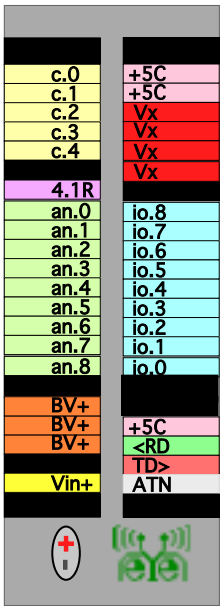
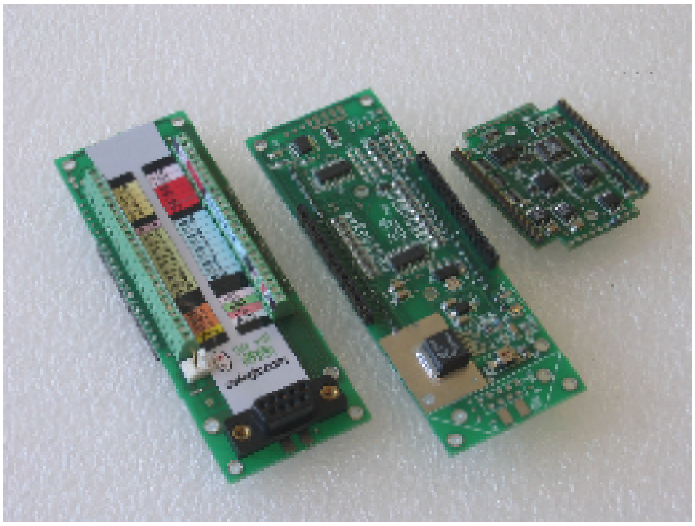
Owl topboard type 1, TB1-1048

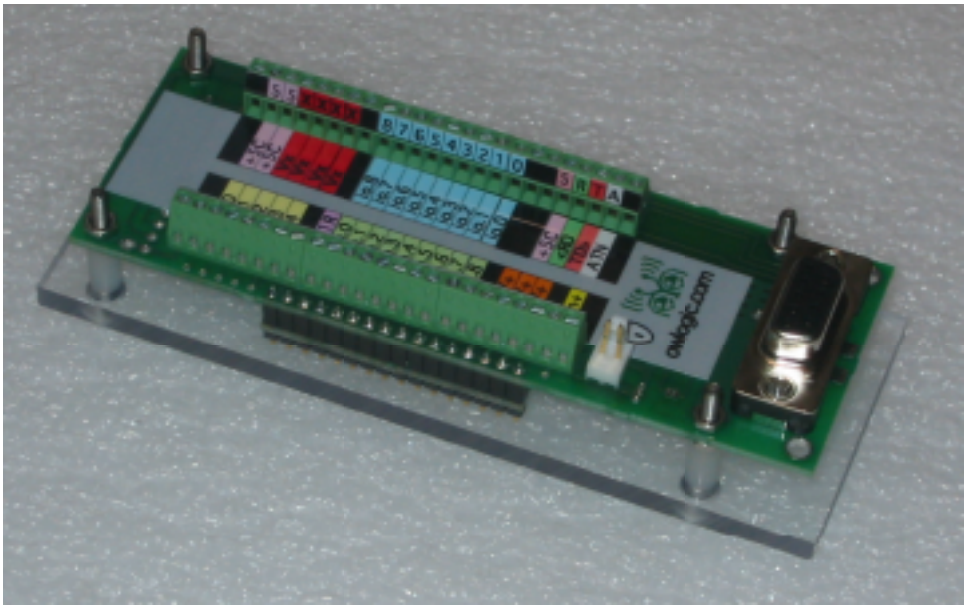
The TB1-1048 top board is designed to bring the OWL2pe signal lines out to rugged and convenient Phoenix terminals, where wires to sensors and other peripherals can be attached with no more than a screwdriver for field wiring. This topboard brings out all 9 OWL2pe analog inputs, 9 direct BASIC Stamp i/o, and the switched, reference and constant power supplies. The topboard adds 5 supplemental counter inputs, a battery charge regulator, as well as supplemental protection from input transients.

