This technical note explains how to interface the RACO Verbatim Gateway system with the Allen-Bradley ControlLogix family of PLCs. All models of the ControlLogix PLC have the 9 PIN, male RS232 port. This allows the Verbatim Gateway to perform its alarm notifications and monitoring functions using the existing wiring to Allen-Bradley ControlLogix 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:
ControlLogix family of PLCs
RS232 cable (simple NULL modem — for RSLogix™ 5000 to PLC)
RSLogix 5000 software version 15.02

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 DF1 over RS232, 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 ControlLogix Platform

The Verbatim Gateway requires we reserve an RS232 port on the ControlLogix. It is therefore important to ensure a communications port is also available for your RSLogix 5000 programming software. **Communication setup is identical to that of the CompactLogix™ platform**, the illustrations show the CompactLogix.

STEP #1 — Launch RSLogix 5000 Software

STEP #2 — 9-Pin RS232 Port
Once your RSLogix 5000 file is open, you will need to configure the communication driver for your 9-Pin RS232 port. The driver parameters can be found under two tabs, Serial Port and System Protocol.

STEP #3 — Serial Port and System Protocol Configuration Tabs
To locate these tabs, click the controller icon as indicated by the red arrow. Once clicked, the "Controller Properties" form will be displayed.

Both the Serial Port and System Protocol tabs can now be accessed.

Should your ControlLogix have more than one RS232 port, the name of the tabs will appear as follows:
      Ch.0 — Serial, Ch.0 — System Protocol
      Ch.1 — Serial, Ch.1 — System Protocol

The two green arrows point to the tabs that configure the DF1 driver details.

STEP #4 — Serial Port Tab
Under the Serial Port Tab, the Mode field has two options, either "System" or "User." Select "System."

RACO recommends the following settings:

- Baud rate = 19,200

- Parity = EVEN

- Stop Bits =1

- Data Bits = 8

- Error Check = CRC

- Control Line = No Handshaking
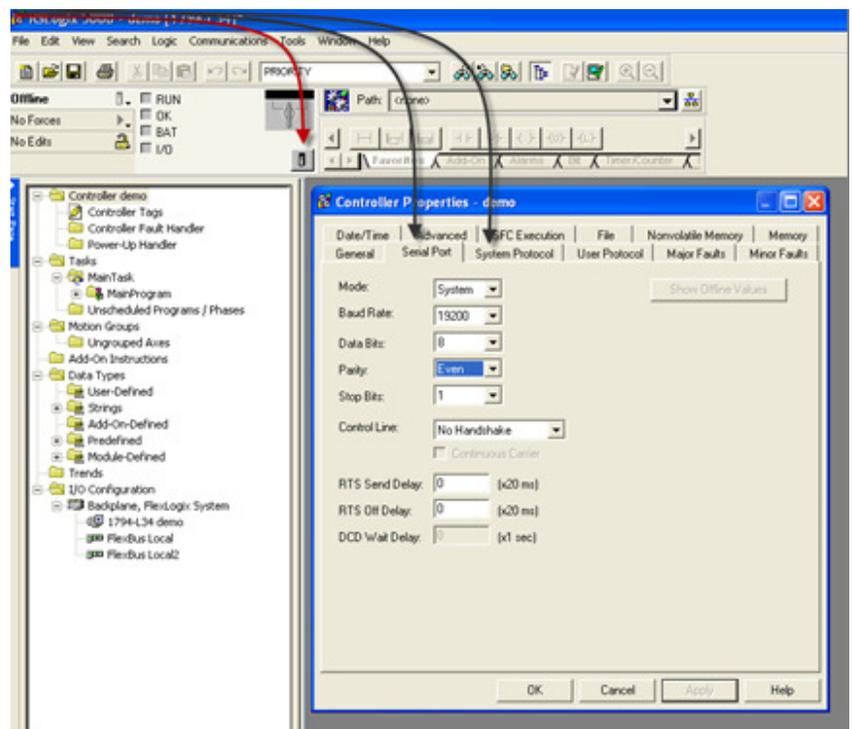
STEP #5 — System Protocol Tab

RACO recommends the following settings:

- Protocol = DF1 Point to Point

- Station Address = 1

- NAK Retries = 3

- ENQ Retries = 3

- ACK Timeout = 2

- Embedded Responses = Enabled / Auto Detect

- Error Check = CRC

All remaining fields can remain at their default settings.
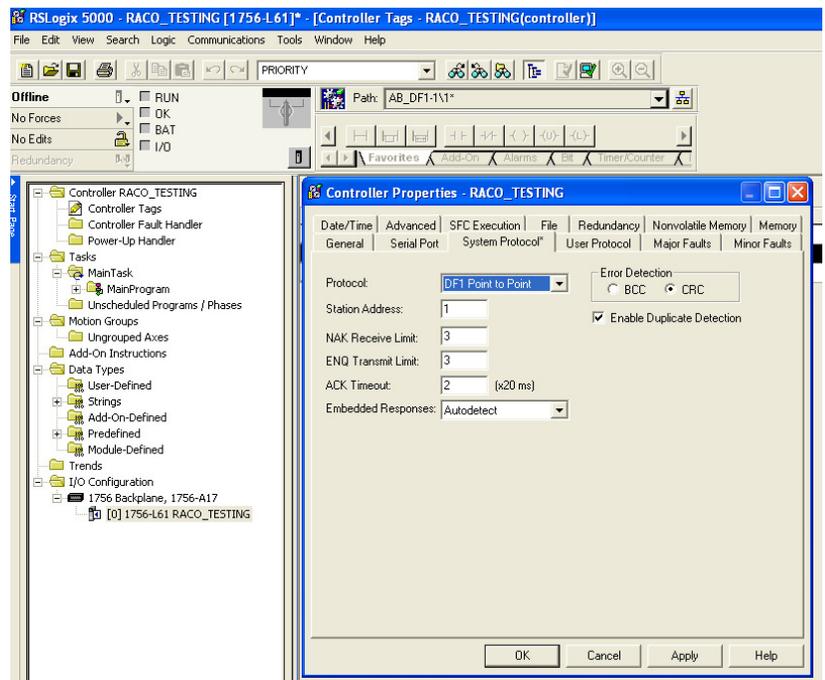
Configuring the Allen-Bradley ControlLogix Registers

The Verbatim Gateway DF1 driver supports the SLC™ platform file structure for referencing data.

The ControlLogix uses "Base" tags that are custom created to address normal internal data. These "Base" tags would not normally be compatible for communications without "Mapping" or converting to the SLC file structure.

In order to convert to the SLC file structure, it is necessary to first configure ControlLogix Base tags.

STEP #1 — Configure ControlLogix Base Tags
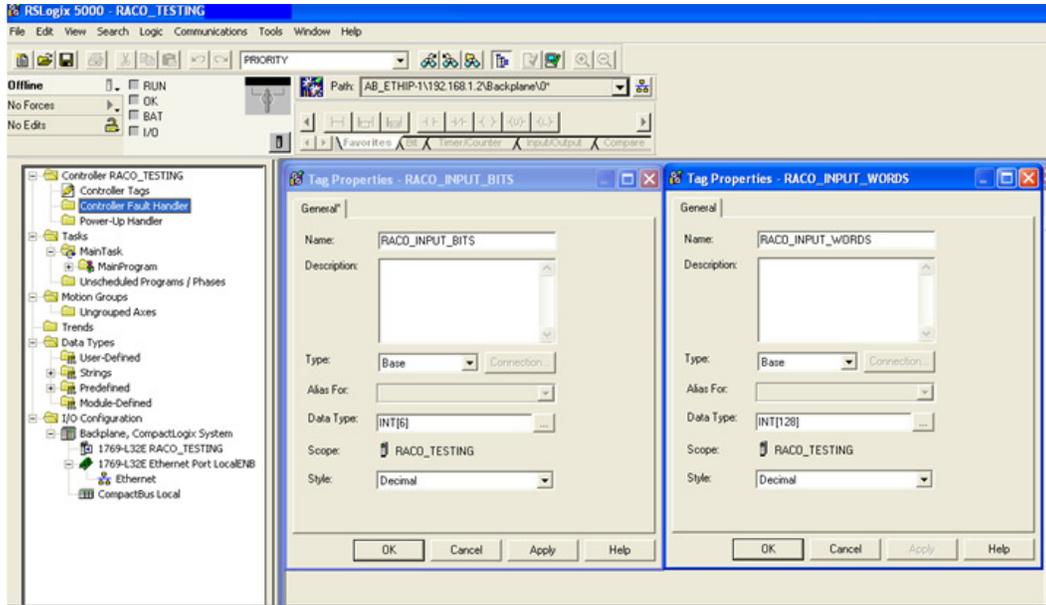
Complete the Tag Property form, as per your application requirements. In the above example, we've created both Boolean and Integer tags. We've selected an array of six words for Boolean. (i.e. 6 * 16 = 96bits) and 96 – 16 bit integer words.
Note: Verbatim Gateway can support up to 96 remote channels.

STEP #2 — Mapping ControlLogix Tags to SLC

In order to access the Mapping feature, first select "Logic."

As indicated by the green arrow, right, click "Logic'" tab and the form will open displaying the "Map SLC" feature as per the red arrow.

