

Valve Commissioning and Maintenance with Wireless Technology



Bluetooth[®] Enabled Discrete Valve Controller Offers Unparalleled Savings and Convenience for Marine Industry

Introduction

Imagine being able to walk up to a valve located in a tight engine room and be able to communicate with it using your smart phone without having to open its cover and connect any wires! Believe it or not, that day has arrived and it unlocks the ability to conveniently and cost-effectively commission, operate and maintain automated valves in marine applications using commercial off-the-shelf equipment that is secure and affordable. This whitepaper describes how valve control systems have evolved to incorporate valve controllers with wireless features that can enable them to be more cost-effective, easier to install, easier to commission and easier to maintain.

Background

Early valve control systems were comprised of individual devices (such as limit switches and solenoid valves) that were mounted on the valve and individually wired back to a control panel. The large number of long cables required made these systems relatively costly to purchase, install and maintain (*fig. 1*).

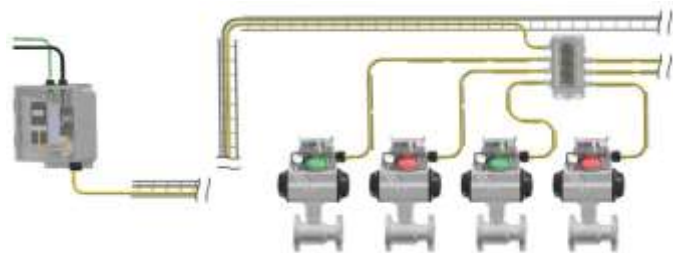
Figure 1



Discrete valve controllers repackaged the individual devices into one assembly mounted on the valve reduced the cost, complexity and maintenance associated with the installation. Migration to network (bus) communications significantly reduced cost but also introduced more complexity

In particular, commissioning and maintaining networked discrete valve controllers require specialized knowledge. In addition, communication equipment such as a handheld calibrator may be required because distributed control systems (DCS) and programmable logic controllers (PLC) provide limited (if any) access to the setup parameters in the valve controller. Further, the communication equipment is temporarily connected to the valve controller wiring which not only consumes time but can also negatively affect the safety of the technician --- especially when the valve controller is difficult to access and/or located in a hazardous location. (*fig. 2*).

Figure 2



Wireless Link Capabilities

Discrete valve controllers communicate to the DCS or PLC via a wired network. With wireless access, the technician (nearby) can make a remote connection to the device (*fig. 3*) to perform setup and operational parameters without having to climb to the valve (when access is poor), open its valve controller and wire his/her handheld device. As such, the technician can perform necessary functions faster without hampering physical safety (such as when climbing) while eliminating the chance of creating a spark that could cause an explosion in a hazardous location. In addition, reducing the time required to access valve parameters and diagnostics can also be a concern for valve manufacturers, OEMs and system

Figure 3



integrators --- especially when it is more convenient and cost-effective to configure valve controllers after the system is built.

Valve controllers enabled with *Bluetooth*[®] wireless technology utilize an iOS device (iPhone[®] or iPad[®]) as the operator interfaces with a wireless link app that can be downloaded and installed for free with no special training required. Therefore, the need for expensive and cumbersome handheld devices is completely eliminated because the app can be economically installed on every technician's iOS device (iPhone[®] or iPad[®]). Not only is the interface cost-effective but it also saves time and provides the technician with more flexibility because he/she can proceed directly to the valve controller to perform the required functions without returning to the maintenance area to get one of a limited number of bulky handheld devices that are often already in use and/or not fully charged. Network security is generally not a concern because the device connects to the valve controller using Bluetooth low energy (Bluetooth LE, BLE or Bluetooth Smart) so the signal transmission is limited to up to approximately 50 meters. The net result is that the person accessing the valve controller must be on the vessel and be within reasonable proximity to the specific valve controller (*fig. 4*).



Figure 4

New Capabilities

The cost associated with configuring or modifying an existing configuration in a discrete valve controller with wireless technology is substantially lower than performing the equivalent function(s) in a controller that does not have wireless capability.

- To commission a Bluetooth enabled valve controller on the bench, power (typically 24 VDC) is connected to the controller and wireless access is obtained using the valve controller manufacturer's wireless link app. In contrast, commissioning of a controller without wireless capabilities entails connecting power (as before) plus physically removing the device cover and connecting a specialized industrial portable or handheld device.
- Conventional valve controller configuration is performed using handheld devices that utilize menus to navigate among parameters that are configured individually. In contrast, using the app, the technician can navigate the device features intuitively with the graphical interface.

