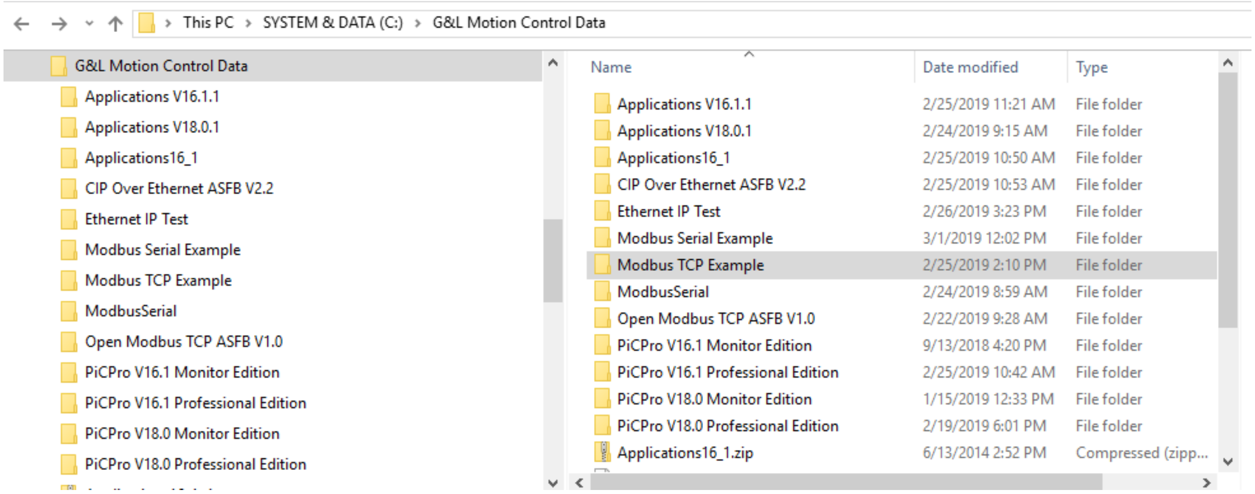
G&L Modbus TCP Example Revision A 6/3/2019

Note!! This example was done with the Digital MMC Smartdrive and Drive Resident Control 16 Axis. The programmer is responsible for any settings and wiring that are different due to differences in hardware.

Also note that the Modbus TCP ASFB library is not free-ware and must be purchased from your local Kollmorgen supplier.

First I created a folder called Modbus TCP Example under the C:\G&L Motion Control Data directory.

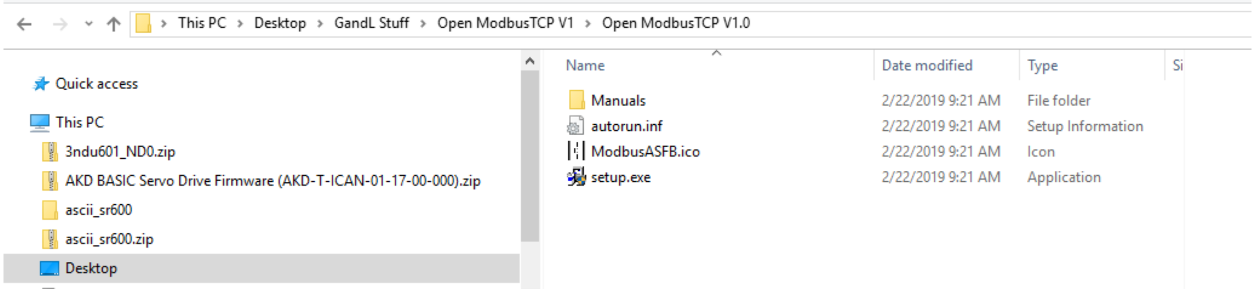


This PC > SYSTEM & DATA (C:) > G&L Motion Control Data

- G&L Motion Control Data
  - Applications V16.1.1
  - Applications V18.0.1
  - Applications16_1
  - CIP Over Ethernet ASFB V2.2
  - Ethernet IP Test
  - Modbus Serial Example
  - Modbus TCP Example
  - ModbusSerial
  - Open Modbus TCP ASFB V1.0
  - PiCPro V16.1 Monitor Edition
  - PiCPro V16.1 Professional Edition
  - PiCPro V18.0 Monitor Edition
  - PiCPro V18.0 Professional Edition

Name	Date modified	Type
Applications V16.1.1	2/25/2019 11:21 AM	File folder
Applications V18.0.1	2/24/2019 9:15 AM	File folder
Applications16_1	2/25/2019 10:50 AM	File folder
CIP Over Ethernet ASFB V2.2	2/25/2019 10:53 AM	File folder
Ethernet IP Test	2/26/2019 3:23 PM	File folder
Modbus Serial Example	3/1/2019 12:02 PM	File folder
Modbus TCP Example	2/25/2019 2:10 PM	File folder
ModbusSerial	2/24/2019 8:59 AM	File folder
Open Modbus TCP ASFB V1.0	2/22/2019 9:28 AM	File folder
PiCPro V16.1 Monitor Edition	9/13/2018 4:20 PM	File folder
PiCPro V16.1 Professional Edition	2/25/2019 10:42 AM	File folder
PiCPro V18.0 Monitor Edition	1/15/2019 12:33 PM	File folder
PiCPro V18.0 Professional Edition	2/19/2019 6:01 PM	File folder
Applications16_1.zip	6/13/2014 2:52 PM	Compressed (zipp...

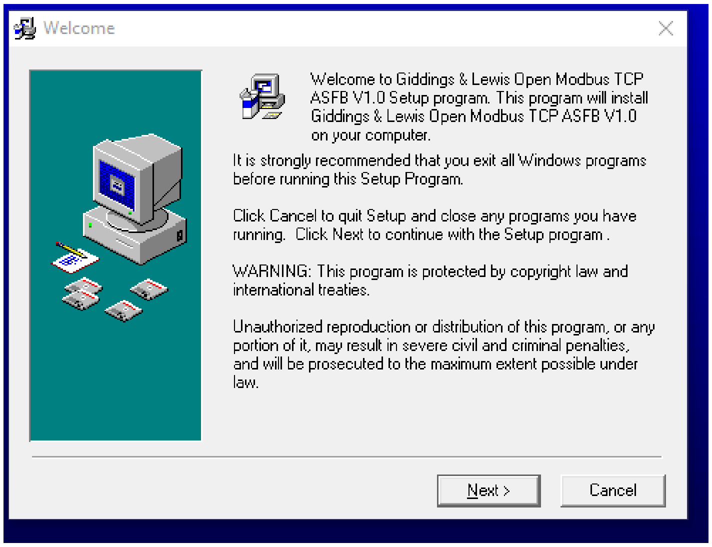
After acquiring and unzipping the Open Modbus TCP support files go to the unzipped folder and click on setup.exe to start the installation process.



This PC > Desktop > GandL Stuff > Open ModbusTCP V1 > Open ModbusTCP V1.0

- Quick access
- This PC
  - 3ndu601_ND0.zip
  - AKD BASIC Servo Drive Firmware (AKD-T-ICAN-01-17-00-000).zip
  - ascii_sr600
  - ascii_sr600.zip
  - Desktop

Name	Date modified	Type	Si
Manuals	2/22/2019 9:21 AM	File folder	
autorun.inf	2/22/2019 9:21 AM	Setup Information	
ModbusASFB.ico	2/22/2019 9:21 AM	Icon	
setup.exe	2/22/2019 9:21 AM	Application	



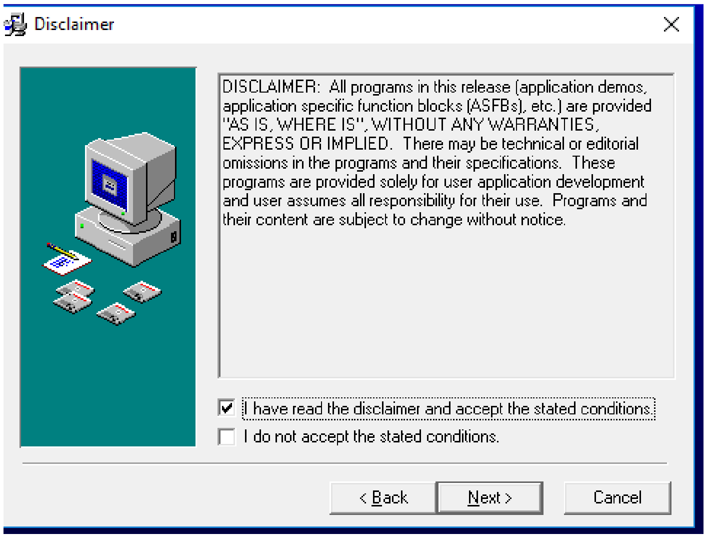
Welcome to Giddings & Lewis Open Modbus TCP ASFB V1.0 Setup program. This program will install Giddings & Lewis Open Modbus TCP ASFB V1.0 on your computer.

It is strongly recommended that you exit all Windows programs before running this Setup Program.

Click Cancel to quit Setup and close any programs you have running. Click Next to continue with the Setup program .

WARNING: This program is protected by copyright law and international treaties.

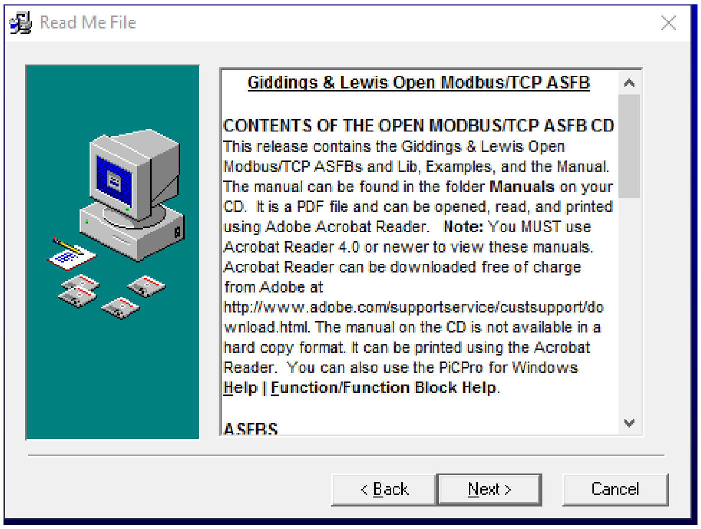
Unauthorized reproduction or distribution of this program, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under law.



DISCLAIMER: All programs in this release (application demos, application specific function blocks (ASFBs), etc.) are provided "AS IS, WHERE IS", WITHOUT ANY WARRANTIES, EXPRESS OR IMPLIED. There may be technical or editorial omissions in the programs and their specifications. These programs are provided solely for user application development and user assumes all responsibility for their use. Programs and their content are subject to change without notice.

☑ I have read the disclaimer and accept the stated conditions.

□ I do not accept the stated conditions.



