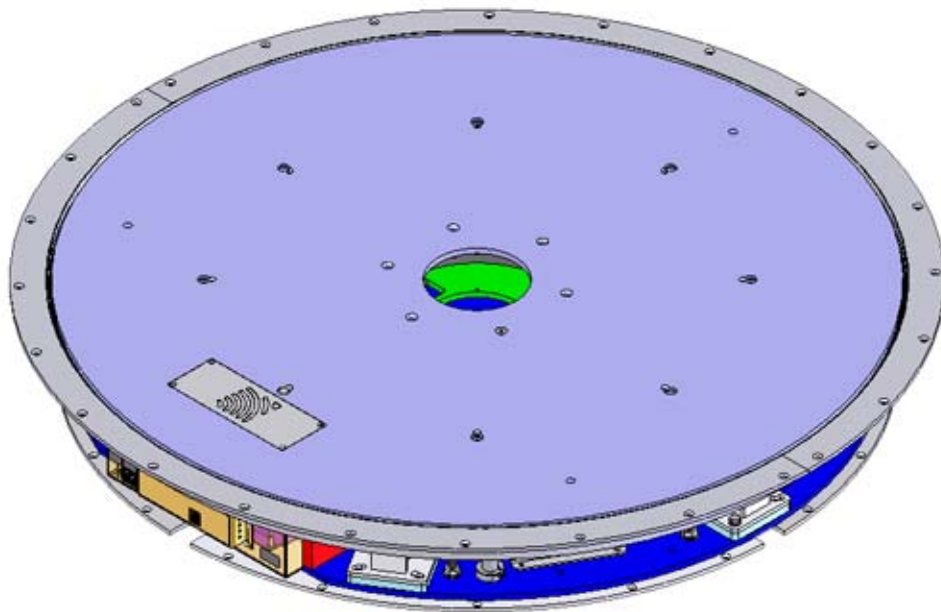


Model 2188
Turntable
1.0-m, 1.2-m, 1.5-m, 2.0-m
User Manual



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Revision Record | MANUAL,TURNTABLES,2188 | Part #399771, Rev. E




Revision	Description	Date
A	Initial Release	November, 2005
B	Added two meter turntable information, updated illustrations and drawings	January, 2006
C	Rebrand	July, 2008
D	Added 1.0 meter turntable information	April, 2017
E	Changed 2090 to EMCenter	January, 2018

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Notes, Cautions, and Warnings

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

The **ETS-Lindgren Model 2188 Turntable** is an electric-powered, variable-speed turntable platform system designed for use with the EMCenter Modular RF Platform (or next generation ETS-Lindgren controller, if applicable) to perform EMI compliance testing. The Model 2188 is available in 1.0-meter, 1.2-meter, 1.5-meter, and 2.0-meter diameters. The turntable is ideal for installations in new or existing test locations where pit excavation is not an option or must be shallow.

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.

The drive motor and gearing are located beneath the platform. The Model 2188 is powered by an electric motor through a worm gear box with a chain and sprocket final drive. The top of the turntable is removable to provide easy access in the event that service is required. The electronics are located in a shielded enclosure. Signal I/O is through fiber optic cable.

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 the front panel of the controller or through the IEEE-488 interface bus.

Standard Configuration

TURNTABLE ASSEMBLY

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

- Single-phase electric drive (208–230 VAC 50/60 Hz)
- Variable-speed drive
- Conductive top
- Continuous rotation
- 10-meter fiber optic control cable
- Fiber optic shield penetration kit
- Fiber optic feedthroughs (2)
- 3-meter fiber optic control cable

EMCenter Modular RF Platform

The ETS-Lindgren EMCenter™ Modular RF Platform (with EMControl™ Positioner Controller Plug-In Card) may be used to control the Model 2188 Turntable. For information on connecting and using the EMCenter, see the *EMCenter Modular RF Platform User Manual*, available for download at ets-lindgren.com.

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 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: If you are unfamiliar with the operation of the EMCenter, see the manual, available for download from ets-lindgren.com.

