Tech Tips

Using DNP3 with Janus Products (2500P-Jxxx, 2500C-Jxxx, 2500P-JACP)

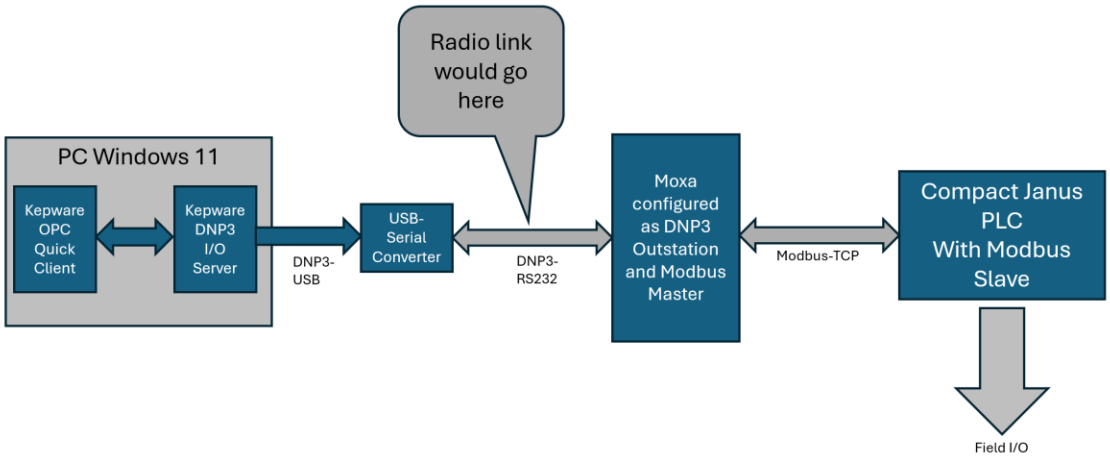
1.1 Overview

Janus products offer extensive communications capabilities, including:

- CAMP Client and Server
- Modbus Client (Master) and Modbus Server (Slave)
- Ethernet/IP – I/O Scanner, I/O Adapter, Tag Client, Tag Server, Flex I/O
- Network Data Exchange
- DataCache to 2500-Cxxx Processors
- MQTT
- OPC-UA Server

In this Tech Tip, we will show how to communicate using DNP3 to Janus devices. This use case is commonly found in electric utilities and water/wastewater applications, where a small PLC operating a remote station needs to communicate with an Enterprise SCADA, often over leased Ethernet or serial lines using radio or cellular.

For this connection, we will employ a Moxa Mgate 5109, which functions as a gateway between the serial DNP3 and Modbus Ethernet.



1.2 Summary of Operation

1. To simulate the SCADA system, we use a PC running Kepware with the DNP3 I/O Server. This is an available I/O server from Kepware which does serial or Ethernet DNP3. Using the OPC Quick Client built-in to Kepware, we can read and write variables through DNP3 to the Compact Janus PLC. In this example, we are reading sixteen words of data from the Janus PLC.
2. Since this is a Windows PC with no serial port, we use a standard USB-Serial converter which maps to a COM port in Windows.
3. A serial RS232 cable links the USB-Serial converter to the Moxa Mgate 5109, which is configured as a DNP3-Modbus gateway. In remote applications, this cable is logically replaced by a serial radio link.
4. On the serial side, the Moxa device is set up as a DNP3 Outstation. One the Modbus side, the Moxa is a Modbus TCP Master (Client). In a remote application, the Moxa device would be co-located with the Compact Janus PLC at the remote site.
5. The Moxa is connected to the Compact Janus PLC using standard Ethernet. They could be connected directly by a cable, or they could be part of the local network at the remote site.
6. On the Compact Janus, a Modbus Slave (Server) configuration completes the communication between Moxa and Janus.

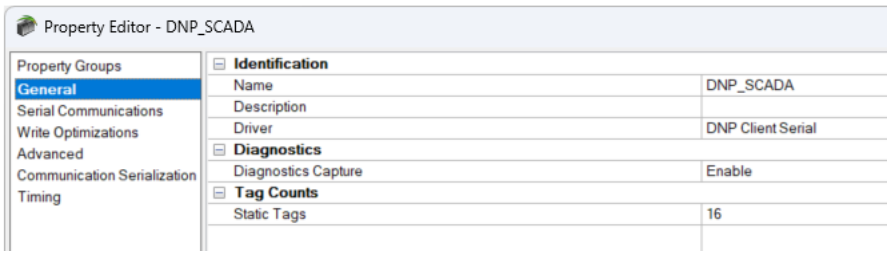
1.3 Demo Project Files

A zip file containing all the required configuration files is available on the CTI web site:

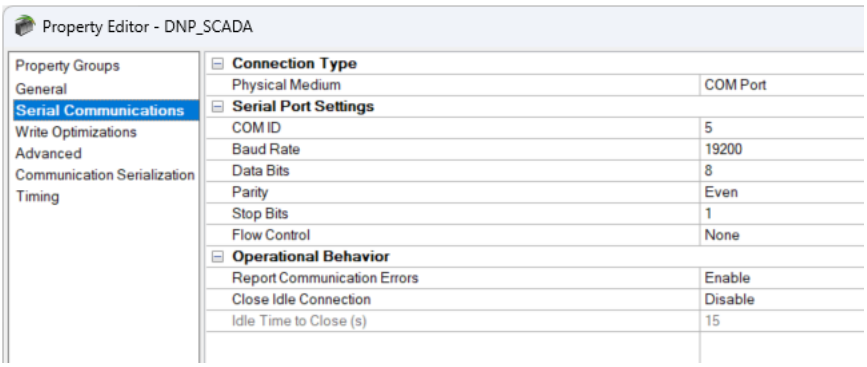
- Kepware server and quick client project files
- Moxa setup file
- Janus Workbench (JSoft) project file

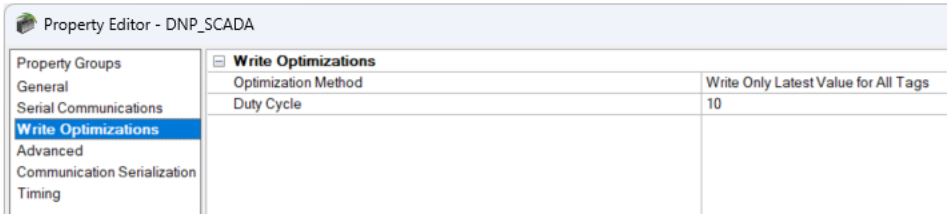
1.4 Kepware Server Setup

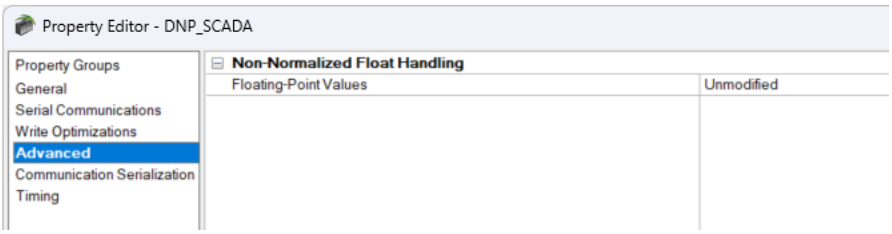
DNP_SCADA Property Editor:

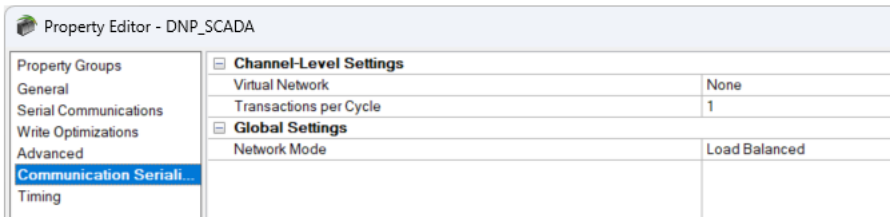


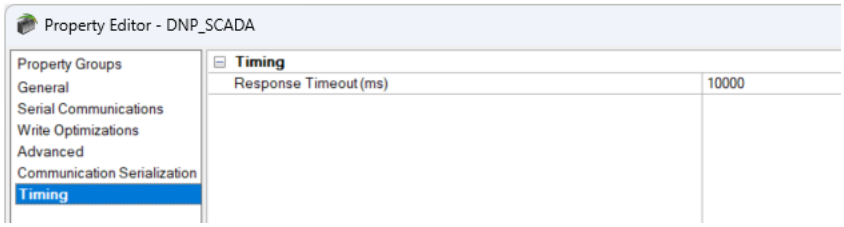
ROCK SOLID PERFORMANCE. TIMELESS COMPATIBILITY.

