

Contents

Introduction	1
Overview	2
Operation	2
ID Number	3
Lap Beacon Use	4
Split Beacon Use	4
Verifying Operation	5
Beacon Transmitter	7
Position	7
Spacing between Transmitters	7
Mounting	7
Aiming / Range	7
ID Number Adjustment	8
LED	8
Power	9
Specifications	9
Beacon Receiver	11
Mounting	11
Range / Aiming	11
Glass	11
Sun Light	11
ID Number	11
LED	12
Wiring	13
Output Signal	13
ECU / Dash Setup	13
Specifications	14
Trouble Shooting	15
Check List : Basic Operation	15
Check List: Operational Problems	16

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Introduction

This manual covers the operation of the *MoTeC* Lap Beacon.

Overview

The **MoTeC** Lap Beacon consists of a Beacon Transmitter and a Beacon Receiver.

The Beacon Transmitter is mounted beside the track and the Beacon Receiver is mounted in the vehicle and connected to a Display or Data Logging system or to an Engine Management System.

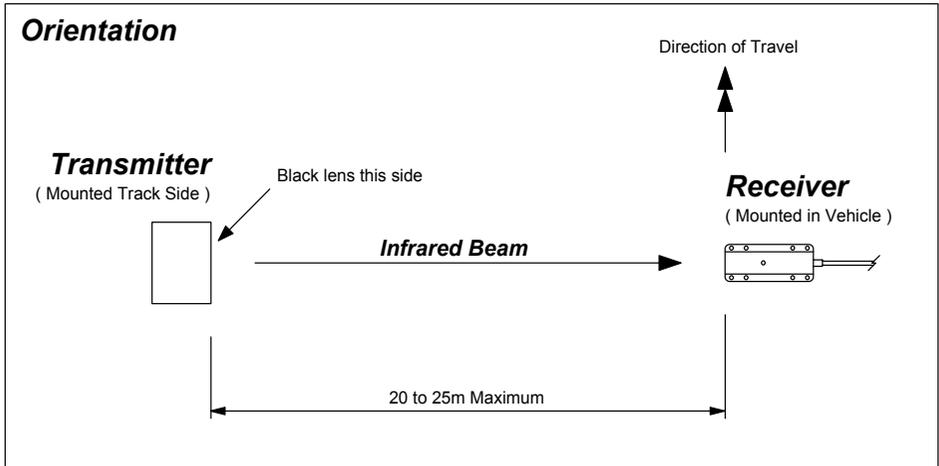
The Lap Beacon system is used to mark the start of a Lap. This can be used by a display system to show the driver lap times and lap number and can be used by a data logging system for lap time and start of lap information. The Lap Beacon may also be used to generate split times by placing multiple transmitters around the race circuit.

Operation

The Beacon transmitter emits a narrow infrared beam, which is encoded with a number that will only be detected by a receiver with the same number. When the receiver detects a transmitter with a matching number a signal is sent to the connected device in the vehicle, typically a **MoTeC ADL Dash/Logger** or a **MoTeC ECU**.

Orientation

The transmitter and receiver must be oriented as shown below:



Range

The **MoTeC** Lap Beacon has a range of up to 25m (80ft). The range depends on the alignment of the transmitter and receiver.

For operation up to 25m (80ft) both the transmitter and receiver must be aligned within 2° of optimum.

For operation up to 20m (65ft) both the transmitter and receiver must be aligned within 5° of optimum.

- Note: Do not place the receiver behind window glass as this can reduce the range substantially.

ID Number

The **MoTeC** Lap Beacon has 1000 different ID numbers. The ID number allows the beacon receiver to ignore all transmitters other than one with the same ID number.

The ID number is selected by setting the Mode, Tens & Units switches in the transmitter and receiver to the same numbers.

4 Overview

- Note that the power to the Beacon Receiver and Beacon Transmitter must be cycled before a number change will take effect.
- To avoid damage to the units and to ensure that the power is cycled, disconnect the power from the units before changing the number.

