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Industrial Control Design AS



DiamondSystemsIO V1.1

User Manual

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1. Introduction

1.1. About DiamondSystemsIO

The DiamondSystemsIO component provides access to the Diamond Systems DMM 16 AT analog / digital card through the DiamondSystemsIO CDP Component. The DiamondSystemsIO is an IO Server based CDP Component that retrieves and sets digital and analog signal values from and to the card. If several cards are connected to the same CDP controller, one DiamondSystemsIO server must exist for each card. If you have two cards, you must have two DiamondSystemsIO servers.

Warning: On system power-up (time from booting until CDP is completely up and running), the digital outputs will be set to a low (value 0), while the Analog outputs might fluctuate. Due to this, essential control outputs should be controlled (enabled) by a high signal from the digital outputs to prevent problems when powering up/down the controller.

An Autocalibrate feature, which assumes that the digital outputs are set to a low value to disable the controlled equipment might also be present, so for this reason, beware of how the board is connected.

This document describes how to set up and use the DiamondSystemIO with the CDP system. The DiamondSystemIO component has the following features:

- Supports the DMM-16-AT card
- Works under On-Time RTOS32.
- Converts CDP Signals to physical signals
- Converts Physical signals into CDP Signals
- Has Online/Offline State for checking communication-problems.

2. Configuration

Configuration is done by modifying the component xml file inside the Application\Components\ folder. It should not be necessary to modify the model xml file. An example DiamondSystemsIO.xml file (component xml) is found in 3.1.

2.1. Card Setup

The DMM 16 AT card must be configured through jumpers. Especially, the BaseAddress must be correctly set up (and noted) to avoid conflicts with other resources in the system.

Jumpers must also be set for the analog output voltage level. Analog inputs should be set to “programmable”. Interrupts are not used in the current version of the driver.

The card supports at most 16 single ended analog inputs (8 differential) and 4 analog outputs. In addition, 8 digital inputs and 8 analog outputs are supported. If you need to mix single-ended and differential inputs, the card jumper must be set to differential inputs. For more information, see the card's documentation.

2.2. fs

The <fs> element specifies the frequency of which to run the reading and writing of the Input/Output values. <fs>100</fs> means 100 Hz, so a read and write is done every 10 milliseconds. If the runningTooFast alarm is constantly set, then you could have specified a too high fs. Typically, the maximum fs for the DiamondSystemsIO is 1000 Hz.

2.3. IOConfig/Node

2.3.1. Description

IOConfig is an XML element that wraps the Input / Output configuration. A minimal configuration is shown below.

2.3.2. Example XML

```
<IOConfig>
  <Node Name="DiamondSystemsIO">
    <BaseAddress>0x300</BaseAddress>
    <Inputs>
    </Inputs>
    <Outputs>
    </Outputs>
  </Node>
</IOConfig>
```

Element	Description
BaseAddress	The Base Address of the card to control. Note that to avoid conflicts with other devices, this number must be unique for the controller that the card is attached to, and must match what is set up through jumpers on the physical card.

2.4. Inputs

2.4.1. Description

Contains the ChannelGroups and Channels / signals to receive input from the physical Inputs on the card.

2.4.2. Example XML

```
<Inputs>
  <ChannelGroup Type="Analog" NumberOf="4" ModuleNr="0" VoltageRange="+-10">
    <Channel Nr="0" Type="unsigned short" Name="AI1" Min="-32768" Max="32767"></Channel>
    <Channel Nr="1" Type="unsigned short" Name="AI2" Min="-32768" Max="32767"></Channel>
    <Channel Nr="2" Type="unsigned short" Name="AI3" Min="-32768" Max="32767"></Channel>
    <Channel Nr="3" Type="unsigned short" Name="AI4" Min="-32768" Max="32767"></Channel>
  </ChannelGroup>
</Inputs>
```

2.4.3. Elements

Element	Description
ChannelGroup	An enclosing element for a group of channels/signals.
Channel	A Signal / Channel that correspond to one value received in.

ChannelGroup	Description
Type	Can be 'Analog' or 'Digital'
NumberOf	The Number of channels in this ChannelGroup
ModuleNr	The physical module number, used only for documentation.
VoltageRange	You must specify the VoltageRange as one of these values: (bi-polar): "+-10", "+-5", "+-2.5", "+-1.25", "+-0.625" (uni-polar): "0-10", "0-5", "0-2.5", "0-125", "0-0.625"

Channel Attribute	Description
Number	The number in a sequence, must be last number+1. On Digital channels this also signifies the bit position, starting at 0.
Type	The c++ data type, can be: bool (on/off), char, byte, unsigned char (one byte), short, unsigned short (two bytes). Typical values are bool and unsigned short.
Name	The signal name for this channel. Feel free to use more understandable names than what is used in the example, like 'Pressure', 'Oil Level' and so on.

