User Manual
&
Command Reference Guide

xml1000

Serial I/O Server

March 2006

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Statement of conditions
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USA requirements only
Federal Communications Commission (FCC) Compliance Notice: Radio Frequency Notice
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

European requirements only
EN 55 022 statement
This is to certify that the SimpleComTools COM1000 is shielded against the generation of radio interference in accordance with the application of Council Directive 89/336/EEC, Article 4a. Conformity is declared by the application of EN 55 022 Class B (CISPR 22).

Canada requirements only
Canadian Department of Communications Radio Interference Regulations
This digital apparatus does not exceed the Class B limits for radio-noise emissions from digital apparatus as set out in the Radio Interference Regulations of the Canadian Department of Communications.

Règlement sur le brouillage radioélectrique du ministère des Communications
Cet appareil numérique respecte les limites de bruits radioélectriques visant les appareils numériques de classe B prescrites dans le Règlement sur le brouillage radioélectrique du ministère des Communications du Canada.

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1 introduction

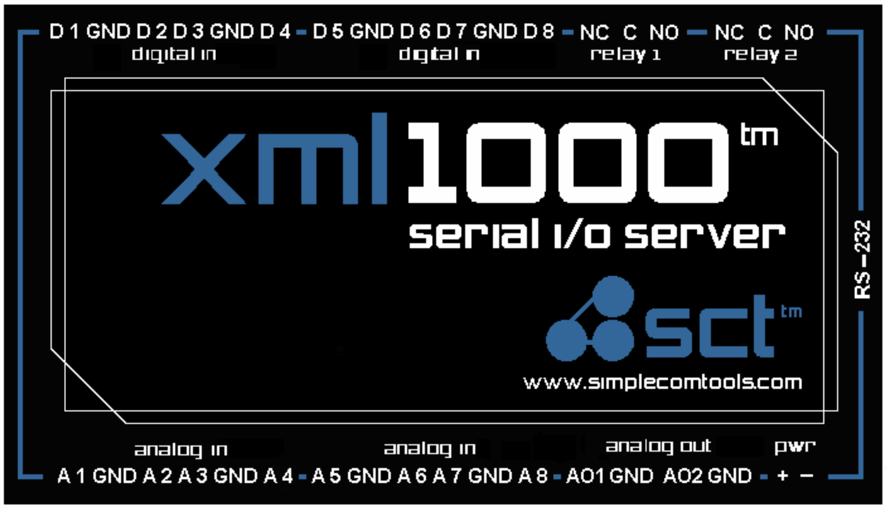
Preface

The XML1000 I/O Server is another member of the Simple Com Tools M2M appliance family. Designed to serve as both a partner to the COM1000 and a stand-alone device, the XML1000 is also an important device servicing the M2M market. Simplistic in both its design and feature set, the XML1000 serves a virtually un-addressed niche in the M2M market – the low-cost standards-based, open-source, hardware appliance for capturing and reporting digital and analog I/O events.

As its name implies, the XML1000 serves the status and changes to its digital and analog interfaces via an XML format. XML (Extensible Markup Language) is a simple, flexible text format similar to HTML. Originally designed to meet the challenges of electronic publishing and electronic data exchange requirements, XML is now also playing an increasingly important role in the exchange of a wide variety of data on the Web, including Telemetry, SCADA, and M2M applications.

The XML1000 comes with three different interface options; RS232, RS485, and Ethernet. This manual is dedicated to the RS232 version only.

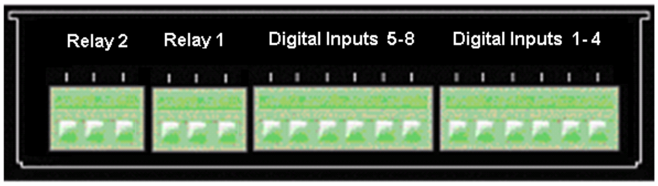
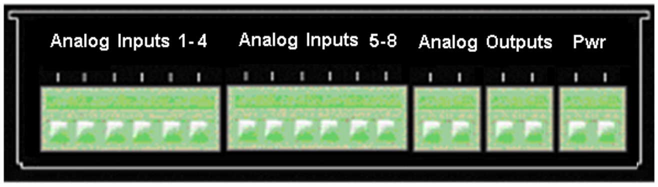
Serial (RS232) version of XML1000

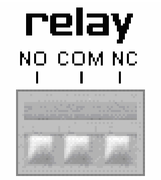
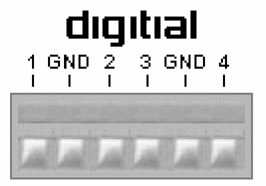
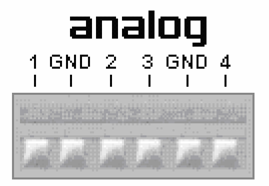
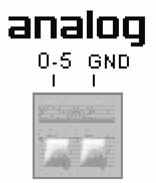
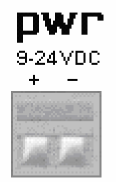

D 1 GND D 2 D 3 GND D 4 - D 5 GND D 6 D 7 GND D 8 - NC C NO - NC C NO
digital in
digital in
relay 1
relay 2
xml1000 tm
serial i/o server
RS – 232
sct tm
www.simplecomtools.com
analog in
analog in
analog out
pwr
A 1 GND A 2 A 3 GND A 4 - A 5 GND A 6 A 7 GND A 8 - AO1 GND AO2 GND - + –

Interfaces

The XML1000 provides the following hardware interfaces:

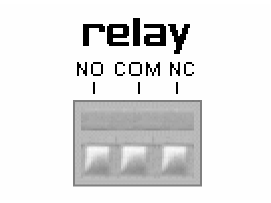
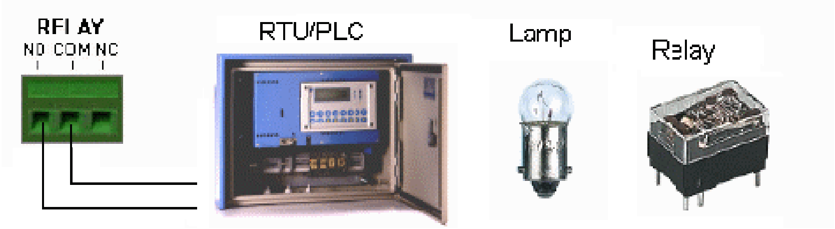
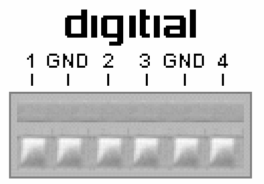
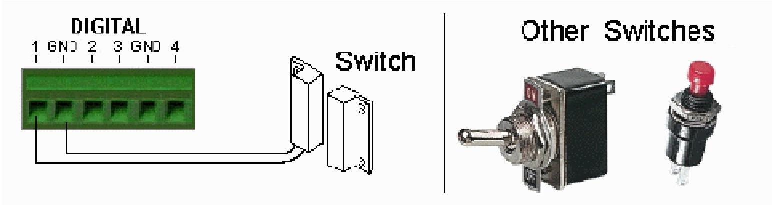
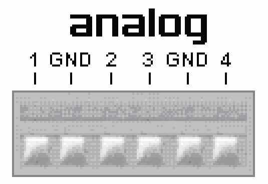
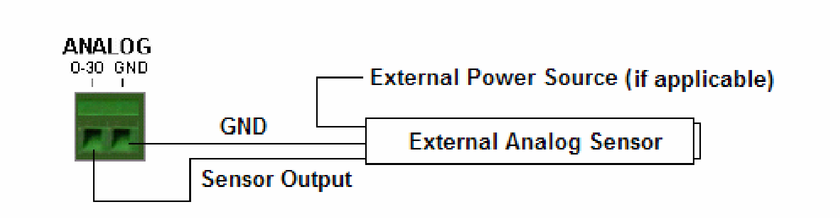
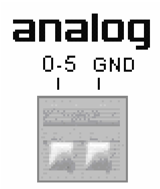
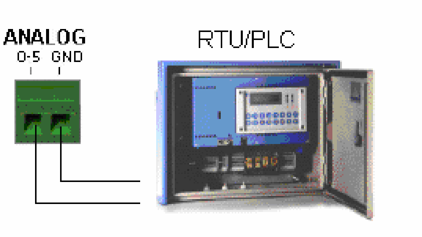
- (8) Digital Inputs
- (8) Analog Inputs
- (2) Relay Outputs
- (2) Analog Outputs
- (1) RS232 DB9 Serial Port

DIGITAL INPUT SIDE
 Relay 2 Relay 1 Digital Inputs 5-8 Digital Inputs 1-4
ANALOG INPUT SIDE
 Analog Inputs 1-4 Analog Inputs 5-8 Analog Outputs Pwr

Relay Outputs	Digital Inputs	Analog Inputs	Analog Outputs	Power Input
				
This interface is used to connect a device that you want to turn on and off.	This interface is used to connect simple contact closure switches.	This interface is used to connect simple analog measurement gauges.	This interface is used to provide variable 0-5vdc analog output.	This interface is used to connect to a 9-30 VDC power source.

Connecting Sensors, Switches, or Devices

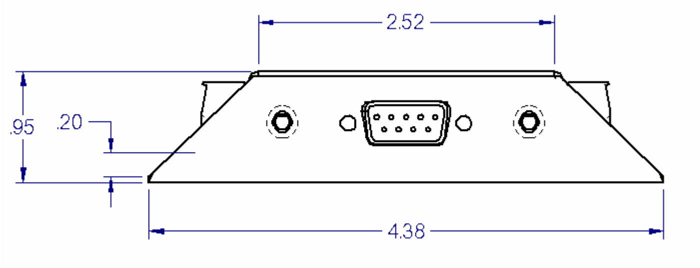
The following describes how to wire sensors, switches or controls to the XML1000 inputs.

