### MGate 5109 with DNP3 SCADA Application

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### **1. System Topology**

This application note demonstrates how to use the **MGate 5109** to communicate with a **DNP3-based SCADA**. **PcVue SCADA** is used as a DNP3 TCP Master to remotely control and monitor Modbus RTU via the MGate 5109.

The MGate 5109's protocol conversion is **DNP3 TCP/UDP Outstation <-> Modbus RTU/ASCII Slave**.



MGate 5109 is the agent to convert Modbus to DNP3, and vice versa. In agent mode, the MGate 5109 uses an internal memory to exchange data between Modbus and DNP3 protocols. The MGate's internal memory is divided into two parts: one for input and the other for output, as shown in the figure below:



In order to simplify the configuration for internal memory mapping, the MGate 5109 shows the corresponding protocol addresses for both Modbus and DNP3, which you will find in the I/O Data Mapping. Let's take DNP3 Binary Output as an example. Because DNP3 Binary Output can be read and written, you will find the following information in the I/O Data Mapping page. The details of the configuration will be explained in this technical note.

| • I/O Data Ma  | • I/O Data Mapping                               |   |  |  |  |
|--|--|---|--|--|--|
|  | Select your scenario DNP                         | 3 TCP/UDP Master> Mod                     | bus RTU/ASCII Sla  | ive 🗸  |  |
| Modbus Mapping address   | arrangement Automatic                            | 2   |  |  |  |
|  | write  |   | write  |  |  |
| Your device :<br>DNP3 TCP/UDP Master                                 | Role 1 of MGate5109 :<br>DNP3 TCP/UDP Outstation | Role 2 of MGate51<br>Modbus RTU/ASC       | 09 :<br>Il Master  | Your device :<br>Modbus RTU/ASCII <b>Slave</b> |  |
| Full mapping : Un-ft      Type      Binary Output      Analog Output | Il mapping : None mapping                        | Name Function<br>WriteBO 15<br>WriteAO 16 | Internal Address           0          1           2          5 | Quantity     2 bytes     4 bytes               |  |
| :• I/O Data Mar  | oping  |   |  |  |  |
| s  | elect your scenario DNP3                         | TCP/UDP Master < Modbu                    | IS RTU/ASCII Slav  | e 🗸  |  |
| Modbus Mapping address arr   | angement Automatic V                             |   |  |  |  |
|  | Pread  |   | Pread  | ©<br>⊨H  |  |
| Your device :<br>DNP3 TCP/UDP Master                                 | Role 1 of MGate5109 :<br>DNP3 TCP/UDP Outstation | Role 2 of MGate5109<br>Modbus RTU/ASCII   | ) :<br>Master  | Your device :<br>Modbus RTU/ASCII Slave        |  |
| : Full mapping 🔲 : Un-full mapping 🔲 : None mapping                  |  |   |  |  |  |
| Туре   | Index  | Name Function                             | on Internal Add  | ress Quantity                                  |  |
| Binary Input 🗸   | 0 15   | ReadBl 1                                  | 0  | 1 2 bytes                                      |  |
| Binary Output 🗸  | 0 15   | ReadBO 1                                  | 2  | 3 2 bytes                                      |  |
| Counter 🗸  | 0 1  | ReadCounter 3                             | 4  | 11 8 bytes                                     |  |
| Analog Input 🗸   | 0 1  | ReadAl 3                                  | 12   | 19 8 bytes                                     |  |
|  |  |   |  |  |  |

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|   | Equipment         | Check items   |
|---|-------------------|---|
|   |                   | Hardware connections.                                     |
| 1 | Modbus TCP Server | Modbus registers to be read or written.                   |
|   |                   | Hardware connections.                                     |
|   |                   | MGate basic settings.                                     |
|   |                   | Modbus master commands.                                   |
| 2 | MGate 5109        | DNP3 outstation settings                                  |
|   |                   | Hardware connections                                      |
|   |                   | DNP3 outstation configurations                            |
|   |                   | DNP3 master address setting                               |
| 1 | DNP3 TCP Master   | DNP3 oustation objects configuration: BI/BO/AI/AO/Counter |

Here is a brief checklist to help you review the steps needed for a successful conversion.

### 2. Required Equipment and Components

#### 2.1. PcVue SCADA

**PcVue SCADA** system is published by **ARC Informatique**. Version **11.1** is used in this demonstration. It has a DNP3 built-in driver for DNP3 communication.

#### 2.2. Modbus Slave

<u>Modbus Slave</u> is the very popular Modbus slave simulator to test and debug your Modbus devices. It supports Modbus RTU/ASCII and Modbus TCP/IP.

Download Website: <a href="http://www.modbustools.com/download.html">http://www.modbustools.com/download.html</a>

### 3. MGate 5109 Setting

Log in to the MGate 5109's web console, and then complete the following settings:

#### 3.1. Serial Settings

Set as below:

#### -Serial Settings

| Port | Baud rate | Parity | Data bit | Stop bit | Flow control | FIFO     | Interface       |
|------|-----------|--------|----------|----------|--------------|----------|-----------------|
| 1    | 115200 🗸  | None 🗸 | 8 🗸      | 1 🗸      | None 🗸       | Enable 🗸 | RS-485 2-wire 🗸 |

### 3.2. Protocol Conversion

Set as below:

• Protocol Conversion

|                       | ₹ |   |         |   | ₹ |                          |
|-----------------------|---|---|---------|---|---|--------------------------|
| DNP3 TCP/UDP Master V |   | Role1 of MGate5109 :<br>DNP3 TCP/UDP Outstation | Agent 🗸 | Role2 of MGate5109 :<br>Modbus RTU/ASCII Master |   | Modbus RTU/ASCII Slave 🗸 |

#### 3.3. DNP3 Settings

In DNP3 TCP/UDP Outstation Settings, complete the following settings below:

- Set the DNP3 address as 4
- Set Enable unsolicited response to Enable. •
- Set the Unsolicited response master DNP3 address as 3
- Set the **Unsolicited response master IP/Port** as PC1's **20000** port. •

### **DNP3 TCP/UDP Outstation Settings**







Role1 of MGate5109 : **DNP3 TCP/UDP Outstation** 

| Role  | e2 of I | MGate | 5109  | 1:   |
|-------|---------|-------|-------|------|
| Modbu | s RTI   | U/ASC | ll Ma | iste |

| Mode selection                           | Outstation     |                     |  |
|--|----------------|---------------------|--|
| Basic Settings                           |                |                     |  |
| DNP3 address                             | 4              | (0 - 65519)         |  |
| Local port                               | 20000          | (1 - 65535)         |  |
| Network Type                             | ● TCP ○ UDP    |                     |  |
| Enable unsolicited response              | Enable 🗸       |                     |  |
| Unsolicited response master DNP3 address | 3              | (1 - 65519)         |  |
| Unsolicited response master IP/Port      | 192.168.32.143 | : 20000 (1 - 65535) |  |

### Set the **Object Point Numbers** as below:

DNP Object Settings

| Object Type   | Number of Points |
|---------------|------------------|
| Binary Input  | 16               |
| Binary Output | 16               |
| Counter       | 2                |
| Analog Input  | 2                |
| Analog Output | 2                |