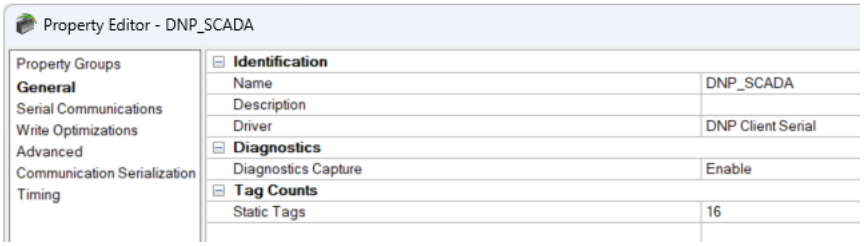




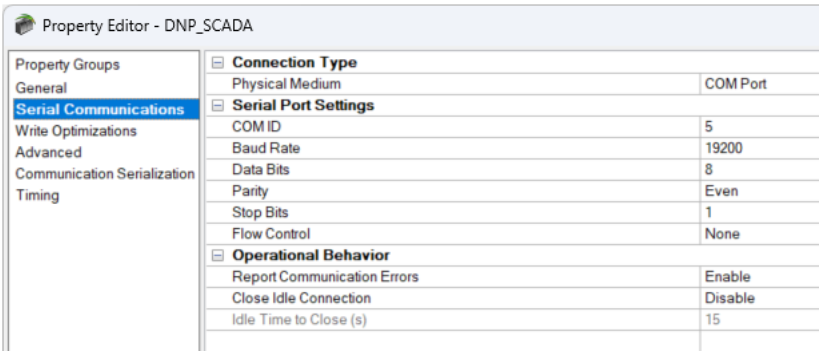


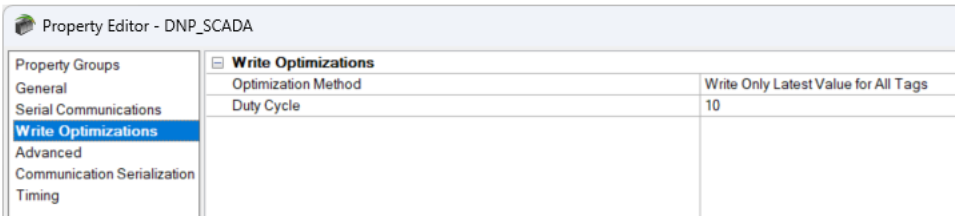


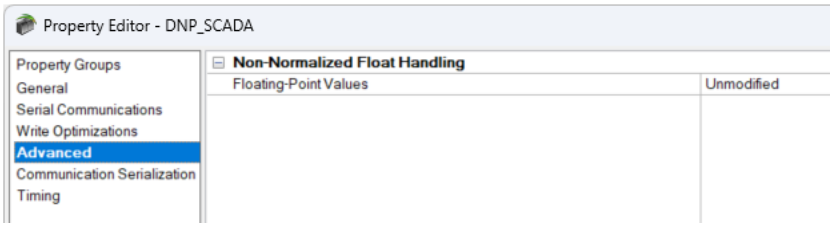




ROCK SOLID PERFORMANCE. TIMELESS COMPATIBILITY.







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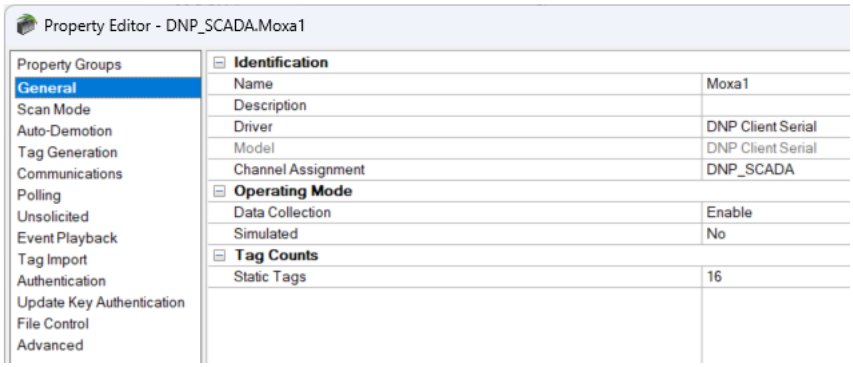
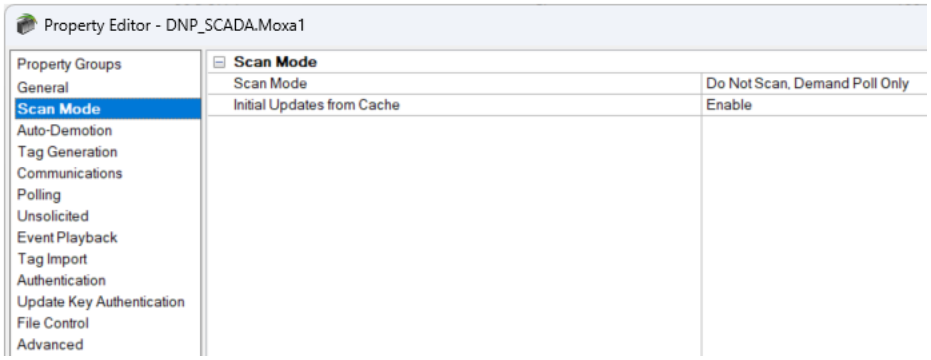
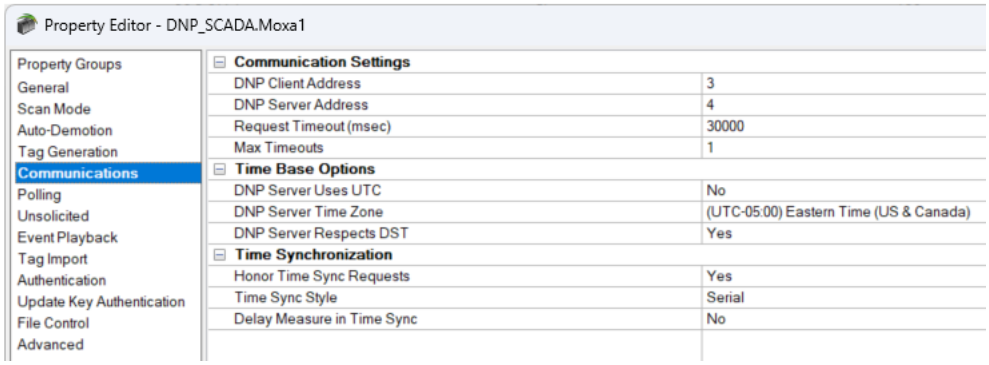
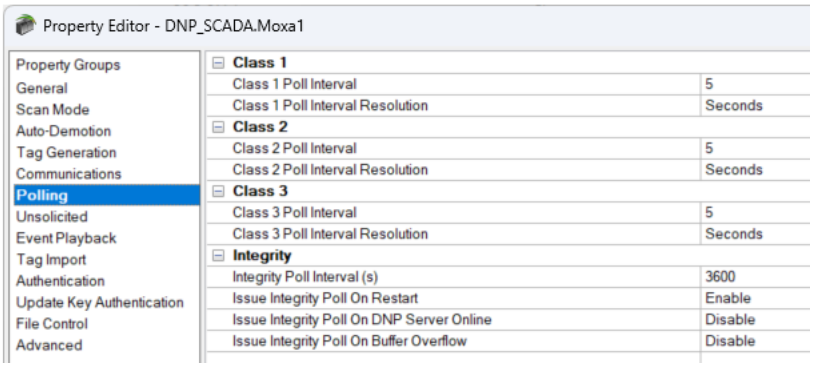
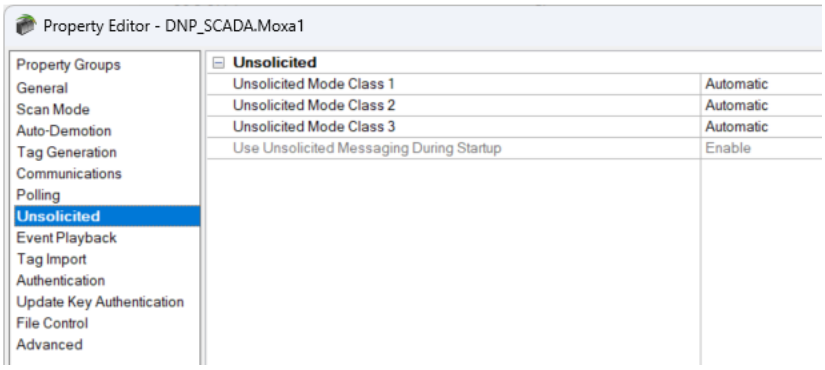




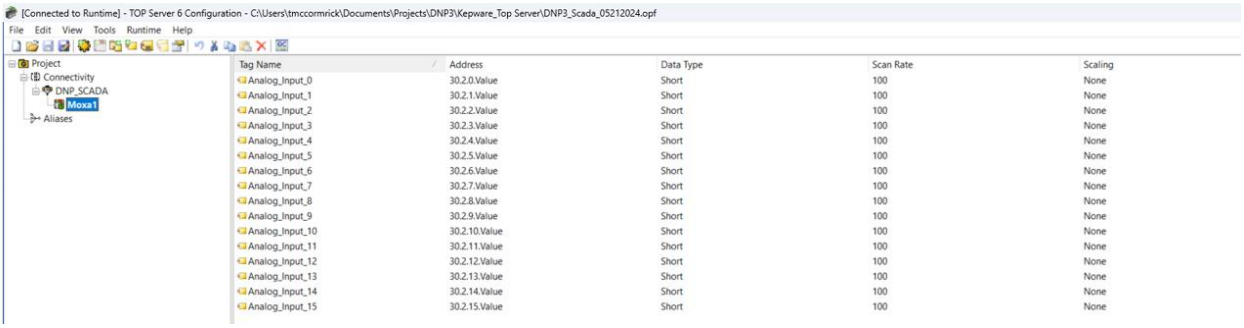






ROCK SOLID PERFORMANCE. TIMELESS COMPATIBILITY.

