How to Configure the MGate 5114 with IEC 60870-5-104 SCADA

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MGate 5114 with IEC 60870-5-104 SCADA

1 System Topology

This technical note demonstrates how to use the **MGate 5114** to communicate with **IEC 60870-5-104 SCADA**. We use **PcVue SCADA** as an IEC 60870-5-104 Client to monitor remote Modbus RTU via the MGate 5114. In this topology, it shows how the MGate 5114 converts between **IEC 60870-5-104 Client** and **Modbus RTU Slave**.



2 Protocol Simulators

2.1 PcVue SCADA

PcVue SCADA system is published by **ARC Informatique**. We use Version **11.1** in this demo. It has an IEC 60870-5-104 built-in driver for IEC 60870-5-104 communication.

2.2 Modbus Slave

<u>Modbus Slave</u> is the very popular Modbus slave simulator for testing and debugging your Modbus devices. It supports Modbus RTU/ASCII and Modbus TCP/IP. **Download website:** <u>http://www.modbustools.com/download.html</u>

3 Simulation of Modbus Slave Settings

In the topology, PC2 runs **Modbus Slave** and connects to the MGate 5114's serial port. The serial parameters are defined as: **115200**, **8/N/1**, **RS-485 (2-wire)** We simulate various Modbus devices with different slave IDs.



in a	P.mbs			×
- 01	- 1: F - 01			
		Alias	0x0000	A
1		SP 1	0	=
_ 2				-

< Step Definition, Slave ID 3 >

	🦻 s	tep.mbs		×			
ID = 3: F = 03							
ſ		Alias	4x0000				
ſ	1	Step 1	0	=			
	2			Ŧ			

(Display: Signed)

< DP Definition, Slave ID 2 >

(10) =	0P.mbs : 2: F = 01		×
	Alias	0x0000	
1	DP 1_OFF	0	=
2	DP 1_On	0	-

< BS32 Definition, Slave ID 4 >

[🗒 BS32.mbs						
ľ	ID = 4: F = 03						
		Alias	4x0000	*			
	1	BS32 1	0x0000	Ξ			
	2		0x0000	-			

(Display: Hex)

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(Display: Hex)



< MS Definition, Slave ID 6 >

(Display: Signed)



(Display: Float CD AB)

< Counter Definition, Slave ID 8 >

ounter.mbs		×
8: F = 03		
Alias	4x0000	
Counter 1	0	=
		-
	ounter.mbs 8: F = 03 Alias Counter 1	Alias 4x0000 Counter 1 0

(Display: Long CD AB)

4 MGate 5114 Settings

For the MGate's 5114 settings, we should access the web console to configure. Here are the configuration steps:

- Step 1. Configuration of serial parameters (Serial Settings)
- Step 2. Protocol selection (Protocol Conversion)
- Step 3. Configuration of protocol 1 (Modbus RTU Master Settings)
- Step 4. Configuration of protocol 2 (IEC 60870-5-104 Server Settings)
- Step 5. I/O data mapping

Step 1. Configuration of Serial Parameters (Serial Settings)

Go to **Serial Settings** to configure the serial parameters, which should be the same as your Modbus device. Here, we configure it as: **115200**, **8/N/1**, **RS-485 (2-wire)**

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 🗸

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Step 2. Protocol Selection (Protocol Conversion)

For a protocol gateway, we have to configure each protocol's role that should be selected here. This is an example of converting from Modbus RTU to IEC 60870-5-104. After protocol selection, the next steps are to configure each side of the MGate.



Step 3. Configuration of Protocol 1 (Modbus RTU Master Settings)

In Modbus RTU Master Settings, the related parameters can be configured. Here, we use the default settings. For details, you can refer to the user's manual.

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)

Then, we have to monitor and control the Modbus slave device. Therefore, Modbus commands should be configured. The Modbus commands are shown as below:

