



DiaLog Elite

Modbus RTU User Guide

Publish Date: January 1, 2005
Document Version 1.2

Copyright and Trademark Information

All Pages Copyright © 2005 Antx, inc. All Rights Reserved.

U.S. Government Users Restricted Rights. Use, duplication, or disclosure by the Government is subject to restrictions as set forth in applicable laws and regulations. Use of the materials by the Government constitutes acknowledgment of Antx's proprietary rights in them. This manual may contain other proprietary notices and copyright information which should be observed.

Information in this document is subject to change without notice. The software described in this document is furnished under a license agreement or nondisclosure agreement. The software may be used or copied only in accordance with the terms of those agreements. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or any means electronic or mechanical, including photocopying and recording for any purpose other than the purchaser's personal use without the written permission of Antx, inc.

Contents

About this Guide	iii
Who Should Use this Guide	iii
How to Use this Guide	iii
Conventions Used in this Guide.....	iii
1 What is the Modbus RTU Interface?	1
2 How to use the Modbus RTU support.....	3
What is the Installation Process?.....	3
3 Modbus Protocol Settings	5
Serial Port settings.....	5
Modem settings.....	5
Modbus Slave ID.....	6
Register Mapping.....	6
Modbus Address	8
Error Returns	10

About this Guide

Who Should Use this Guide How to Use this Guide

This guide is intended to describe how to install and configure the DiaLog Elite Alarm Notification System.

This manual is intended for use by operations technicians who are responsible for installing and configure the DiaLog Elite hardware.

This guide is divided into the following chapters:

Chapter 1, What is the Modbus RTU interface. This chapter provides a general overview of the features and functions of the Modbus RTU interface for the DiaLog Elite alarm notification system.

Chapter 2, How to use the Modbus RTU support. This chapter describes how to set up the DiaLog Elite for Modbus RTU protocol support and how to interface to it from a remote SCADA or other product that supports the Modbus protocol.

Chapter 3, Quick Start. This chapter describes how to get the DiaLog Elite up and running quickly if you just want to program a telephone number and alarm message. It also lists the default factory settings.

In this manual, the terms DiaLog Elite and DiaLog are used interchangeably.




Conventions


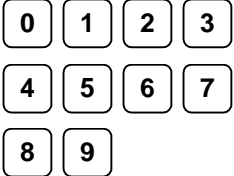





To help you understand the information in this guide, a consistent set of documentation

Used in this Guide

conventions are used to represent certain material.

The following table describes the typographic conventions used in this guide to help you locate and interpret information.

Convention	Description
<i>Italic text</i>	<p>Indicates a parameter that you can set.</p> <p>EXAMPLE:</p> <p>DiaLog accepts a return call as an acknowledgement of all alarms if you enable the <i>Call In Acknowledge</i> feature. The call must come during the 30-second <i>Between Calls Delay</i>, or DiaLog calls the next number on the list.</p>
Courier font	<p>Indicates messages shown on the DiaLog display or information printed on reports.</p> <p>EXAMPLE:</p> <p>If parameters for channel 7 were set up as follows, then this message appears on the pager's display:</p> <pre>NORTHWEST FACILITY-7 NO 2 TANK LEVEL HI 101.5 GALS</pre>
"Text enclosed in quotes".	<p>Indicates messages that DiaLog speaks.</p> <p>EXAMPLE:</p> <p>The power on diagnostics take about 45 seconds to complete, followed by the voice announcing:</p> <p>"This is DiaLog Elite. Program mode activated. System is armed. System ready. Enter selection."</p>
<p>Picture of key from front panel</p> 	<p>These keys are used when a special key on the front panel must be pressed to accomplish a task.</p> <p>EXAMPLE:</p> <p>Press   to enter RUN mode.</p>

