

“Bridging the Gap”: Slot.it oXigen FAQ

Updated January 2012

General questions

Q: what is oXigen?

A: The obvious answer is – an element of the periodic table, normally found in a bi-atomic (O₂) form, wrongly spelled and written with the capital letter in the wrong place.... in the slot world, however, it is a revolutionary wireless control system for slot cars which bridges the gap between digital and analog.

Q: who is developing oXigen?

A: Galileo Engineering, the company known by the brand name 'Slot.it'. The same people who developed all the Slot.it cars and accessories, the SCP-1 electronic controller in all its forms, the Live Timing box, and many other electronic stuff for toy companies in toys, industries and multimedia (Giochi Preziosi, Landi Renzo, IK Multimedia, and others).

Q: how many cars can run on the track at the same time?

A: Up to 20 cars per track in digital mode, or as many cars as lanes in analog.

Q: 'only' 20 cars?

A: Have you ever tried more than 20 cars on a track at one time? :) Technically, we could make more cars run on the same track, but feel that 20 cars per track for a maximum of 4 tracks with 20 cars each in the same wireless area is more than enough...

Q: How does oXigen work?

A: Traditional digital systems use the track rails to bring both the power and the control signals to the cars. This limits the number of cars because the more cars you want to run, the more current you must provide. However, sending control signals to cars through rails becomes increasingly difficult when large currents are involved, as it is the case with many cars. Besides, the control signals are transmitted in a very noisy environment (rails, braids, dirt, and electric arcing from motors) which further complicates things. The oXigen solution is: full power on rails, control signal from wireless 2.4GHz transceivers. So the cars get all the power they need when they need it, and the control signal stays clean.

Q: what do I need then for an O2 system?

A: First of all, a track, controllers and cars: we don't make tracks but we make fine slot cars and controllers. Then, you need at least oXigen in-car chips (O2IC), and SCP-1 controllers fitted with oXigen module. If you already have the SCP-1, all you need is the cartridge: investment in the SCP-1 is safe. With this setup you can run chipped cars as if they were analog cars. A complete digital setup requires a 'dongle', which is a 2.4GHz receiver attached on the USB port of the PC, and lane changers, that can be standard SSD lane changers, or Ninco or Carrera upgraded with the specific LC driver. A Finish Line is not indispensable!

Q: Can I really do without a Finish Line?

A: Yes. O2 has now reached the ultimate goal of a digital track without a dedicated Finish Line but with fully working Finish Line and Pit Lane features. We have devised a clever way to make the system work, count laps and lap times, detect pit lane entry, automatically reduce speed on pit lane, *without dedicated track hardware*. All it takes is placing appropriate magnets under the track, right where you want your FL and Pit lane to be, and in no time you're up and racing. It works well and saves a lot of money and complexity in the setup of the track... besides, removing a dedicated finish

line has deep implication for *multi protocol racing*.

Q: Does it have pit lane speed limit?

A: certainly. Each car's speed can be individually limited, so, once the car enters the pitlane, its speed is reduced. The feature comes basically free with the system. No specific electric hardware is necessary to activate the pit-lane. The system is smart to the point that, once the pitlane entry is detected, even if you remove the car from the rails while in the pit lane, the speed limiting remains in place until the car leaves the pitlane.

Q: What power supply does it need?

A: An adjustable power supply with enough power to satisfy your needs. 9V to 18V with at least 1A per car is what we would recommend.

Q: Is a PC strictly needed?

A: For lap counting and race management in O2 mode, yes. Other operations, like programming the car ID, and running the car alone, do not need a PC. In SSD mode, a PB is all you need.

Q: How do the cars get their ID programmed?

A: There is a specific procedure for the SCP-1: use the knobs to select the channels and program the car and the controller for a specific ID. The LED displays on the controller tell you the programmed ID. Alternatively, it can be done from the PC.

Q: Can the embedded software be reprogrammed in all the devices?

