# S H E R M A N  H I L L
# MODEL RAILROAD CLUB

**October 20, 2006**

## *STANDARDS & RECOMMENDED PRACTICES FOR HO MODULES*

### 1.) PURPOSE

To provide club members interested in building an HO model railroad module(s) with benchwork, track, and wiring standards and recommended practices necessary to insure operating compatibility with other HO modules in a layout configuration. Uniformity of certain module characteristics are necessary to assure fit and function when joined with other modules. Standardization of other characteristics assures operating quality and pleasurable viewing for the public.

### 2.) WHAT IS A MODULE?

A module is a portable section of table type structure which is but one part of a large group of like tables which when assembled together form a fully operating model railroad. Modules are built by individuals as part of a home layout or specifically for use with others in a layout. Modules are built to a set of standards that allow each unit to interface exactly with other units in the overall layout. A module may be a single table or a group of tables which must be capable of interface at each end, but may deviate between these ends so long as operation is not compromised or restricted.

It is recognized that from time to time a module builder may wish to deviate from the recommended practices to achieve a particular effect. Such deviations must not compromise the purposes of the standards or result in sub-standard operation, construction, or appearance. The module builder is responsible for assuring compliance with all interface standards prior to use of the module or group of modules in a layout.

### 3.) DEFINITIONS

**A.)** **STANDARD (S)** - A standard is a figure that is mandatory, "cut in stone" so to speak and must be followed to facilitate interchange or interface with other modules, smooth operation, and provide an overall esthetic

appearance. The standards provided herein were approved by the National Model Railroad Association (NMRA) membership in March 1990.

B.) **RECOMMENDED PRACTICE** - Recommended practices are those figures that are beneficial to operation and overall appearance. However, while recommended, the module builder is not required to adhere to them.

C.) **CONVENTIONS** - Clockwise direction is Westbound; counterclockwise direction is Eastbound; North is the operating side of the module; and South is the viewing side of the module. West is the left end of the module, and East is the right end of the module from the viewing side.

D.) **INTERFACE** - The East and West exterior surfaces (ends) of the module which join with adjacent modules.

E.) **DIORAMA DIVIDERS** - The end pieces of the module framework/skyboard used for separating one diorama scene from another and representing distance between scenes. Provides additional module and skyboard rigidity, and protects scenery while transporting the module. Diorama dividers, on each end, are required for each module or group of modules, yard modules excepted.

F.) **CONNECTING TRACKS** - A two(2) inch length of bare track for joining main and branchline track sections together across the module-to-module interface.

## 4.) STANDARDS & RECOMMENDED PRACTICES - HO MODULES

A.) **MODULE SIZE (S)** - The builder has the option of building straight modules in standard 4', 6' and 8' lengths. Special two (2) foot long bridge modules are sometimes required in certain layout configurations. Inside and outside corner modules are four (4) foot, six (6) foot, or eight (8) foot squares with the interior & exterior corners removed. Standard and optional dimensions are given on data sheets 2 through 11. Modules may be extended not more than 6 inches forward of the normal front edge. If modules are extended forward, the front edge must be tapered between 30 and 45 degrees.

B.) **MODULE HEIGHT (S)** - Module height should be a nominal 40 inches from the floor to the railhead. Legs should be adjustable to provide a minimum of 2 1/2 inches of height adjustment.

C.) **MODULE FRAMING** - Only quality material, such as 1"x4" pine, or cabinet quality plywood should be used for strength and appearance. Avoid any dips across the module, such that the track is perfectly flat. Use standard framework as shown in data sheet 3, L girder as shown in data sheet 5, or unit construction as shown in data sheet 11.

D.) **CONSTRUCTION** - Trackwork shall be securely attached to the roadbed for positive alignment. Ballasting is recommended. All trackwork must be accessible for maintenance purposes.

E.) **INTERFACES** - The ends, interface points, of modules need to be flat, smooth, and square with the sides to assure close joining with adjacent modules and overall square assembly of the layout.

F.) **ASSEMBLY** - Two clamping spots are required at each end of the module, located as per data sheets 4 & 6. The module owner must provide two three (3) inch C-clamps per module.

G.) **SUBROADBED** - Rigid support is required for mainline trackage! Use 1/2 to 5/8 inch plywood for best results on standard or L girder framework. Use ¼ inch plywood and foam on unit construction. The maximum distance between subroadbed supports, risers, should not exceed 18 inches. See data sheets for optional methods.

H.) **ROADBED** - Roadbed providing ballast slopes is to be used for mainlines and branch lines except in yard or terminal areas. Cork, milled roadbed, or contoured homosote are recommended roadbed materials.

I.) **TRACK LOCATION** - Two (2) mainline tracks shall be provided to form two continuous unbroken loops on a layout. An optional branch line may be provided two inches inside the inner track. Optional passing sidings may be located on either side of the mainlines. Track locations are shown on data sheets 4 & 6.

J.) **RAIL SIZE (S)** - Hand laid or commercial code 100 nickel silver. Code 83 nickel silver track may be used, but if code 83 is used, module owner must provide means to transition from code 83 to code 100 for each end of the module or series of modules.

K.) **GRADES (S)** - Mainlines and passing sidings - 0%. Branchlines - 3%.

L.) **TRACK CLEARANCES (S)** - Horizontal = 1-1/32", measured from track centerline to any obstruction. Vertical = 3 1/2", from top of track to overhead obstructions.

M.) **TRACK CENTER LINES - MODULE INTERFACES (S)** - Mainlines 5" & 7", and optional branch line 9" from the viewing side of the module.

N.) **TRACK SETBACK FROM END OF MODULE (S)** - 1". **THIS IS A CRITICAL DIMENSION.** Track shall be laid to the edge of the module, and ballasted. Then rail only shall be cut back one inch from the edge of the module and the rail and fish plates on the top of the ties shall be removed. The ties shall be undercut and the end of the rail to allow rail joiners to installed to splice in a 2 inch section of rail.

O.) **TRACK CENTER LINES (S)** - On curves = 2-1/2". For parallel tracks = 2".

P.) **MINIMUM PARALLEL TANGENT TRACK LEEGTH FOR CURVES (S)** - 3". This is the distance from the end of the bridge track at the interface to the first deviation in the mainline, i.e., a switch, curve, crossover, etc.

Q.) **MINIMUM MAINLINE TURNOUT (S)** - #6.

R.) **MINIMUM BRANCHLINE TURNOUT (S)** - #4.

S.) **MINIMUM RADIUS (S)** - Industrial tracks = 24". Mainline = 32". On corner modules the recommended mainline radius at the top of the arc are: inner main - 33", outer main - 35-1/2".

T.) **BALLAST** - Mainlines - grey.

Passing sidings - grey.
Branch line & Other tracks - black cinder or owners choice.

**U.)** **INSULATED RAILS (S)** - The rails of each module shall be insulated from adjacent modules by using insulated rail joiners at one end of the connecting rail. Both rails of a crossover shall be insulated by either insulated rail joiners or rail cuts filled with epoxy. Any branch line or spur connected to a mainline track shall be insulated at both rails. Turnouts with all-rail frogs shall have both frog rails insulated. Frog power shall be wired thru switch machine contacts.

**V.)** **INSPECTION** All new modules are subject to inspection by an inspection team designated by the club, prior to being placed into a layout for the first time.

## 5.) ELECTRICAL - MODULE WIRING STANDARDS

The electrical system is configured to be the minimum required for versatile operation. Continuous loop running of one train per mainline for small layouts is accommodated as is multi-train block control for large layouts. By disconnecting the coaxial size M power connectors at module interfaces, at pre-selected points around the layout, each mainline can be divided into two or more control blocks.

Wiring diagrams are illustrated on data sheets 11 through 15.

**A.)** **COMPONENTS** -

1.) East Interface Connector (S) - Radio Shack # 274-222 or equivalent.

2.) West Interface Connector (S) - Radio Shack # 274-222 or equivalent.

3.) Cab Input Connector (S) (Optional)- Radio Shack # 274-1563 or equivalent. One per main/branch line.

4.) Terminal Blocks - Screw type 7 position barrier strips.

6.) Wire (S) - 14 gauge stranded wire shall be used for the length of the module for a track bus system. 16 gauge stranded zip cord (lamp cord) for routing track power from track bus system to size M power plug. 20 gauge wire may be used to run power from the terminal blocks to the track.

7.) 110 Volt Accessory Power (S) - A regular power strip shall be provided on the module to carry 110V AC power around the layout to allow for connection of electrical accessories and power packs.

**B.) ASSEMBLY** - These conventions conform to NMRA standards where applicable. (MRP1.3).

1.) The outer shield of the pins and jacks shall go to the rail closest to the front of the module. The outer shield shall be connected to the flat colored or ribbed side of the zip cord.

