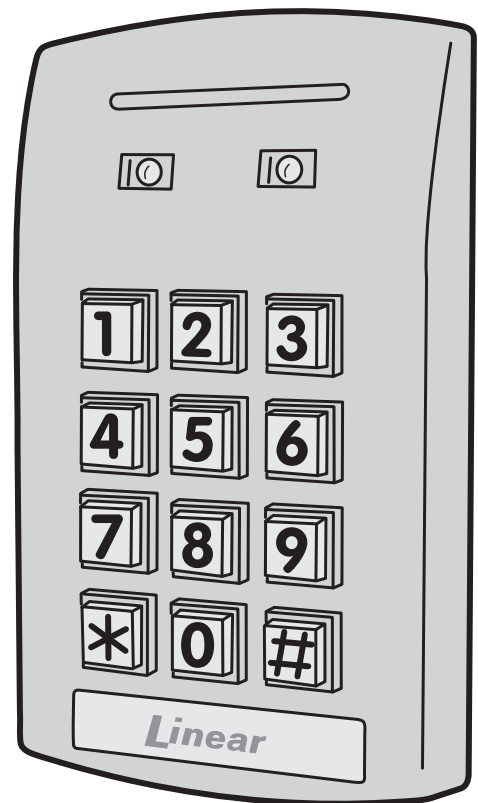


Linear  **ACCESS**

AK-31

**Digital Keyless
Entry System**



Installation and Programming Instructions

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INTRODUCTION

Linear's AK-31 is a digital keyless entry system designed for access control applications. The keypad is housed in a rugged, plastic enclosure and is designed to be mounted in a standard single-gang electrical box. The die-cast keys have bright, easy-to-read yellow graphics.

Up to 480 entry codes, from 1 to 6 digits in length, can be programmed. They can activate either, or both, of the relay outputs. The "anti-passback" feature prevents using the same code again before the programmed time elapses.

All system indicators are long-lasting, solid-state LEDs. Two indicators show the status of the entry system. The left indicator lights red to indicate power, then turns green when access is granted. The right indicator lights yellow when the keypad is in "lockout" condition (from too many incorrect code entries). An internal sounder beeps when each key is pressed. An internal jumper sets the sounder volume high or low.

The **SENSE** input can be used two ways. If programmed for "door sense" the input is wired to a normally closed switch on the door to detect when the door is open or closed. Forced entry or door ajar situations can then be detected. Using door sense, the "Auto-relock" feature will prevent "tailgating" by turning off the Main Relay output immediately when the door is closed after access has been granted. If the **SENSE** input is programmed for "inhibit", the input can be wired to a "service" switch or automatic timer that will disable the Main Relay when required.

The **REQUEST-TO-EXIT** input can be wired to a pushbutton to provide codeless activation of Main Relay, Auxiliary Relay, Output #3, or Output #4 (programmable).

The **ALARM SHUNT** output activates when access is granted. This output can be wired to shunt alarm contacts on the access door/gate to prevent triggering of an alarm when authorized access occurs.

The AK-31 is powered from a 12-24 Volt AC or DC source. Power can be obtained from the access device or a separate power supply. The EEPROM memory retains all entry codes and programming, even without power. An internal jumper is provided to reset the master code. The Main Relay has a 5 Amp capacity. The Auxiliary Relay has a 1 Amp capacity. Two solid state outputs, capable of switching 100 mA to common, are programmable to signal forced entry, door ajar, lockout, alarm circuit shunting, request-to-exit, and keypad active conditions.

FEATURES

- ✓ **KEYPAD PROGRAMMABLE**
No programmer required
- ✓ **480 ENTRY CODE CAPACITY**
Ideal for small & medium traffic installations
- ✓ **1-6 DIGIT ENTRY CODE LENGTH**
Flexible code length for different applications
- ✓ **4 INDEPENDENT OUTPUTS (TIMED/TOGGLED)**
Each output's action is programmable
- ✓ **4 INDEPENDENT TIMERS**
Each output's activation time is programmable
- ✓ **TWO FORM "C" (N.O. & N.C) RELAY CONTACTS**
*Main Relay 5-Amp @ 28 VDC capacity,
Auxiliary Relay 1-Amp @ 28 VDC capacity*
- ✓ **EACH ENTRY CODE CAN ACTIVATE EITHER OR BOTH RELAYS**
Specific entry codes can grant access to different doors
- ✓ **TWO SOLID STATE OUTPUTS**
Auxiliary outputs can indicate access status on external devices
- ✓ **TWO STATUS INDICATORS (2-COLOR RED/GREEN & YELLOW)**
Displays access, lockout, and programming information
- ✓ **PIEZO SOUNDER (TWO SELECTABLE VOLUME LEVELS)**
Programmable for beeps during key presses and output activations
- ✓ **TIMED ANTI-PASSBACK**
Disables entry code for a programmed time after use
- ✓ **AUTO-RELOCK**
Releases the main relay as soon as the door shuts
- ✓ **KEYPAD LOCKOUT**
Locks the keypad after too many incorrect entries
- ✓ **TACTILE KEY FEEL**
Assures complete key presses
- ✓ **DOOR SENSE INPUT**
For sensing door position to control auto-relock and door-ajar features
- ✓ **INHIBIT INPUT**
For temporarily disabling access with a timer or switch
- ✓ **REQUEST-TO-EXIT INPUT**
For codeless activation with a pushbutton
- ✓ **KEYPAD CAN BE POWERED FROM 12-24 VOLTS AC OR DC**
Power can be supplied from a transformer, battery, or power supply

