

SMARTFLASH II



TRAFCON Arrow Board SmartFlash II Controller Installation & Operation Manual



INDUSTRIES, INC.

81 Texaco Road
Mechanicsburg, PA 17050

717-691-8007

717-697-0813 FAX

www.trafcon.com

Manual Table of Contents

SmartFlash II Controller	3
Main Features.....	3
Remote Layout & Functions	5
Connections & Wiring	13
Troubleshooting	18
MB Series – Vehicle Mounted Arrow Board	20
Vehicle Mounted Controller Installation	20
Wireless Option Installation for Remote Control Head and Arrow Board Panel.....	21
Bed Rail Rack Installation Instructions	22
MB Series/MB-ADS Power Tilt Sign Installation.....	24
Adjustable Bed Floor Rack Installation	27
TC1 Series – Trailer Mounted Solar Arrow Board.....	<u>31</u>
Trailer Set-up and Operation	31
Trailer Warning Safety Decals.....	33
Battery Maintenance	35
TC1 Solar Trailer Battery Wiring Diagram	37
TC1 Series Trailer Wiring Diagram	38
Manufacturer’s Warranty	Error! Bookmark not defined.
Limited Warranty Policy.....	Error! Bookmark not defined.
NHTSA Notification Statement.....	41
Tire Safety Information.....	42
Steps for Determining Correct Load Limit – Trailer	42
Steps for Determining Correct Load Limit – Tow Vehicle	44
Glossary Of Tire Terminology.....	44
Tire Safety - Everything Rides On It	49
Safety First–Basic Tire Maintenance.....	50
Information on Passenger Vehicle Tires.....	52
Additional Information on Light Truck Tires	54
Tire Safety Tips.....	55

SmartFlash II Controller

Main Features

- Advanced solid state technology
- LCD graphic display with backlight
- Soft touch keypad with audible confirmation
- Text description of arrow patterns displayed
- Powers up in a “safe” default caution mode
- Automatic short and open circuit protection
- Polarity protected circuitry
- Ability to “hot-swap” controls and plugs
- Automatic dimming
- Manual dimming
- Alarm detection and notification
- Built in diagnostics
- Low battery warnings, automatic switchover to default caution and power down
- Convenient bulb intensity and battery level displays
- Hour meter with user hours that can be reset.

The control system consists of two parts:

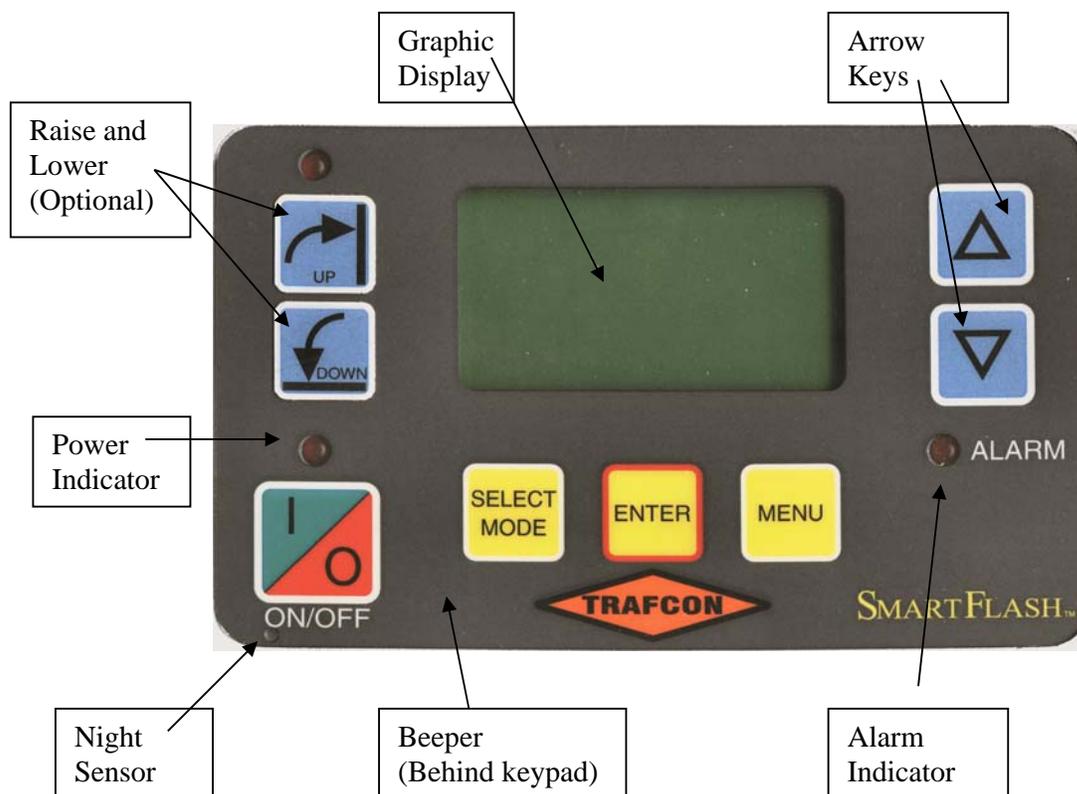
1. Most of the electronics are housed in the **Main Controller** enclosure, which is mounted inside the arrow board.



2. The **Remote** houses a keypad and a graphic display for monitoring & entering data. It is either hardwired or wireless RF linked to the main controller.



Remote Layout & Functions



Power Indicator

This red indicator lights solidly when the remote is “on.”

NIGHT SENSOR

This is an ambient light sensor that can be used to automatically illuminate the remote at night.

Alarm Indicator

This red indicator flashes when there is any alarm condition present. It is off if there is no alarm conditions present

Beeper

The beeper (Not visible but hidden just below the keypad) emits a short high-pitched chirp each time a key is pressed. The beeper also emits a longer and lower pitched chirp periodically when any alarm condition is present.

1/0 Button

This button turns the remote and the controller on or off simultaneously.

Note that the controller always returns to its “default” safety pattern every time the main controller is turned “on”, or has its power interrupted and reapplied. This non-directional pattern is meant to warn drivers of a possible situation ahead without unintentionally indicating an incorrect direction. After each power on event, the user is required to select the desired arrow mode for safety reasons.

Also note that in the case of a Wireless RF system, the remote may not be within range of the main controller to send the on or off signal. In this case the remote on/off status might not match the main controller on/off status. To correct this, simply move the remote within range and press the “1/0” key as necessary to correct.

SELECT MODE Button

Pressing this button switches to the mode where the user may select the desired arrow pattern. Pressing this button repeatedly switches through the available arrow patterns.

ENTER Button

This button is used to confirm selections in the menus.

MENU Button

This button calls up the menu of option functions. Within each option function is a sub-menu.

ARROW Buttons

These buttons are used to step through arrow patterns, menu items or increase & decrease data values. The exact function depends on the item selected on the display at the time.

RAISE and LOWER Buttons (Optional)

These buttons are used to initiate sign raise and lower movements. They operate any time the system is ON.

STATUS Display

This is the default display mode for normal operation. If the user does not press any keys for a period of time, the remote always returns to the STATUS display. Elements of the status display are as follows:

1. The main area of the status display reflects the arrow pattern currently being displayed on the arrow board. This area is also used to indicate problems with individual lamps or circuits on the arrow board.
Round dot = Normal operation for this circuit
Letter "X" = Open circuit detected at this lamp
Letter "s" = Short circuit detected at this lamp
2. The bar graph at the left shows the voltage reading of the main controller battery. The range is 10 to 14 volts. Voltage readings are taken under loaded conditions and may read slightly lower than an unloaded battery.
3. The bar graph at the right shows the current lamp intensity from 0-100% of the maximum allowable intensity. This is usually automatically set by the ambient light sensor, but some models allow manual intensity setting via the menus.
4. The title line displays the NAME of the arrow pattern currently being displayed on the arrow board. Because the user may not always be facing the remote in the same way that traffic sees the arrow board, the name can be useful in avoiding right/left confusion.
5. The alarm line displays any alarms currently detected. If the line is blank, then no alarms are detected. Possible alarm messages are as follows:

LOW BATTERY WARNING!
LOW BATTERY CAUTION!
LOW BATTERY SHUTOFF!
SHORTED CONNECTIONS!
BULBS BURNED OUT!
COMMON WIRE SHORTED!

SELECT MODE Display

Press the “SELECT MODE” button to change the arrow pattern.

The display changes to show the currently displayed arrow pattern and title only. The pattern is displayed with hollow dots instead of solid dots, and the pattern flashes at twice the actual rate to indicate that this is the selection mode rather than the status mode.

Continue pressing the “SELECT MODE” key to advance through all allowable patterns, or use the up and down arrows to browse back and forth through the allowable patterns.

To send the selected pattern to the arrow board lamps press ENTER. The arrow board will not change until you press ENTER.

To exit without changing the arrow board, press “MENU” or simply let the SELECT MODE function time out on its own. Remember, changes will not show on the arrow board unless you press ENTER.

MENU Display

Press the “MENU” button to access the menu of internal options. Once in the menu, use up & down arrows to select the desired menu item with the arrow at the left, and then press ENTER.

Alternatively, press “MENU” again to exit menu mode, or simply let the menu mode time out and the remote will return to the status display.

Menu mode choices are as follows:

SIGN BRIGHTNESS
SIGN INFO
REMOTE POWER SETUP
REMOTE OPTIONS
DIAGNOSTICS

SIGN BRIGHTNESS Mode

Sign Brightness settings are as follows:

AUTO OR MANUAL?
MANUAL SETTING =
MANUAL TIMEOUT =

Use the up and down keys to select the item you wish to modify by moving the arrow at the left. Press the ENTER key to select that item and modify that value. The item value will then flash and may be adjusted with the up and down buttons. Press ENTER again to save the new value & return to the item selection arrow.

AUTO OR MANUAL? May be set to either “AUTO” or “MANUAL”

Note that each time power is turned off & back on, the arrow board always returns to “AUTO.” This is a safety feature. Some models do not allow “MANUAL.”

MANUAL SETTING = May be set from 0 to 100. This is the bulb intensity setting to be displayed in manual.

MANUAL TIMEOUT = May be set from 0 to 24 hours. Some models may not allow a zero setting or may allow less than 24 hours.

A zero setting allows the manual intensity to stay in effect indefinitely until the arrow board is powered off.

A setting of 1 to 24 hours means that the intensity will remain at the manual setting for this period of time, and then automatically switch back to AUTO. The time begins when intensity is set to MANUAL or the time is modified.

SIGN INFO Mode

Sign Info settings are as follows:

CFG = Shows one of the following lamp configurations of the main controller.

