9292 Jeronimo Rd. Irvine,
CA 92618-1905

Feature Summary

Dependant on the central station automation software being utilized, the features described in this document and the features available to you will vary.

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Copyright and Disclaimer

Version History

Revision	Date	Author	Change Description
Rev 1.0	02/22/05	LJH	Initial release

Contents

1 Introduction

This document describes the VertX features including functionality, and characteristics.

1.1 General Description

VertX is an open architecture family of interface devices and controllers that provide a complete and fully functional hardware/firmware infrastructure for access control software host systems. The VertX Feature Summary defines the features of the communications, hardware devices, and firmware functionality. VertX operates on an embedded Linux operating system, currently utilizing the 2.4.26 kernel of Linux.

1.2 Host Communication

VertX communicates with the host system:

- Through three communication channels.
    - By industry standard TCP/IP Protocol over 10/100 Mbps Ethernet.
    - By two RS232 ports which allow for two modems using PPP.
        - Dial-up modem.
        - RF modem.
- Using an open, published protocol.
- With the possibility of multiple (up to 255) backup “hosts”.

1.3 Interfaces

VertX interfaces with the following.

- Card/PIN readers featuring SIA Standard Wiegand or Clock and Data output.
- Monitoring devices which provide a contact closure to indicate status change.
- Controllable devices which require a contact closure to be activated.

1.4 Major Components

VertX consists of the following major components.

- V100 Reader Interface - supports two Wiegand or Clock and Data card / PIN readers.
- V200 Input Monitor Interface - supports 16 analog inputs, and 2 non-latching output relays.
- V300 Output Control Interface - supports 12 latching output relays, and 2 analog inputs.
- V1000 Network Controller - supports up to 32 Reader, Input or Output interface units, and provides a TCP/IP connection to a host system.
- V2000 Reader Interface/Network Controller - supports two Wiegand or Clock and Data card / PIN readers, and provides a TCP/IP connection to a host system.

1.5 VertX Architecture

VertX provides a flexible architecture which can be easily adapted to widely varying requirements.

TCP/IP connections can be used for:

- High speed connection to the host.
- Connectivity through existing network cabling.

RS-232 connections can be used for:

- Connection to host via modem of choice such as POTS or wireless.
- Connection directly to a host PC
- Using the standard Point-to-Point Protocol (PPP)

RS-485 (two wires with shield) connections can be used for connection to field hardware devices, and offers the following features:

- Lower cost.
- Less impact on network capacity.
- Connectivity to existing twisted pair cabling.

Once configured by the host, VertX can be capable of controlling the entire access control device network with or without the host.

2 Regulatory Compliance

2.1 UL Standards

VertX input monitoring and reporting functions can meet applicable UL 1076 Proprietary Burglar Alarm System standards as a UL Recognized system component, including specific requirements for:

- Speed of reporting time.
- Verifying communications with field hardware.
- Detection of substitution of a similar field hardware device.
- Four-state alarm monitoring.

VertX meets applicable UL 294 Access Control standards as a UL Recognized system component, including criteria for:

- False accepts/rejects (erroneous granting/denial of access to a card).
- Attack resistance.
- Electrical safety.

2.2 CE Mark

VertX meets European CE Mark standards for electrical safety and RF emissions.

3 Product Life

VertX is designed to have a product life of ten years based on normal usage levels and environmental conditions. This can include components such as batteries, real time clocks and non-volatile memory.

4 Memory Capacity

Overall memory capacity can depend on how the host software distributes card records across the V1000 and V2000 controllers.

V1000 and V2000 memory capacity is expandable using socketed DIMMs and can be offered with the following capacities:

Memory Size	Card Record Database *	Without Duplicate Card Record Database	Transaction Storage
Standard	28,000	44,000	5,000
32MB Expansion	140,000	250,000	5,000

* Stated card record capacities can allow for duplicate cardholder database at each unit.

5 Compatibility

VertX can be compatible with the following.

- Microsoft® Windows® XP or Windows® 2000 host systems.
- ODBC Systems (File format compatibility only – ODBC (Open Database Connectivity) is not implemented in the Network interface).
- Host systems with HID web browser API or DLL-software installed.
- TCP/IP (using applicable IEEE standards).
- 10 Mbps or 100 Mbps Ethernet.
- Category 5 Cable, using RJ-45 connectors.
- HID Wiegand Standard or Long Formats or C&D Output Readers (up to 128-bit data).
- Any reader that meets the SIA Wiegand Standard.

6 Hardware Features

6.1 V100 Reader Interface

The V100 Reader Interface can perform all of the basic Input/Output and access control functions for two doors (or one door with entry and exit readers). The reader interfaces can connect to a V1000 via an RS-485 network, and can have a rotary address switch (Range: 0 - 15).

The V100 has the following I/O connections:

- Two Readers
- Two Door Monitor switches
- Two Request-to-Exit switches
- AC Fail Monitor (if provided by power supply)
- Battery Fail Monitor (if provided by power supply)
- Enclosure Tamper

The V100 has non-latching relay outputs for:

- Two door locking devices (configurable)
- Two auxiliary devices (door held/forced alarm, alarm shunt, host offline (comms down), or general purpose)

The V100 local processing capabilities can include:

- Alarm Shunt and Strike relay timing and latching functions
- Access control decisions based on facility code (degraded mode)
- Simple input/output linking on the same V100
- LED / Beeper control during Card + PIN and other transactions

The V100 is capable of supporting:

- Two Wiegand interface readers with or without PIN keypads
- Two Clock and Data readers
- Essex keypads (or equivalent)

6.2 V200 Input Monitor Interface

- The V200 panel connects to V1000 controllers via a RS-485.
- Supports 16 2/4-state configurable input circuits
- Provides two auxiliary relay outputs.

