Rail Signals Training Content and Standards,
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Course Title / *Modules* / Learning Objectives	# of Learning Objectives	# of Modules
100 Level Courses: Intro and Overview		
100: Overview	**55**	**12**
History and Purpose of signal systems		
Describe how signals are used to maximize capacity of limited track safely		
Describe different failures that caused something to be done to improve the system		
Describe different systems that have been used throughout history		
Fail safe principles of signals		
Describe the importance of train order/time tables		
Describe how continuous refinements make the system more fail safe		
Explain why system has to fail in a safe manner		
Introduction to Track Circuits		
Describe normally energized relays on track circuits		
Describe normally de-energized relays on track circuits		
Explain how most restrictive aspects/a signal set at "danger"		
Define and describe the uses of vital relays		
Explain reasons for regular inspection and testing of vital relays		
Inspect/Test vital relays		
Perform vital relay testing		
Safety Principles	X	
Describe process of moving people safely		
Explain the how the purpose of system is to keep trains from colliding		
Rail roadway worker protection		
Safe train operation/expedited train movement		
Demonstrate ability to coordinate track related activities with central dispatch		
Describe how individuals responsible for own safety		
Describe importance of maintaining awareness of your environment		
Describe that human communication is a VITAL part of the process -- cannot lose site of those working on the tracks		
Describe the importance of human communications to central control to train mechanics to operators and all staff		
Describe the overall layout of your system to reduce your personal risk/injury		
Describe why there is a need for more reliable system to track whereabouts of those working on the tracks - for safety reasons		
Explain function of permissive proceed signal and how it is unique to each system		

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Course Title			# of Learning Objectives	# of Modules
Modules				
	Learning Objectives			
		Explain purpose of slow zone/work zone		
		Explain results of failure to comply - high risks and dangers		
		Explain rules, policy, procedures at your organization		
		Explain why there is no room for human error		
Regulatory/regulations (importance of testing)				
		Demonstrate awareness and comply with rules and regulations		
		Describe different levels of rules and regulations (Company, FRA, FTA, levels of government) and the jurisdiction of each		
Signal System Operation				
		Demonstrate ability to refer to glossary of terms/nomenclature)		
Special tools				
		Explain the use and purpose of preventive maintenance and standard operating procedures at your agency		
		Explain the use of an access vehicle		
Test Equipment (generally these will be specific to individual agencies)				
		Demonstrate ability to use switch obstruction gauge		
		Demonstrate ability to use oscilloscope/spectrum analyzer		
		Demonstrate ability to use shunt strap/shunt cord		
		Demonstrate ability to use RR volt/ohm meters		
		Demonstrate ability to use automatic train stop test equipment		
		Demonstrate ability to use frequency specific volt meters		
		Demonstrate ability to use IJ checker		
		Demonstrate ability to use Megger		
		Demonstrate ability to use relay testers		
		Demonstrate ability to clamp on amp meter (both AC and DC)		
		Demonstrate use of surge coils		
		Demonstrate ability to use stop watches		
Function and purpose of signal equipment and defining nomenclature				
		Explain FRA nomenclature		
		Explain AREMA nomenclature		
		Explain IEEE nomenclature (developing CBTC)		
		Explaining the use of barcodes		
		Explain Signal nomenclature		
		Explain use and how to access APTA Standards and recommended best practices		
Advanced test equipment				
		Demonstrate ability to maintain, calibrate and care for test equipment		
		Maintain Laptops, software and PTE (Portable Test Equipment)		

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Course Title *Modules* Learning Objectives	# of Learning Objectives	# of Modules
Maintain packet checker		
Demonstrate ability to use clamp on amp meter (both AC and DC)		
Demonstrate ability to use surge coils		
101: Train Control	**19**	**4**
The fundamentals of DC track circuits		
Understand circuit principles and operations of a DC Track Circuit		
Identify track components		
Inspect and perform preventive maintenance on a DC Track Circuit		
Reading track circuit prints and documentation		
Demonstrate ability to use aspect charts		
Demonstrate ability to use track plans		
Demonstrate ability to use train markers		
Demonstrate ability to use electrical prints		
Identify equipment location (rack)		
Identify control lines		
DC track circuits and related components		
Describe signals and aspects		
Demonstrate ability to read schematics		
Describe traffic direction		
Identify and understand function of Rectifier/battery		
Identify and understand function of the resistor		
Identify and understand function of track fuse		
Identify and understand function of Down the rail		
Identify and understand function of fuse on the relay end		
Identify and understand function of 1 to 1 transformer		
Identify and understand function of relay		
Coded track circuits		
102: Turnouts	**5**	**2**
Turnout layout and components		
Describe theory of operation and purpose of Turnouts		
Overview of turnout prints		
Describe turnout components: rail, frogs, points, etc.		
Describe purpose and components of point detection		
Describe purpose and components of electric/mechanical locks		
Types of switches		
103: Grade Crossing	**0**	**1**
Grade crossing warning system theory and operation		
104: Power Distribution	**1**	**2**
Power distribution theory and operation		
Describe theory of operation of local power distribution system		

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Course Title / *Modules* / Learning Objectives	# of Learning Objectives	# of Modules
Primary power sources and system and components		
107: Interlocking	**0**	**1**
Explain concepts of interlocking operation		
200 Level Courses: Inspection and Maintenance		
200 Overview	**11**	**2**
Test Equipment (specialized testing equipment)		
Demonstrate ability to maintain, calibrate and care for test equipment		
Perform maintenance on test equipment		
Demonstrate ability to use and maintain laptops, software and PTE (Portable Test Equipment)		
Perform maintenance on laptops, software and PTE (portable test equipment)		
Perform maintenance on packet checker		
Power		
Verifying operation of power supply		
Check and verify power supply		
Check input/output using prints		
Describe how code is transmitted to the rail		
Identify componends of a coded AC track circuit		
Describe difference between train detection and cab signals		
201 Train Control	**86**	**8**
DC Track Circuits Inspection and Maintenance		
Understand function of all DC Track circuit components		
Perform an inspection and basic maintenance of full circuit, including:		
Demonstrate ability to do track profiles for AC and DC (performance profiles)		
Perform shunt test		
Demonstrate ability to do polarity check (that polarity is different from one track to the next)		
Setup base reference		
Inspect and maintain Rectifier/battery		
Inspect and maintain the resistor		
Inspect and maintain track fuse		
Inspect and maintain Down the rail		
Inspect and maintain fuse on the relay end		
Inspect and maintain 1 to 1 transformer		
Inspect and maintain relay		
Inspect and maintain Automatic Block System		
Inspect and maintain switch circuit controllers		
Inspect and maintain repair relay and relay logic circuits		
DC track Circuits Basic Troubleshooting		