2.) A terminal block under the module is required for track feeder connections.

3.) The following color code shall be used:
RED - outside (Eastbound) mainline.
YELLOW - inside (Westbound) mainline.
BLUE - optional branchline.

4.) Looking from the front of the module, size M DC Power Plugs are on the right, extended 20", and size M DC power Jacks are on the left mounted flush. Wiring shall be located in the approximately 12" back from the nominal front of the module.

5.) Insulated rail joiners are to be used on both rails at one end of the bridge tracks used to join modules. (An exception may be made when two modules belonging to one owner are always together.)

6.) Connections for power feeders from power packs shall be through specified connectors mounted on the rear of the module. The M size DC power jack shall be mounted to the module with the outer shield connected to the rail

closest to the module front, the center pin connected to the inner rail of the track. Each track shall use a separate color coded connector.

7.) Wire required: Zip cord = 2' per track.
14 gauge stranded = module length times 2 times number of tracks.

8.) Feederlines to track from terminal block: Wire may be labeled or color coded to ensure that all circuits are readily identifiable.

9.) DCC wiring: If UP 5 is used one unit should be located on inside of module, and one unit on the outside. The UP 5s should be connected with a short jumper of 6 strand wire with RJ 12 connectors.

## VI.) CONSTRUCTION & SET-UP TIPS

The following tips are offered to club members interested in building a module based on the collective experience of club members who have built either N or HO scale modules. They are included to answer question you may have and to make the building and set-up of your module easier and more enjoyable.

* Make sure your module is square! Corner modules are particularly difficult to build. Take your time, double check your measurements, and make sure your cuts & placement of parts are accurate to ensure your module comes out square.

* Use a combination square or something similar to correctly mark where your tracks are to end at the interface. Make sure your tracks end as close to the standard as possible so that a 2" piece of rail can be used to join modules each time. An error as little as 1/16" means that every time your module is placed in a new position in a layout, a new piece of track has to be cut to fit.

* Watch the weight of your module carefully. Remember, you have to move it around! Make it as light as possible, but sturdy enough to withstand the moving & transportation it

will endure. Styrofoam is a good lightweight support material for mountains.

* Although a variety of screw sizes are called for in the framework data sheets, several members have found that 1-5/8" drywall screws work well and are an inexpensive alternative.

* Eight foot modules offer maximum scenic flexibility, but are heavier and more difficult to move & transport. If you build an 8' module you may wish to mount caster wheels on one end so that it can be rolled into a truck.

* While particle board is cheaper than plywood, it is also heavier and does not hold screws as well. Therefore particle board and chip board **WILL NOT BE USED IN MODULES.**

* Cut your clamp holes exactly as shown. Remember you have to insert your C-clamps through these to hold your module to the adjoining one! Consequently, it's important that these holes line up from module to module.

* Module owners are encouraged to use a leg arrangement utilizing ¾ inch electrical conduit (EMT) or ½ inch threaded pipe legs. This really speeds up set-up, but remember to allow for 2 1/2" height adjustment in each leg!

* When setting up the modules in a layout, remember to use insulated rail joiners on one end of each piece of connecting track. This is essential if the layout is to be broken up in two or more electrically isolated control blocks for operational purposes. More importantly, if there is an electrical problem, it greatly enhances our ability to trace the problem to a specific module through a process of isolation. With metal rail joiners, it can become a nightmare!

* Don't build your benchwork out of sub-standard scraps. You'll find that it won't be sturdy enough for good track work and your scenery will not stand up as well due to the increased flexing it's subjected to. We have also found that there are normally problems interfacing with other modules when sub-standard materials are used, prolonging

set-up time and detracting from reliable operation at public shows.

* Good trackwork is the key to reliable operation. Take time to insure your track centerlines at the interface points are correct, parallel tracks are spaced correctly, you use smooth transitions in the corners, and that straight sections of track are straight.

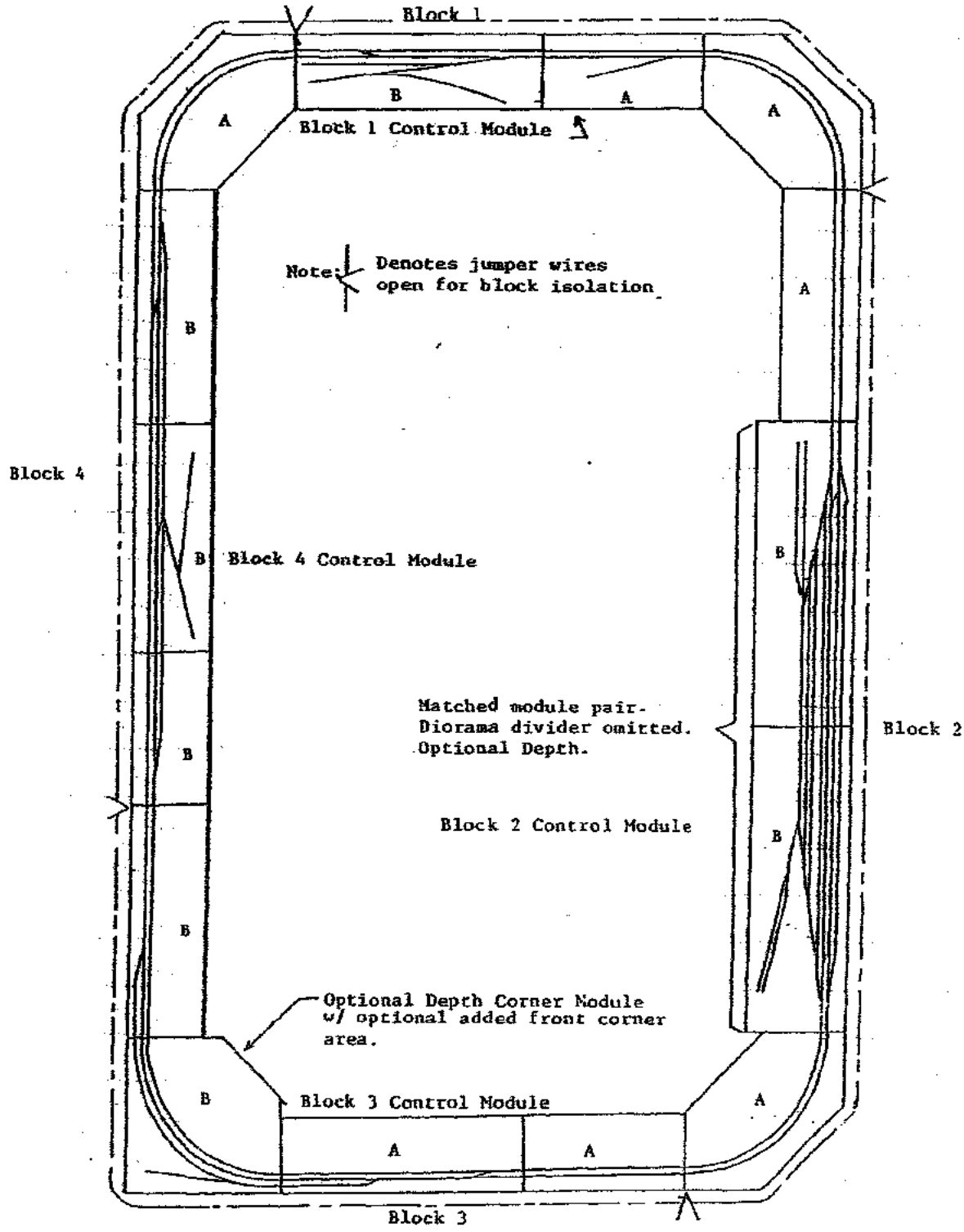
* Solder sections of flex track together before you lay them on curves. This gives you a smooth, trouble free joint in the curve. All rail joints should be soldered to enhance the flow of electricity through the rails.

Remember, if you have a problem, question, or don't understand the reason for a particular standard or recommended practice, help or an answer is usually only a phone call away.