	The RELAY is designed to switch currents (120VAC/2A, 24VDC/5A). In a sense, the RELAY can act as a contact closure or switch for any external device. The relay connections are labeled as Normally Open (NO), Common (COM), and Normally Closed (NC). When wiring, connect your wires to the NO and COM if you want the switched circuit to be CLOSED when the relay is ACTIVATED. Connect your wires to NC and COM if you want the switched circuit to be OPEN when the relay is ACTIVATED. 
	The DIGITAL INPUT interfaces are designed to connect to up to either dry contact closures or voltage pulses. The interface provides two (6) wire inputs; (4) switch inputs and (2) grounds (GND). Switches are connected across any of the inputs (labeled with numbers 1-8). The grounds (labeled with GND) are used as commons, and are where you connect the second switch wire. The reasons for only (4) commons is because you can share the GND inputs between switches the switches. The following is a wiring example: 
	The ANALOG INPUT interface has the ability to interface with any analog sensor with the following voltage output ranges: 0-5 VDC; 0-30 VDC; 4-20mA. The following is a sensor wiring example:  ANALOG 0-30 GND External Power Source (if applicable) GND External Analog Sensor Sensor Output
	The ANALOG OUTPUT interface is designed to provide a variable voltage output of 0-5VDC. 

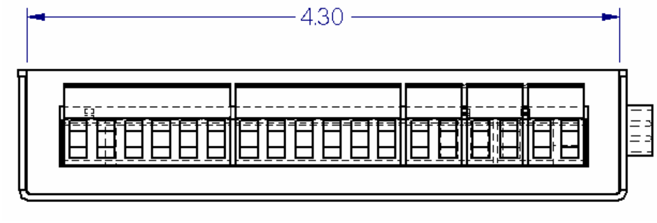
Hardware Dimensions

The XML1000 I/O Server is approximately 4.5” x 4.5” x 1” in size. Exact dimensions are as follows:

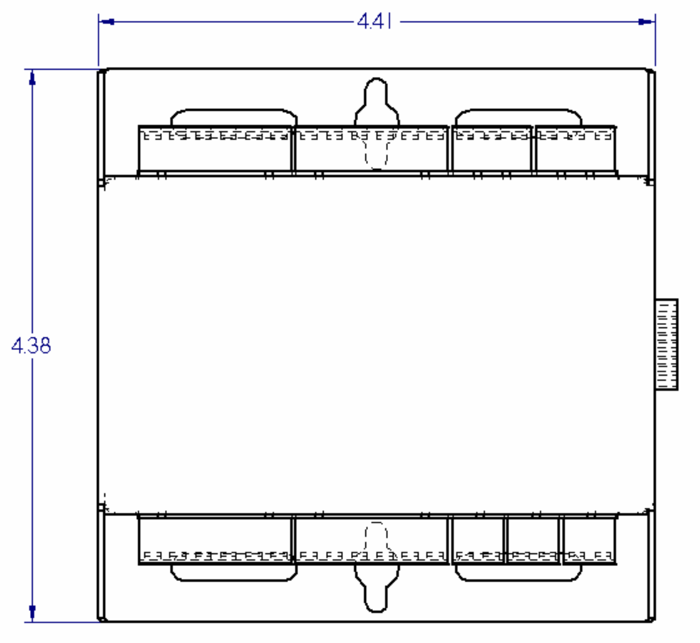
Serial Side View



Terminal Side View



Top View



I/O Options

The XML1000 provides the following hardware interfaces:

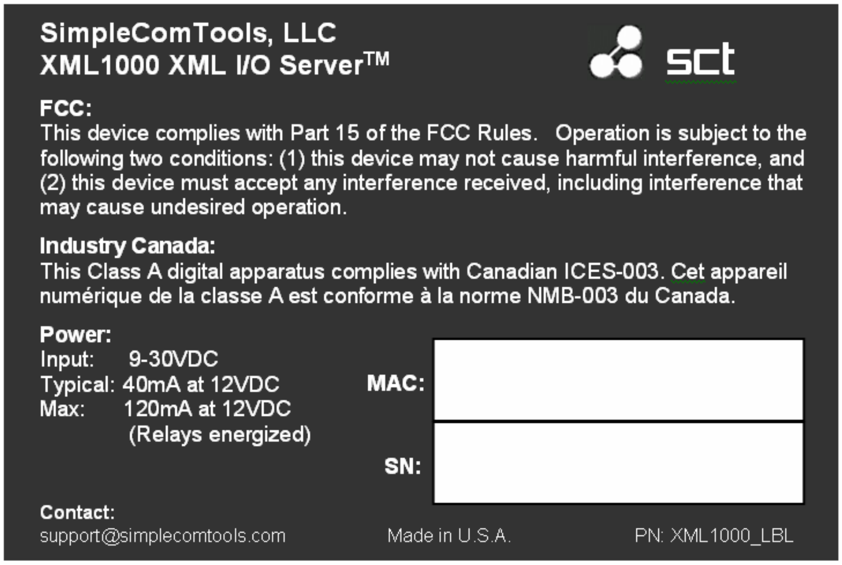
- (8) Digital Inputs
- (8) Analog Inputs
- (2) Relay Outputs
- (2) Analog Outputs

The following describes the potential configuration options available for purchase:

Options		Digital Inputs	Relay Outputs	Analog Inputs	Analog Outputs
A	CC/0-5	(8) Contact Closure Inputs	(2) SPDT Relays 2A at 120 VAC 5A at 24 VDC	(8) Inputs at 0-5 VDC	(2) Outputs at 0-5 VDC
B	CC/0-30	(8) Contact Closure Inputs	(2) SPDT Relays 2A at 120 VAC 5A at 24 VDC	(8) Inputs at 0-30 VDC	(2) Outputs at 0-5 VDC
C	CC/4-20	(8) Contact Closure Inputs	(2) SPDT Relays 2A at 120 VAC 5A at 24 VDC	(8) Inputs at 4-20 mA	(2) Outputs at 0-5 VDC
D	OI/0-5	(8) Optically Isolated Inputs	(2) SPDT Relays 2A at 120 VAC 5A at 24 VDC	(8) Inputs at 0-5 VDC	(2) Outputs at 0-5 VDC
E	OI/0-30	(8) Optically Isolated Inputs	(2) SPDT Relays 2A at 120 VAC 5A at 24 VDC	(8) Inputs at 0-30 VDC	(2) Outputs at 0-5 VDC
F	OI/4-20	(8) Optically Isolated Inputs	(2) SPDT Relays 2A at 120 VAC 5A at 24 VDC	(8) Inputs at 4-20 mA	(2) Outputs at 0-5 VDC

Determining Device Type

The XML1000 provides labeling on the bottom of the device that indicates the device specifications and type.



SimpleComTools, LLC
XML1000 XML I/O Server™

FCC:
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Industry Canada:
This Class A digital apparatus complies with Canadian ICES-003. Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

Power:
Input: 9-30VDC
Typical: 40mA at 12VDC
Max: 120mA at 12VDC
(Relays energized)

MAC:

SN:

Contact:
support@simplecomtools.com

Made in U.S.A.

PN: XML1000_LBL

2
getting started

Before you begin

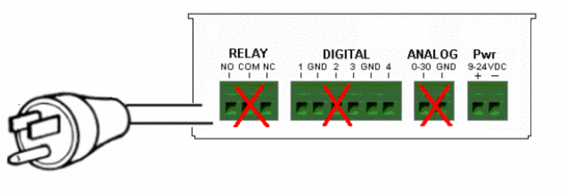
This guide is intended for qualified service personnel who are installing the XML1000 for the first time or who need to install a switch, gauge, modem, or other device to an existing XML1000. However, before you install anything related to the XML1000, make sure that the proper cables have been selected and/or the required network cabling has been installed using standard cable system practices.

Installation Requirements and Instructions

Mounting: The XML1000 has (4) slotted mounting holes and (2) oval mounting holes for easy mounting and installation. You can use either wood or sheet metal screens, hooks, or other common fasteners to mount or hang the device.

Power: The XML1000 will accept 9-30VDC. For locations with 110VAC power, you will need to provide a 100-12VDC power transformer. Tthe XML1000 The power interface is a standard 2-wire (+ and -) terminal strip. Disconnect the 2-lead terminal strip insert plug from the XML1000 power interface. With a power adapter or wire that is not yet connected to a power supply, insert the positive wire into the left (+) side access hole of the insert plug and tighten the retaining screw. Next, insert the ground wire into the right (-) side access hole of the terminal strip and tighten the second retaining screw. Plug the terminal strip plug into the XML1000 power interface. Finally, connect the other end of the wire or the power supply to your power source.

Do NOT insert live power leads directly into the Analog, Digital, and Relay inputs, as this may severely damage the XML1000. Failure to comply with this warning will void any and all existing product warranties or service agreements.



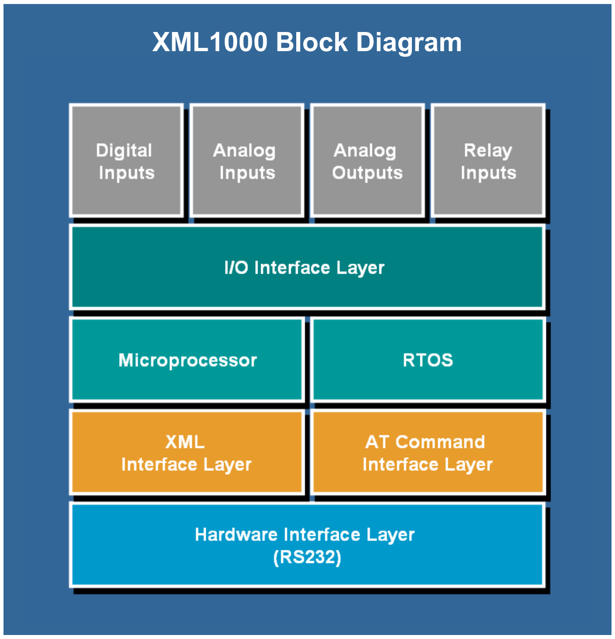
Environment: The XML1000 is NOT water-resistant, waterproof or weatherproof. Installation should include an enclosure to protect electronics. Preferably a NMEA-4 type enclosure to ensure protection from water and humidity.

3

basics of operation

Overview

The XML1000 is a compact XML-based hardware serial I/O server. The term “I/O server” is more commonly used with software based applications running on a PC or server. They allow you to control or monitor PLCs or RTUs using various communication protocols, such as DNP, Modbus, etc. In contrast, the XML1000 Serial I/O server is a hardware appliance that monitors 20 points of I/O locally, allowing you to monitor and control the I/O using XML as the communications protocol. The physical interface is an RS232 DB9 port, which allows for a network agnostic communications transport. Communicating to the XML100 can be done over serial links, leased-lines, dialup, or via TCP/IP using IP-to-Ethernet device servers.