Click **Binary Input** to set **Default static variation** as **2: With Flags**, set **Default event variation** as **2: With Absolute Time**.

| Binary Input             |                         |
|--------------------------|-------------------------|
| Number of points         | 16                      |
| Default static variation | 2: With Flags 🗸         |
| Default event variation  | 2: With Absolute Time 🗸 |
| L                        |                         |

Click the **Event Settings** button to set all of **BI Event Class** as **1**.

|          | :•Binary Inp  | out Settings         |                               |
|----------|---|----------------------|-------------------------------|
|          | Binary Input  |                      |                               |
|          | Number of points<br>Default static variation<br>Default event variation | Quick Events Setting |                               |
| <b>)</b> | Event Settings  | Points Index         | 0-15                          |
|          | Point Index<br>0<br>1<br>2<br>3   | Class of Event       | O O O 1 O 2 O 3<br>Set Cancel |

Click Counter to set Counter Length as 1: 32 Bit. Counter Settings
Counter
Number of points
Counter length
2
1: 32 Bit

Set all **Class of Event** as **2**.

|          | Counter Settings |                      |                 |
|----------|------------------|----------------------|-----------------|
|          | Counter          |                      |                 |
|          | Number of points |                      | 2               |
|          | Counter length   |                      |                 |
| <b>?</b> | Event Settings   | Quick Events Setting |                 |
|          | Point Index      |                      |                 |
|          | 0                | Points Index         | 0-1             |
|          | 1                | Class of Event       | ○ 0 ○ 1 ● 2 ○ 3 |
|          | 1                |                      |                 |
|          |                  |                      | Set Cancel      |

Click Analog Input to set Analog Input Length as 1: 32 Bit.

### Analog Input Settings

| Analog Input        |             |
|---------------------|-------------|
| Number of points    | 2           |
| Analog input length | 1: 32 Bit 🗸 |
|                     |             |

Set AI Class of Event as 3.

Set AI 0 **Event Trigger Method** as **Change of state**. When this value gets changed, it sends an unsolicited message with a notification about the event.

Set AI 1 **Event Trigger Method** as **Deadband** and the value as **10**. If the AI's value is updated to under 10, it does not generate an event. If the AI 1's value is updated to over 10, it sends an unsolicited message with a notification about this event.

| Event Settings |                 |                           |
|----------------|-----------------|---------------------------|
| Point Index    | Class of Event  | Event Trigger Method      |
| 0              | ○ □ ○ 1 ○ 2 ● 3 | Change of state V         |
| 1              | ○0 ○1 ○2 ●3     | Deadband V 10 (0 - 65535) |

### **3.4. Modbus Settings**

In Modbus RTU/ASCII Settings, keep the settings as the default value:

### **\*** Modbus RTU/ASCII Settings

| Your device :<br>DNP3 TCP Master | Role 1 of MGate5109 : Role<br>DNP3 TCP Outstation Modbu | 2 of MGate5109 :<br>s RTU/ASCII Master | Your device :<br>Modbus RTU/ASCII Slave |
|----------------------------------|---|--|---|
| Role                             | Master  |  |   |
| Mode                             | RTU 🗸   |  |   |
| Master Settings                  |   |  |   |
| Initial delay                    | 0   | (0 - 30000 ms)                         |   |
| Max. retry                       | 3   | (0 - 5)                                |   |
| Response timeout                 | 1000  | (10 - 120000 ms)                       |   |
| Inter-frame delay                | 0   | (10 - 500 ms, 0: default)              |   |
| Inter-character timeout          | 0   | (10 - 500 ms, 0: default)              |   |
|                                  |   |  |   |

| Modbus<br>Slave ID | Mapping<br>DNP3<br>Data Object | Modbus<br>Data Type | Points Mapping  | Swap  |  |
|--------------------|--------------------------------|---------------------|---|-------|--|
| 1                  | BT                             | Coil                | BI 0 $\rightarrow$ Coil 1, BI 1 $\rightarrow$ Coil 2, | None  |  |
| -                  | DI                             | Con                 | BI 15 → Coil 16                                       | None  |  |
| 2                  | PO                             | Coil                | BO 0 $\rightarrow$ Coil 1, BO 1 $\rightarrow$ Coil 2, | Nono  |  |
| 2                  | во                             | Con                 | BO 15 → Coil 16                                       | none  |  |
| 2                  | Countor                        | Degister            | Counter 0 $\rightarrow$ Register 1 and 2,             | Mord  |  |
| 3                  | Counter                        | Register            | Counter 1 $\rightarrow$ Register 3 and 4              | wora  |  |
| 4                  | A.T.                           | Desister            | AI 0 $\rightarrow$ Register 1 and 2,                  | Word. |  |
| 4                  |                                | Register            | AI 1 $\rightarrow$ Register 3 and 4                   | wora  |  |
|                    |                                | Deviator            | AO 0 $\rightarrow$ Register 1,                        | Neree |  |
| 5                  | 5 AO Reg                       |                     | AO 1 $\rightarrow$ Register 2                         | None  |  |

Set out the mapping of Modbus RTU to a DNP3 data object as below:

Add Modbus Command to read/write Modbus RTU Slave as below:

Modbus Commands

|       |             |          |          |                              | 🔂 Add       | 🖋 Edit 🛛 🖺 Clone | 🗇 Delete 🏾 🇘 Move |  |      |
|-------|-------------|----------|----------|------------------------------|-------------|------------------|-------------------|--|------|
| Index | Name        | Slave ID | Function | Address / Quantity           | Trigger     | Poll Interval    | Endian Swap       |  |      |
| 1     | ReadBl      | 1        | 1        | Read address 0, Quantity 16  | Cyclic 1000 |                  | None              |  |      |
| 2     | ReadBO      | 2        | 1        | Read address 0, Quantity 16  | Cyclic 1000 |                  | Cyclic 1000 None  |  | None |
| 3     | WriteBO     | 2        | 15       | Write address 0, Quantity 16 | Data Change | N/A              | None              |  |      |
| 4     | ReadCounter | 3        | 3        | Read address 0, Quantity 4   | Cyclic      | 1000             | Word              |  |      |
| 5     | ReadAl      | 4        | 3        | Read address 0, Quantity 4   | Cyclic 1000 |                  | Word              |  |      |
| 6     | ReadAO      | 5        | 3        | Read address 0, Quantity 2   | Cyclic      | 1000             | None              |  |      |
| 7     | WriteAO     | 5        | 16       | Write address 0, Quantity 2  | Data Change | N/A              | None              |  |      |

### 3.5. I/O Data Mapping Settings

In the I/O Data Mapping web page, choose the scenario DNP3 TCP/UDP Master → Modbus RTU/ASCII Slave. Map BO 0-15 and AO 0-1 to WriteBO and WriteAO commands as below and then submit:

