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ENGINEERING DATA TRANSMITTAL

Page 1 of 1

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		Design Authority			
		Design Agent 8/6/98			
1	1	Cog.Eng.: D. A. Barnes - R2-11			
1	1	Cog. Mgr.: ~~M. J. Holm~~ - R2-11			
1	1	QA: ~~E. E. Hawkins~~ H8-43			
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		Env.			

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Signature of EDT Originator
Date 8/10/98

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Authorized Representative for Receiving Organization
Date

20. M. J. Holm
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Date 8/6/98

21. DOE APPROVAL (if required) Ctrl. No.
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Tank Monitor and Control System (TMACS) Software Project Westronics Driver Acceptance Test

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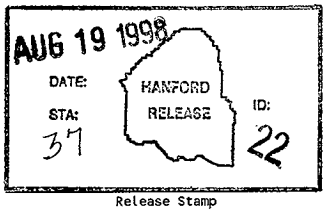
Abstract: The acceptance test for the Westronics driver. This driver connects the Westronics Smart Multiplexer with the TMACS monitoring system.



Release Stamp

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Approved for Public Release

TANK MONITOR AND CONTROL SYSTEM

(TMACS)

SOFTWARE PROJECT

WESTRONICS® DRIVER ACCEPTANCE TEST

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LMSI Software Development and Integration

Test Procedure ID	TEST DESIGN SPECIFICATION ID: **07.08.00 -00**	TITLE: Westronics Driver Acceptance Test	
UTP 07.08.00 -00	TESTING PHASE: Acceptance Test	PLATFORM: UNIX	Page 2 of 27
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FEATURES TO BE TESTED:

This procedure tests the functionality of the TMACS Westronics driver software for user acceptance. The driver is tested while communicating to a Westronics multiplexer in RTU mode with and without a code-operated switch.

TEST CASE DESCRIPTIONS:

Table 1. Test Cases

UTP 07.04.00 -00 -1. Test Embedded Mode Communication without Code Operated Switch
UTP 07.04.00 -00 -2. Test Checksum Errors While in Embedded Mode
UTP 07.04.00 -00 -3. Test Westronics Exception Errors While in Embedded Mode
UTP 07.04.00 -00 -4. Test Station Mismatch Errors While in Embedded Mode
UTP 07.04.00 -00 -5. Test Non-responsive Westronics Stations While in Embedded Mode
UTP 07.04.00 -00 -6. Test Polling Rate Changes while in Embedded Mode
UTP 07.04.00 -00 -7. Test Normal Communication through Code Operated Switch While in Embedded Mode
UTP 07.04.00 -00 -8. Verify Log Messages from Driver – Not applicable in UNIX environment – Do Not Run

Table 2. Appendices

Appendix A: Westronics Emulator Program Display and Commands
Appendix B: Emulator Configuration for Normal Operation
Appendix C: Emulator Configuration for Single Checksum Errors
Appendix D: Emulator Configuration for Multiple Checksum Errors
Appendix E: Emulator Configuration for Single Exception Error
Appendix F: Emulator Configuration for Station Mismatch Error

DEPENDENCIES:

The Westronics driver being tested must be running on the test computer.

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REFERENCES:

The acceptance criteria for this Test Procedure are taken from HNF-2607, the Functional Requirements for the Westronics Multiplexer Interface to the Tank Monitor and Control System (TMACS).

The Westronics commands are detailed in the Westronics Smart Multiplexer User Manual, Part Number MO100144-01, by Westronics, Inc., issued June, 1996 and in the Modicon Modbus Protocol at Internet URL http://www.modicon.com/techpubs/toc7.html.

FEATURE PASS/FAIL CRITERIA:

- The actual result from each test case must match the expected result.
- All incident reports generated while executing the test procedure must be resolved or closed.

TESTER INFORMATION

The TMACS system is an application built using the G2 Real-Time Expert System. The instructions for using the mouse, mouse buttons, and keyboard are given below.

The majority of user control of the system involves pointing at objects on the computer screen using the POINTER. The pointer is an arrow that is pointing to the upper left of the screen. When a user moves the mouse, the pointer moves on the screen.

The G2 system treats the left and right mouse buttons as if they were a single button. Whenever the use of a mouse button is required the user is free to use either of these buttons.

The following terms are used to describe actions performed with the mouse:

- To MOVE the pointer, slide the mouse with no buttons pressed.
- To POINT to a push-button or object, move the pointer to the appropriate place on the screen.
- To CLICK on an object, first move your mouse so that the screen pointer rests on the object. Then, press the mouse button and release immediately without moving the mouse.

To DRAG an object with the mouse, first move the mouse so that the screen pointer rests on the object. Then, press the mouse button and move the mouse without releasing the button. The object moves along with the screen pointer as you move the mouse. Release the button when the object is in the desired place. To drag a window in TMACS place the mouse in a blank area around the margin of the window and drag. (Note: the drag function is not provided for all windows.)

If the G2 screen becomes unreadable or objects overwrite each other the screen can be redrawn by typing Control-C. (Hold down the "Control" key while typing the letter C).

