

FIELD MANUAL · VOLUME 22

Trenched. Sealed. Signed.

The trench is dug once.

Lay the conduit before the gate posts set.

PREPARED FOR

Operators · Project Managers · Designers · Integrators · Owner's Reps

CONTACT

Restrepo Innovations

Franklin Lakes, NJ · mike@restrepoinnovations.com
restrepoinnovations.com · Phone on file with PM

PARTNER

Island Media Systems

Audio · Video · Network · Lighting · Shades
One team. One standard. One execution.



MORE · RESTREPOINNOVATIONS.COM

MANIFESTO

The trench is dug once. Lay the conduit before the gate posts set.

Vol 22 governs the complete specification of luxury residential garage door and gate automation for Restrepo Innovations projects in Franklin Lakes, New Jersey. The scope encompasses six tightly coordinated pillars: garage door openers, swing gate operators, slide gate operators, UL 325-2018 entrapment protection, vehicle loops and free-exit detection, and conduit, trench, and power infrastructure. Smart-home integration via Crestron Home, Control4, and LiftMaster myQ governs five locked operational scenes. Every conduit sleeve, every loop lead-in, every low-voltage home run must be stubbed, pulled, and capped before any paver, concrete, or asphalt contractor begins. The driveway is a finished surface. A saw-cut through decorative concrete or a lifted paver course is a maintenance patch — not an invisible repair. The gate operator is not a technology layer added after the hardscape sets. It is infrastructure from the first trench stake.

SCOPE

Residential-only. Applies to new luxury garage door and gate automation construction and major renovations within Restrepo Innovations projects in the NJ/NY metro corridor. Governing codes: NEC 2023 Articles 110, 210, 250, 300, 352, 422, 680, 725; NEC 210.8(F) outdoor GFCI; NEC 230.67 Type 1 SPD; NEC Table 300.5 burial depth; UL 325-2018 (7th Edition) monitored entrapment; ASTM F2200-24 gate construction; ANSI/DASMA 102-2018 door operator; ICC 600-2020 high-wind; NJ UCC NJAC 5:23; FCC Part 15 RF transmitters; IRC R311 pedestrian egress; IRC R314 smoke. NEC Article 511 hazardous-location wiring is explicitly excluded from this volume — these are residential-only applications. Spare hardware at ≥5% of installed equipment value is delivered and labeled at every project closeout per Restrepo policy. The manifesto: the trench is dug once. Lay the conduit before the gate posts set.

CONTENTS

01	Operating Principles	p. 5
02	Garage Door Openers	p. 8
03	Swing Gate Operators	p. 13
04	Slide Gate Operators	p. 16



05	UL 325 Entrapment Protection	p. 20
06	Vehicle Loops & Free-Exit	p. 23
07	Gate Intercom & Access Control	p. 26
08	Conduit, Trench & Power	p. 29
09	Pedestrian Gate Hardware	p. 32
10	Smart-Home Integration & Scenes	p. 35
11	Without Written Direction	p. 39
12	Pre-Trench & Pre-Pour Checklist	p. 41
13	QC · Audit · Closeout	p. 43

PART 1

Door & Opener

Sections 01–02 — Operating Principles, Garage Door Openers

Operating Principles

PART 1 — DOOR & OPENER

Luxury residential garage door and gate automation is defined by six interdependent pillars — garage door openers, swing gate operators, slide gate operators, UL 325-2018 entrapment protection, vehicle loops and free-exit detection, and conduit, trench, and power infrastructure — each with a one-shot rough-in gate tied to the hardscape schedule. The conduit sleeve for a gate operator feed cannot be added after the driveway pavers are set without saw-cutting a finished surface. The loop lead-in conduit cannot be inserted after a concrete driveway is poured without core-drilling. The trench is dug once. Every conduit is stubbed and capped before the first paving crew mobilizes.

THE FOUR PARTS OF THIS VOLUME

Part	Sections	Primary Disciplines
I — Door & Opener	01–02	Operating principles, six pillars, residential-only posture; garage door openers — LiftMaster jackshaft and belt-drive, Sommer Synoris, Hörmann SupraMatic, Marantec Synergy, Aladdin Connect; NEC 422.10/210.8 GFCI; ANSI/DASMA 102; NEC 511 excluded
II — Gate & Drive	03–04	Swing gate operators — LiftMaster LA500UL, FAAC S418/S450H/412/415/422/770N, Came AXO/FERNI/FROG/KRONO, BFT IGEA/SUB/PHOBOS, Nice Wingo/Toona/HOPP, DoorKing 6100/6500, Viking K-3; Slide gate operators — LiftMaster SL3000UL, FAAC 740/741/746/844 ER, Came BX-241/BX-243, BFT ARES/DEIMOS, Nice Juno, DoorKing 9100/9300, Viking K-2
III — Loop & Access	05–10	UL 325 entrapment, ASTM F2200; vehicle loops — Reno A&E, EMX D-TEK, BD Loops; gate intercom — Aiphone IXG, DoorBird, 2N Verso, Comelit ULTRA; access control — Linear AM3-Plus, HID ProxKey, Schlage Encode Plus, Adams Rite 7200/8400, Locinox MODULEC-SF; conduit/trench/power; pedestrian gate hardware; smart-home scenes
IV — Discipline & Closeout	11–13	Without written direction; pre-trench & pre-pour checklist; QC · audit · closeout signoff; 5% spares; as-built archive

THE SIX PILLARS

Pillar	Scope	One-Shot Gate
--------	-------	---------------



1 — Garage Door Openers	LiftMaster 8500W jackshaft; 87504-267 3/4 HP DC belt-drive with Secure View camera; 84501 mid-range; Sommer Synoris 800/Duo; Hörmann SupraMatic 4/ProMatic Akku; Marantec Synergy 270/370; Aladdin Connect by Genie; NEC 422.10/210.8(F) GFCI; dedicated 20A circuit; ANSI/DASMA 102	Rough-in receptacle, conduit stub to ceiling for jackshaft, and circuit label before drywall closes; jackshaft hardware config per DASMA 102 before spec
2 — Swing Gate Operators	LiftMaster LA400-XL/LA500UL; FAAC S418/S450H/412/415/422/770N hydraulic; Came AXO/FERNI/FROG/KRONO; BFT IGEA BT/SUB EL/PHOBOS BT; Nice Wingo/Toona/HOPP; DoorKing 6100/6500; Viking K-3; UL 325 Class I-IV; NEC 422.31 disconnect within sight	Operator feed conduit stubbed and capped at gate post location before any driveway or gate-pier concrete is placed; gate construction reviewed per ASTM F2200 before operator is ordered
3 — Slide Gate Operators	LiftMaster SL3000UL/SL585UL; FAAC 740/741/746/844 ER (844 ER: 650W/7A/0.87 HP/4,000 lbs/131 ft/70% duty); Came BX-241/BX-243 NA (660 lbs/28 ft/IP54); BFT ARES/DEIMOS BT; Nice TUB/Juno 310 AC; DoorKing 9100/9300; Viking K-2; rack bonded per NEC 250.110; dedicated 20A circuit	Operator feed conduit, low-voltage conduit, and loop lead-in conduit stubbed to gate operator cabinet location before driveway surface is placed; ground rod driven at pedestal before hardscape begins
4 — UL 325 Entrapment	UL 325-2018 (7th Ed.): two independent monitored devices per direction of travel; Type A inherent + Type B1 EMX IRB-MON photo eye or Type B2 Miller Edge MGR/MGS sensing edge; ASTM F2200-24 Class I residential gate construction; 2.25-inch sphere <48 in.; 4-inch sphere 48–72 in.; 16-inch swing entrapment clearance; positive stops	Sensing-edge and photo-eye conduit stubbed with line-voltage conduit at each gate post; monitored wiring mode set on control board at commissioning before any automatic operation
5 — Loops + Intercom + Access	Reno A&E; LM-200/LM-422/LL-622; EMX D-TEK/IL2-12VDC; BD Loops PreFormed; Aiphone IXG-2C7 + IX-DV/IX-DVF; DoorBird D2101V/D21DKV; 2N Verso 2.0; Comelit ULTRA; Linear AM3-Plus (20,000 codes/45,600 tx/4 Form C relays); LiftMaster KPW250 + 893MAX; HID ProxKey III MaxiProx 5375; Schlage Encode Plus HomeKit/Matter; Adams Rite 7200/8400; Locinox MODULEC-SF	Loop preformed lead-in and intercom Cat6A conduits in separate trench from line voltage, minimum 12-inch separation, all capped before pavers; fiber media converter conduit if gate-to-IDF run exceeds 100 m
6 — Conduit/Trench /Power	PVC Sched 40/80 (NEC 352); depth per NEC Table 300.5 (18 in. residential); sweeps min 6× trade-size radius; expansion fittings >100 ft; sleeves before pavers/concrete; 12 AWG TFFN/THWN; separate line-voltage and low-voltage conduit; ground rod NEC 250.52/250.53; GFCI NEC 210.8(F); NEC 230.67 Type 1 SPD + Ditek LVLP secondary; 120V 20A dedicated; UPS 2–4 hr runtime	All conduits stubbed, pulled, and capped before any hardscape contractor mobilizes; ground rod driven at each pedestal; photos timestamped and filed in closeout archive before pavers are set

FIELD RULE**Trench before hardscape. There is no corrective access after the pavers set.**

All line-voltage and low-voltage conduit sleeves, loop lead-in conduits, intercom home-run conduits, photo-eye raceways, and ground rod locations must be set, photographed, and approved before any paver, concrete, or asphalt contractor begins. The pre-trench gate is signed by the GC project manager, electrical subcontractor, and Restrepo AV/smart-home lead. No exceptions are granted after hardscape is placed; corrections require demolition of the finished surface.