Convention	Description												
<p>Small rectangular representation of key</p> 	<p>Indicates keys to press when entering parameter values at the keypad or when communicating with the DiaLog via a touch-tone telephone.</p> <p>EXAMPLE 1: The person answering the call acknowledges it by pressing the *, 8 or 9 key on a Touch-Tone telephone.</p> <p>EXAMPLE 2: In Chapter 7, <i>Programming the DiaLog Elite</i>, 0 - 2 in the What you Enter column means to enter a value between 0 and 2.</p>												
<p>Small rounded rectangular representation of a key</p> 	<p>These keys are used in Chapter 7, <i>Programming the DiaLog Elite</i>, to indicate menu selections. These are used in both the Road Map and the Menu Sequence headings.</p> <p>EXAMPLE: </p> <p>Means to press the keys 9, 0 and 3 to reach the command.</p>												
<p>Road Map </p>	<p>This heading and icon is used at the beginning of a function description to indicate the complete key sequence that the user takes to reach the function being described. The Road Map also includes other parameters within that function.</p> <p>EXAMPLE:</p>												
<p>Channel Configuration</p> <p>Relay Output Channels</p> <p>Channel Number</p> 	<table border="0"> <tr> <td style="border: 1px solid black; padding: 2px;">0</td> <td>Pulse Duration</td> <td>[0-65535]</td> </tr> <tr> <td style="border: 1px solid black; padding: 2px;">1</td> <td>De-energize Relay on Ack.</td> <td>[0-1]</td> </tr> <tr> <td style="border: 1px solid black; padding: 2px;">2</td> <td>Channel Mode</td> <td>[0-1]</td> </tr> <tr> <td style="border: 1px solid black; padding: 2px;">3</td> <td>Channel Alpha ID</td> <td>[A-Z, 0-9]</td> </tr> </table>	0	Pulse Duration	[0-65535]	1	De-energize Relay on Ack.	[0-1]	2	Channel Mode	[0-1]	3	Channel Alpha ID	[A-Z, 0-9]
0	Pulse Duration	[0-65535]											
1	De-energize Relay on Ack.	[0-1]											
2	Channel Mode	[0-1]											
3	Channel Alpha ID	[A-Z, 0-9]											
<p>Description </p>	<p>This heading and icon is used to present an overview of the function being discussed.</p>												
<p>Field Summary </p>	<p>This heading and icon is used to list all parameters that must be entered for the function. The heading includes the name of the Field, Range of values that can be entered, and Factory Setting.</p> <p>EXAMPLE:</p> <table border="0" style="width: 100%;"> <tr> <td style="text-align: left;">Field</td> <td style="text-align: center;">Range</td> <td style="text-align: right;">Factory Setting</td> </tr> <tr> <td>Alarm Delay</td> <td style="text-align: center;">0-65535 seconds</td> <td style="text-align: right;">3</td> </tr> </table>	Field	Range	Factory Setting	Alarm Delay	0-65535 seconds	3						
Field	Range	Factory Setting											
Alarm Delay	0-65535 seconds	3											

Convention	Description
Menu Sequence →	This heading and icon is used to list the menu keys that must be pressed to reach the command being discussed.
CAUTION ⚡	This heading and icon in the margin indicates a special concern that you should take into consideration when performing an action. Cautions not followed could result in danger.
WARNING! ⚠	This heading and icon in the margin indicates advice to heed when performing an action. Warnings not followed could result in damage to the equipment or personal harm.
NOTE 📄	This heading and icon in the margin indicates any exceptions or additional points to the topic being discussed.
EXAMPLE ➤	This heading and icon in the margin indicates that the text contains an illustration of a point being discussed.

What is the Modbus RTU Interface?

The Modbus RTU interface allows the DiaLog Elite to become a Modbus slave device to communicate with any product that supports the Modbus master protocol. Typical devices that support the Modbus master protocol are:

- SCADA/HMI packages like: Wonderware, Intellution, Lookout, Bridgeview, FactoryLink, P-CIM, OI-2000 or a host of other products.

The Modbus RTU interface allows the SCADA/HMI software to read and write information into the DiaLog Elite from either a direct connection via an RS-232 port or over modem.