The Westronics stations associated with an Westronics interface can be displayed in the G2 Inspector workspace. This is very useful in showing the sample frequency for each station and the stations available for an interface. The command needed is: "Display a table of the names, obj-index, polling-freq, and last-recorded-value of every Westronics-station S such that the text of the gsi-interface-name of S = "Westronics-XX" where the "XX" is replaced by the number of the Westronics interface of interest.

Westronics Multiplexer Layout

Each Westronics unit may have up to 5 slots. Each slot may contain up to 20 sample points. The numbering for each point for each slot is:

- Slot 1 starts at point 10 and goes thorough 29.
- Slot 2 starts at point 30 and goes thorough 49.
- Slot 3 starts at point 50 and goes thorough 69.
- Slot 4 starts at point 70 and goes thorough 89.
- Slot 5 starts at point 90 and goes thorough 109.

Emulator Operation

The emulator to use is **westemul.exe**.

Refer to **Appendix A** for basic emulator menus and operation.

PRE-TEST INSPECTION AND SETUP REQUIREMENTS

This Test Procedure is run using the Westronics driver software developed for production.

Test Procedure ID	TEST DESIGN SPECIFICATION ID: **07.08.00 -00**	TITLE: Westronics Driver Acceptance Test	
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The hardware required is:

- The TMACS development computer(s).
- At least an 8-port serial multiplexer is attached to the workstation where the driver is to be tested.
- The Westronics emulator (currently on a separate computer). The emulator can be connected to any port on the driver test machine.
- (Optional if the emulator can support the code-operated switch.) A code-operated switch that can be plugged between the Westronics emulator and the driver test machine.
- A serial analyzer used to monitor the communication between TMACS and the external devices (used to view the code-operated switch commands).

To set this test up the Test Administrator must perform the following steps:

1. Verify that the Westronics Station Objects in the knowledge base use a gsi-interface connected to the Westronics driver.
2. Verify that the Westronics Station Objects have unique station addresses. For release 10.6 of TMACS there will be only analog points supported by the Westronics driver.
3. Verify that the gsi-interface is configured to point to the socket for the driver to be tested (e.g., socket 22214, 22215...) and that the driver being tested will listen on that socket.
4. Make sure the computer that will run the Westronics bridge software is connected to the Westronics emulator program through a port on the serial multiplexer on the computer.
5. If used, make sure a serial analyzer is tied into the connection between the Westronics bridge and the code-operated switch. (This is necessary to observe the data coming across the communication line for the code-operated switch).
6. Verify that the gsi-interface will configure the driver to use the serial port where the emulator/Westronics is connected.
7. Start the Westronics bridge.

Test Procedure ID **UTP 07.08.00 -00** Revision 0	TEST DESIGN SPECIFICATION ID: **07.08.00 -00** TESTING PHASE: Acceptance Test	TITLE: Westronics Driver Acceptance Test PLATFORM: UNIX	

TEST CASES WITH EXPECTED RESULTS:

UTP 07.04.00 -00 -1. Test Embedded Mode Communication without Code Operated Switch

Step	Perform	Expected Result	Initial
1.	Have the Test Administrator set up the emulator for Westronics emulation in RTU mode without the code-operated switch. Configure the Westronics Emulator like **Appendix B**. Start the Westronics emulator. Disable/enable the gsi-interface for the serial port.	Verify that commands received by the Westronics emulator from the Westronics bridge are in the form of hexadecimal digits. [SS][FF][M...M][XXXX] where [SS] is a 2 hex digit station number, [FF] is a 2 hex digit function number, [M...M] is the data field, [XXXX] is the 4 hex digit checksum value of the command.	DG
2.	G2 is running.	Verify that command responses from the Westronics emulator to the Westronics bridge is in the form of hexadecimal digits. [SS][FF][M...M][XXXX] where [SS] is a 2 hex digit station number. [FF] is a 2 hex digit function number. [M...M] is the data field, 2 hex characters for each value returned. [XXXX] is the 4 digit hexadecimal checksum value of the command response.	MB

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UTP 07.04.00 -00 -2. Test Checksum Errors While in Embedded Mode

Step	Perform	Expected Result	Initial
1.	Pause G2. Configure the Westronics Emulator like **Appendix C**. Resume G2.	Verify that TMACS is running.	
2.	Start the Westronics Emulator with display of received and transmitted messages to the screen enabled.	For the Westronics station specified, Verify that a sequence similar to that shown in **Appendix C** is displayed by the emulator after a single checksum error. This error will occur about every third poll.	
3.	G2 is running.	Verify that you do not see a white alarm stating a Checksum error has occurred displayed on the G2 MOST RECENT ALARM window. This is because a retry is attempted before a checksum error will be reported.	
4.	Pause G2. Configure the Westronics Emulator like **Appendix D**. Resume G2.	Verify that TMACS is running. Verify that the emulator is running.	
5.	G2 is running.	For the Westronics station specified: Verify that a sequence similar to that shown in **Appendix D** is displayed by the emulator after a checksum error. This error will occur about every third poll.	
6.	G2 is running.	Verify that a white alarm stating a Checksum error has occurred is displayed by G2. Note: Because of G2 internal data verification an internal alarm message will be generated which will supersede the checksum error message on the "MOST RECENT ALARM" window. Therefore, to see the white alarm you will need to get into the alarm summary paging mode by clicking on the "CURRENT ALARMS" button on the CONTROL PANEL. You will need to page through the alarms until you see the specified checksum error message.	