Giddings & Lewis Open Modbus/TCP ASFB

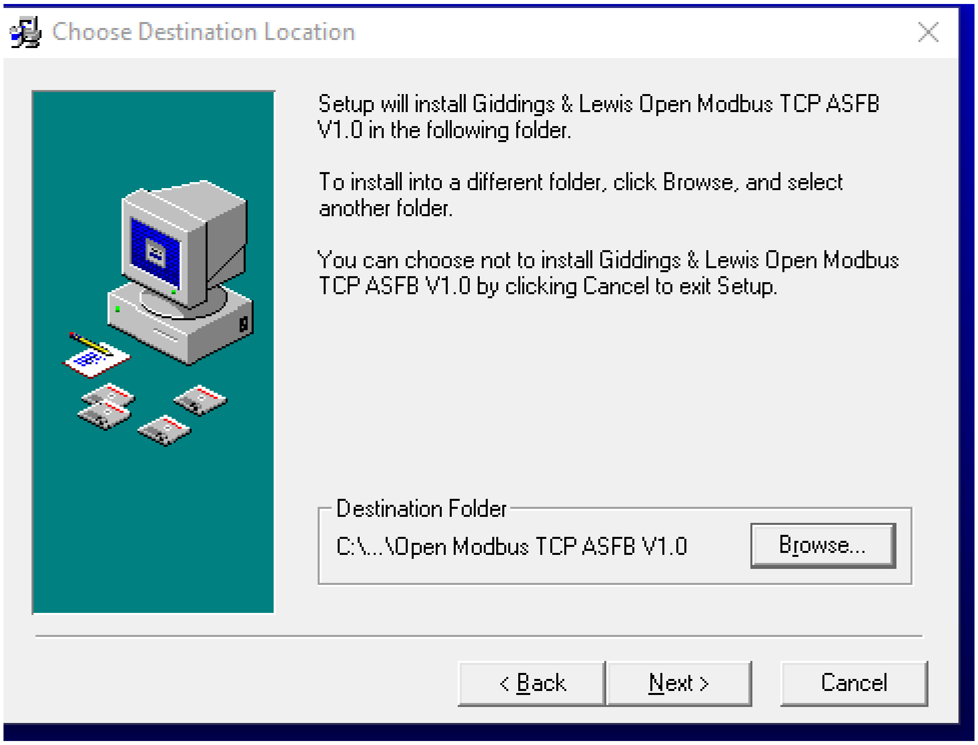
CONTENTS OF THE OPEN MODBUS/TCP ASFB CD

This release contains the Giddings & Lewis Open Modbus/TCP ASFBs and Lib, Examples, and the Manual. The manual can be found in the folder **Manuals** on your CD. It is a PDF file and can be opened, read, and printed using Adobe Acrobat Reader. **Note:** You MUST use Acrobat Reader 4.0 or newer to view these manuals. Acrobat Reader can be downloaded free of charge from Adobe at http://www.adobe.com/supportservice/custsupport/download.html. The manual on the CD is not available in a hard copy format. It can be printed using the Acrobat Reader. You can also use the PiCPro for Windows **Help | Function/Function Block Help**.

ASFBS

Because this installation predates Windows 10 the default destination folder is under the x386 directory. This will cause issues so in this example we're going to install it to the C:\G&L Motion Control Data directory

Click on Browse…



Choose Destination Location

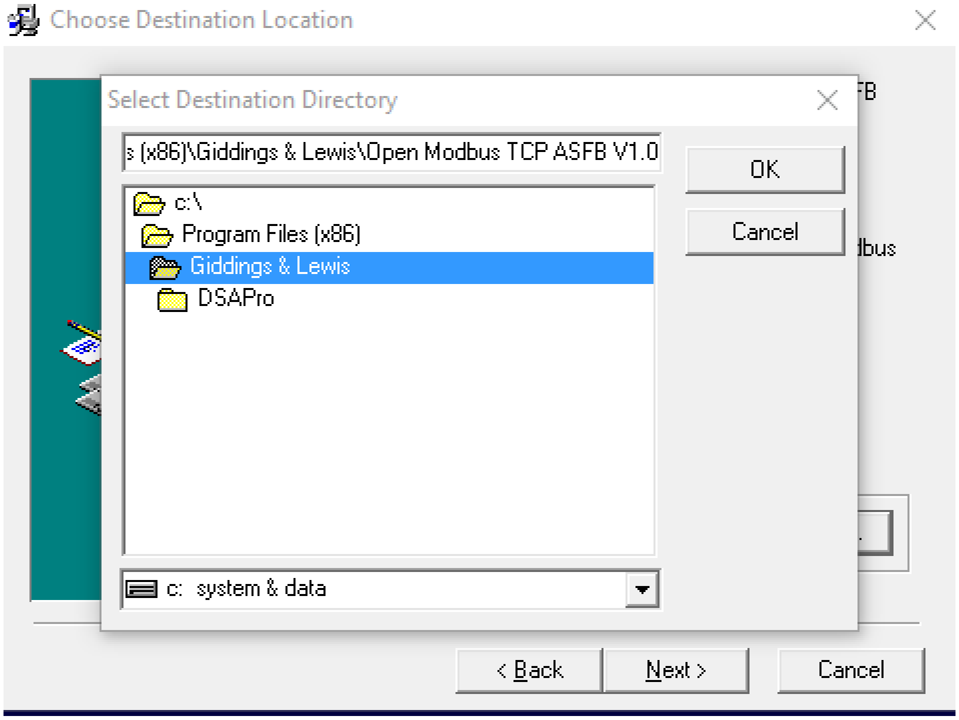
Setup will install Giddings & Lewis Open Modbus TCP ASFB V1.0 in the following folder.

To install into a different folder, click Browse, and select another folder.

You can choose not to install Giddings & Lewis Open Modbus TCP ASFB V1.0 by clicking Cancel to exit Setup.

Destination Folder

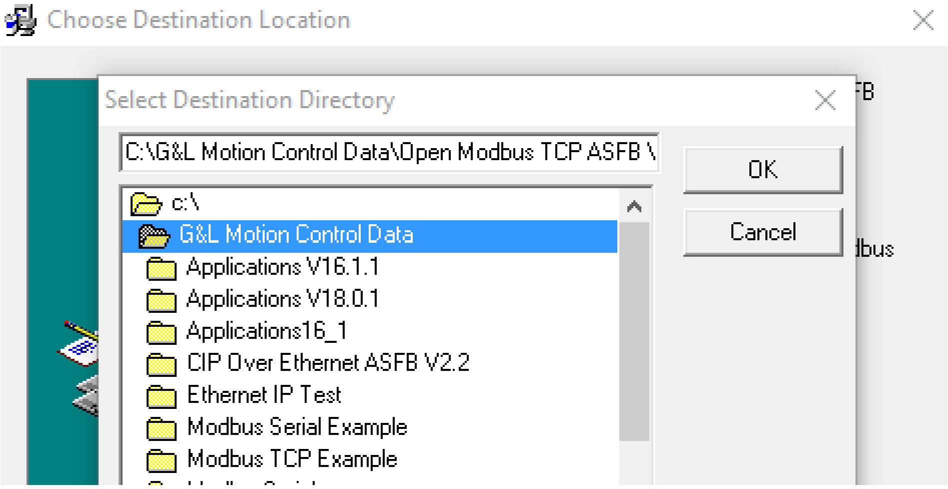
C:\...\Open Modbus TCP ASFB V1.0



Choose Destination Location

Select Destination Directory

s (x86)\Giddings & Lewis\Open Modbus TCP ASFB V1.0

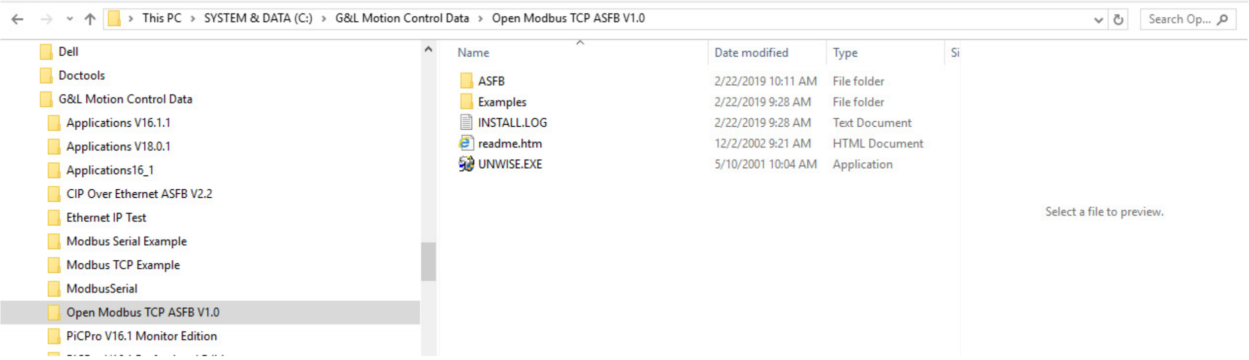


Choose Destination Location

Select Destination Directory

C:\G&L Motion Control Data\Open Modbus TCP ASFB \

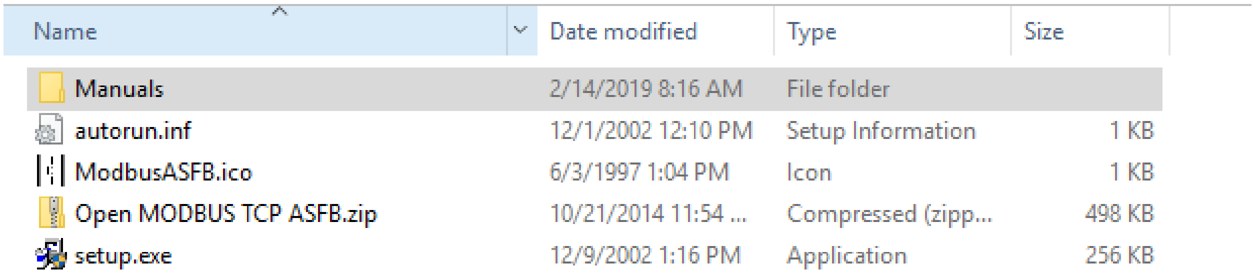
After installation is complete there should be a folder in that directory called Open Modbus TCP ASFB V1.0. If you navigate to it you can see the contents. There are 2 folders: ASFB and Examples.


This PC › SYSTEM & DATA (C:) › G&L Motion Control Data › Open Modbus TCP ASFB V1.0
Search Op...
Dell
Doctools
G&L Motion Control Data
Applications V16.1.1
Applications V18.0.1
Applications16_1
CIP Over Ethernet ASFB V2.2
Ethernet IP Test
Modbus Serial Example
Modbus TCP Example
ModbusSerial
Open Modbus TCP ASFB V1.0
PiCPro V16.1 Monitor Edition
Select a file to preview.

Name	Date modified	Type	Si
ASFB	2/22/2019 10:11 AM	File folder	
Examples	2/22/2019 9:28 AM	File folder	
INSTALL.LOG	2/22/2019 9:28 AM	Text Document	
readme.htm	12/2/2002 9:21 AM	HTML Document	
UNWISE.EXE	5/10/2001 10:04 AM	Application	

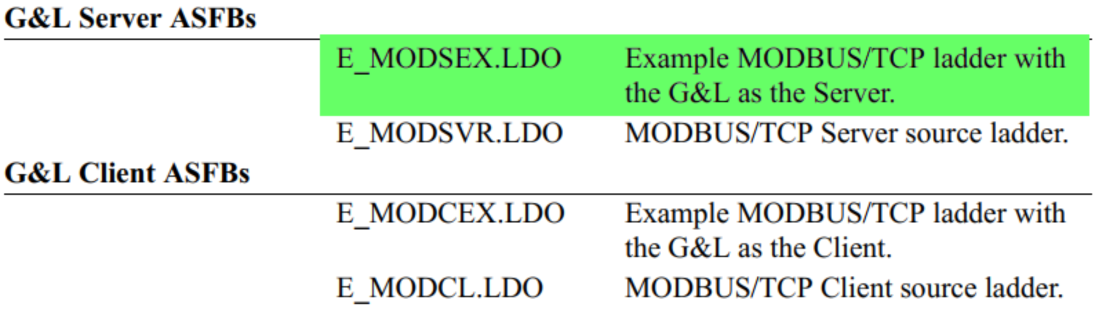
There are sample files per the Modbus TCP ASFB manual that are for two cases where the G&L controller is the client in one case or the server in the other.