The information available to the SCADA/HMI software are:

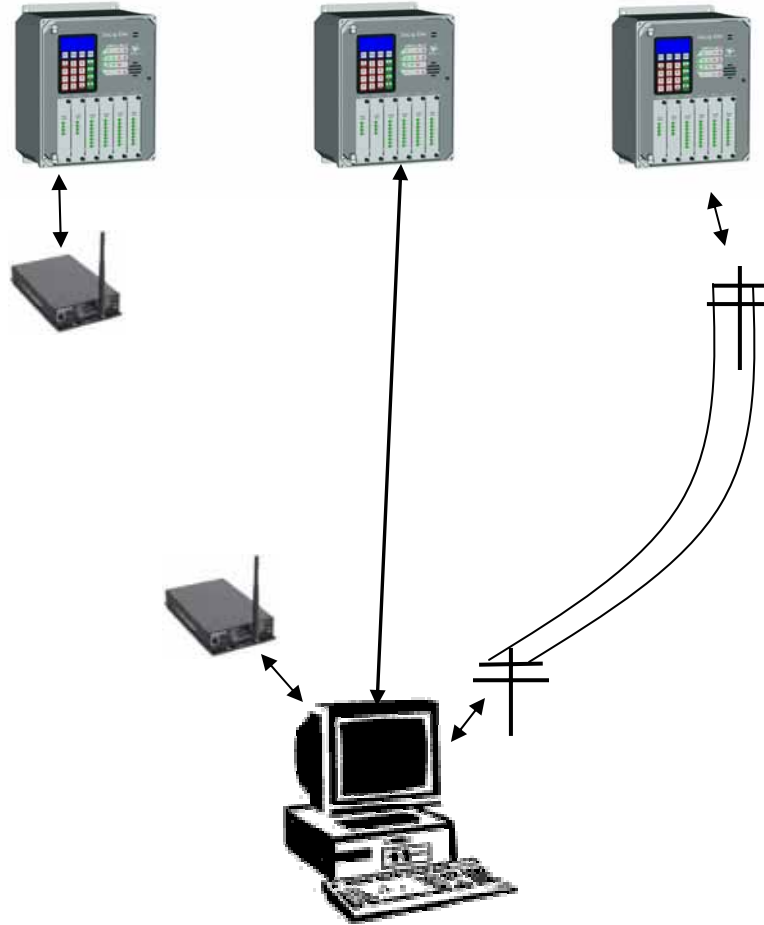
- Read current digital channel states (open/closed)
- Read current digital totalizer and duration counters
- Read current analog channel values
- Read current relay channel states (energized/de-energized)
- Read current alarm state for each channel (in/out of alarm)
- Read current alarm acknowledge state (acknowledged/not acknowledged)
- Write relay channel (energize/de-energize)
- Write digital totalizer and duration counters (preset)

The DiaLog Elite supports Modbus RTU communication over a direct serial connection or a modem.

Radio
Modem

Direct
Connection

Modem



Modbus connections from the DiaLog Elite to a PC

How to use the Modbus RTU support

This chapter describes how to set up the DiaLog Elite for Modbus RTU protocol support and how to interface to it from a remote SCADA or other product that supports the Modbus protocol.

Please read the entire chapter before starting to use the interface.

What is the Installation Process?

The Modbus RTU support is available in DiaLog Elite firmware versions 1.3.0 and later.

You can determine the version of firmware that the Elite has by pressing the following sequence of keys and listening for the version number over the speaker.

1
Prog - Enter programming mode

3 - System Setup

5 - Version Number

If a previous version is present on your Elite, then you should contact Antx toll-free at 877-686-ANTX (2689) to purchase an upgrade. The upgrade can be downloaded over the phone with no visit to the remote site.

If the version of the firmware is 1.3.0 or later, then you need to verify that the Modbus RTU option has been purchased.

The Modbus RTU is selection 2 in the DiaLog Elite System Status. Enter the following commands to determine if Selection 2 is enabled (meaning the Modbus RTU is present and enabled for use) or Selection 2 is disabled (meaning the Modbus RTU support is present but has not been enabled).