13 LAMP STANDARD
13 LAMP WIG-WAG
15 LAMP STANDARD
15 LAMP WIG-WAG
25 LAMP STANDARD
25 LAMP WIG-WAG

*This setting is NOT user changeable and MUST be configured at the factory.

SERIAL NO.: shows the serial number of the main controller. This is an 8 digit number. It is not changeable by the user.

CONTROL VERSION: shows the software version in the main controller. It may or may not be the same version as the software in the remote. The version of the software in the remote can be seen in the upper right corner of the display just after the remote is turned on.

TOTAL HOURS: shows the total number of “on” hours that the unit has been in service. Hours accumulate only when the arrow board is displaying a pattern. This number is not changeable by the user.

USER HOURS: shows another hour meter, but this one is resettable by the user. It can be used as a job or service hourmeter as the user desires.

ZERO USER HOURS? Is used to zero the user hourmeter. Use the up or down arrow keys to change the “N” to a “Y”, and then press “ENTER” to zero the user hourmeter.

REMOTE POWER SETUP Mode

Use the up and down keys to select the item you wish to modify by moving the arrow at the left. Press the ENTER key to select that item and modify that value. The item value will then flash and may be adjusted with the up and down buttons. Press ENTER again to save the new value & return to the item selection arrow.

Remote power setup settings are as follows:

WIRING: DIRECT WIRED or RADIO LINK. This should only be set to the actual type of system in use.

NEVER AUTO SHUTOFF
OFF 5 MIN INACTIVE
OFF 2 MIN INACTIVE
OFF 1 MIN INACTIVE
OFF WHEN SIGN IS OFF

These settings are used to save power in the remote. They are primarily of use in a radio linked system where conservation of the remote battery is an issue. NEVER AUTO SHUTOFF is most appropriate for a direct wired system.

REMOTE BATTERY = displays the voltage detected at the remote battery. This is only of any interest in a wireless RF linked system, where the remote & main controller uses different batteries.

REMOTE OPTIONS Mode

This mode sets internal settings in the remote and does not affect the main controller operation in any way. These options are primarily for operator convenience and power savings.

Use the up and down keys to select the item you wish to modify by moving the arrow at the left. Press the ENTER key to select that item and modify that value. The item value will then flash and may be adjusted with the up and down buttons. Press ENTER again to save the new value & return to the item selection arrow.

REMOTE OPTIONS items are as follows:

KEY BEEP
ALARM BEEP
CONTRAST
BACKLIGHT
KEY LIGHTING
LIGHTING TIMEOUT
NIGHT SENSOR

KEY BEEP may be set to ON or OFF as desired. ON will give a short chirp as each key is pressed, OFF will give no beep.

ALARM BEEP may be set to ON or OFF as desired. ON will allow a short beep when an alarm is present, OFF will not.

CONTRAST sets the contrast of the LCD display. It may be set from 1-100, but practical values are about 1-10.

BACKLIGHT may be set from 0 to 100. This sets the intensity percentage of the LCD backlight. It is normally set to 100. Setting to 0 will result in no backlight and can be used to save significant power in a radio linked remote. The user can set to intermediate values to suit personal preference.

LIGHTING TIMEOUT may be set to NONE, 5s, 10s, 30s or 60s. This is the amount of time that the backlight and key illumination will remain on after the last key press. Setting to NONE means that the lighting will always stay on. Setting to a numeric value can be used to save power in a radio linked remote, or can be used to darken the remote when not in use if the user so prefers.

NIGHT SENSOR can be set to OFF or ON. Default is OFF. If set to ON, then the key illumination and LCD backlight will not be illuminated unless a low ambient light condition is detected at the sensor just below the 1/0 key. This can be useful in vehicle cab mounted applications to automatically illuminate the remote only at night. It also can save power in a radio linked remote by only using the illumination power at night.

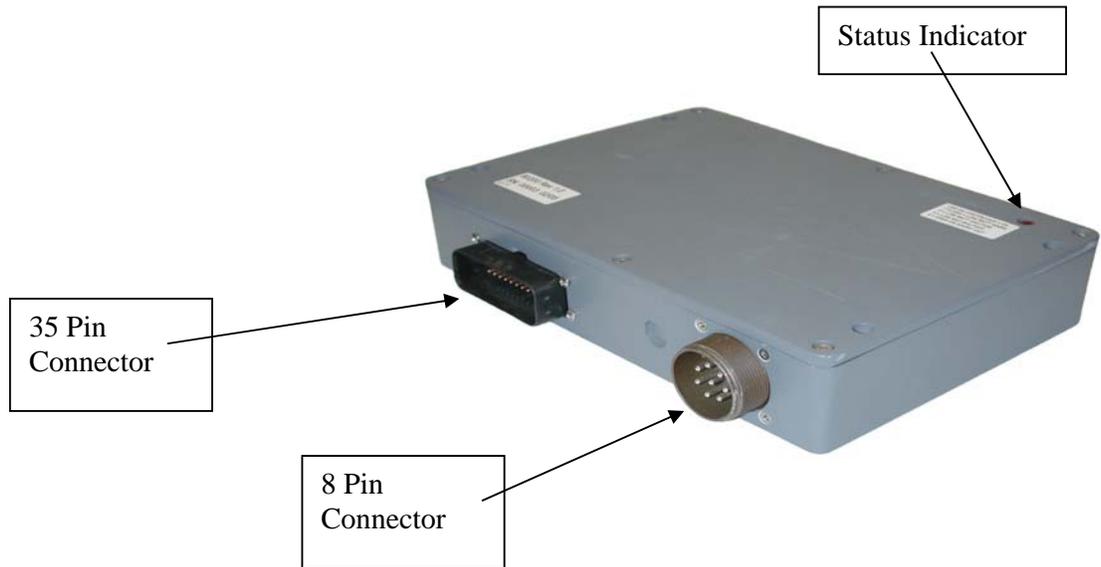
DIAGNOSTICS Mode

Diagnostics mode displays the following values:

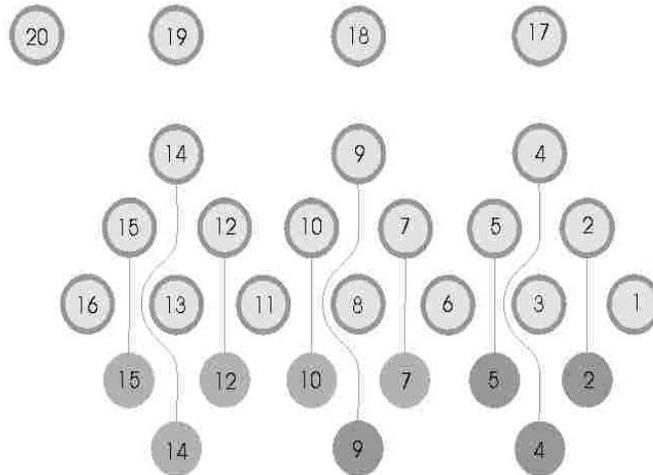
AMBIENT NOW
AMBIENT PERCENT
CONTROLLER BATT
TEMPERATURE

This information is of no real use in ordinary circumstances, but Trafcon service personnel may ask for these readings to assist in troubleshooting.

Connections & Wiring



LAMP CIRCUIT WIRING FOR STANDARD SETUP

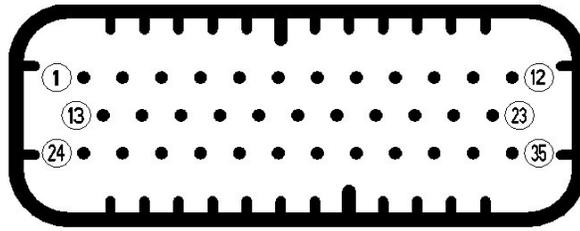


- Lamp circuits 1-20 have a specified Colored 18 gauge wire provided to each lamp. The “Negative” connection will switch on and off causing the lamp to flash.
- Each lamp also has an Orange 14 gauge wire provided for the “Positive Common” lamp connection. The “Positive Common” will turn on with the 1/0 button.

35 PIN CONTROLLER CONNECTOR TO LAMP CIRCUIT STANDARD WIRING

Pin	Wire Color	Gauge	Function	Application
1	Brown	18	Lamp circuit 1	All
13	Red	18	Lamp circuit 2	All
2	Yellow	18	Lamp circuit 3	15,25
14	Green	18	Lamp circuit 4	All
3	Blue	18	Lamp circuit 5	25
15	White	18	Lamp circuit 6	All
4	Gray	18	Lamp circuit 7	25
16	Black	18	Lamp circuit 8	All
5	Brown/White	18	Lamp circuit 9	25
17	Red/White	18	Lamp circuit 10	25
6	Yellow/White	18	Lamp circuit 11	All
18	Green/White	18	Lamp circuit 12	25
7	Blue/White	18	Lamp circuit 13	15,25
19	White/Black	18	Lamp circuit 14	All
8	Gray/White	18	Lamp circuit 15	All
20	Black/White	18	Lamp circuit 16	All
9	Red/Black	18	Mode lamp 17	All except some miniboards
21	Tan	18	Mode lamp 18	All except some miniboards
10	Purple	18	Mode lamp 19	All except some miniboards
22	Pink	18	Low battery lamp 20	Solar models
33	White	18	Data A	Hardwired remote option
27	Green	18	Data B	Hardwired remote option
35	Red	18	+12V to remote	Hardwired remote option
12	Black	18	Ground to remote	Hardwired remote option
30	White/Red	18	Light sensor +	All
23	White/Green	18	Light Sensor -	All
31		18	Power tilt limit	Power tilt limit switch option
11		18	Power tilt limit	Power tilt limit switch option

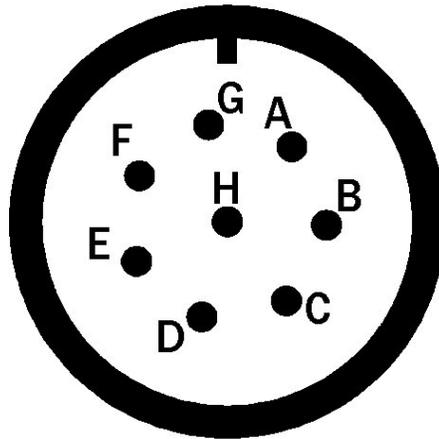
**35 PIN CONTROLLER CONNECTOR
VIEWED FROM WIRE SIDE**



Mating connector housing AMP 776164-1
Mating contact AMP 770520-1
18 AWG wire maximum (0.8mm²)
Wire outer diameter .067" to .106" (1.7-2.7mm)
Wire strip length .200" (5.1mm)

