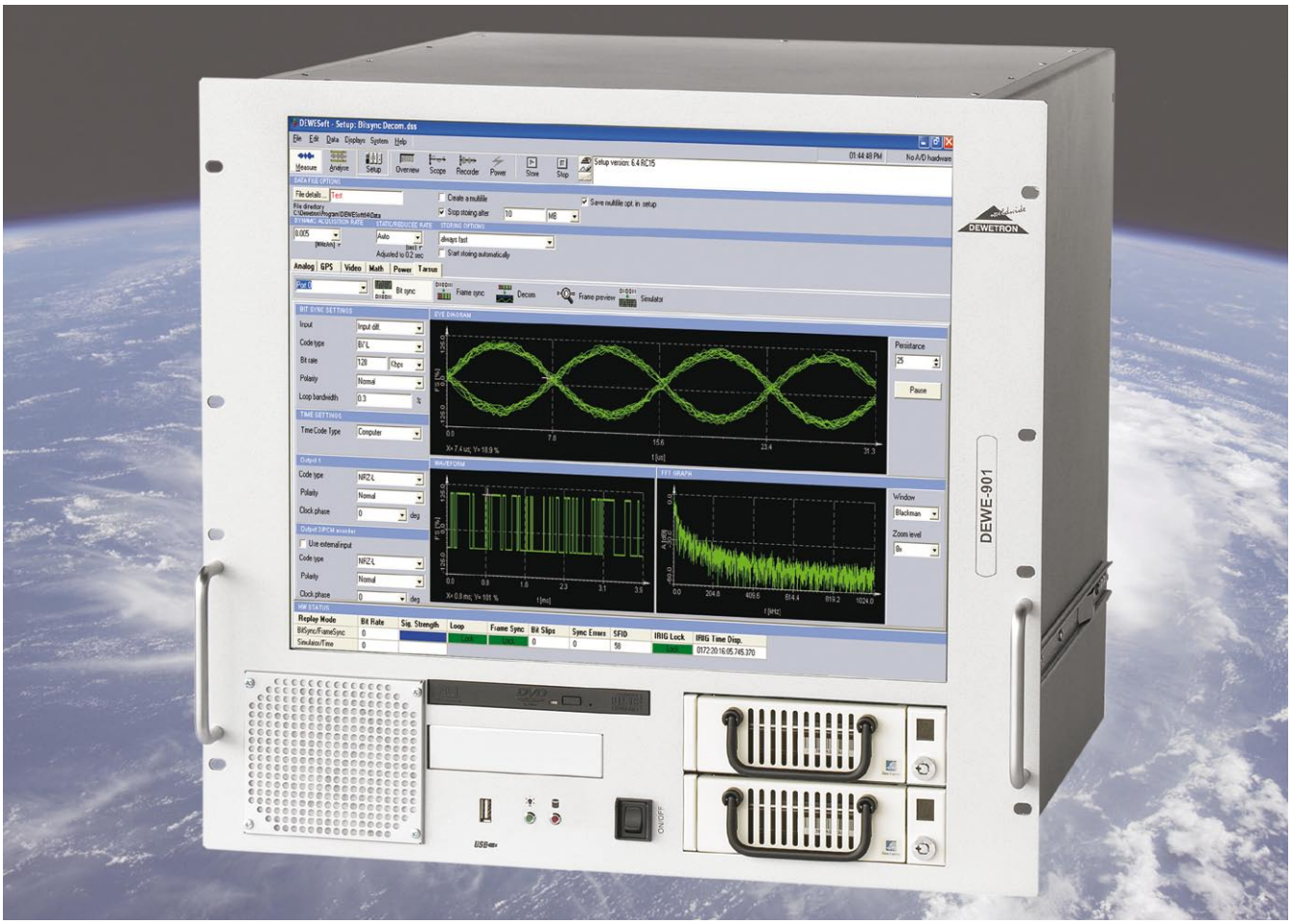


Analog and PCM Data Input

DEWETRON has developed a comprehensive interface to the Tarsus PCI-PCM, an FGPA-based bit-sync/frame sync/ decommutator interface card. This is a PCI form factor card, allowing it to be added to virtually any DEWETRON instrument, from very portable battery-powered units, to larger rack-mounting ones.

