

RACEAMERICA

T i m i n g S y s t e m s

Model 3900A LAP TIMER



Lap Timing System Owner's Manual

Rev B

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RACEAMERICA

T i m i n g S y s t e m s

LIMITED WARRANTY

To the original purchaser of this RACEAMERICA product, RACEAMERICA warrants it to be in good working order for a period of ninety (90) days from the date of purchase from RACEAMERICA or an authorized RACEAMERICA distributor. Should this product malfunction during the warranty period, RACEAMERICA will, at its option, repair or replace it at no charge, provided the product has not been subjected to misuse, abuse, or alterations, modifications, and/or repairs not authorized by RACEAMERICA.

Any product requiring Limited Warranty service during the warranty period should be returned to RACEAMERICA with proof of purchase. If return of merchandise is by mail, the customer agrees to insure the product, prepay shipping charges, and ship the product to RACEAMERICA, Inc., 280 Martin Avenue, Unit #1, Santa Clara, CA 95050.

ALL EXPRESSED AND IMPLIED WARRANTIES FOR THIS PRODUCT ARE LIMITED IN DURATION TO THE ABOVE NINETY DAY PERIOD.

UNDER NO CIRCUMSTANCES WILL RACEAMERICA BE LIABLE TO THE USER FOR DAMAGES, INCLUDING ANY LOST PROFITS, LOST SAVINGS, OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OF, OR INABILITY TO USE, SUCH PRODUCT.

THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH MAY VARY FROM STATE TO STATE.

PRODUCT DESCRIPTION

The 3900 Series LAP TIMER is designed to time multiple laps with a single point start/finish line on oval or closed circuit tracks. This timer allows continuous timing by interleaving the next car into the final lap of each car. This really keeps the race program going. Printouts are kept separate by each vehicle with all their laps printed together. The timer allows selection between two and nine laps. The display is live counting for laps in progress. Each lap finish automatically starts the next lap except on the final lap for each vehicle.

PACKAGE COMPONENTS

The standard 3900 Series LAP TIMER includes:

- 1 - 3900 Series Console Unit factory configured as follows:
 - Standard four time display with keypad control functions
- 1 - 5040A Infra-red Beam Emitter
- 1 - 5140C Infra-red Track Sensor
- 1 - Interconnect Cable Assembly for Track Sensor - 100'
- 1 - Owners Manual

3900 Series Available Options:

- Cabling options:
 - Cable length - 250', 500'
- 7540A Foam Stands
- 5040D Infra-red Beam Emitter
- 6038S Dot-Matrix Timeslip Printer Package
- 6042A Thermal Timeslip Printer Package
- 3122A Custom Timeslip Header
- 6502A AC Power Adapter
- 6070B Carry Case
- 6560B/6860B Large Digital Display
- 4500A Data Communication PODs (for printers and displays greater than 100ft from console)

LOCAL REQUIREMENTS

Additional items required to operate the 3900 Series timing system package and options:

Batteries for Beam Emitter (see table pg 5)
Console - 12VDC automotive battery

Other options:

12VDC source for each Printer/Digital Display
(AC adapters available)

PRODUCT SPECIFICATIONS

The following listing provides the design performance specifications for the 3900 Series timing system:

Start/Finish Lane Width	4 to 50 Feet
ET Timer Capacity	up to 999.999 sec
Time Accuracy	0.001 seconds
Power Requirements:	
Console - Power	12VDC 3A
Emitter	4 - AA batteries

SYSTEM SETUP/OPERATION

SETUP

The LAP TIMER should be setup per Fig. 3, placing the Start/Finish line (Timing Line) at the desired point on the track and the console at its designated location.

The IR Track Sensor at the Start line connects to the Lap Timer TRACK SENSOR port.

The Large Digital Display connects to the Lap Timer EXTERNAL DISPLAY port using a 25 ft, 50 ft, or 100 ft display cable.

The Printer connects to the LAP TIMER RS232 SERIAL PORT using an interface/power cable. This cable can provide a power pigtail to power the printer from the Lap Timer when used within five feet of the console.

Track Sensor and Beam Emitter Operation

RACEAMERICA utilizes a variety of Track Sensors and Beam Emitters in its timing systems. All operate on line-of-sight infra-red beam principles. The beam is created by the Beam Emitter and received by the Track Sensor. The operating specification is for a gap of between four and fifty feet between the Emitter and Sensor. These will operate in conditions ranging from full sun to total darkness without adjustment when properly aligned. The Beam Emitters require a power source (batteries or AC adapters) while the Track Sensors are powered from the cable to the Control Console. The infra-red beam is a coded frequency which is detected by the sensor. Different frequencies are used for different locations in different systems. Beam Emitter voltage should not fall below 4.5 Volts DC while operating.