Tagname database:



Tag Name	Address	Data Type	Scan Rate	Scaling
Analog_Input_0	30.2.0.Value	Short	100	None
Analog_Input_1	30.2.1.Value	Short	100	None
Analog_Input_2	30.2.2.Value	Short	100	None
Analog_Input_3	30.2.3.Value	Short	100	None
Analog_Input_4	30.2.4.Value	Short	100	None
Analog_Input_5	30.2.5.Value	Short	100	None
Analog_Input_6	30.2.6.Value	Short	100	None
Analog_Input_7	30.2.7.Value	Short	100	None
Analog_Input_8	30.2.8.Value	Short	100	None
Analog_Input_9	30.2.9.Value	Short	100	None
Analog_Input_10	30.2.10.Value	Short	100	None
Analog_Input_11	30.2.11.Value	Short	100	None
Analog_Input_12	30.2.12.Value	Short	100	None
Analog_Input_13	30.2.13.Value	Short	100	None
Analog_Input_14	30.2.14.Value	Short	100	None
Analog_Input_15	30.2.15.Value	Short	100	None

Property Editor - DNP_SCADA.Moxa1.Analog_Input_0

Property Groups
General
Scaling

Identification	
Name	Analog_Input_0
Description	
Data Properties	
Address	30.2.0.Value
Data Type	Short
Client Access	Read Only
Scan Rate (ms)	100

Property Editor - DNP_SCADA.Moxa1.Analog_Input_1

Property Groups
General
Scaling

Identification	
Name	Analog_Input_1
Description	
Data Properties	
Address	30.2.1.Value
Data Type	Short
Client Access	Read Only
Scan Rate (ms)	100

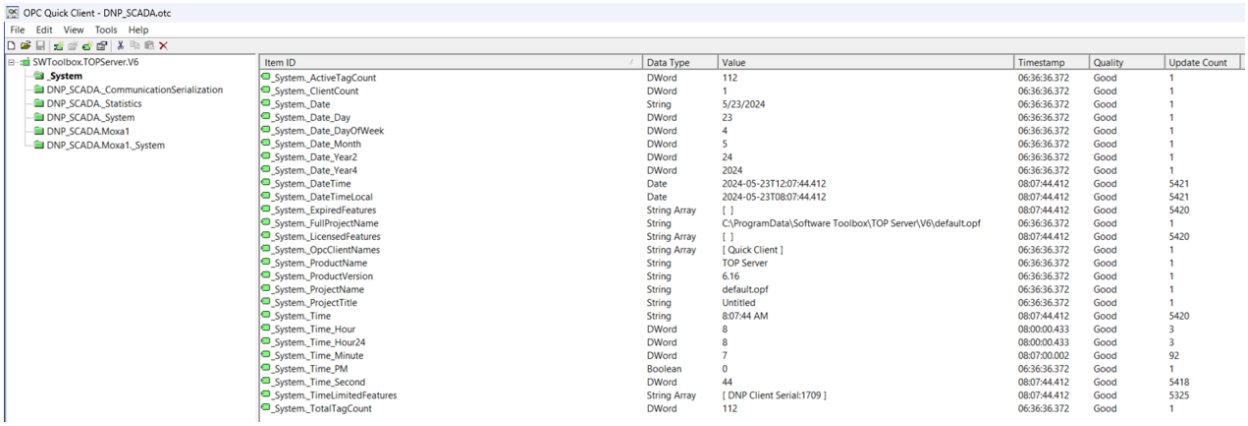
Property Editor - DNP_SCADA.Moxa1.Analog_Input_2

Property Groups
General
Scaling

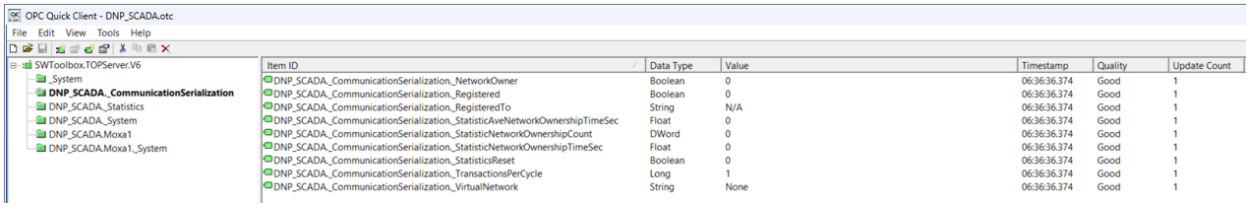
Identification	
Name	Analog_Input_2
Description	
Data Properties	
Address	30.2.2.Value
Data Type	Short
Client Access	Read Only
Scan Rate (ms)	100

ROCK SOLID PERFORMANCE. TIMELESS COMPATIBILITY.

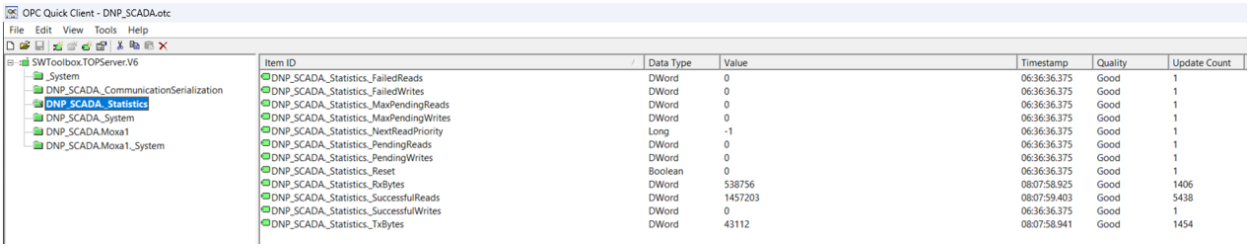
1.5 Kepware OPC Quick Client Setup



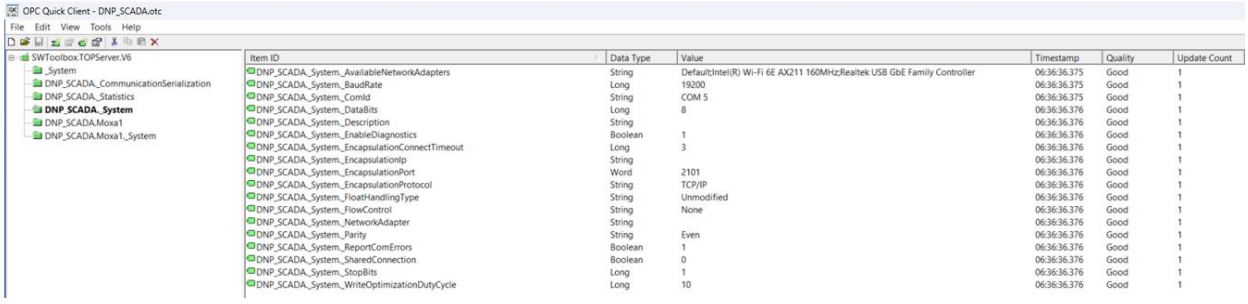
Item ID	Data Type	Value	Timestamp	Quality	Update Count
_System._ActiveTagCount	DWord	112	06:36:36.372	Good	1
_System._ClientCount	DWord	1	06:36:36.372	Good	1
_System._Date	String	5/23/2024	06:36:36.372	Good	1
_System._Date_Day	DWord	23	06:36:36.372	Good	1
_System._Date_DayOfWeek	DWord	4	06:36:36.372	Good	1
_System._Date_Month	DWord	5	06:36:36.372	Good	1
_System._Date_Year2	DWord	24	06:36:36.372	Good	1
_System._Date_Year4	DWord	2024	06:36:36.372	Good	1
_System._DateTime	Date	2024-05-23T12:07:44.412	08:07:44.412	Good	5421
_System._DateTimeLocal	Date	2024-05-23T08:07:44.412	08:07:44.412	Good	5421
_System._ExpiredFeatures	String Array	[ ]	08:07:44.412	Good	5420
_System._FullProjectName	String	C:\ProgramData\Software Toolbox\TOP Server\V6\default.opf	06:36:36.372	Good	1
_System._LicensedFeatures	String Array	[ ]	08:07:44.412	Good	5420
_System._OpcClientNames	String Array	[Quick Client]	06:36:36.372	Good	1
_System._ProductName	String	TOP Server	06:36:36.372	Good	1
_System._ProductVersion	String	6.16	06:36:36.372	Good	1
_System._ProjectName	String	default.opf	06:36:36.372	Good	1
_System._ProjectTitle	String	Untitled	06:36:36.372	Good	1
_System._Time	String	8:07:44 AM	08:07:44.412	Good	5420
_System._Time_Hour	DWord	8	08:00:00.433	Good	3
_System._Time_Hour24	DWord	8	08:00:00.433	Good	3
_System._Time_Minute	DWord	7	08:07:00.002	Good	92
_System._Time_PM	Boolean	0	06:36:36.372	Good	1
_System._Time_Second	DWord	44	08:07:44.412	Good	5418
_System._TimeLimitedFeatures	String Array	[DNP Client Serial:1709]	08:07:44.412	Good	5325
_System._TotalTagCount	DWord	112	06:36:36.372	Good	1