SPECIFICATION**Residential-only discipline throughout.**

Every provision in Vol 22 is residential. NEC Article 511 hazardous-location classification applies only to commercial garages with fuel-dispensing equipment and to in-ground hydraulic lift cylinder pits. NEC 511 is explicitly out of scope for all residential garage door and gate applications in this volume. NJ UCC NJAC 5:23 governs AHJ enforcement. Bergen County AHJ confirmation of current NEC adoption and GFCI/SPD requirements is obtained before permit is issued. Spare hardware at $\geq 5\%$ of installed equipment value is delivered and labeled at every project closeout per Restrepo policy.

NOTE**Code floor — NEC 2023, UL 325–2018, ASTM F2200–24, NJ UCC.**

NEC 2023 Articles 110, 210, 250, 300, 352, 422, 680, 725; NEC 210.8(F) outdoor GFCI; NEC 230.67 Type 1 SPD at service entrance; NEC 250.52/250.53 ground rod at each gate operator pedestal; NEC Table 300.5 burial depth; NEC 725 Class 2 for low-voltage control wiring; UL 325-2018 (7th Edition) monitored entrapment; ASTM F2200-24 gate construction; ANSI/DASMA 102-2018 door operator; ICC 600-2020 high-wind; NJ UCC NJAC 5:23; FCC Part 15 RF transmitters; IRC R311 pedestrian egress; IRC R314 smoke — these are the floor, not the ceiling.

SOURCES

[NEC 2023 Key Articles](#) — [ElectricalLicenseRenewal](#) [UL 325-2018 Resources Hub](#) — [US Automatic Gate Openers](#) [ASTM F2200-24 Gate Construction Standard](#) [NJ UCC](#) — [NJAC 5:23 \(NJ DCA\)](#)

§ 02

Garage Door Openers

PART 1 — DOOR & OPENER

Premium residential garage door openers are defined by DC brushless motor technology for soft-start/soft-stop operation, integrated or available battery backup, Security+ 2.0 or equivalent rolling-code radio encryption, and direct compatibility with major smart-home platforms. For garages with low headroom, cathedral ceilings, high-lift configurations, or four-post lift clearance requirements, jackshaft/side-mount geometry is the default specification. Belt-drive systems occupy the middle tier for standard sectional doors where vibration transmission to adjacent living spaces is a concern. Chain-drive is excluded from Restrepo residential specifications due to noise. NEC Article 511 hazardous-location wiring does not apply to residential attached garage door openers on this project.

PRIMARY GARAGE DOOR OPENER SPECIFICATION

Model	Motor	Circuit	Drive	Backup	Notes
LiftMaster 8500W ¹ Jackshaft Elite	24V DC brushless 115V AC in ~2.7A	20A dedicated 120V GFCI	Jackshaft torsion shaft	Integrated 40 cycles/24 hr	PosiLock; myQ Wi-Fi; Sec+ 2.0; doors ≤14 ft/850 lbs; 200W LED remote light; clears ceiling for 4-post lift rise; ANSI/DASMA 102 jackshaft hardware config confirmed before spec
LiftMaster 87504-267 ² Belt Drive DC	DC brushless 3/4 HP equiv 120V AC	20A dedicated 120V GFCI	Belt drive soft start/stop	Integrated	2,000-lumen 360° LED; 1080P Secure View camera, night vision, 140° wide-angle, two-way audio via myQ app; Sec+ 2.0; PosiLock; lifetime motor and belt; Restrepo default for standard-headroom belt-drive applications
LiftMaster 84501 ³ Belt Drive Mid-Range	DC soft start/stop 120V AC	20A dedicated 120V GFCI	Belt drive	Not included (optional upgrade)	1,500-lumen dual LED; myQ + Sec+ 2.0; no camera; documented for client-supplied substitutions — review for backup and camera completeness before acceptance

Sommer Synoris 800/Duo ⁴	DC brushless 550N or 800N 120V AC	20A dedicated 120V GFCI	Chain-in-tube direct drive	Per model	Ultra-quiet sealed tube; 1.5 in. low headroom; 70 ops/hr; HomeLink compatible; specified for master-bedroom garages and garages with living space above
Hörmann SupraMatic 4E ⁵	800N peak 120V AC US	20A dedicated 120V GFCI	Belt drive HCP bus	Per model	Up to 13.75 m ² door; 20 LED chase; BlueSecur Bluetooth; <1W standby; ProMatic 2 Akku: 400N battery-only for outbuildings without power
Marantec Synergy 370 ⁶	DC belt drive 850N/120V AC	20A dedicated 120V GFCI	Belt drive	Optional	9.3 in/sec; 1,100-lumen LED; optional backup; 315 MHz HomeLink; Synergy 270 (750N) also available; German premium DC belt-drive alternative
Aladdin Connect by Genie ⁷	Per Genie DC opener model	Per opener	Per opener	Per opener	2.4 GHz Wi-Fi; open-API posture; Control4/Crestron third-party drivers; Alexa + Google Home; no native HomeKit; preferred alternative to myQ when open-API platform required after 2023 Chamberlain API restriction

NEC AND CODE REQUIREMENTS — GARAGE DOOR OPENERS

Code	Requirement	Application
NEC 210.8(F)	GFCI at all 125V, 15A and 20A outdoor and garage receptacles	All opener receptacles in attached garage require GFCI; dedicated 20A GFCI-protected circuit is Restrepo standard for every opener
NEC 422.10	Motor-driven appliance branch circuit rated for continuous load	Opener at continuous use: circuit must handle 125% of operating current; 20A circuit standard; confirm with DASMA 102 hardware requirements for jackshaft
NEC 422.31	Lockable disconnect within sight of motor-driven appliance	Lockable disconnect within 50 ft of each opener motor; labeled with circuit ID; lockable in open position; required by most NJ AHJs for garage operators



ANSI/DASMA 102	Jackshaft hardware configuration confirmation	Confirm torsion spring shaft diameter, door weight, and spring balance are within jackshaft operator parameters before ordering; submit DASMA 102 hardware config sheet to project engineer
NEC 511 EXCLUDED	Residential-only; no hazardous-location wiring	NEC 511 applies to commercial garages with fuel-dispensing equipment. This volume is residential-only. NEC 511 does not apply. Document exclusion in permit package for Bergen County AHJ.

SPECIFICATION

ANSI/DASMA 102 — jackshaft hardware configuration must be confirmed.

A jackshaft operator mounted to the wrong torsion spring shaft configuration will fail to lift the door or overtax the spring system. Before specifying the LiftMaster 8500W or any jackshaft operator, confirm: (1) torsion spring shaft diameter (1-inch or 1-1/4-inch); (2) door weight within operator capacity; (3) high-lift or follow-the-curve track configuration; (4) drawbar reinforcement per ANSI/DASMA 102 Table 1. Submit the DASMA 102 hardware configuration worksheet to the Restrepo project engineer before the operator is purchased.

BEST PRACTICE

LiftMaster 87504-267 as the Restrepo default belt-drive specification.

The 87504-267 integrates battery backup, a 2,000-lumen LED, and a 1080P Secure View camera with two-way audio in a single unit — eliminating separate camera, lighting, and backup battery accessories that inflate installed cost and create additional failure points. The Security+ 2.0 rolling code and PosiLock electronic deadbolt satisfy the luxury-residential security baseline. Specify the 8500W jackshaft when the ceiling must be fully cleared for a four-post vehicle lift or when door height exceeds standard trolley clearance.

NOTE

myQ API restriction and Aladdin Connect alternative.

In October 2023, Chamberlain Group blocked unauthorized third-party API access to the myQ ecosystem, removing integration from Home Assistant, Clare Controls, and similar open platforms. The Intrinsic Dev Crestron module operates on the authorized partner API and remains functional. For clients requiring an open-API integration platform, specify Genie quiet-drive DC openers with Aladdin Connect. All myQ integrations on Restrepo projects must use the authorized Intrinsic Dev driver or another authorized partner channel.



FIELD RULE**Sommer Synoris for master-bedroom garages and living-space-adjacent bays.**

The Synoris direct-drive chain-in-sealed-aluminum-tube system is perceptibly quieter than an equivalent open-belt drive at the same load. The sealed tube eliminates open-rail vibration transmission through the framing to the living space above. Specify the Synoris 800 (800N) for standard two-car and three-car garage doors; the Synoris Duo for doors requiring the 1.5-inch low-headroom clearance profile. HomeLink compatibility is standard. Confirm US 120V AC power supply model when ordering from Sommer USA.

SOURCES

¹ [LiftMaster 8500W via Garaga](#) ² [LiftMaster 87504-267 Official Page](#) ³ [LiftMaster 84501 Product Page](#) ⁴ [Sommer Synoris 800 — Sommer USA](#) ⁵ [Hörmann SupraMatic 4 Brochure \(PDF\)](#) ⁶ [Marantec Synergy 270/370 Brochure \(PDF\)](#) ⁷ [Chamberlain myQ API Restriction Statement](#)

PART 2

Gate & Drive

Sections 03–04 — Swing Gate Operators, Slide Gate Operators

§ 03

Swing Gate Operators

PART 2 — GATE & DRIVE

Swing gate operators for luxury residential estates operate in one of four drive geometries: linear actuator (arm extending from a post-mounted pivot), electromechanical arm (articulated crank-arm drive), hydraulic piston, or underground motor with concealed mechanism. All operators specified here carry UL 325 Class I–IV residential listing. NEC Article 511 hazardous-location classification does not apply to these residential swing gate applications. A dedicated 20A, 120VAC GFCI-protected circuit per operator is Restrepo standard per NEC 422.10 and NEC 210.8(F).

