Australian Model Railway Association
Free form module standard

Version 2.2
January 2023

Aim

The aim of this standard is to define the mechanical and electrical interface for single and double track free form modules, using DCC and Wi-Fi for operation of trains that comply with AMRA standards.

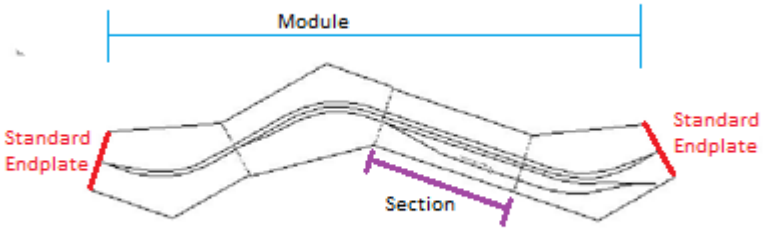
Note: Most mass produced trains comply with AMRA standards.

Introduction

Portable model railways are built in sections called modules. The idea of different people building separate modules and joining them together to make a large model railway has seen the development of many incompatible club standards. In 1989 the friendship association of European model railroaders was formed (FREMO) and developed a number of single track free form style module standards. Unlike the earlier module systems, the FREMO concept allowed for maximum flexibility in module design and has been adapted by various groups around the world.

Module Design

Modules can be constructed of any suitable material as long as it supports the track work and scenery with sufficient strength and stiffness. The shape, width, length and depth of the module can vary except at the module end board. Modules can consist of separate sections allowing greater design flexibility and ease of transport. The section end boards can be of any shape and size and use any method of joining which results in reliable operation. Each module and section shall be self-supported (minimum of 3 legs). The support legs shall have a minimum of 20mm adjustment. The fascia shall be painted satin Black on all external surfaces.



Module Clamping

Modules are joined together using nuts, bolts and large flat washers through holes provided in the module end boards or alternatively using clamps.
The maximum bolt diameter to be used is 6mm.

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Scenery

All modules shall be covered by scenery.
Scenery colours and style are specified in the relevant scale and prototype specific Appendix.

Track

All track work shall be within the limits of the AMRA Fine Tolerance Track standards.
It is recommended that crossing V's and K's (Frogs) be of metal construction.

Minimum track radius

Minimum radius shall be equal or larger than what is calculated in the AMRA Minimum Radius standard.
Minimum turnout size is determined by the minimum radius of the turnout. Larger than the AMRA standard minimum values may be specified in the relevant scale and prototype specific Appendix.

Track centres and clearances

Minimum track centres and clearances shall be equal or larger than the values in the AMRA Track Centre and Clearance standard.

Track at the end board

The track height shall be 1200mm measured from the top of the rail head to the floor.

The rail shall be set back between 0mm and 0.3mm from the outer face of the end board.

The rail at the module end board shall be firmly attached by either soldering to brass counter sunk head screws or at least 2 copper clad sleepers glued in place using epoxy glue.

Tracks at the endplate shall be square and straight for a minimum distance of half the maximum length vehicle used. A larger value may be specified in the relevant scale and prototype specific Appendix.

The height from the top of the rail to the end board shall be the height of the track used and the scaled down nominal prototype ballast height of 600mm or specified in the in the relevant scale and prototype specific Appendix.

