DigiSnap Pro

Product Guide

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# DigiSnap Pro

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Overview

The DigiSnap Pro is an advanced controller for long-term time-lapse photography systems. All of the functions normally required for a long-term time-lapse system using high quality cameras are integrated into this single small device. Both autonomous and networked applications are fully supported. [Please note that at the time of release, there are some features that have not been fully implemented, such as Remote Login.] The DigiSnap Pro was designed and is produced in the USA.

- Camera interfaces: Power, Shutter Release, USB Picture Transfer Protocol (PTP)
- Internal charge controller for dual hot-swappable battery packs
- Multiple battery chemistries are supported (12.1V LiIon, 14.8V LiIon, 12.8V LiFePO4, and 12V Lead-Acid)
- Compatible with a wide range of charge power sources: solar panels, passive PoE, battery backup banks, AC adapters...
- USB host for external mass storage (memory stick / hard-drive), USB cellular modem, or other specialty needs
- Configuration via Bluetooth LE to smart phone or tablet, or remote configuration via network
- Network interface for image transfer and remote control
- Status reports via email
- Image transfer via WiFi, Ethernet, Cellular and satellite terminal.
- Carefully developed for absolutely minimum power use, for extended battery / solar powered applications
- Designed with an auxiliary interface to support future sensors, motion control, and other application specific devices.

DigiSnap Pro Hardware Overview

The DigiSnap Pro incorporates multiple hardware modules, each with its own functionality and means to communicate with other modules. Some devices are hard-wired, and others are hot-plug-able.

DigiSnap Pro Controller Board

The DigiSnap Pro Controller (DSPC) board is the main circuit board. The DSPC forms the base for a complete time-lapse system, including power management features, camera control, and typical time-lapse functions. While the DSPC can operate autonomously, its features are expanded greatly by the addition of the Network Board, and Accessory Modules.

Real-Time Clock

The DSPC includes an internal high-accuracy Real-Time clock, with battery backup. The coin cell battery should maintain time for many years and is user-replaceable. The time and date may be set via the DigiSnap Pro user interfaces and may be automatically corrected if the Network Board is attached to the DSPC and connected to the Internet.
DigiSnap Pro

**Status indications**
A bi-color (Red & Green) LED is visible on the DigiSnap Pro housing to display the status of the system and may be disabled if desired. When the DigiSnap Pro is initially powered on, there will be an 8 flash Green sequence to confirm that the Controller Board is working.

When the system is operating properly, there will be a periodic green blink. If there is a detected fault within the DigiSnap Pro, with communications, the power source or camera, a blinking sequence will be displayed instead of a simple green flash. The blink sequence is described in Appendix 1, but a short video of the blinking sequence can be submitted to Harbortronics for interpretation as well.

While the built-in LED is useful during setup and testing, in typical use the DigiSnap Pro will be installed inside a housing as part of a larger system. An external LED can be connected to the DigiSnap Pro, allowing view of status through the wall of a housing or at some remote distance.

**User Switch**
The DigiSnap Pro Controller includes a simple push-button switch. This switch performs various functions depending on how long it is pressed before being released.

<table>
<thead>
<tr>
<th>Duration</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1 sec</td>
<td>Take picture now (Green LED during this period)</td>
</tr>
<tr>
<td>2-4 sec</td>
<td>Display LED Status sequence (Amber LED during this period)</td>
</tr>
<tr>
<td>10-15 sec</td>
<td>Reset the DigiSnap Pro. (Red LED During this period)</td>
</tr>
<tr>
<td>10-15 sec</td>
<td>If the switch is held for this duration at power-up (power unplugged/restored), the DigiSnap Pro Controller Board is reset to Factory Defaults. There will be a blinking Red LED During this period. The DigiSnap Pro password and other critical parameters are not changed. If reset, the LED will flash Amber briefly.</td>
</tr>
</tbody>
</table>

**Temperature Sensor**
The DSPC includes two on-board temperature sensors, used to monitor the ambient temperature, as well as check for high-temperature conditions on the circuit board. Temperature information is used to control charging to the battery pack, and may be used by the Network board in status reports, or logged with pictures. The DigiSnap Pro can also act as a thermostat to control power to a heater, to warm battery packs, or to clear frost from a window.

**Humidity Sensor**
An on-board humidity sensor can be used to detect moisture build-up, such as from a housing leak. By monitoring the humidity, the operator can be warned early enough to prevent condensation on the optics.

**Scheduled Time-Lapse**
The DSPC includes a scheduled time-lapse process, where up to four time-lapse sequences may be defined. Each sequence has a number of configurable parameters, including the start and stop times, the interval between pictures, and the days of the week the sequence should operate.
**DigiSnap Pro Network Board**

The Network Board mates with the DSPC and includes an embedded computer running a Linux operating system. The embedded computer was selected for its low power, wealth of resources, and small form factor. The addition of the Network Board enhances the DSPC tremendously, adding USB host ports, GPS connection, Ethernet, and WiFi communications. The Network Board allows for transfer of images, notification messaging, and remote access.

In addition, the Network Board provides a platform from which to operate a great range of advanced time-lapse operations through customized applications. Harbortronics can work with you to develop time-lapse processes that incorporate sensors, motion control, and network interaction.

One particularly difficult aspect of providing a camera system with networking is minimizing the power draw. The DigiSnap Pro handles this by controlling the power to the network board, leaving it powered down the majority of the time. When images are ready to transmit individually or in a queue, the network board is powered on and off again later when completed.

**Networking**

A 10/100 Mbps Ethernet connection is provided on the DigiSnap Pro. The Ethernet port is compatible with passive PoE (Power over Ethernet) which uses an external 24V power supply to charge the DigiSnap Pro battery pack(s). The Ethernet connection may be used for direct wired connection to a local area network, or for connection to a satellite terminal.

A WiFi radio is built into the DigiSnap Pro Network Board. The DigiSnap Pro may be embedded inside another housing, so a connection for an external WiFi antenna is provided. An optional antenna with a short cable is available. This short extension is perfect for use in the Cyclapse Housing, raising the antenna to a position inside the dome lid where it has much better coverage. The cable to the antenna has a small connector, which should be routed through the hole in the DigiSnap Pro housing, and connected to the mating connector on the circuit board. This requires the DigiSnap Pro housing to be disassembled, but this is straightforward.

The USB Host ports may be used to communicate with USB cellular modems. The power is electronically controlled as needed to save power. The USB cellular modem can be connected via a short cable to locate it for best radio coverage. A ‘universal’ USB cellular modem from Multi-Tech is also available from Harbortronics.