6.3 V300 Output Control Interface

- The V300 panel connects to V1000 controllers via a RS-485.
- Supports 12 form C latching output circuits.
- Provides two auxiliary 2/4 state inputs.

6.4 V1000 Network Controller

V1000 controllers connect to the host and other controllers via TCP/IP (with Modem backup to the host) and can connect to the V100-Series panels (V100, V200, and V300) via RS-485.

The V1000 controller has the following capabilities:

- Support and communicate any combination of up to 32 V100-Series panels.
- Store a complete access control and configuration database for any combination of up to 32 V100-Series panels.
- Process access control decisions for all connected devices.
- Process input/output linking for all RS-485 connected devices.
- Store a transaction history for all RS-485 connected devices.
- Connect to the host and to other devices on the TCP/IP network.
- Have backup connection to the host via dial-up or wireless modem.
- Report all activity to the host.
- Receive all real-time commands from the host.
- Allow local connection of a laptop computer for diagnostics, and verification; display or change the card and configuration database, and transaction history via the TCP/IP or diagnostic port.
- Control and communicate with all RS-485 connected devices when offline with the host
- Upload all buffered transactions to the host when communications are restored

The V1000 has the following I/O connections:

- RJ-45 connector for Ethernet TCP/IP.
- Four, two wire with shield, RS-485 connections to Reader, Input or Output Interface Units.
- Two configurable analog inputs for general purpose applications.
- Two non-latching output relays for local alarm annunciation.
- Tamper input.
- DC Power input.
- AC Power Fail input.
- Battery Fail input.

The V1000 can have two RS-232 ports, which can allow fallback communications with the host system in the event of loss of the network (TCP/IP Ethernet) by means of dialup modem, or RF modem.

6.5 V2000 Reader Interface/Network Controllers

V2000s combine the transaction processing and host interface functions of the V1000 and the V100 Reader/Door Interface functions. The V2000 supports all of the Input/Output functions for two card readers, as well as being able to make access control decisions and report all transactions to the host. I/O connections can be similar to the V100, except that the V2000 only connects via TCP/IP Ethernet connection to the host.

The V2000 does not include RS-485 ports, or the capability to fall back to a serial modem interface if TCP/IP communications are lost.

The V2000 is capable of supporting:

- Two Wiegand interface readers with or without PIN keypads.
- Two Clock and Data readers.
- Two Essex keypads (or equivalent).

6.6 Product Form Factor

Each VertX unit is available in the following configurations:

- Printed Circuit Board Assembly (PCBA) mounted in a plastic housing.
- PCBA mounted on a plastic back plate, with Mylar overlay.

6.7 Housing Configuration

Each VertX housing consists of a plastic back plate and cover which is approximately 5.8” wide by 4.825” high and 1.275” deep.

VertX units can have right-angle Phoenix type removable screw terminal connectors for all reader, input and output connections, RJ-45 connectors for TCP/IP connections, and pin headers for other connections.

Nomenclature can be silk screened on the housing cover or Mylar overlay (if the plastic housing is not used).

6.8 Communications Indicator

VertX units have a Communications Indicator LED, which flashes whenever communications occur between the interface unit and an upstream device.

- Communications TO the upstream device flash green.
- Communications FROM the upstream device flash red.
- Absence of one color indicates that communications are occurring in one direction only.
- Absence of flashing indicates a communications failure.

VertX reader, output and input interfaces can be capable of providing visual feedback via the LED when communicating with the controller.

6.9 DC Power Indicator

VertX units have a voltage indicator LED on the interface unit, which can indicate that sufficient DC voltage is being provided to the unit.

6.10 Sounder

VertX reader interfaces are capable of using beepers in the connected readers (HID and other manufacturers) to indicate door held/forced, PIN Retry Error, Tamper Alarm, Host Comm. fail, AC Power Fail, Battery Fail, etc.

6.11 Tamper Input

VertX units include a dedicated supervised input for enclosure tamper. By default this input point is configured as an un-supervised (two-state) input.

6.12 AC Fail and Battery Fail Inputs

VertX units have configurable inputs for AC Fail and Low Battery/ Battery Presence, which are compatible with Supervised DC supplies which monitor the AC Input Voltage and Battery Voltage and report status using two dry contact relay outputs. These input points are configured as supervised (four-state) inputs and used as general purpose inputs.

6.13 Mounting

VertX units are capable of mounting on any flat wall surface, using the appropriate fasteners. They can be directly mountable in their standard plastic housings, or they can be mountable in a stacked configuration on non-conductive standoffs inside a customer supplied utility box.

VertX units are installed indoors, within a secure area, such as in a utility closet or on a wall above a suspended ceiling.

VertX units include four mounting screws and an installation sheet.

6.14 Labeling

VertX unit labels include model name and number, FCC warning label, and any required agency approval labels.