The bit sync and frame sync are handled in hardware via the graphical user interface within DEWESoft, whereas the decom is implemented entirely in software. This allows maximum system flexibility, including the ability to handle one or more embedded asynchronous data streams.

The hardware can handle PCM data in numerous popular formats, and at rates up to 33 Mbps. This hardware and software combination, installed within DEWE-901 instruments, is heavily used by NASA's Kennedy Space Center on the US Space Shuttle program, and will be used on Constellation as well.

Key Features

- *User interface guides through all steps*
- *FPGA based hardware for flexibility and easy upgradability*
- *Every graphical widget from DEWESoft can be used to display parameters from PCM*
- *On-line mathematics and scaling functions*
- *Programmable display types show user-defined text in response to discrete values received on any channel*
- *Sychronized PCM, Analog, ARINC 429, and 1553 is possible due to DEWETRON's unique architecture*
- *Video input can be added to most systems*
- *Convenient PCI form factor interface card*
- *Multiple cards can be added to one system*

System Architecture Overview

At the center of most DEWETRON systems is one of our ORION A/D cards. Not only does this card provide high resolution digitizing of the analog signals, but it serves the vital role of providing a high speed master CLOCK for synchronizing the incoming data from PCM, ARINC, 1553, video cameras, CAN bus data, and more.

If your system has only PCM inputs, the DEWETRON ORION card is not needed, as time code can be input directly into the Tarsus PCI-PCM interface card. In that case, the diagram is much simpler than the one shown below. If other input types are needed, however, the ORION A/D card and a DEWETRON IRIG or GPS clock are needed, in order to synchronize all the data together.

PCM Interface
Tarsus PCM card

ARINC / 1553
Interface card(s)

EPAD modules (SERIAL inteface)

VIDEO input
NTSC or camera

DEWE-CAM-01 or
NTSC video streams
or low-light cameras
or infra-red cameras

DEWE-ORION-card

TTL discretes

Digital input

Control signals

Digital output

Rugged PC
PC

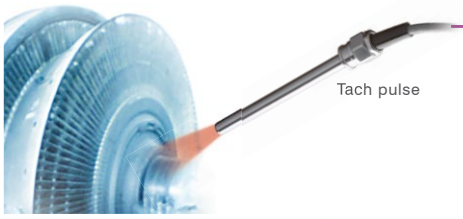
All analog sensors:
STRAIN GAGES
ACCELEROMETERS
MICROPHONES
VOLTAGE
CURRENT
RTDs and T/C's
LOAD CELLS
and more

DEWE Modules
Signal conditioning
Sensor supply

Analog input

CAN BUS interfaces

DEWESoft
OPTION
OPT-PCM
OPTION
OPT-ARINC/1553



Tach pulse

Counter input

IRIG or GPS Time Source

upper: DEWE-IRIG-CLOCK
lower: DEWE-GPS-CLOCK

Note - either can be installed inside the DEWETRON chassis, or remain external boxes as shown here

ext. clock
int. clock

System Background

By 2006, engineers from United Space Alliance and NASA, at the Kennedy Space Center, had replaced many of their older chart recorders with DEWETRON's advanced data acquisition systems. This was a welcome enhancement, but since these systems accepted only analog signals, was only the first stage in a multi-year program aimed at providing a significant upgrade to the data monitoring and analysis operations at the LCC (launch control center).

The LCC still had numerous PDAC's (programmable digital to analog converters), required by the analog-only chart recorders of the past 40 years. They did not have enough of these to convert all of the parameters, and there were other deficiencies with this architecture. So a project was undertaken to add a powerful PCM interface directly into the DEWETRON systems.