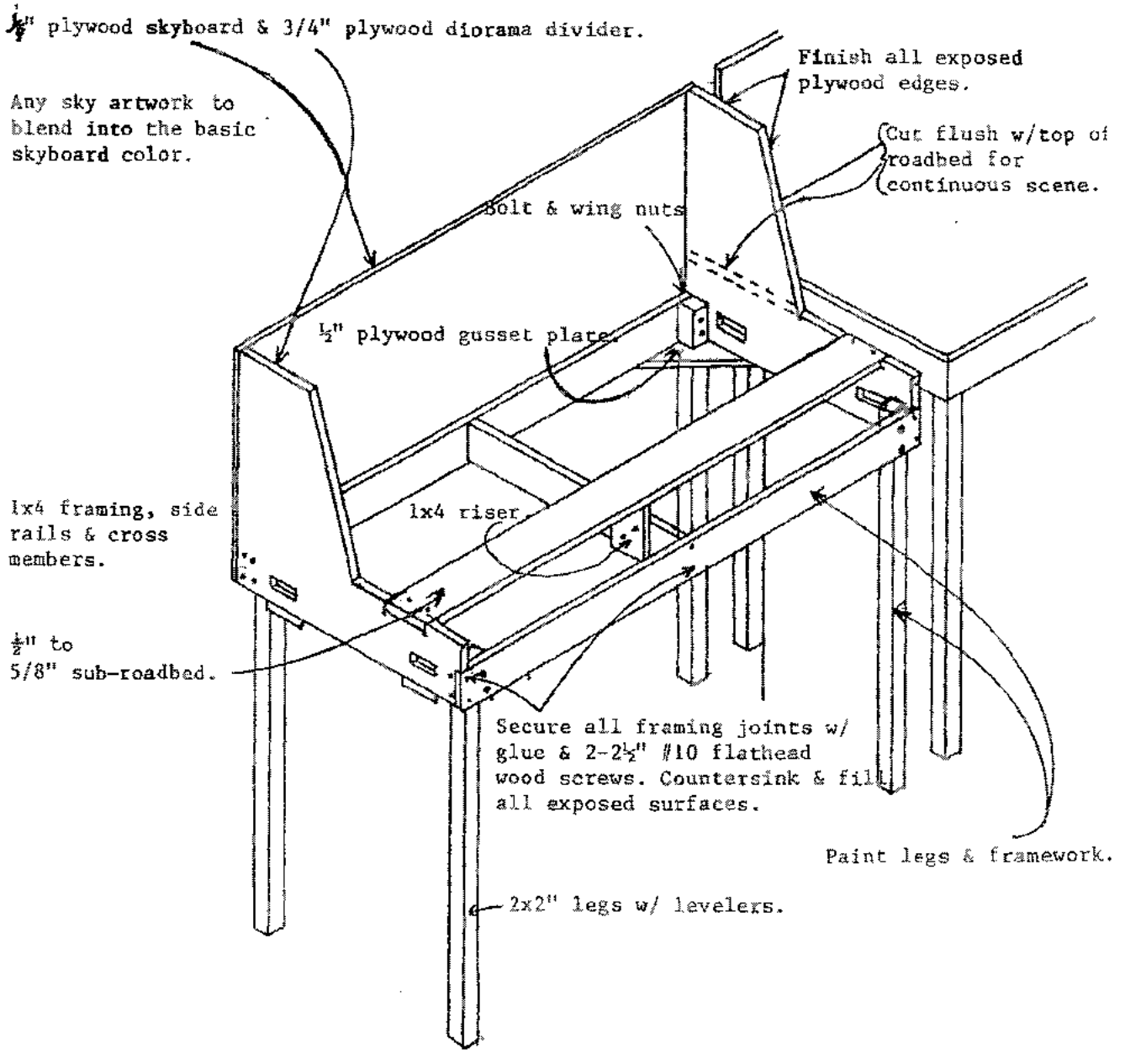
ISSUE DATE:
July 13, 2006

## EXAMPLE OF A MODULAR LAYOUT

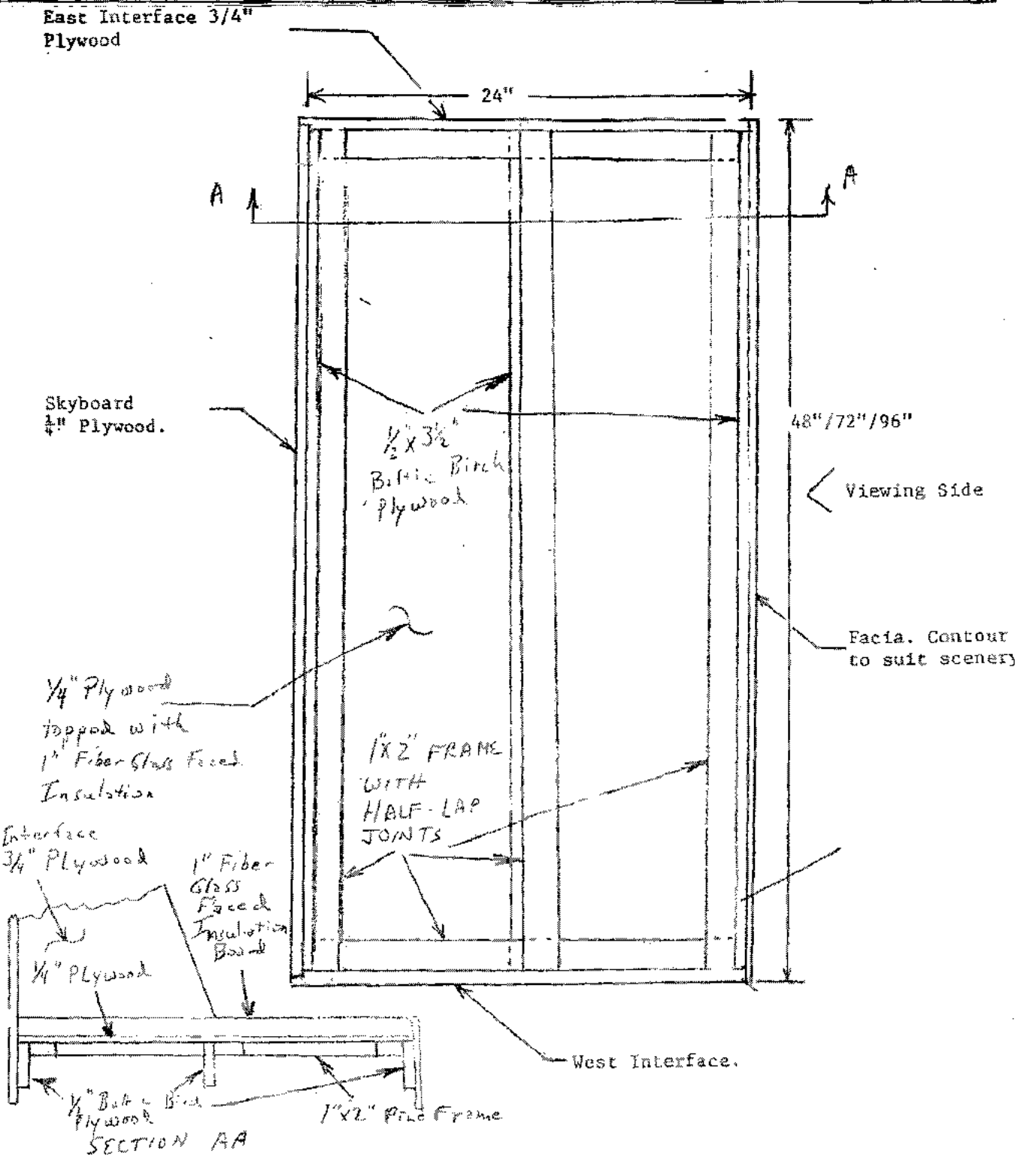
DATA SHEET
# 1



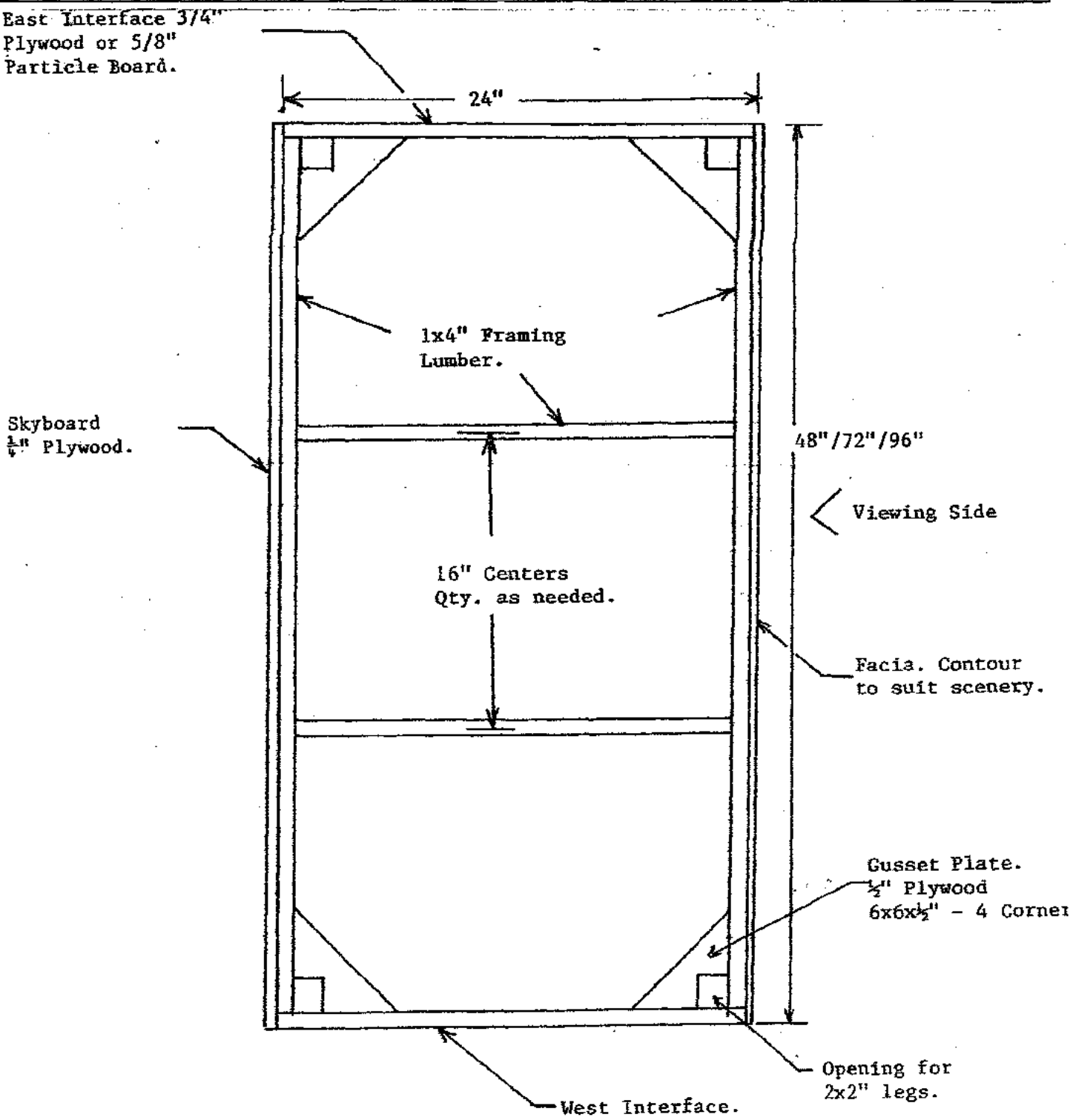
| ISSUE DATE: July 13,2006 | **TYPICAL MODULE CONSTRUCTION** | DATA SHEET # 2 |
|---|---|---|