VertX unit wiring connections are silk screened on the top cover of the plastic housing or on a Mylar overlay.

6.15 Power Requirements:

VertX controllers require a customer-supplied 12VDC regulated Power Supply, with Battery Backup and Input Surge protection, and AC Fail and Battery Low contact outputs.

VertX panels are capable of supplying 12VDC power to most card readers, but door locking hardware requires separate power.

6.16 Operating Parameters

VertX units operate within 0° to 50° C (32° to 120° F), 0-95% RH, Non-condensing.

VertX units are installed in an indoor environment, or otherwise protected in a NEMA-4 Rated Enclosure.

7 Controller Functional Description

VertX controllers provide the following.

- Control cardholder access to secured areas.
- Monitor and report access activity.
- Monitor and report input status changes.
- Control various electrical and annunciation devices.

VertX controllers enable host software to:

- Allow an operator to acknowledge and respond to alarm conditions.
- Allow an operator to configure the VertX units and obtain historical reports.

7.1 Configuration

VertX controllers and panels can be configured via the following methods.

- **Web Interface.** There is a web interface which utilizes the CGI API calls to configure the VertX controllers and any attached V100-Series panels.
- **FTP.** The configuration files can be built on a computer and transferred to the VertX controller.
- **Telnet.** The configuration files can be edited directly on the VertX controller using the VI utility built into the Linux operating system.

7.2 Host Communication

The VertX Controller is uniquely identified through the MAC Address (set by the factory) and InternalID (maximum value for InternalID is 255).

The VertX Controller communicates primarily through TCP/IP and requires an IP Address. The IP Address can be either statically assigned or dynamically assigned using DHCP (Dynamic Host Configuration Protocol).

The VertX Controllers send a Heartbeat message to the host as an “I’m Alive” message or the controllers are configured to send a “Here I Am” message for auto-discovery.

VertX Controllers can download the Program and EEPROM files to the V100-Series panel.

7.2.1 CGI

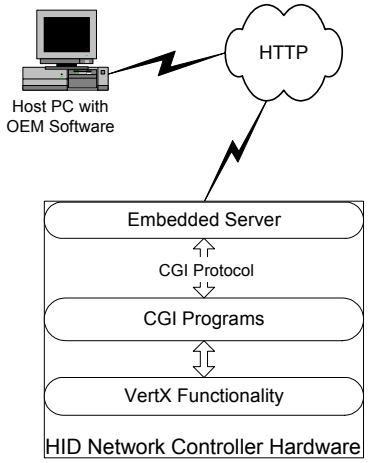
Communication between HID hardware and the host software utilizes the Hypertext Transfer Protocol (HTTP). The hardware functionality is accessed using a Universal Resource Locator (URL) string pointing to the Internet Protocol (IP) address of the CGI program and appending a query string containing the required data. Within this document, the URL and query string combination will be called a **command string** or **command**. Commands to the VertX system must be formatted to comply with the CGI protocol. Each command will have a CGI program name specified and a series of name-value pairs (some of which are required and some optional). Each CGI program will use a different set of required or optional name-value pairs.

The response message will be in one of two formats:

1. Hyper Text Markup Language (HTML) text
2. Plain text

Also, no response message may be selected. HTML formatted text is the default if no response type is specified in the command string.

Communication between the HID hardware and the host software may be done using a web browser (Internet Explorer 5.0®, Netscape Communicator 6.0®) or a client program written in any convenient language.



7.2.2 DLL

The VertX DLL was developed to allow the host to communicate with the VertX V1000/V2000 controller in a more secure manner. The name of the DLL is VertX.dll. The FTP, TELNET, and embedded Web Server (BOA) can be shutdown on the controller, decreasing the number of required ports. Only one user-selected port is required to be open for communication between the host PC and the V1000/V2000 Controller. The DLL communicates using TCP sockets with the communication task embedded on the board. The DLL is multi-threaded and, therefore, multiple V1000/V2000 Controllers may be connected at a time. In addition, one command per controller can be processed at a time; any consecutive commands are queued in the DLL. FTP functionality, such as sending and receiving files, is built into the DLL.

7.2.3 Direct to CommTask

The Direct to CommTask interface allows the host application to open a socket and communicate directly with the CommTask on the V1000/V2000. This gives the host application developer flexibility when designing the application. The host application must open and manage the sockets.

7.3 System Alarm/Event Messages

Event messages are generated in real-time by the VertX system. These events are routed to a task that attempts to forward the message to a host and writes the event to a log file. If the host is offline the messages are stored until communication is restored, the log is then uploaded to the host.

The message log size is configurable from one to 5000 messages. If the log file is full the oldest message will be overwritten. The log file is stored in non-volatile memory so the event log will not be lost if system power is cycled.

VertX allows the configuration of what is an event, what is an alarm, and what messages are ignored. In addition, the configuration of what is an event and what is ignored can be configured based on the utilized communication channel.

VertX Controllers are configured to send messages to the host in four ways.

- No messages.
- Set a static IP Address and port of a host system listening for messages.
- Syslog service in Windows or Linux.
- Commtask (Default way if using DLL).

When messages are sent to the host, the VertX Controller is configured to be sent messages based on any or all of these criteria.

- Time of day (up to four times per day).
- Change of time.
- Number of messages.

The VertX Event Logger is configured to send any or all of the following messages to the host.

