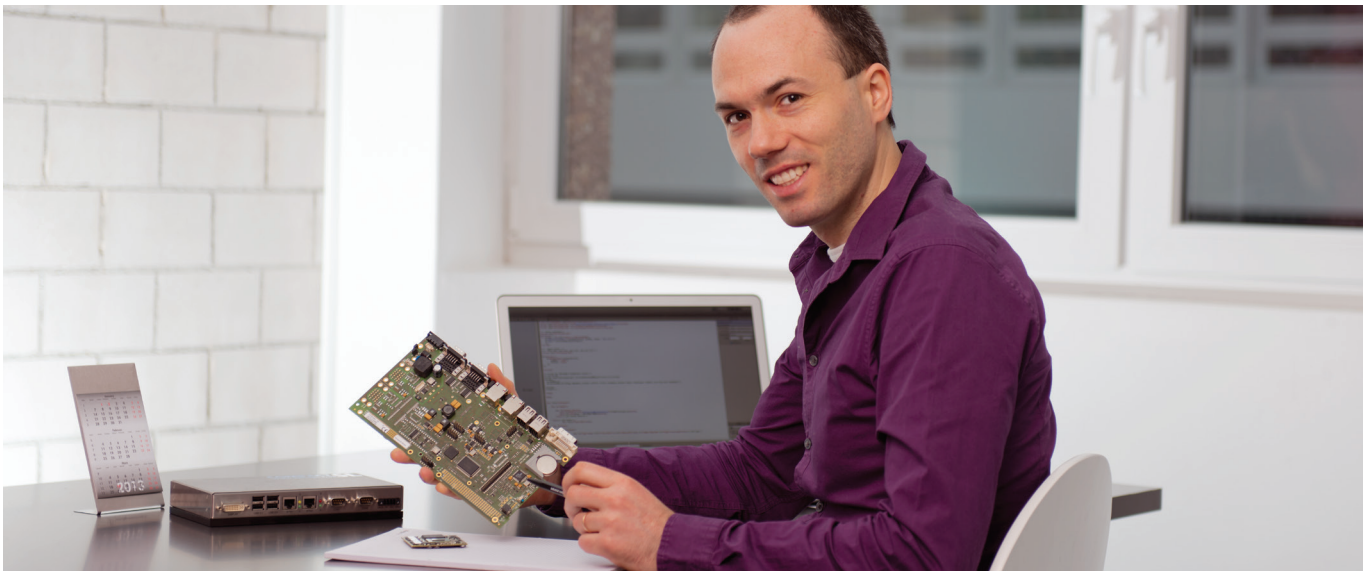
syslogic



Syslogic White Paper

The intelligent power management system of Syslogic industrial computers

1 Introduction

The Embedded Box PCs by Syslogic are developed and manufactured for heavy-duty industrial applications. Their entire concept is designed for high functional reliability in adverse conditions: they are compact and have no fans, solid state drives instead of hard disks, and processors with low power dissipation. Other features that guarantee reliability include the integrated temperature monitor and intelligent power management system (IPM). Using an additional micro-controller, the IPM ensures defined shutdown management, even when the overall system is switched off like a machine. This effectively prevents data loss.

1.1 Function of the intelligent power management system

Interruptions or fluctuations of the power supply of a control computer during startup or shutdown can cause data loss and database corruption. To prevent this, many control computers are equipped with an IPM system. While most manufacturers provide this system as an external module, the embedded specialist Syslogic integrates its intelligent power management in the CPU. This is considerably easier and faster than installing additional hardware.