Item ID	Data Type	Value	Timestamp	Quality	Update Count
DNP_SCADA_CommunicationSerialization._NetworkOwner	Boolean	0	06:36:36.374	Good	1
DNP_SCADA_CommunicationSerialization._Registered	Boolean	0	06:36:36.374	Good	1
DNP_SCADA_CommunicationSerialization._RegisteredTo	String	N/A	06:36:36.374	Good	1
DNP_SCADA_CommunicationSerialization._StatisticAveNetworkOwnershipTimeSec	Float	0	06:36:36.374	Good	1
DNP_SCADA_CommunicationSerialization._StatisticNetworkOwnershipCount	DWord	0	06:36:36.374	Good	1
DNP_SCADA_CommunicationSerialization._StatisticNetworkOwnershipTimeSec	Float	0	06:36:36.374	Good	1
DNP_SCADA_CommunicationSerialization._StatisticsReset	Boolean	0	06:36:36.374	Good	1
DNP_SCADA_CommunicationSerialization._TransactionsPerCycle	Long	1	06:36:36.374	Good	1
DNP_SCADA_CommunicationSerialization._VirtualNetwork	String	None	06:36:36.374	Good	1

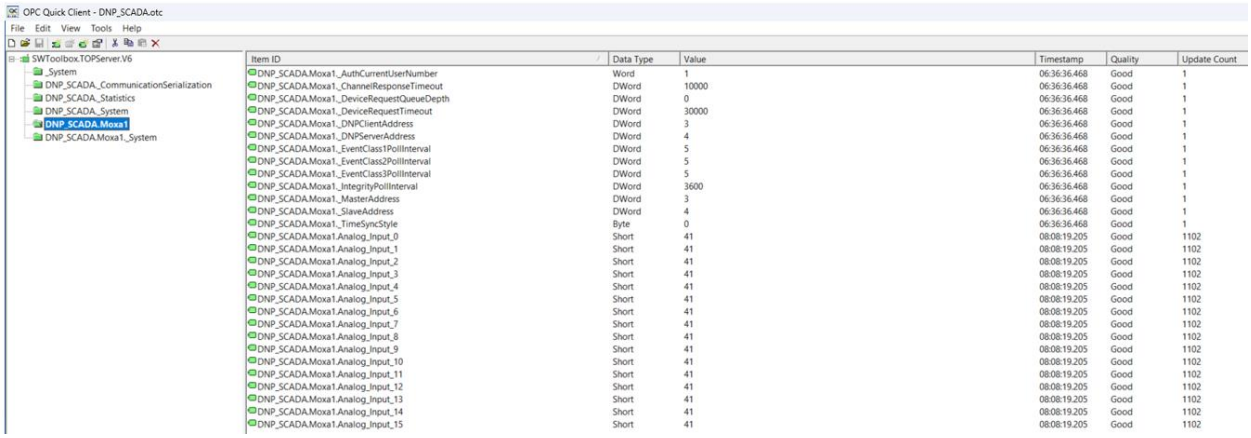


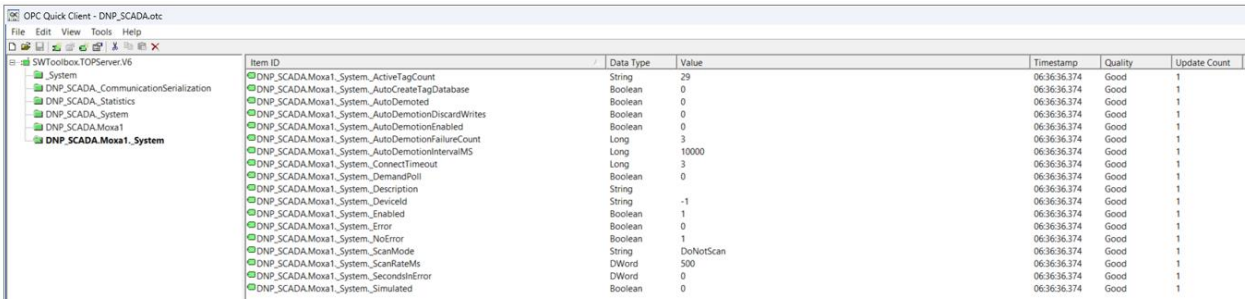
Item ID	Data Type	Value	Timestamp	Quality	Update Count
DNP_SCADA_Statistics._FailedReads	DWord	0	06:36:36.375	Good	1
DNP_SCADA_Statistics._FailedWrites	DWord	0	06:36:36.375	Good	1
DNP_SCADA_Statistics._MaxPendingReads	DWord	0	06:36:36.375	Good	1
DNP_SCADA_Statistics._MaxPendingWrites	DWord	0	06:36:36.375	Good	1
DNP_SCADA_Statistics._NextReadPriority	Long	-1	06:36:36.375	Good	1
DNP_SCADA_Statistics._PendingReads	DWord	0	06:36:36.375	Good	1
DNP_SCADA_Statistics._PendingWrites	DWord	0	06:36:36.375	Good	1
DNP_SCADA_Statistics._Reset	Boolean	0	06:36:36.375	Good	1
DNP_SCADA_Statistics._RxBytes	DWord	538756	08:07:58.925	Good	1406
DNP_SCADA_Statistics._SuccessfulReads	DWord	1457203	08:07:59.403	Good	5438
DNP_SCADA_Statistics._SuccessfulWrites	DWord	0	06:36:36.375	Good	1
DNP_SCADA_Statistics._TxBytes	DWord	43112	08:07:58.941	Good	1454



Item ID	Data Type	Value	Timestamp	Quality	Update Count
DNP_SCADA_System._AvailableNetworkAdapters	String	Default;Intel(R) Wi-Fi 6E AX211 160MHz;Realtek USB GbE Family Controller	06:36:36.375	Good	1
DNP_SCADA_System._BaudRate	Long	19200	06:36:36.375	Good	1
DNP_SCADA_System._ComId	String	COM 5	06:36:36.375	Good	1
DNP_SCADA_System._DataBits	Long	8	06:36:36.376	Good	1
DNP_SCADA_System._Description	String		06:36:36.376	Good	1
DNP_SCADA_System._EnableDiagnostics	Boolean	1	06:36:36.376	Good	1
DNP_SCADA_System._EncapsulationConnectTimeout	Long	3	06:36:36.376	Good	1
DNP_SCADA_System._EncapsulationIp	String		06:36:36.376	Good	1
DNP_SCADA_System._EncapsulationPort	Word	2101	06:36:36.376	Good	1
DNP_SCADA_System._EncapsulationProtocol	String	TCP/IP	06:36:36.376	Good	1
DNP_SCADA_System._FloatHandlingType	String	Unmodified	06:36:36.376	Good	1
DNP_SCADA_System._FlowControl	String	None	06:36:36.376	Good	1
DNP_SCADA_System._NetworkAdapter	String		06:36:36.376	Good	1
DNP_SCADA_System._Parity	String	Even	06:36:36.376	Good	1
DNP_SCADA_System._ReportComErrors	Boolean	1	06:36:36.376	Good	1
DNP_SCADA_System._SharedConnection	Boolean	0	06:36:36.376	Good	1
DNP_SCADA_System._StopBits	Long	1	06:36:36.376	Good	1
DNP_SCADA_System._WriteOptimizationDutyCycle	Long	10	06:36:36.376	Good	1

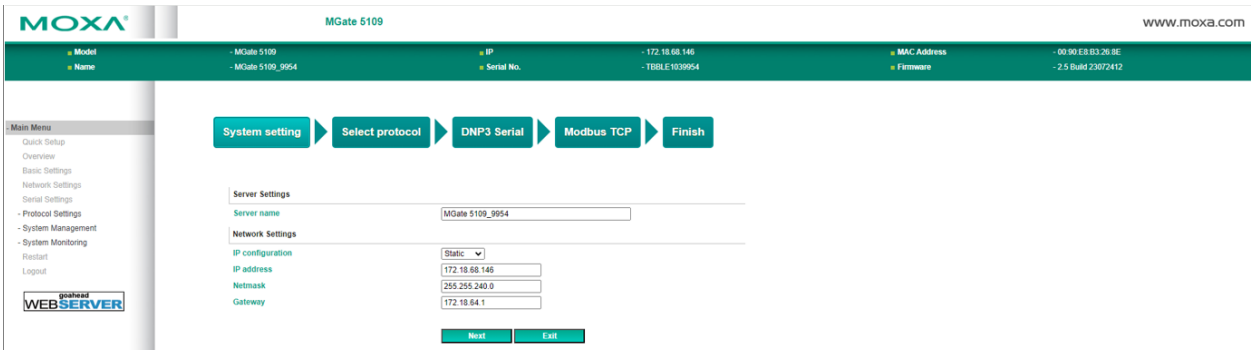
ROCK SOLID PERFORMANCE. TIMELESS COMPATIBILITY.