| ISSUE DATE: Jul 13,2006 | **FRAMEWORK - STRAIGHT MODULE** | DATA SHEET # 3 |
|---|---|---|

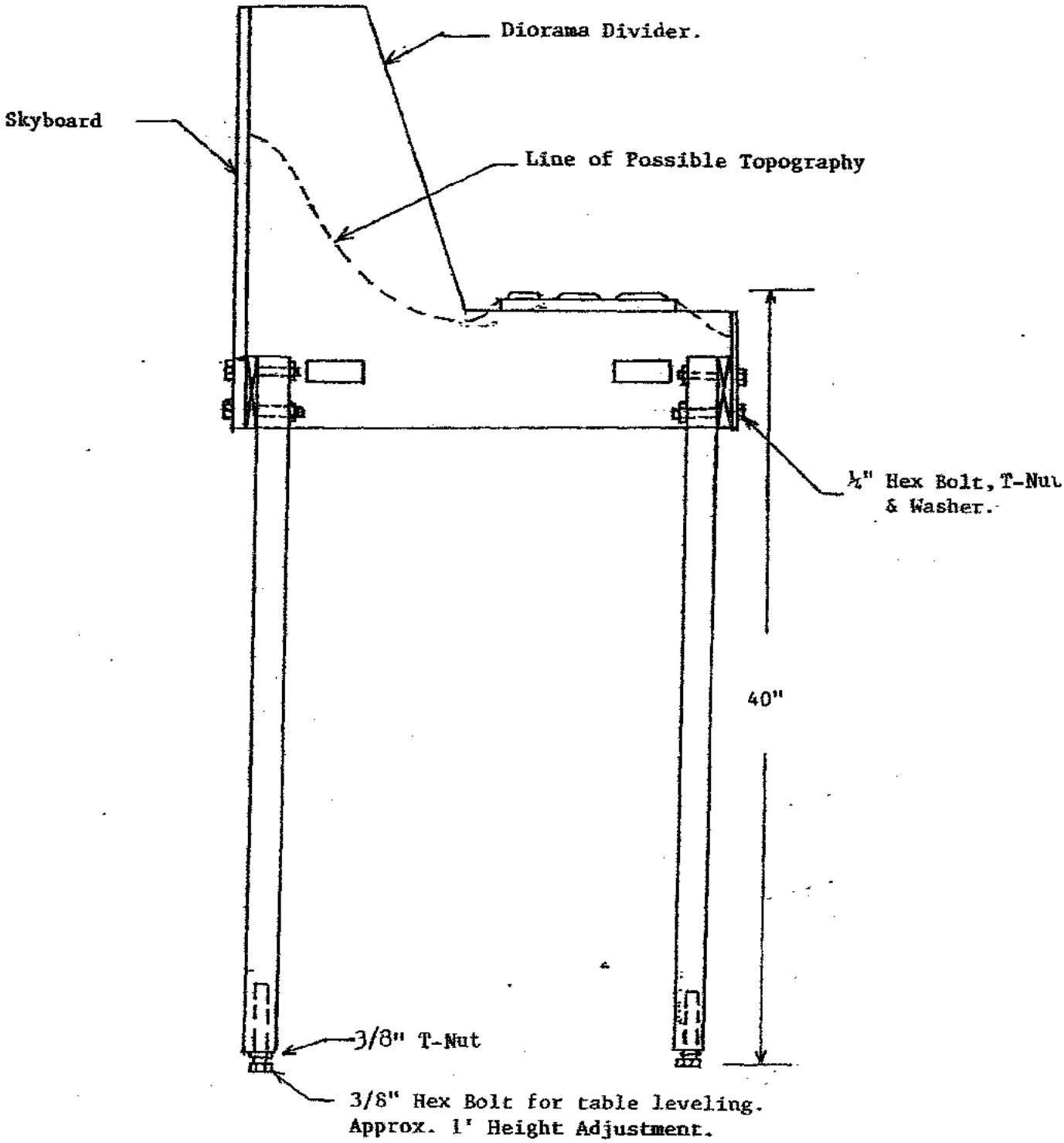


| ISSUE DATE: Jul 13, 2006 | FRAMEWORK - STRAIGHT MODULE | DATA SHEET # 4 |
|---|---|---|

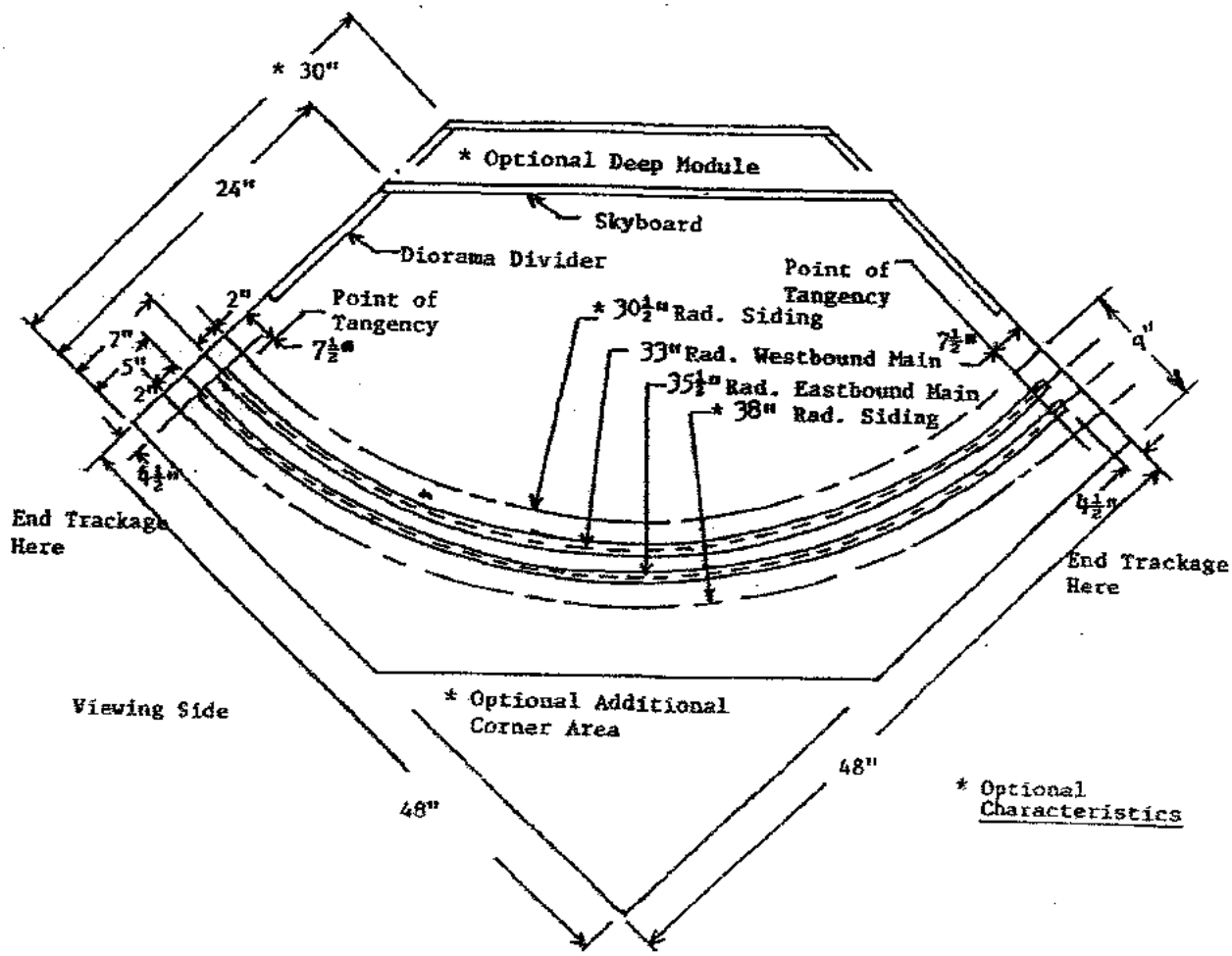


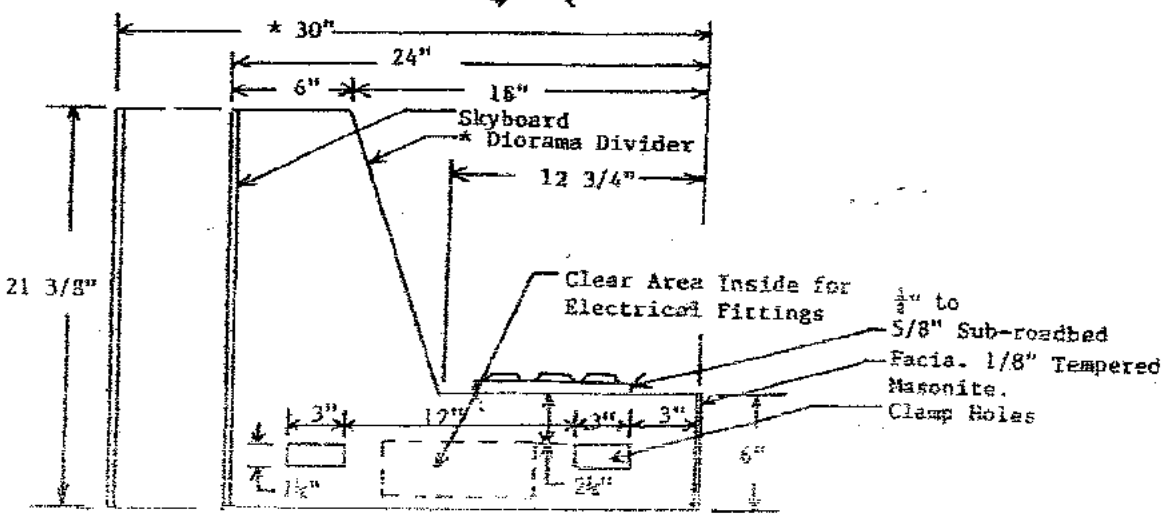

GLUE AND SCREW ALL JOINTS

| ISSUE DATE: Jul 13, 2006 | **INSIDE VIEW OF STRAIGHT MODULE EAST INTERFACE** | DATA SHEET # 5 |
|---|---|---|