				🔂 Add	🖋 Edit 🛛 🛱	Clone 🏛 Del	ete 🇘 Move
Index	Name	Slave ID	Function	Address / Quantity	Trigger	Poll Interval	Endian Swap
1	ReadSP	1	1	Read address 0, Quantity 1	Cyclic	1000	None
2	WriteSP	1	5	Write address 0, Quantity 1	Data Change	N/A	None
3	ReadDP	2	1	Read address 0, Quantity 2	Cyclic	1000	None
4	WriteDP	2	15	Write address 0, Quantity 2	Data Change	N/A	None
5	ReadStep	3	3	Read address 0, Quantity 1	Cyclic	1000	None
6	WriteStep	3	6	Write address 0, Quantity 1	Data Change	N/A	None
7	ReadBS32	4	3	Read address 0, Quantity 2	Cyclic	1000	None
8	WriteBS32	4	16	Write address 0, Quantity 2	Data Change	N/A	None
9	ReadMN	5	3	Read address 0, Quantity 1	Cyclic	1000	None
10	WriteMN	5	6	Write address 0, Quantity 1	Data Change	N/A	None
11	ReadMS	6	3	Read address 0, Quantity 1	Cyclic	1000	None
12	WriteMS	6	6	Write address 0, Quantity 1	Data Change	N/A	None
13	ReadMF	7	3	Read address 0, Quantity 2	Cyclic	1000	None
14	WriteMF	7	16	Write address 0, Quantity 2	Data Change	N/A	None
15	ReadCounter	8	3	Read address 0, Quantity 2	Cyclic	1000	None

Modbus Commands

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Step 4. Configuration of Protocol 2 (IEC 60870-5-104 Server Settings)

In **IEC 60870-5-104 Sever Settings**, there are **Basic Settings** and **Advanced Settings**. For **Basic Settings**, we configure the parameters as below:

- COT size as "2"
- ASDU address as "3"
- Listen Port as **2404** port.

Basic Settings		
COT size	○ 1	
ASDU address	3	(1 - 65534)
Listen port	2404	(1024 - 60000)

For **Advanced Settings**, we configure the parameters as below:

Advanced Settings - Application Layer		
Enable cse active termination	Enable 🔻	
Enable cmd active termination	Enable V	
Select timeout	10	(0 - 600 s)
General interrogation time tag	56bits 🔻	
Event time stamp	56bits 🔻	
Measured value(N) cyclic interval	0	(0 - 2073600 s)
Measured value(S) cyclic interval	0	(0 - 2073600 s)
Measured value(F) cyclic interval	0	(0 - 2073600 s)
Point Status Timeout	60	(5 - 3600 s, 0 for disable)
Endian Swap	Byte 🔻	

Note: If the data can't be read correctly, it may be caused by the big-endian/little-endian. You can try to adjust the **Endian Swap** parameters. The default value "Byte" is for most scenarios.

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MGate 5114 with IEC 60870-5-104 SCADA

The Modbus RTU slave values need to be monitored or controlled by IEC 60870-5-104 Client. At this stage, we have to plan the data mapping table between IEC 60870-5-104 and Modbus RTU. The mapping table should show as below:

Mapping IEC 60870-5-104	Modbus	Madhua Command	Dointe Monning	
Data Object	Data Type		Points Mapping	
Single Points	Coil	ReadSP, WriteSP	SP 1 → Coil 1	
Double Points	Coil	ReadDP, WriteDP	DP 1 → Coil 1~2	
Step position	Register	ReadStep, WriteStep	Step 1 \rightarrow Register 1	
Bitstring32	Register	ReadBS32, WriteBS32	BS32 1 \rightarrow Register 1 and 2	
Measure value(N)	Register	ReadMN, WriteMN	MN 1 \rightarrow Register 1	
Measure value(S)	Register	ReadMS, WriteMS	MS 1 \rightarrow Register 1	
Measure value(F)	Register	ReadMF, WriteMF	MF 1 \rightarrow Register 1 and 2	
Integrated totals	Register	ReadCounter	Counter 1 \rightarrow Register 1 and 2	

Based on the above mapping table, we have to set **Object Point Numbers** in IEC 60870-5-104 as below:

Point Settings

				🔂 Add	ð	Edit	Clone	🖞 Delete	1 Move
Index	Memory /	Access	Object Type			IOA			
1	Read	Write	Single point			1-1			
2	Read	Write	Double point			1-1			
3	Read	Write	Step position			1-1			
4	Read	Write	Bitstring of 32 bit			1-1			
5	Read	Write	Measure value(N)			1-1			
6	Read	Write	Measure value(S)			1-1			
7	Read	Write	Measure value(F)			1-1			
8	Read	Write	Integrated totals			1 - 1			

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Step 5. I/O Data Mapping

After protocol 1 and 2 settings, go to **I/O Data Mapping** to check whether the mapping table is correct. There are two dataflow directions; they are "Read" and "Write" respectively. In this table, make sure all of IEC 60870-5-104 object points are mapping to Modbus commands correctly.