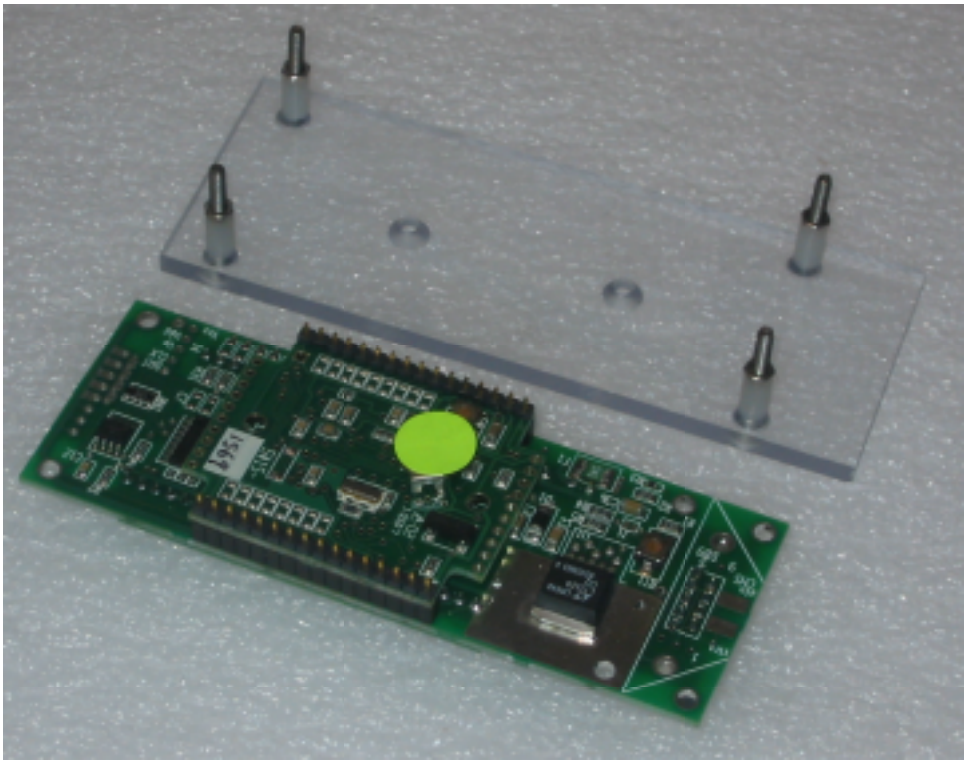
- OWL2pe breakout board with 48 terminals on 0.10" centers
  with provision for 8 additional terminals for special applications.
- size, 4 inches by 1.6 inches, it plugs in on top of the OWL2pe data logger.
- Phoenix screw-down berylium copper terminals.
- 9 dedicated analog to digital channels, an.0 to an.8
- 9 multi-function digital direct BASIC Stamp pins, io.0 to io.8
- 5 dedicated counter inputs for things such as rain and flow gages, c.0 to c.4
- either DB9S or waterproof circular panel connector for RS232 terminal connection.
- I/O protection network for each signal pin, against ESD or miswiring
- Battery charger for 6 or 12 volt sealed Pb-acid battery
- Connector for plug in battery power, marked (+ -) in oval.
- Power supplies:
  fused battery, 0.5 amps total, BV+
  switched 5.5 volts, 150 mA, can be factory set from 5.0 to 12.0 volts , Vx
  constant 5 volts, 100 mA, +5C.
  switched 4.096 volt reference, 5 mA,, 4.1R



The photo shows the TB1-1048 top and bottom side, with the DB9 connector installed. The label strips can be configured for special applications. The OWL2pe core is shown on the right, and it plugs into the mating connector on the TB1-1048.







Installation of the TB1-1048 with the OWL2pe. Note the orientation of the OWL2pe, with the coin battery facing away from the TB1-1048 on the end closest to the power supply and DB9 programming connector.

To install the OWL2pe, set it on top of the TB1-1048. To remove the owl use a soft implement such as a 1/8" wood dowel. Pry up gradually at the 4 corners until the OWL2pe springs free.

The assembly is shown next to a polycarbonate mounting plate.

Further detail:

• Terminals an.0 to an.8 are analog inputs only, from 0 to 4095 millivolts, connected to OWL analog inputs of the same designation. These are color coded green.

• Terminals io.0 to io.8 are direct Stamp i/o only, connected to the Stamp pins p0 to p8. These are color coded blue.

• Terminals c.0 to c.4 are dedicated counter/debouncer inputs for things like rain gages, flow meters, or anemometers. The counter is a dedicated chip that is accessed via OWL2pe signal pin p9. Color coded yellow.

