

G1000[™]

*system overview for
the Mooney M20M & M20R*

Record of Revisions

Revision	Date of Revision	Revision Page Range	Description
A	10/18/04	2-1 – 2-11	Production Release.

2.1 SYSTEM DESCRIPTION

Garmin® International Inc., a unit of Garmin Ltd. introduces the G1000 Integrated Cockpit System for Mooney M20M and M20R aircraft. The G1000 includes the following Line Replaceable Units (LRUs):

- GDU 1040 Primary Flight Display (PFD)
- GDU 1040 Multi Function Display (MFD)
- GIA 63 Integrated Avionics Units (2)
- GEA 71 Engine/Airframe Unit
- GDC 74A Air Data Computer (ADC)
- GRS 77 Attitude & Heading Reference System (AHRS)
- GMU 44 Magnetometer
- GMA 1347 Audio System with integrated Marker Beacon Receiver
- GTX 32 Modes A/C or GTX 33 Mode S Transponder

LRUs are further described in Section 2.2. All LRUs have a modular design, which greatly eases troubleshooting and maintenance of the G1000 system. A top-level G1000 block diagram is given in Figure 2.2.1 to support the description of the system.

and the right display is configured as a Multi Function Display. Both GDU 1040s link and display all functions of the G1000 system during flight. The displays communicate with each other through a High-Speed Data Bus (HSDB) Ethernet connection. Each display is paired with a GIA 63 Integrated Avionics Unit, also via Ethernet connection.



- **GMA 1347** – The GMA 1347 integrates NAV/COM digital audio, intercom system and marker beacon controls. The GMA 1347 also controls manual display reversionary mode (large red button). The GMA 1347 is installed between the MFD and PFD. The GMA 1347 communicates with both GIA 63s using RS-232 digital interface.

2.2 LRU DESCRIPTIONS



- **GDU 1040** – The GDU 1040 has a 10.4-inch LCD display with 1024 x 768 resolution. The left display is configured as a Primary Flight Display



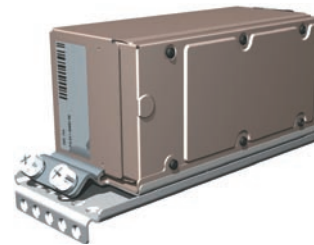
- **GIA 63** – The GIA 63 is the central ‘Integrated Avionics Unit’ of the G1000 system. The GIA 63 functions as a main communications hub, linking all LRUs with the PFD and MFD displays. Each GIA 63 contains a GPS receiver, VHF COM/NAV/GS receivers, and system integration microprocessors. Each GIA 63 is paired with a respective GDU 1040 display through Ethernet. GIAs are not paired together and do not communicate with each other directly.



- **GRS 77** – The GRS 77 is an Attitude and Heading Reference System (AHRS) that provides aircraft attitude and heading information to the G1000 displays and the GIA 63s. The unit contains advanced sensors, accelerometers, and rate sensors. In addition, the GRS 77 interfaces with both the GDC 74A Air Data Computer and the GMU 44 Magnetometer. The GRS 77 also utilizes GPS signals sent from the GIA 63. Attitude and heading information are sent using an ARINC 429 digital interface to both GDU 1040s and GIA 63s.



- **GMU 44** – The GMU 44 Magnetometer measures local magnetic field information. Data is sent to the GRS 77 ARHS for processing to determine aircraft magnetic heading. This unit receives power directly from the GRS 77 and communicates with the GRS 77 using RS-485 digital interface.



- **GDC 74A** – The GDC 74A Air Data Computer processes information from the pitot/static system and the outside air temperature (OAT) sensor. The GDC 74A provides pressure altitude, airspeed, vertical speed, and OAT information to the G1000 system. The GDC 74A communicates with both GIA 63s, GDU 1040s, and GRS 77 using ARINC 429 digital interface.



- **GEA 71** – The GEA 71 receives and processes signals from engine and airframe sensors. Sensor types include engine temperature and pressure sensors as well as fuel measurement and pressure sensors. The GEA 71 communicates with both GIA 63s using RS-485 digital interface.



- **GTX 32** – The GTX 32 is a solid-state transponder providing Modes A and C operation. The PFD provides control and operation of the GTX 32. The transponder communicates with both GIA 63s through RS-232 digital interface.