COMPONENT LOCATIONS

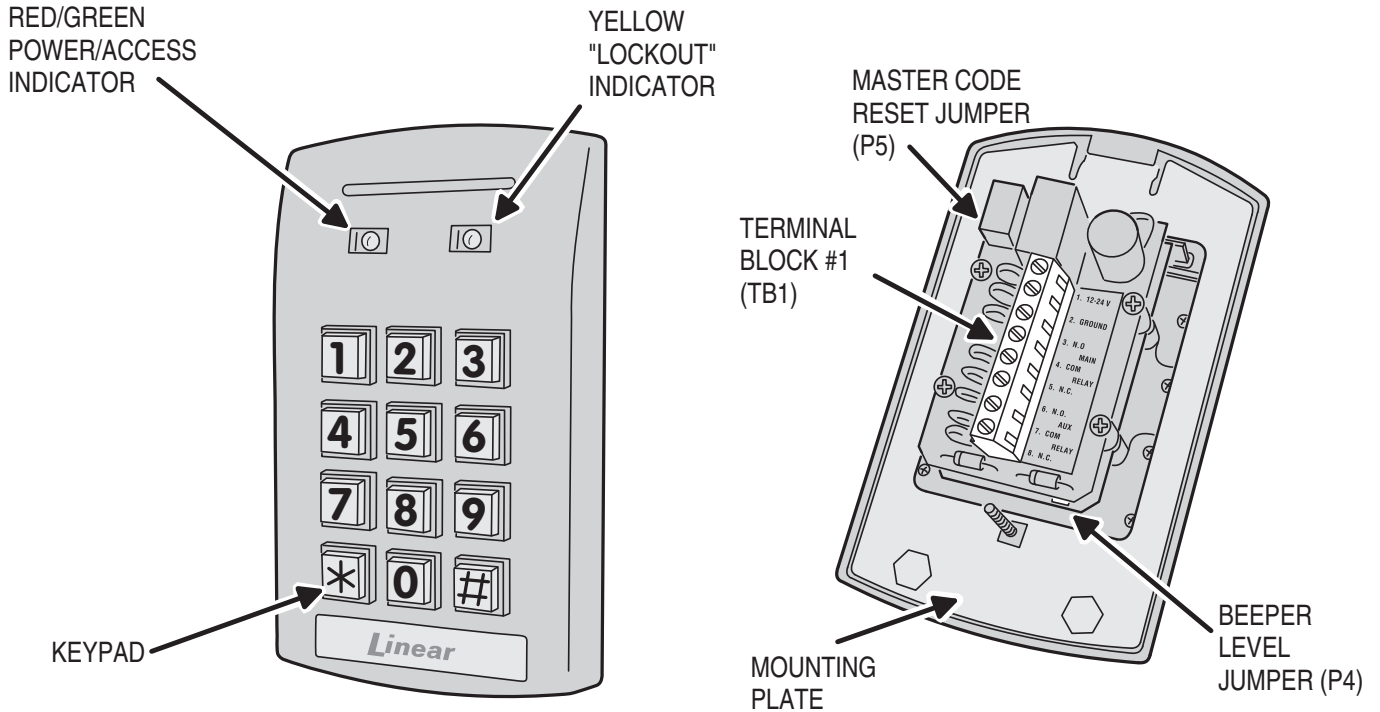
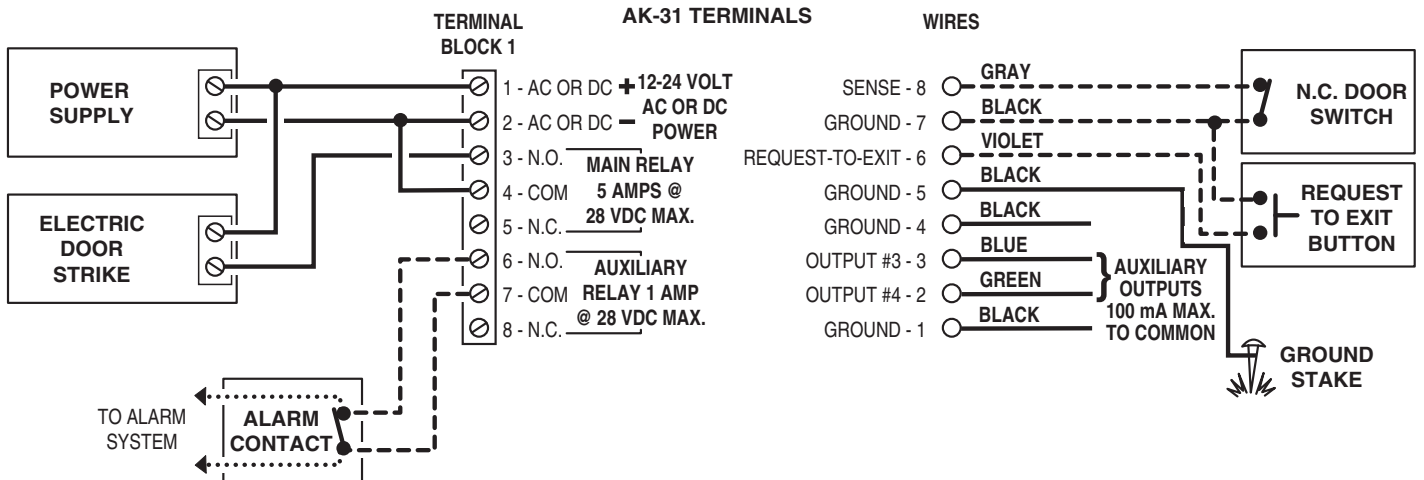


