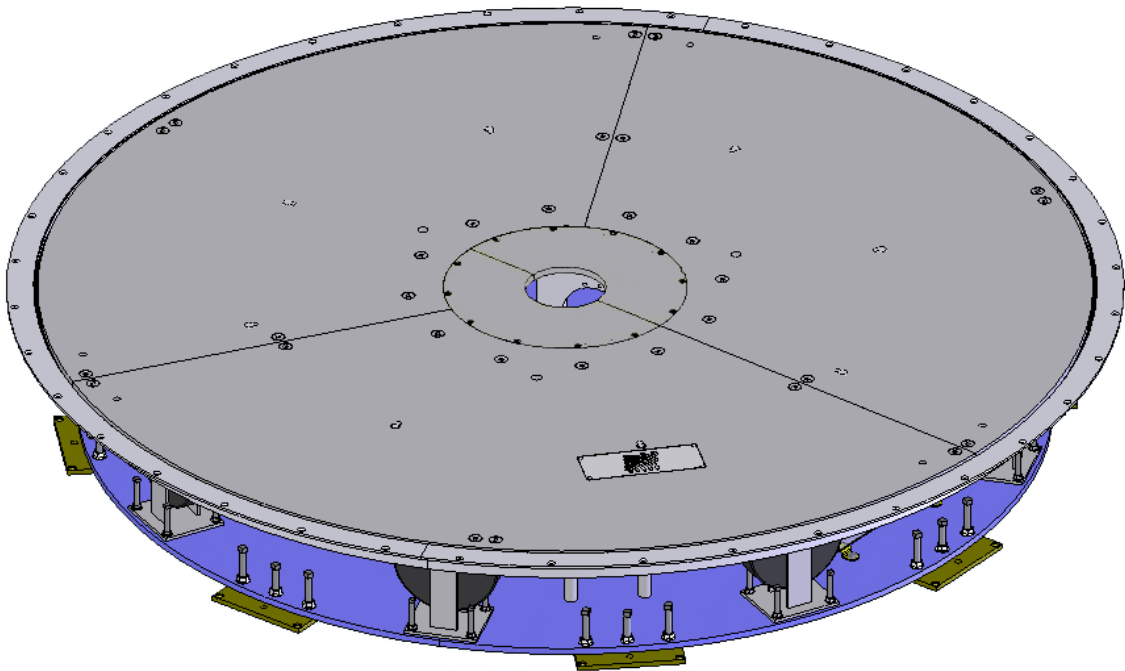


***Model 2187***  
**Electric-Powered Turntable**  
**2-Meter, 3-Meter**  
**User Manual**



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**Revision Record | MANUAL,2187 | Part #399789, Rev. D**

<b>Revision</b>	<b>Description</b>	<b>Date</b>
A	Initial Release	June, 2007
B	Added 3.0 turntable information and drawings	February, 2008
C	Rebrand	July, 2008
D	Changed 2090 to EMCenter™	January, 2018




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## Notes, Cautions, and Warnings

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	<p><b>Note:</b> Denotes helpful information intended to provide tips for better use of the product.</p>
	<p><b>Caution:</b> Denotes a hazard. Failure to follow instructions could result in minor personal injury and/or property damage. Included text gives proper procedures.</p>
	<p><b>Warning:</b> Denotes a hazard. Failure to follow instructions could result in SEVERE personal injury and/or property damage. Included text gives proper procedures.</p>



See the ETS-Lindgren *Product Information Bulletin* for safety, regulatory, and other product marking information.

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## 1.0 Introduction

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The **ETS-Lindgren Model 2187 Turntable** is an electric-powered turntable platform system designed for use with the EMCenter™ Modular RF Platform (or next generation ETS-Lindgren controller, if applicable) for EMI compliance testing. The Model 2187 is available in 2.03-meter and 3.03-meter sizes, both designed for indoor or outdoor use.

