LLAC4
Four-Channel, Low-Level AC Conversion Module

Instruction Manual

23.4.12

CSL 124

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PLEASE READ FIRST

About this manual

Please note that this manual was originally produced by Campbell Scientific Inc. primarily for the North American market. Some spellings, weights and measures may reflect this origin.

Some useful conversion factors:

Area: 1 in^2 (square inch) = 645 mm^2

Length: 1 in. (inch) = 25.4 mm
1 ft (foot) = 304.8 mm
1 yard = 0.914 m
1 mile = 1.609 km

Mass: 1 oz. (ounce) = 28.35 g
1 lb (pound weight) = 0.454 kg

Pressure: 1 psi (lb/in^2) = 68.95 mb

Volume: 1 UK pint = 568.3 ml
1 UK gallon = 4.546 litres
1 US gallon = 3.785 litres

In addition, while most of the information in the manual is correct for all countries, certain information is specific to the North American market and so may not be applicable to European users.

Differences include the U.S standard external power supply details where some information (for example the AC transformer input voltage) will not be applicable for British/European use. *Please note, however, that when a power supply adapter is ordered it will be suitable for use in your country.*

Reference to some radio transmitters, digital cell phones and aerials may also not be applicable according to your locality.

Some brackets, shields and enclosure options, including wiring, are not sold as standard items in the European market; in some cases alternatives are offered. Details of the alternatives will be covered in separate manuals.

Part numbers prefixed with a "#" symbol are special order parts for use with non-EU variants or for special installations. Please quote the full part number with the # when ordering.

Recycling information

At the end of this product's life it should not be put in commercial or domestic refuse but sent for recycling. Any batteries contained within the product or used during the products life should be removed from the product and also be sent to an appropriate recycling facility.

Campbell Scientific Ltd can advise on the recycling of the equipment and in some cases arrange collection and the correct disposal of it, although charges may apply for some items or territories.

For further advice or support, please contact Campbell Scientific Ltd, or your local agent.

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WHEN MEASUREMENTS MATTER

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LLAC4 Four-Channel, Low-Level AC Conversion Module

1. General Description

The LLAC4 is a peripheral device used to increase the number of low-level AC signals a datalogger can monitor. The module enables four datalogger control ports to emulate pulse-counting channels by converting the low-level AC signals to the logic levels datalogger control ports require.

The LLAC4 is often used to measure up to four anemometers, and is especially useful for wind profiling applications. Compatible wind sensors include, but are not limited to, the 05103 Wind Monitor, 05106 Wind Monitor-MA, 05305 Wind Monitor-AQ, 03001 Wind Sentry Set, and 03101 Wind Sentry Anemometer.

Figure 1. LLAC4 four-channel, low-level AC conversion module

2. Specifications

Power: 8 to 16 Vdc
0.1 mA @ 12 Vdc

Signal Conditioning: **Minimum AC Input Voltage versus Output Square Wave Frequency:**

Input Sine Wave (mV RMS)	Output Square Wave Range (Hz)
20	1.0 to 20
200	0.5 to 200
2000	0.3 to 10,000
5000	0.3 to 20,000

AC Coupling Removes DC Offset: up to ±0.5V

Input Hysteresis: 16 mV @ 1 Hz

Max AC Input Voltage: ±20 V

Dimensions: 8.0 W x 5.4 H x 2.5 D cm
(3.1 in x 2.1 in x 1.0 in)

11.2 W x 5.4 H x 2.5 D cm
(4.5 in x 2.1 in x 1.0 in)
including base mounting flange

Cable Length: 0.6 m (2 ft)

Weight: 92 g (3.2 oz)

3. Measurements

Sensors, such as anemometers, may produce a sinusoidal AC signal output where the frequency is proportional to the speed of rotation. This AC signal is induced in a stationary coil by a magnet mounted on a rotating shaft.

The datalogger's pulse channels can read this low-level AC signal directly. The LLAC4 has signal conditioning to convert the low-level AC to a 0 to 5 volt square wave that can be measured on the datalogger's control ports. The frequency response of the LLAC4 is the same as the low-level AC on the pulse inputs.

Typically, propeller type anemometers operate at higher frequencies than cup anemometers at the same wind speed (see Table 1).

Table 1. Sensor Output Frequencies

Sensor	Output @ 50m/s	Type
05103	510Hz	Propeller
03101	67Hz	Cup

The datalogger must also be able to read these high frequency pulses on its control ports. Table 2 shows some common dataloggers and their compatible control port specifications.

Table 2. Control Port Compatibility			
Datalogger	**Input (Hz)**	**Control Port**	**Measurement Type**
CR1000 CR3000	400,000	C1,C2… C8	High Frequency
CR800	400,000	C1,C2,C3,C4	High Frequency
CR5000	5,000,000	C7,C8	High Frequency
CR23X	2,500	C5,C6,C7,C8	High Frequency
CR200(X)	1,000	P_LL,P_SW,C1,C2	High Frequency
CR10X	40	C6,C7,C8	Switch Closure

Comparing Table 1 to Table 2 suggests that the CR10X may not be able to read either type of anemometer in high wind situations. However, all other dataloggers would be appropriate choices.

4. Wiring

Most sensors that have a low-level AC output will have three wires: signal, reference, and drain. The signal wire should go to P1 – P4 on the LLAC4 and the reference and drain wires to a ⏚ on the LLAC4. The LLAC4 also requires that 12 V be applied to its 12 V terminal and G. This power should come from the datalogger or the datalogger's power supply.

A low-level AC signal on P1 will be converted to a 0-5 V square wave on the D1 terminal. D1 can be wired to an appropriate datalogger control port that can make high frequency measurements.