Figure 1. Component Locations

WIRING DIAGRAM

TYPICAL DOOR INSTALLATION WIRING



_____ REQUIRED WIRING
 - - - - - OPTIONAL WIRING
 OTHER WIRING

NOTES:
 1. ALARM SHUNT SET FOR AUXILIARY RELAY
 2. GRAY WIRE SET FOR DOOR SENSE

CAUTION
 IF THE UNIT IS AC POWERED,
 MAKE SURE THE SECONDARY OF THE
 SYSTEM TRANSFORMER IS ISOLATED
 FROM EARTH GROUND

Figure 2. Wiring Diagram

INSTALLATION

Before installing the keypad, the unit must be partially disassembled to access the mounting plate.

Opening the Keypad

The keypad assembly is secured with two screws that are hidden behind the keypad's nameplate. Refer to Figure 3 for disassembly details.

- ❑ Use a *small* flat blade screwdriver to pry off the keypad's nameplate.
- ❑ Use a philips head screwdriver to remove the two screws.
- ❑ Separate the mounting plate from the keypad assembly.

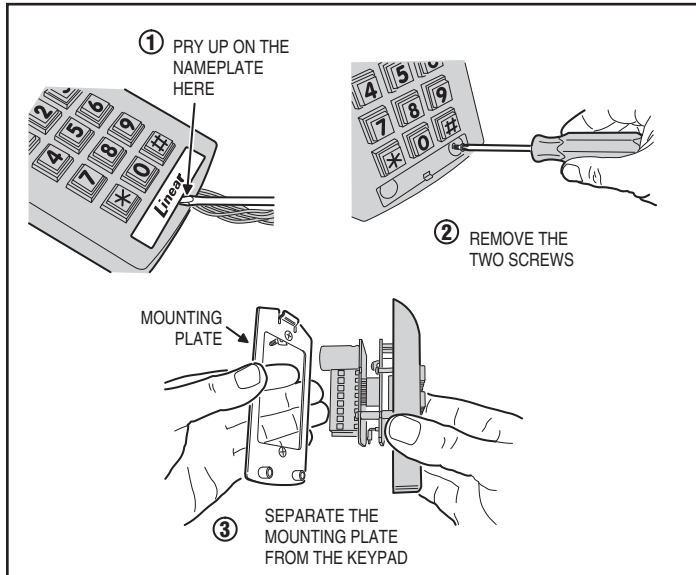


Figure 3. Opening the Keypad

Install the Electrical Box and Mounting Plate

The keypad is designed to fit into a standard single-gang electrical box. Select a location near the controlled door and choose a convenient height for the keypad. Be sure there is good wiring accessibility for the unit's power and the output to the door strike or access device.

- ❑ Install the electrical box in the wall.
- ❑ Screw the mounting plate onto the electrical box (see Figure 4).