The top of the turntable is conductive with a continuous ground brush to electrically couple it to the ground plane. The ground brushes are attached directly to the chamber floor by the floor flange, and are in continuous contact with the turntable top. The brushes point downward from the floor flange.

Both models utilize a pinion and gear drive with a gear reducer and electric motor located beneath the platform. The bearing on which the turntable rotates has the drive teeth cut directly on the outside and will easily support most Equipment Under Test (EUT). Support for the turntable includes casters that aid in the support of cantilevered loads on the outside of the turntable.

The turntable top is sectional to provide easy access if service is required. On standard models, a 15-cm hole is provided in the center of the turntable to accommodate customer supplied cabling to and from the EUT.

To prevent over-travel of the turntable in either direction of movement, hard limits are provided in the form of pins that actuate switches located below the tabletop. These pins allow limits to be set and allow as much as two full rotations. Rotation speed can be varied from a controller (not included) or through the IEEE-488 interface bus.

### Standard Configuration

---

#### **TURNTABLE ASSEMBLY**

Featuring continuous or non-continuous operation, the turntable assembly includes:

- 230 VAC electric motor unit
- Convenient rotational limit adjust switches
- Ground ring assembly with ground brush and floor flange
- 10-meter fiber optic cable

Additionally, the turntable is infrared compatible, and can be used with an optional ETS-Lindgren Infrared Remote Controller (IR remote). For more information on using an IR remote, see *Infrared Remote Controller* on page 8.

## SHIELD ROOM FEED-THROUGH

Routes the fiber optic control cable from the control room to the shield room, maintaining satisfactory shielding attenuation. The unit is made of brass for conductivity and provides attenuation of greater than 100 dB at 10 GHz. A single 22.25-mm (0.875-in) hole is required for mounting.

## POSITIONING CONTROLLER

A positioning controller such as the ETS-Lindgren EMCenter™ Modular RF Platform (with EMControl™ Positioner Controller Plug-In Card) is required for operation, and is sold separately. Contact ETS-Lindgren for ordering information. The EMCenter replaces the 2090 Controller, which has been discontinued. The basic controller configuration is an EMCenter with an EMControl card. This assembly is ETS part number 125241.

Check [ets-lindgren.com](http://ets-lindgren.com) or contact ETS-Lindgren to ensure that your EMCenter, the EMControl card, the backplane, and display all have the current firmware versions.

**EMCenter:** V5.21 (or later)

**EMControl (7006-001) Card:** V2.5.6 (or later)

**Backplane:** V2.3.0 (or later)

**Display:** V1.4.10 (or later)

The EMCenter is also expandable with a variety of additional options available. Please contact ETS-Lindgren with any questions.



**Note:** Existing ETS-Lindgren positioning controllers can be used with the Model 2187 Turntable; contact ETS-Lindgren to confirm your controller is installed with the required firmware.

The 2090 requires firmware revision V 3.21 or higher. It is available for download at [ets-lindgren.com](http://ets-lindgren.com) and requires the program Flash Upgrade Wizard V 4.0 (also available at [ets-lindgren.com](http://ets-lindgren.com)).

