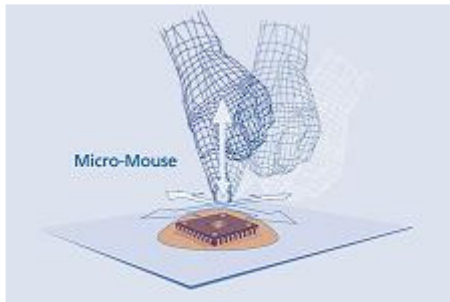


FAQs

Purpose

This article helps in better understanding and using the HALIOS Eva-Kit (dated Dec. 2007) based on 909.05 asic. It reflects questions raised by customers and up to now. It also contains hints on writing own software for the device.



FAQ - Regarding Optoelectronic Systems

- **Optoelectronic general**

What are the advantages of optoelectronic sensors?

Active emitting optoelectronic sensors measure the influence one environmental parameter might have on a signal transmitted actively by the sensor, in this case light. Active sensors have the advantage of generally showing a better relationship of signal to sound than passive sensors, as active sensors are able to determine the measurement signal in appropriate mode and intensity themselves. An additional advantage of the use of active light sensors for such measurements is that active light reacts to the influence of many different materials in a very characteristic way. Optoelectronic sensors are therefore able to identify anything visible to the human eye. They are even able to detect wavelengths and contrasts not visible to the human eye and are therefore the best choice for precise and contact-free measurements.

What are optoelectronic components?

Optoelectronic components are building an interface between the electric and optical transfer of signals. Components transforming power into light are called emitters in this context. MECHALESS Systems is here using LEDs in visible and invisible wave length ranges. Components transforming light into power are called receivers. Although in most cases the receiver is a photodiode, it is also possible to use LEDs

as receivers. For more physical background information, please refer to the link downloads on the Mechaless homepage (www.mechaless.com).

What are optoelectronic input devices?

There are numerous ways to realize the man machine interface (HMIs). One of these is to use optical sensors. They are capable of evaluating the movement of e.g. a finger by detecting and interpreting the reflexive influence the moved part exerts on emitted light. The sensitive area can be restricted to a narrow field by forming the light distribution skillfully. Supported by modern algorithms in signal processing the detection can be robust at a very high resolution. Consequently optoelectronic input devices are not only able to detect a direct touch of the sensitive area, but are already recognizing gestures (e.g. approaching objects).

Is it possible to simulate a mechanical usage, for example a haptic effect, when using optoelectronic sensors?

One disadvantage of optoelectronic input devices is that they are often not giving any direct feedback. Therefore the reaction of the input device, like for example the activation of a push button needs to be reported to the user instantly. This feedback can for example be given via a color change of the background light, via sound feedback, via vibration or via a change in the screen layout of the display. For better orientation the finger is assisted by a slight dent or dome indicating the location of the sensitive area. The kind of feedback the user should receive when operating the device can be chosen according to the specific application, providing greater flexibility and value to the user.

What are optoelectronics?

The field of optoelectronics includes electronic circuits transforming electric information into light and vice versa. To do so, special electronic devices are used. Due to their physical operating mode, these devices are instantly connecting an electronic or electronically influenceable value to light (e.g. LEDs, laser, photodiodes, light-dependent resistor, CCD-arrays). The field of optoelectronics includes all kinds of optical displays as well as systems for optical signal transmission and optical sensors, like for example cameras. At the same time, the field of optoelectronics is as old as the one of electronics itself. Therefore the optically gauged phonogram of a movie is one of the oldest sound storing systems. In the last few decades, however, an immense progress in the field of semiconducting lasers took place. Therefore today in nearly all areas of data transmission fiber glass is used instead of the traditionally used copper wires. The use of optical sensors as cost-efficient, contact-free sensors, however, is only at the starting point of a rapid development. The aim of MECHALESS Systems is to push this development forward.

- **HALIOS®**

What does the word HALIOS® stand for?

HALIOS® is a registered trademark representing a word creation consisting of the words **H**igh **A**mbient **L**ight **I**ndependent **O**ptical **S**ystem. Thus the name of this optical system, developed by MECHALESS Systems, already expresses its perfect independency against influences of ambient light.

What advantages does HALIOS® have?

The HALIOS® principle is able to considerably increase the interference resistance of optoelectronic sensors. Besides an improvement of the signal to noise ratio, a total insensitivity to influences of ambient light conditions is reached. It is therefore possible to use optical sensors in areas, where up to now only other sensor principles were used.

In what kind of products can HALIOS® be implemented?