SWING GATE OPERATOR QUICK REFERENCE

Model	Voltage	Max Leaf	Max Weight	Duty Cycle	Notes
LiftMaster LA500UL ⁸	24VDC (120/230VAC in)	18 ft	1,600 lbs	300 cycles/day	myQ + Sec+ 2.0; 2×7Ah batteries incl; solar-ready; UL 325 I–IV; auto-opens on AC failure; wireless dual-gate sync on dual-leaf installs
FAAC S450H CBAC ⁹ (P/N 1041001577.5)	24VDC hydraulic-hybrid 60W	14 ft	1,100 lbs	Continuous	1,124 lbf thrust; –40°F to +131°F; encoder + battery backup; UL 325; arctic oil; continuous duty for high-cycle estate entries
FAAC 412 ¹⁰	115VAC	14 ft	500 lbs	18 cycles/hr	Self-contained electromechanical arm; UL 325; residential standard
FAAC 415 DC ¹¹	24VDC	15 ft	700 lbs	100%	Low-voltage; battery backup option; 100% duty; UL 325 I–IV
FAAC 770N ¹²	24VDC (115VAC in)	10 ft	1,100 lbs	Continuous	In-ground; IP67; continuous duty; –40°F; ideal for pillar-concealed installations at estate entries
Came AXO AX5024 ¹³	24VDC	16.4 ft	2,205 lbs	Heavy-duty	Encoder-based obstacle detect; battery-ready; CAME CONNECT cloud gateway
Came FROG ¹⁴	115V in-ground	~23 ft	1,100 lbs	30%	IP67; motor access without removing gate leaf; underground installation

BFT PHOBOS BT A ¹⁵	24VDC	16.4 ft	1,100 lbs	Semi-intensive	Electronic torque limiter; 14 sec to 90°; MET Listed UL 325
BFT SUB BT ¹⁵	24VDC underground hydraulic	11.5 ft	1,760 lbs	Very intensive	IP67 equiv; oil pre-heating; weekly timer; cold-climate spec
Nice Toona 5 (TO5024) ¹⁶	24VDC encoder	16.4 ft	882 lbs	Standard	16 sec to 90°; Moonclever MC824H; obstacle detection
DoorKing 6100 ¹⁷	115VAC 1/2 HP	14 ft	500 lbs	Continuous	UL 325 + UL 991; ETL Listed Class I-II; 3 convenience outlets
DoorKing 6500 ¹⁷	115VAC 1/2 or 1 HP	22 ft	800 lbs	Continuous	Breakaway hub; Gate Tracker to DKS access; UL 325 Class I-IV
Viking K-3 ¹⁸	24VDC (120/240VAC in)	Per spec	Per spec	100%	V-Flex LCD; built-in heater; 100-cycle backup; SPS; lightning protection 20,000V/10,000A; G90 galv housing; ANSI/CAN/UL 325 Class I

SPECIFICATION**NEC 511 EXCLUDED — residential swing gate; no hazardous-location requirements.**

NEC Article 511 hazardous-location classification and explosion-proof wiring requirements apply only to commercial garages with Class I flammable vapor hazards from fuel-dispensing equipment. All swing gate operators in this section are installed at residential Class I locations per UL 325. NEC 511 does not apply. NEC 422.10 governs branch circuit rating for motor-driven appliances. NEC 210.8(F) requires GFCI at all outdoor 125V, 15A and 20A receptacles at gate pedestals. NEC 422.31 requires a lockable disconnect within sight of each operator. Document NEC 511 exclusion in the permit package.

BEST PRACTICE**LiftMaster LA500UL for estates requiring battery backup and dual-leaf sync.**

The LA500UL includes two 7Ah batteries and provides auto-open on AC failure or battery depletion — meeting fire department fail-safe requirements without a separate battery cabinet or transfer relay. The wireless dual-gate sync feature eliminates a low-voltage control wire between gate posts on dual-leaf installations, reducing conduit runs and eliminating a common failure point. The 300-cycle-per-day rating supports high-cycle estate entries at 100% duty without derate.



FIELD RULE**FAAC S450H CBAC for continuous-duty hydraulic reliability in NJ climate.**

The S450H CBAC hydraulic-hybrid operator uses arctic-rated oil and an integrated encoder to maintain full 1,124 lbf thrust at -40°F — the most demanding NJ winter design condition. Continuous duty rating means the operator does not require a cooldown period at any cycle rate within the residential use profile. Specify the arctic oil kit (P/N 1041001577.5) for all NJ installations. Confirm FAAC 780 or THALIA L control board is programmed for monitored entrapment sensor mode before commissioning.

INSPECTION STANDARD**ASTM F2200 gate construction review before operator is ordered.**

Automating a gate that was not built to ASTM F2200 requirements exposes the installer to liability. Before ordering any swing gate operator, confirm: (1) gap widths below 48 in. are ≤ 2.25 inches; (2) gap widths 48–72 in. are ≤ 4 inches; (3) 16-inch entrapment clearance at swing pivot; (4) no protrusions on the gate panel; (5) positive stops are present at fully open and fully closed positions. Document the F2200 review in the project commissioning record.

SOURCES

⁸ LiftMaster LA500UL Product Page ⁹ FAAC S450H CBAC — FastGateOpeners ¹⁰ FAAC 412 — Elite Gates ¹¹ FAAC 415 DC Specs ¹² FAAC 770N Catalog — ArchExpo ¹³ Came AXO Product Page ¹⁴ Came FROG Tech Spec (PDF) ¹⁵ BFT Electromechanical Swing Gate Catalog (PDF) ¹⁶ Nice Wingo Specs — Houston Systems ¹⁷ DoorKing 6100 Product Page ¹⁸ Viking Access Systems

§ 04

Slide Gate Operators

PART 2 — GATE & DRIVE

Slide gate operators for luxury residential estates use chain-and-rack or rack-and-pinion drive systems sized for gate weight, gate length, and duty cycle. For ornamental iron slide gates weighing 400–800 lbs and lengths of 20–30 ft, 24VDC operators with integrated control boards are the default specification. For heavier estate gates above 1,500 lbs or requiring 70% duty cycle at high daily cycle volume, step up to the FAAC 844 ER. All operators carry UL 325 Class I listing. Steel rack is bonded to the equipment grounding conductor per NEC 250.110. A dedicated 20A, 120VAC GFCI-protected circuit per operator is standard.

SLIDE GATE OPERATOR QUICK REFERENCE

Model	Voltage	Max Weight	Max Length	Duty Cycle	Notes
LiftMaster SL3000UL ¹⁹ (1/2 HP)	115VAC	1,000 lbs	50 ft	High-traffic	UL 325; 7-yr residential warranty; myQ + Sec+ 2.0; anti-tailgate expansion board available; NEC 422.31 disconnect required
FAAC 740 (24VDC) ²⁰	24VDC (115VAC in)	880 lbs	30 ft	100%	70W; soft-stop; battery backup optional; mechanical locking; residential standard for gates ≤880 lbs
FAAC 741 (115VAC) ²⁰	115VAC 600W	1,984 lbs	49 ft	S3/40%	146 lbf thrust; S3 duty cycle; for heavier ornamental iron panels
FAAC 844 ER ²¹ (P/N 1098371)	115VAC 650W/7A	4,000 lbs	131 ft	70%	0.87 HP; 247 lbf thrust; Z16 pinion; twin-disk oil-bath clutch; 780D control board; UL 325/UL 991 Class I–IV; specified for estate ornamental iron >1,500 lbs or high-cycle entries
Came BX-243 NA ²² (001BX-243U)	120VAC /24VDC 7A	660 lbs	28 ft	Intensive	IP54; encoder obstacle detect; amperometric sensitivity; battery backup option (LB90); UL 325 + CSA C22.2 No. 247; CAME CONNECT cloud gateway; NA residential standard for ≤660 lbs/28 ft
Came BX-241 ²²	230VAC /24VDC 17A	1,760 lbs	46 ft	Intensive	400W; 700N push force; CAME CONNECT; for heavier applications

BFT ARES BT A1000 ²³	24VDC (120VAC in)	2,200 lbs	75 ft	Intensive	11.8 in/sec; D-Track or electronic torque limiter; MET Listed UL 325; adjustable pinion
BFT DEIMOS Ultra BT ²³ A600 UL	24VDC (120VAC in)	1,300 lbs	75 ft	Intensive	Integrated 433 MHz rolling-code receiver; MET Listed UL 325
Nice Juno 310 AC ²⁴	110–230VA C	800 lbs	40 ft	Standard	Mercury 310 board; integrated battery backup; BlueBUS photo eye; 3-yr warranty
DoorKing 9100 ²⁵	115VAC 1/2 HP	1,000 lbs	30 ft	Continuous	10 in/sec; 30:1 oil-bath reduction; anti-tailgating; UL 325 + UL 991; ETL Listed Class I-IV
Viking K-2 (VA-K2SPS) ²⁶	24VDC (120 /240VAC in)	700 lbs	30 ft	100%	V-Flex LCD; SPS; –20°F to +160°F; 100-cycle battery backup; built-in heater; ANSI/CAN/UL 325 Class I

FIELD RULE**Rack bonding and conduit separation discipline for slide operators.**

Steel rack is bonded to the equipment grounding conductor per NEC 250.110 at each splice point. Use 1.25-inch PVC Schedule 40 minimum for the 12 AWG THWN operator feed; run a separate 1-inch conduit for loop lead-in, photo-eye wiring, and 24VDC control runs. Maintain minimum 12-inch physical separation between line-voltage and low-voltage conduit runs per Viking K-2 installation manual and Restrepo standard. Dedicated 20A 120VAC circuit. GFCI circuit breaker per NEC 210.8(F).