Course Title *Modules* Learning Objectives	# of Learning Objectives	# of Modules
Identify and correct basic common faults in DC track circuits		
Check track voltage at the receive end in the house		
Check track voltage at feed end - same as in the house		
Inspect for broken rail and wires		
Check integrity of insulated joints		
AC track circuits Inspection and Maintenance		
Understand function of all AC Track circuit components		
Perform an inspection and basic maintenance of full circuit		
Inspect and maintain Fuse		
Inspect and maintain Transformer		
Inspect and maintain Primary fuse		
Inspect and maintain Secondary		
Inspect and maintain variable resistor		
Inspect and maintain track fuse		
Inspect and maintain rail		
Inspect and maintain bond wires		
Inspect and maintain track leads		
Inspect and maintain insulated joints		
Inspect and maintain fuse on the relay end		
Inspect and maintain adjustable resistor		
Inspect and maintain isolation transformer (on single rail track circuits)		
Inspect and maintain frequency (60 Hz/100 Hz)		
Inspect and maintain Impedance bonds		
Inspect and maintain narrow and broad band shunts		
Inspect and maintain single rail/double rail		
Inspect and maintain AC vane relays		
Inspect and maintain DC to AC code converters		
Inspect negative return bonds		
AC track circuits Basic Troubleshooting		
Identify and correct basic common faults in AC track circuits		
Check track voltage at the receive end in the house		
Check track voltage at feed end - same as in the house		
Inspect rail bonds and for broken rail and wires		
Check integrity of insulated joints		
Determine whether phase angles are correct		
Determine whether a problem is due to a ground or DC propulsion current		
Track circuit protective devices Inspection and Maintenance		
Inspect and maintain surge suppressors		
Inspect and maintain ground fault detectors		
Inspect and maintain lightning arrestors		

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Course Title *Modules* Learning Objectives	# of Learning Objectives	# of Modules
Inspect and maintain equalizers		
Inspect and maintain fuses		
Audio frequency overlay (AFO) train detection systems Inspection and Maintenance		
Inspect and maintain carrier frequency		
Inspect and maintain track frequency		
Inspect and maintain power levels		
Inspect and maintain transmitters, receivers, transceivers		
Inspect and maintain frequency compatibility "for harmonics"		
Inspect and maintain common usage areas - for overrun circuits		
Inspect and maintain transmitter		
Inspect and maintain audio frequency overlay		
Inspect and maintain phase shift overlay		
Inspect and maintain modulated track frequency		
Inspect and maintain indicating track occupancy (no train means that the relay is up)		
Inspect and maintain modulated train/cab frequency (only transmitted when train is present)		
Demonstrate ability to transmit speed information		
Inspect and maintain twisted pair		
Inspect and maintain transmitting mini bond		
Inspect and maintain running rail		
Inspect and maintain receiving mini bond (Tuned to receive signal from the transmitter (frequency selective))		
Inspect and maintain receiver		
Put out DC voltage to energize the relay		
Inspect and maintain track relay (vital relay)		
Audio frequency overlay (AFO) train detection systems Basic Troubleshooting		
Check transmit voltage at test points		
Check train transmit voltage and frequency		
Check receive voltage at test points		
Check track receive voltage		
Check voltage input to receive board		
Check receive level		
Check rail and components		
Check track frequency		
Coded track circuits inspection and maintenance		
Inspect and maintain coded track circuit		
Inspect and maintain Code transmitting and following relays		
Inspect and maintain AC Coded Track		
202 Turnouts	**23**	**4**
Understanding Layout prints		

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Course Title / *Modules* / Learning Objectives	# of Learning Objectives	# of Modules
Demonstrate ability to read switch layout prints (specs, dimensions and tolerances)		
Demonstrate ability to read and understand diagrams, prints and schematics		
Switch Layout and components, Inspection and Maintenance		
Perform inspection (Maintenance and adjustment)		
Perform obstruction tests		
Inspect / Test and maintain detector rods (indication rod)		
Inspect / Test and maintain electric Switch Lock		
Inspect / Test and maintain lock rod		
Inspect / Test and maintain switch circuit controller		
Inspect / Test and maintain switch layout		
Inspect / Test and maintain throw rod		
Inspect / Test and maintain track components (rail, frogs, points)		
Reference fouling wires and circuits (from other modules)		
Explain relationship between various turnout components		
Inspect / Test and maintain bonds		
Inspect / Test and maintain fouling wires and circuits		
Perform Preventive maintenance tasks according to regulations or manufacturer's specifications		
Power switch inspection and maintenance		
Perform Inspection (Maintenance and adjustment)		
Inspect / Test and maintain air source		
Inspect / Test and maintain hydraulic switch		
Inspect / Test and maintain electric (AC/DC) switch machines		
Inspect / Test and maintain pneumatic switch		
Inspect / Test and maintain solenoid switch		
Inspect / Test and maintain switch heaters/snow melters		
Hand throw switches inspection and maintenance		
203 Grade Crossin	**0**	**1**
Grade Crossing Inspection and Maintenance		
204 Power Distribution	**16**	**3**
Primary power sources, Inspection and Maintenance		
Demonstrate ability to troubleshoot using a meter		
Inspect and Maintain DC power rectified		
Inspect and Maintain frequency converters		
Inspect and Maintain rectifiers		
Inspect and Maintain solar panels		
Inspect and Maintain Transfer switches		
Inspect and Maintain transformer, circuit breakers, cables		
Inspect and maintain pneumatic supplies and allied equipment		