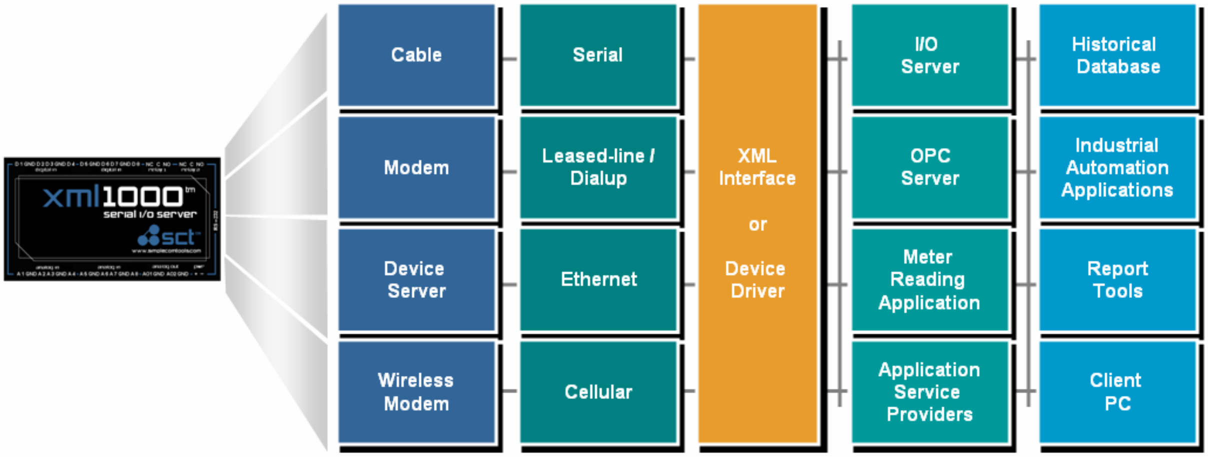

XML1000 Block Diagram

Architecture

The XML1000 is architected to offer an alternative to the traditionally complex means of communicating with hardware I/O. It provides a plain ASCII text based XML interface for capturing and reporting digital and analog I/O events. To facilitate the integration of the XML1000 with applications or devices that do not have the ability to format or parse XML data, the XMl1000 also supports a set of Hayes-style AT Commands.

Integration with SCADA applications

Since the XMl1000 I/O server presents I/O data in an open format, it is easily integrated into existing SCADA, telemetry, or meter reading applications. Applications configured to read I/O from the XML1000 can post the data to a local or remote database, or expose the data points to industrial automation and SCADA client applications using automation industry standard protocols, such as OPC and DDE.



4
Basics of XML

Basics of XML
XML (Extensible Markup Language) is a simple, flexible text format similar to HTML. Originally designed to meet the challenges of electronic publishing and electronic data exchange requirements, XML is now also playing an increasingly important role in the exchange of a wide variety of data on the Web, including Telemetry, SCADA, and M2M applications.

XML provides a text-based means to describe and apply a tree-based structure to information. Since XML is based on ASCII text, an XML document may be viewed or created using any text based editor, such as Notepad, or even word processors such as Microsoft Word. This one factor alone has facilitated the rapid expansion of XML as a document authoring and integration tool.

Prior to the advent of XML, there were very few data description languages that were general-purpose, Internet protocol-friendly, and very easy to learn and author. In fact, most data interchange formats were proprietary, special-purpose, "binary" formats, based on bit sequences rather than characters. (This is a fact that remains true for most SCADA and telemetry devices and applications). However, as processing power and memory resources increase in the world of embedded hardware, XML will likely emerge as a preferred way of presenting I/O status and historical data.

Benefits to using XML
Here are just a few of the benefits of using XML to manage data:
Simplicity
Information coded in XML is easy to read and understand, plus it can be processed easily by computers.

Extensibility
There is no fixed set of tags. New tags can be created as they are needed.

Open Standard
XML has quite a few benefits when it comes to deployment in M2M applications. First, XML is a standard, simple, self-describing way of presenting data. That means the content can be processed with relatively little development effort, and exchanged across diverse hardware, operating systems, and applications and can be used with a wide range of development tools and utilities.

Vendor Neutrality
XML is vendor neutral, which means by using XML in communications protocols, and managing their data in XML formats, companies can maximize the lifetime of their investment and enjoy flexibility in the choices they will be able to make in future products and solutions.

Separation of the content from the presentation
XML tags describe meaning of the data and not the presentation. This allows the presentation of the data to be changed without touching the original data. Making it easy to create innumerable variations of querying or presenting the same data.

Extensive Support
There are a number of companies that have extensive support for XML, including companies such as Software AG, IBM, Sun, Microsoft, Netscape, DataChannel, SAP and many others. In addition, both Microsoft's and Netscape's Web browsers support XML, and Microsoft now uses XML as the data exchange format for Microsoft Office.

Reading an XML Document

At its base level, all information displays as readable text, interspersed with markup tags that indicate the information's logical separation into a hierarchy. That hierarchy has container-like elements, followed by the relevant data. In this respect, browsing through an XML document is similar to looking at the outline of a textbook, or browsing through a PC operating system such as MS Windows.

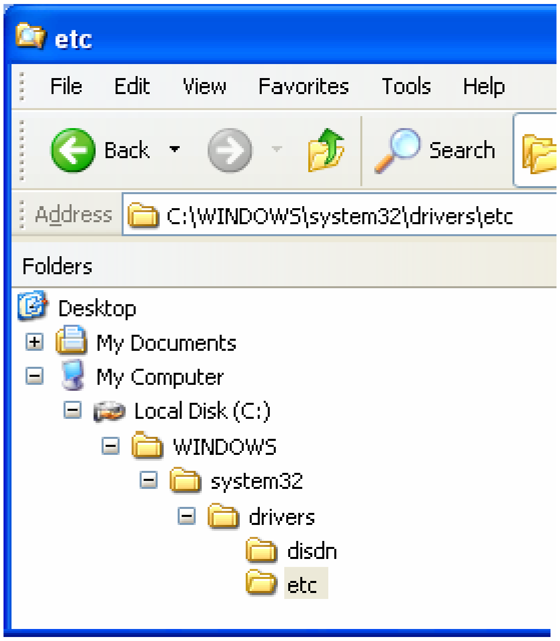
Book Outline Example

1. Chapter 1
    a. Section 1
        i. Data 1
        ii. Data 2
        iii. Data 3
    b. Section 2
        i. Data 1
        ii. Data 2
        iii. Data 3
    c. Section 3

Operating System Hierarchy Example

C:\WINDOWS\system32\drivers\etc

```
C:\
        WINDOWS\
                system32\
                        drivers\
                                etc\
```



C:\WINDOWS\system32\drivers\etc

Familiar example of a data presented in TREE format

XML1000 Example Output 'Document'

```
<?xml version="1.0" encoding="UTF-8"?>

<XML1000>
     <DIN>
          <D1>1</D1>
          <D2>1</D2>
          <D3>1</D3>
          <D4>1</D4>
          <D5>1</D5>
          <D6>1</D6>
          <D7>1</D7>
          <D8>1</D8>
     </DIN>
     <AOUT>
          <AO1>5.0</AO1>
          <AO2>3.5</AO2>
     </AOUT>
     <RELAY>
          <R1>0</R1>
          <R2>0</R2>
     </RELAY>
</XML1000>
```

XML Syntax Overview

Data being returned from the XML100 is in a structured format called a 'document'. Each XML document has both a logical and a physical structure. Physically, the document is composed of units called entities. An entity may be stored or dynamic data, or may refer to other entities to cause their inclusion in the document.

Documents are composed of declarations, elements, comments, character references, and processing instructions, all of which are indicated in the document by explicit markup tags. In order to understand a document and discern the relevant data being provided, you will need to have a detailed description of each component of the document and instructions on how to use it. This is called a syntax description.

XML Declaration

The first line in an XML document is the XML declaration:
Example: <?xml version="1.0" encoding="UTF-8"?>

This is an optional line stating what version of XML is in use (normally version 1.0), and may also contain information about character encoding and external dependencies. It is not often necessary, unless using XSL (e**X**tensible **S**tylesheet **L**anguages) to format the data. Several web-browsers including Internet Explorer, Firefox, and Mozilla support transformation of XML to HTML. Therefore if you are using a browser to view the data from an XML1000, you would want to use the optional XML declaration.

Elements

The remainder of the XML document consists of **nested elements**, some of which have other nested elements and/or content. An **element** typically consists of two **tags** surrounding other elements or data. These tags are called the **start** and **end** tags, or **tag sets.**

The start tag consists of a name surrounded by angle brackets, such as "<sample tag>";
The end tag consists of the same name surrounded by angle brackets,
but with a forward slash preceding the name, such as "</sample tag>".

The element's **content** is everything that appears between the start tag and the end tag, including other (child) elements and actual data. When there is another set of element tags inside a tag set, the outer tag set is referred to as the **parent** tag. The inner tag set that surrounds the data content are called **child** tags.

The following is a complete XML element, with start tag, text content, and end tag:

```
        <ELEMENT1>Test Data</ELEMENT1>
```

The following samples show several XML elements, with start tags, nested elements, and data.

```
<START>
    <PARENT1>
        <NESTEDELEMENT1>Test Data</NESTEDELEMENT1>
   </PARENT1>
</START>


<DATA>
    <PARENT1>
        <NESTEDELEMENT1>Test Data</NESTEDELEMENT1>
        <NESTEDELEMENT2>Test Data</NESTEDELEMENT2>
   </PARENT1>
    <PARENT2>
        <NESTEDELEMENT1>Test Data</NESTEDELEMENT1>
   </PARENT2>
</DATA >
```

Document Correctness

For an XML document to be correct, it must be both **well-formed** and **valid**. That means that the document conforms both to the rules of XML, as well as the requirements of the schema (in this case, the correct values required to interrogate and configure the XML1000).

It is therefore possible that documents could be well-formed but not valid. Conversely, documents could conform to the correct schema, but may not be formatted properly (well-formed). It is essential that both factors are present in order for XML to work properly.

Well Formed Documents

A well-formed document conforms to all of the W3C XML syntax rules.
For more info on well-formed documents, refer to the W3C website at http://www.w3.org/XML.