A: Certainly: reprogramming the software embedded in all the devices is of paramount importance, especially for a new technology like this one. New features can be added and software bugs can be removed throughout the life of the parts. All the components of the O2 system can be reprogrammed either through USB, in case of the 'PC dongle', or 'over the air', that is, by means of the 2.4GHz radio link.

Q: what do I need to transform the SCP-1 into a wireless controller for any system?

A: A complete SCP-1 with a standard oXigen cartridge, and an oXigen-SCP1 cartridge interface. The oXigen cartridge is of course a completely standard unit which can be used inside a full O2 environment.

Q: Does O2 support ghost cars? Refueling? Pace car? Drive through?

A: The SCP-1 already has a built-in ghost feature. Further, the oXigen protocols allow individual setting of speed, braking, and lane changing for each car. This means that the PC can reduce top speed, or reduce braking, for each car to simulate a heavier car right after pit stop. You can even force penalties (drive through pit lane) or herd all cars back to the pit lane after racing. Pit lane speed and pace car mode speed are adjusted from RMS control panel.

Questions on compatibility

Q: can I still run my analog cars on the track, with my old controllers?

A: Certainly. O2 *bridges the gap*, it is 100% compatible with your old analog track. Of course, to change lane, lane changers are necessary, but as long as they stay straight when lane changing is not requested, analog cars can be run along oXigen cars.

Not only that: the latest development in O2 takes advantage of the O2 cartridge, to turn the SCP-1 for any supported system, into a wireless, untethered controller.

Q: What protocols is it compatible with?

A: the LED protocol is based on Hornby's SSD system. In SSD compatibility mode, SSD Power Base and lane changers detect O2 cars as if they were SSD's own. The power Base does not control the car though. Note that by design, O2 cars do not recognize Hornby's rail SSD Protocol: the compatibility is at the lane changing/car detection level.

O2 is not compatible with SCX, Ninco and Carrera protocols. However, O2 chipped cars can race alongside Carrera and Ninco cars on the respective systems. Read below for more information.

Q: Does it work with Scalextric Sport Digital?

A: oXigen is a sophisticated, high performance, reliable stand alone digital system. Thanks to an agreement with Hornby, the communication protocol between the car and the lane changer / lap counter is compatible with Hornby's own. oXigen is the *only* known commercial system being compatible with Hornby SSD. Hence O2 can use existing box stock Scalextric Sport Digital LCs. Besides, if you already have a Scalextric Sport Digital track, O2 cars can be programmed as SSD cars with ID 1 to 6, and they are properly detected by Hornby's PB. You can confidently buy SSD LCs knowing that you will put them to good use in both systems. In other words: when in SSD compatibility mode, oXigen cars 1 to 6 are recognized by SSD power base as cars 1-6; any SSD lane changer works with O2 cars (yes, all 20 of them!); O2 lane changers are fully SSD compatible; under certain conditions oXigen cars and SSD cars can race together.

Q: Does it work with Ninco or Carrera digital systems?

A: A custom, simple and cheap conversion electronic board is available for these systems: it is a effective, smart, lane changer board which replaces or even works side by side with the existing lane changer driver: in other words, if you want to convert your LCs to work with oXigen (or SSD) cars, just replace the existing electronic of your Ninco or Carrera LC. The board has been designed to replace the original electronics (fits in the same space) but can work in parallel with the original unit as well: this means the racer can run his existing system, switch to oXigen or SSD, and then back to the original digital system! (some rewiring is necessary, as SSD needs its own power base, and oXigen needs a DC power. However, it is possible to have a multi-protocol LC). Or, if so desired, race oXigen together with the 'other' digital system.

Q: What! Multi protocol racing?

A: Yes, we believe that it will be possible to race in mixed environments with oXigen and Carrera digital, or oXigen and Ninco digital, or oXigen and SSD. It is obviously a major breakthrough for digital slot racing. It has already been shown that SSD and oXigen cars can race together. However, if O2 LC drivers are assembled in parallel with the existing electronics, no other change required on the wiring of the track, O2 cars can race together with Ninco and Carrera digital models, the race management glueing it all together.

