SBAS–FMS
Satellite-Based Augmentation System – Flight Management System

Certified on Over 50 Aircraft Types
Advanced Interfaces for Communication, Safety and Situational Awareness
TSO-C146c Approved System Supports ADS-B Requirements
When we created the SBAS-FMS, our mission was to design a system that delivered performance in every category, while demonstrating superiority in all of them. The SBAS-FMS – unsurpassed precision and accuracy.  

Platform for NextGen and SESAR

The avionics systems you invest in today must be able to support the Next Generation of Communication, Navigation, Surveillance / Air Traffic Management (CNS/ATM). They must possess the processing power, speed, memory and interface capabilities to meet the growing demands of the US Next Generation Air Transportation System (NextGen) and Europe’s Single European Sky ATM Research (SESAR).

Since introducing the industry’s first multi-sensor FMS (the UNS-1) in 1982, Universal Avionics has continually taken the industry forward with a pilot-focused vision of flight management. Today’s SBAS-capable FMSs build upon the company’s popular market-proven product design, offering more advanced features and interfaces, and a growth path to meet the requirements of the future.

High-Integrity Navigation: SBAS

Universal Avionics SBAS-capable FMSs feature an extremely precise, internal SBAS Global Positioning System (GPS) receiver that improves accuracy and integrity of GPS-derived position information. The Receiver Autonomous Integrity Monitor (RAIM) prediction requirements in US airspace are thereby removed and navigation capabilities for all classes of aircraft in all phases of flight are increased.

The embedded SBAS/GPS receiver provides ILS-like guidance down to near CAT I ILS minimums.

In addition, Universal Avionics SBAS-FMSs meet stringent internal monitoring requirements to provide guidance to any of the Minimum Descent Altitude (MDA) levels for Area Navigation (RNAV) (GPS) approach guidance.

- Europe – European Geostationary Navigation Overlay Service (EGNOS)
- North America – Wide Area Augmentation System (WAAS)
- Japan – Multi-functional Satellite Augmentation System (MSAS)
- India – GPS-Aided Geo-Augmented Navigation (GAGAN)

Universal Avionics SBAS-FMSs are compatible with the regional SBAS around the world:

- Required Navigation Performance (RNP) and RNAV are key aspects of all airspace modernization programs. Performance-Based Navigation (PNB) is proven to save fuel, relieve congestion and reduce delays at many airports, domestic and international. Universal Avionics is the technology leader in both RNAV and RNP.

RNP and RNAV

Required Navigation Performance (RNP) and RNAV are key aspects of all airspace modernization programs. Performance-Based Navigation (PNB) is proven to save fuel, relieve congestion and reduce delays at many airports, domestic and international.

Universal Avionics is the technology leader in both RNAV and RNP. The SBAS-FMSs meet emerging RNP/Actual Navigation Performance (ANP) airspace operational requirements around the world, including European Basic-RNAV (B-RNAV) and Precision-RNAV (P-RNAV).

Implemented in 1998, B-RNAV defines a minimum RNP for aircraft operating in European Civil Aviation Conference (ECAC)-controlled airspace. B-RNAV offers a number of advantages over the conventional ground-based navigation system, including: improved safety, more direct routes and more precise navigational accuracy in the terminal and approach airspace.

As an FAA TSO C-146c approved FMS, Universal Avionics SBAS-FMSs meet the requirement for the navigation source part of an aircraft’s Automatic Dependent Surveillance-Broadcast (ADS-B) Out installation and approval. ADS-B Out is a key part of the FAA’s NextGen National Airspace System (NAS) with mandates beginning in 2020. ADS-B Out is the transmission of a GPS position from an aircraft in order to display the aircraft’s location to Air Traffic Control (ATC) on the ground or to pilots in the cockpits of aircraft equipped with ADS-B In.

Aircraft that are equipped for ADS-B Out realize many benefits, including: improved situational awareness and safety, reduced separation between aircraft and increased coverage.