Note that setting up more channels than the board supports might be possible through software, but it may cause undefined results.

2.5. Outputs

2.5.1. Description

Contains the ChannelGroups and Channels/signals to send as output from the Wago Modules.

2.5.2. Example XML

```
<Outputs>
  <ChannelGroup Type="Analog" NumberOf="2" ModuleNr="5">
    <Channel Nr="0" Type="short" Name="AO1" Min="0" Max="32767"></Channel>
    <Channel Nr="1" Type="short" Name="AO2" Min="0" Max="32767"></Channel>
  </ChannelGroup>
</Outputs>
```

2.5.3. Elements

Element	Description
ChannelGroup	An enclosing element for a group of channels/signals.
Channel	A Signal / Channel that correspond to one value received in.

ChannelGroup	Description
Type	Can be 'Analog' or 'Digital'
NumberOf	The Number of channels in this ChannelGroup
ModuleNr	The physical module number, used only for documentation.
VoltageRange	You must specify the VoltageRange as one of these values: (bi-polar): "+-10", "+-5", "+-2.5", "+-1.25", "+-0.625" (uni-polar): "0-10", "0-5", "0-2.5", "0-125", "0-0.625"
SizeInBytes	Only for Digital ChannelGroups: Specifies the size in bytes of the ChannelGroup. For digital channels that occupy a byte, as in the DMM 16 AT, this is set to 1.

Channel Attribute	Description
Number	The number in a sequence, must be last number+1. On Digital channels this also signifies the bit position, starting at 0.
Type	The c++ data type, can be: bool (on/off), char, byte, unsigned char (one byte), short, unsigned short (two bytes). Typical values are bool and unsigned short.
Name	The signal name for this channel. Feel free to use more understandable names than what is used in the example, like 'Pressure', 'Oil Level' and so on.

Note that setting up more channels than the board supports might be possible through software, but it may cause undefined results.

2.6. AnalogChannel Scaling

Analog Channels can do multipoint scaling each time they are read or written. Please see the document 'AnalogChannel with Multipoint scaling.pdf' in the Doc folder where you installed CDP for more information about this. On a Windows install, there is also a shortcut placed on 'Start Menu'->'CDP'->'Doc'->'IOServers'.

2.7. Alarms

The following alarms can trigger from this IOserver:

Alarm Name	Description
Transmission Error	An error is causing the transmission of signals to fail
RunningTooFast	The <fs> is set too high, the I/O can not keep up.

In addition, you can set up alarms to trigger directly on a Channel mask.

A Channel Alarm is set up in XML like this:

```
<Channel Nr="0" Type="short" Name="750-454 2AI 0.0" ErrorMask="0x0003" AlarmMessageCommand="Stop"
AlarmMessageDestination=".ControlCode" AlarmText="Cable break on Valve feedback" Description="A Cable
break was detected on the first input module in the Winch IO Cabinet (cable from winch speed valve
feedback)"></Channel>
```

The Alarm will get the name of the channel, and " Alarm" is appended to that name. For this reason, make sure the Channel Name is less than 25 characters to avoid the problem with ShortName>31 characters.

Channel Alarm Attribute	Description
ErrorMask	Required. Specifies a Mask to AND (&) with the channel. If the result is non-zero, the alarm is set (see Timeout below)
AlarmMessageCommand	MessageCommand to send when alarm is set.
AlarmMessageDestination	MessageDestination for the AlarmMessageCommand.
AlarmText	Text to set in the Alarm, visible in a visualizer
AlarmDescription	Description to set in the alarm, visible in a visualizer
Timeout	Time in seconds that the error condition must be active, before the alarm is set. Default value 0.

2.8. Signals

The following signals are in the IOserver:

Signal Name	Description
Send-Receive Roundtrip time	The time used for outputting and inputting data, including signal conversion.
outputDisabled	Only used in conjunction with CDP Redundancy: Is set to 1 if parameter 'RD output disable control' is set to 1 and the RDmanager is not in the Active state, else it is 0. This signals tells if the outputs are written out to the physical modules(if value=0) or not (value=1).