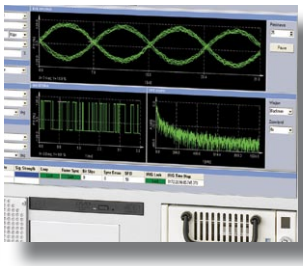
WHAT IS PCM DATA?

We cannot run a wire from a spacecraft or aircraft back to the ground, but we want to send data, so the only way is via transmission. Important data are converted to digital, encoded into a stream, and then transmitted to a ground station for decoding, monitoring, recording, and analysis.

The standard method for doing this is defined by Chapter 4 of the IRIG Standard 106-96. This standard is observed by government ranges and proving grounds involved in testing missiles, aircraft, and even certain terrestrial vehicles, as well as by NASA, for remotely monitoring data from spacecraft - both manned and unmanned.

PCM refers to the pulse code modulation that is used to encode the data. PCM is noise-resistant and easily transmitted, making it the best choice for decades of flight testing applications everywhere.





Project Completion - On Schedule

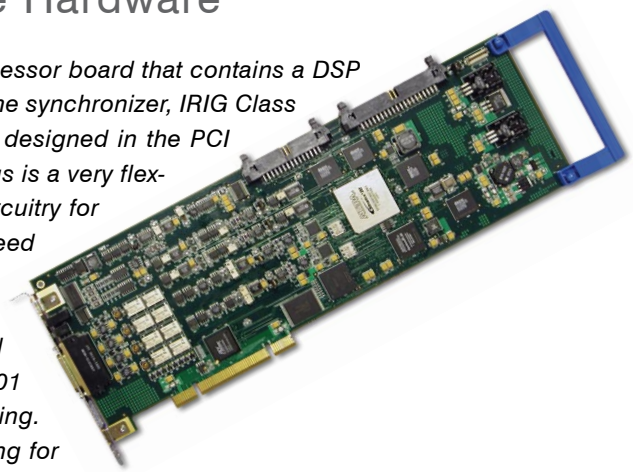
DEWETRON engineers worked closely with NASA and USA engineers in the development of this interface, as well as with PCM card provider Ulyssix, and brought the project in on time and on budget, satisfying a rigorous ATP in 2007.

Today, at several facilities, the space center in Florida uses approximately 50 DEWETRON DEWE-901 systems, each configured with up to 64 analog inputs, and/or a Tarsus PCI-PCM-01 interface card. Each system can and does routinely record hundreds of parameters from the US Space Shuttle, and in fact, all NASA missions operated from KSC. This interface is also used by other NASA facilities and by several of DEWETRON's military customers.

DEWETRON PCM Interface Customers

- *NASA Kennedy Space Center*
- *White Sands Missile Range*
- *Raytheon*
- *and many more*

Tarsus Bit sync/frame sync Interface Hardware



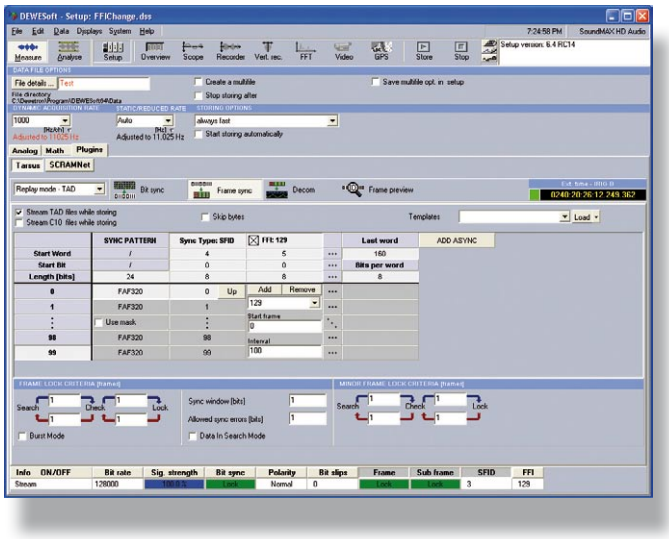
The Tarsus PCI-PCM-HS Processor Board is a complete PCM processor board that contains a DSP (digital signal processor) implemented digital bit synchronizer, frame synchronizer, IRIG Class II PCM decommutator, PCM simulator and IRIG time code reader designed in the PCI form factor. Using state-of-the-art DSP dedicated FPGA's, the Tarsus is a very flexible and technically advanced PCM Processor board. All of the circuitry for the PCM Processor Board is located on a single PCB, without the need for add-on cards. By using DSP-based algorithms including Finite Impulse Response (FIR) filters, multi-stage recursive decimation filters, MNCO's (modulated, numerically-controlled oscillators) and DSP's implemented PLL's (Phase-Locked Loops), the PCI-PCM-01 bit synchronizer section eliminates the need for calibration and tuning. DSP algorithms are implemented in state-of-the-art FPGA's, allowing for rapid enhancements and customization.

