UWBT
Portable Data Acquisition System

OPERATION THEORY PAPER

The UWBT transmitter is a game-changer in process measurement, turning your tablet or smart phone into a portable data acquisition system. This paper demonstrates the innovative features of the UWBT system.
UWBT Portable Data Acquisition System

The OMEGA UWBT transmitter is a portable data acquisition system, consisting of a handheld transmitter communicating via Bluetooth® to an app installed on a smart phone or tablet (see figure 1). The app is compatible with iOS™, Android™, and Fire OS™ operating systems, transforming a smart device into a combination handheld meter and data logger. The apps are conveniently downloaded from the app stores for these operating systems, in the same manner as all other apps. The apps have been tested extensively with devices from Apple®, Samsung®, Google®, Amazon®, Sony®, and Xiaomi®. The iOS app was certified by a third party per the Apple MFi Manufacturing License Agreement. The Android and Fire OS apps were certified online for compatibility with all the latest operating system releases and associated smart devices.

Figure 1: UWBT Transmitter and app

The UWBT transmitter combines the measurement accuracy of an industrial sensor with the convenience and ease of use of smart phones and tablets. Sensor inputs are designed to be general purpose across the full range of sensors used in industrial metrology (see figure 2). The thermocouple transmitters accept input from Type J, K, T, E, R, S, B, C, and N thermocouple probes using flat-pin miniature, round-pin standard, and M12 thermocouple connectors. The RTD transmitters accept input from 2- or 3-wire RTD sensors. They may have either Pt100 or Pt1000 impedance, with the instrument calibrated per a 0.00385 or 0.00392 calibration curve. The pH transmitters accept input from high impedance pH probes with a BNC connector representing both solution pH and temperature, or solely solution pH. In order to optimize humidity accuracy, the RH transmitter accepts input solely from a supplied humidity probe containing a pre-calibrated digital humidity sensor.

The Bluetooth pairing process between the transmitter and smart device works in the same manner as pairing a smart device to a Bluetooth earbud or to a set of automobile speakers. Within the app the smart device discovers active transmitters within pairing range, and the user selects which transmitter he/she wants the smart device to pair with (see figure 3). The app displays both Bluetooth signal strength and transmitter battery charge level. Once pairing is completed the user can adjust a variety of settings, display or log data, and transmit a logged data file externally.
The user can pair with multiple transmitters of any sensor type, and view data in either digital, gauge, or graph format (see figures 4). For the graphical format the time axis can be set to elapsed time or real time mode. Elapsed time shows the data starting with 0:00 with a fixed time interval between the data points. Real time mode shows the data with a fixed real time interval after the actual start time of logging. Data can be logged on a smart phone or tablet at rates of 1 sample per second to 1 sample per minute. Data can also be logged locally on the UWBT transmitter at rates of 10 samples per second to 1 sample per minute, and then downloaded to a smart device at a later time.

The app is available for use in English, French, German, Italian, Spanish, Portuguese, Japanese, Korean, and Simplified Chinese Characters via a simple menu setting. All text and screen shots are shown in the user selected language (see example in figure 5).

The UWBT transmitter comes standard with rechargeable “AA” batteries. It can also be powered by the AC power supply or by connecting a USB cable between the transmitter and the USB port of a PC. A PC application is available to configure the transmitter settings, download logged data, or upgrade the firmware.
UWBT Innovative Design Features

Today's measurement technology requires a user to plug a sensor connector into a handheld instrument replete with a small LCD monitor and an array of buttons with fixed definitions (see figure 6). The handheld instrument is connected via USB cable to a PC or to a wi-fi receiver as part of a networked data acquisition system.

Figure 6: Wireless thermometer

The small size of a typical LCD monitor can make communication to the user cryptic and confusing. Typically, only the current data and/or time is shown on the display, and the USB connection requires a PC for the data acquisition process. Data acquisition via wi-fi can be accomplished only within range of a fixed wi-fi connection, or by dedicating a PC to act as a wireless receiver. Furthermore, typical instruments are often defined as transmitters, with no internal storage capability, or as data loggers with limited communication features. Complex manipulation of measurement parameters is generally accomplished in an accompanying PC software package, as the limited number of buttons on the front face of the instrument is inadequate to allow for data entry.

Where instruments have been sold with an app for a smart device, the apps tend to be narrow in focus. They may be designed for only one metrology: typically pH, relative humidity, or Type K thermocouple measurement but never all of them. In other cases the app is not for general purpose data acquisition. It may be targeted as transmitters, with no internal storage capability, or as data loggers with limited communication features. Complex manipulation of measurement parameters is generally accomplished in an accompanying PC software package, as the limited number of buttons on the front face of the instrument is inadequate to allow for data entry.

Coupled with a smart phone or tablet, the UWBT transmitter gives the user a portable data acquisition system with a user-friendly interface not found in today's process measurement equipment. Ease of use, an array of metrologies, and two-way communication to smart phones and tablets carried by all users are the main attributes of the product platform. The UWBT transmitter contains the electronics required for converting a sensor milli-voltage or milli-current into a calibrated digital signal, as well as a microprocessor and RF module for conveying a digital signal to a smart device (see figure 7). The digital architecture is common for all UWBT models, with a specific analog architecture used for each of the four models shown on the left side of the diagram: thermocouple, RTD, pH, and RH.

