

I/A Series[®] Software DDE I/O Gate



The DDE I/O Gate is the latest development in the I/A Series Open Device Integration architecture. It is shipped with the DI/O-Configurator to simplify I/O connections.

THE NEEDS

Today's plant floor can be ever more efficient as more and more automated machines become available. To tap this potential, the process engineer is faced with the need to integrate these modern machines and sometimes older existing machines with a modern automation system to maximize process efficiency and to make plant floor information available enterprise wide. Plant floor machines vary in complexity from simple card/badge readers and scales to complex paper machines and power turbines. Applications vary from simple read only interfaces to critical complex control systems distributed between machines from several vendors. Interfaces vary from dedicated connections to complex networks.



Since the quantity of connections that must be made to fully automate a plant can be substantial, cost of each connection is often a concern. At the same time, certain plant floor connections are mission critical and may justify additional investment to provide such features as dedicated communication processors. The process engineer needs to be able to implement pilot lines quickly with a minimum investment, knowing that additional communication features can be easily added should the pilot line be upgraded for high volume production. Most of all, plant floor connections must provide a consistent user interface so that similar tools can be used to diagnose and correct problems quickly should they occur.

Most machines used on the plant floor provide some kind of communications capability. Several significant standardization attempts to provide a unified connection capability for the process engineer have been put forth. These include Dynamic Data Exchange (DDE), Remote Procedure Call (RPC), Communication Object Model/Distributed COM (COM/DCOM), OLE for Process Control (OPC), Java Automation API, and others. Many plant floor machine manufacturers support one or more of these approaches, while others provide connection capability with popular plant floor protocols such as Modbus/ModbusPlus. Most of these connection mechanisms can be used on plant floor networks, while others require significant engineering to make a usable connection. Some manufacturers provide Software Development Kits (SDKs) to allow a software engineer to program connections for their products. Older machines, still performing useful functions, and some newer specialty machines only provide proprietary interfaces.

Complicating the situation further, some manufacturers have provided modern connection capability for their machines without making it obvious that certain functionality such as accuracy, sampling synchronization, or passing data stored in certain formats are not available using one connection mechanism that is available on their machines using another connection mechanism. The process engineer may only recognize these limitations after implementations are underway.

THE SOLUTION

To address these complications, Foxboro has introduced a connection architecture using I/O Gates along with an integrated custom driver capability. Each I/O Gate provides a connection capability between I/A Series applications and plant floor machine drivers using a specific connection mechanism such as DDE. If a driver is available for a specific machine from any vendor supporting any of the connection mechanisms supported with an available I/O Gate, the machine can be connected to I/A Series. If not, Foxboro provides a custom driver development service.

Just as important, the choice of an I/O Gate does not effect the design of the database, the way problems are alarmed, or the important diagnostic tools available, even if a custom driver is used. If a decision is made to switch from one connection mechanism to another, the engineering investment in the application database does not change unless the application is to take advantage of additional information available through the new connection mechanism.

I/O GATE OPERATION

The I/O Gate is a piece of software which provides the 'glue' between an I/A Series system and the driver (or server) which connects external machines. The driver is often available from the machine manufacturer, a third party vendor, or from Foxboro. The DDE I/O Gate uses DDE as the connection mechanism between I/A Series and the driver. Additional I/O Gates for other connection mechanisms can be made available from Foxboro.

Each I/O Gate is optimized for plant floor integration and generally uses a COM like internal design. It integrates to the I/A Series System Manager allowing a user to control the connection to each device independently. It supports all I/A Series data types including contacts, integers, and floating point values as well as strings. Previously made connections are automatically reconnected on reboot. If an on-line connection is broken, the loss is alarmed in Station Manager identically to all I/A Series communication connections. Should a driver from a third party vendor not support that capability, a mechanism is provided to allow the user to configure connection loss alarming using data point "heartbeats" which is displayed in the Station Manager display.

I/O Gates are designed to work with I/A Series control blocks and require FoxBlock software to be installed on the same platform as the I/O Gate.

I/O Gate Architecture

The I/O Gate is at the heart of connections. Refer to Figures 1 and 2.

To make a single connection, a user needs an I/O Gate, a driver, and a platform supporting block processing. If a network is used, any number of connections can be made using a single network connection. If dedicated connections are used, each requires a separate driver, but a single I/O Gate can be used for all drivers using the same connection mechanism (e.g. DDE).



Figure 1. Open Device Integration Architecture Showing a DDE I/O Gate with Other I/O Gates

Data flows between I/A Series and plant floor machines through the DDE Server. The single DDE I/O Gate can connect multiple DDE Servers. Depending on the design of the DDE Server, one or more plant floor machines can be connected through a single server. To make the first connection, the user must install the DDE I/O Gate and a DDE Server/Driver.





The DDE I/O Gate connects data between I/A Series blocks and driver software which in turn, communicates with plant floor machines. Since data in I/A Series blocks are available to all I/A Series applications on all I/A Series stations with an I/A Series system, plant floor machines connected to an Application Workstation 70 (AW70) can be connected to any I/A Series application within the system.