The manual is included in the zip support file for Modbus TCP



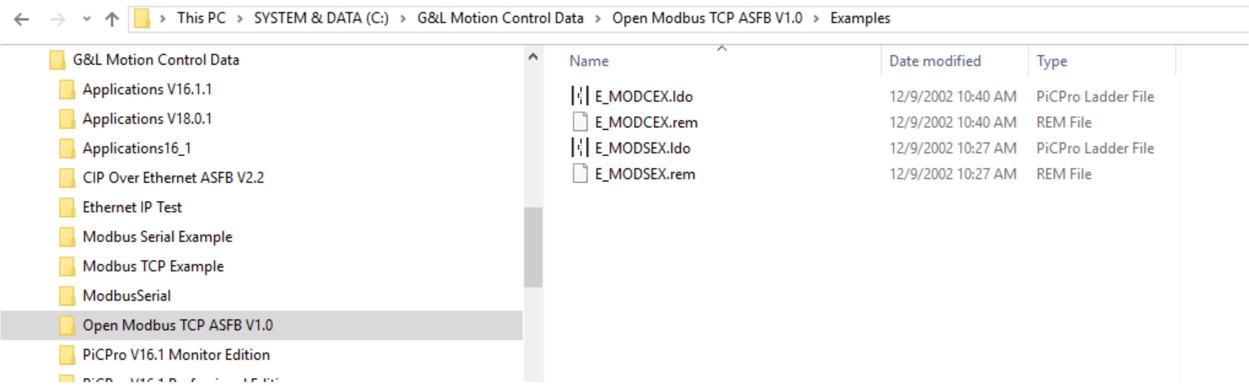
Name	Date modified	Type	Size
Manuals	2/14/2019 8:16 AM	File folder	
autorun.inf	12/1/2002 12:10 PM	Setup Information	1 KB
ModbusASFB.ico	6/3/1997 1:04 PM	Icon	1 KB
Open MODBUS TCP ASFB.zip	10/21/2014 11:54 ...	Compressed (zipp...	498 KB
setup.exe	12/9/2002 1:16 PM	Application	256 KB

Per the manual there are 2 sample ladder (LDO) example ladder but in this application note the G&L controller will be the Server (also known as Modbus TCP Slave).



G&L Server ASFBs		
	E_MODSEX.LDO	Example MODBUS/TCP ladder with the G&L as the Server.
	E_MODSVR.LDO	MODBUS/TCP Server source ladder.
G&L Client ASFBs		
	E_MODCEX.LDO	Example MODBUS/TCP ladder with the G&L as the Client.
	E_MODCL.LDO	MODBUS/TCP Client source ladder.

I copied the E_MODSEX.LDO and E_MODSEX.REM from the Open Modbus TCP ASFB V1.0 folder.

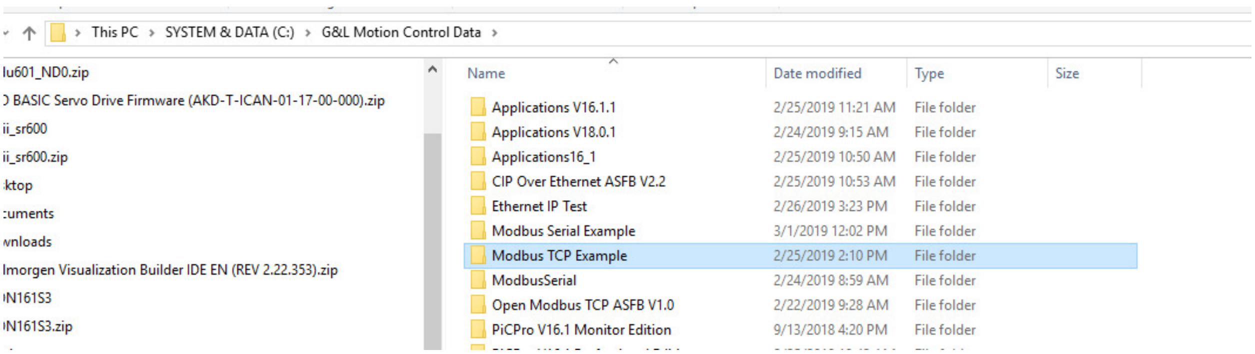


This PC > SYSTEM & DATA (C:) > G&L Motion Control Data > Open Modbus TCP ASFB V1.0 > Examples

G&L Motion Control Data
- Applications V16.1.1
- Applications V18.0.1
- Applications16_1
- CIP Over Ethernet ASFB V2.2
- Ethernet IP Test
- Modbus Serial Example
- Modbus TCP Example
- ModbusSerial
- Open Modbus TCP ASFB V1.0
- PiCPro V16.1 Monitor Edition

Name	Date modified	Type
E_MODCEX.ldo	12/9/2002 10:40 AM	PiCPro Ladder File
E_MODCEX.rem	12/9/2002 10:40 AM	REM File
E_MODSEX.ldo	12/9/2002 10:27 AM	PiCPro Ladder File
E_MODSEX.rem	12/9/2002 10:27 AM	REM File

And then pasted it into the folder I created for this example project called Modbus TCP Example. The intent is to be able to edit the example ladder and leave the original alone for potential reference and use in the future as a template.



This PC > SYSTEM & DATA (C:) > G&L Motion Control Data >

lu601_ND0.zip
) BASIC Servo Drive Firmware (AKD-T-ICAN-01-17-00-000).zip
ii_sr600
ii_sr600.zip
ktop
:uments
wnloads
Imorgen Visualization Builder IDE EN (REV 2.22.353).zip
ıN161S3
ıN161S3.zip

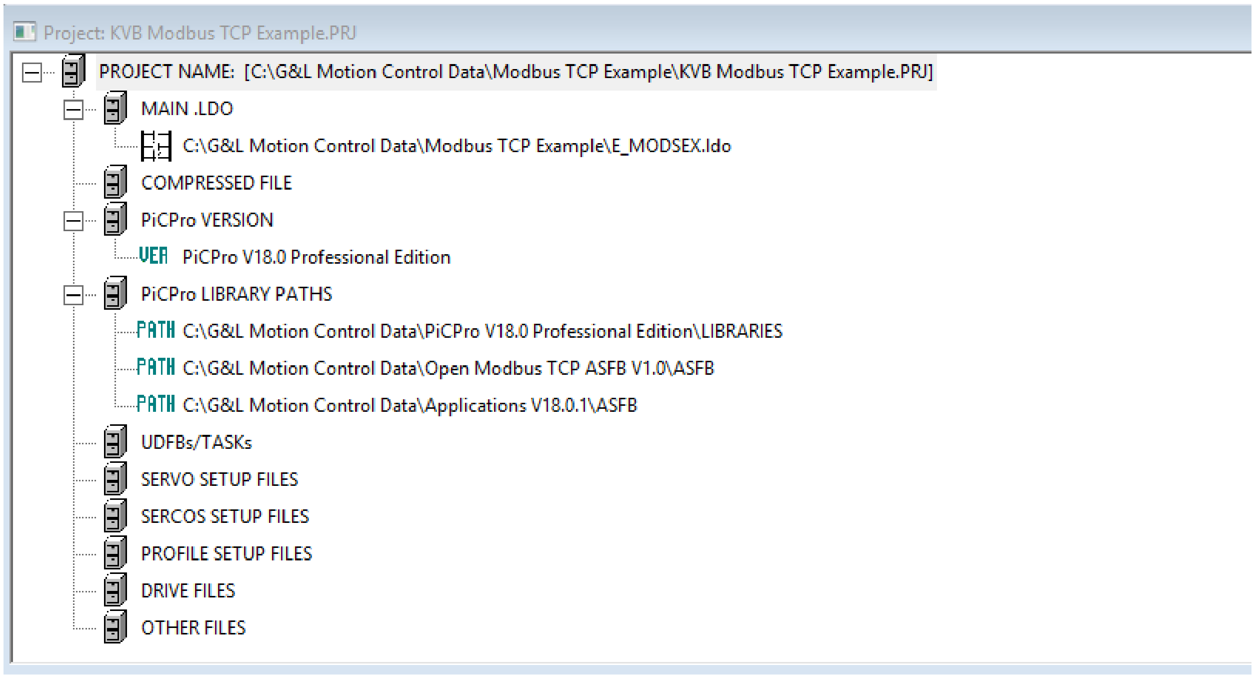
Name	Date modified	Type	Size
Applications V16.1.1	2/25/2019 11:21 AM	File folder	
Applications V18.0.1	2/24/2019 9:15 AM	File folder	
Applications16_1	2/25/2019 10:50 AM	File folder	
CIP Over Ethernet ASFB V2.2	2/25/2019 10:53 AM	File folder	
Ethernet IP Test	2/26/2019 3:23 PM	File folder	
Modbus Serial Example	3/1/2019 12:02 PM	File folder	
Modbus TCP Example	2/25/2019 2:10 PM	File folder	
ModbusSerial	2/24/2019 8:59 AM	File folder	
Open Modbus TCP ASFB V1.0	2/22/2019 9:28 AM	File folder	
PiCPro V16.1 Monitor Edition	9/13/2018 4:20 PM	File folder	

Next I created a project also saved to the Modbus TCP Example folder.

Once the project is created the following paths were setup.

The MAIN.LDO is the copied E_MODSEX.LDO (it could have been renamed if desired).

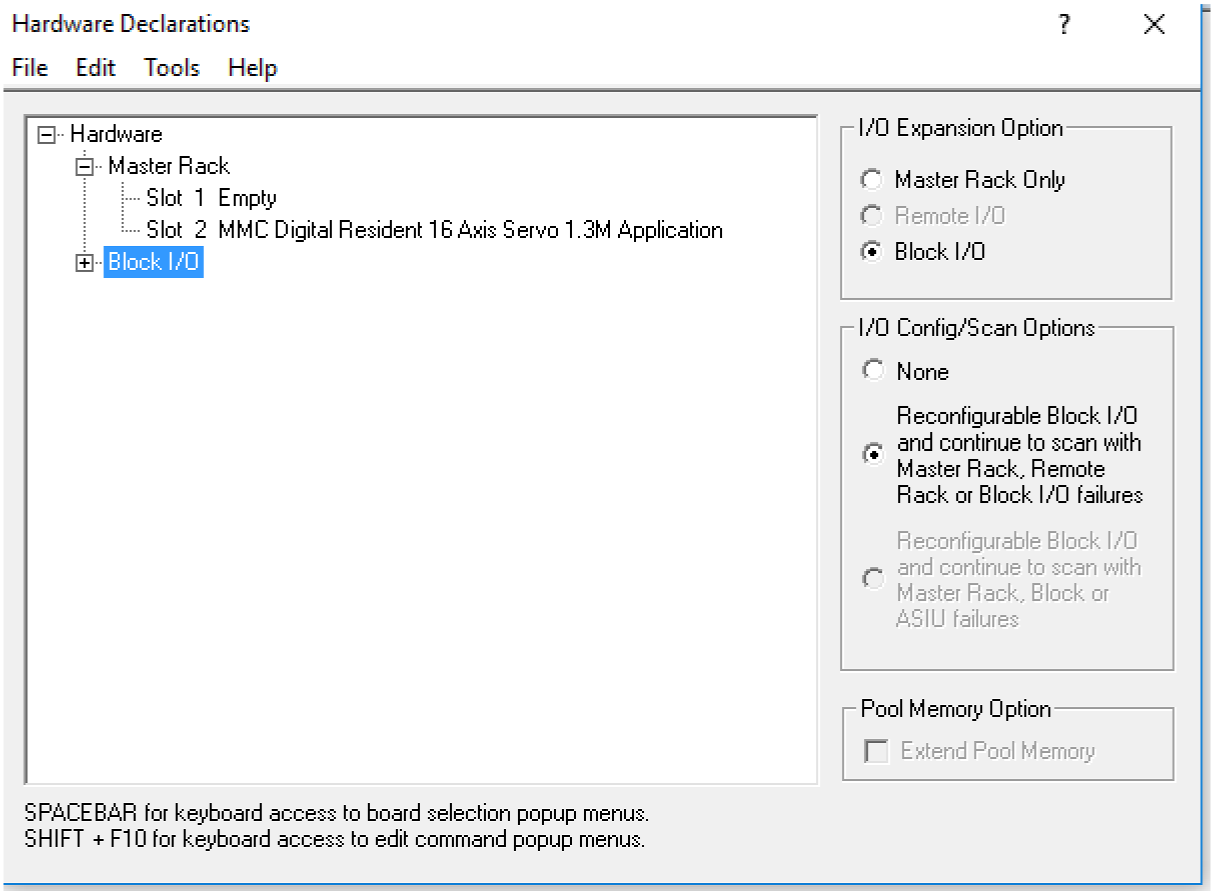
The PicPro Library paths point to the standard libraries for this version of PicPro, the ASFB folder that was created and populated when the Open Modbus ASFB V1.0 was installed, and the standard ASFB library for this verion of PicPro (part of the Applications disk install).