### • I/O Data Mapping

| S                                    | elect your scenario                    | DNP3 TCP/U     | IDP Mast           | er> Modb              | ous RTU          | /ASCI           | II Slave | • •                      |                              |
|--------------------------------------|--|----------------|--------------------|-----------------------|------------------|-----------------|----------|--------------------------|------------------------------|
| Modbus Mapping address arr           | angement Auto                          | matic 🗸        |                    |                       |                  |                 |          |                          |                              |
|                                      | write                                  |                |                    |                       | wr               | <b>→</b><br>ite |          |                          |                              |
| Your device :<br>DNP3 TCP/UDP Master | Role 1 of MGate510<br>DNP3 TCP/UDP Out | 9 :<br>station | Role 2 o<br>Modbus | f MGate51<br>RTU/ASCI | 09 :<br>I Master |                 |          | Your device<br>Modbus R1 | e :<br>TU/ASCII <b>Slave</b> |
| 🗌 : Full mapping 🛛 : Un-full r       | napping 🔲 : None map                   | ping           |                    |                       |                  |                 |          |                          |                              |
| Туре                                 | Index                                  |                | Name               | Function              | Interna          | al Ado          | dress    | Quantity                 |                              |
| Binary Output 🗸                      | 0 15                                   |                | WriteBO            | 15                    | 0                |                 | 1        | 2 bytes                  |                              |
| Analog Output 🗸                      | 0 1                                    |                | WriteAO            | 16                    | 2                | [               | 5        | 4 bytes                  |                              |

Choose another scenario: Modbus RTU/ASCII Slave → DNP3 TCP/UDP Master. Map BI 0-15, BO 0-15, Counter 0-1, AI 0-1 and AO 0-1 to ReadBI, ReadBO, ReadCounter, ReadAI and ReadAO as below and then submit:

### :• I/O Data Mapping

| Select your scenario DNP3 TCP/UDP Master < Modbus RTU/ASCII Slave V |  |                 |                            |                          |         |       |            |                          |                   |
|---|--|-----------------|----------------------------|--------------------------|---------|-------|------------|--------------------------|-------------------|
| Modbus Mapping address a  | rrangement Auto                        | matic 🗸         |                            |                          |         |       |            |                          |                   |
|   | Pread                                  |                 |                            |                          | Pread   |       |            |                          |                   |
| Your device :<br>DNP3 TCP/UDP Master                                | Role 1 of MGate510<br>DNP3 TCP/UDP Out | 9 :<br>istation | Role 2 of MG<br>Modbus RTL | iate5109 :<br>J/ASCII Ma | ster    |       | You<br>Mod | r device :<br>bus RTU/AS | SCII <b>Slave</b> |
| 🗌 : Full mapping 🔲 : Un-full  | mapping 🔲 : None map                   | ping            |                            |                          |         |       |            |                          |                   |
| Туре  | Index                                  |                 | Name                       | Function                 | Interna | al Ad | dress      | Quantity                 |                   |
| Binary Input 🗸  | 0 15                                   |                 | ReadBl                     | 1                        | 0       | ] [   | 1          | 2 bytes                  |                   |
| Binary Output 🗸   | 0 15                                   |                 | ReadBO                     | 1                        | 2       |       | 3          | 2 bytes                  |                   |
| Counter 🗸   | 0 1                                    |                 | ReadCounter                | 3                        | 4       | ] [   | 11         | 8 bytes                  |                   |
| Analog Input 🗸  | 0 1                                    |                 | ReadAl                     | 3                        | 12      | ] [   | 19         | 8 bytes                  |                   |
| Analog Output 🗸   | 0 1                                    |                 | ReadAO                     | 3                        | 20      | ][    | 23         | 4 bytes                  |                   |
|   |  |                 |                            |                          |         |       |            |                          |                   |

Make sure all of the DNP3 object points are mapping to Modbus-command quantities equally.

### 4. Modbus Slave Setting

PC2 runs **Modbus Slave** and connects to the MGate 5109's serial port. Add the Modbus definition as below:

#### **BI Definition, Slave ID 1:**

| 🕎 BI | I.mbs                |        |       |        |
|------|----------------------|--------|-------|--------|
| ID = | <mark>1:</mark> F=01 |        |       |        |
|      | Alias                | 0x0000 | Alias | 0x0010 |
| 1    | BI O                 | 0      | BI 10 | 0      |
| 2    | BI 1                 | 0      | BI 11 | 0      |
| 3    | BI 2                 | 0      | BI 12 | 0      |
| 4    | BI 3                 | 0      | BI 13 | 0      |
| 5    | BI 4                 | 0      | BI 14 | 0      |
| 6    | BI 5                 | 0      | BI 15 | 0      |
| 7    | BI 6                 | 0      |       |        |
| 8    | BI 7                 | 0      |       |        |
| 9    | BI 8                 | 0      |       |        |
| 10   | BI 9                 | 0      |       |        |

#### BO Definition, Slave ID 2:

| 🕎 E  | BO.mbs                   |        |       |        |  |  |  |  |
|------|--------------------------|--------|-------|--------|--|--|--|--|
| ID = | <mark>= 2:</mark> F = 01 |        |       |        |  |  |  |  |
| F    | Alias                    | 0x0000 | Alias | 0x0010 |  |  |  |  |
| 1    | BO 0                     | C      | BO 10 | 0      |  |  |  |  |
| 2    | BO 1                     | 0      | BO 11 | 0      |  |  |  |  |
| 3    | BO 2                     | 0      | BO 12 | 0      |  |  |  |  |
| 4    | BO 3                     | 0      | BO 13 | 0      |  |  |  |  |
| 5    | BO 4                     | 0      | BO 14 | 0      |  |  |  |  |
| 6    | BO 5                     | 0      | BO 15 | 0      |  |  |  |  |
| 7    | BO 6                     | 0      |       |        |  |  |  |  |
| 8    | BO 7                     | 0      |       |        |  |  |  |  |
| 9    | BO 8                     | 0      |       |        |  |  |  |  |
| 10   | BO 9                     | 0      |       |        |  |  |  |  |

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| Ã. | Modbus Slave - Counter.mbs                           |                          |            |     |   |             |  |  |  |
|----|--|--------------------------|------------|-----|---|-------------|--|--|--|
| Ei | <u>File Edit Connection Setup Display View Winde</u> |                          |            |     |   |             |  |  |  |
|    | 2  | 🖻 日 🎒                    | - <u>1</u> | 1 4 |   | Signed      |  |  |  |
|    | <u>بر</u>  | Counter.mbs              |            |     |   | Unsigned    |  |  |  |
|    | ) =  | <mark>: 3:</mark> F = 03 |            |     |   | Hex         |  |  |  |
|    |  |                          |            |     |   | Binary      |  |  |  |
|    |  | Alias                    | 4x0000     |     |   |             |  |  |  |
|    | 1  | Counter 0                | 0          |     | _ | Long AB CD  |  |  |  |
| -  | 2  |                          |            |     |   | Long CD AB  |  |  |  |
| -  | - 4  |                          |            |     |   | Long BA DC  |  |  |  |
|    | 3  | Counter 1                | 0          |     |   | Long DC BA  |  |  |  |
|    | 4  |                          |            |     |   |             |  |  |  |
| -  | 5  |                          |            |     |   | Float AB CD |  |  |  |
| -  |  |                          |            |     |   | Float CD AB |  |  |  |
|    | C  |                          |            |     |   |             |  |  |  |