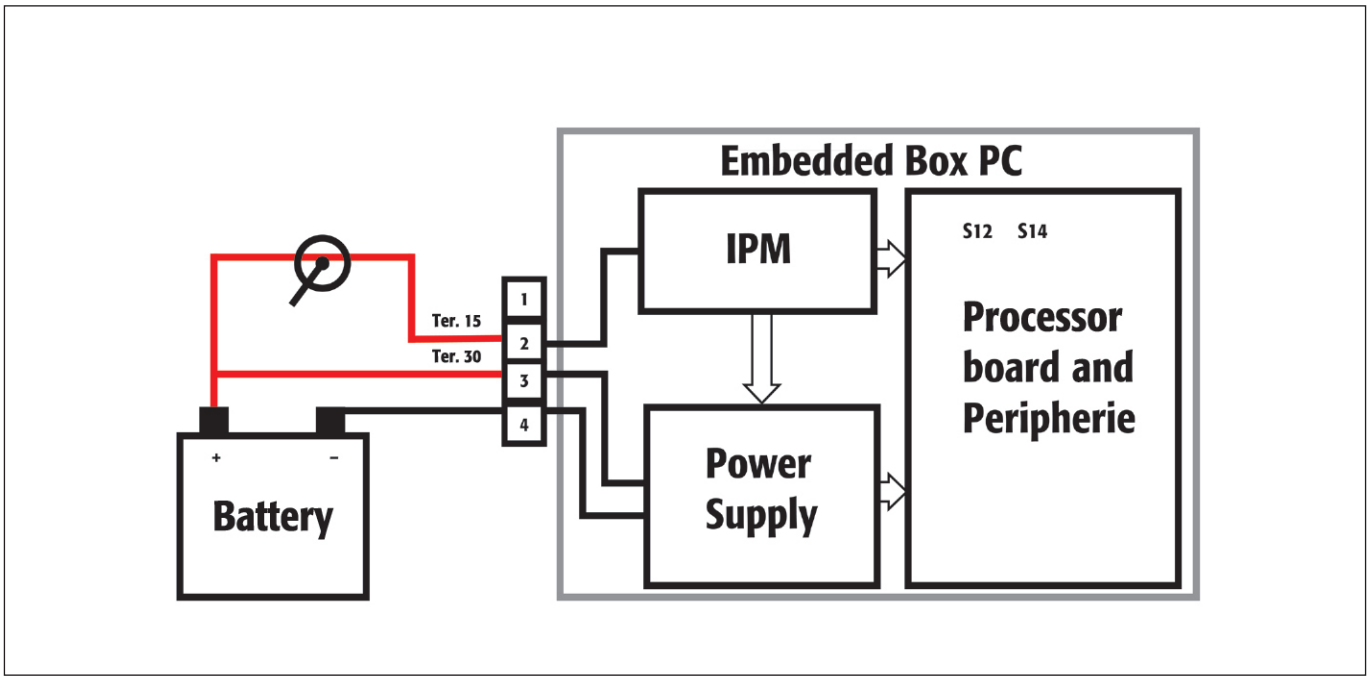
An additional micro-controller ensures a defined state of the embedded computer

The intelligent power management consists of an additional micro-controller on the CPU of the embedded computer. This micro-controller provides an input signal that initiates 'power on' or 'power off'. Using the coding switch S12 on the CPU, the IPM can be used in one of two different modes: power fail or remote control. The coding switch S14 can set the delay times in remote-control mode.

Mode	S12 coding switch	S14 coding switch	Note
Default	2	0	IPM is not used, Pin2 PowerIn (PF) is left unconnected
Remote control	1	1 … F	Remote control signal to Pin2 (PF)
Power fail	2	0	Power fail signal to Pin2 (PF)

Intelligent power management alone cannot guarantee smooth startups and shutdowns. In addition, an uninterruptible power supply (UPS) or a positive pole are needed. The following section explains the two most common applications for intelligent power management: in combination with a positive pole in a vehicle computer and in combination with an UPS in a machine control system.

2.1 Vehicle computer with a positive pole (battery) and an intelligent power management system (IPM)



Embedded computers in vehicles are usually only actively required while the vehicle is in operation. Outside of those periods, the embedded computer remains in standby mode and draws minimal energy from the vehicle battery. This prevents a deep discharge of the battery.

