

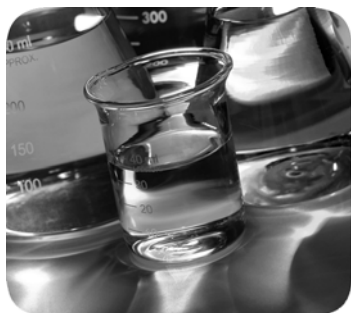
User Manual

Original Instructions



iTRAK System

Bulletin 2198T



Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.



WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.



ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.

IMPORTANT Identifies information that is critical for successful application and understanding of the product.

Labels may also be on or inside the equipment to provide specific precautions.



SHOCK HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.



BURN HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.



ARC FLASH HAZARD: Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

Preface

Summary of Changes	7
Conventions	7
Appropriate Use	7
Additional Resources	8

Chapter 1**Start**

About the iTRAK System	9
Motor Module	12
Mover	14
Support Frame	15
Power Supplies	16
iTRAK Bus Conditioner	16
Gateway	17
Digital USB I/O Module	17
Catalog Number Explanation	18
Safety Information	19
Risk Assessment	19
General Assembly Instructions	19
Machine Guarding	20
Avoid Accidents, Injury, and Property Damage	21
Avoid Electrical Shock	21
Pinch Point Hazard	21
Protection Against Contact with Hot Parts	22
Protection Against Magnetic and Electromagnetic Fields During Installation and Use	22
Safe Magnet Handling	25

Chapter 2**Track Installation**

Install the Track	27
Before You Begin	27
Mount an Oval Track	28
Install the Lubrication System	32
What You Need	33
Mount the Lubricator Pumps	33
Wiring Lubrication Pump	34
Lubrication Pump Configuration	35
Lubrication Volume Calculation	35

Connect Your iTRAK System to a Kinetix 5700 iTRAK Power Supply	Chapter 3	
		Typical iTRAK System with an iTRAK Power Supply 37
		Design Guidelines..... 40
		Determine the Number iTRAK Power Supplies Required 40
		Output Bus Current..... 40
		24V Control Power..... 40
		iTRAK Power Supply Output Power Connections..... 41
		Maximum iTRAK Power Supply to iTRAK Module
		Cable Length 42
		Choose a 2198-Pxxx Kinetix 5700 Power Supply..... 43
		Shunting Capacity..... 44
		Kinetix 5700 System Design..... 44
		Cabinet..... 44
		Ethernet Connection 44
		Wire the iTRAK System 45
		Using Multiple iTRAK Power Supplies 45
		iTRAK Power Supply Connector Data 48
		Wiring Requirements 51
		Wire the iTRAK Power Supply 52
		Wire the Digital Input Connector 52
		Wire the iTRAK PS Ready (IR) connector 53
		Wire the iTRAK Power Supply DC Bus and Control
		Power Output Connectors..... 54
		Apply the iTRAK Power Cable Shield Clamp 55
		Wire the Digital USB I/O Module 56
		Wire the Gateway..... 57
		iTRAK Power Supply Wiring Example 59
		Cable Preparation for iTRAK Power Supply Output
		Power Cables..... 60
		Logix Designer Application Support 63
Install Your System with a Power Control Module	Chapter 4	
		Typical System Configuration Using a PCM 65
		About the Power Control Module..... 67
		PCM Status Indicators..... 68
		PCM Dimensions 69
		PCM Connector Data 70
		About the Gateway..... 73
		Plan Your System Installation 75
		Install the Power Control Module..... 75
		Install the Gateway Enclosure 75
		Connect Cables..... 75

	Chapter 5	
Power on Your System	Before You Power On the Track.....	77
	Identify Controller	77
	Identify Firmware Revision.....	77
	Configure and Customize Project File.....	78
	Apply Power.....	78
	Kinetix 5700 iTRAK Power Supply.....	78
	Power Control Module	79
	Commission with Programming Manual.....	82
	Chapter 6	
Maintenance	Before You Begin.....	83
	Preventive Maintenance	83
	Cleaning.....	83
	Add or Replace Components.....	84
	Install or Remove a Position Magnet Assembly.....	84
	Magnet Plate Assembly Installation	86
	Install or Replace a Mover	88
	Replace a Straight Motor Module.....	92
	Replace a Curved Motor Module	94
	Update Gateway Firmware.....	102
	Firmware Update Troubleshooting	104
	Downgrading Firmware.....	104
	Update Motor Module Firmware.....	104
	Lubrication.....	105
	Initial Lubrication.....	106
	Lubrication During Normal Operation	106
	Replace Mover Lubrication Wipers	106
	Replace Lower Mover Bearing.....	108
	Circuit Breakers.....	111
	Chapter 7	
Troubleshooting	Errors Codes.....	113

	Chapter 8	
Functional Safety	Important Safety Considerations	121
	Category 3 Requirements according to EN ISO 13849-1	121
	Stop Category Definition	122
	Performance Level and Safety Integrity Level (SIL).....	122
	Safety Distance Calculations	122
	Functional Safety Description	122
	Considerations for Category 1 Stop.....	123
	Overall System Stopping Performance	123
	Schematic and Block Diagrams	124
	iTRAK Power Supply.....	124
	Power Control Module	125
	Chapter 9	
Compatibility	Motor Modules	127
	Movers and Magnets	128
	Gateways	128
	Power Supplies.....	128
	Controllers	128
	Appendix A	
Label Placement	Safety Labels.....	129
	Index	133

This manual provides installation instructions to mount, wire, and troubleshoot the iTRAK® system.

This manual is intended for engineers or technicians that are directly involved with the design, installation, and wiring of the iTRAK system, and programmers who are directly involved in the operation, field maintenance, and integration of this system with the EtherNet/IP™ communication module or controller.

If you do not understand the basics of the iTRAK system, contact your Rockwell Automation sales representative for information on available training courses.

Summary of Changes

This manual contains new and updated information as indicated in the following table.

Topic	Pages
Corrected pin numbers in the table entitled IDC and ICP Connector Wiring.	55
Corrected pin numbers in the wiring diagram entitled Connecting an iTRAK Power Supply to a System.	59
Corrected pin numbers in the wiring diagram entitled Kinetix® 5700 iTRAK Power Supply Safety Circuit Block Diagram.	124

Conventions

These conventions are used throughout this manual: Bulleted lists provide information, not procedural steps. Numbered lists provide steps or hierarchical information.

Appropriate Use

Read and understand the safety instructions before using the iTRAK system and review [Label Placement on page 129](#).



ATTENTION: Incorrect use of the products can cause personal injury and property damage.

- Hardware must remain in its original state; never make structural changes.
- Do not de-compile software or alter source codes.
- Do not use damaged or faulty components.
- Install the system in the manner that is described in this manual.
- Operate the system in the ambient conditions that are described in iTRAK System Technical Data, publication [2198T-TD001](#)

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
iTRAK System Technical Data, publication 2198T-TD001	Product specifications for Rockwell Automation iTRAK system components, with performance, environmental, certifications, load force, and dimension drawings.
Kinetix® Servo Drives Specifications Technical Data, publication KNX-TD003	Product specifications for Kinetix Integrated Motion over the EtherNet/IP network, Kinetix 5700 iTRAK Power Supply, Integrated Motion over sercos interface, EtherNet/IP networking, and component servo drive families.
Kinetix 5700 iTRAK Power Supply Installation Instruction, publication 2198T-IN001	Provides information for wiring and connecting the Kinetix 5700 iTRAK power supply to the iTRAK system.
iTRAK System Programming Manual, publication 2198T-PM001	Provides information on how to commission and program an iTRAK system.
3D CAD Models of iTRAK Components 2198T-3DCAD.zip. https://motionanalyzer.rockwellautomation.com/Products/iTrak	Provides 2D outline, assembly, and system drawings, STEP files for the movers and motor modules, and hyper links to complete systems STEP files.
ControlLogix® System User Manual, publication 1756-UM001	Details how to configure, program, and operate a 1756 ControlLogix system, and provides technical specifications
System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001	Information, examples, and techniques that are designed to minimize system electrical noise failures.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://www.rockwellautomation.com/global/certification/overview.page	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at <http://www.rockwellautomation.com/global/literature-library/overview.page>. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

Start

Use this chapter to become familiar with the design, installation, and safety requirements for iTRAK® systems.

Topic	Page
About the iTRAK System	9
Motor Module	12
Mover	14
Support Frame	15
Power Supplies	16
iTRAK Bus Conditioner	16
Gateway	17
Digital USB I/O Module	17
Catalog Number Explanation	18
Safety Information	19

About the iTRAK System

The iTRAK system is composed of motor modules, mounting plates, bearing rails, and movers. The motor modules are an integrated drive motor system with feedback. Mounting plates can be attached to the sides of motor modules and bearing rails can be attached to the mounting plates. Movers have independent linear motor magnets and bearings, and multiple movers can be operated on a motor module at any time. Movers can be synchronized or independently controlled, however they are programmed.

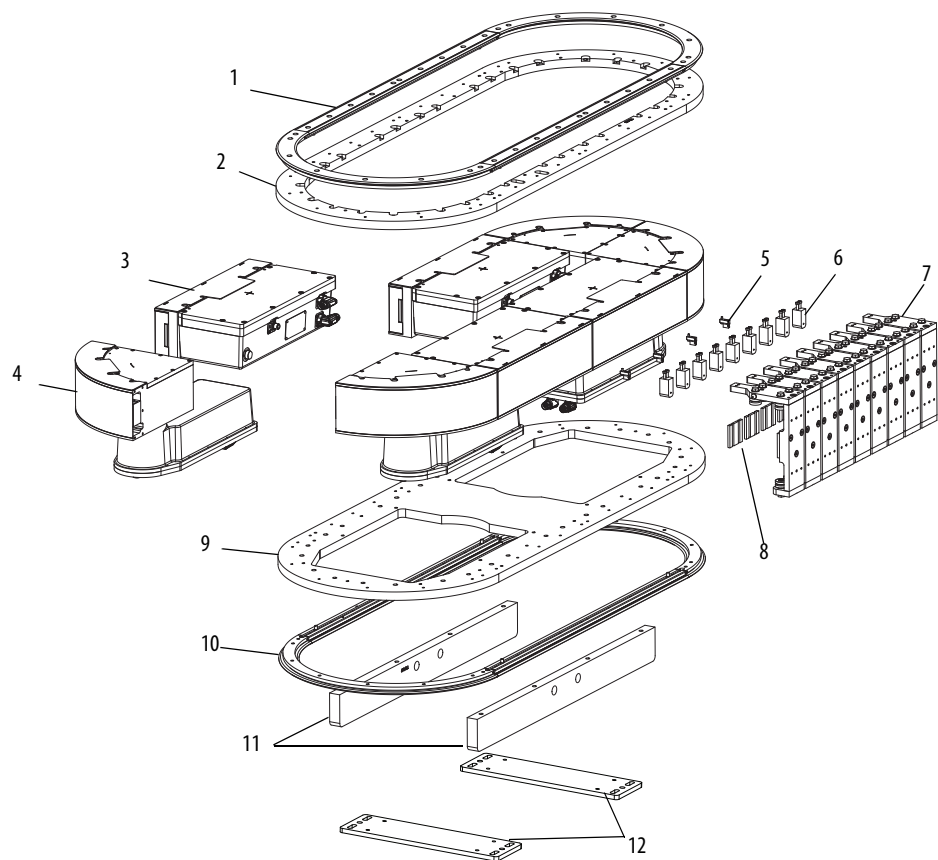
The motor modules are available with both straight and curved motors, and more movers can be added as the system grows. The movers can be stopped and positioned on the curves with high accuracy. When the curves are applied to create an oval, new machine shapes and dynamic performances are possible. The iTRAK system can be arranged and mounted in many configurations, including horizontal carousel, vertical over-under, and stand-up configurations. The system is modular, scalable, and can be expanded to well over 10 meters. Even on large systems, each mover still retains independent servo control. The system can also be built into other geometries such as rectangles.

The iTRAK system can produce high speeds and high forces. The different combinations of magnet sizes and motor coil sizes produce nine different force speed options.

The gateway facilitates communication between the iTRAK system and controller and provides abstraction between physical and virtual mover axes. The iTRAK system requires specialized power supplies that convert three-phase AC power to the appropriate DC bus voltage. The USB I/O module provides discrete communications between the power supplies and the gateway.

An animation of the iTRAK system can be viewed at <https://www.youtube.com/watch?v=1KA0EpQXgx8>.

Figure 1 - Exploded View of the Mechanical and Servo Components



Item	Description
1	Top bearing rail
2	Top frame plate
3	Straight motor modules
4	Curved motor modules
5	Lubrication wipers
6	Position magnets

Item	Description
7	Movers
8	Mover Magnets
9	Bottom frame plate
10	Lower bearing
11	Spine bars
12	Mounting plate

Table 1 - Electromechanical Components of an iTRAK System

iTRAK System Component	Description
Motor module	The motor module is an integrated drive and motor coil unit; it is referred to as a section in the firmware. Motor modules are available in straight and curved shapes.
Track frame	The track frame is designed for your specific application. The track frame in combination with straight and curved modules, and bearing rails creates the track.
Bearing rails	The bearing rails attach to the track frame. They provide high precision guidance for the movers.
Mover	The movers are passive magnetic components. They move along the track in response to the magnetic fields generated by the motor modules. You attach your application end effector to the mover.
Mover magnets (included in mover)	Mover magnet plates can be used to build your own movers to optimize weight or bearing solutions. They are normally included in the mover.
Position magnets	Position magnets are used to actuate sensors in the track. These magnets are typically sold separately from the mover, but are pre-installed on fully assembled systems.
Lubrication wipers	Lubrication wipers are used to spread oil around the track. They are typically attached to some movers, but not all. They are sold separately from the mover, but are pre-installed on fully assembled systems.

Table 2 - Power and Control Components of an iTRAK System

iTRAK System Component	Description
Power circuitry and components	The Power Control Module (PCM) is a fully wired and assembled cabinet. It accepts main power and provides bus power for the motor modules and logic power for the gateway and motor modules. It includes disconnects, fuses, and USB I/O module. It has pre-wired functional safety features such as an E-stop and reset circuit. The iTRAK power supply connects to the Kinetix® 5700 power supply and generates the voltages that are required for the iTRAK system from the full bus voltage. It is used with other Kinetix® 5700 components and branch circuit protection.
Bus conditioner	The bus conditioner module is mounted near the iTRAK for each power cable when using the iTRAK power supply. It incorporates additional filtering and capacitance to improve dynamic servo response and increase reliability of the system.
Power cables	The power bus cables are daisy chained between the motor modules. The number of motor modules on one daisy chain is system-dependent.
Gateway	The Gateway provides communication interface between the Logix controller and all motor modules. It also provides more motion processing for the motor modules.
USB I/O	Executes discrete communication between the Gateway and power components.
Communication cables	Each motor module in the system has a communication cable that is connected directly to the Gateway. Use only the cables that are provided with your system and referenced in this user manual.
Logix controller platform	CompactLogix™ controller or ControlLogix® controller with Ethernet connection that supports Integrated Motion on EtherNet/IP.
Studio 5000 environment	Studio 5000 Logix Designer® application, version 21 or later, provides support to program, commission, and maintain the CompactLogix™ and ControlLogix® controller families that you use with iTRAK system.

You can power your system with a Power Control Module (PCM), which is a fixed output power supply, or a scalable Kinetix 5700 power supply system. The typical system configuration for a PCM powered iTRAK system is shown in [Typical System Configuration Using a PCM](#) on [page 65](#). The typical system configuration for Kinetix 5700 power supply powered iTRAK system is shown in [Typical iTRAK System with an iTRAK Power Supply](#) on [page 37](#).

Motor Module

Your system has two types of motor modules. [Figure 2](#) shows the features of the straight motor module and [Figure 3](#) shows the features of the curved motor module.

Figure 2 - 2198T-L16-Txx04-A00N-2E1E-NS, Straight Motor Module

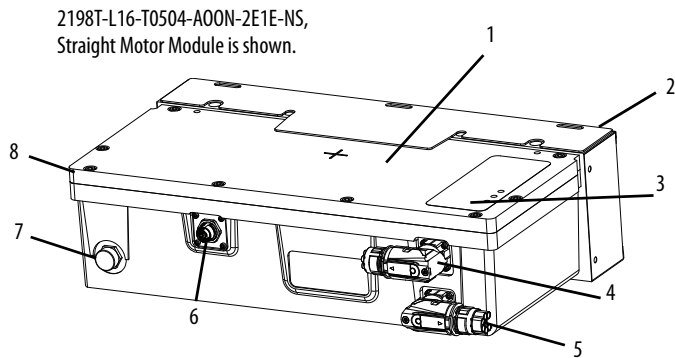


Figure 3 - 2198T-L16-Txx04-B09x-2E1E-NS, Curved Motor Module

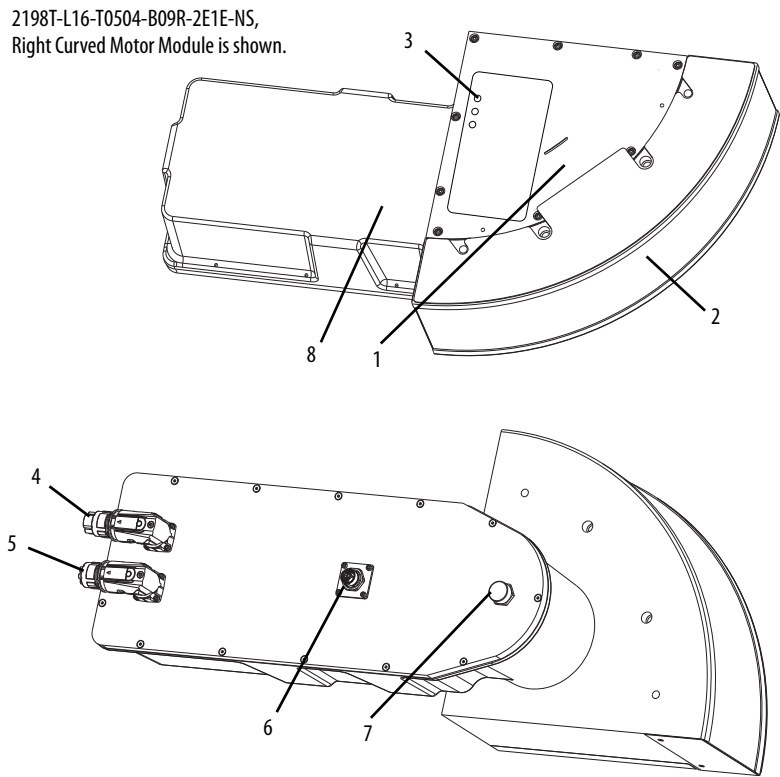


Table 3 - Motor Module Component Description

Item	Description	Item	Description
1	Position sensing surface	5	Incoming bus connector
2	Motor coil assembly	6	Communication connector
3	Motor module status indicator	7	Vent
4	Outgoing bus connector	8	Drive housing

Figure 4 - Series A Motor Module Status Indicators

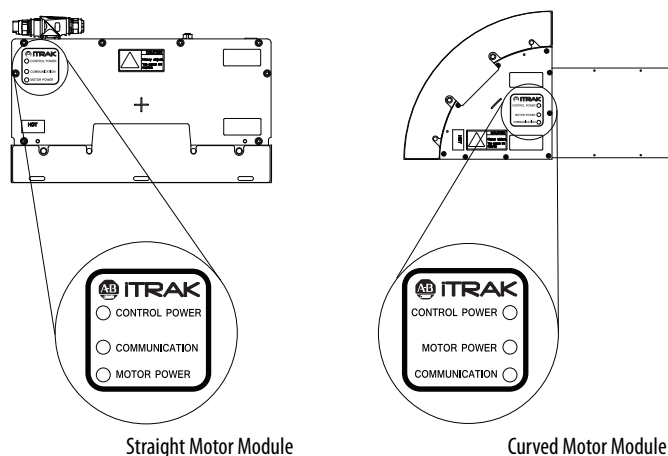


Table 4 - Series A Motor Module Status Indicator Description

Item	Color	Status
Control Power	Green	24V present.
Motor Power	Yellow	Motor module is enabled.
Communication	Green	Motor module is communicating.

Figure 5 - Series B Motor Module Status Indicators

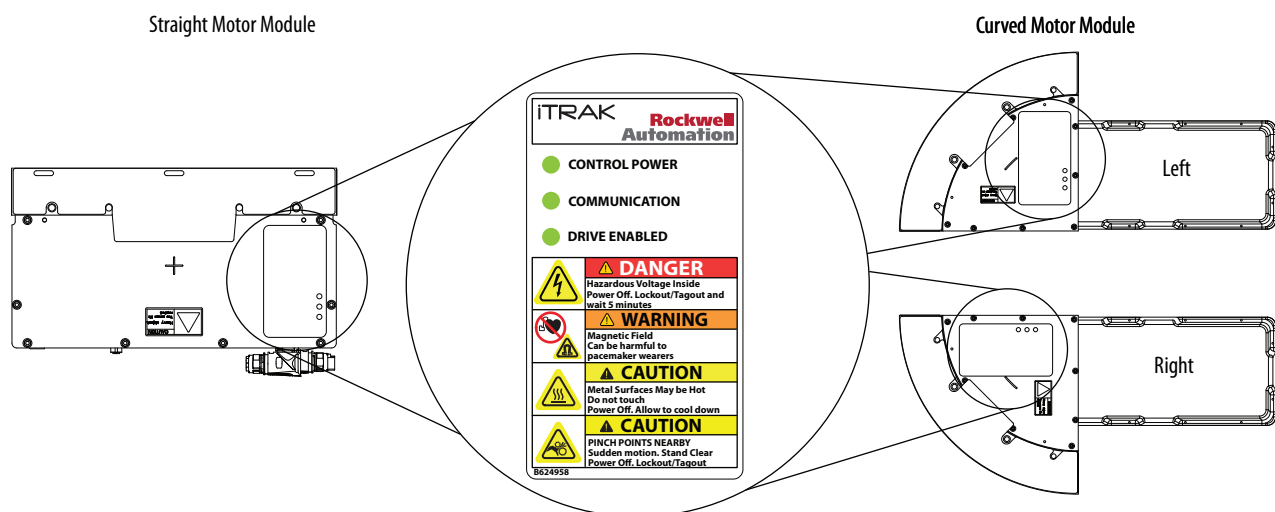


Table 5 - Series B Motor Module Status Indicator Description

Item	Color	Status
Control Power	Green	24V present.
Communication	Green	Motor module is communicating.
Drive Enable	Green	Motor module is enabled.

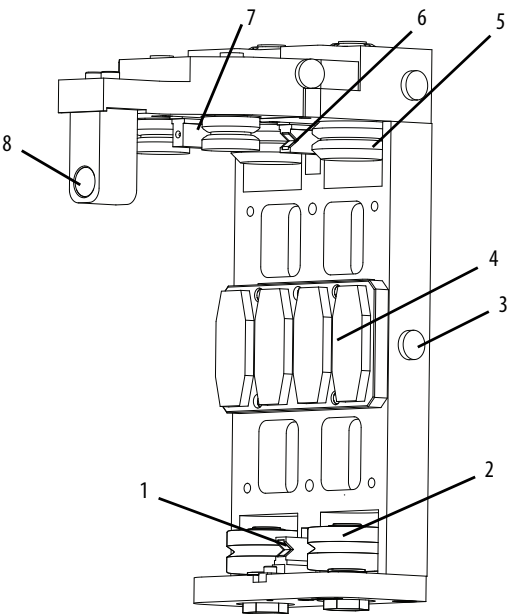
Mover

Movers are available in nine sizes, each with their own force-speed curve. Your system only has one size of mover installed.



ATTENTION: See [Safety Information on page 19](#) before handling a mover.

Figure 6 - 2198T-VTxxx-A, Mover



Shown here is a 2198T-VT0510-A mover and position magnet assembly. Your mover can look slightly different, but will have similar components.

Item	Description
1	Lower bearing-rail lubrication wiper ⁽¹⁾
2	Vee-wheel with integrated bearing (x2)
3	Bumper (x2) for 2198T-VTxx05-A and 2198T-VTxx10-A and (x3) for 2198T-VTxx15-A movers
4	Magnet assembly

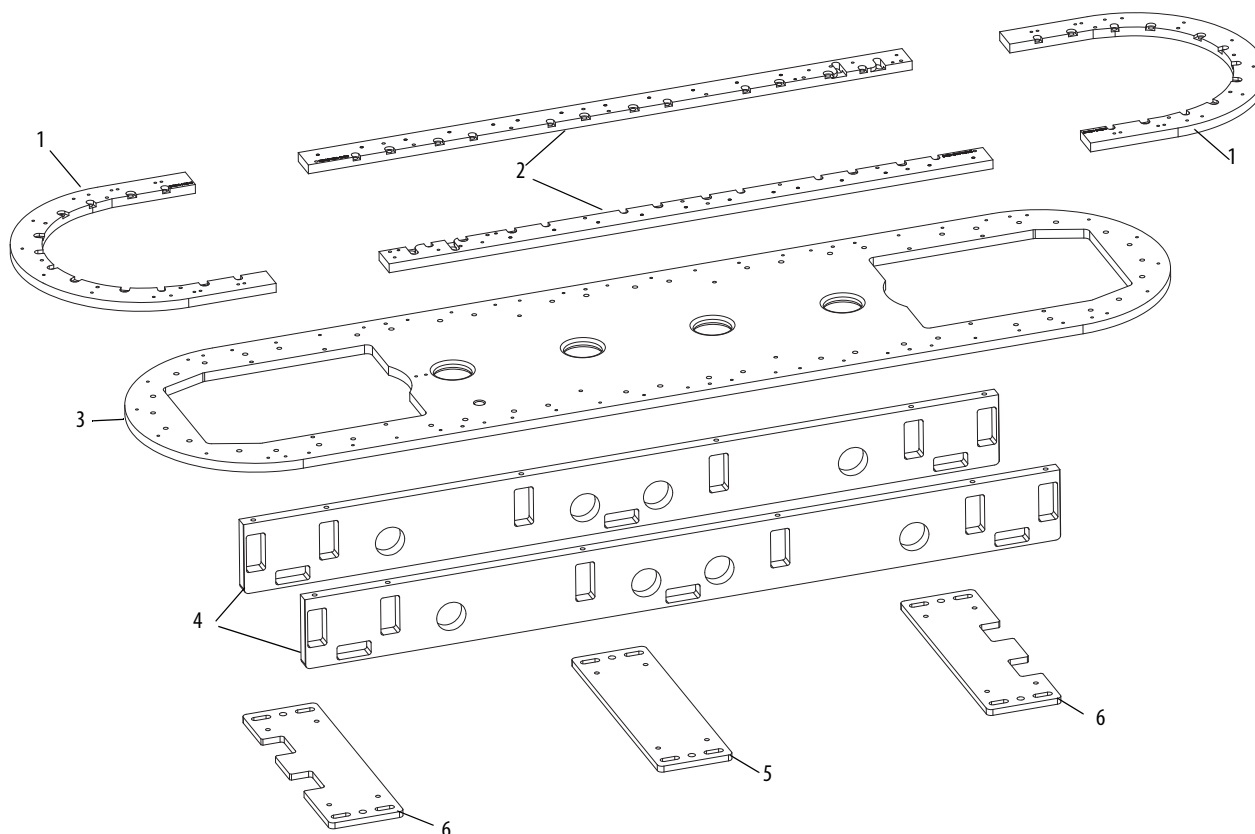
Item	Description
5	Vee-wheel with external bearings (x4)
6	Upper-outer bearing rail lubrication wiper ⁽¹⁾
7	Upper-inner bearing rail lubrication wiper ⁽¹⁾ ⁽²⁾
8	Position feedback magnet (sold separately from the mover)

(1) Not every mover has lubrication wipers. Your system specifications determine the number of movers with lubrication wipers.
(2) 2198T-VTxx05-A movers do not have this lubrication wiper.

Support Frame

The iTRAK system track has a frame to support the motor modules and bearing rails. [Figure 7](#) shows the main components that are used to construct a single-base plate support structure.

Figure 7 - Single Base Plate Support Structure



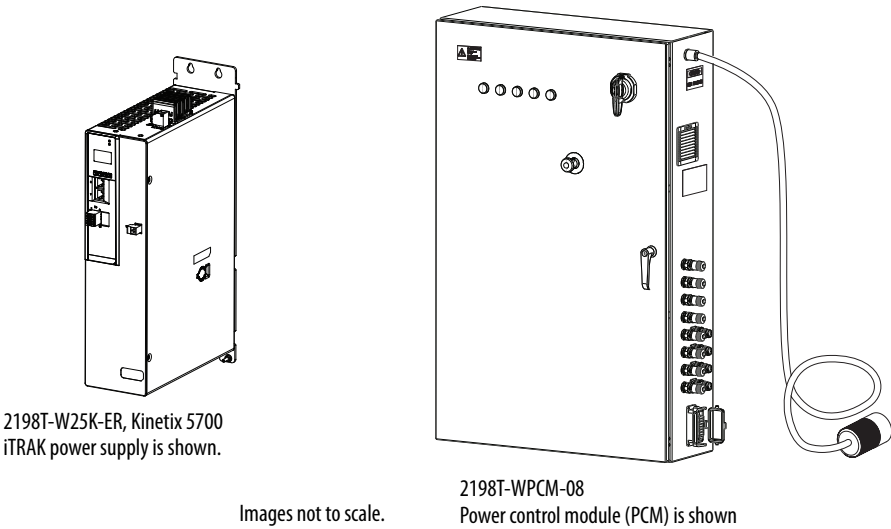
Item	Description
1	Curved top plate
2	Straight top plate
3	Base plate
4	Spine bar
5	Mounting plate
6	Notched mounting plate

Systems that are greater than 2.4 m (8.2 ft) in length use a multi-plate design for items 2, 3, 4. See <https://ramotionanalyzer.blob.core.windows.net/3dmodels/2198T-3DCAD.zip> for more detail.

Power Supplies

The iTRAK system can be powered using a preconfigured Power Control Module (PCM) with fixed output wattage or with a scalable Kinetix 5700 iTRAK power supply as part of a Kinetix 5700 system. Details and installation instructions on for the use of the two power supplies are covered in [Chapter 3](#) and [Chapter 4](#).

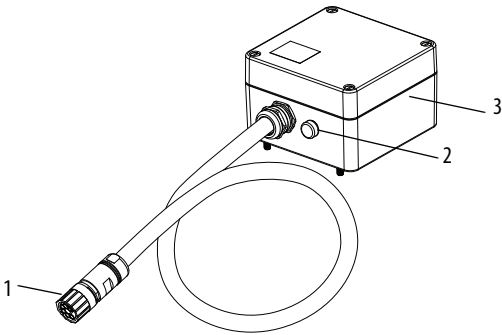
Figure 8 - Two Types of iTRAK Power Supplies



iTRAK Bus Conditioner

The bus conditioner module is mounted near the iTRAK for each power cable when using the iTRAK power supply. The packaging for the bus conditioner is intended to be mounted in the same environments as the iTRAK system. It incorporates additional filtering and capacitance to improve the dynamic servo response and increase reliability of the system.

Figure 9 - 2198T-WBCMOD, iTRAK Bus Conditioner

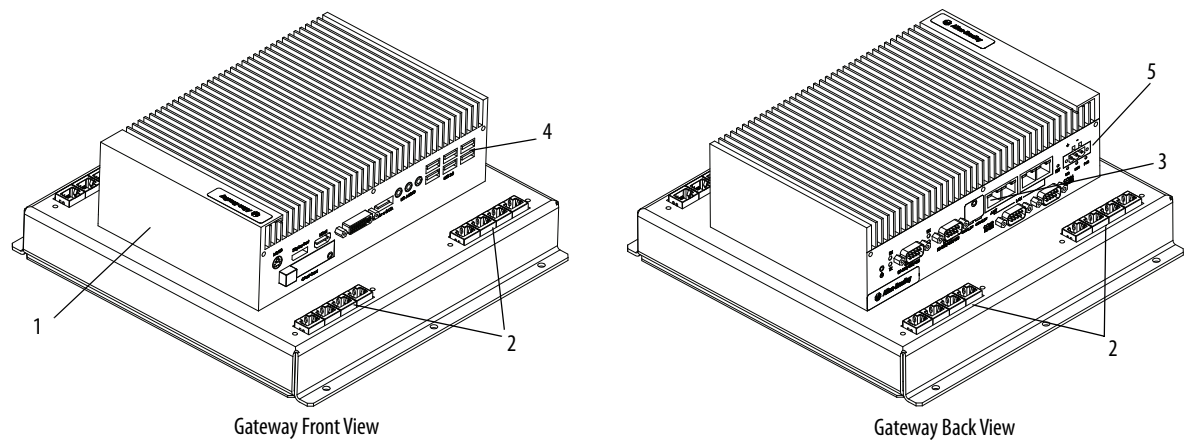


Item	Description
1	Cable and connector to track system
2	Vent
3	Module

Gateway

The gateway provides centralized motion processing and communication between the controller and the motor modules.

Figure 10 - 2198T-G02-016-E, Gateway

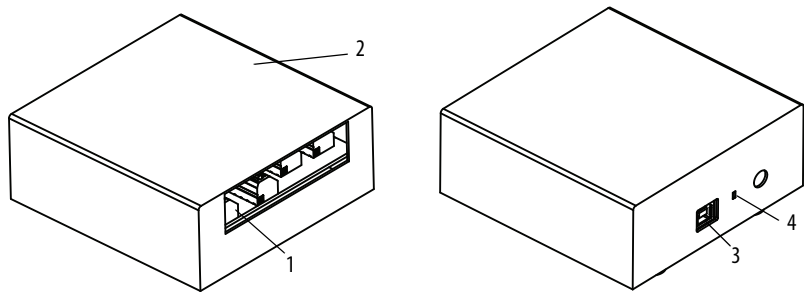


Item	Description	Item	Description
1	Gateway computer	4	USB connections
2	Motor module communication connections	5	24V power input
3	Machine Ethernet connection (AMT)		

Digital USB I/O Module

The digital USB I/O module provides an interface between the power supply that is used by your system and the gateway. This module is integrated in a gateway cabinet and must be included in your system when using Kinetix 5700 iTRAK power supply.

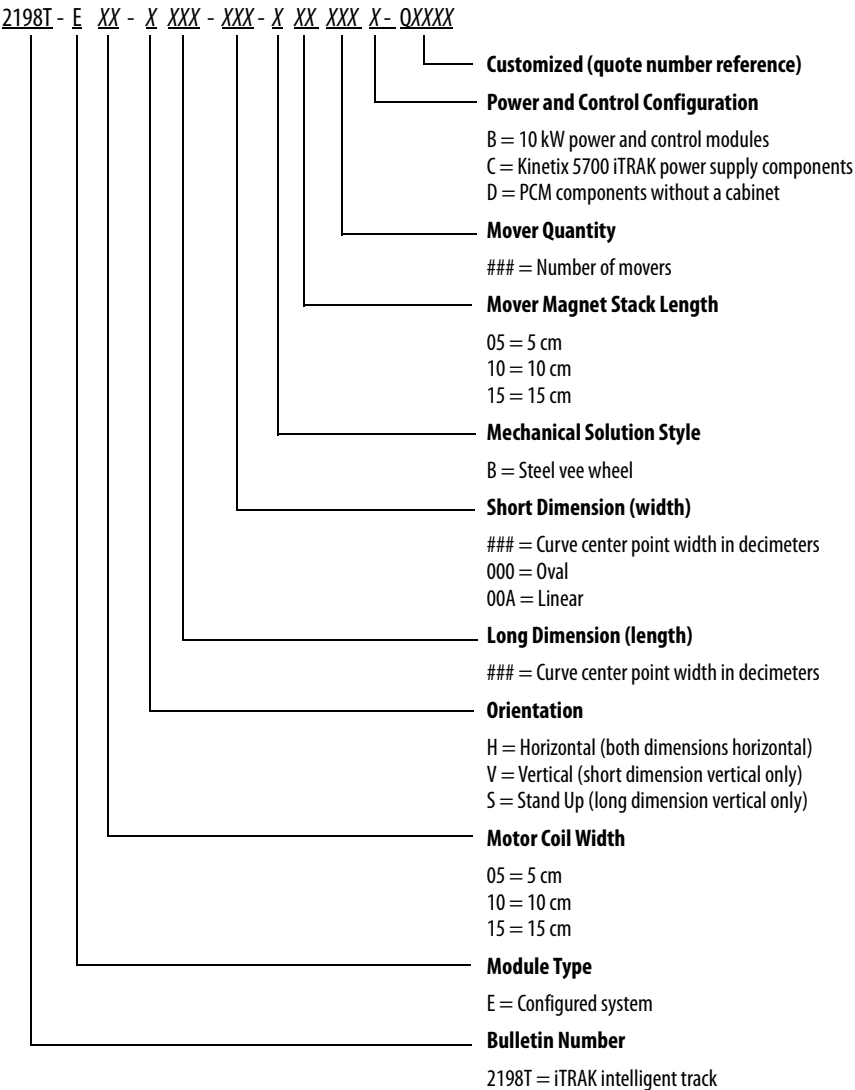
Figure 11 - 2198T-GUSB, Digital USB I/O Module



Item	Description	Item	Description
1	Terminal blocks	3	USB connector
2	Removable cover	4	Power status indicator

The status indicator indicates powers and data transmissions. When the status indicator is in an illuminated steady green state, the module is successfully connected to the gateway computer and the operating system has detected and configured it. When the status indicator blinks continuously, there is data being transmitted over the USB bus.