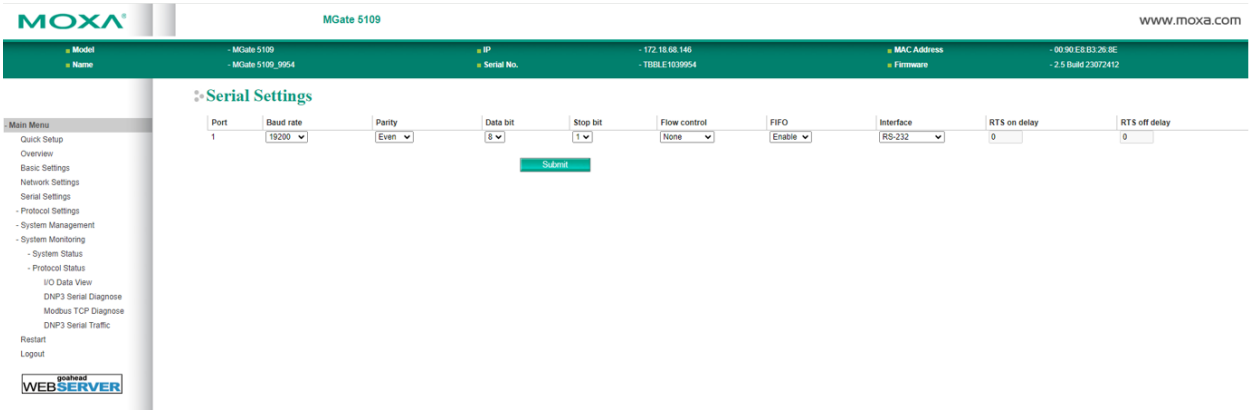


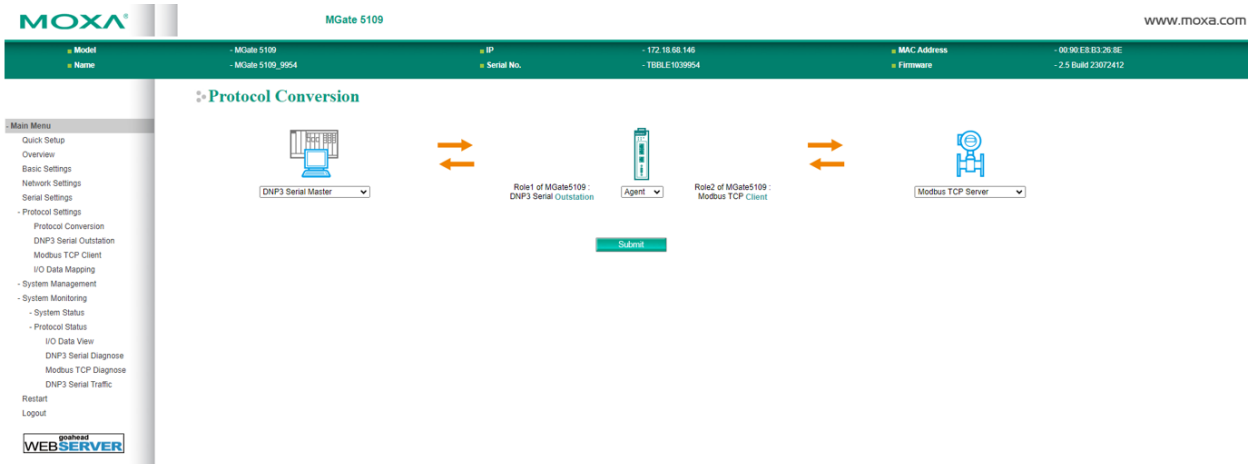
1.6 Moxa Setup

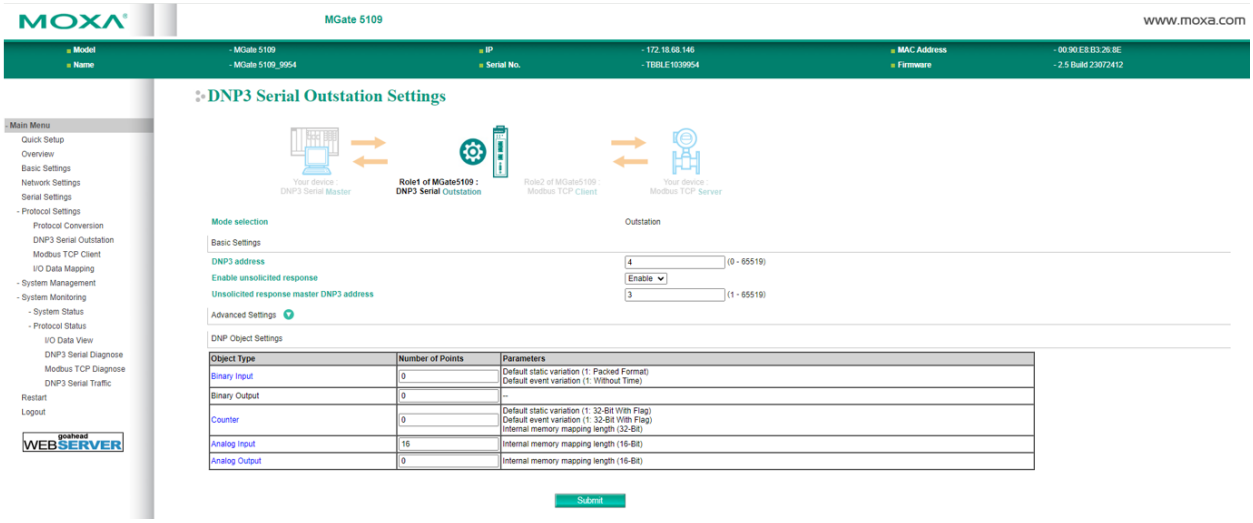
The following series of screenshots show the setup and operation of the Moxa gateway.



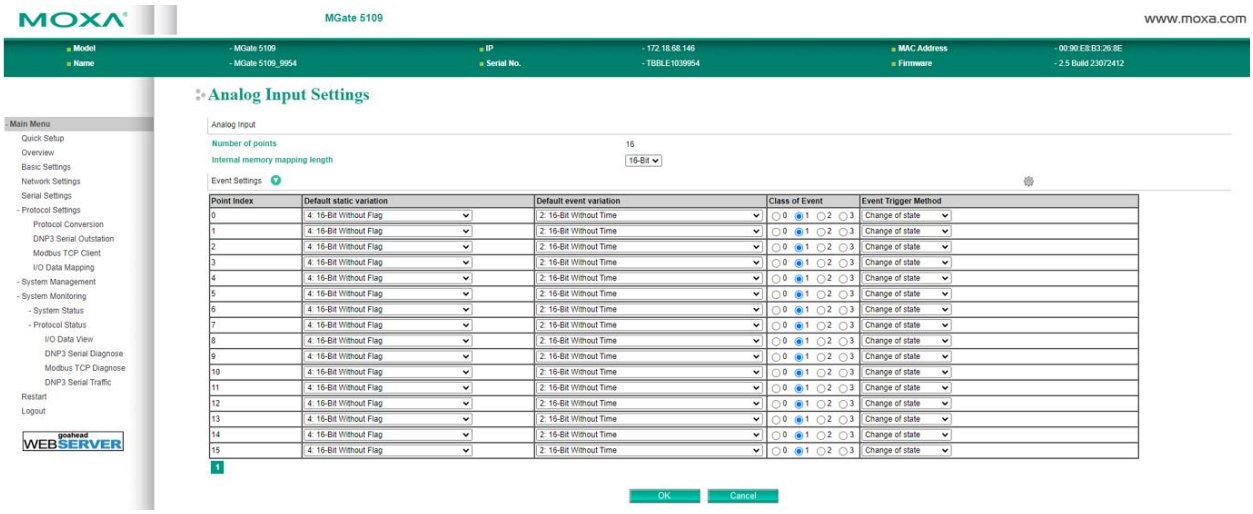
ROCK SOLID PERFORMANCE. TIMELESS COMPATIBILITY.