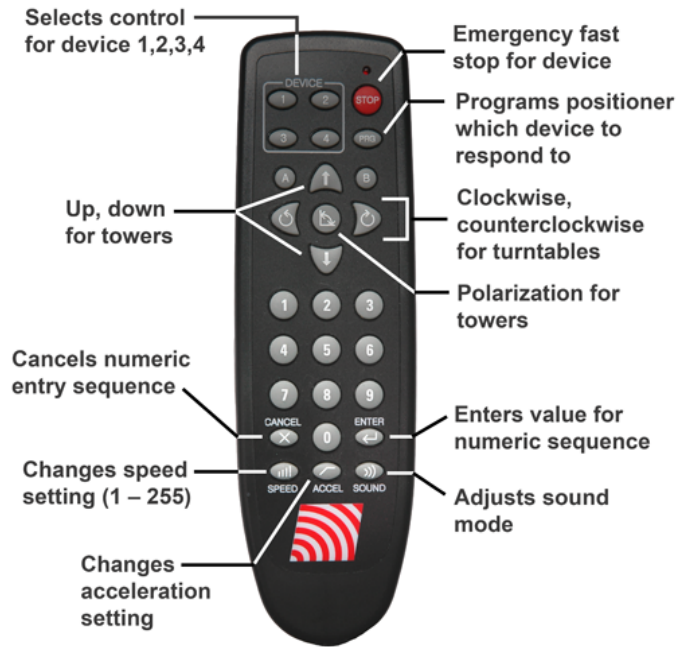
## Optional Items

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### INFRARED REMOTE CONTROLLER

The Model 2187 is infrared compatible, and can be used with a universal remote control programmed to a specific protocol, such as the ETS-Lindgren Infrared Remote Controller (IR remote).





The IR remote communicates with an infrared receiver in the Model 2187 motor base through an IR repeater installed in the floor near the turntable. See *IR Repeater Installation* on page 23 for instructions on installing an IR repeater.

### SLIP RING

Allows continuous rotation of the turntable through the latest technology in mercury slip rings, and either Schuko or NEMA connectors can be ordered with the slip ring. The current rating for the standard electrical assembly is 20 amperes. Contact ETS-Lindgren for custom requirements on slip rings.

### EUT POWER OUTLETS

Receptacles are usually mounted on the base of the turntable at the center axis point. These receptacles can be custom mounted, flush with the tabletop on some turntables. Contact ETS-Lindgren for information.

### MOUNTED LINE IMPEDANCE STABILIZATION NETWORK

A Line Impedance Stabilization Network (LISN) can be mounted to the underside of some turntables. This option is only practical on larger turntables with sufficient clearance.

### ADDITIONAL FIBER OPTIC CABLES

Additional lengths of fiber optic cable may be ordered.

## **ETS-Lindgren Product Information Bulletin**

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See the ETS-Lindgren *Product Information Bulletin* included with your shipment for the following:

- Warranty information
- Safety, regulatory, and other product marking information
- Steps to receive your shipment
- Steps to return a component for service
- ETS Lindgren calibration service
- ETS Lindgren contact information

## 2.0 Maintenance

---

### WARNING

Before performing any maintenance, follow the safety information in the ETS-Lindgren *Product Information Bulletin* included with your shipment.



Regularly inspect all equipment and conduct scheduled maintenance in accordance with the factory recommendations provided.



**BEFORE SERVICING: CONTACT ETS-LINDGREN (+1.512.531.6400)**—Servicing or modifying the unit without ETS-Lindgren authorization may void your warranty. If an attempt to service the unit must be made, disconnect all electrical power prior to beginning. Voltages exist at many points within the instrument that could, if contacted, cause personal injury. Only trained service personnel should perform adjustments and/or service procedures upon this instrument. Capacitors inside this instrument may still be charged even when the instrument is disconnected from the power source.

### Recommended Maintenance Schedule

---

Regular maintenance will prolong the effective operation and reliability of your turntable. Follow the recommended schedule for 6-month and 12-month service.

### CAUTION

Do not perform maintenance while the turntable is operating.

#### 6-MONTH SERVICE

- Lubricate the casters with good quality bearing grease.
- Check the gearbox for fluid leakage. A collection of slight film is normal, but puddles of fluid are not normal. The gearbox is lubricated and sealed at the factory. Under normal conditions, the gearbox should not require servicing during its life.

## 12-MONTH SERVICE

- Lubricate the main bearing race with a grease gun containing good quality bearing grease. The grease fittings are located inside the race, 90 degrees apart, beneath the top. Three discharges from the grease gun in each fitting are adequate.
- Lubricate the gear teeth with good quality grease.

## Replacement and Optional Parts

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Following are the part numbers for ordering replacement or optional parts for the Model 2187 Turntable.