ADS-B Out

When we created the SBAS-FMS, our mission was to design a system that delivered performance in every category, while demonstrating superiority in all of them. The SBAS-FMS – unsurpassed precision and accuracy.
Advanced Interfaces for Communication, Safety and Situational Awareness

The SBAS-FMSs are the most versatile in the industry. Full interface capability is provided for flight guidance systems, autopilots and flight deck displays utilizing both digital and analog formats. The SBAS-FMSs provide navigation from takeoff to touchdown, engineered precisely for your aircraft. Multiple navigation sensor compatibility allows for interfacing to a host of navigation sensors to match your operational requirements. Select from external GPS, Inertial, VHF Omnidirectional Range (VOR), Distance Measuring Equipment (DME), Tactical Air Navigation System (TACAN) and/or Hybrid sensors. In addition, up to four fuel flow sensor inputs, accommodating a variety of formats, are utilized for fuel and performance management calculations depending on system capabilities. A “Best Computed Position” is based upon inputs from the internal SBAS/GPS receiver, auto-scanning DME/DME measurements and data from your complement of external navigation sensors.

TWS provides an exceptionally crisp and clear graphical depiction of actual terrain in three view formats (Map View, 3-D Perspective View and Profile View), on the Flat Panel Control Display Units (FPFCDU). Depiction and alerting of man-made obstacles is also available in the Class A and Class B systems as an optional configuration in the TAWS software, accompanied by a separate Obstacle Database.

The easily programmed module simplifies in-field upgrades and sensor complement modifications. It provides quick configuration verification as well as positive identification of aircraft model for aircraft-specific performance data as applicable.

Terrain Awareness Warning System

Universal Avionics FMSs are designed to interface with both the Class A and Class B Terrain Awareness Warning Systems (TAWS), housed in a separate 2-MCU Line Replaceable Unit (LRU). TAWS increases situational awareness by providing visual terrain displays relative to current and predicted aircraft position supplied by the SBAS-FMS. Alerts in accordance with standard Ground Proximity Warning System (GPWS) modes are also provided. The SBAS-FMSs provide 3-Dimensional guidance using the exact procedures from the navigation database, thereby providing the highest level of safety in protecting against Controlled Flight into Terrain (CFIT) accidents.

Unilink® Communications Management Unit

Universal Avionics’ optional airborne data link system, the Unilink UL-800/801 Communications Management Unit (CMU), provides advanced air-to-ground, two-way data link capabilities. It is housed in a separate 1-MCU LRU and can support single, dual or triple SBAS-FMS installations. Capable of providing FANS 1/A+ and Aeronautical Telecommunications Baseline 1 (ATN B1) operations, the Unilink UL-800/801 includes Controller Pilot Data Link Communications (CPDLC) and Automatic Dependent Surveillance-Contract (ADS-C) functionality.

Configuration Module

A configuration module mounted on the system’s rear connector identifies the aircraft’s specific parameters including the communication formats, all Input/Output (I/O) ports, specifications of navigation sensors, air data, Electronic Flight Instrument System (EFIS) displays, flight guidance systems, fuel inputs and others. The UniLink UL-800/801 CMU provides an opportunity to take full advantage of the benefits that advanced data link capabilities offer, like flight operations efficiency and reduced pilot workload.

Database Integrity

The FMS databases are safely stored in non-volatile flash memory devices. The navigation databases are produced and provided in accordance with the highest quality standards as specified in DO-200A/ED-76. Universal Avionics holds an FAA Type 2 Letter of Acceptance (LOA) for processing and producing the FMS navigation database.
Capabilities

Flight Planning

FMS Flight Planning

The Flight Planning (FPL) function provides you with the quickest, most efficient means of creating a flight plan, and the most pilot-friendly method of altering the flight plan elements as desired or required by ATC. It has been engineered to incorporate the greatest level of safety, with numerous built-in safeguards such as the entry of list-referenced selections which reduce both keystrokes and errors.

Menu format provides selections for flight plan displays, SIDs, STARs, approaches, flight plan storing and reversing. Flight planning is simplified by using High and Low Altitude airways.

Review time, distance and fuel requirements for the flight plan created.

Normal view of flight plan pages shows a wealth of information including altitude restrictions.