Below are some examples of those rules for well-formed documents:

1. The document may have only one root element.
2. Non-empty elements must have both opening and closing tags.
3. Empty elements may be marked with an empty-element (self-closing) tag, such as <EMPTY/>.
4. All attribute values are quoted, either single (') or double (") quotes.
5. Single quotes close a single quote and double quotes close a double quote.
6. Tags may be nested but must not overlap.
7. Each non-root element must be completely contained in another element.
8. Document elements match required case-sensitivity.
   Example: the tag <Sample> is not the same as <SAMPLE>.
9. The document complies to its character set definition.

Valid Documents

Valid document have data that conforms to defined content rules, or XML schema.
Below are some examples of those rules for valid documents:

1. Elements must have the correct data type.
2. Elements required to contain a numeric value, may not contain text.
3. Elements required to contain a text may only not contain a numeric as part of the string.
4. Elements that are numeric, must be displayed as the correct type - integer or decimal.

5
communicating with the XML1000

The following section provides the basic tools needed to begin communicating with the XML1000 using XML.

Communicating to the XML1000 Serial I/O Server

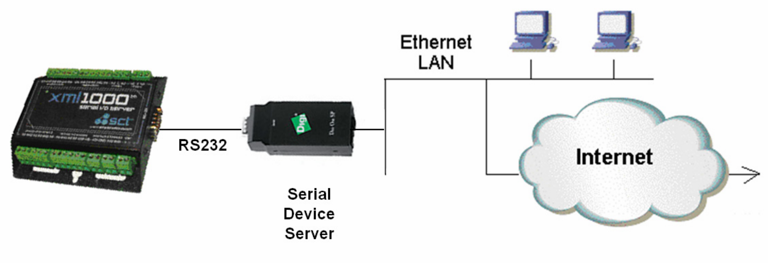
Communicating with the XMl1000 Serial I/O Server is done thru a DB9 male connector (RS232). The port is configured as a DTE (terminal) port with a baud rate of 115200,8N1. No flow control is used as this is a 3 wire device (TX, RX and GND). (All flow control signals are "Looped-Back" for your convenience). Therefore, in order to connect to the XML1000 from a PC, you will need to use either a standard serial cable and a null adapter or a null serial cable.

Connection Examples

Ethernet Network Connection

To connect an XML1000 to an Ethernet LAN, simply use a Serial Device Server such as the Digi One SP or the Lantronix UDS-10.

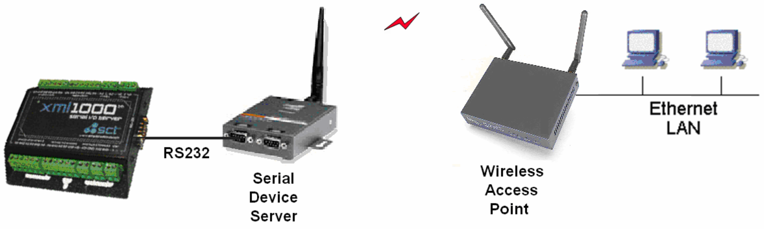
COM1000 connected to a serial device server



Wireless Network Connection (802.11)

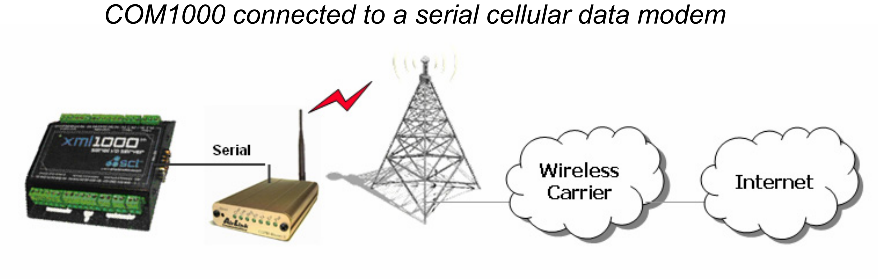
To connect an XML1000 to an Ethernet LAN, simply use a Serial Device Server such as the Digi One SP or the Lantronix UDS-10.

COM1000 connected to a wireless serial device server



Wireless Network Connection (Cellular)
To connect an XML1000 to an Ethernet LAN, simply use a Serial Device Server such as the Digi One SP or the Lantronix UDS-10.

COM1000 connected to a serial cellular data modem



Configuring and Querying the device

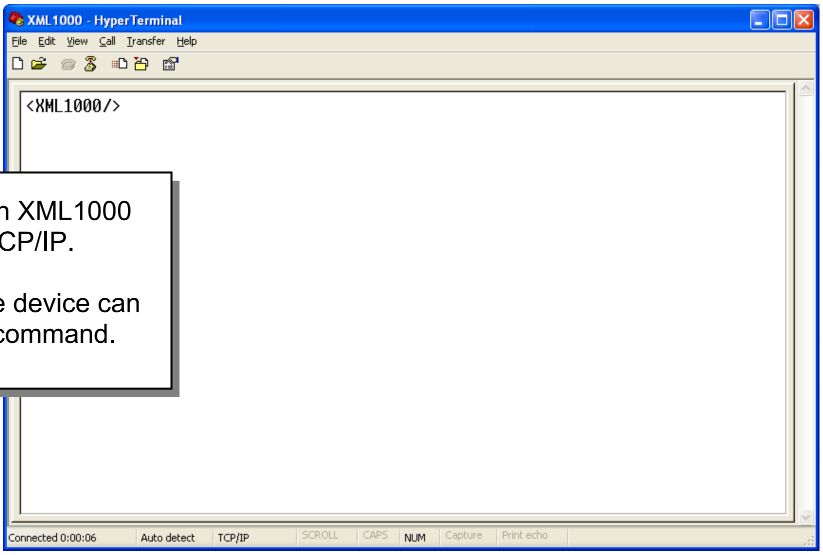
When sending XML formatted commands to the XML1000, it is important know some basic rules:

1 – Messages send to the device are XML documents.
When you format an XML based command to configure or query the XML1000, all the rules that pertain to document presentation apply. That means that commands must be both well-formed and valid. If a command does not meet those rules, the XML1000 will return a document with the <ERROR> element.

2 – Messages face parsing time limitations
XML formatted commands are processed by the XML1000 parser as a complete message. Therefore typing an XML formatted message one character at a time will not work. There is not way to type commands fast enough to send commands by hand.

3 – Support for short (abbreviated) notation.
XML formatted commands may be either normal or abbreviated notation.
For example – when querying the device using the ROOT element, you can send either:

<XML1000></XML1000>	Long Notation
or	
<XML1000/>	Abbreviated Notation



```
<XML1000/>
```

Sample of communicating with an XML1000 using HyperTerminal over TCP/IP.

Sending the ROOT element to the device can be done using the Copy/Paste command.

Querying the Entire Device Configuration

As shown above, sending either <XML1000></XML1000> or <XML1000/> will query the root element. The device will respond with all its element values, including general configuration values and live data values.

Querying Specific Values

To query a specific value, the command will have to include the root element followed by the sub element start and ending tags. Here are some examples:

Query	Response

Query for General Config Values
<XML1000><CFG></CFG></XML1000>
or
<XML1000><CFG/></XML1000>
	<?xml version="1.0" encoding="UTF-8"?>
	<XML1000>
	    <CFG>
	        <UID>TEST1</UID>
	        <VER>XML1000 1.3.002.A</VER>
	        <EID>0</EID>
	        <XSL>1</XSL>
	        <RBX>1</RBX>
	        <RBXTMR>1</RBXTMR>
	        <RBXCNT>0</RBXCNT>
	        <AUNITS>0</AUNITS>
	    </CFG>
	</XML1000>

Query for Digital Input Values
<XML1000><DIN></DIN></XML1000>
or
<XML1000><DIN/></XML1000>
	<?xml version="1.0" encoding="UTF-8"?>
	<XML1000>
	    <DIN>
	        <D1>1</D1>
	        <D2>1</D2>
	        <D3>1</D3>
	        <D4>1</D4>
	        <D5>1</D5>
	        <D6>1</D6>
	        <D7>1</D7>
	        <D8>1</D8>
	    </DIN>
	</XML1000>

Query for Digital Input Counts
<XML1000><DCNT></DCNT></XML1000>
or
<XML1000><DCNT/></XML1000>
	<?xml version="1.0" encoding="UTF-8"?>
	<XML1000>
	    <DCNT>
	        <C1>000000000</C1>
	        <C2>000000000</C2>
	        <C3>000000000</C3>
	        <C4>000000000</C4>
	        <C5>000000000</C5>
	        <C6>000000000</C6>
	        <C7>000000000</C7>
	        <C8>000000000</C8>
	    </DCNT>
	</XML1000>

Query for Analog Input Values <XML1000><AIN></AIN ></XML1000> or <XML1000><AIN/></XML1000>	<?xml version="1.0" encoding="UTF-8"?> <XML1000> <AIN> <A1>0.0</A1> <A2>0.0</A2> <A3>0.0</A3> <A4>0.0</A4> <A5>0.0</A5> <A6>0.0</A6> <A7>0.0</A7> <A8>0.7</A8> </AIN> </XML1000>
Query for Relay Status <XML1000><RELAY ></RELAY></XML1000> or <XML1000><RELAY/></XML1000>	<?xml version="1.0" encoding="UTF-8"?> <XML1000> <RELAY> <R1>0</R1> <R2>0</R2> </RELAY> </XML1000>

Error Messages

As mentioned earlier, when an invalid message is sent to the XML1000, the device will return an <ERROR> element, along with the child element describing the type of effort and the offending data if present. The following described the (5) types of errors:

<BADFORMAT>
This will usually happen if the 5 second inter-character timeout happens and there is garbage in buffer.

<READONLY>
This occurs when attempting to WRITE data to a READ ONLY element.

<DATATYPE>
This occurs when attempting to WRITE an invalid value to any element. (Ex: writing ABC to analog output)

<OUTOFRANGE>
This occurs when attempting to WRITE an unsupported value to any element. (Ex: writing a 2 to relay output).

<SYNTAX>
General error response

XML1000 Element Naming Convention Descriptions

The chosen names for XML elements are what convey the meaning of data in the markup document. This increases human readability while retaining the structure for parsing. The goal is to choose names that imply the meaning of the elements and data to a human reader without requiring a reference manual. However, because being too descriptive can lead to verbose element names (and thus have an impact of processing power and use of network bandwidth), it may be necessary to have tags that are abbreviated.