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Course Title / Modules / Learning Objectives	# of Learning Objectives	# of Modules
Secondary power sources inspection and maintenance		
Demonstrate ability to troubleshoot using a meter		
Inspect and Maintain batteries		
Inspect and Maintain chargers		
Inspect and Maintain inverters		
Inspect and Maintain rectifiers		
Inspect and Maintain secondary power		
Inspect and Maintain solar panels		
Inspect and Maintain UPS (emergency or standby power)		
Power distribution system Inspection and Maintenance		
205 Signals	**9**	**3**
Signaling Systems Inspection and Maintenance		
Inspect / Test and maintain automatic train protection (ATP)		
Inspect / Test and maintain automatic train operation (ATO)		
Inspect / Test and maintain automatic train supervision (ATS)		
Inspect / Test and maintain automatic train supervision (ATS)		
Inspect / Test and maintain automatic train supervision (ATS)		
Inspect / Test and maintain automatic train supervision (ATS)		
Wayside signaling inspection and maintenance		
Inspect / Test and maintain automatic block system (ABS)		
Inspect / Test and maintain wayside signaling		
Inspect / Test and maintain interlocking signal system		
Train wayside communication (TWC) inspection and maintenance		
206 Train Stops	**8**	**4**
Mechanical		
Demonstrate ability to understand electrical prints and ground equipment diagrams		
Explain operation of train stops		
Inspect / test and Maintain mechanical parts		
Inspect / Test / Maintain speed enforcement system (wheel detector)		
Magnetics		
Inspect / test and Maintain magnetic stops		
Inspect / Test / Maintain speed enforcement system (wheel detector)		
Wheel pickups		
Inspect / test and Maintain wheel pickups		
Inspect / Test / Maintain speed enforcement system (wheel detector)		

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Course Title / *Modules* / Learning Objectives	# of Learning Objectives	# of Modules
De-rail		
207 Interlocking	**8**	**1**
Interlocking		
Inspect and maintain manual interlocking		
Inspect and maintain automatic interlocking		
Perform route locking test		
Perform approach locking test		
Perform time locking test		
Perform traffic locking test		
Perform indication locking test		
Download and read event reports		
208 Control Panels	**7**	**2**
Local control panels/human machine interfaces (HMI)		
Inspect and Maintain components		
Inspect and Maintain safety tool		
Inspect and Maintain Communication Based Train Control (GPS)		
Demonstrate ability to read control panel schematics		
Identify functions of each light, button or key.		
Explain each panels function as it relates to interlocking		
Replace light indicators and switches		
New Technology		
300 Level Courses: Troubleshooting and Repair		
301 Train Control	**79**	**8**
DC track Circuits Troubleshooting		
Follow general troubleshooting process including:		
Check status - is it working or not		
Check for presence of a grounded circuit		
Check voltage in/out		
Check relays		
Check insulated joints		
Check bonds		
Understand and check track schematics		
Verify rail integrity		
Check feed and relay resistors		
Check feed and relay fuse		
Check track connections and terminations		
Check fouling wires		
Check train transmit voltage and frequency		
Troubleshoot, adjust or repair 1 to 1 transformer		
Troubleshoot, adjust or repair Fuse on the relay end		
Troubleshoot, adjust or repair Relay		
Troubleshoot, adjust or repair the Rectifier/battery		

Course Title			# of Learning Objectives	# of Modules
	Modules			
		Learning Objectives		
		Troubleshoot, adjust or repair the resistor		
		Troubleshoot and repair Interlocking (verify request / response)		
		Troubleshoot and repair Automatic Block System		
		Troubleshoot and repair switch circuit controllers		
		Troubleshoot and repair relay and relay logic circuits		
		Troubleshoot and repair track circuit		
		Troubleshoot and repair a circuit ground		
	AC Track Circuits Troubleshooting			
		Troubleshoot, adjust or repair adjustable resistor		
		Troubleshoot, adjust or repair frequency (60 Hz/100 Hz)		
		Troubleshoot, adjust or repair fuse on the relay end		
		Troubleshoot, adjust or repair insulated joints		
		Troubleshoot, adjust or repair isolation transformer (on single rail track circuits)		
		Troubleshoot, adjust or repair track leads		
		Troubleshoot, adjust or repair bond wires		
		Troubleshoot, adjust or repair Fuse		
		Troubleshoot, adjust or repair Primary fuse		
		Troubleshoot, adjust or repair Secondary		
		Troubleshoot, adjust or repair track fuse		
		Troubleshoot, adjust or repair Transformer		
		Troubleshoot, adjust or repair variable resistor		
		Troubleshoot, adjust or repair AC vane relays		
		Troubleshoot, adjust or repair DC to AC code converters		
		Troubleshoot, adjust or repair Impedance bonds		
		Troubleshoot, adjust or repair narrow and broad band shunts		
		Troubleshoot, adjust or repair single rail/double rail		
		Test voltage on secondary transformer		
		Troubleshoot and repair a circuit ground		
	Track circuit protective devices Troubleshooting			
		Troubleshoot, adjust or repair equalizers		
		Troubleshoot, adjust or repair fuses		
		Troubleshoot, adjust or repair ground fault detectors		
		Troubleshoot, adjust or repair lightning arrestors		
		Troubleshoot, adjust or repair surge suppressors		
	Audio frequency overlay (AFO) train detection systems Troubleshooting			
		Follow general troubleshooting process including:		
		Adjust transmit voltage and receive voltage		
		Use of frequency selective (or specific) voltmeter		
		Troubleshoot, adjust or repair carrier frequency		
		Troubleshoot, adjust or repair common usage areas - for overrun circuits		

