A LESSON ON Foundation Fieldbus DD's and DD METHODS

BY
SANDRO ESPOSITO

1. Introduction

The Foundation Fieldbus protocol is one of the leaders in the industrial process control arena. Yet, it can provide a challenge to who ever is required to integrate the technology in the field. In order to connect devices with a host seamlessly, it's vital to understand the role of a device driver. This technical article is intended to demystify the role of a "DD" as well as illustrating the benefits of a "DD method".

2. What is a "DD"?

Before describing what are DD methods, it is essential to understand the meaning of a "DD". A device description (DD) is a file created in a standardized programming language called DDL (device description language) and then converted in a usable format for the host system , using a tokenizer. This tokenizer is a computer-based program that converts the strings of text in to "tokens". This DD then allows the host software to understand the meaning of the information contained in the device. Actually, it provides an extended description of the data for each object in the Virtual Field Device (VFD) list. Without it, the host system is only capable of displaying and modifying the universal information contained in each standard function blocks (which are specified by the Fieldbus Foundation). In turn, this deprives the user from accessing pertinent data, executing calibration routines and viewing diagnostic information. In essence, a DD is just like the printer driver provided with a printer. After installing it, the operating system is capable of communicating, printing the fonts and graphics appropriately as well as configuring the printer (quality, spooling, etc).

2.1 DD certification and testing

The Fieldbus Foundation is responsible for testing a device and the DD associated with it. Once a version of a firmware has been tested using the "Interoperable Testing Kit" (has known as ITK 4.1 when this article was written), the device is then certified and the DD (or technically named incremental DD) is made available from the web site www.fieldbus.org. The driver can also be downloaded from the manufacturers web site. Although, certain host systems such as the DeltaV system from Emerson Process Management, can not utilize the DD files created by the manufacturer of the device. Instead, they modify existing DD's for each firmware revision of a device and for each version of the DeltaV system. Also, they create a third file with the extension "FHX". This means that every Foundation Fieldbus device must be certified with the DeltaV host using the "host interoperable system testing" (also referred as H.I.S.T). This testing determines if there is any interoperability problems.

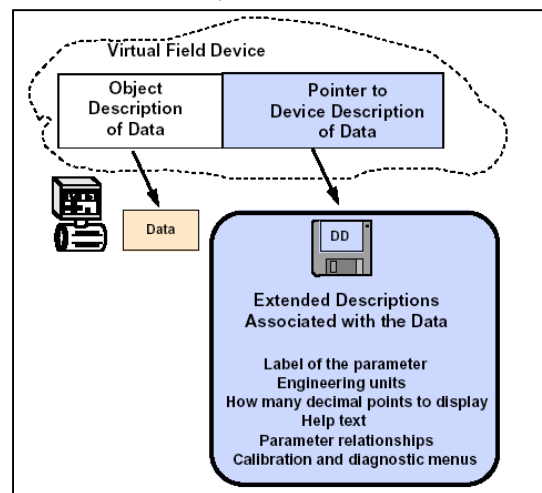The following picture illustrates the relationship between the device, the VFD list and the DD.

Figure 1. Information extracted from the VFD using a device descriptor (DD).

The rule of thumb is to verify with the host system if they have tested the device and what are the required DD files : either the manufacturers file or a subset of files generated by the host manufacturer. The FVP positioner has been tested for interoperability with the following FF hosts: Yokogawa's Centum3000, Emerson's DeltaV, HoneyWell's PlantScape SMAR Systems. For up to date information, it is recommended to consult Masoneilan's website at www.masoneilan.com. Or, consult the website provided by the host system manufacturer.

2.2 Locating the DD files for the FVP

The FVP has (at the time of printing this article) two revisions of the hardware: revision 2 and revision 3. The corresponding DD must be loaded into the host system to properly map the information contained in the device as well as being capable of running sub-routines located in the transducer block. The Fieldbus Foundation as determined a file-naming convention in order to avoid any confusion. The first two digits represent the device revision and the last two, the firmware update revision. A DD isn't backward compatible. That means, for instance, that the DD file "0304" will not function properly with an FVP with a revision 2. In a nutshell, the "DD" revision must match the firmware revision of the device.