If the Modbus RTU is disabled the option has not been purchased. When purchased Antx can enable this option over the phone with no one needing to visit the remote unit.

<i>What you enter:</i>	<i>What DiaLog says:</i>
0	“ System Status. This is DiaLog Elite. Monday, January 31, 2000. 8 hours, 32 minutes. Run mode activated. System is armed. Channels in alarm: Channel 1 High level alarm.”
0	“DiaLog Configuration Slot 10 ... Slot 20 ... Slot 30 ... Slot 40 ... Slot 50 ... Slot 60 ... Selection 2 <enabled or disabled>”

Modbus Protocol Settings

This chapter describes the mapping of Modbus registers to DiaLog Elite channels, the serial port settings and error messages.

Please read the entire chapter before starting to use the interface.

Serial Port settings


The DiaLog Elite is configured as a DTE device to operate the serial port set as follows:

Baud rate:	38400 (can be adjusted by Antx over the phone)	
Data bits:	8	
Parity:	None	
Stop bits:	1	
Flow control:	None	
RCV – Pin 2	XMT – Pin 3	GND – Pin 5

Modem settings

The DiaLog Elite is configured to operate with a modem set as follows:

Init string	X2
-------------	----

Note 

The DiaLog Elite assumes that the Modbus Master software has relaxed the character timing to allow for modem delays. The Elite character timing is adjustable by Antx for any unit, but has not been made accessible to the user. If adjustments are necessary please call Antx customer service toll-free at 877-686-ANTX (2689).

The default receive timeout delay for a direct serial connection is 20ms and for a modem connection is 200 ms.

Modbus Slave ID

The default Modbus slave ID in each DiaLog Elite is 126 decimal.

This can be adjusted by Antx over the phone.

Register Mapping

The DiaLog Elite Modbus RTU interface supports reading or reading and writing from the following registers:

0xxxx	(R/W) coils (relays in the DiaLog Elite)
1xxxx	(R) input status (digital inputs, alarm state, acknowledge state)
4xxxx	(R/W) holding registers (analog inputs, digital totalizers, digital duration counters)

The Modbus function codes that are supported by the DiaLog Elite are:

Function Code	Description
1	Read coil status
2	Read input status
3	Read holding register
5	Force a single coil
6	Preset a holding register
15	Force multiple coils
16	Preset multiple holding registers

If a slot is empty, does not have the correct I/O type or a channel is disabled on the DiaLog Elite, then a '0' will be returned for that corresponding register.

The following tables show the mapping relationship between the I/O channels in the Elite to the standard Modbus registers.

Coils (0xxxx) Relays (Read/Write)

A value of '1' indicates the relay is to be energized or is already energized, '0' indicates the de-energized condition.

Modbus Address	Elite I/O channel
(0)0001-(0)0004	Slot 0 Relays (not applicable)
(0)0005-(0)0008	Slot 10 Relays
(0)0009-(0)0012	Slot 20 Relays
(0)0013-(0)0016	Slot 30 Relays
(0)0017-(0)0020	Slot 40 Relays
(0)0021-(0)0024	Slot 50 Relays
(0)0025-(0)0028	Slot 60 Relays

Input Status (1xxxx) Digital Inputs (Read Only)

A return value of '1' indicates the specified channel is closed, a value of 0 indicates the channel is open.

Modbus Address	Elite I/O channel
(1)0001-(1)0008	Slot 0 Digital Inputs (not applicable)
(1)0009-(1)0016	Slot 10 Digital Inputs
(1)0017-(1)0024	Slot 20 Digital Inputs
(1)0025-(1)0032	Slot 30 Digital Inputs
(1)0033-(1)0040	Slot 40 Digital Inputs
(1)0041-(1)0048	Slot 50 Digital Inputs
(1)0049-(1)0056	Slot 60 Digital Inputs

Input Status (1xxxx) Alarm State (Read Only)

A return value of '1' indicates the specified channel is in alarm, a value of '0' indicates the channel is not in alarm.