Off-Line Flight Planning

The Universal Flight Planning (UFP) Windows-based software package provides you with off-line flight planning and GPS Fault Detection and Exclusion prediction capabilities using a personal computer and your subscription navigation database. The software allows the user to create and edit items in your Pilot Database such as routes, waypoints, departures, arrivals, approaches and more. In addition, the SBAS-FMSs offer a unique Company Routes Database, created only off-line with the UFP program.

Performance

The UNS-1Ew and UNS-1Fw SBAS-FMSs provide a Performance (PERF) option for select aircraft types for which performance charts from the Airplane Flight Manual (AFM) are digitized and stored in memory. These FMSs will use pertinent data such as GW, ALT, OAT, etc., to provide exact values for V1, VR and V2, along with Takeoff N1.

V-bugs may also be driven through the SBAS-FMSs. Required field lengths are computed and displayed, factoring in your entry of runway conditions. During climb and cruise, maximum power setting values are presented for landing. Vref is calculated along with approach speeds for different flap settings.

FlexPerf™ Trip Performance

FlexPerf Trip Performance for Universal Avionics SBAS-FMSs and Multi-Mission Management System (MMMS) provides advanced fuel savings predictions for aircraft performance in Climb, Cruise and Descent phases of flight. FlexPerf provides a standard alerting function, including caution display when:

• An altitude performance constraint is not achievable
• Fuel remaining is predicted to be less than the reserve fuel
• The flight path leg is too short for cruise segment

FlexPerf helps you achieve the most efficient fuel economy by advising the best climb, descent and speed commands for each flight phase. It is available in FMS Software Control Number (SCN) 1001 and MMMS SCN 1101.

Fuel Management

Using inputs from the fuel flow sensors, the SBAS-FMSs provide real-time fuel management with the most extensive fuel information and calculations available—the kind that can eliminate unnecessary fuel stops, save you time and money, and provide increased safety.

Specific range and endurance are provided along with fuel, time and distance predictions for your destination. Fuel requirements are easily accessed and evaluated for alternate destinations as well. For your convenience, data can be entered and displayed in either pounds (lbs) or kilograms (kg).

Real-Time Fuel Management (lbs/kg Selectable)

- Gross weight
- Fuel on board
- Ground nm/lb (or kg)
- Air nm/lb (or kg)
- Range
- Endurance
- Equivalent Still Air Distance (ESAD)
- Fuel overhead destination
- Range overhead destination
- Endurance overhead destination
- Landing weight
- Alternate destination planning

Cruise Performance

Climb Performance

Extensive real-time fuel information
Navigation Data Management

The DATA function key provides easy access to your stored navigation data management capabilities. Pages provide easy access to your stored navigation database for detailed review of SIDs, STARs, approaches, runways, airways, intersections, and airports. Your pilot-defined database can be accessed and edited, allowing you to create new or modify your pre-defined routes, airways, runways, airports, waypoints, alignment points, and stored routes. Your non-editable company route database can be accessed as well.

Enroute Navigation

The SBAS-FMSs will fly all procedural leg types in accordance with ARINC 424. This sophisticated capability allows you to fly the most complex procedures such as heading to altitude, precision arc, procedure turn, holding pattern, and more—all the necessary maneuvers required to accurately fly SIDs, STARs, and approaches. Crosstrack and vertical scaling are provided in accordance with enroute, terminal, and approach criteria set forth in TSO-C146c. The Navigation (NAV) function also displays RNP (associated with your current leg/maneuver as referenced from the navigation database) along with your A/FP LMSs provide quick access to off-flight plan maneuvers such as establishing a parallel-offset course, tracking to/from a Pseudo-VOR, headings, holding patterns, and approaches.

Direct-To

The Direct-To (DTO) function key is specifically dedicated for flight plan changes in response to “Direct-To” clearances. The SBAS-FMSs easily take you from your present position direct to any point on or off your flight plan using circular steering if the desired waypoint is on the flight plan, it may be selected by entering its list reference number. If the desired waypoint is not on the flight plan, the LST function can be used to access other waypoints/airports within the surrounding area from the database, or the identifier can be manually entered into the field.