Course Title			# of Learning Objectives	# of Modules
	Modules			
		Learning Objectives		
		Troubleshoot, adjust or repair frequency compatibility "for harmonics"		
		Troubleshoot, adjust or repair power levels		
		Troubleshoot, adjust or repair track frequency		
		Troubleshoot, adjust or repair transmitter		
		Troubleshoot, adjust or repair transmitters, receivers, transceivers		
		Troubleshoot, adjust or repair modulated train/cab frequency		
		Troubleshoot, adjust or repair audio frequency overlay		
		Troubleshoot, adjust or repair indicating track occupancy		
		Troubleshoot, adjust or repair modulated track frequency		
		Troubleshoot, adjust or repair phase shift overlay		
		Troubleshoot, adjust or repair receiver		
		Troubleshoot, adjust or repair receiving mini bond		
		Troubleshoot, adjust or repair track relay (vital relay)		
		Troubleshoot, adjust or repair transmitting mini bond		
		Troubleshoot, adjust or repair twisted pair		
		Put out DC voltage to energize the relay		
		Replace circuit board with proper frequency		
	Interlocking Troubleshooting			
		Describe how interlocking may be controlled by automatic, remote or local control		
		Describe how interlocking may be controlled by all three, one at a time		
		Troubleshoot and repair event recorders		
	Using frequency shift key (FSK)			
	Coded track circuit troubleshooting			
		Troubleshoot, adjust or repair AC Coded Track		
		Troubleshoot, adjust or repair Code transmitting and following relays		
		Troubleshoot, adjust or repair coded track circuit		
	Advanced track circuit and transmission/receiving Troubleshooting			
		Check train transmit voltage and frequency		
302 Turnouts			**8**	**2**
	Switch layout and components Troubleshooting			
		Troubleshoot, adjust or repair connecting rods		
		Troubleshoot, adjust or repair detector rods (indication rod)		
		Troubleshoot, adjust or repair electric Switch Lock		
		Troubleshoot, adjust or repair lock rod		
		Troubleshoot, adjust or repair switch circuit controller		
		Troubleshoot, adjust or repair switch layout		
		Troubleshoot, adjust or repair throw rod		
		Troubleshoot, adjust or repair track components (rail, frogs, points)		

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Course Title / *Modules* / Learning Objectives	# of Learning Objectives	# of Modules
Power Switch Troubleshooting		
303 Grade Crossing	**0**	**1**
Grade crossing warning system Troubleshooting and Repair		
304 Power Distribution	**23**	**3**
Primary power sources, Troubleshooting		
Troubleshoot, adjust or repair AC power		
Troubleshoot, adjust or repair DC power rectified		
Troubleshoot, adjust or repair rectifiers		
Troubleshoot, adjust or repair transformer, circuit breakers, cables		
Troubleshoot, adjust or repair grounds; determine what type of ground is present		
Replace a rectifier		
Secondary power sources Troubleshooting		
Troubleshoot and replace batteries		
Troubleshoot and replace chargers		
Troubleshoot and replace inverters		
Troubleshoot, adjust or repair secondary power		
Troubleshoot, adjust or repair UPS (emergency or standby power)		
Power distribution system Troubleshooting		
Troubleshoot, adjust or repair AC power		
Troubleshoot and replace batteries		
Troubleshoot and replace chargers		
Troubleshoot and replace frequency converters		
Troubleshoot and replace inverters		
Troubleshoot, adjust or repair primary power		
Troubleshoot, adjust or repair rectifiers		
Troubleshoot, adjust or repair transfer switches		
Troubleshoot, adjust or repair transformer, circuit breakers, cables		
Troubleshoot, adjust or repair UPS (emergency or standby power)		
Troubleshoot, adjust or repair air equipment, such as pneumatic train stops and switches. Sectionalize air mains		
Perform ground detection testing		
305 Signals (Troubleshooting and Repair)	**9**	**3**
Signaling Systems Troubleshooting		
Troubleshoot, adjust and/or repair automatic train protection (ATP)		
Troubleshoot, adjust and/or repair automatic train operation (ATO)		
Troubleshoot, adjust and/or repair automatic train supervision (ATS)		
Troubleshoot, adjust and/or repair centralized traffic control		

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Course Title / Modules / Learning Objectives	# of Learning Objectives	# of Modules
Troubleshoot, adjust and/or repair advanced train control system (ATCS)		
Troubleshoot, adjust and/or repair advanced automatic train control (AATC)		
Wayside signaling Troubleshooting		
Troubleshoot, adjust and/or repair automatic block system (ABS)		
Troubleshoot, adjust and/or repair wayside signaling		
Troubleshoot, adjust and/or repair interlocking signal system		
Train wayside communication (TWC) Troubleshooting		
306 Train Stops	**4**	**4**
Mechanical		
Troubleshoot, adjust or repair mechanical parts		
Identify which modules interface with the trip stop		
Magnetics		
Troubleshoot, adjust or repair magnetic stops		
Wheel pickups		
Troubleshoot, adjust or repair wheel pickups		
De-rail		
307 Interlocking	**0**	**1**
Troublsehooting Interlocks		
308 Control Panels	**3**	**2**
Local control panels/human machine interfaces (HMI)		
Troubleshoot, adjust or repair control panel componentes		
Use control panel to troubleshoot the interlocking		
Troubleshoot, adjust or repair Communication Based Train Control (GPS)		
New Technology		
400 Level Courses: Installation, Rebuild, Set up and Testing		
401 Train Control	**64**	**5**
DC track circuits Installation, Rebuild and Testing		
Install, replace, rebuild, set-up or test 1 to 1 transformer		
Install, replace, rebuild, set-up or test fuse on the relay end		
Install, replace, rebuild, set-up or test Relay		
Install, replace, rebuild, set-up or test the Rectifier/battery		
Install, replace, rebuild, set-up or test the resistor		
AC track circuits Installation, Rebuild and Testing		
Install, Replace, Rebuild, set up or test AC vane relays		
Install, Replace, Rebuild, set up or test DC to AC code converters		
Install, Replace, Rebuild, set up or test Impedance bonds		