• The top board provides protection for the i/o terminals against lightning and mis-wiring. This is implemented by means of 200 ohm resistors in conjunction with an active clamp circuit (SP720-see schematic) on every signal line. The network diverts potentially harmful currents to ground. There are also 330 ohm resistors in series with each input on the OWL2pe board itself, which provide an additional level of protection.

• The TB2-15 has 10 common terminals, coded black. The signals and power supplies are both measured wrt common. All of these common terminals are connected together internally.

Power supplies:

• The operating current is up to 16 milliamps to operate the OWL itself, plus whatever current is required by external circuitry. In sleep mode, the current consumption drops to 60 microamps.

• Input power power from 5.5 to 15 volts DC comes in on the terminal "Vin", This is the input to the battery charger, and it will run the OWL itself even if no battery is present. The battery charger can be set for either 6 or 12 volt charging. The Vin has to be higher than the desired battery charging voltage. For example, to charge a 12 volt Pb-acid battery, the input voltage should be at least 14.3 volts in order to provide the 13.8 recommended float charging voltage. The charger is tempurature compensated and is capable of supplying one amp and is low dropout for efficient operation with solar panels. The maximum input voltage is 30 volts. The regulator is set up to be safe from reversed power connection on either its input or its output.

• The TB1-1048 provides fused constant battery power at up to 400 milliamps on the 3 terminals terminal labeled "BV+".

• A battery can be plugged into the polarized Molex connector. If it is a sealed Pb-acid battery, it can be charged by the on-board battery charger. Other types of batteries can be used with the OWL2pe, but the charger should not be used with those types. If a non-rechargeable battery is desired as a backup for a primary power source (coming in through Vin, with the battery plugged into the keyed terminal), then a diode should be included in the battery lead to prevent current from flowing back into the battery.

• The TB1-1048 provides Vx power on 4 terminals at up to 150 milliamps total. These are red-coded terminals labeled "Vx". This is a voltage selected at the time of ordering the OWL2pe, and is 5.5 volts by default. Other popular options are 5.0 volts, 6.0 volts, 9.0, and 10.0. The primary power supply must be greater by at least 0.3 volts greater than the voltage expected out from Vx.

This Vx power can be switched on and off under program control. The Vx terminals are usually the main power for external sensors and other devices.

• The 4.096 volt reference is available on the terminal labeled "4.1R". Coded pink. This pin has an output resistance of 200 ohms, and a current maximum of 2 milliamps, and it can be switched on and off by the OWL2pe. The reference signal from the OWL2pe is buffered by an op-amp, so as to isolate the OWL reference from the outside world. In order to turn on the reference, the Vx power must also be turned on.

• The analog inputs are not doubled up with the digital, so the total number of signals available is greater than is the case with the multiplexed topboard, type 2. The tradeoff is that there are fewer power supply and common terminals. This is is well suited for situations where there is a wiring harness to connect to the outside world.

• This topboard has mounting holes for #4-40 screws, aligned with the mounting holes in the OWL2pe module. It also has mounting holes on the four corners and next to the DB9 connector. Screws there can also be used for strain relief ties, and for grounding.

• The serial port connections come into the 4 pins at the corner:
  common
  white ATN connects to PC DTR line, reset signal from PC to OWL.
  red TXD connects to PC TXD line, data from PC to OWL
  green RXD connects to PC RXD line, data from OWL to PC

