



APPLICATION NOTE: Titan Device Power

APN-1005

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Overview

This applications note addresses basic Titan device power topics, including the various methods of providing and applying power when Titan devices are connected in a system configuration.

Device Power

Titan devices are available in three power options: +12V DC (isolated), +24V DC (isolated) and +11-32V DC (wide range, non-isolated). The input voltage rating is identified by the final digit in the product number as follows:

- “-x1” - +12V DC
- “-x2” - +24V DC
- “-x3” - +11-32V DC

Titan devices may be furnished with a dedicated DC power adapter. The adapter shipped with Titan Input Modules and Titan DACs has a maximum rating of 2 amps, while the adapter shipped with the Titan CPU has a maximum rating of 3 amps. The actual power consumption of a given Titan device will depend on a number of factors, including sensor excitation, how the device is used in a system, and the power configuration of the system.

Titan Input Modules (Mini-Recorders or Pods)

Titan Input Module types (include AMS, BMS, ADF, BDF, AIV, BSG and Thermocouple (TC) devices. These devices support a wide variety of sensors and can be mixed or matched to provide up to 128 channels of data acquisition when connected to a CPU. Titan Input Modules have four power connections; three of the connections provide power to the device, and the fourth provides power from the Input Module to connected devices like the GPS sensor or the Digital Pod. The four connections are:

- USB
- Auxiliary Power
- COMM
- GPS

USB, **COMM** and **GPS** provide both power and communications through a single connector, while **Auxiliary Power** provides power only.



Figure 1 – Titan Mini-Recorder front and rear panels

USB provides an industry-standard connection that is used when the Input Module is located near a PC host (approx. within 15 feet). A special dual-plug USB cable (typically furnished) must be used for this connection, as Titan Input Modules require two USB ports to provide sufficient power when USB is the sole connection (the PC host must have two powered USB ports).

NOTE – If an Input Module must provide an excitation voltage higher than 2.048V, USB cannot be used as a sole power source. In this case, the Input Module should be powered through the Auxiliary Power connector.

The **Auxiliary Power** connector is an unlabeled connector that appears on the front panel. This connector provides power to the Input Module when USB power is insufficient or impractical, or when the device is operated in stand-alone mode (Titan Mini-Recorder). Two connector types are used for this connection: a 4-pin microphone jack or a 3-pin XLR connector. Titan Input Modules may be furnished with a dedicated DC power adapter, or a separate mating connector that can be used for a custom power solution. A label on the side of the Input Module displays the input voltage pinout of the connector.

NOTE – Input Modules have no power switch, so it is important to make any connections to the Auxiliary Power connector before applying power.

The **COMM** connector provides a combined power and communications connection for use with a Titan CPU or a Titan DAC. A label on the side of the Input Module lists the input voltage that should be applied to this connector. Input Modules are configured for no input voltage (0V), +5V or +12V. These labels are provided to identify compatibility with various versions of the Titan CPU:



Figure 2 – RJ45 Power Label

The **GPS** connector—also referred to as the Auxiliary Digital Input connector—provides combined power and serial communications for either a GPS sensor (a Garmin GPS 18x-5Hz) or an external Digital Pod. The connector pinout is shown in Figure 3 below. In the figure, the transmit (TXD) and receive (RCV) lines are the signals originating from the connected device.

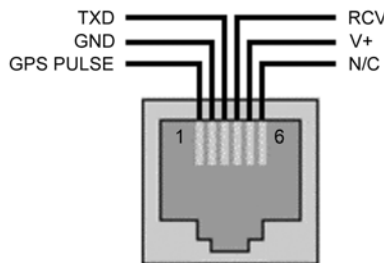


Figure 3 – GPS connector pinout

NOTE – For details on wiring an RJ-11 connector to a Garmin GPS 18x-5Hz sensor, see Mars Labs Assembly Instruction ASY-2075.

Titan CPU

The Titan CPU Channel Multiplexer has a single input **Power Connector**. Two connector types are used for this connection: a 4-pin microphone jack or a 3-pin XLR connector. Titan CPUs are typically furnished with a 3 amp DC power adapter, but alternative power sources may be used. A label on the side of the CPU displays the input voltage pinout of the connector.

Eight **Ports** on the CPU provide combined power and communication connections for up to eight Input Modules using standard Ethernet cabling. The eight ports are split between the front and back of the CPU; five ports (labeled 1 thru 5) appear on the rear panel along with the Input Power connector, and three ports (labeled 6 thru 8) appear on the front panel. All port connectors are standard Ethernet RJ-45 receptacles.



Figure 4 – Titan CPU front and rear panels

The Titan CPU is available in 0V, +5V and +12V versions, meaning that the CPU either supplies no voltage (0V), +5VDC or +12VDC to connected Titan Input Modules. The 5V version can usually be identified by the heat sink mounted atop the CPU. Titan CPUs are otherwise identified by the product number as follows:

If the product number suffix is -0X or -1X, the CPU provides +12VDC.