UTP 07.04.00 -00 -3. Test Westronics Exception Errors While in Embedded Mode

Step	Perform	Expected Result	Initial
1.	Pause G2. Configure the Westronics Emulator like **Appendix E** using any valid exception code. Valid exception code numbers are listed in **Appendix E**. Resume G2 again when this is completed.	Verify that the emulator is communicating with TMACS.	
2.	G2 is running.	For the Westronics station specified: Verify that the sequence similar to that shown in **Appendix E** is displayed after a Westronics reject error. The error will occur about every third poll to the selected address.	
3.	G2 is running.	Verify that a white alarm stating a Westronics reject error has occurred is displayed by G2 with the Westronics error code you specified in the emulator configuration. Note: Because of G2 internal data verification an internal alarm message will be generated which will supersede the reject alarm message on the "MOST RECENT ALARM" window. Therefore, to see the white alarm you will need to get into the alarm summary paging mode by clicking on the "CURRENT ALARMS" button on the CONTROL PANEL. You will need to page through the alarms until you see the specified reject alarm message.	

UTP 07.04.00 -00 -4. Test Station Mismatch Errors While in Embedded Mode

In this section we will test the situation when the driver queries one Westronics station and receives an answer from a different station. When the emulator receives a message for the station with the Selected Address it will return a response with the Mux Address. For example, with Selected Address = 2 and Mux Address = 1, polls to station 2 will be returned as if they came from station 1; the frequency of failure is set by the Error Rate.

Step	Perform	Expected Result	Initial
1.	Pause G2. Configure the Westronics Emulator like **Appendix F**. If not already present, plug the serial analyzer in to the port. Resume G2 again when this is completed.	Verify that the G2 and emulator are running.	DB
2.	G2 is running.	For the Westronics station specified: Verify that the sequence similar to that shown in **Appendix F** is displayed after a Westronics station mismatch error. This should occur about every third poll.	DB
3.	G2 is running.	Verify that a white alarm stating a Westronics station mismatch error has occurred is displayed by G2 with the Westronics error code you specified in the emulator configuration. Note: Because of G2 internal data verification an internal alarm message will be generated which will supersede the reject alarm message on the "MOST RECENT ALARM" window. Therefore, to see the white alarm you will need to get into the alarm summary paging mode by clicking on the "CURRENT ALARMS" button on the CONTROL PANEL. You will need to page through the alarms until you see the specified reject alarm message.	DB

UTP 07.04.00 -00 -5. Test Non-responsive Westronics Stations While in Embedded Mode

In this section we will test the situation when an Westronics station stops communicating with the Westronics bridge that the bridge will not attempt to re-send a command to that station. We will also verify that when communication is restored that the Westronics bridge will only send a retry when a checksum error is received from the station. The serial analyzer is needed to verify the operation of TMACS for these tests.

Step	Perform	Expected Result	Initial
1.	Pause G2. Configure the Westronics Emulator like **Appendix B**. Unplug the cable to the Westronics emulator from the serial multiplexer. If not already present, plug the serial analyzer in to the port. Resume G2 again when this is completed.	Verify that the G2 and emulator are running.	
2.	G2 is running.	Verify that the Westronics stations on this Serial Port no longer respond to commands from the TMACS Westronics Bridge and that the bridge does not resend commands to which no response is received. This can be observed by the use of a Serial Analyzer between the Unix workstation and Westronics emulator.	
3.	G2 is running.	Verify that white alarm messages appear on the G2 message workspace notifying you that communication has been lost with these stations. E.g., "TMACS cannot communicate with this station" with the port number and station identified.	
4.	Plug the cable from the Westronics emulator back into the serial multiplexer.	Verify that the G2 and emulator are running.	
5.	G2 is running.	Verify that the Westronics stations on this Serial Port now respond to commands from the TMACS Westronics Bridge.	
6.	G2 is running.	Verify that white alarm messages appear on the G2 message workspace notifying you that communication has been established with these stations	

Step	Perform	Expected Result	Initial
7.	Stop the driver process.	Verify that there is a white alarm message on the G2 message workspace stating, "The link between TMACS and its I/O driver has been broken" with the port number identified."	DB
8.	Start the driver process.	Verify that G2 does not communicate with the driver.	DB
9.	Disable and enable the gsi-interface object for the channel.	Verify that G2 communicates with the driver and presents a white alarm message on the G2 alarm workspace stating, "The link between TMACS and its I/O driver has been established" with the port number identified.	DB