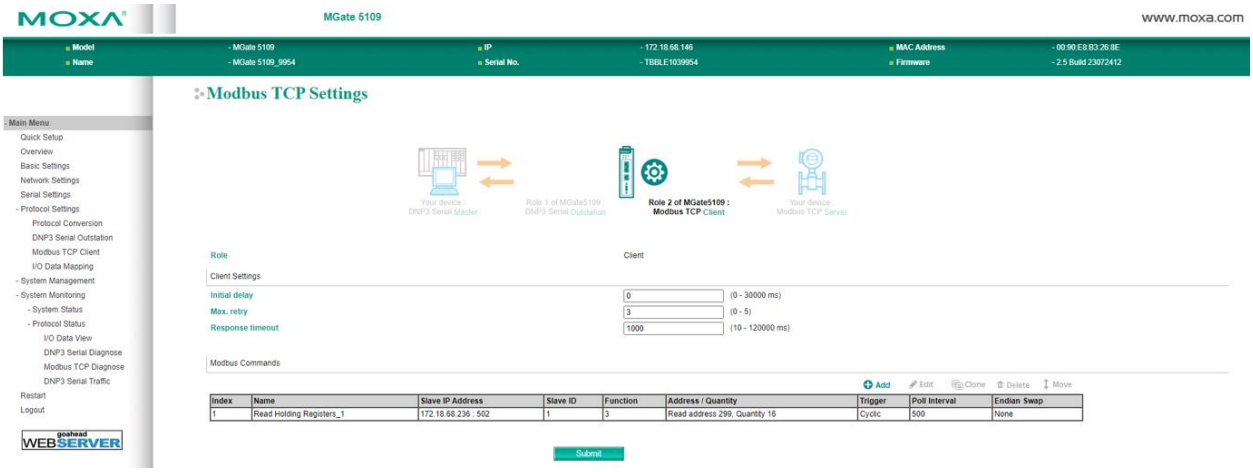


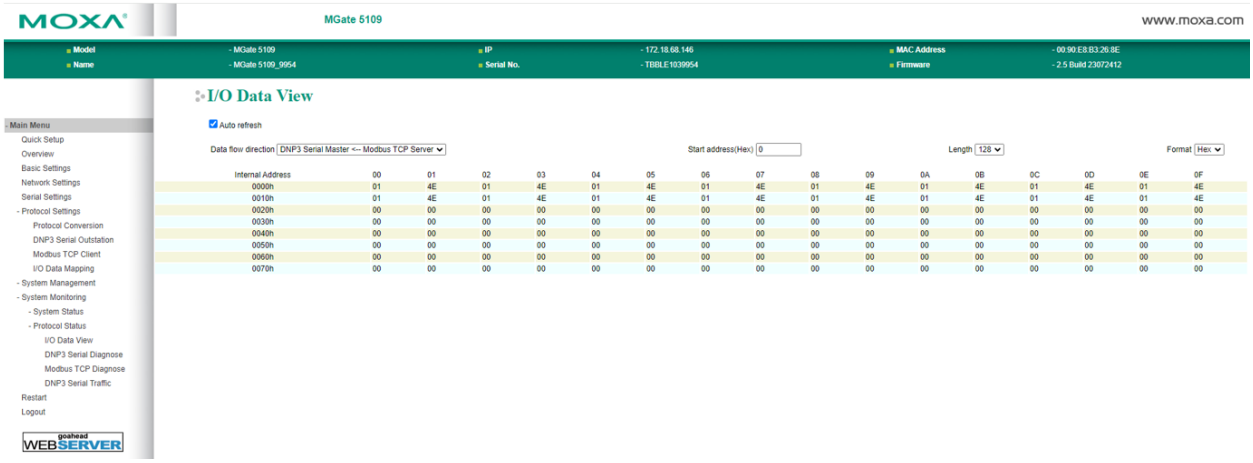




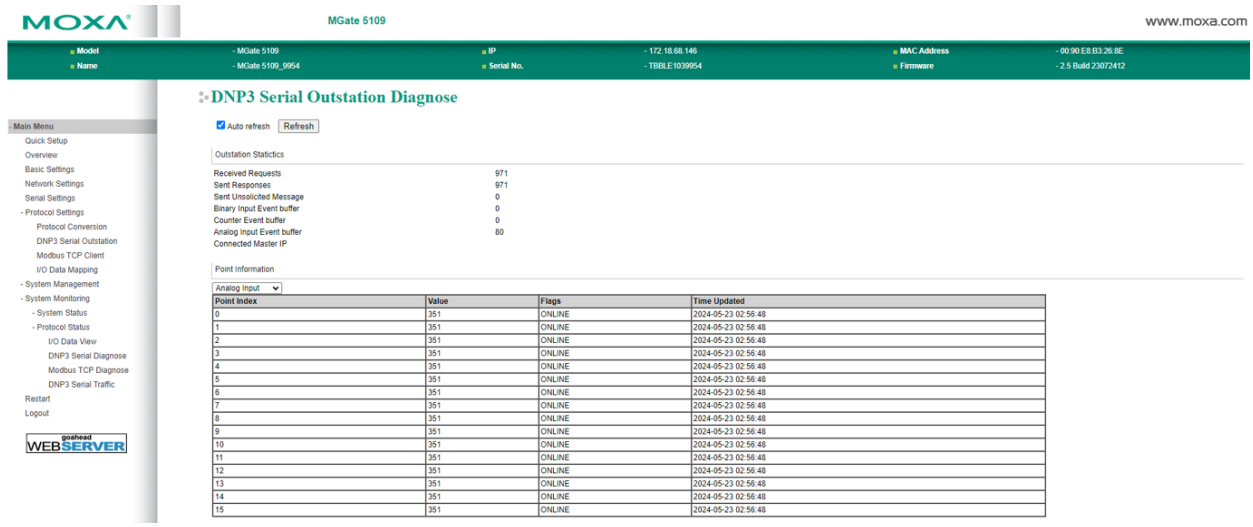
ROCK SOLID PERFORMANCE. TIMELESS COMPATIBILITY.

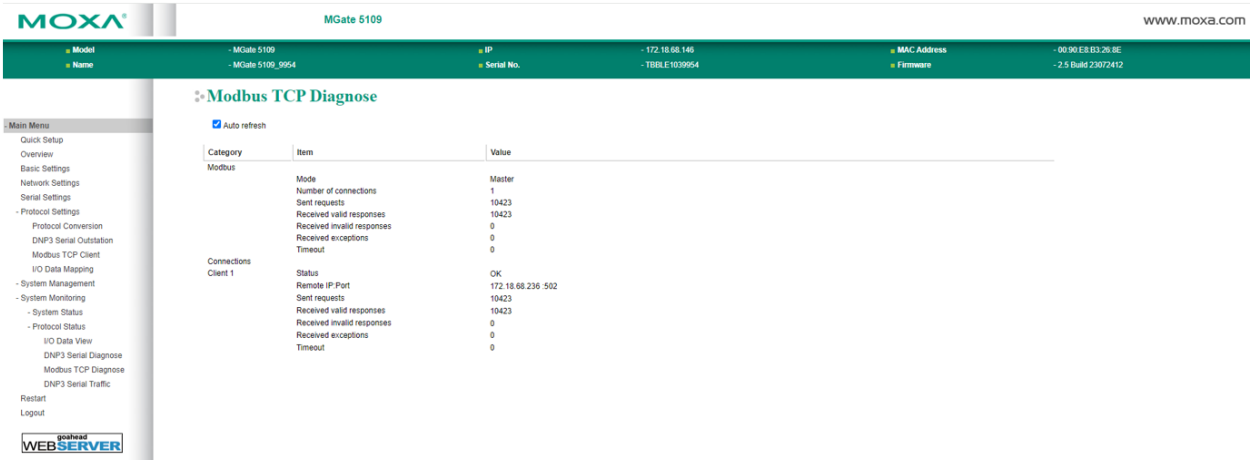


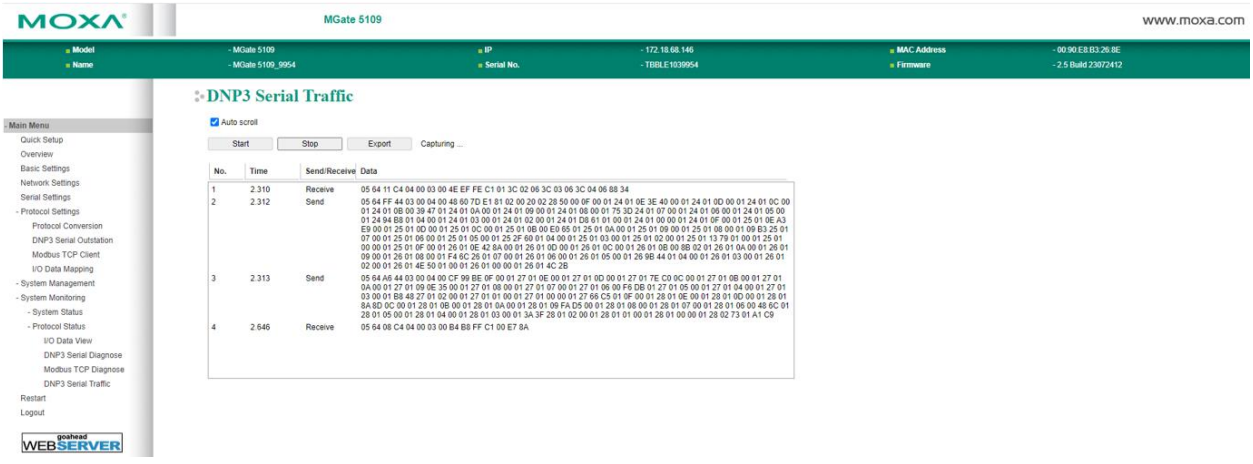




ROCK SOLID PERFORMANCE. TIMELESS COMPATIBILITY.