- Task start.
- Deny access (card/PIN not found).
- Deny access (unknown reader).
- Deny access (card/PIN deleted).
- Card number found.
- Host lookup.
- Card updated.
- Database changeover.
- Grant access.
- Grant access (extended).
- Deny access (no door access).
- Deny access (door schedule).
- Deny access (unknown reader).
- Deny access (card/PIN deleted).

- Deny access (wrong PIN).
- Timed anti-passback violation
- Real anti-passback violation.
- Area violation.
- Real anti-passback violation exit.
- Area violation exit.
- Deny access (door group/schedule not configured).
- Deny access (not active)
- Grant access (in-schedule elevator group).
- Grant access (out-schedule elevator group).
- Visitor message.
- Reset card holder status.
- Card updated.
- Interface function executed
- EEPROM values changed.
- Download interface program.
- Download interface EEPROM.
- Interface status.
- Eventlogger upload current messages.
- Eventlogger upload entire event log file.
- Eventlogger message ID counter rollover.
- Eventlogger upload current messages by class code.
- Eventlogger upload all messages by class code.
- Eventlogger upload messages by message id.
- Eventlogger upload current messages by priority.
- Eventlogger upload all messages by priority.
- Local function executed.
- Local timer changed.
- Local A to D limits changed.
- Local debounce iterations changed.
- Local poll delay changed.
- Set time.
- Set TZ.
- Restart a task.
- Stop a task.
- Invalid host called.

- Card read parity failure.
- Reader I'm alive.
- Card read.
- Door switch.
- Door forced.
- Door held.
- Tamper fail.
- Tamper alarm.
- Battery fail
- Battery alarm
- AC fail
- AC alarm
- REX door bit
- REX door alarm
- Input point state change
- Input point alarm

The VertX Event Logger allows the configuration of the priority (ignored/event/alarm) for each event type. Event message types are grouped into classes for easy configuration.

The VertX can increase the priority of an event/alarm message for a particular reader/door.

The VertX Event Logger can optionally be encrypted to prevent data from being intercepted or simulated by an intruder.

An on-board utility called ReadEvents is available to read the binary eventlog file and all of the events are displayed in the text file /tmp/readevents.

7.4 Error Logging

The VertX Controller has a system error logging facility that is used to report run-time errors to a non-volatile circular buffer. There is a CGI interface as well as an on-board utility for reading the error logs which is then stored in a binary file.

7.5 Access Control

VertX supports several access credential requirements. These include card only, PIN only, card and PIN, and card or PIN. In addition, each reader can be defined for a specific access credential requirement.

VertX provides access control through the possibility of up to 65,535 access groups. An access group can consist of one or multiple pairings of a door group and a schedule.

Each cardholder has up to eight access groups assigned.

VertX logically groups readers together to allow easier access administration. It is possible to have up to 255 groups of readers.

VertX schedules consist of a valid time period for valid days of the week and holiday groups.

There is a maximum of 255 schedules per VertX Controller.

VertX provides up to 255 Holiday Groups, allowing Holidays to be assigned to different schedules. The holidays are entered as the month and day, with the year being optional.

VertX allows any card to have a start, end date and time, in addition to access groups so that the card can be denied access outside the start-end period.

A visiting cardholder can be assigned an 'Escort'. If an escort is assigned, the deny access LED/beeper sequence is suppressed when the card is read at a door. In addition, the card holder can be assigned doors that will allow access.

VertX allows schedules to be assigned to other functions such as input group suppression or output group activation.

7.5.1 Door Monitoring and Control

The VertX Door/Reader Interfaces (V100 and V2000) provide configurable inputs to monitor and report door position to the host.

VertX suppresses door monitor input alarm reporting during a valid access transaction for the duration of the lock relay time, plus the alarm shunt time.

VertX interprets Door Forced and Door Held Open as two distinct alarm conditions.

VertX sends status change data to the host in real time, if the Door Monitor senses a forced door (a door opened without using a card, PIN, REX or host command), and if configured as a Forced Door Alarm, the local Aux Relay can be activated until a valid card or PIN is presented, or until turned off from the host (even if the door is re- closed).

The VertX reader interface can maintain a forced door alarm until cancelled by the host.

The VertX reader interface can have a configurable delay for door forced reporting.

The VertX reader interface can send a Door Held status change to the host, if the Door Monitor senses a door held open beyond the relay + shunt time + reporting delay time, and (if configured as a Door Held Alarm) the local Aux Relay can be triggered and latched until the door is re-closed. VertX can provide a user defined reporting delay time to reduce false alarms.

The VertX reader interface can have a configurable delay for door held reporting.

The VertX can increase the priority of an event/alarm message for a particular door.

7.5.2 Local Relays

The VertX reader interface has one relay per reader, which defaults to be a door lock/strike relay, but can be configurable as a general purpose relay.

The VertX reader interface includes a second relay per side, which can be configured for one of the following functions: off, door forced alarm; door held alarm, door forced and door held alarm, host offline alarm, control a powered door opener, or general purpose.

The VertX reader interface can allow the Aux Relay to be configured to control an annunciation for both Door Held and Door Forced conditions by providing two different default annunciation patterns: for Door Held the relay can be activated 100ms every 2 seconds, and for Door Forced the relay can be activated for ½ second on, ½ second off.

