

Audio Electronics Cuts Build-to-Order System Implementation Time with Think & Do

Customer Profile



Hear the Power of Technology.

Industry & Application

- Professional audio systems
- Material handling

Location & Web Site

- Costa Mesa, CA
- www.qscaudio.com

Key Benefits

Rapid Development

- Think & Do reduced programming time by 50% versus using PLC and C++ solution
- Reuse of subcharts saved 33% in logic development time
- Auto-discovery of intelligent network provided instant I/O configuration
- Think & Do's built-in string functions simplified barcode interfaces

Integrated Solution

- HMI and flowchart tools used common tagname database
- Peer-to-peer communications were made easy with built-in Tag Link driver



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GROWING demand for professional amplifiers prompted QSC Audio Products, Inc. in Costa Mesa to triple their manufacturing facilities by adding a new 41,000 sq. ft. assembly plant. According to Bob Meigs, QSC's Director Operations, "We completely changed our business model. The new assembly line is a build-to-order, demand pull operation, a 'no-inventory design' that will soon pay for itself." In keeping with the challenge-the-old-way philosophy, Meigs goes on to explain some of their new expansion's control system goals: "We wanted to go away from the industrial rat's nest wiring of individual I/O control. We wanted a supportable solution of networked I/O controlled by Think & Do software."



QSC Audio company headquarters

Think & Do — a Sound Decision for QSC Audio

According to Bob Meigs, "When I saw that Think & Do could do control with flowcharts, it seemed easy to understand. When I learned that it connected to an intelligent I/O network, the decision was a no-brainer! Both our support technicians and MIS department understand Windows and networks. It takes us only 5 minutes to get up and running as opposed to much longer with our old UNIX C-based system connected to multiple PLC systems. I knew I wanted to get away from the very high support costs and delays of our old system. From the start, Think & Do software was inexpensive — and from my experience, I have found the lower cost software is better because it *works*. Usually, that type of company (making affordable software) can't afford a huge support staff. However, I am very happy we chose the Think & Do control system."

Project Team Orchestrates Plan

QSC and FloStor Engineering (www.flostor.com) worked together to design the new material handling system to help triple capacity. Included are roller and belt conveyors, horizontal carousels, radio frequency identification (RFID) tags, and barcodes.¹

FloStor followed Meigs' project plan and teamed up with Kim Controls System Group, Inc. (www.kimcontrols.com, an experienced Think & Do system integrator) to design, implement and start up the new conveyor system. It uses two Think & Do systems and a Smart Distributed System (SDS) from Honeywell Sensing and Control. The Smart Distributed System is based on CAN (Controller Area Network) and enables factory devices to be connected using a single 4-wire cable. *Smart* devices such as proximity sensors, limit switches, photoelectric sensors directly connect to the intelligent network, therefore no messy I/O wiring to/from the control cabinet is required. In addition, SDS provides device-level, system-level, and preventative diagnostics. Think & Do complements the SDS solution because their intelligent network driver auto-discovers devices on the network and allows direct access to device attribute information and diagnostic data during development of flowchart and screen programming. QSC's application has over 240 nodes over 4 separate SDS busses.

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“Think & Do provides all the tools in one application environment, and therefore the programming was greatly simplified...if a PLC was required we would have had to have a C++ type software engineer, which would have increased programming and testing time by 50%.”

—Eric Ellsworth, Kim Controls

QSC's Process Overview Amplified...

The whole process from receipt of plant floor order to “pack-out” is two hours. The first hour of a production run is spent making the order's *printed circuit boards* (PCBs) with QSC's new surface-mount and through-hole assembly machines. According to Meigs, prioritized orders are received with printed barcode labels. A single barcode is applied to each PCB. The barcode data contains the part number, revision, and serial numbers. The build-to-order system allows a lot size of one: an order can be different from the one before or after it, so there are 93 different QSC products that are manufactured on the same assembly line. Finished PCBs are then transferred to a roller conveyor line, where they are placed on Work In Process (WIP) pallets through chassis assembly steps and out to a pack-out line.



Honeywell SDS interface to I/O devices

This second part of the manufacturing process uses both the barcodes and Radio Frequency ID (RFID) tags. Basically the assistant scans the barcodes for assembly instructions. The RFID tag provides the system with WIP routing information. This is where the Think & Do project kicks into action. The application controls and tracks the orders through the three remaining processes. These include parts assembly, test, and HI-POT test (electrical insulation).

Control Flowcharts Don't Miss a Beat

The Think & Do project flowcharts were written by Eric Ellsworth, a Project Engineer for Kim Controls' Systems Group. Ellsworth describes the basic application, “The Think & Do application sends the WIP pallet to the least busy assembler's queue. If all the assembler queues are full then it goes to recycle mode and is scheduled later. When the assembler receives a WIP pallet they scan in the barcode to get the specific amplifier part number and then use their Intranet browser to find the work instructions (or recipe) for that part number. The operator then gets the parts needed from the horizontal carousels that stocks all the pieces needed for any order. With the unique deployment of carousels as “a parts kitting method” to the factory floor, the production staff is assured of readily available parts when they need them without complex controls on the system. The Think & Do system keeps track of where each WIP pallet has been and each test completed. The operator reads the RFID tag to send the WIP pallet to the next phase of manufacturing.”