If the product number suffix is -2X or -3X, the CPU provides +5VDC.

If the product number suffix is -4X or -5X, the CPU provides no voltage (0V).

When making connections, it is vitally important to match the CPU version with the appropriate Input Module COMM port rating. A 5V CPU should be matched with an Input Module with a 5V COMM port rating, while a 12V CPU should be matched with an Input Module with a 12V COMM port rating. A 0V CPU can be matched with *any* Input Module, but those modules will need to be powered separately.



A 12V CPU should never be connected to an Input Module with a 5V COMM port rating—doing so will subject the module to an overvoltage condition that may damage the device. Before making any connections, always check to make sure the devices are compatible. Refer to the Titan Device Compatibility Chart below for more information.

Titan DAC

The Titan DAC has a single input **Power Connector** on a 4-pin microphone jack. Titan DACs are typically furnished with a DC power adapter, but alternative power sources may also be used. A label on the side of the DAC shows the input voltage pinout of the connector.



Figure 5 – Titan DAC front and rear panels

NOTE – Titan DACs have no power switch, so it is important to make any connections to the Auxiliary Power connector *before* applying power.

On the DAC, **USB** provides a communications connection only. The DAC will not operate solely on USB power; external power must be provided.

DACs are connected to Input Modules via the **COMM POD** port. Since this port provides power as well as communication, it is important to observe the same precautions as with the CPU when making connections to Titan input Modules.

DACs with a product model number that ends with a “-x1” or “-x2” provide 5V to the **COMM POD** port. These DACs must be paired *only* with Input Modules having a 5V COMM port rating.

DACs with a product number that ends with a “-x3” have an internal jumper that selects the power option for the **COMM POD** port. This jumper (“J5”) sets the port in one of three possible configurations:

1. Provide power from the DAC to the Titan Input Module (factory default configuration)
2. Pass power from the COMM CPU port to the Titan Input Module
3. Provide no power connection

When the DAC is configured to provide power, the power source that is connected to the DAC Power Connector also provides power to the COMM POD port. In this configuration, the Input Module’s COMM port voltage rating must match the DAC input voltage rating.

When the DAC is configured to pass power, the power coming into the COMM CPU port is passed through to the COMM POD port. In this configuration, the Input Module’s COMM port voltage rating must match the CPU’s rating as defined in the ‘Titan CPU’ section above.

When the DAC is configured for no power connection, no power is supplied to the COMM POD port. In this configuration, the Input Module will work with any CPU or DAC, but the module must be powered from a separate power source.

For more information on configuring the J5 jumper, see the DAC User Manual.

Titan Device Power Compatibility

When a Titan Input Module is powered through its COMM port, care must be taken to ensure that the connected device that is supplying the power (either a Titan CPU or a Titan DAC) is voltage-compatible. The table below lists the compatibility of Input Modules when used with the CPU and DAC hardware. In the table, "Approved" indicates an approved device combination, while "Permissible" indicates a device combination that works but requires an additional power connection for the Input Module*. Combinations that are not allowed are indicated by the blacked-out cells; these combinations should not be attempted - doing so will subject the Input Module(s) to an overvoltage condition *that may destroy the device*.

Titan Input Modules	COMM Input Voltage (Note 1)	CPU		DAC (Note 2)	
		5V Out	12V Out	-x1 / -x2	-x3
ADF	5V	Approved		Approved	
	12V	Permissible	Approved	Permissible	Approved
BDF	5V	Approved		Approved	
	12V	Permissible	Approved	Permissible	Approved
AMS	5V	Approved		Approved	
	12V	Permissible	Approved	Permissible	Approved
BMS	5V	Approved		Approved	
	12V	Permissible	Approved	Permissible	Approved
BSG	5V	Approved		Approved	
	12V	Permissible	Approved	Permissible	Approved
TC	5V	Approved		Approved	
	12V	Permissible	Approved	Permissible	Approved

Table 1 – Titan Device Power Compatibility

* Titan Input Modules rated for a 12V input *can* be used with a 5V CPU, but those devices will need to be powered separately because the voltage supplied by the CPU is not sufficient to run the device.

Note 1 - A power label located on the side of the module (as shown below) indicates the voltage that should be applied through the RJ-45 (COMM) connector (either +5V or +12V). If the label reads "RJ45 power not connected", the module will need to be powered separately when connected CPU or DAC.



Figure 6 – RJ45 Power Label

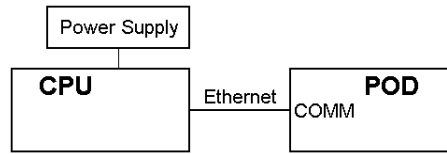
Note 2 - The DAC "-x3" column lists the compatible devices when the internal jumper is configured for the DAC to provide power to the Pod (factory default configuration). If the DAC is configured to pass power from the CPU, refer to the appropriate CPU voltage column (5V or 12V) to identify the compatible Titan Input Modules. For more information on power configurations, see the Titan Device Power and Communication Configurations section below.