Catalog Number Explanation Use the following key to identify your iTRAK system and its options.



Safety Information

Follow all safety information that is presented in this section while working with or near an iTRAK system.



ATTENTION: Lockout and tagout input power before servicing.

Before working with iTRAK systems or components, review the EU Declarations of Incorporation, Directive 2006/42/EC that is appropriate for your installation and the [General Assembly Instructions](#).

- 2198T Kinetix iTRAK System with PCM - CE DoC, publication [2198T-CT003](#)
- 2198T Kinetix iTRAK System without PCM - CE DoC, publication [2198T-CT004](#)

The iTRAK system is partly completed machinery. This machinery must not be put into service until the final machinery into which it is to be incorporated has been declared in conformity with relevant provisions of the Machinery Directive.

Risk Assessment

A risk assessment must be prepared for the installation of the machine, within its application conditions, and with the system components installed. As a result of the risk assessment, you must provide for monitoring functions and higher-level measurement for personal safety. The safety regulations applicable to the installation of the machine must be considered. Unintended machine movements or other malfunctions are possible if safety devices are disabled, bypassed, or not activated.

General Assembly Instructions

- When integrating the iTRAK system to tools and external machinery, see <https://ramotionanalyzer.blob.core.windows.net/3dmodels/2198T-3DCAD.zip> for models and outline drawings
- See the iTRAK System Technical Data, publication [2198T-TD001](#) for operational ratings. Do not exceed these ratings.
- The iTRAK system must be only used in the environment specified.
- See [Chapter 2 - Track Installation](#) and [Chapter 3 - Connect Your iTRAK System to a Kinetix 5700 iTRAK Power Supply](#) or [Chapter 4 - Install Your System with a Power Control Module](#) for system installation instructions. Larger iTRAK systems are shipped in multiple sections. Use the special assembly instructions that are provided with these section shipments.

- Although system components have IP65 protection, the mover bearings and rails exposure to water must be minimized, as they can corrode over time.
- Bearing rails must be lubricated. See [Install the Lubrication System](#).
- If necessary, additional precautions must be taken to help prevent excess lubrication from product contamination or external machinery.
- Power and data cables must be managed or located to help prevent trip hazards for machine operators.
- When you install tools on movers, consider that there can be high accelerations and forces in particular when movers transition between straight and curve modules.
 - Consider mass and center of gravity of tools that are mounted to movers.
 - When you fasten tools, and machinery to movers, use the two dowel pins, and four 5 mm screws. Be sure that the screws engage is at least 10 mm (0.39 in.) of thread and the screw is locked in place.
 - When you load movers with product, take care to be sure that they are fastened securely for all anticipated forces and accelerations.
- Do not install ferromagnetic material near the movers. Maintain a minimum distance is 50 mm (2.0 in.) for any installation ferromagnetic material.
- Control systems must be designed and constructed in such a way as to help prevent hazardous situations from arising, see [Chapter 8 - Functional Safety](#).
- Movers can fall when motor power is removed or servo control is disabled on vertical or standup iTRAK system installations.
- Help prevent the risk of contact with parts that move by the use of guards and protective devices, see [Machine Guarding](#).

Machine Guarding

The movers can have high acceleration and carry application loads. The movers experience more acceleration in the curved sections of the track due to vector directional changes. Machine guards and safety enclosures must be implemented to offer protection to personnel. The shielding and enclosure must be designed to help protect against tangential projectiles along the system perimeter.

Avoid Accidents, Injury, and Property Damage

- Mount emergency stop switches in the immediate reach of the operator.
- Keep free and clear of the range of motion of the machine and parts that move. Help prevent personnel from accidentally entering the range of motion by using:
 - Safety fences
 - Protective coverings
 - Safety guards
- Safety fences and protective coverings must be strong enough to resist maximum kinetic energy of the system, See [Machine Guarding on page 20](#).
- Light barriers are not recommended without detailed risk assessment, due to the high kinetic energy of the movers.
- After the drive power is switched off secure vertical axes against falling by:
 - Securing the vertical axes mechanically
 - Adding an external braking, arrester, or clamp mechanism
 - Having sufficient equilibrium of the vertical axes.
- Avoid the operation of high-frequency, remote control, and radio equipment near system electronics and their power supply leads. If the use of these devices is necessary, check that they do not interfere or cause malfunctions in the machine operation. We recommend performing an electromagnetic compatibility test before putting the system into service.

Avoid Electrical Shock



ATTENTION: The PCM, motor modules, Kinetix 5700 iTRAK power supply, and the bus conditioner require 5 minutes to discharge before electrical you handle wire and cable connections.



ATTENTION: Permanent magnets can act as generators when power is removed. The voltage that is generated is proportional to the speed of the movers. The electronics are designed to handle high voltages, however if the cables are not connected, the terminals can have voltage potential of up to 35 V/m/s.

Pinch Point Hazard



ATTENTION: There is a pinch point hazard while installing a mover. A mover can have sudden and fast motion due to magnetic attraction. Do not put fingers between the mover and motor module.

Protection Against Contact with Hot Parts



BURN HAZARD: Some components of the system have hot surfaces.

See [Safety Label Placement on page 129](#) for location of [Hot Surface](#) label.

- Do not touch hot surfaces such as brake resistors, heat sinks, power supply units, drive controllers, motors, windings, and laminated cores.
- Temperatures of the track motor-stator covers can be higher than 60° C (140° F) during or after operation.
- After powering down the motor modules, let them cool before touching. Motor modules can require 140 minutes to cool.
- After powering down switching chokes, power supply units, and drive controllers, let them cool for 15 minutes before touching.

Protection Against Magnetic and Electromagnetic Fields During Installation and Use

See [Safety Label Placement on page 129](#) for location of series A motor module labels.

The motor modules, when in use, and permanent motors magnets pose a danger to persons with heart pacemakers, metal implants, and hearing aids.



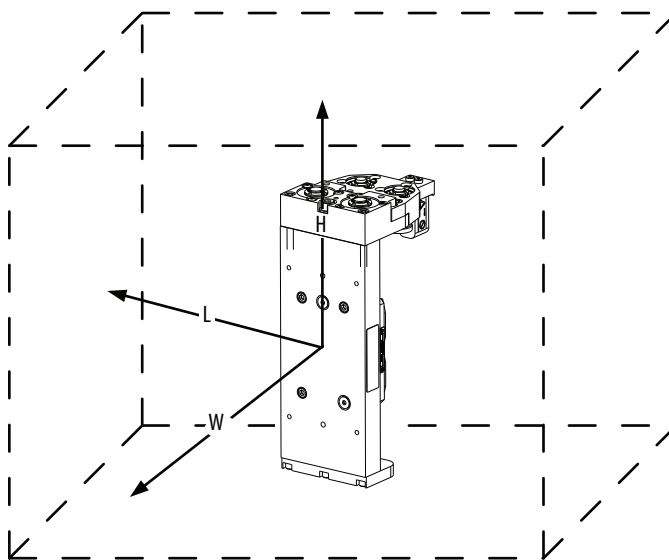
ATTENTION: The mover uses strong magnets. There is a risk of health hazard for persons with heart pacemakers, metal implants, and hearing aids while in proximity of magnetic and magnetic-field producing components. The magnetic field that is generated can disrupt the functionality of automatic-implantable cardioverter defibrillators (AICD). People with cardiac pacemakers must not work near the iTRAK system.

Magnetic Field Strength

The movers of the iTRAK system contain components with strong magnetic fields. The motor modules also produce magnetic fields while movers are being commanded. This section shows the strength of the field for an enabled mover, uninstalled mover, and an uninstalled position magnet.

When motion is present on the system, the magnetic field does not exceed 0.05 mT at 500 mm (19.7 in.) in any direction from the track. Ferrous metals can influence the magnetic field direction and strength. For the most accurate data, measure the magnetic field strength on a track that is installed in its final configuration.

Figure 12 - Mover Magnetic Field Orientation



To avoid the interaction with magnetic field, [Table 6](#) shows the magnetic field strength versus distances from the center point of an uninstalled mover.

Table 6 - Magnetic Field Strength of an Uninstalled Mover

Cat. No.	Magnetic Strength											
	0.05 mT				0.1 mT				0.5 mT			
	L (+/-) mm (in.)	W+ mm (in.)	W- mm (in.)	H (+/-) mm (in.)	L (+/-) mm (in.)	W+ mm (in.)	W- mm (in.)	H (+/-) mm (in.)	L (+/-) mm (in.)	W+ mm (in.)	W- mm (in.)	H (+/-) mm (in.)
2198T-VT0505-A	180 (7.1)	145 (5.7)	310 (12.2)	90 (3.5)	140 (5.5)	120 (4.7)	130 (5.1)	70 (2.8)	90 (3.5)	65 (2.6)	95 (3.7)	55 (2.1)
2198T-VT0510-A	215 (8.5)	175 (6.9)	375 (14.8)	140 (5.5)	180 (7.1)	135 (5.3)	260 (10.2)	120 (4.7)	125 (4.9)	70 (2.8)	140 (5.5)	55 (2.1)
2198T-VT0515-A	220 (8.7)	190 (7.5)	320 (12.6)	140 (5.5)	190 (7.5)	145 (5.7)	190 (7.5)	130 (5.1)	140 (5.5)	70 (2.8)	100 (3.9)	50 (2.0)
2198T-VT1005-A	170 (6.7)	200 (7.9)	230 (9.1)	165 (6.5)	120 (4.7)	150 (5.9)	160 (6.3)	145 (5.7)	70 (2.8)	60 (2.4)	110 (4.3)	75 (3.0)
2198T-VT1010-A	230 (9.1)	200 (7.9)	360 (14.2)	165 (6.5)	200 (7.9)	150 (5.9)	255 (10.0)	150 (5.9)	150 (5.9)	70 (2.8)	135 (5.3)	80 (3.1)
2198T-VT1015-A	260 (10.2)	200 (7.9)	300 (11.8)	170 (6.7)	220 (8.7)	155 (6.1)	200 (10.0)	150 (5.9)	150 (5.9)	85 (3.3)	120 (4.7)	80 (3.1)
2198T-VT1505-A	180 (7.1)	255 (10.0)	310 (12.2)	240 (9.4)	140 (5.5)	180 (7.1)	190 (7.5)	220 (8.7)	90 (3.5)	65 (2.6)	125 (4.9)	95 (3.7)
2198T-VT1510-A	245 (9.6)	225 (8.9)	375 (14.8)	190 (7.5)	220 (8.7)	165 (6.5)	260 (10.2)	180 (7.1)	175 (6.9)	70 (2.8)	140 (5.5)	105 (4.1)
2198T-VT1515-A	300 (11.8)	210 (8.3)	320 (12.6)	200 (7.9)	250 (9.8)	165 (6.5)	210 (8.3)	170 (6.7)	160 (5.9)	85 (3.3)	140 (5.5)	110 (4.3)

To avoid the interaction with magnetic field, [Table 7](#) shows the magnetic field strength versus distances from the center point of a mover that is installed on a track.

Table 7 - Magnetic Field Strength of an Installed Mover, Enabled at Zero Speed

Cat. No.	Magnetic Strength								
	0.05 mT			0.1 mT			0.5 mT		
	L (+/-) mm (in.)	W mm (in.)	H (+/-) mm (in.)	L (+/-) mm (in.)	W mm (in.)	H (+/-) mm (in.)	L (+/-) mm (in.)	W mm (in.)	H (+/-) mm (in.)
2198T-VT0505-A	220 (8.7)	125 (4.9)	125 (4.9)	195 (7.7)	95 (3.7)	70 (2.8)	75 (3.0)	40 (1.6)	55 (2.2)
2198T-VT0510-A	250 (9.8)	95 (3.7)	130 (5.1)	210 (8.3)	60 (2.4)	120 (4.7)	120 (4.7)	20 (0.8)	55 (2.2)
2198T-VT0515-A	300 (11.8)	150 (5.9)	140 (5.5)	220 (8.7)	100 (3.9)	130 (5.1)	120 (4.7)	30 (1.2)	60 (2.4)
2198T-VT1005-A	330 (13.0)	125 (4.9)	170 (6.7)	175 (6.9)	95 (3.7)	130 (5.1)	75 (3.0)	40 (1.6)	70 (2.8)
2198T-VT1010-A	340 (13.4)	130 (5.1)	165 (6.5)	190 (7.5)	100 (3.9)	125 (4.9)	100 (3.9)	40 (1.6)	65 (2.6)
2198T-VT1015-A	360 (14.2)	130 (5.1)	170 (6.7)	290 (11.4)	105 (4.1)	130 (5.1)	130 (5.1)	40 (1.6)	105 (4.1)
2198T-VT1505-A	440 (17.3)	125 (4.9)	215 (8.5)	195 (7.7)	95 (3.7)	190 (7.5)	75 (3.0)	40 (1.6)	85 (3.3)
2198T-VT1510-A	430 (16.9)	165 (6.5)	200 (7.9)	210 (8.3)	140 (5.5)	130 (5.1)	120 (4.7)	60 (2.4)	70 (2.8)
2198T-VT1515-A	420 (16.5)	150 (5.9)	200 (7.9)	360 (14.2)	110 (4.3)	130 (5.1)	140 (5.5)	50 (2.0)	150 (5.9)

Figure 13 - Position Magnet Magnetic Field Orientation

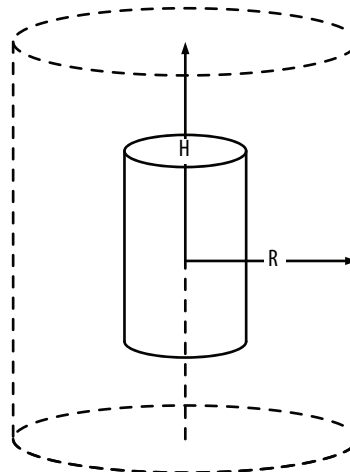


Table 8 - Magnetic Field Strength of an Uninstalled Position Magnet

Cat. No.	Magnetic Strength					
	0.05 mT		0.1 mT		0.5 mT	
	R mm (in.)	H (+/-) mm (in.)	R mm (in.)	H (+/-) mm (in.)	R mm (in.)	H (+/-) mm (in.)
2198T-NN-318 2198T-NS-318	135 (5.3)	276 (10.9)	120 (4.7)	221 (8.7)	80 (3.1)	131 (5.2)

Safe Magnet Handling



ATTENTION: The strong magnets of the mover can attract metal objects that are in its proximity. When you handle and install, maintain distance between the mover and ferrous metal mounting surfaces or structures.

Maintenance personnel must avoid the use of metallic tools and secure items such as badge clips and other personnel effect that could be attracted to the strong magnetic field.

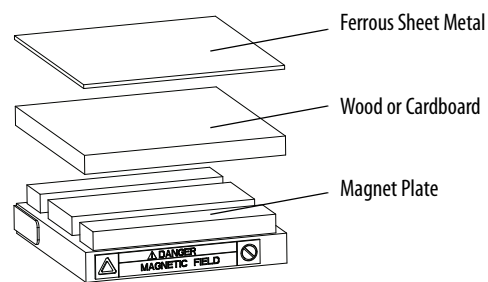
Strong magnets can erase magnetic media. Never let credit cards or electronic media contact or come near the mover or iTRAK system.

- The track creates strong magnetic fields while energized during operation.
- Persons with heart pacemakers, metal implants, or hearing aids must not enter the following areas.
 - Where components of the drive and control systems are mounted, commissioned, and operated.
 - Where parts of motors with permanent magnets are stored, repaired, or mounted.

Magnet Plate Keeper

Exposed or uninstalled magnet plates, whether they are mounted to a mover or free-standing, must have a keeper that covers the entire magnet face. The keeper must consist of 5...10 mm (0.2...0.4 in.) wood or cardboard over the magnets and a 0.5...1.5 mm (0.02...0.06 in.) thick ferrous sheet metal over the wood or cardboard.

Figure 14 - Magnet Plate Keeper



Magnet plates that are covered with a keeper are fairly safe to handle. They must be kept at least 305 mm (12 in.) away from other magnet plates and other ferrous metal parts such as hardware and tools.

Magnet plates without keepers must be kept a minimum of 1 m (3.3 ft) away from other magnet plates and ferrous metal parts.

Notes:

Track Installation

Use this chapter to install an iTRAK® system track and lubrication system.

Topic	Page
Install the Track	27
Install the Lubrication System	32

Choose the location for system components following these considerations:

- operator and maintenance access to movers and motor modules
- cable lengths
- vibration free surfaces



ATTENTION: Before you start the installation of the system, read the See [Safety Information on page 19](#) to reduce the risk of injury and property damage.



WARNING: Improper use of these components, failure to follow the safety instructions, tampering with the product, or disabling of safety devices could result in property damage, injury, electric shock, or death.

Install the Track

Use the following sections as guide for the installation of your preassembled track. Your track can be made with more or less motor modules than are shown in these procedures, but the same principles apply.

Before You Begin



ATTENTION: There is a risk of injury by improper handling. Injury by crushing, shearing, cutting, hitting can occur while handling system components.

- Only qualified persons can work with components of the system or within their proximity.
- Observe the relevant statutory regulations of accident prevention.
- Use protective equipment such as hard hat, safety goggles, safety shoes, safety gloves while handling system.

- Proper transport, storage, mounting and installation, and care in operation and maintenance are prerequisites for optimal and safe operation of the system.
 - Use suitable equipment for mounting and transport.
 - Use proper tools and use special tools if specified.
 - Use hoist equipment and tools in the correct manner.
 - Avoid jamming and crushing by using safety measures.
 - Do not stand under loads.
- Use the components of the system only in the manner that is defined as appropriate. See [Appropriate Use on page 7](#)
- Follow the safety regulations and requirements of the country in which the system is operated.
- Only operate if the national Electromagnetic Compatibility (EMC) regulations for the application are met.
- In accordance with EMC requirements, the machine or installation manufacturer is responsible for compliance with the limit values as prescribed in the national regulations.

Mount an Oval Track

To mount the oval track or oval track sections, do the following.

1. Calculate the weight of the track or track section.

Frame Size	Weight, Approx
50	123 kg/m (83 lb/ft)
100	156 kg/m (105 lb/ft)
150	189 kg/m (127 lb/ft)

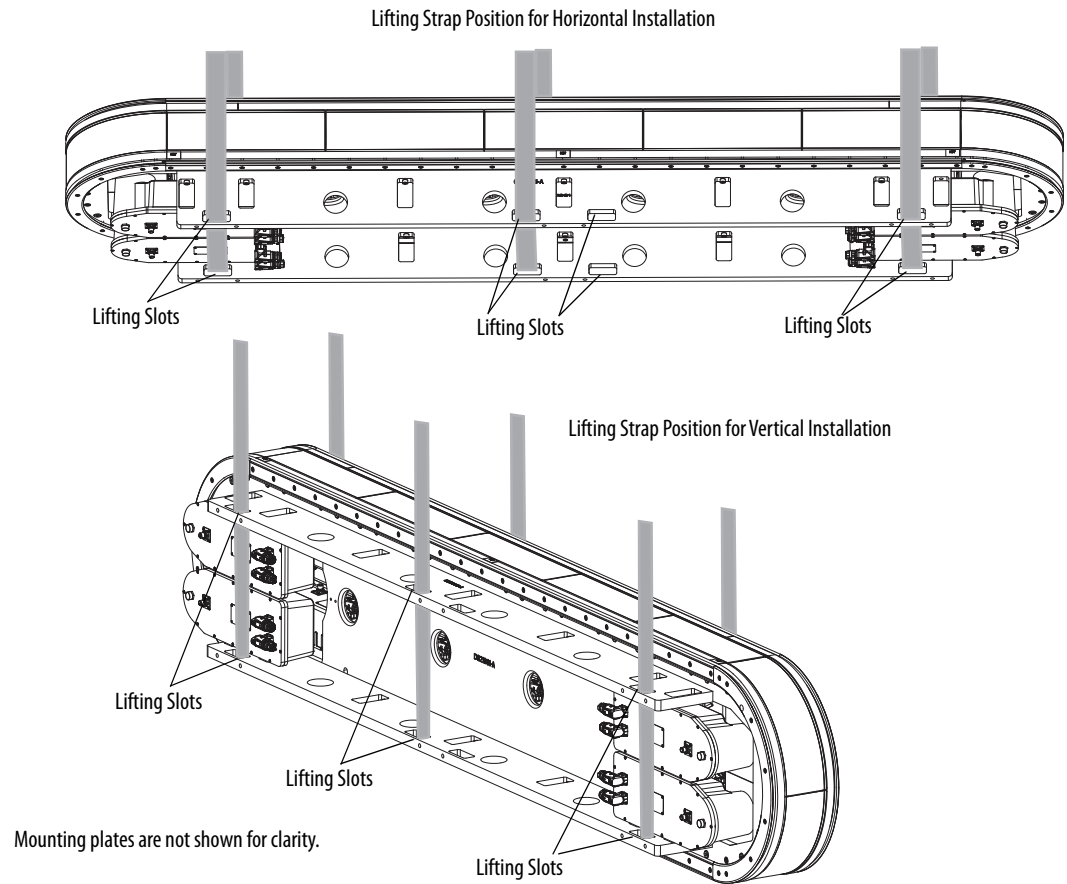
IMPORTANT Be sure that the lifting machinery can lift the load.

2. Make sure that the mounting surface supports the track evenly so that it is free of mechanical stress and distortion.

If mounting the iTRAK track directly to mounting surface, make sure that the mounting surface has a flatness of 0.05 mm per 300 x 3 00 mm (0.002 in. per 11.8 x 11.8 in.). For systems longer than 2400 mm (94.48 in.), we recommended that you use leveling feet between iTRAK mounting plates and the mounting surface.

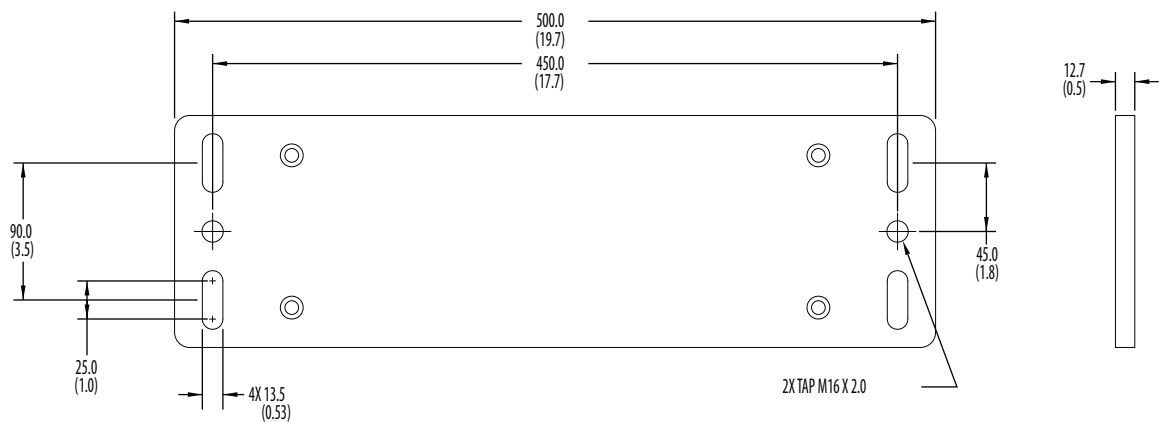
3. Unpack track sections within the crate so that the lifting slots are easily accessible.

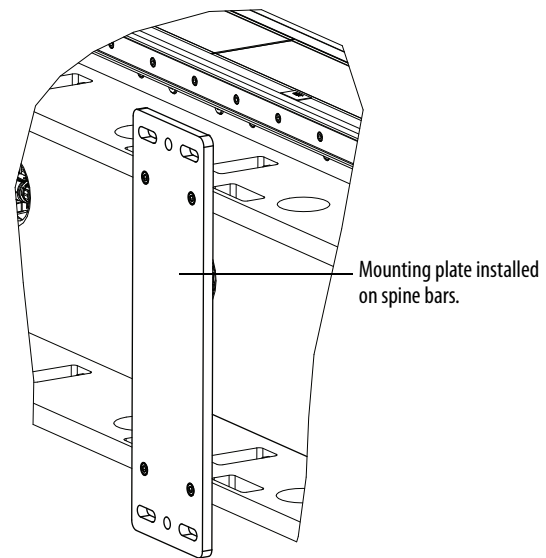
4. Thread lifting straps through lifting slots as necessary for your installation and secure them to lifting machinery.



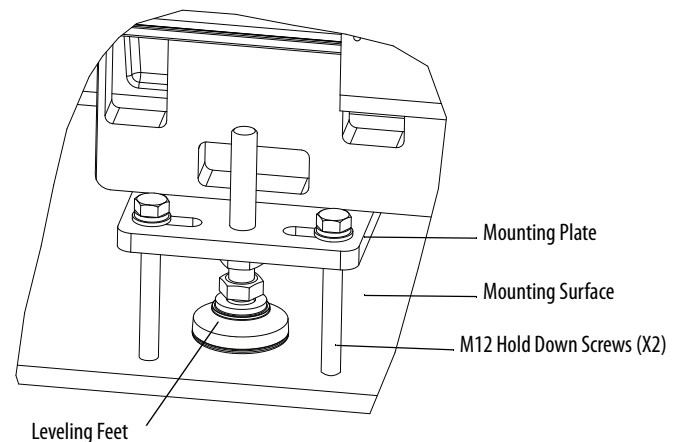
5. Lift and transfer track section to its intended location.

Mount by using the M16 x 2 threaded holes and the slots in mounting plate.





We recommend using leveling feet at each mounting point. For example, Misumi Adjuster Feet - Resin Rubber Type, Misumi part number AJPDR16-100E.



6. If your system was shipped multiple segments, do the following, otherwise skip to next step.
 - a. Align track sections by using the shoulder bolt holes of the motor modules and the track frame.
 - b. Apply Loctite 243 (blue) to threads of M10 x 8 socket-head cap screw shoulder bolts and secure the motor module to the adjacent track section.
 - c. Torque shoulder bolts to 13 N•m (9.6 lb•ft).
 - d. Insert bearing rail key in the end of a pre-installed bearing rail.
 - e. Place bearing rail on locator pins.

Bearing rails are scribed with the location identifiers. See mechanical installation drawing that is shipped with your system for placement.

- f. Apply Loctite 243 (blue) to threads of M8 x 25 socket head cap screws, quantity as required, and secure the bearing rail.
- g. Torque all bearing rail screws to 22 N•m (16.22 lb•ft).
- h. Check rail alignment.

If mis-alignment is less than 0.0254 mm (0.001 in.), then restone. If greater than 0.0254 mm (0.001 in.) readjust rail alignment.

- 7. Remove shipping clamps.
- 8. Follow the guidelines in System Design for Control of Electrical Noise Reference Manual, publication [GMC-RM001](#), and Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#) to obtain proper low-impedance grounding for high-frequency electrical noise.

Install the Lubrication System

Catalog number 2198T-AL-SYS iTRAK Lubrication System, comes with a coil of tubing to connect system fittings to the remotely located pumps and system fittings. The assembled pumps have push-to-connect connectors with plugs. These plugs help prevent oil from leaking during shipment. You remove these plugs when you are ready to connect the tubing. The pump fittings contain a check valve to help prevent backflow when a replacement reservoir is installed.

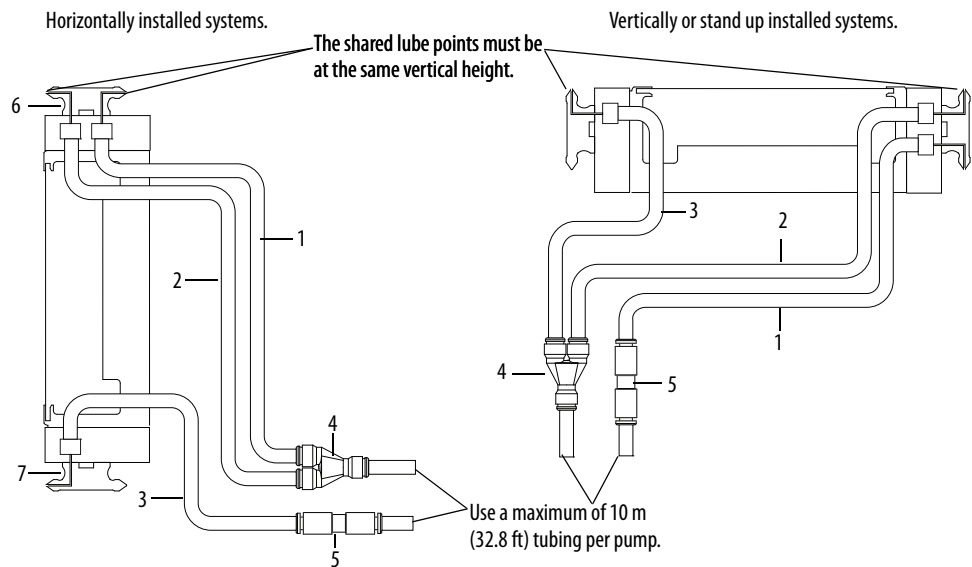
The lubrication system is assembled with right angle fittings. Additional straight hex nipple fittings are provided to let you redirect pump tubing. If your system requires straight exit from the pump, use the supplied straight fittings to replace the right angle fittings. Use Teflon tape for the tapered NPT threads.

The reservoir uses a straight 1/4 BSPP thread. A sealing washer is supplied with the support bracket. Do not use Teflon tape at this joint.

IMPORTANT The lubrication tubes that are provided in your iTRAK system are all of equal length, the equal length splits the flow evenly and avoids back flow. Do not modify their length.

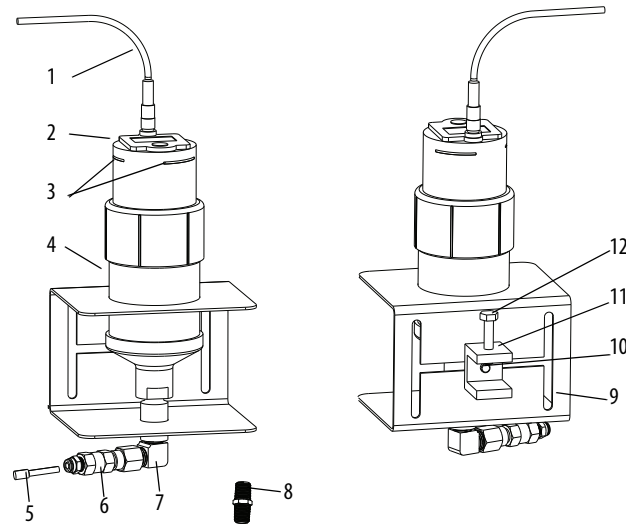
For systems installed horizontally, the shared lube ports are for the top rail. For systems installed vertically or stand up, the shared ports are for the highest weep holes on the upper and lower rail.

Figure 15 - Lubrication Tubing Configuration



Item	Description
1	Top inner lubrication tube
2	Top outer lubrication tube
3	Bottom outer lubrication tube
4	Y-split push-to-connect tube connector

Item	Description
5	Straight push-to-connect tube connector
6	Top rail
7	Bottom rail

Figure 16 - Lubrication Pump Description

Item	Description
1	5 m (16.4 ft) Digital signal cable
2	Digitally activated pump
3	Pump status indicators
4	Lubricant cartridge
5	Plug
6	Check valve

Item	Description
7	Brass elbow fitting
8	Straight brass fitting ⁽¹⁾
9	Mounting bracket
10	0.25-20 x 0.5 bolt
11	Beam clamp
12	0.25-20 x 1.25 bolt

(1) If your installation requires the tubing to exit the pumps vertically, you can replace the brass elbows with the two straight brass nipples that are supplied with the kit.

What You Need

7/16 in. open-end wrench

Mount the Lubricator Pumps

To mount the lubricator pumps, do the following.

1. Locate a mounting position for the pumps.

The pump must be located within the 10 m (32.8 ft) of tube routing distance to the iTRAK system lubrication connectors and 5.0 m (16.4 ft) of the power cable routing distance to 24V I/O port of your controller. The location must be accessible for maintenance and visible for monitoring the pumps status indicators. Observe the clearance requirements that are shown in [Figure 17](#).

- Adjust the beam clamp to accommodate the attachment surface by using a 7/16 in. open-end wrench.

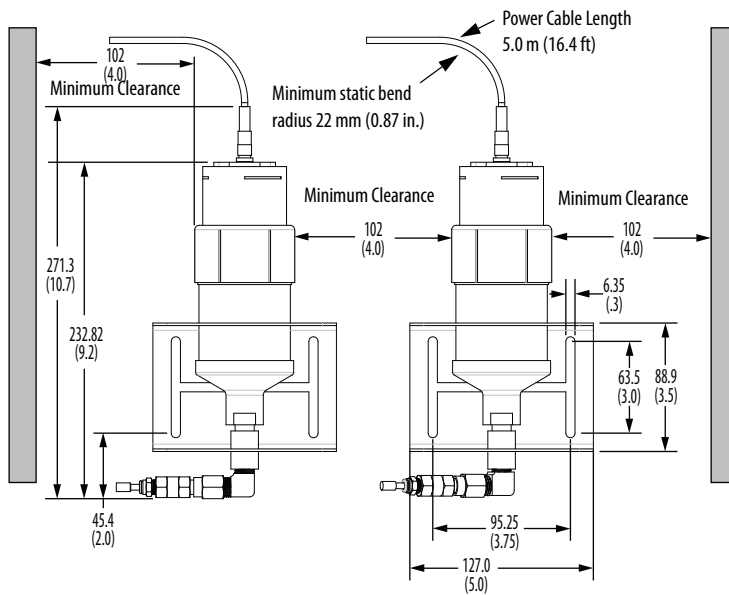
The beam clamp can be positioned anywhere on the H pattern of the mounting clamp.

- Attach the lubricator pumps to their mounting surface by the beam clamp by using 7/16 in. open-end wrench.
- Label, route, and secure the tubing from the pumps to the lubrication connectors on the iTRAK system.
- Remove the plug from the lubricator pump connector and immediately replace with the tubing.

To remove the plug, pull back on the connector face and pull out the plug.

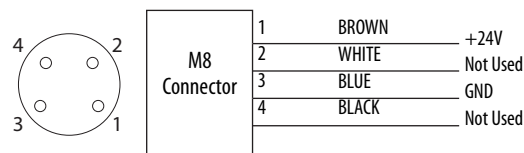
- Repeat [step 5](#) for the other pump and at each connector on the iTRAK system.

Figure 17 - Mounting Dimensions and Clearance



Wiring Lubrication Pump

Connect the power cable the 24V I/O port of your controller.



An initial coating of oil is required on the entire track before operating the iTRAK and auto lubrication systems.

IMPORTANT The mover wheels and lubrication wipers help to distribute the oil on the track. The movers must be in motion when the pump is activated, otherwise the oil drips away.

Lubrication Pump Configuration

Table 9 - Recommend Lubrication Pump Settings

Feature	Setting
Mode	Impulse
Top rail	0.8 cc/pulse
Bottom rail	0.4 cc/pulse

Lubrication Volume Calculation

To calculate the volume of oil that is required to coat the running surfaces of the iTRAK system with 0.025 mm (0.001 in.) thickness of oil.

$$\text{Volume (cc)} = 0.393 + 0.0002445 \times l + 0.033 \times m$$

Where,

l = straight length of track in mm

m = the quantity of movers

EXAMPLE For 1200 mm (94.5 in.) track with eight movers.

$$\text{Volume (cc)} = 0.393 + 0.0002445 \times 1200 + 0.033 \times 8$$

$$\text{Volume (cc)} = 0.9504 \text{ cc}$$

See [Lubrication Examples on page 106](#) for more examples.