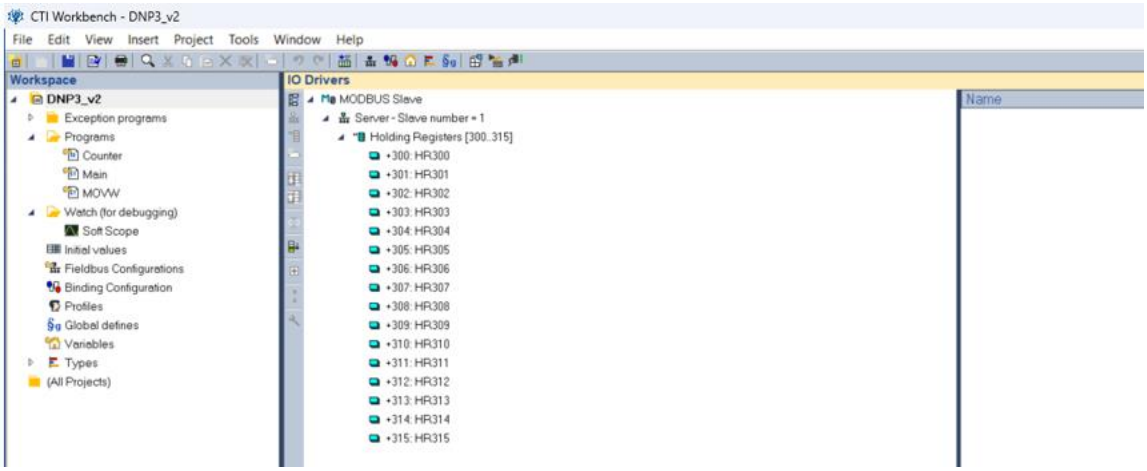


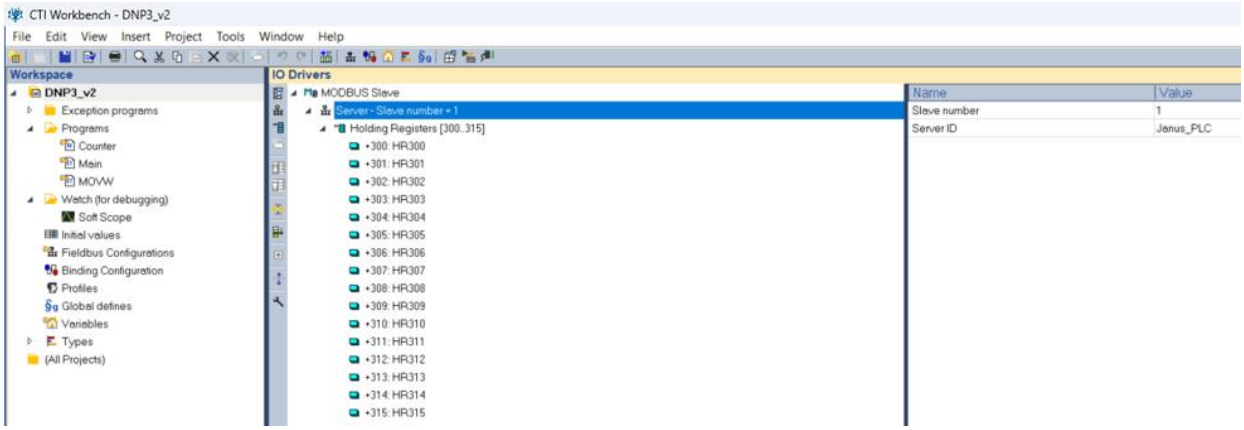


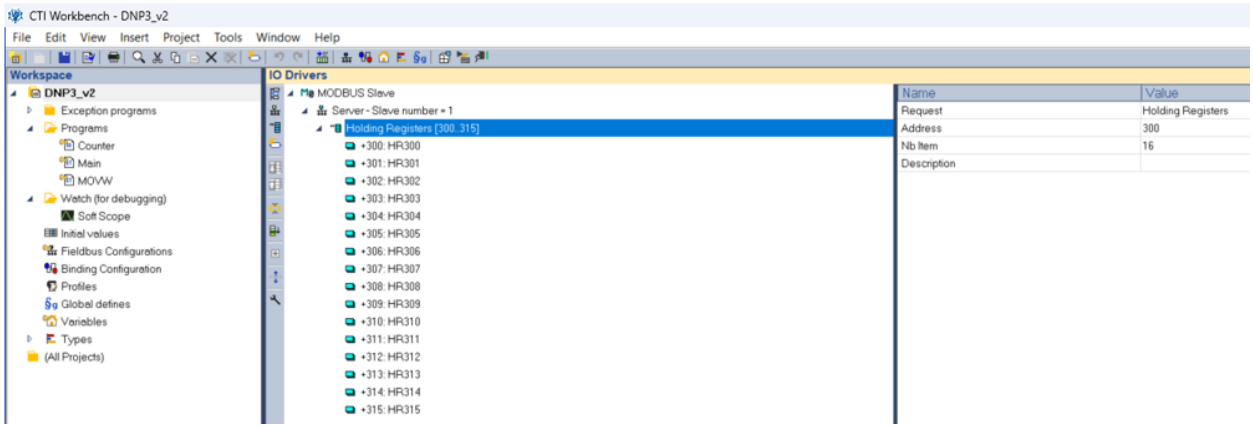


ROCK SOLID PERFORMANCE. TIMELESS COMPATIBILITY.

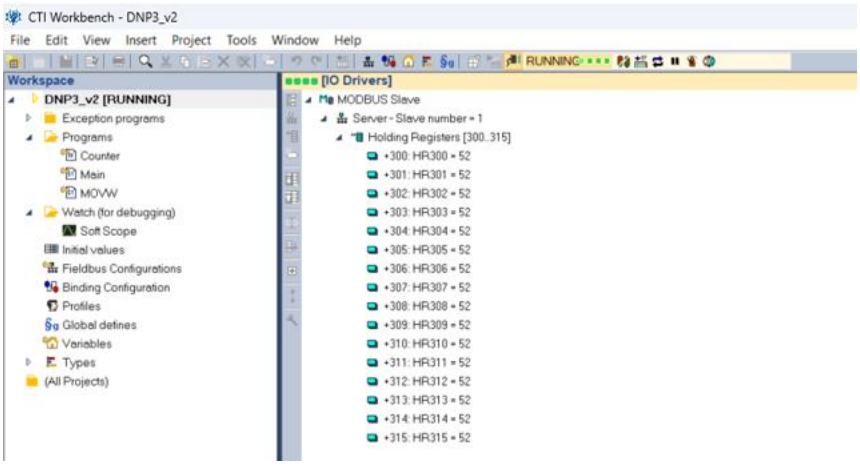
1.7 Janus PLC Setup

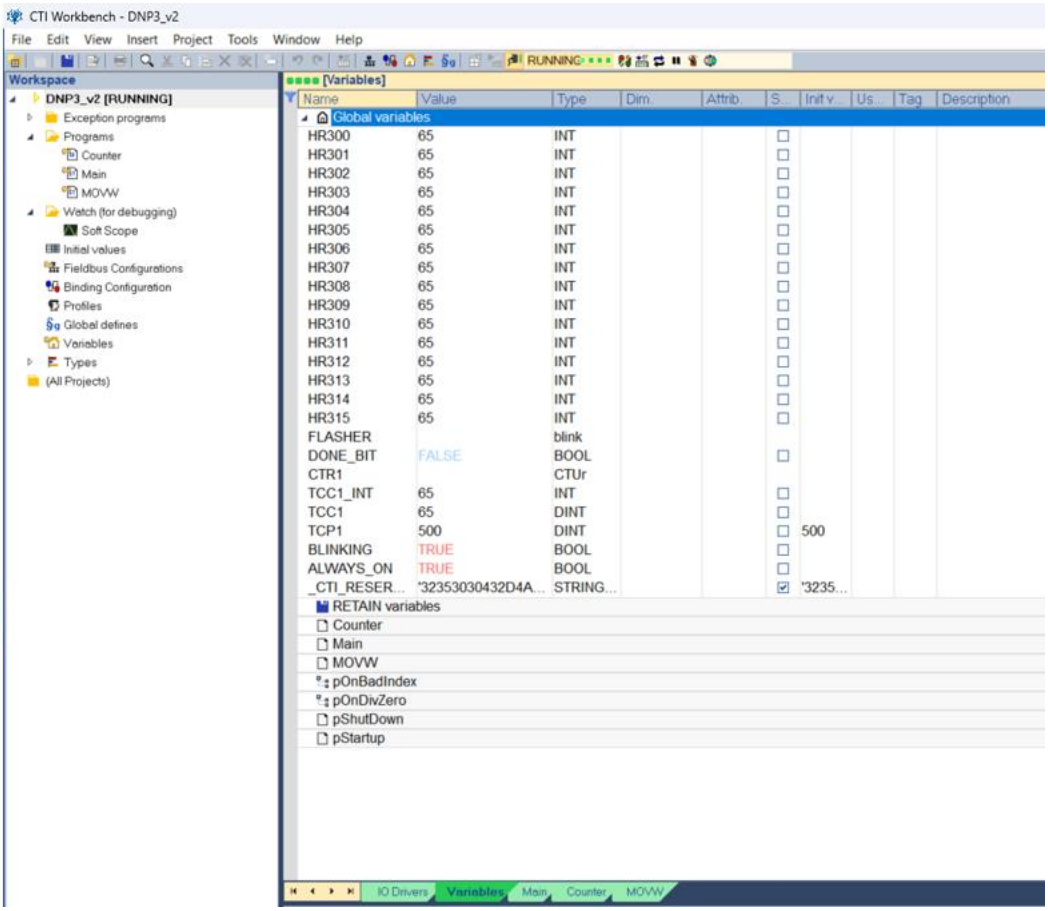






ROCK SOLID PERFORMANCE. TIMELESS COMPATIBILITY.