Heading Mode with the HDG line select key on the normal NAV display. Simply enter your desired heading to activate your command. With compatible EFIS flight guidance systems, these heading commands are interactive with the flight guidance heading select knob.

Frequency Management

Universal Avionics SBAS-FMSs incorporate the most advanced concepts in vertical guidance and control. VNAV pages provide for such features as computed Top-Of-Descent, Target Vertical Speed indication and selection, and Vertical Direct-To commands. Vertical waypoints can be conveniently defined with altitudes or Flight Levels, and lateral offsets.

Messages

An extensive library of messages has been programmed into the SBAS-FMSs. The message annunciator alerts you of system status advisories, including waypoint alerts, sensor watchdog functions, TAWS alerts and self-test.

Holding Patterns

Holding patterns are accurately flown through the SBAS-FMSs automatically, complete with appropriate entry procedure: direct, parallel or teardrop. The navigation database includes holding patterns that are part of departure, arrival, approach and missed approach procedures. The system will fly the normal flight plan legs and then automatically enter the holding pattern upon reaching the holding fix. You may also manually define a holding pattern by specifying the holding fix, inbound course, turn direction and either time or distance of holding leg. When armed, the holding pattern will be entered automatically upon reaching the fix. A DTO HOLD command is also provided to enable you to go direct to a holding fix at any time.

When cleared to proceed, the aircraft will continue the current holding circuit until overflying the holding fix and then proceed to the next waypoint. You can also exit the pattern at any time by initiating a Direct-To command.

Frequency management through the SBAS-FMS. The message (MSG) key may also be used to access data link communications should this optional equipment be installed.

"Pop-up" messages in response to invalid entries further simplify system operation. The Message (MSG) key may also be used to access data link communications should this optional equipment be installed.

The SBAS-FMSs output vertical deviations for flight guidance displays. Pitch commands are output to the autopilot for fully coupled descents.

The unique LIST function provides a quick and efficient means to access and enter data, minimizing alphanumeric entries and reducing input errors. The "smart" lists are geographically prioritized based on aircraft position and course, then alphabetized on each page. You can quickly enter airports, navads, intersections and airways all by simply entering the list reference number corresponding to the data desired. Plan language references for airports, Very High Frequency (VHF) and Non-Directional Beacon (NDB) navads eliminate confusion over airport/navad identifiers. In addition to providing an advanced shortcut for flight planning, making entries through the LIST function increases both the accuracy and the safety of off-flight plan maneuvers.

Other CDTA pages provide access to, and control of, your complement of navigation and air data sensors. The status of each navigation sensor and its position as compared with the SBAS-FMS "Best Computed Position" is displayed. Sensor selection/de-selection, position updating, Unlink communications and TAWS display controls are available through this function as well.

Heading direction options (LEFT, RIGHT) allow you to force the turn direction in those cases when ATC commands a "long way around" Direct-To.

Lines select keys provide access to SBAS-FMS commanded Holding Mode, maneuvers such as holding patterns and PVOR tracking, and the Approach mode.

Headings can be flown through the SBAS-FMS, complete with auto intercept selection and interactive heading bug control.

Frequency management capabilities allow you to tune your NAV and COMM radios through the SBAS-FMS—completely interfaced with your existing Radio Management Unit. The SBAS-FMSs present a list of suggested COM, NAV and NDB frequencies pre-selected based on aircraft position and phase of flight. Additionally, you can customize the radios tuned through the SBAS-FMS by storing an active and up to four "preselect" frequencies. A "recall" feature allows you to swap the active with the last frequency tuned without affecting the preselect frequencies.

VOR and NDB frequencies can be readily tuned by their navial identifer or choosing from the suggested frequency list utilizing the LIST function or simply typing in the identifier. The SBAS-FMS would automatically tune the appropriate frequency.
Approach

Once near your destination, you can easily link the appropriate approach for the active runway into your flight plan. Approaches and runways from the navigation database, and those which have been pilot defined, are easily accessed.