Course Title			# of Learning Objectives	# of Modules
	Modules			
		Learning Objectives		
		Install, Replace, Rebuild, set up or test narrow and broad band shunts		
		Install, Replace, Rebuild, set up or test single rail/double rail		
		Install, replace, rebuild, set-up or test adjustable resistor		
		Install, replace, rebuild, set-up or test frequency (60 Hz/100 Hz)		
		Install, replace, rebuild, set-up or test fuse on the relay end		
		Install, replace, rebuild, set-up or test insulated joints		
		Install, replace, rebuild, set-up or test isolation transformer (on single rail track circuits)		
		Install, replace, rebuild, set-up or test track leads		
		Install, replace, rebuild, set-up or test bond wires		
		Install, replace, rebuild, set-up or test Fuse		
		Install, replace, rebuild, set-up or test Primary fuse		
		Install, replace, rebuild, set-up or test Secondary		
		Install, replace, rebuild, set-up or test track fuse		
		Install, replace, rebuild, set-up or test Transformer		
		Install, replace, rebuild, set-up or test variable resistor		
	Audio frequency overlay Installation, Rebuild and Testing			
		Install, Replace, Rebuild, set up or test modulated train/cab frequency		
		Install, Replace, Rebuild, set up or test audio frequency overlay		
		Install, Replace, Rebuild, set up or test indicating track occupancy		
		Install, Replace, Rebuild, set up or test modulated track frequency		
		Install, Replace, Rebuild, set up or test phase shift overlay		
		Install, Replace, Rebuild, set up or test receiver		
		Install, Replace, Rebuild, set up or test receiving mini bond		
		Install, Replace, Rebuild, set up or test track relay (vital relay)		
		Install, Replace, Rebuild, set up or test transmitting mini bond		
		Install, Replace, Rebuild, set up or test twisted pair		
		Put out DC voltage to energize the relay		
		Install DC voltage to energize the relay		
		Install, Replace, Rebuild, set up or test carrier frequency		
		Install, Replace, Rebuild, set up or test common usage areas - for overrun circuits		
		Install, Replace, Rebuild, set up or test frequency compatibility "for harmonics"		
		Install, Replace, Rebuild, set up or test power levels		
		Install, Replace, Rebuild, set up or test track frequency		

Course Title *Modules* Learning Objectives	# of Learning Objectives	# of Modules
Install, Replace, Rebuild, set up or test transmitter		
Install, Replace, Rebuild, set up or test transmitters, receivers, transceivers		
Coded track circuits installation, rebuild and testing		
Install, replace, rebuild, set-up or test AC Coded Track		
Install, replace, rebuild, set-up or test Code transmitting and following relays		
Install, replace, rebuild, set-up or test coded track circuit		
Track circuit protective devices installation, rebuild and testing		
Install, replace, rebuild, set-up or test equalizers		
Install, replace, rebuild, set-up or test fuses		
Install, replace, rebuild, set-up or test ground fault detectors		
Install, replace, rebuild, set-up or test lightning arrestors		
Install, replace, rebuild, set-up or test surge suppressors		
Describe theory of operation - how do switches work		
Describe main features of various types of switches		
Inspect / Test and maintain electric/mechanical locks		
Inspect / Test and maintain spring switch		
Inspect / Test and maintain slap switch or variable point switch		
Troubleshoot, adjust or repair electric/mechanical locks		
Troubleshoot, adjust or repair hydraulic switch		
Troubleshoot, adjust or repair motor AC/DC		
Troubleshoot, adjust or repair pneumatic switch		
Troubleshoot, adjust or repair power (electric) switch		
Troubleshoot, adjust or repair solenoid switch		
Troubleshoot, adjust or repair spring switch		
Troubleshoot, adjust or repair switch circuit controller		
Troubleshoot, adjust or repair switch heaters/snow melters		
402 Turnouts	**49**	**2**
Switch Layout and Components Installation, Rebuild and Testing		
Install, replace, rebuild, set-up and/or test connecting rods		
Install, replace, rebuild, set-up and/or test detector rods (indication rod)		
Install, replace, rebuild, set-up and/or test electric Switch Lock		
Install, replace, rebuild, set-up and/or test hydraulic switch		
Install, replace, rebuild, set-up and/or test lock rod		
Install, replace, rebuild, set-up and/or test switch circuit controller		
Install, replace, rebuild, set-up and/or test switch layout		
Install, replace, rebuild, set-up and/or test throw rod		

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Course Title *Modules* Learning Objectives	# of Learning Objectives	# of Modules
Install, replace, rebuild, set-up and/or test track components (rail, frogs, points)		
Power Switch Installation, Rebuild and Testing		
Install, replace, rebuild, set-up and/or test electric/mechanical locks		
Install, replace, rebuild, set-up and/or test hydraulic switch		
Install, replace, rebuild, set-up and/or test motor AC/DC		
Install, replace, rebuild, set-up and/or test pneumatic switch		
Install, replace, rebuild, set-up and/or test power (electric) switch		
Install, replace, rebuild, set-up and/or test solenoid switch		
Install, replace, rebuild, set-up and/or test spring switch		
Install, replace, rebuild, set-up and/or test switch heaters/snow melters		
Describe grade crossing warning systems history		
Describe equipment, circuits and warning devices		
Describe grade crossing types, (gated and non-gated) and levels of protectin		
Describe types of warning systems, constant warning time vs. fixed distance warning		
Describe regulations pertaining to grade crossings		
Describe types and operation of gatee mechanisms		
Perform Preventive maintenance tasks according to regulations or manufacturer's specs, including items below:		
Inspect and Maintain warning devices (gates, warning lights, signage, bells and grade)		
Inspect and Maintain grade crossing controls (prediction/protection)		
Inspect and Maintain crossing structures		
Inspect and Maintain crossing signage		
Inspect and Maintain barriers/gate arm		
Inspect and Maintain gate mechanisms		
Inspect and Maintain approach and island circuits		
Inspect and Maintain non gated grade crossing		
Inspect and Maintain event recorders/monitoring equipment		
Inspect and Maintain quad gates		
Inspect and Maintain traffic signal interface (preemption)		
Perform a post accident inspection		
Troubleshoot causes of false activations and activation failures		
Explain processes for if a warning system cannot be repaired promptly		