Recommended ID Number Settings

The following ID numbers are recommended for normal operation:

Mode Switch	Set to suit race category (MoTeC will advise)
Tens & Units Switches	Set to vehicle number (Don't use 00)

The mode switch is used to avoid two teams in different race categories from using the same beacon ID.

- Beacon ID 999 is reserved for a master beacon that can be setup for the use of anyone at a race meeting.

Two Vehicle Teams

Set the Tens and Units of both vehicle receivers to the lowest number of the two vehicles so that only one beacon transmitter is required.

Lap Beacon Use

Normally the **MoTeC** Lap Beacon is used as a standard Lap beacon, ie. one beacon transmitter placed at the start of the lap.

The beacon ID should be set as recommended above to ensure that no two teams use the same number.

Split Beacon Use

The **MoTeC** Lap Beacon may also be used to generate split times by placing multiple transmitters around the race circuit. All beacon transmitters must have the same Mode setting, but different Tens and Units settings. The beacon receiver must have the same Mode setting as the transmitter, however both the Tens and Units must be set to zero. Setting the Tens and Units to zero instructs the receiver to recognise all transmitters with the same Mode. The Tens and Units value of each transmitter will be reported to the

connected device, typically a **MoTeC ADL** or **MoTeC ECU**. The value is encoded in the pulse width sent to the connected device.

Split beacons are generally only suitable for private practice, however beacon mode 9 has been allocated specifically for split beacon use. It is important to ensure that only the beacons for split usage are operating on mode 9 otherwise unexpected beacon signals may be received. Beacon number 999 has been reserved as a master beacon, therefore this ID should generally be used as the lap beacon. The software for the connected device will normally need to know the number of the transmitter that marks the start of the lap. The use of the master beacon ID should ease the setup of a split beacon system.

Verifying Operation

To test if the lap beacon is working correctly, aim the transmitter at the receiver, the Red LED on the receiver should glow brightly. If the LED glows very dimly then the receiver and transmitter numbers probably do not match. Note that the LED brightness is effected by the ambient lighting conditions and full brightness will appear very dim in bright sunlight.

To test that the connected device is working correctly, wave the transmitter past the receiver and check for correct operation of the device (eg. Lap Time display).

- Note that it is important to ensure that the lap time reset condition is not met, otherwise a lap time will not be displayed even if the beacon is operating correctly. This may require that the engine is running depending on the setup of the connected device.
- Note that for correct Lap Time display the transmitter will need to be waved passed the receiver twice and at least 5 seconds is required between each pass (possibly more depending on the software setup)

Beacon Transmitter

Position

The beacon transmitter may be placed at any point around the track.

- It is recommended that the beacon transmitter is always placed in the same position at a particular track, this avoids offsets when data from a previous session needs to be compared with the current data. If the same position cannot be used then the **MoTeC Interpreter** software can compensate for the offset in the beacon position.
- To ensure that the lap time recorded is the same as the official lap time, the beacon transmitter should be placed close to the official timing point – normally located at the start/finish line.

Spacing between Transmitters

The spacing between adjacent transmitters must be at least 6m (20ft) to avoid the signals from each transmitter conflicting with each other. This also includes other manufacturers' beacons that emit an infrared beam.

Mounting

The beacon transmitter has 4 holes outside the sealing ring of the case, these may be used to mount the unit to a backing plate. Note that the backing plate should include a hole so that the LED is visible.

Aiming / Range

The Beacon Transmitter must be aimed so that the beam is parallel to the road and at the same height above the road as the vehicle receiver, therefore the mounting system must be capable of height and tilt adjustment.

- For operation up to 25m (80ft) the beam must within 2° of parallel to the road surface.