Data flow	<i>i</i> direction	IEC60870-5-10	4 Client> Modbus	RTU/AS	CII Slave	e V
Mapping address arrangement	Autor	natic 🔻				
	write			V	vrite	© 时
Your device : IEC60870-5-104 Client	Role 1 of MG IEC60870-5-1	Gate 5114 : 104 <mark>Server</mark>	Role 2 of MG Modbus RTU	ate 5114 /ASCII	4 : Master	Your device : Modbus RTU/ASCII Slave
Туре	IOA Internal Ad	dress Data Size	Name Fu	inction I	nternal A	ddress Quantity
Single point (value)	1 - 1 0 0	1 bytes	WriteSP	5 () (0 1 bytes
Double point (value)	1-111	1 bytes	WriteDP	15 1	1	1 1 bytes
Step position (value)	1 - 1 2 3	2 bytes	WriteStep	6 2	2;	3 2 bytes
Bitstring of 32 bit (value)	1 - 1 47	4 bytes	WriteBS32	16 4	4	7 4 bytes
Measure value(N) (value) 1 - 1 89	2 bytes	WriteMN	6 8	3	9 2 bytes
Measure value(S) (value) 1 - 1 10 11	1 2 bytes	WriteMS	6 1	10	11 2 bytes
Measure value(F) (value) 1 - 1 1218	5 4 bytes	WriteMF	16 1	12	15 4 bytes
Data flow Mapping address arrangement	direction Autom	IEC60870-5-104	l Client < Modbus	RTU/AS	CII Slave	
Your device :	Role 1 of MGa	ate 5114 :	Role 2 of MG	r ate 5114	Pead	Your device :
IEC60870-5-104 Client	IEC60870-5-1	04 Server	Modbus RTU	ASCII	Master	Modbus RTU/ASCII Slave
Type	IOA Internal Add	Iress Data Size	Name	Function	n Interna	Address Quantity
Single point (value)	1-10.0	1 bytes	ReadSP	1	U	U 1 bytes
Double point (value)	1-11.1	1 bytes	ReadDP	1	1	1 1 bytes
Step position (value)	1 - 1 23	2 bytes	ReadStep	3	2	3 2 bytes
Bitstring of 32 bit (value)	1 - 1 47	4 bytes	ReadBS32	3	4	. 7 4 bytes
Measure value(N) (value)	1-189	2 bytes	ReadMN	3	8	9 2 bytes
Measure value(S) (value)	1 - 1 1011	2 bytes	ReadMS	3	10	. 11 2 bytes
Measure value(F) (value)	1 - 1 12 15	4 bytes	ReadMF	3	12	15 4 bytes
Integrated totals (value)	1 - 1 16 . 19	4 bytes	ReadCounter	3	16	. 19 4 bytes

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For example, Modbus RTU Master sends a "ReadSP" to read the value from the Modbus slave device. If IEC 60870-5-104 Client wants to read the value through the "Single point IOA 1", **the settings of internal address should be the same**. If you want to make adjustments, please change the default arrangement "Automatic" to "Manual" first, then you can adjust the Internal Address.

Data flow direction IEC60870-5-104 Client < Modbus RTU/ASCII Slave V										
Mapping address arrangement		A	utomatic	▼						
	ľ	Pead					r	Pead		© ₽
Your device : IEC60870-5-104 Client	R IE	ole 1 of EC60870	MGate 5)-5-104 §	114 : erver		Role 2 of MG Modbus RTU	iate 5114 I/ASCII N	: laster		Your device : Modbus RTU/ASCII Slave
Туре	IOA	Interna	Address	Data Size		Name	Function	Internal	Address	Quantity
Single point (value)	1 - 1	0	0	1 bytes		ReadSP	1	0	0	1 bytes
Double point (value)	1 - 1	1	1	1 bytes		ReadDP	1	1	1	1 bytes
Step position (value)	1 - 1	2	3	2 bytes		ReadStep	3	2	3	2 bytes
Bitstring of 32 bit (value)	1 - 1	4	7	4 bytes		ReadBS32	3	4	7	4 bytes
Measure value(N) (value)	1 - 1	8	9	2 bytes		ReadMN	3	8	9	2 bytes
Measure value(S) (value)	1 - 1	10	11	2 bytes		ReadMS	3	10	. 11	2 bytes
Measure value(F) (value)	1 - 1	12	15	4 bytes		ReadMF	3	12	. 15	4 bytes
Integrated totals (value)	1 - 1	16	19	4 bytes		ReadCounter	3	16	19	4 bytes

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5 Simulation of IEC 60870-5-104 Setting by PcVue

Here, PC1 runs PcVue as IEC 60870-5-104 Client, trying to connect the MGate 5114. The following shows how to configure IEC 60870-5-104 Client. For PcVue, click **Configure** \rightarrow **Communication** \rightarrow **IEC 60870-5-104** to establish a connection.