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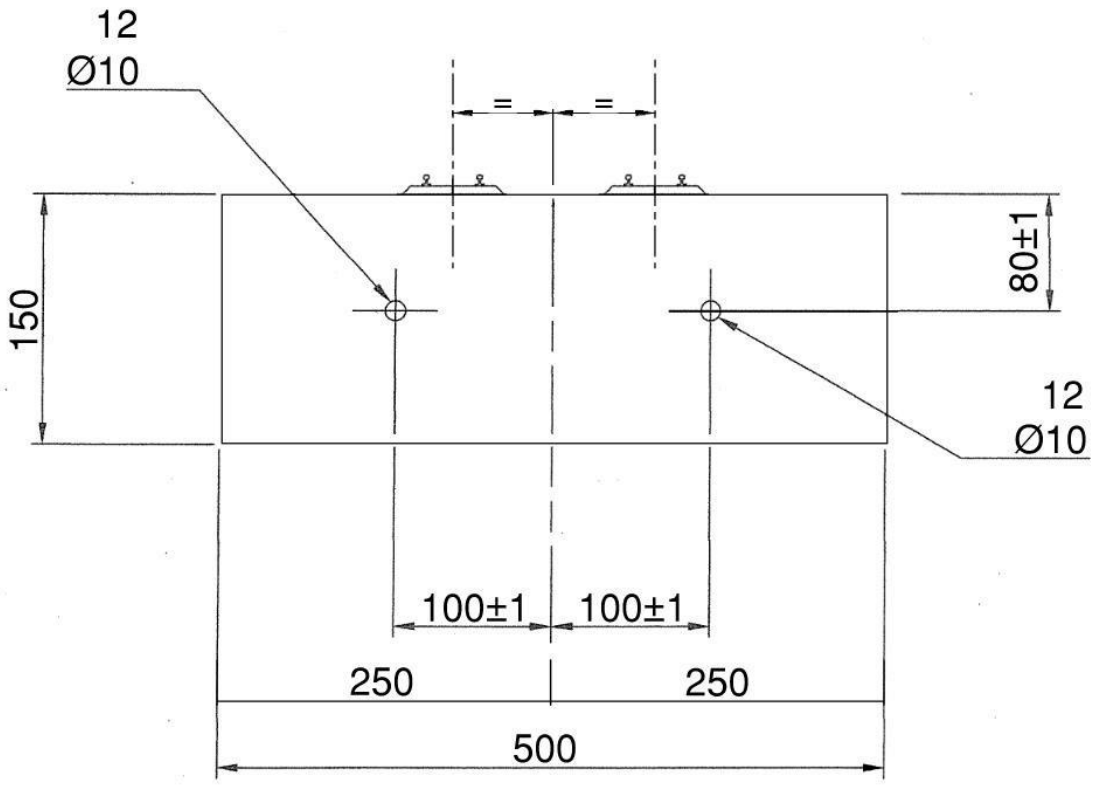
Double Track Module End Board



All dimensions: mm
Tolerance unless otherwise stated: +/- 6mm
Minimum end plate thickness: 17mm
End plate material: Plywood

For double track modules each track shall be equally spaced from the centerline of the end board. The track centre distance shall be equal or larger than the minimum track centre distance in the AMRA clearance and track standard for the minimum radius used. This value may be specified in the relevant scale and prototype specific Appendix.

Note: MDF or dimensional timbers are not to be used for the end board. Metal or composites of demonstrated stiffness and strength can be substituted as the end board material

Rail joiners or bridging rails are not to be used at the interface between modules.

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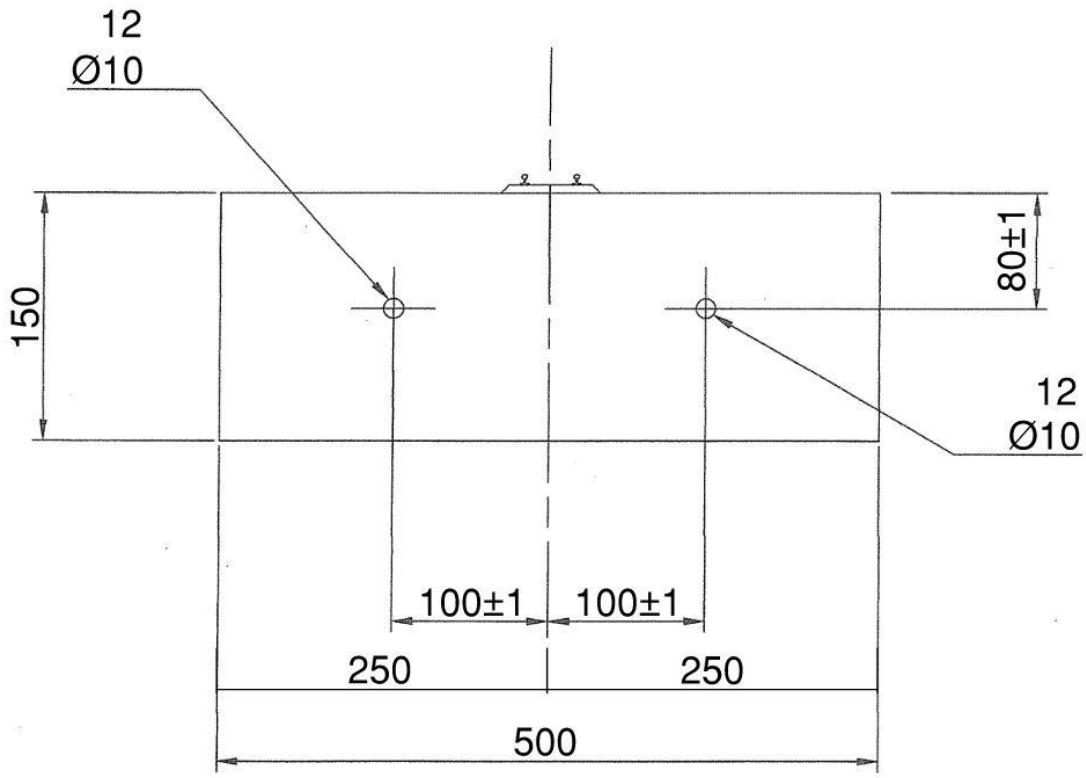
Single Track Module End Board