UTP 07.04.00 -00 -6. Test Polling Rate Changes while in Embedded Mode

Step	Perform	Expected Result	Initial
1.	Have the Test Administrator set up the test for Westronics emulation mode without using the code-operated switch. Configure the Westronics Emulator like **Appendix B**. When the Westronics emulator and Westronics driver software are running, enable the display of send and received commands on the emulator.	Verify that the emulator is communicating with G2.	DB
2.	Login in the administrator mode and bring up the display of an Westronics object that is connected to the test port. Observe the sample frequency of the Westronics object.	Write the value here 60. A value of 1 = sampled every 1 seconds. A value of 2 = sampled every 10 seconds. A value of 3 = sampled every 60 seconds. A value of 4 = sampled every 600 seconds. Verify that the object does poll at the expected rate by looking for the polling message on the serial analyzer or emulator.	DB
3.	Change the sample frequency of the Westronics object. Valid values as of 6/1/98 are 1,2,3 and 4.	Write the new value here 10. Verify that the object is polled only at the new rate by looking for the polling message on the serial analyzer.	DB.
4.	Change the sample frequency of the Westronics object to 0.	Verify that the object is no longer polled at any rate. (This will require observing for > 10 minutes.)	DB

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Step	Perform	Expected Result	Initial
5.	Change the sample frequency of the Westronics object to the original value.	Verify that the object is polled only at the new rate by looking for the polling message on the serial analyzer or emulator.	

UTP 07.04.00 -00 -7. Test Normal Communication through Code Operated Switch While in Embedded Mode

As of May, 1998, the Westronics emulator does not support emulation of the code-operated switch. To run this section a code-operated switch must be connected between the Westronics driver serial port and the Westronics emulator or test unit.
A serial analyzer is needed to see the arming character and channel selection character for the code-operated switch. This analyzer should be connected between the driver serial port and the code-operated switch since the code-operated switch does not pass on the arming and port selection characters.

Step	Perform	Expected Result	Initial
1.	Have the Test Administrator set up the test for Westronics emulation mode using the code-operated switch. Configuration for the Westronics Emulator is given in **Appendix B except that the code-operated switch is enabled**. When the Westronics emulator, code-operated switch, and Westronics driver software are running, enable the display of send and received commands on the emulator.	Verify that commands sent from the port on the slave are in the form of ASCII hexadecimal digits and ASCII characters: [A][P][SS][FF][M...M][XXXX] where [A] is the code-operated switch arming character, [P] is the port number character. [SS] is a 2 hex digit station number, [FF] is a 2 hex digit function number, [M...M] is the data field, [XXXX] is the 4 hex digit checksum value of the command.	

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Step	Perform	Expected Result	Initial
2.	G2 is running.	Verify that command responses from the Westronics emulators to the Westronics bridge is in the form of ASCII hexadecimal digits and ASCII characters given below: [SS][FF][M...M][XXXX] where [SS] is a 2 hex digit station number. [FF] is a 2 hex digit function number. [M...M] is the data field, 2 hex characters for each value returned. [XXXX] is the 4 digit hexadecimal checksum value of the command response.	

UTP 07.04.00 -00 -8. Verify Log Messages from Driver – Not applicable in UNIX environment – Do Not Run

Step	Perform	Expected Result	Initial
1.	On the computer running the driver, use the Event Viewer to check the Event Log for messages from the Westronics Driver.	Verify that there is a startup message dated when the Westronics driver was started for this testing.	
2.		Verify that there is a shutdown message from step UTP 07.04.00 -00 -4.	
3.		Verify that there is a startup message from step UTP 07.04.00 -00 -4.	
4.		Verify that there are no other driver messages produced as a result of this testing.	

Appendix A: Westronics Emulator Program Display and Commands

Display on startup

C:\TMACS\Emulator executables>westemul
Term_Emulator, Version 1: Press Control-A for a summary of commands

Main Menu for Westronics Emulator Program

Main Menu

A. Data Format, Baud rate
B. RS-232 control
C. Transmit BREAK signal
D. Upload Text File
E. Download Text File (small buffer)
F. Download Text File (large buffer)
G. Access Menu Character
H. Display characters in HEX
I. Enable output poll string
J. Define output poll string
K. Set output poll delay time
L. Configure TMACS Emulator
Q. EXIT from TERM.

Enter selection (CR to quit menu):

From the Main menu Option L brings up the menu:

CURRENT EMULATOR MODE: Disabled

Choice Options Are
1. Disable
2. Acromag
3. Enraf
4. Panalarm
5. Westronics

Enter your choice (press Return to exit):

Then Option 5 brings up the menu:

Westronics Emulator Menu
---

1. Read Configuration File
2. Display Configuration Parameter Values
3. Change Configuration Parameter Values
4. Save Configuration To File
5. Enable WESTRONICS Emulator
6. Disable WESTRONICS Emulator

Enter selection (CR to quit menu) :

Then Option 2 brings up the display:

Display Configuration Parameters WESTRONICS PARAMETERS

1. Code Operated Switch: OFF
2. Tx Delay Time: 0.00
3. Error Rate %: 0.00
4. Multiple Error: 0 hex, 0 dec
5. Checksum Mask: 0 hex, 0 dec
6. Exception Value: 0 hex, 0 dec
7. Modbus Mode RTU: ON
8. Coil Register: 0 hex, 0 dec
9. Status Register: 0 hex, 0 dec
10. Hold Register #01: 0 hex, 0 dec
11. Hold Register #02: 0 hex, 0 dec
12. Hold Register #03: 0 hex, 0 dec
13. Hold Register #04: 0 hex, 0 dec
14. Hold Register #05: 0 hex, 0 dec
15. Hold Register #06: 0 hex, 0 dec
16. Hold Register #07: 0 hex, 0 dec
17. Hold Register #08: 0 hex, 0 dec
18. Hold Register #09: 0 hex, 0 dec
19. Hold Register #10: 0 hex, 0 dec
20. Hold Register #11: 0 hex, 0 dec

(- Press any key to continue -)

21. Hold Register #12: 0 hex, 0 dec
22. Hold Register #13: 0 hex, 0 dec
23. Hold Register #14: 0 hex, 0 dec
24. Hold Register #15: 0 hex, 0 dec
25. Hold Register #16: 0 hex, 0 dec
26. Hold Register #17: 0 hex, 0 dec

27. Hold Register #18: 0 hex, 0 dec
28. Hold Register #19: 0 hex, 0 dec
29. Hold Register #20: 0 hex, 0 dec
30. Mux Address: 0 hex, 0 dec
31. TC Temperature: 130.00
32. Temperature Mux Offset: 5.00
33. Temperature Register Offset: 1.00
34. Selected Address: 0 hex, 0 dec
35. Selected Register: 0 hex, 0 dec
36. Selected TC Temperature: 0.00

(- Press any key to continue -)

Pressing the Enter key brings up the Menu:

Westronics Emulator Menu
---

1. Read Configuration File
2. Display Configuration Parameter Values
3. Change Configuration Parameter Values
4. Save Configuration To File
5. Enable WESTRONICS Emulator
6. Disable WESTRONICS Emulator

Enter selection (CR to quit menu) :

From the Westronics Emulator Menu Option 5 enables the Westronics emulator. The emulator will be started when you press the Enter key twice.

When the emulator is operating it recognizes the following commands:

- " " = Display total transmitted responses
- "B" = Audible bell enable, disable
- "F" = Display command identification
- "R" = Display received commands
- "S" = Display sent responses
- "+" = Raise selected temperature
- "-" = Lower selected temperature
- "=" = Display selected temperature
- "?" = List valid commands

If the bell is used it will upset the timing of the emulator and cause time-out failures in TMACS. Do not use the bell for normal operation.

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Appendix B: Emulator Configuration for Normal Operation

Display Configuration Parameters WESTRONICS PARAMETERS

1. Code Operated Switch: OFF
2. Tx Delay Time: 0.00
3. Error Rate %: 0.00
4. Multiple Error: 0 hex, 0 dec
5. **Checksum Mask: 10 hex, 16 dec**
6. Exception Value: 0 hex, 0 dec
7. **Modbus Mode RTU: ON**
8. Coil Register: 0 hex, 0 dec
9. Status Register: 0 hex, 0 dec
10. Hold Register #01: 0 hex, 0 dec
11. Hold Register #02: 0 hex, 0 dec
12. Hold Register #03: 0 hex, 0 dec
13. Hold Register #04: 0 hex, 0 dec
14. Hold Register #05: 0 hex, 0 dec
15. Hold Register #06: 0 hex, 0 dec
16. Hold Register #07: 0 hex, 0 dec
17. Hold Register #08: 0 hex, 0 dec
18. Hold Register #09: 0 hex, 0 dec
19. Hold Register #10: 0 hex, 0 dec
20. Hold Register #11: 0 hex, 0 dec
21. Hold Register #12: 0 hex, 0 dec
22. Hold Register #13: 0 hex, 0 dec
23. Hold Register #14: 0 hex, 0 dec
24. Hold Register #15: 0 hex, 0 dec
25. Hold Register #16: 0 hex, 0 dec
26. Hold Register #17: 0 hex, 0 dec
27. Hold Register #18: 0 hex, 0 dec
28. Hold Register #19: 0 hex, 0 dec
29. Hold Register #20: 0 hex, 0 dec
30. **Mux Address: 1 hex, 1 dec**
31. **TC Temperature: 130.00**
32. **Temperature Mux Offset: 5.00**
33. **Temperature Register Offset: 1.00**
34. **Selected Address: 1 hex, 1 dec**
35. **Selected Register: 0F hex, 15 dec**
36. Selected TC Temperature: 0.00