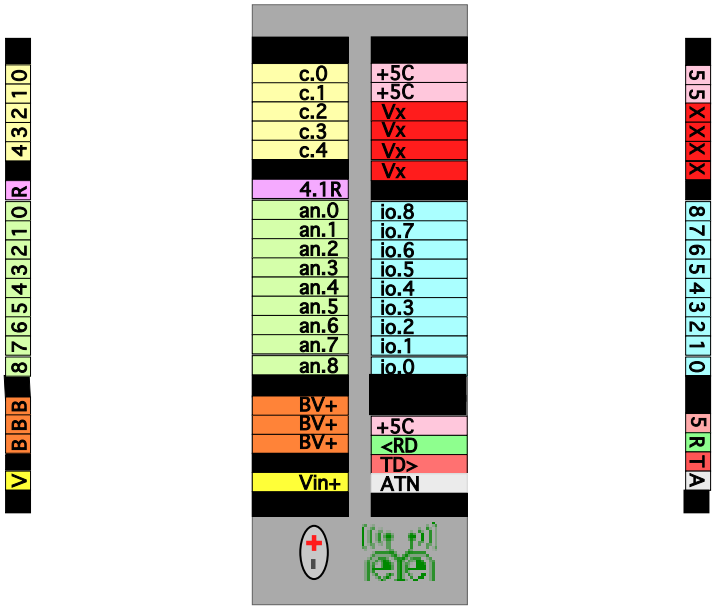
• Optional connectors

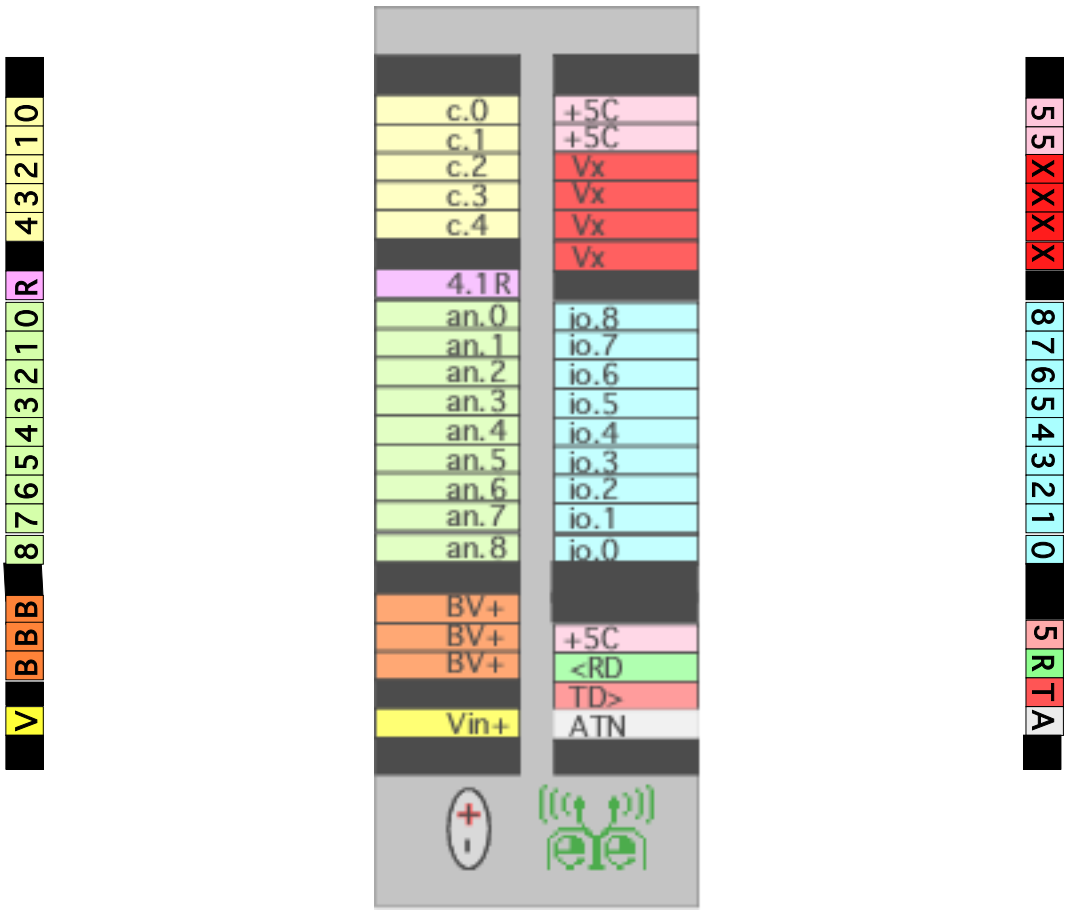
• additional terminals

The photo above shows the OWL2pe with a topboard, mounted in a gasketed (NEMA4) polycarbonate enclosure. This contains a battery pack. Wiring passes through 5 to 10 gland nuts. The connector on the end is the Switchcraft waterproof CN5, for the RS232 offload and test functions.

