

The Selection, Training, and Survival of an Instrument Engineer

The Chosen Few

We would like to say that a person becomes an instrument engineer after years of diligent study and academic preparation, but this is a nonfiction book. No one plans to become an instrument engineer. The prospective instrument engineer doesn't even know the profession exists until the job offer comes. There are few curricula in universities with even a remotely similar title, no mention of the profession by counselors, and no recognition of the profession in such technical societies as IEEE and AIChe. On top of this, public understanding of the profession is nonexistent. Have you ever tried to explain to a spouse or a friend what an instrument engineer does? Tell them you specify D/Ps, RTDs, PLCs, and PCVs. It leaves them speechless.

One usually becomes an instrument engineer by default or, in other words, because one has found nothing better to do. The lure of gainful employment has attracted chemical, mechanical, and electrical engineers to this technology. (There was once even a civil engineer in instrumentation, but he kept trying to bury his installation mistakes in concrete. He now works for the nuclear industry.)

If you are one of the chosen few who have a job offer in front

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of you right now and want to know if you've got what it takes to become an instrument engineer, you need to truthfully answer. the following questions: Do you like to thumb through glossy pages in hundreds of catalogs? (We personally like to sniff the new pages.) Do you like to keep track of the intricate details of thousands of gadgets that change yearly? (We never were very good at this, but fortunately our employer expedited standardization by acquiring an instrument company.) Are you capable of forgetting all the math you learned in college? (The few cases in which algebra might be needed, such as control valve and orifice sizing, were done first with special-purpose slide rules and then with special-purpose personal computer programs. There is some debate as to whether an instrument engineer even needs to be able to count! This does not mean that the village idiot can become an instrument engineer, although a prefrontal lobotomy can help you maintain your composure during a performance review. You must be able to learn on the job how to specify, install, check out, and start up complicated systems.)

Instrument engineering is basically a lot of fun. It is like being paid to go shopping at your nearest electronics or computer store. Americans love to go shopping. Just look at how crowded your favorite shopping mall is on the weekends. As an instrument engineer, you get to buy thousands of gadgets with someone else's money. You also get to watch these gadgets in action. The visual and audible feedback in a control room is impressive.

The Learning Experience

It is an undeniable truth that instrument engineers learn by making mistakes. In fact, to be a really good instrument engineer, you should leave a trail of disasters in your past as long and incomprehensible as the course of the Amazon. Your goal is to go from being a lowlife engineer on the early shift of winter start-ups to being a consultant after a golden handshake in a

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plush office complete with stereo and wet bar. If you can't wait that long, you can acquire the same comforts by becoming either a manager or an instrument sales representative, or both.

Some chemical companies have recognized the need for onthe-job training (usually after a new engineer is found wandering aimlessly on a job site with his calculus book) and have tried to establish their own instrument engineering school or have brought in an outside consultant. The schools until recently either have taught process control from the professor's viewpoint (the same one who thinks the universe is described by partial differential equations) or have taught instrumentation from the illegible notes of comatose engineers who mumbled in monotone. What is unfortunate is that experienced engineers typically don't like to speak in public or write. Also, they are usually too busy to extrapolate beyond their experiences or to develop principles to guide their own future actions or those of others. The result is a shortage of good mentors and instructors. Professional societies such as the Instrument Society of America have done an excellent job of seeking out and finding engineers able to communicate their experiences. (This last statement has nothing to do with the Society's decision to publish this book.)

To be really effective, a school should give the student engineer a trial run at a career in instrumentation by condensing years of mistakes into one very intense experience, which should be as close to real life as possible. First, the student should be bombarded with thousands of facts on how instruments work until he or she suffers a mental meltdown. To insure plenty of mistakes will be made, no information should be given on how to determine what instrument is best for a given application. The student should be given a project where the instruments have already been purchased and the design drawings issued for a lump sum bid. Verbal harassment by a real-life project manager about schedules and budgets should be used to add a greater touch of realism. The student should receive a set of process and engineering diagrams drawn with disappearing ink so that process revisions can be made with a clear conscience. The process should be revised hourly. Chemicals and/or concentrations

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should be chosen that do not appear in handbooks on physical properties or materials of construction. Electrical engineers, mechanical engineers, and chemical engineers should be given solids-handling projects, computer projects, and electrical distribution monitoring projects, respectively. For start-up, each engineer should be reassigned to a completely different project.

A tour of duty with a large engineering department is equivalent to attendance at the school described above. Such organizations create an environment for the maximization of mistakes. They like to play musical chairs with the assignment of engineers to projects so that there is no continuity or foundation of knowledge to build on. You will never be asked to work on a project that is technically related to anything you have worked on previously.

Of course, you must know when you have made mistakes and have a chance to correct them in order to learn from them. Therefore, it is not wise to go to work for a contract engineering firm until you have been exposed to a lot of mistakes or, in other words, until you are experienced. In such firms, you are either in a design or field section with no overlap in function. In the design section you move from one project to another without having to try to make your designs work. In the field section you spend all your time fixing other people's mistakes but don't get to make any design mistakes of your own.

A stint as a plant engineer is necessary to round out your perspective. Only by facing the day-to-day repair problems can you appreciate the impact of instrument selection, documentation, location, and installation on its serviceability. Many of the operational problems don't surface until after start-up. If all your field experience ends after commissioning, your viewpoint is distorted. You may be happy in your ignorance, but the plant engineer who has to live with your design will not be.

As a rule, plant engineers do not think highly of either corporate or contract engineers. These organizations tend to have engineers with average or above average technical capability but below average maintenance experience. Corporate engineers have more start-up experience than contract engineers, but

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they are less likely to treat the plant engineer as a customer. Nothing infuriates a plant engineer more than a corporate engineer refusing to alter a design for better reliability because it threatens the budget or the schedule. Even though the project money is allocated to and paid by the plant, corporate engineering acts as though it has total responsibility for the money. Therefore, plant engineers feel they have no control over corporate engineers and, for this reason, prefer contract engineers. The lesson to be learned here is to treat whoever uses the installation as a customer and seek to identify the short-term and long-term needs of that customer. While all this seems like common sense, it is not widely practiced. Consequently, corporate departments have recently begun to make their employees sit through several days of sheer excitement called 'Total Quality' programs to explain this fundamental principle. (This comes too late for many corporate departments, based on the present binge of decentralizations.)

The Game

In most large companies, you don't have to worry about your mistakes adversely affecting your potential for raises and promotion. Your performance review is based on a set of goals concerning whether the instruments were purchased on time and within the budget and not on whether they function properly or not. Thus, you can include lots of extra instruments in your estimate, buy the ones with the shortest delivery, have instrument systems fail right and left, and still meet your goals! Even if you mess up the estimate and don't meet your goals. don't worry. Your promotion and raise is based on how well you play the corporate game and not on your performance review. There are many rules to the game, but the foremost one is, "Don't rock the boat." The maintenance of the status quo is of primary importance. The primary goal in the life of a manager is not to upset the next level manager. The sole purpose of each level of management is to sooth the next level by means of