TAS48

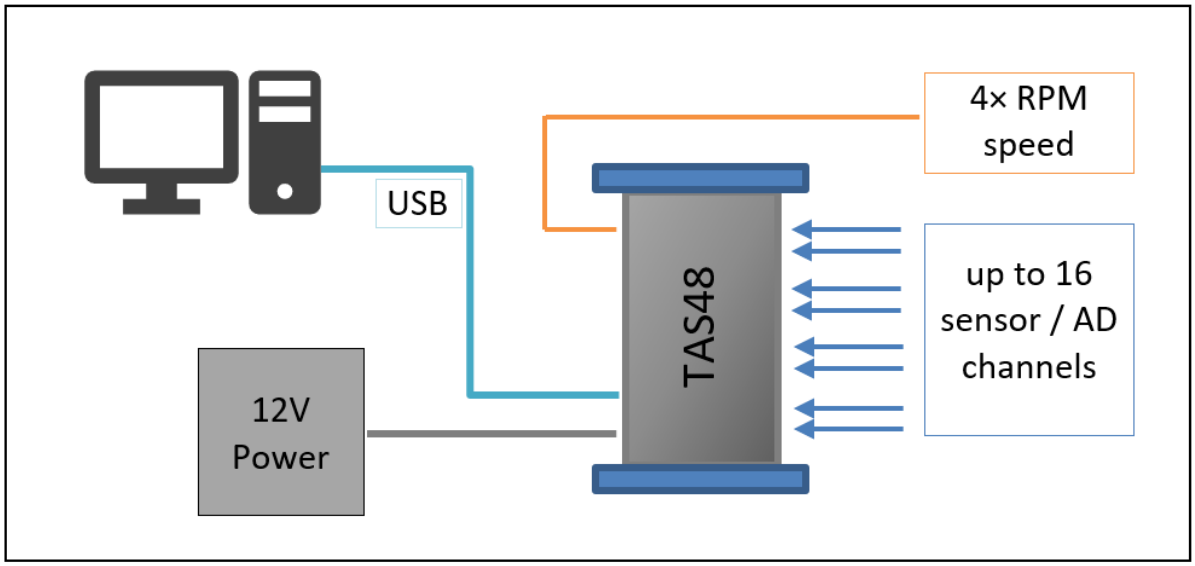
Data Acquisition Front-End

- ✓ Industrial, universal, modular front-end for acoustical and vibration measurements
- ✓ up to 16 universal channels for analog voltage or IEPE with high resolution A/D converters
- ✓ 4 high resolution RPM channels
- ✓ Optional optical SPDIF channel for torsional vibration (see TAC sensor)
- ✓ Modularity enables optimal configuration for your testing application

TAS48

TAS48 is a modular multi-channel data acquisition front-end with the following features:

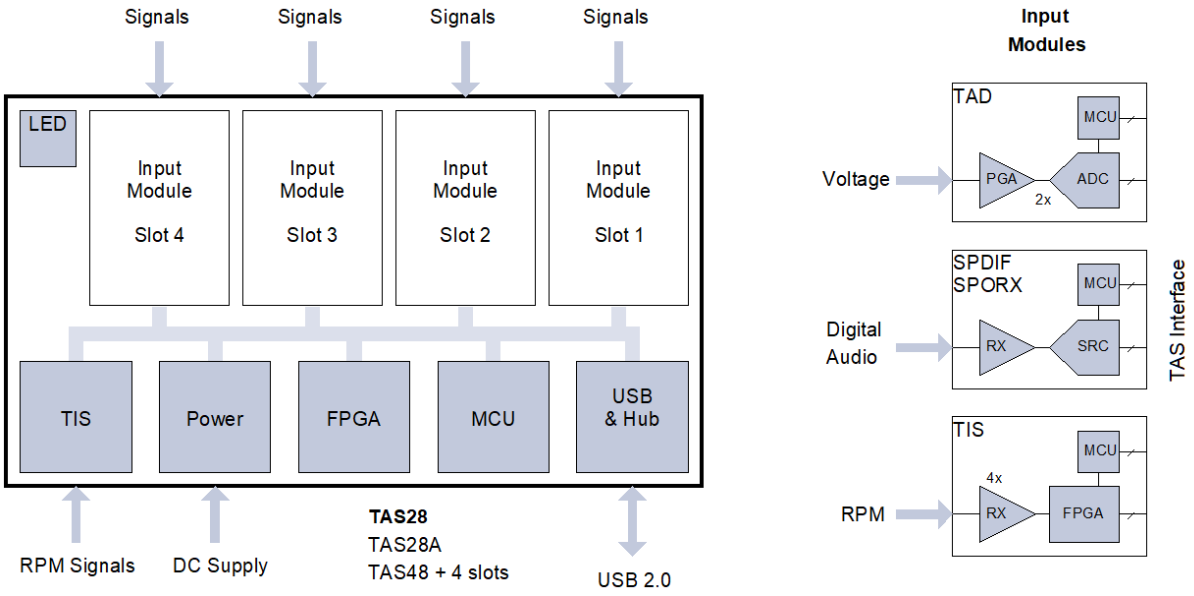
- ADC: Up to 16 analog voltage / IEPE channels with 24bit / 200kHz A/D converters
- RPM: 4 high resolution isolated RPM inputs on-board, easily expandable with further modules
- Sampling: 2 main system clocks are available, providing either 24/48/96/192kHz or 25/50/100/200kHz sampling rates
- USB 2.0 high speed interface to the host PC
- Dimensions: 102.7mm × 230mm × 48.7mm, 1094g, in a robust aluminum housing



Specifications

The following pages contain the specifications of the base system and available modules.

TAS48 can contain up to 8 input modules and always has a built-in TIS module:



Picture above: block diagram of TAS base card and modules

1 TAS48 Environmental & Dimensions

TAS48 System Specifications		
Environment		
Temperature	0°C .. 45°C - Operation -20°C .. 70°C - Storage	
Humidity	85% rel. humidity - Operation 95% rel. humidity - Storage	non-condensing at 20°C non-condensing at 50°C
Mechanical		
Dimensions	102.7mm × 230mm × 48.7mm	
Weight	1094g	
Electrical		
Power Supply	12V DC / 1A	dedicated power supply, no other loads connected

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2 TAS48_BASE – USB Interface

TAS48_BASE Specifications		
Interface	USB 2.0	
Datarate	480Mbit/sec	theoretical USB2.0 maximum
Internal Interface	I2S decoder for ADC data to 8-bit parallel bus to USB	FPGA, SW-reconfigurable
Data Buffers	2MB SRAM for AD & RPM data, 4kB FPGA SRAM for control data	for host latency compensation (>500ms for 16 AD/RPM channels at f_S = 50kHz)
Power Input	10V – 18V DC, 700mA via LEMO connector	
IEPE Supply Voltage (ICP®, CCLD®)	24V ±5% / 20mA	
Power Monitoring	10-bit ADC	all internal voltages are monitored by the MCU's 10-bit ADC
Temperature Sensor	±1.0°C from −25°C to +85°C (max)	
RPM Features	4 RPM / TIS inputs on board	for specs see TIS48
Clocks	2 crystal oscillators on board: 25.6MHz 24.576MHz	for sampling frequencies of 50kHz / 100kHz / 200kHz or 48kHz / 96kHz / 192kHz
Clock Accuracy	±50ppm	affects frequency measurements
Calibration	-	-
Power Consumption	1.2W	with 12V external supply, on-board TIS running at f_S = 100kHz
PCB Dimensions	212.5mm x 92.0mm	

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3 TAD48 – Analog Input, Low Power