The beam operates on a generally established condition (ie, the sensor senses the presence of the beam), and is interrupted (broken) by the racer (beam blocked). The beam will automatically reestablish after being blocked. The detection of vehicles passing through the beam rapidly highlights the sophistication of this technology. In fact, many small items such as leaves, water, snow can interrupt the beam. RACEAMERICA tries to minimize the impact of these occurrences by requiring multiple short interruptions of the beam to indicate an interruption as well as verification of expected beam conditions before a race is allowed to start.

RACEAMERICA offers several different sensor and emitter models; depending on a variety of requirements. The following table summarizes the different Sensor/Emitter combinations utilized with the Model 3900 Lap Timer system.

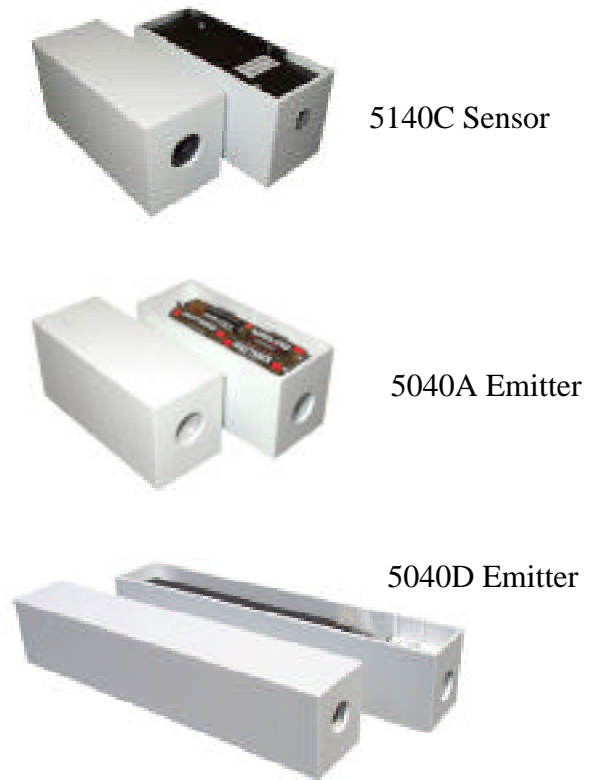


Fig. 1 IR Track Sensor & Beam Emitter

Note cable connector is located in the side facing away from the track on the 5140C Sensor. Pictures show top and bottom of units to show battery storage areas.

Sensor	Emitter	Application
5140C Single Beam Sensor	5040A Single Emitter, 'AA' Batteries (4) 5040D Single Emitter, 'D' Batteries (4)	Start/Finish Detection

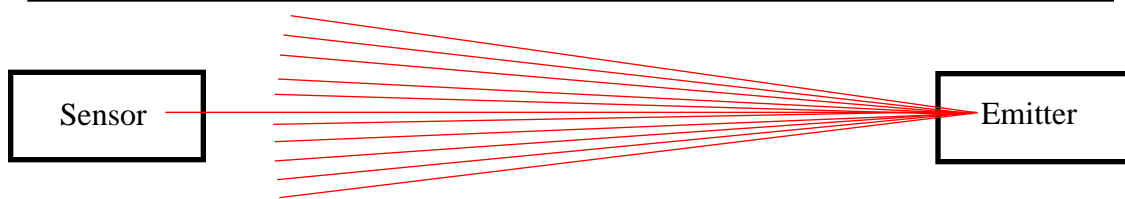


Fig. 2 Emitter/Sensor operation theory

The Emitter throws a spot light like beam of infra-red light; the Sensor should be aligned near the center of the beam for optimal reception and alignment.