The HALIOS® technology is an improvement of any sensor based on reflection or absorption. Therefore the HALIOS® technology can be implemented in any products, using conventional optical sensors (e.g.: light scanner, light barrier). Due to a clear improvement of the signal to noise ratio and the complete elimination of influences of ambient light conditions, the HALIOS® technology makes it now possible to use optical sensors in application areas, which had been closed to optical sensor principles until today. Especially capacitive input devices can now be replaced by HALIOS® products, as moisture and water do hardly influence HALIOS® input devices in any way.

What kind of materials can be used, which materials are usually used with the HALIOS® technology?

The HALIOS® technology is working with light (in general IR light). Therefore the surface has to be, at least partly, light transparent for the light wavelength used. When using infrared light, it is possible to use opaque materials which are not transparent to the human eye. Typical materials here are acryl in various different colors and with various different surface structures, polycarbonate, polystyrene and many other synthetic materials. Of course even glass in many different colors can be used. Many colors and lacquers are also sufficiently transparent to infrared light to make the use of the HALIOS® technology possible. Metal oxide vaporized mirrors can be used as substitutions for metallic surfaces. As a special service MECHALESS Systems offers the measurement of customer specific samples of materials in its own optic lab.

What makes HALIOS® resistant to external influences?

The HALIOS® principle is a closed control loop, eliminating the characteristics of a photodiode. Specially developed evaluation algorithms are compensating any kind of drifting. Therefore the HALIOS® system is resistant to age effects, temperature and scratches on the surface.

What kind of functionalities can be realized with HALIOS®, what possibilities are there to initiate these functionalities?

With HALIOS® sensors it is possible to identify movements of objects (e.g. parts of a body) in close and far distances to the sensor. The sensor is able to distinguish different kind of movements, e.g. in direction or speed. The HALIOS® sensor can therefore recognize standard movements like tapping, turning, pushing, pulling, and wiping. Due to a high sensibility of the sensor, even the slightest differences in contrast can be identified, making expensive camera systems less and less relevant. Furthermore, whole rooms and room sections can be monitored using sensors for long distance detection.

Is it possible to measure distances using HALIOS® sensors?

HALIOS® sensors are working either absorptively or reflexively. If the sensors are working reflexively, the value of the output signal is dependent on the surface structure of the object and the distance between the sensor and the reflecting object. In this case, it is possible to detect a movement of an object, but not its absolute distance to the sensor.

When using absorptive sensors, the light is taken away by the object. A suitable alignment allows measuring the relative position of the object to the sensor. With the use of more than one HALIOS® sensor distances can be detected even in a reflexive configuration by using the triangulation method.

Are there any external factors, which are influencing HALIOS® sensors?

Thanks to HALIOS® the sensors are totally immune to ambient light influences of any kind, temperature changes and changes concerning the surface structure (scratches, condensation). HALIOS® sensors can be used at temperatures between -40°C to 85°C.

Other temperature ranges are quite conceivable, but would have to be tested according to the specific application.

What is the difference between optical sensors based on the HALIOS® principle and conventional optical sensors?

The HALIOS® principle eliminates any changes in the sensitivity of the photodiode caused by ambient light or temperature changes. Therefore optoelectronic sensors

based on the HALIOS® principle are particularly resistant to any influences of ambient light conditions (sunlight, flashlights, neon lamps) eliminating the need of using optical filters or any other kind of adjustment. Furthermore in many cases special calibrating circles to blank the background are dispensed with. Using the HALIOS® principle the photodiode only has to provide the information which LED (sending LED or compensator) is emitting more light. Therefore the receiving path can be set up highly sensitive. Thanks to the high sensitivity of the HALIOS® systems they are able to enter domains which until recently were only realizable under laboratory conditions. Depending on the optics, it is therefore now possible for standard LEDs to realize movements within a scope of 0-5 m.

Compared to conventional light barriers, HALIOS® systems are able to improve the signal to sound ratio by a power of ten. This improvement can then be used to either increase the functional reliability or the scope or to dispense with expensive interference filters. Therefore any active optical sensor profits from the use of the HALIOS® principle, as well as in its robustness against disturbances as in its sensitivity.

Are there already any HALIOS® applications on the market?

More than 6 Mio HALIOS® applications worldwide in the most disparate areas are proving everyday their high sensitivity and at the same time their high level of robustness.

• MECHALESS Systems GmbH

What does the company name "MECHALESS" mean, what does it stand for?

In course of the fast development of the computer technology, one element nearly stayed the same, the keyboard. Today it is still consisting of mechanical keys. The mechanical keyboard, as well as other outmoded input devices inspired MECHALESS Systems to develop and create input devices operating intuitively and abrasion free. This idea led to the creation of the company name "MECHALESS" being a composition of "Mecha", short for mechanics and "less". The name MECHALESS is registered trademark of MECHALESS Systems in Karlsruhe specializing in the development of products with less mechanics, respectively products without any moving parts.

What kind of service does MECHALESS Systems offer?