Course Title *Modules* Learning Objectives	# of Learning Objectives	# of Modules
Troubleshoot, adjust or repair warning devices (gates, warning lights, signage, bells and grade)		
Troubleshoot, adjust or repair grade crossing controls (prediction/protection)		
Troubleshoot, adjust or repair crossing structures		
Troubleshoot, adjust or repair crossing signage		
Troubleshoot, adjust or repair barriers/gate arm		
Troubleshoot, adjust or repair gate mechanisms		
Troubleshoot, adjust or repair approach and island circuits		
Troubleshoot, adjust or repair non gated grade crossing		
Troubleshoot, adjust or repair event recorders/monitoring equipment		
Troubleshoot, adjust or repair quad gates		
Troubleshoot, adjust or repair traffic signal interface (preemption)		
403 Grade Crossing	**33**	**1**
Grade crossing warning system installation, rebuild, setup and testing		
Explain how to safely disable a crossing to facilitate emergency repairs		
Demonstrate track circuit frequency selection for grade crossing repairs		
Install, replace, set-up or test warning devices (gates, warning lights, signage, bells and grade)		
Install, replace, set-up or test grade crossing controls (prediction/protection)		
Install, replace, set-up or test crossing structures		
Install, replace, set-up or test crossing signage		
Install, replace, set-up or test barriers/gate arm		
Install, replace, set-up or test gate mechanisms		
Install, replace, set-up or test approach and island circuits		
Install, replace, set-up or test non gated grade crossing		
Install, replace, set-up or test event recorders/monitoring equipment		
Install, replace, set-up or test quad gates		
Demonstrate ability to read schematics		
Describe how incoming power comes from utilities, the types of power and its uses for signaling systems		
Describe operation of breakers		
Describe power source		
Explain how to sectionalize power sources for testing and troubleshooting and repair on low and high tension		
Explain how to properly phase different power sources		
Explain how to use voltage tester and phasing tester		
Explain how to perform insulation testing and cable fault testing on low and high tension sources		

Course Title *Modules* Learning Objectives	# of Learning Objectives	# of Modules
Describe theory of operation of pneumatic power distribution system		
Explain how to sectionalize power sources for testing and troubleshooting and repair on pneumatic systems		
Demonstrate ability to troubleshoot using a meter		
Inspect and Maintain AC power		
Inspect and Maintain batteries		
Inspect and Maintain Chargers		
Inspect and Maintain DC power rectified		
Inspect and Maintain primary power		
Inspect and Maintain rectifiers		
Inspect and Maintain solar panels		
Inspect and Maintain transfer switches		
Inspect and Maintain transformer, circuit breakers, cables		
Inspect and Maintain UPS (emergency or standby power)		
404 Power Distribution	**29**	**3**
Primary power sources Installation		
Install, replace, rebuild, set-up or test AC power		
Install, replace, rebuild, set-up or test Batteries		
Install, replace, rebuild, set-up or test Chargers		
Install, replace, rebuild, set-up or test DC power rectified		
Install, replace, rebuild, set-up or test frequency converters		
Install, replace, rebuild, or set-up Inverters		
Install, replace, rebuild, set-up or test primary power		
Install, replace, rebuild, set-up or test rectifiers		
Install, replace, rebuild, set-up or test transfer switches		
Install, replace, rebuild, set-up or test transformer, circuit breakers, cables		
Install, replace, rebuild, set-up or test UPS (emergency or standby power)		
Secondary power source Installation		
Install, replace, rebuild, set-up or test AC power		
Install, replace, rebuild, set-up or test frequency converters		
Install, replace, rebuild, set-up or test meter		
Install, replace, rebuild, set-up or test Transfer switches		
Install, replace, rebuild, set-up or test transformer, circuit breakers, cables		
Power distribution system Installation		
Install, replace, rebuild, set-up or test batteries		
Install, replace, rebuild, set-up or test chargers		
Install, replace, rebuild, set-up or test inverters		
Install, replace, rebuild, set-up or test secondary power		

Course Title *Modules* Learning Objectives	# of Learning Objectives	# of Modules
Install, replace, rebuild, set-up or test UPS (emergency or standby power)		
Inspect / Test and maintain movable Block		
Inspect / Test and maintain communication based train control (CBTC)		
Inspect / Test and maintain Positive Train Separation (PTS)		
Inspect / Test and maintain automatic train control (ATC)		
Troubleshoot, adjust and/or repair movable Block		
Troubleshoot, adjust and/or repair communication based train control (CBTC)		
Troubleshoot, adjust and/or repair Positive Train Separation (PTS)		
Troubleshoot, adjust and/or repair automatic train control (ATC)		
405 Signals	**15**	**3**
Signaling Systems Installation, rebuild and set up		
Install, rebuild, set-up and/or test automatic train protection (ATP)		
Install, rebuild, set-up and/or test automatic train operation (ATO)		
Install, rebuild, set-up and/or test automatic train supervision (ATS)		
Install, rebuild, set-up and/or test centralized traffic control		
Install, rebuild, set-up and/or test advanced train control system (ATCS)		
Install, rebuild, set-up and/or test advanced automatic train control (AATC)		
Wayside signaling installation, rebuild and set up		
Install, rebuild, set-up and/or test automatic block system (ABS)		
Install, rebuild, set-up and/or test interlocking signal system		
Train wayside communication (TWC) installation, rebuild and set up		
Install, rebuild, set-up and/or test movable Block		
Install, rebuild, set-up and/or test communication based train control (CBTC)		
Install, rebuild, set-up and/or test Positive Train Separation (PTS)		
Install, rebuild, set-up and/or test automatic train control (ATC)		
Inspect / test and Maintain de-rail		
Inspect / Test / Maintain speed enforcement system (wheel detector)		
Troubleshoot, adjust or repair de-rail		
406 Train Stops	**13**	**4**
Mechanical		