The latest[1] DD files for the FVP are :

0201.ffo
0201.sym   DEVICE REVISION **2**
020101.cff

0304.ffo
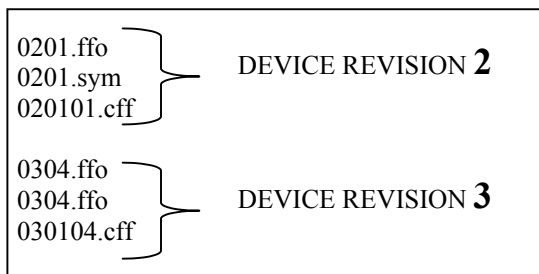0304.ffo   DEVICE REVISION **3**
030104.cff

Figure 2. File format vs Device Revision.

The other file, which may be necessary for a host system, is known as the "capabilities" file (or CFF). It allows the host to generate a template to build control schemes. This file can also be downloaded from www.masoneilan.com and www.fieldbus.org.

2.3 Identifying the revision of the FVP

The revision of a device is located in the resource block and it is broken down in four distinct parameters:

1- MANUFAC_ID: This identifies who is the manufacturer of the device. This number is assigned by the Fieldbus Foundation. This number is h445644 (or 4478532 in decimal) for Dresser and h595643 (decimal 5854787) for Yokogawa.

2- DEV_TYPE: This will always be "1" which correspond to the FVP110 model (or YVP110).

3- DEV_REV: This is the firmware revision of the device. Currently, the number can be 2 or 3, where the revision three will support DD methods and onboard valve signatures.

4- DD_REV: It is the revision of the device description file assigned to the FVP.

Current combinations:

Parameter	Initial Product (w/o DD method)	DD Method support
MANUFAC_ID	445644	445644
DEV_TYPE	1	1
DEV_REV	2	3
DD_REV	1	1

Table 1. Device revisions.

Therefore, to successfully match a DD in a host system with a device, it is necessary to identify the manufacturer and the revision number. Then, with this information, download the DD from www.fieldbus.org/downloads (or the specific website from the device's manufacturer). To avoid any issues with DD mismatching, we suggest to load all of the available DD's for the FVP in the host system. Control System's are designed in a way to support multiple version of a device description. The FVP's device description can be found at the Masoneilan's website, www.masoneilan.com .

For the DeltaV system, the device description must be downloaded from www.easydeltav.com. It is critical in the case of this host system to identify its version, and then locate the DD's accordingly.

3. DD Methods

Abstract
A DD method provides an interactive and also a user-friendly way to set up a field device through a Foundation Fieldbus control system. It allows the end user to access configuration, calibration and diagnostic routines directly from the host. Therefore, it is not necessary to physically connect a computer running a specific software, in order to set up a field device. Without DD methods, it is still possible to properly setup any Foundation Fieldbus device from the host. It can be done by modifying numerous parameters in the transducer block and in the analog output block.

---

[1] Consult Masoneilan's website for up to date information

3.1 Where they reside

The DD methods reside in the firmware of the field device. For the FVP , only the revision three and above supports them.   Also, the DD for the FVP contains the necessary information for the host to interact with it.   The DD provides the information to be displayed on the screen of the host while a method is in operation.   Also, since a method may require some input from the end user, the DD will provide the appropriate input boxes and data validation rules.

3.2 Host systems supporting DD Methods.

The Foundation Fieldbus host system supporting DD methods, so far, are:

Manufacturer	Brand of Control System (host)	Version
Yokogawa	Centum	3000
Emerson Process Management	DeltaV	6.3.2
National Instruments	Configurator	2.3.6

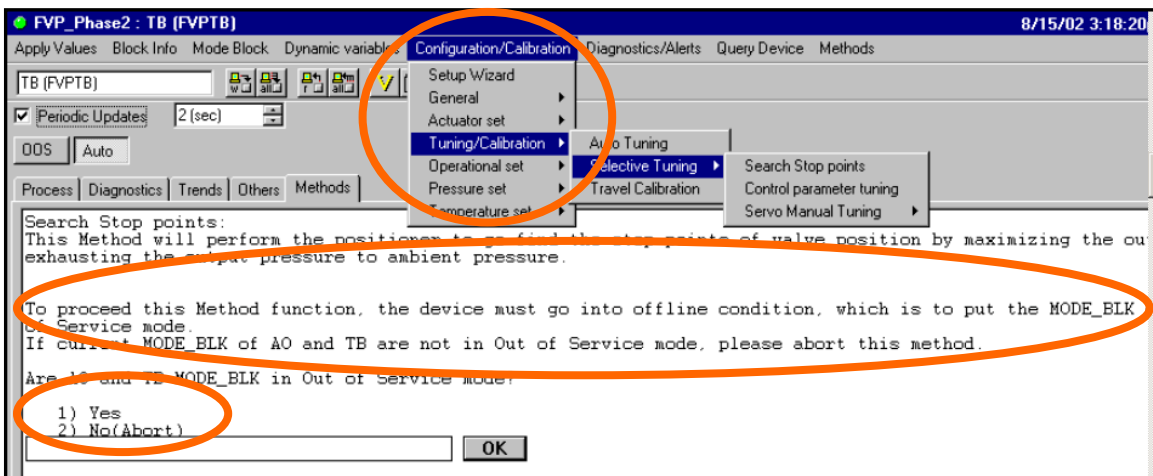See appendix A for screen shots from each host.