Part Description	Part Number
Turntable assembly	For a list of all turntable parts, see the drawings located in the back of this manual.
IR Remote Controller	707030
NEMA connectors for slip ring	103441
Schuko connectors for slip ring	103351

## Service Procedures

---

For the steps to return a system or system component to ETS-Lindgren for service, see the *Product Information Bulletin* included with your shipment.

### 3.0 Specifications

#### Electrical Specifications

<b>Drive Speeds:</b>	Variable
<b>Nominal AC Voltage:</b>	208–230 VAC
<b>Input Frequency:</b>	50/60 Hz
<b>Current Rating:</b>	15 amp service
<b>Current Draw:</b>	< 10 amps
<b>RPM:</b>	0.5–2.0
<b>Phase:</b>	Single (1)

#### Mechanical Specifications

<b>Diameter:</b>	2.03 meters	3.03 meters
<b>Minimum Height:</b>	27.63 cm 10.88 in	27.63 cm 10.88 in
<b>Maximum Height:</b>	31.57 cm 12.43 in	31.57 cm 12.43 in
<b>Required Pit Diameter:</b>	202.56 cm ± .63 cm 79.75 in ± .25 in	302.56 cm ± .63 cm 119.12 in ± .25 in
<b>Distributed Load Rating:</b>	910 kg 2000 lb	1100 kg 2500 lb



**Distributed Load Rating** applies when:

- Load is evenly distributed on top;
- No point loads under 0.19 sq m (2.0 sq ft) should exceed 100 kg (220 lb);
- And not over 28.5 kg (62.8 lb) should be applied to a 45-degree segment at the table outer edge.

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## 4.0 Turntable Installation Considerations

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### **WARNING**

Before assembling, installing, or connecting any components, follow the safety information in the ETS-Lindgren *Product Information Bulletin* included with your shipment.

### Before You Begin—Precautions

---



Read this manual completely before starting installation. This equipment should be installed and operated only by qualified personnel.

Do not attempt to service unless qualified to do so. As with any electrical equipment, make sure unit electrical power has been disconnected and secured when performing scheduled maintenance or adjustments.



Do not make any modifications to this unit without consulting the factory directly.

Regularly inspect all equipment for loose fasteners and wear. Conduct scheduled maintenance in accordance with the factory recommendations provided.

Only use replacement parts and fasteners ordered directly from the factory.



Stay clear of all moving components on this equipment.

Do not operate turntable while someone is physically on the turntable top.



Do not, at any time, place hands or feet in the vicinity of the drive pinion on the turntable.

## Power and Signal Lines

---

### CONDUIT

Power and signal line paths should be planned in advance. Conduit should be in place before pouring concrete or installing the ground plane. Consider the size of the cable bundle when selecting conduit diameter.

### ELECTRICAL CONSIDERATIONS

**CAUTION**

**Electrical connection is subject to local electrical codes, and should only be performed by a qualified electrician.**

A qualified and licensed electrical contractor should install power lines, and the installation should comply with all applicable regulatory agencies. A dedicated circuit should be used, with the shortest distance possible between the power source and the turntable.

For more information on electrical installation, see page 17.

### ACCESS

An access area beneath the turntable is advisable for large diameter installations. A service switch should be installed to deactivate the turntable during service.

## Outdoor Installations

---

### DRAINAGE

A centerline drain of at least 15 cm (6 in) must be installed to provide proper drainage during rainstorms and other moisture-collecting situations.

### COLD CLIMATE CONDITIONING

The oil used in the gear assemblies will congeal at 2°C (28°F). Turntables operated in these temperatures should include a heat source or dehumidifier, or both.



## 5.0 Electrical Installation

---

### WARNING

Before assembling, installing, or connecting any components, follow the safety information in the ETS-Lindgren Product Information Bulletin included with your shipment.

### CAUTION

Electrical installation must be performed by a qualified electrician, and in accordance with local and national electrical standards.



**Make sure the power is off and secured before proceeding.**

The Model 2187 Turntable is configured to operate using 208-230 VAC, single phase, 50/60 Hz service. It is recommended to operate at this voltage level to reduce the surge currents necessary to power an electric motor.