#### Counter Definition , Slave ID 3:

AI Definition , Slave ID 4:

| 23 N     | Modbus Slave - [AI.mbs]   |                 |                |        |            |   |  |  |  |
|----------|---------------------------|-----------------|----------------|--------|------------|---|--|--|--|
| <b>P</b> | <u>F</u> ile <u>E</u> dit | ay <u>V</u> iew | <u>W</u> indow |        |            |   |  |  |  |
| 10       | 🖻 🖬 é                     | 3  🗂   🖳 🧯      |                | Signed |            |   |  |  |  |
| ID =     | <mark>: 4:</mark> F = 0   | 3               |                |        | Unsigned   |   |  |  |  |
|          |                           |                 |                |        | Hex        |   |  |  |  |
|          | Alias                     | 4x0000          |                |        | Binary     |   |  |  |  |
| 1        | AI 0                      | 0               |                |        | Long AB CD |   |  |  |  |
| 2        |                           |                 |                |        | Long CD AB | 3 |  |  |  |
| 3        | AI 1                      | 0               |                |        | Long BA DC |   |  |  |  |
| 4        |                           |                 |                |        | Long DC BA |   |  |  |  |
| 5        |                           |                 |                | -      |            |   |  |  |  |

#### AO Definition , Slave ID 5:



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### **5. PcVue Setting**

PC1 runs PcVue. Click **Configure->Communication->DNP3** to set DNP3 communications.



Click **New network** to add a DNP3 TCP network.

| 😻 PcVue - DNP3 |  |      |             |
|----------------|--|------|-------------|
| File View      |  |      |             |
| DNP3           |  | DNP3 | <b>D</b>    |
| Settings       | General Advanced Traces          Name         DNP3TCP         Description         Image: Construction of the start of the star |      | Description |

| Vie - DNP3   |  |
|--|--|
| <u>File V</u> iew  |  |
| DNP3TCP         New device         Start network         Stop network         Remove         Mapping         Properties         Copy | DNP3<br>DNP3T<br>New device<br>Start network<br>Stop network<br>Remove<br>Mapping<br>Properties<br>Copy<br>Cut |

Right-click this network to add **New device**.

Input MGate 5109's IP in **IP address** field. Set **Link address** as **4**.

| Name<br>MGate5109 |                      |  |
|-------------------|----------------------|--|
| Description       |                      |  |
|                   |                      |  |
| IP address        | 192 . 168 . 32 . 157 |  |
| Link address      |                      |  |
| 4                 |                      |  |
|                   | οp                   |  |
|                   |                      |  |
|                   |                      |  |
|                   |                      |  |



Change Local link address to 3 in the Advanced tab.

Click **Enable Unsolicited Message** and set the **Polling period** under **Integrity Poll** at **60000ms**.

| B DNP3 device properties MGate5109  | ×        |
|---|----------|
| General Advanced Traces   |          |
| General Advanced Traces   | ▲<br>III |
| □ ··· □ Interrogation of classes<br>↓ ··· □ Class 0<br>↓ ··· □ Class 1<br>↓ ··· □ Class 2 | •        |
| OK Cancel A   | .pply    |

Click **Start device.** SCADA will then try to connect to the MGate 5109. If the MGate 5109 is connected, the **State** would show **Connected**.

|   |                     | DN          | P3TCP                |           |
|---|---------------------|-------------|----------------------|-----------|
| i |                     |             |                      |           |
|   | Name                | Description | Address              | State     |
|   | is MGa Start device |             | 192.168.32.157:20000 | Connected |
|   |                     |             |                      |           |

Click **Mapping** for a DNP3 Object Status window to pop up.

| 🐼 PcVue - DNP3            |      |  |  |  |  |  |
|---------------------------|------|--|--|--|--|--|
| <u>F</u> ile <u>V</u> iew |      |  |  |  |  |  |
| DNP3TCP                   | DNP3 |  |  |  |  |  |
| 💦 New device              |      |  |  |  |  |  |
| 🐞 Start network           |      |  |  |  |  |  |
| Stop network              |      |  |  |  |  |  |
| 💕 Remove                  |      |  |  |  |  |  |
| Mapping                   |      |  |  |  |  |  |
| 👔 Сору                    |      |  |  |  |  |  |
| 👆 Cut                     |      |  |  |  |  |  |
| MGate5109                 |      |  |  |  |  |  |
| Start device              |      |  |  |  |  |  |

See SCADA poll back the MGate 5109's objects, including BI, BO, AI, and AO.

Also see these object points' value.

| DNP3TCP DNP3 mapping                        |   |             |          |       |  |  |  |  |
|---|---|-------------|----------|-------|--|--|--|--|
|   | Name  | Description | Variable | Value |  |  |  |  |
| Binary inputs (BI) - Group I                | <b>311</b> O  |             |          | 0     |  |  |  |  |
| - Company Company (BC) - Group 10           | 01 1  |             |          | 0     |  |  |  |  |
| Frozen counters (FCC) - Group 20            | <b>311</b> 2  |             |          | 0     |  |  |  |  |
| Analog inputs (AI) - Group 30               | 3   |             |          | 0     |  |  |  |  |
| Analog outputs (AO) - Group 40              | <b>91</b> 4   |             |          | 0     |  |  |  |  |
| Internal indications (IIN) - Group 80       | 011 5   |             |          | 0     |  |  |  |  |
| Attributes - Group 0                        | <b>91</b> 6   |             |          | 0     |  |  |  |  |
|   | 011 7   |             |          | 0     |  |  |  |  |
|   | 911 S   |             |          | 0     |  |  |  |  |
|   | 9 9   |             |          | 0     |  |  |  |  |
|   | <b>911</b> 10   |             |          | 0     |  |  |  |  |
|   | 011 11  |             |          | 0     |  |  |  |  |
|   | <b>911</b> 12   |             |          | 0     |  |  |  |  |
|   | <b>91</b> 13  |             |          | 0     |  |  |  |  |
|   | <b>91</b> 14  |             |          | 0     |  |  |  |  |
|   | <b>912</b> 15   |             |          | 0     |  |  |  |  |
|   |   |             |          |       |  |  |  |  |
|   |   |             |          |       |  |  |  |  |
|   | •   |             |          | •     |  |  |  |  |
| "Binary inputs (BI) - Group 1" of MGate5109 | "Binary inputs (BI) - Group 1" of MGate5109 16 items: |             |          |       |  |  |  |  |

### 6. Communication Test

#### 6.1. MGate Protocol Diagnose Introduction

In the MGate 5109 web console, **Protocol Status** diagnoses the protocol status. It includes **I/O Data View** and **DNP3 TCP/UDP Diagnose** as below:

• DNP3 TCP/IIDP Outstation Diagnose

|                           |                           | outstation Diagno | 50        |
|---------------------------|---------------------------|-------------------|-----------|
| Main Menu                 | Auto refresh Refresh      |                   |           |
| Quick Setup               |                           |                   |           |
| Overview                  | Outstation Statictics     |                   |           |
| Basic Settings            | Received Requests         | 23                |           |
| Network Settings          | Sent Responses            | 23                |           |
| Serial Settings           | Sent Unsolicited Message  | 0                 |           |
| - Protocol Settings       | Binary Input Event buffer | 0                 |           |
| Protocol Conversion       | Counter Event buffer      | 0                 |           |
| DNP3 TCP/UDP Outstation   | Connected Master IP       | 0<br>192 168 32 1 | 43        |
| Modbus RTU/ASCII Master   |                           |                   |           |
| I/O Data Mapping          | Point Information         |                   |           |
| - System Management       | Binary Input              |                   |           |
| - System Monitoring       | Point Index               | Value             | Flags     |
| - System Status           | 0                         | OFF               | OFFLINI   |
| - Protocol Status         | 1                         | OFF               | OFFLINI   |
| I/O Data View             | 2                         | OFF               | OFFLIN    |
| DNP3 TCP/UDP Diagnose     | 3                         | OFF               | OFFLIN    |
| Modbus RTU/ASCII Diagnose | 4                         | OFF               | OFFLIN    |
| Modbus RTU/ASCII Traffic  | 5                         | OFF               | OFFLIN    |
|                           | 16                        | IOFE              | I OFFLINI |

In the I/O Data View web page, select Data flow direction to see the IO raw data in DNP3 TCP/UDP Master-> Modbus RTU/ASCII Slave or Modbus RTU/ASCII Slave -> DNP3 TCP/UDP Master.