The DSPC provides switched power outputs which can be used to power WiFi routers, cellular modems, and satellite terminals. In normal operation the network connection and power to external radios will be established only as long as needed for image transfer and status reports, saving power.

**USB Host**

The DigiSnap Pro Network Board includes a pair of USB 2.0 host ports, which may be used to connect to a camera USB port for camera control and image download. The USB connection is also perfect for use with a hard drive or flash memory device. Consider a camera system where a flash memory stick is connected to the end of a long USB cable routed down from the camera on a pole.
Configure the system to copy the images to the external memory, and simply swap the memory stick with a new one to collect the images.

**DigiSnap Pro Accessory Modules**

The DigiSnap Pro introduces a unique scheme for the use of a wide range of accessories. A well-defined connection and communication protocol has been created that will allow attachment of sensors, operator interfaces, and motion control devices. It has been designed to accommodate devices and applications that may be defined well into the future. As Accessory Modules are developed, their definition may be added to the system via software updates.

Each Accessory Module is intended to perform a specific task, such as sensing light, providing a means for a user to interact with the DigiSnap Pro, control motion via servo motors, etc. Accessory modules will be developed for the DigiSnap Pro system as time allows and interest dictates. Motion control is a popular technique to add to time-lapse projects. Harbotronics had a very early integrated time-lapse motion control rig (Snap360), and we understand the impact that motion control can have on a time-lapse movie. One of the 'Holy Grail' problems in time-lapse is controlling a camera for a smooth exposure transition from day to night. We have an idea for an integrated light sensor which may help. Many researchers and just-plain-folk have used motion sensing cameras, and we plan to offer motion sensing modules to our system to implement a very high quality and featured 'trail cam'. Other specialized applications require other sensor technologies for triggering cameras, and our ability to quickly develop custom sensing modules based on a common structure may be quite useful.

Each Accessory Module will include the means to communicate with the DigiSnap Pro Controller, Network Board, and all other attached Accessory Modules. The DigiSnap Pro Controller Board includes three Accessory Module ports, and a Module Expander can increase the number of Modules connected to the DigiSnap Pro.

**BLEM: Bluetooth Low Energy Module**

The BLEM is designed to leverage the most user friendly and ubiquitous electronic interfaces ever developed... smart phones. The BLEM is a small micro-powered radio transceiver providing a wireless connection to smart phones, tablets, and other Bluetooth enabled computers. An Android app has been developed to configure and control the DigiSnap Pro via smartphones and tablets.

The BLEM is normally purchased with each DigiSnap Pro as the primary method to configure the system. Android tablets are an excellent low-cost way to get started with the DigiSnap Pro, if an Android smartphone is not already available. Bluetooth 4.0 or greater is required to communicate with the DigiSnap Pro.

**Debug Module**

The Debug Module is a cable (containing electronics) which connects the DigiSnap Pro FM Port to a USB port on a standard computer. A Windows-based computer program is included which allow the operator to configure and control the DigiSnap Pro. Mac users can run the Debug program with Boot Camp or virtualization software such as Parallels or VMware Fusion.

The Debug Module is an optional accessory for the DigiSnap Pro. It was developed to aid in testing the DigiSnap Pro, and was not intended for normal use by customers, but can be a valuable resource to customers who require access to all features.

**GPS Module**

The GPS module provides collection of time and position information. GPS positioning is not necessary for most time-lapse projects, but can be essential for some projects. Consider a time-lapse camera on an iceberg transmitting images and position via satellite. Imagine a camera attached to an animal in the field… there are many potential applications that could make use of position data in addition to images.

**Design Considerations**

**Power**

- Solar, battery, or AC Mains adapters can be used to Charge Battery Pack(s)

One particularly difficult aspect of long term time-lapse projects is finding a way to power the equipment.

AC mains power is great it is available, and if it's reliable. The longer the project, the more likely it is that the power will drop out sometime during the shoot. If you are on a construction site, you can be assured that someone is going to unplug your power cord, "just for a minute" to use their drill or intentionally disable the system. AC/battery/inverter backup systems are available, but are bulky, expensive, very inefficient, and small commercial units only last for a few hours. Then there's the matter of finding a place for the large the backup unit, protecting it from the elements, etc. Dedicated AC power requires electricians, conduit, digging, and other expensive resources.

If you don't have reliable AC power handy, rechargeable battery power is essential. There are various ways to gather energy, such as solar or wind (and even AC) power, but these sort of energy sources are never constant and are unreliable. These intermittent power
sources are however quite useful for charging batteries, which then power the equipment. In some short/medium term projects, enough battery power can be supplied to eliminate the need for charging, but most applications will benefit from charging in the field.

The DigiSnap Pro is designed specifically for use with battery power. There are connections for two battery packs, which may be hot-swapped as needed. The DigiSnap Pro takes in energy from an external power source and maintains the charge on one or two connected battery packs. The charger can work from any DC voltage from 16 to 30 VDC, connected either via network cabling or the charge port connector. A MPPT (maximum power point tracking) technique is used to optimally extract power from solar panels or variable output power sources.

The DigiSnap Pro is designed to work with multiple types of battery packs. Three and four cell Lithium-Ion, four cell Lithium-Iron-Phosphate, and standard 12V Lead Acid. Lithium Ion has the highest energy density (smallest/lightest packs), do not out-gas during charging. They cannot be charged at very low temperatures, but this hasn't significantly limited their use all over the planet. Lithium Iron Phosphate battery packs may be safer than Lithium-Ion, and may have a longer operational life. Lead-Acid batteries are universally available, and may charged at lower temperatures, but will outgas hydrogen during charging so they may not be used in a sealed housing. Lead-acid battery packs are also large and heavy! The DigiSnap Pro can be configured to work with any of these battery types.

**Camera Control**
- Industry standard Half/Full contacts, USB PTP

On modern digital cameras, there are three interfaces of interest when considering time-lapse applications. Power, shutter release, and image storage.

Internal batteries in a camera are insufficient for anything beyond a short time-lapse project. The DigiSnap Pro has an efficient switching supply to convert the power from an external battery pack to the correct voltage needed by the camera. Most cameras will shut down to a low power state (sleep) between pictures, which is normally adequate to reduce the power consumption of the system. With some camera models, the camera does not conserve power automatically, and the power to the camera can be controlled dynamically by the DigiSnap Pro, completely shutting the power off when not needed.

The DigiSnap Pro monitors the current drawn by a camera in order to detect a camera failure or a full memory card. This information can be used to stimulate a message to the operator via networking.