SPECIFICATION**FAAC 844 ER — the heavy-duty estate slide gate specification.**

The FAAC 844 ER (P/N 1098371) delivers 0.87 HP, 247 lbf thrust, and 4,000-lb gate capacity at 131-ft run length with 70% duty cycle. The twin-disk oil-bath clutch provides mechanical anti-crush protection independent of the electronic current-sensing circuit. The 780D control board supports all UL 325 entrapment device inputs in monitored mode. Specify for estate ornamental iron slide gates over 1,500 lbs or high-cycle service entries. For gates under 880 lbs, the FAAC 740 24VDC is the correct residential specification.



BEST PRACTICE**Came BX-243 NA as the residential standard for gates ≤660 lbs/28 ft.**

The BX-243 (001BX-243U) is the Came North American residential standard for slide gates up to 660 lbs and 28 ft. The encoder-based obstacle detection, IP54 enclosure, UL 325 + CSA C22.2 No. 247 listing, and optional LB90 battery backup card make it a complete residential specification at a competitive price point. The CAME CONNECT gateway enables cloud-based remote access via the CAME Back-Office platform for clients with Crestron or Control4 integration.

INSPECTION STANDARD**NEC 422.31 — lockable disconnect within sight of each slide gate operator.**

A lockable disconnect switch must be installed within sight of (and within 50 ft of) each gate operator per NEC 422.31. Most NJ AHJ inspectors require this for all outdoor motor-driven appliances. Use a NEMA 3R fusible safety switch rated for the operator's operating current. Label the disconnect with circuit ID, panel location, and fuse rating. Field tag identifies the circuit.

SOURCES

¹⁹ [LiftMaster SL3000UL Product Page](#) ²⁰ [FAAC 740-741 Technical Manual \(PDF\)](#) ²¹ [FAAC 844 ER Z16 — FastGateOpeners](#) ²² [Came BX-243 Spec Sheet \(PDF\)](#) ²³ [BFT ARES BT A1000](#) ²⁴ [Nice Juno Residential Slide — Protec Controls](#) ²⁵ [DoorKing 9100 Product Page](#) ²⁶ [Viking K-2 Product Page](#)

PART 3

Loop & Access

Sections 05–10 — UL 325 Entrapment, Vehicle Loops & Free-Exit, Gate Intercom & Access Control,

§ 05

UL 325 Entrapment Protection

PART 3 — LOOP & ACCESS

UL 325-2018 (7th Edition) — effective for operators manufactured after August 1, 2018 — is the primary safety standard governing automatic gate operator installation in the United States. A gate operator shipped without UL 325 compliance cannot legally be installed in the United States. The 7th Edition explicitly added Table 32.2, which requires a minimum of two independent monitored entrapment protection means in each direction of travel where a risk of entrapment exists. This is the most frequently violated provision in residential gate installations.

UL 325 DEVICE TYPES AND MONITORED WIRING REQUIREMENTS

Type	Description	Monitored?	Application
Type A	Inherent operator sensor: electronic torque limiter, current sensing, or mechanical force limiter; built into every UL 325-compliant operator; Device 1 in every installation	Yes — built in	Present in all specified operators; not an add-on; always Device 1
Type B1	Non-contact photoelectric beam sensor (EMX IRB-MON); detects object in gate path without contact; must use monitored supervision relay output to confirm alignment and functionality	Yes — required	Second independent entrapment device for all swing and slide gates; mount at mid-height for swing gates; 12–18 in. above grade for slide gate leading edge
Type B2	Contact sensing edge (Miller Edge MGR20/MGS20); pressure-sensitive PVC wrap on gate leading edge; must use 2-wire 10K or 8.2KΩ EOL resistor or 4-wire supervised wiring	Yes — required	Leading-edge entrapment protection; install on both street-facing and property-facing edges of every swing and slide gate
Type D	Wireless device worn by person or attached to vehicle; prevents gate operation when in entrapment zone	Yes — required	Less common in luxury residential; use where a person regularly works near gate during operation

MILLER EDGE MGR20/MGS20 AND EMX IRB-MON SPECIFICATIONS

Component	Spec	Wiring	Notes
Miller Edge MGR20/MGS20 ²⁷ Sensing Edge	3-sided; 2-in post; 4–7 lbf; 24VAC/DC; max 10 ft; –30°F to +155°F	2-wire 10K or 8.2KΩ EOL or 4-wire supervised	UL 325 Recognized Component; Alumaglas contact element; Restrepo standard for gate leading-edge entrapment; install on both approach and closing-strike sides of every gate

EMX IRB-MON ²⁸ Monitored Photo Eye	Active infrared; UL 325 Type B1; 12–24VDC or 24VAC; monitored supervision relay	Monitored supervision relay output wired to operator input	Confirms alignment and function continuously; weatherproof; mount at mid-height (swing) or 12–18 in. (slide); combined with Type A provides two required independent devices
--	---	--	--

ASTM F2200-24 — GATE CONSTRUCTION REQUIREMENTS (CLASS I RESIDENTIAL)

Requirement	Dimension	Zone	Verification
Sphere test — lower zone	2.25-inch sphere must not pass through	Below 48 in. above grade	Measure or use 2.25-in. gauge; chain-link, expanded metal, or ornamental pickets ≤ 2.25 in. satisfy
Sphere test — upper zone	4-inch sphere must not pass through	48–72 in. above grade	Ornamental pickets ≤ 4 in. satisfy; verify on shop drawings
Swing entrapment clearance	16 inches minimum clearance at pivot	Gate panel to fixed structure	Measure from gate panel edge to any fixed post or column when gate is in any open position; mount hinge at rear face of column
Roller guards	Required for all weight-bearing rollers	Below 8 ft above grade	Verify roller cover plates are ordered and installed on all slide gate hardware before commissioning
Positive stops	Required at fully open and fully closed positions	Gate travel limits	Physical stop present and confirmed; gate does not travel beyond stop under motor force or gravity
Protrusions	No protrusions that could snag a limb or neck	Full gate panel	All bolts, pins, and exposed hardware must be flush or capped; no exposed sharp edges on automated gate panels

SPECIFICATION

Two independent monitored entrapment devices — every direction, every gate.

UL 325-2018 Table 32.2 requires a minimum of two independent entrapment protection means in each direction of travel where a risk of entrapment exists. The operator's built-in Type A sensor is Device 1. An external monitored sensing edge (Type B2) or monitored photo eye (Type B1) is Device 2. Both devices must be in monitored mode — the operator board must continuously verify sensor circuit continuity and will not permit automatic operation if any monitored circuit is open. Many boards ship in legacy unmonitored mode. Set monitored mode before commissioning. Document monitored circuit verification in the project commissioning record.

DO NOT**Do not bypass or wire entrapment sensors in unmonitored mode.**

Installing a sensing edge or photo eye in unmonitored mode renders the installation non-compliant with UL 325-2018 and exposes the installer to liability. Unmonitored mode means the operator continues to function automatically even if the sensor wire is cut, disconnected, or failed. Monitored mode stops automatic gate operation on any circuit fault. Proceeding with unmonitored sensor wiring requires written direction from the project engineer with specific code justification. No exceptions.

NOTE**Reno A&E; reverse loop satisfies UL 325 Type B1 entrapment in closing direction.**

A vehicle loop detector in the reverse-loop position — inside the gate, property side, gate closing direction — detects a vehicle still present in the entrapment zone and holds the gate open or triggers reversal. This satisfies UL 325 Type B1 entrapment protection for the closing direction when wired to the monitored input on the operator control board. The loop must be properly sized, installed in dedicated conduit, and connected to a monitored detector channel. See Section 06 for full loop specifications.

SOURCES

²⁷ [Miller Edge MGR20/MGS20 Spec Sheet \(PDF\)](#) ²⁸ [EMX IRB-MON / D-TEK Manual \(PDF\)](#) [UL 325-2018 Resources Hub](#)
[DASMA TDS353 UL 325 Entrapment \(PDF\)](#) [ASTM F2200-24 DASMA Installer Guide to ASTM F2200](#)

§ 06

Vehicle Loops & Free-Exit

PART 3 — LOOP & ACCESS

Vehicle loop detectors use inductive loop technology embedded in the pavement surface to sense the presence of a vehicle and trigger gate open, hold-open, or reversal commands. All gate-application loops operate in the 20–100 kHz frequency range. BD Loops PreFormed direct-burial loops are the Restrepo standard for new construction — installed in the pavement base course before concrete, asphalt, or pavers are placed, consistent with the pre-trench discipline of this volume.