- 1 = LAMP 1
- 2 = LAMP 3
- 3 = LAMP 5
- 4 = LAMP 7
- 5 = LAMP 9
- 6 = LAMP 11
- 7 = LAMP 13
- 8 = LAMP 15
- 9 = LAMP 17
- 10 = LAMP 19
- 11 = Ground (either pin 11 or 12 may be used for RS-232 ground)
- 12 = Ground (either pin 11 or 12 may connect to pin 2 of remote unit)
- 13 = LAMP 2
- 14 = LAMP 4
- 15 = LAMP 6
- 16 = LAMP 8
- 17 = LAMP 10
- 18 = LAMP 12
- 19 = LAMP 14
- 20 = LAMP 16
- 21 = LAMP 18
- 22 = LAMP 20
- 23 = Analog ground for photocell – do not connect to anything else!
- 24 = Not connected
- 25 = Not connected
- 26 = POWER DOWN (connect to ground to turn off & reduce power consumption)
- 27 = DATA B (connect to DATA B of remote unit)
- 28 = RS-232 Receive in (connect to transmit out of configuration computer)
- 29 = RS-232 transmit out (connect to receive in of configuration computer)
- 30 = Photocell positive (photocell connects between pins 30 & 23)
- 31 = Limit switch (for power tilt, optional)
- 32 = IGN (ignition) – (can be used as a power on signal – not currently used)
- 33 = DATA A (connect to DATA A of remote unit)
- 34 = START (can be used to blank sign when engine cranking – not currently used)
- 35 = REMOTE +12V (connect to pin 1 of remote unit)

**8 PIN CONTROLLER CONNECTOR
VIEWED FROM WIRE SIDE**



Mating connector ITT-Cannon CA3106E22-23SB
12AWG wire maximum (3.3 mm²)

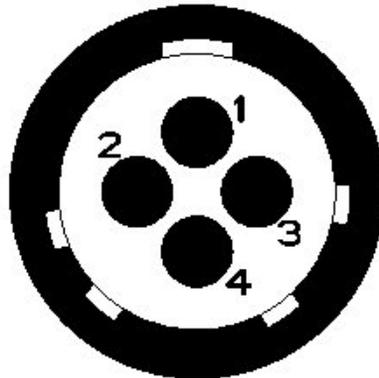
- A = Power tilt positive
- B = +12V to battery (must connect both terminals B & H to provide adequate current)
- C = Lamp positive common 1
- D = Lamp positive common 2
- E = GROUND to battery (must connect both E & F to provide adequate current)
- F = GROUND to battery (must connect both E & F to provide adequate current)
- G = Power tilt negative
- H = +12V to battery (must connect both terminals B & H to provide adequate current)

**8 PIN CONTROLLER CONNECTOR
STANDARD WIRING**

Pin	Wire Color	Gauge	Function
A	Green/Yellow or White	12 12	Actuator – Positive
B	Red	12	Power – Positive
C	Orange	12	Common to Lamps
D	Orange	12	Common to Lamps
E	Black	12	Ground - Negative
F	Black	12	Ground - Negative
G	Black/Yellow or Black	12 12	Actuator - Negative
H	Red	12	Power – Positive

4 PIN REMOTE CONNECTOR

**VIEWED FROM WIRE SIDE
(HARDWIRED REMOTE OPTION ONLY)**



Mating connector housing AMP 206060-1
Cable clamp AMP 206062-3
Mating contact AMP 66101-4 or 66100-9
18 AWG wire maximum (0.8mm²)
Wire outer diameter .080" to .100" (2.0-2.5mm)
Wire strip length .200" (5.1mm)

1 = +12V battery
2 = Ground
3 = Data A (connect to data A of controller)
4 = Data B (connect to data B of controller)

**4 PIN REMOTE CONNECTOR
STANDARD WIRING**

Circuit	Wire Color	Gauge
1	Red	18
2	Black +Shield	18
3	White	18
4	Green	18

NOTE: Use only shielded cable.

Troubleshooting

Symptom	Possible cause
No display – No backlight	Dead battery Plug(s) not connected Defective controller
No display – Backlight works	No mode selected Plug(s) not connected Defective controller
No dimming	Defective photocell Shorted photocell wires Defective controller
Lamps stay dim	Defective photocell Broken photocell wire Defective controller
Some lamps do not light	Defective lamp(s) Short at lamp Broken wire(s) Defective controller
Power tilt does not work	Broken wire(s) Defective actuator or control Defective controller

For further trouble shooting assistance call:

TRAFCON TECH SUPPORT at 717-691-8007

**Please have Arrowboard serial number when calling
for Technical Support**

MB Series – Vehicle Mounted Arrow Board

Vehicle Mounted Controller Installation

1. Connect one 12 gauge Black wire to the Negative terminal of the battery. Do NOT use a smaller wire gauge. **THE BLACK NEGATIVE WIRE MUST BE CONNECTED FIRST.**
* Note if 4412A lamps are used in the sign panel, use the supplied Black 8 gauge wire for the Negative battery connection.
2. Connect the one 12 gauge White wire to the Positive terminal of the battery. Do NOT use a smaller wire gauge.
* Note if 4412A lamps are used in the sign panel, use the supplied Red 8 gauge wire for the Positive battery connection.
3. If fusing is preferred it is recommended that a 35A fuse be installed on the red wire at the battery.
4. Mount the remote control head in a convenient location within the vehicle cab.
5. Route the gray four-conductor cable from the sign panel to the remote control head and connect.
6. Installation is now complete. See Operating Instructions section.
Test all mode and arrow board functions thoroughly before use.

Wireless Option Installation for Remote Control Head and Arrow Board Panel

1. Locate suitable mounting location for the Smart Flash Remote with Internal RF option. The manufacturer preferred mounting locations are on or above the dash of the vehicle where there is access to a 12VDC power point. Mounting in locations other than these may affect the performance of the internal wireless module.
2. Insert the power plug into a cigarette plug receptacle or a power point of your vehicle. It is recommended that you leave the plug connected at all times. If you prefer to hard wire the remote to a permanent power source, proceed with the following step otherwise proceed to step 6.
3. Cut the power plug off directly behind the plug. Separate the two wires and strip the ends. Terminate the ends with the appropriate terminals for the desired power connection
4. Connect the positive wire to a point that is connected to the positive terminal of a 12volt DC battery.

Alternatively, connecting the positive wire to the ignition switch will only enable arrow board operation when the ignition is on. This configuration is not normally used.

5. Connect the negative wire to a point that is connected to the negative terminal of a 12volt DC battery.
6. Installation is now complete of the Smart Flash Remote with Internal RF option.
7. Connect and route sign panel power cable per MB Series installation instructions.
8. Turn power on at Remote Control Head and test all modes. If unit tests ok it is now ready to be put in service.

AGENCY NOTICE

Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

Bed Rail Rack Installation Instructions

Before beginning installation, inspect the truck bed rails. If bed rail protectors or an over the rail bed liner are in place proceed to the first step of installation. If no protection is in place it is recommended that adhesive foam strips be placed on the bottom runner, on each side of the cross bed rack. This will prevent damage to the truck finish.

1. Position the bed rail rack on the truck bed rails at your desired mounting location. Align the bed rail rack as evenly as possible on both sides. This is a universal mount, for all makes of full size pickup trucks; it may not reach the outside edge on all makes. (see figure 1)



(figure 1)

2. Locate a suitable position to drill thru the truck bed rail to attach the bed rail rack. The holes should be positioned as close to center of the truck bed rail as possible. (see figure 2)
3. When the bed rail rack is in position, drill thru the bottom runner and the truck bed rail on each side. A minimum of (3) x 3/8" holes on each side. Before drilling the holes, check for any obstructions that may be under the truck bed rails. (see figure 2)



(figure 2)

4. It is necessary to custom fabricate support brackets for the underside of the truck bed rails where the bed rail rack is going to be bolted thru. These brackets are not supplied due to the many variations in truck beds and mounting applications. Washers only, are

not recommended. Material for the backing plate should be a minimum of 1/8" thick metal. Installation on a truck with a bed liner may require cutting an access area into the bed liner to install backing plate and hardware. (see figure 3)



(figure 3)

5. Install and tighten all hardware. **Do not use impact tools, body damage may occur!**
(see figure 4)



(figure 4)

This completes installation of the Bed Rail Rack.

MB Series/MB-ADS Power Tilt Sign Installation

Before beginning installation, decide on the method of lifting the sign onto the Bed Rail Rack. Methods typically used are lifting by hand, forklift, or small hoist. After you have decided the method, determine what areas of the sign will need to be protected. Any area of the sign that will be in contact with the lifting device should be protected.

1. Lift the sign and position it above the Bed Rail Rack. (*see figure 5*)



(figure 5)

2. Lower the sign onto the Bed Rail Rack and measure the over hang on each side. Position the sign with equal over hang on each side. (*see figure 6*)



(figure 6)

3. After the sign has been centered on the bed rail rack, install the (4) hat bracket sets supplied. One set should be installed in each corner. Install by placing one half over the sign panel mount tubing and place the other half directly below covering the bed rail rack tubing. (*see figure 7*)



(*figure 7*)

4. Fasten the halves together with the hardware provided. (*see figure 8*)



(*figure 8*)

This will complete the mounting of a sign panel mount.

The next step of installation is routing and connecting power and data cables. Before beginning to route cables, decide on where the controls will be located and where the power connections will be made. After these areas have been located, determine the best path to route the cables. Check for problem areas and be sure to avoid them. Some areas that should be avoided are:
Exhaust systems, drivelines, chaffing areas and pinch points. If any electrical connections are made where moisture is a possibility, it is recommended that anti-corrosive lubricants, and heat shrink be applied to prevent corrosion.

5. Route the power and data cables, starting from the sign and working towards the Remote/HHT and the power point. (see figure 9 and figure 10)



(figure 9)



(figure 10)

6. Mount Remote/HHT where it is easily accessible to the driver but does not interfere with any of the vehicle's controls. After Remote/HHT is mounted in place, connect data cable. (see figure 11)



(figure 11)

7. After the Remote/HHT has been mounted and cables connected, continue to route the power cables to the power source. (see figure 12)



(figure 12)

8. Before making the power connection to the battery, install inline fusing if applicable. Installation of inline fusing should be in close proximity to the battery. Remove the fuse from the inline holder, install inline holder and connect to the battery positive. After the connection has been made, reinstall the fuse. MB-ADS message boards and MB series arrow boards are fused at the controller. If fuse protection between the controller and the power supply is desired, the manufacturer recommends using a CUSTOMER SUPPLIED inline fuse with a rating of 35 amps.
9. After the power has been connected and wiring secured, turn sign on and verify the operation of the sign. (*see figure 13*)



(*figure 13*)

10. This completes the installation of the MB Series/MB-ADS power tilt sign.

Installation Instructions for Adjustable Bed Floor Rack

1. Measure the inside width of the bed, on the vehicle that the unit is being mounted to. Subtract $\frac{1}{4}$ " from this measurement and write it down for reference in Step 3. See figure 1.