Figure 7: UWBT block diagram

It is much more convenient for a UWBT user to interface with a sensor using his/her own smart device than to a carry around a dedicated handheld instrument. The app on a smart device takes the place of the LCD display, buttons, and PC configuration software of an instrument. The pair key on the transmitter functions similarly to the pair key on a Bluetooth ear bud. In addition, the app is inherently more flexible than the LCD display and buttons of the handheld instrument. Thus, the user gets the benefits of using a more complex sensor interface, without sacrificing ease of use.

The highest level app menus are organized in a typical chronological sequence for a user: pairing with a transmitter, defining sensor settings, determining logging settings, downloading data to a smart device, and communicating data from the smart device to the Cloud (see Figure 8). A video has been created to demonstrate this sequence to all users. Web links to the video are found on the OMEGA web site and within the app. Point your browser to one these two url’s below to see the video:

http://www.omega.com/video/uwbt.html
https://www.youtube.com/watch?v=LKKKJbL99hY
The UWBT app spares the user from unnecessary configuration work. When the UWBT transmitter is paired with a smart device, the app automatically recognizes the metrology type of the transmitter (thermocouple, RTD, humidity, pH, etc.). The app displays only the screens relevant for that metrology. The configuration details in figures 9 are automatically customized for the metrology. Details are displayed only for lower level items dependent on metrology. The app provides convenient pull-down menus for a user to select from one of several pre-defined options. Once sensor settings are defined, the app provides the user with a feature rich set of logging and alarm settings, consistent with high end data logging equipment. These features include ability to display and sound alarms on smart devices, add an offset correction to sensor data, log data at different frequencies internally on the transmitter or directly to a smart device, and set a deadband for alarm levels. Data entry for complex data (transmitter names, etc.) is achieved by bringing up the standard keyboard for a smart device, the same one used in text messaging and writing email (see figure 10). The app comes standard in 9 languages, with language change executing upon changing the setting. The language strings for the app source code have been organized in a tabular fashion. Additional languages may be added at a future date by translating a standard set of character strings from English to the new language, and then recompiling the source code.
Context sensitive help messages are displayed as both warnings and for user data entry errors. These messages are shown in the language that the user has selected. Figure 11a shows information about the Bluetooth pairing process.

The UWBT comes with a fully featured help menu, organized in the same manner as the display and settings menu (See figure 12a). Clicking on any of the five boxes on the left side will bring up relevant information on the subjects listed. Where applicable, the help descriptions point out minor variations in the app screens and function required to conform to programming rules of the iOS and Android operating systems (see figure 12b).

The percentage completion of the download process is incremented until the process is 100% complete. Figure 11c makes sure that the user really wants to erase all data from the internal memory of the transmitter before executing this command.

Figure 10: Smart device keyboard used for data entry

Figure 11a: Bluetooth pairing request

Figure 11b: Status of data download

Figure 11c: Warning message for erasing internal memory

Figure 12a: Help menus

Figure 12b: Display description
Clicking “Download Manual” actuates the web browser for the smart device and loads in the .pdf file for the manual directly from the omega.com website (see figure 12c). In this manner the user does not have to rely on downloading the latest version of the manual to his/her smart device. Updates to the manual are posted on the omega.com website. The user then is guaranteed to review the latest version of the on-line manual at all times. The “Download Manual” command understands the language in which the user is operating the app. Thus, the user will be shown the online manual in the same language in which the app is operating (e.g. using the app in French language will cause the French version of the online manual to be displayed, etc.)

**Clicking “Transmitter Info” brings up information about the transmitter to which the smart device is currently paired (see figure 12d). This includes the transmitter name, sensor type, production serial number, MAC address, firmware version within the transmitter, and software version of the app. The firmware can be upgraded in the field by connecting the transmitter to the PC software on a PC running Windows 7 or 8. The app software can be upgraded by connecting the smart device to the IOS App Store or Google Play online stores. Notices of new releases of the app will be pushed to the user’s smart device from these on-line stores, with the user given the option of whether or not to upgrade the app.**

**UWBT Transmitter : Convenience in Process Measurement**

The UWBT transmitter complements BYOD (bring your own device) in the field of process measurement. BYOD refers to corporate policies allowing employees to bring personally owned smart devices to work, and use them to perform their every day job. BYOD is making significant inroads in the industrial and business world, with some businesses even encouraging it.

The traditional handheld instrument was owned by the industrial employer, with the employee using this company property to take process measurements when doing lab experiments or checking production processes. Coupled with the UWBT app, the UWBT transmitter resides squarely in the new world of BYOD. With this product it is no longer necessary to borrow a company owned handheld instrument for an employee to take process measurements. Only the transmitter is needed. If a company owned tablet is available for work, the employee can load the UWBT app and use it. If an employee wants to use a personal smart device, he/she can do that too. If the employee uses a personal smart device to obtain process measurement data, he/she can still email the data to a company maintained user id. Alternately, an employee can use a company owned smart device to obtain process data, and then upload the data to a company owned id on a cloud computing service. In sum, the UWBT transmitter provides a simple, user-friendly means of gathering process data.

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