SPECIFIC FEATURES OF DDE I/O GATE

Platforms

In general, I/O Gates will run on any I/A Series platform. The DDE I/O Gate is intended to work with Microsoft's DDE interface which limits its use to platforms running a Microsoft OS. The AW70 platform uses Microsoft's Windows-NT OS and allows Control Processing. It is currently the only I/A Series platform which can run the DDE I/O Gate.

Unrestricted Expansion Capabilities

The I/O Gate architecture places no logical limits on the number of points connected per device, the total number of devices connected, or on the total number of drivers (servers) being used with the DDE I/O Gate. The practical limitations in a system are determined by the host hardware being used, and the implementations of the applications connected through the DDE I/O Gate. That means that as more powerful workstations and faster media become available, a given application can be upgraded to take advantage of the increased capability without running into logical limitations or having to change the database for the existing connections. More specifically, the practical limitations in an application are determined by:

- The processing power and memory available to process the data on the DDE I/O Gate host platform. For example, the AW70 Style B platform can process more points per second than the AW70 Style A platform.
- The number of blocks or ECBs which can be supported on a given host platform. For example, if the I/A Series limitation for a given platform is 4000 blocks, the number of points that can be handled by the platform is limited to the number of points that can be handled by the 4000 blocks. The DDE I/O Gate can be used to connect all the data points in the 4000 blocks to plant floor devices. If new I/A Series workstations become available that can handle more blocks, the DDE I/O will be able to connect all the data points up to the new platform's limitation.
- The specified limitations of the media. For example, Modbus has certain throughput limitations. If the Modbus protocol is the limiting factor in your data throughput, upgrading the driver to a ModbusPlus driver with the DDE I/O Gate will enhance the system throughput without changing the DDE I/O Gate.

• The memory size, processing speed, and other restrictions of the connected device. For example, a given PLC may only handle 100 points and may only be able to process 25 points per second.

Drivers from Many Vendors Run on I/A Series

The DDE mechanism has some of the widest support of any available connection mechanism from vendors of plant floor machines and their drivers. Any driver implemented as a DDE Server and which presents data in a form compatible with I/A Series data types (contact in packed or unpacked form, 16-or 32-bit integer, or IEEE 32-bit floating point) or ANSI strings can connect those points using the DDE I/O Gate. In some cases, it may be necessary to use I/A Series blocks to condition the data for your application. Since installation and setup of the server will generally be unique to each vendor, the vendor must supply a way to setup and configure the server.

Network Support

The DDE I/O Gate supports direct and network connections and connections to devices on subnetworks from a main network when the DDE Server supports these features.

Simplified Connection Configuration

Once a DDE Server is set up (port or socket connections, baud rate, etc.), the tedious job of configuring the connections for each device and each point on the device is simplified with the DI/O-Configurator. The DI/O-Configurator works with the same database as Foxboro's Integrated Control Configurator. All I/O can be configured using the Integrated Control Configurator, but the DI/O-Configurator is optimized for, and greatly simplifies I/O Connections. The DI/O-Configurator is shipped with the DDE I/O Gate.

The illustration on the cover of this document is a sample display from the DI/O-Configurator. The lower part of the left window (Under Device Integration) diagrams the user's I/O configuration while the upper part of the same window shows the I/A Series Compound block organization. The window on the right is a list of all connected points.

In the cover illustration (lower part of left window), the DDE I/O Gate and three drivers are installed, Data for Windows, ModbusPlus and Moore3202 (the Moore3202 is scrolled off the lower part of the window). Drivers from Foxboro and drivers from other vendors all appear identically. In this example, all three drivers use the DDE I/O Gate so all show up as branches under the DDE I/O Gate in the DI/O Configurator display. The user simply creates compounds and inserts the Port and Device ECBs to model the networks he is connecting, using the top part of the left window for this work. These new Ports (networks) and Devices (for example, PLCs) show up in tree form in the lower part of the window, diagramming the user's networks. The user then creates a connection list for each device using the right window. Each row in the connection list shows the I/A Series name for the data point (compound:Block.Parameter) with the I/O name for the same data point (Driver:Device.Item).

This connection list is a convenient way to show all I/O connections. The list can be grouped and displayed in any order as specified by the user (compound:block as shown or by driver:device, for example) by selecting the column that is to be ordered.

Configuration is simple and quick since in most cases the user is not asked for any protocol specific information, but simply a list of the data points to be connected. As can be seen, Data for Windows, Moore3202 and ModbusPlus interfaces are all configured using the same simple techniques. The Data Base Engineer does not need to be an I/O expert and does not need to know specifics of each protocol to be able to configure interfaces. Groups of data points can be inserted in the list by a single command, simply indicating how the names in the group increment. Individual points or any set of points can be high lighted and edited as a group using the I/O Block Properties pop up window shown.

Even the user literature included with each Foxboro I/O Driver is simple and to the point. There is nothing complex to explain. Diagrams are used to show how a user's network can be modeled and which parameters on the I/O Block Properties are useful for the particular driver.