The VertX reader interface can allow the Aux Relay to be configured as a Shunt relay, such that it can bypass a door contact connected to a separate alarm system during the Access/Alarm shunt time period.

7.5.3 Access Timing

The VertX reader interface is capable of providing configurable normal and extended access times. VertX is configured so any designated card may have extended access time at readers also configured to provide extended access times.

7.5.4 Reader Beeper Control

The VertX reader interface can be capable of causing the HID or certain other readers to beep upon detecting a door forced or door held condition.

The VertX reader interface can be capable of causing the HID or certain other readers to emit a distinctive beep upon denial of access.

The VertX reader interface can be capable of causing the HID or certain other readers to emit a distinctive beep upon entry of an invalid PIN.

The VertX reader interface can be capable of using the HID or certain other readers' beeper and LED to annunciate AC fail, Battery Fail, and Tamper alarm states.

The VertX reader interface can be capable of allowing the host to also cause the readers to emit a distinctive beep upon a command.

The VertX system controls the LED and beeper of connected readers. In this configuration the LED and beeper will provide audio visual feedback to a user when the following conditions exist:

- Door Held
- Door is unlocked
- Access denied etc.

7.5.5 Parity Checking

VertX performs parity checking of the card data, and can notify the network device on a parity failure.

PIN Reader Configuration

VertX allows any HID or certain other Card/PIN readers to be configurable to require Card and PIN, PIN only, Card or PIN, or Card only. VertX includes translation tables so that different keypad data formats are supported.

VertX allows the configuration of the pin size; up to 15-digits if the configuration is a pin only, or up to 8-digits if the pin is a confirming pin.

VertX provides PIN suppression schedules so the readers will operate in Card only mode on a scheduled basis.

VertX is capable of signaling the cardholder with an alternating red/green LED (if a reader has dual LEDs) when a card is presented and PIN is also required. In addition, there is a configurable time limit on pin entry.

VertX invokes a configurable PIN Error lockout period of up to 99 seconds. This can prevent the reader from being used after a configurable number of incorrect PINs have been attempted.

7.5.6 Biometrics

VertX allows biometric readers to be used under certain conditions. The conditions include where the biometric template is recorded on a smart card, and the biometric reader compares the stored template with a live biometric read. If the live read compares with the stored template, the reader sends access control data from the card to the VertX reader interface.

7.5.7 Pin Commands

VertX allows keypad commands to lock or unlock the door through a manually entered command. This is configurable per reader.

7.5.8 Anti-Tailgating

When anti-tailgating is enabled, VertX causes the Relay Timer to be cancelled 100 ms after the Door Monitor input senses the door is opened.

VertX allows anti-tailgate feature to be turned on or off at any given door.

7.5.9 Facility Code Only

VertX is configurable to provide access on the basis of facility code only when communications with the network controller are lost; alternately the Door/Reader Interface can be configurable to deny access to all when communications with the network controller are lost.

7.5.10 REX Processing

Each V100 or V2000 can include a Request to Exit (REX) Input for each controlled door, which is used to suppress the Door Monitor alarm, and optionally, unlock the lock for an authorized entrance or exit without the use of a card.

The V100 or V2000 can allow the Green LED at the associated reader to be suppressed during REX activation, to avoid alerting potential intruders when the door has been unlocked from the inside.

VertX can be configurable to provide grant access on REX when communications are lost with the network interface.

7.5.11 Anti-passback/Area Control

VertX has three implementations of Anti-passback/area control.

7.5.11.1 Timed Anti-passback

VertX provides timed Anti-passback which prevents a card from being used in a reader (or group of readers) until a configurable timer expires.

VertX allows any cardholder to be designated exempt from Anti-passback.

7.5.11.2 Hard and Soft Area Control

There are two types of area control.

- Hard area control will deny or perform a man trap in the next area.
- Soft area control will log the violation but allow access into the next area.

VertX provides that when area control is implemented, each cardholder's status can be defined as:

- IN – within a defined area.
- OUT – not in any area.
- UNDEFINED – status is unknown.
- EXEMPT – is exempt from the area control rules.

VertX can allow an area to be defined by reader-controlled entrances and exits. Readers may be designated as IN and/or OUT readers to specified areas.

When hard anti-passback/area control is enabled, VertX can deny access to a card which is re-used at an IN reader prior to presenting a badge at an OUT reader. Alternatively, VertX can be configured to grant access while logging an Anti-passback violation at an IN reader, subsequently denying access when the cardholder attempts to exit the Anti-passback area at an OUT reader.

When soft anti-passback/area control is enabled, VertX can grant access to a card which is reused at an IN reader prior to presenting a badge at an OUT reader but log the violation.

VertX can be configured so an area-in-area control can be spread across multiple VertX controllers (current limitation is a maximum of four controllers) to allow "Global" anti-passback and area control.

7.5.12 Cards and Card Formats

VertX handles cards of up to 128 bits in length.

VertX is capable of accepting multiple card formats numbering up to 253. This allows multiple existing card populations to be merged into the same access control network.

VertX can accept card format files downloaded from the host.

VertX can store the raw hex value of the card if the card format is unknown.

VertX can have the host lookup unknown cards and determine whether to grant, deny access, or add the card to the card database, rechecking the card based on its access rules.

