

Substation Automation and Protection Division

ORION Quick Start Guide For The Conitel C300 Or C2020 To ABB Protective Relays Using Modbus

This Quick Start Guide shall enable the user to attach a single ABB 2000R series protective relay to the ORION unit communicating over a 485 physical cable connection.

Required equipment:

- A. ORION UNIT
- B. ONE ABB PROTECTIVE RELAY (TPU/GPU/DPU 2000R)
- C. IBM Compatible PC with DOS 5.0 (or greater), Windows 3.1, 95, or 98 installed.
- D. ONE CABLE ASSEMBLY KIT WHICH CONTAINS:
 - a. One RS 232 Cable.
 - b. One RS 485 Cable.
 - c. One Troubleshooting Diskette.

1. Apply power to the universal power supply according to the markings on the unit as shown in Figure 1 illustration 1. The unit accepts voltages from 55 to 200 V a.c. or 20 to 280 V d.c.

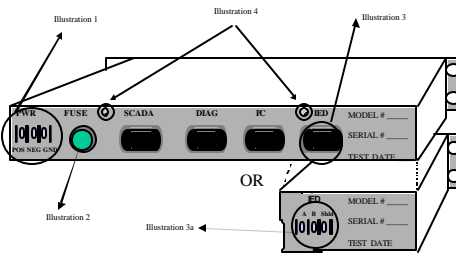
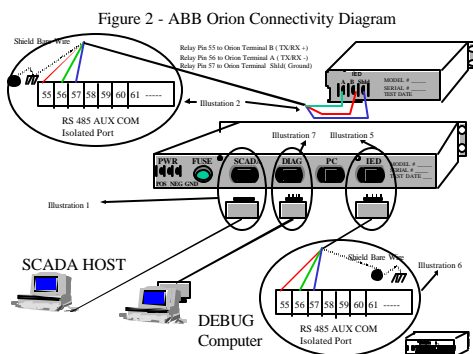


FIGURE 1 ORION Connector Location

2. Connect the SCADA host to the ORION SCADA MASTER RS 232 port with a 9 pin D shell connector. The cable end should mate with the ORION's male connector. The unit is a DTE pinout and a custom cable may have to be developed for your application since SCADA Host RS 232 connections, handshaking requirements vary per each manufacturer. The ORION SCADA MASTER RS 232 port connection is shown in Figure 2 illustration 1.



3. Configure the IED port in RS 485 mode. The IED port is shown in Figure 1, illustrations 3 and 3a. Some units may have a DB 9 port for RS 485 device connection whereas others may have three screw terminals for an IED port physical connection. Remove the two screws from the rear of the unit as shown in Figure 1, illustration 4. Slide the metal cover away from the unit to expose the electronic boards contained within the enclosure. As shown in Figure 3, five jumpers, JP 11, JP 12, JP 13, JP 14, and JP15 shall be placed in the appropriate positions as indicated in Figure 3. Breakouts of each of the jumper locations are shown in Illustration 1 and Illustration 2. The position of the jumpers in the "open" or "closed" positions are highlighted.
4. Replace the metal cover and tighten the two sheet metal screws (Figure 1 Illustration 4) to retain the cover in position.