The start and stop of the vehicle and activation and deactivation of the ignition are stored as fixed events in the intelligent power management system. The IPM, i.e. the micro-controller upstream of the internal power supply of the CPU, ensures that the vehicle computer is in a defined state permanently. This means that it debounces supply fluctuations, which can occur during the first fractions of a second after ignition. The vehicle computer only starts up once the voltage is stable.

When the vehicle is switched off, the positive pole maintains the infeed. The intelligent power management ensures that the vehicle computer is shut down in an orderly manner and goes into standby mode afterwards.

Combining a positive pole with the IPM ensures the defined state of the vehicle computer even if the ignition is turned on and off again immediately. The initiated startup process is completed before the vehicle computer is shut down again due to the ignition being turned off.

Timings for the vehicle start and stop are pre-programmed in the intelligent power management system. The coding switch S14 selects a timing from the four pre-defined sets of parameters. While it is active, the coding switch S12 must be set to position 1 (remote on/off).

Config switch S14 position	$t_{debounce\_on}$ On debouncing (setup)	$t_{debounce\_on}$ Off debouncing (hold)	$t_{startup}$ Hold time until switch off signal is routed to processor, if system is still booting	$t_{hard\text{-}off}$ Timeout until switch off signal is generated from processor (after that hard off)
0	-	-	-	-
1	2 s	60 s	5 s	60 s
2	2 s	60 s	60 s	300 s
3	2 s	60 s	60 s	120 s
4	1 s	5 s	5 s	60 s
5	5 s	5 s	60 s	60 s
6	0 s	0 s	60 s	60 s
7	0 s	0 s	60 s	60 s
8	0 s	0 s	60 s	60 s
9	0 s	0 s	60 s	0 s
A – F	n/a	n/a	n/a	n/a

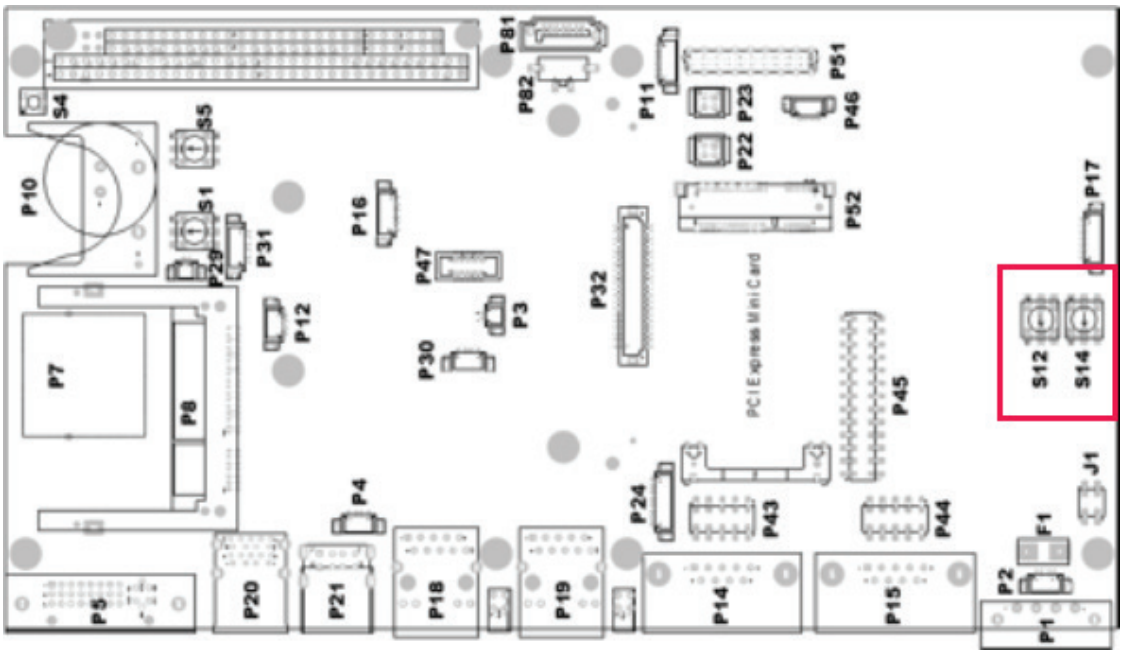
If these timings are adjusted to customer-specific settings, the EEPROM entries must be modified accordingly in the intelligent power management:

```
__EEPROM_DATA( 0, 0, 0, 0, 0, 0, 0, 0); // mode 5 (reserved)
__EEPROM_DATA( 0, 0, 0, 0, 0, 0, 0, 0); // mode 6 (reserved)
__EEPROM_DATA( 0, 0, 0, 0, 0, 0, 0, 0); // mode 7 (reserved)
__EEPROM_DATA( 0, 0, 0, 0, 0, 0, 0, 0); // mode 8 (reserved)
__EEPROM_DATA( 0, 0, 0, 0, 0, 0, 0, 0); // mode 9 (reserved)
__EEPROM_DATA( 2, 0, 60, 0, 5, 0, 60, 0); // mode A (user-progr.)
```