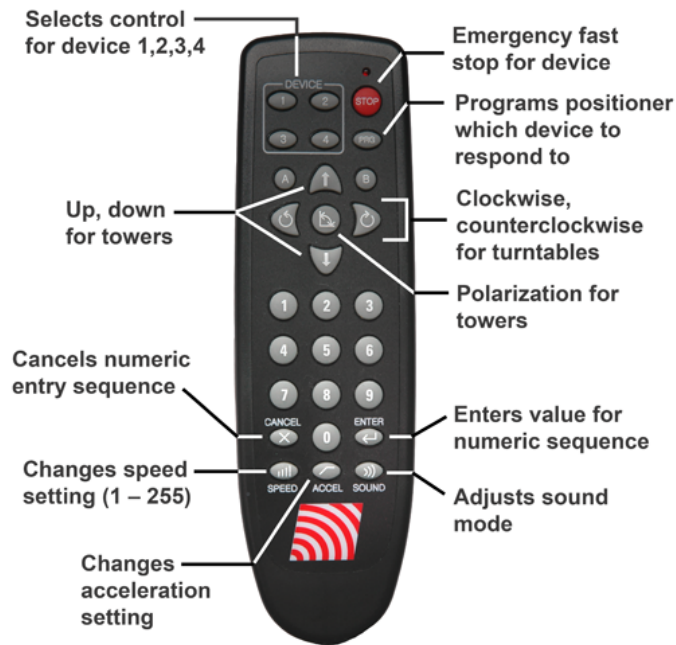
The EMCenter replaces the 2090 Controller, which has been discontinued.

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

Optional Items

INFRARED REMOTE CONTROLLER

The Model 2188 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).



ADDITIONAL FIBER OPTIC CABLES

Additional lengths of fiber optic cable may be ordered.

ETS-Lindgren Product Information Bulletin

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

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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 routine, 6-month, and 12-month service.

CAUTION

Do not perform maintenance while the turntable is operating.

ROUTINE MAINTENANCE

Routine maintenance should be conducted prior to each use of the turntable.

- **Remove foreign objects from between turntable top and floor flange**—Visually inspect the turntable prior to use, and look for foreign objects in the gap between the turntable top and the floor flange. Remove the objects, if possible.
- **Check for excessive rotation**—Attempt to rotate the turntable top by hand. Excessive rotation may indicate a loose drive component.
- **Listen for excessive noise**—Listen for excessive or unusual noise during turntable operation.

6-MONTH SERVICE

- **Lubricate the casters**—Lubricate the casters with good quality bearing grease.
- **Inspect the ground brush for contaminants**—Vacuum the ground brush to remove unwanted debris. If required, add a small amount of conductive lubricant to the brush interface.
- **Inspect the ground brush for wear**—Visually inspect the ground brush for wear; if necessary, replace the ground brush.

12-MONTH SERVICE

- **Lubricate the main bearing race**—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 chain and sprocket of the chain drive**—Apply good quality grease to the chain and sprocket.

Replacement and Optional Parts

Following are the part numbers for ordering replacement or optional parts for the Model 2188 Turntable.

Part Description	Part Number
Turntable Assembly	For a list of all turntable parts, see the drawings located in the back pocket of this manual.
IR Remote Controller	707030

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.

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3.0 Specifications

Electrical Specifications

Nominal AC Voltage:	230 VAC
Input Frequency:	50/60 Hz
Phase:	Single Phase
AMP:	2.0
RPM:	0.5 / 2.0 variable

Physical Specifications

	1.0-meter	1.2-meter	1.5-meter	2.0-meter
Height (Minimum):	16.51 cm (6.12 in)	16.51 cm (6.12 in)	16.51 cm (6.12 in)	16.51 cm (6.12 in)
Distributed Load Rating:	500 kg (1100 lb)	500 kg (1100 lb)	1000 kg (2200 lb)	1000 kg (2200 lb)



Distributed Load Rating applies when:

- Load is evenly distributed to each section;
- No point loads under 0.37 sq m (4.0 sq ft) should exceed 500 kg (1100 lb);
- And not over 400 kg (882 lb) should be applied to a 45-degree segment outboard of the casters.

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4.0 Turntable Installation Considerations

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 19.

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.

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 2188 Turntable is configured to operate using 208-230 VAC, single phase, 50/60 Hz service. This voltage level is recommended for operation 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 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 information is included only to provide an informational overview of the installation process.