Many digital cameras have an electronic shutter release connection, which is the easiest, fastest, and lowest power method of triggering the camera shutter. This is essentially the same as pressing the shutter button manually. With most cameras, activating this interface will wake the camera from a sleep state. The dwell time for the half and full press states can be individually configured within the DigiSnap Pro.

Many other digital cameras do not include a shutter release jack, but can be remotely controlled with commands via the USB port. This method is more complex and uses substantially more power, but also may allow control over photographic parameters. Images can also be extracted via the USB port for buffering and transfer.

The DigiSnap Pro has connections to control cameras via shutter release jack or USB port.

**Image Storage**
- Camera Memory Card, Local USB Stick, or Remote Image Transfer to the 'cloud'

The DigiSnap Pro was designed from the outset to be network-able via the Network Board. Images (full size or thumbnails) can be automatically transferred to internet servers as they are taken or in scheduled queued bursts to optimize power use.

Historically, Harbortronics equipment have been designed for autonomous operation, where the images were simply stored on the camera's internal memory card, and periodically swapped in the field. This mode of operation is still preferred in many situations, as the system power is minimized, and there is no requirement for wireless and network services and their monthly fees. In many remote locations, networking may not be possible. The DigiSnap Pro can be operated as an autonomous controller, where images are simply left on the memory card for periodic gathering.

One of the USB ports can be used with extended cables to connect to a remote storage device. This could be as simple as a USB memory stick on the end of cable at the bottom of the mounting pole. Other mass storage devices such as a USB hard-drive can be accommodated easily. Power is disconnected when not needed.

When configured for use with a network via WiFi, Ethernet, or cellular modem, the DigiSnap Pro can automatically transfer images via FTP or SFTP to a networked storage location, which could be the operator's own server or a managed time-lapse photo service.

Unlike many other companies, the Harbortronics DigiSnap Pro uses open, industry standard communication protocols to allow images to be transferred with no service fees / monthly contracts to Harbortronics!
Connections
One major goal for the DigiSnap Pro was to integrate all of the pieces typically needed for a long term time-lapse project into a single
device. This means that there are a lot of ways to use the DigiSnap Pro, and a lot of connections! Not all connections are required for
every installation. Harbortronics can assist in configuring the optimum cable solution for your application. The connectors on the
DigiSnap Pro are unique to their use, so there is no concern for mis-connecting the cables.

Charger
The DigiSnap Pro must be powered from a local battery pack(s). External power sources, such as a solar panel, windmill, AC power
supply, battery bank, passive Power over Ethernet (PoE), etc., are used to keep the battery pack(s) charged. Power is drawn from
external power sources only as needed to recharge the connected battery pack(s). The charge current to the battery packs is limited to
2 Amps, and the maximum power drawn from any power source is approximately 32 watts. In addition to charge control, the
DigiSnap Pro uses an energy harvesting algorithm that optimizes power extraction from any DC power source, at whatever power
level they are able to supply.

Solar Panel Size
Given that the DigiSnap Pro has an efficient energy harvesting process, you can use small panels (i.e., 5 watts) for projects that will
take a limited number of pictures per day (i.e. under 100), and infrequent networking use. You may also use large solar panels
without fear of overcharging the battery packs or drawing excessive current. The DigiSnap Pro will only draw a maximum of 32
watts, so a large panel may not be fully utilized, but there may be some advantages as there will be a greater amount of power
available for more hours in the day.

The charge power connections are not DC isolated from the main circuit. This is not at all unusual, but it is advisable to use an
isolated charge power source. Solar panels, AC / DC power supplies, and external batteries are all normally isolated from earth
ground, and may be used without concern.

Connector: DC Power Jack, 1.3/3.5mm
Mating Connector: 1.3/3.5mm barrel plug.
Function: Power Source for charging internal and external battery packs
Typical Use: Solar Panels, AC/DC Power Supplies, 24VDC Battery Banks

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Center</td>
<td>Positive power, 16-30 Volts DC</td>
</tr>
<tr>
<td>2</td>
<td>Outside</td>
<td>Power return</td>
</tr>
</tbody>
</table>

Battery Packs (2 jacks provided)
The DigiSnap Pro is always powered from one or two battery packs. When AC power is available, a standard AC/DC power supply
may be used as a charge power source, and a low capacity battery pack may be sufficient. For long term unattended applications,
larger battery packs are advisable to keep the system operating during the inevitable periods where the charge power may drop out.
Harbortronics has been using these sort of battery packs for many years and would be happy to recommend or supply battery packs
for your project.

Battery Packs should be internally-protected Lithium-Ion (12.1V or 16.8V), internally protected 12.8V Lithium Iron Phosphate, or
12V Lead-Acid battery packs. The battery connections are designed to allow connection of battery packs of different charge states
and capacities. Capacities of 3-15 AH are well suited for this system. The peak charging current is 2 Amps. Hot-swap capability is
built into the DigiSnap Pro, allowing the battery packs to be connected or disconnected without having to match their charge state.
When two battery packs are used, they must be the same type (i.e. 12.1V cell Lithium Ion), but they can have different capacity
ratings.

Connector: DC Power Jack, 2.1/5.5mm
Mating Connector: 2.1/5.5mm barrel plug.
Function: Connection to external battery pack(s)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Center</td>
<td>Positive terminal of battery pack</td>
</tr>
<tr>
<td>2</td>
<td>Outside</td>
<td>Power return, circuit ground</td>
</tr>
</tbody>
</table>

Camera Shutter Release
The DigiSnap Pro is designed for compatibility with a wide range of commercial digital stills cameras. Most compatible cameras will
have a connection for a ‘remote shutter release cable’. There are a variety of connections used in the industry, and every few years a
new format is introduced. The DigiSnap Pro uses a shutter release control technique which will work with the majority of them. All
Canon SLR cameras use either an N3 or E3 connector, Nikon SLR cameras may use a 10Pin, DC1 or DC2 connector, Pentax SLR
cameras may use the E3 style connection, Panasonic, Sony, etc., may use different designs. Harbortronics can provide cables to
connect between the DigiSnap Pro and your compatible camera.
Some other cameras may be supported via connection to the USB port on the Network Board, using the USB 'Picture Transfer Protocol'.