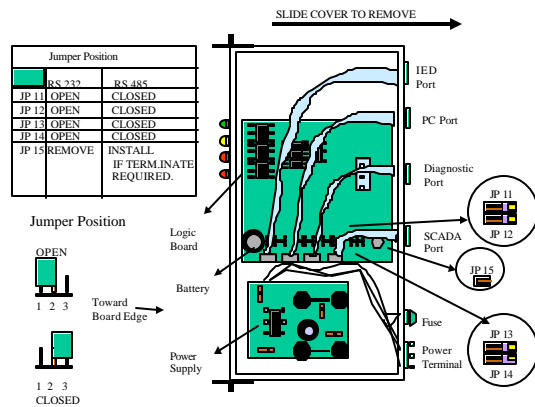


Figure 3 - ORION Jumper Locations

5. Within the optional cable assembly pack is a 50 foot length of cable with a 9 pin D shell connector on one end and three bare conductors (red, green, and blue), with a shield on the other. If the IED port on the supplied unit is a 9 pin DB9, connect the male D shell connector to the IED port which is shown in Figure 1 illustration 3 as well as Figure 2 Illustrations 5 and 6. Tighten the cable retaining screws to firmly attach the cable to the unit. If the physical connection not a DB 9 connection, interconnect the devices as shown in Figure 2 Illustration 2. Refer to the OPTIONAL INFORMATION section at the end of this document for specific cable pinout designations.
6. The DPU/GPU/TPU 2000R relays allow for RS 485 communication through the AUX COM PORT. Its location is shown in Figure 2 (illustration 6 and Illustration 5 or Illustration 2 depending upon the physical connection type). Connect the conductors as follows. RED (TX/RX +) to terminal 55, GREEN (TX/RX -) to terminal 56, and common Blue (Common). The shield (in this quick start case only), shall be connected to the frame ground connector as shown. Reference the ABB literature for setting the relay jumpers on the RS 485 communication card to install termination, pull-up and pull-down resistors on the last unit on the IED chain. The example in this Quick Start guide only incorporates one ABB protective device. Termination resistors for the AUX COM Port J6, J7, and J8 should be set to the "IN" position. In an installation involving more than one IED, the last IED on the communications cable should be the only unit with termination and pull-up/down resistors installed.
7. The DPU/GPU/TPU 2000R relays must be configured to allow for MODBUS communications via the RS 485 AUX COM PORT. Most of the relays are purchased with a Front Panel LCD operator interface. Configuration keystrokes are described which place the relay in MODBUS RTU mode which enables communication between the ORION IED port and the ABB protective relay port.
 - A. From the front panel MMI enter the Settings Menu. Then enter the Change Settings menu.
 - B. Cursor down to the Communications menu and enter it.
 - C. Cursor down to RP232 Baud menu and enter it.
 - D. Arrow right until the desired baud rate is found. Press enter.

- E. Press clear to return to Communications menu.
- F. Cursor down to RS485 Frame menu and enter it. Arrow right until E-8-1 is displayed.
- G. Press enter and then press clear to return to Communications menu. Arrow down to Parameter 1 and enter it by pressing enter key.
- H. Arrow right for 2.00. Press enter and then clear to exit back to Communications menu.
- I. Arrow down to Mode 1 and press enter. Arrow right to select DISABLE and press enter.
- J. Press clear to exit to Communications menu.
- K. Press clear once more and select YES to save settings.

The parameters are now set as per the following:

Parameter 1 = 2

Mode Parameter 1 =Disabled

Mode Parameter 2 =Disabled The Relay is now set for the following operational modes : Port 3 (RS 232) =STD 10 byte and AUX COM Port =Modbus RTU

- 8. The ORION unit allows the operator to configure the unit by connecting an IBM compatible PC RS 232 port via a cable. Attach the RS 232 cable to the ORION DIAGNOSTIC PORT as shown in Figure 2, illustration 7.
- 9. SOFTWARE CONFIGURATION: Supplied with the unit is a diskette with a file “ CTL2MOD.exe”. This file configures the point mapping for the Conitel C300 to Modbus conversion. The Conitel information varies from the format of Modbus and therefore the mapping of the two dissimilar protocol’s points must occur. Place the file into the a directory within the personal computer. TYPE “CTL2MOD” and depress the “ENTER KEY”.
- 10. Use the arrow keys to scroll to the “Setup” Menu. Select the submenu titled PC –Prot Conv. The following menu shall appear. Select the parameters as shown. The Port selection, however should be modified to match your computer systems hardware configuration. After selection of all parameters, simultaneously depress the “CONTROL and ENTER” key on the configuration terminal’s keyboard.