Q: So I can run SSD on other track made by other brands?

A: Yes. Just replace or complement the other brand's electronic LC board with oXigen's and hook up an SSD PB to the rails.

Q: Can I use O2 cars along with SSD cars in a SSD environment?

A: Type 'a' O2 in-car module makes it possible, through an external add-on board (a bridge rectifier), to place the O2 car on SSD powered rails and race it along with SSD cars. Type 'b' will work directly on the AC system used by SSD. The only drawback is that, as we make no attempt to decode the SSD protocol, race start and stop are not under the control of the SSD base, unless dedicated sw (e.g. PCLapCounter) and a dongle are used to start/stop the race, oXigen side. O2 cars can obviously be programmed as cars 1 to 6 only to be detected by the SSD powerbase.

Q: Can I use O2 parts within SSD?

A: Yes, O2 Lane Changers are SSD compatible.

Q: is the RMS software available for anything other than MS Windows?

A: The software tool that we use for writing the RMS is available for Linux and Mac as well. Our company works mostly on Linux PCs, but the world doesn't, so we developed a Windows RMS version first. Hopefully we will also release Linux and Mac versions (at a certain point). The dongle protocol will be disclosed free of charge. As far as the PC is concerned, the dongle is only a serial port. The Slot.it RMS has grown into a well structured and capable software, which is available for free. Some features, like fuel based racing management, are left to the external developers' RMS, like PCLapCounter.

Q: will any of the existing RMS programs be compatible with O2?

A: PCLapCounter supports oXigen.

Q: can I use my analog cars with O2?

A: On the same track, O2 can peacefully coexist with analog cars, but of course to run digital races with all that's involved you need to run the chipped cars. However, please read the "SCP-1 cartridge radio interface" section to see how O2 can turn any SCP-1 in a remote wireless controller.

Q: is O2 compatible with the Slot.it Live Timing (also known as Telemetry) Box

A: Yes: a Live Timing Box mounted on an oXigen SCP-1 in an oXigen world behaves just like a Live Timing Box mounted on an analog SCP-1 in a standard analog world. In addition, there is no need for the track interface box.

Hardware components: PC 2.4GHz interface (dongle)

Q: What is the 'dongle'?

A: a USB small key which plugs into any USB port and glues all the parts of the O2 system together with the SW running on the PC.

Q: is there a specific software?

A: Yes, the RMS sw speaks to the dongle which in turn speaks to the various parts of the O2 system: FL, LCs, and controllers.



O204a

Hardware components: in-car chip module (ICM)

Q: is the in-car chip be specific to Slot.it cars only only?

A: Certainly not; but for ease of design and testing, we have started with the traditional Slot.it shape: part is O201a. The 'b' version, code O201b, is universal, including Slot.it cars that are too small for the current PCB.

Q: can the car detect SSD rail code?

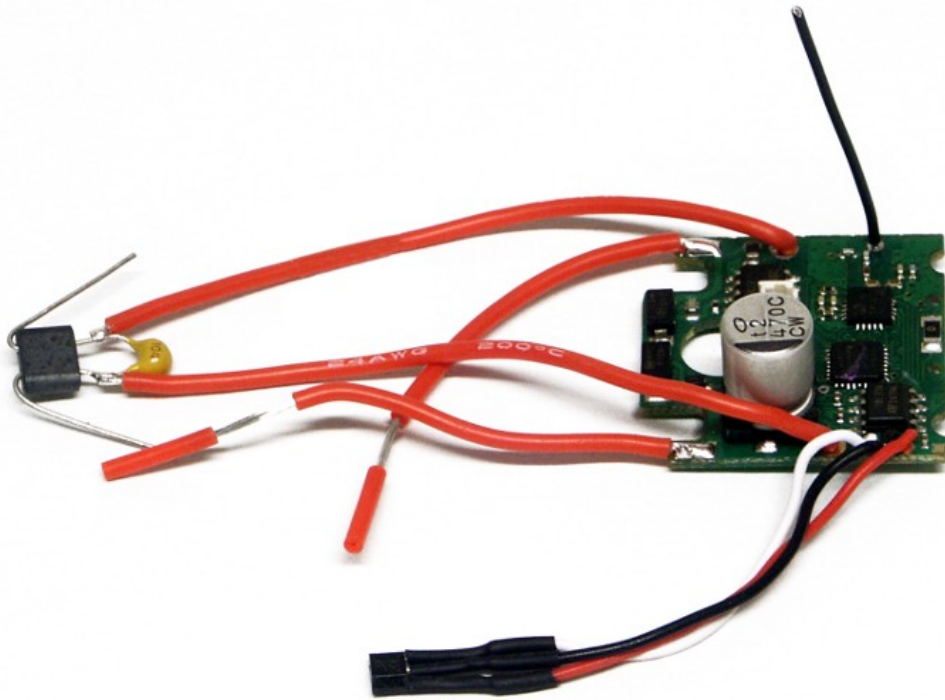
A: No. And no Ninco, SCX or Carrera either.