- **GTX 33** – The GTX 33 is a solid-state Mode S transponder providing Modes A, C, and S operation. The PFD provides control and operation of the GTX 33. The transponder communicates with both GIA 63s through RS-232 digital interface.



NOTE: See the Aircraft Flight Manual to determine which transponder is installed in your aircraft.

SYSTEM OVERVIEW

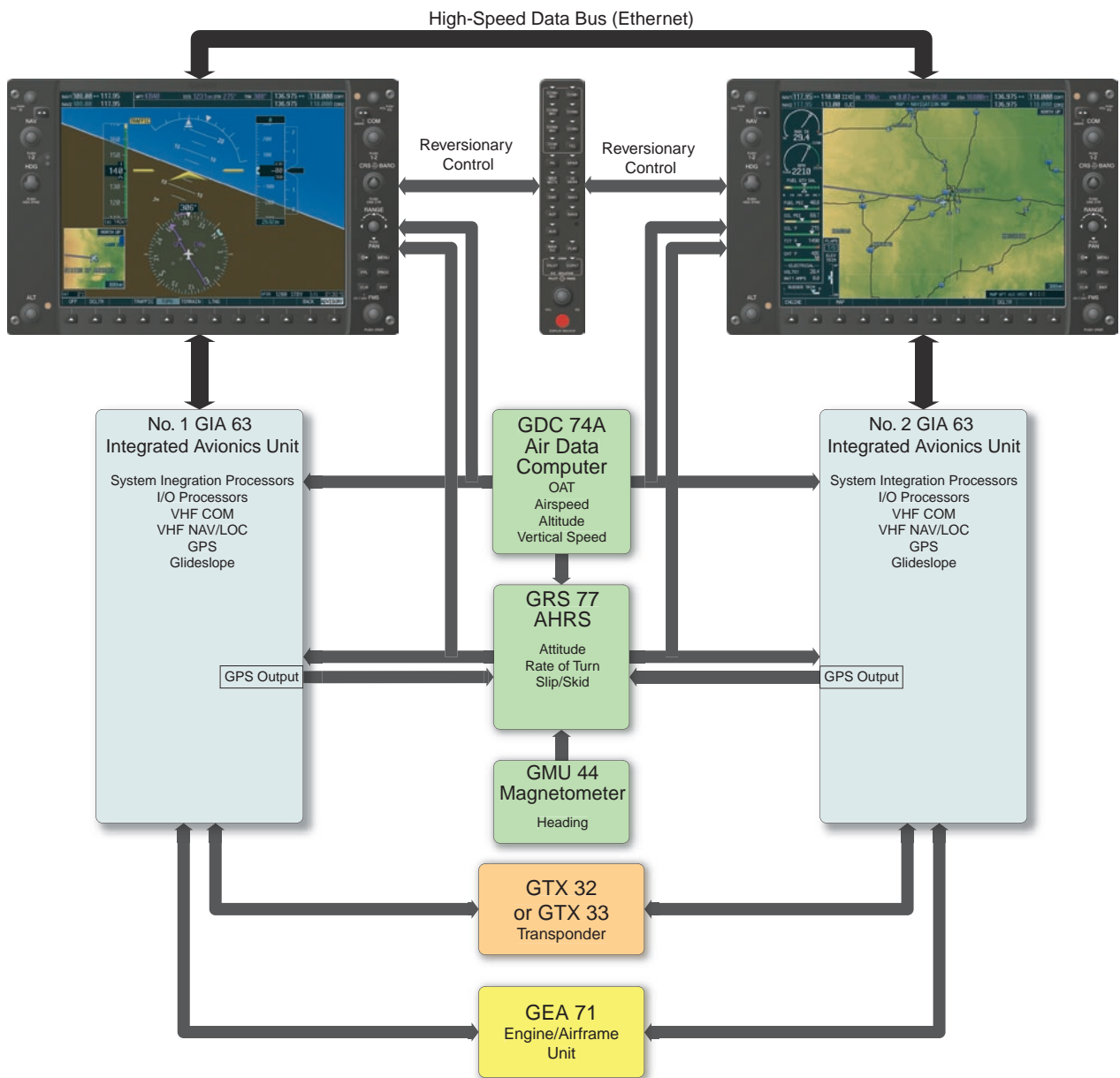


Figure 2.2.1 G1000 System Block Diagram

2.3 PFD/MFD CONTROLS

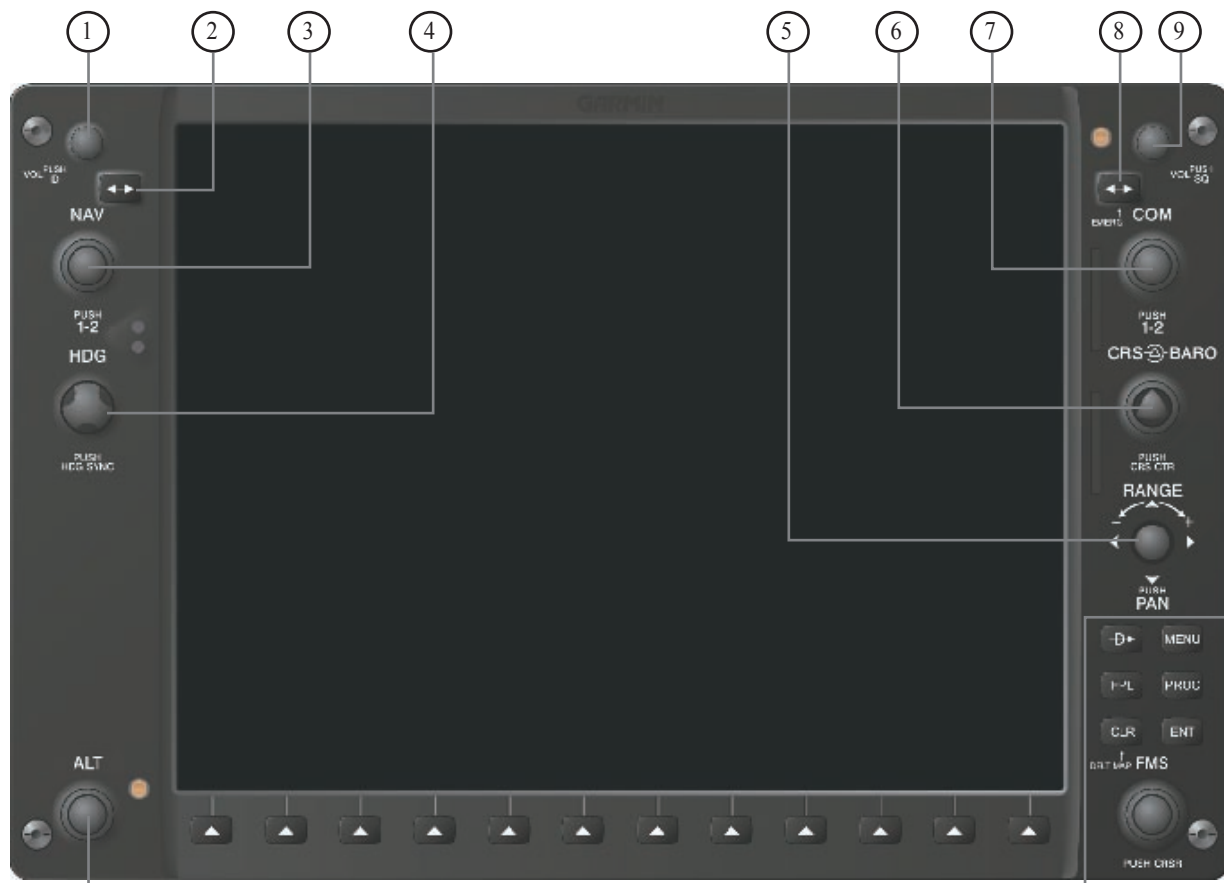
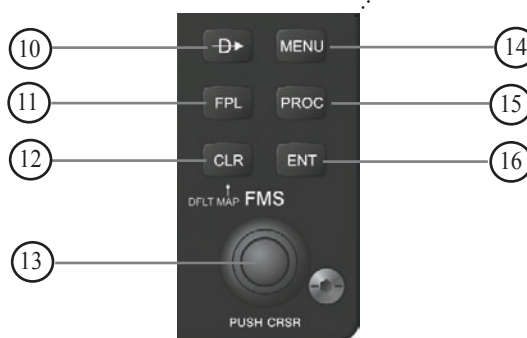



