

This technical note explains how to interface the RACO Verbatim Gateway system with the Allen-Bradley MicroLogix family of PLCs containing a native *Modbus RTU Slave* driver. This allows the Verbatim Gateway to perform its alarm notifications and monitoring functions using the existing wiring to Allen-Bradley MicroLogix PLCs as inputs via data communications. This technical note is applicable for all Verbatim Gateway models.

RACO-supplied components:

Verbatim Gateway (any model)
 510VAB-1 Cable

Allen-Bradley-supplied components:

MicroLogix family of PLCs as listed in the table below
 1761-CBL cable
 RSLogix[™] 500 software version 8.10.00
 Or
 RSLogix Micro software



Modbus RTU Slave Driver is available within the following MicroLogix PLCs

Model #	Series #
1100	A & B
1200	A & B & C
1400	A
1500 LSP	B & C
1500 LRP	B & C

9 PIN FEMALE
RS232 CONNECTOR



9 Pin Connector Pin-Out		
1	—	—
2	RXD	Data from Gateway
3	TXD	Data to Gateway
4	DTR	Data Terminal Ready (Jumpered to DSR at 9 pin conn. only)
5	SGND	Signal Ground
6	DSR	Data Set Ready (Jumpered to DTR at 9 pin conn. only)
7	RTS	Request To Send (Jumpered to CTS at 9 pin conn. only)
8	CTS	Clear To Send (Jumpered to RTS at 9 pin conn. only)
9	—	—

In order to facilitate data communications via Modbus RTU Master / Slave over RS232 data interface, RACO provides a simple NULL Modem serial cable, VAB-1 (see above). This cable has the RJ-45 connector required to connect to the Verbatim Gateway. In addition, parameters need to be set within the Allen-Bradley and RACO Verbatim Gateway.

No additional hardware is required.

Communication Setup for the Allen-Bradley MicroLogix

When configuring communications for the Allen-Bradley, a communication cable and either the RSLogix 500 or RSLogix Micro software are required.

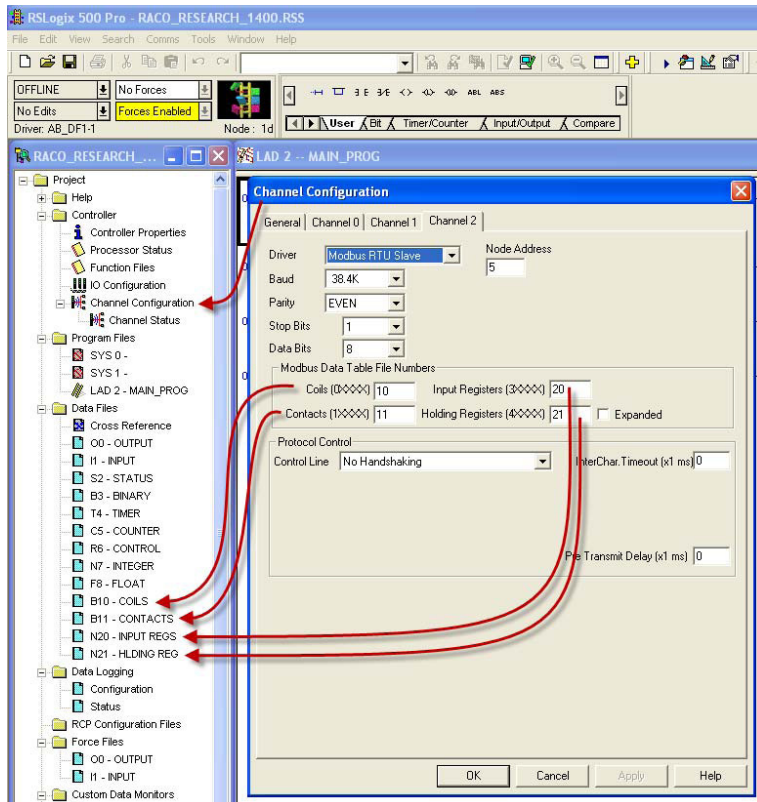
Use the 1761-CBL cable for communication between the PLC and your PC, available from Allen-Bradley. This cable has a round 8-pin mini DIN plug on one end and the 9-pin female (computer side) on the other. This cable connects to Channel “0” in the MicroLogix, where the DF1 Full Duplex driver by default is ready to communicate to your RSLogix™ software.