Having tags that accomplish the goal of readership without being too verbose is the ideal goal. The XML1000 element names were designed for just that reason. While they may seem a little bit cryptic at first, their meanings becoming quite clear once they are defined. The following table details each tag and its relationship to the parent element.

TAG	DESCRIPTION	DATA TYPE	PARENT
XML1000	Root element	N/A	None
CFG	Parent for CFG elements	N/A	XML1000
UID	Unique Device ID	string	CFG
VER	Firmware Version	string	CFG
EID	Include UID in data responses and RBX	integer	CFG
XSL	Include XML declaration in output	integer	CFG
RBX	Report By Exception feature	integer	CFG
RBXTMR	Time between RBX reports	integer	CFG
RBXCNT	Time between RBX reports	integer	CFG
AUNITS	Sets analog to be volts or decimal	integer	CFG
DIN	Parent for Digital Inputs	N/A	XML1000
Dn	Analog Output values	integer	DIN
DTYPE	Parent for Digital Input Types	N/A	XML1000
Tn	Sets Digital Inputs to NO or NC	integer	DTYPE
DCNT	Parent for Digital Input Counts	N/A	XML1000
Cn	Digital Input counts	integer	DCNT
AIN	Parent for Analog Inputs	N/A	XML1000
An	Analog Input values	decimal	AIN
AMINVAL	Parent for Analog Input Min Values	N/A	XML1000
AnMN	Lowest value since last request	decimal	AMINVAL
AMAXVAL	Parent for Digital Input elements	N/A	XML1000
AnMX	Highest value since last request	decimal	AMAXVAL
AMINSETPT	Parent for Digital Input elements	N/A	XML1000
AnMNSP	Low setpoints for RBX reporting	decimal	AMINSETPT
AMAXSETPT	Parent for Digital Input elements	N/A	XML1000
AnMXSP	High setpoints for RBX reporting	decimal	AMAXSETPT
AOUT	Parent for Digital Input elements	N/A	XML1000
AOn	Analog Output values	decimal	AOUT
RELAY	Parent for Relay Outputs	N/A	XML1000
Rn	Relay Output values	decimal	RELAY

XML1000 Example Output ‘Document’

```
<?xml version="1.0" encoding="UTF-8"?>

<XML1000>
    <ID>TEST1</ID>
    <CFG>
        <UID>TEST1</UI
        <VER>XML1000 1.3.002.A</VER>
        <EID>1</EID>
        <XSL>1</XSL>
        <RBX>1</RBX>
        <RBXTMR>1</RBXTMR>
        <RBXCNT>0</RBXCNT>
        <AUNITS>0</AUNITS>
    </CFG>
    <DIN>
        <D1>1</D1>
        <D2>1</D2>
        <D3>1</D3>
        <D4>1</D4>
        <D5>1</D5>
        <D6>1</D6>
        <D7>1</D7>
        <D8>1</D8>
    </DIN>
    <DCNT>
        <C1>000000001</C1>
        <C2>000000001</C2>
        <C3>000000001</C3>
        <C4>000000001</C4>
        <C5>000000001</C5>
        <C6>000000001</C6>
        <C7>000000001</C7>
        <C8>00000000
    </DCNT>
    <AIN>
        <A1>0.0</A1>
        <A2>0.0</A2>
        <A3>0.0</A3>
        <A4>0.0</A4>
        <A5>0.0</A5>
        <A6>0.0</A6>
        <A7>0.0</A7>
        <A8>0.7</A8>
    </AIN>
    <AOUT>
        <AO1>5.0</AO1>
        <AO2>3.5</AO2>
    </AOUT>
    <RELAY>
        <R1>0</R1>
        <R2>0</R2>
    </RELAY>
</XML1000>
```

XML1000 Example Output ‘Document’

```
<?xml version="1.0" encoding="UTF-8"?>

<XML1000>
    <UID>TEST1</UID>
    <CFG>
        <UID>TEST1</UI
        <VER>XML1000 1.3.002.A</VER>
        <EID>1</EID>
        <XSL>1</XSL>
        <RBX>1</RBX>
        <RBXTMR>1</RBXTMR>
        <RBXCNT>0</RBXCNT>
        <AUNITS>0</AUNITS>
    </CFG>
    <DIN>
        <D1>1</D1>
        <D2>1</D2>
        <D3>1</D3>
        <D4>1</D4>
        <D5>1</D5>
        <D6>1</D6>
        <D7>1</D7>
        <D8>1</D8>
    </DIN>
    <DCNT>
        <C1>000000001</C1>
        <C2>000000001</C2>
        <C3>000000001</C3>
        <C4>000000001</C4>
        <C5>000000001</C5>
        <C6>000000001</C6>
        <C7>000000001</C7>
        <C8>00000000
    </DCNT>
    <AIN>
        <A1>0.0</A1>
        <A2>0.0</A2>
        <A3>0.0</A3>
        <A4>0.0</A4>
        <A5>0.0</A5>
        <A6>0.0</A6>
        <A7>0.0</A7>
        <A8>0.7</A8>
    </AIN>
    <AOUT>
        <AO1>5.0</AO1>
        <AO2>3.5</AO2>
    </AOUT>
    <RELAY>
        <R1>0</R1>
        <R2>0</R2>
    </RELAY>
</XML1000>
```

- <XML1000> is the ROOT (top hierarchal) element
- Main ‘container’ for all other elements & data
- Equivalent to the MAIN C:\ drive of your PC
- Each lower data element is wrapped in a container
- Equivalent to a folder or sub-directory on your PC
- Data array is wrapped with a start and closing tag

- General configuration values (CFG)
- Includes UID, VER, EID, XSL, RBX and more

- Digital input STATUS data
- <DIN><D1>data</D1></DIN>

- Digital input COUNT data
- DCNT is the ‘parent’ container
- Each COUNT has it’s own container as well
- <DCNT><C1>data</C1></DCNT>

- Analog input STATUS
- <AIN><A1>data</A1></AIN>

- Analog output STATUS
- <AOUT><AO1>data</AO1></AOUT>

- Relay output STATUS
- <RELAY><R1>data</R1></RELAY>

- ‘</XML1000>’ is the closing tag for the ‘document’

6

using the xml1000 configuration utility

The XML1000 Configuration Utility is provides a desktop style GUI to allow you to read and configure the XML1000 using simple select boxes and buttons. The utility is also designed to present the end user or developer with the ability to see the actual XML code being sent to and received from the device in real time.

Configuration Utility

Layout

The utility is broken down into various sections and functional blocks. The layout and explanation of the functions is as follows:

- CONNECTION Enables connection to the device over Com Port or TCP/IP connection.
- GENERAL Displays and sets Unit ID value and displays current firmware version.
- DEVICE CONFIGURATION Displays and configures global display and reporting behaviors.
- DIGITAL INPUTS Displays Digital Input states.
- DIGITAL COUNTS Displays and sets Digital Input counts.
- ANALOG INPUTS Displays and sets Analog Input values.
- RELAY OUTPUTS Displays and sets Relay Output states.
- ANALOG OUTPUTS Displays and sets Analog Output values.
- SENT Displays the XML code most recently sent to the device.
- RECEIVED Displays the XML code most recently received from the device.

Configuration Utility Connection Steps

Step 1:

Connect your PC to the XML1000 RS232 interface using a standard RS232 cable and null adapter or a null RS232 cable. The XML1000 interface is a DTE port, so a standard serial cable alone will not work.

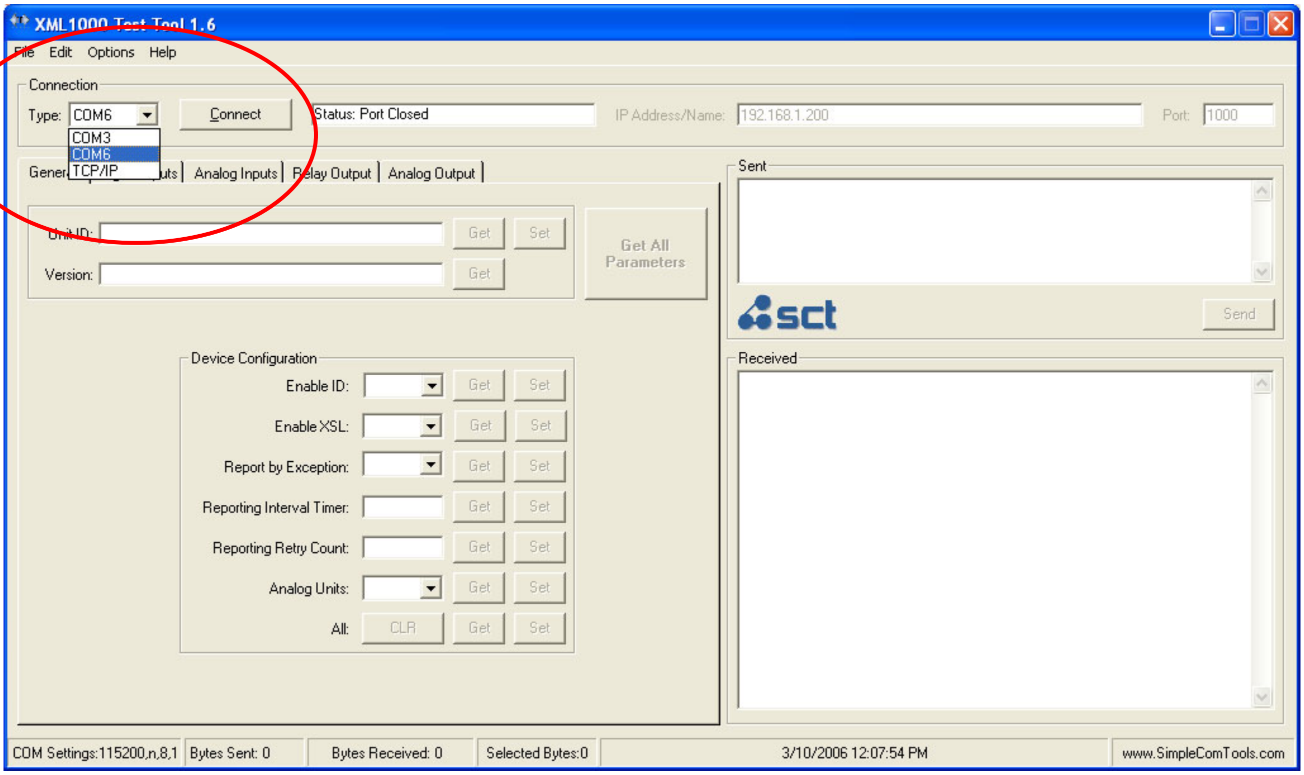
Step 2:

Launch the XML1000 Configuration Utility. Select the correct COM Port on your PC from the Connection Type drop down menu and click on **CONNECT**. You will be able to view the status of the connection in the Status window.