The navigation database contains precision and non-precision approaches, including bent and curved approaches with multiple step-down fixes. When you select the approach transition and approach, both are inserted into the flight plan along with the missed approach procedure. Using the appropriate navigation sensor input, the SBAS-FMS will fly a three-dimensional precision or precision-like approach to any airport in the world. Computed pseudo-localizer and pseudo-glide slope information will be output to the flight guidance system and displays, providing a stabilized descent complete with pseudo- glideslope information will be output for landing in areas of extreme cold.

Features

All FPCDUs are capable of displaying graphics, and video, as available from Universal's UniLink Video and graphics capabilities are standard features on the MCDU.

Display and User Control

Display and user control is provided through the 4-inch or 5-inch FPCDU. A Multi-Function Control Display Unit (MCDU) is especially tailored for airline or special mission operations. Universal’s FPCDUs feature graphics capabilities and incorporate the latest technology in Active Matrix Liquid Crystal Color Displays (AMLCD). They incorporate the latest technology in Active Matrix Liquid Crystal Color Displays (AMLCD). They provide the highest contrast, lowest reflection and greatest horizontal and vertical viewing angles available, and offer superb sunlight readability. Unique parallel control is also provided. The system uses two character sizes and line graphics to enhance data recognition.

Night Vision Goggle–Compatible

Universal Avionics 4-inch and 5-inch FPCDUs are modified with Night Vision Goggle (NVG)-compatible glass display panels, which changes the lighting output in such a way that the unit can be used in flight decks where operators are wearing night vision goggles.

Certified on Over 50 Aircraft Types

Universal Avionics specializes in flight deck upgrades, providing flexible options for over 50 aircraft types, ranging from the Pilatus PC-12 to the Boeing 747. Avionics for your aircraft, and the way you fly - Universal Avionics.
Universal Avionics SBAS-FMSs combine the benefits of advanced programming, compact, lightweight packaging and installation flexibility. Four basic models provide you with the ability to select the optimum system to meet your desired features and capabilities that match your aircraft equipment and interface requirements.

**MCDU**

Developed for airline or special mission operations, the MCDU features additional ARINC 429 I/O ports which can support up to six ARINC 739 interfaces for ACARS, Satcom and future NextGen CNS/ATM systems.

The MCDU interfaces with the UNS-1Fw and UNS-1Lw NCUs. It also includes an ARINC 702 bus for interface with third party FMSs.

**UNS-1Lw**

The UNS-1Lw features a standard set of I/O capabilities for interface with essential components of the flight deck. The system is comprised of a 4- or 5-inch FPCDU along with a remotely mounted NCU. The NCU is contained in a 2-MCU LRU which includes the integral SBAS/GPS receiver.

**UNS-1Ew**

The UNS-1Ew features a self-contained design which includes control/display functions and the NCU with integral SBAS/GPS receiver. The system includes a graphics- and video-capable 5-inch diagonal display with a housing depth of approximately 9 inches.

A special package version, the UNS-1Espw has a reduced depth and includes the same features with the exception that it is an all-digital system only. The UNS-1Espw is ideal for applications where console or panel depth pose an integration challenge. Analog Roll steering and discretes are included with the UNS-1Espw.

**UNS-1Fw**

The UNS-1Fw is comprised of an FPCDU and a remotely mounted Navigation Computer Unit (NCU). Three FPCDUs are available: a compact FPCDU with 4-inch color display, the standard FPCDU with 5-inch color display and an airline-type MCDU. The NCU is housed in a 2-MCU sized LRU which includes the integral SBAS/GPS receiver.

The UNS-1Fw incorporates extensive I/O capabilities for advanced system integration and includes twice the number of ARINC ports available as the UNS-1Lw.

**LP/LPV Monitor**

The LP/LPV Monitor is a 2-MCU LRU specifically designed to provide LP/LPV approach capability for single SBAS-FMS installations.

The LP/LPV Monitor provides monitoring and positioning information for RNAV (GPS) approaches with LP/LPV minima. The unit incorporates a second SBAS receiver operating with the most advanced software ever developed to monitor the guiding SBAS-FMS during critical LP/LPV operations.

Together, the LP/LPV Monitor and SBAS-FMSs provide the level of integrity required to meet the performance criteria mandated by certification authorities. The LP/LPV Monitor is certified to TSO C146c Class Gamma-3.