Connector: 2.5mm stereo jack (Canon E3 style)
Mating Connector: 2.5mm stereo plug
Function: Digital Camera Shutter Release

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tip</td>
<td>Full Press</td>
<td>Switched to common to take a picture.</td>
</tr>
<tr>
<td>Center Ring</td>
<td>Half Press</td>
<td>Switched to common to activate metering and focus.</td>
</tr>
<tr>
<td>Base Ring</td>
<td>Return</td>
<td>Returned to circuit common</td>
</tr>
</tbody>
</table>

**Camera Power**

In short term applications, for instance time-lapse photography of clouds, fireworks, etc., the internal battery of the camera may be sufficient. For long term time-lapse applications (months or years), providing reliable external power to the camera is an essential component of time-lapse equipment. The DigiSnap Pro is designed to provide power for a digital stills camera, simplifying the design of the overall system. The camera power voltage can be configured for any voltage from 3V to 10V, which is sufficient range to cover all digital cameras on the market.

Cameras typically use one of two means of connecting to external power: via the battery compartment using a 'dummy battery', or through a dedicated connector on the camera. Most manufacturers have moved to the use of dummy battery packs, with a cable entering the battery compartment. Harbortronics can supply dummy battery packs with appropriate cabling for the DigiSnap Pro, as well as cables to connect to dedicated power connectors on cameras.

The current drawn by the camera is monitored by the DigiSnap Pro to confirm camera function. For instance, if the camera does not seem to draw current when triggered, there is likely a problem with the camera, and the operator may optionally be notified via and Email status message.

Connector: DC Power Jack, 1.7/4.75mm
Mating Connector: 1.7/4.75mm barrel plug.
Function: Power supply for digital camera
Typical Use: External power for camera
Rating: 3.5 Amps capability, please limit to 1 Amp average current. Most SLR cameras draw 1.5 - 2.5A for a short time when taking a picture, and draw very little the rest of the time.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Center</td>
<td>Positive voltage to camera, configurable for 3-10 volts DC</td>
</tr>
<tr>
<td>2</td>
<td>Outside</td>
<td>Power return, circuit ground</td>
</tr>
</tbody>
</table>

**Input / Output Signaling**

Over the many years Harbortronics has been designing and supplying time-lapse equipment, an amazing variety of applications have been addressed. Some of these applications involved responding to events, such as motion detectors, remote triggering via radio, and response to a variety of environmental parameters, such as rock fall, temperature changes, water depth, remote switches, etc. Essentially all of these 'real world' triggering sensor/mechanisms can be adapted to output a 'dry contact closure' type of signal. The DigiSnap Pro has an input connection which is compatible with this standard type of trigger signal.

In addition to having an input signal connection, the DigiSnap Pro has an output signal which can be used for a number of applications. The are a variety of external devices that may need activation in conjunction with taking pictures. For instance, a window wiper, external mechanical shutter, power for lighting, and simple motion control devices can all be synchronized to the camera via the output signal.

The DigiSnap will often be used with other networking devices. Two power outlets are provided to power such devices. One output is essentially a switched connection to the battery power, which can perfect for powering a satellite terminal, and the other is a switched 5V output source which may be useful for a router or cellular modem.

The switched battery output can also be used to power a heater. The DigiSnap Pro includes an algorithm to power a heater on/off as needed to keep the temperature above freezing, which can be useful in some applications. In the majority of applications, even in the Arctic, a heater isn't required.

Connector: Molex Micro-Fit 3.0, 6 pins, 43045-0600
Mating Connector: Molex part number 43025-0600
Function: Simple signaling to/from external devices, and switched power.
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<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Batt Out</td>
<td>Switched Battery Voltage, positive, 10-16.8 Volts (depends on battery type and state of charge). Maximum 5 Amp capacity, may also be limited by the particular battery pack.</td>
</tr>
<tr>
<td>2</td>
<td>Input</td>
<td>Connect to ground to trigger the DigiSnap. Internally pulled up to 3.6 Volts with 220K resistor.</td>
</tr>
<tr>
<td>3</td>
<td>Ground</td>
<td>Common to circuit ground</td>
</tr>
<tr>
<td>4</td>
<td>Ground</td>
<td>Common to circuit ground</td>
</tr>
<tr>
<td>5</td>
<td>5V Out</td>
<td>Switched 5V voltage, 1.2A total capacity, shared with other devices.</td>
</tr>
<tr>
<td>6</td>
<td>Output</td>
<td>Open Drain Output, 200mA capacity. Internally pulled up to 3.6 Volts with 33K resistor. Normally open/high.</td>
</tr>
</tbody>
</table>

The operation in response to the Input trigger signal may be configured within the DigiSnap Pro. The Burst mode is useful for a number of applications, such as animal motion sensing.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Input Trigger Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Do Nothing</td>
</tr>
<tr>
<td>1</td>
<td>Take picture now</td>
</tr>
<tr>
<td>2</td>
<td>Take a burst of pictures. The delay, number of pictures in the burst, and the interval may also be defined.</td>
</tr>
<tr>
<td>3</td>
<td>Enable all DigiSnap Pro Controller time-lapse sequences, if disabled.</td>
</tr>
</tbody>
</table>

The three output signals (Battery Out, 5V Out, Output) may be activated synchronously with taking pictures. For instance the 5V Out may be used to power a WiFi router, turning it on a few seconds before taking a picture, and leaving it on for a few minutes afterward to allow a WiFi memory card to transmit the image to a network. There are a variety of applications which can make use of these signals, and the timing may be configured within the DigiSnap Pro. The Before and After times can be independently configured.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Output Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Do Nothing</td>
</tr>
<tr>
<td>1</td>
<td>Before: Activate the signal for a period of time before the picture is taken (charge a strobe for instance)</td>
</tr>
<tr>
<td>2</td>
<td>After: Activate the signal for a period of time after the picture (reposition the camera for instance)</td>
</tr>
<tr>
<td>3</td>
<td>Before &amp; After: The signal is active for a period of time both before and after a picture. (Router...)</td>
</tr>
<tr>
<td>4</td>
<td>Always: The signal is always active. Useful to provide a constant Battery or 5V power source.</td>
</tr>
<tr>
<td>5</td>
<td>Heater Control. When external charge power is available, and the temperature is below freezing, the output is applied, which can be used to control or power a small heater inside the system housing.</td>
</tr>
</tbody>
</table>

Visual Status Monitor -External
Connector: TE Connectivity 292206-3
Mating Connector: TE Connectivity 353908-3 or 353253-3
Function: Status indication
Typical Use: LED attached through environmental housing wall, visible outside

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Red</td>
<td>3.6V signal, 33 ohm source resistance, to power a Red LED (10mA typical)</td>
</tr>
<tr>
<td>2</td>
<td>Ground</td>
<td>Receive input to DigiSnap Pro</td>
</tr>
<tr>
<td>3</td>
<td>Green</td>
<td>3.6V power, 33 ohm source resistance, to power a Green LED (10mA typical)</td>
</tr>
</tbody>
</table>

The LEDs are used to periodically display the status of the system, and may be configured to be enabled or disabled. Please refer to Appendix 1 for more description of the LED blink sequence.