1. The branch circuit supplying power to the motor base should be protected from excess current according to local electrical codes. An integral circuit breaker is mounted inside the main bearing on one of the bearing support blocks. The circuit breaker is specifically designed for the inductive load presented by the electric motor.
2. Make sure the conductor size is adequate for the motor load and the distance from the mains source. Improperly sized conductors will lead to a high voltage drop in the power conductors and cause reduced starting torque and premature motor failure.
3. The motor base assembly is provided with a non-terminated flexible conduit with input power leads exposed. The flexible conduit is to be terminated into a junction box fitted on or near the motor base. Terminate the power leads of the motor base assembly according to local electrical code requirements. Following is the conductor color code:

**Brown:** AC high

**Blue:** AC neutral

**Green/Yellow:** Protective earth/safety ground

Connect the fiber optic control cable and install the power connection according to local electrical code. See the controller manual for information on connecting the fiber optic cable. After the fiber optic cable is installed, secure it with a wire tie to one of the leveling screws.

To feed the fiber optic connectors through a waveguide in the chamber, cables are included to connect from the feedthroughs on the penetration panel to the controller and motor base.

## 6.0 Assembly and Installation

---

### **WARNING**

**Before assembling, installing, or connecting any components, follow the safety information in the ETS-Lindgren *Product Information Bulletin* included with your shipment.**



Prior to assembly and installation, review the drawings located in the back pocket of this manual.

Proper installation of the turntable directly affects performance. The installation of turntables two meters and larger will be performed by factory installation specialists or individuals authorized by ETS-Lindgren to perform such work. The following installation information is included only to provide an informational overview of the installation process.

1. Uncrate all parts and check for shipping damage. Create a clear area to safely assemble the turntable unit. Do not discard any packing material until unit is fully assembled.
2. Remove the bolts that attach the top onto the turntable drive assembly. Make note of the placement of each top section as it is removed.

### **CAUTION**

**Only qualified personnel should use a forklift or other lifting machinery to lift the turntable assembly.**

3. Using a forklift or other appropriate lifting machinery, place the turntable bottom or bearing support section into position. If the turntable is to be installed in a pit, center and level the assembly.

### **CAUTION**

**Make sure power is off and secured before proceeding.**

4. The drawings in the back of this manual show the placement of floor plates and leveling screws to anchor and level the turntable. Anchor the turntable through the attachment holes using the concrete expansion bolts provided. After installing the floor plates and leveling screws, level the entire turntable by adjusting all the leveling screws between and under the casters, and in the center section of the turntable.
5. Tighten all lock nuts accompanying the leveling screws to lock the height of the turntable into place.

6. Connect the fiber optic control cable and install the power connection according to local electrical code. The standard power configuration is 230 VAC 50/60 Hz.