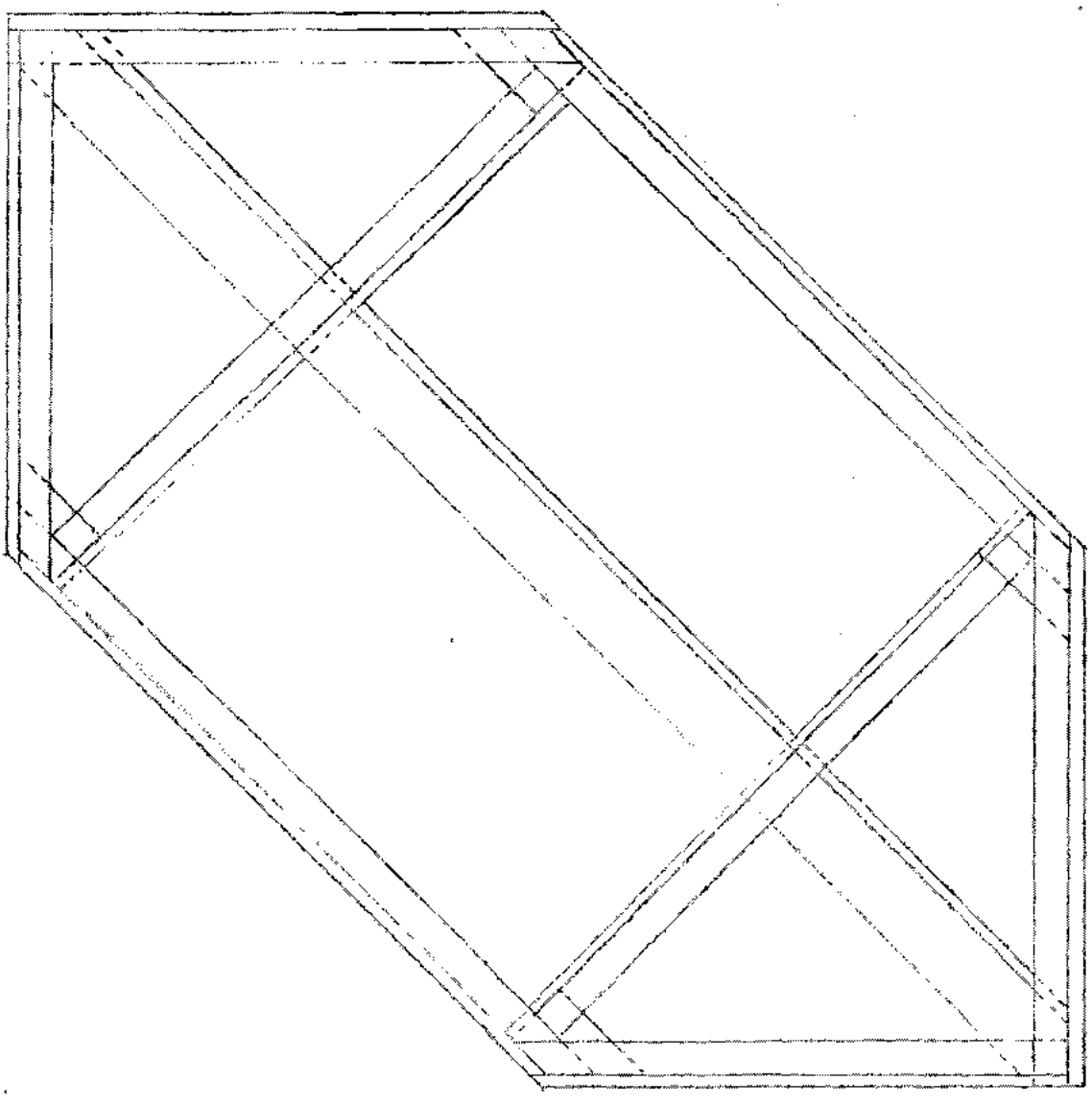


| ISSUE DATE: Jul 13, 2006 | **DIMENSIONS - CORNER MODULE** | DATA SHEET # 6 |
|---|---|---|



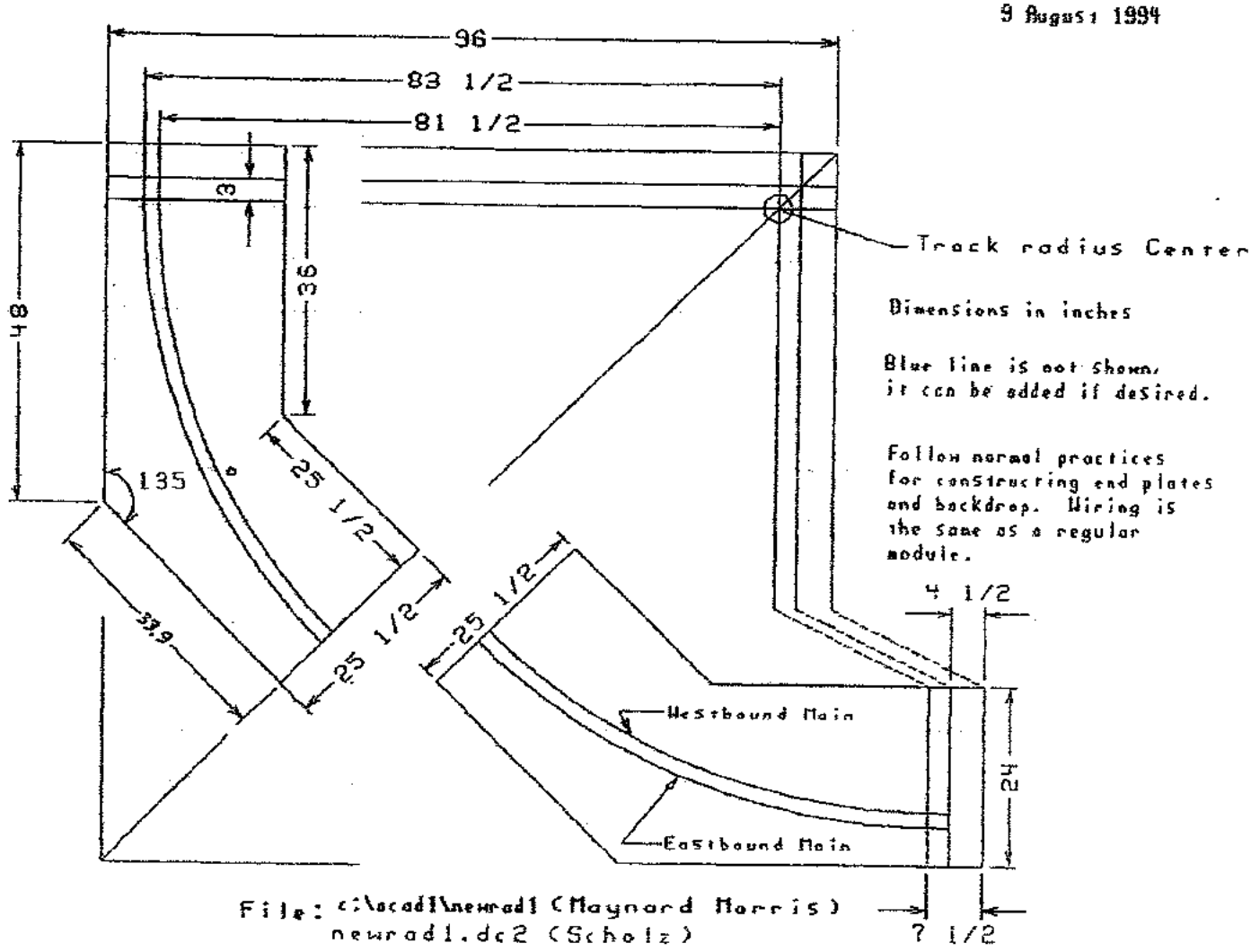



| ISSUE DATE: Jul 13, 2006 | **FRAMEWORK - CORNER MODULE** | DATA SHEET # 7 |
|---|---|---|



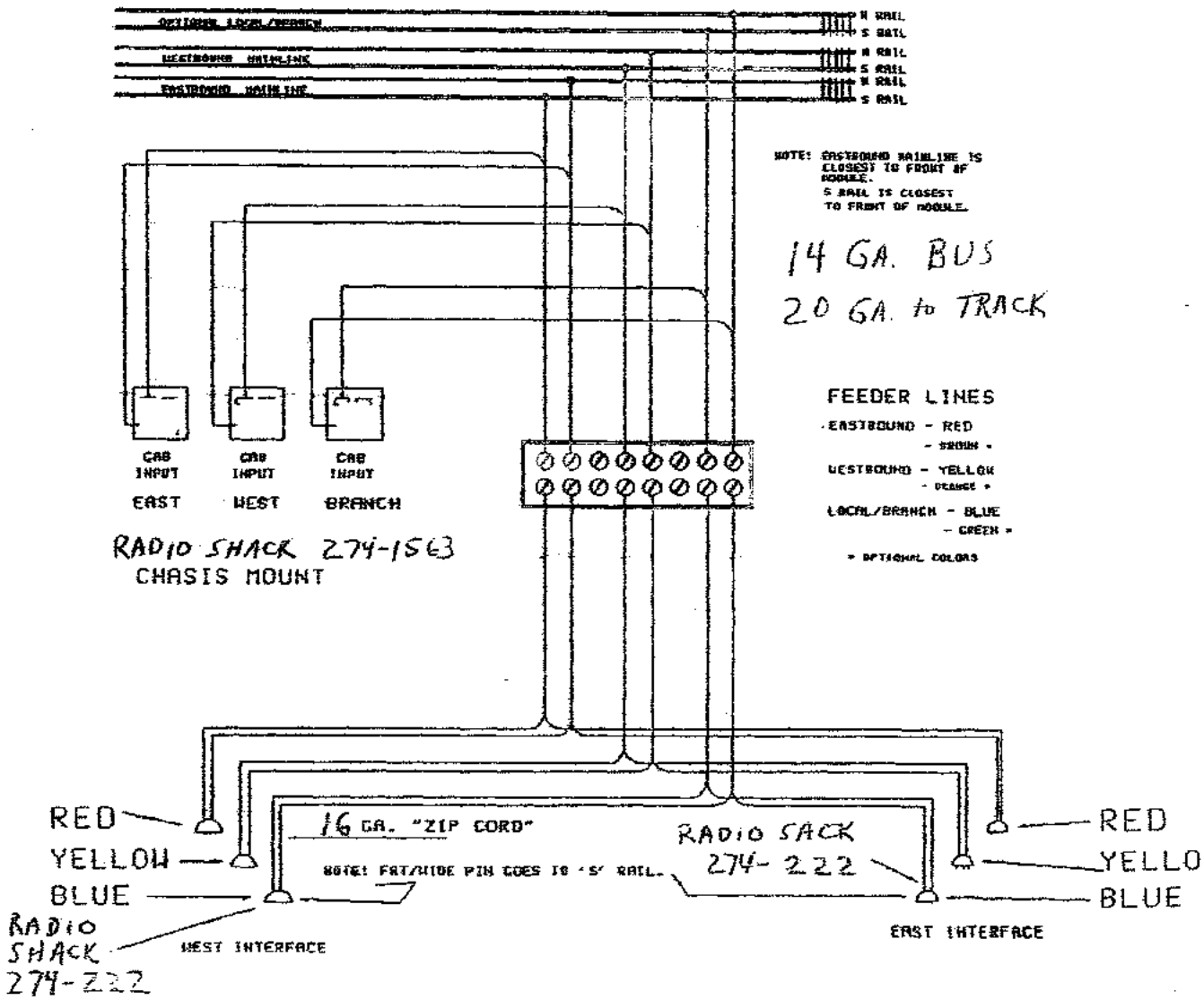
| ISSUE DATE: | OPTIONAL WIDE RADIUS CORNER | DATA SHEET |
|---|---|---|
| Jul 13, 2006 | **TWO MODULES REQUIRED** | # 8 |