Versatile Input Configuration

The bit synchronizer accepts all of the IRIG106-05 code types and has Eb/N0 rejection of better than 1 dB to the theoretical BER published curve. The input AGC accepts inputs from 75 mVpp to 10 Vpp. You can set up each channel with easy to use GUI interface which includes indicators for loop lock, frame lock, subframe lock, AGC strength as well as scope outputs for the AGC data, eye pattern lock representation as well as a full frame dump display. The output of the frame synchronizer also can be dumped to the host computer hard drive for archivial and data reduction applications.

The decommutator section of the PCI-PCM-HS is designed to support all of the IRIG Class II features including variable word lengths per channel and non-standard PCM frame formats. The input serial bit stream to the decommutator is either TTL or RS-422 differential levels with input data rate capability from 1 bit per sec. (bps) to 33 Mbps. Two on board 12 bit DACs are standard features that give the TarsusPCM standalone parameter analog capability.

There is also a full PCM simulator on board that has all the same frame and word features as the decommutator with user-definable waveform or table data values on a word-per-word basis. There is also an IRIG Time Code Reader AM demodulator section to allow the user to embed externally or internally generated time into the output data of the decommutator.



DEWETRON Aerospace Customers

- *NASA (KSC, Glenn, WSTF, JSC, LARC, JPL, etc.)*
- *US Air Force (VAFB, Eglin, WPAFB, etc.)*
- *US Navy (Patuxent River, China Lake, etc.)*
- *Lockheed Martin, Raytheon, Goodrich, Sikorsky, Honeywell, Northrop Grumman, Boeing, UT...*
- *and many more*

