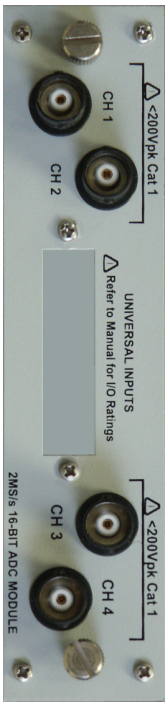
# 2 MSps Synergy *SY6216-4D-V*




**Hi-Techniques Synergy Non-Isolated Amplifier**
**SY6216-4D-V**
**Last update : Rev. E, May 2009**

**Single-Ended or Differential Non-Isolated Voltage**

All channels may be software selected for single-ended or differential voltage. Additionally, all channels may be set to measure Frequency, Mean or RMS value of their inputs in real time for storage as a trace and/or for triggering.

| | | |
|---|---|---|
| Number of Channels | : | 4 |
| Input Connector | : | Insulated BNC per channel. In Differential coupling BNC shell carries (-) input |
| Input Ranges | : | ±20 mV to ±20 V in 1-2-5 sequence |
| Input Impedance | : | Single-ended: 1 MΩ to ground<br>Differential: inputs each 1 MΩ to ground; 2 MΩ from (+) to (-) |
| Coupling | : | DC Single-ended/DC Differential/Ground<br>(AC coupling and sensor signal conditioning available as SY6216-4D-VC) |
| Calibration Wizard | : | Measure physical input or enter datasheet sensitivity |

**Acquisition Modes**

| | | |
|---|---|---|
| Scope/Transient | : | 1 MHz bandwidth, 2 MS/s 16-bit digitizer per channel. For single-shot or repetitive high-speed events. Data is saved to high-speed transient RAM. |
| Recorder | : | 80 kHz bandwidth, streaming to disk at up to 200 kS/s per channel. For continuous streaming acquisition. Data may be saved to Windows hard disk at full rate: to USB flash modules, RAID, server, other Windows-supported storage devices at media-dependent rates. |
| Frequency Analyzer | : | Real-time FFT analysis up to 1 MHz, with or without simultaneous time-domain displays. |
| Signal Averager | : | Both time-domain and frequency-domain averaging are provided to reduce noise and increase resolution. |

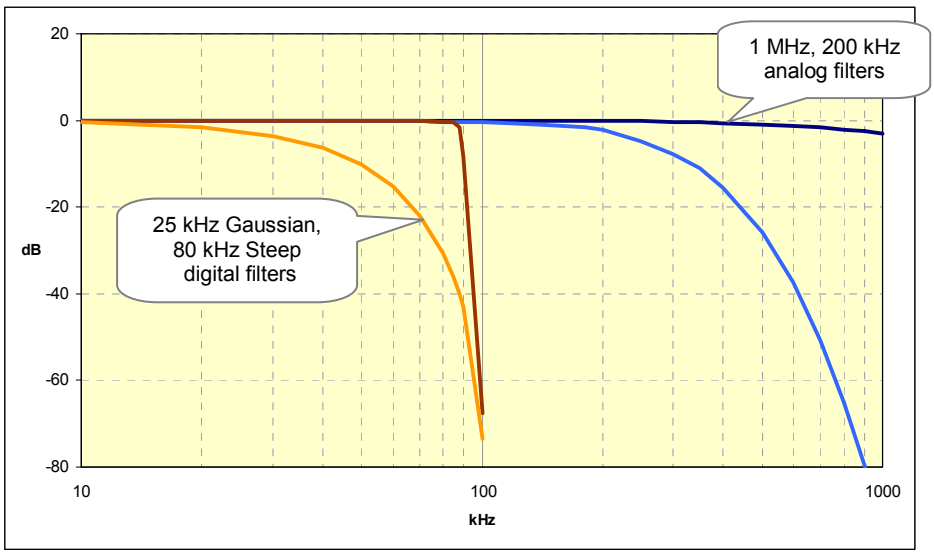
**Acquisition Specifications**

| | | |
|---|---|---|
| Sample Rates | : | Decimal rates 2 MS/s to 0.5 S/s in 1, 2, 5 steps.<br>Binary rates 1.024 MS/s to 0.512 S/s.<br>External Clock up to 2 MS/s (>33,000 RPM at 3600 ppr.) Synchro feature multiplies Ext Clk by 1 - 65,535 |
| Sample Rate Accuracy | : | <25 ppm |
| Abs. Time Accuracy | : | With IRIG/GPS option <1 μs, PC time accuracy without |
| Transient Memory | : | Standard: 64 MS per 4-channel module, shared across enabled channels. Over 8 seconds storing all ch at 2 MS/s.<br>Optional: 128 MS per module |
| Sweep Length | : | 64 samples to max transient memory in scope mode, unlimited length in recorder mode |
| Pre-trigger | : | 1 sample to 100% sweep length in scope mode, up to full disk in recorder mode |
| Post-trigger delay | : | 1 – 1E9 samples, 1 – 64K trigger events |
| Triggering | : | Any input channel, +/-/dual slope with variable hysteresis; DSP measurements from any channel, or External |
| Logical Trigger | : | OR of all channels, plus separate Gate input |
| Trigger Sequences | : | Up to 65,536 segments with time stamps |
| Signal Averaging | : | Up to 65,536 sweeps, selectable artifact rejection |
| ClearVU | : | Max/Min, other statistical information saved in real time for accurate live displays and fast review |