9 August 1994



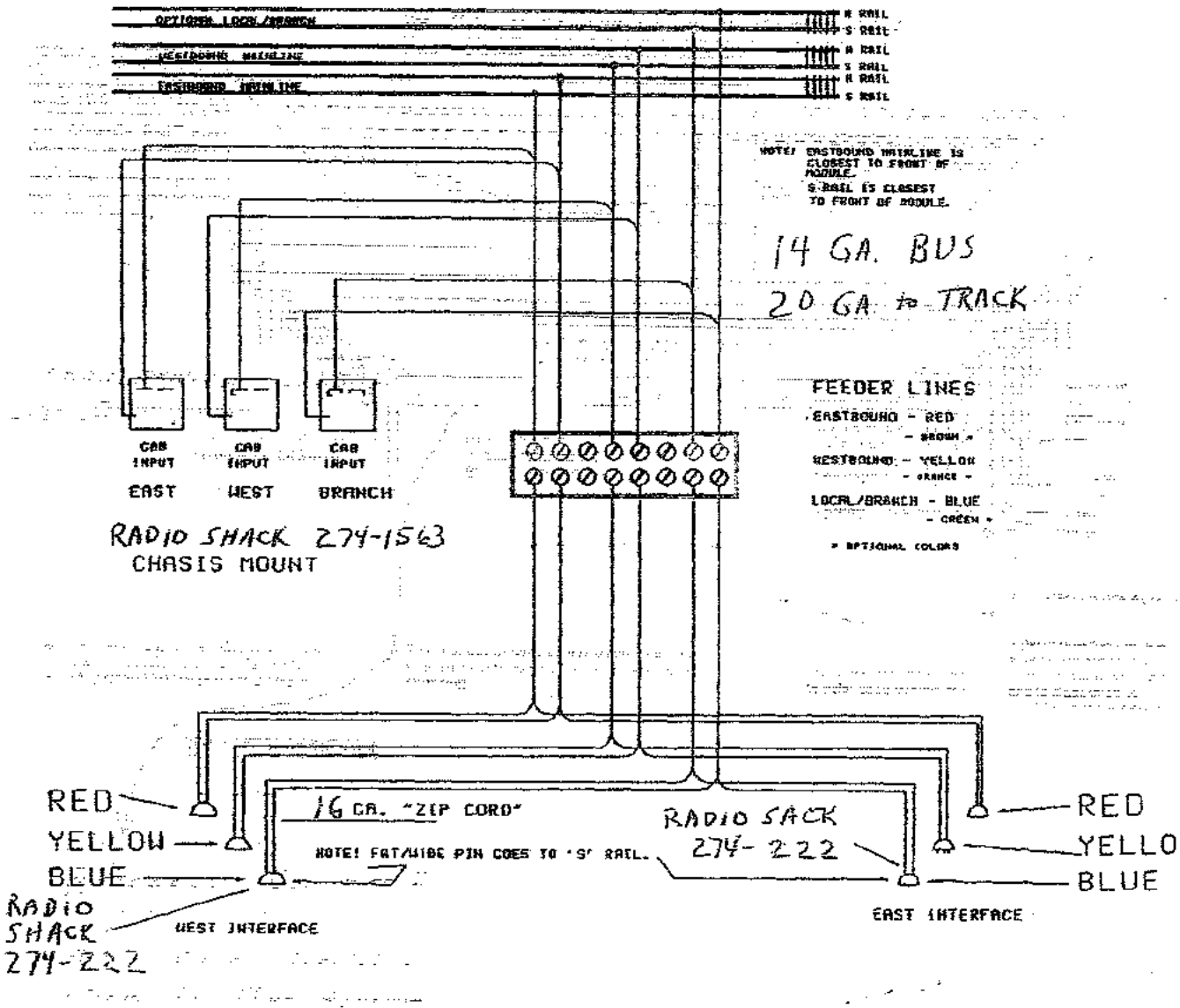

File: c:\acad1\newrad1 (Maynard Morris)
newrad1.dc2 (Scholz)