Notes:

Connect Your iTRAK System to a Kinetix 5700 iTRAK Power Supply

This chapter contains information for designing a system that uses the iTRAK® power supply, including connectivity to the motor modules, the USB I/O, and the gateway.

The iTRAK power supply derives bus power for and distributes control power to the iTRAK system. It is a Kinetix® 5700 component, and is designed to work with the 2198-Pxxx Kinetix 5700 power supplies as part of a Kinetix 5700 system.

Topic	Page
Typical iTRAK System with an iTRAK Power Supply	37
Design Guidelines	40
iTRAK Power Supply Connector Data	48
Wiring Requirements	51
Wire the iTRAK Power Supply	52
Apply the iTRAK Power Cable Shield Clamp	55
Wire the Digital USB I/O Module	56
Wire the Gateway	57
iTRAK Power Supply Wiring Example	59
Cable Preparation for iTRAK Power Supply Output Power Cables	60
Logix Designer Application Support	63

Typical iTRAK System with an iTRAK Power Supply

The iTRAK power supply interfaces to the gateway computer via a USB I/O module. The gateway sends enable and disable signals and clears faults for iTRAK power supply. The iTRAK power supply reports its status through a relay that the USB I/O monitors.

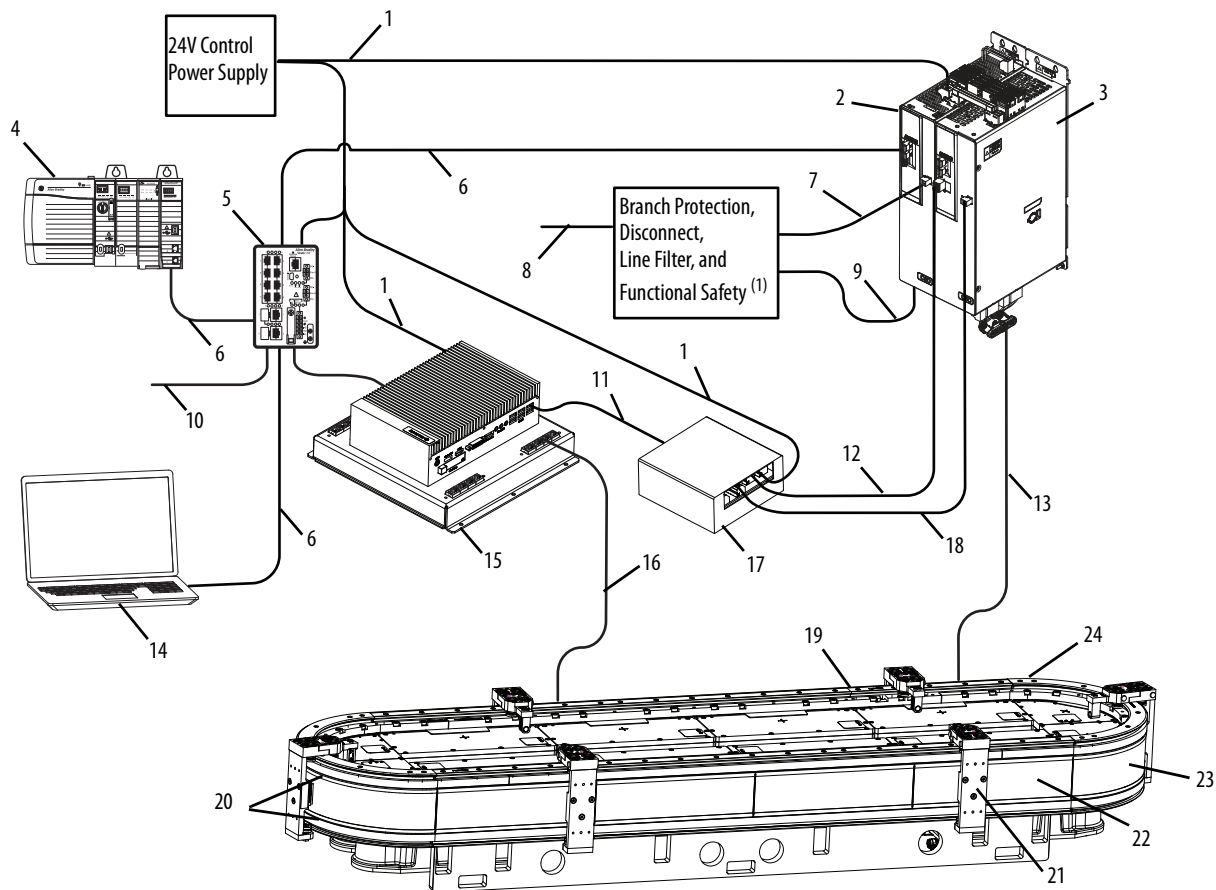
There is sample code for Logix Designer that provides code for the gateway computer to control the iTRAK power supply and interface to the rest of the Kinetix 5700 system. See [Logix Designer Application Support on page 63](#) for more information.



ATTENTION: The correct Logix Designer code must be used as instructed to control the iTRAK power supply and provide fault support to the Kinetix 5700 system. Failure to use the program can result in equipment damage.

Figure 18 is a full view of the system that includes customer supplied components, iTRAK solutions, and wiring.

Figure 18 - Typical iTRAK System with an iTRAK Power Supply



(1) See Kinetix 5700 Servo Drives User Manual, publication [2198-UM002](#), for more information on these components.

Item	Description
1	24V control power
2	Kinetix 5700 power supply
3	Kinetix 5700 iTRAK power supply
4	Controller
5	Managed Ethernet Switch
6	Machine Ethernet
7	Contactor enable signal line
8	Mains power (460V nominal)
9	Kinetix 5700 line voltage
10	Plant Ethernet
11	USB cable
12	iTRAK power supply I/O connections

Item	Description
13	Motor module power bus and control power (number of cables vary by system)
14	Studio 5000® Programming Interface (not supplied with system)
15	Gateway
16	Communication cable to motor module (one cable per motor module)
17	Digital USB I/O module
18	iTRAK ready connection
19	Bearing rail
20	Track frame
21	Mover
22	Straight motor module
23	Curved motor module
24	iTRAK bus conditioner (not visible mounted below track frame)

For detailed information on the installation and how to wire the iTRAK power supply into a Kinetix 5700 system, see the Kinetix 5700 Servo Drives User Manual, publication [2198-UM002](#). The Kinetix 5700 Servo Drives User Manual publication contains the information that is needed for using the other parts of the Kinetix 5700 system, including:

- 2198-Pxxx Kinetix 5700 power supply
- Other Kinetix 5700 components that can be part of your Kinetix 5700 system
- Branch protection, disconnect, and line filter hardware
- Enclosure requirements
- Requirements for EMC and agency compliance
- Kinetix 5700 hardware mounting
- Bonding, wire routing, EMC considerations

As shown in [Figure 18](#), components of the iTRAK power supply based system include items that are listed in [Table 10](#).

Table 10 - Components of an iTRAK System Using an iTRAK Power Supply

Item	Description
iTRAK track	Frame, bearings, motor modules, and movers.
iTRAK power supply, bus conditioner, and power cables	Creates bus voltages and distributes control power for the iTRAK system.
Kinetix 5700 power supply	Creates the bus voltage that is used by other Kinetix 5700 modules, including the iTRAK power supply.
Gateway and communication cables	Controls and coordinates iTRAK motor modules, provides an interface for them to the Logix system. In systems with an iTRAK power supply, the gateway also enables, disables, and clears the faults for the iTRAK power supply.
USB I/O module	The USB I/O module serves as the physical input and output interface between the iTRAK power supply and gateway computer.
Other Kinetix 5700 components and related hardware	Other components that are used in your Kinetix 5700 system and other hardware that is used for connecting the Kinetix 5700 system to three-phase input power, as needed for branch protection, filtering, contactor, and other functions.

Design Guidelines

Use the following guidelines to help design the iTRAK system that includes an iTRAK power supply.

Determine the Number iTRAK Power Supplies Required

The number of iTRAK power supplies can be scaled to match the power needs of the iTRAK system closely. Additional iTRAK power supplies can be added to the system as needed. The following factors impact the number of iTRAK power supplies required for a system.

- Output Bus current
- 24V Control Current
- Cable length

If needed, See [Using Multiple iTRAK Power Supplies](#) for information on how to connect a system with multiple iTRAK power supplies.

Output Bus Current

Sizing is the process of determining the required size and quantity of power hardware components and motor modules for an application. Sizing an iTRAK system involves many variables. Call a Rockwell Automation application engineer to size your system.

24V Control Power

The following criteria must be met for the operation of the system.

- Sufficient current can be delivered.
- The required voltage is maintained at the input to the iTRAK power supply.
- Maximum iTRAK power supply input current is never exceeded.
- Maintaining an acceptable voltage drop from the iTRAK power supply to the iTRAK motor modules, see the [Maximum iTRAK Power Supply to iTRAK Module Cable Length](#).

The iTRAK power supply uses 24V control power to run all low voltage circuits and it distributes 24V control power to the iTRAK motor modules that are connected to it.

24V Current Requirements

Determine the amount of current required; add the current draw of the iTRAK power supply to the current used by each of the motor modules that are connected to that iTRAK power supply. Make sure that you include all iTRAK motor modules that are connected to both the A and B outputs. When designing the system, be sure to account for the 16 A pass through limit of the

iTRAK power supply to the iTRAK motor modules. See iTRAK System Technical Data, publication [2198T-TD001](#) for the amount of current required for the iTRAK power supply and the iTRAK motor modules.

Input Voltage

See [Table 11](#) for the control-power input-voltage requirements. The table shows the voltage that is required at the input connector on the iTRAK power supply. You must take in account for all voltage drops in wiring from the 24V power supply to the iTRAK power supply and the motor modules.

Table 11 - 24V DC Control Power Input (CP) Specifications

Connector	Input Voltage, Max	Input Voltage, Min	iTRAK Power Supply Consumption, Max	Pass Through to Motor Modules, Max	Total at Input, Max
24V DC Control Power Input (CP)	26.4V DC	21.6V DC	1 A	16 A	17 A

Table 12 - 24V DC Control Power Output (ICP) Specifications

Connector	Pass Through to Motor Modules, Max ⁽¹⁾
24V DC Control Power Output to iTRAK (ICP)	16 A

(1) These ratings apply to both the total combined current from connector A and B, and also applies to the rated output for connector A or B individually.

iTRAK Power Supply Output Power Connections

The iTRAK power supply has two sets of output power cable connectors, referenced as A and B; they let you connect two power cables to the iTRAK system. The two sets of connectors have identical sets of signals, they are connected internally, and are interchangeable.

By using multiple cables the iTRAK power supply can deliver control power to more iTRAK motor modules, see [Maximum iTRAK Power Supply to iTRAK Module Cable Length](#).

Maximum iTRAK Power Supply to iTRAK Module Cable Length

Account for the resistive losses in the 2198T-CHBFLS8-12AAxx power cable that connects the iTRAK power supply to motor modules. Make sure that there is sufficient control power voltage at the input to all motor modules. The amount of current flow and the number of motor modules that are connected in series limits the length of this cable.

See [Table 13](#) to determine the maximum length of a power cable that is based on the number of motor modules that are connected to it at the minimum control power input voltage. This table is for 2198T-CHBFLS8-12AAxx cables, which are the only cables supported.

Cables between the iTRAK power supply and the iTRAK system are limited to 30 m (98 ft).

The cable length calculations are made separately for output A and B.

Table 13 - Number of Series A Motor Modules Connected to a Single Input Cable

Cable Length ⁽¹⁾	Motor Module Quantity										
	1	2	3	4	5	6	7	8	9	10	11
3 m (9.8 ft)											
6 m (19.7 ft)											
9 m (29.5 ft)											
12 m (39.4 ft)											
15 m (49.2 ft)											
30 m (98.4 ft)											

(1) The cable lengths that are shown are for the cable from the iTRAK power supply to the first motor module. It is assumed that the subsequent motor modules are connected using short motor module-to-motor module cables.

Table 14 - Number of Series B Motor Modules Connected to a Single Input Cable

Cable Length ⁽¹⁾	Motor Module Quantity																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
3 m (9.8 ft)																		
6 m (19.7 ft)																		
9 m (29.5 ft)																		
12 m (39.4 ft)																		
15 m (49.2 ft)																		
30 m (98.4 ft)																		

(1) The cable lengths that are shown are for the cable from the iTRAK power supply to the first motor module. It is assumed that the subsequent motor modules are connected using short motor module-to-motor module cables.

Choose a 2198-Pxxx Kinetix 5700 Power Supply

The iTRAK power supply connects to the Kinetix 5700 DC-bus created by the 2198-Pxxx, Kinetix 5700 power supply. The Kinetix 5700 power supply must be sufficiently sized to support the iTRAK power supply load and any other servo drive load.

Sizing an iTRAK system involves many variables. Call a Rockwell Automation application engineer to size your system.

The iTRAK power supply creates two power buses that are used by iTRAK motor modules. The topology of the iTRAK motor modules uses the center voltage bus as a return, and the upper and lower as sources.

Once the output current requirements of the iTRAK power supplies are known, the amount of power that is required from the Kinetix 5700 power supply for the iTRAK power supplies is calculated by using this equation.

$$P \text{ (Watts)} = \text{Output Current} * (\text{Nominal Bus Voltage 1} + \text{Nominal Bus Voltage 2}) + \text{iTRAK Power Supply Losses}$$

See Kinetix Servo Drives Specifications Technical Data, publication [KNX-TD003](#), for iTRAK power supply losses

Any other Kinetix 5700 components that are connected to the Kinetix 5700 power supply bus must also be added to this number.

[Table 15](#) shows the nominal bus voltages and currents of the iTRAK power supply.

Table 15 - Bus Output (IDC) Specifications

Connector	Continuous Output Current	Peak Output Current	Nominal H to DC-Voltage	Nominal L to DC- Bus Voltage
Bus Output (IDC) ⁽¹⁾	12.5 A	25.0 A	330V DC	165V DC

(1) These ratings apply to both the total combined current from connector A and B, and also applies to the rated output for connector A or B individually.

The Kinetix 5700 power supply that is used must be able to deliver the total power to be consumed. The Kinetix 5700 Servo Drives User Manual, publication [2198-UM002](#), has more information.

Kinetix Servo Drives Specifications Technical Data, publication [KNX-TD003](#), contains the power ratings of the 2198-Pxxx Kinetix 5700 power supplies. Their power ratings are derived assuming 460V AC line input; scale their power rating based on your line voltage.

Verify that the shunting capacity of the system that the 2198-Pxxx Power Supply manages is not exceeded. For further details, see [Shunting Capacity](#).

Shunting Capacity

The iTRAK power supply can move regenerative energy from the iTRAK system back to the Kinetix 5700 DC bus. The Kinetix 5700 power supply turns on a shunt to limit DC bus voltage if the DC bus voltage gets too high. The amount of shunting capacity available depends on which 2198-Pxxx Kinetix 5700 power supply that is used and whether an external shunt is present. See the Kinetix 5700 Servo Drives User Manual, publication [2198-UM002](#), for more information on shunting capacity.

Kinetix 5700 System Design

When the number of iTRAK power supplies and type of 2198-Pxxx Kinetix 5700 power supplies are known, the Kinetix 5700 system design can be determined.

The important items to be determined and designed are listed here.

- Connections of the Kinetix 5700 components including the iTRAK power supply
- Cabinet selection
- Cabinet layout and wiring
- Other components as required such as contactor and line filter

See the Kinetix 5700 Servo Drives User Manual, publication [2198-UM002](#), for information regarding design of these Kinetix 5700 components.

Cabinet

Cabinet selection is important to maintain a proper temperature and EMC performance. See the Kinetix 5700 Servo Drives User Manual, publication [2198-UM002](#), for information regarding cabinet selection, parts layout, wiring, and other information.

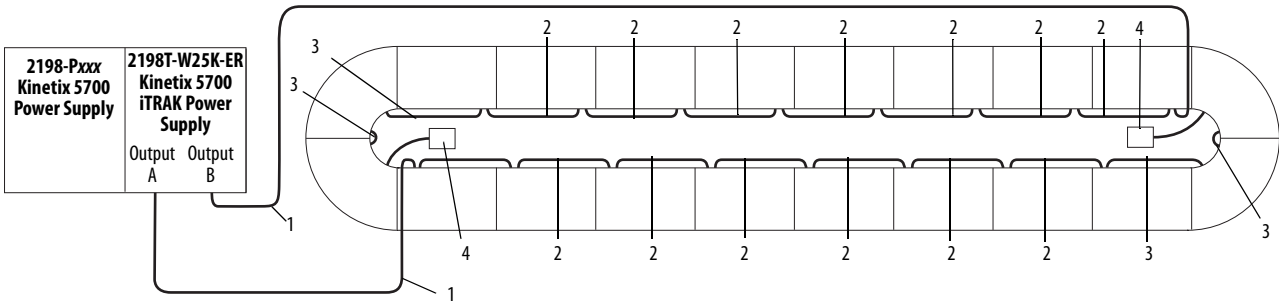
Ethernet Connection

Connection to the EtherNet/IP™ network is not required during runtime for the iTRAK power supply. An Ethernet connection is required when downloading firmware updates by using ControlFLASH™ software.

Wire the iTRAK System

An iTRAK power supply can power up to 20 Series A or 32 Series B motor modules depending on current requirements. See [Figure 19](#) for a typical layout on how to wire a system using one iTRAK power supply. Detailed wiring the connections to the iTRAK power supply are shown in [Figure 30 on page 59](#).

Figure 19 - Wiring an iTRAK System with an iTRAK Power Supply



Item	Description
1	2198T-CHBFLS8-12AAxx, iTRAK power supply to motor module cable
2	2198T-CHBP8S8-12P3, power cable
3	2198T-CHBP8S8-12P6, power cable
4	2198T-WBCMOD, iTRAK bus conditioner

Wiring the connections from multiple iTRAK power supplies is shown in [Figure 20 on page 46](#) and [Figure 21 on page 47](#).

See the Kinetix 5700 Servo Drives User Manual, publication [2198-UM002](#), for details on how to wire the rest of the Kinetix 5700 system. Information on how to wire to the iTRAK power supply is found in [Wire the iTRAK Power Supply on page 52](#).

Using Multiple iTRAK Power Supplies

Follow these guidelines when using multiple iTRAK power supplies in an iTRAK system.

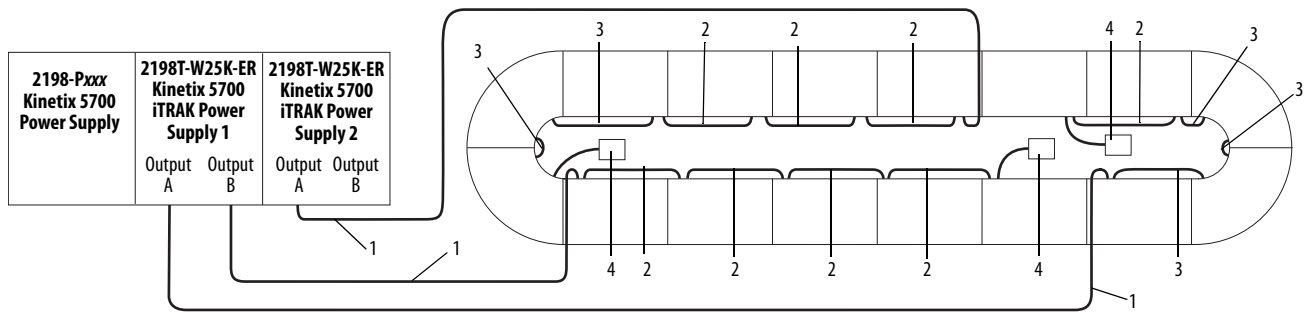
When using multiple iTRAK power supplies, the system must be parsed into separate electrical pieces for each of the iTRAK power supplies.

The iTRAK power supply is not designed to have the output buses of multiple power supplies connected together to create one bus of higher current capacity.

IMPORTANT In systems that use multiple iTRAK power supplies, make sure that the output bus of one power supply is never connected to the output bus of another power supply.

Use the following scenario to understand the use of multiple iTRAK power supplies for systems that require a higher current draw. In this example, part of the track has a high-power demand, and the rest of the track has a lower power demand. In this case iTRAK power supply 1 powers the first group of ten motor modules, while iTRAK power supply 2 provides power to the remaining six motor modules. The DC buses of these two groups are electrically isolated from each other as shown in [Figure 20](#).

Figure 20 - Connecting Multiple iTRAK Power Supplies in a System



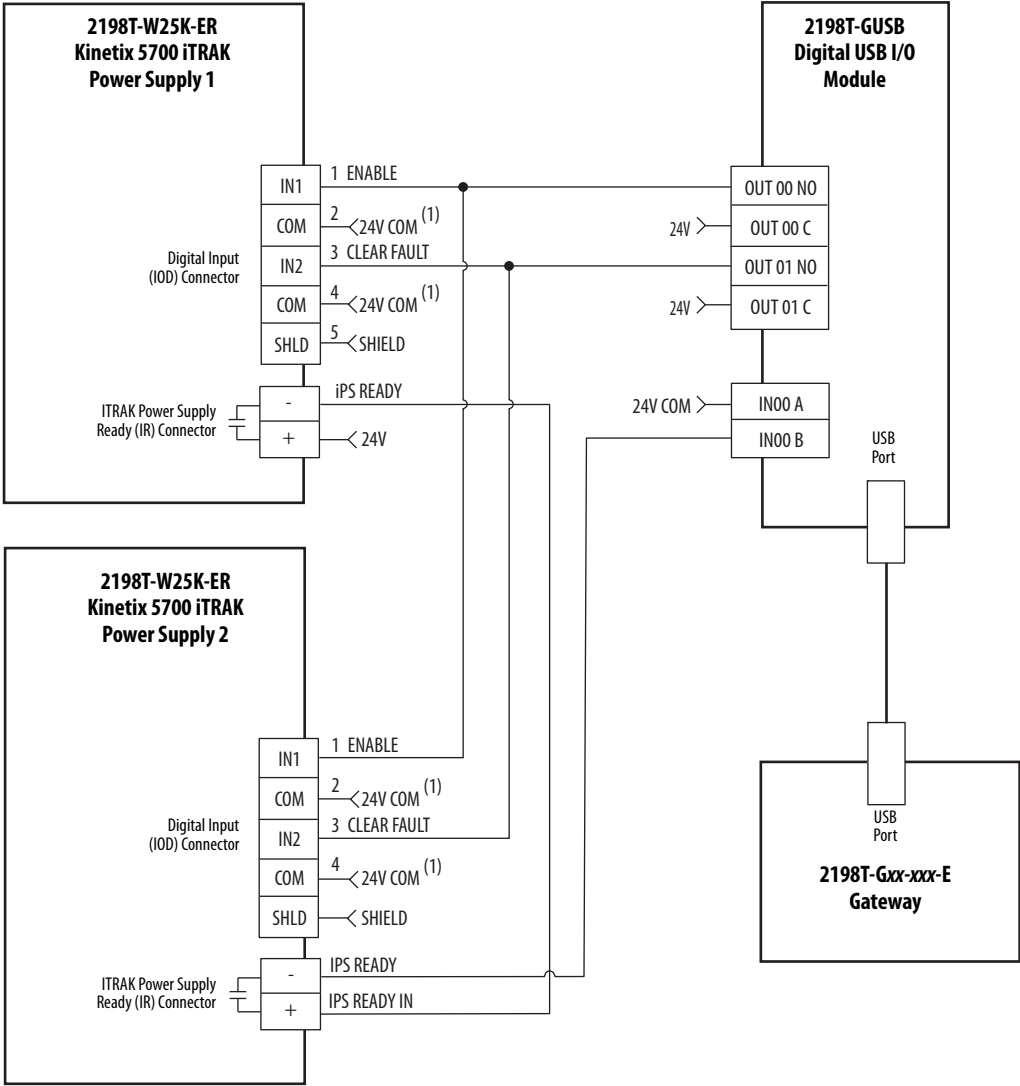
Item	Description
1	2198T-CHBFLS8-12AAxx, iTRAK power supply to motor module cable
2	2198T-CHBP8S8-12P3, power cable
3	2198T-CHBP8S8-12P6, power cable
4	2198T-WBCMOD iTRAK bus conditioner



ATTENTION: Power from iTRAK power supply 1 must not be connected to the power from iTRAK power supply 2.

One gateway can interface to multiple iTRAK power supplies through the Digital USB I/O Module. When you use this configuration, connect the Enable and Clear Fault signals in parallel, and connect the IPS Ready signal in series through all iTRAK power supplies as shown in [Figure 21](#).

Figure 21 - Wiring Multiple iTRAK Power Supplies to the Digital USB I/O Module

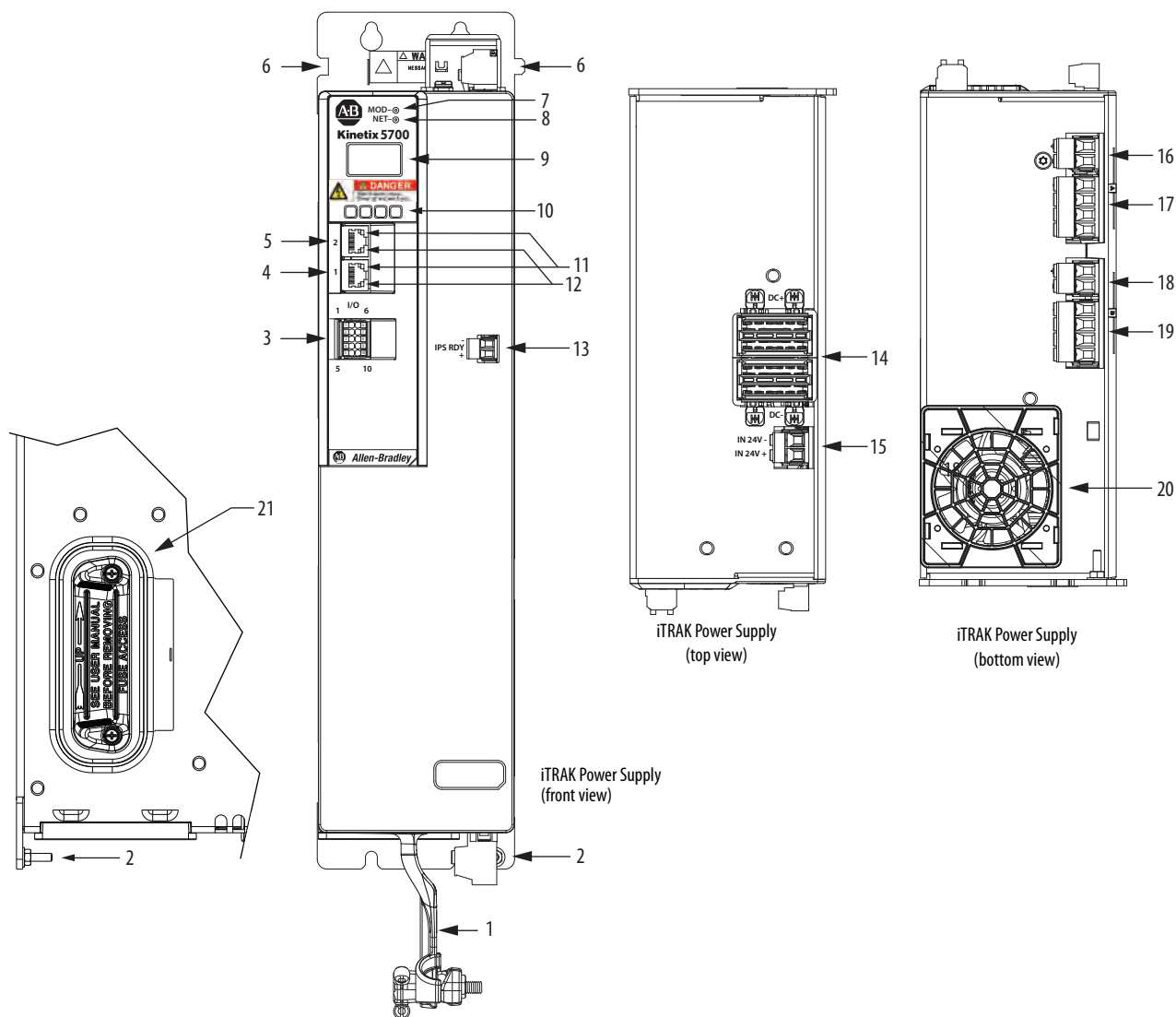


(1) Only one connection to 24V Com is required for each iTRAK power supply. Either pin 2 or pin 4 must be connected, it is not necessary to connect both.

iTRAK Power Supply Connector Data

Use this illustration to identify the iTRAK power supply features and indicators.

Figure 22 - iTRAK Power Supply Features and Indicators (2198T-W25K-ER)



Item	Description
1	Power bus cable clamp
2	Ground lug
3	Digital inputs (IOD) connector
4	Ethernet (PORT1) RJ45 connector
5	Ethernet (PORT2) RJ45 connector
6	Zero-stack mounting tab/cutout
7	Module status indicator

Item	Description
8	Network status indicator
9	LCD display
10	Navigation push buttons
11	Link speed status indicators
12	Link/Activity status indicators
13	iTRAK PS ready (IR) connector
14	DC bus input (DC) connector

Item	Description
15	24V control input power (CP) connector
16	24V control output power (ICP) connector - A
17	DC bus output (IDC) connector - A
18	24V control output power (ICP) connector - B
19	DC bus output (IDC) connector - B
20	Cooling fan
21	Fuse holder

Table 16 - iTRAK Power Supply Connectors

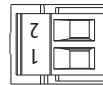
Designator	Description	Connector
DC	DC common bus power	DC-bus links and end caps
CP	24V control input power	2-position plug, terminal screws
IDC	iTRAK DC bus output A and B	4-position plug, terminal screws
ICP	iTRAK 24V control output power A and B	2-position plug, terminal screws
IOD	Digital inputs	10-position plug, spring terminals
IR	iTRAK power supply ready	2-position plug, terminal screws
PORT1, PORT2	Ethernet communication ports	RJ45 Ethernet

Table 17 - DC Bus Input Power Connector

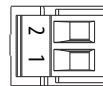
DC Pin	Description	Signal
Bus bar	DC bus connections	DC-
		DC+

Table 18 - Control Input Power (CP) and Control Output Power A and B (ICP) Connectors Pinout

Pin	Description	Signal
2	24V common	24V-
1	24V power supply, customer-supplied	24V+



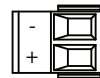
Control Input Power (CP) Connector



Control Output Power A and B (ICP) Connectors

Table 19 - iTRAK Power Supply Ready (IR) Connector Pinout

IR Pin	Description	Signal
2	iTRAK PS ready	RDY-
1		RDY+

**Table 20 - DC Power Bus Output A and B (IDC) Connectors Pinout**

IDC Pin	Description	Signal
4	Chassis ground	GND
3	DC high voltage	H
2	DC low voltage	L
1	DC- bus	DC-

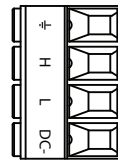
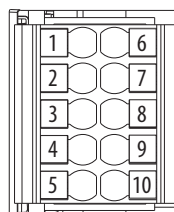


Table 21 - Digital Inputs (IOD) Connector Pinout

IOD Pin	Description	Signal
1	Digital input #1	Enable
2	I/O common for customer-supplied 24V supply	COM
3	Digital input #2	Fault Clear
4	I/O common for customer-supplied 24V supply	COM
5	I/O cable shield termination point	SHLD
6	Digital input #3	IN3
7	I/O common for customer-supplied 24V supply	COM
8	Digital input #4	IN4
9	I/O common for customer-supplied 24V supply	COM
10	I/O cable shield termination point	SHLD



Wiring Requirements

The wire must be copper with 75 °C (167 °F) minimum rating. Phasing of the mains AC power is arbitrary and earth ground connection is required for safe and proper operation.

IMPORTANT The National Electrical Code and local electrical codes take precedence over the values and methods provided.

Table 22 - iTRAK Power Supply (2198T-W25K-ER) Wiring Requirements

Description	Connects to Terminals		Wire Size mm ² (AWG)	Strip Length mm (in.)	Torque Value N·m (lb-in)
	Pin	Signal			
DC-bus input power	Bus bar	DC– DC+	N/A ⁽²⁾	N/A ⁽²⁾	N/A ⁽²⁾
SELV/PELV rated 24V power (connector plug)	CP-1 CP-2	24V+ 24V–	1.5...4 ⁽³⁾ (16...12)	10.0 (0.39)	0.5...0.6 (4.4...5.3)
			6 ⁽³⁾ (10)	10.0 (0.39)	0.7...0.8 (6.1...7.0)
iTRAK power supply ready	IR-1 IR-2	RDY+ RDY–	0.05...2.5 (30...12)	7.0 (0.28)	0.4...0.5 (3.5...4.4)
24V iTRAK control power ⁽¹⁾	ICP-1 ICP-2	24V+ 24V–	1.5...6 (16...10)	10.0 (0.39)	0.7...0.8 (6.1...7.0)
DC-bus output power A and B ⁽¹⁾	IDC-1 IDC-2 IDC-3 IDC-4	DC- L H GND	2.5...6.0 (12...10)	10.0 (0.39)	0.7...0.8 (6.1...7.0)
Digital inputs	IOD-1 IOD-2 IOD-3 IOD-4 IOD-5 IOD-6 IOD-7 IOD-8 IOD-9 IOD-10	Enable COM Clear Fault COM SHLD IN3 COM IN4 COM SHLD	0.20...1.31 (24...16)	10.0 (0.39)	N/A ⁽⁴⁾

(1) The iTRAK control power (ICP) and iTRAK DC bus output (IDC) connections must be made using catalog number 2198T-CHBFLS8-12AAxx.

(2) Shared DC-bus power connections are always made from power supply to power supply over the bus-bar connection system. These terminals do not receive discrete wires.

(3) Use sufficient wire size to support the complete control power load, including Kinetix 5700 modules and pass-through current for the attached motor modules.

(4) This connector uses spring tension to hold wires in place.



ATTENTION: To avoid personal injury and/or equipment damage, observe the following:

- Make sure that installation complies with specifications regarding wire types, conductor sizes, branch circuit protection, and disconnect devices. The National Electrical Code (NEC) and local codes outline provisions for safely installing electrical equipment.
- Use motor power connectors only for connection purposes. Do not use them to turn on or off the unit.
- Ground shielded power cables to help prevent potentially high voltages on the shield.

Wire the iTRAK Power Supply

The following sections cover wiring the iTRAK power supply to an iTRAK system.

For information on how to wire to the input control power (CP) connector and connect the DC-power bus links, see the Kinetix 5700 Servo Drives User Manual, publication [2198-UM002](#).

Wire the Digital Input Connector

The digital inputs are part of a required I/O interface with the gateway. The digital inputs are connected to the gateway through the digital USB I/O module.

Figure 23 - Digital Input Connector Wiring

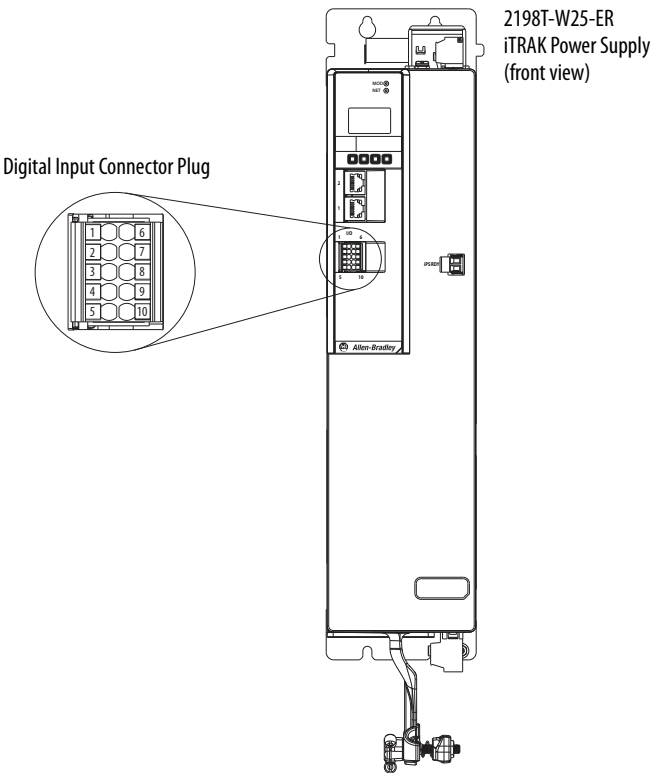


Table 23 - Digital Input Connector Plug Specifications

Description	Pin	Signal	Recommended Wire Size mm ² (AWG)	Strip Length mm (in.)	Torque Value N·m (lb·in)
Digital inputs	I0D-1 I0D-2 I0D-3 I0D-4 I0D-5	Enable COM Clear Fault COM SHLD	0.20...1.31 (24...16)	10.0 (0.39)	— ⁽¹⁾

(1) This connector uses spring tension to hold wires in place.