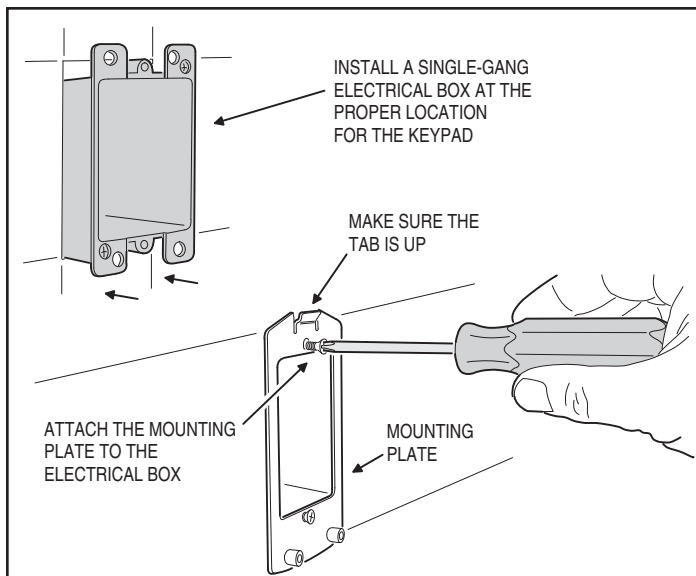


Figure 4. Installing the Mounting Plate

Final Keypad Installation

After wiring the keypad (see next page), complete the installation by securing the keypad to the mounting plate.

- ❑ If a lower beeper sound level is required, before installing the keypad, remove Jumper at P4 (place the jumper block on one pin to save the jumper).
- ❑ Hook the keypad assembly onto the mounting plate tab (see Figure 5).
- ❑ Secure with two philips screws.
- ❑ Snap nameplate into position over screws.

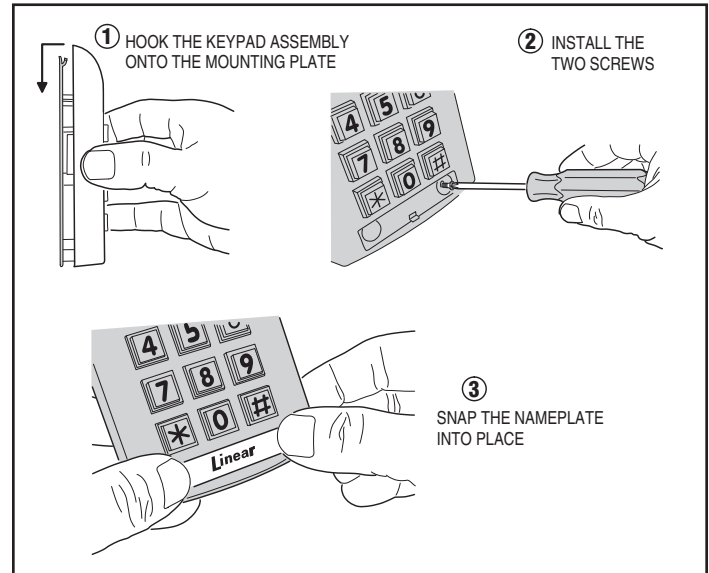


Figure 5. Connecting the Keypad to the Mounting Plate

Keypad Wiring

See Figure 6 for an example of a basic door installation. The keypad is mounted adjacent to the door. An electric door strike is mounted in the door jamb to release the door lock. A magnetic switch is mounted on the top of the door jamb for detecting when the door is open.

Use the following steps to wire the keypad. Refer to the wiring diagram shown in Figure 7 to assist in the wiring.

NOTE: Up to 500 feet of 18 AWG wire can be run for power, use larger wire for longer runs. Use 22 AWG or larger (depending on the load) for other connections.

OUTPUT

- Install a low voltage electric door strike for unlocking the door.
- Route two wires between the door strike and the keypad box. Connect one of the door strike wires to the keypad's **MAIN RELAY N.O.** terminal (TB1 #3). Connect the other door strike wire to the keypad's **AC/DC +** terminal (TB1 #1). Connect a wire between the keypad's **AC/DC -** terminal (TB1 #2) and the **MAIN RELAY COM** terminal (TB1 #4).

POWER

- Choose a location for the power supply or transformer.
- Route two wires between the power supply and the keypad box. Connect the power supply's output terminals to the keypad's **AC/DC** input terminals (TB1 #1 & #2). Observe wiring polarity if using DC.

◆ **CAUTION:** If the unit is AC powered, make sure the secondary of the system transformer is isolated from earth ground.