MECHALESS Systems supports its customers during the whole product development phase with its know-how in order to guarantee that the HALIOS® technology is integrated optimally in their applications. MECHALESS System calculates, simulates and builds prototypes, writes software algorithms for an optimal signal analysis and assists with the specification or rather the layout of the hardware. The service of MECHALESS Systems even includes the support and monitoring of the development of an application specific integrated circuit for mass production

(ASIC). This will be developed, produced and supplied by ELMOS Semiconductor AG in Dortmund.

Is it possible to implement particular customer preferences, when creating new products?

MECHALESS Systems, consisting of a large, motivated team of specialized engineers is able to rapidly and flexibly realize customer preferences at a high level in the company's own workshop.

Which role does the producer of semi-conductors ELMOS Semiconductor AG play in this context?

Elmos Semiconductor AG is the major shareholder of MECHALESS Systems since the end of 2003 and producer and supplier for all HALIOS[®]-ICs.

Are standard ICs available or do customers have to order ASICs?

The following standard ICs are available:

E909.01	Optical Switch with proximity function in close-up range
E909.05A	Multifunctional optical input device sensor (3DHMI, proximity function in approx. 0-3 m)

For more details please see separate HALIOS[®] IC-Information.

FAQ - Software Development

• Toolchain

Are there any additional tools (compilers, etc.) or software that is needed to purchase to do own software development for HALIOS?

There is a Programmer Package available for this eva-kit that contains the hardware required for flashing the HALIOS chip on the eva-board. Together with the complete software development toolchain that comes with the EVA-KIT-CD (intergrated development environment from IAR System modified for HALIOS development, a device-driver for the parallel-port JTAG adapter, HALIOS docu+libraries and an additional FLASH-tool) you are able to develop your own software and flash it to the HALIOS asic.

Note: The IAR IDE is a full featured 30-day-test-version that must be upgraded after 30 days from activation date for further usage.

Is it possible to use the cost-free "IAR Quickstart Version" available from the IAR website?

Because of the built-in code-size restriction (4 kByte of code) of this version it is not possible to use it together with the necessary HALIOS libraries.

What are the requirements (OS, other) to run the software development toolchain?

The IAR IDE runs on Windows 2000 and Windows XP. The EVA-KIT-CD contains a complete toolchain consisting of an intergrated development environment from IAR System modified for HALIOS development and an additional FLASH-tool. There has to be a parallel-port (port-addr. 0x378) in your pc in order to use the programming adapter. There is an PCMCIA-adapter solution available for laptops without parallel-port on request. Windows Vista is not supported right now due to a Vista parallel-port-driver problem.

• Flashing

ATTENTION!!!! - The JTAG-interface is very sensible. When the flash-tool echo is

JTAGfunc: Get device successful...

and then some errors occure check your scematic of some parasitic circles at the JTAG-pins. This can be:

- Any other MCU connected to GPIO 2..5 --> bring other MCU to tristate or cut connection
- Some pull-up or pull-down resistors or any capacity
- Any gate of a FET connected dirctly without any resistor (> 1kOhm)

How can i flash new software/updates to the micro-controller?

The programming interface of the asic is JTAG. There is a Programmer Package available including necessary hardware to flash the device via JTAG. If you like to create your own FLASH-concept please note: while flashing TMODE-pin has to be on high-level (DVDD = 2.5V).

Is "in-circuit-programming" possible?

Yes, see "*Programmer Package*" (Page 11 of 12).

I need "end-of-line"-flashing for mass-production. How can it be done?

There are several options available. Please contact ELMOS Semiconductor AG via halios-kit@elmos.eu for further details.

How long will it take to flash the device?

It depends on the application's size - usually seconds.

When I tried to flash my eva-board it says: "Clock sync failed" or "Get device failed" - What shall I do?

Please turn switch SW501 from PC to SA in order to allow proper JTAG-handling over the GPIO-pins.

• Hardware

My laptop has a parallel-port via docking station, but the flashing tool has problems to flash the software into the asic - what went wrong?

Some laptops (some Lenovo models like the T60 for example) have a synthesized parallel-port - that means there is no standard parallel-port chipset or the port is connected via USB etc. This may lead to incorrect timing behavior. There is an PCMCIA-adaptor solution available for laptops on request - please contact halios-kit@elmos.eu.

• Software

How can I use the HALIOS functionality in my own software on this device - is there an example project available?

Yes, on the HALIOS Evaluation CD you can find three projects in the following folders:

```
[EVA-KIT-CD:] \doc\firmware_and_usb  
[EVA-KIT-CD:] \doc\haliostools  
[EVA-KIT-CD:] \doc\coordinates_3d
```

Please start the IAR Embedded Workbench with a clean workspace and load into this workspace the requested projectfile:

```
[EVA-KIT-CD:] \doc\firmware_and_usb\e90905_app.ewp  
[EVA-KIT-CD:] \doc\halios_tools\halios_tools_app.ewp  
[EVA-KIT-CD:] \doc\coordinates_3d\c3d_app.ewp
```

Does the HALIOS product come with predeveloped software and we only change parameters?