STANDARD LOOP POSITIONS — RESIDENTIAL GATE

Loop Position	Location	Function	UL 325 Role
Free-Exit Loop	Outside gate — street side; short leg: 4 ft; long leg: driveway width – 4 ft	Triggers open for exiting vehicles without transmitter; no resident action required for normal departure	Type B1 — entrapment protection in opening direction for exit vehicles; verified at commissioning
Safety / Center Loop	Under gate panel in closed position; centered over gate travel path	Holds gate open while vehicle is detected; prevents gate from closing on a stopped or slow vehicle	Type B1 — entrapment protection in closing direction; holds gate open while detect is active
Reverse Loop	Inside gate — property side; in closing direction, vehicle still present zone	Prevents gate from closing if vehicle still in entrapment zone; triggers reversal if gate begins to close with vehicle present	Type B1 — primary entrapment device in closing direction; Restrepo standard third loop on all installations
Anti-Tailgate Loop (optional)	Inside gate — immediately behind main vehicle path; detects second vehicle following too closely	Activates alarm or holds gate open for second vehicle; prevents tailgating at high-security estate entries	Not a UL 325 requirement; estate security enhancement on Class IV applications

LOOP DETECTOR SELECTION

Detector	Power	Channels	Sensitivity	Notes
Reno A&E; AX2 Dual-Channel ²⁹	120VAC (AX2-3) or 12/24VDC/24 VAC (AX2-4)	2 channels 1 unit	4 levels DIP	20–2,000 µH; 4 DIP-selectable freq/channel prevents crosstalk; relay 6A/300VAC; lightning protection 10 µF@2,000V; combine safety + reverse on single card; Restrepo standard dual-channel detector

EMX Ultra II D-TEK ²⁸ Plug-in	12–24VDC or 24VAC	1 channel	10 levels (0–9 Ultra METER)	4 selectable freq; ASB auto-sensitivity boost for high-clearance vehicles; Extend Detect 3/6/9 sec; –40°F to +180°F; 7-position detachable terminal block
BD Loops PreFormed ³⁰ Direct-Burial	— (passive loop wire only)	—	Per detector	RL lead-in (≤40 ft) or EL (>40 ft); short leg 4 ft; long leg = driveway width – 4 ft; installed in base course before concrete/pavers; no saw-cutting required; slide gates: 3 loops standard; swing gates: 3 loops minimum (4 for high-traffic estates)

FIELD RULE**Loop lead-in conduit: separate from line-voltage, minimum 12-inch separation.**

Electromagnetic interference from 120VAC line-voltage conductors in the same conduit or within 12 inches of loop lead-in signal wires causes false detects and loop failure. Run loop lead-in in a dedicated 1-inch PVC Schedule 40 conduit (1.25 inch preferred for two conductor pairs plus pull string). Maintain minimum 12-inch physical separation from all line-voltage conduit runs. Burial depth: 18 inches minimum per NEC Table 300.5 for PVC Schedule 40. Loop lead-in conductor: No. 14 AWG twisted pair per Reno A&E; and BD Loops spec.

BEST PRACTICE**BD Loops PreFormed in base course — no saw-cutting, no surface disruption.**

PreFormed loops installed in the pavement base course before concrete, asphalt, or pavers are placed eliminate the saw-cut approach that introduces moisture infiltration, concrete cracking, and disruption of decorative surfaces. Consistent with the Restrepo pre-trench discipline: the loop lead-in conduit is pulled to the operator cabinet location and capped before the hardscape contractor mobilizes. The loop wire is laid in the base course, photographed, and covered as part of the hardscape sequence.

SPECIFICATION**Loop lead-in conductor labeled at both ends before conduit is capped.**

Every loop lead-in conductor is labeled at both conduit ends with circuit ID and loop position (free-exit, safety, reverse) before the conduit is capped and the pavement is placed. Photographs of the labeled loop wire in the base course are filed in the project closeout archive. The drain wire is grounded at the operator cabinet end only — not at the loop end. DIP-selectable frequencies are set to prevent cross-talk in multi-loop installations; document frequency assignments in the commissioning record.

SOURCES

²⁹ [Reno A&E; AX2 Spec Sheet — Signal Control \(PDF\)](#) ³⁰ [BD Loops Direct Burial Loops BD Loops Placement and Sizing Guide \(PDF\) NEC Table 300.5 Burial Depths — ExpertCE](#)

§ 07

Gate Intercom & Access Control

PART 3 — LOOP & ACCESS

Luxury residential gate intercom systems are IP-based with PoE power, Cat6A cabling, and SIP or cloud-based call routing to resident smartphones and indoor panels. For gate-to-house runs exceeding 100 meters, single-mode fiber with PoE media converters at the gate post is required — Cat6A tops out at 100 m for reliable PoE power delivery, and fiber eliminates ground-loop and lightning-induced surge risk on long driveway runs. Access control for estate properties uses the Linear AM3-Plus as the backbone controller with HID proximity credentials at vehicular gates.

INTERCOM AND VIDEO DOOR STATION SELECTION

Model	Power	Camera	Integration	Notes
Aiphone IXG-2C7 ³¹ + IX-DV/IX-DVF	PoE 802.3af Class 0 1.9W–5.9W	7-in color LCD touch master; IX-DV: IP video gate station	SIP smartphone forwarding; visitor image capture	Full-duplex audio/video; vandal-resistant IX-DV flush or surface at gate pillar; Cat6A minimum; beyond 100 m use fiber media converter at gate post — eliminates ground-loop and lightning surge risk
DoorBird D2101V ³²	15VDC PoE	HD + IR night vision	DoorBird app; ONVIF; SIP; IFTTT; Alexa; Google Home	IP65/IK08; FCC Part 15; relay output for gate trigger on answered call; –25°C to +55°C; ideal for compact gate pillar installations; D21DKV multi-button version for multiple entry points
2N IP Verso 2.0 ³³ (P/N 9155211C)	PoE	Full HD 1080P; 138° H; WDR; Zipstream; Axis ARTPEC-7	SIP; REST API; ONVIF; Control4; Alexo; Google	Anodized aluminum chassis; IP54/IK08; PIN, RFID, WaveKey, QR code; 20+ modular add-ons (keypad, card reader, fingerprint); Zipstream: H.265-class compression at 50% lower bit rate
Comelit ULTRA ³⁴ (UT8020)	PoE or 2-wire SimpleBUS1	2 MP; 160° H; dual MEMS mic	SimpleBUS1 or ViP IP; Comelit App; Virtual Key	Widest field of view in class; 2-wire SimpleBUS1 option simplifies retrofit where Cat6A is not yet available to gate post

ACCESS CONTROL — LINEAR AM3-PLUS AND HID CREDENTIAL SYSTEM

Component	Spec	Application
-----------	------	-------------

Linear AM3-Plus ³⁵ Access Controller	4 controlled entry points; 20,000 codes; 45,600 block-coded transmitters; 4 Form C relays 3A @ 24V; 4 RTE inputs; RS-485 to Linear phone entry; 2 Wiegand inputs (26/30/31-bit); 12–24 VAC/DC	Estate backbone controller — vehicular gate, pedestrian gate, pool house, and service entry in a single credential database; accepts HID ProxKey III keyfobs and proximity readers
HID ProxKey III 1346 ³⁶ Key Fob Credential	125 kHz passive; 26-bit H10301; up to 85-bit code space; 137 billion+ unique codes	Keyfob credential for staff, family, and vendors; field-programmable without technician visit; works with all HID readers below
HID MaxiProx 5375 ³⁶ Long-Range Reader	125 kHz; up to 12-inch read range; with ProxPass vehicle tag; Wiegand 26-bit output	Hands-free drive-through access at vehicular gate — driver does not lower window; vehicle tag on windshield; ideal for luxury estate primary entry
LiftMaster KPW250 ³⁷ Wireless Keypad	Sec+ 2.0 rolling code; 250 codes; battery; backlit; no wiring to operator	Programs directly to LiftMaster myQ openers and gate operators; visitor and vendor codes without credential hardware
Schlage Encode Plus ³⁸ Pedestrian Gate	Wi-Fi direct; HomeKit; Matter Home Key NFC; ANSI/BHMA Grade 1	For Apple-ecosystem clients at pedestrian gates; NFC tap-to-open via iPhone or Apple Watch; pair with Locinox housing for exposed outdoor installation

SPECIFICATION**Cat6A minimum for all new intercom home runs to gate posts.**

All new intercom and access control cabling is Cat6A minimum to support future PoE++ (802.3bt) power upgrades and eliminate bandwidth constraints. Cat5e is acceptable only in documented retrofit constraints with engineering approval. For runs exceeding 100 m from gate post to IDF: specify single-mode OS2 fiber with PoE media converters at both ends. Fiber eliminates all ground-loop and lightning-induced surge risk on long driveway runs. NEC 725 Class 2 wiring applies to all 24VDC access control circuits.

FIELD RULE**Linear AM3-Plus as the estate access control backbone.**

The AM3-Plus manages four controlled entry points — primary vehicular gate, secondary gate, pedestrian gate, and service entry — from a single credential database with 20,000 codes and 45,600 enrolled transmitters. The four Form C relays and four RTE inputs allow direct connection to gate operators without a separate relay board. RS-485 to Linear telephone entry systems enables code-managed telephone access from the same controller. FCC Part 15 marking is confirmed on all RF transmitters and intercoms at project commissioning.



BEST PRACTICE**HID MaxiProx 5375 with ProxPass vehicle tag for primary estate entry.**

The MaxiProx 5375 reader delivers 12-inch hands-free read range when paired with a ProxPass windshield-mount vehicle tag — the resident drives through the entry at reduced speed without lowering the window. The reader outputs standard Wiegand 26-bit to the Linear AM3-Plus. All HID credentials are issued and revoked remotely via HID credential management without a technician visit, providing a meaningful operational advantage for estates with staff turnover.

SOURCES

³¹ [Aiphone IXC-2C7 Product Page](#) ³² [DoorBird D2101V Datasheet \(PDF\)](#) ³³ [2N IP Verso 2.0 Product Page](#) ³⁴ [Comelit ULTRA Product Page](#) ³⁵ [Linear AM3-Plus Spec Sheet \(PDF\)](#) ³⁶ [HID ProxKey III — HID Global](#) ³⁷ [LiftMaster KPW250 Product Page](#) ³⁸ [Schlage Encode Plus Product Page](#)

§ 08

Conduit, Trench & Power

PART 3 — LOOP & ACCESS

The first axiom of gate automation installation is infrastructure before hardscape. All conduit sleeves, loop lead-in conduits, intercom home-run conduits, photo-eye raceways, and ground rods are set, photographed, and approved before any paver, concrete, or asphalt contractor begins work. PVC Schedule 40 is the standard underground conduit. Schedule 80 is required at all risers from grade to operator cabinet, and for any conduit within 18 inches of finished grade on the property side. Separate conduits for line-voltage and low-voltage runs, minimum 12-inch physical separation.