Figure 2.3.1 PFD/MFD Controls

- ① NAV VOL / ID Control
- ② NAV Frequency Toggle Key
- ③ NAV Frequency Selector
- ④ Heading Selector
- ⑤ Joystick
- ⑥ Course/Baro Selector
- ⑦ COM Frequency Selector
- ⑧ COM Frequency Toggle Key
- ⑨ COM VOL/SQ Control
- ⑩ Direct-to Key
- ⑪ Flight Plan Key
- ⑫ Clear Key
- ⑬ Flight Management Knobs
- ⑭ Menu Key
- ⑮ Procedures Key
- ⑯ Enter Key
- ⑰ Altitude Reference Control



The G1000 controls and keys have been designed to simplify operations and minimize workload and time to access sophisticated functionality. The following provides an overview of the primary function(s) for each key and control.

- **(1) NAV VOL / ID Control** – Controls the NAV audio level. Press to toggle the ident filter ON and OFF. Volume increase and decrease is shown in the field as a percentage.
- **(2) NAV Frequency Toggle Key** – Swaps the standby NAV frequency and the active NAV frequency when pressed (the standby NAV frequency is white whereas the active NAV frequency is green). Note that NAV frequencies are shown as active only when the HSI is set to either NAV1 or NAV2.
- **(3) NAV Frequency Selector** – The concentric knobs tune the MHz (large) and kHz (small) standby frequencies for the NAV receiver. Press on the **small** knob to toggle the tuning cursor (cyan box) between the NAV1 and NAV2 fields.
- **(4) Heading Selector** – Manually selects a heading. When this knob is pressed, a window displaying a digital heading momentarily appears to the left of the Heading Indicator and the heading bug synchronizes with the compass lubber line.
- **(5) Joystick** – Changes the map scale when rotated. When pressed, it activates the map pointer.
- **(6) CRS/BARO Selector** – The **large** knob sets the altimeter barometric pressure and the **small** knob adjusts course. Course is adjustable when the HSI is in NAV 1 & 2 or OBS/SUSP modes only). Pressing the **small** knob centers the CDI on the currently selected VOR.
- **(7) COM Frequency Selector** – The concentric knobs tune the MHz (large) and kHz (small) standby frequencies for the COM receiver. Pressing the **small** knob toggles the tuning cursor (cyan box) between the COM 1 and COM 2 fields.
- **(8) COM Frequency Toggle Key** – Swaps the standby COM frequency and the active COM frequency. Pressing and holding this key for ten seconds automatically makes the 121.5 MHz emergency frequency the active frequency.
- **(9) COM VOL/SQ Control** – Controls the COM audio level. Pressing this knob turns the COM automatic squelch ON and OFF. Audio volume increase and decrease is shown in the field as a percentage.
- **(10) DIRECT-TO Key** () – Allows the user to enter a destination waypoint and establish a direct course to the selected destination (specified by identifier, chosen from the active route, or taken from the map cursor position).
- **(11) FPL Key** – Displays the active Flight Plan Page for creating and editing the active flight plan or accessing stored flight plans.
- **(12) CLR Key (Default)** – Erases information or cancels an entry. To immediately display the Navigation Map Page, press and hold **CLR** (MFD only).
- **(13) FMS Knobs** – The concentric knobs are used to select the page to be viewed (only on the MFD)— the **large FMS** knob selects a page group (MAP, WPT, AUX, NRST) while the **small FMS** knob selects a specific page within the page group. Pressing the **small FMS** knob turns the on-screen cursor ON and OFF. When the cursor is on, data may be entered in the different windows using a combination of the **small** and **large FMS** knobs. The **large FMS** knob is used to move the cursor on the page. The **small FMS** knob is used to select individual characters for the highlighted cursor location. When the G1000 displays a list of information that is too long for the display screen, a scroll bar appears along the right side of the display. The scroll bar graphically indicates the number of additional items available within the selected category.

Press the **FMS/CSRS** to activate the cursor and turn the **large FMS** knob to scroll through the list.