2.2 Configuration hardware

In order to start or shut down an IPC via remote on/off function, the power management controller has to be physically configured on the board. To do this the computer must be opened and the position of switch S12 and optionally S14 must be adjusted.

The image below shows the location of the S12 and S14 switched on a Syslogic IPC/SL8x board.



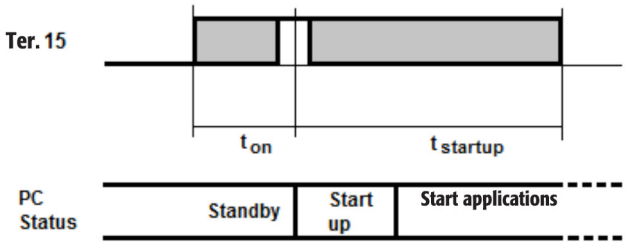
To use the remote on/off feature the position of switch S12 must be rotated to position „1".

Switch	Configuration	Remarks
S12	position '0' = test mode (powerfail active) position '1' = internal pulldown (remote on/off mode) position '2' = internal pullup (power fail mode) position '3' to 'F' = reserved (do not use)	check chapter 3.3.14/3.3.15

Switch S14 is used to set custom delay timings for remote on/off (see table under section 2.1).

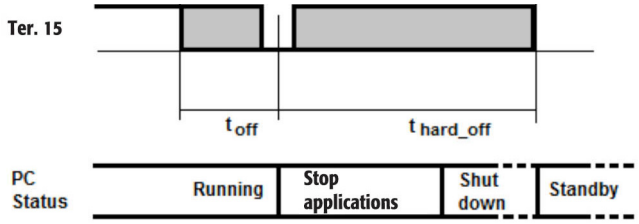
After configuring remote on/off, when the IPC is supplied with power it will not boot up immediately. The computer will only start when the ignition is switched on (meaning, the PF pin is pulled to +24V). To turn off the computer, the ignition must be switched off again (meaning +24V gets removed from the PF pin). For switching off the computer properly the software pfmon must be running (see section 2.5).

2.3 Scheme: vehicle start



When the vehicle starts, the LH edge ("LH"- switch on, "HL" - switch off) at terminal 15 initiates the startup process. The time period t_{on} provides security for contact debouncing at the ignition switch; afterwards, the actual startup process is initiated. The embedded box PC boots, its applications start. During $t_{startup}$, the status of terminal 15 is not evaluated.

2.4 Scheme: vehicle stop



The HL edge at terminal 15 initiates the stopping process after $t_{startup}$. When the debounce security period t_{off} expires, the box PC initiates the closing of the applications and shutdown of the box PC. If the applications have not closed and the box PC is not in standby mode by the time t_{hard_off} runs out, this is effected by the hardware. The internal power supply is shut off. For the duration of t_{hard_off}, the status of terminal 15 is not evaluated.