Figure 1.

2. Position the sign panel with the power tilt mount on a forklift or suitable lifting device. See figure 2. Note that the top of the sign panel should face the forklift. The top of the sign can be determined by locating the photocell and the antenna jack. See figure 3.



Figure 2.



Figure 3.

3. Position the bed floor risers so that the bottom skids have the offset facing each other. See figure 4. Locate the risers under the sign panel mount with the outside to outside measurement that was calculated in Step 1. See figure 5.



Figure 4.



Figure 5.

- Lower sign panel mount onto bed floor risers. Note that the sign panel mount cross members should be centered on the mounting plates located at the top of each riser. Position the sign panel mount so there is an equal amount of over hang on each side. Attach hat brackets and hardware and only hand tighten hardware at this time. See figure 6 and figure 7.



Figure 6.



Figure 7.

- Set unit into vehicle bed and manually position into desired mounting location. Be sure that the sign panel is facing the rear of the vehicle when in the down, travel position. See figure 8 and figure 9.



Figure 8.



Figure 9

- Locate a suitable area to drill a minimum of (4) 7/16" mounting holes. Holes must be drilled thru bottom skids and body floor. There must be a minimum of (2) holes per skid, located as close to each riser upright as possible.

*

Note- carefully inspect the underside of the bed floor before drilling. Check for any obstructions, i.e.: Cross members, fuel tanks & lines,

wiring, etc.

See figure 10.



Figure 10.

7. Install mounting bolts use a minimum of (4) 3/8" grade 5 bolts of suitable length with washers and lock nuts. It is recommended that a backing plate be fabricated and installed on the underside of the bed floor where each mounting bolt is located.
8. Tighten all floor mounting hardware.
9. Tighten hardware that was previously only hand tightened in Step 4.

See figure 11.



Figure 11.

10. Route the power cable, starting from the sign and working towards the battery.
- See figure 12.



Figure 12.

11. Install RF antenna that has been supplied with your sign panel. The antenna jack is located in the channel at the top of the sign panel. Align the pins and push down and twist a ¼ turn clockwise to attach the RF antenna. See figure 13.



Figure 13.

12. Before making the power connection to the battery, if fuse protection is desired between the sign panel connection and the battery, the manufacturer recommends using an inline fuse with a rating of 15 amp See figure 14.



Figure 14.

13. Mount Remote where it is easily accessible to the driver but does not interfere with any of the vehicle's controls. After Remote is mounted in place, connect to closest power point. See figure 15.



Figure 15.

14. After Remote has been mounted and connected, make final battery power connection. Check that all wiring has been secured, turn remote on and verify the operation of the sign.
15. This completes the installation of the MB Series sign with power tilt.

TC1 Series – Trailer Mounted Solar Arrow Board

Trailer Set-up and Operation

Follow set-up steps for safe operation.

1. Deploy and lock the tongue jack in the vertical position to support trailer.
2. Disconnect trailer from towing vehicle.

3. Aim rear of trailer toward oncoming traffic
4. Lower and pin rear drop jacks, raise tongue screw jack until rear drop jacks are firmly touching ground.
5. Lower and pin front drop jacks, raise tongue screw jack until the trailer is resting on all 4 drop jacks.
Note: trailer is most stable with weight on all 4 drop jacks.
6. Loosen tension on sign lifting hand winch.
7. Remove (2) 1/2" keeper pins on lift arms.
8. Crank winch, retracting cable, until lift arms are vertical and keeper pin holes align.
9. Insert keeper pins in lift arm and trailer support.

~WARNING~

10. **Do not attempt to move trailer with drop jacks down.**
11. **Lower *and* replace keeper pins in arrow board frame prior to transport.**

Trailer Warning Safety Decals

- Familiarize yourself with all trailer Warning and Safety decals, set-up and operation procedures for your TC1 trailer.
- The following are examples of safety warning labels attached to your trailer when you received it. If you repaint the trailer, you will need to replace these labels.

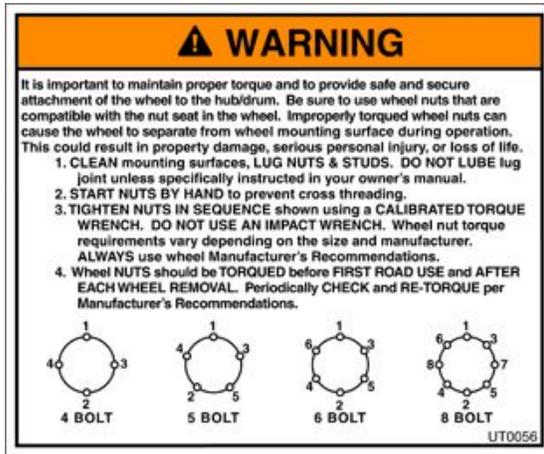
⚠ WARNING	
<p>Uncoupling will cause trailer to come loose from tow vehicle. You must:</p> <ol style="list-style-type: none"> 1. CHECK that ball LOAD RATING is same as or greater than coupler LOAD RATING. 2. CHECK that ball SIZE is same as coupler. 3. CLOSE COUPLER CLAMP on ball. 4. LIFT coupler upwards to test that it will not separate from ball. 5. LOCK coupler clamp with pin or padlock. <p><small>©2002 NATM UT0016</small></p>	

⚠ WARNING	
<p>ALWAYS use safety chains. Chains hold trailer if connection fails. You must:</p> <ol style="list-style-type: none"> 1. CROSS chains underneath coupler. 2. ALLOW slack for trailer to turn. 3. ATTACH chain hooks securely to tow vehicle frame. <p><small>©2002 NATM UT0020</small></p>	

⚠ WARNING	
<p>Uncoupling will cause trailer to come loose from tow vehicle.</p> <ol style="list-style-type: none"> 1. CHECK that pintle LOAD RATING is same or greater than ring LOAD RATING. 2. LOCK the clamp in place using a pin or lock. <p><small>©2002 NATM UT0029</small></p>	

⚠ WARNING	
<p>Uncoupling will cause trailer to come loose from tow vehicle.</p> <ol style="list-style-type: none"> 1. CHECK that pintle LOAD RATING is same or greater than ring LOAD RATING. 2. LOCK the clamp in place using a pin or lock. <p><small>©2002 NATM UT0029</small></p>	

⚠ WARNING	
<p>Tire, wheel or lug nut failure can cause loss of control. Before towing, you must CHECK:</p> <ol style="list-style-type: none"> 1. Tire pressure and tread. 2. Tires and wheels for damage. 3. Lug nuts for tightness. <p>For new and remounted wheels, re-tighten lug nuts at the first 10, 25 and 50 miles of driving.</p> <p><small>©2002 NATM UT0019</small></p>	



For both Trailer and Vehicle Mounted Arrowboards:

~WARNING~
DO NOT EXCEED 35mph
WITH THE ARROW PANEL
IN THE RAISED POSITION.

Battery Maintenance

Batteries should be carefully inspected on a regular basis; the system can become discharged for a number of reasons, for example:

- Operating conditions during the “winter” months of November through February, when the power provided by the array is reduced.
- Improper maintenance, such as not cleaning the PV array.
- Electrolyte in the battery cells not maintained at the proper level.
- Loose or corroded battery terminal connections.
- Improper position of the system where the PV array is in the shadow of an object, or tilted away from the sun.
- Prolonged cloudy weather where the system is operating.

Maintenance of batteries, especially the proper voltage level, in the above situations should be performed as required. In some instances, it will be necessary to provide multiple recharges from an external source or replace with fresh batteries.

Caution ! It is important to maintain the proper level of electrolyte in the batteries at all times. If the level is too high the electrolyte will “boil” out of the top of the battery during charging and corrode the terminal connections. If the level is too low the battery life will be severely shortened.

Warning ! Charging batteries produce hydrogen, which can explode when proper operating procedures are not followed. To prevent severe personal injury, death, or substantial property damage when working around batteries, be extremely careful. Always use approved eye protection, face shield, rubber gloves, and insulated tools.

Electrolyte levels should be just below the bottom of the vent well, about $\frac{1}{2}$ to $\frac{3}{4}$ inch above the tops of the separators. The electrolyte level should not drop below the top of the plates. See figure 1 for additional information.

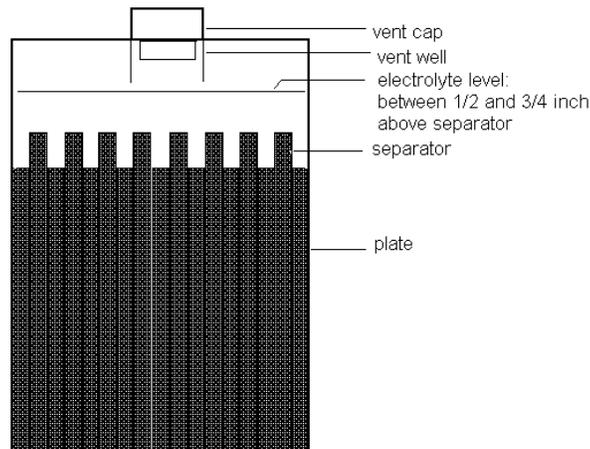


Figure 1. Battery (showing inside elements)

After checking electrolyte, check that all vent caps are tightly in place.

Loose or corroded connections create high resistance that could cause battery bank overcharging or undercharging and possibly damage the battery bank.

Cleaning the terminals, tightening the connections, and applying a thin coat of petroleum jelly (Vaseline) will help to prevent corrosion.

Use the following table to determine the status of each battery in the system:

6-Volt Battery	12-Volt Battery	Specific Gravity	State of Charge
6.36 or more	12.72 or more	1.295 or more	100%
6.15 to 6.36	12.30 to 12.72	1.250 to 1.295	75% to 100%
6.00 to 6.15	12.00 to 12.30	1.200 to 1.250	50% to 75%
5.85 to 6.00	11.70 to 12.00	1.175 to 1.200	25% to 50%
5.70 to 5.85	11.40 to 11.70	1.120 to 1.175	0% to 25%

1. Check the voltage levels with a digital voltmeter and the specific gravity with an approved hydrometer.
2. Before taking any readings, run system on the batteries for a few minutes. This removes any minor surface charge on the battery plates. The surface charge will affect the accuracy of your readings.
3. Service or replace any battery with a specific gravity that is ten percent higher or lower than the average.