- **(14) MENU Key** – Displays a context-sensitive list of options. This options list allows the user to access additional features or make settings changes that relate to certain pages.
- **(15) PROC Key** – Selects approaches, departures and arrivals from the flight plan. When using a flight plan, available procedures for departure and/or arrival airport are automatically suggested. If a flight plan is not used, the desired airport, and the desired procedure may be selected. The procedures key selects IFR departure procedures (DPs), arrival procedures (STARs) and approaches (IAPs) from the database and loads them into the active flight plan.
- **(16) ENT Key** – Accepts a menu selection or data entry. The enter key is used to approve an operation or complete data entry. It is also used to confirm selections and information entries.
- **(17) Altitude Reference Control** – Sets the reference altitude in the window over the altimeter tape. The **large ALT** knob selects thousands, the **small ALT** knob selects hundreds.



NOTE: The selected (green) COM is controlled by the mic select on the audio control panel (GMA 1347).

2.4 SECURE DIGITAL CARDS

The GDU 1040 data card slots use Secure Digital (SD) cards. SD cards are used for aviation database updates and terrain database storage.

To install an SD card:

1. Press the card into place until it seats on the internal connector and the front of the card is flush with the face of the display bezel

To remove an SD card:

1. Gently press on the card to release the spring latch and partially eject the card.



NOTE: See Appendix A of this Pilot's Guide for instructions on updating the aviation database.

2.5 SYSTEM POWER-UP

The G1000 system is integrated with the aircraft electrical system and receives power directly from electrical busses. Garmin G1000 PFD/MFD and supporting subsystems include both power-on and continuous built-in test features that exercise the processor, RAM, ROM, external inputs and outputs to provide safe operation.

While the system begins to initialize, test annunciations are displayed to the pilot at power up, as shown in Figure 2.5.1. All system annunciations should clear within 1 minute of power up. The GMA 1347 also annunciates all bezel lights briefly upon power up.

On the PFD, the AHRS system displays the 'AHRS ALIGN: Keep Wings Level' message and begins to initialize. AHRS should display valid attitude and heading fields within 1 minute of power up. The AHRS can align itself while the aircraft taxis or during level flight.



NOTE: See the approved Airplane Flight Manual Supplement for specific procedures concerning avionics power application and emergency power supply operation.



NOTE: See the Annunciations & Alerts Pilot's Guide for more information regarding system annunciations and alerts.

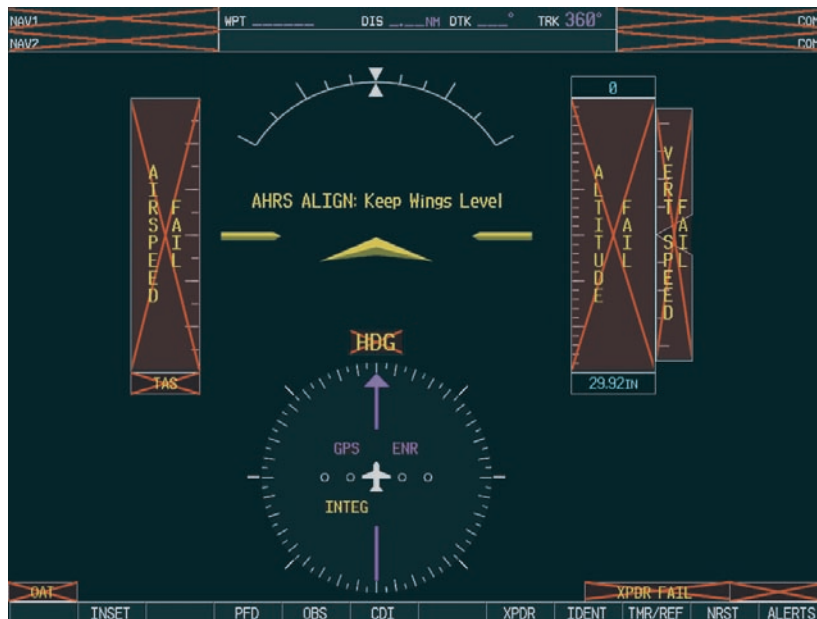


Figure 2.5.1 PFD Initialization

When the MFD powers up, the MFD Power-Up page displays the following data:

- System version information
- Copyright string
- Garmin Corporation name
- Checklist filename
- Land database name and version
- Obstacle database name and version
- Terrain database name and version
- Aviation database name, version, and effective dates

When the list has been reviewed for currency (to ensure that no databases have expired), the pilot is prompted to continue. Current database information is displayed with valid operating dates, cycle number and database type indicated.