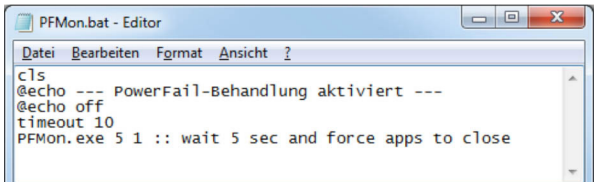
Note: Due to the internal pulldown (a resistor that pulls a signal to low) in the embedded Box PC, terminal 15 only uses Vin=24VDC for "on", while 0VDC or HighZ (connection open) are sufficient for "off".

2.5 Use in Windows

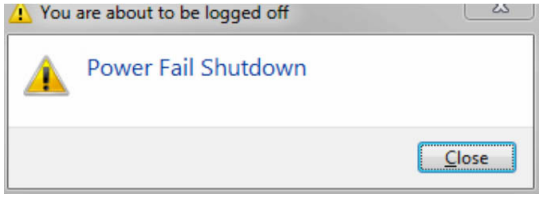
To close the application and initiate shutdown, software support from the system is required. In Windows, the PFMon application from the utilities of the embedded Box PC can be used. This program must be embedded in a batch file that is activated via auto start during startup.

The batch file executes **PFMon Timeout Force** with the parameters
- timeout: timeout in seconds (0 = no timeout)
- force: 0 = do not force apps to close, 1 = force

The batch file has a similar structure and must be activated via auto start:



If **PFMon** is activated, a similar system message will occur for "ignition off" after the period t_{off}, and the system will shut down.



2.6 Use in Linux

Remote control can be used independently of the operating system. Linux (Debian8 and Debian9) offers a comparable routine, power fail, in /etc/init.d, which sets the minutes until shutdown via fail time.

This module is loaded via the pfmon.bash file
Create a bash file with the following contents:

```
#!/bin/bash
modprobe pfmon
echo "1" >/sys/kernel/syslogic/pfmon/mode
```

This process can be automated, for example with an entry in the file
/etc/rc.local or **/root/.profile.**

After the event (ignition off) has been initiated, the following system message occurs after the corresponding delay:

```
broadcast message from root@netipc
…
The system is going DOWN for system halt in 1 minute!
```

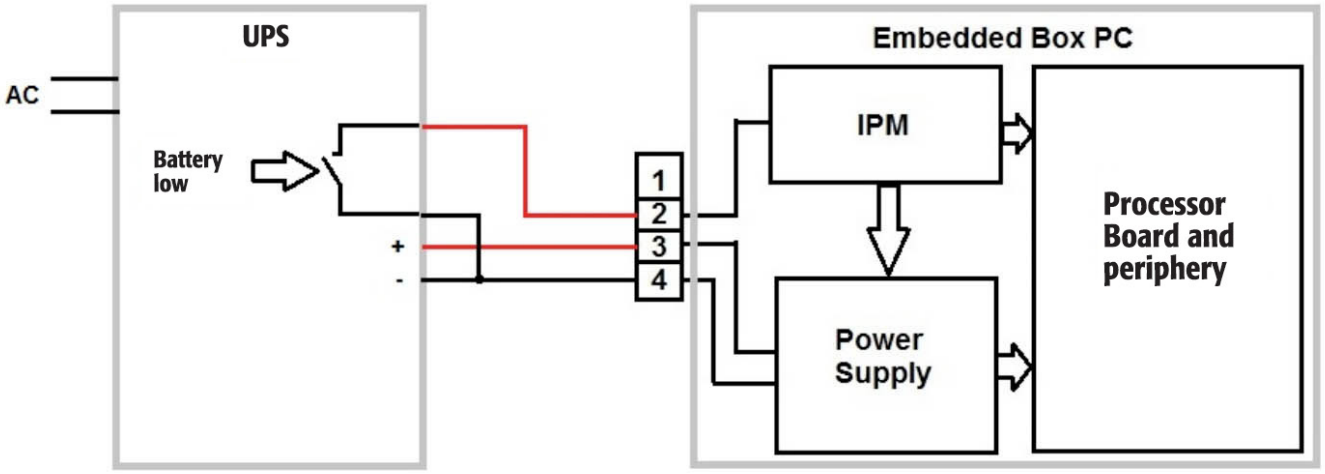
After the shutdown delay, the system shuts down and can be restarted using the ignition.