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Course Title / *Modules* / Learning Objectives	# of Learning Objectives	# of Modules
Use track install diagram		
Install, replace, rebuild, or set-up mechanical parts		
Magnetics		
Install, rebuild, or set-up magnetic stops		
Wheel pickups		
Install, rebuild or set-up wheel pickups		
De-rail		
Install, rebuild, or set-up de-rail		
Inspect and Maintain Electronic Track Circuit		
Inspect and maintain programmable logic controllers		
Inspect and maintain solid state interlocking		
Inspect and maintain computer based interlocking		
Troubleshoot, adjust or repair Electronic Track Circuit		
Troubleshoot and repair PLCs (Programmable Logic Controllers)		
Troubleshoot and repair solid state interlocking		
Troubleshoot and repair computer based interlocking		
408 Control Panels	**4**	**2**
Local control panels/human machine interfaces (HMI)		
Fulfilling testing requirements		
Install or replace control panels		
Perform simulations to test interlocking		
New Technology		
Install, replace, rebuild, set-up or test Electronic Track Circuit		
Total: **30**	**581**	**94**

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ID	Module Title / Responsibilities / Course Content / Learning Objectives	Changes from previous version based on APTA comments	Original APTA Comments
	Signals Overview (2 modules -- level 100 and 200)		
	100 Overview	A preface to this and other standards needs to be developed to discuss the implementation at local agencies	
100-1	*History and Purpose of signal systems*		
100-2	*Fail safe principles of signals*		
100-3	*Introduction to Track Circuits*		
100-4	*Safety Principles*		
100-5	*Rail roadway worker protection*		
100-6	*Safe train operation/expedited train movement*		
100-7	*Regulatory/regulations (importance of testing)*		
100-8	*Signal System Operation*		
100-9	*Special tools*		
100-10	*Test Equipment (generally these will be specific to individual agencies)*		
100-11	*Function and purpose of signal equipment and defining nomenclature*		
100-12	*Advanced test equipment*		
	200 Overview		
200-1	*Test Equipment (specialized testing equipment)*		
200-2	*Power*		

ID	Module Title / Responsibilities / Course Content / Learning Objectives	Changes from previous version based on APTA comments	Original APTA Comments
	Train Control (4 modules -- levels 100 through 400)		
	101 Train Control (Intro and Overview)		
101-1	*The fundamentals of DC track circuits*		
101-2	*Reading track circuit prints and documentation*		
101-3	*DC track circuits and related components*		
101-4	*Coded track circuits*		
	201 Train Control (Inspection and Maintenance)		
201-1	*DC Track Circuits Inspection and Maintenance*		
201-2	*DC track Circuits Basic Troubleshooting*		
201-3	*AC track circuits Inspection and Maintenance*		
201-4	*AC track circuits Basic Troubleshooting*	see new learning objectives added at 201-4-6; 201-4-7	comment: a section should be added to help an individual to determine whether the phase angles are correct. It is rare but if the phase angles are not right the track relay will not pick up. A section should also be added to help an individual detemrine whether the problem is due to a ground or DC propulsion current
201-5	*Track circuit protective devices Inspection and Maintenance*		
201-6	*Audio frequency overlay (AFO) train detection systems Inspection and Maintenance*		
201-7	*Audio frequency overlay (AFO) train detection systems Basic Troubleshooting*		
201-8	*Coded track circuits inspection and maintenance*		
	301 Train Control (Troubleshooting and Repair)		
301-1	*DC track Circuits Troubleshooting*		
301-2	*AC Track Circuits Troubleshooting*		

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ID	***Module Title*** / *Responsibilities / Course Content* / Learning Objectives	Changes from previous version based on APTA comments	Original APTA Comments
301-3	*Track circuit protective devices Troubleshooting*		
301-4	*Audio frequency overlay (AFO) train detection systems Troubleshooting*		
301-5	*Interlocking Troubleshooting*		
301-6	*Using frequency shift key (FSK)*		
301-7	*Coded track circuit troubleshooting*		
301-8	*Advanced track circuit and transmission/receiving Troubleshooting*		
	401 Train Control (Installation, Rebuild, Set up and Testing)		
401-1	*DC track circuits Installation, Rebuild and Testing*		
401-2	*AC track circuits Installation, Rebuild and Testing*		
401-3	*Audio frequency overlay Installation, Rebuild and Testing*		
401-4	*Coded track circuits installation, rebuild and testing*		
401-5	*Track circuit protective devices installation, rebuild and testing*		

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	Turnouts (Switches) (4 modules -- levels 100 through 400)		
	102 Turnouts (Intro and Overview)		
102-1	*Turnout layout and components*		
102-2	*Types of switches*		
	202 Turnouts (Inspection and Maintenance)		
202-1	*Understanding Layout prints*		
202-2	*Switch Layout and components, Inspection and Maintenance*		
202-3	*Power switch inspection and maintenance*		
202-4	*Hand throw switches inspection and maintenance*		
	302 Turnouts (Troubleshooting and Repair)		
302-1	*Switch layout and components Troubleshooting*		
302-2	*Power Switch Troubleshooting*		
	402 Turnouts (Installation, Rebuild, Set up and advanced testing)		
402-1	*Switch Layout and Components Installation, Rebuild and Testing*		
402-2	*Power Switch Installation, Rebuild and Testing*		