Storing and Handling Batteries:

The electrolyte in discharged batteries may freeze if the outside air temperature drops below the freezing point of water: 32°F (0°). When a battery is discharged, the electrolyte solution in the battery is mostly water. The electrolyte in a fully charged battery has a much higher concentration of sulfuric acid and therefore freezes at a much lower temperature.

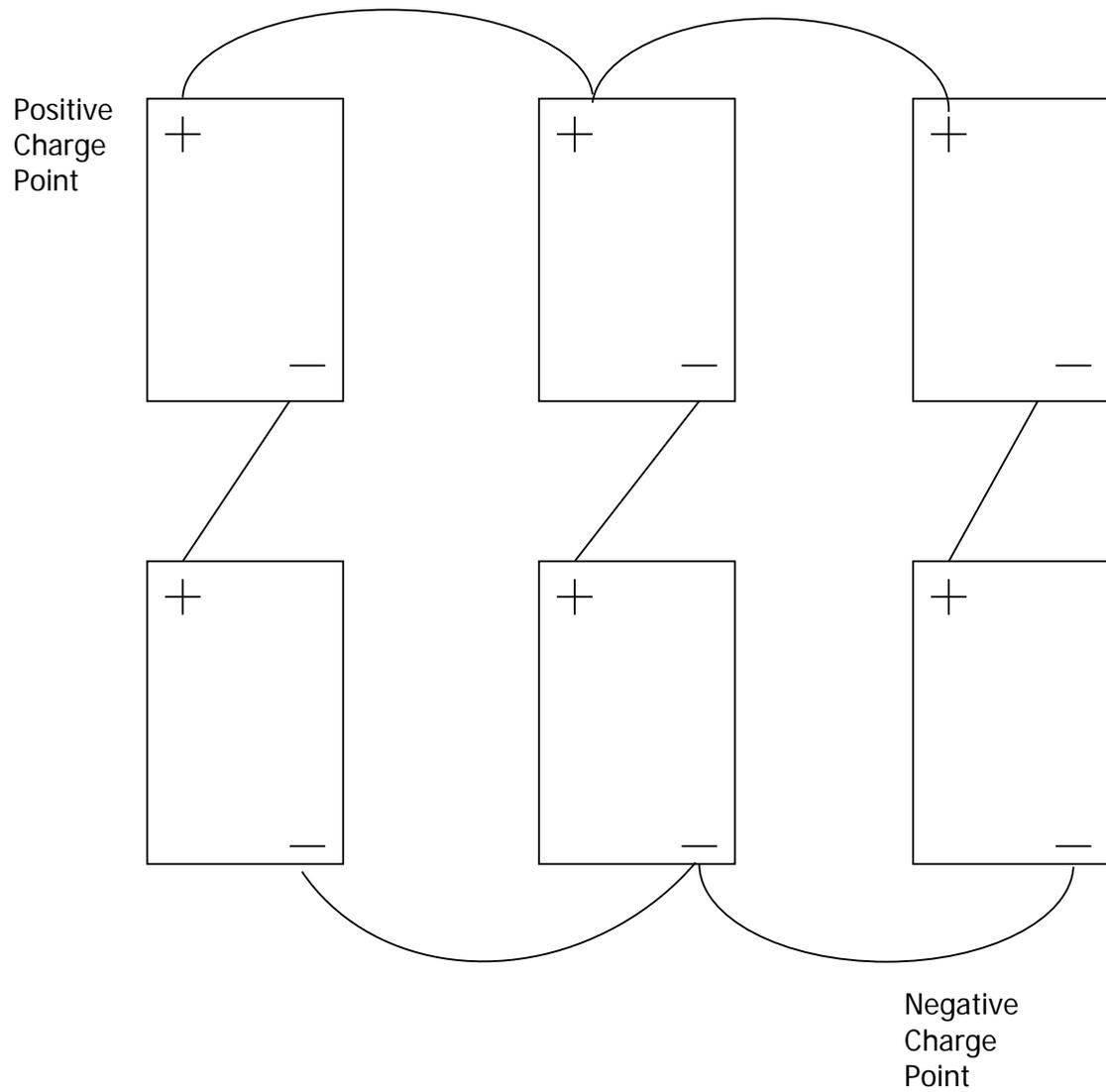
The Specific Gravity/Freeze Temperature chart provides information on specific gravity verses freezing temperature for the batteries used in the system.

Specific Gravity	Freeze Temperature
1.250	-62°F (-52°C)
1.200	-16°F (-27°C)
1.150	5°F (-15°C)
1.100	19°F (-7°C)

Care for batteries that are stored during winter months or slow periods is as follows:

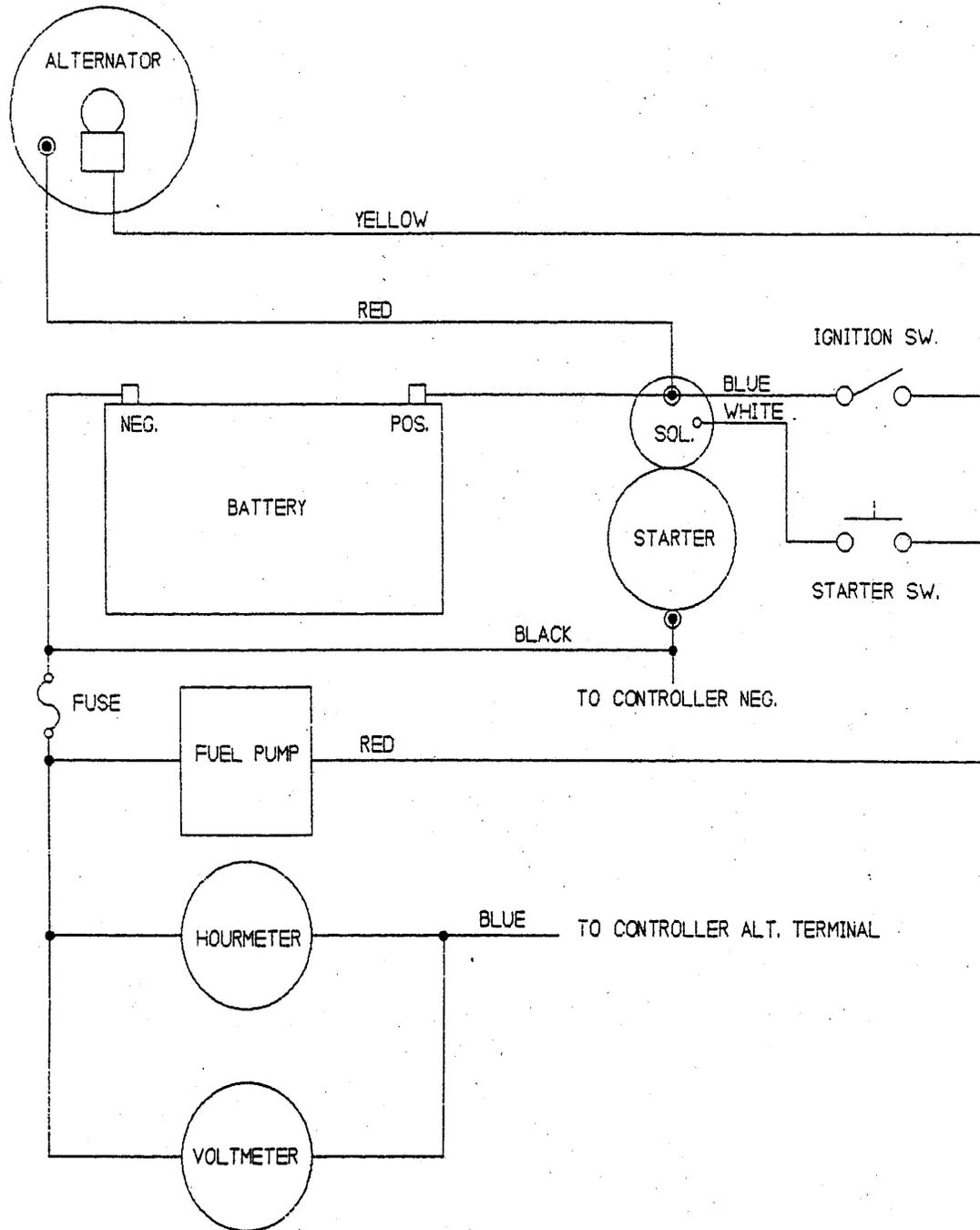
1. Fill battery as required with distilled water.
2. Fully charge to a specific gravity of 1.272.
3. Place in a cool place between the temperatures of 32°F (0°C) and 80°F (38°C). If one battery's voltage differs from the rest of the bank by 5 percent, check its specific gravity.

TC1 Solar Trailer Battery Wiring Diagram



* The batteries are 6 Volt, Group Size GC2, Deep Cycle Batteries.

TC1 Series Trailer Wiring Diagram- Engine Powered



TRAFCON INDUSTRIES, INC.

MANUFACTURER'S WARRANTY

LIMITED WARRANTY POLICY

Trafcon Industries, Inc. (Trafcon) hereby warrants to the original purchaser (customer), sold directly or through an authorized dealer, the product(s) listed for the time period(s) listed, from the date of purchase. Trafcon warrants the product(s) against defects in material and workmanship provided the products are installed and maintained properly, and operated under normal conditions. This warranty does not apply to product(s) that have been improperly applied, installed or maintained. *The customer will be responsible for removing any defective item(s) from the product and returning the item(s), or the entire product, transportation costs prepaid, to Trafcon 81 Texaco Rd, Mechanicsburg, PA 17050. The customer will be responsible for reinstallation of item(s) upon return. All returns must have a Return Material Authorization (RMA) number prior to shipping. RMA numbers can be obtained by contacting Trafcon at 717-691-8007.* Proof of purchase may be required to obtain the RMA. Trafcon will, at its option, repair or replace defective product(s) or component part(s). Such item(s) will be returned by Trafcon, transportation costs paid (normal ground delivery), within the United States. Repaired or replaced product(s) or component part(s) will carry the remainder of their respective original warranty term(s).

Exclusions from this warranty are: unauthorized sale outside the United States, the finish, tires, incandescent lamps, any condition(s) caused by abnormal use or service, negligent operation, act of God, and product specific limitations, if any, listed below.

THE LOSS OF USE OF THE PRODUCT, LOSS OF TIME, INCONVENIENCE, COMMERCIAL LOSS OR CONSEQUENTIAL DAMAGES ARE NOT COVERED. TRAFCON RESERVES THE RIGHT TO CHANGE THE DESIGN OF ANY PRODUCT WITHOUT ASSUMING ANY OBLIGATION TO MODIFY ANY PRODUCT PREVIOUSLY MANUFACTURED.