3.1 Machine control with an uninterruptible power supply and intelligent power management

When embedded computers are used for 24/7 control or monitoring tasks, an uninterruptible power supply (UPS) is used to protect the power supply from brief outages. This ensures data security.

If the UPS bridges a power outage and the signal "battery low" occurs after a while, the intelligent power management system will initiate a controlled shutdown of the control computer. This prevents sudden power cuts and data loss during operation.

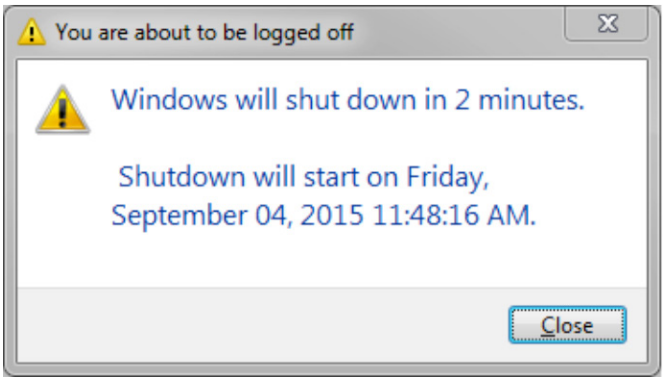
Combining an UPS with the intelligent power management system ensures that the control computer is started and shut down in a defined state when the overall system is turned on or off. This also applies when the system is turned on and off again immediately. As in the previous example, the intelligent power management ensures that the startup process is completed once it has been initiated and that the shutdown of the computer is only initiated afterwards.



The embedded box PC must be configured to power fail mode as per the manual (coding switch S12 to position 2, coding switch S14 to position 0). To initiate the power fail if the uninterruptible power supply does not provide sufficient power, you must set the signal on pin 2 to low or bridge pin 2 and pin 4.

3.2 Use in Windows

The state evaluation and initiation of shutdown can be effected via the power fail monitor PFMon. A system message will confirm the initiation, and the system will be shut down after the timeout period defined in the batch file.



3.3 Use in Linux

Power fail can be used independently of the operating system. Linux (Debian8 and Debian9) offers a comparable routine, power fail, in **/etc/init.d**, which sets the minutes until shutdown via fail time (parameterizable).

The module is loaded via the **pfmon.bash** file:

```
#!/bin/bash
modprobe pfmon
echo "1" >/sys/kernel/syslogic/pfmon/mode
```

This process can be automated, for example with an entry in the file **/etc/rc.local** or **/root/.profile**.

After the event (battery low) has been initiated, the following system message occurs after the corresponding delay:

```
broadcast message from root@netipc
…
The system is going DOWN for system halt in 1 minute!
```

After the shutdown delay, the system shuts down and can be restarted using power-on .

4 An intelligent power management system as an ideal addition to industrial CPUs

It only ensures the defined startup and shutdown of an industrial computer. It does not affect its operation.

Even for an industrial computer with an intelligent power management system, you must verify that it is designed for industrial use: they must work without fans, have low power consumption and be resistant to shock and vibration.

Syslogic helps its customers adapt the intelligent power management system to their applications. This includes adjusting the preset time periods and integrating a reset button or impulse control. Syslogic customers also benefit from technical support throughout all project phases.