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ID	***Module Title*** / *Responsibilities / Course Content* / Learning Objectives	Changes from previous version based on APTA comments	Original APTA Comments
	Grade Crossing (4 modules -- levels 100 through 400)		
	103 Grade Crossing (Intro and Overview)		
103-1	*Grade crossing warning system theory and operation*		
	203 Grade Crossing (Inspection and Maintenance)		
203-1	*Grade Crossing Inspection and Maintenance*		
	303 Grade Crossing (Troubleshooting and Repair)		
303-1	*Grade crossing warning system Troubleshooting and Repair*		
	403 Grade Crossing (Installation, Rebuild, Set up and Testing)		
403-1	*Grade crossing warning system installation, rebuild, setup and testing*		

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ID	Module Title / Responsibilities / Course Content / Learning Objectives	Changes from previous version based on APTA comments	Original APTA Comments
	Power Distribution (4 modules -- levels 100 through 400)		
	104 Power Distribution (Intro and Overview)		
104-1	*Power distribution theory and operation*		
104-2	*Primary power sources and system and components*		
	204 Power Distribution (Inspection and Maintenance)		
204-1	*Primary power sources, Inspection and Maintenance*		
204-2	*Secondary power sources inspection and maintenance*		
204-3	*Power distribution system Inspection and Maintenance*		
	304 Power Distribution (Troubleshooting and Repair)		
304-1	*Primary power sources, Troubleshooting*		
304-1-5	Troubleshoot, adjust or repair grounds; determine what type of ground is present	Learning objective added in response to comment	comment: A section should also be added to demonstrate how to troubleshoot grounds. It should also include how to determine what type of ground is present (+ or -)
304-1-6	Replace a rectifier	Learning objective added in response to comment	comment: a section should be added demonstrating how to put a spare rectifier online in the event the normal rectifier fails
304-2	*Secondary power sources Troubleshooting*		
304-3	*Power distribution system Troubleshooting*		

ID	*Module Title* / *Responsibilities / Course Content* / Learning Objectives	Changes from previous version based on APTA comments	Original APTA Comments
304-3-11	Troubleshoot, adjust or repair air equipment, such as pneumatic train stops and switches. Sectionalize air mains	Learning objective added in response to comment	comment: a section should be added relating to air equipment. Air is used to operate train stops and switches. If an airline was to break, train stops and switches would fail to operate. Students should know how to sectionalize the air mains to minimize the number of air stops and switches affected by the airline break.
304-3-12	Perform ground detection testing	Learning objective added in response to comment	comment: the document does not appear to mention that power distribution systems are typically equipped with ground detection equipment. Therefore, either mention performing ground detection activities or crreate a separate section to address ground detection equipment and testing
	404 Power Distribution (Installation, Rebuild, Setup and Testing)		
404-1	*Primary power sources Installation*		
404-2	*Secondary power source Installation*		
404-3	*Power distribution system Installation*		

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	Signals (3 modules -- levels 200 through 400)		
	205 Signals (Inspection and Maintenance)		
205-1	*Signaling Systems Inspection and Maintenance*		
205-2	*Wayside signaling inspection and maintenance*		
205-3	*Train wayside communication (TWC) inspection and maintenance*		
	305 Signals (Troubleshooting and Repair)		
305-1	*Signaling Systems Troubleshooting*		
305-2	*Wayside signaling Troubleshooting*		
305-3	*Train wayside communication (TWC) Troubleshooting*		
	405 Signals (Installation, Rebuild, Setup and Advanced Testing)		
405-1	*Signaling Systems Installation, rebuild and set up*		
405-2	*Wayside signaling installation, rebuild and set up*		
405-3	*Train wayside communication (TWC) installation, rebuild and set up*		

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ID	Module Title / Responsibilities / Course Content / Learning Objectives	Changes from previous version based on APTA comments	Original APTA Comments
	Train Stops (3 modules -- levels 200 through 400)	see the addition below	comment: add speed enforcement system (wheel detector) to each module
	206 Train Stops (Inspection and maintenance)		
206-1	*Mechanical*		
206-2	*Magnetics*		
206-3	*Wheel pickups*		
206-4	*De-rail*		
	306 Train Stops (Troubleshooting and Repair)		
306-1	*Mechanical*		
306-2	*Magnetics*		
306-3	*Wheel pickups*		
306-4	*De-rail*		
	406 Train Stops (Installation, Rebuild, Setup and Advanced Testing)		
406-3	*Mechanical*		
406-2	*Magnetics*		
406-4	*Wheel pickups*		
406-1	*De-rail*		

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ID	Module Title / Responsibilities / Course Content / Learning Objectives	Changes from previous version based on APTA comments	Original APTA Comments
	Interlocking (2 modules -- levels 100 and 200)		
	107 Interlocking (Intro and Overview)		
107-1	*Explain concepts of interlocking operation*		
	207 Interlocking (Inspection and Maintenance)		
207-1	*Interlocking*		
	307 Interlocking (Troubleshooting and Repair)		
307-1	*Troublsehooting Interlocks*		

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ID	***Module Title*** / *Responsibilities / Course Content* / Learning Objectives	**Changes from previous version based on APTA comments**	**Original APTA Comments**
	Control Panels (3 modules -- levels 200 through 400)		
	208 Control Panels (Inspection and Maintenance)		comment: add content on solid state interlocking and computer based interlocking
208-1	*Local control panels/human machine interfaces (HMI)*		
208-2	*New Technology*		
	308 Control Panels (Troubleshooting and Repair)	see additions below	comment: add content on solid state interlocking and computer based interlocking
308-1	*Local control panels/human machine interfaces (HMI)*		
308-2	*New Technology*		
	408 Control Panels (Installation, Rebuild, Setup and Testing)		
408-1	*Local control panels/human machine interfaces (HMI)*		
408-2	*New Technology*		