TAD48 Specifications		
Analog Inputs	2 BNC	
Input Coupling	AC / DC / IEPE Single-Ended (SE) / Differential (DIF)	IEPE: ICP®, CCLD® DIF: not for IEPE
Input Impedance, SE	33.7kΩ ±2% || 150pF max 26.8kΩ ±2% || 150pF max (±30V)	
AC Coupling	f_C = 4.7Hz ±10% f_C = 5.9Hz ±10% (±30V)	f_C : -3dB corner frequency
IEPE Supply Current	2.2mA ±5%	
IEPE Supply Voltage	depends on base card (24.5V or 21.0V for mob. sys.)	
IEPE Coupling	AC / SE DC / SE with ±30V input range	
Input Range Max.	±30V peak	
Without Damage	$60V_{PP}$ DC/AC	
Gain Accuracy @ 1kHz	±0.5dB at 25°C ±10°C	without calibration
Offset ±10V	≤ 10mV (0.1% FS) / ≤ 12mV IEPE	
Offset ±1V	≤ 2mV (0.2% FS) / ≤ 5mV IEPE	
Offset ±100mV	≤ 1.5mV (1.5% FS) / ≤ 5mV IEPE	
Noise (BW 20kHz)	≤ 15µVrms RTI @ max gain	input shorted / 50Ω
SNR (BW 20kHz)	≥ 106dB (±10V) ≥ 90dB (±1V) ≥ 105dB (±30V)	shorted / 50Ω
THD (1kHz)	≥ 90dB (-6dBFS) ≥ 80dB (-6dBFS, ±1V)	
CMRR	≥ 60dB @ 1kHz ≥ 50dB @ 50Hz	DC/DIF coupling
Crosstalk	> 120dB @ 1kHz > 110dB @ 10kHz	adjacent channels
Anti-Aliasing Filter	3-pole, f_C = 160kHz -0.2dB @ 40kHz	f_C : -3dB corner frequency
Passband	DC .. 0.40 * f_S	f_S = sampling rate
PB Ripple (BW 20kHz)	±0.1dB	
Stopband	0.50 * f_S	
Stopband Attenuation	≥ 116dB	
Phase Match	1 sample	adjacent channels
ADC Resolution	24 bits	

Sampling Rate	200kHz max	
Dynamic Range	≥ 120dB (BW 20kHz)	input shorted / 50Ω, incl. gain
SFDR	≥ 110dB (BW 20kHz)	input shorted / 50Ω
ADC Group Delay	42 samples	compensated by TasAlyser
Calibration	ext. manual / SW calib.	recom. calibration interval: 1/year
Power Consumption	≤ 0.4W without IEPE	at f_S = 100kHz IEPE: + 60mW / channel
PCB Dimensions	70mm x 48mm	

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4 TAD48+ – Analog Input, High End

TAD48+ Specifications		
Analog Inputs	2 BNC	
Input Ranges	±30V / ±10V / ±5V / ±1V / ±0.5V	
Input Coupling	AC / DC / IEPE Single-Ended (SE) / Differential (DIF)	IEPE: ICP®, CCLD® DIF: not for IEPE
Input Impedance, SE	130.4kΩ ±1% || 150pF max 310.3kΩ ±1% || 150pF max (±30V)	
AC Coupling	f_C = 4.8Hz ±5% f_C = 1.6Hz ±5% (±30V)	f_C : -3dB corner frequency
IEPE Supply Current	2.3mA ±5%	
IEPE Supply Voltage	depends on base card (24.5V or 21.0V for mob. sys.)	
IEPE Coupling	AC / SE DC / SE with ±30V input range	limited bandwidth, see below
Input Without Damage	$30V_{PP}$ DC/AC $60V_{PP}$ DC/AC, ±30V input range	
Gain Accuracy @ 1kHz	±0.3dB at 25°C ±10°C	without calibration
Offset	≤ 0.05% FS / ≤ 4mV with IEPE	AC or DC, SE, input open
Noise (BW 20kHz)	≤ 2.1µVrms RTI @ max gain	input shorted / 50Ω
SNR (BW 20kHz)	≥ 112dB (±10V) ≥ 108dB (±1V) ≥ 104dB (±0.5V) ≥ 110dB (±30V)	input shorted / 50Ω
THD (1kHz)	≥ 90dB (-6dBFS) ≥ 70dB (-10dBFS, ±30V)	
CMRR (1kHz)	≥ 60dB ≥ 40dB (±30V)	DC/DIF coupling
Crosstalk	> 120dB @ 1kHz > 110dB @ 10kHz > 110dB @ 1kHz, ±30V DIF > 100dB @ 10kHz, ±30V DIF	adjacent channels
Anti-Aliasing Filter	4-pole, f_C = 100kHz -0.1dB @ 20kHz -0.4dB @ 40kHz	f_C : -3dB corner frequency
Passband	0.40 * f_S	f_S = sampling rate
PB Ripple (BW 20kHz)	± 0.1dB	all gains, except ±30V, see below
Passband ±30V	-1dB @ 8kHz -3dB @ 40kHz	
Stopband	0.50 * f_S	