This warranty gives you specific legal rights and you may have other rights, which may vary from state to state.

THERE ARE NO WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS, WHICH EXTEND BEYOND THIS WARRANTY PERIOD. THERE ARE NO WARRANTIES THAT EXTEND BEYOND THE FACE HEREOF. SELLER DISCLAIMS IMPLIED WARRANTY OF MERCHANTABILITY.

THE WARRANTY SHALL NOT APPLY TO ANY TRAFCON PRODUCT WHICH HAS BEEN MODIFIED, IMPROPERLY INSTALLED, IMPROPERLY MAINTAINED OR IMPROPERLY USED.

The product(s) and time period(s) under this warranty are as follows:

**1. FLASHING ARROW BOARDS, TRAILER MOUNTED, SOLAR (TC1)
LIMITED 3 YEAR WARRANTY**

Limited 3 year warranty on these Trafcon products. Trafcon warrants each new unit against factory defects in material and workmanship for a 3 year period from the original date of purchase.

EXCEPTIONS: Solar modules- 24 months*, Batteries- 18 months*.

THIS WARRANTY DOES NOT COVER THE FOLLOWING: Labor, Tires, Finish.

**2. FLASHING ARROW BOARDS-VEHICLE MOUNTED (MB & TM)
LIMITED 1 YEAR WARRANTY**

Limited 1 year warranty on these Trafcon products. Trafcon warrants each new unit against factory defects in material and workmanship for a 1 year period from the original date of purchase.

THIS WARRANTY DOES NOT COVER THE FOLLOWING: Labor, Finish, Incandescent lamps.

3. ARROW DYNAMIC SIGNS-TRAILER MOUNTED (TC-ADS)

LIMITED 1 YEAR WARRANTY

Limited 1 year warranty on these Trafcon products. Trafcon warrants each new unit against factory defects in material and workmanship for a 1 year period from the original date of purchase.

EXCEPTIONS: Solar modules- 24 months*, Batteries- 18 months*.

THIS WARRANTY DOES NOT COVER THE FOLLOWING: Labor, Tires, Finish.

4. ARROW DYNAMIC SIGNS- VEHICLE MOUNTED (MB-ADS)

LIMITED 1 YEAR WARRANTY

Limited 1 year warranty on these Trafcon products. Trafcon warrants each new unit against factory defects in material and workmanship for a 1 year period from the original date of purchase.

THIS WARRANTY DOES NOT COVER THE FOLLOWING; Labor, Finish.

5. SPEED DISPLAY SIGNS- STATIONARY, VEHICLE & TRAILER MOUNTED (SST)

LIMITED 1 YEAR WARRANTY

Limited 1 year warranty on these Trafcon products. Trafcon warrants each new unit against factory defects in material and workmanship for a 1 year period from the original date of purchase.

EXCEPTIONS: Solar modules- 24 months*, Batteries- 18 months*.

THIS WARRANTY DOES NOT COVER THE FOLLOWING: Labor, Tires, Finish.

7. PORTABLE EQUIPMENT PLATFORMS (PEP)

LIMITED 1 YEAR WARRANTY

Limited 1 year warranty on these Trafcon products. Trafcon warrants each new unit against factory defects in material and workmanship for a 1 year period from the original date of purchase.

EXCEPTIONS: Solar modules- 24 months*, Batteries- 18 months*.

THIS WARRANTY DOES NOT COVER THE FOLLOWING: Labor, Tires, Finish.

RIGHTS RESERVED

Trafcon reserves the right to make changes in design, materials and specifications or to make product changes as deemed necessary without prior notice. Obligations or liabilities will not be assumed with respect to similar products previously advertised or produced.

PRINTING ERRORS

Every effort has been made to avoid printing errors in our printed literature and on our website. Should there have been any specification or application errors, we must disclaim responsibility.

OMISSIONS

Any product(s) or component(s) not specifically covered or excluded herein, will be covered for a 1 year period from date of purchase or by the Original Equipment Manufacturer's warranty, whichever is greater.

* Solar module and battery warranties are of the suppliers of these respective products. All claims are subject to the terms and conditions of the suppliers of these products.

NHTSA Notification Statement (CFR 575.6)

If you believe that your vehicle has a defect which could cause a crash or could cause injury or death, you should immediately inform the National Highway Traffic Safety Administration in addition to notifying Trafcon Industries.

If NHTSA receives similar complaints, it may open an investigation, and if it finds that a safety defect exists in a group of vehicles, it may order a recall and remedy campaign. However, NHTSA cannot become involved in individual problems between you and your dealer, or Trafcon Industries.

To contact NHTSA, you may either call the Auto Safety Hotline toll free at 1-888-327-4236 or (TTY: 1-800-424-9153) or go to <http://safercar.gov> or write to NHTSA, US Department of Transportation, 1200 New Jersey Ave. SE, Washington, DC 20590. You can also obtain other information about motor vehicle safety from the hotline.

You can also obtain other information about motor safety from <http://www.safercar.gov>

Tire Safety Information

This portion of the User's Manual contains tire safety information as required by 49 CFR 575.6.

Section 2.1 contains "Steps for Determining Correct Load Limit - Trailer".

Section 2.2 contains "Steps for Determining Correct Load Limit – Tow Vehicle".

Section 2.3 contains a Glossary of Tire Terminology, including "cold inflation pressure", "maximum inflation pressure", "recommended inflation pressure", and other non-technical terms.

Section 2.4 contains information from the NHTSA brochure entitled "Tire Safety – Everything Rides On It".

This brochure, as well as the preceding subsections, describes the following items;

- Tire labeling, including a description and explanation of each marking on the tires, and information about the DOT Tire Identification Number (TIN).
- Recommended tire inflation pressure, including a description and explanation of:
 - Cold inflation pressure.
 - Vehicle Placard and location on the vehicle.
 - Adverse safety consequences of under inflation (including tire failure).
 - Measuring and adjusting air pressure for proper inflation.
- Tire Care, including maintenance and safety practices.
- Vehicle load limits, including a description and explanation of the following items:
 - Locating and understanding the load limit information, total load capacity, and cargo capacity.
 - Calculating total and cargo capacities with varying seating configurations including quantitative examples showing / illustrating how the vehicles cargo and luggage capacity decreases as combined number and size of occupants' increases. This item is also discussed in Section 3.
- Determining compatibility of tire and vehicle load capabilities.
- Adverse safety consequences of overloading on handling and stopping on tires.

Steps for Determining Correct Load Limit – Trailer

Determining the load limits of a trailer includes more than understanding the load limits of the tires alone. On all trailers there is a Federal certification/VIN label that is located on the forward half of the left (road) side of the unit. This certification/VIN label will indicate the trailer's Gross Vehicle Weight Rating (GVWR). This is the most weight the fully loaded trailer can weigh. It will also provide the Gross Axle Weight Rating (GAWR). This is the most a particular axle can weigh. If there are multiple axles, the GAWR of each axle will be provided.

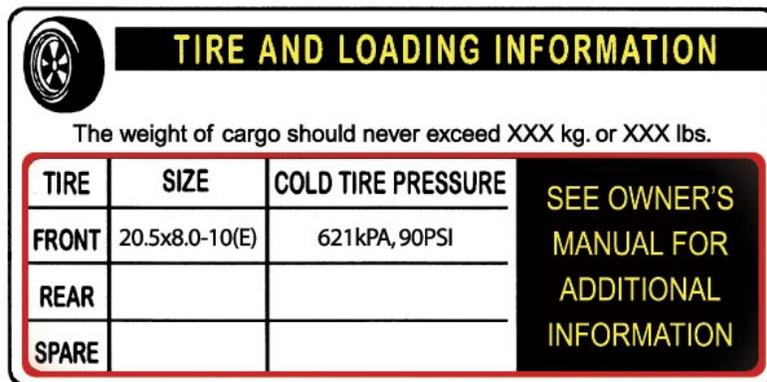
If your trailer has a GVWR of 10,000 pounds or less, there is a vehicle placard located in the same location as the certification label described above. This placard provides tire and loading information. In addition, this placard will show a statement regarding maximum cargo capacity. Cargo can be added to the trailer, up to the maximum weight specified on the placard. The combined weight of the cargo is provided as a single number. In any case, remember: the total weight of a fully loaded trailer can not exceed the stated GVWR.

For trailers with living quarters installed, the weight of water and propane also need to be considered. The weight of fully filled propane containers is considered part of the weight of the trailer before it is loaded with cargo, and is not considered part of the disposable cargo load. Water however, is a disposable cargo weight and is treated as such. If there is a fresh water storage tank of 100 gallons, this tank when filled would weigh about 800 pounds. If more cargo is being transported, water can be off-loaded to keep the total amount of cargo added to the vehicle within the limits of the GVWR so as not to overload the vehicle. Understanding this flexibility will allow you, the owner, to make choices that fit your travel needs.

When loading your cargo, be sure it is distributed evenly to prevent overloading front to back and side to side. Heavy items should be placed low and as close to the axle positions as reasonable. Too many items on one side may overload a tire. The best way to know the actual weight of the vehicle is to weigh it at a public scale. Talk to your dealer to discuss the weighing methods needed to capture the various weights related to the trailer. This would include the weight empty or unloaded, weights per axle, wheel, hitch or king-pin, and total weight.

Excessive loads and/or underinflation cause tire overloading and, as a result, abnormal tire flexing occurs. This situation can generate an excessive amount of heat within the tire. Excessive heat may lead to tire failure. It is the air pressure that enables a tire to support the load, so proper inflation is critical. The proper air pressure may be found on the certification/VIN label and/or on the Tire Placard. This value should never exceed the maximum cold inflation pressure stamped on the tire.

Trailers 10,000 Pounds GVWR or Less



Tire and Loading Information Placard – Figure 1-1

1. Locate the statement, “The weight of cargo should never exceed XXX kg or XXX lbs.,” on your vehicle’s placard. See figure 1-1.
2. This figure equals the available amount of cargo and luggage load capacity.
3. Determine the combined weight of luggage and cargo being loaded on the vehicle. That weight may not safely exceed the available cargo and luggage load capacity.

The trailer’s placard refers to the Tire Information Placard attached adjacent to or near the trailer’s VIN (Certification) label at the left front of the trailer.

Trailers Over 10,000 Pounds GVWR (Note: These trailers are not required to have a tire information placard on the vehicle)

1. Determine the empty weight of your trailer by weighing the trailer using a public scale or other means. This step does not have to be repeated.
2. Locate the GVWR (Gross Vehicle Weight Rating) of the trailer on your trailer's VIN (Certification) label.
3. Subtract the empty weight of your trailer from the GVWR stated on the VIN label. That weight is the maximum available cargo capacity of the trailer and may not be safely exceeded.

