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BUSINESS CASE FOR USE OF FOUNDATION FIELDBUS

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Abstract Testimonials are out there talking about significant savings users have when they use FF technology for their project, but each and every case is different and savings are claimed under the project specific environment. Preparing a business case and doing an economical analysis between conventional and FF systems assists in identifying potential savings. Savings will fall under two categories. CAPEX reducing project engineering cost and OPEX reducing operations and maintenance cost.

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1. Business Case for use of Foundation Fieldbus

A business case is used as a tool that can support planning and decision making for any small or large project. A business case is not only needed to get financial approval but also to point out the issues and opportunities with the recommended solution. Even if project funding is already approved, writing a business case will help capture ideas for optional solutions to the problem being addressed. It is always a good idea to go through the brain storming session with the team to catch all the ideas and solutions for the issues. Issues can be either to upgrade obsolete equipments or to improve process efficiency and product quality. This brainstorming will give an alternate solution with impacts and benefits for issues being addressed. The business case will have all relevant facts for the project documented and linked together. While the business case should include financial justification, that should not be the only purpose for the document. Most projects follow the model of **Concept→Definition→Design→Development→Implementation→Operation** and the business case should be written at the completion of the concept phase. It should have a very clear and concise objective supported by accurate data. Accuracy of data is very important as it will make or break your case. When planning on using or promoting Foundation Fieldbus for an upcoming project, the information presented in this paper may be very useful to win your business case. Following are the essential sections for a good business case to implement FF in a project.

1.1. Executive Summary

The executive summary is a snapshot of your entire business case with details and analysis to follow. If you are buying a new computer for your office today, you always consider using the latest technology available in market, so your investment will be protected for several years to come. Foundation Fieldbus is the new innovative technology for the Instrumentation and Control field which offers benefits, not only to reduce capital cost, but also to reduce operational and maintenance costs as well. Bottom line for executive summary should be the financial benefits to the organization from using FF instead of conventional technology.

1.2. Assessment of issue/opportunity

Whether it is a grass root project, expansion of current facility, or re-instrumentation project, projects are approved to gain market share in today's competitive world. Issue being resolved can be obsolete instruments or DCS which are very hard to maintain and spares are not available or to achieve operational performance to reduce product cost and improve product quality. A thorough assessment of the current situation should be done considering historic, current and future issues. One must also consider the industry and market trends and what competitors are doing to get an edge in this competitive market. Wide acceptance of Foundation Fieldbus technology is setting up a market trend that cannot be ignored while choosing technology for the next automation project.

For example, we will consider a re-instrumentation project where all the pneumatic instruments in the plants are obsolete and spare parts are not available to maintain them. Centralized control has limited space and process control needs improvement. This can be an assessment of an issue or an opportunity.

1.3. Project Description and Solution Overview

The project description will define the objective of the project with the proposed solution for the issue faced by an organization. It will define processes, procedures, systems and organizations included within the scope of the project. The solution overview will define the desired goal for the project and how it can be achieved. The solution detail will clarify the issues presented earlier and how they will be resolved using this solution. Alternate solution options should be proposed and discussed in cost and benefits section.

Continuing the example for this re-instrumentation project, the proposed solution will be to convert the plant instrumentation with Foundation Fieldbus technology to address the obsolete instrument issue. Using FF technology for the new project will require a change in the skill set of technical staff and may necessitate additional training. It will change some processes and procedures in the plant and support systems. An alternate solution can be to use HART or conventional 4-20 mA devices, which certainly address the current issue, but may not address future requirements and industry trends.

1.4. Cost and Benefits

This is a very important section, which will assist you to win or lose the business case. Accuracy of data and analysis of benefits are a very critical part of this section. Hiring an independent or outside consultant to verify the accuracy of data is worth the effort. Foundation Fieldbus technology will help you win the cost and benefit battle with flying colours. Following is a list of areas where FF has a definite edge over other solutions.

Project Engineering cost {CAPEX}

FF Technology helps lower total installed project cost and reduce commissioning time for field instruments and DCS components.