#### • I/O Data View

|   | Auto refresh     |    |    |    |    |               |        |    |    |    |    |
|---|------------------|----|----|----|----|---------------|--------|----|----|----|----|
| Data flow direction DNP3 TCP/UDP Master> Modbus RTU/ASCII Slave V |                  |    |    |    | St | art address(F | Hex) 0 |    |    |    |    |
|   | Internal Address | 00 | 01 | 02 | 03 | 04            | 05     | 06 | 07 | 08 | 09 |
|   | 0000h            | 00 | 00 | 00 | 00 | 00            | 00     | 00 | 00 | 00 | 00 |
|   | 0010h            | 00 | 00 | 00 | 00 | 00            | 00     | 00 | 00 | 00 | 00 |
|   | 0020h            | 00 | 00 | 00 | 00 | 00            | 00     | 00 | 00 | 00 | 00 |
|   | 0030h            | 00 | 00 | 00 | 00 | 00            | 00     | 00 | 00 | 00 | 00 |
|   | 0040h            | 00 | 00 | 00 | 00 | 00            | 00     | 00 | 00 | 00 | 00 |
|   | 0050h            | 00 | 00 | 00 | 00 | 00            | 00     | 00 | 00 | 00 | 00 |
|   | 0060h            | 00 | 00 | 00 | 00 | 00            | 00     | 00 | 00 | 00 | 00 |
|   | 0070h            | 00 | 00 | 00 | 00 | 00            | 00     | 00 | 00 | 00 | 00 |

In the **DNP3 TCP/UDP Outstation Diagnose** web page, users can monitor the DNP3 Outstation status, including its Data Object Points status.

| • DNP3 TCP/UDP Outstation Diagnose |                |         |              |  |  |  |  |
|------------------------------------|----------------|---------|--------------|--|--|--|--|
| Auto refresh Refresh               |                |         |              |  |  |  |  |
| Outstation Statictics              |                |         |              |  |  |  |  |
| Received Requests                  | 27             |         |              |  |  |  |  |
| Sent Responses                     | 27             |         |              |  |  |  |  |
| Sent Unsolicited Message           | 0              |         |              |  |  |  |  |
| Binary Input Event buffer          | 0              |         |              |  |  |  |  |
| Counter Event buffer               | 0              |         |              |  |  |  |  |
| Analog Input Event buffer          | 0              |         |              |  |  |  |  |
| Connected Master IP                | 192.168.32.143 |         |              |  |  |  |  |
| Point Information                  |                |         |              |  |  |  |  |
| Binary Input V                     |                |         |              |  |  |  |  |
| Point Index                        | Value          | Flags   | Time Updated |  |  |  |  |
| 0                                  | OFF            | OFFLINE | N/A          |  |  |  |  |
| 1                                  | OFF            | OFFLINE | N/A          |  |  |  |  |
| 2                                  | OFF            | OFFLINE | N/A          |  |  |  |  |
| 3                                  | OFF            | OFFLINE | N/A          |  |  |  |  |
| 4                                  | OFF            | OFFLINE | N/A          |  |  |  |  |
| 5                                  | OFF            | OFFLINE | N/A          |  |  |  |  |
| 6                                  | OFF            | OFFLINE | N/A          |  |  |  |  |

#### 6.2. DNP3 Connection Status

Check System Monitoring → Protocol Status → DNP3 TCP/UDP Diagnose, and make sure Connected Master IP is PC1.

#### **DNP3 TCP/UDP Outstation Diagnose**

| Auto refresh Refresh           |                |         |              |
|--------------------------------|----------------|---------|--------------|
| Outstation Statictics          |                |         |              |
| Received Requests              | 27             |         |              |
| Sent Responses                 | 27             |         |              |
| Sent Unsolicited Message       | 0              |         |              |
| Binary Input Event buffer      | 0              |         |              |
| Counter Event buffer           | 0              |         |              |
| Analog Input Event buffer      | 0              |         |              |
| Connected Master IP            | 192.168.32.143 |         |              |
| Point Information Binary Input |                |         |              |
| Point Index                    | Value          | Flags   | Time Updated |
| 0                              | OFF            | OFFLINE | N/A          |
| 1                              | OFF            | OFFLINE | N/A          |
| 2                              | OFF            | OFFLINE | N/A          |
| 3                              | OFF            | OFFLINE | N/A          |
| 4                              | OFF            | OFFLINE | N/A          |
| 5                              | OFF            | OFFLINE | N/A          |
| 6                              | OFF            | OFFLINE | N/A          |
|                                | ·              |         |              |

### 6.3. Read BI Test

Change Modbus Slave ID 1's Alias BI 0, 2, 4, 11, 13, 15 status to **On** as below:

| Modbus Slave - [BI.mbs]                                    |       |        |       |        |  |  |  |
|--|-------|--------|-------|--------|--|--|--|
| <u>File Edit Connection Setup Display View Window Help</u> |       |        |       |        |  |  |  |
|  |       |        |       |        |  |  |  |
| ID = 1: F = 01   |       |        |       |        |  |  |  |
|  | Alias | 0x0000 | Alias | 0x0010 |  |  |  |
| 1  | BI O  | 1      | BI 10 | 0      |  |  |  |
| 2  | BI 1  | 0      | BI 11 | . 1    |  |  |  |
| 3  | BI 2  | 1      | BI 12 | 2 0    |  |  |  |
| 4  | BI 3  | 0      | BI 13 | 1      |  |  |  |
| 5  | BI 4  | 1      | BI 14 | 0      |  |  |  |
| 6  | BI 5  | 0      | BI 15 | i 1    |  |  |  |
| 7  | BI 6  | 0      |       |        |  |  |  |
| 8  | BI 7  | 0      |       |        |  |  |  |
| 9  | BI 8  | 0      |       |        |  |  |  |
| 10   | BI 9  | 0      |       |        |  |  |  |