Steps for Determining Correct Load Limit – Tow Vehicle

1. Locate the statement, "The combined weight of occupants and cargo should never exceed XXX lbs.," on your vehicle's placard.
2. Determine the combined weight of the driver and passengers who will be riding in your vehicle.
3. Subtract the combined weight of the driver and passengers from XXX kilograms or XXX pounds.
4. The resulting figure equals the available amount of cargo and luggage capacity. For example, if the "XXX" amount equals 1400 lbs. and there will be five 150 lb. passengers in your vehicle, the amount of available cargo and luggage capacity is 650 lbs. (1400-750 (5 x 150) = 650 lbs.).
5. Determine the combined weight of luggage and cargo being loaded on the vehicle. That weight may not safely exceed the available cargo and luggage capacity calculated in Step # 4.
6. If your vehicle will be towing a trailer, load from your trailer will be transferred to your vehicle. Consult the tow vehicle's manual to determine how this weight transfer reduces the available cargo and luggage capacity of your vehicle.

Glossary Of Tire Terminology

Accessory weight

The combined weight (in excess of those standard items which may be replaced) of automatic transmission, power steering, power brakes, power windows, power seats, radio and heater, to the extent that these items are available as factory-installed equipment (whether installed or not).

Bead

The part of the tire that is made of steel wires, wrapped or reinforced by ply cords and that is shaped to fit the rim.

Bead separation

This is the breakdown of the bond between components in the bead.

Bias ply tire

A pneumatic tire in which the ply cords that extend to the beads are laid at alternate angles substantially less than 90 degrees to the centerline of the tread.

Carcass

The tire structure, except tread and sidewall rubber which, when inflated, bears the load.

Chunking

The breaking away of pieces of the tread or sidewall.

Cold inflation pressure

The pressure in the tire before you drive.

Cord

The strands forming the plies in the tire.

Cord separation

The parting of cords from adjacent rubber compounds.

Cracking

Any parting within the tread, sidewall, or inner liner of the tire extending to cord material.

CT

A pneumatic tire with an inverted flange tire and rim system in which the rim is designed with rim flanges pointed radially inward and the tire is designed to fit on the underside of the rim in a manner that encloses the rim flanges inside the air cavity of the tire.

Curb weight

The weight of a motor vehicle with standard equipment including the maximum capacity of fuel, oil, and coolant, and, if so equipped, air conditioning and additional weight optional engine.

Extra load tire

A tire designed to operate at higher loads and at higher inflation pressures than the corresponding standard tire.

Groove

The space between two adjacent tread ribs.

Gross Axle Weight Rating

The maximum weight that any axle can support, as published on the Certification / VIN label on the front left side of the trailer. Actual weight determined by weighing each axle on a public scale, with the trailer attached to the towing vehicle.

Gross Vehicle Weight Rating

The maximum weight of the fully loaded trailer, as published on the Certification / VIN label. Actual weight determined by weighing trailer on a public scale, without being attached to the towing vehicle.

Hitch Weight

The downward force exerted on the hitch ball by the trailer coupler.

Innerliner

The layer(s) forming the inside surface of a tubeless tire that contains the inflating medium within the tire.

Innerliner separation

The parting of the innerliner from cord material in the carcass.

Intended outboard sidewall

The sidewall that contains a white-wall, bears white lettering or bears manufacturer, brand, and/or model name molding that is higher or deeper than the same molding on the other sidewall of the tire or the outward facing sidewall of an asymmetrical tire that has a particular side that must always face outward when mounted on a vehicle.

Light truck (LT) tire

A tire designated by its manufacturer as primarily intended for use on lightweight trucks or multipurpose passenger vehicles.

Load rating

The maximum load that a tire is rated to carry for a given inflation pressure.

Maximum load rating

The load rating for a tire at the maximum permissible inflation pressure for that tire.

Maximum permissible inflation pressure

The maximum cold inflation pressure to which a tire may be inflated.

Maximum loaded vehicle weight

The sum of curb weight, accessory weight, vehicle capacity weight, and production options weight.

Measuring rim

The rim on which a tire is fitted for physical dimension requirements.

Pin Weight

The downward force applied to the 5th wheel or gooseneck ball, by the trailer kingpin or gooseneck coupler.

Non-pneumatic rim

A mechanical device which, when a non-pneumatic tire assembly incorporates a wheel, supports the tire, and attaches, either integrally or separably, to the wheel center member and upon which the tire is attached.

Non-pneumatic spare tire assembly

A non-pneumatic tire assembly intended for temporary use in place of one of the pneumatic tires and rims that are fitted to a passenger car in compliance with the requirements of this standard.

Non-pneumatic tire

A mechanical device which transmits, either directly or through a wheel or wheel center member, the vertical load and tractive forces from the roadway to the vehicle, generates the tractive forces that provide the directional control of the vehicle and does not rely on the containment of any gas or fluid for providing those functions.

Non-pneumatic tire assembly

A non-pneumatic tire, alone or in combination with a wheel or wheel center member, which can be mounted on a vehicle.

Normal occupant weight

This means 68 kilograms (150 lbs.) times the number of occupants specified in the second column of Table I of 49 CFR 571.110.

Occupant distribution

The distribution of occupants in a vehicle as specified in the third column of Table I of 49 CFR 571.110.

Open splice

Any parting at any junction of tread, sidewall, or innerliner that extends to cord material.

Outer diameter

The overall diameter of an inflated new tire.

Overall width

The linear distance between the exteriors of the sidewalls of an inflated tire, including elevations due to labeling, decorations, or protective bands or ribs.

Ply

A layer of rubber-coated parallel cords.

Ply separation

A parting of rubber compound between adjacent plies.

Pneumatic tire

A mechanical device made of rubber, chemicals, fabric and steel or other materials, that, when mounted on an automotive wheel, provides the traction and contains the gas or fluid that sustains the load.

Production options weight

The combined weight of those installed regular production options weighing over 2.3 kilograms (5 lbs.) in excess of those standard items which they replace, not previously considered in curb weight or accessory weight, including heavy duty brakes, ride levelers, roof rack, heavy duty battery, and special trim.

Radial ply tire

A pneumatic tire in which the ply cords that extend to the beads are laid at substantially 90 degrees to the centerline of the tread.

Recommended inflation pressure

This is the inflation pressure provided by the vehicle manufacturer on the Tire Information label and on the Certification / VIN tag.

Reinforced tire

A tire designed to operate at higher loads and at higher inflation pressures than the corresponding standard tire.

Rim

A metal support for a tire or a tire and tube assembly upon which the tire beads are seated.

Rim diameter

This means the nominal diameter of the bead seat.

Rim size designation

This means the rim diameter and width.

Rim type designation

This means the industry of manufacturer's designation for a rim by style or code.

Rim width

This means the nominal distance between rim flanges.

Section width

The linear distance between the exteriors of the sidewalls of an inflated tire, excluding elevations due to labeling, decoration, or protective bands.

Sidewall

That portion of a tire between the tread and bead.

Sidewall separation

The parting of the rubber compound from the cord material in the sidewall.

Special Trailer (ST) tire

The "ST" is an indication the tire is for trailer use only.

Test rim

The rim on which a tire is fitted for testing, and may be any rim listed as appropriate for use with that tire.

Tread

That portion of a tire that comes into contact with the road.

Tread rib

A tread section running circumferentially around a tire.

Tread separation

Pulling away of the tread from the tire carcass.

Treadwear indicators (TWI)

The projections within the principal grooves designed to give a visual indication of the degrees of wear of the tread.

Vehicle capacity weight

The rated cargo and luggage load plus 68 kilograms (150 lbs.) times the vehicle's designated seating capacity.

Vehicle maximum load on the tire

The load on an individual tire that is determined by distributing to each axle its share of the maximum loaded vehicle weight and dividing by two.

Vehicle normal load on the tire

The load on an individual tire that is determined by distributing to each axle its share of the curb weight, accessory weight, and normal occupant weight (distributed in accordance with Table I of CRF 49 571.110) and dividing by 2.

Weather side

The surface area of the rim not covered by the inflated tire.

Wheel center member

In the case of a non-pneumatic tire assembly incorporating a wheel, a mechanical device which attaches, either integrally or separably, to the non-pneumatic rim and provides the connection between the non-pneumatic rim and the vehicle; or, in the case of a non-pneumatic tire assembly not incorporating a wheel, a mechanical device which attaches, either integrally or separably, to the non-pneumatic tire and provides the connection between tire and the vehicle.

Wheel-holding fixture

The fixture used to hold the wheel and tire assembly securely during testing.

Tire Safety - Everything Rides On It

The National Traffic Safety Administration (NHTSA) has published a brochure (DOT HS 809 361) that discusses all aspects of Tire Safety, as required by CFR 575.6. This brochure is reproduced in part below. It can be obtained and downloaded from NHTSA, free of charge, from the following web site:

http://www.nhtsa.dot.gov/cars/rules/TireSafety/ridesonit/tires_index.html

Studies of tire safety show that maintaining proper tire pressure, observing tire and vehicle load limits (not carrying more weight in your vehicle than your tires or vehicle can safely handle), avoiding road hazards, and inspecting tires for cuts, slashes, and other irregularities are the most important things you can do to avoid tire failure, such as tread separation or blowout and flat tires. These actions, along with other care and maintenance activities, can also:

- Improve vehicle handling
- Help protect you and others from avoidable breakdowns and accidents
- Improve fuel economy
- Increase the life of your tires.

This booklet presents a comprehensive overview of tire safety, including information on the following topics:

- Basic tire maintenance
- Uniform Tire Quality Grading System
- Fundamental characteristics of tires
- Tire safety tips.

Use this information to make tire safety a regular part of your vehicle maintenance routine. Recognize that the time you spend is minimal compared with the inconvenience and safety consequences of a flat tire or other tire failure.

Safety First—Basic Tire Maintenance

Properly maintained tires improve the steering, stopping, traction, and load-carrying capability of your vehicle. Underinflated tires and overloaded vehicles are a major cause of tire failure. Therefore, as mentioned above, to avoid flat tires and other types of tire failure, you should maintain proper tire pressure, observe tire and vehicle load limits, avoid road hazards, and regularly inspect your tires.

Finding Your Vehicle's Recommended Tire Pressure and Load Limits

Tire information placards and vehicle certification labels contain information on tires and load limits. These labels indicate the vehicle manufacturer's information including:

- Recommended tire size
- Recommended tire inflation pressure
- Vehicle capacity weight (VCW—the maximum occupant and cargo weight a vehicle is designed to carry)
- Front and rear gross axle weight ratings (GAWR—the maximum weight the axle systems are designed to carry).