Project: KVB Modbus TCP Example.PRJ

```
PROJECT NAME:  [C:\G&L Motion Control Data\Modbus TCP Example\KVB Modbus TCP Example.PRJ]
    MAIN .LDO
        C:\G&L Motion Control Data\Modbus TCP Example\E_MODSEX.ldo
    COMPRESSED FILE
    PiCPro VERSION
        VER  PiCPro V18.0 Professional Edition
    PiCPro LIBRARY PATHS
        PATH C:\G&L Motion Control Data\PiCPro V18.0 Professional Edition\LIBRARIES
        PATH C:\G&L Motion Control Data\Open Modbus TCP ASFB V1.0\ASFB
        PATH C:\G&L Motion Control Data\Applications V18.0.1\ASFB
    UDFBs/TASKs
    SERVO SETUP FILES
    SERCOS SETUP FILES
    PROFILE SETUP FILES
    DRIVE FILES
    OTHER FILES
```

Under the View pull-down menu->Hardware Declarations I configured this for the hardware of my demo. This will depend on your hardware.



- Hardware
  - Master Rack
    - Slot 1 Empty
    - Slot 2 MMC Digital Resident 16 Axis Servo 1.3M Application
  - Block I/O

I/O Expansion Option

○ Master Rack Only
○ Remote I/O
● Block I/O

I/O Config/Scan Options

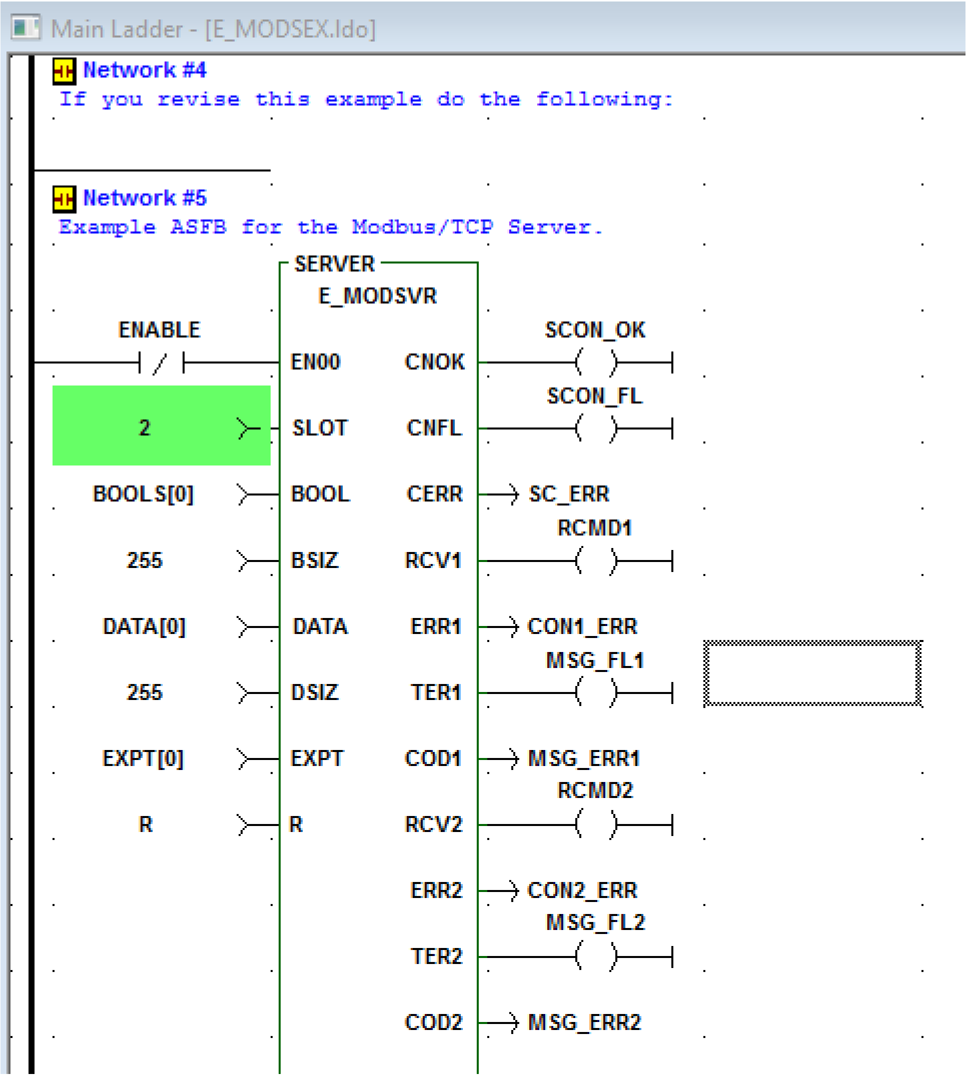
○ None
● Reconfigurable Block I/O and continue to scan with Master Rack, Remote Rack or Block I/O failures
○ Reconfigurable Block I/O and continue to scan with Master Rack, Block or ASIU failures

Pool Memory Option

□ Extend Pool Memory

SPACEBAR for keyboard access to board selection popup menus.
SHIFT + F10 for keyboard access to edit command popup menus.

Per the above my Ethernet port is on Slot 2 (which is the Digital MMC Drive Resident card). For other hardware types the Slot number of the Ethernet port may vary. You will need to edit the Slot# on the following function block input for the correct slot # of your device.



Main Ladder - [E_MODSEX.ldo]

Network #4

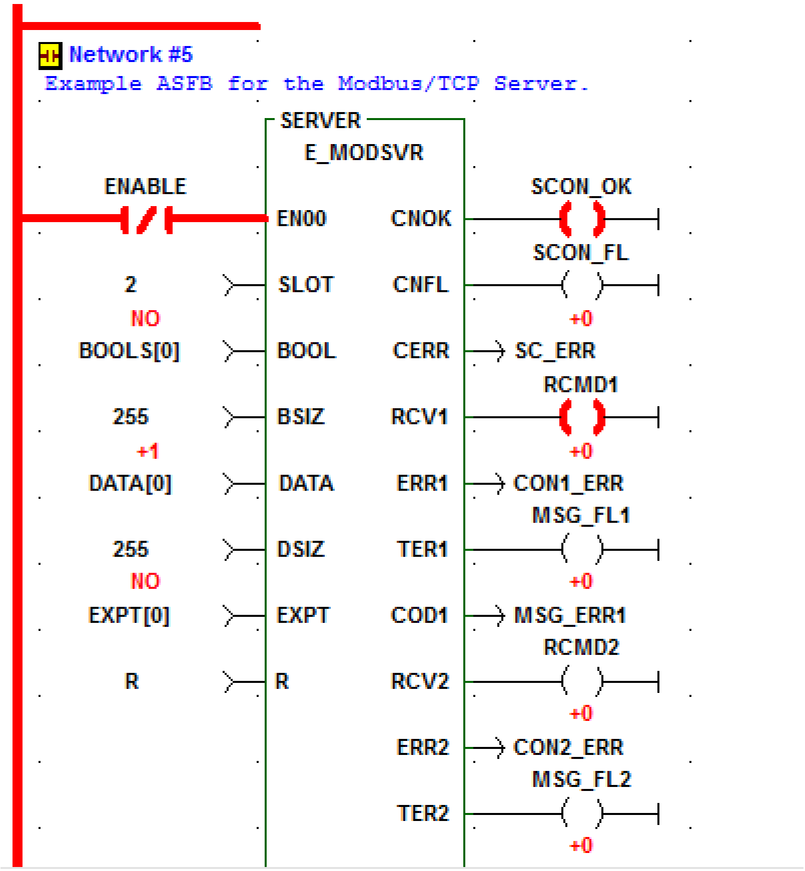
If you revise this example do the following:

Network #5

Example ASFB for the Modbus/TCP Server.

Finally, I saved the ladder changes and project and then compiled and downloaded it to the control and animated.

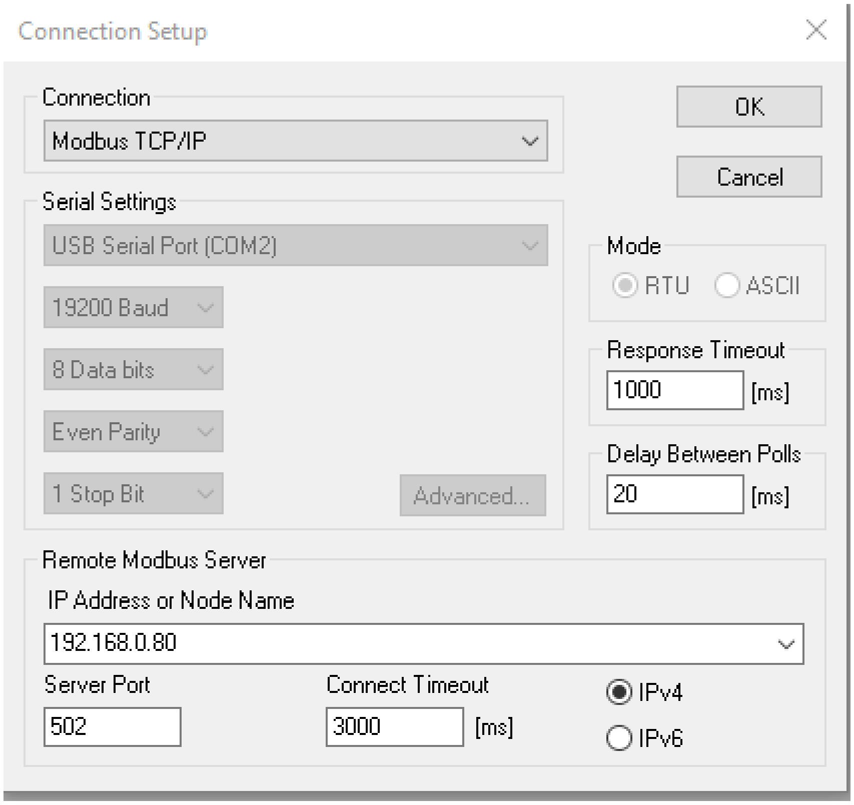
Note the E_MODSVR is enabled, SCON_OK and error outputs are all zero.