7.5.13 Visitor Control

VertX allows cardholders to be designated as visitor cards. These visitor cards can be assigned to an escort card so visitors require an escort to obtain access. Access is not provided to the visitor, but to the escort. This allows for tracking the location of the visitor.

7.5.14 Elevator Control

VertX provides elevator control by using a Card/PIN reader to control relays, which in turn can enable or disable elevator floor call buttons. This can be accomplished by assigning output control relays to specific floors, by allowing cardholders to be configured for access to specified floors and schedules.

Elevator control components consist of:

- Designated reader located in elevator cab.
- V100 Door/Interface panel.
- One or more V300 Output Control Interface panels with relay outputs connected to logic inputs of the elevator control equipment.

- Designated cardholder with an associated predefined group of output relays.

A card read invokes timed relay closures which enable the floor call buttons in the elevator.

The reader can be located in the elevator cab, and the V300 panels are located in the Elevator Machine Room.

VertX allows elevator control to be implemented on a schedule, such that certain floors can be configured for public access during normal business hours, and a card is not required to use them. Some or all floor call buttons may be restricted at night and/or on weekends, so that a card is required to use them. Certain floors can always require a card for access.

VertX allows elevator control access privileges to be assigned to cardholders for specific floors.

VertX logically groups elevator floors together to allow easier administration of access.

7.5.15 Host Card Lookup

VertX supports host lookup of a card number. Each door can be configured so that a card number that is not found in the local VertX card database will generate a message to the host application. The reader LED and beeper are set to provide feedback to the user indicating that the system is performing additional processing. The host application then has the responsibility to decide if the card should be granted access, denied access or the card should be added to the local VertX database.

7.6 Time Schedules

VertX utilizes a series of user defined schedules as part of the access and IO Linker processing. The system will support up to 255 individual schedules.

Each schedule can include one or more days of the week as well as any number of holiday groups. Each day period can include up to six 'IN' period definitions. Each period can be resolved to the second if that is needed.

7.7 I/O Linker

The I/O Linker task embedded in the VertX system allows the generation of

- Event messages.
- Drive outputs.
- Timers.
- Set logical bits based on a change in an input point value.
- Schedules.
- Logical inputs.

This is a powerful tool, used for processes such as generating alarm messages or scheduling a door to be unlocked all day.

The I/O Linker can also be utilized to monitor inputs from other VertX Controllers (currently a maximum of four controllers) to be able to drive local controller outputs.

7.7.1 Event Messages

An event message can be generated by a change in an input point value, schedule, timer, or a logical bit. This is very useful for reporting alarms based on changes with input values or status bits. Event message ID's are user defined integer values.

7.7.2 Outputs

Outputs can be grouped together or driven individually.

- Door Strike Relays.
- Aux Relays.
- Reader LEDs.
- Reader Beepers.
- Reader Data Hold Line.
- Door Access Mode (Normal or Extended).
- Door Grant Access.
- Door Deny Access.
- Reader Request PIN.
- Door Held Alarm (Enabled or Disable or Clear).
- Door Forced Alarm (Enabled or Disable or Clear).
- Door Anti Tail Gate.
- Interface Hardware Alarms (Enable or Disable local audio/visual feedback on alarm conditions).
- Disable Relay (Disabled or Enabled).

7.7.3 Timers

There are four types of timers that can be created with the I/O Linker.

- Delay interruptible.
- Delay uninterruptible.
- Triggering, and interruptible.
- Triggering, and uninterruptible.

An interruptible timer will have its interval reset and restarted if the timer is retriggered during the countdown. The new interval can be longer or shorter than the original. An interruptible timer can be disabled by supplying a timer interval of zero.

An uninterruptible timer and any triggering actions during the countdown interval are ignored. It does not matter whether the new interval would extend or decrease the original.

7.7.4 Inputs

Inputs can be used to trigger event messages, drive outputs, set timers, or set logical bits. Inputs include status bits as well as actual Input Points.

- Reset Bit
- Reader Parity Failure

- Reader I'm Alive Fail
- Card Read
- Door REX Switch
- Door REX Switch Alarm
- Door Switch
- Door Switch Alarm
- Tamper Switch
- Tamper Switch Alarm
- AC Failure Switch
- AC Failure Alarm
- Battery Failure Switch
- Battery Failure Alarm
- Door Held Alarm
- Door Forced Alarm
- Input Point Off-Normal
- Input Point Alarm

7.7.5 Input Point Groups

VertX input points can be logically grouped to allow simultaneous control.

It is possible for input reporting of any point or group of input points to be suppressed on a scheduled basis. For example, this can be used to disarm intrusion or door-open detectors during the day.

7.7.6 Logical Bits

The VertX Controller can have up to 255 logical bits. Logical bits can be set by changing inputs, schedules, or commanded from the host.

The logical bit can be used to trigger a message, output, or timer.

7.8 Operator Initiated Actions

Any of the VertX system relays or control groups can be set or reset by an operator or OEM software program. The operator or OEM software program may request specific device actions by specifying either a single relay or a control group, and the desired state.

7.9 Input Points

Physical inputs include AC Fail, Battery Fail, Tamper, and general purpose inputs.

