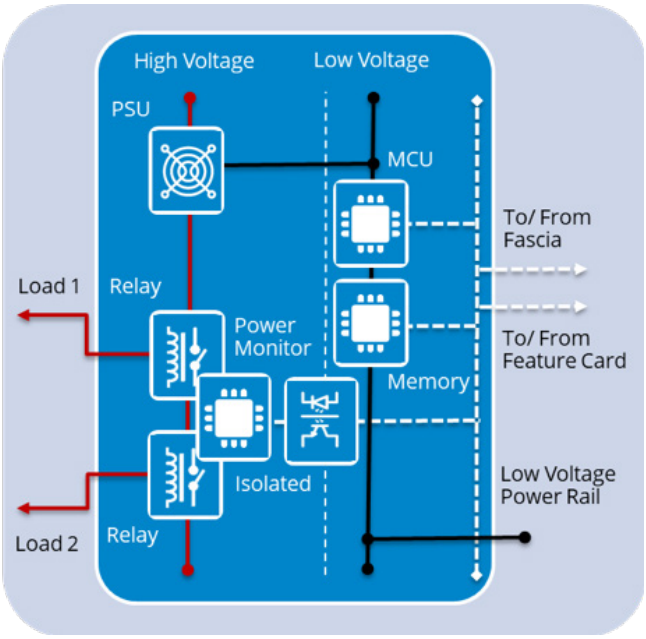

Figure 6: **Block Diagram of A/C Controller (GPO)**

The Feature Card

The Feature Card is responsible for communication between Quantify Technology qDevices. The Feature Card contains the radio technology used to securely connect the qDevice to the customer's wireless data network and the central qDevice processor (CPU).

Designed to be field replaceable, the Feature Card can easily be upgraded, which allows Quantify Technology to support current and emerging technologies. Should requirements change, such as a different wireless technology, then the Feature Card can be changed. Ease of change provides a level of future-proofing to the customer environment.

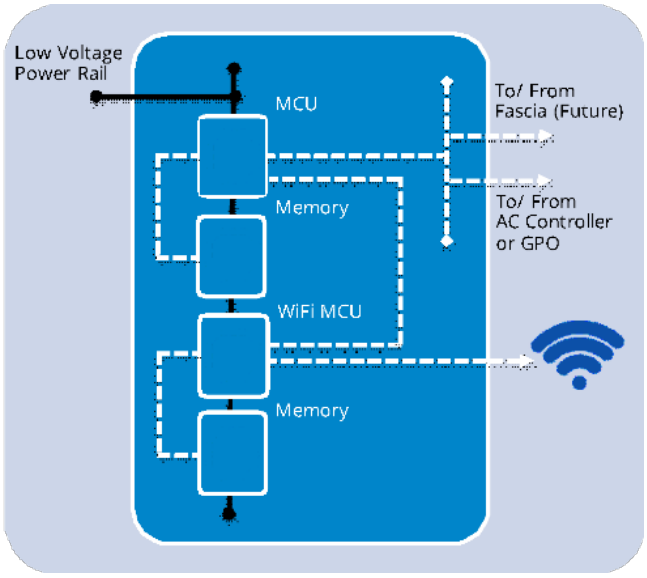

Figure 7: **Block Diagram of Feature Card**

The Touch Panel

The Touch Panel is responsible for interaction between the end-user and the Quantify Technology qDevice. All Touch Panels are designed to be user-replaceable and interchangeable. Interchangeable Touch Panels mean the customer now has the choice of where they want specific controls to be and, if they change their mind, can easily move the Touch Panel.

Touch Panels support multiple Light Emitting Diode (LED) displays, multiple touch zones and haptic feedback to support a rich user experience. Adaptable design future proofs the Quantify Technology platform which is designed to support not only current but future, Truly Intelligent Buildings.

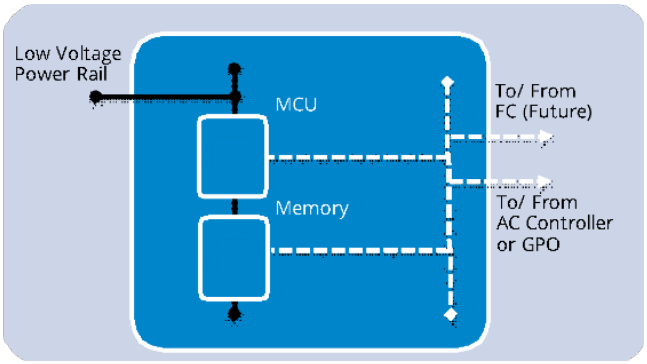

Figure 8: **Block Diagram of a Touch Panel**

The qApplications

Quantify Technology provide two companion mobile applications for the qDevices. These applications are qCommission and qLiving. Designed to be installed on phones and tablets, these applications are available from the Apple and Google Play stores.