Network #5

Example ASFB for the Modbus/TCP Server.

Next using Modbus Poll as the Modbus TCP master and to check if values can be written.

The target IP address (of the G&L) must be specified (and the Ethernet card on your PC has to be on the same network (first 3 octets of the IP address) and both have to have a unique final octet. X.X.X.y.



Connection Setup

Connection: Modbus TCP/IP

Serial Settings: USB Serial Port (COM2), 19200 Baud, 8 Data bits, Even Parity, 1 Stop Bit

Mode: ● RTU ○ ASCII

Response Timeout: 1000 [ms]

Delay Between Polls: 20 [ms]

Remote Modbus Server

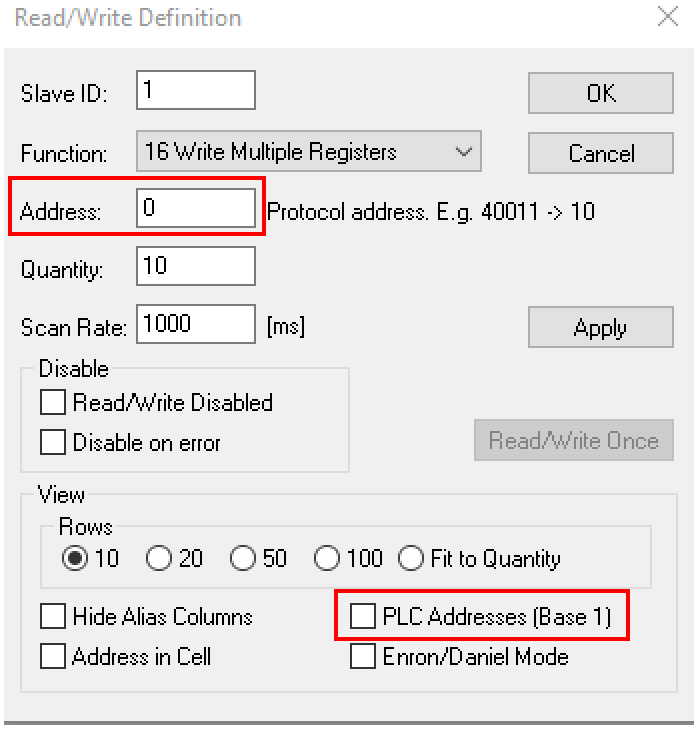
IP Address or Node Name: 192.168.0.80

Server Port: 502

Connect Timeout: 3000 [ms]

● IPv4
○ IPv6

Initially the starting address will be zero and not using Base 1.



Read/Write Definition

Slave ID: 1

Function: 16 Write Multiple Registers

Address: 0 Protocol address. E.g. 40011 -> 10

Quantity: 10

Scan Rate: 1000 [ms]

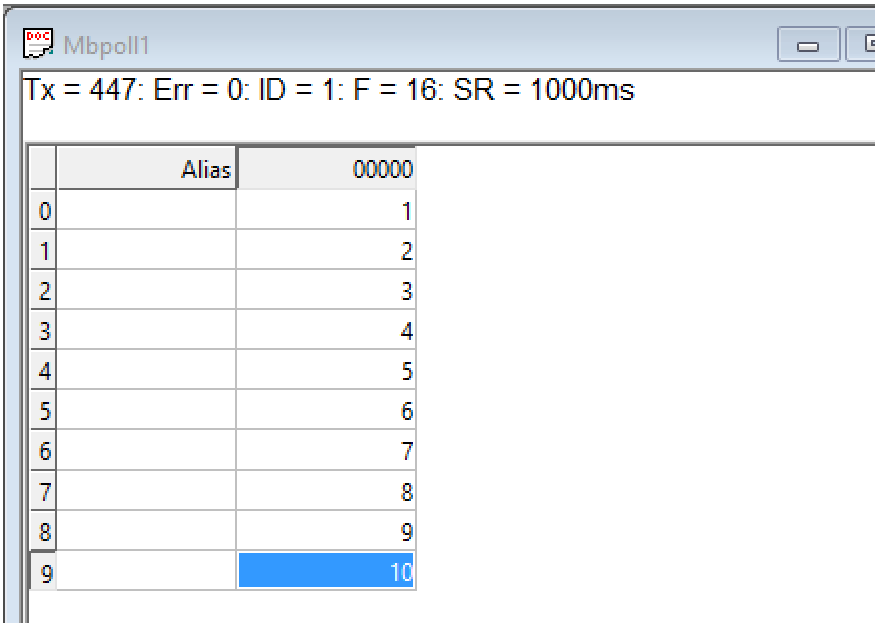
Disable
- □ Read/Write Disabled
- □ Disable on error

View

Rows: ● 10 ○ 20 ○ 50 ○ 100 ○ Fit to Quantity

- □ Hide Alias Columns
- □ PLC Addresses (Base 1)
- □ Address in Cell
- □ Enron/Daniel Mode

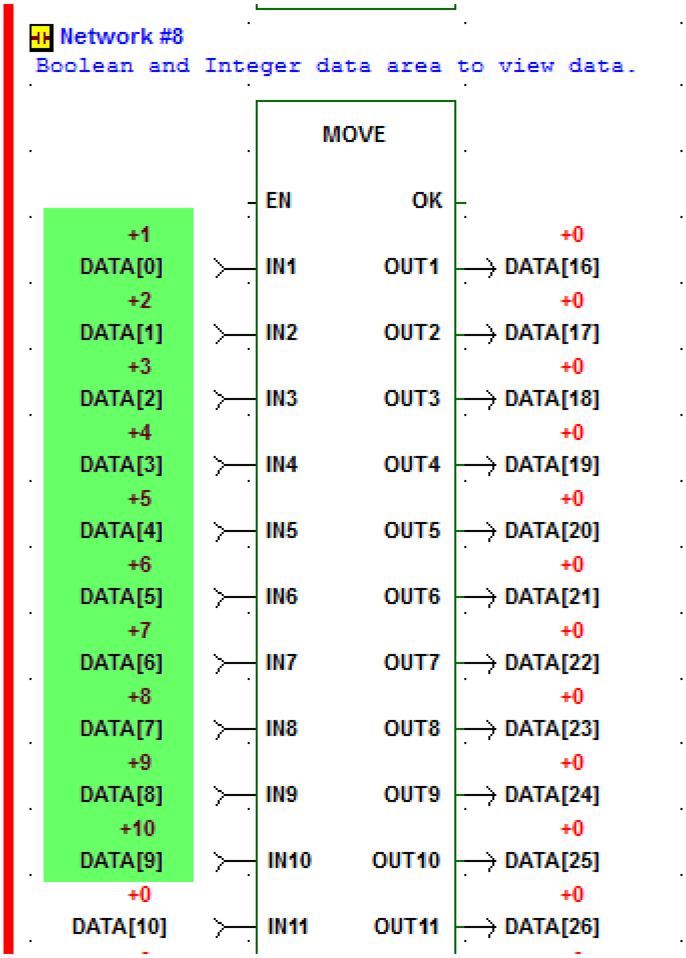
On connection there are no errors so for demonstration purposes I set the first 10 registers (0 through 9) to test values 1,2,3,….etc.



Tx = 447: Err = 0: ID = 1: F = 16: SR = 1000ms

	Alias	00000
0		1
1		2
2		3
3		4
4		5
5		6
6		7
7		8
8		9
9		10

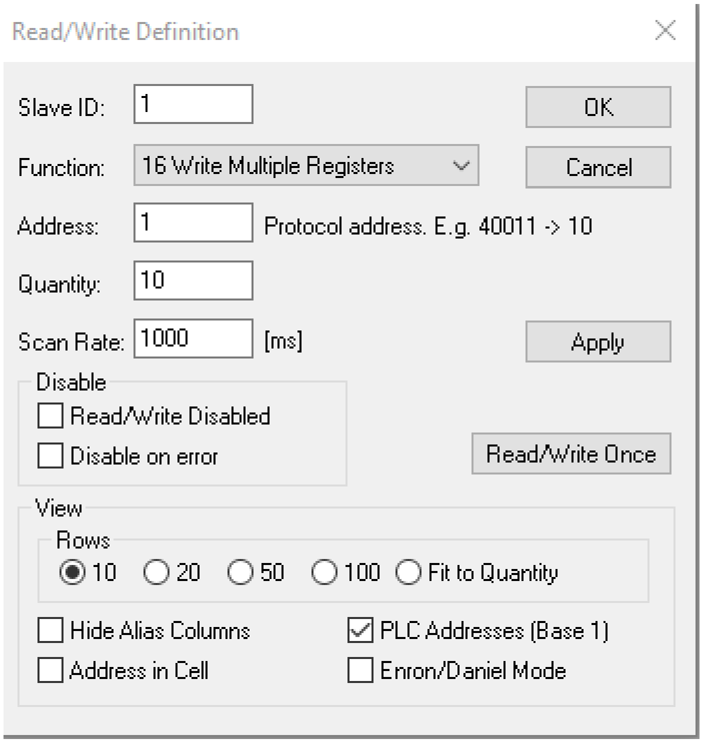
Now switching back to the animated ladder in PicPro and monitoring Network 8 the array of DATA[0] through DATA[9] is the set values set by Modbus Poll. Keep in mind some Modbus TCP masters start their address at 1, 40001, 400001, etc. where 1 will likely be equivalent to DATA[0] which is an offset in addressing.



Network #8
Boolean and Integer data area to view data.

```
                    MOVE
                EN          OK
   +1                                 +0
DATA[0]   >---  IN1       OUT1  ---> DATA[16]
   +2                                 +0
DATA[1]   >---  IN2       OUT2  ---> DATA[17]
   +3                                 +0
DATA[2]   >---  IN3       OUT3  ---> DATA[18]
   +4                                 +0
DATA[3]   >---  IN4       OUT4  ---> DATA[19]
   +5                                 +0
DATA[4]   >---  IN5       OUT5  ---> DATA[20]
   +6                                 +0
DATA[5]   >---  IN6       OUT6  ---> DATA[21]
   +7                                 +0
DATA[6]   >---  IN7       OUT7  ---> DATA[22]
   +8                                 +0
DATA[7]   >---  IN8       OUT8  ---> DATA[23]
   +9                                 +0
DATA[8]   >---  IN9       OUT9  ---> DATA[24]
   +10                                +0
DATA[9]   >---  IN10      OUT10 ---> DATA[25]
   +0                                 +0
DATA[10]  >---  IN11      OUT11 ---> DATA[26]
```

The following yields the same result.