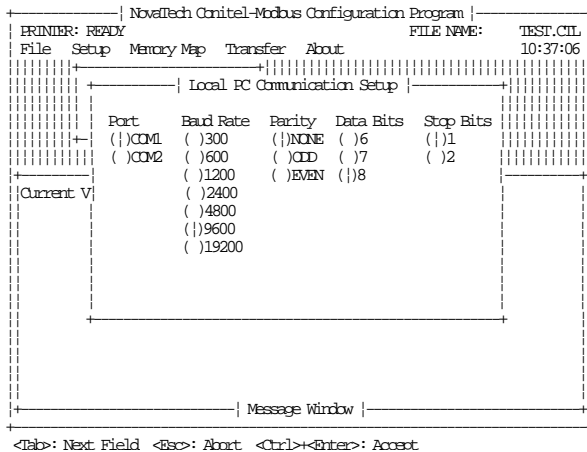


Figure 4 – Local PC Communication Setup Screen For The Orion Diag Port.

- 11. With the “SETUP” parameter highlighted, select the ProtConv Modbus Setup submenu selection, until the following screen is displayed. The parameters listed in Figure 5 match those in the protective device configuration (Step 7). After selection of all parameters, simultaneously depress the

“CONTROL and ENTER” key on the configuration terminal's keyboard.

```

+-----+ NovaTech Conitel-Modbus Configuration Program +-----+
| PRINTER: READY                                     FILE NAME: TEST.CIL |
| File Setup Memory Map Transfer About              10:37:10 |
+-----+-----+-----+-----+
| PC-P+-----+ Modbus Communication Setup +-----+
| Prot|
| Prot|
|-----+-----+-----+-----+
| Baud Rate Parity Data Bits Stop Bits |
| ( )300 ( )NONE ( )6 ( )1 |
| ( )600 ( )ODD ( )7 ( )2 |
| ( )1200 ( )EVEN ( )8 |
+-----+-----+-----+-----+
| Current Video |
| ( )2400 |
| ( )4800 |
| ( )9600 |
| ( )19200 |
| WarmUp Time [ms]: 10 |
| WarmDown Time [ms]: 10 |
| Response Timeout [ms]: 1000 |
| Intercommand Delay [ms]: 100 |
+-----+-----+-----+-----+
| Message Window |
+-----+-----+-----+-----+
| <Tab>: Next Field <Esc>: Abort <Ctrl>+<Enter>: Accept |

```

Figure 5 - Orion Modbus IED Port Configuration Screen.

- With the “SETUP” parameter highlighted, select the ProtConv Conitel Setup submenu selection, until the following screen is displayed. The parameters listed in Figure 6 match those in the Conitel Host. After selection of all parameters, simultaneously depress the “CONTROL and ENTER” key on the configuration terminal's keyboard.

```

+-----+ NovaTech Conitel-Modbus Configuration Program +-----+
| PRINTER: READY                                     FILE NAME: TEST.CIL |
| File Setup Memory Map Transfer About              10:37:15 |
+-----+-----+-----+-----+
| PC+-----+ Edit Conitel Cnm Parameters +-----+
| Pro|
| Pro|
|-----+-----+-----+-----+
| Station Address: 1 |
| Baud Rate: 1200 |
| Warmup Time [ms]: 40 |
| Warmdown Time [ms]: 0 |
| Timeout [ms]: 800 |
| PLC with Reset Coil: 1 |
| Reset Coil: 9999 |
| Check Back Before Operate Time [ms]: 1000 |
+-----+-----+-----+-----+
| Message Window |
+-----+-----+-----+-----+
| <Esc>: Abort <Ctrl>+<Enter>: Accept New Parameters |