The qCommission App is for a qualified electrical contractor to configure and test the electrical settings of the qDevices. qCommission is designed to be used by trained installers and integrators, incorrect usage could result in damage to the qDevices.

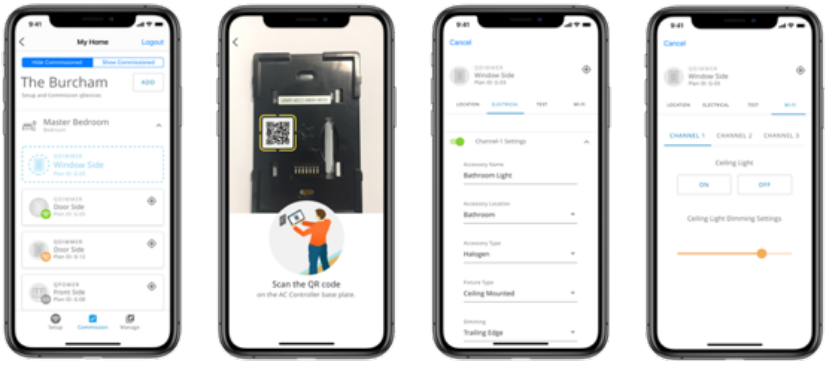

Figure 9: **The qCommission Application**

The qLiving application allows you to control your qDevices, including scenes, lights, light groups and anything connected to the system, right from the palm of your hand.

With groups and scenes, qLiving gives you the capability to orchestrate customised lighting and environmental scenarios in your home. Set your lighting and dimming to match your mood, even adapt to your social surroundings. Whether you're outside or upstairs, the environments within your house can be conveniently defined and controlled by Groups.

Figure 10: **The qLiving Application**

The Quantify Cloud

Underpinning the Quantify Technology platform is the cloud service. The Quantify Cloud is responsible for the secure validation and onboarding of the Quantify Technology hardware (qDevices). Additionally, the Quantify Cloud allows the consumer to change their experiences in a building.

The Quantify Cloud is powerful; it also allows connection via secure API (Application Programming Interface), traditionally referred to as a High-Level Interface (HLI). Through this API, the Quantify Cloud can perform bi-directional communication with other cloud services.

SUMMARY

Quantify Technology's qDevices and cloud platform provide more than just another "me too" home automation system. The platform is designed to scale and connect to all aspects of a building, unlike traditional proprietary systems, as to control and manage power thereby reducing cost and managing risk. Quantify Technology's key benefits can be summarised as:

Retrofittable

Quantify Technology qDevices designs are installable in both new and existing buildings. The product will fit in industry-standard wall cut-outs and only requires industry-standard power cables to operate. The devices operate in both two and three-wire modes. Management operates over industry-standard wireless protocols and does not necessitate the use of any wired technology for inter-device or management communications.

Cost-Effective

The Quantify Technology solution is designed to reduce the initial capital cost and ongoing operational costs against any other competitive building control platform.

Simple

Both in installation and operation, the Quantify Technology solution is simple. Installation requires standard electrician skills. Operation requires voice interaction, standard web or mobile device user skills.

Scalable

Whether one device at one site or many devices in many places, the Quantify Solution is designed to scale. We support scalability at a management and operational level with the product only sending data on networks on an as needs basis, avoiding all unnecessary network chatter.

Extensible

The product is designed to allow for the convergence of adjacent technologies into the Quantify Technology Platform. Any technology that utilises user input and output in a building is a candidate for convergence into the Quantify Technology Platform. Examples include sensor networks, alarm networks and low power wearable consumer technology.

Autonomous

The Quantify Technology Platform is designed to operate autonomously, without reliance on the Quantify Cloud. The management platform provides product validation, onboarding, reporting and changes in the device configuration. Any preconfigured policies will operate "as is" without necessitating access to the management platform and device reporting is cached locally to be presented to the management platform when next available

Secure

The Quantify technology platform protects against malicious actors accessing customer identifying information. We are embedding systems that prevent sniffed data from performing replay attacks, or from illegitimately taking control of a customers' installation. In the case where compromise attempts are detected, we are building capabilities into the platform to self-harden and inform the customer of the risk. Failure to begin with a secure platform approach will only result in complications later. Those complications mean only one thing, cost!

Upgradeable

Once fitted to the wiring of the building, a qDevice is field upgradeable by a consumer. Consumers can upgrade the communications and processing capacity via a Feature Card swap and change the User Experience with a Touch Panel swap.

Quantify Technology products provide a building automation experience that delivers tangible value. The consumer has invested in a sophisticated IoT platform, designed to grow with their changing needs.

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