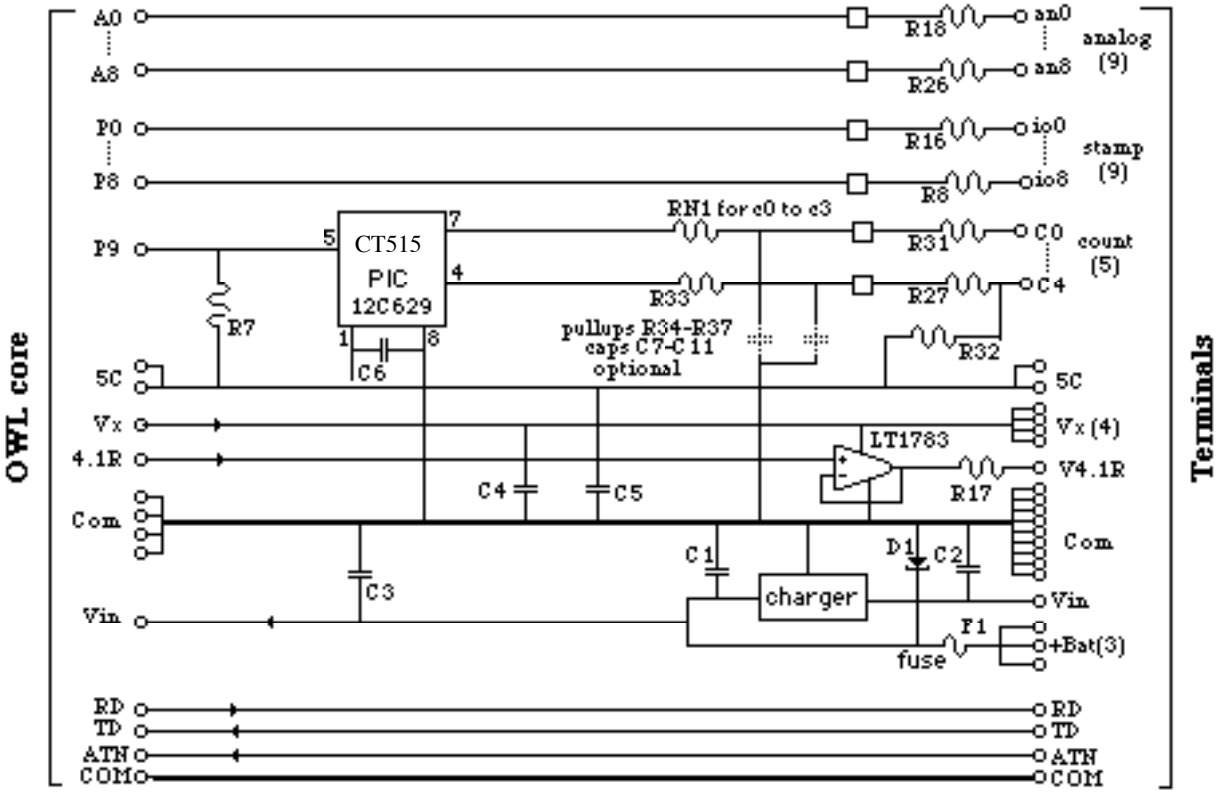
Summary for field wiring:

- Molex header next to +/- in oval at bottom left is the battery connector. Use either 12 or 6 volt Pb acid battery, matched to the charger setting. Other battery types can be used if they are isolated with a steering diode.
- **Vin** -- connect to (+) side of power supply, (-) side to neighboring common (black). This is the input to the battery charger.
- VB+ These 3 terminals provide direct battery power, unswitched, limited by a 0.5 amp self-resetting polyfuse. Vin has to be greater than the float charging voltage for the Pb-acid battery (13.8 or 6.9), and Vin must be greater than Vx..
- **Vx** -- switched voltage. up to 150 ma. 5.5 volts is the default, but it can be set at the factory to any voltage from 3.75 to 12.0 volts, 150 milliamps.
- **5C** -- 5 volt regulated, 100 ma. Be careful with this as it is the main processor power
- **4.1R** -- reference voltage output, 4.096 volts, 5 ma maximum, 10Ω output resistance. This is isolated from the OWL reference by a buffer op-amp, and Vx power must be turned on also for 4.096 to be available.
- **common** -- (black, 10 places)
- **A.0–A.8**-- analog inputs, 0 to 4.096 12 bits, 1 mV per bit, high impedance inputs
- **io0 to io8** -- digital inputs or outputs, PBASIC capable pins (see text)
- c0 to c4 -- dedicated counter inputs.