Q: what are the operating limits the in-car chip can withstand?

A: Current: 3A continuous, 6A peak at least. Voltage: 9 to 18V.

Q: does it have a lighting system, and if so, how is it operated

A: yes, it is compatible with Slot.it's lighting system SP16. Lights can be remotely operated from the SCP-1 buttons



O201a

Hardware components: Controller (SCP)

Q: is it a specific controller?

A: No, it is an SCP-1 with dedicated cartridge. The cartridge receives the operating data from the top part of the SCP-1 and sends it to the car.

Q: can I use my old SCP-1?

A: Yes.

Q: can I use my SCP-1 Live timing (telemetry box)?

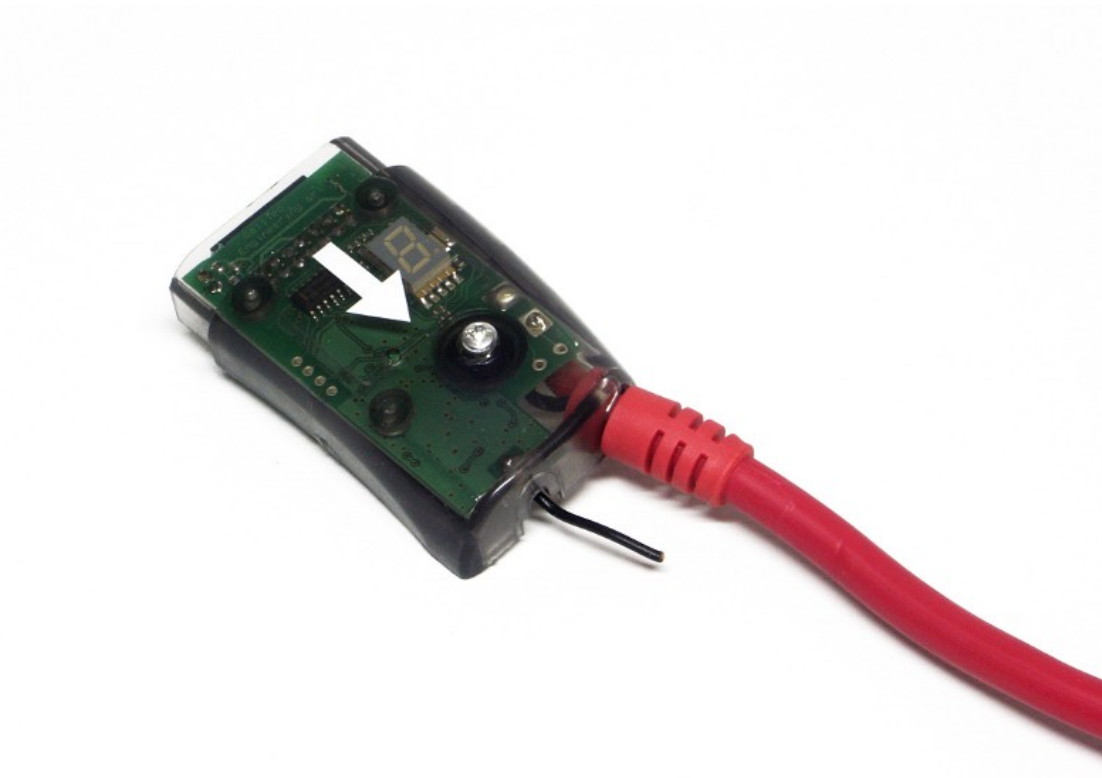
A: Yes, it is compatible with O2.