8 Beacon Transmitter

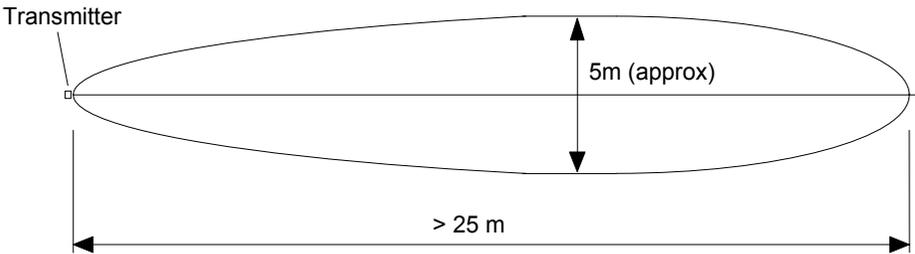
- For operation up to 20m (65ft) the beam must within 5° of parallel to the road surface.

Beam Pattern

The approximate beam pattern is shown below.

The pattern shows the limits of operation, when the beacon receiver is within 2° of axial to the beam.

Notice that at distances greater than about 20 m (65 ft) the beam becomes narrower which is why the angle of the transmitter becomes more critical at longer distances.



ID Number Adjustment

Turn the power off before adjusting the ID number to avoid accidental damage to the electronics.

The ID number is set using the rotary switches inside the unit. To access the switches remove the 4 screws from the front cover of the unit.

LED

The LED has three colours that have the following meanings:

Green	OK
Orange	Low battery voltage (Less than 10.5V)
Red	Fault or very low battery voltage

- The beacon transmitter will operate when the LED is orange, however the transmitted power is reduced which reduces the operating range.

Power

The unit should be powered from a 12V rechargeable battery. A small car battery is recommended as it is easily charged and will operate the transmitter continuously for up to 20 days. The battery may also be used as a weight at the base of the mounting system for stability.

Connect the Red Wire to Battery Positive, and the Black wire to Battery Negative.

Note that the unit requires at least 10 V for proper operation.

It is recommended that the battery be charged regularly to ensure good battery life.

Specifications

Electrical

Operating Voltage Range: 10V to 16V

Operating Current: 70 mA typical

Mating Connector

Connector: Hirschman CM06EA14S-7S

<i>Pin Number</i>	<i>Wire Colour</i>	<i>Function</i>
A	Black	Battery -
B		Not Used
C	Red	Battery +

Beacon Receiver

Mounting

Mount using the plastic mounting plate attached to the base of the beacon receiver. Do not earth the Case. The receiver mounting should be designed to allow the receiver to be mounted at either side of the vehicle, depending on which side of the track the transmitter will be located.

- Do not mount near a radio transmitter or radio transmitter antenna.
- Do not mount near the engine ignition system.

Range / Aiming

Aim the unit parallel to the road and square to the direction of travel

- For operation up to 25 m (80 ft) the unit must be within 2° of parallel to the road and 2° of square to the direction of travel.
- For operation up to 20 m (65 ft) the unit must be within 5° of parallel to the road and 5° of square to the direction of travel.

Glass

Do not aim through glass, as it will typically halve the range.

Sun Light

Unlike many other systems, the receiver will operate with the sun pointing directly into the receiving lens without affecting the range.

ID Number

The beacon receiver will only report a beacon transmitter with matching Mode, Tens and Units, unless the receiver Tens and Units are both set to

12 Beacon Receiver

zero, this special case allows the receiver to report all beacons with the same Mode setting for split beacon use. The output of the beacon receiver is encoded with the beacon number to allow the beacon transmitter number to be identified, this is normally only required for split beacon use so that the Lap Beacon may be identified.

- Turn the power off before adjusting the number, to avoid accidental damage to the electronics and to ensure that the power is cycled before use. Changing the ID switches while the power is on will have no affect until the power is cycled.
- Be careful to read the labels for the switches, located on the inside of the lid, so as to set the switches correctly.

LED

The Red LED will be ON when it is receiving a valid number.