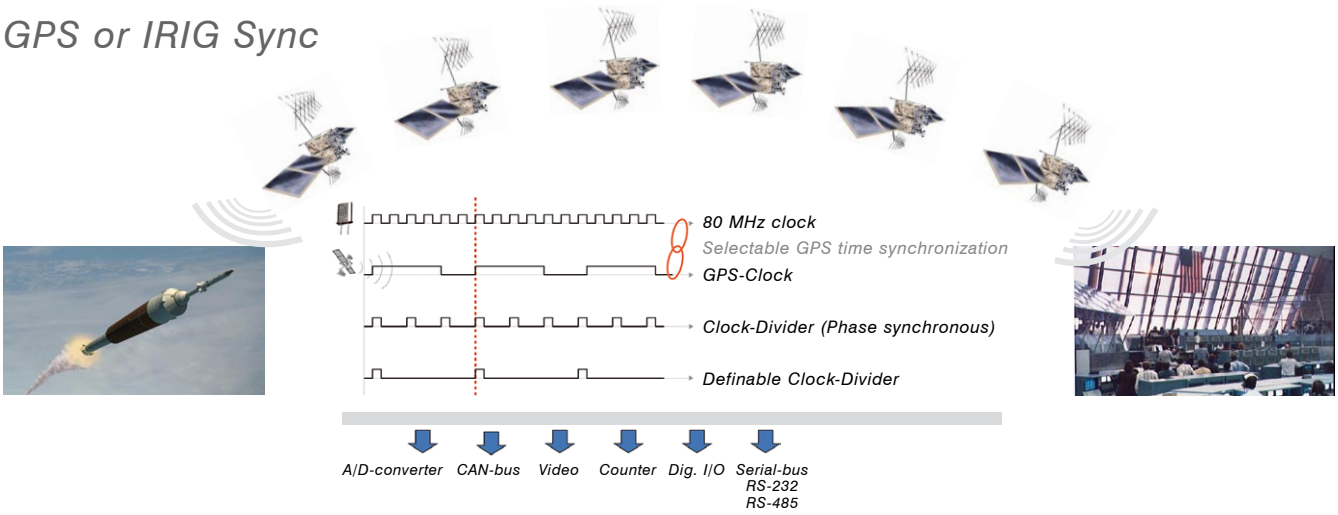
DEWESoft Net

DEWESoft Net allows the communication between different DEWETRON instruments. Each unit can be configured as stand alone, as master or as slave. It's also possible to use any PC to control a measurement unit remotely.

Systems need a TCP/IP connection, which can be wired or wireless - using any connection method (ethernet is the most common). Systems that are networked also need to be time-synched, and there are three different ways to do it, which can be used in different combinations:

- *Direct sync connection from one unit to the next one (co-located)*
- *IRIG interface option and connection*
- *GPS interface option and connection*

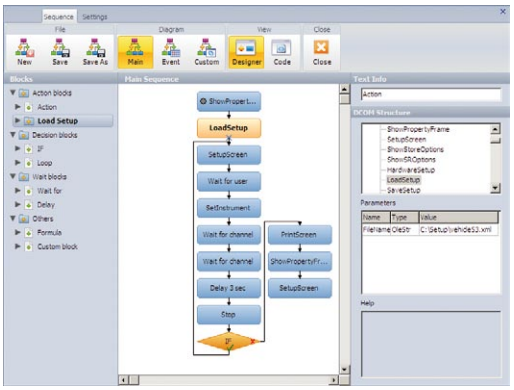
GPS or IRIG Sync



Sequence Control

The sequencer is a tool to predefine process steps in a sequential format. The interface can be graphically programmed or in a code oriented view. It is possible to manage these sequences centrally to guarantee a standardized and defined measurement procedure.

Within the sequencer you can access all relevant DEWESoft features - apply actions and formulas and make decisions, wait for interaction or a preset delay and define your customized sequences. So it's possible to define different sequences and fit them together in a single sequence, where the sub sequences are done sequentially. The sequences can be controlled by the user or by an event caused by a trigger of a certain channel.