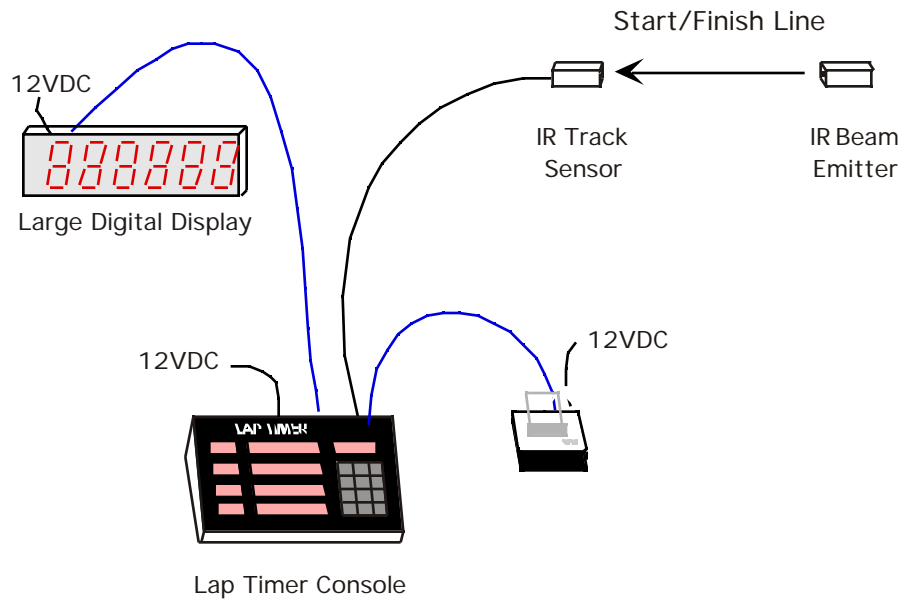


Fig. 3 LAP TIMER Cabling and Equipment Setup

THEORY OF OPERATION

The 3900 LAP TIMER is a microprocessor controlled completely self contained lap timing system utilizing the latest CMOS technology circuit components to provide a highly accurate timing solution. The system contains an internal quartz crystal clock to maintain time accuracy and display of race results to one thousandth of a second.

Power is supplied to the timer console and track sensor from a 12VDC source.

The beam emitter and track sensor operate on invisible (to the unaided human eye) Infra-red light. The coded light frequencies are constantly received by the track sensor until a car interrupts reception ('breaks' the beam).

The IR beam emitter to track sensor transmission operates on Line-of-Sight principles. This makes alignment of these units critical.

Once the system is properly set up and aligned on the racing surface, the timer console is reset to start timing the first driver/car.

After the system is reset, the first beam interruption starts the timer (unless the racer/car

number option is activated), each subsequent beam interruption (lap completed) freezes the time on the display, sends the time to any connected printers and/or digital displays, immediately starts the next lap in the background. This continues until the system is reset for another driver.

POWER ON/SELF-TEST

Connecting the 12VDC battery places the RACEAMERICA LAP TIMER into a self-test of the microprocessor circuitry and LED displays (Light Emitting Diode). This is an internal test as well as a visual check of each display. The Status Display sequences through each segment of all digits, then illuminates each segment and decimal point of all digits until the number 8 is illuminated with the decimal point. The LED Display then places an 8 with decimal point in the far right digit and shifts the display to the left through all four digits.

The Run Number displays and the Timer displays then sequence through 0 through 9, blank out, then reset to the initial timer setting of 0.000 seconds.

The Status Display then sequences through the PRODUCT number and the CODE revision level contained within the computer.

The Status Display then prompts for the number of laps per vehicle; enter the number (two through nine) and press [#] to accept. To change the number of laps, cycle power to the system and enter the new number when prompted.

The system then moves to the alignment mode.

ALIGNMENT MODE

To verify all Track Sensors are properly aligned with their Beam Emitters, the Status Display enters into the Alignment Mode immediately after the power on selftest or when the operator selects the Alignment Mode by pressing the [5] key on the Keypad with the Track Sensors disabled (this is covered later in these instructions). The Status Display momentarily indicates the position on each sensor on the display with letters represent each emitter/sensor pair [S--]. The [S] indicates the START emitter/sensor pair. The Status Display then changes each digit to a zero for each sensor being monitored [0---]. If the Beam Emitter and Track Sensor are operating properly and aligned, the 0 digit will not change. If the Beam Emitter and Track Sensor

are not properly aligned, the 0 digit for each emitter/sensor pair will count slowly if slightly out of alignment or continuously if they are not functioning properly or way out of alignment. Once the emitter/sensor pair are aligned properly, the digit will stop counting. If the alignment is off a little or intermittent, the digit for that emitter/sensor pair will count when they float out of alignment. Remember, the Beam Emitters and Track Sensors operate on a 'Line-of-Sight' concept and may require shims if they are installed on a street with a crown. Leaves, people, and other debris will also break the beams and could give false signals, so keep everyone and everything clear of the Beam Emitters and Track Sensor during racing activity.