VertX can provide input points to monitor switch contact status changes. All inputs can be supervised (four state), with a specified resistor value (1KΩ to 10KΩ) wired both in series and parallel with the switch and a 5VDC voltage (supplied by the VertX) applied to the circuit. This allows an input to be reported in any of three states:

- Normal
- Off-Normal

- Alarm

Two-state inputs can also be permitted, configurable to allow either OPEN or SHORT as the off-normal state.

7.9.1 Input Point Groups

VertX Input points can be logically grouped in software to allow simultaneous control.

It can be possible for input reporting of any point or group of input points to be suppressed on a scheduled basis. For example, this can be used to disarm intrusion or door-open detectors during the day.

7.9.2 Input Point Status

VertX input points can be configurable so that the normal or off normal state of any given input can be set for Normally Open (NO) or Normally Closed (NC) devices.

VertX input points can be configurable to match the EOL resistance (1KΩ to 10KΩ) used with any input.

VertX allows the host system to query the DC voltage present at any input.

VertX allows status changes to be reported to the host in 0.5 seconds or less. (This is subject to network conditions.)

7.9.3 Input/Output Linking

VertX allows the status of any input to be linked to any output. In addition, any predefined group of outputs can reflect the status of the input in one of the following ways:

- Track with the input status.
- Reverse track.
- Latch.
- Reverse latch.
- Latch for a configurable time period.

If an output group is latched, VertX allows one of the following to occur.

- Cleared from the host.
- Cleared by an authorized card with output group control privileges.
- Cleared by an existing time-scheduled reset.

If a VertX input is linked to an output (on the same interface unit), the link can be active even if network communication fails.

VertX allows an Output Relay Group to be defined as a named list of output points which can be activated or reset as a group. It can be associated with an input point or a schedule.

7.10 Outputs

VertX defines a set of functionality known as “outputs”.

These include:

- Relays
- Reader LEDs

- Reader beepers
- Access mode (normal or extended)
- Grant or deny access
- Clearing of door alarms
- Enable or clearing of hardware alarms

Each of these specific functions can be driven to the 'On' state or 'Off' state. Some of the functions include an associated timer so they can be driven to a timed state. (The timer duration is configurable.)

Outputs can be grouped together so that a single command can drive them to a predefined state. The state of each output is defined in the output group definition. One can be driven to the 'On' state while others can be driven to the 'Off' state with a single command.

Output groups can be the target argument for an I/O Linker rule.

VertX monitors outputs so that the last command sent to the output is saved in memory, this feature is known as saved outputs. This feature is useful if a V100-Series panel goes off-line, the panels relays may not be in the last known state. The saved outputs feature can then drive the outputs to their last known state.

7.11 System Diagnostics

There are several diagnostic or system maintenance functions available: auto-discovery, reboot a board, and monitor task.

The auto-discovery configuration allows for the discovery of V1000/V2000 Controllers on the network. In addition, discovery and identification of V100-Series panels that are part of the VertX system is also possible.

With Reboot a Board, a controller or panel can be rebooted remotely.

The monitor which runs on the controller can restart or stop running tasks. The controller monitor task automatically restarts tasks that stop.

7.12 Card Database Files

The controller card database is stored in binary files. Only the data required for access control is stored. External Windows programs exist to allow for the batch processing of cardholders. The CGI, DLL, and Direct to CommTask interfaces also provide for the addition, modification and deletion of individual cardholders.

7.13 Modem Configuration

Using the VertX V1000 Controller the user can connect to host PCs with one or both of the onboard RS-232 ports attached to a modem. The Communication Task controls the modem access and allows either the host PC or V1000 to initiate the modem connection. Once the modem connection is complete, PPP (Point-to-Point Protocol) is used to allow TCP/IP-like communication between the controller and the host PC.

Modem communication also works with a VertX Controller using a modem to dial into a Cisco 1600 Router with WIC installed.

7.14 Memory Expansion Configuration

Flash memory can be added to the VertX V1000 and V2000 Controllers. Currently there are 16MB and 32MB versions available. The additional memory expansion board is mounted in the Linux file system as mnt/flash2. If configuration files are to be stored on the expanded memory, the **Configuration File List (CfgFile)** path information must be changed to access the files in their new location. Expanded memory can be added to the system after the boards are installed in the field. The memory board is connected through P15.

7.15 Communications

7.15.1 Network Communications

VertX V1000 Network Controllers have three communication channels, TCP/IP & two RS-232 ports. Each channel can be configurable as a primary or backup communications channel. V2000 Door Interface/Network Controllers communicates through TCP/IP only.

VertX Controllers can send a periodic "I'm Alive" message to the host at a configurable interval.

VertX has includes a firewall which can be used to restrict access thru the TCP/IP port. The VertX can be configured to require the controller to call back a host requesting a connection or simply accept the connection request. If the VertX is configured for callback on a connection request, only host IP addresses or Hostnames that have been previously configured will be called back.

7.15.2 Configuration

The VertX Controller allows the configuration of communication parameters such as:

- Hostname.
- IP Address (static or dynamically through DHCP).
- Communication port number.
- Time outs.
- Use of encryption.
- Connection maintenance.

7.15.3 Peer-to-Peer

The VertX Controller allows for network peer-to-peer communication of VertX Controllers to permit Global Area Control/Anti-passback and Global I/O Linking without the host. Currently, there is a maximum of four controllers permitted, depending on card holder traffic. The TCP/IP port used by the peer-to-peer functionality can be configured by the user.