All dimensions: mm
Tolerance unless otherwise stated: +/- 6mm
Minimum end plate thickness: 17mm
End plate material: Plywood

For single track modules the track shall be centered at the end board.

Note: MDF or dimensional timbers are not to be used for the end board. Metal or composites of demonstrated stiffness and strength can be substituted as the end board material

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DCC Wiring

Turnout controls

All turnouts will be wired so they can be operated from both sides of the module.
It is recommended that the control buttons do not protrude beyond the fascia to avoid damage.

Track Power Bus

The track power bus uses 2 insulated wires to carry track power through modules. It is recommended that the insulation colours used be red and black.

The track power bus shall use a minimum 1.6mm diameter (14 AWG) copper wire or multiple strand cable with a minimum 2mm² copper conductor cross sectional area.

At the end board, the track power bus cable shall be terminated by soldering to a Black Anderson SB50 Plug with #6 AWG contacts.

The connector shall be mounted on the inside of the module end board facing down using 2 screws.

The right hand conductor shall be electrically connected via the track feeds to the right hand rail when looking at the end board. The left hand conductor shall be electrically connected via the track feeds to the left hand rail when looking at the end board.

Note: No accessories shall be powered from the track power buss

Track Feeds

The track feed wires shall use a minimum 0.5mm diameter (24 AWG) copper wire or multiple strand cable with a minimum 0.22mm² copper conductor cross sectional area.

Each rail shall have its own track feed wire including crossing V's and K's.

It is recommended that the feed wire insulation colours be red and black for the feed wires directly connected to the track buss and yellow for polarity switched feed wires from crossing V's and K's.

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DCC Wiring

Accessory Power Bus

The accessory power bus uses 2 insulated wires to carry accessory power between modules. It is recommended that the insulation colours used be brown and blue.

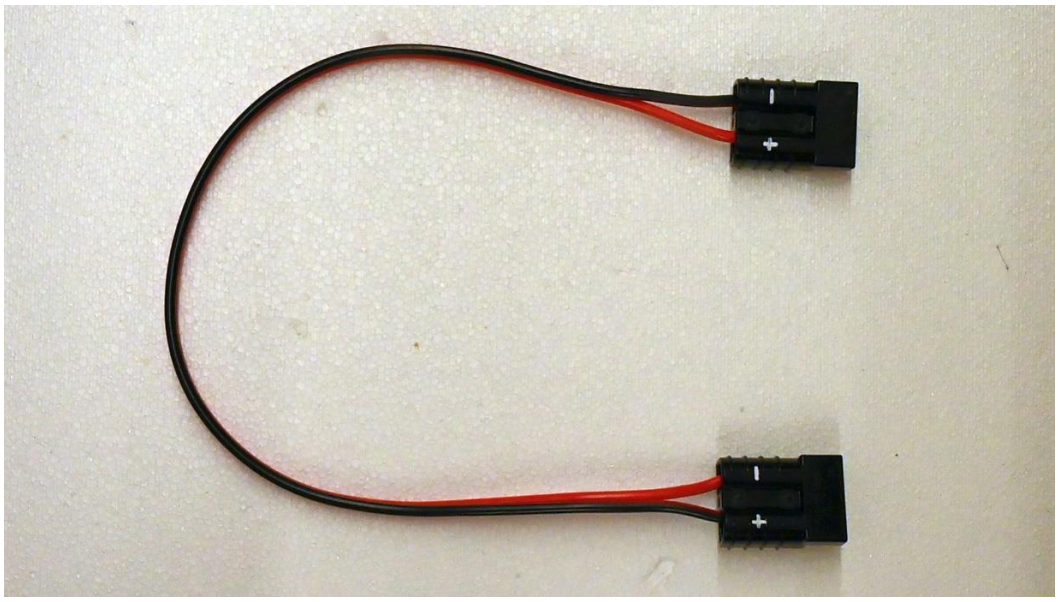
The accessory power bus shall use a minimum 1.6mm diameter (14 AWG) copper wire or multiple strand cable with a minimum 2mm² copper conductor cross sectional area.