To maximize the alignment of the emitter/sensor pairs, it is suggested to rotate the Beam Emitter slowly left and right until the alignment for that pair begins to count. This technique will determine the maximum lateral detection angle. Rotating the Beam Emitter up and down until the alignment starts counting determines the maximum vertical detection angle. Once these extremes are established, position the Beam Emitter in the center of the left/right detection angle and up/down detection angle. Repeat this same process with the other Beam Emitter and both Track Sensors. This will maximize the alignment accuracy. Press the [#] pound sign key to exit Alignment Mode.

SERIAL PORT CONFIGURATION

The RS232 Serial Port can be configured for a printer or to interface to a PC running race management software. There are two printout formats available standard with the LAP TIMER, a Timeslip format and a Data Logging format. The Status Display will enter the Print Format Mode indicated by [HEAd]. The Status Display will indicate [SLiP] to enable the operator to select the Timeslip format for the printer by pressing the [#] pound sign key. Pressing any other key will toggle the selection to Data Logging format as indicated by [Log] in the Status Display. Pressing

the [#] pound sign key will select the Data Logging format for the printer. Pressing any other key will toggle the selection to PC mode as indicated by [PC] in the Status Display. Pressing the [#] pound sign key will select the RS232 Serial Communications Port to be used in PC mode to interface to a PC running race management software. Pressing any other key will toggle the selection back to the Timeslip format selection.

If the [#] pound sign key was pressed to select a printer output format, a sample timeslip or data logging header will be printed. If the [#] pound sign key was pressed to use the RS232 Serial Port for connection to a PC, a signal is sent from LAP TIMER to the PC to let the PC software know the timer is ready to time the first car.

NOTE: When connecting a printer to the Serial Port, the printer must be configured as 1200 baud, 1 stop bit, no handshake, and no parity. When connecting a PC to the Serial Port, the PC interface must be configured as 9600 baud, 2 stop bits, no handshake, and no parity.

OPERATION

The LAP TIMER operates in a mode of interleaving cars on the final lap of each preceding car. Once a car on the track has crossed the start line to begin their final lap, the next car must begin and cross the start line before the first car completes their final lap.

The timer prompts the user for the number of laps each car will make in total including warmup laps. The Status Display displays [LAPS] waiting for a number between 2 and 9 to be pressed. At this point the timer is ready to time the first car and has disabled the sensors and displays [OFF] in the Status Display. Enable the sensors by pressing the [0] key to begin.

In the following example, 3 laps were entered. The first car crosses the start line beam and a timer begins counting and the lap number appears to its left as lap 01. When the first car crosses the start line again to end their warmup lap, the first timer stops and a second timer begins

to count with lap 02 indicated. Lap 01 time is the warmup lap time. When the first car crosses the start line again ending lap 2 and starting the third lap, the timer stops timer lap 2 and starts a timer for lap 3. Since lap 3 is the first car's final lap, the second car now crosses the start line to begin a warmup lap. The timer starts a new timer and indicates lap 01 for the second car. Lap 3 timer for the first car continues to count until the first car crosses the start line where it is stopped to indicate the time for lap 03.

NOTE: When the final car has started its final lap, the timer is expecting the next car to start its warmup lap and cross the start line. Pressing the [3] key manually starts a car simulating the next car crossing the start line. A new timer is started but should be disregarded once the final car completes its final lap.

Any time a next car does not start, a new timer must be started manually to get a final lap time for the vehicle on track.

PC MODE OPERATION

LAP TIMER is designed to interface with third party race management software. The timer sends signals to the PC when LAP TIMER enters PC mode, the LAP TIMER Console is stopped or cleared, cars break the start line beams, a timer is restarted or continued, and when the sensors are enabled and disabled. The following communication strings are sent to the PC on each event:

Enter PC mode:	[hexF0][cr][lf]
Console stopped:	[hexF0][cr][lf]
Console cleared:	[hexF0][cr][lf]
Car starts:	[hex90][cr][lf]
Car finishes:	[hex80]fffsss[cr][lf]
	or [hex80]fffssm[cr][lf]
A timer is restarted:	[hexA0][cr][lf]
Sensors are disabled:	[hexB0][cr][lf]
Sensors are enabled:	[hexC0][cr][lf]



Fig. 4 LAP TIMER Keypad

KEYPAD FUNCTIONS

KEY 0

The [0] key is used to enable (on) and disable (off) the detection of cars by the Track Sensor. The Status Display will indicate the sensor is on [SnSr][on] or off [SnSr][OFF] and must be off to use functions [2], [5], and [8]. Attempting to access functions [2], [5], and [8] with the sensors enabled will cause the Status Display to display the message [SnSr][on] and abort the function. Pressing the [0] key repeatedly will toggle the sensor on and off.