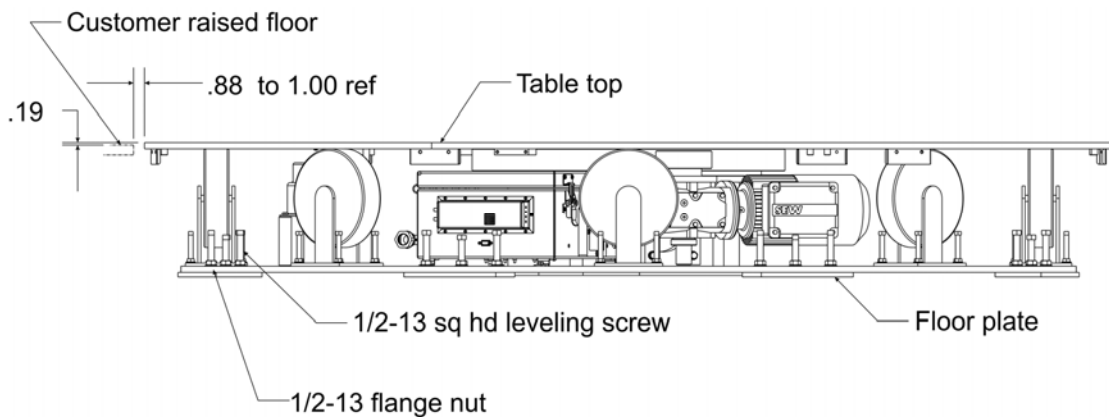
**CAUTION**

**Keep all body parts away from the drive pinion when the turntable is energized.**

7. Follow the instructions in the next section, *Floor Flange Installation in a Paneled Floor*, to install the ground ring assembly.
8. Reinstall the top section removed in step 2 of these instructions.

### **Floor Flange Installation in a Paneled Floor**

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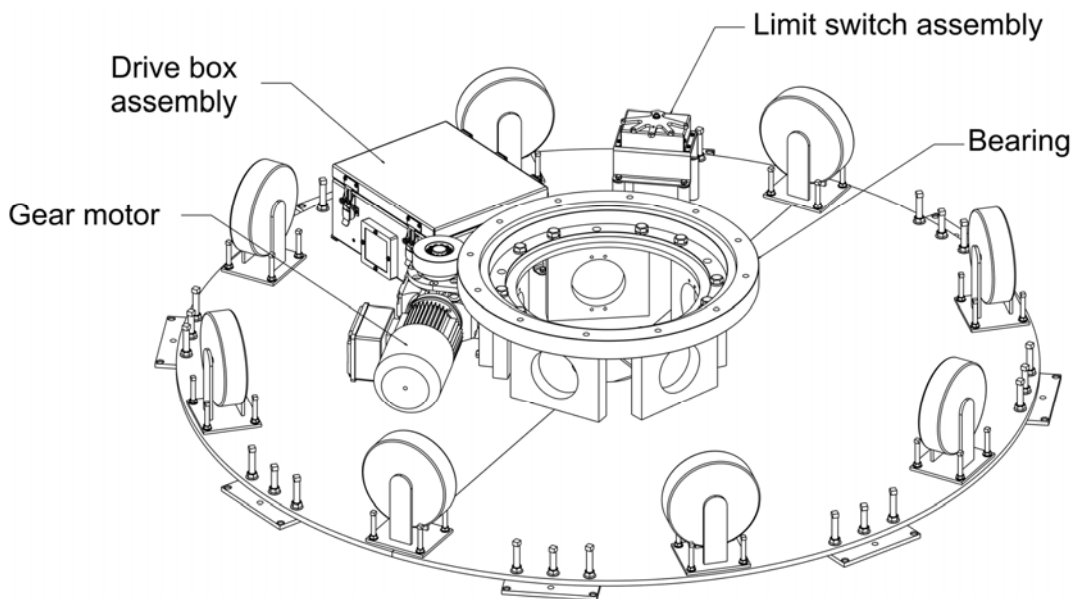
The ground ring assembly includes a floor flange with a mounted brush ring that interfaces with the contact ring mounted beneath the turntable top. The floor flange provides constant electrical contact with the ground plane.

Mounting methods vary according to user specifications. Clearance holes are provided at evenly-spaced intervals along the outside perimeter of the floor flange to attach to a customer-supplied ground plane. These instructions describe installation for a paneled floor. For concrete pit mounting instructions, see *Floor Flange Installation in Concrete Pit* on page 22.

Installing the ground ring assembly requires these tools:

- 1/4-in spacers (3)
- Hand drill
- 5/32-in drill bit
- #3 Phillips drive bit
- Small square
- #14 x 1 wood/metal screws

The turntables each have two floor flange pieces. All flanges are pre-cut at the factory for a drop-in fit.



1. Lay the floor flange into the opening of the raised floor and push outward to the diameter of the opening.
2. Attach the turntable top onto the center bearing with the hardware provided.
3. Using a pipe clamp and 1/4-in Allen wrenches or 1/4-in pin, place a spacer between the turntable and floor flange starting in three places in the center or on the flange.