CTI Workbench - DNP3_v2
File Edit View Insert Project Tools Window Help
RUNNING
Workspace
DNP3_v2 [RUNNING]
Exception programs
Programs
Counter
Main
MOVW
Watch (for debugging)
Soft Scope
Initial values
Fieldbus Configurations
Binding Configuration
Profiles
Global defines
Variables
Types
(All Projects)
[IO Drivers]
MODBUS Slave
Server - Slave number = 1
Holding Registers [300..315]
+300: HR300 = 52
+301: HR301 = 52
+302: HR302 = 52
+303: HR303 = 52
+304: HR304 = 52
+305: HR305 = 52
+306: HR306 = 52
+307: HR307 = 52
+308: HR308 = 52
+309: HR309 = 52
+310: HR310 = 52
+311: HR311 = 52
+312: HR312 = 52
+313: HR313 = 52
+314: HR314 = 52
+315: HR315 = 52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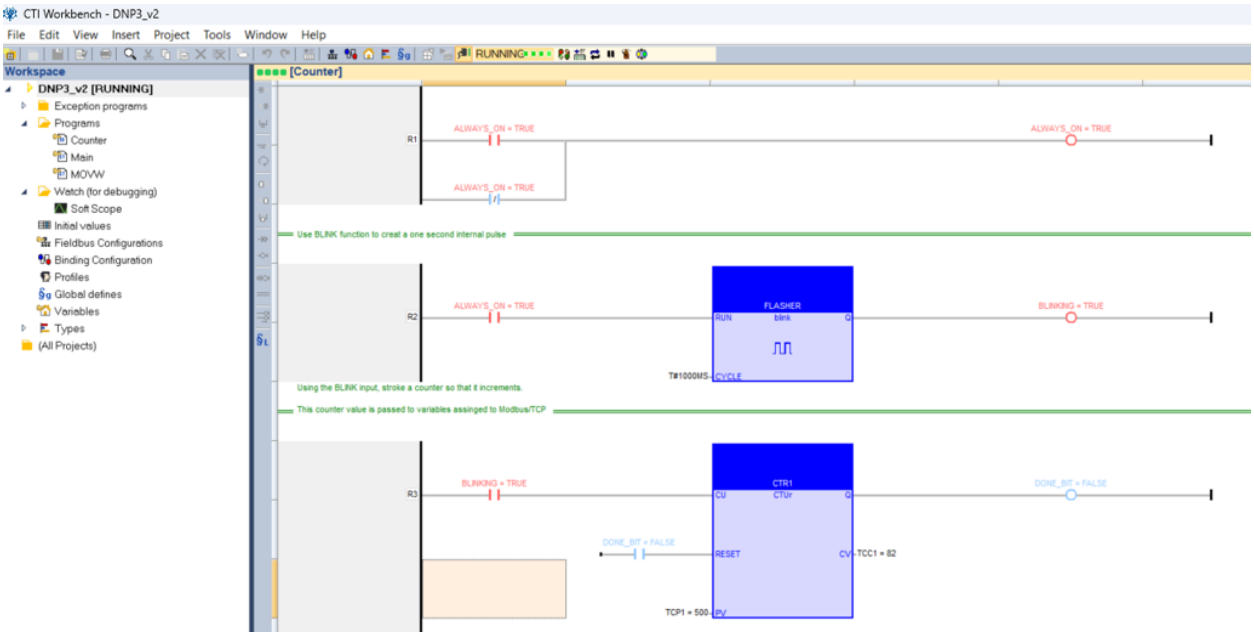
Variables
Types
(All Projects)
[Variables]
Name Value Type Dim. Attrib. S... Init v... Us... Tag Description
Global variables
HR300 65 INT
HR301 65 INT
HR302 65 INT
HR303 65 INT
HR304 65 INT
HR305 65 INT
HR306 65 INT
HR307 65 INT
HR308 65 INT
HR309 65 INT
HR310 65 INT
HR311 65 INT
HR312 65 INT
HR313 65 INT
HR314 65 INT
HR315 65 INT
FLASHER blink
DONE_BIT FALSE BOOL
CTR1 CTUr
TCC1_INT 65 INT
TCC1 65 DINT
TCP1 500 DINT 500
BLINKING TRUE BOOL
ALWAYS_ON TRUE BOOL
_CTI_RESER... '32353030432D4A... STRING... '3235...
RETAIN variables
Counter
Main
MOVW
pOnBadIndex
pOnDivZero
pShutDown
pStartup
IO Drivers
Variables
Main
Counter
MOVW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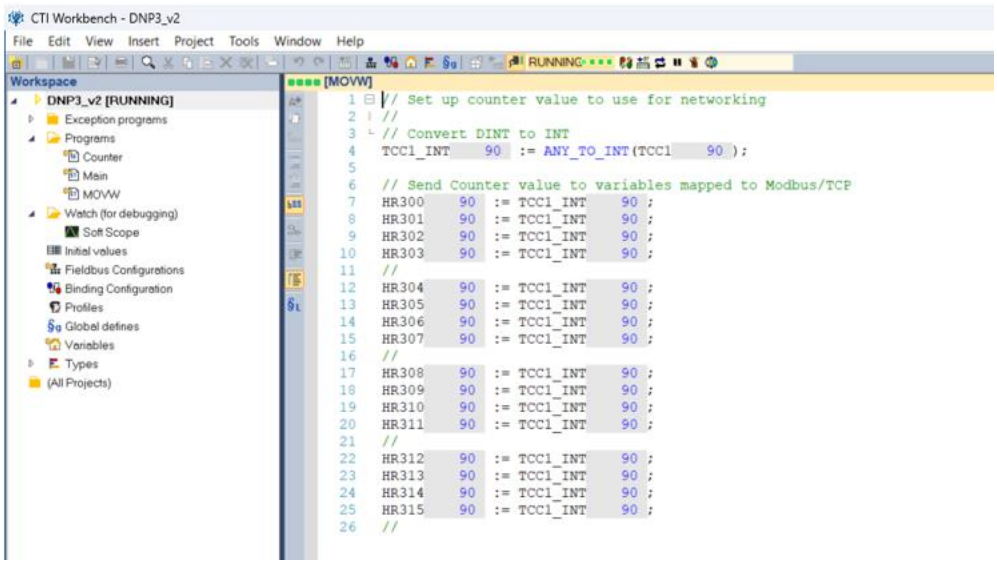
[Counter]
R1
ALWAYS_ON = TRUE
ALWAYS_ON = TRUE
ALWAYS_ON = TRUE
Use BLINK function to creat a one second internal pulse
R2
ALWAYS_ON = TRUE
FLASHER
RUN
blink
Q
BLINKING = TRUE
T#1000MS
CYCLE
Using the BLINK input, stroke a counter so that it increments.
This counter value is passed to variables assinged to Modbus/TCP
R3
BLINKING = TRUE
CTR1
CU
CTUR
Q
DONE_BIT = FALSE
DONE_BIT = FALSE
RESET
CV
TCC1 = 82
TCP1 = 500
PV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[MOVW]
1 // Set up counter value to use for networking
2 //
3 // Convert DINT to INT
4 TCC1_INT 90 := ANY_TO_INT(TCC1 90);
5
6 // Send Counter value to variables mapped to Modbus/TCP
7 HR300 90 := TCC1_INT 90 ;
8 HR301 90 := TCC1_INT 90 ;
9 HR302 90 := TCC1_INT 90 ;
10 HR303 90 := TCC1_INT 90 ;
11 //
12 HR304 90 := TCC1_INT 90 ;
13 HR305 90 := TCC1_INT 90 ;
14 HR306 90 := TCC1_INT 90 ;
15 HR307 90 := TCC1_INT 90 ;
16 //
17 HR308 90 := TCC1_INT 90 ;
18 HR309 90 := TCC1_INT 90 ;
19 HR310 90 := TCC1_INT 90 ;
20 HR311 90 := TCC1_INT 90 ;
21 //
22 HR312 90 := TCC1_INT 90 ;
23 HR313 90 := TCC1_INT 90 ;
24 HR314 90 := TCC1_INT 90 ;
25 HR315 90 := TCC1_INT 90 ;
26 //