STEP #1 — Launch RSLogix Software

STEP #2 — Set Communications Driver to Modbus RTU Slave

Open the Channel Configuration form and select an available channel other than Channel “0,” where possible.

Caution: It is not recommended to configure communications to Modbus should your PLC have only a single communications port, as Channel 0 should remain available to RSLogix software for program upload / download and monitoring.



As shown at left, the Channel configuration form has four tabs, General, Channel 0, Channel 1 and Channel 2. Since we will reserve Channel 0 for RSLogix software, we will select the Channel 2 tab. (Select Channel 1 if Channel 2 does not exist.) Once the Driver field is clicked, a drop-down menu of driver choices will be visible. Select Modbus RTU Slave, as shown.

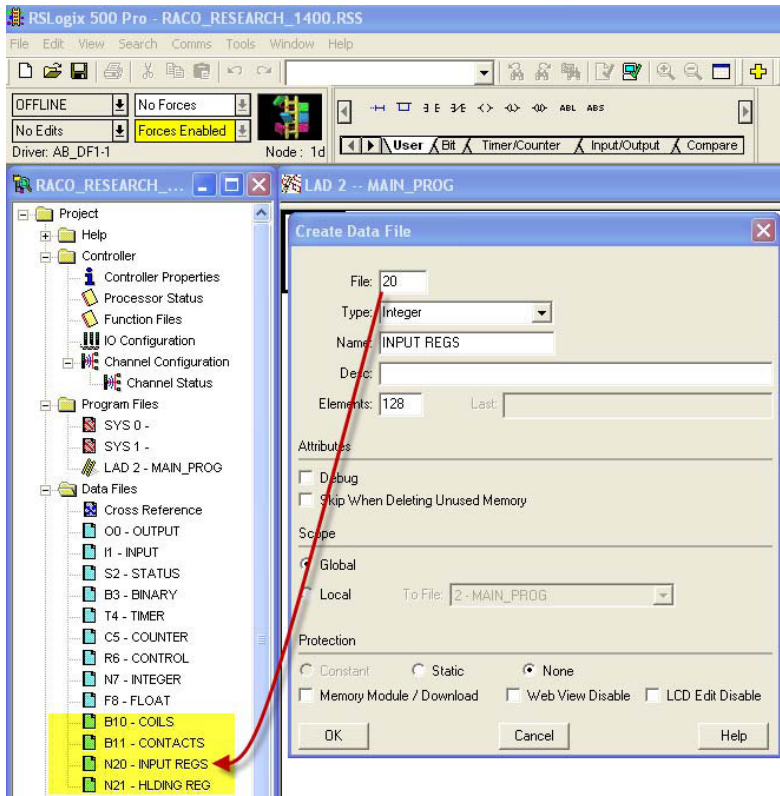
STEP #3 – Select Communication Parameters

Gateway Node Address default is “1” so anything other than 1, up to 256, is acceptable.

RACO recommends the following settings:

- Baud rate = 19,200
- Parity = EVEN
- Stop Bits = 1
- Control Line = No Handshaking

STEP #4 — Select PLC Data Files



Available file numbers are 3, 7 and 9 – 255. When selecting the data files, ensure that they exist. If the files do exist, ensure the elements within the file exist, and are not being utilized elsewhere in your program.

In the example, at left, new data files were created and named exclusively for Modbus communications (highlighted in yellow).

Once a file number has been assigned, select the data type. Type the name you wish to call the file in the “Name” field. Our name follows the assignment as per Modbus. (See Table #1.)

MicroLogix only allows Binary or Integer type data files to be linked to the Modbus convention. Floating point files are not currently accepted (i.e. 5xxxx).

In our example, 128 elements were selected. In the case of both “Coil number” and “Contact number,” where an address is only a single bit, this translates to 2048 available addresses (i.e. 128 * 16 bits).

In the case of “Input Register number,” 128-16 bit integer addresses are available.