NOTE: when the sensor is off, it will not detect any cars crossing the starting line. As a reminder to the operator, [OFF] will be displayed in the Status Display when the sensor is disabled and no other function is being used.

KEY 1

Pressing [1] on the keypad will halt all currently counting timers. This is convenient when something happens on the track requiring a restart of all cars being actively timed. The next run will be assigned the next Run Number when the start beam is interrupted.

KEY 2

See **PRINTER OUTPUT SETUP TABLE** for instructions on the use of the [2] key to edit the 20-character timeslip header.

KEY 3

Pressing the [3] key will manually start a timer. This is the same function as breaking the start beam. If all four timers are counting and the [3] key is pressed, the bottom timer will be lost and a new timer will be started at the top of the display. Since this is manual mode, the operator has full control of the timer starting function.

KEY 4

Pressing the [4] key halts all timers, resets all four timers back to **0.000** seconds, clears the run numbers, and resets the next run number to **01**. This function is used to completely reset the LAP TIMER back to its initial startup point.

KEY 5

To enter alignment mode, the sensors must first be disabled (turned off). This is accomplished by pressing the [0] key and viewing [SnSr][OFF] in the Status Display. The [5] key is then pressed to enter alignment mode. See the section on **ALIGNMENT MODE** earlier in this manual.

KEY 6

To manually stop the next timer, press the [6] key. This is the same function as a car crossing the start line and blocking the beam.

KEY 8

See **PRINTER OUTPUT SETUP TABLE** for instructions and use of the [8] key for printing timeslips.

STATUS DISPLAY MESSAGES

During normal operation, messages will appear in the Status Display. These messages indicate status, mode of operation, or events occurring on the race track. Many of these messages are covered elsewhere in this manual and are alphabetically summarized in the following section as a reference:

Align S---

When entering Alignment Mode, these messages will appear in sequence to indicate the alignment of the Track Sensors and Beam Emitters will be continuously monitored and the results displayed.

CLr

This message confirms all timers have been stopped, reset to 0.000 seconds, and run numbers have been reset to start with 01. The LAP TIMER is ready for the next run.

Code

This message appears during the power-up sequence and indicates the software code level running in the RACEAMERICA timer.

End

This messages indicates the stopping of a timer. It will appear every time the finish line beam is interrupted by a car or the manual stop key is pressed on the keypad. The timer in the Timer Display currently counting with the highest time elapsed is stopped and output is sent to the printer.

Edit

This message will appear momentarily when entering the Edit Timeslip Mode. It confirms the keypress by the operator.

HEAd

During power-up of the LAP TIMER, the operator is prompted for the print format. This message is displayed momentarily as the operator enters into the Print Format Mode to select the format of race results sent to the printer after every run.

Log

During power-up of the LAP TIMER, the operator is prompted for the print format. This message indicates run results Data Logging format will be selected by pressing the '#' key.

OFF

This message will keep appearing if the sensors have been disabled by the operator. This message is a reminder to enable the sensors prior to the start of the race event in order to detect cars at the start and finish lines.

Out

This message will appear when the operator determines a car has strayed off course and the respective timer in the Timer Display is no longer valid. The timer in the Timer Display currently counting with the highest time elapsed is stopped, set to the maximum time value, and output is sent to the printer.

PC

During power-up of the LAP TIMER, the operator is prompted for the use of the RS232 Serial port. This message indicates the PC mode will be selected by pressing the '#' key.

Prod

This message appears during the power-up sequence and indicates the product number of the RACEAMERICA timer.

Prnt

This message will appear when the operator is manually printing a timeslip to verify the timeslip header after entry. The message indicates the LAP TIMER is busy outputting a timeslip to the printer.

SbAd

This message indicates the alignment of the Track Sensor and Beam Emitter at the start line has failed to maintain alignment while the LAP TIMER was performing realtime testing after a car passed through the start line beam. This message will disappear when another message is displayed in the Status Display. It will appear each time the start line alignment is detected as bad.

SLiP

During power-up of the LAP TIMER, the operator is prompted for the print format. This message indicates run results Timeslip format will be selected by pressing the '#' key.

