L-3’s PCM400 is a fifth generation micro-miniature programmable data acquisition system suited for ultra-small weapons and UAS tactical and flight test missions.

Delivering advanced capabilities to acquire, convert and process today’s high data rate signals, L-3’s PCM400 provides a flexible, high-performance platform, supported by state-of-the-art signal conditioning for the most demanding applications.

Its flight heritage is based on the highly successful L-3 PCM330 and PCM600 data acquisition products that have been provided for smart weapons, UAS and launch vehicle programs.

The PCM400 brings unparalleled acquisition capabilities while continuing to set new standards for size, weight and power-constrained applications.

Users may select from a multi-functional suite of acquisition modules to develop a data acquisition solution that meets tough modern day requirements in a cohesive and flexible fashion. Special design constraints were considered to deliver superior capabilities for high-speed serial data interfaces, video, and fast sample rate analog and discrete data acquisition channels.

Easy configuration setup, control and monitoring is accomplished via L-3’s Vista-Tec™, a telemetry and avionics user application with an intuitive graphical user interface, (GUI) that is additionally coupled with ground processing capabilities. This provides a complete, fully integrated end-to-end solution for the instrumentation and flight test engineer.

Driven by demands for increased functionality, performance and channel density, the PCM400 is the encoder that users are turning to when they need small size, high data rates, high fidelity, tight tolerances and an unmatched history of successful in-flight performance.

FEATURES

- Ultra-small footprint/volume for compact telemetry system requirements
- High-speed operation - up to 40 Mbps
- PCM and IRIG 106 Chapter 10 Ethernet outputs
- IRIG time synchronization and generation: G PWM mode
- Embedded triaxial accelerometers
- User-programmable through Ethernet and USB interfaces
- ESD-protected digital I/O
- Programmable signal conditioning and serial digital interfaces
- Standard serial digital interfaces: USB, Ethernet and UART
- User-configurable with over 20 modules in a synchronized master/remote system
- Extensive built-in-test: temperature, internal voltages, serial link status, accelerations
- Fault-protected analog I/O, excitation & power
PCM400 – OVERVIEW

In any test environment, features, reliability, size, ease of use and cost are major factors in selecting data acquisition equipment. Additionally, today’s modern test environments require flexibility as a key element for the successful deployment of any telemetry system, especially when the current data acquisition system must not only support the current development, but also any future anticipated programs.

The PCM400 data acquisition offerings were specifically designed to address the dynamic needs of modern test systems in an ultra-miniature form factor while still supporting legacy interfaces to ease the transition as test environments are modernized.

These needs are addressed with L-3’s PCM400 and its simple, modular architecture consisting of interface and power supply modules.

MODULES OVERVIEW

Modules can be interconnected in a branching multi-level array using up to a 1 to 4 fan-out ratio; therefore, a three-level system could have up to 21 interface modules. The modules can be co-located or distributed throughout the vehicle. Module interconnections are a proprietary two-pair serial interface providing synchronizing system clock, time and bidirectional data capabilities.

System time and synchronization are critical for correlating sensor information. Each module supports receiving and generating PWM IRIG system time and will discipline the system bit rate to the IRIG input time when present. Additionally, when the PCM400 encoder is feeding into a larger telemetry system, the PCM data rate may be slaved or disciplined to the system, such as when providing telemetry data to a serial input of another master encoder.

Every module gathers local telemetry, such as temperature, power supply levels, serial link status, accelerometer and pressure information. There are two tri-axial accelerometer systems, a low bandwidth (~3 kHz, ±200 g) and wide bandwidth (~10 kHz) factory-settable (± 70, 250 or 500 g) system. In distributed module system configurations, these local accelerometers may be able to eliminate the need for external accelerometers or at a minimum can provide useful redundant motion information.

The common core design supports network connectivity, USB, UART, serial data interfaces (e.g., SDLC, 1-wire, 2-wire & 3-wire configurations) and digital discrete I/O. Furthermore, the core design provides legacy PCM outputs for traditional PCM links while simultaneously streaming a Chapter 10 IRIG UDP output on the Ethernet port. Therefore, any module type can serve as the master encoder, which provides great flexibility in configuring the master/remote module locations.
**PCM410 – BASE UNIT MODULE OVERVIEW**

The PCM410 module is a multi-functional base unit with the core interface support mentioned previously augmented with 10 precision differential analog channels supporting onboard bridge completion, attenuation and/or RFI filtering. Additionally, the module provides voltage or current mode excitation selectable on a channel-by-channel basis and also sends out the excitation on the user interface connector for external sensor biasing. Providing a highly flexible base unit that supports the majority of data acquisition needs simplifies the initial hardware selection, procurement and spare stocking. After installation, users need less training as fewer module-specific GUIs are required.

PCM400 modules are powered from a nominal external bus voltage of 15 V. If 15 V is not available locally, the PSM410 is available, which takes in standard 28 V avionics power and provides an isolated 15 V at up to 40 W making it capable of powering multiple PCM400 modules.