Read/Write Definition

Slave ID: 1

Function: 16 Write Multiple Registers

Address: 1 Protocol address. E.g. 40011 -> 10

Quantity: 10

Scan Rate: 1000 [ms]

Disable

□ Read/Write Disabled

□ Disable on error

View

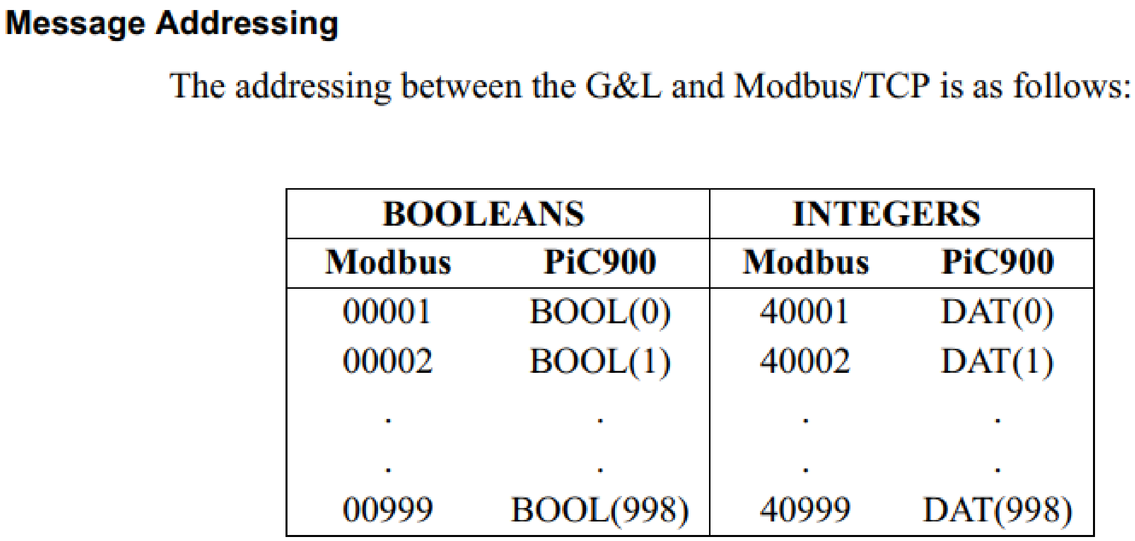
Rows

● 10 ○ 20 ○ 50 ○ 100 ○ Fit to Quantity

□ Hide Alias Columns ☑ PLC Addresses (Base 1)

□ Address in Cell □ Enron/Daniel Mode

Note the Modbus TCP ASFB manual assumes a base 1 addressing scheme. Also note the array is shown as BOOL(x) in the chart but in the sample project the array is named BOOLS(x). Likewise the integer array is shown as DAT(x) in the chart but DATA(x) in the sample project.

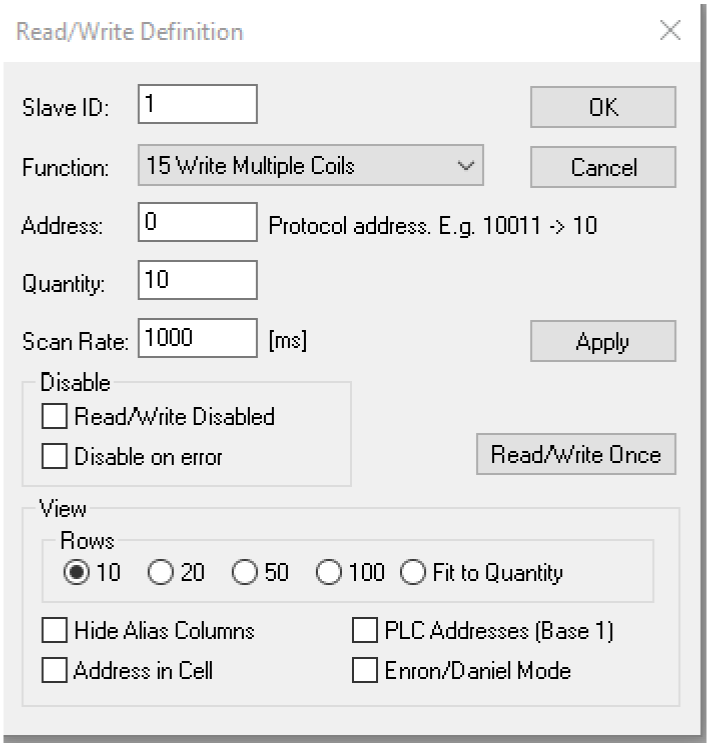


Message Addressing

The addressing between the G&L and Modbus/TCP is as follows:

BOOLEANS		INTEGERS	
Modbus	**PiC900**	**Modbus**	**PiC900**
00001	BOOL(0)	40001	DAT(0)
00002	BOOL(1)	40002	DAT(1)
.	.	.	.
.	.	.	.
00999	BOOL(998)	40999	DAT(998)

To test the Boolean data I setup Modbus Poll to use function 15-Write Multiple Coils.



Read/Write Definition

Slave ID: 1

Function: 15 Write Multiple Coils

Address: 0 Protocol address. E.g. 10011 -> 10

Quantity: 10

Scan Rate: 1000 [ms]

Disable

☐ Read/Write Disabled

☐ Disable on error

View

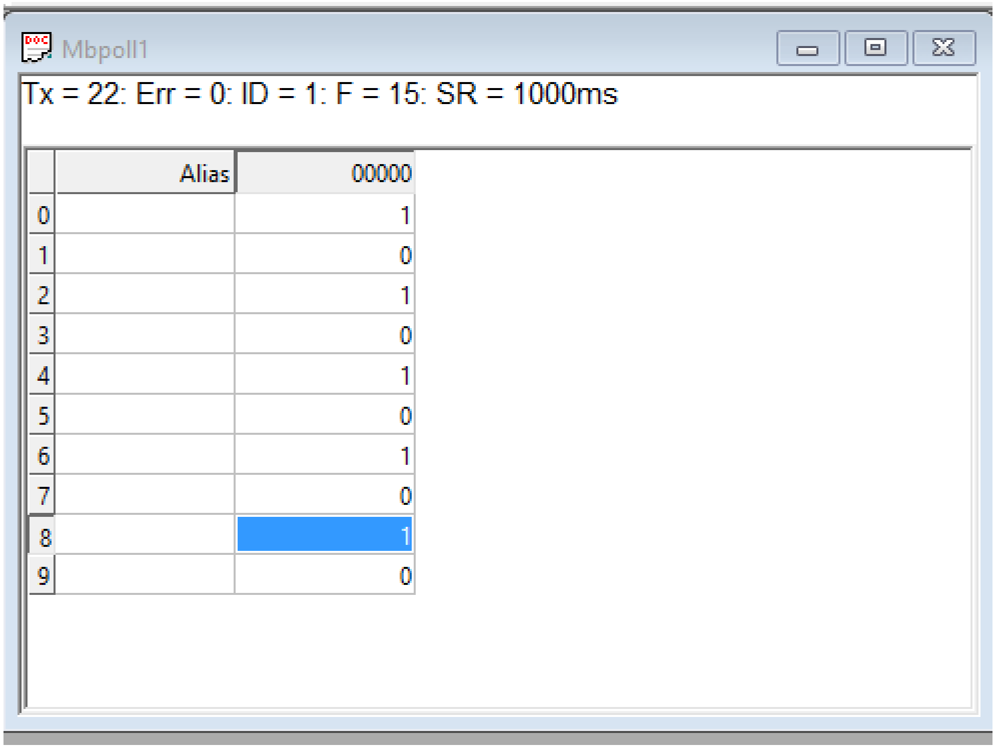
Rows

● 10 ○ 20 ○ 50 ○ 100 ○ Fit to Quantity

☐ Hide Alias Columns ☐ PLC Addresses (Base 1)

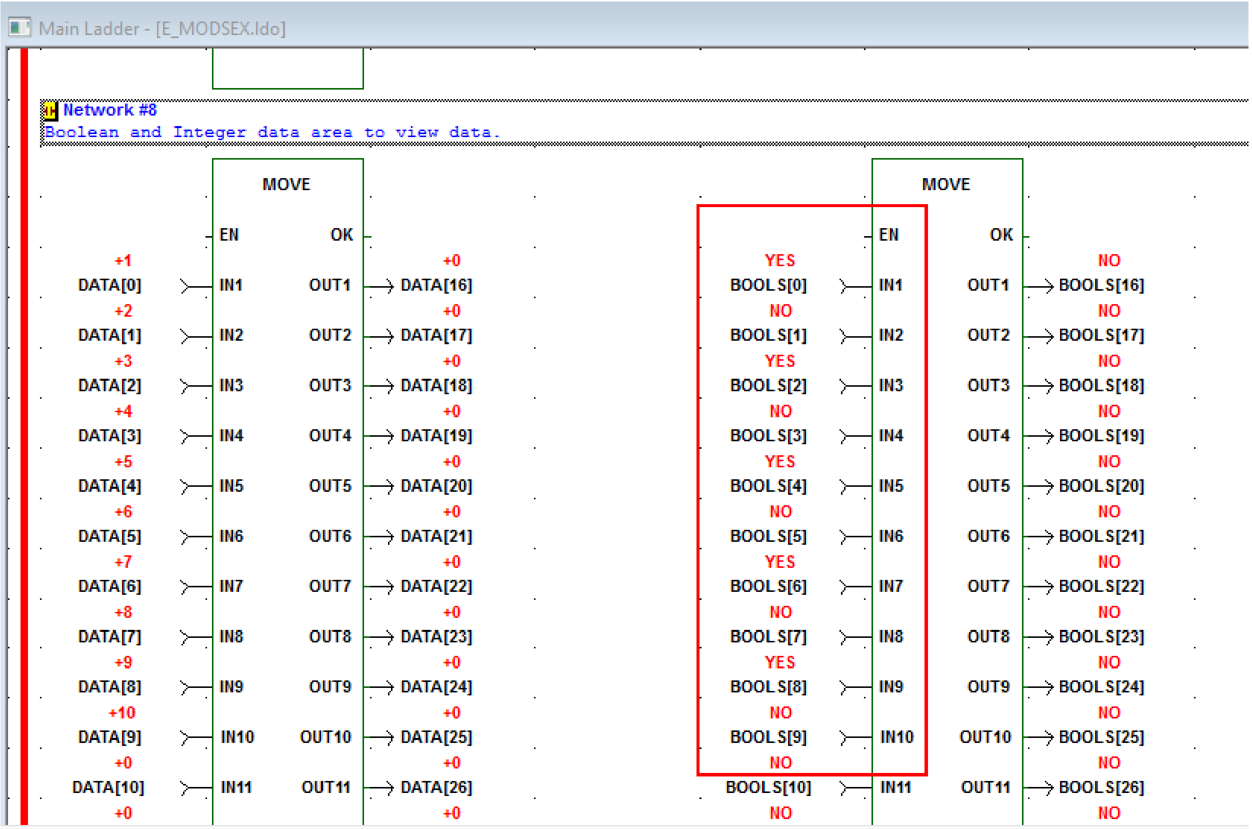
☐ Address in Cell ☐ Enron/Daniel Mode

For demonstrational purposes I set every other coil to 1.