See [Connecting an iTRAK Power Supply to a System on page 59](#) for wiring diagram information.

Wire the iTRAK PS Ready (IR) connector

The iTRAK PS relay output is part of a required I/O interface with the gateway and is connected to the gateway through the digital USB I/O module.

Figure 24 - iTRAK PS Ready (IR) Connector Wiring - Connector Plug

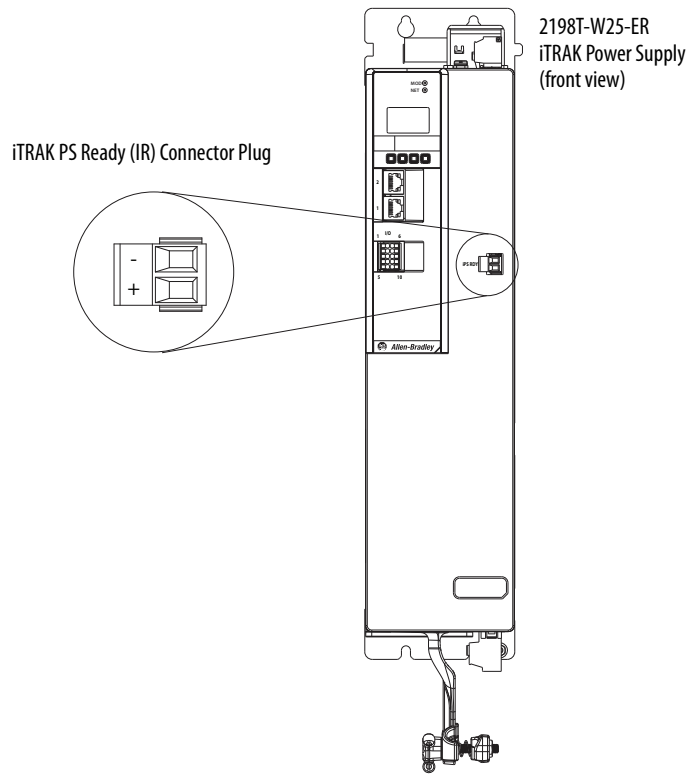


Table 24 - iTRAK PS Ready (IR) Connector Plug Specifications

Description	Pin	Signal	Recommended Wire Size mm ² (AWG)	Strip Length mm (in.)	Torque Value N·m (lb·in)
iTRAK power supply ready	2	-	0.14...2.5 (26...12)	7.0 (0.28)	0.4...0.5 (3.5...4.4)
	1	+			

See [Connecting an iTRAK Power Supply to a System on page 59](#) for wire diagram information.

Wire the iTRAK Power Supply DC Bus and Control Power Output Connectors

The iTRAK power supply uses one cable, 2198T-CHBFLS8-12Axx, to connect to the iTRAK system. The single cable terminates at two connectors on the iTRAK power supply: one for iTRAK control power (ICP) and one for iTRAK DC bus power (IDC). Two sets of these connectors, referenced as A and B, are provided on the iTRAK power supply to allow using two cables for larger iTRAK systems.



ATTENTION: Make sure that the iTRAK power connections are correct when wiring the plugs and that the plug is fully engaged in the module connector. Incorrect wiring, polarity, or loose wiring can cause an explosion or damage equipment.

You can create custom cable lengths by cutting a 2198T-CHBFLS8-12Axx to length, remove the flying lead end and preparing new leads. See [Cable Preparation for iTRAK Power Supply Output Power Cables on page 60](#) for instructions.

Figure 25 - IDC and ICP Connector Wiring

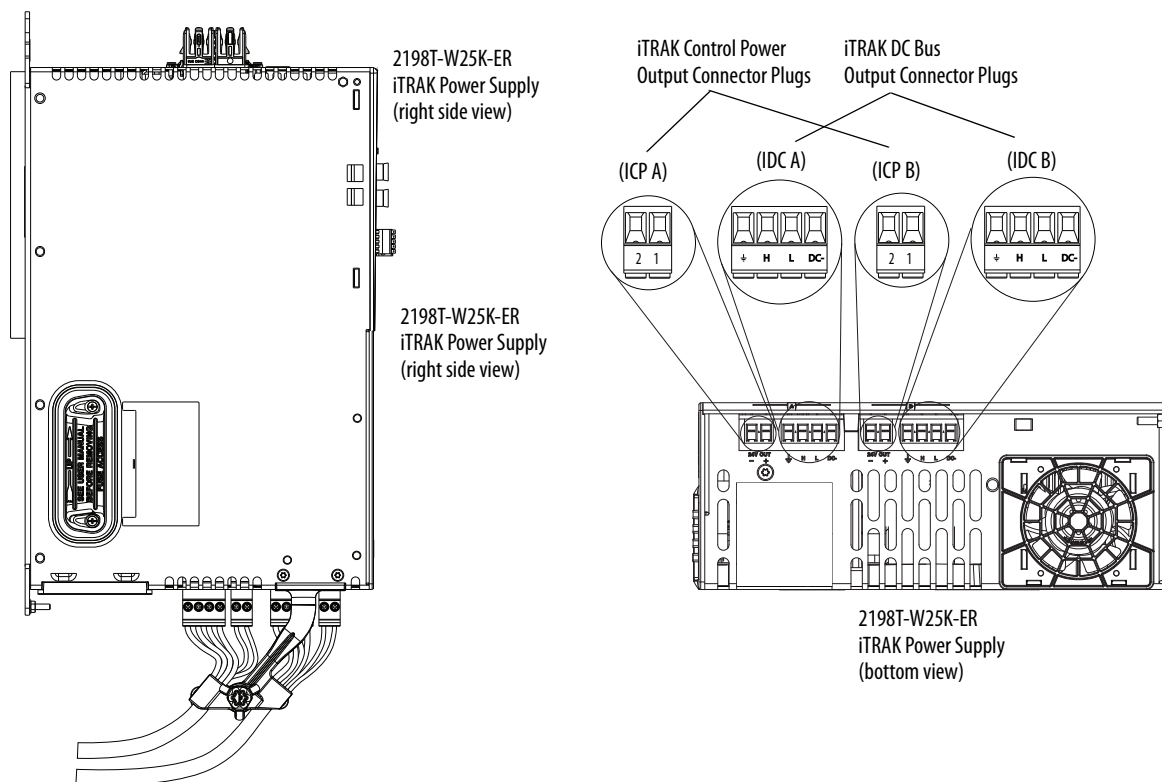


Table 25 - IDC and ICP Connector Wiring

Description	Connects to Terminals		Wire Color	Wire Size mm ² (AWG)	Strip Length mm (in.)	Torque Value N·m (lb·in)
	Pin	Signal				
24V iTRAK control power ⁽¹⁾	ICP-1 ICP-2	24V+ 24V–	White Red	1.5...6 (16...10)	10.0 (0.39)	0.7...0.8 (6.1...7.0)
DC-bus output power A and B ⁽¹⁾	IDC-4 IDC-3 IDC-2 IDC-1	GND H L DC–	Green/Yellow Brown Black Blue	2.5...6.0 (12...10)	10.0 (0.39)	0.7...0.8 (6.1...7.0)

⁽¹⁾ The iTRAK control power (ICP) and iTRAK DC bus output (IDC) connections must be made using catalog number 2198T-CHBFLS8-12AAxx.

Apply the iTRAK Power Cable Shield Clamp

Factory-supplied 2198T-CHBFLS8-12AAxx iTRAK cables are shielded. The braided cable shield must terminate at the iTRAK power supply when installed. A small portion of the cable jacket has been removed to expose the shield braid. The exposed area must be clamped by using the clamp on the bottom front of the iTRAK power supply.

This procedure assumes that you have completed wiring your IDC and ICP connectors and are ready to apply the cable shield clamp.

To apply the iTRAK power-supply cable-shield clamp, do the following.

1. Loosen the clamp knob.
2. Position the exposed portion of each cable braid directly in line with the clamp.
3. Hand tighten the clamp knob.

Only finger-tight torque on the clamp knob is required. The cable must not move within the clamp under its own weight or when slight pressure is applied by hand.

Wire the Digital USB I/O Module

The digital inputs and output from the iTRAK power supply communicate with the gateway through the 2198T-GUSB Digital USB I/O Module.

To access the connectors, do the following.

- 1. Remove the four Phillips head screws that secure the cover.
- 2. Remove the cover.

Figure 26 - 2198T-GUSB, Digital USB I/O Module Connector Wiring

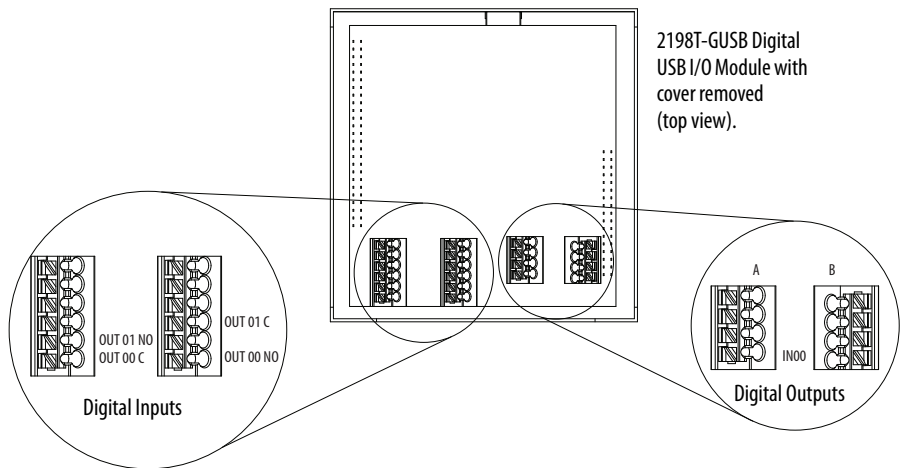
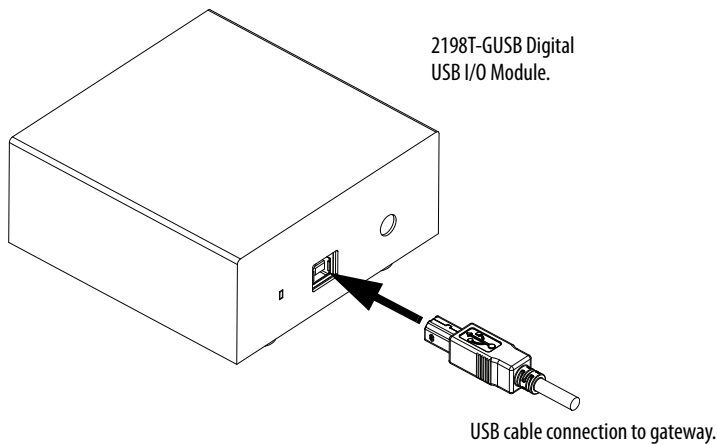


Table 26 - Digital USB I/O Module Connector Specifications

Description	Pin	Signal	Recommended Wire Size mm ² (AWG)	Strip Length mm (in.)	Torque Value N·m (lb·in)
iTRAK power supply ready	IN00 A IN00 B	- +	0.14...2.5 (26...12)	9.0 (0.35)	N/A ⁽¹⁾
Digital inputs	OUT 00 NO OUT 00 C OUT 01 NO OUT 01 C	Enable COM Clear Fault COM	0.20...1.31 (24...16)		

(1) This connector uses spring tension to hold wires in place.

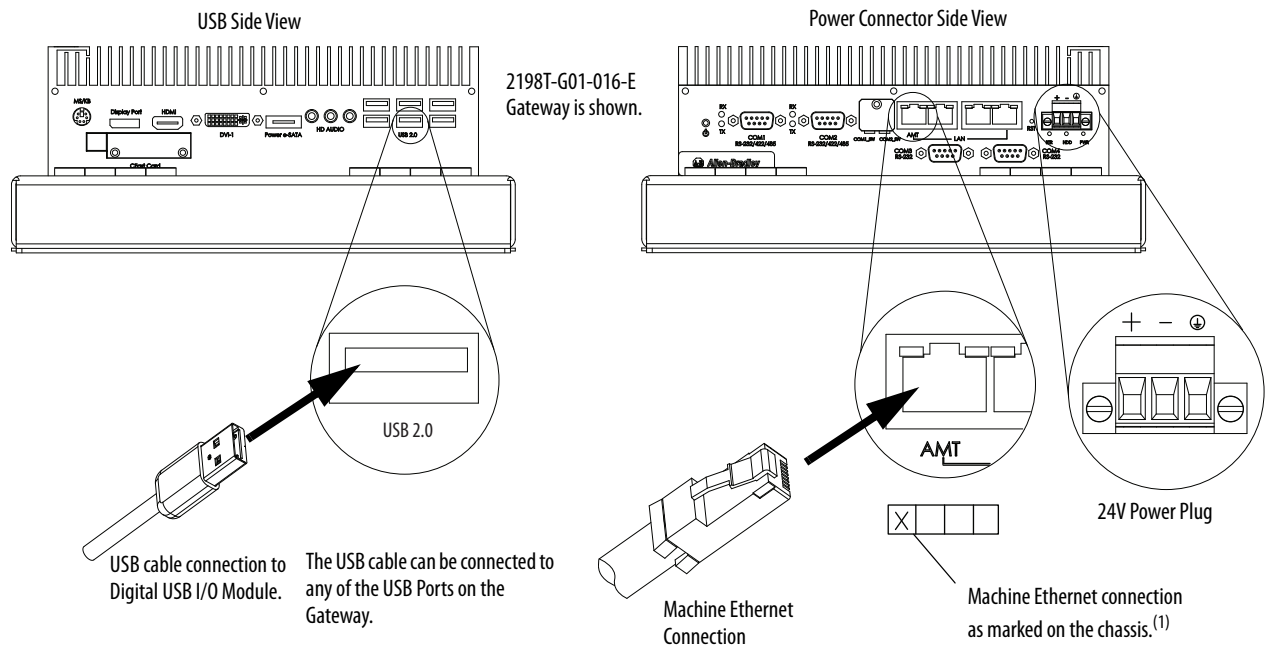
Figure 27 - Connect the USB Cable



Wire the Gateway

Wire the gateway with 24V power input, a machine Ethernet connection, the USB cable from the digital USB I/O module and a communication cable from each of the motor modules.

Figure 28 - Gateway USB, LAN, and 24V Power Plug Wiring



(1) Make only this connection. Do not use any other Ethernet ports for machine Ethernet.

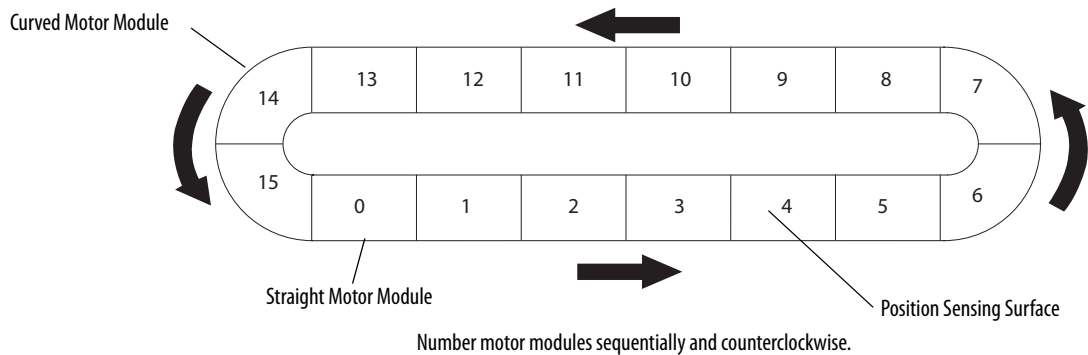
Table 27 - Gateway 24V Power Plug Specifications

Description	Pin	Signal	Recommended Wire Size mm ² (AWG)	Strip Length mm (in.)	Torque Value N·m (lb·in)
Gateway 24V Power Plug	+	24V	0.82 (18)	7 (0.25)	0.79 (7.0)
	-	24V Comm			
	GND	PE	2.08 (14)		

Numbering the Motor Modules

Motor module 0 can be any motor module in the system, but they must be sequentially numbered counterclockwise facing the position sensing surface.

Table 28 - Numbering the Motor Modules - Example



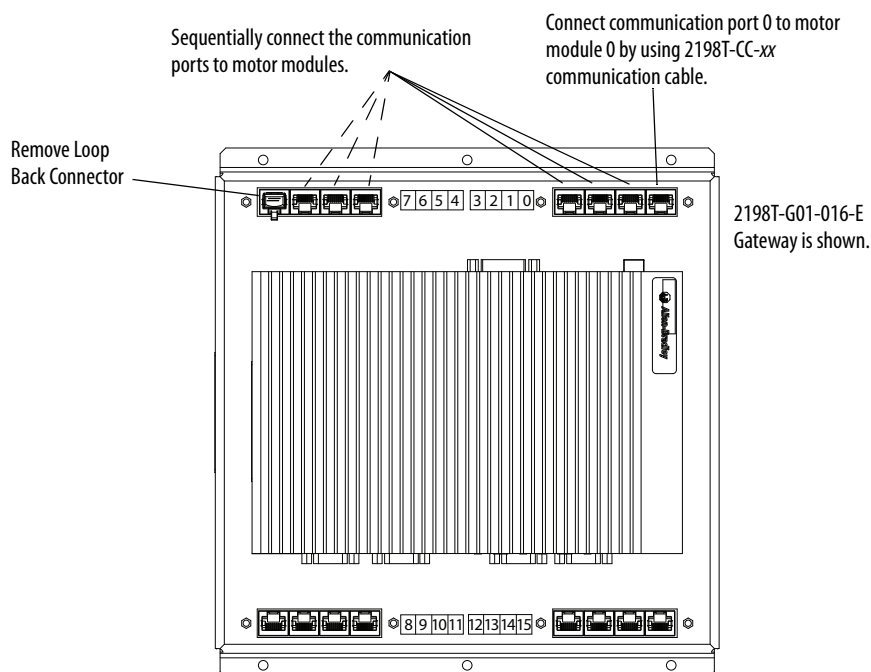
To wire the motor modules to the gateway, do the following.

1. Remove the loopback connector from the number seven communication port.

If the number of communication ports in your gateway is 16, 32, 48, or 64, and you have an equal number of motor modules in your system, you can discard the loop back connector. If it is not, save the loop back connector for use in [step 4](#).

2. Attach the 2198T-CC-xx communication cables, start by connecting motor module 0 to communication port 0.
3. Continue to make connections for each motor module by matching the motor module number, as numbered in [Numbering the Motor Modules](#), to the communication port number, until all motor modules are connected.
4. If the number of motor modules is not equal to 16, 32, 48, or 64, install the loop back connector in the next available communication port.

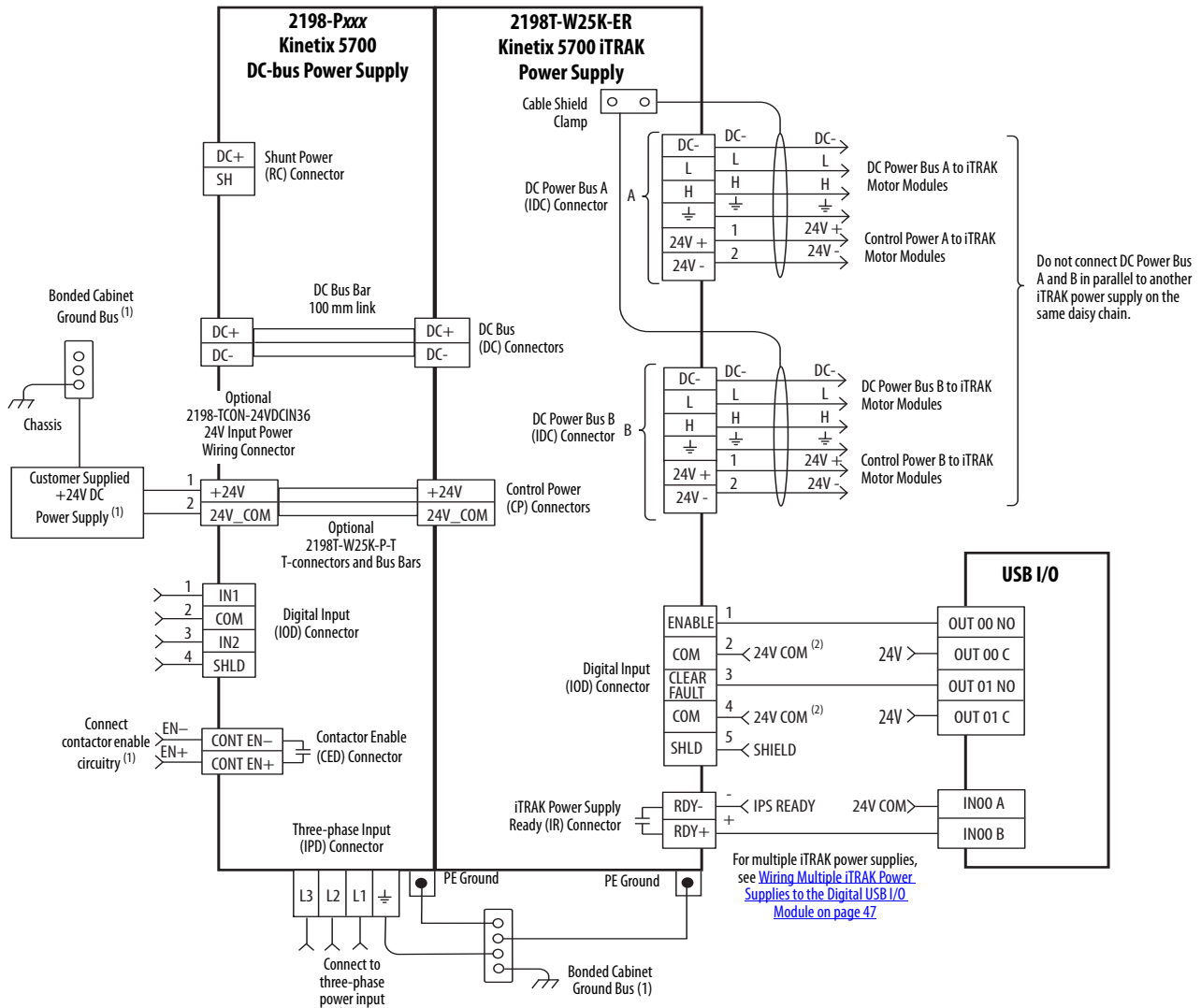
Figure 29 - Gateway to Motor Module Wiring



iTRAK Power Supply Wiring Example

Use the following wiring diagram to connect your iTRAK power supply.

Figure 30 - Connecting an iTRAK Power Supply to a System



(1) Customer supplied.

(2) Make only one of these 24V COM connections.

Cable Preparation for iTRAK Power Supply Output Power Cables

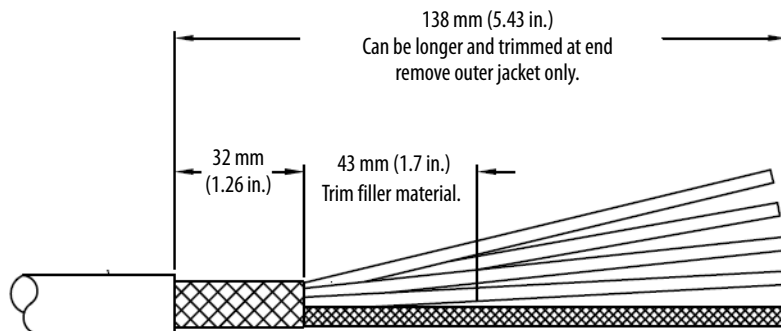
Follow these instructions to prepare the wires for creating custom length 2198T-CHBFLS8-12Axx cables.

These instruction steps assume that the cable has already been cut to the desired length.

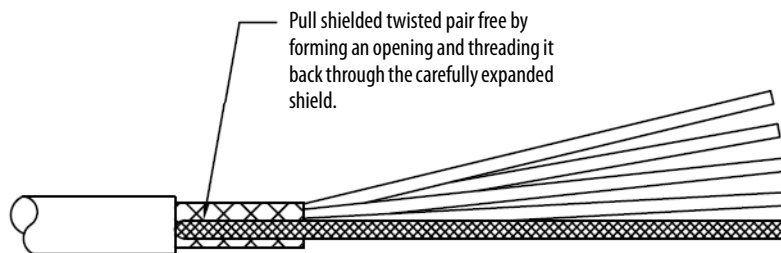
1. Mark the cable at 138 mm (5.4 in.) from the end.
2. Carefully cut away the outer jacket at the mark.
Be mindful not to damage the braided shield underneath.
3. Measure 32 mm (1.26 in.) from where the outer jacket ends and cut and remove the braided metal shield.

Save the braided metal piece that was trimmed for use in [step 8](#).

4. Measure 75 mm (3 in.) from where the outer jacket ends or 43 mm (1.7 in.) from where the shield ends, and trim the blue filler material.

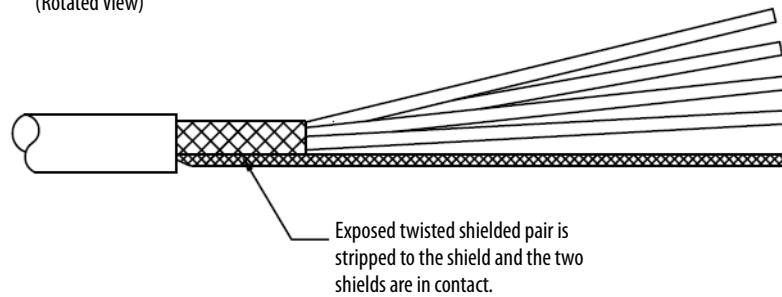


5. Pull back the outer braided shield and carefully create an opening in the braid as close as possible to where the outer jacket ends.
6. Feed the internal shielded twisted pair through the opening in the outer braided shield, and pull it through tight.

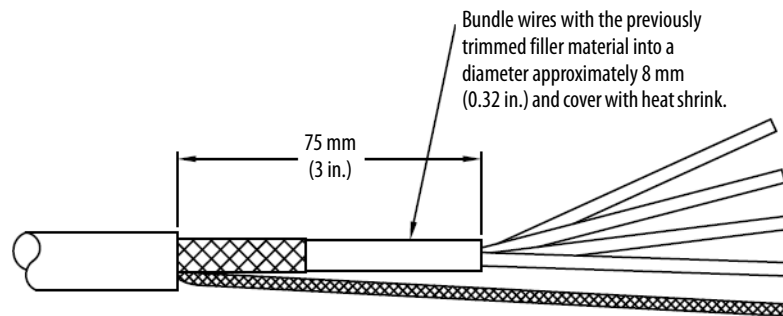


The shielded twisted pair is now outside of the main braided shield and the two shields are in contact.

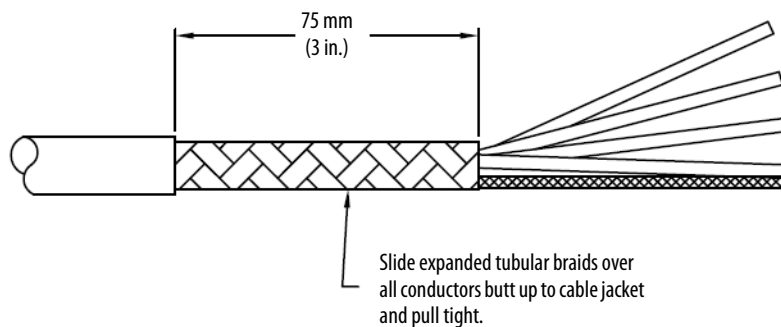
(Rotated View)



7. To hold the wires together, bundle the group of four wires with the previously trimmed filler material and slip on a 45 mm (1.8 in.) length piece of shrink tube.

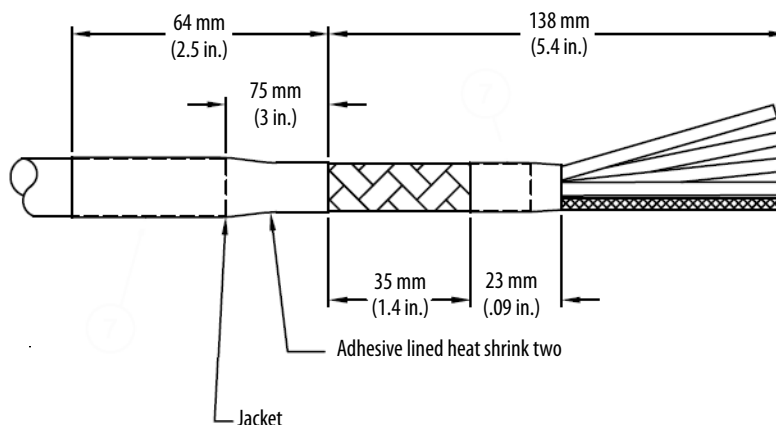


8. Slide previously trimmed piece of the outer braided shield over the entire bundle, butt it up to the cable jacket, pull tight, then trim the piece so it is approximately 75 mm (2.9 in.) long.

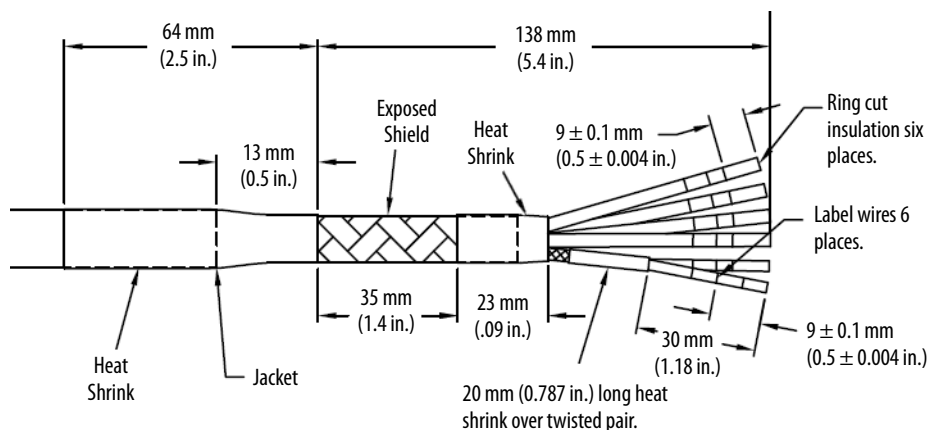


9. Place a 64 mm (2.5 in.) length of adhesive-lined shrink tube over the cable located 113 mm (4.4 in.) from the end of the wires.

10. Place a 23 mm (0.9 in.) length piece of adhesive-lined shrink tube over the cable so that a 35 mm (length of shielded braid is left exposed.



11. Trim the braided shield on the twisted-pair shield back 40 mm (1.6 in.) from the end of the wires.
12. Place a 20 mm (0.79 in.) length piece of shrink tube over the twisted pair approximately 30 mm (1.18 in.) from the end of the wires.
13. Strip the individual wires back 9 mm (0.35 in.).



Label wire with the signal names as shown in [Table 29](#)

Table 29 - Power Supply Wire Labels

Color	Gauge	Signal
Brown	12	H
Black		L
Blue		DC-
Green/Yellow		PE
Red	14	+24V
White		-24V

Logix Designer Application Support

The Studio 5000 Logix Designer® application controller program necessary to support the iTRAK power supply is provided in the Pxx_IPS_Support program. The code performs the following functions.

- Sends the power supply type for PCM or iTRAK power supply to the gateway.
- Sends the DC-bus power supply DCBusUPStatus to the gateway. The bus up status is used by the gateway to gate the iTRAK power supply Enable signal.
- Monitors DC-bus power supply DCBusUnload in the sample code to trigger stopping actions.

The code also provides examples for disabling the iTRAK power supply via the gateway.

Name the DC-bus power supply axis DFE. If you use a name other than DFE, update the DFE tags to match the name that is given to the DC-bus power supply.

The Pxx_IPS_Support program version can be checked in Logix under controller tag FeatureRevision.

[-] iTRAK_IPSSupport	{...}
[-] iTRAK_IPSSupport.RunningIPSMde	1
[+] iTRAK_IPSSupport.POSTDone	0
[+] iTRAK_IPSSupport.FeatureRevision	6
[+] iTRAK_IPSSupport.IPS_FaultMessage	' '
[-] iTRAK_IPSSupport.MinCompatibleFWVersion	{...}
[+] iTRAK_IPSSupport.MinCompatibleFWVersion....	1
[+] iTRAK_IPSSupport.MinCompatibleFWVersion....	103
[+] iTRAK_IPSSupport.MinCompatibleFWVersion....	35

IMPORTANT You must import Pxx_IPS_Support program into the same task as the iTRAK_IO code.



ATTENTION: The Studio 5000 Logix Designer application Pxx_IPS_Support program must be used as instructed to control the iTRAK power supply properly and provide required fault support to the Kinetix 5700 system. Failure to use this program code can result in equipment damage.

You can obtain the Studio 5000 Logix Designer controller ladder code by going to the Rockwell Automation Knowledgebase article [778917](#).

IMPORTANT Do not add the iTRAK power supply to Logix I/O tree. If you do, unexpected results can occur.

Notes:

Install Your System with a Power Control Module

The power control module (PCM) is a fully wired and assembled cabinet. It accepts main power and provides bus power for the motor modules and logic power for the gateway and motor modules. It includes disconnects, fuses, and USB I/O module. It has pre-wired functional safety features such as an E-stop and reset circuit.

Topic	Page
Typical System Configuration Using a PCM	65
About the Power Control Module	67
About the Gateway	73
Plan Your System Installation	75
Install the Power Control Module	75
Install the Gateway Enclosure	75
Connect Cables	75

Typical System Configuration Using a PCM

Table 30 - System Component Overview Using a PCM

System Component	Description
Motor Module	The motor module is an integrated drive and motor coil unit, it is referred to as a section in the firmware. Motor modules are available in straight and curved orientations.
Track Frame	The track frame is designed for your specific application. The track frame in combination with straight and curved modules, and bearing rails creates the track.
Mover	The movers are passive magnetic components. They move along the track in response to the magnetic fields generated by the motor modules. You attach your application end effector to the mover.
Gateway	The Gateway provides communication interface between the Logix controller and all motor modules. It also provides more motion processing for the motor modules.
Power Control Module (PCM)	The PCM accepts mains power and provides bus power for the motor modules and logic power for the Gateway and the motor modules. It has E-stop, guard, reset, monitoring functions. The PCM also has external connectors for connecting to a remote E-stop and monitoring station.
Cables	Each motor module in the system has a communication cable that is connected directly to the Gateway. The power bus cables are daisy chained between the motor modules. The number of motor modules on one daisy chain is system-dependent. Use only the cables that are provided with your system and referenced in this user manual.

Figure 31 shows a typical iTRAK® system that uses a PCM. Your system can vary in the quantity and layout of each component, but all follow the same concept.