EARTH GROUND

- To avoid damage to the unit from static discharges, connect the **EARTH GROUND** black wires E1, 4, 5 or 7 to a good earth grounding point. Suggested wiring size is 18 AWG for earth ground.

SENSE INPUT

- ◆ **NOTE:** **SENSE** terminal (gray wire) can be programmed for either a door sense or inhibit input. Both features cannot be used at the same time.
- To use the door sense feature to detect forced entry or door ajar conditions, install a *normally closed* door switch on the door and route two wires from the switch to the keypad box. Connect the door switch to the keypad's **SENSE** input (gray wire, E8) and **COM** (any black wire, E7).
- If an inhibit switch or timer is going to be used for temporarily disabling the keypad, route two wires from the switch or timer to the keypad box. Connect the inhibit switch/timer *normally open* terminals to the keypad's **SENSE** input (gray wire E8) and **COM** (any black wire, E7).

REQUEST-TO-EXIT INPUT (wiring shown on Page 1, Figure 2)

- If a request-to-exit pushbutton is going to be used, route two wires from the keypad box to a normally open pushbutton mounted on the secure side of the door. Connect the wires to the pushbutton and to the keypad's **EXIT** input (violet wire, E6) and **COM** (any black wire, E7).

Solid State Outputs

The two solid state outputs (Output #3 & Output #4) can be programmed to activate during various conditions. These outputs can be used to activate indicators or sounders. See Figure 8 for wiring examples using the solid state outputs.