3.3 Running a DD Method

The figure 3 illustrates three fundamental concepts of a DD method : First, how methods are grouped and how they can be selected. Second, the dialog which guides the user in accomplishing a given task.   Third, the interactive dialog which allow the user to select what's appropriate to pursue the task.

To run a DD method   successfully, specific function blocks must be set in a given mode . For example, to run the FVP's SETUP WIZARD, the analog output block and the transducer block   must be set in the "out of service" (OOS) mode prior to executing a method. If not, the method will be aborted. The mode can be easily toggled from the host system and doesn't require any specific software to do this. It's a built in functionality of every control systems using the Fieldbus Foundation protocol.

3.4 ValVueFF or "Menus and Methods" ?

Currently, the ValvueFF software can only communicate to an FVP by connecting the computer to the segment (cable run) on which the positioner   branches off (see figure 4). Hence, it is not possible to run off the software directly from the FF host and therefore tying in on the FF hub (using an ethernet connection for example).
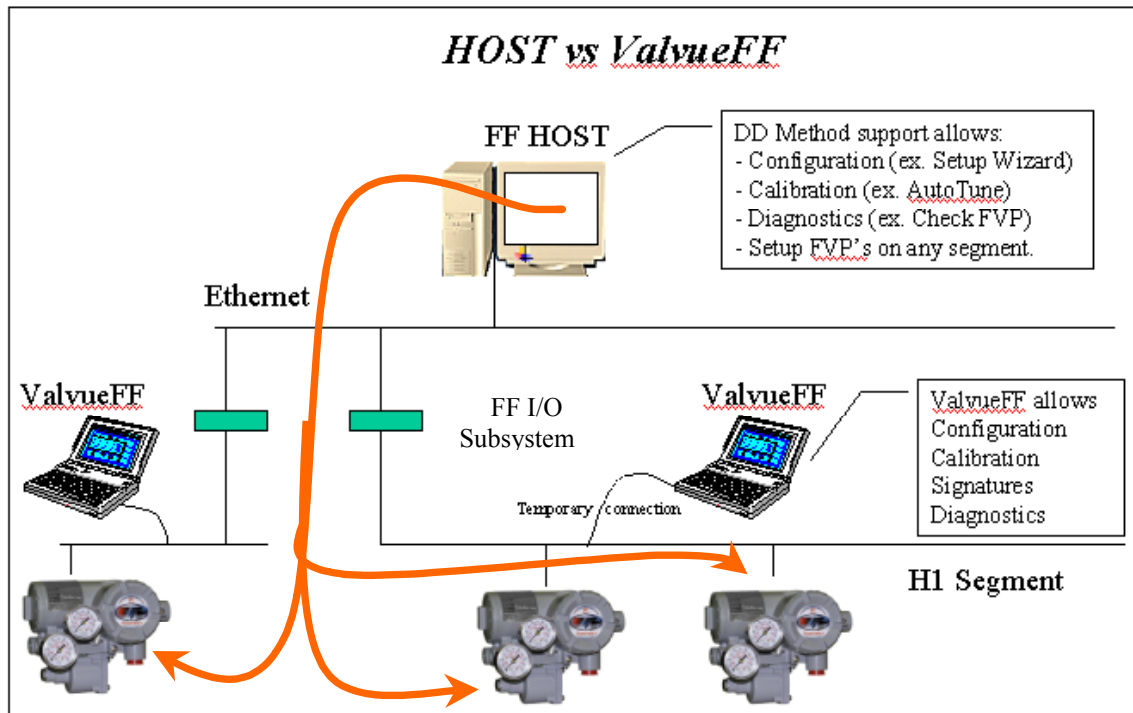

Figure 3. Example of a accessing and running a DD method from NI Configurator

Figure 4. Setting up a device through the host or using ValvueFF attached on a segment.