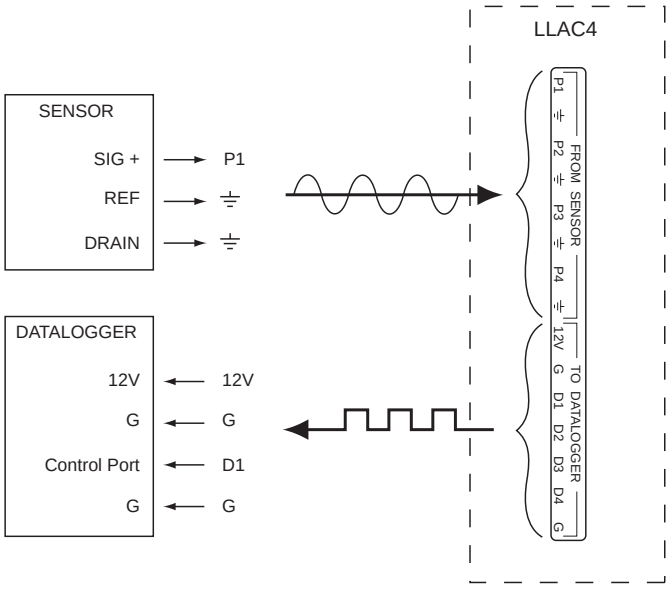

Figure 2. LLAC to TTL

5. Program Examples

Using the CR1000, let's measure four different wind speed sensors that produce low-level AC signals. These will include the RM Young 05103, 05106, 05305, propeller type anemometers, and RM Young 03101 cup anemometer. Program examples are provided for both the CR1000 and the CR200(X).

Wiring						
Sensor			**LLAC4**		**CR1000**	**CR200(X)**
05103-L	Sig +	Red	P1			
	Ref	Black	⏚			
	Drain	Clear	⏚			
05106-L	Sig +	Red	P2			
	Ref	Black	⏚			
	Drain	Clear	⏚			
05305-L	Sig +	Red	P3			
	Ref	Black	⏚			
	Drain	Clear	⏚			
03101-L	Sig +	Black	P4			
	Ref	White	⏚			
	Drain	Clear	⏚			
			12 V	Red	12 V	Battery +
			G	Black	G	G
			D1	White	C5	PLL
			D2	Green	C6	C1/SDI-12
			D3	Yellow	C7	C2
			D4	Blue	C8	P_SW
			G	Clear	G	G

CR1000 Example Program

```
'CR1000 Series Datalogger
'LLAC4 Sample Program
'Record 10-minute average wind speed in m/s for:
'1 RM Young 05103-L Wind Monitor Anemometer
'1 RM Young 05106-L Marine Wind Monitor Anemometer
'1 RM Young 05305-L AQ Wind Monitor Anemometer
'1 RM Young 03101-L Wind Sentry Anemometer

'Declare Public Variables
Public RMY05103WS
Public RMY05106WS
Public RMY05305WS
Public RMY03101WS

'Define Data Tables
DataTable (WindSpd,1,-1)
  DataInterval (0,10,min,0)
    Average (1,RMY05103WS,FP2,False)
    Average (1,RMY05106WS,FP2,False)
    Average (1,RMY05305WS,FP2,False)
    Average (1,RMY03101WS,FP2,False)
EndTable

'Main Program
BeginProg
  Scan (1,Sec,0,0)
    PulseCount (RMY05103WS,1,15,0,1,0.098,0.0)
```

```
    PulseCount (RMY05106WS,1,16,0,1,0.098,0.0)
    PulseCount (RMY05305WS,1,17,0,1,0.1024,0.0)
    PulseCount (RMY03101WS,1,18,0,1,0.750,0.20)
    If RMY03101WS < 0.21 Then
      RMY03101WS = 0.0
    EndIf
  CallTable WindSpd
  NextScan
EndProg
```

CR5000 Example Program

```
'CR5000 Series Datalogger

Public Pulse_LLAC(2)

BeginProg
  Scan (1,Sec,0,0)
    'Measure low level AC signal (RMY 05103) on LLAC4 wired to C7 and C8 on CR5000
    TimerIO (Pulse_LLAC,11000000,88000000,10,mSec)  'NOTE: Only ports CR5000 C7 and C8
                                                    'support Function 8 (frequency in Hz).
  NextScan
EndProg
```

CR200(X) Example Program

```
'CR200(X) Series Datalogger
'LLAC4 Sample Program
'Record 10-minute average wind speed in m/s for:
'1 RM Young 05103-L Wind Monitor Anemometer
'1 RM Young 05106-L Marine Wind Monitor Anemometer
'1 RM Young 05305-L AQ Wind Monitor Anemometer
'1 RM Young 03101-L Wind Sentry Anemometer

'Declare Public Variables
Public RMY05103WS
Public RMY05106WS
Public RMY05305WS
Public RMY03101WS

'Define Data Tables
DataTable (WindSpd,1,-1)
  DataInterval (0,10,min)
    Average (1,RMY05103WS,False)
    Average (1,RMY05106WS,False)
    Average (1,RMY05305WS,False)
    Average (1,RMY03101WS,False)
EndTable

'Main Program
BeginProg
  Scan (1,Sec)
    PulseCount (RMY05103WS,P_LL,0,1,0.098,0.0)
    PulseCount (RMY05106WS,C1,0,1,0.098,0.0)
    PulseCount (RMY05305WS,C2,0,1,0.1024,0.0)
    PulseCount (RMY03101WS,P_SW,0,1,0.750,0.20)
    If RMY03101WS < 0.21 Then
```

```
            RMY03101WS = 0.0
        EndIf
    CallTable WindSpd
  NextScan
EndProg
```

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