Accessory Port (3 independent ports provided)
Connector: Hirose MQ172X4
Mating Connector: Hirose MQ172X4 Plug
Function: Connection to accessory module
Potential Uses: Motion Control, Ambient Light, Motion Sensor, Water Level, Temperature, etc.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FM Power</td>
<td>Switched Battery Voltage, positive, 10-16.8 Volts (depends on battery type and state of charge). Maximum 5 Amp capacity, may also be limited by the particular battery pack.</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>TxD</td>
<td>Transmit from DigiSnap Pro</td>
</tr>
<tr>
<td>3</td>
<td>RxD</td>
<td>Receive input to DigiSnap Pro</td>
</tr>
<tr>
<td>4</td>
<td>Ground</td>
<td>Common to circuit ground</td>
</tr>
</tbody>
</table>

The Accessory Modules and their connection/communication protocol are described in a separate document.

**USB Host (2 provided) [Network Board]**
Connector: Industry standard USB A jack
Mating Connector: Industry standard USB A Plug
Function: USB 2.0 Specification, High-Speed
Typical Use: Camera USB/PTP
Note: The USB port power is switched by the DigiSnap Pro. You may need to configure the system before it will apply power to, and recognize your USB device.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>USB Power</td>
<td>+5 Volts Power when enabled, 1.2A total capacity, shared with other devices.</td>
</tr>
<tr>
<td>2</td>
<td>USB D-</td>
<td>Bi-direction data twisted pair with pin 3</td>
</tr>
<tr>
<td>3</td>
<td>USB D+</td>
<td>Bi-direction data twisted pair with pin 2</td>
</tr>
<tr>
<td>4</td>
<td>Ground</td>
<td>Common to circuit ground</td>
</tr>
</tbody>
</table>

**Ethernet [Network Board]**
Connector: RJ45
Mating Connector: Industry standard network cabling
Function: 10/100 Mbps Ethernet
Passive Power over Ethernet (POE) supported, via common connection. Does NOT support IEEE standard POE.
Note: The Ethernet signals and POE power are not DC isolated from the circuit ground. The RJ45 shield is connected to circuit ground.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TX+</td>
<td>Transmit from DigiSnap Pro, twisted pair with pin 2</td>
</tr>
<tr>
<td>2</td>
<td>TX-</td>
<td>Transmit from DigiSnap Pro, twisted pair with pin 1</td>
</tr>
<tr>
<td>3</td>
<td>RX+</td>
<td>Receive input to DigiSnap Pro, twisted pair with pin 6</td>
</tr>
<tr>
<td>4</td>
<td>POE +</td>
<td>Common with Pin 5, positive POE voltage (16-30VDC)</td>
</tr>
<tr>
<td>5</td>
<td>POE +</td>
<td>Common with Pin 4, positive POE voltage (16-30VDC)</td>
</tr>
<tr>
<td>6</td>
<td>RX-</td>
<td>Receive input to DigiSnap Pro, twisted pair with pin 3</td>
</tr>
<tr>
<td>7</td>
<td>POE Return</td>
<td>Common with Pin 8, POE supply return [Low value sense resistor to ground]</td>
</tr>
<tr>
<td>8</td>
<td>POE Return</td>
<td>Common with Pin 7, POE supply return [Low value sense resistor to ground]</td>
</tr>
</tbody>
</table>

**GPS [Network Board]**
Connector: TE Connectivity 292206-4
Mating Connector: TE Connectivity 353908-4 or 353253-4
Function: Asynchronous Serial Data, 3 Volt logic levels.
Typical Use: GPS Receiver Module

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Serial Power</td>
<td>3.6 Volts Power when enabled (please limit to 100 mAmps)</td>
</tr>
<tr>
<td>2</td>
<td>Serial Rx</td>
<td>Receive input to DigiSnap Pro</td>
</tr>
<tr>
<td>3</td>
<td>Serial Tx</td>
<td>Transmit from DigiSnap Pro</td>
</tr>
<tr>
<td>4</td>
<td>Ground</td>
<td>Common to circuit ground</td>
</tr>
</tbody>
</table>

**WiFi [Network Board]**
Connector: U.FL miniature coax
Function: 802.11 a/b/g/n WiFi
Typical Use: Cable connection to remote antenna. Harbortronics can provide an antenna on a short cable which has be pre-certified for use with the WiFi module inside the DigiSnap Pro.
Configuration

There is a big list of configurable settings in the DigiSnap Pro. This can seem overwhelming at first! It can be very helpful to just consider one piece of the system at a time and work through the configuration slowly. In the vast majority of applications, there are only a few items that will need to be adjusted.

Harbortronics is happy to pre-configure your DigiSnap Pro if desired, or make suggestions for your application.

The DigiSnap Pro may be configured in the office or in the field via an Android smartphone or tablet using a Bluetooth LE radio link. The DigiSnap Pro App is available for free in the Google Play store. The optional Bluetooth LE Module accessory must be connected to one of the Accessory ports of the DigiSnap Pro for this configuration method.

A direct connection to a Windows PC or Mac computer with virtualized Windows installation can be established using the Debug Module cable and the Debug Module software. This connection method allows control over all of the DigiSnap Pro configurable settings, as well as factory test and setup.

Camera

The DigiSnap Pro can be used with a wide range of cameras, from small point-and-shoot cameras, to high-end Medium Format cameras. The vast majority of long term time-lapse projects make use of SLR cameras, so the DigiSnap Pro is optimized for the interfaces generally provided on these cameras. We would be happy to recommend cables and configuration settings for your camera.

Power Supply Voltage

Digital cameras will use a range of battery types, but generally they use lithium-ion chemistry, and are single or dual cells. The DigiSnap Pro is often used with a 'DC Coupler' or 'battery substitute' cable assembly, which plugs into the battery compartment in place of the battery pack.

The vast majority of SLR cameras use battery packs made with two cylindrical battery cells, and often this is obvious from the shape of the battery pack. These are all rated at 7.4V, and will range from 6.0V to 8.4V depending on the state of the charge. We suggest setting the camera power supply voltage to 8.0 volts.

Some cameras, such as the Panasonic Lumix cameras for instance, will sense the difference between using a DC coupler and a normal battery pack, and require the voltage to be 8.4V or higher.

Some cameras may use a single cell battery pack, and for these we recommend using a 4.0V setting.

Some cameras may provide a dedicated jack for external power. In all of these cameras, the voltage is specified on the camera body next to the connector making it easy to set up the DigiSnap Pro.