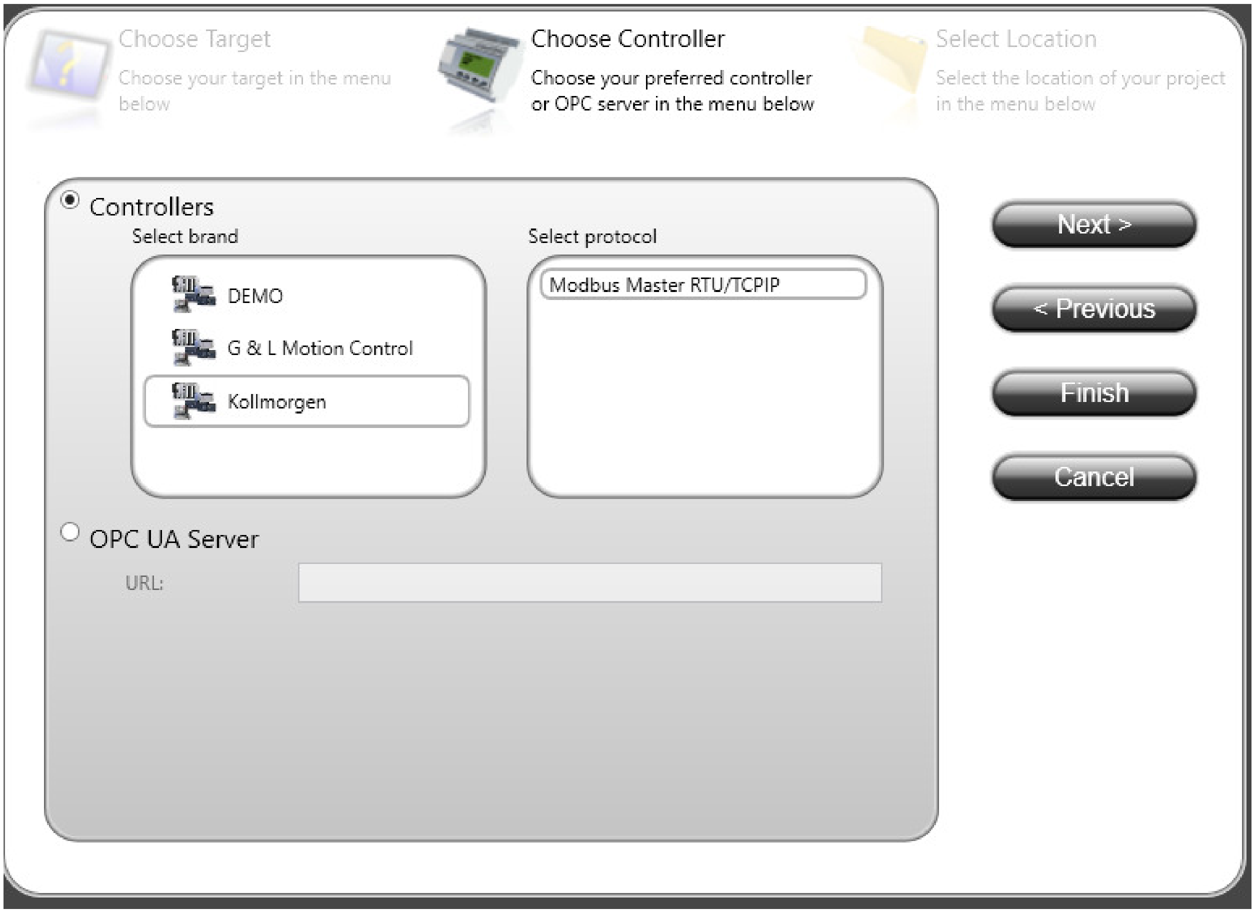
Tx = 22: Err = 0: ID = 1: F = 15: SR = 1000ms

	Alias	00000
0		1
1		0
2		1
3		0
4		1
5		0
6		1
7		0
8		1
9		0



Next I will demonstrate using KVB software to do the same thing as Modbus Poll.

I started by creating a new project and selecting Kollmorgen->Modbus Master RTU/TCPIP as shown below.



Choose Target

Choose your target in the menu below

Choose Controller

Choose your preferred controller or OPC server in the menu below

Select Location

Select the location of your project in the menu below

● Controllers

Select brand

- DEMO
- G & L Motion Control
- Kollmorgen

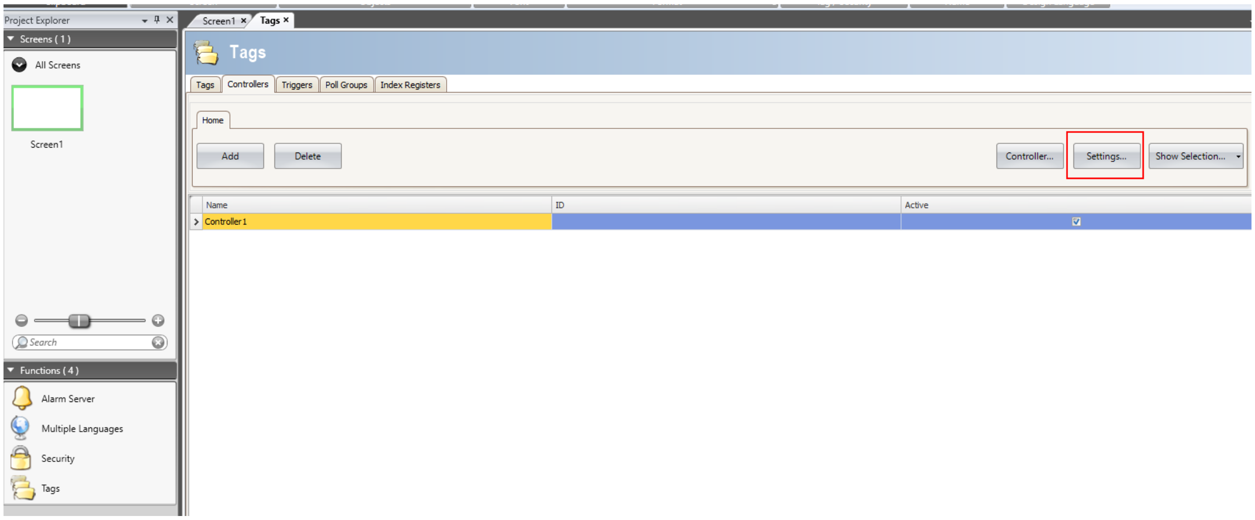
Select protocol

- Modbus Master RTU/TCPIP

○ OPC UA Server

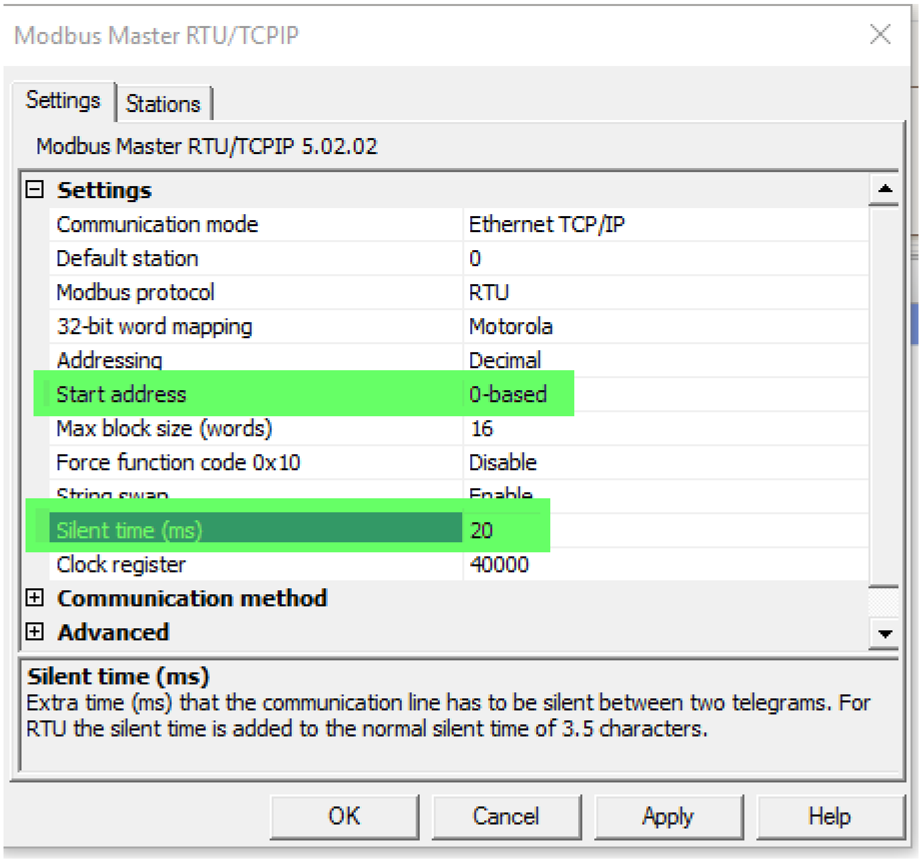
URL:

Under Tags->Controllers->Settings:



Name	ID	Active
Controller1		☑

Under the Settings tab note the default is 0-based. If you want the addressing to look like the table in the Modbus TCP ASFB manual you need 1-based but in this example I left it at 0-based because I like the Modbus address count to be the same as the index of the DATA[x] array. I also added 20msec of silent time.



Modbus Master RTU/TCPIP 5.02.02

⊟ **Settings**

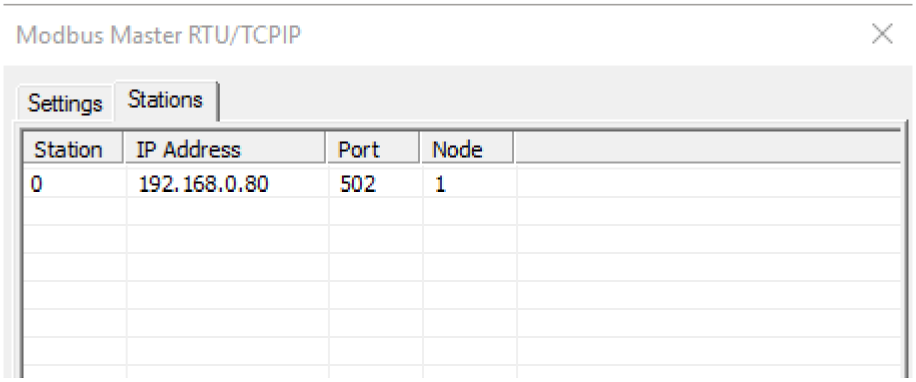
Communication mode	Ethernet TCP/IP
Default station	0
Modbus protocol	RTU
32-bit word mapping	Motorola
Addressing	Decimal
Start address	0-based
Max block size (words)	16
Force function code 0x10	Disable
String swap	Enable
Silent time (ms)	20
Clock register	40000

⊞ **Communication method**

⊞ **Advanced**

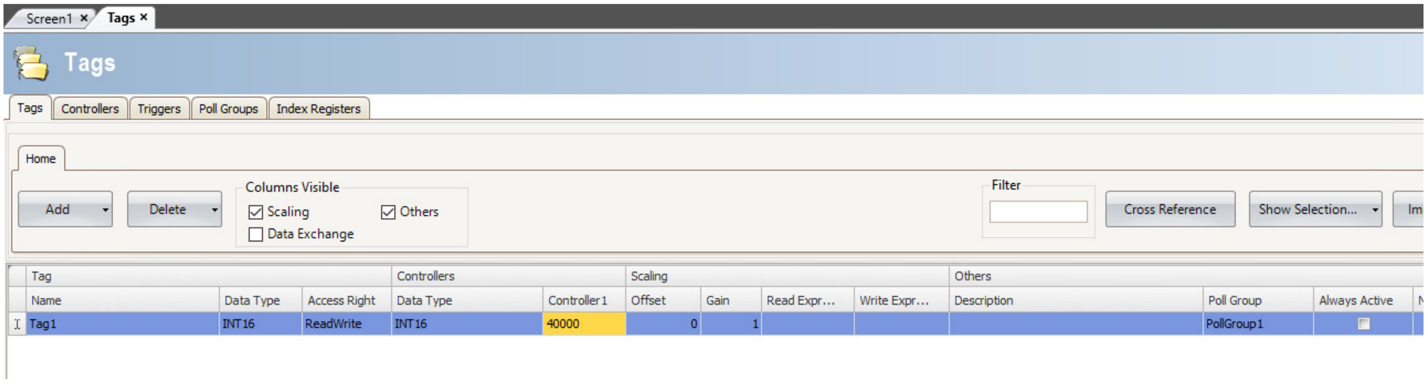
Silent time (ms)
Extra time (ms) that the communication line has to be silent between two telegrams. For RTU the silent time is added to the normal silent time of 3.5 characters.