Q: can I use any other controllers?

A: No. At least not for now.

Q: do I get curves, selectable braking, antispin, telemetry...?

A: Everything the SCP-1 can do, is transferred to O2. Selectable curve(s)/linear mode, power reduction, adjustable braking, ghost mode, selective lane change, telemetry and lap timing audio playback compatible...



O202a

Q:can it be battery operated (untethered)?

A: Yes, battery power is not an issue anymore: take a look for example at <http://www.batteryjunction.com/> : the choice is simply mindboggling.

We are designing an external piggyback case which will contain the necessary batteries (6*AAA rechargeable NiMh) and recharge circuits.

In any case, a standard 9V transistor battery, rechargeable or otherwise, can be used. Lithium 9V rechargeable batteries are on the market already , with a capacity of 500mA which guarantee, with their flat discharge, several hours of continuous use and zero live operating costs. The first generation of SCP-1 (1.0) needs at least 8 V to operate, so NiMh 9V batteries can only be used if rated at 9V, not 7.2V or 8.4V. The latest SCP-1 operate down to 6.1V, extending the hours of use of the battery (and the number of cells needed) considerably.

Another option are 7.4V Lithium packs - very convenient and last a long time.



O205a

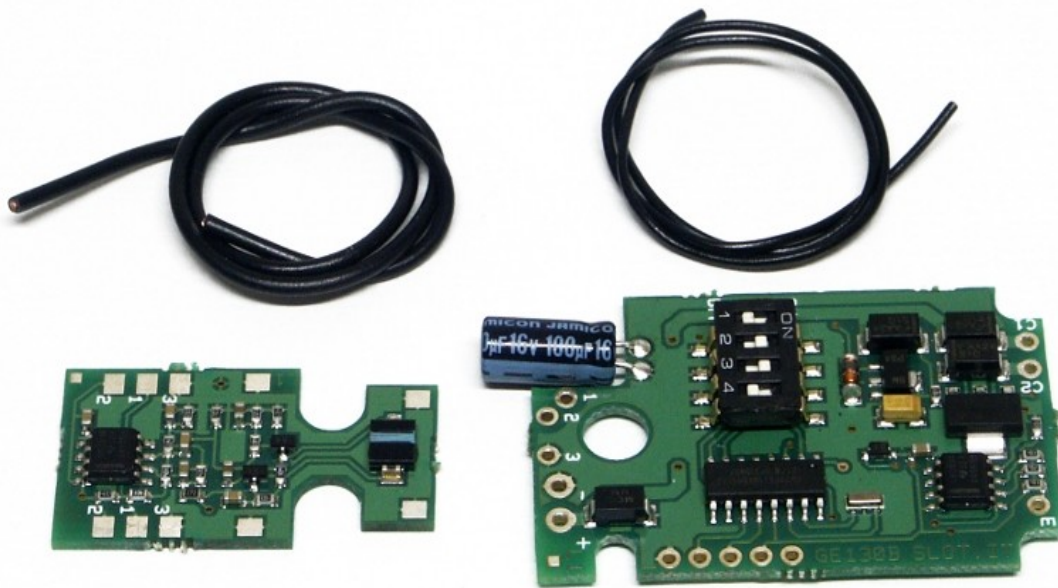
Hardware components: Lane Changer driver (NCDB)

Q: what does it do?

A: It replaces or complements the original LC driver board in Ninco or Carrera lane changers, to adapt them to O2 and SSD lane changing protocols. It is necessary if you want to use oXigen or SSD on these other two tracks.