Host system and devices

To compare apples to apples, host system and field device prices should be compared between conventional and FF system selected for the project. On the host system or DCS side, the price for software and hardware with licensing fees, costs for different I/O cards, costs of termination panels and costs of I/O card carriers should all be considered. Generally, the cost of fieldbus devices is slightly higher than conventional 4-20 mA devices, but fewer I/O cards will offset some of the cost increase associated with fieldbus devices. Most of the host will have FF interface cards, which can support 2 or 4 segments per I/O card with 16 to 32 devices per segment. That way your footprint for DCS I/O cards will be smaller, as one FF interface card can support 32 to 64 I/O points per card. Also, the multi-variable measurement capability of newer FF devices can increase the I/O count per FF interface card. For example, a new multi-sensor temperature transmitter supports 8 temperature measurements per device, so with one FF H1 interface card, you can measure 256 temperature points. The list of multi-variable devices registered at Fieldbus Foundation is growing day by day. FF implementation will also have additional costs for the power supply/conditioner and terminators per segment. For a true comparison, the cost of these components should be included in the cost analysis. The requirement for hazardous area classification should also be considered. This may bring additional savings since one barrier can be used for a complete segment in FF.

Wiring, conduit, cable trays

Several papers are published for savings on wiring, conduit and cable trays using FF technology. Each and every case will give you different sets of cost numbers. FF will definitely have savings in wiring but the percentage of savings will vary from project to project. When you can put 16 devices on one twisted- shielded wire pair compared to one device per wire pair, you will have wiring cost savings. Foundation Fieldbus recommends Type A cable for FF. This may have a slightly higher price than standard instrument cable. Also the plant standard for conduit and cable trays requirement should be evaluated and compared for cost analysis.

Installation

Installation savings will include the feet of cable drawn for the project, and termination of cable from control cabinet to field device. Here is typical example of classic wiring and FF wiring for 12 devices. FF will reduce field termination from 17 terminations per device into 6.83 terminations per device. This will have significant savings in field labour cost to install a device using FF technology. Pre-wired junction boxes will also reduce the time for field device installation.