The Universal Avionics SBAS-FMS Family

The Universal Avionics SBAS-FMS Family provides you with the ability to select the optimum system to meet your desired features and capabilities that match your aircraft equipment and interface requirements.
Specifications

<table>
<thead>
<tr>
<th><strong>Hardware</strong></th>
<th><strong>UNS-1Ew</strong></th>
<th><strong>UNS-1Espw</strong></th>
<th><strong>UNS-1Fw</strong></th>
<th><strong>UNS-1Lw</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Weight</strong></td>
<td>8.1 lbs.</td>
<td>7.2 lbs.</td>
<td>6.7 lbs.</td>
<td>6.7 lbs.</td>
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<tr>
<td><strong>Mounting</strong></td>
<td>¼ turn Dzus Fasteners</td>
<td>¼ turn Dzus Fasteners</td>
<td>2 MCU Rack</td>
<td>2 MCU Rack</td>
</tr>
<tr>
<td><strong>Control/Display</strong></td>
<td>Integral 5-inch color Flat Panel Display</td>
<td>Integral 5-inch color Flat Panel Display</td>
<td>Compatible with MCDU, 5-inch FPCDU, 4-inch FPCDU</td>
<td>Compatible with MCDU, 5-inch FPCDU, 4-inch FPCDU</td>
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<tr>
<th><strong>Standard Interfaces</strong></th>
<th><strong>LP/LPV Monitor</strong></th>
<th><strong>UNS-1Ew NCU</strong></th>
<th><strong>UNS-1Espw NCU</strong></th>
<th><strong>UNS-1Fw NCU</strong></th>
<th><strong>UNS-1Lw NCU</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary Input</strong></td>
<td>16 Inputs/8 Outputs (All Digital)</td>
<td>16 Inputs/8 Outputs</td>
<td>16 Inputs/8 Outputs</td>
<td>16 Inputs/8 Outputs</td>
<td></td>
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<tr>
<td><strong>Lighting</strong></td>
<td>28 VDC standard</td>
<td>28 VDC standard</td>
<td>28 VDC standard</td>
<td>28 VDC standard</td>
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<td><strong>Consumption</strong></td>
<td>5 or 28 VDC</td>
<td>5 or 28 VDC</td>
<td>5 or 28 VDC</td>
<td>5 or 28 VDC</td>
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<tr>
<td><strong>Cooling</strong></td>
<td>Convection</td>
<td>Convection</td>
<td>Convection</td>
<td>Convection</td>
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<tr>
<th><strong>Power</strong></th>
<th><strong>Internal SBAS/GPS Receiver</strong></th>
<th><strong>FAA TSO/ETSO</strong></th>
<th><strong>LP/LPV Monitor</strong></th>
<th><strong>Control Display Units</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Internal SBAS/GPS Receiver</strong></td>
<td>FAA TSO/ETSO</td>
<td>C109, C115a, C146c, C190, JTSO-C115b</td>
<td>12-Channel Satellite Tracking Engine, TSO-C146c, Class Gamma-3, FDE Prediction Program for Remote/Oceanic Ops</td>
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<table>
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<tr>
<th><strong>Control Display Units</strong></th>
<th><strong>MCDU</strong></th>
<th><strong>5-inch FPCDU</strong></th>
<th><strong>4-inch FPCDU</strong></th>
</tr>
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<tbody>
<tr>
<td><strong>Size</strong></td>
<td>7.125 in. H x 5.75 in. W x 7.87 in. D</td>
<td>6.37 in. H x 5.75 in. W x 4.177 in. D</td>
<td>4.50 in. H x 5.75 in. W x 3.25 in. D</td>
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<tr>
<td><strong>Weight</strong></td>
<td>5.98 lbs.</td>
<td>2.41lbs - 4.1 lbs.</td>
<td>2.41lbs - 4.1 lbs.</td>
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<tr>
<td><strong>Display</strong></td>
<td>Color</td>
<td>Color</td>
<td>Color</td>
</tr>
<tr>
<td><strong>Faceplate Color</strong></td>
<td>Gray or Black</td>
<td>Gray or Black</td>
<td>Gray or Black</td>
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