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MODEL 3500 ONLINE DOOR CONTROLLER WITH DOOR STATUS
FOR OEM & DEVELOPER APPLICATIONS
HARDWARE MANUAL
FIRMWARE VERSION 1.1.0
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Introduction

The Model 3500 Online Door Controller is a simple online door control that translates 26-bit Wiegand input into a useable ASCII represented card number. This unit is designed to communicate with online software via Ethernet. The unit has an integrated Ethernet adaptor, wiegand reader input, door position switch input, request to exit input, a relay for triggering an electric strike or mag-lock, a programmable SPI serial port for use with integrated LCD Display units and other SPI based peripherals and a small EEPROM memory that is used to store configuration options. The unit is housed in a plastic enclosure for wall or desktop mounting and is designed to run off a 12 volt DC plug-in wall transformer.

Ethernet Port

The unit is furnished with an integrated Ethernet adaptor, that can be used to communicate between a PC and the integrated processor and control firmware of the unit. The Ethernet adaptor supplied is either a Lantronix (www.lantronix.com) XPort Direct or a Digi (digi.com) DigiConnect ME. The controller is designed to accept either one of these Ethernet modules, but the Lantronix is the standard offering. The Ethernet adaptors are configured using software from the appropriate manufacturer. Both manufacturers offer easy to use configuration software for these adaptors and can be freely obtained from their websites.

Hardware Features

The Ethernet adaptor communicates with an onboard ATMega16 processor running at 2 Mhz. This processor accepts commands via a TCP/IP connection from the adaptor and processes the software command accordingly. The unit can also generate alarms and command messages during normal door usage. This command set has been developed by Highpower and is part of the unit's internal firmware. The command set is described in the following section.

Command Formats

The controller has a command set that can be used to monitor status in the controller, trigger actions in the controller and change default settings saved in the unit's integrated non-volatile EEPROM memory.   Commands are sent to the unit with a TCP/IP connection using the onboard Ethernet adaptor.

The unit accepts Highpower formatted commands and a small set of commands that are compatible with hardware from other manufacturers. The Highpower style commands typically have the following format:

Fxxaaa

Where:
> F   is an upper-case "F" (ascii 70)
> xx   are a command number
> aaa   are arguments for the command
>   (which vary based on the command chosen by XX)

An example of a command in the Highpower format would be "F0105". This indicates command "1" with an argument of "5". Command 1 activates the output

relay for XX seconds. In this case XX is "05" so the relay would actuate for 5 seconds.

Compatible commands are in the form of:

caaa

Where:
    c   is a character that indicates a particular command
    aaa   are arguments for the command
    (which vary based on the command chosen by C).

An example of a command in the compatible format would be "V". This command has no arguments and would return the Version message of the unit's firmware (firmware is the on-board hardware operating software).

RETURN TYPE INDICATION

The controller will add a character to the front of all returns, except returns that are card swipes. This character will tell you the nature of the message that the controller is sending.

If the return is a message, the message will be preceded by an ascii value of 1.

If the return is an alarm, the message will be preceded by an ascii value of 2.

If the return is a card swipe, then messages will have no prefix character.

Command Set

In this section, if you see the brackets *[ ]*, that means that a character is being represented by its ASCII value. All responses sent back from the controller are followed by a carriage return character, which is ASCII 13, and is indicated in this document by *[13]*. With commands that do not provide responses, the controller will send back a carriage return *[13]* to indicate that the command was processed.

All commands sent to the controller should be followed by a carriage return in order to tell the controller to process the command. We have omitted the carriage return notation in the command structure for clarity. An example of this would be (F00 *[13]*) which we show as F00.

RETURN FIRMWARE VERSION

F00

Returns the version number of the unit's firmware. This message is good to use to check for connectivity.

After sending this command, the controller will respond with the following response:
[1] Highpower Model 3500 V1.1.0 *[13]*

There is also a short compatible form command for this function. Send over a uppercase V *[86]* followed by a carriage return *[13].*

TRIGGER OUTPUT RELAY

F01xx

Triggers the output relay. XX is the number of seconds the relay should be triggered for. If you are triggering the relay for less than 10 seconds, you need to include a leading zero in the first X. (For example, triggering the relay for 5 seconds would be "F0105".) Sending zero seconds with this command (xx=00) will toggle the relay on and off.

After sending this command, the unit will respond with the string "*[1]* OK *[13]*".