4. Once tension is placed on all three wrenches, drill a 5/32-in hole through the counter-sunk holes in the floor flange. Drill completely through the panel and place screws into the holes.
5. Continue working around the floor flange, completing two or three holes at a time.



Make sure that a 1/4-in gap between the turntable top and the mounted brush ring be held as close as possible so that the grounding brushes seat properly. Also, make sure the flange ends are flush with each other.

6. Continue mounting until all screws are installed. Some screws may fall between the floor panel joints. Try to position the flanges, making sure as few screws hit these points as possible, and making sure that the first or last hole in the flange is not too close to one of these joints. Trim the top floor joint strips to fit up against the flange.

### **Floor Flange Installation in a Concrete Pit**

---

Installing in a concrete pit is the same as a paneled floor, with the exception of the mounting hardware. Instead of the #14 x 1-in square socket flat head screws, use 1/4 x 1.75-in Phillips flat head concrete anchors.

These tools are required for the next stage of installation:

- 1/2-in hammer drill
- 3/16 x 3.5-in hammer drill bit, at minimum
- Vacuum to clean inside the drilled holes for maximum thread engagement



When drilling holes, be aware of buried conduit and pit drainpipes. Drill 3/16-in holes, two inches minimum depth.

## IR Repeater Installation

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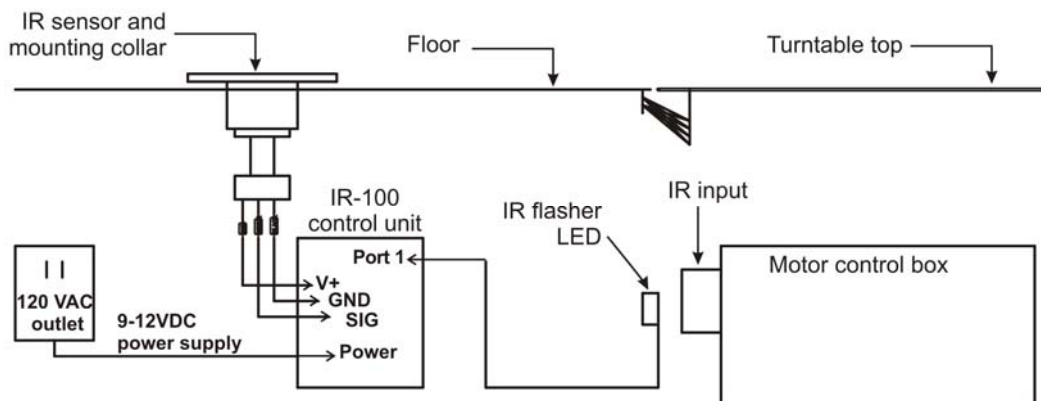
### INSTALLATION ASSEMBLY COMPONENTS

- Infrared sensor
- Mounting collar
- IR-100 control unit
- IR flasher LED
- 9–12VDC power supply
- Connection cable
- Flathead mounting screws

### REQUIRED TOOLS FOR INSTALLATION

- Electric drill
- 1-in hole saw to create a
- 1/16-in drill bit
- Small flat blade screwdriver
- Phillips #2 bit driver
- Adhesive tape

### INSTALLATION STEPS



1. Choose a location for the IR infrared sensor that is away from traffic.
2. Using a 1-in hole saw, cut an opening in the floor for the IR sensor.
3. Connect the **V+**, **GND**, and **SIG** wires to the IR sensor as shown in the diagram, and feed the cable through the hole.

4. Use the 1/16-in drill bit and four flathead mounting screws to mount the IR sensor collar.
5. Connect the **V+**, **GND**, and **SIG** wires from the IR sensor to the IR-100 control unit as shown in the diagram.
6. Using adhesive tape, attach the IR flasher LED directly over the IR input on the motor control box.
7. Connect the IR flasher to port 1 on the IR-100 control unit.
8. Plug the 9–12VDC power supply into the power connector on the IR-100 control unit, and then plug the power supply into a 120 VAC outlet.