Auto Reconnect

Once a connection is configured, the DDE I/O Gate remembers all configured information. If the AW70 power is lost and then restored, or is rebooted for any reason, the connection is automatically restored.

Consistent Look and Feel

A consistent look and feel across all supported connection mechanisms. That means that a plant using Foxboro's I/O Gates does not need to standardize on a single connection mechanism or a single communication protocol to get consistency or "ease of use". Technicians do not need to learn the details of each or how to use tools specific to each to be able to service them. One set of tools and one set of knowledge allows a technician to diagnose and repair most communication problems, independent of the connection mechanism used.

DI/O-Configurator works consistently on different I/O Gates supporting different connection mechanisms. For example, the DDE grouping names (Application, Topic, Item) are replaced by other names when using different connections mechanisms, but connection concepts are represented consistently. Consistent operation across multiple connection mechanisms exist in related I/A Series applications including the System Manager, Display Handler, and FoxWatch.

SYSTEM CONFIGURATIONS

The DDE I/O Gate can be installed on any AW70. It does not matter to the DDE I/O Gate if the AW70 is operating as a stand-alone station or is networked to other I/A Series stations, nor if the AW70 is connected to a nodebus or Ethernet. The DDE I/O Gate is compatible with and can work along side other AW70 I/O connections including Modbus, Allen-Bradley, GE, and Fieldbus.

To use DDE I/O Gate, you will need to install it and as many drivers (servers) as you want to use with it. DDE I/O Gate makes no logical limitations on the number of servers it works with, how many plant floor machines are connected to each server, or how many data points are connected to each machine. It also makes no difference to the DDE I/O Gate which hardware interface the driver uses (Serial, Ethernet, ARCnet, or a proprietary physical connection such as SY/NET or Rnet). There are however physical limitations that you need to consider. These include:

Available PCI and ISA Card Slots

Most drivers require that you use a particular interface card (e.g., an Ethernet card). You need to consider all the interfaces being made on the AW70 and which of the available PCI or ISA slots each is using. Availability of card slots is often the limiting factor on how many interfaces an AW70 can support. If the driver requires a specific interface card, it must be able to use one of the available interrupts after all other cards have been assigned their interrupts.

Driver Limitations

When you select a driver, you need to determine how many machines can be connected to its interface bus or network. The limitation can be physical such as the loading limits on an RS-485 bus, they can be logical such as the number of available addresses in a network, or there can be traffic limitations for the bus or for the driver itself. The vendor supplying the driver is the best source of information on the limitations for the driver and the network or bus it is interfacing.

Supported I/A Series Platforms AW70

Supported Physical Connections

Generally unrestricted including serial, Ethernet, ARCnet, etc.

Installation

One DDE I/O Gate per AW70

Data Types

Single Contacts, Packed Contacts, 16-Bit Integers, 32-Bit Integers, 32-bit IEEE Floating Point and Strings.

Number of Servers (Applications) Supported

Platform dependent - available card slots, processing power.

Number Topics Supported

Platform/server dependent

Number of Items Supported

Platform/application dependent

Maximum Update Rates

AW70 blocks update every 1/2 second

AW70 Processing Power

Processing power of an AW70 can be the determining factor for the number of DDE points that can be connected. As faster processors with deeper cache continually become available, more data points can be processed. Processor loading in the "Functional Specifications" section is for the AW70 Style A. Processor loading of all applications running on the AW70 needs to be considered in determining how many machines a given AW70 can integrate.

FUNCTIONAL SPECIFICATIONS

Processing Load for DDE I/O Gate

The DDE I/O Gate will use less than 5% of the available AW70 Style A CPU power to connect between 50 and 300 points depending on the point type, assuming every point changed at least once every 1/2 second. If values change on average once a minute, 120 times that many points will load the processor by less than 5%.

Shipped Components

- Diskettes containing the DDE I/O Gate and the DI/O-Configurator.
- A user manual including installation instructions and support information for installing and demonstrating the DDE I/O Gate. Detailed support for your application can be purchased from Foxboro.
- A list of drivers which have been tested as of the shipping date. These can be purchased directly from Foxboro.
- A list of known DDE drivers from third party vendors including addresses and phone numbers of the vendors. These have not been tested and are not warranted by Foxboro but should be supported by the vendor listed.

The Foxboro Company

33 Commercial Street Foxboro, Massachusetts 02035-2099 United States of America <u>http://www.foxboro.com</u> Inside U.S.: 1-508-543-8750 or 1-888-FOXBORO (1-888-369-2676) Outside U.S.: Contact your local Foxboro Representative.

Fox, Foxboro, and I/A Series are registered trademarks of The Foxboro Company. Ethernet is a trademark of Xerox Corp. Modbus and Modbus Plus are trademarks of AEG Schneider Automation, Inc. Microsoft and Windows NT are trademarks of Microsoft Corporation.

Copyright 1997 by The Foxboro Company All rights reserved

MB 021

Printed in U.S.A.

An Invensys company