Figure 31 - Typical iTRAK System Configuration Using a PCM

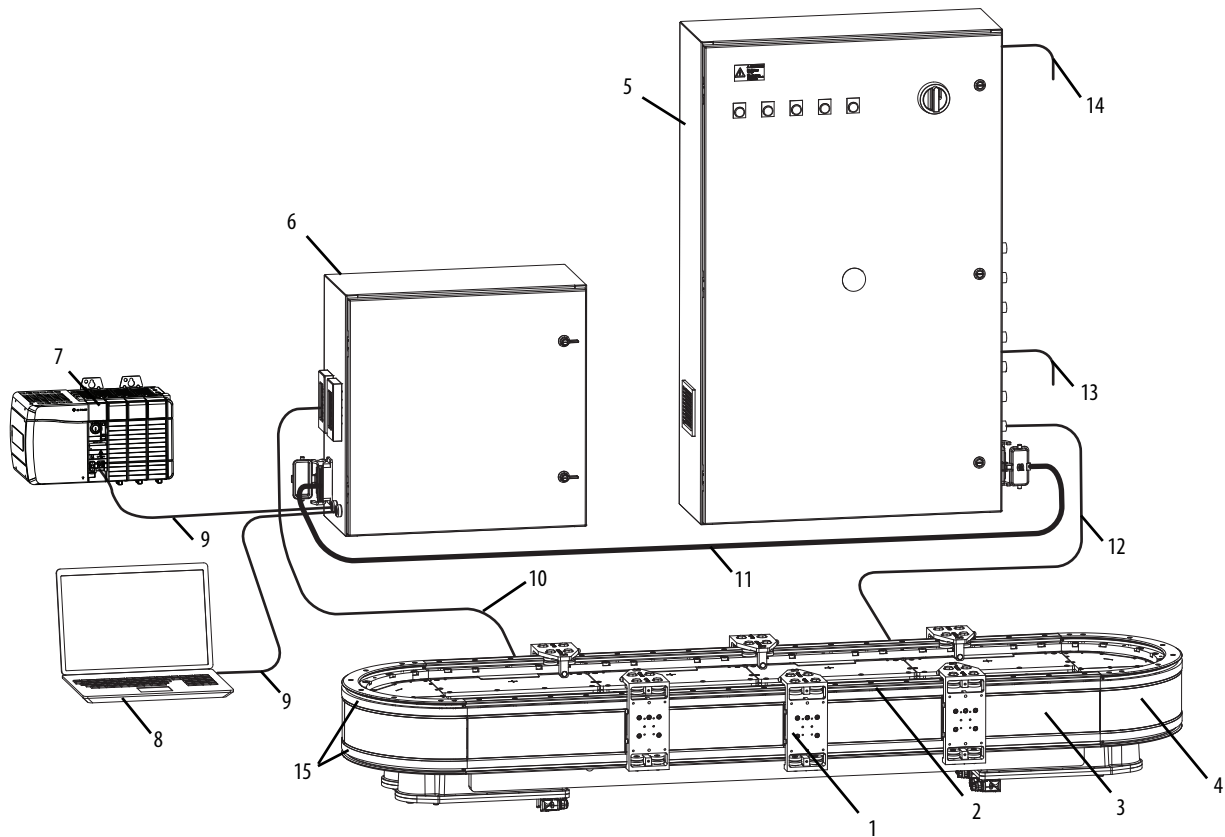


Table 31 - System Component Description

Item	Description	Item	Description
1	Mover	9	EtherNet/IP communication cables
2	Bearing rail	10	Communication cable to motor module (one cable per motor module)
3	Straight motor module	11	PCM to Gateway power and communication
4	Curved motor module	12	Motor module power bus (number of cables vary by system)
5	Power control module (PCM)	13	External monitoring, reset, guard stop, E-stop connections
6	Assembled gateway cabinet	14	Mains power (460V nominal)
7	Controller (sold separately)	15	Track frame
8	Computer (not supplied with system)		

About the Power Control Module

[Figure 32](#) shows a typical power control module (PCM). Your system can differ in the layout and the number of connectors, but has the same components.

Figure 32 - Power Control Module

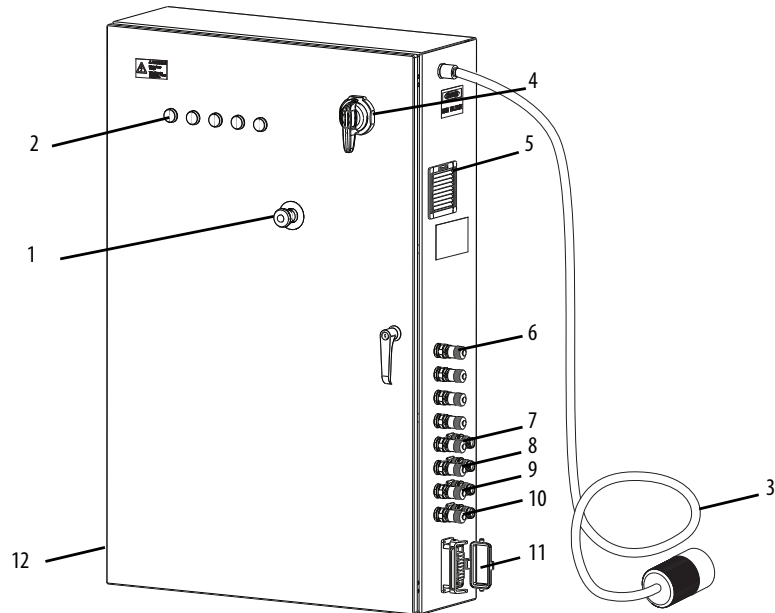


Table 32 - PCM Component Description

Item	Description
1	Emergency stop switch
2	Status indicators (x5)
3	Power cable (not included)
4	Main power switch
5	Exhaust vent
6	Power bus connectors are shown with cap (quantity is system-dependent)
7	External emergency stop switch connector
8	External guard-switch connector
9	External reset-switch connector
10	External monitoring connector
11	PCM to Gateway communication connector
12	Intake vent (not shown)

PCM Status Indicators

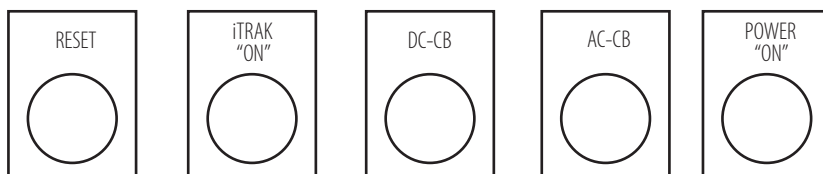


Table 33 - PCM Status Indicator Description

Status Indicator	Description
RESET	This blue status indicator is off when bus power is unavailable or when the E-stop button is pressed or Shutdown routine is performed. After an E-stop condition, reset the E-stop button and press the Reset button to enable restoration of the bus power.
iTRAK "ON"	This yellow status indicator is on when iTRAK_Start command is executing in Logix Application Designer. It turns off after the iTRAK_Stop command is executed, E-stop is pressed, or shutdown operation is performed.
DC-CB	This blue status indicator lights when DC Line is high or when iTRAK system has 24V DC. It turns off when relays R1C and R2C are open or when circuit breakers CB02, CB03, or CB04 are tripped.
AC-CB	This blue status indicator lights when the AC Line is high. It turns off when relays R1B and R2B are open or when circuit breakers CB05, CB05A, CB06, or CB07 are tripped.
POWER "ON"	This white status indicator lights when the AC input line is high. It turns off when ESR, GSR, IC1 or IC2 are tripped.

If any of the status indicators do not light when expected, check the associated circuit breakers. See [Circuit Breakers on page 111](#).



ATTENTION: The DC power bus capacitors have residual voltage for 5 minutes. Wait 5 minutes before attempting to service the PCM or the bus power cables.

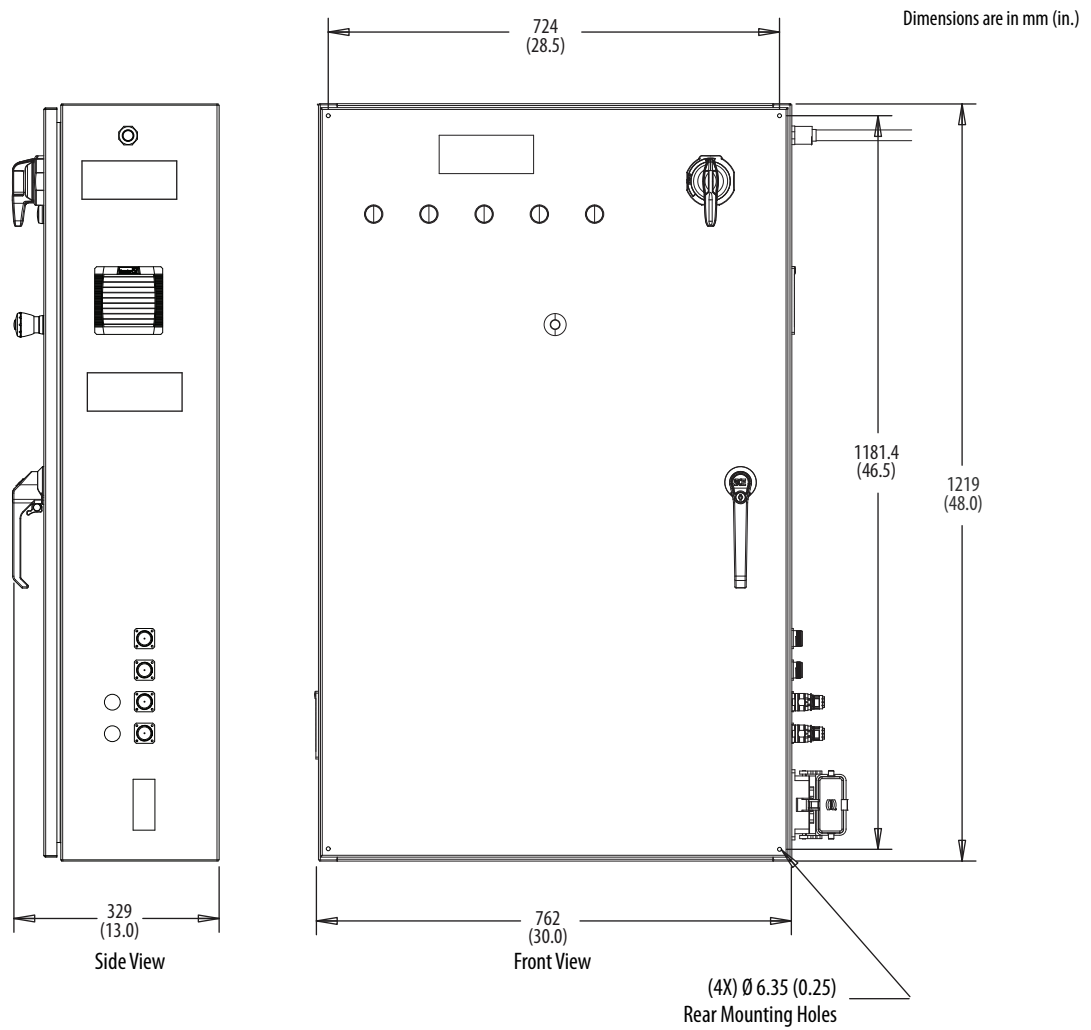


ATTENTION: If the ESR and GSR safety relays appear to be faulty, contact Rockwell Automation for service. Do not attempt to service or repair ESR and GSR safety relays.



ATTENTION: If the braking resistors or the power supplies overheat, contact Rockwell Automation for service.

PCM Dimensions



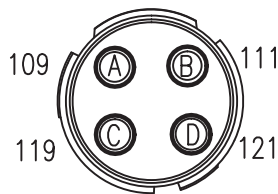
PCM Connector Data

The PCM has external connections to the E-stop, guard, reset switches, and monitoring capabilities. This section shows the wiring information that you can use to add more safety switches and monitoring capability.

The PCM connectors for external E-stop switch (P5), guard switch (P4), reset switch (P3), and monitor (P2), use the connectors that are supplied with the system.

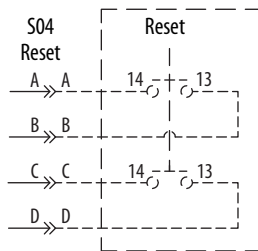
[Figure 33](#) shows the pinout for the reset connector.

Figure 33 - Reset Connector Pinout (P3)



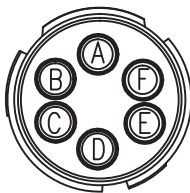
[Figure 34](#) shows the schematic for the reset circuit.

Figure 34 - Reset Switch Circuit Schematic

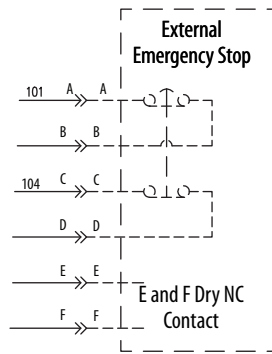


[Figure 35](#) shows the pinout for the E-stop and guard connectors.

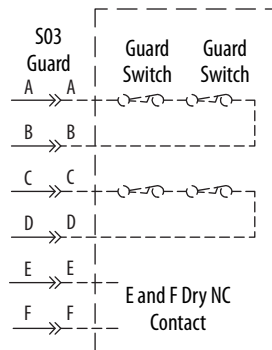
Figure 35 - E-Stop and Guard Connector Pinout (P4 and P5)



[Figure 36](#) shows the schematic for the E-stop circuit.

Figure 36 - E-Stop Switch Circuit Schematic (P5)


[Figure 37](#) shows the schematic for the guard switch circuit.

Figure 37 - Guard Switch Circuit Schematic (P4)


[Figure 38](#) shows the pinout for the monitor connector.

Figure 38 - Monitor Connector Pinout (P2)


Figure 39 shows the schematic for the monitor circuit.

Figure 39 - Monitor Circuit

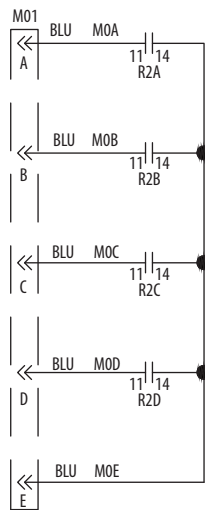


Table 34 - Monitor Circuits Descriptions

Monitor (PCM Status Indicator)	Description
A	Bus voltage (0, 160V and 320V) is on
B	AC circuit breaker tripped
C	DC circuit breaker tripped
D	PCM main circuit breaker (CB01) is on

Figure 40 - PCM (P7) to Gateway (P6) Cable Connector Pinout

Pin	Signal
1	24V (CB 05, Gateway 1)
2	24V (CB 05A, Gateway 2)
3	24V (CB 06, Ethernet Hub)
4	PS02 Undervoltage
5	PS02 Option COM
6	PS02 Power Fail
7	PS02 Logic Return
8	PS01 Undervoltage
9	PS01 Option COM
10	PS01 Power Fail
11	PS01 Logic Return
12	PS01 Logic Inhibit
13	PS02 Logic Inhibit
14	iTRAK Power On/Off
15	24V (TB05, I/O USB)
16	24V Common (TB05C I/O USB)

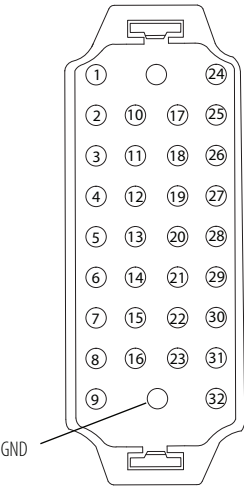
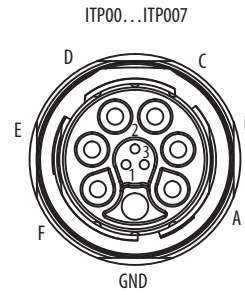


Figure 41 - Power Bus Connector Pinout (ITP00...ITP007)

Pin	Signal
A	320V DC
B	160V DC
C	0V DC
D	—
E	24V
F	24V Common
GND	PE



About the Gateway

[Figure 42](#) shows a typical 16-port gateway. Your system can differ in the layout and the number of connectors, but has the same components.

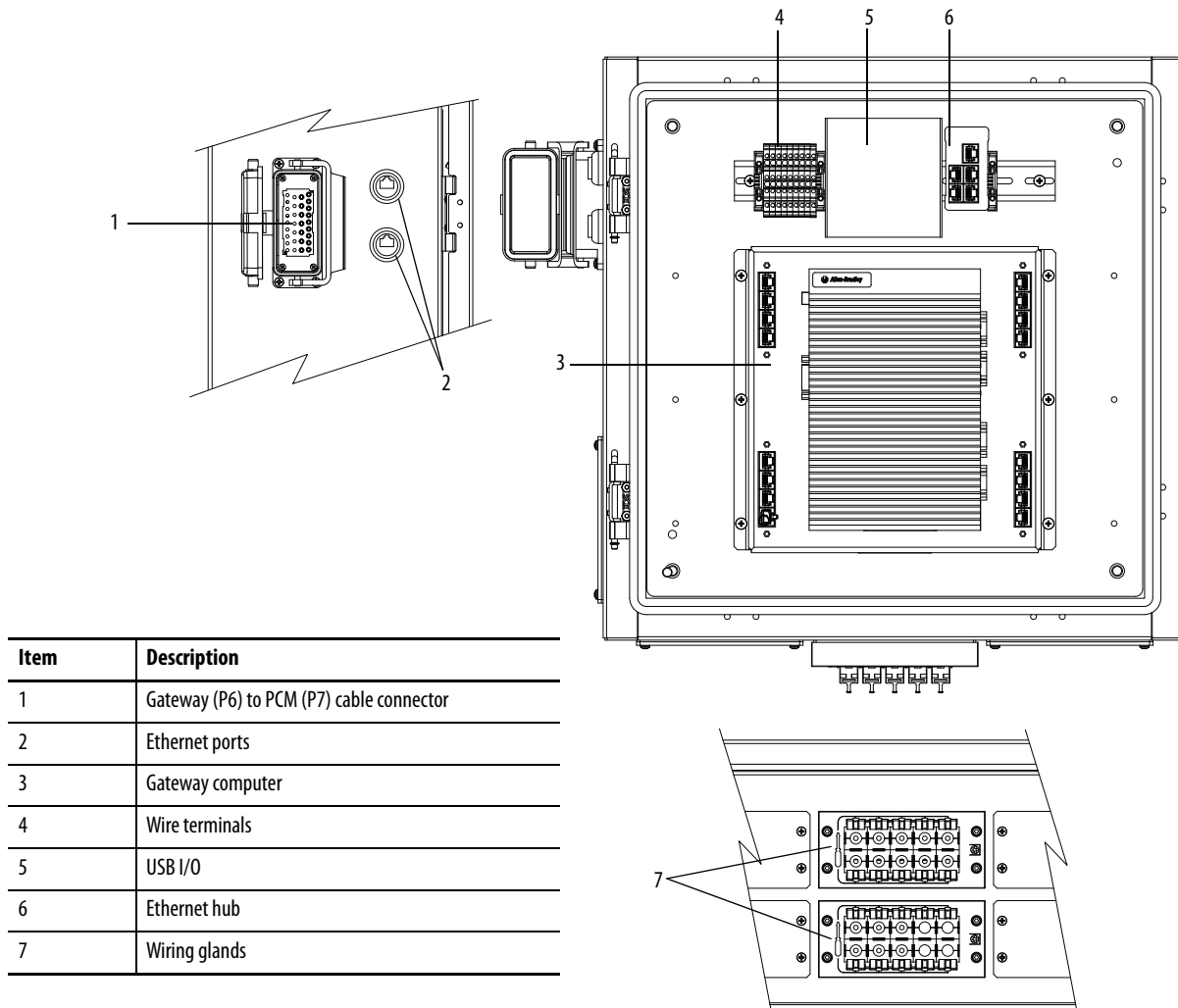
Figure 42 - Gateway Enclosure Components


Figure 43 - Gateway Dimensions

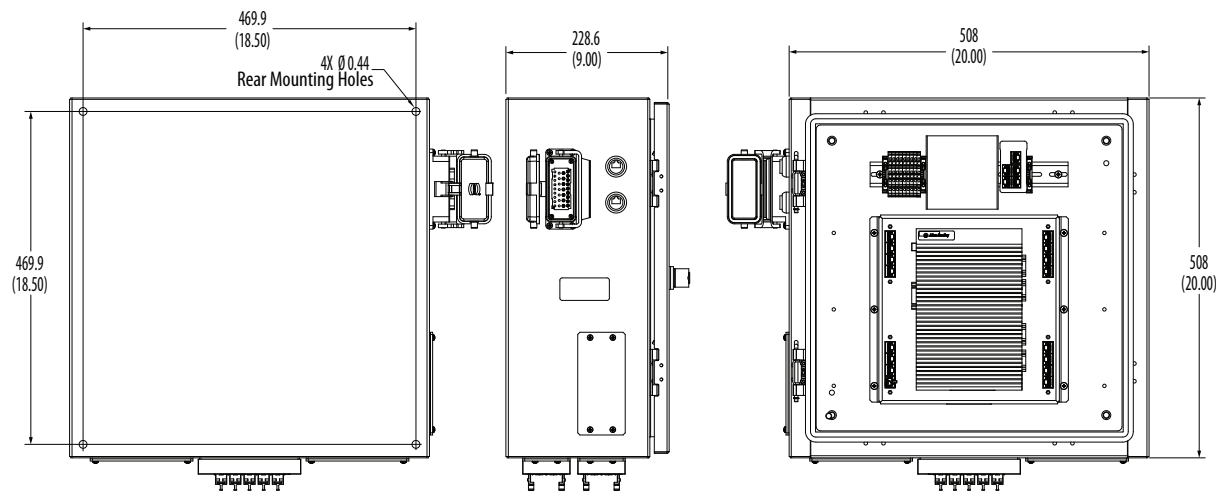
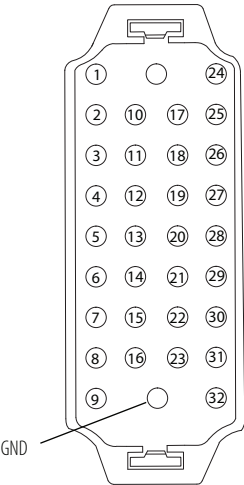


Figure 44 - Gateway (J6) Cable Connector to PCM (J7) Pinout

Pin	Signal
1	24V (gateway 1 power input)
2	24V (gateway 2 power input)
3	24V (Ethernet Hub power input)
4	PS02 Undervoltage
5	PS02 Option COM
6	PS02 Power Fail
7	PS02 Logic Return
8	PS01 Undervoltage
9	PS01 Option COM
10	PS01 Power Fail
11	PS01 Logic Return
12	PS01 Logic Inhibit
13	PS02 Logic Inhibit
14	iTRAK Power On/Off
15	24V (TB05, I/O USB)
16	24V Common (TB05C I/O USB)



Plan Your System Installation

Choose the location for system components by following these considerations:

- operator access to emergency stop switch on the power control module (PCM)
- operator and maintenance access to movers, motor modules, power control module, and gateway
- cable lengths
- vibration free surfaces

Install the Power Control Module

IMPORTANT The 10 kW PCM weighs approximately 100 kg (220 lb). Be sure the lifting machinery that is used can lift the load.

1. Mount PCM to a solid vibration-free vertical surface.
2. Secure by using all mounting holes inside the enclosure. See [PCM Dimensions on page 69](#).
3. Connect the system ground conductor to the main power supply.

Before switching on the equipment, cables with a ground conductor must be permanently connected to all electric components in accordance with the connection diagram.

Do not use residual-current-operated circuit breakers for drives.

Install the Gateway Enclosure

IMPORTANT The gateway enclosure weighs approximately 27 kg (60 lb). Be sure to use a two man lift when installing the gateway cabinet.

1. Mount the gateway enclosure to a solid vibration-free surface.
2. Secure by using all four mounting holes in the enclosure. See [Gateway Dimensions on page 74](#).
3. Connect the 2 m (6.6 ft) Gateway-PCM Interconnect cable from the gateway to the PCM.

The connectors are keyed and the same on either end. Be sure to secure with the locking mechanism.

Connect Cables

Your system comes with the power bus and communication cables. You are required to route and connect them to the motor modules, PCM, and gateway. To connect these cables following the system diagram.

The motor module-to-motor module power-bus jumper cables and the power-bus terminator are already installed.

To access standard systems diagrams, do the following.

1. Browse to <https://motionanalyzer.rockwellautomation.com/Products/iTrak>.
2. Click 3D CAD Models of iTRAK Components.
3. Open 2198T-3DCAD.zip.
4. Double-click 2D Outline and Assembly Drawings.
5. Double-click C806607-3-X_REVA.
6. Click Open.

To connect system cables, do the following.

IMPORTANT	Help protect cables from stress and damage during use of the system.
------------------	--

1. Route and connect the power bus cables from the appropriate motor module to the PCM.

See your system diagram to determine power bus cable that is required for each motor module. Power bus cables are labeled on the ends of cable next to the SpeedTec connector.

2. In the gateway enclosure, remove the loopback connector from the number seven communication port.

If the number of motor modules in your system is 16, 32, 48, or 64, and you have an equal number of motor modules, you can discard the loop back connector. If it is not, save the loop back connector for use in [step 4](#).

3. Route and connect communication cables from the motor modules to the gateway.

The communication cables are labeled with the motor module number 0...63 depending on the number of motor modules in your system. Be sure to pass the cable through the cable gland of the gateway. Each gland can take up to 10 cables.

4. If the number of motor modules is not equal to 16, 32, 48, or 64, install the loop back connector in the next available communication port.
5. Secure the communication cables to the cable gland by using the Skintop cube. See Lapp Kable instructions [BS09/3878-3](#)
6. Connect the PCM to mains power line.

Use minimum of 10 mm²(8 AWG) copper for the ground wire.

7. Connect your personal computer and Allen-Bradley® controller to the gateway Ethernet ports.

Power on Your System

Use this chapter to power on your system by using a Kinetix® 5700 system or a PCM.

Topic	Page
Before You Power On the Track	77
Apply Power	78
Commission with Programming Manual	82

Before You Power On the Track

There are some items that you can review before the system is powered that can speed up the time to commission your system.

Identify Controller

The controller that you use determines which type of Starter Project is best suited for your application. Consider the memory requirements, axis count, and motion task utilization when choosing the catalog number of controller. Integrated Architecture® Builder from Rockwell Automation can help you size the application and estimate which controller is properly suited for you; see Knowledgebase Article [1040301](#), How to size an iTRAK® in IAB? for more information.

Identify Firmware Revision

Each firmware revision is designed to operate with a paired version of the iTRAK_IO Add-On Instruction. Identify which firmware revision of the iTRAK system you plan to use before starting your application code development. We recommend that you use the latest published firmware revision. Firmware revisions are available from the Rockwell Automation [Product Compatibility and Download Center](#).

To update your motor module firmware see [Update Motor Module Firmware on page 104](#)

If you plan to do a Factory Acceptance Test with Rockwell Automation, contact ICTSupport@ra.rockwell.com to determine which firmware revision is planned for your visit.

Configure and Customize Project File

When you download the firmware revision from the Rockwell Automation [Product Compatibility and Download Center](#), the software files for Studio 5000® Logix Designer are included. Choose the appropriate project file that is based on the features and controller for that firmware revision.

The iTRAK System Programming Manual, publication [2198T-PM001](#), is available on the Rockwell Automation Literature Library. It includes detailed descriptions of the Starter Projects and the procedures to develop your own project file. After you have configured your project file according to the instructions in the programming manual, proceed with [Apply Power](#).

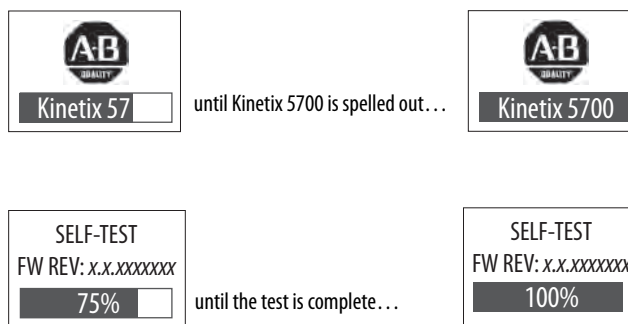
Apply Power

There are different sequences to follow that depend on the type power supply that you have in your system. For Kinetix 5700 systems, see [Kinetix 5700 iTRAK Power Supply](#) section. For PCM systems, see [Power Control Module](#) section.

Kinetix 5700 iTRAK Power Supply

1. Energize your ControlLogix® or CompactLogix™ processor.
2. Download the ACD file to the controller.
3. Start the initialization sequence of the Kinetix 5700 system, motor modules, and the gateway by applying 24V control power to the gateway safety circuit, and motor modules, and Kinetix 5700 system.

On initial powerup, the drive performs a self-test. Upon successful completion, the firmware revision is displayed.

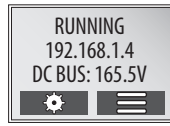


When the Kinetix 5700 power supply is ready, the contactor enable relay is closed so that main power can be applied to the Kinetix 5700 system bus.

4. Apply bus voltage.

The bus voltage is applied to the system when the appropriate commands are sent from the processor to the gateway. This action triggers the Kinetix 5700 iTRAK power supply via the USB I/O module. See the Motion Commands section of the iTRAK Programming Manual, publication [2198T-PM001](#), for more information.

When the high-voltage power completes initialization, the displays change to Running mode.



iTRAK Power Supply

The DC BUS voltage that is displayed can differ depending on your system configuration.

5. To determine if the iTRAK system is ready for application of the bus voltage, monitor the status indicators from the gateway in Studio 5000 Logix Designer® software.

There are two controller tags that indicate the status of the gateway and iTRAK power supply.

	iTRAK_Control.Status	{ ... }
	iTRAK_Control.Status.GatewayRunning	1
	iTRAK_Control.Status.DCBusContactor	1

The iTRAK_Control.Status.GatewayRunning indicates that the iTRAK system initialization is finished, and the gateway is ready to respond to requests from the controller.

The iTRAK_Control.Status.DCBusContactor = 1 means the iTRAK high-voltage bus is closed, and the iTRAK power supply is providing high voltage to the iTRAK system.

Power Control Module

1. Energize your ControlLogix® or CompactLogix™ processor.
2. Energize the main disconnect switch on the front of the panel of the PCM.

Main power is applied to the 24V control power supply and the low voltage components begin to come on line including the gateway, safety circuit, and motor modules. The amber CONTROL POWER status indicator illuminates.

3. Check that the red EMO button is pulled out.

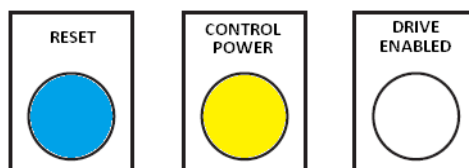
The red status indicator stays illuminated.

4. Press and release the RESET push button on the PCM panel.

This action clears the cold start inhibit condition of the safety circuit. The blue RESET status indicator illuminates and the red EMO status indicator turns off.

5. Determine if the system is ready for the application of main bus voltage by monitoring the status indicators from the gateway in Studio 5000 Logix Designer® Software.

After main bus voltage is applied to the system and the command motor power is sent from the processor to the gateway, look for following status indicators.



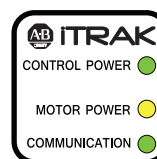
On the PCM, the white DRIVE ENABLED status indicator is on when iTRAK_Start command is executing in the Logix Application Designer. It turns off after the iTRAK_Stop command is executed, E-stop is pressed, or shutdown operation is performed.

6. Verify power and communication.

For the series A motor modules, all three status indicators are solidly illuminated. Control Power and Communication status indicator illuminates green. Motor Power status indicator illuminates amber.

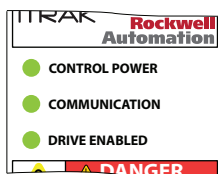


Straight Motor Modules
Status Indicators



Curved Motor Modules
Status Indicators

For the series B motor modules, all three status indicators are solidly illuminated green. The series B status indicator uses different nomenclature. The Drive Enabled status indicator on series B motor modules replaced Motor Power status indicator on a series A motor module.

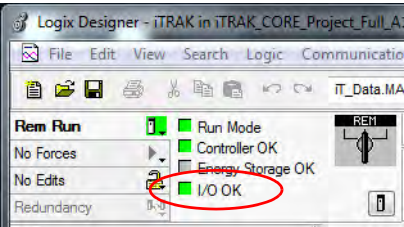


IMPORTANT Series B motor modules require firmware revision 1.107 or later to function. The Drive Enabled status indicator is turned on by the firmware when conditions are met in the gateway and Logix Designer application. Prior versions of firmware allow the module to operate however the Drive Enabled status indicator never illuminates.

For the gateway, there are no physical status indicators on the gateway that would notify that it is ready for motion. The status indicators are displayed in the Logix Designer application, which is discussed in the next section.

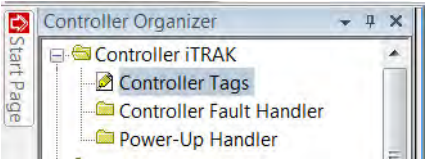
In the Logix Designer application, there are numerous status indicators that verify the iTRAK is ready for motion.

In the top left-hand corner of the Logix Designer application, I/O OK status indicator is solidly green.



If the gateway is not ready, the I/O OK status indicator turns to a flashing green and say I/O NOT RESPONDING.

Under the Controller Tags, the iTRAK_Control tags are displayed.



Under the iTRAK_Control tag, there are three subsets of tags, .Cmd, .Status, and .Data are displayed.














[-] iTRAK_Control	{ ... }
[+] iTRAK_Control.Cmd	{ ... }
[+] iTRAK_Control.Status	{ ... }
[+] iTRAK_Control.Data	{ ... }

Under the iTRAK_Control.Cmd tags are displayed.

[-] iTRAK_Control	{ ... }
[-] iTRAK_Control.Cmd	{ ... }
[-] iTRAK_Control.Cmd.iTRAKStart	1
[-] iTRAK_Control.Cmd.iTRAKStop	0
[-] iTRAK_Control.Cmd.ServoOn	1

Setting Cmd.iTRAKStart to 1 enables the iTRAK and Cmd.ServoOn bit automatically sets to 1.

Under the iTRAK_Control.Status tags are displayed.

	iTRAK_Control.Status	{ ... }
	iTRAK_Control.Status.GatewayRunning	1
	iTRAK_Control.Status.DCBusContactor	1
	iTRAK_Control.Status.ReadyForMotion	1
	iTRAK_Control.Status.Faulted	0
	iTRAK_Control.Status.GatewayFaultCode	0
	iTRAK_Control.Status.SectionFaultCode	0
	iTRAK_Control.Status.SectionNumberFaulted	0
	iTRAK_Control.Status.SectionDeviceFaulted	0
	iTRAK_Control.Status.SectionFaultData	0
	iTRAK_Control.Status.FaultMessageLine1	' '
	iTRAK_Control.Status.FaultMessageLine2	' '
	iTRAK_Control.Status.CoarseUpdatePeriod	0

The tags Status.GatewayRunning, Status.DCBusContactor, and Status.ReadyForMotion all set to 1. These bits are set when the iTRAK is enabled with Cmd.iTRAKStart.

If any of these tags have values in them, the iTRAK cannot be enabled because of an existing fault condition:

- iTRAK_Control.Status.Faulted
- iTRAK_Control.Status.FaultMessageLine1
- iTRAK_Control.Status.FaultMessageLine2

See the Motion Commands section of the iTRAK Programming Manual publication [2198T-PM001](#), for more information.

**Commission with
Programming Manual**

Configure, tune, and program the iTRAK system by following the instructions in the iTRAK Programming Manual, publication [2198T-PM001](#).

Maintenance

This chapter contains information for on how to care for your system, replace component, and update firmware.

Topic	Page
Before You Begin	83
Preventive Maintenance	83
Add or Replace Components	84
Update Gateway Firmware	102
Update Motor Module Firmware	104
Lubrication	105
Circuit Breakers	111

Before You Begin

Before you attempt maintenance on the system, do the following.

- Make sure that the movers are motionless.
- Disconnect electrical power to the system by using the master switch and lockout.

Preventive Maintenance

Cleaning

To prolong the life of your iTRAK® system, do the following cleaning procedures. The frequency in which to perform them is depended on the machine usage, the environment in which it is used, and the exposure to containments. You must determine through best engineering practices how often to perform the following procedure.

Before You Begin



ATTENTION: Before attempting any service to an iTRAK system See [Safety Information on page 19](#).

Bearing Rail

1. Wipe the rails down with a lint free cloth.
If necessary, you can use isopropyl alcohol on the lint free cloth.
2. Apply a thin coat of Kluber oil (Kluber 4-UH1-68N) on all exposed bearing rail surfaces.

Track Components

Clean the following surfaces with isopropyl alcohol and soft lint free cloth.

- position sensor
- top and bottom plates
- motor module coil

If there is ferrous debris on the magnet plates, remove them with the sticky side of duct tape or clay.

Add or Replace Components

The following procedures show you how to install or replace system components.

Install or Remove a Position Magnet Assembly

To install or remove a position magnet assembly, do the following.

Before You Begin



ATTENTION: Before attempting any service to an iTRAK system See [Safety Information on page 19](#).

What You Need

- 2.5 mm Allen wrench
- Loctite 222
- 2198T-NN-318 or 2198T-NS-318, position magnet assembly
- 2198T-VTxxxx-A, mover

Position magnet assemblies can be replaced while the mover is on the track.