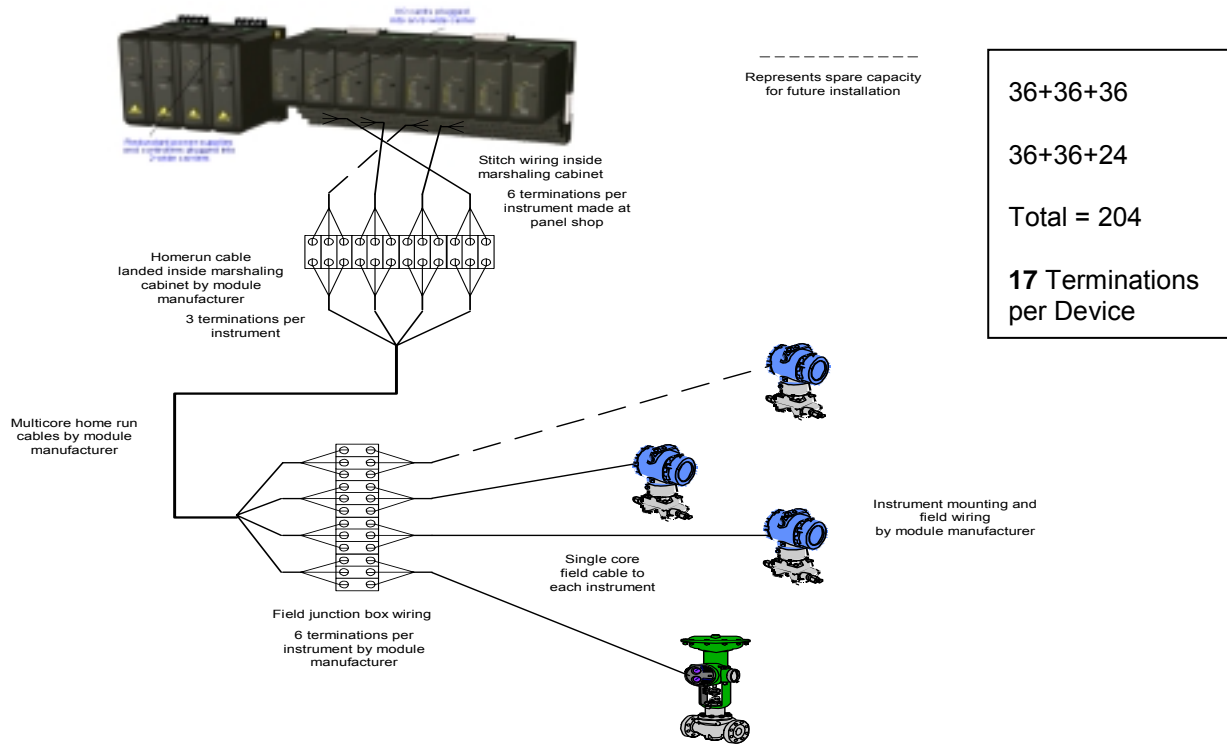


Figure 1 – Termination count for classic 4-20 mA wiring

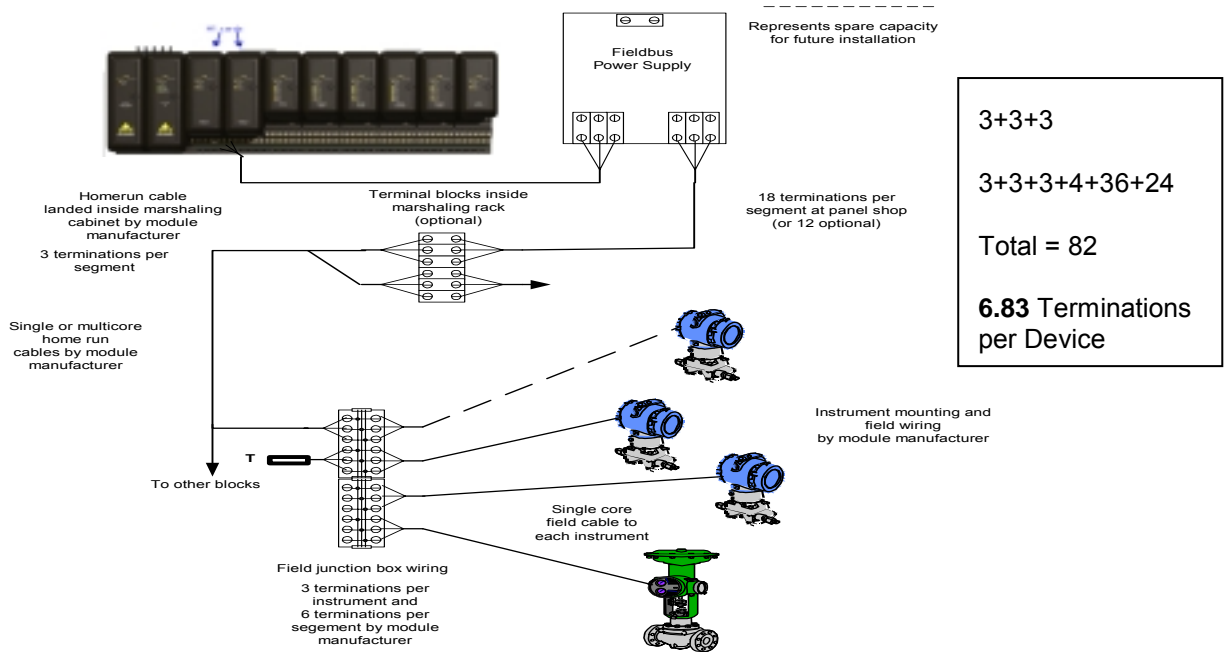


Figure 2 – Termination count for FF Wiring

Cabinets, junction boxes

The reduction in the I/O footprint for the DCS system will reduce the number of cabinets needed in the control room. FF technology will also eliminate the need for marshalling panels between field wiring and control system cabinets. FF technology also enables use of pre-wired and pre-fabricated field junction boxes that will eliminate manual errors in field wiring and add ease of installation. In early days, there were limited options regarding field junction boxes, but with more manufacturers competing in this market, we have a lot more options and features available for the field junction box. Topology used for FF wiring and selection of type of field junction boxes will have a variable cost on your project and should be carefully considered in the cost analysis.

Reduced space requirements

The reduction in the number of cabinets for I/O and elimination of the marshalling cabinet will decrease the cost of control room design and real estate requirement. This will have more significant value in a re-instrumentation project as control room real estate is limited and expansion is impossible in most cases. Historic information and the lay out design of control room is key criterion in making this cost calculation fruitful.

Engineering

Engineering cost savings can come from configuration and documentation savings. Sometimes it is difficult to justify savings in configuration, as you may need the same amount of time to configure a traditional DCS versus FF DCS. FF field devices can be pre-configured at the factory. The upload capability of the DCS to bring field device information into the DCS database can have significant savings on the DCS configuration side, which will convert into savings for engineering efforts. Engineering savings from loop drawings to segment drawings is very easy to justify and changes made to segment drawings will add more savings.