Stopband Attenuation	≥ 116dB	
Phase Match	1 sample	adjacent channels
ADC Resolution	24 bits	
Sampling Rate	200kHz max	
Overall Dynamic Range (BW 20kHz)	140dB	input shorted / 50Ω, incl. gain
SFDR	> 130dB	input shorted / 50Ω
ADC Group Delay	42 samples	compensated by TasAlyser
Calibration	ext. manual/SW calib.	recom. calibration interval: 1/year
Power Consumption	≤ 0. 5W without IEPE	
PCB Dimensions	70mm x 48mm	

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5 TIS48 – RPM / Encoder Input

TIS48 Specifications (also for TAS28 / TAS48 on-board TIS)				
Inputs	4 differential, RS-485			see connector layout below
Input Connector	D-Sub9, female			
Standard Input Voltage	3.3V, differential RS-485			
Input Options	• Divider for 12V & 24V signals • Single Ended Reference • Rising or Falling Edge Detection			these options can be switched only for channel pairs
Maximum Input Voltage	$24V_{PEAK}$ single ended with attenuator			
Without Damage	$\pm 30V_{PEAK}$			
Pulse Detection Algorithm Frequency $\mathbf{f_{RPM}}$ and Timing Resolution $\mathbf{T_{RPM}}$	f_S	$\mathbf{f_{RPM}}$	$\mathbf{T_{RPM}}$	f_S : TAS sampling rate
	200kHz	12.8MHz	78.125ns	
	100kHz	12.8MHz	78.125ns	
	50kHz	12.8MHz	78.125ns	
	25kHz	6.4MHz	156.25ns	
Frequency Dividers	up to 65534 (even numbers only)			
RPM Bandwidth	10MHz differential, 10MHz single-ended (min. 5V TTL)			with input frequency divider to keep divided signal < TAS' f_S
Frequency Accuracy	$\pm$50ppm			depends on base card's oscillator
Rotary IE / AB Detection Algorithm Frequency $\mathbf{f_{IEAB}}$ and Timing Resolution $\mathbf{T_{IEAB}}$	f_S	$\mathbf{f_{IEAB}}$	$\mathbf{T_{IEAB}}$	TIS48 only (FPGA firmware version ≥ 0x0B) IE = incremental encoder
	200kHz	25.6MHz	39.0625ns	
	100kHz	25.6MHz	39.0625ns	
	50kHz	25.6MHz	39.0625ns	
	25kHz	12.8MHz	78.125ns	
Rotary IE / AB Detection Max. IEAB Signal Input Frequency $\mathbf{f_{IEMAX}}$	f_S	$\mathbf{f_{IEMAX}}$		TIS48 only (FPGA firmware version ≥ 0x0B) quadrature decoding
	200kHz	3.2MHz		
	100kHz	2.1MHz		
	50kHz	1.5MHz		
	25kHz	0.7MHz		
RPM LED	2			to show any channel's activity
RPM LED Dividers	2^n ; with n = 0..14			
RPM LED Hold Time	25ms			
Isolation	≥ 1kV to TAS			cable shield must be connected on one side only
Calibration	-			
Power Consumption	≤ 0.5W			f_S = 100kHz
PCB Dimensions	70mm x 48mm			as module