Yes, it is possible to do so. In the E909.05A on the HALIOS Evaluation Kit the "Coordinates 3D"-software is flashed in. With the HAcO PC-Software you're able to configure the HALIOS parameters and the UserSpace of the Firmware. For further information please refer to the following documents that can be found in the following location on the HALIOS EVA-KIT-CD:

```
[EVA-KIT-CD:] \pdffiles\firmware_spec_v03_00.pdf  
[EVA-KIT-CD:] \pdffiles\halios_tools_v03_00.pdf  
[EVA-KIT-CD:] \pdffiles\coordinates3d_v03_00.pdf
```

I would like to make changes to the HALIOS pre-defined software on the device. What project do i have to start from?

Please copy the folder

```
[EVA-KIT-CD:] \doc\coordinates_3d
```

to a place on your hard-disk, where you want to make your software-development. Then start the IAR Embedded Workbench with a clean or available workspace. Add the project by opening from main-menu: Project, Add Existing Project... and choose the file

```
c3d_app.ewp
```

from the folder you just copied and this project is added to your workspace. Make this project the active project if necessary (right-click on the root-folder of this project in the workspace-view and select Set as Active). This is the project that generates the pre-defined software. It's a good start for your own experiments.

I got an "Error[e117]: Incompatible runtime models" when using the HALIOS support libraries in my own projects. What is wrong?

It looks like you are not using the provided IAR development environment (Version 3.42). The libraries are generated to be used with this version of IAR. Please install the supplied version or - if you purchased the newer IAR Development System Vers. 4.11 - request an updated set of libraries from halios-kit@elmos.eu.

- **Device**

What is the EL16 micro-controller core? Is this an Elmos specific device?

Yes, it is an ELMOS specific micro controller device.

Is there in-circuit debugger for this device?

There is no in-circuit-debugging option. Software debugging is possible by setting a signal or printing data to an i/o-component.

What application code size is possible?

The 909.05A has 3 kByte (1.5k * 16) SRAM and 32 kByte (16k * 16) FLASH and a 8 MHz clock (typ.).

FAQ - Applications

What does "AutoCalib" in the HALIOS software?

AutoCalib is a function member of the HALIOS-tools-library: it automatically adjusts the compensator-offset so the pre-defined quiescent value could be kept as accurately as possible. It is activated in the eva-kit software implementation and runs every 5 min. while the sensor is in idle state (not part of the standard firmware). Note: the optimal way of calibration depends on the application requirements.

Is the Timer-ISR wake-up able?

No. When the e909.05 goes to OFF MODE the Timer-ISR-Event is not able to trig. The function haliosWaitForTimer() controls the system mode in depending on the elected CommDevice in function haliosSetCommDevice:

STANDBY MODE: HALIOS_NO_COMM, HALIOS_I2C_SPI, HALIOS_SPI

OFF MODE: HALIOS_I2C

I2C only Slave?

Yes. The e909.05 contains only an I2C-slave-module.

Is it possible to save single bytes in the FLASH?

No. You can only erase pages of 512 bytes.

Where does the firmware-lib store the parameters when it was flashed?

The parameters are at 0x8000 - 0x8200 saved. The function `devceRestoreSFR()` check this area and restore SFR and USERSPACE if ther is something usefull.

Coding Restrictions

There are some coding restrictions for customer software development on the HALIOS eva-kit:

- It is recommended to use the documented callback-concept introduced by the HALIOS libraries for proper operation.
- In STOP mode only the I2C and Wakeup interrupts are active, all other interrupts are not able to wake up the processor. This means that in STOP mode the Timer 1 module, the SPI module and the HALIOS module are not active.

Programmer-Package for Customer Software-Development

The programmer-package is designed for customer software-development purposes with the HALIOS eva-kit. It contains

- the JTAG-Adapter (requires standard pc parallel-port on addr. 0x378)
- updated software and information as available
- installation-manual
- eva-kit board update service (it is necessary to send in your eva-kit-board for a hw-upgrade)

Please note: this package requires the HALIOS EVA-KIT-CD that contains a complete (time limited) toolchain for customer-specific software-development. The toolchain based on IAR Development System Version 3.42A and is a 30-days-limited version for evaluation purposes. It can be upgraded from IAR to a full unlimited version.

For laptops without a standard parallel-port there is a PCMCIA-based option available to connect to the JTAG-adapter. Please contact info@mechaless.eu

Update-Service

If you want news and updates about the HALIOS product, please drop a note to info@mechaless.eu.