But, the above picture illustrate that the menus and methods provide an easy way of setting up an FVP directly from a control system. This is achieved no matter where the FVP is located. On the other hand, it doesn't provide all the tools necessary to fully take advantage of the FVP's capabilities. The ValvueFF software interface does everything a control system can do in order to set it up, but not directly from the control system.

Obviously, because the ValVueFF software is a graphical interface designed specifically for the FVP, it has more graphical capabilities and also, it has more functionality's, such as: running and viewing diagnostic signatures, cloning FVP's configuration, trending information, etc.

In Summary…

The Foundation Fieldbus protocol has standardized the communications between hosts and devices, but has indirectly created islands of software tools for field devices. This gap in software tools with control systems can now be filled with the menus and methods functionality

provided by the FVP. It is a very powerful and differentiating solution in the Foundation Fieldbus arena. With this functionality, the value of the product is increased, the cost of ownership reduced because of the ease of setting up the FVP and commissioning it.

In a sense, it enhances control systems where it is still not possible to have the ValvueFF software communicating directly with the FVP through the existing control system's architecture.

The ValvueFF software still has it's place. This easy-to-use interface leverages to FVP product to another level with capabilities such as advanced diagnostic signature testing, trending and troubleshooting. It's only a matter of time before some control systems will provide a door for ValvueFF to enter it's communication architecture.
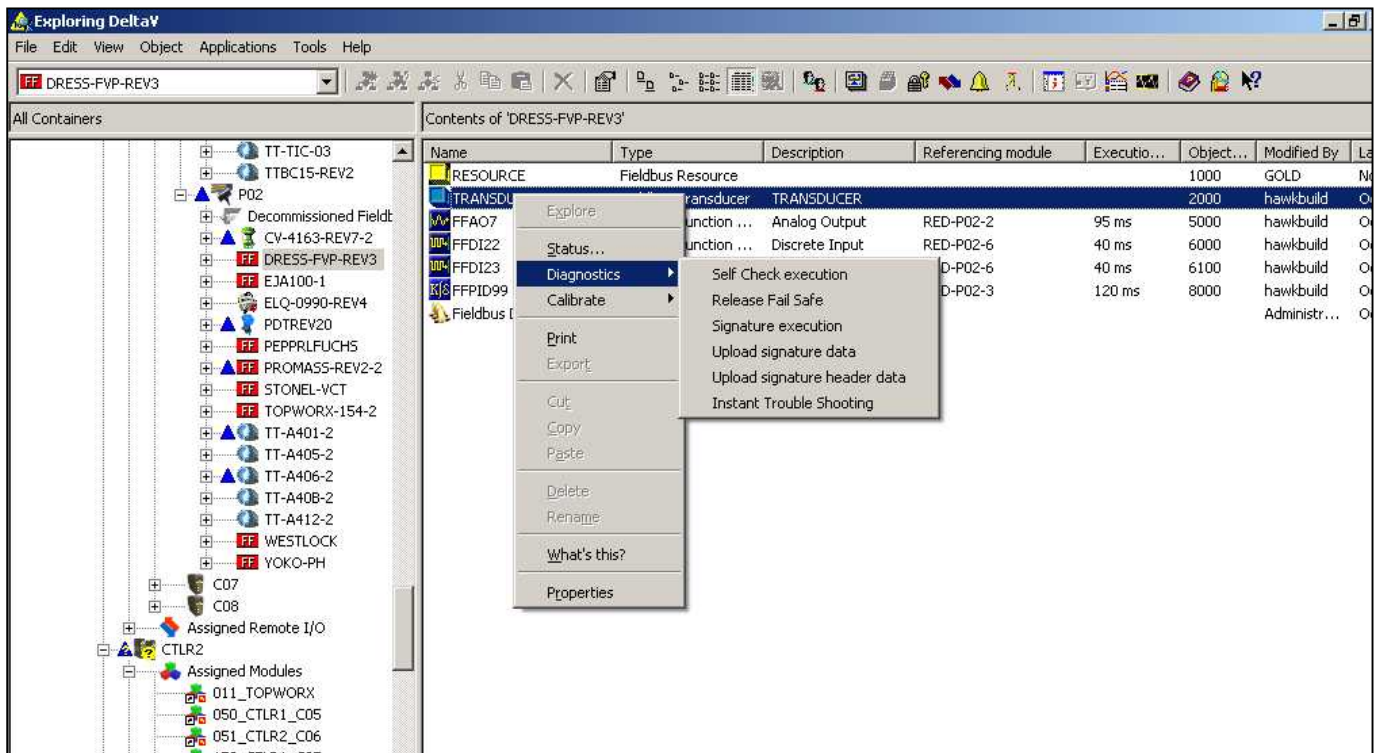
Authored by Sandro Esposito
Dresser Measurement And Control
Masoneilan Operations