Once the "Map SLC" feature is clicked (red arrow), the SLC Mapping form will be displayed on screen.
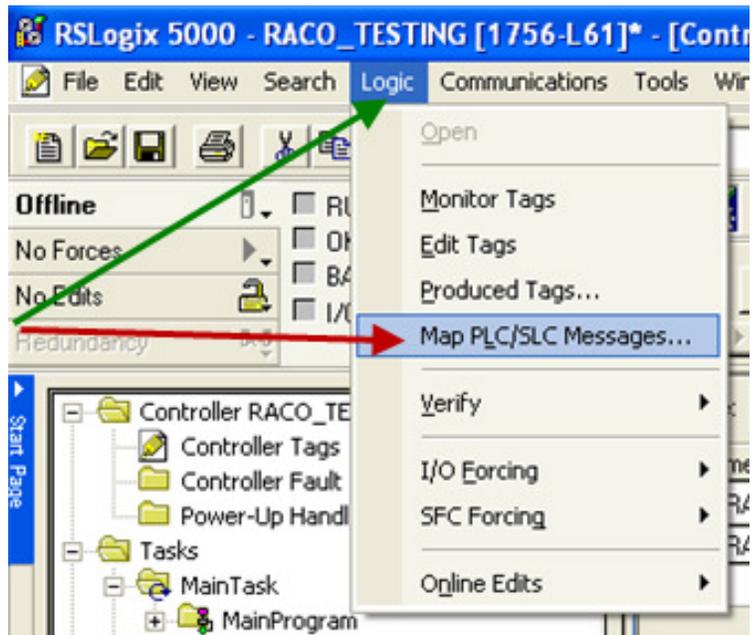
STEP # 3 — Completing the SLC Mapping Form
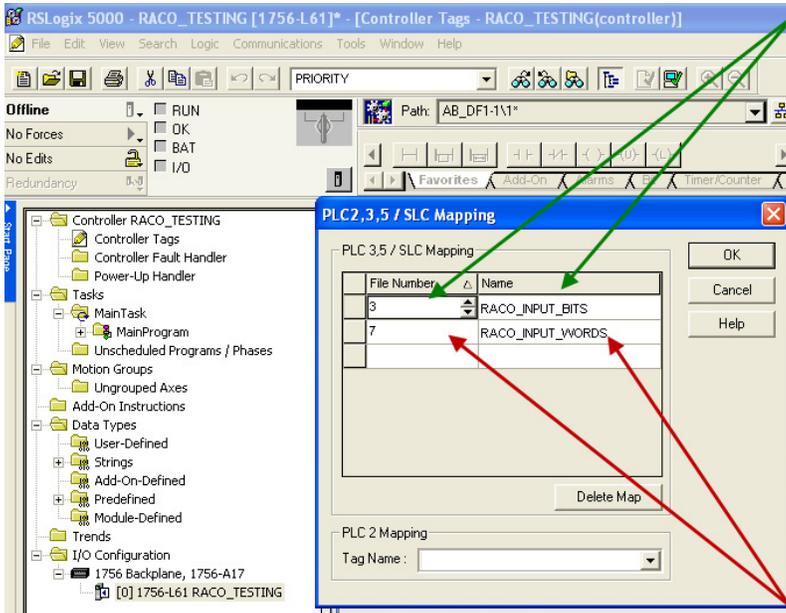
With the SLC Mapping form now open, select the Tag Name configured for binary; in this example the name RACO_INPUT_BITS will be assigned to file number 3.

Below, add RACO_INPUT_WORDS under Tag Name and associate it with File Number 7.

Click OK and your Tag mapping to the SLC file structure is complete. The PLC is now ready to communicate with the Verbatim Gateway.

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 via DF1. Once linked, the Verbatim Gateway will monitor RC status and Alarms according to your settings.

Connections to the PLC are via the onboard RJ45 port or NET. With the V232/485 comm card, two NET / ports are provided. NET ID = 1 is dedicated to the DH485 protocol and NET ID = 2 is configurable for either Modbus RTU Master or DF1. (Refer to table #1.)

Table #1

N	Protocol	Reference	Description	Nets
0	NONE		Device disbled	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**

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.

As per the Table #1 above, set the Protocol Driver to DF1 on NET 2.
Key in 4906 2<point> 3 <enter>
To read the Protocol Driver for Net 2, key in 4906 2<enter>

STEP #2 — Node Address (4905)

Choose a unique DF1 NODE address for the Verbatim Gateway. As illustrated above, we've already selected NODE / STATION 1 for the PLC. DF1 allows NODE addresses to range from 1–64.

For example, set the Gateway NODE address to "2" by using code 4905.
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 PLC.

RACO recommends the following communication settings:

BAUD rate =   19200   for "19200," key in 4901 <point>19200 <enter>
Stop Bits =   1   for "1" on NET 2, key in 4903 2<point> 1 <enter>
Parity =   EVEN   for "EVEN" on NET 2, key in 4904 2<point> 2 <enter>

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

STEP #4 — Confirmations (4900, 4901, 4930, 4946)
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 that communication settings reflect the above, at NET 2, key in 4900 21<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 DF1 (i.e. 2)
2   NODE / STATION address of the target PLC
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 "1" of NET 2, key in 4911 1 <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.

The two examples that follow illustrate the link to the PLC data table (via DF1, Table #2) to the Verbatim Gateway channels.

Example #1
To link B3:0/0 in the PLC to Channel 1 as per the PLC file structure illustrated above, type the following…

4501 <point> <shift> <B> <3> <shift> <:> <0> <shift> </> <0> <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 link N7:0 in the SLC PLC to Channel 2 as per our PLC file structure illustrated above, type the following…

4502 <point> <shift> <N> <7> <shift> <:> <0> <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.

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 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