- Multiple parameters are displayed and can be modified within the graphical menu on the app that allows faster commissioning of parameters such as the initial limit switch setup, bus addresses, baud rate...
- Vessel safety is enhanced if technicians make fewer input errors. The app's intuitive graphical display can help reduce the number of input errors made by technicians as compared to using a handheld device that is more abstract in nature.
- The safety of personnel is enhanced when the technician does not have to be directly at the valve controller in order to perform the required functions.
 - Understanding that valves are often located in areas that are physically inaccessible, technicians can observe valve operation and modify configurations of several nearby devices from one safe location. In general, if you can see the valve --- you will most likely be able to communicate with it wirelessly.
 - Similarly, nameplates with information about the valve controller (containing the manufacturer, model number, serial number, tag number...) may be located in an orientation that cannot be readily seen by the technician from a safe location. Many times, the nameplates are so faded as to be unreadable from any angle. The wireless link allows this information to be readily available to the technician on the app's display.
- The operational and diagnostic information about the valve is easily retrieved because the data is stored in the Wireless Link capable module in the valve controller. This access occurs without interfering with or affecting the device's operation over wires to the DCS or PLC.
 - The configuration can only be changed with the wireless link app if the controller is configured to allow such changes. This gives the end-user the option of allowing the technician to only monitor valve controller operation but not change any parameters.
- The app allows the technician to directly connect to the valve controller manufacturer's website and download the appropriate maintenance and operation manual. This is in stark contrast to using a handheld device that is menu-driven (with no internet connectivity) so the technician must return to the shop to search for appropriate literature when questions arise.

Installation, Commissioning and Maintenance

Valve controllers enabled with wireless technology are mounted on valves and wired via networks to a DCS or PLC in a manner similar to previous hard wired networks. However, after downloading the free app to an iOS device and conveniently pairing to Bluetooth enabled valve controllers in range, the connection presents significant advantages with regard to their commissioning and ongoing maintenance using wireless access (*fig. 5*). The app can be used to:

- configure valve controllers in less time because only 24VDC power (No communication signal) is required
- import configuration information from spreadsheets to the valve controllers which reduces the configuration time
- export configuration information from valve controllers to spreadsheets to quickly provide accurate documentation of each valve controller
- Operate the valve in the vessel with improved safety because no wired connections are required --- especially when the valve controller is difficult to access (as is often the case)
- access valve controller diagnostics in real time that can be exported to a spreadsheet for storage and/or further analysis
- access the maintenance manual because it is available through a web link in the app

In addition, the wireless link app allows information about the valve controller (such as tag number, maintenance history...) to be entered into text fields.



Figure 5

Security

Valve controllers with Bluetooth wireless technology are wired to a DCS or PLC under normal operating conditions so they are just as secure as previous designs. The network protocol (Bluetooth wireless technology) is so secure that it is also used for critical medical applications.

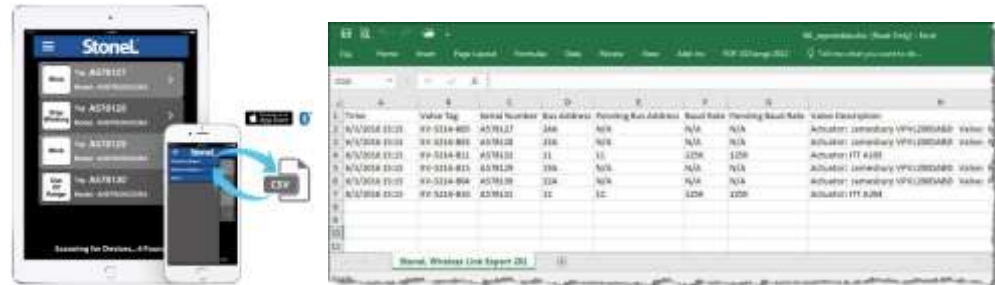
Once communication over the network is enabled all of the operating and input parameters are “Locked Down”. However, all valve controllers may be fully monitored and installation manuals accessed in the locked down mode. Individual valve controllers may be unlocked by the control system if needed for special situations to enable inputs to be made and operation from the wireless link app.

Further mitigating security concerns is the maximum distance of approximately 50 meters for the Bluetooth signal from the valve controller. The wireless signal also will not penetrate nonporous vessel metal infrastructure insulating the controller from any unauthorized Bluetooth signals not in or on the vessel.

Documentation

Valve controllers with advanced wireless features can not only import configuration information from a spreadsheet but can also export their configurations for documentation and export diagnostic information for further analysis (*fig. 6*). This provides accurate and efficient information transfer from the valve controllers to the app and vice versa that saves time for the technician ---

Figure 6



not only when performing these functions per se but also should a valve controller need replacement.

Trends

Wireless access to valve controllers are but one part in a number of trends that are playing out over the long term and will likely continue into the future. Looking at the past, recent decades have seen a clear evolution from technicians using their “muscle” to using their brains. Valve controllers evolved from individually-wired individual discrete devices to individually-wired integrated devices to networked integrated devices to networked integrated wireless devices --- each of which illustrate steps in this evolution.

Looking forward, much has been said and written about the Internet of Things (IoT) and the Industrial Internet of Things (IIoT) where everything is connected and can communicate with everything else. To date, there has been lots of “talk” and few products to actually show. That said, valve controllers with wireless capabilities are a real part of the IIoT trend that provide ubiquitous low-cost connectivity between the technician and the valve controllers that he/she commissions, installs and maintains.

In line with these long-term trends, implementing wireless access to valve controllers significantly lowers the costs associated with commissioning, installation and maintenance while significantly increasing safety --- which reduce vessel downtime, increase vessel reliability and increase the profitability of the vessel.

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