Reduced commissioning time

Each FF device will have device ID, physical device tag and physical device address on the segment. This will give each FF device a unique combination of these three items, which will reduce commissioning time and streamline start up efforts. An FF device can perform self tests to check its health and operating condition. After downloading the control strategy configuration to field devices, you can simultaneously perform the loop check and get confirmation of loop availability. It is hard to quantify how much time is saved using FF technology, but good engineering procedures and quick test in the lab, will help you quantify the savings in commissioning time. When one FF device communicates on the segment, it will confirm the wiring integrity check for entire segment.

Operational cost {OPEX}

The operational cost benefit for using FF technology on the project is very difficult to quantify. Historical data collection for operational costs will be helpful, but that data may not be available in all cases. It is hard to determine cost of having unscheduled shutdowns, environmental fines due to leakage, and faster turnaround during normal shutdown, etc.

Additional stream time

Due to reduced commissioning time FF technology can have a plant available to make product sooner than using convention technology in any project. Careful planning and proper procedures will have the project running on or before the scheduled completion time.

Improved quality and productivity

Accurate process data from FF measurement devices, actual position of FF valve positioner, advanced process diagnostics capability of FF devices and predictive diagnostics will help improve the product quality in any plant. This can be achieved either by reducing the rework on final product, scrap and waste disposal cost, blending improved or by reducing off spec products. Quick turnaround time and predictive diagnostics from FF devices will improve the throughput and availability of the plant. FF technology will allow field devices to send diagnostic alerts to the control system instead of polling of diagnostics information. This can reduce the bus traffic and have more accurate information available from devices, which are closest to the process.

Knowledge-based process decision

Each data transmission by a FF device will have status associated with the data value. This will help in making the knowledge base process decision and improve product quality. Each FF device has a lot more information available beside process variable and final position of valve. This information can be used and configured to take maximum advantage of the benefits offered by FF technology.

Lower cost of incremental expansion

FF technology will help address future incremental expansion of the plant. Each FF segment can have 16 to 32 devices, but normal practice will use only 10 to 12 devices per segment. If FF is used through out the plant, this will add 25 to 38% spare capacity per segment that can be used for future process enhancement without any significant cost to existing plant,.

Maintenance cost {OPEX}

Reductions in maintenance cost can be divided in different categories. FF technology will reduce spares inventory cost. The traditional device, for example, will have ability for range down to 10:1 ratio as the A/D converter will be the limiting factor to getting the desired accuracy. For an FF device, there is no A/D conversion as devices are transmitting data digitally over the bus and can have 100:1 range down. This will help in reducing inventory of required spares for the plant. FF devices will have centralized station to evaluate field device problems. A centralized maintenance station will allow instrument technician to access any device connected to the process. Diagnostics and status information will help him or her to troubleshoot the problem quickly and reduce unnecessary trips to the field. This can have significant savings especially for un-manned or remote platformoperation. FF

devices will have predictive diagnostics so devices or sensors can be replaced before they fail completely.

1.5. Assumptions and risk analysis

Assumptions made for the cost analysis and benefits should be clearly mentioned and the rationale behind each assumption should be defined. For an FF project, it can be the number of devices per segment, assumed cable length per segment, engineering rate for configuration and commissioning efforts, FF topology selected, type of field junction boxes used, fieldbus ancillary products, loop execution time, marshalling methods, hazardous area classification, etc. The risk analysis and critical factors for success should be clearly marked. Risk can be interoperability, training, skill set required for project management, timeline, cost, etc. Risk analysis should look at Strengths, Weaknesses, Opportunities and Threats (SWOT) proposed for the project. It is always good to demonstrate how FF technology will maximize strengths and opportunities and minimize threats and weaknesses.

1.6. Alternate solutions

One must also discuss alternate solutions available to address the issue. The risk analysis associated with alternate solutions should also be done with related cost and benefits.

For example in our re-instrumentation project, an alternate solution could be conventional 4-20 mA devices or a different bus offering. Each solution should be carefully compared with the FF solution and benefits and limitations of alternate solutions should be discussed in detail.

1.7. Conclusion and Recommendations

This section will summarize the issues, costs and benefits of the solution. Emphasis on the goal for your project is to reduce production cost, increase profit, accelerate the profit (Timeline), or to sustain the profit. Reaffirm how FF technology will help achieve financial benefits over the project lifecycle, including Return on Investment (ROI) analysis, should be clearly displayed. Close reiterating the goal of the solution achieved using FF technology.

2. References

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