### PCM410 FEATURES & FUNCTIONAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>General</th>
<th>Power Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCM Bit Rate Stability 78.125 Kbps to 40 Mbps, ±20 ppm</td>
<td>Input Range: 15 V±5% Low Ripple Source &lt; 50 mVpp measured in a 1 kHz to 20 MHz bandwidth</td>
</tr>
</tbody>
</table>

**Control Interfaces**

- Programming & Status via: Ethernet, USB & Serial Port

**Asynchronous Serial Data Interfaces (LVDS)**

- Up to 4 Asynchronous ports
- 300 to 1 Meg baud rates
- 255 word buffers
- 7, 8 or 9 bits
- Parity: odd/even/none

**Synchronous Serial Data (LVDS)**

- Up to 4 synchronous 1, 2 & 3 wire interfaces, SDLC
- Burst rates to 40 Mbps
- 16 K word buffers

**Other Serial Data Interface**

- Serial data can be inserted into the PCM stream from Ethernet UDP packets or Host USB 2.0 interface

**Auxiliary I/O**

- 12 differential LVDS ports 100 Ohm terminations

**Module Interconnect**

- Up to 100 ft. w/individually shielded twisted pairs

**Programmable Outputs (LVDS)**

- PCM Data/Clock Major/Minor frame strobe; word strobe; PWM IRIG Time Code; Trigger Events

**Embedded Tri-Axial**

- Sensor 1: ±200 g range typical 3 kHz bandwidth
- Sensor 2: Factory settable range, ±70, 250 or 500 g, 10 kHz bandwidth

**Environmental**

<table>
<thead>
<tr>
<th>Temperature Operation: -40 °C to +85 °C</th>
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</thead>
<tbody>
<tr>
<td>Base plate temperature storage: -54 °C to +125 °C</td>
</tr>
</tbody>
</table>

**Vibration**

- Sine: 20 g, 20 to 2000 Hz
- Random: 71.43 g, 20 to 2,000 Hz

**Acceleration**

- 125 g all axis, 5 min. per axis

**Humidity**

- 1% to 98% Relative

**Shock**

- 1500 g half sine, 0.5 ms
- 10 Kg @10 kHz, Q=10

**Power Usage**

- 2.5 W to 3.2 W nominal 3.4 W to 4.2 W worst-case Factory option dependent excitation not included
### PCM400—NETWORKED PCM ENCODER DATA ACQUISITION SYSTEM

#### DIFFERENTIAL ANALOG INPUTS

<table>
<thead>
<tr>
<th><strong>Inputs</strong></th>
<th>10 channels</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Software-Programmable Input Range</strong></td>
<td>±10 mV to ±10 V primary channels Higher input ranges supported with fixed input attenuators up to ±40 V Gain/Offset are automatically controlled based on the input levels</td>
</tr>
<tr>
<td><strong>Inputs</strong></td>
<td>Input Impedance &gt; 10 MΩ Input Bias Current &lt; ±2 nA Input Offset Current &lt; ±2 nA AC coupling options to ~1 Hz</td>
</tr>
<tr>
<td><strong>Input Protection</strong></td>
<td>Standard: Unpowered ±25 V Powered ±40 V (Contact factory for higher options)</td>
</tr>
<tr>
<td><strong>Analog Filtering</strong></td>
<td>Factory setttable input RFI filtering (8.5 KHz to 85 KHz) w/o attenuators, (1.4 KHz to 36 KHz) with attenuators 3rd order anti alias filter with typical 33 KHz -3 dB bandwidth &amp; 10 KHz 0.2 dB bandwidth Factory options down to ~7 KHz</td>
</tr>
<tr>
<td><strong>Sampling/Accuracy</strong></td>
<td>Up to 125 ksp/s per channel Simultaneously sampled ±0.5% plus ±1 bit worst case ±0.1% plus ±1 bit typical. Relative to full scale</td>
</tr>
</tbody>
</table>

#### Programmable Digital

- 1st Order High pass Filter: Bypassed or Filtering -~1 Hz to 500 Hz cutoff
- Low pass bandwidths: 5%, 10%, 15%, 20% & 25% relative to sample rate
- Filter Responses: Optimized
- Step Response, Optimized Frequency Selectivity Custom responses downloaded via the GUI

| **Resolution** | ~12 to 16 bits Scales with sample rate & digital filtering bandwidth |
| **Common-Mode Rejection** | DC to 10 Hz 120 dB - 20 Log (Pre-Amp Gain) typical - 20 dB per decade above 10 Hz Pre-Amp Gain: ¼ to 128 |
| **Crosstalk** | <0.002% typical @ 10 kHz (Changes proportionately with frequency) |
| **Excitation** | Voltage Excitation: Software Programmable Range: 5 V to 10 V Max Current = 500 mW/(15 V-Vout) Factory-Settable Current Limiting |
| **Bridge Completion** | Internal Bridge resistors - factory option connected to voltage or current mode excitation |

#### PSM410 - POWER SUPPLY SPECIFICATIONS

| **Input Voltage Range & Surges** | 17 VDC to 45 VDC MIL-STD 704F, (except abnormal & emergency inputs below 17 VDC) |
| **Output Voltage** | 15 VDC ±3% |
| **Output Voltage Trim** | ±10% |
| **Protection Modes** | Input Over Voltage Output Over/Short Circuit |
| **EMI & Transient Spikes** | MIL-STD 461F CE102, RE101, RE102, CS106 |
| **Output Power** | 40 W 15 VDC at 2.67 A Continuous |
| **Status** | Isolated MOS relay: Normal Operation - Closed ~10 W, Fault Condition - Open Temperature Sensor: Die temperature monitor accurate to ±50 K, 10 mV/oK |
| **Over & Reverse Voltage** | Continuous ±45 VDC |

#### PSM410 - POWER SUPPLY MODULE

2.4’ L x 1.4” W x .58” H

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