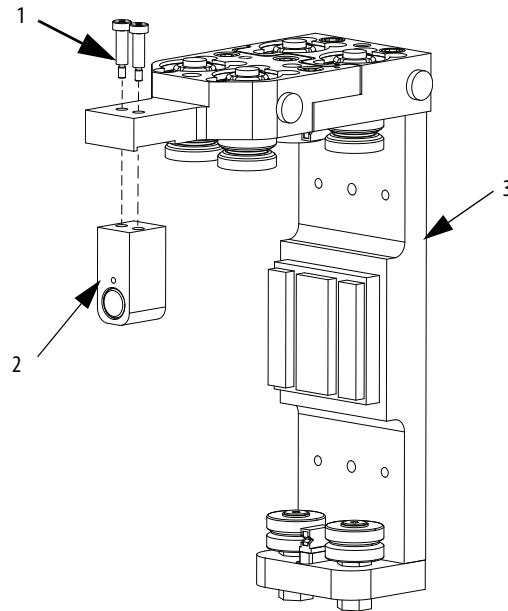
To remove a position magnet assembly, do the following.

Remove the shoulder socket head cap screws that secure the position magnet assembly to the mover by using a 2.5 mm Allen wrench.

To install a position magnet assembly, do the following.

1. Clean shoulder socket-head cap screws and apply fresh Loctite 222.
2. Install position magnet assembly onto the mover with shoulder socket-head cap screws by using 2.5 mm Allen wrench, torque to 0.85 N•m (7.5 lb•in)
3. Check that the polarity of position magnets alternate between north and south on adjacent movers.

You can check the polarity by examining the color of the magnets.



Item	Description
1	Shoulder Socket-Head Cap Screws
2	Position Magnet Assembly
3	Mover

Magnet Plate Assembly Installation

Follow this procedure to install or remove a magnet plate assembly.

Before You Begin



ATTENTION: Before attempting any service to an iTRAK system See [Safety Information on page 19](#).



ATTENTION: If you are using your own design for a mover, make sure of the following.

- The mounting hardware is not too long that it protrudes past or pops through the magnet plate.
- Be sure to use all mounting holes. By using all mounting holes, the magnet maintains correct orientation of north-south magnet polarity.

What You Need

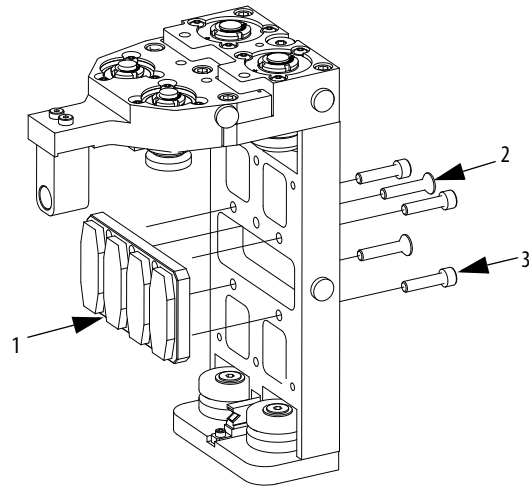
- 6 mm Allen wrench
- Loctite 243
- 2198T-Mxxxx-A000, magnet assembly
- M6 x 25 socket head cap screws and M6 x 30 flat head socket screws as shown in [Table 35](#).

Table 35 - Screws Required for Mounting Magnet Plates

Cat. No.	FHCS M6 X 30 Quantity	SHCS M6 X 25 Quantity
2198T-M0505-A000	3	-
2198T-M0510-A000	3	-
2198T-M0515-A000	5	-
2198T-M1005-A000	2	3
2198T-M1010-A000	2	3
2198T-M1015-A000	2	3
2198T-M1505-A000	2	3
2198T-M1510-A000	2	3
2198T-M1515-A000	2	3

To install a magnet plate assembly, do the following.

1. Remove mover by following the procedure in [Install or Replace a Mover on page 88](#).
2. Clean all screws and apply Loctite 243.
3. Install magnet plate assembly and torque M6 Socket head cap screws to 9 N•m (6.6 ft•lb) and M6 flat head cap screws to 7 N•m (5.2 ft•lb).



Item	Description
1	Magnet plate assembly
2	Flat head cap screw
3	Socket head cap screw

Install mover by following the procedure in [Install or Replace a Mover on page 88](#).

Install or Replace a Mover

Follow this procedure to install or replace a mover.

Before You Begin



ATTENTION: Before attempting any service to an iTRAK system See [Safety Information on page 19](#).

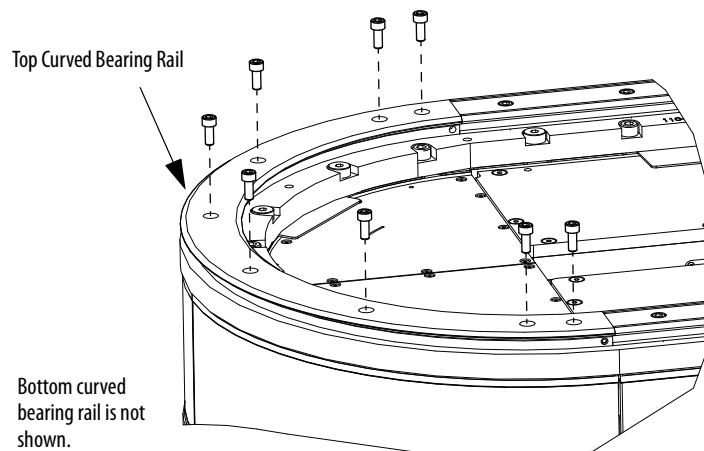
Choose an accessible curved section of the track. Position the mover that you want to replace over a straight motor module next to the curved section. Move all other movers off the curved end of the track.

What You Need

- 2.5 mm and 5 mm Allen wrenches
- Loctite 243
- 2198T-A01, Pair of mover installation fixtures
- 2198T-VTxxxx-A, mover assembly

To remove a mover, do the following.

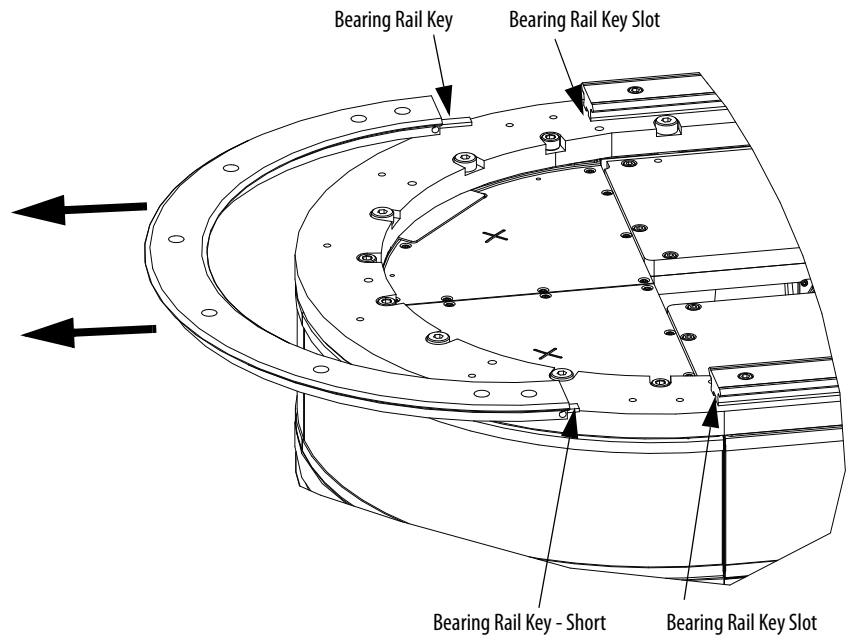
1. Remove the position magnet assembly by following the procedure [Install or Remove a Position Magnet Assembly on page 84](#).
2. Remove the socket head cap screws from the curved top bearing rails by using a 5 mm Allen wrench.



3. Remove the curved bearing rails by pulling parallel to the track away from the straight bearing rails.

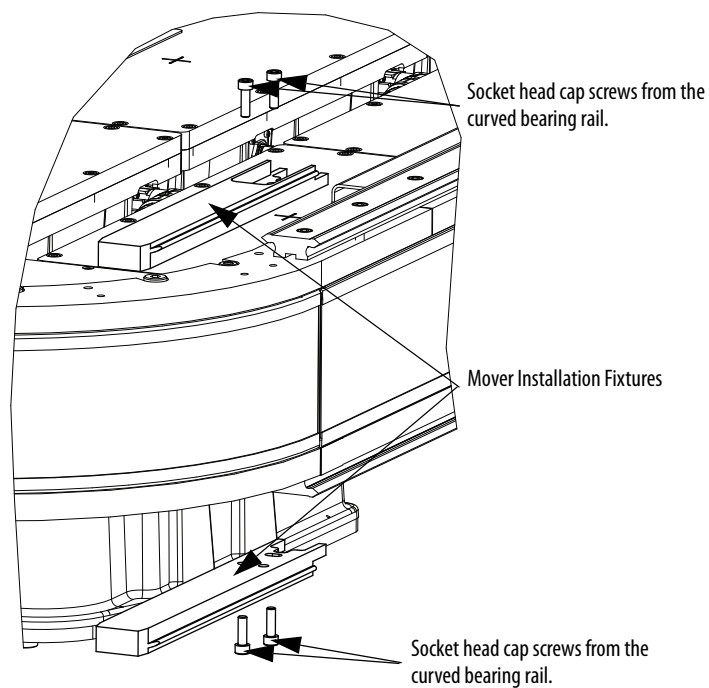


ATTENTION: Avoid bending the bearing-rail key. Do not lift the curve bearing rail up until the bearing-rail keys have cleared the straight bearing-rail key slot.

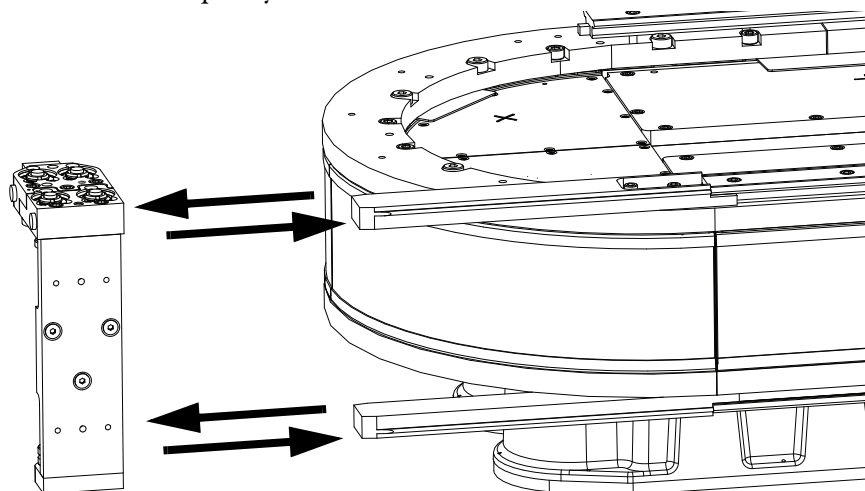


4. Repeat [step 1](#) through [step 3](#) for the bottom bearing rail.

5. Attach mover installation fixtures to the end of straight bearing rails by using two socket head cap screws from the curved bearing rail.



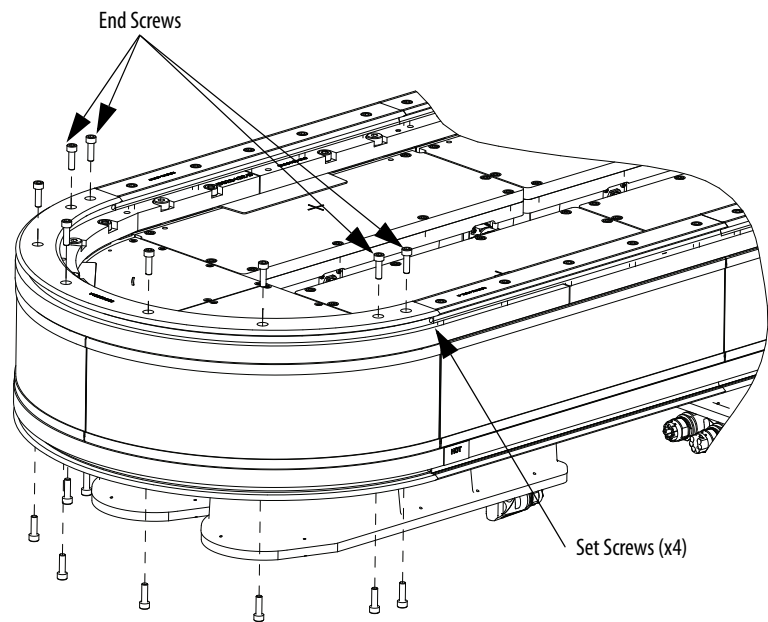
6. Install or replace your mover.



ATTENTION: When removing or installing the mover, keep the mover square to the fixtures and take care not to damage the felt surfaces of the lubrication wiper assemblies.

7. Remove the mover installation fixtures.
8. Clean all bearing rail screws and apply fresh Loctite 243.

9. Install the curved bearing rails by holding them parallel to the track and aligning the bearing rail keys with the bearing-rail key slots on the straight bearing rails. Slide the bearing rails keys into straight bearing-rail key slots.
10. Torque the middle screws to 22 N•m (16.2 lb•ft) by using 5 mm Allen wrench; leave the two screws on each end of the curved rail loose.
11. If necessary, align the straight and curve rails by adjusting the set screws on the ends of the curved rails to within 0.0127 mm (0.0005 in.) by using 2.5 mm Allen wrench.
12. Torque the remaining screws to 22 N•m (16.2 lb•ft) by using 5 mm Allen wrench.



13. Install the position magnet assembly by following the procedure [Install or Remove a Position Magnet Assembly on page 84](#).

Replace a Straight Motor Module

To replace a straight motor module, do the following.

Before You Begin



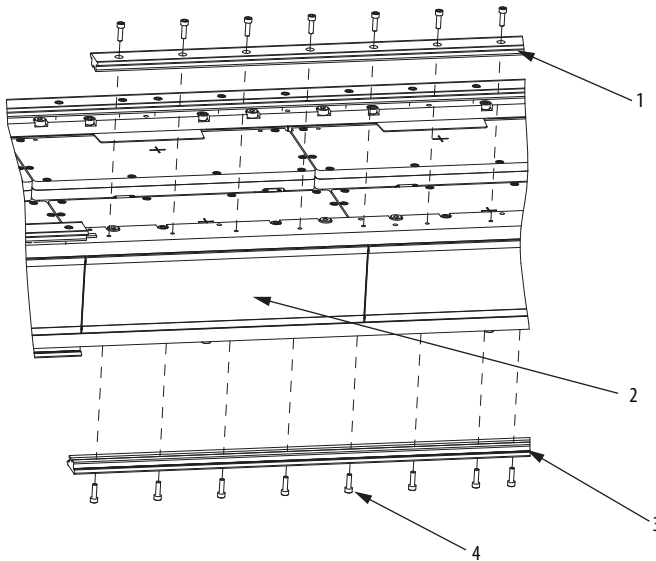
ATTENTION: Before attempting any service to an iTRAK system See [Safety Information on page 19](#).

What You Need

- 5 mm and 6 mm Allen wrenches
- Loctite 243
- 2198T-L16-Txxxx-A00N-2E1E-NS, straight motor module

To remove the straight motor module, do the following.

1. Remove the socket head cap screws M6 x 20 that secure the rails above and below the module you are replacing.



Item	Description
1	Upper rail
2	Module to be replaced
3	Lower rail
4	Socket head cap screws M6 x 20

2. Fully support the motor module.

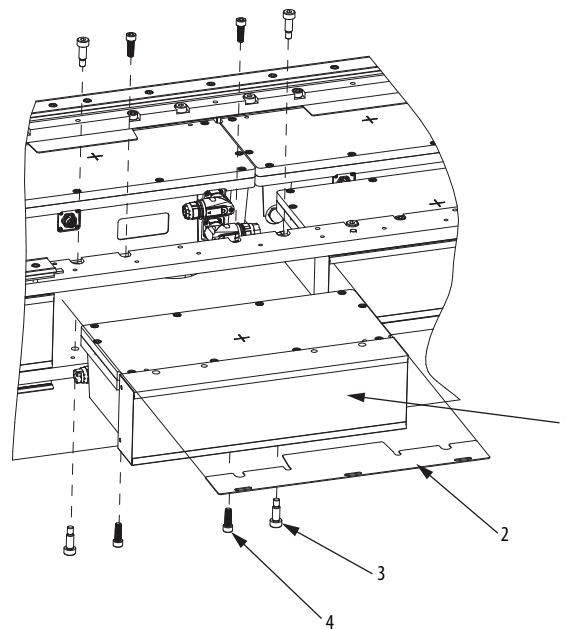


ATTENTION: You must support the motor module while performing the next step. If the motor module is not supported before you remove the screws the motor module drops.



ATTENTION: The straight motor modules can weigh up to approximately 25 kg (54 lb). Be sure to use a two man lift when moving the straight motor module.

3. Remove the socket head cap screws M8 x 25 and shoulder bolts, shoulder Ø 20 x10, thread M8 x 25 that secures the motor module to the top and bottom frames.



Item	Description
1	Motor module
2	Motor module shim
3	Shoulder bolts, shoulder Ø 20 x 10, thread M8 x 25 (x4)
4	Socket head cap screw M8 x 25 (x4)

4. Remove motor module shim.
5. Slide motor module from frame and disconnect the communication and Motor-power bus cables.
6. Clean all screws and bolts and apply Loctite 243.
7. Install new module by reversing [step 5](#) through [step 2](#).
8. Torque shoulder bolts to 13 N•m (9.6 lb•ft) and torque socket head cap screws to 22 N•m (16.2 lb•ft).

9. Loosely secure the top and bottom straight rails in position by using all socket head cap screws M6 x 20.
Be sure to minimize gap between rails.
10. Torque screws to 16 N•m (11.8 lb•ft) by using 5 mm Allen wrench.
11. Update motor module firmware, see [Update Motor Module Firmware on page 104](#).

Replace a Curved Motor Module

To replace a curved motor module, do the following.

Before You Begin



ATTENTION: Before attempting any service to an iTRAK system See [Safety Information on page 19](#).

What You Need

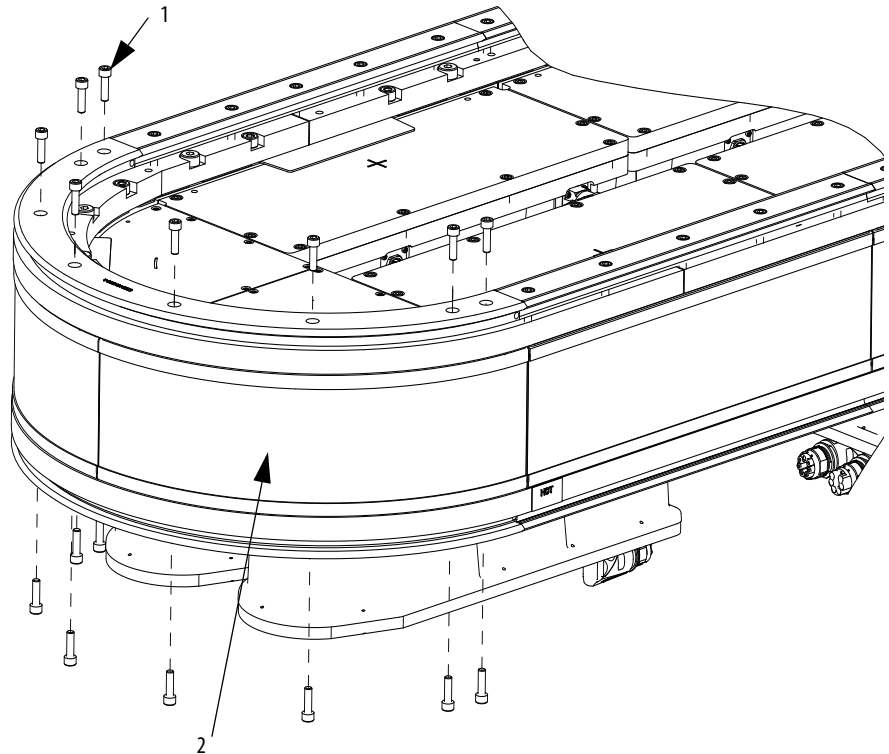
- 2.5 mm, 5 mm, and 6 mm Allen wrenches
- Loctite 243
- 2198T-L16-Txxxx-B09x-2E1E-NS, curved motor module

To remove the curved module, do the following.

1. Move movers away from the area where the curved module is to be replaced.

If you have to remove the movers follow steps in [Install or Replace a Mover on page 88](#).

2. Remove all M6 x 20 socket head cap screws from the curved bearing rails on the top and bottom of the track by using a 5 mm Allen wrench..

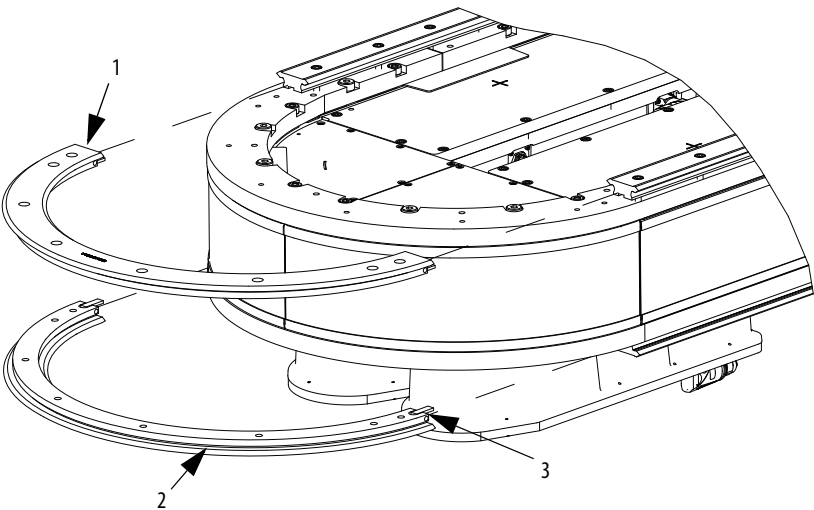


Item	Description
1	Socket head cap screws M6 x 20
2	Curved motor module to be replaced

3. Remove the top and bottom curved bearing rail by pulling parallel to the track away from the straight bearing rails.

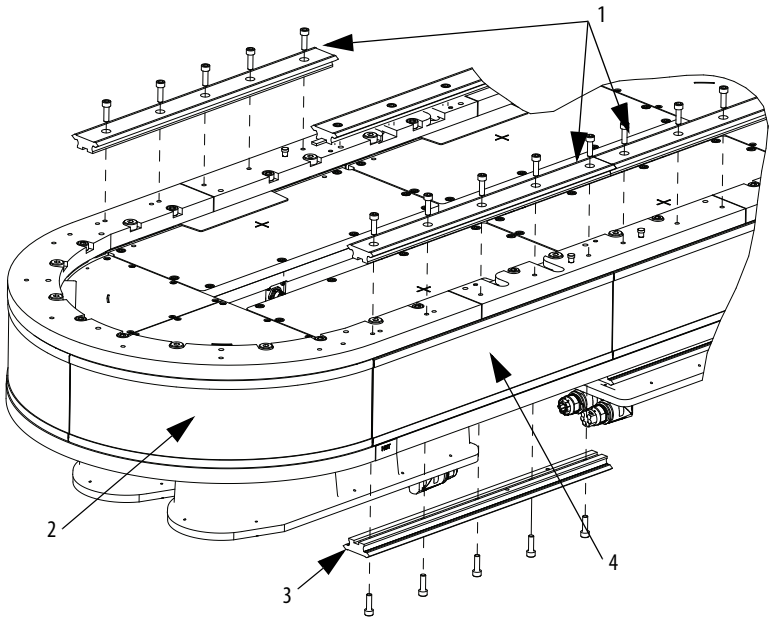


ATTENTION: Avoid bending the bearing key. Do not lift the curve bearing rail up until the bearing keys have cleared the straight bearing rail key slot.



Item	Description
1	Top curved rail
2	Bottom curved rail
3	Bearing rail key (X4)

4. Remove the socket head cap screws M6 x 20 that secure the straight rails to the curved top plate and the bottom straight rail that is located below the adjacent straight motor module by using a 5 mm Allen wrench and remove the straight rails.

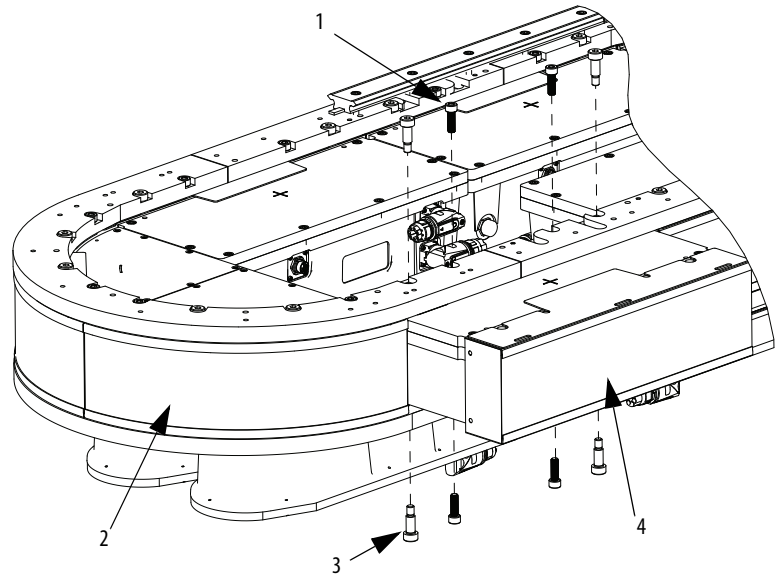


Item	Description
1	Upper straight rails
2	Curved motor module to be replaced

Item	Description
3	Bottom straight rail
4	Adjacent straight motor module

Before removing the curved motor module, the straight motor module located next to it must be removed to clear the removal of the curved motor module.

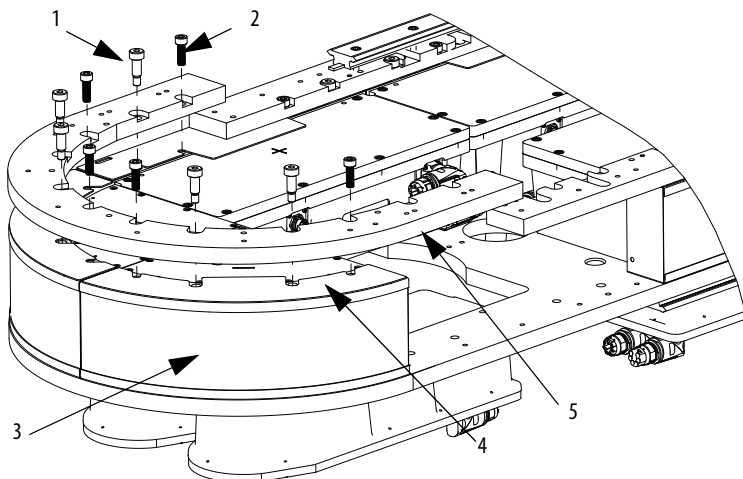
5. Remove the adjacent straight motor module by following the procedure to [Replace a Straight Motor Module on page 92](#).



Item	Description
1	Socket head cap screws
2	Curved motor module to be replaced

Item	Description
3	Shoulder bolts
4	Adjacent straight motor module

7. Remove the socket head cap screws and shoulder bolts that secure the top curved plate to the curved modules by using a 6 mm Allen wrench and remove the top curved plate.



Item	Description
1	Shoulder bolts
2	Socket head cap screws
3	Curved motor module to be replaced

Item	Description
4	Shim
5	Top curved plate

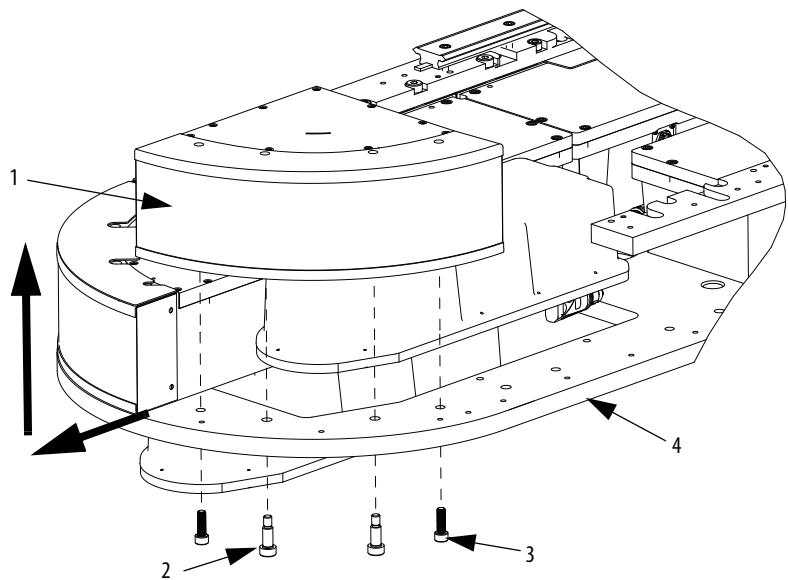
- 8. Remove the bottom socket-head cap screws and shoulder bolts that secure the curved module to the base plate by using 6 mm Allen wrench.
- 9. Remove motor module shim.
- 10. Move the curved motor module towards the end of the iTRAK system about 25.4 mm (1 in.) and disconnect the cables.
- 11. Lift the curved module straight up and out.



ATTENTION: The curved motor modules can weigh up to approximately 29 kg (64 lb). Be sure to use a two man lift when moving the curved motor module.



ATTENTION: You are exposed to pinch points between base plate and motor module when removing and installing the curved motor module.

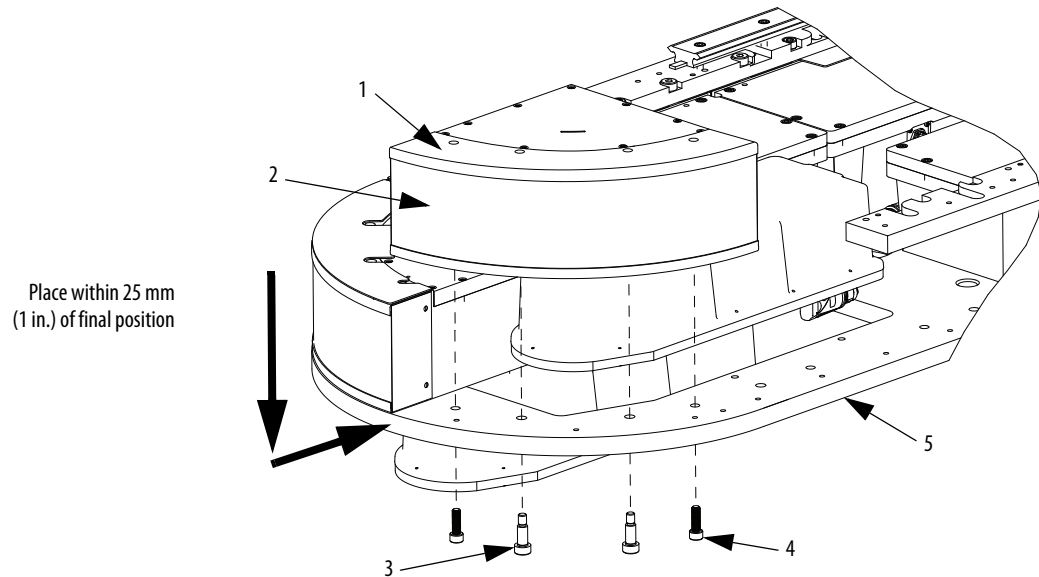


Item	Description
1	Curved motor module to be replaced
2	Shoulder bolts

Item	Description
3	Socket head cap screws
4	Base plate

To install replacement curved module, do the following.

1. Clean base and curved top plates.
2. Clean all screws and bolts and apply Loctite 243.
3. Place the replacement curved motor module about 25.4 mm (1 in.) from its final position and reconnect the cables.



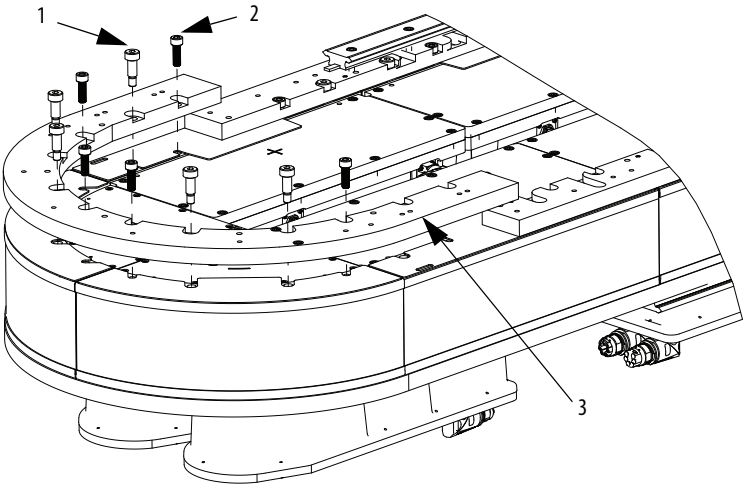
Item	Description
1	Shim
2	Curved motor module to be replaced.
3	Shoulder bolts

Item	Description
4	Socket head cap screws
5	Base plate

4. Move the replacement curved motor module into its final position.
5. Bolt the curved motor module to the base plate from the bottom. Torque shoulder bolt screws to 13 N•m (9.6 lb•ft) and torque M8 socket head cap screws to 22 N•m (16.2 lb•ft).
6. Place shim on top as shown
7. Reinstall the top curved plate by loosely attaching all bolts.
8. Install the adjacent straight motor module.

For the straight module installation, follow the procedure to [Replace a Straight Motor Module on page 92](#).

9. Torque shoulder bolt screws to 13 N•m (9.6 lb•ft) and torque M8 socket head cap screws to 22 N•m (16.2 lb•ft).

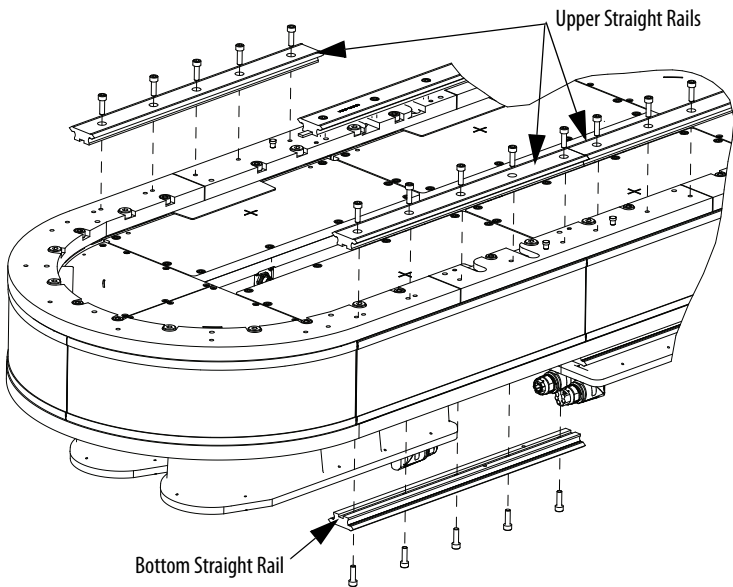


Item	Description
1	Shoulder Bolts
2	Socket Head Cap Screws
3	Top Curved Plate

10. Loosely secure the top and bottom straight rails in position by using all screws.

Be sure to minimize gap between rails.

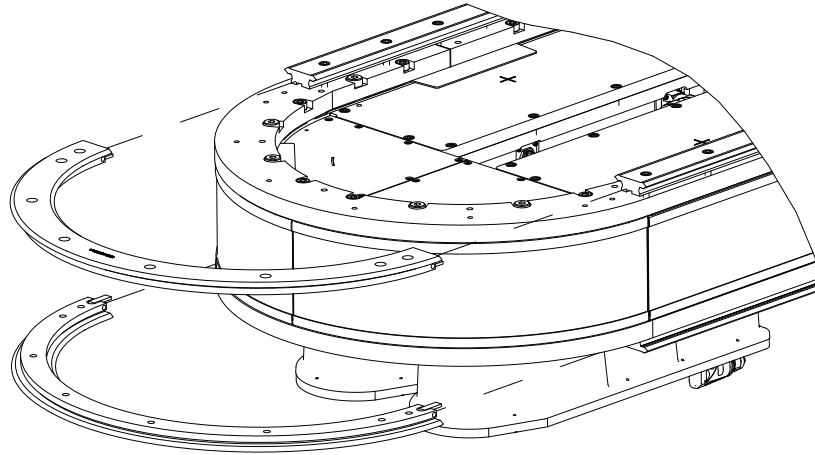
11. Torque screws to 16 N•m (11.8 lb•ft) by using 5 mm Allen wrench.