| ISSUE DATE: Jul 13,2006 | ELECTRICAL SYSTEM FOR TYPE C BLOCK CONTROL MODULE | DATA SHEET # 10 |
|---|---|---|



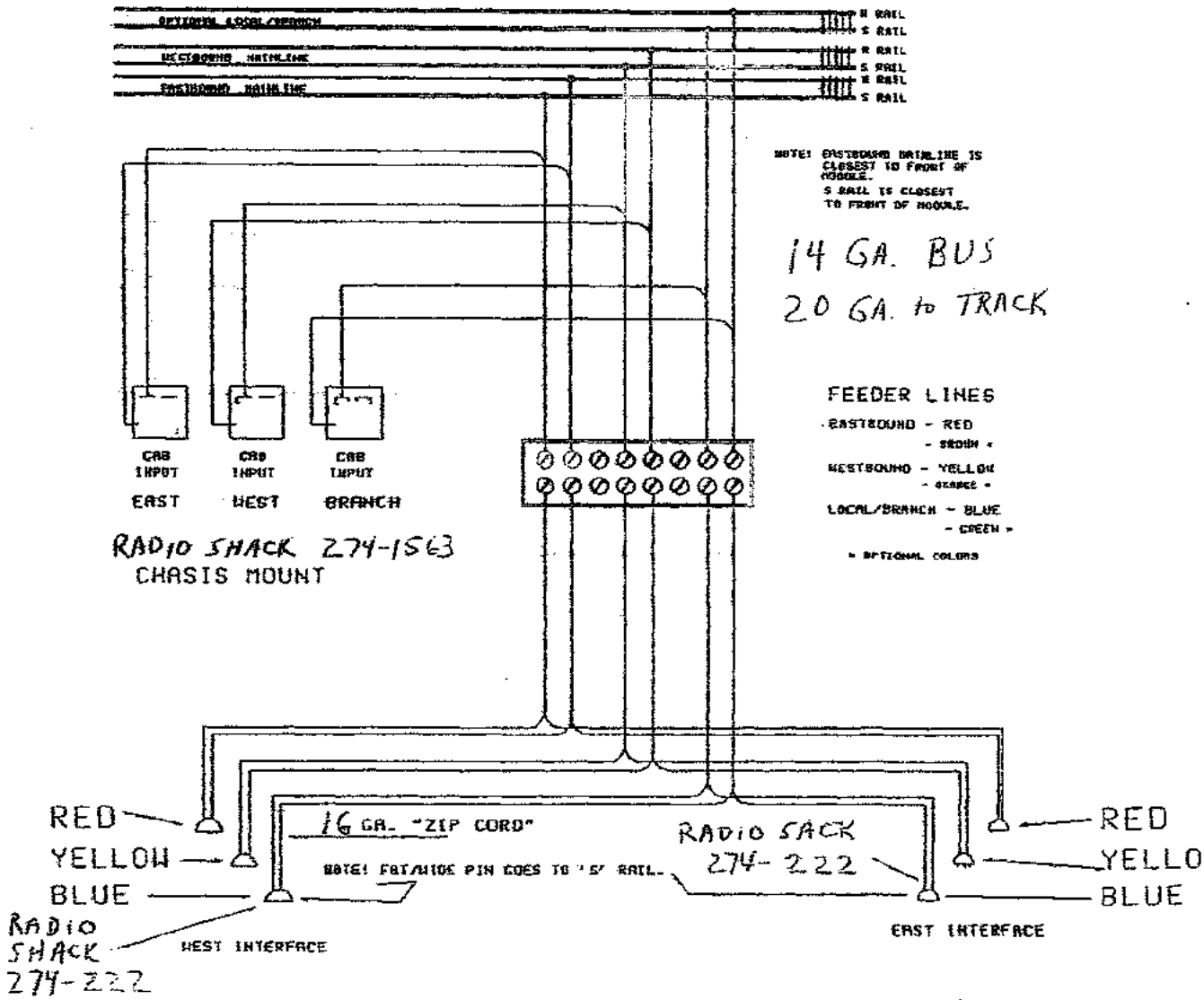

FILE: HO_STNDC.DC2 (SCHULZ)
DATE: 2/15/94

| ISSUE DATE: Jul 13,2006 | ELECTRICAL SYSTEM FOR TYPE C BLOCK CONTROL MODULE | DATA SHEET # 10 |
|---|---|---|




FILE: HO_STNDC.DC2 (SCHOLZ)
DATE: 2/15/94

| ISSUE DATE: Jul 13,2006 | **ELECTRICAL SYSTEM FOR TYPE C BLOCK CONTROL MODULE** | DATA SHEET # 10 |
|---|---|---|

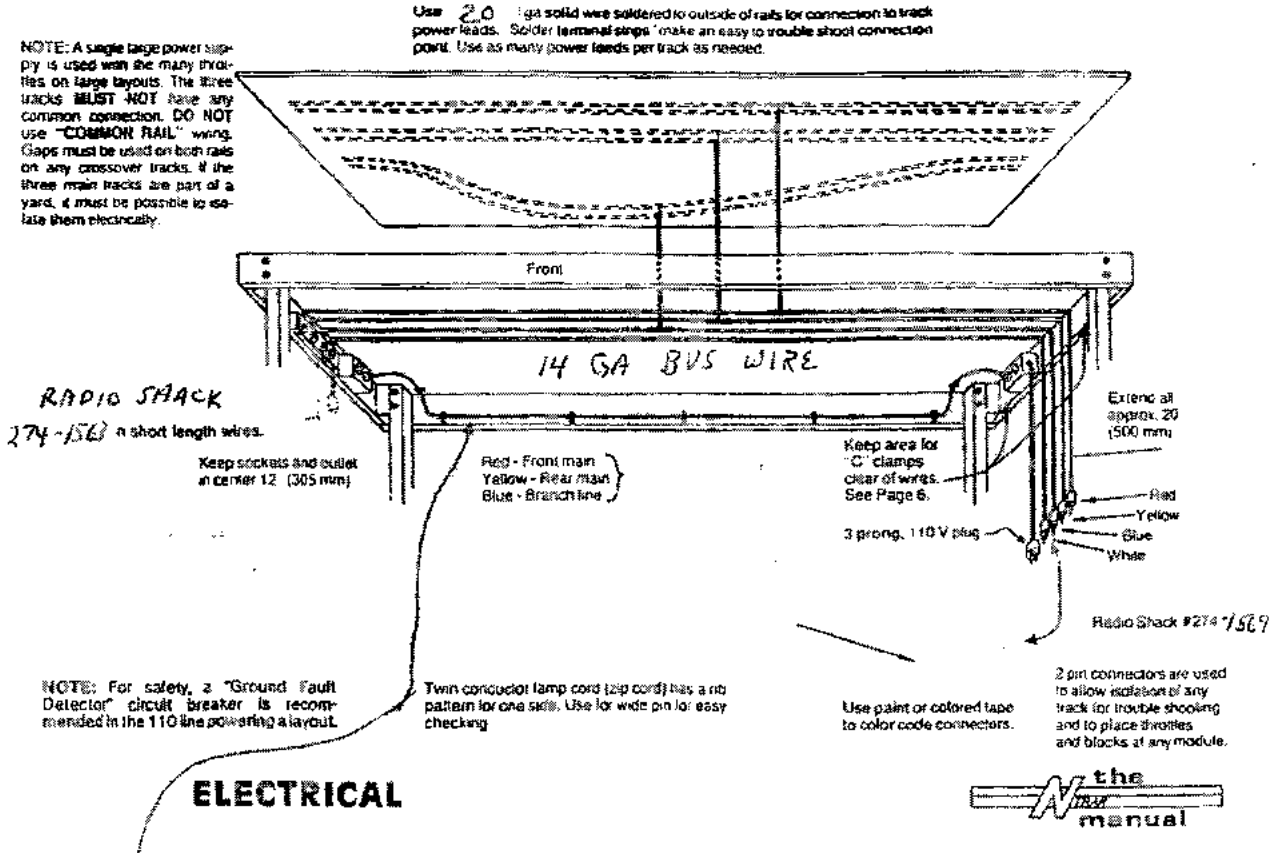



FILE: MO_STNDC.DC2 (SCHOLZ)
DATE: 2/15/94

ISSUE DATE: Jul 13, 2006

# WIRING SCHEMATIC FOR A TYPICAL MODULE

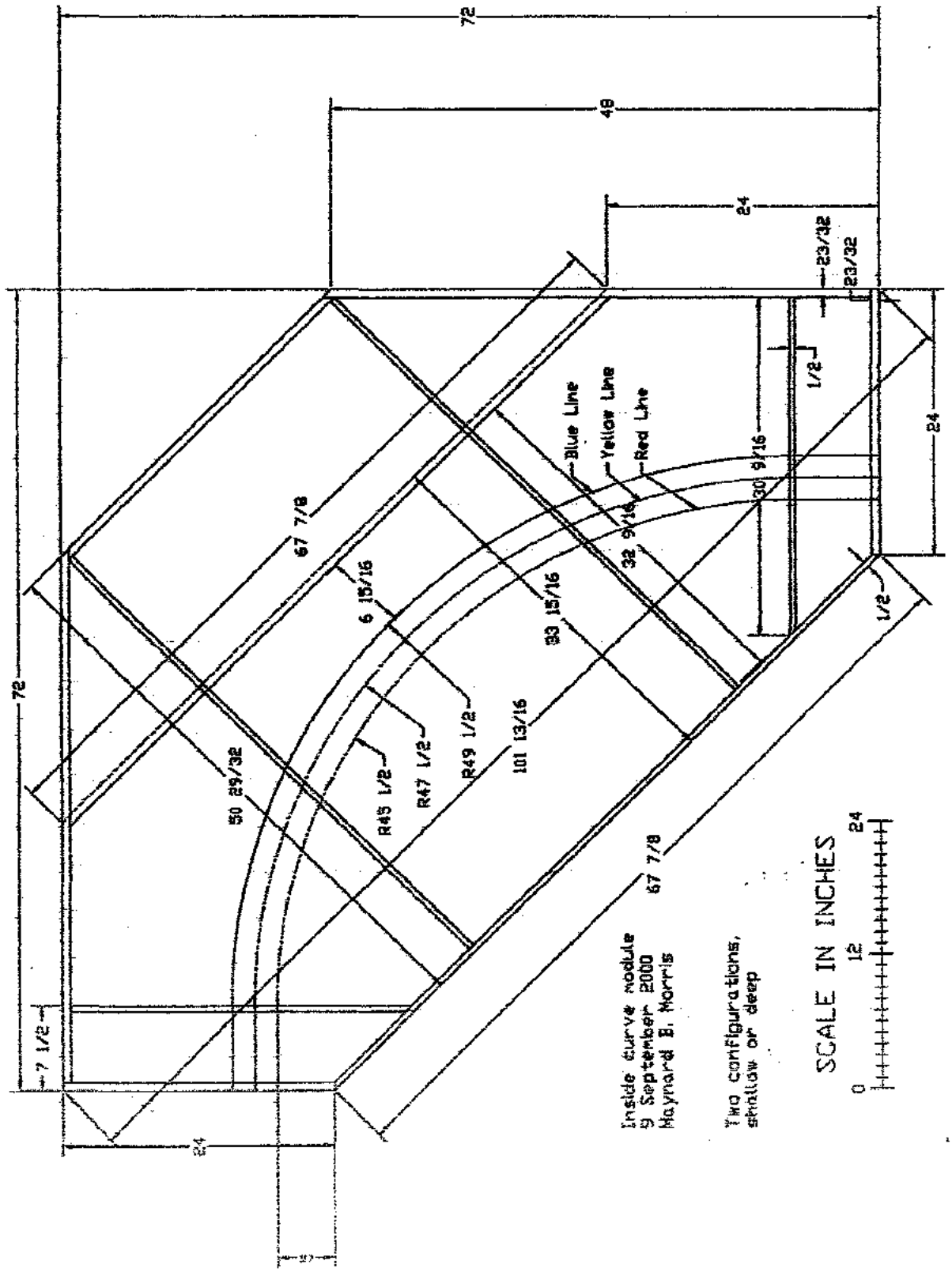
DATA SHEET # 11




## ELECTRICAL

Alternate - Use 6 or 8 outlet Electrical Strip Make sure Electrical cord is 14 ga. w/ground.

| ISSUE DATE: Jul 13, 2006 | **WIDE RADIUS INSIDE CORNER MODULE** | DATA SHEET # 12 |
|---|---|---|



NMRA Recomended Practices RP 20.1 Car Weight
File:NMRAWGHT.WK1 (Scholz)
Today: 13-Feb-94