Click "New network" to add an IEC 60870-5-104 network.

🤡 PcVue - IEC 60870-5-104	
File View	
IEC 60870-5-104	
Settings	🗱 Network creation
New network	General Advanced Traces
	Name MGate5114 Description Activate at start-up OK Cancel Apply

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🍃 PcVue - IEC 60870-5-104	Name of Street, or other	100000000000	NUMBER OF STREET, SQUARE, ST
File View			
IEC 60870-5-104 Settings New network	⊞-₩ IEC 60870-5-104	Name MGate5114	Description
MGate5114 MGate5114 Kew device Start network Kemove Mapping Properties Copy Cut	Device creation General Advanced Traces Name Address3 Description IP address 10 . 14 IV Activate at start-up	4.36.17	

Click "**New device**" to create a device. Input name and input the MGate 5114's IP address.

Click "Add Sector" to create a Sector. Input "Common address of ASDU" as 3, which is the same as that of the MGate 5114.

E-₩ IEC 60870-5-104	Address3					
⊡-∰ MGate5114 ∰ Address3	1					
	Name	Description	Address	State		
Sector creation General Advanced Name Sector03 Description Common address of 3 V Activate at start-	Traces ASDU up					

MGate 5114 with IEC 60870-5-104 SCADA

Select MGate5114 network, click "**Start network**" and SCADA will try to connect the MGate 5114. If the MGate 5114 is connected, the **State** would show "**Connected**".

Ver - IEC 60870-5-104			And the second	and the second second	
<u>F</u> ile <u>V</u> iew					
MGate5114	E-102 IEC 60870-5-104		MGate	5114	
New device	Address3	ja k			
Start network		Name	Description	Address	State
Stop network		⊌s Address3		10.144.36.17:2404	Connected
Remove					
🝺 Mapping					
🙀 Properties					
📄 Сору					
😽 Cut					

Click **Mapping** and an IEC 60870-5-104 object window will pop up. You can see several object points that are detected by the PcVue after making a connection according to the IEC 60870-5-104 communication characteristics. The objects include single-point information, double-point information, etc. They should be the same IEC 60870-5-104 server objects (MGate 5114).

<u>F</u> ile <u>V</u> iew					
MGate5114	□ ₩ IEC 60870-5-104 □ # MGate5114 □ # Address3	j. €	MGa	ate5114	
Start network		Name	Description	Address	State
Start network		🎼 Address3		10.144.36.17:2404	Connected
Stop network			-		
💏 Remove	U MGate5114 IEC 608	370-5-104 mapping			
🔰 Mapping	🖃 🎼 Address3			Name	
🙀 Properties	E Sector03	information (SP) [1.2.20]		012 1	
Copy	Double-poin	t information (DP) [3,4,31]			
de Cut	- 💋 Step position	information (STPV) [5,6,	32]		
- B Cut	Bitstring of a	32 bits (BSV) [7,8,33] lue, normalized value (MN	V) [9 10 34]		
	- 💋 Measured va	lue, scaled value (MSV) [1	1,12,35]		
	📁 Measured va	lue, short floating point val	ue (MFP) [13,14,36]		
	Integrated to	uais (11) [10,10,37]			
				< Ⅲ ►	
	"Single-point informat	tion (SP) [1,2,30]" of Ad	ddress3.Sector03	1 item:	- F

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Create variables to show the values for these points with the following steps: For example, choose Single Point IOA 1, right-click and select **"Create variable"**.

🕼 MGate5114 IEC 60870-5-104 mapping		
Address3 Sector03 Double-point information (SP) [1,2,30] Double-point information (DP) [3,4,31] Step position information (STPV) [5,6,32] Bitstring of 32 bits (BSV) [7,8,33] Measured value, normalized value (MIVV) [9,10,34] Measured value, scaled value (MSV) [11,12,35] Measured value, scale value (MSV) [11,12,35] Measured value	Name Variabl	ble Variable selector Create variable Unmap item
"Single-point information (SP) [1,2,30]" of Address3.Sector	03	1 item

Choose "Use the full hierarchical name" and click OK.