2.9. Parameters

Parameter Name	Description
RD output disable control	Only used in conjunction with CDP Redundancy: Set to 1 to make RDManager disable output if RDManager is not in Active State.
SignalTimeout	The SignalTimeout parameter is a value used for setting the signal age threshold (in seconds) for entering 'Offline' state.

2.10. Routing

To get the IOserver to output sensible signals, you will have to route the signals from another component. In CDP version 2.3.1.0 and earlier you can **not** set routing directly on an IOserver such as this. You will have to 'push' the routing from a signal on the same controller as the IOserver is located. 'Push' routing only works on components running inside the same controller. For instance, a 'Sinus' component could have routing on its 'Output' signal set to 'DiamondSystemsIO.Analog Output 1', this will effectively 'write' the sinus out to the channel containing that signal.

2.11. Modify the project .xml files

Add the following to your project's Application.xml file:

Inside the <Components> element, add an instance of a DiamondSystemsIO component, for instance:

```
<Component Name="DiamondSystemsIO" src="Components/DiamondSystemsIO.xml"></Component>
```

This will make the component a so-called 'top-level' component, quickly accessible from anywhere in the network. In a CDPBrowser, the component will then be visible on the same level as other Application components.

If you want to have the component 'hidden' inside your application, add the following inside the <Subcomponents> element:

```
<Subcomponent Name="DiamondSystemsIO" Model="DiamondSystemsIO"  
src="Components/DiamondSystemsIO.xml"></Subcomponent>
```

This will tell CDP to initialize a component named "DiamondSystemsIO" from a component file located at "Components/DiamondSystemsIO.xml", and place it below the Application component.

Make sure that your Models\ folder contains a DiamondSystemsIO.xml model file, or the component will not be initialized correctly.

The DiamondSystemsIO Model file can be found in \$(CDPBase)\Templates\Project_template\Application\Models\, and an example DiamondSystemsIO component file can be found in \$(CDPBase)\Templates\XML Templates\IO Servers.