SnSr OFF

These messages will appear in sequence to confirm the sensors have been disabled by the operator.

SnSr on

These messages will appear in sequence when the sensors have been enabled by the operator or the operator is attempting to enter a mode of operation requiring the sensors to be disabled (off) prior to the LAP TIMER entering the requested mode of operation.

StoP

This message confirms all timers have been stopped and are ready for the next run to begin with the next run number.

Strt

This message indicates the starting of a new timer. It will appear every time the starting line beam is interrupted by a car or the manual start key is pressed on the keypad. The four timers in the Timer Display are rotated downward. The topmost timer of the Timer Display is reset to zero and starts counting.

PRINTER OUTPUT SETUP TABLE

Character Position	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
Display Character																				
Character Code																				

Character Position	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
Display Character																				
Character Code																				

STEP 1 - Select the 20 characters to be used as the timeslip header. Enter the characters in one of the Setup Tables above. To center the heading, place blank spaces before and after the characters to be printed. The power-on default timeslip header is **Autocross Lap Timer** and will be replaced by your input until the LAP TIMER is powered off.

STEP 2 - Using the Character Code Table on the next page, find the character code for each of the 20 characters. All printable characters are listed in the Character Code Table. Remember to enter the code for a blank space between words as code 00.

STEP 3 - Disable the Sensors by pressing [0] on the keypad. The Status Display will confirm the state of the sensors with [SnSr][OFF].

STEP 4 - Enter the Edit Timeslip Header Mode by pressing [2]. The Status display confirms by displaying [Edit].

STEP 5 - The Status Display places 4 digits in the display. The left two digits represent the character position of the above Setup Table. The right two digits represent the character code of the current character of the timeslip. To change the character, enter the two digit number on the keypad. Press [#] the pound sign to save your input for that character. The Status Display will increment the left two digits to the next character position and the right two digits to the character code of the current printing character. Continue editing until all 20 characters have been entered. Press [*] the asterick key to exit Edit Mode.

STEP 6 - Press [8] to print a timeslip to verify everything was entered correctly.

STEP 7 - Remember to enable the Track Sensors by pressing [0] and viewing [SnSr][on] in the Status Display.

CHARACTER CODE TABLE

Character	Code	Character	Code
Space	00	P	48
!	01	Q	49
@	02	R	50
#	03	S	51
\$	04	T	52
%	05	U	53
&	06	V	54
'	07	W	55
(08	X	56
)	09	Y	57
*	10	Z	58
+	11	[59
'	12	v	60
-	13		61
.	14]	62
/	15	_	63
0	16	`	64
1	17	a	65
2	18	b	66
3	19	c	67
4	20	d	68
5	21	e	69
6	22	f	70
7	23	g	71
8	24	h	72
9	25	i	73
:	26	j	74
;	27	k	75
<	28	l	76
=	29	m	77
>	30	n	78
?	31	o	79
@	32	p	80
A	33	q	81
B	34	r	82
C	35	s	83
D	36	t	84
E	37	u	85
F	38	v	86
G	39	w	87
H	40	x	88
I	41	y	89
J	42	z	90
K	43	{	91
L	44		92
M	45	}	93
N	46	~	94
O	47		

MAINTENANCE

The 3900 LAP TIMER Console, Beam Emitters, and Track Sensors do not require any special maintenance. Keeping the equipment clean and dry when not in use is recommended.

To insure uninterrupted operation on raceday, it is suggested to keep track of battery usage hours so as to have fully charged batteries. Plan to replace the alkaline AA cells in the beam emitters after about 60 hours use. If you are using rechargeable AA cells, recharge them each day. Low battery voltage (emitters below 4.5VDC) will cause intermittent operation of the system resulting in intermittent cars detected at the starting line or the finish line as the batteries power weakens.

To maintain the highest level of timing accuracy and minimize false trips, annual preventative maintenance and calibration should be performed on all system track sensors and beam emitter units.

SPARE PARTS

Further to minimize race program interruptions, RACEAMERICA recommends some spare parts. A spare emitter/sensor pair and end of track cable sections should be available in the event of an unfortunate accident during a program. Contact RACEAMERICA for availability and pricing of spares items.

SUPPORT AGREEMENTS

Support agreements are available from RACEAMERICA providing Telephone Assistance on technical issues and operational questions, repair and/or replacement of hardware failures, Software and Firmware updates and bug reporting, and Annual Preventative Maintenance on all system track sensors and beam emitter units. Contact RACEAMERICA for more information and pricing of Support Agreements.