In the case of “Output Register number,” 128-16 bit integer addresses are available

Note: Although we have assigned data tables 128 words in length, we are bound to the number of channels on the Gateway end. Please refer to model numbers listed above to select a unit with the desired number of channels to suit your application.

Upon completion of your data file assignment you are ready, at the Allen-Bradley end, to communicate.

Communication Setup for the Verbatim Gateway

The following seven-step procedure will configure your Verbatim Gateway to link its Remote Channels (RC) to your PLC addresses, via your Modbus RTU Master/Slave network.

It is important to recognize the physical NET/PORT being used for communications to the MicroLogix PLC. Connect the NET ID (port) that supports Modbus RTU Master Protocol. Typically this is NET 2 however; the VCP card offers this protocol on NET 1.

STEP #1 — Protocol Driver (4906)

When setting the Protocol, Node Address and Communication parameters, it is good practice to include the NET ID (i.e. 4901, 4903, 4904, 4905 and 4906).

Insert the NET ID immediately following the parameter number, as defined below.

Table #1

N	Protocol	Reference	Description	Nets
0	NONE		Device disabled	All nets
2	DH485	7.4.2	Allen-Bradley DH485 protocol	Net1 on V232/485 only
3	DF1	7.4.1	Allen-Bradley serial interface	Net1 (on VDP only) Net2
4				
5	MODBUSM	7.4.3	Modbus Master	Net1 (on VDP only) Net2
128	LDL	7.4.5	Local Data Logging May only be used on one device	Net1 (on VDP only) Net2, 4

As per the Table #1 above, set the Protocol Driver to Modbus RTU Master / Slave on NET 2

Key in 4906 2 <point> 5 <enter>

To read the Protocol Driver for NET 2, key in 4906 2 <enter>

STEP #2 — Node Address (4905)

Choose a unique Modbus RTU Master / Slave DF1 NODE address for the Verbatim Gateway. As illustrated above, we've already selected NODE 5 for the MicroLogix. NODE addresses to range from 1–256.

For example, set the Gateway NODE address to “2” by using code 4905 2<point> <2> <enter>

To set the NODE address of NET 2, key in 4905 2<point> <2> <enter>

To read the NODE address of NET 2, key in 4905 2 <enter>

STEP #3 — Communication Parameters (4901,4903,4904)

Select the communication parameters. These must match with the driver settings on your Modbus network.

RACO recommends the following communication settings:

BAUD rate = 19200 for “9600” on NET 1, key in 4901 2<point>9600 <enter>

Stop Bits = 1 for “1” on NET 2, key in 4903 2<point> 1 <enter>

Parity = NONE for “NONE” on NET 2, key in 4904 2<point> <0> <enter>

Parity Definition: 0 = No, 1 = ODD, 2 = EVEN, 3 = SPACE, 4 = MARK

Communication settings can be viewed by entering any one of the above 4-digit codes followed by the <enter>

DATA Bits cannot be altered and remain at 8.

STEP #4 — Confirmations

Step #4 will validate all preceding steps.

To verify successful network communications on NET 2, key in 4930 <point> 2 <enter>

To read the BAUD rate for NET 2, key in 4901 2 <enter>

To verify communication settings reflect the above, at NET 2, key in 4900 2<enter>

To verify active node addresses on NET 2, key in 4946 2<enter>

STEP #5 — Set Defaults

This step simplifies Channel Configuration (i.e. Step 6).

By setting to Default both the NET ID and NODE / STATION address, it is no longer necessary to reference them when setting Channel Configuration.

Set the following to DEFAULT.

- 1 NET ID, used to communicate via your Modbus RTU Master, in this example “2.”
- 2 NODE address of the target PLC, in this example “5.”

To change the NET ID to “2,” key in 4910 2 <enter>

To confirm the NET ID, key in 4910 <enter>

To change the PLC NODE/STATION address to “5” of NET 2, key in 4911 5 <enter>

To confirm PLC NODE/STATION address, key in 4911 <enter>

STEP #6 Channel 1 & 2 Configuration (4501) (4502)

Since Verbatim Gateway channels are completely compatible with the logical and I/O addressing scheme for the file structure of the SLC series processors, the table below should look familiar.