Press the **ENT** key to acknowledge the list information and proceed to the Navigation Map Page. When the system has acquired a sufficient number of satellites to determine a position, the Navigation Map Page appears showing your present position.



Figure 2.5.2 MFD Power-up Page

2.6 DISPLAY BACKLIGHTING

The G1000 PFD and MFD displays use photocell technology to automatically adjust for ambient lighting conditions. Photocell calibration curves are pre-configured to optimize display appearance through a broad range of cockpit lighting conditions. PFD, MFD, and GMA 1347 bezel/key lighting is normally controlled directly by the existing instrument panel dimmer bus.

If desired, the PFD and MFD display backlights may be adjusted manually. PFD, MFD, and GMA 1347 bezel/key brightness can also be adjusted manually as well. GMA 1347 bezel/key brightness is directly tied to the MFD bezel/key adjustment.



Refer to the G1000 Primary Flight Display Pilot's Guide for instructions on how to manually adjust the backlighting.

2.7 G1000 REVERSIONARY MODE

G1000 PFD and MFD are connected together on a single Ethernet bus, allowing communication between the two units to occur at a high rate of speed. Each GIA 63 Integrated Avionics Units is connected to a single display, as shown in Figure 2.2.1. This allows the units to share information, enabling true integration of the system.

In normal operating mode, the PFD displays graphical flight instrumentation in lieu of traditional gyro instruments. Attitude, heading, airspeed, altitude, and vertical speed are all shown on one display. The MFD shows a full-color moving map with navigation information. Both displays offer control over COM and NAV frequency selectors, as well as heading, course/baro and altitude reference functions. On the left of the MFD display, an Engine Indication System (EIS) cluster shows graphical depictions of engine and airframe instrumentation. Figure 2.7.1 gives

an example of the G1000 system in normal mode.

Should a failure occur in either display, the G1000 automatically enters reversionary mode. Figure 2.7.2 shows an example where the PFD fails. In reversionary mode, critical flight instrumentation is combined with engine instrumentation on the remaining display. Minimal navigation capability is also available on the reversionary mode display.

It should be noted that if a display fails, the GIA 63-GDU 1040 Ethernet interface is cut off. Thus the GIA can no longer communicate with the remaining display (refer to Figure 2.2.1). Because of this, the NAV and COM functions provided by the GIA to the failed display are flagged invalid on the remaining display. The system reverts to using backup paths for the GRS 77, GDC 74A, GEA 71 and GTX 33, as required. The change to backup paths is completely automated for all LRUs and no pilot action is required.



NOTE: *The system alerts the pilot when backup paths are utilized by LRUs. Refer to the Annunciations & Alerts Pilot's Guide for further information regarding these and other system alerts.*

Reversionary display mode may also be manually activated by the pilot, if the system fails to detect a display problem. The reversionary mode is activated manually by pressing the large red button on the bottom of the GMA 1347. Pressing the red reversionary mode button again deactivates reversionary mode.



Figure 2.7.1 G1000 Normal Mode



Figure 2.7.2 G1000 Reversionary Mode: Failed PFD



Garmin International, Inc.
1200 East 151st Street
Olathe, KS 66062, U.S.A.
p: 913.397.8200 f: 913.397.8282

Garmin AT, Inc.
2345 Turner Road SE
Salem, OR 97302, U.S.A.
p: 503.391.3411 f: 503.364.2138

Garmin (Europe) Ltd.
Unit 5, The Quadrangle
Abbey Park Industrial Estate
Romsey, SO51 9DL, U.K.
p: 44/1794.519944 f: 44/1794.519222

Garmin Corporation
No. 68, Jangshu 2nd Road
Shijr, Taipei County, Taiwan
p: 886/2.2642.9199 f: 886/2.2642.9099

www.garmin.com