Decreate variable						
Variable name						
O Use the full hierachical name as variable name						
🔽 Use network name as prefix						
🔘 Customize the variable name						
MGate5114.Address3.Sector03.SP.1						
Hide this window (display again with [Shift] on variable creation)						
OK Cancel						

MGate 5114 with IEC 60870-5-104 SCADA

Use the same method to create variables for other object points. **Open Configure → Application Explorer Windows**.



We can check each object's value as below:

PcVue - Application Explore	r - [IEC104_MGate5114 project]					
File View Windows	Help					- 8 ×
MGate5114.Addre		^	 📬 🚮 🎺	MGate511	4.Address3.Sector03	.SP
Add bit		E	Name 300 1	Description	Value 0	Time stamp 20/09/18 18:20:28:695

6 Communication Test

6.1 Read Single-Point Test

Modify Modbus Slave ID 1's Alias SP 1 status from $0(OFF) \rightarrow 1(ON)$ as below:

< Modbus Slave-Single Point >

₽ D	S	P.mbs : 1: F = 01			×
F			Alias	0x0000	
	1		SP 1	1	
1	2				-

You can go to the Diagnose page to check whether the value has been updated in the MGate IEC 60870-5-104 server.

<MGate IEC 60870-5-104 Diagnose>

:•IEC60870-5-104 Server Diagnose

Auto refresh Refresh

Server Statictics

Error Message	OK
Received Requests	59
Sent Non-spontaneous Responses	426
Sent Spontaneous Responses	2
Connected Client IP	10.144.36.1

Point Information

Single	Point	•			
IOA Value Flags		Flags	Time Tag	Point Status	Time Updated
1	ON VALID		2018-09-20 17:57:37	ок	2018-09-20 17:57:37

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PcVue as IEC 60870-5-104 Client shows receiving the value "1(ON)" in the object.

⊟ 🤞 IEC104_MGate5114 project			MGate5114.Add	ress3.Sector03.SP
🗈 🄐 Communication 🖆 🍱 Variables		彦 🖬 🖓 🥗		
i - ♥ Variables tree i ♥ MGate5114 i ♥ Address3 i ♥ Sector03		Name 1	Description	Value 1
	Ш			
<mark>- ∅ SP</mark> ⊕ ∅ STPV ⊕ ∅ System		•	III	

< PcVue SCADA Single Point Status>

6.2 Read Double Point Test

Double point indicates 2-bit status; the status shows in the table below:

0 0	Indeterminate or intermediate state				
1 0	Determined state OFF (0)				
01	Determined state ON (1)				
11	Indeterminate state				

Modify Modbus Slave ID 2's Alias DP 1_Off status as "1" as below:

< Modbus Slave-Double Point >

🕎 C)P.mbs		×
ID =	2: F = 01		
	Alias	0x0000	
1	DP 1_OFF	1	=
2	DP 1_On	0	_
· ·			v

Check the following status in the MGate's diagnose page

<MGate IEC 60870-5-104 Diagnose>

Point Information

Double	Point	•			
IOA	Value	Flags	Time Tag	Point Status	Time Updated
1	Off	VALID	2018-09-21 10:30:53	ОК	2018-09-21 10:30:53

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< PcVue SCADA Double Point Status >

Modify Modbus Slave ID 2's Alias DP 1_On status as "1" as below:

< Modbus Slave-Double point >

🕎 C)P.mbs		×
ID =	2: F = 01		
	Alias	0x0000	
1	DP 1_OFF	1	=
2	DP 1_On	1	_
			·

Check PcVue DP 1 status: its value is still 0, but Quality is "NS". It means this DP status is under "Indeterminate" State.

< PcVue SCADA Double Point Status >



Modify Modbus Slave ID 2's Alias DP 1_OFF status as "0" as below:

< Modbus Slave-Double Point >

[]] D =	0P.mbs : 2: F = 01		×
	Alias	0x0000	
1	DP 1_OFF	0	=
2	DP 1_On	1	-

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Check PcVue DP 1 status; its value is 1:

< PcVue SCADA Double Point Status >							
	^	MGate5114.Address3.Sector03.DP					
Gesteree Geste	-	Name	Description	Value 1	Time stamp 21/09/18 10:45:56:403	Quality	

6.3 Read Step Position Test

Modify Modbus Slave ID 3's Alias Step 1 status as "1" as below:

🕎 S	Step.mbs		×
ID =	: 3: F = 03		
	Alias	4x0000	
1	Step 1	1	=
2			-

< Modbus Slave-Step Position Point>

Check following status in the MGate's Diagnose page:

<MGate IEC 60870-5-104 Diagnose>

Point	Point Information								
Step I	Step Position 🔻								
IOA Value Flags Time Tag Point Status Time Updated					Time Updated				
1	1 (not transient)	VALID	2018-09-21 10:58:14	ок	2018-09-21 10:58:14				

Check PcVue DP 1 status; its value is 1:

<	PcVue	SCADA	Step	Position	Status	>
---	-------	-------	------	----------	--------	---

		MGa	ate5114.4	Address3.Sector03.S ⁻	TPV
i i i i i i i i i i i i i i i i i i i	📬 वर्ष 🗸	2 🥵			
BSV DP DP IT MFP MNV MNV MSV SP STPV	Name	Description	Value 1.00	Time stamp 21/09/18 10:58:15:156	Quality

MGate 5114 with IEC 60870-5-104 SCADA

 Step.mbs
 Image: Constraint of the step in th

Modify Modbus Slave ID 3's Alias Step 1 status as "129" as below:

< Modbus Slave-Step Position Point >

PcVue shows this point's raw data as 129.

☐ [] MGate5114	*		MGa	ate5114.A	ddress3.Sector03.S	TPV
Address General Sector 03		卢 न्य 🗸	7 📌			
BSV		Name	Description	Value	Time stamp	Quality
		~ 1		129.00	21/09/18 11:20:24:327	
in in in in in in in in						
🖶 📁 MNV						
🖶 💋 MSV						
H- 🗾 SIPV						

< PcVue SCADA Step Position Status >

6.4 Read MF Test

Modify Modbus Slave ID 7's Alias MF 1 status as "1.234" as below:

< Modbus Slave-MF Point >

🕎 N	/IF.mbs		×
ID =	7: F = 03		
	Alias	4x0000	
1	MF 1	1.234	=
2			-

Check the following status in the MGate's diagnose page

<MGate IEC 60870-5-104 Diagnose>

Point Infor	Point Information							
Measure Va	Measure Value(F) V							
IOA	Value	Flags	Time Tag	Point Status	Time Updated			
1	1.234	VALID	2018-09-21 13:12:43	ок	2018-09-21 13:12:43			

MGate 5114 with IEC 60870-5-104 SCADA

The value has been changed to 1.234

	•	📁 वर्ष 🗸	MGate	5114.Addro	ess3.Sector03.MFP	
BSV DP IT MFP MNV MSV SP STPV System		Name	Description	Value 1.234	Time stamp 21/09/18 13:12:43:642	Q

< PcVue SCADA Step Position Status >

6.5 Write SP Test

In order for the variable to trigger a command, we should enable "Command" property. In the "General" tab, enable "Command".

Bit variable MGate5114.Address3.Sector03.SP.1	X
General Source Extended attributes Advanced	
Name 1	
Description	
Domain	
	•
Nature	•
Associated label	
	-
Command	
Alarm []	
Log	
OK Cancel	Apply

Moxa Tech Note MGate 5114 with IEC 60870-5-104 SCADA

🔝 Bit va	riable M0	Gate5114.Address3.Sector03.SP.1
General	Source	Extended attributes Advanced
Sour	`o	
M	Gate5114	▼
IEC	60080 E 1	
IEC	00870-5-1	
De	vice	
Ac	ldress3	▼
Se	ctor03	▼
Ob	ject type	
Si	ngle-point	information (SP) [1,2,30] 🔹
Inf	ormation of	bject address (IOA)
0		0 1
W	riting infor	mation object address (IOA)
0		0 1
		OK Cancel Apply

In the "Source" tab, modify "Write information object address (IOA)" as 1:

In the "Advanced" tab, choose "Select before operate (SBO)" under IEC 60870-5-104 \rightarrow Control:

Bit variable MGate5114.Address3.Sector03.SP.1	X
General Source Extended attributes Advanced	
Monitoring Permanent scan for mimics All stations Server station None Networking Clients (No list selected) Clients (No list selected) Control parameters Control parameters Control pirect execute (DE) Qualifier (QU) Control the fore operate (SBO) Control the fore operate (SBO)	
 Time tagged Not time tagged 	
OK Cancel	Apply
	.:

MGate 5114 with IEC 60870-5-104 SCADA



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

The rectangle will be Green, standing for SP 1 "1(On)".

Mimic1	
ATTRIBUT 14	A

Click the button, the rectangle will then be Red, standing for SP 1 "0(Off)".