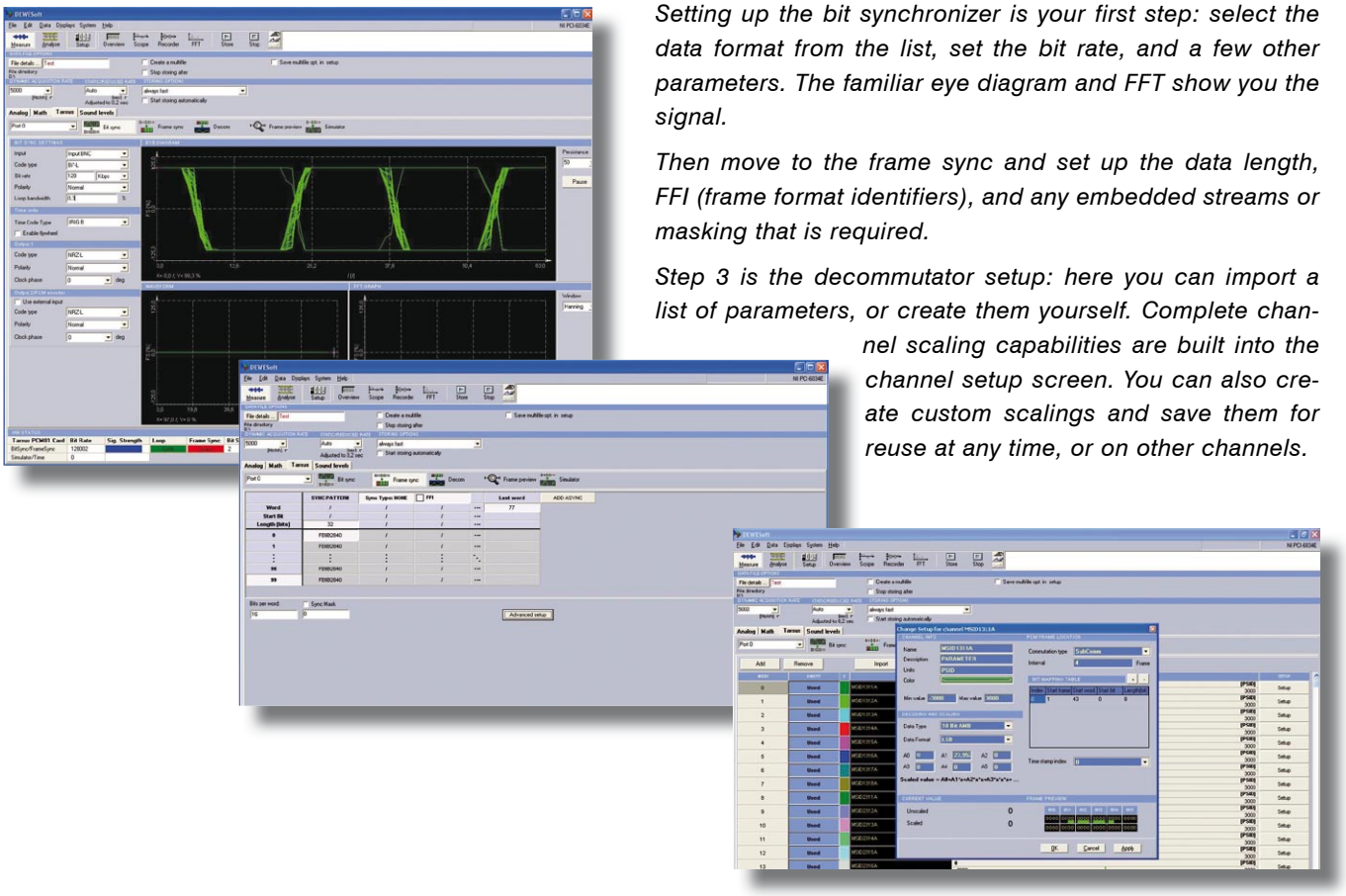


Sensor Database

DEWESoft includes a SENSOR DATABASE. This is an XML database you can use to enter and maintain the critical information about all of your sensors, including scaling factors (linear or non-linear), engineering units, and even the settings for the DEWETRON amps that you use with them! The best part is that you can simply choose any sensor on the DEWESoft setup screen, and it will make all the settings for you in the software to set up this channel! (You may allow or disallow additional zeroing and scaling at your option). This ensures quality control, and prevents errors.

The XML nature of the sensor database makes it easy to import data into it from other sources - you may already have a spreadsheet of sensors that you want to bring in - this is easily done. The sensor database is a standard feature of DEWESoft.

Easy Setup and Graphical User Interface



Setting up the bit synchronizer is your first step: select the data format from the list, set the bit rate, and a few other parameters. The familiar eye diagram and FFT show you the signal.

Then move to the frame sync and set up the data length, FFI (frame format identifiers), and any embedded streams or masking that is required.

Step 3 is the decommutator setup: here you can import a list of parameters, or create them yourself. Complete channel scaling capabilities are built into the channel setup screen. You can also create custom scalings and save them for reuse at any time, or on other channels.