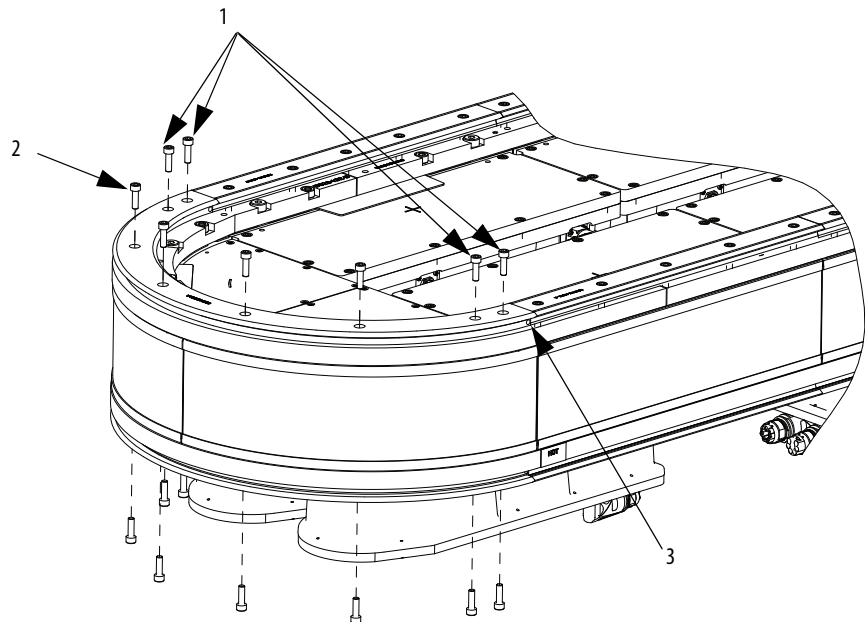
Item	Description
1	Upper straight rails

Item	Description
2	Bottom straight rail

12. Place the curved top and bottom rails in position by sliding them into the bearing key slots and loosely attach by using all screws.



13. Torque the middle screws to 16 N•m (11.8 lb•ft) by using 5 mm Allen wrench leave the two screws on each end of the curved rail loose.
14. Align the straight and curve rails by adjusting the set screws on the ends of the curved rails to within 0.0127 mm (0.0005 in.) by using 2.5 mm Allen wrench.
15. Torque the remaining screws to 16 N•m (11.8 lb•ft) by using 5 mm Allen wrench.



Item	Description
1	End bolts
2	Socket head cap screws
3	Set screws (X4)

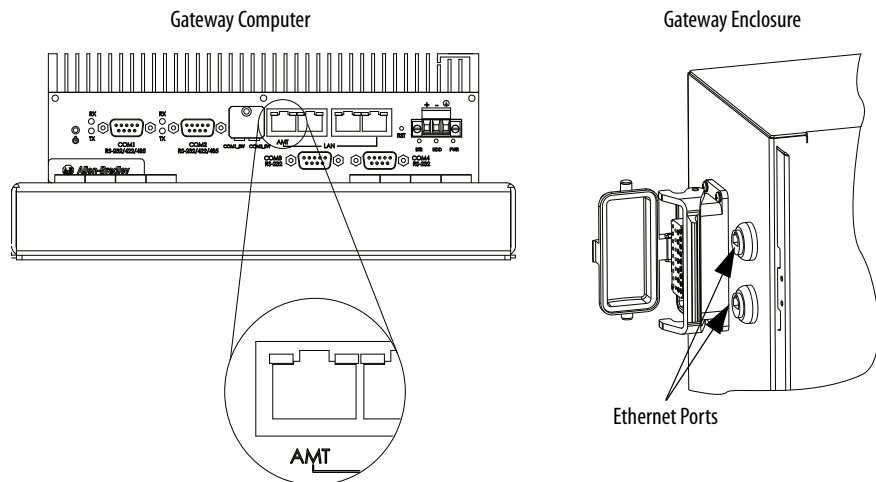
16. Update motor module firmware, see [Update Motor Module Firmware on page 104](#).

Update Gateway Firmware

To update the firmware using iTFlash, do the following.

1. Download the appropriate revisions of iTFlash from the [Rockwell Automation Product Compatibility and Download Center](#)
2. Make sure that your computer is connected to the gateway computer with an Ethernet cable.

The Ethernet port is marked AMT on the gateway computer. If you have a gateway in an enclosure, make a connection to either enclosure Ethernet port.

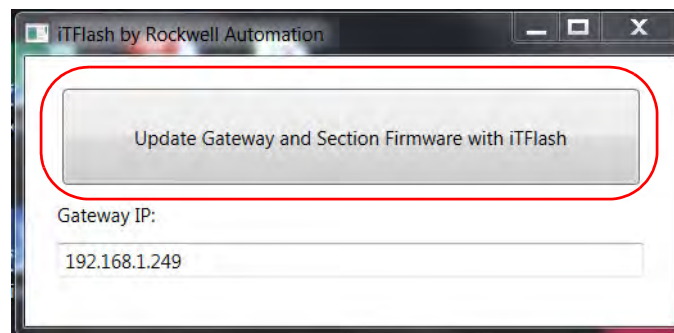


TIP You can validate that communications are properly established by pinging the gateway at its base IP address, typically 192.168.1.249.

3. Run iTFlash.exe on the computer.

TIP You can see a limited number of command prompt windows display briefly, then disappear. If a command prompt window asks for a Host Key stays displayed, answer y or yes to any security questions.

4. From the dialog box, change the base IP address if needed, and click the Update Gateway and Section Firmware with iTFlash button.



The software copies files to the system over the network. It can take up to ten minutes.

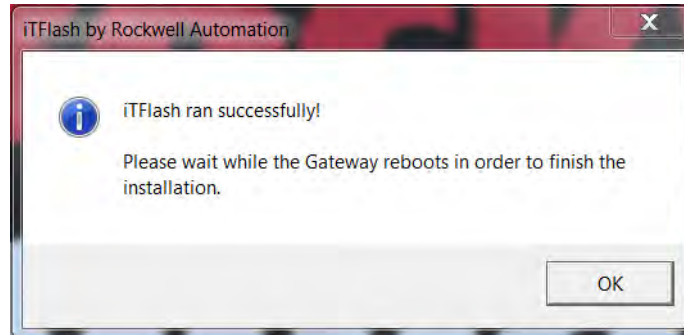
TIP If the dialog box has not appeared within 5 minutes of running iTFlash.exe, see the [Firmware Update Troubleshooting](#) section.



ATTENTION: Do not remove power during the process. If you remove power you risk permanently damaging the motor module.

5. If you are changing to revision 1.099 or earlier, when the iTFlash Success dialog box is displayed, wait at least 1 minute, and cycle power on the gateway to restart it.

In revisions greater than 1.099, the gateway automatically restarts itself.



TIP If the iTFlash failed dialog box comes up, see the [Firmware Update Troubleshooting](#) section.

6. Wait the operating system (OS) and gateway to restart.

Gateway Cat. No.	No. OS Restarts	No. Gateway Restarts	Total Restart Time (m)
2198T-Gx1-xxx-E	2	1	15
2198T-Gx2-xxx-E	2	1	10

7. See iTRAK System Programming Manual, publication [2198T-PM001](#), for details on Logix Designer application project file changes associated with firmware revisions.

Firmware Update Troubleshooting

In some rare cases when iTFlash has been previously executed, extra steps can be required to complete the installation. Follow this procedure if the operation failed.

1. Execute the iTFlash.exe file from a Command Prompt window.
2. Note the names of the files that the Command Prompt window indicates that they exist.
3. Find the location of the listed files on your system, and navigate to the enclosing directory.
4. Delete the enclosing directory and all of its contents.
5. Rerun the iTFlash.exe file. If a problem persists, contact Rockwell Automation Technical support at ICTSupport@ra.rockwell.com.

Downgrading Firmware

If the currently installed firmware revision is revision 1.101, contact Rockwell Automation Technical support at ICTSupport@ra.rockwell.com. All other firmware revisions use the standard updating process for downgrading firmware.

Update Motor Module Firmware

To update the firmware of a newly installed motor module, do the following.

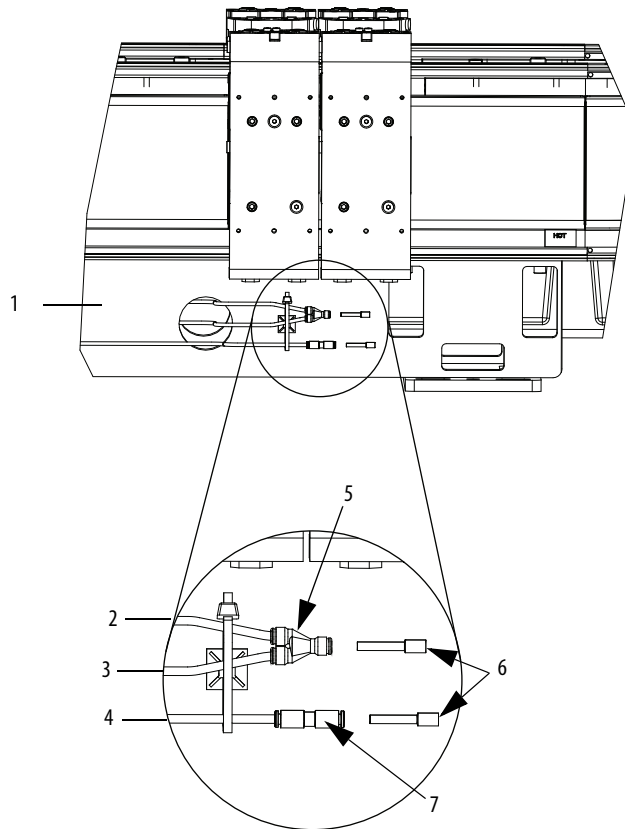
1. Disconnect the communication cable to the new motor module.
2. Power on the gateway.
3. To update all existing motor modules to 2198T-VTxx05-A firmware, toggle `Cmd.FlashSections50mm`.
4. Power down the gateway.
5. Plug in the communication cable for the new motor module.
6. Power on the gateway.
7. Toggle `Cmd.FlashSectionsxxxmm` that corresponds to the mover type you have. There are three types of movers:
 - 2198T-VTxx05-A
 - 2198T-VTxx10-A
 - 2198T-VTxx15-A.

For troubleshooting, see Knowledgebase Article [600812](#).

Lubrication

The bearings are an open system that requires continuous lubrication. To avoid breakdown of the lubrication, the bearings must have a film of oil on them. Typically indications of breakdown are discoloration and excessive wear on the inner and outer bearing surfaces. The interval to resupply the lubrication depends on the length of stroke, duty cycle, and environmental factors. Use 68 viscosity mineral oil, such as Kluber 4 UH1-68N, to lubricate the bearing rails.

To provide continuous lubrication, we recommend that you use the iTRAK Lubrication System, catalog number 2198T-AL-SYS, installation instructions start on [page 111](#). If you design and supply your own oil bleed system, you can use these installation instructions for guidance. The iTRAK system comes equipped tubing that is connected to the bleed points on the bearing rail.



Items	Description
1	Spine bar
2	Top inner lubrication tube
3	Top outer lubrication tube
4	Bottom outer lubrication tube
5	Y-split push-to-connect tube connector
6	Plug
7	Straight push-to-connect tube connector

Initial Lubrication

During first-time start or when rails have been completely cleaned do the following.

1. Run system at 0.5 m/s mover velocity.
2. Pump at 0.7 cc (0.024 oz) increments every 10 minutes until the furthest rail section from the pump has become lubricated.

TIP The film of oil is thin and can be hard to see. Wipe the rail section that contacts the mover roller with a finger you want to see a small amount of lubricant.

It is normal for some of the oil to become black, but you must not see signs of rusting or burnt grease, which is a sign of missing lubrication.

Lubrication During Normal Operation

Lubrication amounts and frequency during normal operation depend on many factors including length of track, number of movers, application motion profile, cleanliness of the operating environment and other factors. [Table 36](#) is a rough guideline that must be adjusted for each application strike a balance between keep a thin film of oil on the rail contact surfaces and over lubrication that causes excess oil splatter.

Table 36 - Lubrication Examples

System Length mm (ft)	Amount of Movers	Pump Volume cc (oz)	Time Interval in Hours
800...2400 (2.6...7.9)	1...12	0.7 (0.002)	2
2400...4800 (7.9...15.7)	1...12	1.4 (0.047)	
5200...10000 (17.1...32.8)	24...36	2.8 (0.095)	

The values in [Table 36](#) are guidelines only; monitor the rails every few hours until a quantity and frequency can be established for the current application. It is best to have a higher frequency with lower amounts of oil dispense to allow the oil to coat the rails evenly.

For systems with large number of movers, increase the pump volume by 1...2 cc (0.034...0.068 oz).

Replace Mover Lubrication Wipers

Before You Begin



ATTENTION: Before attempting any service to an iTRAK system See [Safety Information on page 19](#).

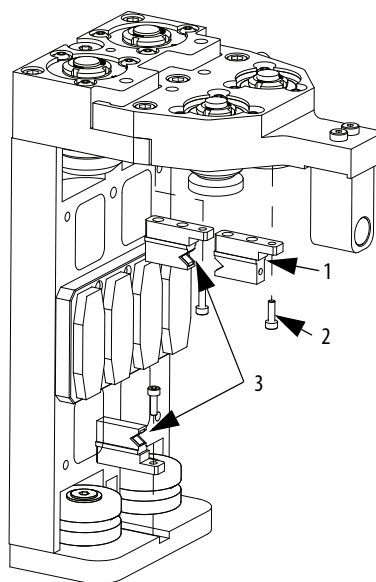
What You Need

- 2.5 mm Allen wrench
- Loctite 243
- The quantity of replacement lubrication wipers as shown in [Table 37](#).

Table 37 - Number of Lubrication Wipers on a Mover

Cat. No.	Replacement Part Number	Lubrication Wiper Quantity	Location
2198T-VTxx05-A	2198T-AL-PAD-V-50	2	One upper and one lower.
2198T-VTxx10-A	2198T-AL-PAD-V	3	Two upper and one lower.
2198T-VTxx15-A	2198T-AL-PAD-V		

1. Remove mover by following steps in [Install or Replace a Mover on page 88](#).
2. Remove lubrication wipers by using a 2.5 mm Allen wrench.



Item	Description
1	Inner Track Lubrication Wiper Assembly
2	Socket Head Cap Screw (x3)
3	Outer Track Lubrication Wiper Assembly (x2)

3. Clean all screws and apply Loctite 243.
4. Install new lubrication wipers and hand tighten.
5. Reinstall mover by following steps in [Install or Replace a Mover on page 88](#).



ATTENTION: Use caution when installing mover to help prevent damage to the felt on the lubrication wipers.

Replace Lower Mover Bearing

The top four bearings are not field replaceable. For further information contact a Rockwell Automation sales representative. There are two procedures for replacing the lower bearings. The first one is for 2198T-VTxx05-A movers and the second is for 2198T-VTxx10-A and 2198T-VTxx15-A wide movers.

Use the following procedure for movers with these catalog numbers.

- 2198T-VT0505-A
- 2198T-VT1005-A
- 2198T-VT1505-A

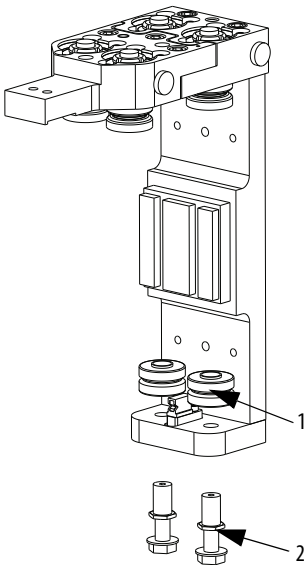
Before You Begin



ATTENTION: Before attempting any service to an iTRAK system See [Safety Information on page 19](#).

What You Need

- 17 mm socket wrench
 - Loctite 243
1. Remove mover by using the procedure found in [Install or Replace a Mover on page 88](#).
 2. Remove the two bottom bearings by using a 17 mm socket wrench.



Item	Description
1	Vee-wheel with integrated bearing
2	Lock nut

3. Clean all bolts and apply Loctite 243.
4. Attach new bearings to the mover.
5. Torque all bolts to 18 N•m (13.3 lb•ft).
6. Follow steps in [Install or Replace a Mover on page 88](#) to reinstall mover.

Use the following procedure for movers with these catalog numbers.

- 2198T-VT0510-A
- 2198T-VT0515-A
- 2198T-VT1010-A
- 2198T-VT1015-A
- 2198T-VT1510-A
- 2198T-VT1515-A

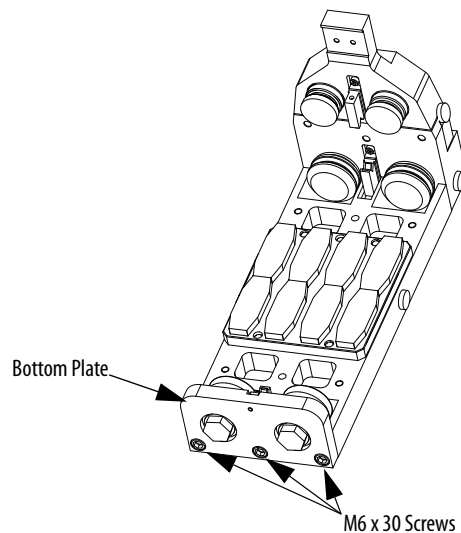
Before You Begin



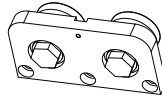
ATTENTION: Before attempting any service to an iTRAK system See [Safety Information on page 19](#).

What You Need

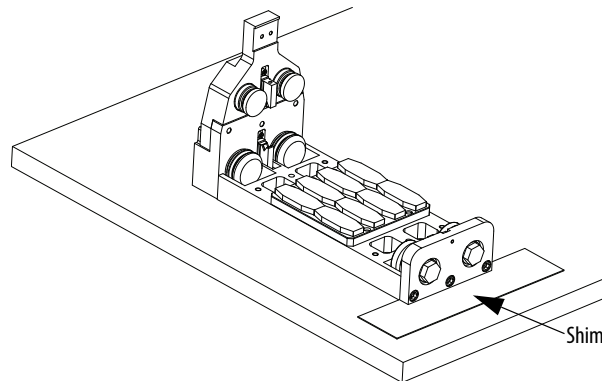
- 17 mm socket wrench
 - Loctite 243
 - 0.8 mm (0.03 in.) shim
1. Remove mover by using the procedure found in [Install or Replace a Mover on page 88](#).
 2. Remove three M6 x 30 screws to separate bottom plate from mover.



3. Remove the two bottom bearings by using a 17 mm socket wrench.



4. Clean all bolts and apply Loctite 243.
5. Attach new bearings to the bottom plate.
6. Torque all bolts to 18 N•m (13.3 lb•ft).
7. Lay the mover and bottom plate on a flat surface.
8. Assemble bottom plate to mover put a 0.8 mm (0.03 in.) shim underneath the mover plate.



9. Clean the three M6 x 30 screws and apply Loctite 243.
10. Insert and tighten three M6 x 30 screws to 17 N•m (12.5 lb•ft).

Circuit Breakers

Use [Figure 45](#) to locate circuit breakers in the PCM. Before accessing the PCM, read the following.



BURN HAZARD: Some components of the system have hot surfaces.

- Do not touch hot surfaces such as brake resistors, heat sinks, power supply units, drive controllers.
- After powering down switching chokes, power supply units, and drive controllers, let them cool for 15 minutes before touching.



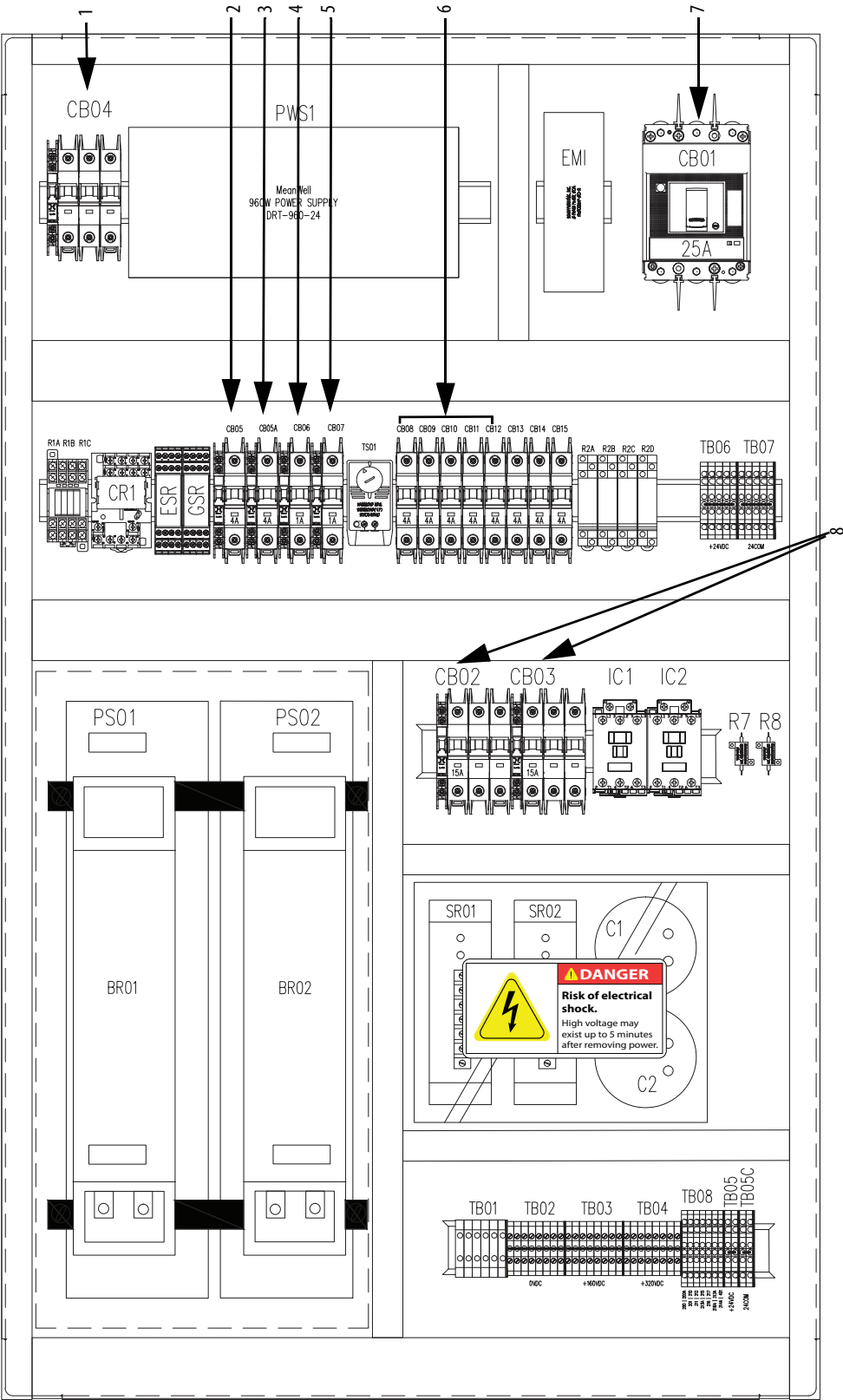
SHOCK HAZARD: Before accessing electrical components with voltage potentials higher than 50V, disconnect them from the mains or power supply.

Wait 5 minutes after switching off power to let capacitors discharge. See [High Voltage \(capacitors\) on page 131](#).

Measure the voltage before working on components to make sure that they are safe to touch.

- Do not connect, disconnect, or touch electrical connections or components when power is applied.
- Only take measurements or test the operation of the system if a ground conductor is properly connected.

Figure 45 - PCM Circuit Breakers



Item	Description
7	CB01 AC Main Disconnect ⁽¹⁾
8	CB02, CB03 High-Voltage Supply Lines

Item	Description
1	CB04 AC Input to 24V Supply
2	CB05 24V Gateway 1
3	CB05A 24V Gateway 2
4	CB06 24V Ethernet Switch
5	CB07 Fan
6	CB08...CB12 24V to Track Motor Modules

(1) Location is dependent on the presence of a panel disconnect interlock.

Troubleshooting

Use the system reported errors in this section to diagnose iTRAK® system problems.

Topic	Page
Errors Codes	113

Errors Codes

The iTRAK system can generate errors from the Gateway or from the motor modules. The error codes are pushed from those devices to tags in the control structure. These error codes are in addition the Logix Designer application generated codes. Error codes from the motor module are displayed in iTRAK_Control.Status tag.

The codes are created from the following tags.

Table 38 - Error Code Tags

Tag	Description
iTRAK_Control.Status.GatewayFaultCode	This tag contains the error codes from the Gateway. In Table 39 it is referred to as the Gateway Code.
iTRAK_Control.Status.SectionFaultCode	This tag contains the error codes from the motor module. In Table 39 it is referred to as the Device Code.
iTRAK_Control.Status.FaultMessageLine1	This tag contains the first line of displayed text in the error code description.
iTRAK_Control.Status.FaultMessageLine2	This tag contains the second line of displayed text in the error code description.
iTRAK_Control.Status.SectionNumberFaulted	This tag indicates the motor module that failed.
iTRAK_Control.Status.SectionDeviceFaulted	This tag indicates if a motor module error is power-related or position related. 0 - position-related 1 - power-related
iTRAK_Control.Status.SectionFaultData	Helpful data to troubleshoot the error.

The error codes are described in [Table 39](#).

Table 39 - iTRAK System Error Codes

iTRAK_Control.Status. GatewayFaultCode	iTRAK_Control.Status. SectionFaultCode	Displayed Text	Description and Solution
3	20	ERR_VOLTS_LO: Section voltage is too low or off. Check Power Supply, Power Cables, Power Supply IO, etc. IF problem persists, Call FOR Service.	<p>This error indicates that the motor module has lost high voltage on one or both of its buses. The following are possible causes.</p> <ul style="list-style-type: none"> • Loose cables • Module incorrectly wired • Power supply has faulted <p>The iTRAK_Control.Status.SectionNumberFaulted tag contains the motor module that is reporting this fault.</p> <p>The iTRAK_Control.Status.SectionFaultData tag indicates the bus that has failed.</p> <p>If the iTRAK_Control.Status.SectionFaultData tag = 0, then the high-voltage rail is lower than 35V.</p> <p>1, then the common rail is lower than 17V.</p> <p>3, then the voltage of the common rail is less than ¼ of the high-voltage rail.</p> <p>Other values, then the PWM board in this motor module has no current, call for service.</p> <p>Check power supply and power cables. Reset power supply.</p>
	21	ERR_VOLTS_HI: Section voltage is too high. Emergency shunting has been activated. Check Power Supply AND Shunt Regulator. Call FOR service	<p>Check status indicator on the power supply and power cables. Reset power supply.</p> <p>There can be an issue with the power supply that is being reported by a motor module.</p> <p>The iTRAK_Control.Status.SectionNumberFaulted tag contains the motor module that is reporting this fault.</p> <p>If the iTRAK_Control.Status.SectionFaultData tag = 0, then the high-voltage rail is higher than 509V.</p> <p>1, then the common rail is higher than 254V.</p> <p>2, then the voltage of the common rail is greater than 9/10 of the high-voltage rail.</p> <p>Other values, then the voltage of motor module exceeds the safety range.</p>
9	0	Fault_FieldBusSys - Sign of Life between controller and gateway has been lost. Increase sync period AND check cables.	<p>This error indicates the EtherNet/IP™ connection between the controller and the gateway has dropped. The following are possible causes.</p> <ul style="list-style-type: none"> • The time Sync of the Ethernet module is not configured for Time and Motion in the .acd file. • The controller is not configured for Time Synchronization in the .acd file. • The Ethernet connection to the gateway can need to be manually reset. <ul style="list-style-type: none"> a. Unplug the Ethernet cable from the gateway. b. Cycle the power on the gateway, wait 3...4 minutes until the gateway powers up. c. Reconnect the Ethernet cable. • Unshielded cables. • Bad switch. • Faulty hardware. • Overuse of Logix Designer application trending. <p>Turn off application trending. Check cabling.</p> <p>The iTRAK_Control.Status.SectionNumberFaulted tag is not applicable for diagnostics. When this fault occurs, record the information and be prepared to provide it to Customer Support if requested.</p>

Table 39 - iTRAK System Error Codes (Continued)

iTRAK_Control.Status.GatewayFaultCode	iTRAK_Control.Status.SectionFaultCode	Displayed Text	Description and Solution
10	0	Headway Fault. Two movers cmd or actual pos is under headway setting. Increase amt	<p>This error indicates that at the end of the next Coarse Update Period two movers can crash into each other. The following are possible causes.</p> <ul style="list-style-type: none"> Two motion commands are not synchronized to run in the same Coarse Update Period. A mover was applied over another mover. Tasks have overlapped and cannot finish in allocated time. <p>The iTRAK_Control.Status.SectionNumberFaulted tag contains the motor module that is reporting this fault.</p> <p>If the iTRAK_Control.Status.SectionFaultData tag = 0, then the headway fault happened between mover 0 and the mover with the largest mover number.</p> <p>7, then the neighbor movers did not trigger the fault.</p> <p>Check for task overlaps. Verify proper motion instruction execution order.</p>
11	0 or 7	<p>Displayed Text varies according to the value of iTRAK_Control.Status.SectionNumberFaulted:</p> <p>Value 0: Wrong Number of movers reported. A mover has been lost on the system or the wrong number specified in the active axis tag. Check magnets or re-number with HMI tag.</p> <p>Value 7: iTRAK could not find all movers at their last reported positions. The movers have been automatically renumbered.</p>	<p>This error indicates the following.</p> <ul style="list-style-type: none"> The number of movers exceeds the maximum number that is specified in the iTRAK_Control.Data.ActiveMovers tag. A mover was lost in the middle of the track. Movers have been moved when the gateway is off. <p>If the iTRAK_Control.Status.SectionFaultData tag = 0, then the number of movers that are specified in the Logix Designer application doesn't match the number of movers actually found.</p> <p>To reset this fault, do the following.</p> <ol style="list-style-type: none"> Correct the value in the iTRAK_Control.Data.ActiveMovers tag. Renumber the movers by latching iTRAK_Control.Cmd.RenumberMovers. Reset the fault by latching iTRAK_Control.Cmd.FaultReset <p>If the iTRAK_Control.Status.SectionFaultData tag = 7, then upon start-up, the movers were not found in the same positions as they were when the track was shut down. The movers on the track have been automatically renumbered.</p> <p>Check position magnets. Check specified movers and licenses. Check track for debris.</p>
12	0	Fault_InternalComm - Data could not be written to sections.	<p>This error indicates that a motor module is not responding to commands. The following are possible causes.</p> <ul style="list-style-type: none"> Low-voltage power loss Communication cables are not connected Communication cables are loose Electrical noise <p>The iTRAK_Control.Status.SectionNumberFaulted tag contains the motor module that is reporting this fault.</p> <p>If the iTRAK_Control.Status.SectionFaultData tag = 0, then writing data to a motor module failed.</p> <p>1, then the motor module received too many communication errors.</p> <p>2, then the force command was not received or the neighborhood command was not received.</p> <p>This fault can cause the gateway to lose movers; therefore, the movers must be renumbered before clearing this fault.</p> <p>Check power connections. Cycle power.</p>
	2	ERR_OVERCURRENT_FAULT: Section has an overcurrent fault. Reset system.	<p>This error indicates that the current in the motor module has risen to an unacceptable level.</p> <p>The iTRAK_Control.Status.SectionNumberFaulted tag contains the motor module that is reporting this fault.</p> <p>The iTRAK_Control.Status.SectionDeviceFaulted tag is the PWM board number.</p> <p>The iTRAK_Control.Status.SectionFaultData tag is the bad coil.</p> <p>Verify that the sizing of system is correct. Reduce the acceleration and deceleration.</p>

Table 39 - iTRAK System Error Codes (Continued)

iTRAK_Control.Status. GatewayFaultCode	iTRAK_Control.Status. SectionFaultCode	Displayed Text	Description and Solution
12	6	ERR_WAYWARD_ISR: Section is reporting an Wayward ISR fault. Call FOR service.	This error indicates an electronics failure in a motor module. The iTRAK_Control.Status.SectionNumberFaulted tag contains the motor module that is reporting this fault. Replace the failed module.
	7	ERR_SENSOR_TIMEOUT: Section is reporting a sensor hardware fault. Call for service.	This error indicates a failure in the position sensing hardware. The iTRAK_Control.Status.SectionNumberFaulted tag contains the motor module that is reporting this fault. Replace the failed module.
	8	ERR_INVALID_PKT: Section received an invalid packet. Reset system.	This error indicates a failure in communication from the gateway to the motor module. The iTRAK_Control.Status.SectionNumberFaulted tag contains the motor module that is reporting this fault. If the iTRAK_Control.Status.SectionFaultData tag < 12, then the iTRAK_Control.Status.SectionFaultData tag has a gain that is 0. If the iTRAK_Control.Status.SectionFaultData tag ≥ 12, the section is not calibrated properly. Check the cable and reset the system.
	12	ERR_COMMUTATOR_TIMEOUT: Commutator could not finish in allocated time. Call FOR Software update.	This error indicates communication failure between the gateway and a motor module. The iTRAK_Control.Status.SectionNumberFaulted tag contains the motor module that is reporting this fault. The iTRAK_Control.Status.SectionDeviceFaulted tag = The PWM board number. Check the cable. Reset the system. Contact Rockwell Automation Technical Support for service.
	14	I2T Error: A coil or all coils have been on for too long for heat. ExtraData=Coil	This error indicates that there is something physically wrong with the track. The following are possible causes. <ul style="list-style-type: none"> • The movers path is physically impeded • Bearings are binding • A motor module is loosely mounted • General over all performance is low The iTRAK_Control.Status.SectionNumberFaulted tag contains the motor module that is reporting this fault. If the iTRAK_Control.Status.SectionFaultData tag < 12, then the coil with number equal to iTRAK_Control.Status.SectionFaultData is overheated, stop the system. If iTRAK_Control.Status.SectionFaultData tag = 12, then overcurrent has run for too long. Check track path and cables or reduce motion profile demands. To clear this fault properly, do the following. 1. Leave the iTRAK high voltage off for 5 minutes, Do not turn off the control voltage. 2. Check the track path. 3. Clear the fault and start the track 4. If the fault is reproduced, reduce motion profile demand.

