

# NR500 Series Industrial Cellular VPN Router

# Application Note 061

# **MQTT to DO and Modbus**

Version:V1.0.0Date:Sep. 2021Status:Confidential





# **Directory**

1.	Introd	duction	3
	1.1 O	verview	3
	1.2 C	ompatibility	3
	1.3 V	ersion	3
	1.4 C	orrections	3
2.	Торо	logy	4
3.	MQTI	to Digital Output	5
	3.1	Configuration on NR500	5
	3.2	Test	6
4.	MQTI	to Modbus	7
	4.1	Configuration on Modbus Slave	7
	4.2	Configuration on NR500	7
	4.3	Test	9



# 1. Introduction

## 1.1 Overview

This document contains information regarding the configuration and use of MQTT to DO and Modbus.

This guide has been written for use by technically competent personnel with a good understanding of the communications technologies used in the product, and of the requirements for their specific application.

# 1.2 Compatibility

This application note applies to: **Models Shown:** NR500 series. **Firmware Version:** V1.1.6(2e031bb) or newer **Other Compatible Models:** None

### 1.3 Version

Updates between document versions are cumulative. Therefore, the latest document will include all the content of previous versions.

Release Date	Doc. Version	Firmware Version	Change Description		
2021/09/30	V1.0.0	V1.1.6(2e031bb)	First released		

### 1.4 Corrections

Appreciate for corrections or rectifications to this application note, and if any request for new application notes please email to: **support@navigateworx.com** 



# 2. Topology



- 1. NR500 Router runs as Modbus Master and connect to Modbus Slave via Ethernet, RS232 or RS485 interface.
- 2. NR500 runs as MQTT Client and connect to the MQTT Broker
- 3. Another MQTT Client connect to the MQTT Broker and send the commands to control the Digital Output and write the Slave device

Note: For this Application Note, we will set the Connection Type as "RS232" as an example, which means that NR500(Modbus Master) will connect to the Modbus Slave via RS232. Of course, it also works with RS485 and Ethernet Port.



# 3. MQTT to Digital Output

### 3.1 Configuration on NR500

1. Go to **Industrial Interface>Digital IO**, enable digital output feature and set the Alarm Source as Modbus Transport, as below:

Overview	State	us	Digital IO					
Link Management	Digital	Input	Settings					
Industrial Interface	Index 1	Enab	Digital Output					M
<ul> <li>Digital IO</li> </ul>	2	fals	Digital Output Settings					C
Network	Digital	Outp	Index	1			_	
Applications	Index	Enab	Enable					
VPN	1	true	Alarm Source	Modbus Transport 🗸 🗸				Ø
Maintenance	2	true	Alarm ON Action	High 🗸				Ø
maintenance			Alarm OFF Action	Low 🗸				-
					Save	Close		

- 2. Click Save>Apply.
- 3. Go to **Applications>Modbus Transport**, to specify the parameters for MQTT to make the router connect to MQTT Broker, and also set a Subscribe Topic as "test1", the other settings leave it as default.

Overview	Status	Modbus Transport	X.509 Certificate						
Link Management	Connection	<b>Connection Settings</b>							
Industrial Interface	Index	Connection List						^ st	÷
Network	1		Index	1	]			ER,\$	$\boxtimes$
Applications			Enable						
DDNS			Description						
SMS Schedule Reboot			Protocol	MQTT ~					
Call			Server Address	192.168.111.101					
Modbus Master			Server Port	1883	]				
<ul> <li>Modbus Transport</li> </ul>			Enable SSL						
VPN			Username	test	]				
Maintenance			Password	•••••					
			Client ID		0				
			Subscribe Topic	test1	0				
			Keepalive	60	0				
		F	Reconnect Interval	60	] ⑦				
		Co	onnection Timeout	10	0				
			Enable LWT						
		E	nable Verbose Log						
		Terrorat Data Cattin						Save	Apply
					Sa	ive	Close	Save	мррту

- 4. Click Save>Apply.
- 5. Router had connected to MQTT Broker successfully:

Stat	us M	lodbus Transpo	rt X.509 Ce	rtificate	
Conne	ction Stat	tus			
Index	Enable	Description	Protocol	Status	Uptime
1	true		MQTT	Connected	00:07:23



# 3.2 Test

1. Run the MQTT Client on the PC and connect to MQTT Broker, Publish a topic as "test1", and send the command to the router to control the Digital Output:

🌚 MQTT.fx - 1.7.1		- 🗆 X
File Extras Help		
MQTT TEST	Connect     Disconnect	<b>_</b> ∩●
Publish Subscribe Scripts	Broker Status Log	
» test1	Publish	Qo Qo Qo Retained 😋 🗸
{ "connection_index"	: 0, "slave_id": 1, "func_code": 50, "reg_addr": 1, "endian": "ab", "valu	Je": "1" }

#### 2. Test successfully:

Overview	Stat	us	Digital IO	
Link Management	Digital	Input In	formation	
Industrial Interface	Index	Enable	Logic Level	Status
Serial	1	false	High	Alarm OFF
► Digital IO	2	false	High	Alarm OFF
Network	Digital	Output 1	Information	
Applications	Index	Enable	Logic Level	Status
VPN	1	true	High	Alarm ON
Maintenance	2	true	High	Alarm ON