In addition to setting the camera's power supply voltage, the timing when the power is applied may be configured. Most modern cameras do a very good job of minimizing power within the camera and don't require additional control. For instance, many cameras will switch to a low power 'sleep' state 10 or 30 seconds after a picture has been taken, and this sleep state is generally low enough as to be negligible. For these cameras, the power may be left 'always on'. It's often a good idea to periodically remove power from even these cameras, just in case the camera were to experience an internal issue or 'lock-up'. Removing and re-applying power can often allow the camera to recover from these rare issues. Our recommended configuration is the 'Reset Power Daily' setting. Some cameras may draw significant power during their 'sleep' state, or may not even fall into a sleep state between pictures. For these cameras you may wish to turn the power to the camera on before the picture, and off a short time after the picture, to save power.

Shutter Release Timing

Triggering a digital camera via the standard shutter release connection is a two-step process. If you manually activate a camera you have done this without even thinking about it. Lightly pressing the shutter release button wakes the camera and sets the focus and exposure. Once these processes have finished, pressing the shutter release button fully triggers the camera to take the image.

The DigiSnap Pro controls the timing of both of these signals to the camera, the Half-Press and Full-Press. When the camera is awake, and the lens is set to manual focus, the camera can be triggered very quickly. On the other hand, if the camera is asleep between pictures in a time-lapse sequence, or if the lens is set to auto-focus, it can take much longer.

The Half-Press duration may be set to about 2 seconds for a typical Canon or Nikon SLR whose lens is set to manual focus. This is long enough to wake the camera from sleep, and set the exposure. Other cameras, such as the Sony A7 series require a longer time, about 4 seconds to reliably perform these operations. If the lens is set to auto-focus (which we don't recommend), you may need to increase this time to 10 seconds or more, but even then the camera might not focus on the subject you desire. The configuration range is from 1/16th second to 16 seconds.
Once the camera has been awakened and is ready, it only takes a very brief period of activating the Full-Press signal to trigger the camera to take the picture. We typically suggest setting to 1/8 second.

The DigiSnap Pro has the ability to activate the Full-Press signal for as short as 10mS and as long as 6 hrs, with a 1/12th stop resolution. This capability is useful when the camera is set to BULB mode, and attempting to perform a 'Holy-Grail' time-lapse, from day to night.

**Time-Lapse Sequences**

The DigiSnap Pro allows up to four independent time-lapse sequences to be configured, which will work even when the scheduled times overlap. A time-lapse sequence has several configuration parameters.

- **Enable/Disable**
  Most projects may only require one time-lapse sequence, so the others would be disabled.

- **Start / Stop Time**
  The DigiSnap Pro handles time-lapse on a daily basis, which works well for projects where the activity is limited to certain times during the day, such as construction projects, daylit scenes, etc. If you set the Start and Stop times to the same time, the time-lapse will be active all of the time (24 hours / day).

- **Days of the Week**
  In addition to selecting daily windows of time to take pictures, you may also select the days of the week. This is particularly useful for human work related projects, like construction.

**Burst Sequence**

There are many possible projects where the event to be captured with photography may be sporadic. Animal/trail photography is a good example. The DigiSnap Pro has an input signal that can be configured to start a limited (Burst) time-lapse sequence when triggered. A Burst sequence is configured by the interval between pictures, and the number of pictures to take.

**Battery Type**

When used in the Cyclapse housing, Harbortronics will supply one or two 14.8V Lithium Ion battery pack(s). Other systems with sealed housings may be built using 11.1V Lithium Ion, or 12.6V Lithium Iron Phosphate (LiFePO4) battery packs. Internally protected battery packs must be used!

If the battery pack is external to the housing (connected through a SHORT) cable, 12V Lead Acid batteries may also be used. Lead Acid batteries must never be recharged inside a sealed housing!

**Please take care to select the correct battery type when configuring the system! If the setting is wrong, the battery could be overcharged which could destroy the battery pack and possibly be a safety hazard! Alternatively, a wrong setting could undercharge the battery pack leading to very poor performance.**

The battery type can also be set to 'No Charging', which would permit use with primary (non-rechargeable) batteries, or directly from an AC power supply (not recommended for a long term application).

**Image Storage**

When pictures are taken, the images are saved on the memory card in the camera. The DigiSnap Pro can be configured to connect to the camera via USB, extract and move those images. There are two general locations that the DigiSnap Pro can use to transfer the images: local storage and remote storage. If the storage media isn't connected, the images are simply left on the camera.

Local storage would consist of a USB hard-drive or memory stick. Consider a Cyclapse camera system with the DigiSnap Pro mounted on a utility pole overlooking a construction site. Accessing the camera would require climbing the pole, a tall ladder, or a bucket-truck. Alternatively, a USB cable could be connected to the DigiSnap Pro, routed to the base of the pole, and a USB memory stick connected. Images could be collected instantly by swapping memory sticks.

Remote storage is any location on a network or the internet. The DigiSnap Pro can connect to the internet and transfer images to a designated server for instance. The network location may be anywhere you designate. Harbortronics can assist with setting up your own image repository on the 'cloud' if desired. When connecting to a network or internet site, additional settings are required to specify the location, and login.

A major consideration for networking is power consumption. The Network Board, Camera, and storage media must all be powered on and active during image transfer. It can take a fair amount of time to power everything up and establish communication. If the system is solar powered, the power consumption can be optimized by transferring multiple images at a time, rather than each time a new picture is taken. Image transfer can be enabled to occur every time a picture is taken, after multiple (#N) pictures, once per day, once per week, never, or only when remotely commanded.
Networking

In order to save power, the DigiSnap Network Board will be inactive most of the time. When it is powered on to perform a task such as image transfer, it will automatically check the various ports to find a connection to a network. Connection may be made via WiFi, Ethernet, USB cellular modem, or even satellite terminal.

Once the connection path has been found, there may be a log-in for that path, such as a WiFi password. When connected to a network, there may be other log-in processes required for connection to a remote storage location. All of these locations and log-ins may be configured and retained in the DigiSnap Pro.

- Email address, for sending status messages.
- Network URL, Login, and Password, to connect to a remote storage folder, typically on the internet.
- Remote access Login and Password, to remotely control the DigiSnap Pro, from an internet connection.
- Email require several configuration settings: SMPT server address, SMPT port, SMPT user name. Harbortronics has pre-loaded our own email server info into the DigiSnap Pro, so you can get started more quickly.
- WiFi connection password, to connect to a local router.