Required Tools

- 3/16-in Allen wrench
- 1/4-in Allen wrench
- 3/8-in Allen wrench (3)
- 6-mm Allen wrench
- 3/8-in ratchet wrench
- 12-in crescent wrench
- 15-mm, 12-point socket for 1/2-in square head screws
- 7/16-in open/box end wrench
- 1/2-in open/box end wrench
- 3/4-in open/box end wrench
- 0.120 drill bit for 6–32 self-tapping screws
- #7 drill bit for 1/4–20 tap
- 3/4-in pipe clamp ends
- 3/4-in pipe (about 6 feet; length depends on turntable size)
- 1 1/2-in C clamp (8)
- Measuring tape
- Pry bar
- Level
- Square
- Hacksaw
- Black marker
- File
- WD-40®
- Cutting oil

- 3/8-in hand drill
- 9/32 drill bit
- #2 Phillips screw bit
- #3 Phillips screw bit
- 1.2-in hammer drill
- Syringe to apply conductive grease
- Grease gun
- Vacuum

Assembly Instructions



Do not discard any packing material until the turntable is fully installed and operational.

CAUTION

When working around the turntable, do not step on the fiber optic connectors located on the motor base.

1. Uncrate all parts and check for shipping damage. Create a clear area to safely assemble the turntable unit.
2. Verify that that fiber optic cable is long enough to reach from the turntable to the control room.
3. If the turntable is to be installed in a pit, measure the depth and inside diameter of the depth. Compare the measurements with the drawings located in the back pocket of this manual.

The inner diameter of the pit should be as follows:

- **1.0-meter turntable**—49.00 in (+/-0.25 in)
 - **1.2-meter turntable**—49.00 in (+/-0.25 in)
 - **1.5-meter turntable**—60.00 in (+/-0.25 in)
 - **2.0-meter turntable**—79.75 in (+/-0.25 in)
4. Remove the bolts that attach the top onto the turntable drive assembly; these are the six flat-head bolts closest to center of the turntable top.
 5. Remove the turntable top and place it in a safe location.

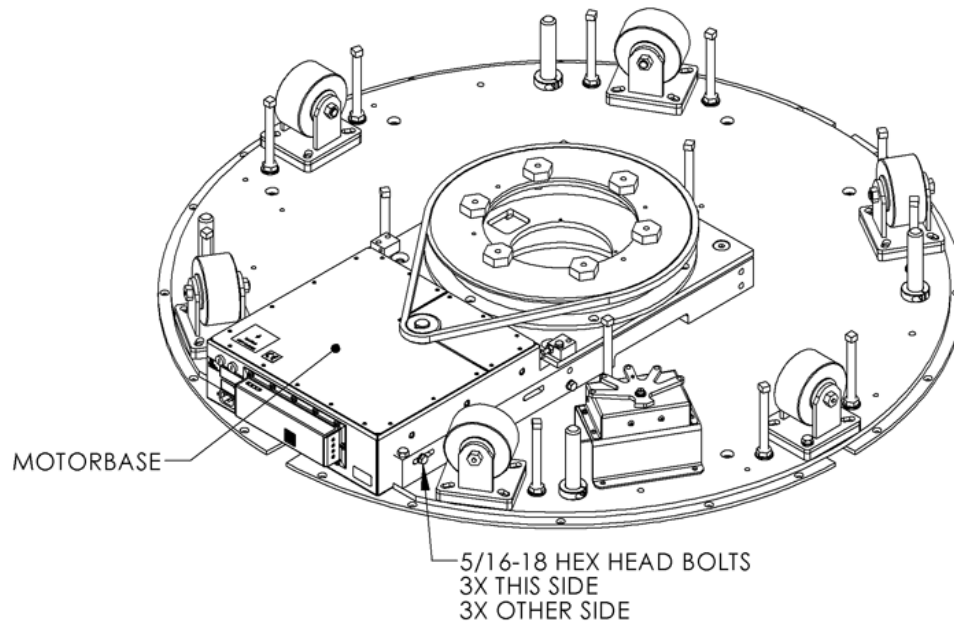
CAUTION

Only qualified personnel should use a forklift or other lifting machinery.