Check the following's status in MGate DNP3 TCP/UDP Diagnose page:

| Point Information |       |        |                     |
|-------------------|-------|--------|---------------------|
| Binary Input V    |       |        |                     |
| Point Index       | Value | Flags  | Time Updated        |
| 0                 | ON    | ONLINE | 2017-01-05 17:50:55 |
| 1                 | OFF   | ONLINE | 2017-01-05 17:50:55 |
| 2                 | ON    | ONLINE | 2017-01-05 17:50:55 |
| 3                 | OFF   | ONLINE | 2017-01-05 17:50:55 |
| 4                 | ON    | ONLINE | 2017-01-05 17:50:55 |
| 5                 | OFF   | ONLINE | 2017-01-05 17:50:55 |
| 6                 | OFF   | ONLINE | 2017-01-05 17:50:55 |
| 7                 | OFF   | ONLINE | 2017-01-05 17:50:55 |
| 8                 | OFF   | ONLINE | 2017-01-05 17:50:55 |
| 9                 | OFF   | ONLINE | 2017-01-05 17:50:55 |
| 10                | OFF   | ONLINE | 2017-01-05 17:50:55 |
| 11                | ON    | ONLINE | 2017-01-05 17:50:55 |
| 12                | OFF   | ONLINE | 2017-01-05 17:50:55 |
| 13                | ON    | ONLINE | 2017-01-05 17:50:55 |
| 14                | OFF   | ONLINE | 2017-01-05 17:50:55 |
| 15                | ON    | ONLINE | 2017-01-05 17:50:55 |

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#### **MGate IO Dataview:**

| :• I/O Dat          | a View      |               |              |             |        |    |         |             |     |   |
|---------------------|-------------|---------------|--------------|-------------|--------|----|---------|-------------|-----|---|
|                     | BI 7 6 5 4  | 3210          | BI 15 14     | 4 13 12 11  | 10 9 8 |    |         |             |     |   |
| Auto refresh        | 0001        | 0101          | 1 0          | 101         | 000    |    |         |             |     |   |
| Data flow directior | DNP3 TCP/00 | )P Master < M | odbus RTU/AS | CII Slave 🗸 |        |    | Start a | iddress(Hex | ) 0 | ] |
| Internal Addre      | ss 🔹        | 00            | 01 🖌         | 02          | 03     | 04 | 05      | 06          | 07  | 0 |
| 0000h               |             | 15            | A8           | 00          | 00     | 00 | 00      | 00          | 00  | 0 |
| 0010h               |             | 00            | 00           | 00          | 00     | 00 | 00      | 00          | 00  | 0 |
| 0020h               |             | 00            | 00           | 00          | 00     | 00 | 00      | 00          | 00  | 0 |

#### **PcVue SCADA BI Status**



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#### 6.4. Read Counter Test

Change Modbus Slave ID 3's Alias Counter 0's status to 1 and Counter 1's status to 2 as below:

| <b>2</b> 0 | ounter.mbs |        |                   |        |
|------------|------------|--------|-------------------|--------|
| ID =       | 3: F = 03  |        |                   |        |
|            | Alias      | 4x0000 | r                 |        |
| 1          | Counter 0  | 0      | Edit Long Integer |        |
| 2          |            |        | Value: 1          | ок     |
| 3          | Counter 1  | 0      |                   |        |
| 4          |            |        | Auto increment    | Cancel |
| 5          |            |        |                   |        |

Check the following's status:

| Point Information |       |        |                     |  |  |  |  |
|-------------------|-------|--------|---------------------|--|--|--|--|
| Counter V         |       |        |                     |  |  |  |  |
| Point Index       | Value | Flags  | Time Updated        |  |  |  |  |
| 0                 | 1     | ONLINE | 2017-01-05 18:48:23 |  |  |  |  |
| 1                 | 2     | ONLINE | 2017-01-05 18:48:23 |  |  |  |  |

#### **MGate IO Dataview:**

| Data flow direction DNP3 TCP/UDP Master < Modbus RTU/ASCII Slave 🗸 |    |    |    | Coun | ter 0 st | art address(H | Hex) 0 | Cou | nter 1 | Le | ngth 128 🗸 |    |
|--|----|----|----|------|----------|---------------|--------|-----|--------|----|------------|----|
| Internal Address   | 00 | 01 | 02 | 03   | 04       | 05            | 06     | 07  | 08     | 09 | 0A         | 0B |
| 0000h  | 15 | A8 | 00 | 00   | 00       | 01            | 00     | 00  | 00     | 02 | 00         | 00 |
| 0010h  | 61 | 4E | 00 | BC   | 00       | 00            | 00     | 00  | 00     | 00 | 00         | 00 |

**PcVue SCADA Counter Status:** 



#### 6.5. Read AI Test

Modify Modbus Slave ID 3's Alias AI 0 status to **-12345678** and AI 1 status to **12345678** as below:

|   | 開 ≠ | 4.mbs<br>: 4: F = 0 | 3         |  |
|---|-----|---------------------|-----------|--|
|   |     | Alias               | 4x0000    |  |
| I | 1   | AI 0                | -12345678 |  |
| l | 2   |                     |           |  |
|   | 3   | AI 1                | 12345678  |  |
|   | 4   |                     |           |  |
|   |     |                     |           |  |

Check the following's status:

Point Information

| Analog Input 🗸 |           |        |
|----------------|-----------|--------|
| Point Index    | Value     | Flags  |
| 0              | -12345678 | ONLINE |
| 1              | 12345678  | ONLINE |

#### MGate IO Dataview:



#### **PcVue SCADA AI Status:**



If we change the status of Modbus Slave ID 3's Register 3 and 4 (AI 1) to 1, it wouldn't generate an event because its deadband is 10. SCADA's AI 1 must wait for the next Integrated Poll (interval is 60000ms) to update its value.

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### 6.6. Write BO and AO Test

In **DNP3TCP DNP3 mapping**, right-click on BO 0 to set **Create variable**.

| DNP3TCP DNP3 mapping  |  |  |   |
|---|--|--|---|
| MGate5109     Binary inputs (BI) - Group 1     Binary outputs (BO) - Group 10     Running counters (RC) - Group 20     Frozen counters (FZC) - Group 21     Analog inputs (AI) - Group 30     Analog outputs (AO) - Group 40     Internal indications (IIN) - Group 80     Attributes - Group 0 | Name<br>010<br>011<br>012<br>012<br>013<br>014<br>015<br>015<br>015<br>015<br>017<br>017<br>017<br>017<br>017<br>017<br>017<br>017 | Description Variable<br>Variable selector<br>Create variable<br>Unmap item | Value<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0 |

#### Use the default setting and click **OK**.

| Create variable  |  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|--|
| Variable name  |  |  |  |  |  |  |  |
| O Use the full hierachical name as variable name                   |  |  |  |  |  |  |  |
| ✓ Use network name as prefix                                       |  |  |  |  |  |  |  |
| Customize the variable name  |  |  |  |  |  |  |  |
| DNP3TCP.MGate5109.BO.0   |  |  |  |  |  |  |  |
| Hide this window (display again with [Shift] on variable creation) |  |  |  |  |  |  |  |