Properties Panel

Eliminates searching through menus, simplifies setup

Discrete channels

Create channels that display words or images based on data values

Strip charts & scopes

The full range of DEWESoft graphics are available to you

Tabular data

Create tables of incoming data values, updated at definable rates

All-in-One Solutions

All of these inputs in a portable unit:

- *16 high speed ANALOG channels, any sensor or signal*
- *2 x synchronous counter/encoders*
- *8 x digital I/O lines*
- *PCM interface for hundreds of parameters from spacecraft*
- *ARINC 429 - up to 16 receive and 16 transmit channels*
- *1553 - single or multiple function interface*
- *Video input from camera or NTSC*
- *IRIG time code sync, or GPS time code/ position data for mobile applications*

Integrated Portability

Small instruments like the DEWE-2600 are capable of being configured with analog, PCM, ARINC 429, and 1553 data inputs, as well as VIDEO input and either IRIG or GPS time code. The DEWE-2600 are powered via 18-24 VDC, and also have built-in lithium-ion batteries, which allow them to run for hours without any power connected. An AC/DC adapter is also included so you can run and charge the system from 120/240 VAC.

Inside are seven PCI slots, providing room for ORION cards (100, 200, 500, 1000 kS/s/ch max sample rate cards available, from 16- to 24-bit). These are connected to the DAQP and/or MDAQ modules which are located on the rear panel. Choose from voltage, IEPE, or universal modules (universal modules can handle strain, voltage, IEPE, charge, thermocouple, RTD, and more using our MSI adapters).

One inside slot can hold the PCI-PCM-01 bit synchronizer/frame sync hardware, providing access to hundreds or even thousands of parameters from the PCM stream.

Another slot can hold our PCI-ARINC/1553 card, which can be configured with various combinations of ARINC 429 and 1553 channels. PCM and ARINC/1553 connections are located on the right side panel, where the computer interfaces are also found.

PCM Solutions

	DEWE-3028-PCM	DEWE-2601-PCM	DEWE-901-PCM
Application	PCM-only instrument	Multi-function, portable	Multi-function, rack-mount
Analog input channels	N/A	16 MDAQ inputs (max. 64)	64 MDAQ inputs
Digital channels	N/A	8 DIO + 2 CTR or 8 DI	8 DIO + 8 CTR or 32 DI
Channel expansion	Yes	Yes	Yes
PCM input option	Yes	Yes	Yes
ARINC / 1553 option	Yes	Yes	Yes
CAN interfaces	N/A	Up to 8 (opt.)	Up to 8 (opt.)
Video	DEWE-CAM or USB DirectX	DEWE-CAM or USB DirectX	DEWE-CAM or USB DirectX
Display	15" 1024 x 768	15" 1024 x 768	19" 1280 x 1024
Power supply	115 / 240 V_{AC} or 10 - 32 V_{DC} (UPS battery 5 min)	Battery powered, 18 - 24 V_{DC}, external AC power supply	115 / 240 V_{AC}
Dimensions (W x D x H)	380 x 295 x 155 mm 15 x 11.6 x 6.1 in.	417 x 246 x 303 mm 16.4 x 9.7 x 11.9 in.	483 x 503 x 444 mm 19 x 19.8 x 17.4 in.
Weight	Typ. 7 kg (15.4 lb.)	Typ. 14 kg (31 lb.)	Typ. 25 kg (55.1 lb.)

System Choices

DEWETRON offers a wide range of platforms which can be configured with both analog and PCM interfaces, or just with analog - or just with PCM interfaces. A popular PCM-only model is the DEWE-3108-PCM.

There are many models which can be configured with both analog and PCM interfaces. These are provided in three different form factors: Portable, Benchtop, and Rack-mounting

- ***Portable multi-function DEWETRON systems:***
  DEWE-3200 series, DEWE-3030 series
- ***Benchtop multi-function DEWETRON systems:***
  DEWE-2600, DEWE-5000 series
- ***Rack-mounting multi-function DEWETRON systems:***
  DEWE-800, DEWE-900 series

There is a DEWETRON model for most scenarios. We recommend that you discuss your requirements with a DEWETRON application engineer or authorized sales engineer in order to determine the best possible fit for your current and future requirements.

Re-inventing Data Acquisition

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