Step 3:

Once you have successfully gained access to the device, you can view or edit any of the XML1000 application registers. To view ALL the current register settings, click on the **Get All Parameters** button.

Select your communications method



Type: COM6

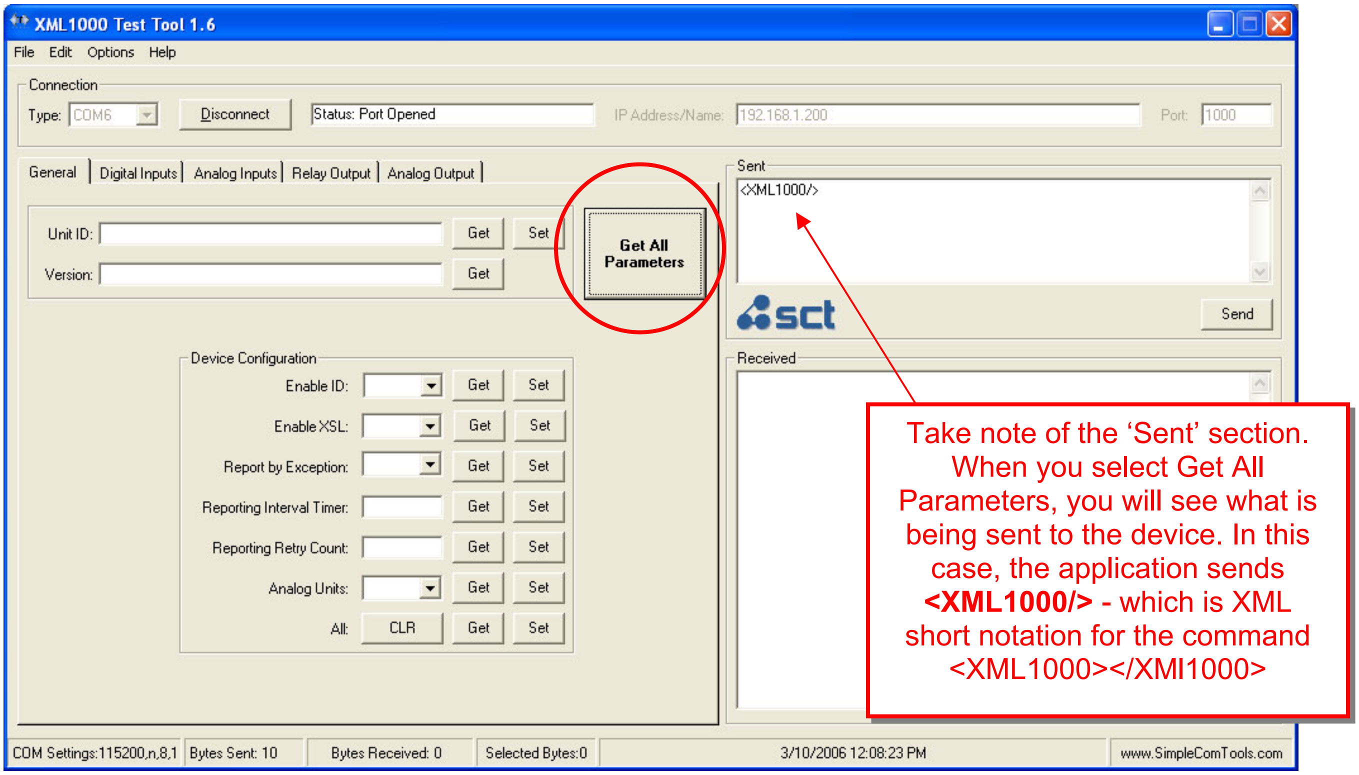
Status: Port Closed

IP Address/Name: 192.168.1.200

Port: 1000

COM Settings:115200,n,8,1 | Bytes Sent: 0 | Bytes Received: 0 | Selected Bytes:0 | 3/10/2006 12:07:54 PM | www.SimpleComTools.com

*Clink on **Get All Parameters** to read device*



Type: COM6

Status: Port Opened

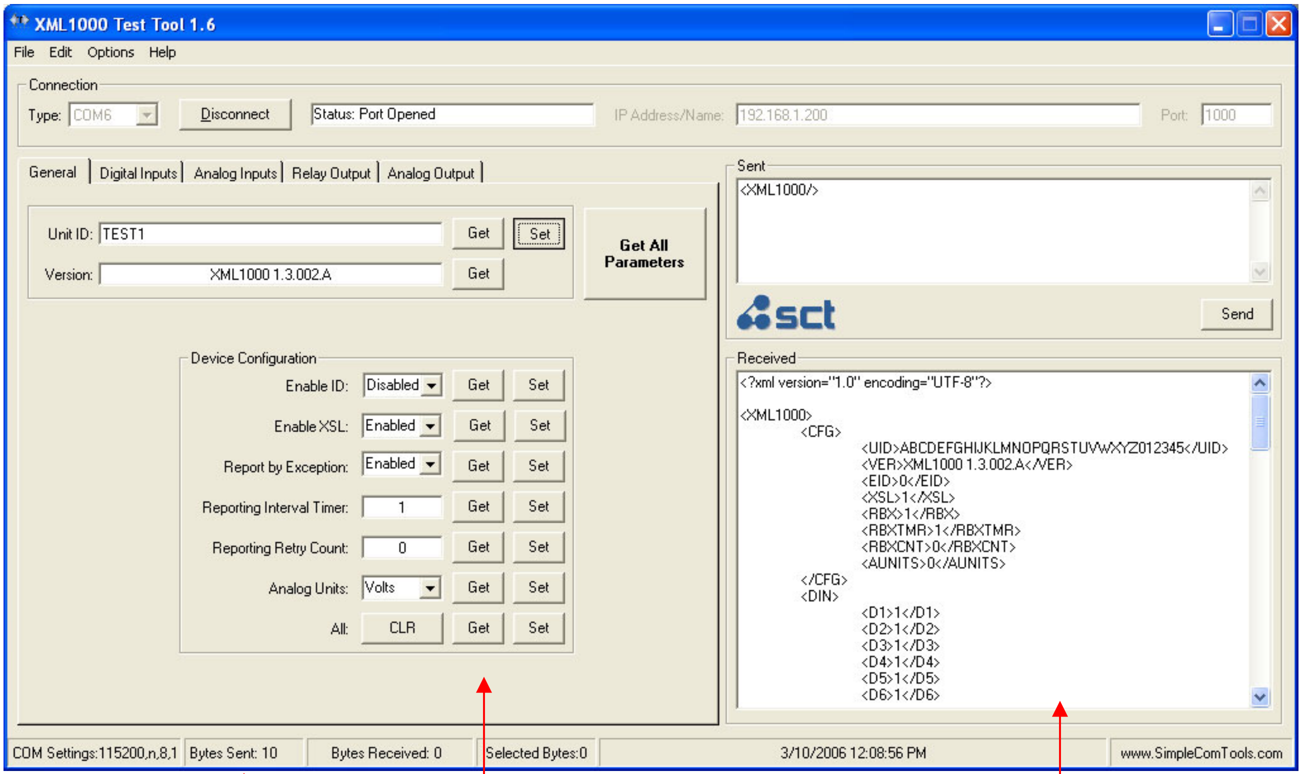
IP Address/Name: 192.168.1.200

Port: 1000

Sent: <XML1000/>

COM Settings:115200,n,8,1 | Bytes Sent: 10 | Bytes Received: 0 | Selected Bytes:0 | 3/10/2006 12:08:23 PM | www.SimpleComTools.com

Take note of the 'Sent' section. When you select Get All Parameters, you will see what is being sent to the device. In this case, the application sends **<XML1000/>** - which is XML short notation for the command <XML1000></XMl1000>



Connection

Type: COM6

Status: Port Opened

IP Address/Name: 192.168.1.200

Port: 1000

Unit ID: TEST1

Version: XML1000 1.3.002.A

Device Configuration

Enable ID: Disabled

Enable XSL: Enabled

Report by Exception: Enabled

Reporting Interval Timer: 1

Reporting Retry Count: 0

Analog Units: Volts

All:

Sent

```
<XML1000/>
```

Received

```
<?xml version="1.0" encoding="UTF-8"?>

<XML1000>
        <CFG>
                <UID>ABCDEFGHIJKLMNOPQRSTUVWXYZ012345</UID>
                <VER>XML1000 1.3.002.A</VER>
                <EID>0</EID>
                <XSL>1</XSL>
                <RBX>1</RBX>
                <RBXTMR>1</RBXTMR>
                <RBXCNT>0</RBXCNT>
                <AUNITS>0</AUNITS>
        </CFG>
        <DIN>
                <D1>1</D1>
                <D2>1</D2>
                <D3>1</D3>
                <D4>1</D4>
                <D5>1</D5>
                <D6>1</D6>
```

COM Settings:115200,n,8,1 | Bytes Sent: 10 | Bytes Received: 0 | Selected Bytes:0 | 3/10/2006 12:08:56 PM | www.SimpleComTools.com

Take note of the values located on the status tab.