```

Figure 6 – Conitel Configuration Screen For The Orion Scada Port

- The configuration of each of the hardware communication ports is now completed. The next steps illustrate the configuration of a single point map from the Conitel unit to the Modbus nodes attached. Within the Configuration Program, select the MEMORY MAP item in the configuration selection, a display with several choices is displayed. Select the ADD INPUTS selection.

```

+-----+ NovaTech Conitel-Modbus Configuration Program |-----+
| PRINTER: READY | FILE NAME: TEST.CTL |
| File Setup Memory Map Transfer About | 10:37:30 |
+-----+-----+-----+
| Standard | Add Inputs |
| Special +-| Select Point Type +---+
|          | 1: Conitel Input - AI |
|          | 2: Conitel Input - ACCUM |
|          | 3: Conitel Input - POLL  |
|          | 4: Conitel Input - MCD-NO|
|          | 5: Conitel Input - MCD-NC|
|          | 6: Conitel Input - STATUS|
|          | 7: Conitel Input - FLOAT |
+-----+-----+-----+
| Current Video Mode = 80x25 |
+-----+-----+-----+
| Message Window |
+-----+-----+-----+
Use Cursor Keys to Move Select Bar then <Enter>, <Esc>: Quit
    
```

Figure 7 – Add Inputs Point Configuration Screen

- For this “QUICK START” example, Conitel Input AI shall be configured for a DPU 2000R device attached to the IED port. If the DPU 2000R Modbus document is reviewed, Phase A, B, and C, load currents and their respective load angles are located at eight consecutive registers beginning at 40257 through 40264 and they shall be remapped to the Conitel blocks 1b through 5a. The Conitel SCAN INPUT command shall access these blocks. After selection of all parameters, simultaneously depress the “CONTROL and ENTER” key on the configuration terminal’s keyboard.

```

+-----+ NovaTech Conitel-Modbus Configuration Program |-----+
| PRINTER: READY | FILE NAME: TEST.CTL |
| File Setup Memory Map Transfer About | 10:38:33 |
+-----+-----+-----+
| Standard Modbus-Conitel Input |
+-----+-----+-----+
| Conitel Data Type: AI |
| Point Description: Analog Input #1 |
| Conitel Group: 1 |
| Conitel Point Start: 1 |
| Number of Conitel Points: 8 |
| Conitel Section Start: 1b |
| Conitel Section End: 5a |
|
| MODICON PLC Address: 2 |
| Start Modbus Register: 40257 |
| Number of Registers: 8 |
| Zero Value: 0.0000 |
| Span Value: 400.00 |
+-----+-----+-----+
| Message Window |
+-----+-----+-----+
<Tab>: Next Field <Esc>: Abort <Ctrl>+<Enter>: Accept
    
```

Figure 8 – Analog Input Mapping Screen

- The configuration files must now be downloaded to the ORION unit. Select the TRANSFER menu and then select the Download Option. The following screen should be displayed. When the parameters are accepted by the ORION, an indication shall be shown on the screen. Additionally, the amber CONFIG LED at the front panel of the unit shall not flash. A constant illumination shall appear on the LED. Figure 9 illustrates the menu selection for download selection.

```

+-----+ NovaTech Conitel-Modbus Configuration Program +-----+
| PRINTER: READY                                     FILE NAME: TEST.CTL |
| File  Setup  Memory Map  Transfer  About          10:36:58 |
|-----+-----+-----+-----+-----+-----+
|                                     Run MMI         |
|                                     DownLoad ->    |
|                                     UpLoad  <-|    |
|-----+-----+-----+-----+-----+-----+
| Current Video Mode = 80x25                    |
|-----+-----+-----+-----+-----+-----+
|                                     Message Window |
+-----+-----+-----+-----+-----+
Open Window to Run the Protocol Converter MMI
    
```

Figure 9 – Transfer And Debug Configuration Screen

16. The ORION Unit is now configured for communication to both the Conitel Host and the Modbus IED. When the Conitel Host polls the ORION unit, the Red TX and RX LED's shall illuminate on a Host Transmission and ORION Response. To observe the communication strings sent/received by the ORION, by selecting the "RUN MMI" menu item as illustrated in Figure 9, shall reveal the following menu items displayed upon the PC screen.