Q: what is it?

A: A small printed circuit board, shaped to fit exactly under the plastic cover of the above said Lane Changers.



O203a

Q: can SSD Lane Changers be used?

A: For Scalextric Sport tracks, Hornby SSD Lane changers are a perfect first choice. Reliable and reasonably priced, they can also be integrated into Ninco tracks by commercial Ninco and Scalextric track adaptors.

Q: how is the car detected?

A: By decoding the LED code

Q: can LCs from other makers be used?

A: For Ninco and Carrera, a custom, simple and cheap conversion electronic board (NC Driver Board) has been designed: it's a small board which replaces or even works side by side with the existing lane changer driver: to convert existing LCs to work with oXigen (or SSD) cars, just replace the existing electronic or install it alongside the existing unit to run your existing system, switch to oXigen or SSD cars, and then back to your original digital system. The shape of the board has been designed as an easy retrofit inside the existing LC. No external boxes, wiring, *velcroing* ...

Q: what sort of skill is needed to update existing lane changers to O2?

A: soldering, common sense, and a screwdriver.

Q: do these board enable 'selective lane changing'?

A: Yes.

Q: what is the 'Selective Lane Change'?

A: when driving a digital car, fast approaching a lane changer, the decision which must be taken is either to stay on the lane or change... but to which one? Is the next LC going from, say, lane 2 to 3, or from lane 2 to 1? From lane 4 to 3 or from lane 4 to 5? Anyone racing with digital slot car systems knows that it takes a long time to master the circuit well enough to know where each lane changer leads to, lane by lane. Well, the O2 native LC board, together with the SCP-1, offer this unique feature: want to change from lane 4 to 5? Press the UP button. Want to move to an inner lane? Then press the DOWN button on the SCP-1. Want to change, no matter the direction? Press both UP and DOWN at the same time.

It works like this: each Lane Changer can be 'instructed' by DIP switches whether crossing from right to left moves you to the inside or the outside of the circuit, and viceversa. So that when you reach the LC with the DOWN button pressed, if you are on the, say, left lane, and the LC knows that a LC from left to right brings you to the inner lanes, it will change lane for you, else, if it knows that the same left to right change moves to an outer lane, it will not.

Actually when we designed the SCP-1 we put in two LC buttons imagining that some day some big company would build a digital system with this feature built in, and we could make it compatible – we could not imagine we would have used it for our own digital system.

Q: are there O2 specific lane changers (track pieces)?

A: Slot.it is developing oXigen lane changers for Scalextric Sport, and Ninco tracks. For Ninco, it is a large investment requiring many moulds. Hence the NCDB (Ninco/Carrera driver board) is probably the most cost-effective way to get started.

Q: what sort of skill is needed to assemble these lane changers (track pieces)?

A: None, these parts will be compatible with standard track pieces.

Q: do the lane changers send radio signals to the car?

A: no, it is not necessary, because it would currently just make things more complicated. The O2 architecture is based around a server (the PC through the USB 2.4GHz dongle interface) with a lot of distributed intelligence in the nodes (controllers, cars, LCs). If a specific action must be taken on a specific car (e.g. drive through, speed reduction...), the nodes know what to do.

Q: can I use the car without a PC?

A: Certainly. The PC is there to count laps, start/stop races, etc. The O2 cars can be used on a standard analog track as well.

Hardware components: SCP-1 cartridge radio interface (optional, CRI)

Q: what does it do?

A: It enables radio, wireless communication between the hand controller (SCP-1 only) and *any* system in the world – analog or digital, as long as there is a standard SCP-1 cartridge for it. If you have a SCP-1, no matter for which system, you can turn your controller into a wireless controller.

Q: what is it?