At the end board, the accessory power buss cable shall be terminated by soldering to a grey Anderson SB50 Plug with #6 AWG contacts. The connector shall be mounted on the inside of the module end board facing down using 2 screws.

Module Power Bus Connection Cables

Each module shall have 2 Power connection Bus cables, each 600mm in length.

Track Power Bus Connection Cable



The track power bus connecting cable shall be terminated by soldering to each end with a Black Anderson SB50 Plug with #6 AWG contacts and will be cross wired (The red wire at one end shall be connected to the + terminal, and at the other end shall be connected to the – terminal). The wires shall use a minimum 1.6mm diameter (14 AWG) copper wire or multiple strand cable with a minimum 2mm² copper conductor cross sectional area. It is recommended that the insulation colours used be red and black.

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DCC Wiring

Accessory Power Bus Connecting Cable

The accessory power bus connecting cable shall be terminated by soldering to each end with Grey Anderson SB50 Plugs with #6 AWG contacts and will be straight through wired (brown wire + terminal, Blue wire – terminal). The wires shall use a minimum 1.6mm diameter (14 AWG) copper wire or multiple strand cable with a minimum 2mm^2 copper conductor cross sectional area. It is recommended that the insulation colours used be brown and blue.

Overload Protection

Each module that has a turnout shall provide overload protection between the power bus and track feeds. The overload trip current must be less than the current capacity of the DCC system / booster track bus supply.

For Z to S scale /gauge a range of 1A to 2.5A trip current shall be used.

Note: 5W light globes in series with the turnout crossing V (frog) yellow wire can be used instead of a circuit breaker for Z to S scale / gauge.

Each module that has an accessory connected to the accessory bus shall provide overload protection between the accessory power bus the local accessory bus or accessory feeds. The maximum overload trip current must be less than the current capacity of the DCC accessory buss supply.

Note: Suitable valued light globes can be used in series between the accessory buss and the accessory feed wire.

RC Filters

RC filters shall be fitted to the furthest modules from the DCC track and DCC accessory bus power supplies on a layout set up that is more than 10m long. This shall be achieved by using module cables with Anderson plugs and a 100 Ohm 1/2W resistor and a 0.1uF ceramic or film Capacitor that can support 25V or more wired in series across the wires for HO gauge and smaller. A 100 Ohm 1 Watt resistor shall be used for larger scales.

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Appendix 1

H0 gauge 1:87 scale Australian prototype

Track at the end board

The height difference from the top of the rail to the scenery at the module endplate shall be 7.5mm. (This height is achieved if you use Peco code 83 track on 3mm thick underlay).

The track gauge at the end board shall be between 16.5mm and 16.6mm

The track shall be square and straight at the end board for a minimum distance of 140mm.

On double track module end boards, the track centerline spacing shall be 51mm +/- 0.1mm

Track Rail Height

Maximum rail height allowed is 2.1mm (code 83)
Minimum rail height allowed is 1.3mm (code 55)

Suitable brands of track are Peco, Walthers, Shinohara, Micro Engineering and Tillig.

Note: Peco code 75 track is not to be used as it has over scale sleepers for 1:87 scale.

Minimum track radius

Minimum track radius allowed is 914mm (36”)

Turnouts

Recommended turnouts are:
Peco code 83 #8 radius =1702mm Electrofrog
Peco code 83 #6 radius =1092mm Unifrog
Peco code 70 #6 radius =1092mm Unifrog
Homemade turnouts built to the AMRA fine tolerance track standard.

Note: Turnouts built to the MOROP NEM 110, NMRA S3.2 and AMRA intermediate tolerance track standards are allowed.

