Why a Description of Operation is a Good Idea

I work for my family business, which is a material handling/industrial automation company. By title I am a Systems Engineer and Project Manager, but I get involved in many other aspects of the business. One particular project comes to mind about the importance of clear communication. The project involved relocating a customer's conveyor system from his old warehouse to a new location. These days, it is difficult to say when process automation stops and discrete starts. As an integrator, we have to be ready for anything.

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We were the system integrator, so we needed to not only relocate and set up the system but also to re-design the layout using existing material. In addition, we were responsible for programming, installing controls, and testing to ensure everything was working properly.

The actual relocation went rather smoothly, with only a few small hitches due to our demolition team cutting the wiring for the 24 VDC photo eye sensors along the conveyor lines. Instead of taking each section apart and splicing the cable at each break point they decided to chop the wire at each sensor. No worry, we thought, we would just re-wire when we get to the new location.

I produced a CAD drawing of the design layout indicating how the existing system would fit together. Included on this drawing were an electrical layout featuring the location of the photo eyes; a schematic for wiring the motors; motor schedules and a schematic for start/stop switches; and a series of 120V plug boxes we were putting in for use on the production line.

What could go worng? Worng?

Everything seemed to be in order; all points were covered with the customer. As usual, we had a meeting and explained to him what the production line would accomplish. We repaired his existing automated taping machines, which we were going to install one per line. The material, including all the electrical wiring and sensors, was delivered to the job site. What could possibly go wrong?

As it turns out, my troubles were only beginning. First of all, we were short on photo eyes. Our demolition boys had neglected to tell us that in their haste they had broken more than a few of the existing sensors. Secondly, our customer, who by the way is a very nice guy, begins to make changes on the design of the system. He informs us that he wants to move a straight transportation conveyor section that does not have photo eyes in place of one that has photo eyes and can shut down in a series of zones.

This is after we had our electricians install the conduit for the motor wiring, the cabling for the 24 VDC photo eyes, and the 120V wiring for the plug boxes onto each section. Can you say, "Change order?" For reasons that still elude me, we decided to go ahead with this without too much protest. I can only guess that by this time all any of us cared about was finishing the project.

What's a Change Order?

Moving along, we finally got the system in correctly to the customer's satisfaction. We purchased the additional photo eye sensors, and I assisted in the re-installation of the wiring and cables. Could we get closure on this? Not quite yet. The customer now noticed he did not like the location of the 120V boxes. He felt they were too far from the workstations. So again we needed to change something that was clearly marked on the drawing.

Another problem had just surfaced. The automated tape machines the customer supplied were not reading the boxes properly. It seems the front switch on the machine was having difficulty starting the side motor that propelled the tracks, which moved the boxes into the taping mechanism.

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We resolved this by adjusting the height of the in-feed conveyor leading into the tape machine down slightly, so the box would create more pressure on the switch and activate the motor.

Finally, we were able to get the system up and running. Unfortunately, the in-line electronic scales the customer supplied were not calibrated and had no vibration dampers, so their readings were all over the board. We took a sample-mounting bracket back to our shop and fabricated a new one complete with dampers.

The Moral of the Story

What is the moral of this story? First of all, that Murphy is alive and well and if you don't have all your ducks in row he can really mess up your day. Secondly, even if you have a project mapped out with drawings and descriptions, if the customer does not have a clear understanding of his objective, you are in trouble. Thirdly, if the customer does have a clear understanding of his objective, make sure he has communicated it to you and you are both in agreement on what it is. A concisely written description of operation is a capital way to ensure this.

Scott Little
Systems Engineer
Southwest Material Handling
E-mail: Scottl@swmhinc.com

Editor's Note: *I had a similar conversation with Nels Tyring and his daughter Linda, who run TVC Systems, a Registered CSIA Founding Member integrator. The Tyrings gave me seven "commandments" for successful integration:*

1. *Get a firm and detailed definition of the project's scope. If you keep control of the project, you will succeed. If the customer gets control, you're in trouble.*
2. *Write your own functional hardware and software specification and get it signed off, regardless of how good the documents you are given appear.*
3. *Get your sequence of operation document signed off, and then everything not called for is a change order. Make sure all exclusions are agreed to in writing.*
4. *Do a Factory Acceptance Test, and get it signed off. This gives the process engineer a chance to see if there are any process design errors. Fixing those errors should be extra.*
5. *Do your own field wiring, and hire your own electricians who understand controls. Most electricians do not understand controls, and need to be taught.*
6. *Do a Site Acceptance Test, and get it signed off.*
7. *Provide very good documentation. This assists the end user, and also makes it easier for you to troubleshoot or upgrade the system years from now.*