A: A small module, a pocket size receiver which plugs directly into *any* SCP-1 cartridge, regardless of polarity and type. It comes with a small plastic case which secures itself on the cartridge (think of it as the middle half of the SCP-1 controller). It connects by 2.4GHz radio link to the oXigen cartridge which is plugged into the controller, and transmits in real time the power, brake and any other commands (lane change, lights, etc.) coming from the controller to the cartridge, thus creating a wireless, remote control SCP-1 for all the SCP-1 supported systems: analog (common ground or common positive), and digital (Hornby, Carrera, Ninco, SCX).

Q: do I need it to run a full oXigen system to have this?

A: Not at all. This is independent of the O2 system but takes advantage of the O2 cartridge and technology.

Q: So to make my existing analog or digital system wireless what do I need exactly?

A: SCP-1 throttle, oXigen standard cartridge, oXigen radio interface for the cartridge, SCP-1 cartridge. In other words: a complete working SCP-1, an oXigen cartridge and an interface.

Hardware components: Start/Finish lines (FL)

Q: A system with no FL?

A: Yes. We have been able to reach this goal which dramatically reduces cost and complexity. You can place your finish line and pitlane wherever you want. Just place magnets where you want it to be.

Q: Why then do I need a F/L at all?

Please note: during the course of development we've found out that the system based on magnet detection works so well that development on the SSD finish line was paused as it is completely unnecessary for oXigen. It may resume in the future, if there is enough interest from people running SSD. This is why this chapter is grayed out. Keep this in mind when reading below.

A: If you plan to run SSD cars on the same track, and want to extend it to more than 6 cars and two lanes with oXigen, then a FL is necessary.

Q: Why a dedicated unit and not using any of the LCs?

A: Keeping LCs separated from the FL has paid off as it enabled us to make low-cost LCs and FL-less systems. A do-it-all board would have driven costs much higher.

There might be specific cases though where a separate FL would be necessary:

1. A separate analog lap counter is anyway necessary to run analog races on the very same track: oXigen's FL can do that, as well as counting SSD and oXigen cars. So, in this case, a O2 FL may be the most cost-effective way.
2. If you plan an hybrid SSD/oXigen system, you can use either Hornby's Power Base, limited to 6 cars and 2 lanes, or use oXigen's FL with up to ten lanes and 20 cars.

Q: how is the car detected?

A: For systems comprising the FL, it works like this: O2 lap counting works with LEDs the same way as SSD does, but with an extra sensor, whose purpose is to raise a warning should any cars cross the line without being properly detected. The RMS or the race director can then take appropriate actions. This extra sensor (IR barrier for pickup detection) is used for analog racing lap counting as well as speed measurement for digital cars.

Q: how can I use the FL line within SSD?

A: O2 finish lines properly detect Hornby's SSD cars 1-6. The PC dongle works with the RMS to display lap counting. This actually gives to SSD the possibility of using more than two lanes for lap counting.

Q: So what cars can O2's FL line detect?

A: It detects up to 20 different oXigen cars or 6 SSD cars, and analog cars as well, for up to 10 lanes. In other words it can be used as an oXigen SF, an SSD FL for more than 2 lanes, or a traditional analog FL. In most cases, the O2 FL line requires a PC interface (dongle) and an O2 race RMS, but something might change here to make matters even more simple.

Q: what brands are you making the FL line for?

A: oXigen gets rid of a dedicated finish line, and the oXigen detection works exceptionally well, so currently we have halted any developments on the LED based FL detection. It may continue for SSD tracks in the future, but certainly not for other tracks.

Pricing (*preliminary, might vary*) in EU – retail

<i>Item</i>	<i>Code</i>	<i>Suggested retail, EU incl taxes</i>
Dongle	O204a	89,00
In-car chip	O201a	35,00
SCP-1 oXigen cartridge	O202a	75,00
Lane Changer Converters (NC)	O203a	29,00
9V Battery case	O205a	5,90
Advanced RMS sw		0,00

The complete SCP-1 for oXigen will retail for about 110 EU.

Q: Does this *include shipment and taxes*?

A: Yes of course. There are no hidden extra charges – we publish retail prices at your preferred shop. *Please keep in mind that these prices are preliminary and might change.*