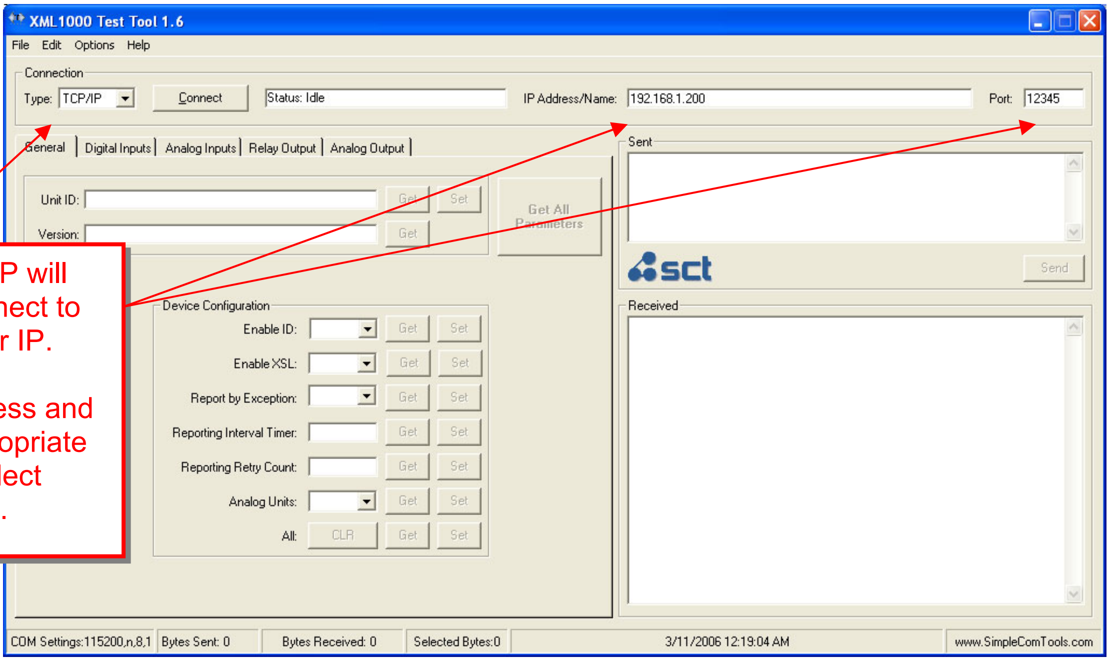
This tab displays COM setting as well as the number of bytes sent and received.

Take note of the values located on the tab.

These values will be populated when the values are returned from the device.

Take note of the 'Received' section.

This will show you the exact XML data returned from the device.



Connection

Type: TCP/IP

Status: Idle

IP Address/Name: 192.168.1.200

Port: 12345

Unit ID:

Version:

Device Configuration

Enable ID:

Enable XSL:

Report by Exception:

Reporting Interval Timer:

Reporting Retry Count:

Analog Units:

All:

Sent

Received

COM Settings:115200,n,8,1 | Bytes Sent: 0 | Bytes Received: 0 | Selected Bytes:0 | 3/11/2006 12:19:04 AM | www.SimpleComTools.com

Selecting TCP/IP will allow you to connect to the device over IP.

Enter the IP address and port into the appropriate boxes and select CONNECT.

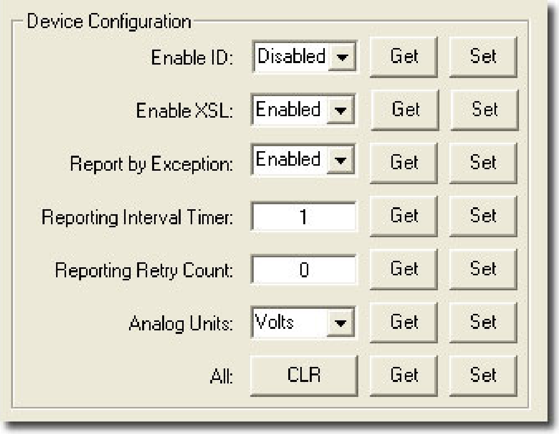
Reading and making changes to the device

Reading any individual value is done by using the **Get** button. Changes can be made by using either the drop-down menu or entering the desired value in the text box and hitting the **Set** button.

All changes are immediately written to the device.
There is no need to 'save' any set changes.

Clearing existing values

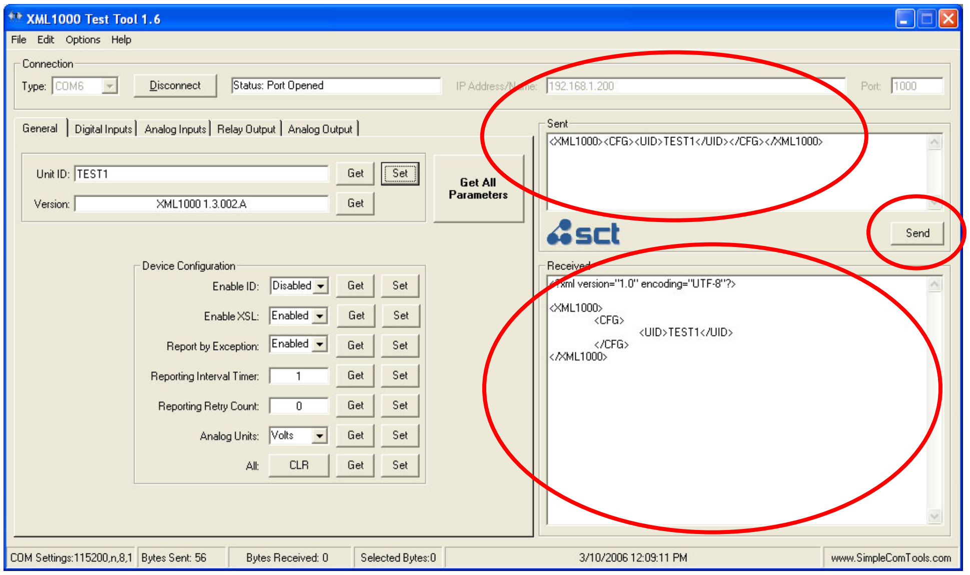
In the case of numeric values, clearing is simply done by entering a zero. In the case of text values, clicking on the Set button with an empty text field will clear the value from the device.


Device Configuration

Enable ID: Disabled
Enable XSL: Enabled
Report by Exception: Enabled
Reporting Interval Timer: 1
Reporting Retry Count: 0
Analog Units: Volts
All: CLR

Making manual changes to commands being sent to the device

While it is possible to change what commands are being sent to the device using the provided Get and Set buttons, the utility also provides you the ability to manually edit the SENT commands inside the Sent window.



Connection

Type: COM6
Status: Port Opened
IP Address/Name: 192.168.1.200
Port: 1000

Unit ID: TEST1
Version: XML1000 1.3.002.A

Device Configuration

Enable ID: Disabled
Enable XSL: Enabled
Report by Exception: Enabled
Reporting Interval Timer: 1
Reporting Retry Count: 0
Analog Units: Volts
All: CLR

Sent

```
<XML1000><CFG><UID>TEST1</UID></CFG></XML1000>
```

Received

```
<?xml version="1.0" encoding="UTF-8"?>

<XML1000>
        <CFG>
                <UID>TEST1</UID>
        </CFG>
</XML1000>
```

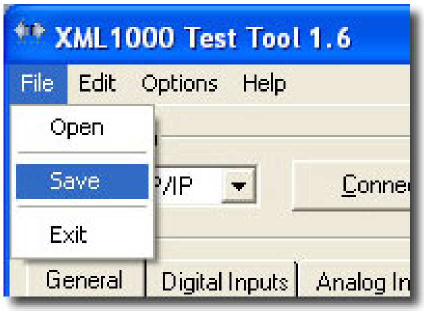
COM Settings:115200,n,8,1 | Bytes Sent: 56 | Bytes Received: 0 | Selected Bytes:0 | 3/10/2006 12:09:11 PM | www.SimpleComTools.com

This allows you to test your understanding of XML syntax. Simply change the command being sent to what you would like to test, and then click on the Send button.

What you see in the Sent window will now be sent to the device. The new response will appear in the refreshed Received window.

Saving the settings as a template

The XML1000 configuration utility has a TEMPLATE function. This feature is designed to provide the ability to save a device configuration for future use or application to another device. Here are the basic options:



<u>Saving a configuration</u>

Select the File/Save and give the file a name and save it with either a **.txt or .xml** extension.

<u>Reading a configuration</u>

Select File/Open and select the configuration file you want to use. When opened, the settings will populate. Edit values if appropriate, and click on any individual **Set** button or the **Set** button next to the **ALL** heading.

6
using 'AT' commands

As mentioned earlier, the XML1000 AT Commands are a format similar to traditional Hayes-Compatible AT Commands, but because the device is not a modem, the similarities are modest. In order to configure the device using AT Commands, follow these directions:

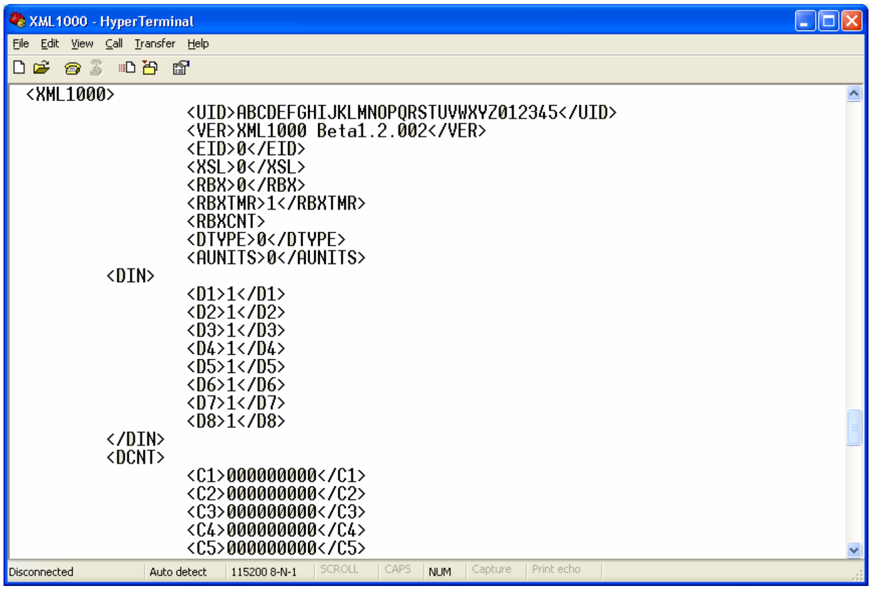
Connection Steps

Step 1:

Connect your PC to the XML1000 RS232 interface using a standard RS232 cable and null adapter or a null RS232 cable. The XML1000 interface is a DTE port, so a standard serial cable alone will not work.