Appendix C: Emulator Configuration for Single Checksum Errors

Display Configuration Parameters WESTRONICS PARAMETERS

1. Code Operated Switch: OFF
2. Tx Delay Time: 0.00
3. **Error Rate %: 30.00**
4. Multiple Error: 0 hex, 0 dec
5. **Checksum Mask: 10 hex, 16 dec**
6. Exception Value: 0 hex, 0 dec
7. Modbus Mode RTU: ON
8. Coil Register: 0 hex, 0 dec
9. Status Register: 0 hex, 0 dec
10. Hold Register #01: 0 hex, 0 dec
11. Hold Register #02: 0 hex, 0 dec
12. Hold Register #03: 0 hex, 0 dec
13. Hold Register #04: 0 hex, 0 dec
14. Hold Register #05: 0 hex, 0 dec
15. Hold Register #06: 0 hex, 0 dec
16. Hold Register #07: 0 hex, 0 dec
17. Hold Register #08: 0 hex, 0 dec
18. Hold Register #09: 0 hex, 0 dec
19. Hold Register #10: 0 hex, 0 dec
20. Hold Register #11: 0 hex, 0 dec
21. Hold Register #12: 0 hex, 0 dec
22. Hold Register #13: 0 hex, 0 dec
23. Hold Register #14: 0 hex, 0 dec
24. Hold Register #15: 0 hex, 0 dec
25. Hold Register #16: 0 hex, 0 dec
26. Hold Register #17: 0 hex, 0 dec
27. Hold Register #18: 0 hex, 0 dec
28. Hold Register #19: 0 hex, 0 dec
29. Hold Register #20: 0 hex, 0 dec
30. **Mux Address: 1 hex, 1 dec**
31. **TC Temperature: 130.00**
32. **Temperature Mux Offset: 5.00**
33. **Temperature Register Offset: 1.00**
34. **Selected Address: 1 hex, 1 dec**
35. **Selected Register: 0F hex, 15 dec**
36. Selected TC Temperature: 0.00

Sample Output From Westronics Emulator for Single Checksum Error

This example is for a Westronics emulator #1, slot 1. The actual port and Westronics station number may be different in testing. The displays were captured with the emulator options "F" and "S" turned on. The check sums are **bolded**.

Response to driver from emulator with valid check sum. There is a single poll and response.

```
Function (04) - Read Input Registers
01 04 24 05 46 05 50 05 5A 05 64 05 6E 05 E6 05 82 05 8C 05 96 05 A0 05 AA 05 B4
 05 BE 05 C8 05 D2 05 DC 05 E6 05 F0 0A D7
```

Response to driver from emulator with invalid check sum, followed by valid check sum. The poll with the invalid check sum is followed immediately by a retry from the driver.

```
Function (04) - Read Input Registers
01 04 24 05 46 05 50 05 5A 05 64 05 6E 05 E6 05 82 05 8C 05 96 05 A0 05 AA 05 B4
 05 BE 05 C8 05 D2 05 DC 05 E6 05 F0 0A DD
Function (04) - Read Input Registers
01 04 24 05 46 05 50 05 5A 05 64 05 6E 05 E6 05 82 05 8C 05 96 05 A0 05 AA 05 B4
 05 BE 05 C8 05 D2 05 DC 05 E6 05 F0 0A D7
```

Appendix D: Emulator Configuration for Multiple Checksum Errors

Display Configuration Parameters WESTRONICS PARAMETERS

1. Code Operated Switch: OFF
2. Tx Delay Time: 0.00
3. **Error Rate %: 30.00**
4. **Multiple Error: 1 hex, 1 dec**
5. **Checksum Mask: 10 hex, 16 dec**
6. Exception Value: 0 hex, 0 dec
7. Modbus Mode RTU: ON
8. Coil Register: 0 hex, 0 dec
9. Status Register: 0 hex, 0 dec
10. Hold Register #01: 0 hex, 0 dec
11. Hold Register #02: 0 hex, 0 dec
12. Hold Register #03: 0 hex, 0 dec
13. Hold Register #04: 0 hex, 0 dec
14. Hold Register #05: 0 hex, 0 dec
15. Hold Register #06: 0 hex, 0 dec
16. Hold Register #07: 0 hex, 0 dec
17. Hold Register #08: 0 hex, 0 dec
18. Hold Register #09: 0 hex, 0 dec
19. Hold Register #10: 0 hex, 0 dec
20. Hold Register #11: 0 hex, 0 dec
21. Hold Register #12: 0 hex, 0 dec
22. Hold Register #13: 0 hex, 0 dec
23. Hold Register #14: 0 hex, 0 dec
24. Hold Register #15: 0 hex, 0 dec
25. Hold Register #16: 0 hex, 0 dec
26. Hold Register #17: 0 hex, 0 dec
27. Hold Register #18: 0 hex, 0 dec
28. Hold Register #19: 0 hex, 0 dec
29. Hold Register #20: 0 hex, 0 dec
30. **Mux Address: 1 hex, 1 dec**
31. **TC Temperature: 130.00**
32. **Temperature Mux Offset: 5.00**
33. **Temperature Register Offset: 1.00**
34. **Selected Address: 1 hex, 1 dec**
35. **Selected Register: 0F hex, 15 dec**
36. Selected TC Temperature: 0.00

Sample Output From Westronics Emulator for Multiple Checksum Errors

This example is for a Westronics emulator #1, slot 1. The actual port and Westronics station number may be different in testing. The displays were captured with the emulator options "F" and "S" turned on. The check sums are **bolded**.