MGate 5114 with IEC 60870-5-104 SCADA

We can then check the following status:

<MGate IEC 60870-5-104 Diagnose>

Point Information

Single Point							
IOA	Value	Flags	Time Tag	Point Status	Time Updated		
1	OFF	VALID	2018-09-21 16:23:00	ОК	2018-09-21 16:23:01		

The value has been written to the Modbus Slave:

< Modbus Slave-Single Point >

🕎 S	P.mbs		×
ID =	: 1: F = 01		
	Alias	0x0000	A
1	SP 1	0	Ξ

6.6 Write DP Test

In DP 1's General tab, enable "Command".

Bit variable MGate5114.Address3.Sector03.DP.1						
General Source Extended attributes Advanced						
Name						
Description						
Domain						
▼						
Nature						
Associated label						
•						
Command						
Alarm						
Log						
OK Cancel Apply]					
	:					

Moxa Tech Note MGate 5114 with IEC 60870-5-104 SCADA

💀 Bit variable MGate5114.Address3.Sector03.DP.1
General Source Extended attributes Advanced
General Source Source IEC 60870-5-104 Device Address3 Address3 • Sector Sector Sector03 • Object type Double-point information (DP) [3,4,31] Information object address (IOA) 0 0 0 1 Writing information object address (IOA) 0 0
OK Cancel Apply

In the Source tab, modify "Write information object address (IOA)" as 1:

In the Advanced tab, choose "Select before operate (SBO)" under IEC 60870-5-104 \rightarrow Control:

Bit variable MGate5114.Address3.Sector03.DP.1	X
General Source Extended attributes Advanced	
Seneral Source Extended attributes Invalues Image: Seneral scan for mimics All stations Seneral scan for mimics Image: Seneral scan for mimics None Seneral scan for mimics Image: Seneral scan for mimics Seneral scan for mimics Image: Seneral scan for mimics Seneral scan for mimics Image: Seneral scan for mimics Seneral scan for mimics Image: Seneral scan for mimics Seneral scan for mimics Image: Seneral scan for mimics Seneral scan for mimics Image: Seneral scan for mimics Seneral scan for mimics Image: Seneral scan for mimics Seneral scan for mimics Image: Seneral scan for mimics Seneral scan for mimics Image: Seneral scan for mimics Seneral scan for mimics Image: Seneral scan for mimics Seneral scan for mimics Image: Seneral scan for mimics Seneral scan for mimics Image: Seneral scan for mimics Seneral scan for mimics Image: Seneral scan for mimics Seneral scan for mimics Image: Seneral scan for mimics Seneral scan for mimics Image: Seneral scan for mimics Seneral scan for mimics Image: Seneral scan for mimicscan for mimics Seneral scan for	
	₹ Vlag
	.::

MGate 5114 with IEC 60870-5-104 SCADA

Right-click on Mimic to execute "**Run**" mode. The rectangle shows Green, standing for DP 1 "1(On)".



Click the button. The rectangle's turns Red, standing for DP 1 "0(Off)".



When Double Point shows "Off", we can check the following status:

<MGate IEC 60870-5-104 Diagnose>

Point Information

Double	Point	•			
IOA	Value	Flags	Time Tag	Point Status	Time Updated
1	Off	VALID	2018-09-21 17:03:06	ок	2018-09-21 17:03:07

MGate 5114 with IEC 60870-5-104 SCADA

🕎 C)P.mbs		×
ID =	2: F = 01		
	Alias	0x0000	
1	DP 1_OFF	1	=
2	DP 1_On	0	-

< Modbus Slave-Double Point >

7 Troubleshooting Tool

7.1 MGate Protocol Diagnose Introduction

In the MGate 5114 web console, there is "**Protocol Status**" to diagnose Protocol Status, which include two powerful troubleshooting tools, "**Protocol Diagnose**" and "**Protocol Traffic**", as below:



< Protocol Status >

In the "**IEC 60870-5-104 Diagnose**" web page, we can monitor IEC 60870-5-104 Server connection status and the Object Points status.

< IEC 60870-5-104 Server Diagnose >

MGate 5114 with IEC 60870-5-104 SCADA

•IEC60870-5-10	4 Server
Auto refresh Refresh	
Server Statictics	
Error Message	ок
Received Requests	21
Sent Non-spontaneous Responses	148
Sent Spontaneous Responses	0
Connected Client IP	10.144.36.1
Point Information	
Qia ele Deiet	

Single F	Point	•			
IOA	Value	Flags	Time Tag	Point Status	Time Updated
1	OFF	VALID	2018-09-20 16:29:15	ОК	2018-09-20 16:30:28

7.2 MGate Traffic Monitor Introduction

In the "**IEC 60870-5-104 Traffic**" web page or "**Modbus RTU Traffic**" web page, these running communication traffics can be captured by clicking "Start". After clicking "Stop", we can export them in TXT file or PCAP file formats. the PCAP file can be executed by Wireshark tool, which helps to analyze the data easily.