3. Appendix

3.1. Example DiamondSystemsIO XML-file

```

<?xml version="1.0" encoding="ISO-8859-1" ?>

<!-- DiamondSystemsIO component model. -->
<Component Name="DiamondSystemsIO" Type="DiamondSystemsIO">
  <!-- The frequency that data-access should be performed at -->
  <Activate>1</Activate>
  <Description>
  <![CDATA[
    DiamondSystems DMM-16-AT IO driver
  ]]>
  </Description>
  <fs>10</fs>
  <IOConfig>
    <Node Name="DiamondSystemsIO">

      <!-- IONode baseaddress -->
      <BaseAddress>0x300</BaseAddress>

      <Inputs>
        <ChannelGroup Type="Analog" NumberOf="4" ModuleNr="0" VoltageRange="+-10">
          <Channel Nr="0" Type="unsigned short" Name="AI1" Min="-32768" Max="32767"></Channel>
          <Channel Nr="1" Type="unsigned short" Name="AI2" Min="-32768" Max="32767"></Channel>
          <Channel Nr="2" Type="unsigned short" Name="AI3" Min="-32768" Max="32767"></Channel>
          <Channel Nr="3" Type="unsigned short" Name="AI4" Min="-32768" Max="32767"></Channel>
        </ChannelGroup>

        <ChannelGroup Type="Analog" NumberOf="4" ModuleNr="1" VoltageRange="0-10">
          <Channel Nr="0" Type="unsigned short" Name="AI5" Min="0" Max="65535"></Channel>
          <Channel Nr="1" Type="unsigned short" Name="AI6" Min="0" Max="65535"></Channel>
          <Channel Nr="2" Type="unsigned short" Name="AI7" Min="0" Max="65535"></Channel>
          <Channel Nr="3" Type="unsigned short" Name="AI8" Min="0" Max="65535"></Channel>
        </ChannelGroup>

        <ChannelGroup Type="Analog" NumberOf="4" ModuleNr="2" VoltageRange="0-5">
          <Channel Nr="0" Type="unsigned short" Name="AI9" Min="0" Max="65535"></Channel>
          <Channel Nr="1" Type="unsigned short" Name="AI10" Min="0" Max="65535"></Channel>
          <Channel Nr="2" Type="unsigned short" Name="AI11" Min="0" Max="65535"></Channel>
          <Channel Nr="3" Type="unsigned short" Name="AI12" Min="0" Max="65535"></Channel>
        </ChannelGroup>

        <ChannelGroup Type="Analog" NumberOf="4" ModuleNr="3" VoltageRange="+-2.5">
          <Channel Nr="0" Type="unsigned short" Name="AI13" Min="-32768" Max="32767"></Channel>
          <Channel Nr="1" Type="unsigned short" Name="AI14" Min="-32768" Max="32767"></Channel>
          <Channel Nr="2" Type="unsigned short" Name="AI15" Min="-32768" Max="32767"></Channel>
          <Channel Nr="3" Type="unsigned short" Name="AI16" Min="-32768" Max="32767"></Channel>
        </ChannelGroup>

        <ChannelGroup Type="Digital" NumberOf="8" ModuleNr="4">
          <Channel Nr="0" Type="bool" Name="DI0"></Channel>
          <Channel Nr="1" Type="bool" Name="DI1"></Channel>
          <Channel Nr="2" Type="bool" Name="DI2"></Channel>
          <Channel Nr="3" Type="bool" Name="DI3"></Channel>
          <Channel Nr="4" Type="bool" Name="DI4"></Channel>
          <Channel Nr="5" Type="bool" Name="DI5"></Channel>
          <Channel Nr="6" Type="bool" Name="DI6"></Channel>
          <Channel Nr="7" Type="bool" Name="DI7"></Channel>
        </ChannelGroup>
      </Inputs>
      <Outputs>
        <ChannelGroup Type="Analog" NumberOf="2" ModuleNr="5" VoltageRange="+-5">
          <Channel Nr="0" Type="short" Name="AO1" Min="0" Max="32767"></Channel>
          <Channel Nr="1" Type="short" Name="AO2" Min="0" Max="32767"></Channel>
        </ChannelGroup>

        <ChannelGroup Type="Analog" NumberOf="2" ModuleNr="6" VoltageRange="+-5">
          <Channel Nr="0" Type="short" Name="AO3" Min="0" Max="32767"></Channel>
          <Channel Nr="1" Type="short" Name="AO4" Min="0" Max="32767"></Channel>
        </ChannelGroup>

        <ChannelGroup Type="Digital" NumberOf="8" ModuleNr="7">
          <Channel Nr="0" Type="bool" Name="DO0"></Channel>
          <Channel Nr="1" Type="bool" Name="DO1"></Channel>
        </ChannelGroup>
    </Node>
  </IOConfig>
</Component>
  
```

```

<Channel Nr="2" Type="bool" Name="DO2"></Channel>
<Channel Nr="3" Type="bool" Name="DO3"></Channel>
<Channel Nr="4" Type="bool" Name="DO4"></Channel>
<Channel Nr="5" Type="bool" Name="DO5"></Channel>
<Channel Nr="6" Type="bool" Name="DO6"></Channel>
<Channel Nr="7" Type="bool" Name="DO7"></Channel>
</ChannelGroup>
</Outputs>

</Node>
</IOConfig>
<Alarms>
  <Alarm Name="Transmission Error" Text="DiamondSystemsIO transmission-error alarm" Level="Warning"
Enabled="1"></Alarm>
  <Alarm Name="RunningTooFast" Group="" Level="Warning" Trig="0" Enabled="1" EnabledState="Online"
Signal="" Inverted="0" SignalOutSet="" Text="The I/O frequency is set too high, the hardware can not keep
up." Description="The I/O frequency is set too high, the hardware can not keep up."
CppName="m_runningTooFast"></Alarm>
</Alarms>

<Signals>
  <Signal Name="Send-Receive Roundtrip time" Unit="s" Type="double" Description="The time needed to
perform one send and receive."></Signal>
  <Signal Name="outputDisabled" Unit="0/1" Input="0" Type="bool" Description="Is set to 1 when outputs
are disabled. Controlled by IOserver baseclass."></Signal>
</Signals>

<Parameters>
  <Parma Name="SignalTimeout" Unit="s" Value="0.1" DefaultValue="0.0" PreviousValue="0.0"
TimeLastChanged="0" Description="Timeout in seconds before going to Offline stat."></Parma>
  <Parma Name="RD output disable control" Unit="0 / 1" Value="0" DefaultValue="0" PreviousValue="0"
TimeLastChanged="Fri Oct 03 11:21:50 2008" Description="Redundancy: Set to 1 to make RDManager disable
output if RDManager is not in Active State."></Parma>
</Parameters>
</Component>

```