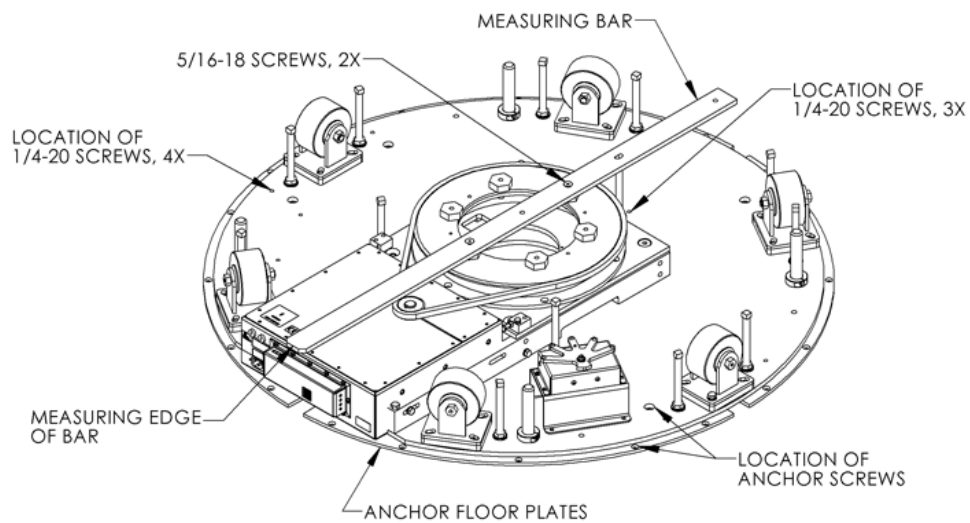
- Using a forklift or other appropriate lifting machinery, place the turntable bottom into position. The motor base with the fiber optic connectors should point in the direction that the fiber optic cable will be installed. This position will reduce the chance of the cable being kinked or twisted.

CAUTION

Make sure power is off and secured before proceeding.



Interior Design



Pit Locator Detail

7. Position the turntable as close as possible to the center. Attach the measuring bar to the brass spacers mounted onto the bearing; the hole-mount locations are appropriate to the size of the turntable to be installed.

Rotate the bearing and make sure approximately 7/8 in to 1 in spacing exists between the edge of the outer measuring bar and the diameter of hole cut into the pit. Adjust if necessary.

8. Once the center is located, mark around the perimeter of the turntable base or outer floor plates. These marks may be used for reference if the assembly moves during placement of the floor shims or anchor plates.



When installing and positioning the turntable on modular shielding, make as many anchor holes miss the floor joint strips as possible; use the shim plates provided.

9. The Model 2188 Turntable includes curved floor anchor plates that are under the base unit. The 1.5-m and 2.0-m models include an outer ring of floor plates to support additional casters.

To ensure proper spacing, place the four connector strips (included) between the base unit and outer plates. For placement and securing of floor plates, see the *Pit Locator Detail* illustration on page 23 and the drawings located in the back pocket of this manual.

If the turntable is to be installed into a welded chamber with a steel pit and steel raised floor, see step 13.

10. The anchor plates are held in place by 1/4–20 screws and set collars. Screw the anchor plates to the floor using #14x1-in #3 square socket flat-head screws. Drill 1/8 in pilot holes for these screws and vacuum up shavings so that you have good contact with the floor. Continue mounting the rest of the plates.
11. Once all anchor plates are securely mounted, remove and discard the 1/4–20 screws that hold the anchor plates to the base.
12. Level the turntable to the raised floor.

- When mounting to a steel pit and steel raised floor, a #7 drill bit for tapping or a 9/32 drill bit to create through holes is required when mounting anchor plates to the steel raised floor. Locate and mark holes in each group of anchor plates. Drill and tap or drill through each hole and then screw in 1/4–20 hardware so that the turntable does not move as you go around each location.