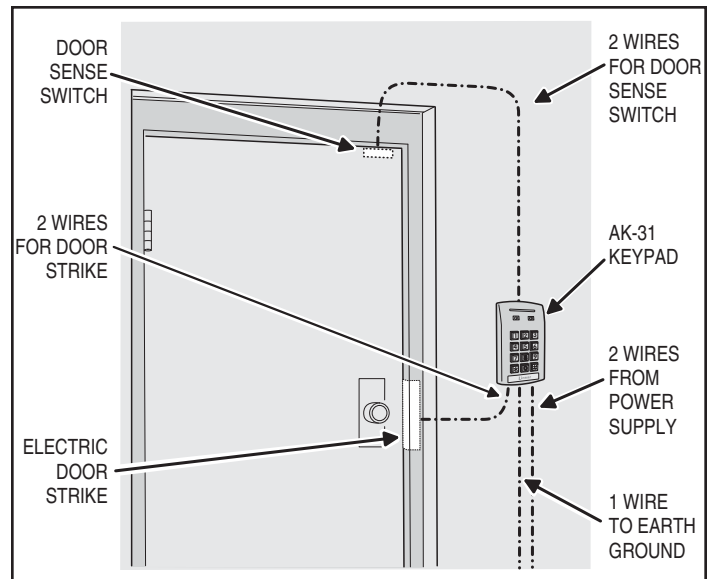


Figure 6. Basic Door Installation

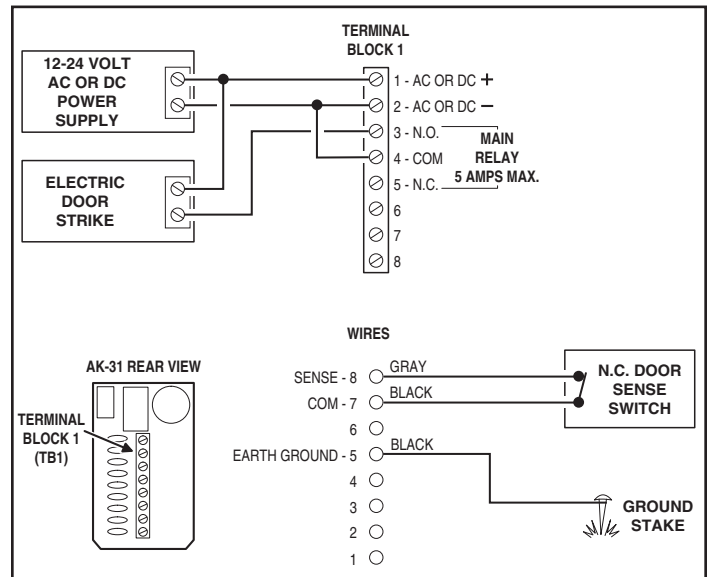


Figure 7. Basic Door Installation Wiring

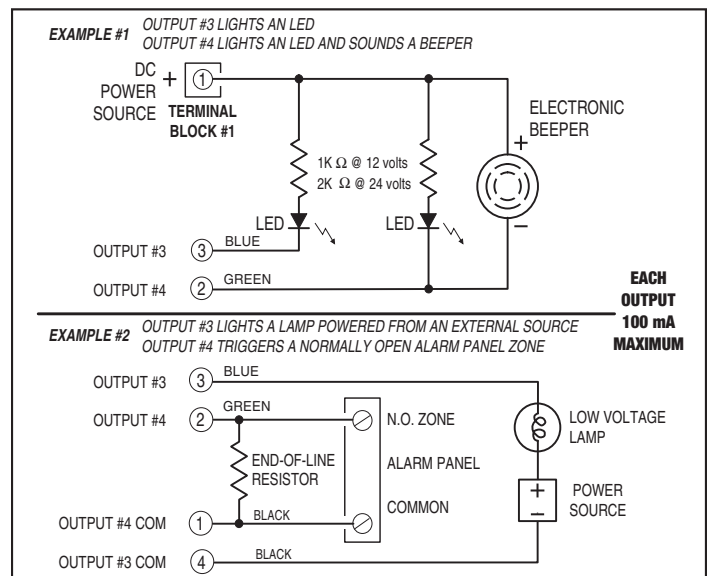


Figure 8. Using Solid State Outputs

FACTORY DEFAULTS

MASTER PROGRAMMING CODE	123456
ENTRY CODE LENGTH	4 DIGITS
REQUEST-TO-EXIT OUTPUT RELAY	MAIN RELAY
ALARM SHUNT OUTPUT	DISABLED
FORCED ENTRY OUTPUT	OUTPUT #3
DOOR AJAR OUTPUT	OUTPUT #4
MAIN RELAY ON TIME	2 SECONDS
AUXILIARY RELAY ON TIME	2 SECONDS
SOLID STATE OUTPUT #3 ON TIME	2 SECONDS
SOLID STATE OUTPUT #4 ON TIME	2 SECONDS
DOOR SENSE/INHIBIT INPUT	DOOR SENSE
KEYPAD LOCKOUT OUTPUT	DISABLED
KEYPAD ACTIVE OUTPUT	DISABLED
BEEPER SOUNDS WHEN KEY PRESSED	YES
BEEPER SOUNDS DURING RELAY #1	NO
BEEPER SOUNDS DURING RELAY #2	NO
BEEPER SOUNDS DURING OUTPUT #3	NO
BEEPER SOUNDS DURING OUTPUT #4	NO
KEYPAD LOCKOUT COUNT	3 TRIES BEFORE LOCKOUT
ANTI-PASSBACK TIME	NO ANTI-PASSBACK
AUTO-RELOCK	ON

BASIC PROGRAMMING

When the AK-31 is in Programming Mode, both indicators will turn off until programming begins. After a programming option number is entered the yellow indicator will blink. This shows that the AK-31 is ready to accept the new programming data. After the new data entry is complete, the yellow indicator will flash while the data is being stored. The green indicator will light if the data is accepted. The red indicator will light if any programming data is entered incorrectly, and the command will have to be fully re-entered.

Entering Programming Mode

The 6-digit Master Programming Code (default = 123456) is used to enter Programming Mode.

Press: **# 9 # Master Code**

Master Code = the current 6-digit Master Programming Code

Exiting Programming Mode

Press: *** * #**

The red indicator will light after exiting Programming Mode.

NOTE: The AK-31 will automatically exit Programming Mode after two minutes of inactivity.

Re-entering a Command After a Mistake

If the red indicator lights, signaling an incorrect entry, or an incorrect key is pressed during programming, to clear the keypad and re-enter the command:

Press: *** 9 #**

Setting Entry Code Length

Default: 4 digits

Press: **0 3 # Length #**

Length = 1 - 6 for entry code length

NOTE: If the Entry Code Length is going to be changed from the factory default of four digits, make this change first, before programming any entry codes.

Adding a New Entry Code

Press: **01 # Code # Code # Action #**

Code = The new entry code: 1-999999, depending on code length

Action = Relay output entry code will activate as follows:

1 = Relay #1, timed open

2 = Relay #2, timed open

3 = Both Relays, timed open

10 = Relay #1, toggled

20 = Relay #2, toggled

30 = Both Relays, toggled

12 = Relay #1 toggled; Relay #2, timed open

21 = Relay #1 timed open; Relay #2 toggled

The yellow LED will flash quickly while the AK-31 searches its memory for available space and duplicate entries. The green LED will light when the new code is stored.

If the new entry code chosen is already being used for another entry code, the red LED will light. A new *unique* code needs to be entered.

NOTE: Leading zeros (zeros before the code number, i.e. 0001) do not need to be entered when programming a new entry code. The AK-31 will internally add any zeros to fill all digits determined by the entry code length setting. Leading zeros **will** have to be entered by the user when entering their code to gain access.

Erasing a Single Entry Code

Press: **0 2 # Code # Code #**

Code = The entry code to delete.