Modbus Address	Elite I/O channel
(1)0057-(1)0064	Slot 0 Alarm State
(1)0065-(1)0072	Slot 10 Alarm State
(1)0073-(1)0080	Slot 20 Alarm State
(1)0081-(1)0088	Slot 30 Alarm State
(1)0089-(1)0096	Slot 40 Alarm State
(1)0097-(1)0104	Slot 50 Alarm State
(1)0105-(1)0112	Slot 60 Alarm State

Input Status (1xxxx) Acknowledge State (Read Only)

A return value of '1' indicates the specified channel is in alarm and acknowledged, a value of '0' indicates the channel is not acknowledged regardless of the alarm state.

Modbus Address	Elite I/O channel
(1)0113-(1)0120	Slot 0 Acknowledge State
(1)0121-(1)0128	Slot 10 Acknowledge State
(1)0129-(1)0136	Slot 20 Acknowledge State
(1)0137-(1)0144	Slot 30 Acknowledge State
(1)0145-(1)0152	Slot 40 Acknowledge State
(1)0153-(1)0160	Slot 50 Acknowledge State
(1)0161-(1)0168	Slot 60 Acknowledge State

Holding Registers (4xxxx) Analog Inputs (Read Only)

Values for Slot 0 are returned in counts from 0 - 255.

Values for Slots 10-60 are returned in counts from 0 – 4095, or 2-s compliment (-2047 to +2048) if the analog channel is configured as +/-1, +/-5 or +/-10V.

Modbus Address	Elite I/O channel
(4)0001-(4)0008	Slot 0 Analog Input
40001	Primary Power (0-17.2V)
40002	Battery Power (0-17.2V)
40003	Phone Fault (0-good, 1-fault)
40004	Elite Temperature (-20 - +60C)
40005	24VDC Supply (0-33.7V)
(4)0009-(4)0016	Slot 10 Analog Input
(4)0017-(4)0024	Slot 20 Analog Input
(4)0025-(4)0032	Slot 30 Analog Input
(4)0033-(4)0040	Slot 40 Analog Input
(4)0041-(4)0048	Slot 50 Analog Input
(4)0049-(4)0056	Slot 60 Analog Input

Holding Registers (4xxxx) Digital Input Totalizers (Read/Write)

These registers are 32-bit registers ordered from high byte to low byte. All registers are non-volatile.

Modbus Address	Elite I/O channel
(4)0057-(4)0072	Slot 0 DIN Totalizer (not applicable)
(4)0073-(4)0088	Slot 10 DIN Totalizer
(4)0089-(4)0104	Slot 20 DIN Totalizer
(4)0105-(4)0120	Slot 30 DIN Totalizer
(4)0121-(4)0136	Slot 40 DIN Totalizer
(4)0135-(4)0152	Slot 50 DIN Totalizer
(4)0153-(4)0168	Slot 60 DIN Totalizer

Holding Registers (4xxxx) Digital Input Duration (Read/Write)

These registers are 32-bit registers ordered from high byte to low byte.

Modbus Address	Elite I/O channel
(4)0169-(4)0184	Slot 0 DIN Duration (not applicable)
(4)0185-(4)0200	Slot 10 DIN Duration
(4)0201-(4)0216	Slot 20 DIN Duration
(4)0217-(4)0232	Slot 30 DIN Duration
(4)0233-(4)0248	Slot 40 DIN Duration
(4)0249-(4)0264	Slot 50 DIN Duration
(4)0265-(4)0280	Slot 60 DIN Duration

Error Returns

If the DiaLog Elite detects an error in the request, then the following standard Modbus exceptions are returned:

Condition	Exception returned	Exception Code
Register address is out of range or the starting address plus the number of registers exceeds the address range of the Elite.	ILLEGAL_ADDRESS	2
Number of registers requested is too large, i.e. beyond the range of the Elite	ILLEGAL_VALUE	3
Unsupported function code is received.	ILLEGAL_FUNCTION	1
If the slave cannot respond because the response message is too large (too much data was asked for)	SLAVE_DEV_FAILURE	4