| SCALE | INITIAL (Ounces) | ADD/INCH (Ounces) | Car length in inches 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| O | 5.00 | 1.000 | 6.000 | 7.000 | 8.000 | 9.000 | 10.000 | 11.000 | 12.000 | 13.000 | 14.000 | 15.000 | 16.000 | 17.000 |
| On3 | 1.50 | 0.750 | 2.250 | 3.000 | 3.750 | 4.500 | 5.250 | 6.000 | 6.750 | 7.500 | 8.250 | 9.000 | 9.750 | 10.500 |
| S | 2.00 | 0.500 | 2.500 | 3.000 | 3.500 | 4.000 | 4.500 | 5.000 | 5.500 | 6.000 | 6.500 | 7.000 | 7.500 | 8.000 |
| Sn3 | 1.00 | 0.500 | 1.500 | 2.000 | 2.500 | 3.000 | 3.500 | 4.000 | 4.500 | 5.000 | 5.500 | 6.000 | 6.500 | 7.000 |
| HO | 1.00 | 0.500 | 1.500 | 2.000 | 2.500 | 3.000 | 3.500 | 4.000 | 4.500 | 5.000 | 5.500 | 6.000 | 6.500 | 7.000 |
| HOn3 | 0.75 | 0.375 | 1.125 | 1.500 | 1.875 | 2.250 | 2.625 | 3.000 | 3.375 | 3.750 | 4.125 | 4.500 | 4.875 | 5.250 |
| TT | 0.75 | 0.375 | 1.125 | 1.500 | 1.875 | 2.250 | 2.625 | 3.000 | 3.375 | 3.750 | 4.125 | 4.500 | 4.875 | 5.250 |
| N | 0.50 | 0.250 | 0.750 | 1.000 | 1.250 | 1.500 | 1.750 | 2.000 | 2.250 | 2.500 | 2.750 | 3.000 | 3.250 | 3.500 |

ISSUE DATE: Jul 13, 2006

**NMRA RECOMMENDED STANDARDS - CAR WEIGHTING** DATA SHEET # 13