Note: Peco Unifrog crossing V’s shall be wired the same as Electrofrog crossing V’s

Note: Peco code 75 turnouts and crossings shall not to be used as they have over scale sleepers for 1:87 scale.

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Appendix 1

H0 gauge 1:87 scale Australian prototype

Scenery

Scenery shall represent inland Australia.

At the ends of the module static grass can be used to help hide the join.

Buildings and structures shall be based on Australian prototypes.

Track ballast

Track ballast shall be Woodlands Scenics Fine Dark Brown ballast mixed in equal proportions with Woodlands Scenics Fine Grey ballast for the through tracks.

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Appendix 1

H0 gauge 1:87 scale Australian prototype

Recommended scenery materials for Australian inland scenery

Brand	Type	Code/Description	Colour
HEKI	Static grass	3363 Grafaser 100g 'Winterboden'	Dead/brown grass
		3367 Grasfaser 75g 'Wildgras Wiesengrun'	Green/brown grass
		3368 Grasfaser 75g 'Wildgras Waldboden'	Green
	Foreground Trees	1971 10 tree armatures + some foliage 'Baum-Bausatz'	
		1940 Oak Tree x 1 - No foliage Excellent for large gum	
		1507 8 - 9" Linden trees x 2 - No foliage Excellent gum trees	
Woodland Scenics	Tree Armatures	114 ¾ - 2" bushes/small trees	Brown plastic trunks
	Tree Armatures	57 2 – 3" small trees	Brown plastic trunks
	Clump Foliage	FC181 165 cu.in. bag Ground cover and Tree Foliage	Burnt Grass
	Clump Foliage	FC182 165 cu.in. bag Ground cover and Tree Foliage	Light Green
	Clump Foliage	FC1644 50 cu.in bottle Bushes	Olive Green
	Static Grass	FL631 50 cu.in bottle 'Wild Honey'	Fawn
	Static Grass	FL632 50 cu.in bottle 'Harvest Gold'	Brown
	Static Grass	FL634 50 cu.in bottle 'Light Green'	Light olive
	FineLeaf Foliage	F1133 75 cu.in. box Bushes	Olive Green
Model Terrain	Foliage	500ml bag Tree foliage	Olive Green
	Foliage	500ml bag Tree foliage	Light Olive
Scenic Express	Foreground Trees	EX1228 8" White Birch Trees x 2 Good gum trees	
		Other smaller trees in 2 and 4 packs	
Mini Natur	Static Grass	006-34	Late Fall
MRC (Also JTT Trees)	Small bushes or branches	95080 (Fb1001) – 1" to 3" approx. 100	Mid green
Noch	Static Grass	Various	

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Appendix 2

N gauge 1:160 Australian prototype

Track at the end board

The height difference from the top of the rail to the scenery at the module endplate shall be 6mm. (This height is achieved if you use code 55 track on 3mm thick underlay).

The track gauge at the end board shall be between 9.0mm and 9.1mm

The track shall be square and straight at the end board for a minimum distance of 100mm.

On double track module end boards, the track centerline spacing shall be 30mm +/- 0.1mm

Track Rail Height

Maximum rail height allowed is 1.3mm (code 55)
Minimum rail height allowed is 1.3mm (code 40)

Suitable brands of track are Peco, Atlas, Micro Engineering.

Minimum track radius

Minimum track radius is 450mm
Minimum track radius for through tracks is 600mm

Turnouts

Recommended turnouts are:
Peco code 55 large radius =914mm Electrofrog
Atlas #7 and #10
Homemade turnouts built to the AMRA fine tolerance track standard.

Note: Turnouts built to the MOROP NEM 110, NMRA S3.2 and AMRA intermediate tolerance track standards are allowed.

Note: Peco Unifrog crossing V's shall be wired the same as Electrofrog crossing V's

Note: Peco small radius turnouts and Atlas #5 turnouts are not to be used as the radius is too small for large locomotives.

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Appendix 2

N gauge 1:160 Australian prototype

Scenery

Scenery shall represent Australia.

Buildings and structures shall be based on Australian prototypes.

Track ballast

Track ballast shall be Woodlands Scenics Fine Dark Brown ballast mixed in equal proportions with Woodlands Scenics Fine Grey ballast for the through tracks.