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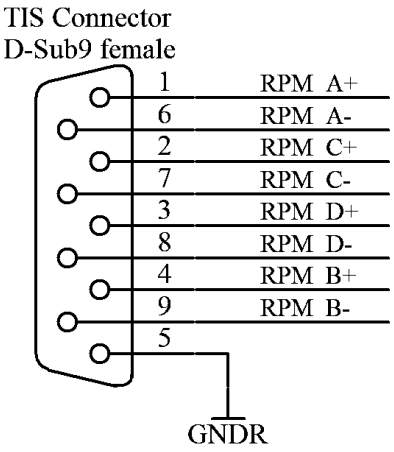
5.1 TIS Connector

This is the layout of the **female 9-pin D-Sub** connector:

D-Sub 9 Pin	Signal	RPM Channel
1	RPM_A+	1+
2	RPM_C+	3+
3	RPM_D+	4+
4	RPM_B+	2+
5	GND	GND
6	RPM_A-	1-
7	RPM_C-	3-
8	RPM_D-	4-
9	RPM_B-	2-



TIS: single-ended input signal switching thresholds

"-" input pin		SW setting		threshold (referred to single-ended signal on +input pin)		
adapter	voltage	high reference	attenuation	low to high ±20%	high to low ±20%	hysteresis ±20%
GND	0.0V	-	-	0.9V	-0.7V	1.6V
open	0.7V	-	-	2.5V	0.8V	1.7V
GND	0.0V	ON	-	3.9V	2.2V	1.7V
open	1.7V	ON	-	5.2V	3.5V	1.7V
GND	0.0V	-	ON	3.3V	1.1V	2.2V
open	0.8V	-	ON	6.8V	4.4V	2.4V
GND	0.0V	ON	ON	9.6V	7.5V	2.1V
open	1.7V	ON	ON	12.6V	10.2V	2.4V

TIS: differential input signal and connection requirements

- GND must be connected between differential source and TIS.
- **Cable shield** must be connected *on one side only* to prevent ground loops.

Common Mode Voltage V_{CM}	-2V .. +5V
V_{CM} max. deviation between +/- input	±30%
Differential Input Threshold V_{TH}	1.4V
Hysteresis V_{HY} (V_{CM} = 1.5V)	0.7V

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6 TAS48_SPOVL – Optical Digital Input

TAS48_SPOVL Specifications		
Input Connector	Versatile Link	optical receiver
Input Formats	S/PDIF, AES3	
Input Channels	2	stereo digital audio stream
Sample Rate Conversion (SRC)		
Sample Rate Input Range	11kHz .. 200kHz	automatic conversion to TAS48 sample rate
Sample Rate Input / Output Ratios Maximum	1:6 F_{SI}:F_{SO} Up 6:1 F_{SI}:F_{SO} Down	F_{SI}: input sample rate F_{SO}: output sample rate
Output Resolution	24 bits	
Interchannel Gain Mismatch	0dB	
Interchannel Phase Deviation	0°	
Gain Error	< -0.2dB	
Dynamic Range	> 130dB	depends on F_{SI} / F_{SO} ratio
THD (1kHz)	> 110dB	depends on F_{SI} / F_{SO} ratio
Passband (Up or Down Sampling)	0.4535 * min (F_{SI}, F_{SO})	
Passband Ripple	± 0.05dB	
Stopband	0.5465 * F_{SO} (output sample rate)	
Stopband Attenuation	125dB	
Group Delay	Total Group Delay = 8.7/ F_{SI} + 8/ F_{SO}	
Calibration	-	
Power Consumption	≤ 0.4W	f_S = 100kHz
PCB Dimensions	70mm x 48mm	

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