There is also a short compatible form command for this function. Send over an exclamation point symbol [33] followed by the seconds and a carriage return:

!05

When the door is in lockdown mode, and the F01 command is issued, the controller will return *[01]* DOOR IS LOCKED DOWN *[13].*

When the door is in the passage mode and the F01 command is issued, the controller will return *[01]* DOOR IS IN PASSAGE MODE *[13].*

REQUEST TO EXIT DELAY TIME

F02xx

Sets the delay time that the Request to Exit input triggers the output relay. This delay time is stored in non-volatile EEPROM memory in the controller and will be restored every time the controller is powered up. XX is the number of seconds

the request to exit input triggers the output relay after releasing the input. The input is a normally open switch contact. When the request to exit input is closed the unit will trigger the onboard relay and send back the following string: *[2]* ALARM REQUEST_TO_EXIT *[13]* which allows software to monitor when the request to exit button is pushed.

After sending this command, the controller will respond with the following response:

[1] RELAY DELAY SET TO xx *[13]*

FORCED DOOR ALARM

F03x

Turns on the Forced Door Alarm. When x = 0, the forced door alarm is turned off. When x = 1, the forced door alarm is turned on. The forced door alarm when triggered will send a string out of the Ethernet port. The string is *[2]* ALARM FORCED_DOOR *[13]*. The door position switch input is a normally closed input. When this input opens and the onboard relay is de-energized (locking hardware is secure, locked) this condition means that the door has been broken through despite the fact that the lock is locked. If this feature is turned on, your software will be able to detect this condition and go into an alarm mode indicating the violation. If this alarm is turned off, the string will not be reported to your software in this condition. This setting is stored in non-volatile memory and recalled when the unit is re-powered.

After sending this command, the controller will respond with one of following responses:

[1] FORCED DOOR ALARM OFF*[13]*
[1] FORCED DOOR ALARM ON*[13]*

DOOR AJAR ALARM

F04x

Turns on the Door Ajar Alarm. When x = 0, the door ajar alarm is turned off. When x=1, the door ajar alarm is turned on. The door ajar alarm when triggered will send a string out of the Ethernet port. The string is *[2]* ALARM DOOR_AJAR*[13]*. The door ajar alarm monitors the door position switch input after the relay has been energized and the door opened. If the door is left open a set amount of seconds after the relay time expires, this indicates that the door is ajar (it has been held or propped open). If this feature is turned on, your software

can detect this condition and go into an alarm mode indicating the violation. Once the door is re-closed, the alarm will end and the controller will send back another string, *[2]* ALARM DOOR_RESTORED*[13]* indicating that the door has been re-closed. If this alarm is turned off, the strings will not be reported to your software. This setting is stored in non-volatile memory and recalled when the unit is re-powered.

After sending this command, the controller will respond with one of following responses:

[1] DOOR AJAR ALARM OFF*[13]*
[1] DOOR AJAR ALARM ON*[13]*

DOOR AJAR TIME SET

F05xx

Sets the amount of delay time before a door ajar alarm triggers. The door ajar alarm triggers xx seconds after the on board relay de-energizes and the door is held open.

After sending this command, the controller will respond with the following response:

[1] AJAR DELAY SET TO xx*[13]*

TURN ON ANTI-TAILGATING

F06x

The anti-tailgating feature, when turned on will lock the door immediately when the door position switch indicates that the door has been re-closed after passage. The output relay will de-energize (re-lock) immediately after closing the door despite the fact that there may be more relay time left after triggering the relay with Function 02. This feature, when turned on, prevents unauthorized people from sneaking through the door behind valid personnel. This setting is stored in non-volatile memory and recalled when the unit is re-powered.

After sending this command, the controller will respond with one of following responses:

[1] ANTITAILGATING OFF *[13]*
[1] ANTITAILGATING ON *[13]*

CHECK DPS STATUS

F07

This command shows the status of the door position switch (DPS), whether it is open or closed. When the DPS is open the door is open. When the DPS is closed the door is closed.

After sending this command, the controller will respond with one of following responses:

[1] OPEN *[13]*
[1] CLOSED *[13]*

CHECK RELAY STATUS

F08

This command shows the status of the relay.