Response to driver from emulator with valid check sum. There is a single poll and response.

```
Function (04) - Read Input Registers
01 04 24 05 46 05 50 05 5A 05 64 05 6E 05 E6 05 82 05 8C 05 96 05 A0 05 AA 05 B4
 05 BE 05 C8 05 D2 05 DC 05 E6 05 F0 0A D7
```

Response to driver from emulator with invalid check sum, followed by invalid check sum. The poll with the invalid check sum is followed immediately by a retry from the driver. After the second bad checksum there will be an error in G2. There will be no more retries until the next scheduled poll time.

```
Function (04) - Read Input Registers
01 04 24 05 46 05 50 05 5A 05 64 05 6E 05 E6 05 82 05 8C 05 96 05 A0 05 AA 05 B4
 05 BE 05 C8 05 D2 05 DC 05 E6 05 F0 0A DD    /*  Bad Checksum */
Function (04) - Read Input Registers
01 04 24 05 46 05 50 05 5A 05 64 05 6E 05 E6 05 82 05 8C 05 96 05 A0 05 AA 05 B4
 05 BE 05 C8 05 D2 05 DC 05 E6 05 F0 0A DD    /* Bad Checksum */
```

Appendix E: Emulator Configuration for Single Exception Error

Table 1. Valid Exception Codes, Names, and Meanings

Code	Name	Meaning
01	Illegal Function	The function code received in the query is not an allowable action for the slave.
02	Illegal Data Address	The data address received in the query is not an allowable address for the slave.
03	Illegal Data Value	A value contained in the query data field is not an allowable value for the slave.
04	Slave Device Failure	An unrecoverable error occurred while the slave was attempting to perform the requested action.
05	Acknowledge	The slave has accepted a request and is processing it but a long duration time is required.
06	Slave Device Busy	The slave is processing a long-duration program command.
07	Negative Acknowledge	The slave cannot perform the program function received in the query.
08	Memory Parity Error	The slave attempted to read e3xtended memory but detected a parity error in the memory.

Display Configuration Parameters WESTRONICS PARAMETERS

1. Code Operated Switch: OFF
2. Tx Delay Time: 0.00
3. **Error Rate %: 30.00**
4. Multiple Error: 0 hex, 0 dec
5. Checksum Mask: 0 hex, 0 dec
6. **Exception Value: 01 hex, 1 dec**
7. Modbus Mode RTU: ON
8. Coil Register: 0 hex, 0 dec
9. Status Register: 0 hex, 0 dec
10. Hold Register #01: 0 hex, 0 dec
11. Hold Register #02: 0 hex, 0 dec
12. Hold Register #03: 0 hex, 0 dec
13. Hold Register #04: 0 hex, 0 dec
14. Hold Register #05: 0 hex, 0 dec
15. Hold Register #06: 0 hex, 0 dec
16. Hold Register #07: 0 hex, 0 dec
17. Hold Register #08: 0 hex, 0 dec
18. Hold Register #09: 0 hex, 0 dec
19. Hold Register #10: 0 hex, 0 dec
20. Hold Register #11: 0 hex, 0 dec
21. Hold Register #12: 0 hex, 0 dec
22. Hold Register #13: 0 hex, 0 dec
23. Hold Register #14: 0 hex, 0 dec
24. Hold Register #15: 0 hex, 0 dec
25. Hold Register #16: 0 hex, 0 dec
26. Hold Register #17: 0 hex, 0 dec
27. Hold Register #18: 0 hex, 0 dec
28. Hold Register #19: 0 hex, 0 dec
29. Hold Register #20: 0 hex, 0 dec
30. **Mux Address: 1 hex, 1 dec**
31. **TC Temperature: 130.00**
32. **Temperature Mux Offset: 5.00**
33. **Temperature Register Offset: 1.00**
34. **Selected Address: 1 hex, 1 dec**
35. **Selected Register: 0F hex, 15 dec**
36. Selected TC Temperature: 0.00

Sample Output From Westronics Emulator for Single Exception Error

This example is for a Westronics emulator #1, slot 1. The actual port and Westronics station number may be different in testing. The displays were captured with the emulator options "F" and "S" turned on.

Response to driver from emulator with valid poll and response.

```
Function (04) - Read Input Registers
01 04 24 05 46 05 50 05 5A 05 64 05 6E 00 00 05 82 05 8C 05 96 05 A0 05 AA 05 B4
 05 BE 05 C8 05 D2 05 DC 05 E6 05 F0 BB D5
```

Response to driver from emulator with exception code. When the request is rejected the high bit in byte 2 is set on (**80h**) and the exception code is set in the lower bits of byte 2. In this example a exception code of **4h** is returned so the second byte is **84h** (80h + 4h).

```
Function (04) - Read Input Registers
01 84 02 C2 C1  01 04 00 09 00 12 A0 05
```