On the Stations tab I set the IP Address to the same as the target IP Address of the G&L controller (Ethernet port):



Station	IP Address	Port	Node
0	192.168.0.80	502	1

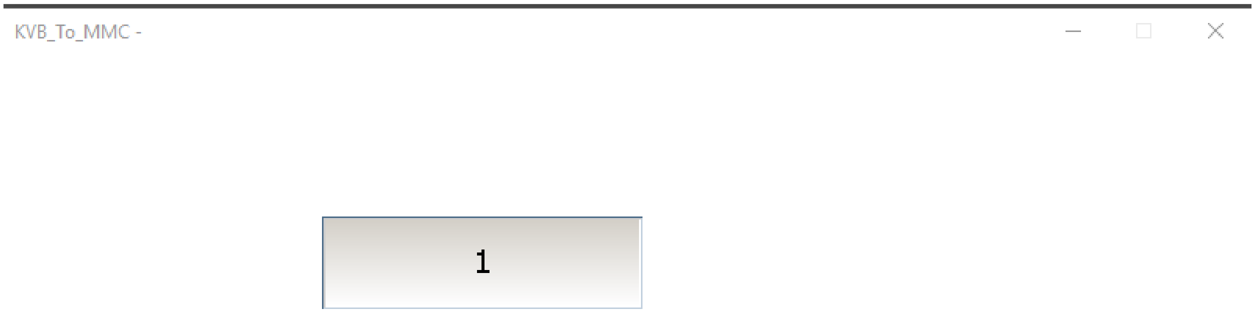
For the initial test I created a tag1 as INT16 and assigned the tag Controller1 Modbus address 40000 which should be DATA[0] in the ladder using 0 based addressing.



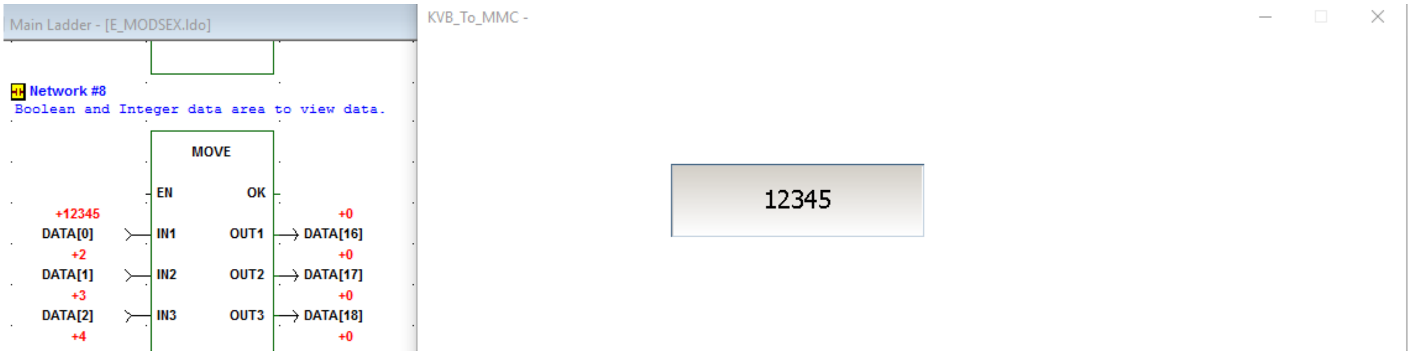
Tag			Controllers		Scaling				Others			
Name	Data Type	Access Right	Data Type	Controller1	Offset	Gain	Read Expr...	Write Expr...	Description	Poll Group	Always Active	N
Tag1	INT16	ReadWrite	INT16	40000	0	1				PollGroup1	☐	

I added an Analog Numeric data field to the default screen and set it up to point to Tag1.

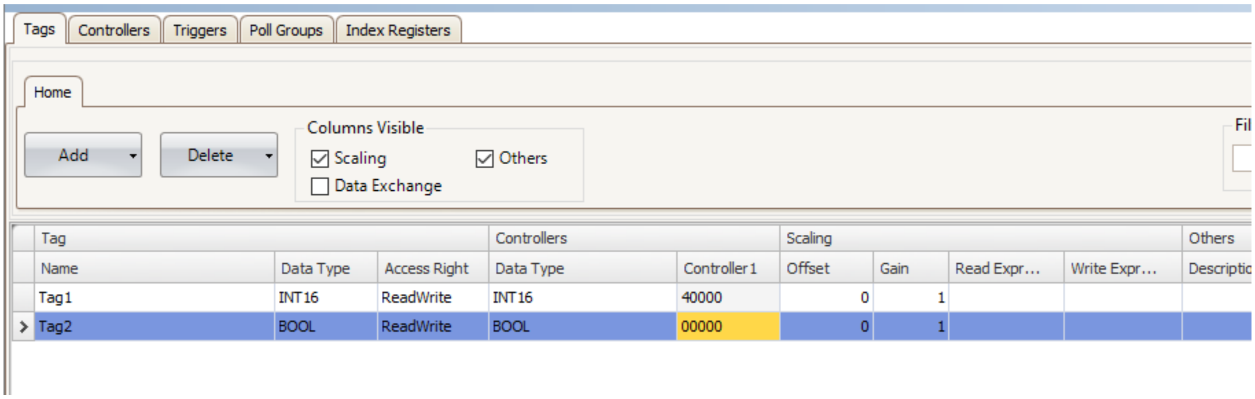
I built and ran the project. The value is displayed as 1 as expected.



Next I changed the value on the touchscreen to 12345 and as you can see below DATA[0] changed.



To test the BOOL I added another tag in KVB and set it up as type BOOL and set the tag controller address to 00000.

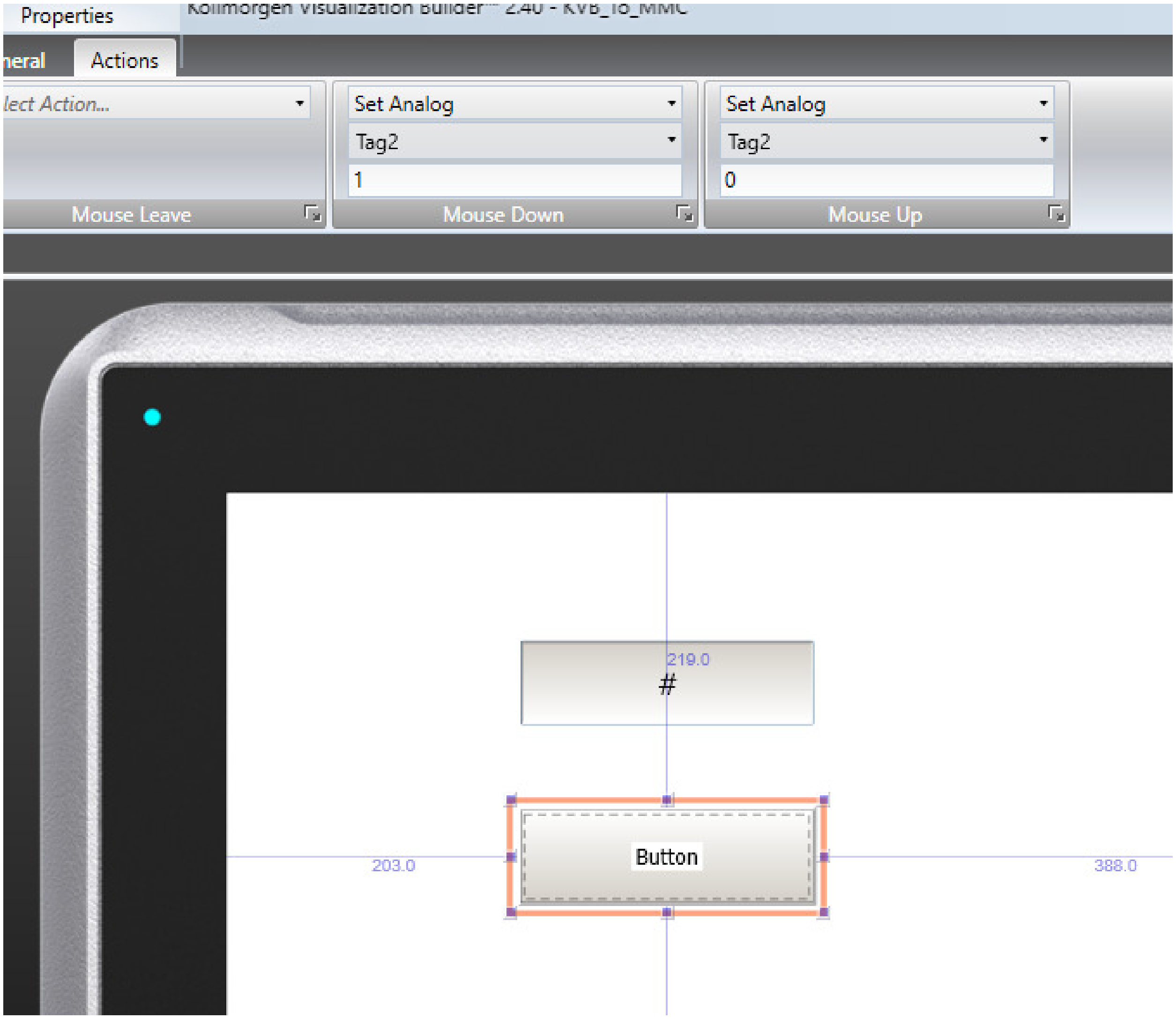


Columns Visible

☑ Scaling ☑ Others
□ Data Exchange

Tag			Controllers		Scaling				Others
Name	Data Type	Access Right	Data Type	Controller1	Offset	Gain	Read Expr...	Write Expr...	Descriptio
Tag1	INT16	ReadWrite	INT16	40000	0	1			
Tag2	BOOL	ReadWrite	BOOL	00000	0	1			

I added a button on the screen and pointed it to Tag 2.

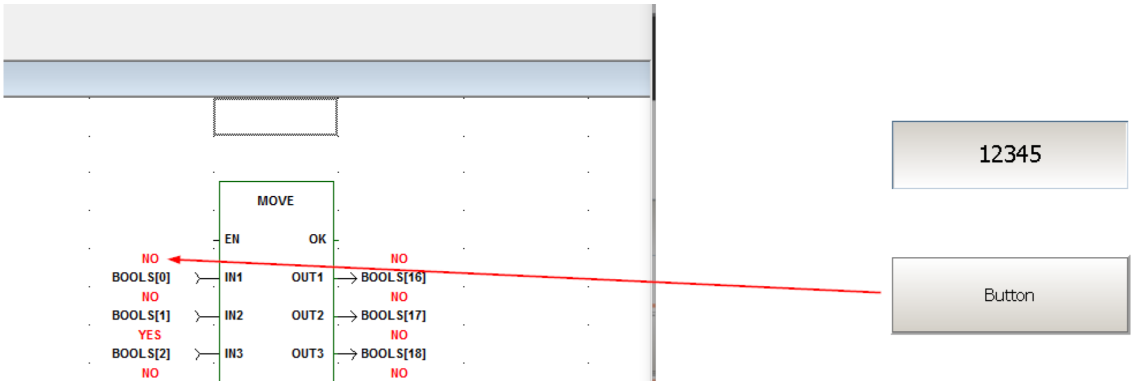


Mouse Leave: lect Action...

Mouse Down: Set Analog, Tag2, 1

Mouse Up: Set Analog, Tag2, 0

I built and ran the project again in KVB and during runtime when pressing and releasing the button on the touchscreen I could see tha value of BOOLS[0] change from NO when not pressing to YES when pressing the button.


MOVE
EN
OK
NO
BOOLS[0]
IN1
OUT1
NO
BOOLS[16]
NO
BOOLS[1]
IN2
OUT2
NO
BOOLS[17]
YES
BOOLS[2]
IN3
OUT3
NO
BOOLS[18]
NO
NO
12345
Button