After sending this command, the controller will respond with one of following responses:

[1] DEENERGIZED *[13]*
[1] ENERGIZED *[13]*

SEND A BYTE TO SPI OUTPUT (DISPLAY)

F09xxx

This command sends a byte of data out of the SPI serial port. The SPI port is a small 10 pin header located at the bottom of the controller. This port has power and data outputs that can be connected to a display. Sending byte commands to an integrated display will allow you to control the functions and send characters to the display. The unit has been tested to work with the CrystalFontz (www.crystalfontz) LCD display Model CFA632-YMC-KS but it may be compatible with many other SPI based displays.

The xxx is the numeric representation of a byte character. In example, in order to send the letter "A" to a display, you would need to send over the ascii value '65'. To do this, the command would be *F09065*.

There is also a short compatible form command for this function. Send over a quotation symbol *[34]* followed by the three digit ascii value: *"065*

VERSION TO DISPLAY

F10

This command will send the version message of the door controller to the display. This can be used to test the display connections to the controller.

NORMAL DOOR OPERATION

F11

This command will take the door out of a lockdown or passage mode condition. The controller will return *[01]* NORMAL *[13]*.

LOCKDOWN DOOR MODE

F12

This command will force the door into a locked condition. When the controller is in this mode, the door will stay locked and the F01 command will not unlock the door. When the door is in lockdown mode, and the F01 command is issued, the controller will return *[01]* LOCKDOWN *[13]*.

PASSAGE DOOR MODE

F13

This command will force the door into an unlocked condition. When the controller is in this mode, the door will stay unlocked and the F01 command will not affect the door. When the door is in the passage mode and the F01 command is issued, the controller will return *[01]* PASSAGE *[13]*.

REPORT DOOR MODE

F14

This command, when issued will report the lockdown or passage mode state of the door. The controller will respond with one of the following:

NORMAL – the door is in normal operation mode.
PASSAGE – the door is forced unlocked, in passage mode.
LOCKDOWN – the door is forced locked, in lockdown mode.

CARRIAGE RETURN AFTER CARD SWIPE DATA

F15x

This mode specifies that the controller should add a [13] (carriage return character) after the card swipe data. This character is used by some programs to determine that data transmission is complete.

When X =0, the controller will send just the card ID digits.
When X=1, the controller will send the card ID digits followed by a carriage return character, [13].

FACTORY RESET

F99

The factory reset command changes the values stored in the EEPROM configuration to default factory values. These values are:

Request to exit relay trigger time: 5 Seconds
Forced door alarm: disabled
Door ajar alarm: disabled
Door ajar delay: 20 seconds
Anti-tailgating feature: enabled
Carriage return after card swipe data: enabled

This command returns *[1]* FACTORY RESET *[13]* when issued.

TRANSACTION TAGS

Transaction tags can be used to determine where the responses from the controller should be routed in your software. If you include an ascii value 3 after any command, the controller will interpret this as the start of a transaction tag. When the controller returns the response of a command with a transaction tag, the response will be followed by a *[3]* and the tag itself. The tag is alphanumeric and can be long in length. For example:

Sent command: F00 *[3]* VERSION *[13]*
Return from the controller: *[1]* Highpower Model 3500 V1.0 *[3]* VERSION *[13]*

OTHER NOTES ON FUNCTIONS

Sending over a function that is not present in the controller will cause the controller to ignore the input. The controller will send back a carriage return *[13]* to indicate that this ignored command was processed.

Sending over a function with an incorrect syntax will cause the controller to send back the response *[1]* ?SYNTAX ERROR *[13]*

If you are providing a command to the controller, all of the characters sent to the controller after the command and before the carriage return *[13]* are ignored. Commands will still be valid if you send over extra values before sending the carriage return.

WIEGAND DATA OUTPUT

The controller accepts 26 bit wiegand inputs. This data is typical of what comes off a proximity card reader when using 26 bit cards. The controller will output the ascii representation of the ID portion of the 26 bit card when the card is presented to the reader. The output of the card number is seen in the text stream coming off of the network. This is a 5 digit number from 0 to 65535. If the card number is less than 5 digits in length, the controller will add leading zeros to string. For example, if the card ID's value is '1000' the controller will output 01000 *[13]*.

HARDWARE FEATURES

LED Indicators

The controller has two bi-color LEDs to indicate status. The LED at the left of the unit at the bottom of the board (LED 1) is normally off. It will flash a red color when receiving serial data from the network adaptor. It will flash a green color when sending data to the network.