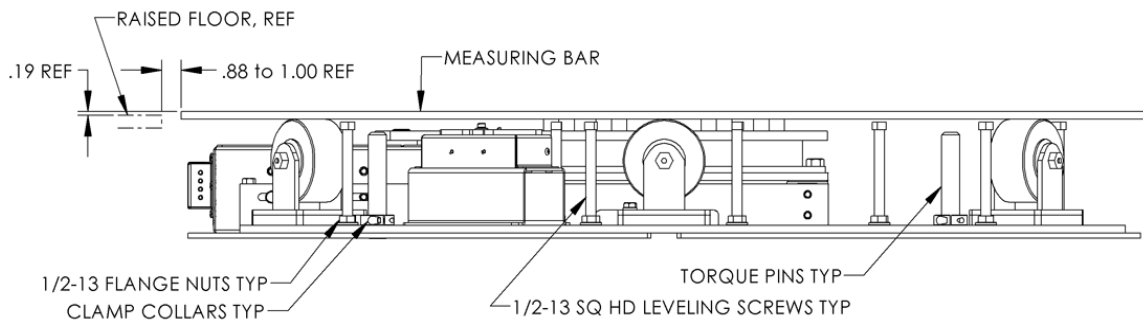
CAUTION

Before leveling, make sure all 1/2–13 flange nuts and clamp collars are backed off completely to avoid pulling plates off the floor.

- Raise the turntable by turning the 1/2–13 square head screws clockwise until the measuring bar top is 3/16 in above the raised floor; this is just a rough finished height. Check the height with a leveling instrument.

When the turntable is leveled, tighten flange nuts on the square head screws and secure set collars on the torque pins down onto the base top surface and outer plate, if applicable. Remove the measuring bar. See the *Elevation View* illustration in the next section and the drawings located in the back pocket of this manual.

FLOOR FLANGE INSTALLATION IN A PANELED FLOOR



Elevation View

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 26.

Installing the ground ring assembly requires these tools:

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

The turntables 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 to the brass spacers 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 1-3/4-in Phillips flat head concrete anchors.

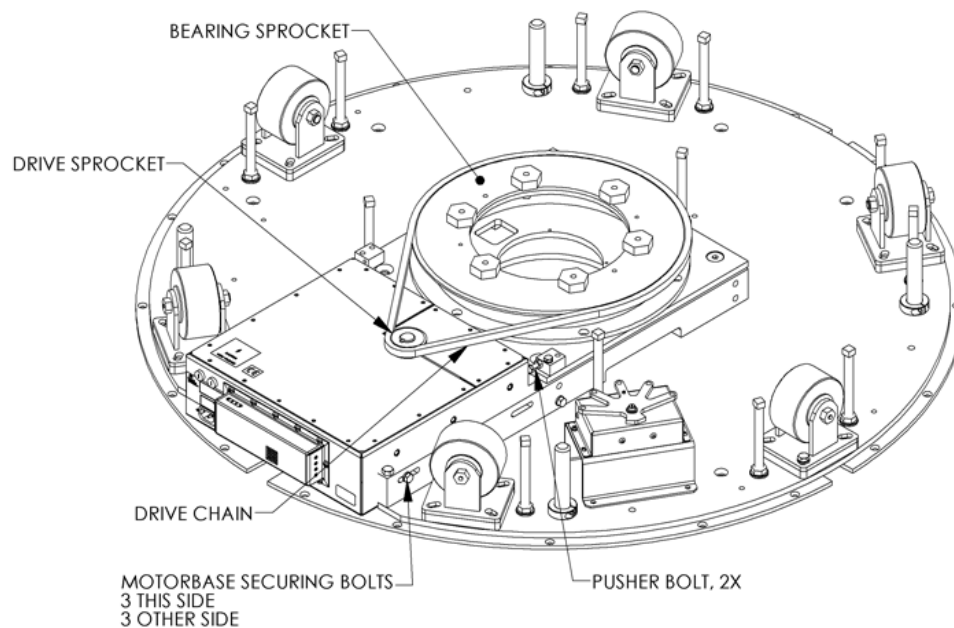
These tools are required for the next stage of installation:

- 1/2-in hammer drill
- 3/16 x 3 1/2-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.

Motor Base Attachment



Turntable Motor Base

1. Locate the box that contains the motor base. The box also includes the hardware needed to attach the motor base to the turntable. See the illustration, *Turntable Motor Base*, to locate the drive chain and bolts to secure the motor base. Slide the motor base between the two rails provided.
2. Attach three bolts, flat and lock washers (provided) on each side of the motor base. Do not tighten them completely at this time.

3. Attach the chain around the bearing sprocket and the drive sprocket. Adjust the motor base using the two pusher bolts provided. Allow only 1/4-in maximum side-to-side motion for proper chain tension on the motor.
4. Tighten the six securing bolts.