PRESS ANY KEY TO CONTINUE

POLLING STATUS: CONITEL OFF, ADDR 1, MODBUS OFF.

- 1) TOGGLE CONITEL PORT DISPLAY, CURRENTLY OFF.
- 2) TOGGLE MODBUS PORT DISPLAY, CURRENTLY OFF.
- M) MODEM SETUP and TEST MENU
- S) DISPLAY COMMUNICATION STATISTICS.

Please enter your Selection:

- 17. Depress "2" to select the Modbus Port Display , the menu should be redisplayed with the status of the port.
- 18. Depress "S" to display the communication strings sent and received over the ORION IED port. The status of the communication statistics sends and replies will also be displayed.
- 19. Depress 1 to select the Conitel Port Display strings sent and received over the ORION SCADA port.
- 20. If the software or hardware configuration or setups of the unit are incorrect, the unit may not report a response or a transmission. Refer to Table 1 of this document to aid in troubleshooting the ORION installation.
- 21. If the PORT CONFIGURATION and the CONITEL/MODBUS point mapping is correct, the data strings will reveal the Modbus/CONITEL commands sent/received over the network. The total of commands, sent/received shall be approximately the same.

ORION Troubleshooting Guide

This section illustrates some common solutions to problems encountered when configuring an ORION unit in the configuration described in this Quick Start Guide. Reference Table 1 below.

Table 1 – Troubleshooting Guide

ISSUE	RESOLUTION
1. The ORION unit LED's do not illuminate.	<ul style="list-style-type: none"> A. Verify the power wiring to the power connector (Figure 1 Illustration 1). B. Check for a blown fuse (Figure 1 Illustration 2).
2. The ORION Green RUN LED does not flash at a 1 second interval.	A. Unit is defective. Contact reseller for a return authorization number
3. Communication does not occur between the Diagnostic port and the emulator terminal on the ORION. (Unit will not attach for configuration of the unit [Steps 15 through 21]).	<ul style="list-style-type: none"> A. Verify the RS 232 Cable Connections from the PC to ORION Diag port. (Figure 2 Illustration 7). B. Verify the PC to Prot Conv settings accessible through the setup menu of the CON2MOD setup utility. (Step 10 Figure 4). C. Does the PC com port match the com port settings in the PC to Prot Conv setting menu. (Step 10 Figure 4).
4. The ORION Amber CONFIG LED flashes .	A. The ORION has not been configured. Download the saved configuration file from the configuration terminal. (Step 15 Figure 9)
5. Communication does not occur between the relay and the ORION connection via the IED port on the ORION.	<ul style="list-style-type: none"> A. Verify the Supplied IED RS 485 connections and cable connections as shown in Figure 2. B. Verify the port parameters in the attached relay as described in Step 7. C. Verify the ORION configuration settings as described in Step 11 Figure 5. D. Have the configuration settings been downloaded to the ORION as described in Step 15 Figure 9. E. Modify the Warm –Up and Warm Down delays in the Modbus IED port parameterization screen to be 10 mS less than is presently configured. Download the new configuration to the ORION Unit. (Step 11 Figure 5 and Step 15 Figure 9).
6. The Red TX or RX LED's do not illuminate on the ORION Unit when the Conitel Host communicates to the ORION Unit.	<ul style="list-style-type: none"> A. Verify the SCADA Port Cabling per the Host manufacturer's specification. B. Verify the Conitel Port Configuration through the setup menu of the CON2MOD setup utility. (Step 12 Figure 6). C. Port Timeout has occurred; decrease the Warm Up and Warm-down timeout values by 10 mS until issue resolved.
7. Communications Strings are not visible when the RUN MMI and submenu 2 Toggle Modbus Port Display) selection are visible (steps 16 through 21)	<ul style="list-style-type: none"> A. Verify the Supplied IED RS 485 connections and cable connections as shown in Figure 2. B. Verify the port parameters in the attached relay as described in Step 7. D. Verify the ORION configuration settings