Both placards and certification labels are permanently attached to the trailer near the left front.

Understanding Tire Pressure and Load Limits

Tire inflation pressure is the level of air in the tire that provides it with load-carrying capacity and affects the overall performance of the vehicle. The tire inflation pressure is a number that indicates the amount of air pressure—measured in pounds per square inch (psi)—a tire requires to be properly inflated. (You will also find this number on the vehicle information placard expressed in kilopascals (kpa), which is the metric measure used internationally.)

Manufacturers of passenger vehicles and light trucks determine this number based on the vehicle's design load limit, that is, the greatest amount of weight a vehicle can safely carry and the vehicle's tire size. The proper tire pressure for your vehicle is referred to as the "recommended cold inflation pressure." (As you will read below, it is difficult to obtain the recommended tire pressure if your tires are not cold.)

Because tires are designed to be used on more than one type of vehicle, tire manufacturers list the "maximum permissible inflation pressure" on the tire sidewall. This number is the greatest amount of air pressure that should ever be put in the tire under normal driving conditions.

Checking Tire Pressure

It is important to check your vehicle's tire pressure at least once a month for the following reasons:

- Most tires may naturally lose air over time.
- Tires can lose air suddenly if you drive over a pothole or other object or if you strike the curb when parking.
- With radial tires, it is usually not possible to determine underinflation by visual inspection.

For convenience, purchase a tire pressure gauge to keep in your vehicle. Gauges can be purchased at tire dealerships, auto supply stores, and other retail outlets.

The recommended tire inflation pressure that vehicle manufacturers provide reflects the proper psi when a tire is cold. The term cold does not relate to the outside temperature. Rather, a cold tire is one that has not been driven on for at least three hours. When you drive, your tires get warmer, causing the air pressure within them to increase. Therefore, to get an

accurate tire pressure reading, you must measure tire pressure when the tires are cold or compensate for the extra pressure in warm tires.

Steps for Maintaining Proper Tire Pressure

- Step 1: Locate the recommended tire pressure on the vehicle's tire information placard, certification label, or in the owner's manual.
- Step 2: Record the tire pressure of all tires.
- Step 3: If the tire pressure is too high in any of the tires, slowly release air by gently pressing on the tire valve stem with the edge of your tire gauge until you get to the correct pressure.
- Step 4: If the tire pressure is too low, note the difference between the measured tire pressure and the correct tire pressure. These "missing" pounds of pressure are what you will need to add.
- Step 5: At a service station, add the missing pounds of air pressure to each tire that is underinflated.
- Step 6: Check all the tires to make sure they have the same air pressure (except in cases in which the front and rear tires are supposed to have different amounts of pressure).

If you have been driving your vehicle and think that a tire is underinflated, fill it to the recommended cold inflation pressure indicated on your vehicle's tire information placard or certification label. While your tire may still be slightly underinflated due to the extra pounds of pressure in the warm tire, it is safer to drive with air pressure that is slightly lower than the vehicle manufacturer's recommended cold inflation pressure than to drive with a significantly underinflated tire. Since this is a temporary fix, don't forget to recheck and adjust the tire's pressure when you can obtain a cold reading.

Tire Size

To maintain tire safety, purchase new tires that are the same size as the vehicle's original tires or another size recommended by the manufacturer. Look at the tire information placard, the owner's manual, or the sidewall of the tire you are replacing to find this information. If you have any doubt about the correct size to choose, consult with the tire dealer.

Tire Tread

The tire tread provides the gripping action and traction that prevent your vehicle from slipping or sliding, especially when the road is wet or icy. In general, tires are not safe and should be replaced when the tread is worn down to 1/16 of an inch. Tires have built-in treadwear indicators that let you know when it is time to replace your tires. These indicators are raised sections spaced intermittently in the bottom of the tread grooves. When they appear "even" with the outside of the tread, it is time to replace your tires. Another method for checking tread depth is to place a penny in the tread with Lincoln's head upside down and facing you. If you can see the top of Lincoln's head, you are ready for new tires.

Tire Balance and Wheel Alignment

To avoid vibration or shaking of the vehicle when a tire rotates, the tire must be properly balanced. This balance is achieved by positioning weights on the wheel to counterbalance heavy spots on the wheel-and-tire assembly. A wheel alignment adjusts the angles of the wheels so that they are positioned correctly relative to the vehicle's frame. This adjustment maximizes the life of your tires. These adjustments require special equipment and should be performed by a qualified technician.

Tire Repair

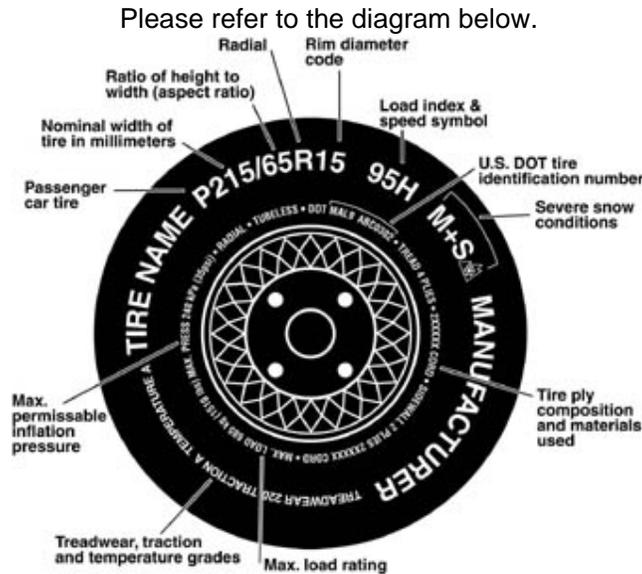
The proper repair of a punctured tire requires a plug for the hole and a patch for the area inside the tire that surrounds the puncture hole. Punctures through the tread can be repaired if they are not too large, but punctures to the sidewall should not be repaired. Tires must be removed from the rim to be properly inspected before being plugged and patched.

Tire Fundamentals

Federal law requires tire manufacturers to place standardized information on the sidewall of all tires. This information identifies and describes the fundamental characteristics of the tire

and also provides a tire identification number for safety standard certification and in case of a recall.

Information on Passenger Vehicle Tires



P

The "P" indicates the tire is for passenger vehicles.

Next number

This three-digit number gives the width in millimeters of the tire from sidewall edge to sidewall edge. In general, the larger the number, the wider the tire.

Next number

This two-digit number, known as the aspect ratio, gives the tire's ratio of height to width. Numbers of 70 or lower indicate a short sidewall for improved steering response and better overall handling on dry pavement.

R

The "R" stands for radial. Radial ply construction of tires has been the industry standard for the past 20 years.

Next number

This two-digit number is the wheel or rim diameter in inches. If you change your wheel size, you will have to purchase new tires to match the new wheel diameter.

Next number

This two- or three-digit number is the tire's load index. It is a measurement of how much weight each tire can support. You may find this information in your owner's manual. If not, contact a local tire dealer. Note: You may not find this information on all tires because it is not required by law.

M+S

The "M+S" or "M/S" indicates that the tire has some mud and snow capability. Most radial tires have these markings; hence, they have some mud and snow capability.

Speed Rating

The speed rating denotes the speed at which a tire is designed to be driven for extended periods of time. The ratings range from 99 miles per hour (mph) to 186 mph. These ratings are listed below. Note: You may not find this information on all tires because it is not required by law.

Letter Rating	Speed Rating
Q	99 mph
R	106 mph
S	112 mph
T	118 mph
U	124 mph
H	130 mph
V	149 mph
W	168* mph
Y	186* mph

* For tires with a maximum speed capability over 149 mph, tire manufacturers sometimes use the letters ZR. For those with a maximum speed capability over 186 mph, tire manufacturers always use the letters ZR.

U.S. DOT Tire Identification Number

This begins with the letters "DOT" and indicates that the tire meets all federal standards. The next two numbers or letters are the plant code where it was manufactured, and the last four numbers represent the week and year the tire was built. For example, the numbers 3197 means the 31st week of 1997. The other numbers are marketing codes used at the manufacturer's discretion. This information is used to contact consumers if a tire defect requires a recall.

Tire Ply Composition and Materials Used

The number of plies indicates the number of layers of rubber-coated fabric in the tire. In general, the greater the number of plies, the more weight a tire can support. Tire manufacturers also must indicate the materials in the tire, which include steel, nylon, polyester, and others.

Maximum Load Rating

This number indicates the maximum load in kilograms and pounds that can be carried by the tire.

Maximum Permissible Inflation Pressure

This number is the greatest amount of air pressure that should ever be put in the tire under normal driving conditions.

UTQGS Information

Treadwear Number

This number indicates the tire's wear rate. The higher the treadwear number is, the longer it

should take for the tread to wear down. For example, a tire graded 400 should last twice as long as a tire graded 200.

Traction Letter

This letter indicates a tire's ability to stop on wet pavement. A higher graded tire should allow you to stop your car on wet roads in a shorter distance than a tire with a lower grade. Traction is graded from highest to lowest as "AA", "A", "B", and "C".

Temperature Letter

This letter indicates a tire's resistance to heat. The temperature grade is for a tire that is inflated properly and not overloaded. Excessive speed, underinflation or excessive loading, either separately or in combination, can cause heat build-up and possible tire failure. From highest to lowest, a tire's resistance to heat is graded as "A", "B", or "C".

Additional Information on Light Truck Tires

Please refer to the following diagram.



Tires for light trucks have other markings besides those found on the sidewalls of passenger tires.

LT

The "LT" indicates the tire is for light trucks or trailers.

ST

An "ST" is an indication the tire is for trailer use only.

Max. Load Dual kg (lbs) at kPa (psi) Cold

This information indicates the maximum load and tire pressure when the tire is used as a dual, that is, when four tires are put on each rear axle (a total of six or more tires on the vehicle).

Max. Load Single kg (lbs) at kPa (psi) Cold

This information indicates the maximum load and tire pressure when the tire is used as a single.

Load Range

This information identifies the tire's load-carrying capabilities and its inflation limits.

Tire Safety Tips

Preventing Tire Damage

- Slow down if you have to go over a pothole or other object in the road.
- Do not run over curbs or other foreign objects in the roadway, and try not to strike the curb when parking.

Tire Safety Checklist

- Check tire pressure regularly (at least once a month), including the spare.
- Inspect tires for uneven wear patterns on the tread, cracks, foreign objects, or other signs of wear or trauma.
- Remove bits of glass and foreign objects wedged in the tread.
- Make sure your tire valves have valve caps.
- Check tire pressure before going on a long trip.
- Do not overload your vehicle. Check the Tire Information and Loading Placard or User's Manual for the maximum recommended load for the vehicle.