Networking numerous and large image files via radio can be problematic. For instance, consider a system taking a picture every 5 minutes during a 10 hour work day, 5 days per week. This works out to about 2400 pictures per month. A typical 18MP JPEG image is on the order of 8MB. A 20GB cellular data plan would be required to transfer all images, which might be expensive or perhaps not even available in some locations. A satellite terminal installed in the wilderness might only be able to transfer 20MB per month!

The DigiSnap Pro can be configured to send a reduced set of images (one of N) to reduce the information transmitted. All of the images in this case would be retained on the memory card or local storage for later (manual) collection. This technique requires more interaction with the camera to catalog which images have been sent, so this might draw more power than normal.

Instead of transmitting full sized images (RAW or JPEG), much smaller thumbnail image files can be selected for transmission via networking. While limiting the amount of data sent can reduce the utility of the transmitted images, they can give peace of mind that the system is working, while not requiring a great deal of radio time and expense.

Specifications

Size: 2.3” wide, 3.5” long, 1.0” Tall (easily fits in shirt pocket)
Weight: 156 grams, 5.5 oz
Power Consumption: Approximately 100mW at idle, approximately 2 watts while networking

Power:
- Rechargeable battery pack (2 connections, hot-swap safe)
- 16-30 VDC Input Charge Power Source
  - Power-Over-Ethernet via Network connector, and AC mains power source
  - Dedicated connector (solar panel, battery bank)
- Camera Power: 3-10 VDC output, 3.5 Amp peak capacity. Current monitored to validate camera operation.
- 5V accessory power output, 3A capacity
- Switched 5V and Battery outputs

Signaling:
- Trigger Input (configurable, such as Burst Time-Lapse triggered from motion detector)
- Contact Output (configurable, such as triggering Shoot-Move-Shoot motion controllers)
- Switched 5V Output (configurable, such as powering a network router, or LED illumination)
- Switched Battery Output (configurable, such as powering a heater when temperature is below freezing)
- Remote LED (status indicator)
- Camera Shutter Release (Half/Full Press controls)

Other Connections:
- USB Host (USB 2.0, 2 ports. Camera PTP, Memory Stick, cellular modem)
- MicroSD card (Software Updates, and internal functions)
- UART (GPS, Satellite Terminals)
- Network (10/100 Ethernet)
- DigiSnap Pro Accessory Ports (3x, for additional functions and future applications)
- WiFi (802.11a/b/g/n, external antenna)

The DigiSnap Pro was designed at Harbortronics in Fort Collins, Colorado, USA. All machining, circuit board assembly, final assembly, programming, and testing is performed at Harbortronics, in Fort Collins, Colorado, USA. The DigiSnap and Cyclapse names are trademarks of Harbortronics.
DigiSnap Pro Optional Accessories

The cables and accessories shown here and listed below cover a huge range of requirements, and may not be required for your particular application. Some of these are intended for use with a weatherproof housing such as the Cyclapse.

- **A. USB Cable to Camera**
  A USB cable normally comes with the camera, however we sometimes will provide a right/angle cable to reduce the space the cable takes inside the Cyclapse housing. This of course depends on the camera model used in the system.

- **B. Shutter Release Cable to Camera**
  SLR cameras are easily triggered to take a photo using their remote shutter release port. There are a number of connector types used by the camera manufacturers, but Harbortronics can supply cables for all of these types.

- **C. Power Cable to Camera**
  Most SLR cameras use a 'dummy battery' also called a DC coupler for external power. Other cameras may have a dedicated connector on the camera body. Each camera model may have a specific coupler or connector, but Harbortronics can provide a cable assembly to provide power to all of these cameras.

- **D. WiFi Antenna (Harbortronics p/n 001004)**
  The DigiSnap Pro includes the ability to communicate via WiFi, but this is a short range technique, so is not commonly used to connect to a network. The DigiSnap Pro housing is made from machined aluminum in order to provide shielding against high electric field events (such as nearby lightning), so an external antenna will be required to use WiFi. This antenna uses a short cable, and is perfect for use inside a housing such as the Cyclapse. It does not need to be attached to anything… it can be left standing up unsupported.
DigiSnap Pro

- **E. Bluetooth LE Module** (Harbortronics p/n 001005)
  This device includes a Bluetooth LE module, allowing communication to a smartphone or tablet. The DigiSnap Pro housing is made from machined aluminum in order to provide shielding against high electric field events (such as nearby lightning), so this external device is needed for radio communication.

- **F. Android App**
  The DigiSnap Pro App is provided free of charge, and may be acquired through Google Play, or Amazon App Store. The App is currently for Android only. This App is the primary user interface to the DigiSnap Pro, allowing configuration from a short distance away! If you do not currently own a compatible Android device, we encourage you to purchase a low cost tablet. Please refer to the DigiSnap Pro documentation for suggestions.

- **G. USB Cellular Modem, Multi-Tech (Harbortronics p/n 001028)**
  Automated image transfer from a construction site or other random location is best handled by connection to the internet via a USB Cellular Modem. There are literally dozens of modems on the market, and each cellular network seems to have preferred models. While the DigiSnap Pro 'might' be compatible with a locally provided modem, the Multi-Tech modems are intended to be 'universal', and we are able to support them on most networks. You will need to acquire a SIM card from your local network provider, and register it with a data plan to support the amount of images you plan to transfer.

- **H. Battery Pack**
  The DigiSnap Pro is designed to always operate with an attached battery pack. Multiple battery pack chemistries are supported. The DigiSnap Pro has two connections for battery packs, allowing battery hot-swapping, or simply to increase the total battery capacity. The battery packs shown are designed for the Cyclapse housing.

- **I. Debug Module Cable (not shown) (Harbortronics p/n 001000)**
  The Debug Module is a combination of a custom USB/Serial cable (not shown), and a custom program running on a Windows computer. The Debug Module is normally used for development purposes, but can be used by a customer for configuration, if the Bluetooth LE process is not permitted.

- **J. Ethernet Cable Assembly, Watertight Connection (Harbortronics p/n 001030)**
  When a local area network is available, a direct connection to the Ethernet port on the DigiSnap Pro provides the optimum network connection. This cable and watertight connector extend the Ethernet connection through the wall of a housing, such as the Cyclapse.

- **K. Charge Power Port, Watertight Connection (Harbortronics p/n 000453)**
  A charge power source, such as a solar panel or AC adapter is normally used to keep the attached battery pack charged. This cable assembly extends the charge port connection on the DigiSnap Pro through the wall of a housing, such as the Cyclapse. Mating connectors, solar panels, extension cables, AC power sources, etc., are also available from Harbortronics.