Appendix F: Emulator Configuration for Station Mismatch Error

Display Configuration Parameters WESTRONICS PARAMETERS

1. Code Operated Switch: OFF
2. Tx Delay Time: 0.00
3. **Error Rate %: 30.00**
4. **Multiple Error: 1 hex, 1 dec**
5. Checksum Mask: 0 hex, 0 dec
6. Exception Value: 0 hex, 0 dec
7. Modbus Mode RTU: ON
8. Coil Register: 0 hex, 0 dec
9. Status Register: 0 hex, 0 dec
10. Hold Register #01: 0 hex, 0 dec
11. Hold Register #02: 0 hex, 0 dec
12. Hold Register #03: 0 hex, 0 dec
13. Hold Register #04: 0 hex, 0 dec
14. Hold Register #05: 0 hex, 0 dec
15. Hold Register #06: 0 hex, 0 dec
16. Hold Register #07: 0 hex, 0 dec
17. Hold Register #08: 0 hex, 0 dec
18. Hold Register #09: 0 hex, 0 dec
19. Hold Register #10: 0 hex, 0 dec
20. Hold Register #11: 0 hex, 0 dec
21. Hold Register #12: 0 hex, 0 dec
22. Hold Register #13: 0 hex, 0 dec
23. Hold Register #14: 0 hex, 0 dec
24. Hold Register #15: 0 hex, 0 dec
25. Hold Register #16: 0 hex, 0 dec
26. Hold Register #17: 0 hex, 0 dec
27. Hold Register #18: 0 hex, 0 dec
28. Hold Register #19: 0 hex, 0 dec
29. Hold Register #20: 0 hex, 0 dec
30. **Mux Address: 2 hex, 2 dec**
31. **TC Temperature: 130.00**
32. **Temperature Mux Offset: 5.00**
33. **Temperature Register Offset: 1.00**
34. **Selected Address: 1 hex, 1 dec**
35. **Selected Register: 15 hex, 15 dec**
36. Selected TC Temperature: 0.00

HEX DECIMAL
1C 28 Jar

Sample Output From Westronics Emulator for Station Mismatch Error

This example is for a Westronics emulator #1, slot 1. The actual port and Westronics station number may be different in testing. The displays were captured with the emulator options "F", "R", and "S" turned on. The display has been reformatted for clarity.

The first character sent by either device is the station number. In this example the driver is asking for station #1. The emulator is responding as station #2. G2 should report this as an error immediately.

```
01 04 00 09 00 12 A0 05   /* Request for read from station 1 */
Function (04) - Read Input Registers
02 04 24 05 46 05 50 05 5A 05 64 05 6E 00 00 05 82 05 8C 05 96 05 A0 05 AA 05 B4
 05 BE 05 C8 05 D2 05 DC 05 E6 05 F0 A0 61      /* Response from station 2 */
```

Test Procedure ID	TEST DESIGN SPECIFICATION ID: **07.08.00 -00**	TITLE: Westronics Driver Acceptance Test
UTP 07.08.00 -00	TESTING PHASE: Acceptance Test	PLATFORM: UNIX Page 26 of 27
Revision 0		

ACCEPTANCE TEST PROCEDURE COVER SHEET

APPROVAL OF TEST PROCEDURE

D Barnes — 6/22/98
DA Barnes TMACS Cognizant Engineer — Date

J A Glasscock — 6/22/98
J. A. Glasscock TMACS Project Manager — Date

Execution Number for this Test : 1 — Execution Test Date/Time: 1400 1 JULY 98

Tester: David Barnes — Witness: J A Glasscock

Comments ls -l WESTRONICS- brg Jun 9 06:25 212992 byte
RUNNING ON PORT 22210

TEST was (circle one) (Successful) Unsuccessful Re-test

CERTIFICATION OF SATISFACTORY EXECUTION

All of the test cases for this test procedure have been tested and all anomalies for this test procedure have been resolved.

D Barnes — 7/1/98
DA Barnes TMACS Cognizant Engineer — Date

J A Glasscock — 7/1/98
J. A. Glasscock TMACS Project Manager — Date

SURV SYS Walkthrough Log

Review Item: WESTRONICS DRIVER	Functional Area(s): 7.8	Date of Review: 7/19/95
Facilitator: DA BARNES	Walk-through Type: B	Life-cycle Phase: TESTING
Attendees: JA GLASSCOCK, SC CANTRELL		Start Time: 1400 End Time: 1600

Item	Identifier	Comment/Action Item	Author	Assignee	Status	Initial	Date
1	C -7	Line numbs for COS was set to "NA". Got error message. As expected from TAC LIST.	SCC	—			
2	-3	Tested that the driver did not return a value ~~after~~ to G2 when there was an error. THIS IS GOOD	DAB	—			
3							

Walkthrough types: A - One-on-one peer. B - One-on-one user. C - One-on-one management D - Formal task group E - Formal program group
F - Customer management G - Change control board H - External

DISTRIBUTION SHEET

To	From	Page 1 of 1
Distribution	Process Engineering	Date 7/16/98
Project Title/Work Order		EDT No. 625027
Tank Monitor and Control System (TMACS) Software Project Westronics Driver Acceptance Test		ECN No. N/A

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
D. A. Barnes	R2-11	X			
V. L. Benson	R1-01	X			
J. A. Glasscock	R1-01	X			
M. J. Holm	R2-11	X			