	<p>as described in Step 11 Figure 5.</p> <p>E. Have the configuration settings been downloaded to the ORION as described in Step 15 Figure 9.</p> <p>F. A timeout has occurred. Modify the Warm-Up and Warm Down delays in the Modbus IED port parameterization screen to be 10 mS less than is presently configured. Download the new configuration to the ORION Unit. (Step 11 Figure 5 and Step 15 Figure 9).</p>
<p>8. Excessive CRC errors result when viewing the communication strings via the con2mod diagnostic screens.</p>	<p>A. Determine that the jumper settings have been set for RS 485 (Step 3 Figure 2) operation.</p> <p>B. .Verify that the termination resistor and the pullup resistors are configured in the IED protective relay (Jumpers J6 [termination], J8 [Pullup], and J7 [Pulldown]) (Step 6).</p>
<p>9. Communications Strings are not visible when the RUN MMI and submenu 1 Toggle Conitel Port Display) selection are visible (steps 16 through 21)</p>	<p>A. Check the SCADA Port Cabling per the Host manufacturer's specification.</p> <p>B. Verify the (SCADA) Conitel Port Configuration through the setup menu of the CON2MOD setup utility. (Step 12 Figure 6).</p> <p>C. Conitel (SCADA) Port Timeout has occurred decrease the Warm Up and Warm-down timeout values by 10 mS until issue resolved.</p> <p>D. Verify the Supplied IED RS 485 connections and cable connections as shown in Figure 2 (Step 6).</p> <p>E. Verify the IED port parameters in the attached relay as described in Step 7.</p> <p>G. Verify the ORION IED configuration settings as described in Step 11 Figure 5.</p> <p>H. Have the configuration settings been downloaded to the ORION as described in Step 15 Figure 9.</p> <p>I. A timeout has occurred. Modify the IED's Warm-Up and Warm Down delays in the Modbus IED port parameterization screen to be 10 mS less than is presently configured. Download the new configuration to the ORION Unit. (Step 11 Figure 5 and Step 15 Figure 9).</p> <p>J. If the communications between the IED and ORION are RS 485, verify that the termination resistor has been installed (JP 15) in the ORION (Figure 3).</p>

	<p>K. If the communications between the IED and ORION are RS 485, verify that the termination resistor and the pullup resistors are configured in the “end” protective relay (Jumpers J6 [termination], J8 [Pullup], and J7 [Pulldown]) (Step 6).</p>
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Optional Information

The RS 232 Cables and RS 485 Cable diagrams are included below for reference:

ORION RS 232 C CABLE

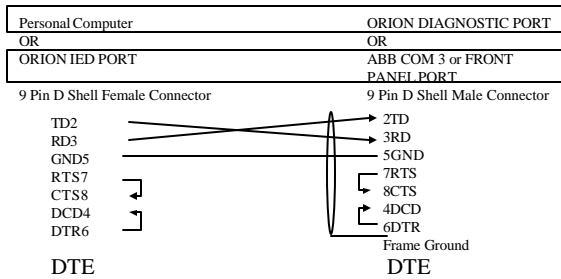
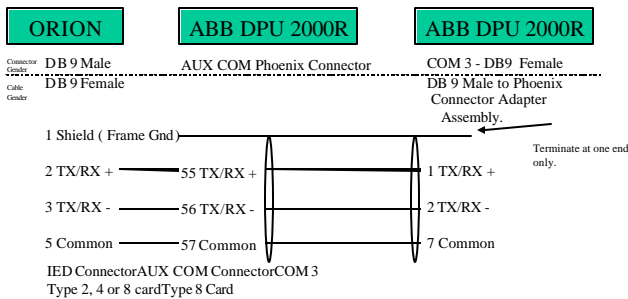


Figure 10 - Orion RS 232 Cable For Communications From The Diag Port To Personal Computer.

ORION RS 485 CABLE



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