NEC TABLE 300.5 BURIAL DEPTHS — GATE APPLICATIONS

Wiring Method	Under Buildings	Under Driveways	Open Residential Areas
Direct-burial cable	0 in.	18 in.	24 in.
PVC Schedule 40 or 80 (NEC Article 352)	0 in.	18 in. (12 in. w/ 2-in. concrete cover, confirm with AHJ)	18 in.
RMC / IMC	0 in.	6 in.	6 in.
Low-voltage landscape (<30V direct burial)	—	—	6 in.

CONDUIT SIZING AND CONDUCTOR SPECIFICATIONS

Run Type	Conduit	Conductor	Notes
Line-voltage operator feed (120VAC gate operator)	1.25-in. PVC SCH 80 (Restrepo standard; SCH 40 min. per NEC)	12 AWG THWN copper; 12 AWG green THWN EGC	Dedicated 20A circuit; GFCI breaker per NEC 210.8(F); NEC 422.31 disconnect within sight
24VDC control wiring (operator to accessories)	1-in. PVC SCH 40 (separate from line-voltage)	12 AWG TFFN or THWN (runs >50 ft); 14 AWG for short runs	12 AWG governs at 24VDC — voltage drop is the controlling constraint at 24V on runs over 50 ft
Loop lead-in wiring	1-in. PVC SCH 40 (1.25-in. preferred; separate conduit)	No. 14 AWG twisted pair (per Reno A&E; and BD Loops spec)	Minimum 12-inch physical separation from line-voltage; drain wire grounded at operator cabinet end only
Photo-eye wiring	3/4-in. or 1-in. PVC SCH 40 (separate conduit)	18 AWG shielded 2-conductor (Belden 8760 equiv)	Shield drain grounded at operator cabinet end only; run in separate conduit from all other circuits

Intercom / Cat6A home-run	1-in. PVC SCH 40 (Cat6A in conduit; fiber if >100 m)	Cat6A; OS2 fiber + PoE media converter if >100 m	NEC 725 Class 2 for 24VDC control; Cat6A supports future PoE++ upgrades; fiber eliminates ground-loop risk on long driveway runs
---------------------------	--	--	--

GROUNDING, GFCI, AND SURGE PROTECTION

Item	Spec	Code Reference
Ground rod at each gate operator pedestal	8-ft copper-clad steel rod driven vertically; target ≤ 25 ohms resistance to earth; supplemental electrode if >25 ohms; GEC: 6 AWG copper per NEC 250.66	NEC 250.52/250.53; NEC 250.66
GFCI at gate pedestal receptacles	GFCI circuit breaker or GFCI receptacle at all 125V, 15A and 20A receptacles at gate pedestals; operator cabinet convenience outlets are receptacles	NEC 210.8(F) 2023
NEC 230.67 Type 1 SPD at service entrance	Type 1 or Type 2 SPD at service equipment; required at all new residential services per 2023 NEC	NEC 230.67
Secondary SPD at gate operator cabinet	Ditek DTK-2LVLPHWPLUS for 120VAC 20A line protection; Ditek LVLP Series 24V for control circuit protection; 5,000A surge; -40°F to $+158^{\circ}\text{F}$	NEC 230.67 (supplemental); Ditek Gate Access Guide
Dedicated circuit	120V 20A dedicated circuit per operator; no shared loads; one circuit per gate pedestal location	NEC 422.10; Restrepo standard
Battery backup / UPS	24VDC operators: integral battery 2–4 hr runtime standard; 120VAC operators: APC SMT 1,500VA for 2–4 hr, 600VA/360W for 15–30 min; transfer switch to generator option	Restrepo sizing standard

SPECIFICATION

PVC expansion fittings on runs exceeding 100 ft in NJ climate.

PVC Schedule 40 and 80 conduit expands approximately 3/8 inch per 100 ft per 50°F temperature change per NEC 352.44. A 200-ft driveway run moves approximately 3/4 inch seasonally in NJ (-10°F winter to $100^{\circ}\text{F}+$ summer). Without an expansion fitting, seasonal stress fractures couplings and pulls joints apart at buried connections. Install one PVC expansion coupling per 100 ft of conduit run on all gate automation conduit runs exceeding 100 ft. Mark expansion fitting locations on as-built drawings.

FIELD RULE**Sweep radius and cumulative bends — Restrepo 270° standard.**

NEC 352.24 requires minimum 6× conduit trade-size sweep radius for PVC (1-inch conduit: 6-inch minimum radius). NEC 352 allows 360° cumulative bends between pull points. Restrepo standard is 270° before a pull box is required — more conservative than the code minimum, allowing standard fish tape and cable pulling equipment. Install pull boxes at every direction change that combines with other bends to exceed 270° cumulative. Mark pull box locations on as-built drawings with circuit ID.

BEST PRACTICE**Ground rod grounding is critical at gate posts on long driveway runs.**

The gate post is often the highest metallic object on a residential property and acts as a lightning collection point. An 8-foot copper-clad steel ground rod driven vertically at each gate operator pedestal provides the primary dissipation path. Measure resistance to earth with a proper ground resistance meter at commissioning; document the measurement. Supplement with a second rod if initial reading exceeds 25 ohms. The secondary Ditek LVLP SPD at the operator cabinet supplements but does not replace proper grounding.

SOURCES

[NEC Table 300.5 Burial Depths](#) — [ExpertCE NEC 250.52 Grounding Electrodes](#) — [ElectricalLicenseRenewal Ditek Gate Access Surge Protection Guide \(PDF\)](#) [Ditek — Understanding 2023 NEC Surge Rules](#) [Legrand 2023 NEC GFCI Requirements](#)

Pedestrian Gate Hardware

PART 3 — LOOP & ACCESS

UL 325 explicitly states that every automated vehicular gate installation must provide a separate pedestrian gate or bypass path. Pedestrian use of automated vehicular gates is prohibited per UL 325. Hardware selection for pedestrian gates depends on the security requirement (fail-secure vs. fail-safe), whether the gate is on a fire egress path, and whether the gate serves a pool area subject to child-safety code requirements.

PEDESTRIAN GATE HARDWARE DECISION MATRIX

SECURITY-FIRST / KEYED EXTERIOR	FIRE EGRESS PATH / FAIL-SAFE
Adams Rite 7200 electric strike — 12 or 24 VAC/VDC; fail-secure; ANSI/BHMA Grade 1; 30 lbs preload; field-convertible to fail-safe; NEC 725 Class 2 wiring: 18 AWG CL2 minimum; dedicated conduit from line-voltage	Adams Rite 8400 Series life-safety exit device — UL 305 panic hardware; ANSI/BHMA A156.3 Grade 1; MLR or LR electrification; 30–48-inch narrow-stile aluminum; single-motion egress in all power states per IRC R311
Locinox FIFTYLOCK mortise lock — stainless mechanism; Click-It mounting; adjustable daybolt; accepts Euro-profile cylinder; MODULEC-SF electric strike: 12–24V AC/DC, 500,000 cycles, fail-close or fail-open	Securitron Magnalock — 600–1,200 lbs holding; 12 or 24VDC; fail-safe (releases on loss); NEC 725 Class 2; REX passive-IR or pushbutton RTE on secure side
HID ProxKey III + ProxPro reader — 12-inch hands-free on MaxiProx; Wiegand 26-bit to Linear AM3-Plus; remote credential issuance and revocation via HID management portal	Schlage Encode Plus — HomeKit/Matter NFC tap-to-open for Apple-ecosystem clients; fail-safe mode for egress; pair with Locinox outdoor housing

PEDESTRIAN GATE HARDWARE SPECIFICATIONS

Component	Voltage / Power	Rating	Notes
Adams Rite 7200 ³⁹ Electric Strike	12 or 24 VAC/VDC	ANSI/BHMA Grade 1; ANSI/UL 294; fail-secure	Opens with up to 30 lbs of preload; monitoring signal switch optional; for narrow-stile aluminum pedestrian gates with Locinox mortise lock; NEC 725 Class 2: 18 AWG CL2 minimum
Adams Rite 8400 ⁴⁰ Life-Safety Exit Device	Per MLR/LR model	UL 305 panic; ANSI/BHMA A156.3 Grade 1	IRC R311 single-motion egress; required on pedestrian gates on fire egress path; MLR motorized latch retraction or LR electric latch retraction; 30–48-inch narrow-stile aluminum



Locinox FIFTYLOCK ⁴¹ + MODULEC-SF	FIFTYLOCK: mechanical; MODULEC-SF: 12–24V AC/DC universal	Stainless 316; Click-It mounting; 500,000 cycles	Adjustable daybolt; B-SAFE safety cable; Euro-profile cylinder; MODULEC-SF electric strike: fail-close or fail-open field-selectable; H-METAL latch for low-traffic garden gates without electrification
Securitron Magnalock ⁴²	12 or 24VDC	600–1,200 lbs holding force; fail-safe	NEC 725 Class 2; appropriate for pool area gates and fire egress paths; not appropriate for perimeter security where fail-secure is required; REX passive-IR or pushbutton RTE on secure side required

SPECIFICATION

NEC 725 Class 2 wiring for all 24VDC access control circuits at pedestrian gates.

All 24VDC control wiring to electric strikes, magnetic locks, and electronic access hardware is Class 2 wiring per NEC Article 725. Use minimum 18 AWG CL2 listed cable. Run in a dedicated conduit physically separate from any line-voltage conduit. NEC 725.136(A) limits Class 2 conductors and Class 1/power conductors to the same enclosure only when maintaining 0.25-inch separation or using an approved barrier. Field tag every Class 2 circuit at the panel and at the termination point.

FIELD RULE

Fire department Knox Box keyswitch on all vehicular gates opening to a public street.

Every automated vehicular gate that opens to or is visible from a public street must be equipped with a fire department Knox Box keyswitch that allows fire apparatus to open the gate in an emergency. Confirm the specific Knox Box model number required by the Bergen County AHJ and local fire authority having jurisdiction (AHJ). Locate the Knox Box adjacent to the operator cabinet in a position accessible from the street without entering the property. Wire the Knox Box keyswitch to the operator open/stop terminal.