Titan Device Power and Communication Configurations

The Titan family of modules offer a number of communication and power configuration options that can simplify wiring and eliminate the need for extra power supplies. Shown below are examples using a CPU, a single Pod, a DAC (-x3 type), and a PC to illustrate the configuration possibilities.

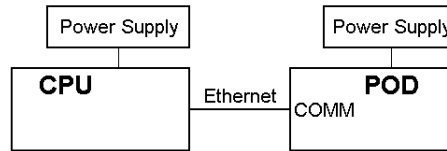
Configuration 1: A CPU with a Pod

The CPU provides power and communication to the Pod through a single Ethernet connection (a CPU can support up to eight 16-channel Pods). This configuration is recommended for all Titan Input Modules when sensor excitation is not required.



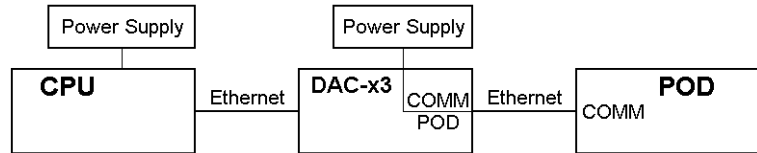
Configuration 2: A CPU with a Pod

Same as configuration 1, but the Pod is powered separately. Recommended when sensor excitation is required or when redundancy is desired in critical test applications.



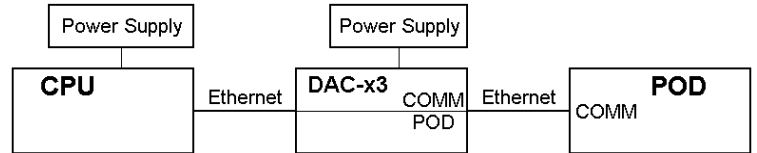
Configuration 3: A CPU with a DAC/Pod pair

A system that includes a DAC configured to provide power to the Pod through the COMM POD connector. Recommended when power is otherwise unavailable for the Pod.



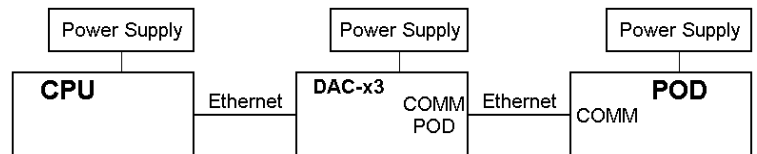
Configuration 4: A CPU with a DAC/Pod pair

A system with a DAC configured to pass power from the CPU to the Pod (through the DAC) to the COMM POD connector. Recommended when power is otherwise unavailable for the Pod and the distance between the CPU and Pod is not more than 25 feet.



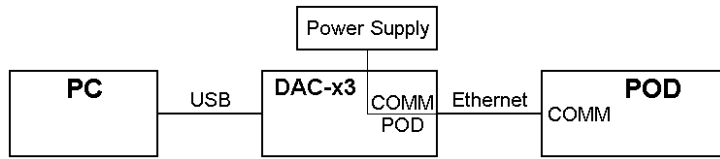
Configuration 5: A CPU with a DAC/Pod pair

A system with a DAC configured for no power to the COMM POD connector. In this configuration, all devices must be powered separately. Recommended when Ethernet distances between devices exceeds ___ feet, or when redundancy is desired in critical test applications.



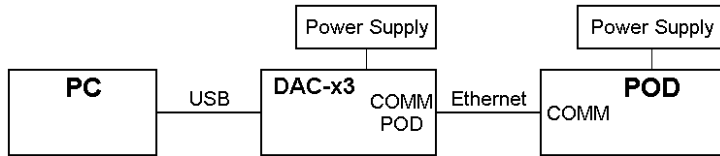
**Configuration 6:
A DAC/Pod pair connected to a PC via USB**

A DAC configured to provide DAC power to the Pod through the COMM POD connector. Recommended when power is otherwise unavailable for the Pod.



**Configuration 7:
A DAC/Pod pair connected to a PC via USB**

A DAC configured for no power to the COMM POD connector. In this configuration, both devices must be powered separately. Recommended when distances between Ethernet devices exceeds ___ feet.



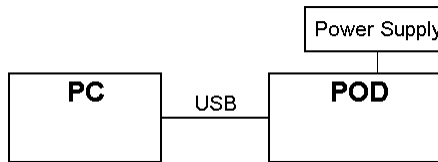
**Configuration 8:
A Pod connected to a PC via USB**

In this configuration, the PC provides power and communications via a special dual-plug USB cable. Recommended for AMS/ADF/AIV devices only.



**Configuration 9:
A Pod connected to a PC via USB**

In this configuration, USB provides communications only while the Pod is powered separately. This configuration is recommended for all Titan Input Modules.



**Configuration 10:
A Pod connected to a PC via a USB/RS-422 Converter**

A converter is used to translate USB to RS-422. This configuration is recommended when the Pod is separated from the PC by distances greater than USB will support.