## 7.0 Operation

---

### **WARNING**

Before placing into operation, follow the safety information in the ETS-Lindgren *Product Information Bulletin* included with your shipment.

With the assembly of the turntable complete, the EMCenter Modular RF Platform (or next generation ETS Lindgren controller, if applicable) must be connected to the unit and power applied to both the motor base and controller. See the controller manual for complete information on connecting the fiber optic cable and operating the controller. A manual is available for download from [ets-lindgren.com](http://ets-lindgren.com).



**Note:** If you are unfamiliar with the operation of the EMCenter, see the manual, available for download from [ets-lindgren.com](http://ets-lindgren.com).

The EMCenter replaces the 2090 Controller, which has been discontinued.

The 2090 requires firmware revision V 3.21 or higher. It is available for download at [ets-lindgren.com](http://ets-lindgren.com) and requires the program Flash Upgrade Wizard V 4.0 (also available at [ets-lindgren.com](http://ets-lindgren.com)).

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## **Appendix A: List of Assembly Drawings**

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Following is a list of the assembly drawings located in the back of this manual. Prior to assembly and installation, review the drawings. Refer to the drawings during assembly and installation for detailed information.

- **2187-2.0:** 2-meter turntable (3 pages)
- **2187-3.0:** 3-meter turntable (2 pages)

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## Appendix B: Warranty

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See the *Product Information Bulletin* included with your shipment for the complete ETS-Lindgren warranty for your Model 2187 Turntable.

### DURATION OF WARRANTIES FOR MODEL 2187

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All product warranties, except the warranty of title, and all remedies for warranty failures are limited to two years.

Product Warranted	Duration of Warranty Period
ETS-Lindgren Model 2187 Turntable	2 Years

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## Appendix C: EC Declaration of Conformity

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The EC Declaration of Conformity is the method by which ETS-Lindgren, L.P. declares that the equipment listed on this document complies with the EMC Directive (EEC/89/336) and Low Voltage Directive (EEC/73/23), including applicable amending directives.

**Factory**

ETS-Lindgren, L.P.  
1301 Arrow Point Drive  
Cedar Park, TX, USA 78613

**Issued by**

ETS-Lindgren, L.P.  
1301 Arrow Point Drive  
Cedar Park, TX, USA 78613

The products listed below are eligible to bear the CE mark:

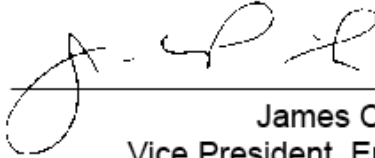
– Model 2187 Electric Powered Turntable, 2-Meter and 3-Meter with 2088 style motor base

### APPLICABLE REQUIREMENTS

<b><u>Standard</u></b>	<b><u>Criteria</u></b>
EN 55011	Group 1, Class B
EN 61000-4-2:1995	Level 2/3 (4/8 kV)
EN 61000-4-3:1997	Level 2 (3 V/m)
EN 61000-4-4	Level 2 (1/0.5 kV)
ENV 50204:1996	Level 2 (3 V/m)
EN 61000-4-5:1995	Level 3 (2/1 kV)
EN 61000-4-11:1994	2 kV
EN 61010-1	Safety requirements for electrical equipment for measurement, control, and laboratory use

### AUTHORIZED SIGNATORIES

  
Bryan Sayler,  
General Manager

  
James C. Psencik,  
Vice President, Engineering

The authorizing signatures on the EC Declaration of Conformity document authorize ETS-Lindgren, L.P. to affix the CE mark to the indicated product. CE marks placed on these products will be distinct and visible. Other marks or inscriptions liable to be confused with the CE mark will not be affixed to these products. ETS-Lindgren, L.P. has ensured that appropriate documentation shall remain available on premises for inspection and validation purposes for a period of no less than 10 years.