#### BO 0 will map to this variable.

| 1 | DNP3TCP DNP3 mapping   |             |             |                        | E     |
|---|--|-------------|-------------|------------------------|-------|
|   | Brieger inputs (BI) - Group 1  | Name        | Description | Variable               | Value |
|   | Binary outputs (BO) - Group 10                                       | 010         |             | DNP3TCP.MGate5109.BO.0 | 0     |
|   | $\square$ Running counters (RC) - Group 20                           | 011         |             |                        | 0     |
|   | Frozen counters (FZC) - Group 21                                     | 01 2        |             |                        | 0     |
|   | Analog inputs (AI) - Group 30  | 01.3        |             |                        | 0     |
|   | Analog outputs (AO) - Group 40 Internal indications (IIN) - Group 80 | <b>91</b> 4 |             |                        | 0     |
|   |  | 01.5        |             |                        | 0     |
|   | Attributes - Group 0   | <b>91</b> 6 |             |                        | 0     |
|   |  | 01 7        |             |                        | 0     |

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Use the same method to create the AO 0 variable as below:

| DNP3TCP DNP3 mapping  |                |             |                                    | ć                             |
|---|----------------|-------------|------------------------------------|-------------------------------|
| MGate5109     Binary inputs (BI) - Group 1     Binary outputs (BO) - Group 10     Running counters (RC) - Group 20     Frozen counters (FZC) - Group 21     Analog inputs (AI) - Group 30     Analog outputs (AO) - Group 40     Internal indications (IIN) - Group 80     Attributes - Group 0 | Name<br>0<br>1 | Description | Variable<br>DNP3TCP.MGate5109.AO.0 | Value<br>0.000000<br>0.000000 |

In PcVue Main window, click Configure → Variables → Selector.



Click the AO 0 variable **Properties** to edit:

| PcVue - Variables    |  | -                   |
|----------------------|--|---------------------|
| File View            |  |                     |
| DNP3TCP.MGate5109.AO | □ Variables tree<br>□ [] DNP3TCP<br>□ [] MGate5109 | <br>  🚅   🚅 🥐   🛃 🧭 |
| Add bit              | ⊕ BO<br>⊕ BO<br>⊕ System                           | Name Description    |
| Add register         |  | Properties          |
| Add text             |  | Copy                |
| DNP3TCP.MGate5109.A  |  |                     |

Because the MGate 5109 only supports **DNP3 Level2**, the AO **variation type** should select **16 Bit** under the **Source** tab.

| neral So | ource                | Extended attributes | Advanced |  |      |  |
|----------|----------------------|---------------------|----------|--|------|--|
|          |                      |                     |          |  |      |  |
| Source   |                      |                     |          |  | <br> |  |
| 🏥 DNH    | 23TCP                |                     |          |  | -    |  |
| DUDO     |                      |                     |          |  |      |  |
| DNP3     |                      |                     |          |  | <br> |  |
| Devic    | e                    |                     |          |  |      |  |
| MGa      | te5109               |                     |          |  | -    |  |
| Objec    | t type               |                     |          |  |      |  |
| Analo    | og outp              | uts (AO) - Group 40 |          |  | -    |  |
| Point    | address              |                     |          |  |      |  |
| 0        |                      |                     |          |  |      |  |
| Variat   | tion typ             | e                   |          |  |      |  |
| 16 B     | it                   |                     |          |  | -    |  |
| 32 Bi    | it                   |                     |          |  |      |  |
| 16 Bi    | it 🛛                 | · •••               |          |  |      |  |
| Doub     | e precis<br>de preci | ion Floating point  |          |  |      |  |
| Doub     | ac pieci             | sion riceang point  |          |  |      |  |

| Register variable DNP3TCP.MGate5109.AO.0  | × |
|---|---|
| General Source Extended attributes Advanced   |   |
| Simulated<br>Saved<br>Recorder<br>Remote access<br>No context window<br>Monitoring<br>Permanent scan for mimics<br>All stations<br>Server station<br>None<br>Note   |   |
| <ul> <li>Actional g</li> <li>Servers</li> <li>Clients</li> <li>Control parameters</li> <li>Control parameters</li> <li>Default</li> <li>Direct operate</li> <li>Direct operate</li> <li>Select before operate</li> <li>Select before operate</li> <li>Select before operate</li> <li>Use a different address for writing</li> </ul> | Ш |
| O Default     O Time tagged     Not time tagged   | - |
| OK Cancel A   |   |

Under the **Advanced** tab, configure the **Control** parameters as below:

Under BO 0 variable's advanced setting, select the **CROB** parameter. Use **Latching Relay ON** and **Latching Relay OFF**.

| 🖃 🛷 Variables tree |              |  | DNP3TCP.MGate5109.BO |
|--------------------|--------------|--|----------------------|
|                    | 📁 नई 🖓       | 🕏 of 🧟   |                      |
| 📁 AO               | Name         | Description Value  | Time stamp           |
| ⊞…⊖ System         | <b>312 O</b> | Bit variable DNP3TCP.MGate5109.BO.0  |                      |
|                    |              | General Source Extended attributes Advanced  |                      |
| uction             | Name         | (No list selected)<br>DNP3<br>Control parameters<br>Direct operate<br>Direct operate | E                    |
|                    |              | ОК   | Cancel Apply         |
| 5 - 31             |              |  | :                    |

Under the **PcVue Main window**, click **New** to create a new **Mimic**. Mimic is PcVue's HMI graphic object.



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### Click Insert → Symbol.

| PcVue - Main window - ARC Informatique (Administrator) |              |                 |     |       |              |                  |                 |   |     |
|--|--------------|-----------------|-----|-------|--------------|------------------|-----------------|---|-----|
| <u>F</u> ile   | <u>E</u> dit | Displa <u>y</u> | Ins | ert   | <u>D</u> raw | A <u>r</u> range | <u>A</u> nimate | M | ode |
|  |              |                 | 3   | Sym   | bol          |                  |                 | X | h   |
|  |              |                 |     | Imag  | ge           | 15               |                 |   | _   |
| k  | 🎫 Mi         | mic1            | X   | Activ | /eX co       | ntrol            |                 |   |     |
| C  |              |                 | X   | Favo  | orite Ac     | tiveX cont       | rols 🕨          |   | -   |
| R  |              |                 | ø   | 3D n  | nodel.       |                  |                 |   | ¦   |
| 8  |              |                 | T   | 3D t  | ext          |                  |                 |   |     |
|  |              |                 |     | 3D c  | ustom        | camera           |                 |   |     |
| $(\mathbf{i})$   |              |                 |     | an k  | uilt-in      | comero           |                 |   | 1   |

Choose a button symbol.