The LED will glow dimly when receiving a signal that is the incorrect number or an infrared signal is being received from some other source.

The LED will also glow dimly if the receiver is picking up interference from the car ignition or a radio transmitter. This is undesirable and must be rectified before the receiver will operate reliably, as the interference signal can mask out the real signal which will result in missed beacons.

Wiring

The beacon receiver signal wire should be connected to a Digital Input on a **MoTeC ADL Dash/Logger** or **MoTeC ECU**

Do not run the wiring near the engine ignition system.

The receiver must be powered by 8V from an ADL or ECU. The receiver may be damaged if connected directly to battery voltage.

<i>Wire Colour</i>	<i>Function</i>
Red	8V Power from Dash or ECU
White	Signal to Dash or ECU
Black	0V Power from Dash or ECU

Output Signal

The output is an “Active Low”, open collector type, ie. it is normally off and switches to ground when a valid transmitter is detected.

Note that the output only stays low for a short period, even if the transmitter is still present.

The width of the output pulse represents the beacon transmitter number (units and tens only), and varies between 0.2 sec and 1.7 sec depending on the number.

The output is current limited to protect the beacon receiver against incorrect wiring.

ECU / Dash Setup

Setup the input pin as the beacon channel and set the logic polarity to “Low Volts = Active”.

Specifications

Electrical

Operating Voltage Range: 6V to 9V

Current Consumption: 20 mA typical

Trouble Shooting

Check List : Basic Operation

To confirm basic operation of the beacon, check the following :

1. Check the Transmitter LED

Green

OK

Orange

The battery voltage is less than 10.5 Volts, the battery requires charging.

Red

- If the battery voltage is less than 10.5 Volts charge the battery.
- If the battery voltage is greater than 10.5 Volts, return the unit to **MoTeC** for servicing.

LED Off

Check that the battery is connected correctly, Red to Positive, Black to Negative and that the battery is supplying at least 10.5 volts.

2. Check the Receiver LED

Aim the Transmitter at the Receiver and check the LED:

LED Bright

OK

Dim LED

If the LED glows dimly then check that the ID number is set correctly in both the Transmitter and the Receiver and that the power has been switched off and on since the numbers were changed. Be careful that

16 **Trouble Shooting**

the switches are set correctly, particularly on the Receiver where the switch identifications are marked under the Lid.

LED Off

Check that the receiver has 8 volts between the red and black wires. Note that the connected device (ECU or ADL) must have its power turned on.

3. Check the Connected Device (ECU or ADL)

If the connected device does not register the beacon

- Check that the wiring is OK.
- Check the software setup on the connected device.
- Ensure that the reset condition for Lap Time is not met (eg. RPM = 0)

Check List: Operational Problems

If any operational problems occur such as missed beacons, check the following:

1. Check Wiring

Check the wiring for intermittent connections or damaged wires.

2. Check Aiming

Check that the Transmitter and Receiver are aligned correctly, both must be within 2° for 25m operation or 5° for 20m operation.

3. Check Transmitter Spacing

Check that the Transmitter is at least 6m (20ft) from any adjacent transmitters.

4. Check Operating Range

Check that the unit operates at the required distance.

If the range is short:

- Check that the Receiver is not aimed through glass, as this can significantly reduce the range.
- Check that the Transmitter and Receiver are aligned correctly, both must be within 2° for 25m operation or 5° for 20m operation.
- Check that the Receiver lens is clean

5. Check Receiver for Interference Signals

Turn the Beacon Transmitter power off and check that the Receiver LED does not glow dimly under any of the following circumstances.

Note that to see the LED glowing dimly the LED must be shielded from bright light.

LED glows dimly when a radio is operating

Move the offending radio or radio antenna, or move the beacon receiver.

LED glows dimly when the engine is running

- Check that the Receiver is mounted using the plastic mounting base and that the case is not touching any grounded parts.
- Check that the receiver and its wiring are not near the engine ignition system.