The yellow indicator will flash quickly while the AK-31 searches its memory for the code to erase. The green indicator will light when the code is erased.

Erasing All Entry Codes

★ WARNING: PERFORMING THIS COMMAND WILL REMOVE ALL ENTRY CODES FROM THE MEMORY.

Press: **9 7 # 0 0 0 0 0 0 # 0 0 0 0 0 0 #**

NOTE: The green indicator will light while the memory is being erased. This may take up to 15 seconds.

Changing the 6-Digit Master Programming Code

Press: **9 8 # Master Code # Master Code #**

Master Code = The new 6-digit Master Programming Code

New master code: _____

PROGRAMMING OPTIONS

There are several AK-31 programming options. For most installations, the factory set default options are sufficient. The keypad must be in Programming Mode to make these changes.

Select Door Sense or Inhibit Input **Default: Door Sense**
The input (gray wire) can be programmed for **DOOR SENSE** or **INHIBIT**.

Press: **1 0 # Input #**

Input = 0 for Door Sense, = 1 for Inhibit

When programmed for **DOOR SENSE**, if an open condition on the input occurs before access is granted (with an entry code or with the request-to-enter input) a **FORCED ENTRY** output will occur. If an open condition remains 60 seconds after a relay activation for access, a **DOOR AJAR** output will occur.

When programmed for **INHIBIT**, a closed condition on the input will prevent Relay #1 from activating when access is requested with an entry code. This mode is typically used with an external timer to disable the access device at certain times.

Select Forced Entry Output **Default: Output #3**
Sets which output activates if the **DOOR SENSE** input opens before access is granted. This output is not timed.

Press: **1 1 # Output #**

Output = Output to Activate (0-4)

1 = Main Relay 2 = Auxiliary Relay 3 = Output #3 4 = Output #4 0 = No Output

Select Door Ajar Output **Default: Output #4**
Sets which output activates if the **DOOR SENSE** input stays open 60 seconds after access is granted. This output is not timed.

Press: **1 2 # Output #**

Output = Output to Activate (0-4)

1 = Main Relay, 2 = Auxiliary Relay, 3 = Output #3, 4 = Output #4, 0 = No Output

Select Keypad Lockout Output **Default: No Output**
Sets which output activates when the keypad is "locked out" after too many incorrect entry code attempts. The lockout time is 60 seconds.

Press: **1 3 # Output #**

Output = Output to Activate (0-4)

1 = Main Relay, 2 = Auxiliary Relay, 3 = Output #3, 4 = Output #4, 0 = No Output

Select Keypad Active Output **Default: No Output**
Sets which output activates when any keys are pressed. This output is timed. If toggle mode is selected for the output, the timer value defaults to 2 seconds.

Press: **1 4 # Output #**

Output = Output to Activate (0-4)

1 = Main Relay, 2 = Auxiliary Relay, 3 = Output #3, 4 = Output #4, 0 = No Output

Select Alarm Shunt Output **Default: No Output**
Sets which output activates during the time access is granted. (Use this output to shunt alarm contacts attached to the access door.) This output may be timed or toggled.

Press: **1 5 # Output #**

Output = Output to Activate (0-4)

1 = Main Relay, 2 = Auxiliary Relay, 3 = Output #3, 4 = Output #4, 0 = No Output

Select Request-to-Exit Output **Default: Main Relay**
Sets which output activates when the Request-to-Exit input is grounded. This output may be timed or toggled.

Press: **1 6 # Output #**

Output = Output to Activate (0-4)

1 = Main Relay, 2 = Auxiliary Relay, 3 = Output #3, 4 = Output #4, 0 = No Output

Main Relay On-time **Default: 2 Seconds**
Sets the length of time the Main Relay activates when triggered.

Press: **2 1 # Seconds #**

Seconds = Output time in seconds (0-60)

Auxiliary Relay On-time **Default: 2 Seconds**
Sets the length of time Auxiliary Relay activates when triggered.

Press: **2 2 # Seconds #**

Seconds = Output time in seconds (0-60)

Solid-state Output #3 On-time **Default: 2 Seconds**
Sets the length of time Output #3 activates when triggered.

Press: **2 3 # Seconds #**

Seconds = Output time in seconds (0-60), 99 = Toggle Mode

Solid-state Output #4 On-time **Default: 2 Seconds**
Sets the length of time Output #4 activates when triggered.

Press: **2 4 # Seconds #**

Seconds = Output time in seconds (0-60), 99 = Toggle Mode

Beep Sounds on Keystrokes **Default: Yes**
Selects whether or not the keypad beeps as each key is pressed.