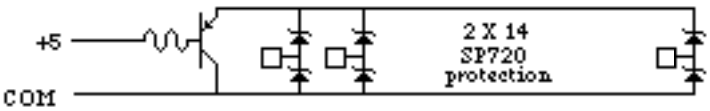


This sheet can help to plan and document sensor wiring to the top board TB1-1048



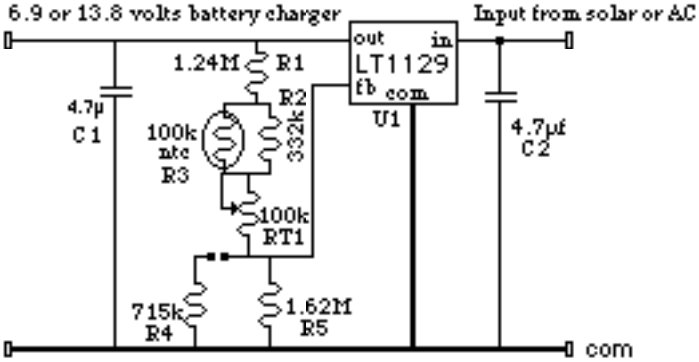
The TB1-1048 schematic is depicted above and below. OWL2pe analog inputs a0 to a8, pass through to terminals an.0 to an.8, via 200 ohm resistors and an active transient clamp circuit. The clamp is an SP720, designated as a small square. Likewise, general purpose i/o pins p0 to p8 pass through to terminals io.0 to io.8. The CT515 is an especially programmed PIC12F629, dedicated to scanning and debouncing switch inputs. The OWL2pe addresses the CT515 via pin p9. The LT1783 is an op-amp that serves to buffer the output of the reference. This output is active only when both the Vx power and the 4.096 reference power are turned on by the OWL2pe. The battery charger is based on the LT1129 regulator, and includes temperature compensation for charging 6 or 12 vo Pb-acid batteries. Jumper J1 is closed for 12 volt batteries and open for 6 volt. The jumper is a solder pad located next to the battery connector on the circuit board.

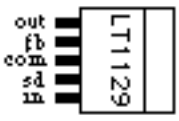
Protection network:



Each square corresponds to a signal node on the TB1048

Charger:

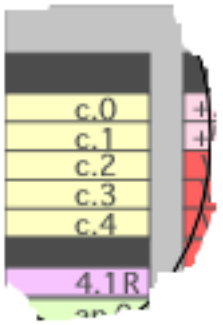




thermistor compensates charger for ambient temperature
jumper selects 6 or 12 volt charger
trim for 13.8 or 6.9 volts output at 25 °C

CT515

Counter channels are useful for rain gages, anemometers, flow meters, traffic counters, pushbuttons, and many other peripherals. The TB1048 includes a chip that allow counting tasks to be offloaded from the main BASIC Stamp processor. This saves power, because the BASIC Stamp can spend more time asleep. And it simplifies the programming, because the BASIC Stamp does not have to maintain the counts, rather, it only has to read out the counts from the CT515 at regular intervals.



There are 5 counter channels on the TB1048, labeled C0 to C5. These channels have a built-in 20kΩ pullup resistor, so that normally open switches can be attached to the pins with not further interface required. The counter is debounced so that mechanical switches can be used without danger that multiple counts will occur as the switch opens and closes. Here is typical switch wiring.

The CT515 is connected to the OWL2pe/BASIC Stamp via a single pin. OWL2pe top boards make this connection via pin P9, and the example programs refer to that pin. (www.owlogic.com) Data is transferred at 9600 baud True (It rests at high level, 5 volts, and goes low zero volts for the start bit.)

When a program needs to read the counters, it brings the data pin low for at least 10 milliseconds, and then releases it to the high level. The CT515, after a 3ms delay to allow the Stamp to prepare, sends back an ascii string (ttl level rs232). The string consists of ascii $80 followed by a byte that contains the immediate state of the 5 inputs, and then 5 binary counter word values, each sent least significant byte first. The bytes are paced, one millisecond apart. After the CT515 sends out this string, it resets all of the counters to zero.

		cwv		cww		cwx		cwy		cwz	
$80	$xx	lsb	msb	lsb	msb	lsb	msb	lsb	msb	lsb	msb

```
go_count:
     LOW goCountPin
     PAUSE 10
     INPUT goCountPin    ' pullup resistor pulls the pin high
     SERIN goCountPin,$54,100,noData,[WAIT ($80),xx,STR cwv0\10]
     RETURN
```

The SERIN command in this syntax, using the STR modifier, will put the 5 counter results in the 10 bytes, 5 words, cwv to cwz, where the program can subsequently display them and do its calculations and take other actions.