TABLE #2

Identifier	File Type	Example
O	Output	O:1.0/0 (SLC500) O:017/10 (PLC5)
I	Input	I:0.1/0 (SLC500) I:013/07 (PLC5)
S	Status	S:2 (word) S:2/0 (bit)
B	Bit	B:0 (word) B9:0/1 (bit)
T	Timer	T4:0.2 (word) T:0.0/1 (bit)
C	Counter	C5:0.2 (word) C10:0.0/1 (bit)
R	Control	R6:2.1 (word) R:2/15 (bit)
N	Integer	N:1 (word) N:1/0 (bit)
F	Floating Point	F:2 (32-bit word)
NOTE: Cannot specify 16 or 1-bit points with F file type.		
D, G, M1, etc...	All other types	Not Supported

Table #2 shows the Allen-Bradley-supported address types available to link to Verbatim Gateway channels. Indirect, indexed and symbolic addressing schemes are not supported.

Table #3

Register Address	Description	Size / Limitation
0xxxx	Coil number xxxx	1-bit
1xxxx	Input number xxxx	1-bit
3xxxx	Input register number xxxx	16-bit
4xxxx	Output register number xxxx	16-bit
5xxxx	Floating Point register	32-bit

Table #3 illustrates the Modbus data file convention within the Verbatim Gateway. These Modbus Register Addresses map to the MicroLogix registers as per the Modbus Table File numbers, on the Channel Configuration form within RSLogix 500, illustrated above (see page #3).

Important:

Although Holding Registers are not currently applicable to MicroLogix, it should be noted that Output Register (4xxxx) and Holding Register (5xxxx) data types use the same data area at the Verbatim Gateway end. The Holding Register (5xxxx) uses two consecutive 16-bit addresses that are interpreted as a 32-bit floating point number (i.e. 5xxxx & 5xxxx+1). Not unlike the Holding Register, the Output Register (4xxxx) also reserves two consecutive 16 bit words; however the extended word is left blank.

Similarly, when addressing the input register (3xxxx), allow for two consecutive 16 bit words, keeping in mind the word is reserved but not used. Hence, consecutive addressing of both Input and Output Registers will appear as follows. For example, first Input Register address point 30001, second address point 30003, third address point 30005, etc.

The two examples below illustrate the PLC link via Modbus tagging convention (Table #3) to the Verbatim Gateway channel.

Example #1

To configure B11:0/0 in the MicroLogix to Channel 1 as per our MicroLogix settings illustrated above, type 4501 <point> 100001 <point> <enter>

To verify the current address entered, key in 4501<point><enter>

To read address value, key in 4001<point><enter>, this will read actual PLC value assigned to Channel 1.

Example #2

To configure N20:0 in the MicroLogix to Channel 2 as per our MicroLogix settings illustrated above, type 4502 <point> 300001 <point> <enter>

To verify the current address entered, key in 4502<point><enter>

To read address value, key in 4002<point><enter>, this will read actual PLC value assigned to Channel 2.

Once channels are configured, they are ready to be assigned to your project typically linked to Alarm Notifications, Data Logging and Messaging.

STEP #7 — Assignment of Alarm Conditions

Having created and tested your Remote Channels, Step #6, you are now able to assign alarm conditions.

Channel #1, configured as Discrete, is either ON or OFF.

Should this channel be linked to a "Failsafe" point in the PLC, (i.e. ON = NORMAL, OFF = ALARM) we would alarm when OFF. In this case, we would key in 45 01 2. To alarm when ON, (i.e. signal is HIGH) key in 45 01 1

To alarm when OFF, (i.e. signal is LOW) key in 45 01 2

To read Alarm status for Channel 1, key in 4001 <enter>

Channel #2, configured as Analog, operates within the range from 0 to 65, 535.

Should this channel be linked to a pressure signal in the PLC, and the process requires pressure remain within an acceptable level, otherwise ALARM. (For example, BELOW 10,000 AND ABOVE 30,000.) We would key in the following:

To alarm when the analog signal falls below a value, for example 10,000: key in 45 02 5 10000

To read the LOW set point alarm; key in 45 02 5

To alarm when the analog signal rises above a value, for example 30,000, key in 45 02 6 30000

To read the HIGH set point alarm; key in 45 02 6

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