7.15.4 RS-485 Communications

The VertX V1000 Network Controller is capable of supporting up to 32 of any combination V100-Series panels on four RS-485 serial ports.

VertX uses CRC validation and calculation on all RS-485 messages.

VertX has a local indicator LED on the V100-Series panels for if RS-485 communications are lost.

VertX can detect and respond to any change of local addressing at a V100-Series panel.

VertX can log and notify the host of interface communication loss.

7.15.5 Reader Supervision

The VertX Door/Reader Interfaces can monitor a periodic Reader Supervision message from a reader. The VertX Door/Reader Interfaces can also send a Reader Offline message to the host, if the message is not received in the event of reader failure or tampering.

7.15.6 Clock Synchronization

VertX can allow all controllers to be synchronized with the host. Time Sync can be sent automatically at regular intervals.

VertX can be setup to handle Daylight Savings Time.

7.15.7 Host Control Commands

VertX is able to execute operator or system commands received via the Network from the host, including:

- Open Door. Specifying the door name, unlocks door, shunts associated alarm, for locally programmed unlock times. Door then relocks automatically when timers expire -- overriding any restrictions.
- Open a Group or list of doors. Same as open door, specify door group or list.
- Open all Doors. Same as above.
- Unlock Door (Group/list, or All doors). Specify door(s), unlocks doors indefinitely -- usually used in an emergency situation -- overriding any restrictions.
- Lock Door (or group/list, or All Doors). Resets Unlock Door, overriding any current/pending “door unlock by time schedule” controlled at the interface level.
- Set Output Relay. Latch a relay, or group/list of relays indefinitely.
- Reset Output Relay (or group/list).
- Reset Various Local Alarm conditions (as annunciated by aux relay or reader beeper) including:
    - Door Held
    - Door Forced

VertX can allow the host system to query any local database for status or configuration information.

VertX Door/Reader Interfaces can contain flash memory, allowing them to be reprogrammed from the host if necessary.

VertX is capable of receiving a command from the host operator which can manually override any locally-invoked relay condition, in either latched or timed mode.

VertX is capable of receiving a command from the host operator which can manually override the condition of any Aux relay. It can also be capable of enabling, disabling or resetting any individual alarm.

VertX Door/Reader Interfaces are capable of receiving a command from the host operator which can manually activate or release the hold line on any connected reader having the Hold feature.

VertX allows the host system to query any reader, output or input interface as to the application file revision, EEPROM file revision, ID number, and type.

VertX allows the host to do the following.

- Set time of day on all controllers.
- View add or modify card records.
- Control outputs
- Get input or output status.
- Write to the EEPROM.
- Read local memory.
- Get a/d values
- Upload the current messages.
- All messages in the Event log.
- Clear the event file.
- Reload the card database.
- Reload access configuration files.
- Get or set I/O linker inputs.
- Reboot any interface.

The host system is able to send a command to VertX to obtain the current state of each input and output.

8 V100-Series Firmware

8.1 Finite State Machines

Finite State Machines (FSMs) are pieces of data that are utilized by the V100-Series firmware. The FSMs are usually packaged into a hex file that is flashed to the on-board EEPROM. The FSMs control the behavior around a “door”. An example of a FSM is what occurs on a grant access described as:

- Energizes Door Relay
- Commands Reader LED Green
- Disables Internal Door Forced Alarm
- Starts Door Open Timer
- Starts Door Held Timer
- Optionally – the AUX relay on a V100 can be used to shunt an Alarm

FSMs can be customized to a wide variety of functionality.

Examples of V100 FSM functionality are:

- Card in free out (this is the default).
- Card in free out that does not trigger the door strike relay on a REX.

- Card in card out.
- Card in card out that does not trigger the door strike relay on a REX (if a REX device was attached in a card in card out scenario).

8.2 Commands

VertX commands the following outputs on V100-Series panels:

- V100 - Door Strike Relays, Aux Relays, Reader LEDs, Reader Beepers, Reader Data Hold Lines, Grant Access, Deny Access, and the Enable/Disable of Door Held or Forced Alarms
- V200 – Aux Relays.
- V300 – Aux Relays.
- V2000 – the same as the V100.

The VertX Controller handles the downloading of Program and EEPROM files to the V100-Series panels.

8.3 Reporting

VertX can report the following input point changes: Normal, Off-Normal, Alarm or direct A to D values. The Inputs include:

- All – AC Fail, Battery Fail, and Tamper Input point statuses and/or alarms
- V100 – Card Read parity failure, Reader I'm Alive, Reader Card Read, Door REX, and Door Monitor Switch.
- V200 – All Input points status.
- V300 – All Input points status.
- V2000 – The same as a V100.

8.4 Configuration

VertX allows the configuration of the following:

- V100 – Grant access time, grant access extended time, door held time, Reader type (Wiegand or Clock and Data), I'm Alive enabled, I'm Alive message, Input Point A to D Limits, Input Point Debounce timers, degraded mode card information.
- V200 – Relay timer values, Input Point A to D limits, and Input Point Debounce timers.
- V300 – Relay timer values, Input Point A to D limits, and Input Point Debounce timers.
- V2000 – The same as V100.

VertX allows each V100-Series panel to have a different EEPROM file downloaded. This allows customized functionality (FSMs) at each V100-Series panel.