Step 2:
Open a connection using any Terminal program, such as HyperTerminal or TeraTerm. The default setup for the port is 1152000, 8, None, and 1

Step 3:
Once connected, enter 'AT' and hit the RETURN or ENTER key. You should 'OK' as the response.
To view ALL the current register settings, enter **AT&V**.



```
<XML1000>
                <UID>ABCDEFGHIJKLMNOPQRSTUVWXYZ012345</UID>
                <VER>XML1000 Beta1.2.002</VER>
                <EID>0</EID>
                <XSL>0</XSL>
                <RBX>0</RBX>
                <RBXTMR>1</RBXTMR>
                <RBXCNT>
                <DTYPE>0</DTYPE>
                <AUNITS>0</AUNITS>
        <DIN>
                <D1>1</D1>
                <D2>1</D2>
                <D3>1</D3>
                <D4>1</D4>
                <D5>1</D5>
                <D6>1</D6>
                <D7>1</D7>
                <D8>1</D8>
        </DIN>
        <DCNT>
                <C1>000000000</C1>
                <C2>000000000</C2>
                <C3>000000000</C3>
                <C4>000000000</C4>
                <C5>000000000</C5>
```

Step 4: Once you have successfully gained access to the command prompt, you can view or edit any of the XML1000 application registers. The following pages detail the available commands.

Configuration Using AT Commands

The XML1000 Serial I/O Server supports two communications protocols: XML and AT Commands.
The following is a list of the AT Commands listed by category:

Basic Device Configuration Parameters

AT Command	Description
&V	**Description:** Returns state of all device registers. **Query** AT&V Returns entire device configuration showing all registers.
AUNITS	**Description:** Analog Input Units; sets values to be either raw voltage or decimal **Query** AT*AUNITS **Configuration** AT*AUNITS=n Options: 0 = Raw Voltage Value (Default) 1 = Decimal Value (0-1023)
EID	**Description:** Choose to include the UID in every report and response. **Query** AT*EID **Configuration** AT*EID=n Options: 0 = Disabled (Default) 1 = Enabled
RBX	**Description:** Report By Exception; enables automatic reporting of changes in I/O or passing analog set point thresholds. **Query** AT*RBX **Configuration** AT*RBX=n Options: 0 = Disabled (Default) 1 = Report only the specific INPUT value that has changed 2 = Report the entire GROUP when any of the group changes 3 = Report the entire DEVICE when any inputs has changed

RBXNUM	**Description:** Report By Exception number; # of repeat RBX reports. **Query** AT*RBXNUM **Configuration** AT*RBXNUM=n Options: n = (0 –Never Reports) n = (1 – 255)
RBXTMR	**Description:** Report By Exception timer. Time between RBX reports (in MIN). **Query** AT*RBXTMR **Configuration** AT*RBXTMR=n Options: n = (0 - 255) Note: Setting the value to 0 means RBX will never repeat.
UID	**Description:** Reads or sets the Unique Device ID (UID). **Query** AT*UID **Configuration** AT*UID=xxxxx Options: x = Up to 32 alphanumeric characters.
VER	**Description:** Current Firmware Version. **Query** AT*VER Returns current XML1000 firmware version.
XSL	**Description:** XSL Header setting. Enables/disables the XML header for facilitating the presentation of XML data in an XML tree format when using a browser. **Query** AT*XSL **Configuration** AT*XSL=n Options: 0 = Disabled (Default) 1 = Enabled

Analog Inputs

AT Command	Description
An	**Description:** Analog Input Status. **Query** AT*An Query the state of any Analog Input. Options: n = (1 – 8) Response value is contingent upon the status of the AUNITS register. (0.00 – 5.00) for units with 0-5VDC inputs when AUNITS=0 (0.00 – 30.00) for units with 0-30VDC inputs when AUNITS=0 (0.00 – 16.00) for units with 4-20mA inputs when AUNITS=0 (0 – 1023) when AUNITS=1
AnMN	**Description:** Analog Input Minimum LOWEST value attained since the last read request. **Query** AT*AnMN Query the LOWEST attained value for the analog input. Response value will be in either VOLTAGE or DECIMAL format, whichever one is selected in the AUNITS register. Options: n = (1 – 8) Response value is contingent upon the status of the AUNITS register. (0.00 – 5.00) for units with 0-5VDC inputs when AUNITS=0 (0.00 – 30.00) for units with 0-30VDC inputs when AUNITS=0 (0.00 – 20.00) for units with 4-20mA inputs when AUNITS=0 (0 – 1023) when AUNITS=1 **Configuration** AT*AnMN=y Command to reset the LOWEST reached value for the analog input. New value must be in the same format selected in the AUNITS register. Options: n = (1 – 8) y = (0.00 – 5.00) for units with 0-5VDC inputs when AUNITS=0 y = (0.00 – 30.00) for units with 0-30VDC inputs when AUNITS=0 y = (4.00 – 20.00) for units with 4-20mA inputs when AUNITS=0 y = (0 – 1023) when AUNITS=1

AnMNSP	**Description:** Analog Input Minimum Setpoint. The LOW setpoint for exception reporting. **Query** AT*AnMNSP Query the MINIMUM (LOW) SETPOINT of the analog input. Response value will be in either VOLTAGE or DECIMAL format, whichever one is selected in the AUNITS register. Options: n = (1 – 8) Response value is contingent upon the status of the AUNITS register. (0.00 – 5.00) for units with 0-5VDC inputs when AUNITS=0 (0.00 – 30.00) for units with 0-30VDC inputs when AUNITS=0 (0.00 – 20.00) for units with 4-20mA inputs when AUNITS=0 (0 – 1023) when AUNITS=1 **Configuration** AT*AnMNSP=y Command to <u>set</u> the MINIMUM (LOW) SETPOINT for the analog input. New value must be in the same format selected in the AUNITS register. Options: n = (1 – 8) y = (0.00 – 5.00) for units with 0-5VDC inputs when AUNITS=0 y = (0.00 – 30.00) for units with 0-30VDC inputs when AUNITS=0 y = (4.00 – 20.00) for units with 4-20mA inputs when AUNITS=0 y = (0 – 1023) when AUNITS=1
AnMX	**Description:** Analog Input Maximum HIGHEST value attained since the last read request. **Query** AT*AnMX Query the HIGHEST attained value for the analog input. Response value will be in either VOLTAGE or DECIMAL format, whichever one is selected in the AUNITS register. Options: n = (1 – 8) Response value is contingent upon the status of the AUNITS register. (0.00 – 5.00) for units with 0-5VDC inputs when AUNITS=0 (0.00 – 30.00) for units with 0-30VDC inputs when AUNITS=0 (0.00 – 20.00) for units with 4-20mA inputs when AUNITS=0 (0 – 1023) when AUNITS=1 **Configuration** AT*AnMX=y Command to <u>reset</u> the HIGHEST reached value for the analog input. New value must be in the same format selected in the AUNITS register. Options: n = (1 – 8) y = (0.00 – 5.00) for units with 0-5VDC inputs when AUNITS=0 y = (0.00 – 30.00) for units with 0-30VDC inputs when AUNITS=0 y = (4.00 – 20.00) for units with 4-20mA inputs when AUNITS=0 y = (0 – 1023) when AUNITS=1

AnMXSP	**Description:** Analog Input Maximum Setpoint. The HIGH setpoint for exception reporting. **Query** AT*AnMXSP Query the MINIMUM (LOW) SETPOINT of the analog input. Response value will be in either VOLTAGE or DECIMAL format, whichever one is selected in the AUNITS register. Options: n = (1 – 8) Response value is contingent upon the status of the AUNITS register. (0.00 – 5.00) for units with 0-5VDC inputs when AUNITS=0 (0.00 – 30.00) for units with 0-30VDC inputs when AUNITS=0 (0.00 – 20.00) for units with 4-20mA inputs when AUNITS=0 (0 – 1023) when AUNITS=1 **Configuration** AT*AnMNSP=y Command to set the MAXIMUM (HIGH) SETPOINT for the analog input. New value must be in the same format selected in the AUNITS register. Options: n = (1 – 8) y = (0.00 – 5.00) for units with 0-5VDC inputs when AUNITS=0 y = (0.00 – 30.00) for units with 0-30VDC inputs when AUNITS=0 y = (4.00 – 20.00) for units with 4-20mA inputs when AUNITS=0 y = (0 – 1023) when AUNITS=1

Digital Inputs (States)

AT Command	Description
Tn	**Description:** Digital Input TYPE. Adjusts the value of the input between Normally Open and Normally Closed. **Query** AT*Tn Query the state of a Digital Input. Options: n = (1 - 8) **Configuration** AT*Tn=y Options: n = (1 – 8) y = (0 or 1) y = 0 (Normally Open) y = 1 (Normally Closed)
Dn	**Description:** Current state of the Digital Input. Response value will indicate the state of the switch displayed as a 0 or 1. **Query** AT*Dn Query the state of a Digital Input. Options: n = (1 – 8)

Digital Inputs (Counts)

AT Command	Description
Cn	**Description:** Digital Input Counts. Response value will be a 9 digit value between 0 and 999999999. **Query** AT*Cn Query the accumulated COUNT value of a Digital Input. Options: n = (1 – 8) **Configuration (Reset)** AT*Cn=y Command to reset the COUNT value of a Digital Input. Option is given to set the counter to any value between 0 and 999999999. Options: n = (1 – 8) y = (0 – 999999999) Sets the counter any desired value

Relay Outputs

AT Command	Description
Rn	**Description:** Relay Output state. Response value displayed as a 0 or 1. **Query** AT*Rn Query the state of the Relay Output. Options: n = (1 – 8) **Configuration** AT*Rn=y Changes the state of the Relay Output. Options: n = (1 or 2) y = (0 or 1) y = 0 (De-energized) y = 1 (Energized)

Analog Outputs

AT Command	Description
AOn	**Description:** Analog Output value. **Query** AT*A0n Query the state of an Analog Output. Options: n = (1 or 2) Response value is contingent upon the status of the AUNITS register. (0.00 – 5.00) for units with 0-5VDC inputs when AUNITS=0 (0.00 – 30.00) for units with 0-30VDC inputs when AUNITS=0 (0.00 – 20.00) for units with 4-20mA inputs when AUNITS=0 (0 – 1023) when AUNITS=1 **Configuration (Output Send)** AT*A0n=y Command to set the voltage OUTPUT for an Analog output. Options: n = (1 or 2) y = (0.00 – 5.00) for units with 0-5VDC inputs when AUNITS=0 y = (0.00 – 30.00) for units with 0-30VDC inputs when AUNITS=0 y = (4.00 – 20.00) for units with 4-20mA inputs when AUNITS=0 y = (0 – 1023) when AUNITS=1