• IEC60870-5-104 Traffic

Start Stop Export TXT File Export PCAP File Ready to capture. No. Time Send/Receive Remote IP : port Data 1 0.968 Receive 10.144.36.1:31533 68 0E 02 00 04 00 64 01 06 63 03 00 00 00 01 4 2 0.979 Receive 10.144.36.1:31533 68 0E 02 00 04 00 64 01 07 63 03 00 00 00 01 4	
No. Time Send/Receive Remote IP : port Data 1 0.968 Receive 10.144.36 1:31533 68 0E 02 00 04 00 64 01 06 63 03 00 00 00 01 14 2 0.979 Receive 10.144.36 1:31533 68 0E 04 00 04 00 64 01 07 63 03 00 00 00 01 14	
1 0.968 Receive 10.144.36.1:31533 68 0E 02 00 04 00 64 01 06 63 03 00 00 00 01 4 2 0.979 Receive 10.144.36.1:31533 68 0E 04 00 04 00 64 01 07 63 03 00 00 00 01 4	
2 0.979 Receive 10.144.36.1:31533 68 0E 04 00 04 00 64 01 07 63 03 00 00 00 01 4	
3 0.979 Receive 10.144.36.1:31533 68 15 06 00 04 00 1E 01 14 63 03 00 01 00 00 08 B5 89 09 94 09 12	
4 0.979 Receive 10.144.36.1:31533 68 15 08 00 04 00 1F 01 14 63 03 00 01 00 00 08 85 89 09 94 09 12	
5 0.980 Receive 10.144.36.1:31533 68 16 0A 00 04 00 20 01 14 63 03 00 01 00 00 01 00 B8 B5 89 09 94 09 12	
6 0.980 Receive 10.144.36.1:31533 68 19 0C 00 04 00 21 01 14 63 03 00 01 00 00 00 00 00 08 B5 89 09 94 09 12	
7 0.980 Receive 10.144.36.1:31533 68 17 0E 00 04 00 22 01 14 63 03 00 01 00 00 00 00 B8 B5 89 09 94 09 12	
8 0.980 Receive 10.144.36.1:31533 68 17 10 00 04 00 23 01 14 63 03 00 01 00 00 00 00 08 B5 89 09 94 09 12	
9 0.980 Receive 10.144.36.1:31533 68 19 12 00 04 00 24 01 14 63 03 00 01 00 00 00 00 00 00 B8 B5 89 09 94 09 12	
10 0.980 Receive 10.144.36.1:31533 68 0E 14 00 04 00 64 01 0A 63 03 00 00 00 01 4	
11 0.983 Receive 10.144.36.1:31533 68 04 01 00 06 00	

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Modbus RTU/ASCII Traffic

Auto scroll

S	tart	Stop	Export	TXT File	Export PCAP File Ready to capture.
No.	Time	Send/Receive	Slave ID	Function Code	Data
1	0.043	Send	1	1	01 01 00 00 00 01 FD CA
2	0.084	Receive	1	1	01 01 01 00 51 88
3	0.133	Send	2	3	02 03 00 00 00 01 84 39
4	0.176	Receive	2	3	02 03 02 00 00 FC 44
5	0.182	Send	3	3	03 03 00 00 00 01 85 E8
6	0.225	Receive	3	3	03 03 02 00 01 00 44
7	0.243	Send	4	3	04 03 00 00 00 02 C4 5E
8	0.286	Receive	4	3	04 03 04 00 00 00 00 AF 33
9	0.312	Send	5	3	05 03 00 00 00 01 85 8E
10	0.355	Receive	5	3	05 03 02 00 00 49 84
11	0.373	Send	6	3	06 03 00 00 00 01 85 BD
12	0.415	Receive	6	3	06 03 02 00 00 0D 84
13	0.443	Send	7	3	07 03 00 00 00 02 C4 6D
14	0.486	Receive	7	3	07 03 04 00 00 00 00 9C 33
15	0.492	Send	8	3	08 03 00 00 00 02 C4 92
16	0.540	Receive	8	3	08 03 04 00 00 00 00 63 33

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