NOTE

Pool area gates — child-safety self-closing hardware is mechanical, not electrified.

Pool area pedestrian gates in NJ are governed by the NJ Swimming Pool Safety Act and require self-closing, self-latching hardware on the pool-side of the gate. These requirements are mechanical — not electrified. Install self-closing hinges, a pool-compliant gate latch at least 54 inches above grade, and no gap wider than 4 inches anywhere in the pool enclosure. Electric strikes and magnetic locks are permitted in addition to the required mechanical hardware but do not substitute for the self-latching requirement.

SOURCES



³⁹ [Adams Rite Electric Strikes Overview](#) ⁴⁰ [Adams Rite 8400 Series Life-Safety Exit Device](#) ⁴¹ [Locinox FIFTYLOCK — US Lock Supply](#) ⁴² [Securitron Magnalock — All Security Equipment](#)

§ 10

Smart-Home Integration & Scenes

PART 3 — LOOP & ACCESS

Smart-home integration for gate and garage automation is built on two layers: a cloud-connected layer (Crestron Home OS via Intrinsic Dev myQ module, or Control4 via authorized partner driver) and a local deterministic layer (dry-contact relay output wired directly to the operator open/close terminal). The local layer operates without internet connectivity and provides the fallback for all five locked scenes. All cloud-dependent integrations are secondary to the local relay path. NEC 725 Class 2 governs all relay wiring.

FIVE LOCKED SCENES — VOL 22

Scene	Trigger	Actions	Fallback
Departure Mode	Keypad or app; Lutron RA3 VCRX visor control	All garage doors confirmed closed — myQ status query; driveway gate confirmed closed — magnetic contact sensor; perimeter cameras armed — NVR recording mode; exterior lighting to security level; gate keypad deactivated for 12-hour window	Local relay confirms gate-closed contact; operator holds closed regardless of cloud state
Arrival Mode	Geofence (500-ft radius) + camera detection secondary	Driveway gate opens on geofence + secondary camera trigger; designated garage door opens for expected vehicle; path lighting to 80%; myQ/Crestron push notification confirms gate and door status	Visor remote (LiftMaster 893MAX) as manual fallback; keypad code as secondary
Delivery Mode	Resident issues time-limited access code via app	Pedestrian gate unlocks for 15-minute window via Linear AM3-Plus code; intercom call relayed to resident smartphone; gate auto-closes and relocks after window expires; event logged with timestamp in AM3-Plus and Crestron program	AM3-Plus code management is cloud-independent; event log stored locally on controller
Lockdown	Resident push or scheduled 10 PM auto-trigger	All gates confirmed closed; operators in hold-close mode; exterior cameras set to continuous recording; all keypads deactivated; push alert to resident with status confirmation	Local operator hold-close terminal activated by relay board; Crestron LAN monitoring sends alert on any gate-contact-open event

Storm Mode	Wind alert or resident push	All gates and doors confirmed closed; garage door openers disconnected from all auto-open triggers including geofence; wind-load monitoring alert active; UPS battery backup status queried — alert if battery below 80%;	Local relay disables auto-open trigger at operator board; UPS SNMP trap (if configured) provides battery alert via LAN
------------	-----------------------------	---	--

SMART-HOME PLATFORM INTEGRATION

Platform	Method	Cloud Dependency	Notes
Crestron Home OS ⁴³	Intrinsic Dev myQ module (authorized partner API)	Cloud-relayed for status + command; local relay for critical actions	Native Garage Door screen on Crestron touch panels; one-time module license; supports all myQ-connected LiftMaster openers; must use authorized partner API — not unofficial API bridge
Control4	Local relay/contact board (dry contact to operator open/close terminal)	Local/deterministic; no cloud dependency	Magnetic contact sensor on gate reports open/closed to Control4 I/O Extender; most reliable integration for client-critical scenes; cloud API driver available from authorized dealer as supplement
Aladdin Connect by Genie	Open-API driver; Control4/Crestron third-party drivers	Cloud-based; open API stance	Preferred alternative to myQ for clients requiring open automation platform; no authorized-partner API restriction as of 2025; Alexa and Google Home native; no native HomeKit
Lutron RA3 Keypad Triggers	Dry-contact relay output from RA3 output relay; 18 AWG NEC 725 Class 2	Local/deterministic	RA3 VCRX visor control enables Departure Mode trigger from driveway; all RA3 zone assignments, button labels, and scene rules archived in Lutron Designer file and cloud backup at closeout
Matter / Thread ⁴⁴	Not yet field-deployable for gate operators as of early 2025	N/A	Matter garage door device type finalized in 2023; no UL-listed Matter-certified residential gate operator shipped as of 2025; use Crestron or Control4 authorized driver for Matter interoperability today; revisit annually as Matter device ecosystem matures

SPECIFICATION**Five scenes tested end-to-end with gate and door physically operating before closeout.**

All five scenes — Departure, Arrival, Delivery, Lockdown, and Storm Mode — are tested with the gate and garage door physically cycling before the project punch-list closeout. myQ and Crestron/Control4 credentials for all gate and garage devices are transferred to the owner account before final payment. The authorized partner API driver version and configuration are committed to the project closeout archive. Geofencing radii and notification thresholds are documented in program notes.

BEST PRACTICE**Local relay-based backup control — deterministic and cloud-independent.**

Every smart-home integration for gate and garage automation includes a local relay board wired directly to the operator open/close terminals with a magnetic contact sensor reporting gate/door status back to the automation controller. This local layer operates without internet connectivity and without any cloud service. Test the local relay path independently of all cloud services during commissioning — this is the failure-mode path that will matter when the gateway is offline, the ISP is down, or the API is restricted.

FIELD RULE**Notification matrix — configure and document before owner walkthrough.**

Configure push alerts for: gate or door open more than 15 minutes (daytime) or 5 minutes (after 10 PM); operator fault or UPS battery low; entrapment sensor monitored circuit open; intercom missed call or failed relay trigger; SPD indicator status change; camera offline or tamper event; Crestron LAN loss to any gate or garage IP device. Document the notification matrix in Crestron program notes and the owner closeout archive.

SOURCES

⁴³ [Official myQ Module for Crestron — Intrinsic Dev Crestron Home Garage Door Documentation](#) ⁴⁴ [Home Assistant myQ Removal Post](#) [ClareControls myQ Sunset Notice](#)

PART 4

Discipline & Closeout

Sections 11–13 — Without Written Direction, Pre-Trench & Pre-Pour Checklist, QC · Audit · Closeout

§ 11

Without Written Direction

PART 4 — DISCIPLINE & CLOSEOUT

The following actions require written direction from the engineer of record or the Restrepo project manager before they may proceed. They are framed as conditions requiring documentation — not as absolute prohibitions — because in rare circumstances a waiver supported by engineering analysis may be appropriate. The default answer is to comply with the standard; only written direction with documented technical justification changes the default.

DO NOT**BX/MC cable in any buried or trench gate conduit run.**

Default specification is PVC Schedule 80 for all risers and Schedule 40 for all buried runs. Armored cable (BX/MC) in any buried or conduit-encased gate wiring run is without written direction from the engineer of record. Type MC cable may not be used as the sole wiring method in direct-burial applications per NEC 330.10. PVC Schedule 80 conduit with THWN conductors is the correct specification for all gate operator wiring at grade transitions.

DO NOT**Gate operator circuit shared with any other load.**

Restrepo standard is one dedicated 20A circuit per gate operator location. Sharing an operator circuit with lighting, convenience receptacles, intercom power supplies, or any other load is without written direction and is inconsistent with NEC 422.10 dedicated circuit requirements for motor-driven appliances. Battery chargers on 24VDC operators draw continuous load even when the gate is idle; sharing circuits risks nuisance tripping during simultaneous load cycles.

DO NOT**Monitored entrapment device bypassed or wired in unmonitored mode.**

UL 325-2018 Table 32.2 requires all external entrapment sensors to be continuously monitored by the operator control board. Installing a sensing edge or photo eye in unmonitored mode is without written direction and renders the installation non-compliant with UL 325. Unmonitored mode allows the gate to operate automatically even if the sensor wire is cut or the sensor fails. Monitored-mode commissioning verification must be documented in the project commissioning record. No exceptions without written direction.

DO NOT**Gate operator installed without ASTM F2200 gate construction review.**

Automating a gate that was not built to ASTM F2200-24 requirements — gap widths, entrapment clearances, positive stops, roller guards, and protrusion restrictions — is without written direction from the project engineer. ASTM F2200 compliance is required for any gate that will be or is currently automatically operated. The review must occur before the operator is ordered and must be documented in the project commissioning record.

DO NOT**Loop lead-in wire sharing conduit with 120VAC operator feed.**

Electromagnetic interference from line-voltage conductors causes false loop detects and loop failure. Separate conduits with minimum 12-inch physical separation between line-voltage and low-voltage loop lead-in conduit are required. Sharing is without written direction from the engineer of record. Viking K-2 installation manual explicitly requires 12-inch minimum separation. Document the conduit separation in the as-built drawings and closeout archive.

DO NOT**Conduit sleeves omitted before hardscape placement.**

Saw-cutting an existing decorative concrete or paver driveway to add a conduit missed during pre-trench coordination is a visible maintenance patch that cannot be made invisible. Proceeding without all conduit sleeves set and capped before hardscape placement is without written direction from the project architect or engineer of record acknowledging the patch quality impact. The trench is dug once.