Reference: FF Technical Overview FD-043

For any questions or comments please feel free to e-mail at sandro.esposito@masoneilan.com.
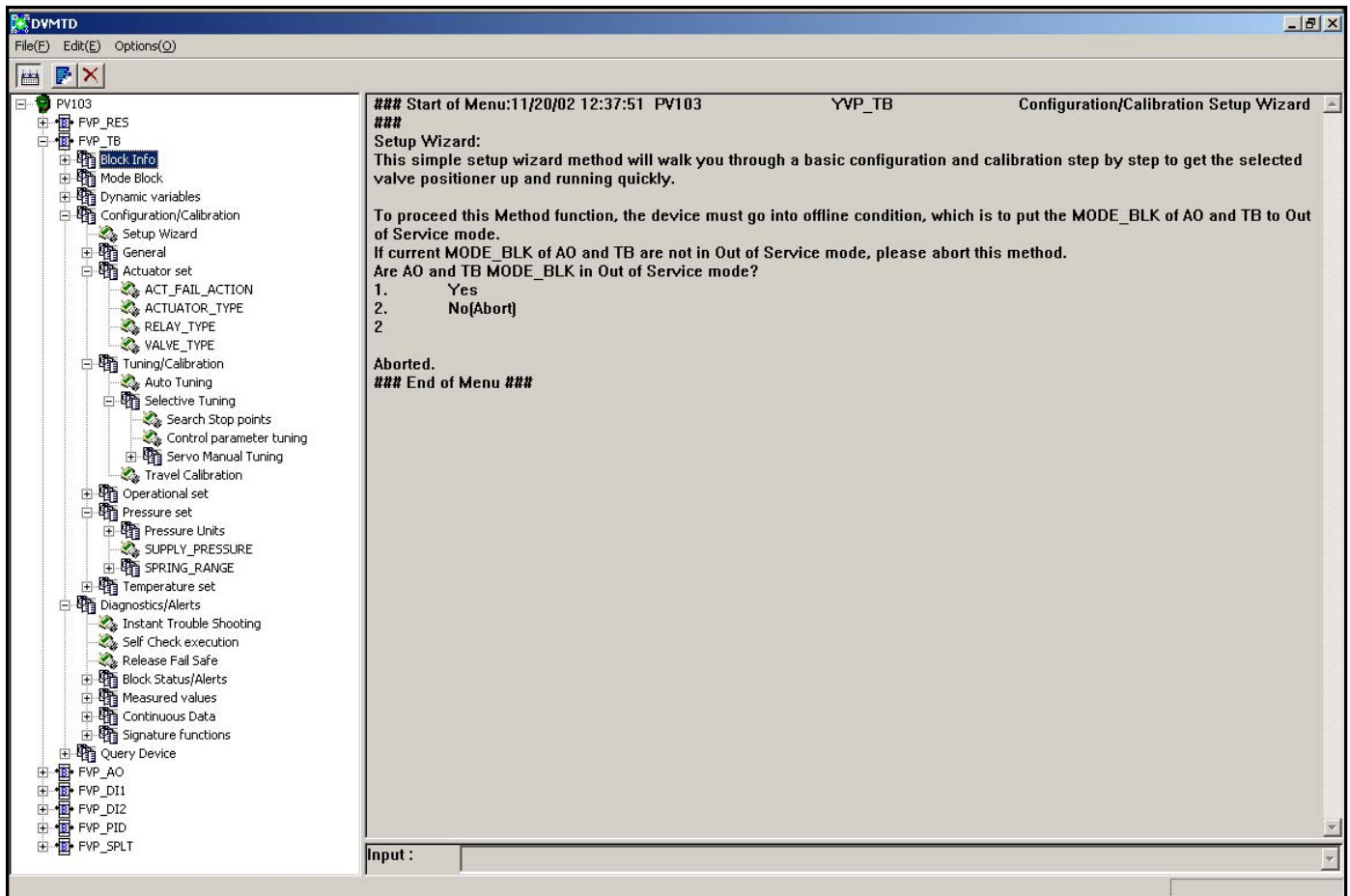
Screen shot from Yokogawa's Centum 3000 control system.

Screen shot from Emerson's DeltaV control system.