- **L. Signaling Cable (not shown)**
  The DigiSnap Pro has a connection designed to work with external trigger sources, and to control external devices. These are not normally used in a long term time-lapse application, so the cable assembly will be customized as needed, to suit your application.

Long term time-lapse projects may use networking to transfer images, but this is not always necessary, practical, or desirable. In these cases, local collection of the images may be needed. While the camera memory card could be accessed by opening the housing, the most practical way to do extract images manually using the DigiSnap Pro is to connect a USB flash drive (memory stick), through a cable attached to the housing!

- **M. USB Port, Watertight Connection (Harbortronics p/n 001029)**
  This cable assembly extends a USB port on the DigiSnap Pro through the wall of a housing, such as the Cyclapse. A watertight cap is provided, for those times that a mating cable is not attached.

- **N. USB Extension Cable, Outdoor, 15ft (5M) (Harbortronics p/n 000943)**
  This cable mates with the USB port on the housing, providing a watertight cable that may be routed to a convenient location for access.

- **O. USB Adapter, Female-Female Type A (Harbortronics p/n 001007)**
  This adapter simply changes the gender of the cable to allow connection to a local storage device, or to an active repeater cable.

- **P. Local Storage Media**
  A flash drive (memory stick), or even a USB hard-drive may be attached, to receive the images transferred from the camera by the DigiSnap Pro. Harbortronics does not normally provide this device.
Service / Warranty

Philosophy:
Harbortronics is a small private company, and has been in business since 1998, starting in a small basement office, and now operating out of a custom designed 3000 square foot facility with several employees. All of our sales have been derived from word-of-mouth and internet searches. We realized early that customer feedback, either directly to us or to other people on the internet, is stimulated by one of two reasons... either the customer is irritated by a problem, or they are excited about their experience. One of my goals as the Chief Engineer of the company is to reduce the irritations, and try to stimulate excitement! Given the growth of the company, and high number of repeat purchases, I'm encouraged that we may be doing things fairly well.

If you have a problem with our equipment, if you have difficulties getting things to work, or have any complaints about how we have treated you, my philosophy is to do my absolute best to find a way to satisfy you. That may mean going beyond the legal obligations of our warranty, suffer complete loss of profit on an occasional sale, or whatever it takes. It's been immensely satisfying to find that over the last decade, this philosophy has created such satisfaction in our customers. We take great pride that of the many hundreds of comments on the internet about Harbortronics, there are almost no negative comments! That's not to say that we haven't had our share of problems with our equipment, but again, I do my best to quickly and effectively address customer concerns! -Mark Roberts

Legal:
All Harbortronics products are warranted against any manufacturing defects for a period of one (1) year from the date of purchase. Defective products should be returned to Harbortronics. Harbortronics will at its discretion, repair or replace such products without charge, and will return to the customer. Except as mentioned above, no other warranty expressed or implied, applies to this Harbortronics product. All other claims, of any nature, including but not limited to camera damage, and loss of data are not covered. This warranty does not cover damage caused by misuse, accident, or abuse. This warranty does not cover consequential damages or other incidental damages. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusions may not apply to you. Contact Harbortronics at www.Harbortronics.com for service instructions.

Appendix 1: LED Blinking Sequence

Summary Status
During initial power-up, the internal and External LEDs will blink green 8 times to indicate that it is operating. If the DigiSnap is reset to factory default conditions, they will blink amber 8 times.

In normal operation, the LEDs will flash periodically to indicate the status of the system, as well as the time to the next picture. The internal and external LED be disabled if needed. The LEDs will be off during the periods of time that the shutter is open.

The flash color indicates the status of the system. Green indicates that no issues have been detected. Amber indicates that the system is operating, but there is no charge power source, or that the battery voltage is somewhat low. Red indicates that there is a problem that needs to be addressed, such as a camera failure, a very low or over charged battery, or a power supply failure.

Green: OK
Amber: An issue has been detected, but the system may still be operating.
Red: A problem has been detected, which needs to be addressed.

Time between flashes depends on the estimated time to the next scheduled picture:

<table>
<thead>
<tr>
<th>Time between sequences</th>
<th>Time to next Picture</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 sec</td>
<td>Less than 2 min</td>
</tr>
<tr>
<td>20 sec</td>
<td>2.. 5 min</td>
</tr>
<tr>
<td>30 sec</td>
<td>5..10 min</td>
</tr>
<tr>
<td>40 sec</td>
<td>10..20 min</td>
</tr>
<tr>
<td>50 sec</td>
<td>20..40 min</td>
</tr>
<tr>
<td>60 sec</td>
<td>40..90 min</td>
</tr>
<tr>
<td>70 sec</td>
<td>90..180 min</td>
</tr>
<tr>
<td>80 sec</td>
<td>180..360 min</td>
</tr>
<tr>
<td>90 sec</td>
<td>More than 360 min</td>
</tr>
</tbody>
</table>
**Detailed Status**

A special status sequence will be displayed when the user push button is used to request more detailed information (held for 2-4 sec, or until the Amber color is displayed).

**Blink:**
- Standard blink per item: 200mS on, 1S off
- Extended blink: 1S on, 1S off

**Status Sequence**

1. **Overall for all items below.**
   - If all OK/Normal, Extended Green, and skip all of the rest of the status items
   - If any significant failures below, Extended Red, otherwise Extended Amber.
2. **Camera:**
   - If last picture is suspected to have failed, Extended Red.
   - If power is not supplied by the DigiSnap Pro, Extended Amber.
   - If power is supplied by DigiSnap Pro, and no failure of last pic detected, Extended Green.
3. **Battery Voltage:**
   - 12.6-14.5V: Amber
   - 14.5-16.1V: Green
   - 16.1-16.8V: Amber
   - Otherwise: Red
4. **Battery Charger:**
   - Extended Green if all sub-items are OK, Extended Amber if not
   1. **Input Voltage:**
      - 16-30V: Green
      - 5-16V: Amber
      - Otherwise: Red
   2. **Charger Electronics:** Green if OK, Red if fault
5. **Controller Board:**
   - Extended Green if all sub-items are OK, Extended Red if not
   1. **Power Supplies:** Green/Red
   2. **Real time clock:** Green/Red
6. **Network Board:**
   - Extended Green if all sub-items are OK, Extended Amber if a problem detected.
   - Note: If the Network Board is not installed, there will be no status shown.
   1. **Camera Memory Full:** Green/Red
   2. **External Memory Full:** Green/Red
   3. **Network Availability:** Green/Red
   4. **Image Transfer:** Green if successful or not enabled, Red if failure

If you need to contact Harbortronics to interpret the status display, you can record the external led display on your cell phone video camera and send to Harbortronics for review.