DO NOT**LiftMaster SL585UL or SL595UL specified for residential applications.**

The SL585UL and SL595UL are commercial and industrial slide gate operators in the LiftMaster portfolio. They are excluded from luxury residential specifications in this volume. Specifying commercial operators at residential Class I locations requires written direction from the Restrepo project engineer with documentation of the gate parameters that justify the commercial-class operator.

§ 12

Pre-Trench & Pre-Pour Checklist

PART 4 — DISCIPLINE & CLOSEOUT

All items below must be completed, photographed, and signed off by the GC project manager, electrical subcontractor, and Restrepo AV/smart-home lead before any hardscape contractor begins work. Photographs are timestamped and labeled by gate location and circuit function, and filed in the project closeout archive.

PRE-TRENCH CHECKLIST

- ☐ **VERIFY** Line-voltage conduit stubs at each gate operator pedestal — 1.25-in. PVC Schedule 80; pull string installed; ends capped and labeled by gate location and circuit function (operator feed, disconnect feed)
- ☐ **VERIFY** Low-voltage conduit stubs at each pedestal — 1-in. PVC Schedule 40 for loop lead-in, intercom Cat6A home-run, photo-eye wiring, and 24VDC control; separate runs from line-voltage; minimum 12-in. physical separation confirmed
- ☐ **VERIFY** BD Loops PreFormed or preformed loop wire installed in base course — loop size confirmed (short leg 4 ft, long leg = driveway width minus 4 ft); positions documented (free-exit, safety, reverse) and photographed before base course covered
- ☐ **VERIFY** Loop lead-in wire pulled to operator cabinet conduit location — labeled at both ends with circuit ID and loop position; drain wire direction noted
- ☐ **VERIFY** Ground rod driven at each gate operator pedestal — 8-ft copper-clad steel rod driven vertically; location staked and photographed; GEC route from rod to operator cabinet documented on as-built drawing
- ☐ **VERIFY** Intercom and access control conduit confirmed — Cat6A conduit from gate post to IDF capped; fiber conduit confirmed if run exceeds 100 m; HID reader, keypad, and intercom conduit confirmed at each controlled entry point
- ☐ **VERIFY** Photo-eye conduit between gate posts confirmed — 18 AWG shielded wiring conduit separate from line-voltage; ends capped and labeled
- ☐ **VERIFY** Spare hardware ≥5% ready for delivery at closeout — conduit fittings, pull strings, GFCI breakers, sensing-edge EOL resistors, photo-eye mounting hardware, loop lead-in wire spool confirmed in spare order
- ☐ **VERIFY** NJ UCC electrical subcode permit submitted before work begins — Bergen County AHJ confirmation of NEC edition and GFCI/SPD requirements obtained; permit posted at site; all inspections scheduled
- ☐ **ABSENT** Saw-cutting planned for conduit not stubbed in pre-trench — resolve by adding conduit stubs during pre-trench; saw-cutting requires written direction from project engineer and architect
- ☐ **ABSENT** Hardscape contractor scheduled before pre-trench sign-off is complete — reschedule hardscape; no paving contractor mobilizes before gate sign-off
- ☐ **ABSENT** Loop wire installed in same conduit as line-voltage gate feed — separate conduits required; minimum 12-in. physical separation



- ☐ **VERIFY** Conduit ends documented in as-built sketch — conduit routes, loop locations, circuit labels, and ground rod locations drawn on site plan; filed in project archive

§ 13

QC · Audit · Closeout

PART 4 — DISCIPLINE & CLOSEOUT

All items below are verified by the Restrepo field technician and signed by the owner or owner's representative before final payment is released. The closeout archive includes operator manuals, UL 325 and ASTM F2200 compliance documentation, NJ permit and inspection certificate, as-built conduit schedule, and 5% spare hardware in labeled bins.

COMMISSIONING AUDIT GRID

Audit Item	Test Method	Pass Criterion	Signed By
UL 325 monitored entrapment — both devices per gate per direction	Disconnect sensor circuit while gate is in auto mode; verify gate refuses to operate; reconnect; verify normal operation	Gate will not operate in auto mode with any monitored circuit open; board confirms circuit OK before enabling operation	Field tech + owner
ASTM F2200 gate construction — sphere tests, clearances, stops	2.25-in. sphere gauge test below 48 in.; 4-in. sphere test 48–72 in.; measure swing clearance at pivot; verify positive stops present and operative	All sphere tests pass; 16-in. swing clearance confirmed; positive stops present; roller guards installed; no protrusions observed	Field tech + project engineer
NEC 210.8(F) GFCI at all outdoor 125V gate-pedestal receptacles	GFCI test button at each receptacle; GFCI circuit breaker indicator lamp green	All outdoor receptacles trip GFCI; all breakers reset normally; indicator lamps green	Electrician of record
NEC 422.31 lockable disconnect within sight of each operator	Confirm disconnect location within sight and ≤50 ft; lock in open position; verify operator cannot be started	Disconnect lockable in open position; operator de-energized when disconnect open; field tag label present	Electrician of record
NEC 230.67 SPD at service entrance + Ditek LVLP at operator cabinet	Visual indicator lamp check on primary SPD; verify Ditek LVLP installed at each operator cabinet and wired per spec	Primary SPD indicator green; LVLP installed, wired, indicator green; installation records filed in closeout archive	Electrician of record
Ground rod resistance at each pedestal	Earth resistance test with clamp-on or fall-of-potential meter	≤25 ohms resistance to earth; supplemental electrode installed if initial reading exceeds 25 ohms; GEC continuity confirmed	Electrician of record

Five smart-home scenes end-to-end — gate physically operating	Trigger each scene (Departure, Arrival, Delivery, Lockdown, Storm Mode) with gate and door physically cycling; verify notifications received; disconnect internet and verify local relay fallback operates	All five scenes execute; local relay path confirmed cloud-independent; push notifications received at resident device	Field tech + owner
Loop detector function — free-exit, safety, reverse per loop	Drive test vehicle over each loop at gate-operating speed and slow approach; verify free-exit triggers open; safety holds gate open; reverse re-opens gate when vehicle present	All three loop functions confirmed per gate; no cross-channel interference; frequencies documented	Field tech
Intercom, reader, and access control — all credentials tested	Video call from gate station to smartphone and indoor panel; gate relay trigger from answered call; HID credential at reader; Linear AM3-Plus relay outputs tested per channel	Video call connects bidirectional; gate relay triggers on answer; all issued credentials accepted; FCC Part 15 marking confirmed on all RF transmitters and intercoms	Field tech + owner
Battery backup under simulated power failure	Open main circuit breaker at operator; cycle gate on battery; count cycles to manufacturer rated backup count; verify smart-home UPS/battery low alert	Gate cycles on battery to rated count; low-battery alert confirmed in Crestron/Control4 program; battery age and replacement interval documented in closeout archive	Field tech

5% SPARE HARDWARE — DELIVERED AND LABELED AT CLOSEOUT

Item	Quantity	Delivery
Sensing-edge end-of-line resistors (10K Ω and 8.2K Ω)	$\geq 5\%$ of installed qty, minimum 2 of each	Labeled bin: ENTRAPMENT SENSING
Photo-eye mounting hardware and cables	$\geq 5\%$ of installed qty, minimum 1 complete pair	Labeled bin: ENTRAPMENT SENSING
Loop lead-in wire spool (No. 14 AWG twisted pair)	Minimum 50 ft per gate installation	Labeled bin: LOOP WIRE
Gate operator mounting fasteners (model-specific kit)	$\geq 5\%$ of installed fastener qty	Labeled bin per operator model
Keypad batteries (per installed keypad model)	$\geq 5\%$ of installed qty, minimum 2 sets	Labeled bin: KEYPAD BATTERIES

Conduit fittings (90° ells, couplings, end caps per conduit size)	≥5% of installed qty	Labeled bin: CONDUIT FITTINGS
Gate hardware touch-up paint (per gate finish)	1 quart minimum per gate color	Labeled bin: GATE TOUCH-UP
Operator manuals and UL 325/ASTM F2200 documentation	1 set per installed operator	Closeout archive binder + digital PDF

OWNER SIGNOFF BLOCK

Project:	_____	Date:	_____
Gate Locations Commissioned:	_____		
Restrepo Field Technician:	_____	Signature:	_____
Owner / Owner's Representative:	_____	Signature:	_____
Electrician of Record:	_____	License #:	_____
NJ UCC Inspection Certificate #:	_____	AHJ:	_____
5% Spare Hardware Delivered:	Confirmed	Closeout Archive Delivered:	Confirmed

INSPECTION STANDARD

NJ UCC final inspection certificate filed before owner occupancy.

The NJ electrical subcode inspection must be passed and the certificate of approval filed before the owner takes occupancy of the automated gate system. Bergen County AHJ sign-off is confirmed. All permit fees are paid and the permit card is posted or archived per local AHJ requirements. The inspection certificate is included in the project closeout binder and the digital closeout archive.

FIELD RULE**As-built conduit schedule archived with owner before final payment.**

Conduit routes, loop locations, circuit labels, ground rod locations, and SPD installation records are drawn on a site plan and filed in the owner closeout archive before final payment. Crestron Home and myQ configuration are committed to cloud backup and local media (USB drive or similar). NJ UCC permit and inspection certificate, operator manuals, UL 325 compliance documentation, and ASTM F2200 shop drawings are all included in the closeout binder. The binder is handed to the owner at the owner walkthrough.

NOTE**Operator manuals and compliance documentation are part of the project deliverable.**

Every project closeout includes: operator installation and owner manuals for all installed gate operators and garage door openers; UL 325-2018 compliance documentation for each installed operator; ASTM F2200-24 shop drawing review sign-off for each automated gate; NJ UCC permit and inspection certificate; as-built conduit schedule with loop locations, circuit labels, and ground rod locations; Linear AM3-Plus credential database printout; Crestron or Control4 program file version and cloud backup confirmation.