The LED at the right of the controller (LED 2) will stay lit red when the power is applied to the controller and serves as a power indicator. This power light will turn green in color when the output relay is energized, indicating that the door should be unlocked and that the relay has changed to the energized state (perhaps do to a valid card swipe). After the relay is de-energized the led will return to the red state. Either LED 2 state will indicate that power has been established to the controller with an external 12VDC power adaptor.

Power Connector

The power adaptor should be 12VDC 1 AMP and should have a 2.5mm barrel adaptor. The inside (tip) of the barrel adaptor should be +12V and the outside is ground.

Communication settings

The adaptor communicates with the processor at 9600 baud, 8 data bits, 1 stop bit and no parity **with hardware flow control**. Make sure your adaptor is properly set to these settings when configuring the network adaptor with the adaptor setup software.

Network adaptor reset button

There is a small reset button on the board near the network connection that can be used to reset the network adaptor. This can be used to reset the adaptor after network trouble has caused its malfunction. Holding in the reset button momentarily will reset the network adaptor and cause any current network connections to be dropped.

Link and activity LEDs

There are two LEDs located on the shell of the RJ-45 connector. The green LED indicates network activity and the amber LED indicates that a network link has been established to a network switch.

Terminal block

The terminal block allows for multiple wire connections to be attached to the controller. The terminal block is a two-piece removable type. The terminal block has 12 connections as follows:

Terminal Position	Function
1	+12V Reader Power
2	Ground connection to Reader (and also shield connection)
3	Reader Wiegand Data 0 input
4	Reader Wiegand Data 1 input
5	Reader LED control line (may not function will all manufacturers.)
6	Relay output Common
7	Relay output Normally Open
8	Relay output Normally Closed
9	Ground Connection for Request to Exit
10	Request to Exit Input (normally open contact)
11	Ground Connection for DPS input
12	Door Position Switch (DPS) input (normally closed contact).

Relay Common Header

There is a 4 pin .100" pin header next to the terminal block. This header connects 12V to the common side of the relay. The two left-most positions of this header can be closed in order to use the plug in transformer as a power supply for devices that are connected to the relay. The second two positions act as storage for the jumper header.

JTAG Header

Internal to the controller is a JTAG header for in-circuit programming and debugging of the ATMega16 processor. Used by the factory for firmware flashing and maintenance.

Expansion Header

This header is mainly used to connect an SPI device (like an LCD display) to the controller. There are also a few other signals available in this header to act as auxiliary inputs or outputs. This is a two row .100 header with 12 pins that is

placed just to the right of the plug in transformer connector. The pin-out for this header is the following:

Pin configuration:

1	2	3	4	5	6
7	8	9	10	11	12

PIN	Function
1	SPI Clock (PB7 signal)
2	Auxiliary input or output (reserved currently) (PB6 signal)
3	SPI Data (PB5 signal)
4	Auxiliary input or output (reserved currently) (PB4 signal)
5	+5V 1 Amp regulated out
6	+5V 1 Amp regulated out
7	SPI Busy input (currently unused) (PC0 signal)
8	Auxiliary input or output (reserved currently) (PC1 signal)
9	RX RS232 5V signal between network adaptor and ATMega 16
10	TX RS232 5V signal between network adaptor and ATMega 16
11	Ground connection
12	Ground connection

Connection to CrystalFontz LED Display Model CFA632 YMC-KS

Connection to the Crystal Fontz Display is done using the onboard SPI serial port on the controller. In order to configure the CrystalFontz display to use the SPI port, you must close a jumper on the displays circuit board to enable SPI mode. You close this jumper by placing a small solder bead across two pads on the board. The jumper is labeled "JPA" on the board and is located in the upper right side of the back of the board.

In order to connect the board to the controller wires need to be soldered onto pads found at the bottom right of the display's circuit board. These wires then need to be terminated with a double row, 12 position, .100" pin header. Using the signal descriptions of this pin header described above, the wiring should be the following:

Display Solder Pad Label	Controller Expansion Header Pin Number
GROUND	PIN 12, 11: GROUND
+5V(LCD)	Pin 5 or 6, +5V regulated out 1 Amp
+5V(LED)	Pin 5 or 6, +5V regulated out 1 Amp
DATA_IN	Pin 3, SPI Data
SPI_CS	Pin 12, 11: Ground
SPI_CLK	Pin 1: SPI Clock
SPI_Busy	Pin 7: SPI Busy input