Press: **4 0 # Sound #**

Sound = 1 for Yes, = 0 for No

Beep Sounds During Main Relay **Default: No**
Selects whether or not the keypad beeps during Main Relay activation.

Press: **4 1 # Sound #**

Sound = 1 for Yes, = 0 for No

Beep Sounds During Auxiliary Relay **Default: No**
Selects whether or not the keypad beeps during Auxiliary Relay activation.

Press: **4 2 # Sound #**

Sound = 1 for Yes, = 0 for No

Beep Sounds During Output #3 **Default: No**
Selects whether or not the keypad beeps during Output #3 activation.

Press: **4 3 # Sound #**

Sound = 1 for Yes, = 0 for No

Beep Sounds During Output #4 **Default: No**
Selects whether or not the keypad beeps during Output #4 activation.

Press: **4 4 # Sound #**

Sound = 1 for Yes, = 0 for No

Keypad Lockout Count

Default: 3 Tries

Sets the number of incorrect entry code attempts allowed before the keypad "locks out".

Press: **5 0 # Attempts #**

Attempts = Number of attempts before lockout (2-7)

Anti-passback Time

Default: No Anti-passback

Sets the length of time an entry code will not function after it is used.

Press: **5 1 # Minutes #**

Minutes = Time in Minutes (1-4), 0 = No Anti-passback

RESETTING KEYPAD

Master Reset

- ◆ **CAUTION: Performing a master reset will clear the entire memory of the AK-31 and return all programmable options to the factory default values. ALL ENTRY CODES WILL BE ERASED.**

STEP 1 Disconnect power from the keypad.

STEP 2 Press and hold down the * and # keys.

STEP 3 Apply power to the keypad, continue holding the keys down until the red indicator starts flashing.

STEP 4 Release the keys. The red and yellow indicators will remain lit until the process is complete, then the yellow indicator will go out.

Resetting the Master Code

STEP 1 Open the AK-31 case.

STEP 2 Locate jumper at P5. This jumper is used to reset the master code.

STEP 3 With power applied to the keypad, remove the jumper at P5. The keypad will begin to beep, signaling that the code has been reset.

STEP 4 Replace jumper on P5.

THE MASTER PROGRAMMING CODE IS NOW 123456.

AK-31 OPERATION

Keypad users request access by entering their code.

- Users of the AK-31 have up to 40 seconds to key in their entry code.
- Up to eight seconds are allowed between each keystroke.
- All digits of the entry code must be entered. Example: If the code is 0042, the user must enter "0 0 4 2".
- If the wrong key is pressed, pressing the * key will reset the keypad. The correct code can then be re-entered.
- After a correct code is entered, the red indicator will turn green and the programmed relay will activate for the programmed time.
- If the number of incorrect codes entered exceeds the keypad lockout count, the yellow indicator will light, indicating that the keypad is locked out. The lockout will remain for one minute.
- After a valid code has been entered, it will be unusable until the anti-passback time expires.

SPECIFICATIONS

MECHANICAL

Dimensions: 3.00" W x 5.00" H x 3.00" D

ELECTRICAL

Voltage: 12-24 Volts AC or DC

Current: 30 mA typical, 150 mA maximum

Outputs: Main Relay:

Form "C" 5 Amps @ 28 Volts maximum

Auxiliary Relay:

Form "C" 1 Amp @ 28 Volts maximum

Solid state outputs (Outputs #3 & #4):

Short-to-common 100 mA @ 24 VDC maximum

ENVIRONMENTAL

Temperature: -22°F to 149°F (-30°C to 65°C)

Humidity: 5% to 95% non-condensing

LINEAR LIMITED WARRANTY

This Linear product is warranted against defects in material and workmanship for twenty-four (24) months. The Warranty Expiration Date is labeled on the product. This warranty extends only to wholesale customers who buy direct from Linear or through Linear's normal distribution channels. Linear does not warrant this product to consumers. Consumers should inquire from their selling dealer as to the nature of the dealer's warranty, if any. **There are no obligations or liabilities on the part of Linear LLC for consequential damages arising out of or in connection with use or performance of this product or other indirect damages with respect to loss of property, revenue, or profit, or cost of removal, installation, or reinstallation.** All implied warranties, including implied warranties for merchantability and implied warranties for fitness, are valid only until Warranty Expiration Date as labeled on the product. **This Linear LLC Warranty is in lieu of all other warranties express or implied.**

All products returned for warranty service require a Return Product Authorization Number (RPA#). Contact Linear Technical Services at 1-800-421-1587 for an RPA# and other important details.

FCC NOTICE

Changes or modifications not expressly described in this manual or approved by the manufacturer could void the user's authority to operate the equipment.

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.