#### Note: Command explanation as below:

#### 1. Command to control the Digital Output 1 ON:

{ "connection\_index": 0, "slave\_id": 1, "func\_code": 50, "reg\_addr": 1, "endian": "ab", "value": "1" }

#### 2. Command to control the Digital Output 1 OFF:

{ "connection\_index": 0, "slave\_id": 1, "func\_code": 50, "reg\_addr": 1, "endian": "ab", "value": "0" }

#### 3. Command to control the Digital Output 2 ON:

{ "connection\_index": 0, "slave\_id": 1, "func\_code": 50, "reg\_addr": 2, "endian": "ab", "value": "1" }

#### 4. Command to control the Digital Output 2 OFF:

{ "connection\_index": 0, "slave\_id": 1, "func\_code": 50, "reg\_addr": 2, "endian": "ab", "value": "0" }



# 4. MQTT to Modbus

### 4.1 Configuration on Modbus Slave

1. Here we use "Modbus Slave" software to simulate the end device (Modbus Slave device), and specify the Slave ID: 1, Function Code: 03-Holding-Register:

	Modbus Slave - Ml	oslave1						- 🗆	×			
File	Edit Connection	n Setup Display	View Window	Help								
D												
1	💭 Mbslave1											
ID	= 1: F = 03											
	Alias	00000	Alias	00010	Alias	00020	Alias	00030				
0		0		0		0		0				
1		0		0		0		0				
2		0		0		0		0				
3		0		0		0		0				
4		0		0		0		0				
5		0		0		0		0				
6		0		0		0		0				
7		0		0		0		0				
8		0		0		0		0				
9		0		0		0		0				
For H	Port 3: 115200-8-N-1											

# 4.2 Configuration on NR500

1. Go to **Applications>Modbus Master>Modbus Poll**, specify the Modbus setting to make it connect to the slave, as below:

Overview	Status	Modbus Poll	Modbus Alarm Mod	bus W	rite								
Link Management	Connectio	Connection Sett	ings										
Industrial Interface	Index	Connection List							ress	Server P	ort	(	Ð
Network	1		Index	1						502		20	3
Applications			Enable	✓									
DDNS			Description										
SMS Schadula Raboot			Scan Rate	100	000		0						
Call			Response Timeout	100	00		?						
► Modbus Master			Delay Between Polls	0			0						
Modbus Transport			Connection Type	RS	232	~							
VPN			Enable Show Status	<b>~</b>									
Maintenance			Enable Verbose Log										
		Serial Settings											
			Baud Rate	115	5200	~							
			Parity	No	ne	~							
			Data Bits	8		~							
			Stop Bits	1		~							
		Channel List											
		Index Enable	e Description	Slave ID	Function Code		Register Address	(	Э				
							Save	Close	\$	Save	A	Apply	



- 2. Click Save>Apply.
- 3. Go to **Applications>Modbus Transport**, to specify the parameters for MQTT to make the router connect to MQTT Broker, and also set a Subscribe Topic as "test1", the other settings leave it as default.

Overview	Status	Modbus Transport	X.509 Certificate					
Link Management	Connection	<b>Connection Settings</b>						
Industrial Interface	Index	Connection List					^ st	$\oplus$
Network	1		Index	1	]		ER,\$	
Applications			Enable	<ul><li>✓</li></ul>				
DDNS			Description					
SMS Schedule Reboot			Protocol	MQTT ~	]			
Call			Server Address	192.168.111.101	]			
Modbus Master			Server Port	1883	]			
<ul> <li>Modbus Transport</li> </ul>			Enable SSL					
VPN			Username	test	]			
Maintenance			Password	•••••				
			Client ID		0			
			Subscribe Topic	test1	0			
			Keepalive	60	0			
			Reconnect Interval	60	] ⑦			
		C	onnection Timeout	10	0			
			Enable LWT					
		E	nable Verbose Log					
		T					Save	Apply
					Save	Close	Save	Арриу

- 4. Click Save>Apply.
- 5. Router had connected to MQTT Broker successfully:

Status Modbus Transport X.509 Certificate								
Connection Status								
Index	Enable	Description	Protocol	Status	Uptime			
1	true		MQTT	Connected	00:07:23			



## 4.3 Test

1. Run the MQTT Client on the PC and connect to MQTT Broker, Publish a topic as "test1", and send the command to the router to control the slave device:

😡 MQTT.fx - 1.7.1	- 🗆 ×
File Extras Help	
MQTT TEST Connect Disconnect	<b>-</b>
Publish Subscribe Scripts Broker Status Log	
» test1	Qo Qo Qo Retained
{"connection_index":1, "slave_id":1, "func_code":06, "reg_addr":0, "endian":"cd_ab", "value":"69"}	

2. Test successfully, finally we are able to send the command via MQTT to control the slave device:

	<b>1</b> M	lodbus Slave - M	bslave1						- 🗆	$\times$
F	ile	Edit Connectio	n Setup Display	y View Window	v Help					
D C A A A A A A A A A A A A A A A A A A										
Ш						[				
		Alias	00000	Alias	00010	Alias	00020	Alias	00030	)
L	0		69		0		0		(	D
L	1		0		0		0		(	D
L	2		0		0		0		(	D
	3		0		0		0		(	D

#### Note:

Control command to set the value as 69 to the salve 1 and register address 0 as an example:

{"connection\_index":1, "slave\_id":1, "func\_code":06, "reg\_addr":0, "endian":"cd\_ab", "value":"69"}