Table 39 - iTRAK System Error Codes (Continued)

iTRAK_Control.Status. GatewayFaultCode	iTRAK_Control.Status. SectionFaultCode	Displayed Text	Description and Solution
12	15	ERR_CHECKSUM: Section communication error. Check comm. cable. Reset system.	<p>This error indicates a communication failure between the gateway and a motor module.</p> <p>The iTRAK_Control.Status.SectionNumberFaulted tag contains the motor module that is reporting this fault.</p> <p>If the iTRAK_Control.Status.SectionFaultData tag = 2, 4, 6, 7, 8, 9, 10, or 11, then iTRAK_Control.Status.SectionFaultData is the communications packet ID number on which the checksum error occurred.</p> <p>If the iTRAK_Control.Status.SectionFaultData tag = 3, then the packet is not from the gateway.</p> <p>5, then the packet that was received is not for this motor module.</p> <p>13, then the packet that was received is not good.</p> <p>14, then the size of the packets exceeds maximum size.</p> <p>100, then there were ten communication errors in a row.</p> <p>109...112, then check the communication cable shield and ground and all other potential interference on serial communication, Move noise producing devices such as transformers and AC drives away from the gateway. If the fault is reproduced, replace the motor module.</p> <p>Check the communication cable and reset the system.</p>
	16	ERR_POS_RANGE: Position Sensor error. Indicates electrical fault. Extra Data indicates which sensor. Call FOR service.	<p>This error indicates a failed position sensor.</p> <p>The iTRAK_Control.Status.SectionNumberFaulted tag contains the motor module that is reporting this fault.</p> <p>The iTRAK_Control.Status.SectionFaultData tag is the number of the sensor whose analog-to-digital converter is out of range.</p> <p>Replace the failed motor module.</p>
	17	ERR_CUR_RANGE: Current Sensor error. Indicates electrical fault.	<p>This error indicates a failed current sensor.</p> <p>The iTRAK_Control.Status.SectionNumberFaulted tag contains the motor module that is reporting this fault.</p> <p>The iTRAK_Control.Status.SectionFaultData tag contains the failed sensor.</p> <p>If iTRAK_Control.Status.SectionFaultData < 20, then iTRAK_Control.Status.SectionFaultData is the number of the coil that has a failed sensor. This fault happens during run time.</p> <p>If iTRAK_Control.Status.SectionFaultData ≥ 20, then (iTRAK_Control.Status.SectionFaultData - 20) is the number of the coil that has a failed sensor. This fault happens during the power on self test.</p> <p>Replace the failed motor module.</p>
	18	ERR_PCB_TEMP: Drive overtemperature fault. Check mover bearings, venting, reduce motion profile demands. IF problem persists, call FOR service.	<p>This error indicates that the electrical boards are warm. This error is usually the result of failed mechanical part that caused the motor to over work and transfer heat.</p> <p>The iTRAK_Control.Status.SectionNumberFaulted tag contains the motor module that is reporting this fault.</p> <p>The iTRAK_Control.Status.SectionFaultData tag is the temperature of the device.</p> <p>Check mover bearings, vents, or reduce motion profile demands.</p>

Table 39 - iTRAK System Error Codes (Continued)

iTRAK_Control.Status. GatewayFaultCode	iTRAK_Control.Status. SectionFaultCode	Displayed Text	Description and Solution
12	20	ERR_VOLTS_LO: Section voltage is too low or off. Check Power Supply, Power Cables, Power Supply IO, etc. IF problem persists, Call FOR Service.	<p>This error indicates that the motor module has lost high voltage on one or both of its buses. The following are possible causes.</p> <ul style="list-style-type: none"> • Loose cables • Module incorrectly wired • Power supply has faulted <p>The iTRAK_Control.Status.SectionNumberFaulted tag contains the motor module that is reporting this fault.</p> <p>The iTRAK_Control.Status.SectionFaultData tag indicates the bus that has failed.</p> <p>If the iTRAK_Control.Status.SectionFaultData tag =</p> <p>0, then the high-voltage rail is lower than 35V.</p> <p>1, then the common rail is lower than 17V.</p> <p>3, then the voltage of the common rail is less than ¼ of the high-voltage rail.</p> <p>Other values, then the PWM board in this motor module has no current, call for service.</p> <p>Check power supply and power cables. Reset power supply.</p>
	21	ERR_VOLTS_HI: Section voltage is too high. Emergency shunting has been activated. Check Power Supply AND Shunt Regulator. Call FOR service	<p>This error indicates that the motor module voltage is too high.</p> <p>The iTRAK_Control.Status.SectionNumberFaulted tag contains the motor module that is reporting this fault.</p> <p>If the iTRAK_Control.Status.SectionFaultData tag =</p> <p>0, then the high-voltage rail is higher than 509V.</p> <p>1, then the common rail is higher than 254V.</p> <p>2, then the voltage of the common rail is greater than 9/10 of the high-voltage rail.</p> <p>Other values, then the voltage of motor module exceeds the safety range.</p> <p>Check power supply and power cables. Reset power supply.</p>
	22	ERR_PWRSTAGE_TEMP: Power stage is overtemperature. Check mover bearings, venting, reduce demands. IF problem persists, call FOR service.	<p>Power stage is overtemperature.</p> <p>The iTRAK_Control.Status.SectionNumberFaulted tag contains the motor module that is reporting this fault.</p> <p>The iTRAK_Control.Status.SectionFaultData tag is the amplifier module has reported this fault.</p> <p>Check mover bearings, how the machine is vented, or reduce demands.</p>
	23	ERR_ONE_BAD_COIL: Power on Self Test indicates at least one coil is bad. Extra data indicates Coil. System may still run. Call FOR service	<p>There is a bad coil.</p> <p>The iTRAK_Control.Status.SectionNumberFaulted tag contains the motor module that is reporting this fault.</p> <p>The iTRAK_Control.Status.SectionFaultData tag contains the number of the bad coil.</p>
	24	ERR_TOO_MANY_BAD_COILS: Power on Self Test indicates at multiple coils are bad. System will NOT run. Call FOR Service	<p>There are too many bad coils.</p> <p>The iTRAK_Control.Status.SectionNumberFaulted tag contains the motor module that is reporting this fault.</p> <p>The iTRAK_Control.Status.SectionFaultData tag contains the number of the first bad coil. Call service to replace the module.</p>
	25	N/A	<p>Nonvolatile memory operations failed.</p> <p>The iTRAK_Control.Status.SectionNumberFaulted tag contains the motor module that is reporting this fault.</p> <p>If the iTRAK_Control.Status.SectionFaultData tag =</p> <p>30, then the erase Hold Buffer failed.</p> <p>31, then the received data is too small, missed block, changed in the number of blocks, wrong block size, or wrong byte size.</p> <p>32, then the burn Hold Buffer failed.</p> <p>33, then the received data did not match.</p>
	Any other value.	Any other value.	Contact ICTSupport@ra.rockwell.com.

Table 39 - iTRAK System Error Codes (Continued)

iTRAK_Control.Status. GatewayFaultCode	iTRAK_Control.Status. SectionFaultCode	Displayed Text	Description and Solution
17	0	Position Window Err: a mover is outside its position window. Check or increase win	<p>This error indicates that a mover is no longer within the window between the command and actual position as specified by the position window tag in the HMI. The following are possible causes.</p> <ul style="list-style-type: none"> • Mechanical failure • Over-aggressive programming • The following error set too low in the HMI. <p>The iTRAK_Control.Status.SectionNumberFaulted tag contains the mover that is reporting this fault.</p> <p>Check or increase the position window.</p>
18	0	Sections are not connected correctly or too many movers reported or NOT communicating or wrong track length	<p>This error indicates that there is a difference in track length or number of active axes as downloaded from the control structure than what the gateway is reporting. The following are possible causes.</p> <ul style="list-style-type: none"> • The control tags are set incorrectly. • The motor modules are improperly cabled. • Foreign magnetic material on the track is adding an extra mover. • If there is a newly installed motor module on the track, this error can indicate that the firmware in the newly installed motor module does not match the firmware for the mover type that is specified for that track. <p>If the iTRAK_Control.Status.SectionNumberFaulted tag = 0, then the track length that is specified in iTRAK_Control.Data.TrackLength doesn't match the track length the gateway calculated.</p> <p>Otherwise, iTRAK_Control.Status.SectionNumberFaulted tag contains the motor module that has reported this fault.</p>
20	30	The iTRAK power supply has a fault. Check the iTRAK power supply screen and gateway terminal for details.	The iTRAK power supply is not in Running mode. Check the iTRAK power supply screen for more information and acknowledge the fault.
	31		The gateway failed to acknowledge the fault on the iTRAK power supply. Check the iTRAK power supply wiring and acknowledge the fault.
	32		The gateway failed to enable the iTRAK power supply. Check the iTRAK power supply wiring and acknowledge the fault.
	34		The wiring of the iTRAK power supply is incorrect. Check the wiring and reboot the gateway to clear the fault.
23	N/A	N/A	During the download of the user-specified External Force Compensation table, two adjacent entries were found to have the same position value, which is not permitted. You must change at least one of the position values, and re-trying the download of the External Force Compensation table.
	1	N/A	The External Force Compensation table contains more than six entries. Six entries is the maximum.
24	N/A	N/A	During the download of the user-specified External Current Limit table, two adjacent entries were found to have the same position value, which is not permitted. You must change at least one of the position values, and re-trying the download of the External Current Limit table.
	1	N/A	The External Current Limit table contains more than six entries. Six entries is the maximum.

Table 39 - iTRAK System Error Codes (Continued)

iTRAK_Control.Status. GatewayFaultCode	iTRAK_Control.Status. SectionFaultCode	Displayed Text	Description and Solution
25	1	N/A	Sub code 1. The velocity bandwidth is out of the range of 1 . . . 1000
	2	N/A	Sub code 2. The velocity integrator is out of the range of 1 . . . 2000.
	3	N/A	Sub code 3. The gain values are attempting to be applied to a motor module number that is not in the range of 0 . . . (Number of motor modules on the track - 1).
	4	N/A	Sub code 4. The gain values are attempting to be applied to a mover number that is not in the range of 0 . . . 15. Per-mover gains may be specified only for the first 16 movers on an iTRAK system.
26	0	Mover size mismatch, size of movers are not consistent on the track Check section types and set them to correct types, Call service for more details	There is an inconsistency between the size of the movers on the iTRAK system, and the firmware that is downloaded into one or more of the motor modules. Fix the error by toggling the appropriate iTRAK_Control.Cmd.FlashSections<x>mm controller tag.

Functional Safety

The iTRAK® components do not have Safe Torque Off or any other features that are described in EN 61800-5-2. When combined into a system, implement safety functions to prevent motor actuation. Remove the AC power by using similar methods that are used for variable frequency drives that do not have Safe Torque Off. The safety function subsystem that is described here explains how to wire contactors for the successful removal of power to the iTRAK system.

Topic	Page
Important Safety Considerations	121
Category 3 Requirements according to EN ISO 13849-1	121
Stop Category Definition	122
Performance Level and Safety Integrity Level (SIL)	122
Safety Distance Calculations	122
Functional Safety Description	122
Considerations for Category 1 Stop	123
Overall System Stopping Performance	123
Schematic and Block Diagrams	124

Important Safety Considerations

You are responsible for the following.

- Validation of any sensors or actuators that are connected to the system.
- Completing a machine-level risk assessment.
- Certification of the machine to the desired EN ISO 13849 performance level or IEC 62061 SIL level.
- Project management and proof tests in accordance with EN ISO 13849 or IEC 62061.

Category 3 Requirements according to EN ISO 13849-1

Safety-related parts are designed with these attributes.

- One fault in any of these parts of the control system does not lead to the loss of the safety function.
- One fault is detected whenever reasonably practicable.
- Accumulation of undetected faults can lead to the loss of the safety function and a failure to remove power that produces motion from the motor.

Stop Category Definition

Stop Category 0 as defined in IEC 60204 is achieved with immediate removal of power that produces actuator motion.

Stop Category 1 as defined in IEC 60204 is achieved with the delayed removal of power that produces actuator motion, to facilitate the controlled stoppage of elements that move.

Performance Level and Safety Integrity Level (SIL)

For safety-related control systems, Performance Level (PL), according to EN ISO 13849-1, and SIL levels, according to IEC 61508 and IEC 62061. Include a rating of the ability of the system to perform its safety functions. All safety-related components of the control system must be included in both a risk assessment and the determination of the achieved levels.

See the EN ISO 13849-1, IEC 61508, and IEC 62061 standards for complete information on requirements for PL and SIL determination.

Safety Distance Calculations

Detailed calculation of a proper safety distance is beyond the scope of this document, but here are some considerations to follow.

System safeguards must be in place such that a person cannot reach a hazardous motion before the safeguarding system has brought that hazardous motion to a halt. These issues are addressed in safety standards relevant to this application that are listed here.

- ISO 14119 Safety of machinery - Interlocking devices that are associated with guards - Principles for design and selection.
- ISO 13855 Safety of machinery - Positioning of safeguards regarding the approach speeds of parts of the human body.
- ANSI B11.19 Performance Criteria for Safeguarding.

Functional Safety Description

The safety logic device, such as a configurable safety relay or programmable safety automation controller, monitors the safety input device, such as a door switch or emergency stop button, for commands, proper operation, and safety demands. The safety logic device must monitor itself for any internal faults.

When actuated, the safety logic device sends a safety stop command to the motion control device and start the configurable timer. During this time, the iTRAK system must decelerate to zero speed.

When the timer expires, power is removed from the safety output contactors that remove power that produces motion from the iTRAK system. If the track is in motion, it coasts to a stop.

The safety logic device must monitor the contactors for welded contacts via feedback from two normally closed contacts in a series, one from each contactor, in the reset circuit. If a contact is welded, the normally closed

contact is held open, which breaks the reset circuit. The system must not be restarted until appropriate measures have been taken.

Considerations for Category 1 Stop

If there is a malfunction, it is possible that stop category 0 can occur. When designing the machine application, timing and distance must be considered for a coast to stop and the possibility of the loss of control of a vertical load. The malfunction that causes this condition maybe when a signal to the output contactor coil were to go low. A low can happen when a wire falls off or control power fails before the iTRAK system has a chance to come to a complete stop. Use additional protective measures if this occurrence can introduce unacceptable risks to personnel.

Overall System Stopping Performance

ISO 14119 6.2.1 stipulates that the overall system stopping time for a hazardous machine that is safeguarded by an interlock must be less than the access time. If the overall system stopping performance is equal to or greater than the access time, an interlock with guard locking must be used, the distance from the safeguard to the hazard must be increased, or another, more suitable method must be used to safeguard the hazard.

The overall stopping performance of these applications is the sum of the following.

- Response time of the safety input device.
- Safety logic devices.
- Any delay that is configured in the safety logic devices.
- The safety reaction time of the output contactors used.
- The coast-to-stop time of the hazardous motion.

The response and reaction times can be taken from the product support literature.

IMPORTANT Determine the overall system stopping performance of a safeguarding system by actual system testing and measurement. The worst-case, overall system stopping performance from these tests and measurements must be used to evaluate the safety distance requirements.

The sum response and reaction time of the safety logic devices, output contactors, and worst-case, coast-to-stop portion of the overall system-stopping performance is the same regardless of the input device used.

It is useful to estimate how fast the hazardous motion must coast to a stop before the safeguarded system is available for testing.

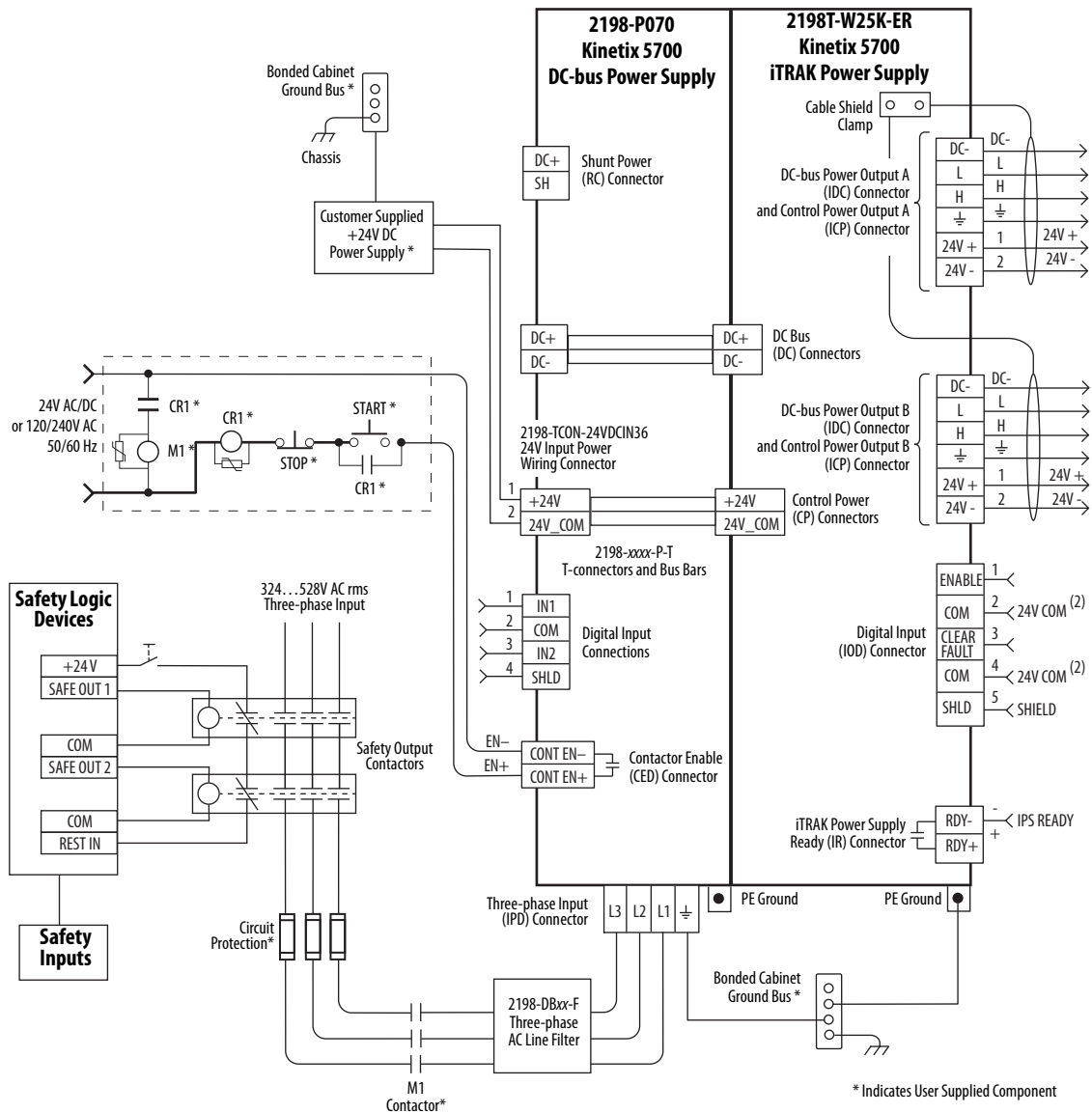
Schematic and Block Diagrams

These simplified schematic diagrams are intended to inform qualified engineers on how to structure a safety system around the iTRAK system. They are not considered complete.

iTRAK Power Supply

The block diagram that is shown in [Figure 46](#) is an outline schematic for the safety circuit to use with a system that uses an iTRAK power supply.

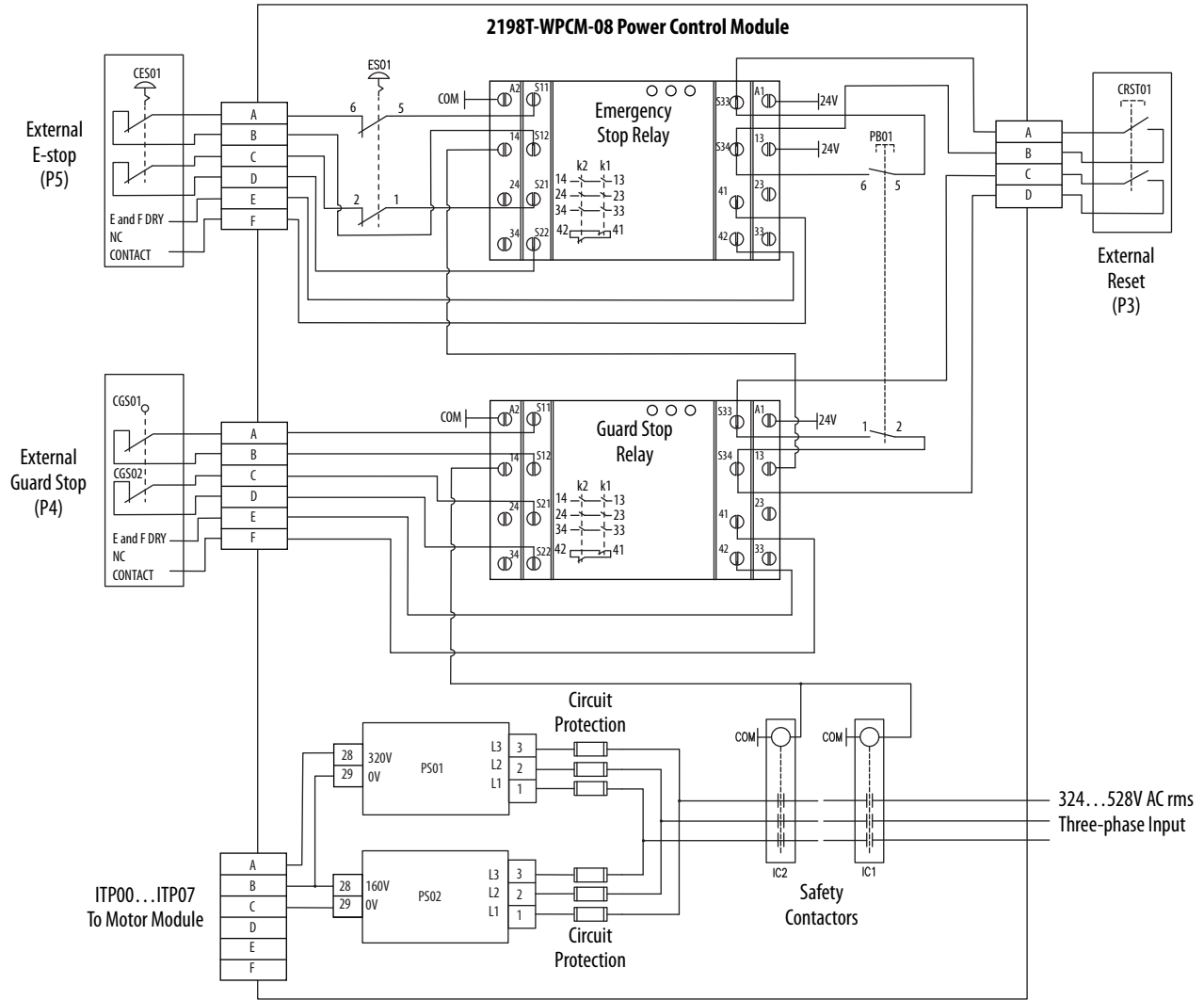
Figure 46 - Kinetix® 5700 iTRAK Power Supply Safety Circuit Block Diagram



Power Control Module

When the iTRAK system is used with a pre-assembled power control module, the safety logic devices and safety output contactors are pre-wired in the cabinet. You are responsible for wiring safety input devices to the appropriate connectors on the cabinet. The safety circuit wiring schematic included in a pre-assembled cabinet is shown in [Figure 47](#).

Figure 47 - Power Control Module Safety Circuit



Notes:

Compatibility

Use this chapter to determine compatibility between newer and older components of your iTRAK® system.

Topic	Page
Motor Modules	127
Movers and Magnets	128
Gateways	128
Power Supplies	128
Controllers	128

Motor Modules

Bulletin 2198T iTRAK motor modules are compatible and can be mixed mechanically, regardless of the series.

- If you have any series B modules in your system, the minimum firmware revision for the entire system is 1.107.
- There are minor differences in labeling and appearance but the modules are functionally the same.

Bulletin IT3 iTRAK motor modules have limited compatibility with the Bulletin 2198T iTRAK motor modules.

- Bulletin IT3 iTRAK motor modules have higher cogging force in the motors and can require modifications to the tuning when replacing with Bulletin 2198T iTRAK motor modules.
- If a Bulletin 2198T iTRAK motor module is replacing a Bulletin IT3 iTRAK motor module, all similar modules that are adjacent must be replaced also.
 - If replacing one curve module, the adjacent curve module must be replaced also. The straights and opposite curve can stay.
 - If replacing a straight module, all of straight modules between the nearest curve modules must also be replaced. The opposite straights and curves can stay in the system.
- All modules must be updated to the same firmware revision that the newest module requires.
- Contact ICTSupport@ra.rockwell.com before making any Bulletin IT3 to Bulletin 2198T migrations for additional support.

Movers and Magnets

Mover magnets on a track must all be the same size and geometry. All mover magnets are compatible with all motor modules of the same frame size.

Gateways

Two styles of gateways are supported for the iTRAK system.

Generation one gateways are compatible with all motor module types and firmware revisions.

Generation two gateways are compatible with all motor module types, from firmware revision 1.100 and later for tracks smaller than 16 motor modules and firmware revision 1.108 for larger tracks.

Power Supplies

Two styles of power supplies are supported for the iTRAK system. They must not be used on the same system.

The assembled Power Control Module (PCM), or components of the PCM assembled by the customer, is designed to work with all types of iTRAK motor modules.

If you are using the Kinetix® 5700 iTRAK power supply, you must use firmware revision 1.110 or later and the associated ladder logic that is referenced in Knowledgebase Article [778917](#). If using a Kinetix 5700 iTRAK Power Supply at lower firmware revisions, contact ICTSupport@ra.rockwell.com for assistance and sizing.

Controllers

The iTRAK system is designed to work with the controllers that are shown in [Table 40](#).

Table 40 - Compatible Controllers

Platform	Controller
ControlLogix®	5580 ⁽¹⁾
	5570 ⁽²⁾
CompactLogix™	5380 ⁽¹⁾ ⁽³⁾
	5370 ⁽³⁾
	5480 ⁽¹⁾

- (1) The minimum firmware revision to use these processors is 1.103.
- (2) The communication to the gateway must be through 1756-ENxT modules capable of Integrated Motion on EtherNet/IP™.
- (3) The memory requirements and CPU utilization of typical iTRAK applications can reduce the possible catalog numbers available in these families. Work with Rockwell Automation application engineering to determine suitability.

Label Placement

Use this chapter to understand the safety labels and what is on a safety label if it is unlegible.

Topic	Page
Safety Labels	129

Safety Labels

The following safety-identification labels are affixed to the iTRAK® system. To help prevent injury and damage to the system, review the safety labels, their details, and locations before using the system.

Figure 48 - Safety Label Placement

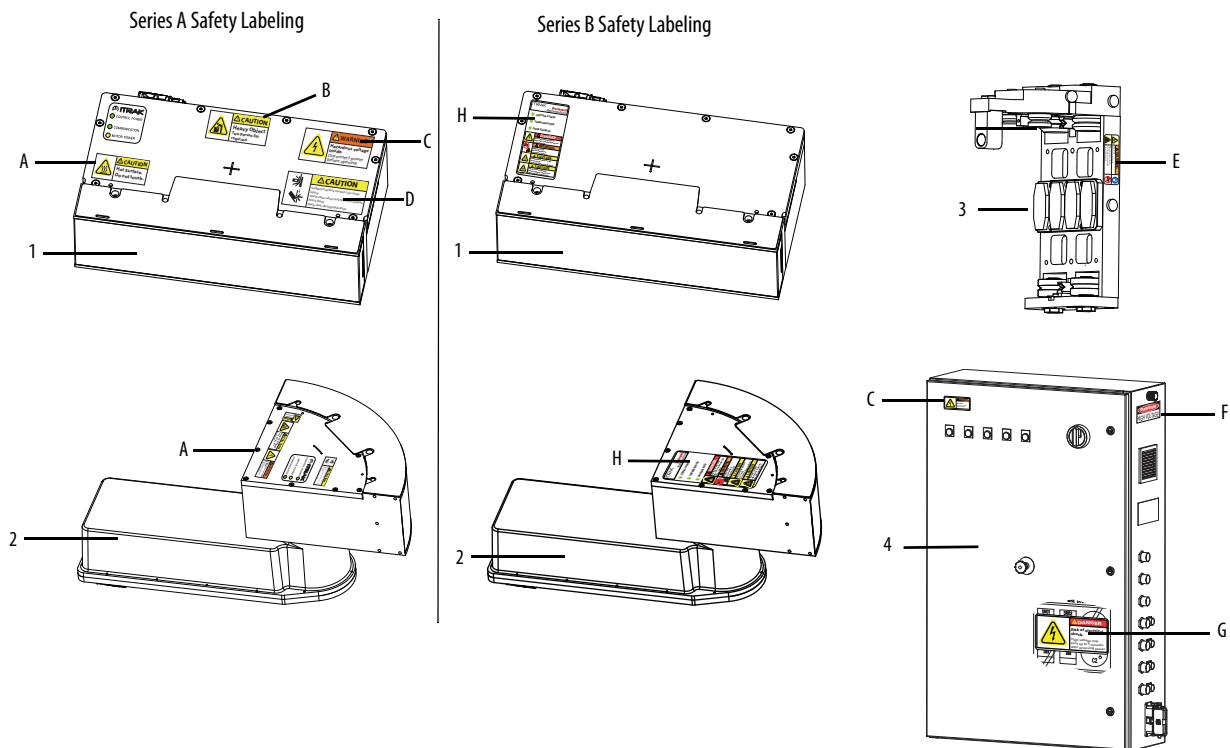


Table 41 - System Components with Safety Labels

Item	Component	Item	Component
1	Straight Motor Module	3	Mover
2	Curved Motor Module (left and right modules are labeled the same)	4	Power Control Module

Table 42 - Safety Labels




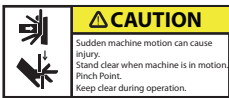


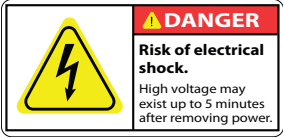

Title	Component	Location	Label	Details
Hot Surface	Series A Motor Module	A		Indicates that the surface can be hot enough to burn if touched.
Heavy Object	Series A and B Motor Modules	B		Components with this label are 22.7 kg (50.0 lb) or more and require two people to lift.
Hazardous Voltage	Series A Motor Module and PCM	C		Do not open PCM, motor module, or right angle connectors while the cables are connected. Lockout/tagout if access to the motor module is required during maintenance.
Automated Machinery and Pinch Points	Series A Motor Module	D		Movers can make as sudden and unexpected movements while the system is powered. Lock-out/tag out before servicing.
Magnet and Pinch Points	Mover	E		<p>The mover uses strong magnets. The magnetic field that is generated can disrupt the functionality of automatic-implantable cardioverter defibrillators (AICD). People with cardiac pacemakers must not work near the iTRAK system. The strong magnets of the mover can attract metal objects that are in its proximity. When you handle and install maintain distance between the mover and ferrous metal mounting surfaces or structures.</p> <p>Maintenance personnel must avoid the use of metallic tools and secure items such as badge clips other personnel effect that could be attracted to the strong magnetic field.</p> <p>Strong magnets can erase magnetic media. Never let credit cards or electronic media contact or come near the mover or iTRAK system.</p> <p>Pinch points exist between adjacent movers and motor modules and movers. Keep your hands clear of a system under power.</p>
High Voltage	PCM	F		The power control module can have voltages greater than 240V present inside the cabinet and at the connectors.

Table 42 - Safety Labels (Continued)

Title	Component	Location	Label	Details
High Voltage (capacitors)	PCM	G		The capacitors inside the PCM can have high voltage present for 5 minutes. Do not attempt to service the PCM until 5 minutes after power has been removed.
Unified Safety Label	Series B Motor Module	H		See Safety Information on page 19 for details on danger, warnings, and cautions on this label.

Notes:

Numerics

2198T-A01 88
2198T-AL-SYS 105
 configuration 35
 installation 32
2198T-CHBFLS8-12AAxx 42, 45, 46
2198T-CHBFLS8-12Axx
 installation 54
2198T-CHBP8S8-12P3 45, 46
2198T-CHBP8S8-12P6 45, 46
2198T-G02-016-E 17
2198T-GUSB 17, 47, 56
2198T-Gxx-xxx-E 47
2198T-L16-Txx04-A00N-2E1E-NS 12
2198T-L16-Txx04-B09x-2E1E-NS, 12
2198T-L16-Txxxx-A00N-2E1E-NS 92
2198T-L16-Txxxx-B09x-2E1E-NS 94
2198T-M0505-A000 86
2198T-NN-318 84
2198T-NS-318 84
2198T-VT0505-A 108
2198T-VT0515-A 109
2198T-VT1005-A 108
2198T-VT1010-A 109
2198T-VT1015-A 109
2198T-VT1505-A 108
2198T-VT1510-A 109
2198T-VT1515-A 109
2198T-VTxxx- 88
2198T-VTxxx-A 14, 84
2198T-W25K-ER 16, 47, 48
2198T-WBCMOD 16, 46
2198T-WPCM-08 16

A

**automatic implantable cardioverter
 defibrillator (AICD)** 130

B

bearing
 installation 108
block diagram
 iTRAK power supply 38
 iTRAK power supply safety 124
bus cable
 preparation 60
 resistive loss 42
bus conditioner 38
 description 16
 installation 45, 46
bus reset 68

C

cable
 installation 75
cable gland
 installation 76
cable installation 75
circuit breaker
 10 kW power control module type 2 112
cleaning 83
commission 82
compatibility
 controller 128
 gateway 128
 motor module 127
 mover 128
 power supply 128
component description
 curved motor module 12, 38, 66
 gateway 38, 65, 66
 gateway enclosure 74
 mover 14, 38, 66
 power control module 65, 66, 67
 straight motor module 12, 38, 65, 66
connector locations
 digital USB I/O 56
 gateway 57
 iTRAK power supply 48
contoller
 compatibility 128

D

description
 iTRAK power supply 48
dimensions
 gateway enclosure 74
 PCM 69

E

enclosure
 Ethernet ports 102
error codes 113
e-stop
 circuit schematic 71
 pinout 70
Ethernet
 ports 102

F

firmware
 downgrade 104
 update gateway 102
 update motor module 104
 update troubleshooting 104

G**gateway 75**

- compatability 128
- installation 75
- weight 75
- wire 57

gateway enclosure

- description 74
- dimension 74

guard

- circuit schematic 71
- pinout 70

I**installation**

- bus conditioner 45
- lubricaiton system horizontal 32
- lubricaiton system vertical 32
- multiple iTRAK power supplies 45
- multiple segments 30
- track 27

installation bus conditioner 46**instructions**

- bus cable preparation 60
- installation 27, 75
 - bearings 108
 - cable gland 76
 - cables 75
 - curved motor module 94
 - gateway 75
 - lubrication wiper 106
 - magnet plate 86
 - mover 88
 - planning 27, 75
 - position magnet 84
 - power control module 75
 - straight motor module 92

iTRAK power supply

- block diagram 38
- connectors 48
- description 48
- multiple 45
- safey circuit 124
- status indicators 78, 79
- wire 59
- wiring requirements 51

L**label**

- series B motor module 13

labels

- automated machinery 130
- high voltage 130
- hot surface 130
- series A motor module 13
- strong magnets 22

leveling feet 30**lifting slots 29****loop back connector 58****lubrication**

- first time 106
- frequency 106
- Kluber 4-UH1-68N 84
- straight nipple fittings 32
- weep holes 32

lubrication pump

- configuration 35
- description 33
- installation 33
- mounting dimensions 34
- volume calculation 35, 106
- wire 34

lubrication system

- installation
 - horizontal 32
 - vertical 32

M**magnet plate**

- handeling 25
- install 86
- magnetic field strength 22, 25

magnetic plate

- screws 86

mechanical and servo components 10**monitor**

- circuit schematic 72
- pinout 70

motor module

- compatability 127
- firmware update 104
- installation
 - curved 94
 - straight 92
- numbering 57

mount 75

- gateway 75
- PCM 75
- track 27

mounting holes 29**mover**

- compatability 128
- description 14
- installation 88
- magnetic field strength 22
- replace 88

N**number motor modules 57****P****PCM**

- mount 75
- safety circuit 125
- status indicators 68
- weight 75

PCM dimensions 69

pinout

- e-stop 70
- gateway to PCM cable 74
- guard 70
- monitor 70
- reset 70

position magnet

- magnetic field strength 24

power control module

- circuit breaker
 - 10 kW type 2 112
- description 67
- installation 75

power supply

- compatibility 128

R**replace**

- curved motor module 94
- mover 88
- position magnet 84

reset

- bus 68
- circuit schematic 70
- pinout 70

S**safety**

- automated machinery 130
- handling 27
- heat 130
- high voltage 130
- machine guarding 19
- risk assessment 19
- strong magnets 22

schematic

- e-stop circuit 71
- guard circuit 71
- monitor circuit 72
- power control module safety 125
- reset circuit 70

series A

- labels 13

series B

- label 13

status indicators

- iTRAK power supply 78, 79
- PCM 68
- series A motor module 13
- series B motor module 13

T**tags**

- controller 81

track

- installation 27
- weight 28

U**USB I/O**

- description 17
- wire 56

W**warning**

- automatic implantable cardioverter
defibrillator (AICD) 130
- powerful forces 130

weight

- gateway 75
- PCM 75
- track 28

wire

- gateway 57
- iTRAK power supply 59
 - multiple 46
 - single 45
- lubrication pump 34
- USB I/O 56

Notes:

Rockwell Automation Support

Use the following resources to access support information.

Technical Support Center	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	https://rockwellautomation.custhelp.com/
Local Technical Support Phone Numbers	Locate the phone number for your country.	http://www.rockwellautomation.com/global/support/get-support-now.page
Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	http://www.rockwellautomation.com/global/support/direct-dial.page
Literature Library	Installation Instructions, Manuals, Brochures, and Technical Data.	http://www.rockwellautomation.com/global/literature-library/overview.page
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	http://www.rockwellautomation.com/global/support/pcdc.page

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