Volumes of Savings with Think & Do

Now, Ellsworth describes how he programmed the Think & Do application: “I had to address two basic parts — the control algorithm for managing the queue work load, and the RFID data tables. It took me a month to write the program. There are about 180 flowcharts between two PCs for the control, parts tracking and queue work load management, about 3 flowcharts to handle the RFID program, and about 60 subchart references.” Ellsworth further explains the benefits of subcharts: “I had a 33% savings in development time because I was able to use existing subcharts.” Subcharts are reusable flowchart control logic that has its own set of parameters and local data items.



Controller using Think & Do as HMI

Subcharts can be *called* by Think & Do's flowchart and other subcharts. Kim Controls had created subcharts with a previous application. By using those existing subcharts, Kim Controls reused tested, familiar subcharts and saved development efforts.

“Think & Do provides better integrated tools than their alternative PLC/HMI approach,” according to Ellsworth. Other benefits of using Think & Do include:

- Ability to share data between two applications using Tag Link — The Think & Do Tag Link driver provides a peer-to-peer communications link with remote computers over a Windows NT network. You can easily map local data points to tagnames on the other computer. “If I tried to link data between two PLCs it would have been serial nightmare program or I would have wasted I/O to interface status to both machines. Tag Link made running a program between two machines easy,” states Ellsworth.
- Easily bringing in serial data from RFID — “There are a couple of points here,” Ellsworth continues. Number one... it is easy to add a serial driver and begin reading data, no extra ASCII Module required. The second point is... I do not have to do any funky manipulating of numbers and turning them into ASCII to manipulate strings (like you would have to do with a PLC). Think & Do provides all the tools in

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— Bob Weeks, FloStor

one application environment, and therefore, the programming was greatly simplified. I pretty much did the RFID portion of the program in 3 flowcharts. He adds, “I do not believe I could have done the RFID portion of the package with a PLC type programming tool. If a PLC was required we would have had to have a C++ type software engineer, which would have increased programming and testing time by 50%.”

- Developing HMI screens with a basic tool saved time — According to Ellsworth, “We developed 27 operator screens using Think & Do integrated HMI. The two Think & Do systems have the same 27 screens on each system with Tag Link as the mode of updates. Kim Controls created 16 HMI Screens for the Honeywell/SDS diagnostics screens that are used on all the Think & Do projects. The basic tools were good enough to create the screens that we needed to get the information to the operator. The hassle of an outside HMI package was not

needed.” The HMI editor, ScreenView, accesses the same list of application data names as the flowchart tools do; development time is saved because no retyping of data names is required. Compared to other competitive control solutions where the HMI package is separate, the designer would have setup the HMI package and possibly retyped or recreated another HMI database.

Tooting the Horn of Success

Startup of the Think & Do / SDS system went smoothly. Meigs notes, “My technicians said the big expansion project with Think & Do and Honeywell was easier than a small traditional I/O & PLC project that we had a couple of months ago.”

According to Bob Weeks, FloStor’s President, “A true testament of system startup success is that we *received no punch list*.” He went on to explain, “A system of this size can consist of thousands of items that could potentially fail, ranging from actual hardware equipment to control software changes. He goes on to explain, “It is typical to receive a long list of items to fix on a system (a punch list) — but with QSC’s new system, it just worked.”

According to Ellsworth, “FloStor’s team, lead by Project Foreman Jimmy Smith, did a thorough job which was important because the plant areas were started up in phases. QSC ran for one week without us before the commissioning of the project. Because of Think & Do’s ease-of-use and the help of QSC’s technicians, I was able

to walk QSC through remote support (via telephone) with Think & Do programming. The QSC technicians are able to do the changes and start right up. The technicians think that’s great. We save time and travel expenses because I don’t have to go out to California every time they need help.”

Meigs was a hands-on project manager. He was involved with various aspects of the project and comments, “The Think & Do people I’ve been in contact with are friendly, knowledgeable and interesting — which is an important part of business to me.” Ellsworth also praises the technical support folks at Think & Do, “I know the folks on a first-name basis; they are great to bounce ideas off of and have really helped me in the past.”

Segue to the Future...

Meig’s helps summarize: “Now that I know Think & Do, it is our new standard. We have had no problems in using Think & Do, Windows NT, and the intelligent network (SDS). A large number of our people are being trained; I think we may add this type of solution to other parts of the plant as needed.” Think & Do software is a great, integrated tool set that provided benefits to the system integrators during the project and continues to provide support benefits to QSC’s technicians.

For more information on how Think & Do can help solve your application, visit our website at www.thinkndo.com, or call (800) 722-6875.



Final assembly highway with Think & Do control PC (left)



Final assembly spur conveyors

Note 1: Reference: 03/01/2000 Modern Materials Handling Magazine, “Pump up the volume: Amplifier maker QSC Audio Products triples capacity with conveyors, carousels, RFID, and bar codes so the tempo of manufacturing keeps up with demand.” by Tom Feare, Senior Editor