| Insert sym | bol   |
|------------|---|
| Library    | COMMANDS -  |
| Name       | COMMANDS_PUSH_BUTTON_ROUND_FACEPLATE_IND  |
| Filter     | *.* I I I I I I I I I I I I I I I I I I   |
|            | DS_PUSH_BUTTON_ROUND_ELEC_1BTN_RED_ANI  |
| COMMANI    | DS_PUSH_BUTTUN_RUUND_ELEC_28TNS_ANI DS_PUSH_BUTTON_ROUND_FACEPLATE_INDUSTRY_BLACK_ANI |
| СОММАНІ    | DS_PUSH_BUTTON_ROUND_FACEPLATE_INDUSTRY_BLUE_ANI                                      |
|            | DS_PUSH_BUTTON_ROUND_FACEPLATE_INDUSTRY_GREEN_ANI                                     |
|            |   |
|            | DS PUSH BUTTON ROUND FACEPLATE INDUSTRY WHITE ANI                                     |
| •          | 4   |
| Branch     | Insert Close  |

| ATTRIBUT 14         Cut       Cut+x         Copy       Ctrl+X         Copy       Ctrl+C         Pelete       Delete         Group       Ungroup         Lock       Unlock         Arrange       Backface culling         Backface culling       Teste symbol         VBA control       Bit         Symbol project in VBA       Double bit         View script       Color         Properties list       Color         Properties       Symbol ranslations         Symbol translations       Titext         Visibility       Regione         Visibility       Languages | mimic1      |  |                            |   |  |                         |
|--|-------------|--|----------------------------|---|--|-------------------------|
| Cut Ctrl+X   Copy Ctrl+C   Delete Delete   Group Ungroup   Lock Unlock   Arrange Backface culling   Create symbol Treat   VBA control Bit with color   Symbol project in VBA Color   View gcript Double bit   Animate Color   Properties list Properties   Symbol translations Yisbility   Visibility Time table   Region Nisbility  | ATTRIBUT 14 |  |                            |   |  |                         |
| VBA control         Symbol project in VBA         View script         Animate         Properties list         Properties         Symbol translations         Visibility         Propulation         Image: Symbol translations   |             | Cut<br>Copy<br>Delete<br>Group<br>Ungroup<br>Lock<br>Unlock<br>Arrange<br>Backface culling<br>Create symbol                    | Ctrl+X<br>Ctrl+C<br>Delete |   |  |                         |
| Send Send  |             | VBA control<br>Symbol project in VBA<br>View <u>s</u> cript<br>Animate<br>Properties list<br>Properties<br>Symbol translations | Þ                          | <ul> <li>Color</li> <li>T Text</li> <li>Symbols</li> <li>Position</li> <li>Visibility</li> <li>Send</li> <li>Run</li> </ul> | Image: state of the state | olor<br>vit<br>le<br>es |

Right-click this symbol, then click **Animate**  $\rightarrow$  **Send**  $\rightarrow$  **Bit** 

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| Symbol properties                    |
|--------------------------------------|
| 🥕 Base 🎝 Symbol 🎬 Bit send           |
| Bit @DNP3TCP.MGate5109.BO.0          |
| Comment                              |
| Command                              |
| Reversed to 0 to 1 Variable          |
| Variable 🖉                           |
| Sending mode                         |
| Direct Label Handled                 |
| With beep Pulse                      |
| Accelerator None Disable mouse click |
| <b>↓</b>                             |
| OK Cancel Help                       |

Set BO 0's variable in the **Bit** field. Under **Command type**, select **Reversed**.

Right-click on **Mimic** to execute **Run** mode.



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If you click this BO 0 button; it would write BO 0 **On**. Because this object command type is **Reversed**, click it again so that it would write BO 0 **Off**.



#### MGate DNP3 Diagnose:

| Binary Output 🗸 |       |        |                     |  |  |  |
|-----------------|-------|--------|---------------------|--|--|--|
| Point Index     | Value | Flags  | Time Updated        |  |  |  |
| 0               | ON    | ONLINE | 2017-01-06 13:32:43 |  |  |  |
| 1               | OFF   | ONLINE | 2017-01-06 13:32:43 |  |  |  |
| 2               | OFF   | ONLINE | 2017-01-06 13:32:43 |  |  |  |
| 3               | OFF   | ONLINE | 2017-01-06 13:32:43 |  |  |  |

#### Modbus Slave-BO:

| 📴 BO.mbs       |       |        |          |  |  |
|----------------|-------|--------|----------|--|--|
| ID = 2: F = 01 |       |        |          |  |  |
|                | Alias | 0x0000 | <u> </u> |  |  |
| 1              | BO 0  | 1      |          |  |  |
| 2              | BO 1  | 0      |          |  |  |
| 3              | BO 2  | 0      |          |  |  |
| 4              | BO 3  | 0      |          |  |  |
| 5              | BO 4  | 0      |          |  |  |
| c              | PO 5  |        | <b>T</b> |  |  |

Return to **Edit** mode. Click **Draw** → **Text**.



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#### Right-click this text object, click **Animate** $\rightarrow$ **Text** $\rightarrow$ **Register Value**. Ctrl+X Cut <u>С</u>ору Ctrl+C X <u>D</u>elete Delete Mext... 📜 Group 🐠 Text with color on bit... Ungroup 🥑 Text with color on alarm... 6 Lock 🥗 Label... Unlock 🐠 Label with color on bit... Arrange 🦪 Label with color on alarm... Backface culling 🤣 Display register... ۲ 🖑 Display register with color on bits... 🤼 Create symbol... 🌯 Bit... VBA control 🕌 Bit group... Symbol project in VBA 🐜 Register bit... 🐁 View <u>s</u>cript 🔩 Alarm.. 🎬 <u>A</u>nimate 🍠 Color × ۲ 🝓 Register value. T Text ۲ 3 🔲 Properties list , Symbols . Properties...

#### Input text as "######".

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| (                     | Text properties   |  |
|-----------------------|---|--|
| ° <del>########</del> | \Upsilon Text 🗔 Aspect 🎬 Text register value  |  |
|                       | Register @DNP3TCP.MGate5109.AO.0  |  |
|                       | <ul> <li>0</li> <li>&lt; 0</li> <li>&lt; 0</li> <li>&lt; 0</li> <li>&lt; 0</li> <li>&lt; 0</li> <li>&lt; 0</li> </ul> |  |
|                       | Register<br>unavailable<br>Register out of<br>level   |  |
|                       | <b>↓ ↓</b>  |  |
|                       | OK Cancel Help  |  |

Select the AO 0 variable in the **Register** field.

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Right-click this text object and click **Animate**  $\rightarrow$  **Send**  $\rightarrow$  **Register**.

X Text properties 🎬 Register send 🎬 Text register value T Text 🔲 Aspect @DNP3TCP.MGate5109.AO.0 Register Ł Comment 📝 Display value Format Auto - 👂 Sending mode Default Keyboard Step Keypad Direct 📃 Keep box Password 📃 Empty field Accelerator None Disable mouse click Ĩ ~ OK Cancel Help

Select the AO 0 variable in the **Register** field. Select **Keyboard** as the **Sending mode**.

Right-click on **Mimic** to execute **Run mode**.

This text object will show the current status as **0**. When you right-click on it, a keyboard to input **Control value** will pop up. Input **123** and click **OK**.

| Control value sen | Ч                    | ×                |
|-------------------|----------------------|------------------|
| DNP3TCP.MGate5    | 5109.AO.0            |                  |
| Minimum<br>O      | Current value<br>0   | Maximum<br>65535 |
| ?                 | Control value<br>123 | OK<br>Cancel     |

#### MGate DNP3 Diagnose:

| Po | int Information |  |
|----|-----------------|--|
|    |                 |  |

| Analog Output 🗸 |       |        |                     |  |  |
|-----------------|-------|--------|---------------------|--|--|
| Point Index     | Value | Flags  | Time Updated        |  |  |
| 0               | 123   | ONLINE | 2017-01-06 11:39:11 |  |  |
| 1               | 0     | ONLINE | 2017-01-06 11:39:11 |  |  |

#### Modbus Slave-AO:



After **Integrated Poll** (interval as 60000 ms), this text object's value will be updated as **123**.