Post Installation Steps

FINAL LEVEL OF TURNTABLE

Once the turntable is in place with the floor flange and wear strip mounted, check that the table is level. Verify that it is level and all screws, nuts, and collars are tightened.

CONDUCTIVE GREASE APPLICATION

Before placing the turntable into operation, apply conductive grease to the ground brush. Apply the contents of one tube of conductive grease to the brush. Apply one tube per meter size of the diameter of the turntable.

7.0 Operation

WARNING

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

EMCenter Modular RF Platform

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.



Note: If you are unfamiliar with the operation of the EMCenter, see the manual, available for download from 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 and requires the program Flash Upgrade Wizard V 4.0 (also available at ets-lindgren.com).

Motor Base Status Indicators

Following are actions of the status indicators when used with the Infrared Remote Controller (IR remote). For more information on the IR remote, see page 8.

State	1	2	3	4
Power	Any	Any	Any	Any
Init	Cycling		Amber	
Up/CW	Green			
Down/CCW		Green		
Polar			Green	
Upper Limit	Red			
Lower Limit		Red		

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Appendix A: Warranty



See the *Product Information Bulletin* included with your shipment for the complete ETS-Lindgren warranty for your Model 2188.

DURATION OF WARRANTIES FOR MODEL 2188

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
Model 2188 Turntable	2 Years

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Appendix B: Drawings

These drawings are located in the back pocket of this manual:

Drawing Description	Drawing Number
1.0m, With Ground Ring (2 pages)	2188-1.00
1.2m, With Ground Ring (2 pages)	2188-1.23
1.5m, With Ground Ring (2 pages)	2188-1.53
2m, With Ground Ring (2 pages)	2188-2.03
2188-1.23 (2 pages)	108912
2188-1.23, Sub-Assembly, Top	110053
2188-1.53, Sub-Assembly, Top	110277
2188-2.03, Sub-Assembly, Top	110406
2188 Limit Switch, Instructions	398790

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Appendix C: EC Declaration of Conformity



We, ETS-Lindgren, L.P., 1301 Arrow Point Drive, Cedar Park, TX, 78613, USA, declare under sole responsibility that the:

Model/Part Number: 2188
Model/Part Name: 2188 Turntable with 2188 style motor base
Date of Declaration: 07 November, 2005

to which this declaration relates, meets the requirements and is in conformity with the relevant EC Directives listed below using the relevant section(s) of the following EC harmonized standards and other normative documents;

Applicable Directive(s):

Low Voltage Directive (LVD), 73/23/EEC and its amending directives
Electromagnetic Compatibility Directive (EMC), 89/336/EEC and its amending directives

Applicable harmonized standard(s) and/or normative document(s):

EN 55011: Electromagnetic emissions requirements for Industrial, Scientific and Medical (ISM) Equipment
EN 61000-4-11:1994 Electromagnetic compatibility Part 4. Testing and measurement techniques section 11: Voltage dips, short interruptions and voltage variations immunity tests
EN 61000-4-2:1995 Electromagnetic compatibility (EMC) -- Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test
EN 61000-4-3:1997 Electromagnetic compatibility for Electrical and Electronic Equipment, Part 3: Immunity to radiated, radio frequency, electromagnetic fields
EN 61000-4-4:1995 Electromagnetic compatibility for industrial process measurement and control equipment, Part 4: Electrical fast transient/burst requirements
EN 61000-4-5:1995 Electromagnetic compatibility for electrical and electronic equipment, Part 5: Surge immunity requirements
EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use
ENV 50204:1996 Radiated electromagnetic fields from digital radio telephones - Immunity test

Authorized Signatories:

Handwritten signature of Bryan Saylor in black ink.

ETS-Lindgren L.P.
Bryan Saylor, General Manager

Handwritten signature of James C. Psencik in black ink.

ETS-Lindgren L.P.
James C. Psencik, Vice President of Engineering

The authorizing signatures on this Declaration of Conformity document authorizes 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 mistaken with the CE mark will not be affixed to these products.

ETS-Lindgren, L.P. has ensured that technical documentation shall remain available on premises for inspection and validation purposes for a period ending at least 10 years after the last product has been manufactured.