**Performance Specifications**

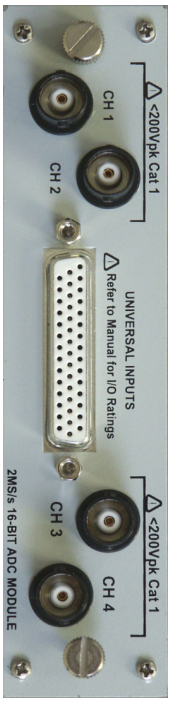
| | | |
|---|---|---|
| DC Accuracy | : | < 0.10% Maximum Static Error (Gain + Offset + Static Integral Non-Linearity) |
| | | Offset drift automatically zeroed with each sweep |
| CMV Range | : | 20 – 200mV ranges : ±10 V |
| | | 500mV – 2V ranges: ±100 V |
| | | 5V – 20V ranges : ±500 V |
| CMRR | : | 20 – 200mV ranges : > 90 dB @ 50 Hz and 10 kHz |
| | | 500mV – 2V ranges: > 80 dB @ 50 Hz, >60 dB @ 10 kHz |
| | | 5V – 20V ranges : > 60 dB @ 50 Hz, >50 dB @ 10 kHz |
| Noise, rms % of FS | : | < 0.01% All ranges, Recorder Mode, Steep Filter, 80 kHz bandwidth, 200 kS/s |
| | | < 0.002% Typical, 200 mV range at 80 kHz bandwidth |
| | | < 0.02% Scope Mode, Filters Off, 2 MS/s, 1 MHz bandwidth, 50 mV range and higher |
| | | < 0.04% Scope 20 mV Range only |
| Channel Matching | : | Phase Match: <0.5 degree to 80 kHz, <1 degree to 200 kHz |
| | | Amplitude Match: <0.1 dB to 80 kHz, <0.2 dB to 200 kHz |

| | | |
|---|---|---|
| Analog Filters | : | Selectable, 1 MHz Wideband or 200 kHz Anti-alias |
| Wideband | : | 4-pole Gaussian filter, -3 dB ±0.25 dB at 1 MHz |
| Anti-alias | : | 10-pole Linear Phase filter, -3 dB at 200 kHz, -90 dB at 1 MHz |
| Digital Anti-alias Filter | : | Selectable: Steep-slope for best frequency response, Gaussian for best time-domain step response |
| Filter Bandwidth | : | 80 kHz maximum, user-selectable lower frequencies. Auto mode tracks 0.4x sample rate. |



HI-TECHNIQUES DIGITIZER BOARD SPECIFICATIONS

# 2 MSps Synergy SY6216-4D-VC




**Hi-Techniques Synergy Universal Input Amplifier**
**SY6216-4D-VC**
**Last update : Rev. E, November, 2008**

**DC Bridge, Accelerometer, Thermocouple, Differential or Single-Ended Voltage Input**

All channels may be software selected for signal conditioning, single-ended or differential voltage. Additionally, all channels may be set to measure Frequency, Mean or RMS value of their inputs in real time for storage as a trace and/or for triggering.

| | | |
|---|---|---|
| Number of Channels | : | 4 |
| Input Connector | : | Insulated BNC per channel for voltage and IEPE<br>44-pin D-sub for voltage, IEPE, bridge and TC<br>Connector block with screw terminals optional |
| Input Ranges | : | ±20 mV to ±20 V in 1-2-5 sequence |
| Input Impedance | : | Single-ended: 1 MΩ to ground<br>Differential: inputs each 1 MΩ to ground; 2 MΩ from (+) to (-) |
| Coupling | : | DC, DC Differential, Ground, AC @ 1.5 Hz, AC Differential, IEPE, Bridge, TC |
| Calibration Wizard | : | Measure physical input, enter datasheet sensitivity, bridge shunt calibration |

**Signal Conditioning Modes**

| | | |
|---|---|---|
| DC Bridge | : | Excitation 0-10 Vdc in 2000 steps, up to 40 mA per channel<br>Software selection of full, half or quarter bridge modes<br>Internal 350 ohm ¼-bridge completion resistor; connector block provides location for additional user-installed values.<br>Location provided on connector block for shunt cal resistor, software switchable into + or - polarities. |
| IEPE | : | Constant-current source of 4 mA per channel supports all IEPE sensors including accelerometers, microphones, pressure and force sensors. Brand names include ICP®, ISOTRON®, Piezotron®, DeltaTron®.<br>Charge-mode sensors are also supported with in-line charge converters. |
| Thermocouple | : | Supports J, K, T, E, R, S type thermocouples.<br>Screw terminals and cold junction compensation are located on external connector block. |
| Voltage Inputs | : | Voltage input is software switchable between single-ended and differential input, AC or DC coupling.<br>In differential mode BNC shell carries (-) input. D-Sub connector provides (+), (-) and ground pins for each ch. |

**Acquisition Modes**

| | | |
|---|---|---|
| Scope/Transient | : | 1 MHz bandwidth, 2 MS/s 16-bit digitizer per channel. For single-shot or repetitive high-speed events. Data is saved to high-speed transient RAM. |
| Recorder | : | 80 kHz bandwidth, streaming to disk at up to 200 kS/s per channel. For continuous streaming acquisition. Data may be saved to Windows hard disk at full rate: to USB flash modules, RAID, server, other Windows-supported storage devices at media-dependent rates. |
| Frequency Analyzer | : | Real-time FFT analysis up to 1 MHz, with or without simultaneous time-domain displays. |
| Signal Averager | : | Both time-domain and frequency-domain averaging are provided to reduce noise and increase resolution. |

HI-TECHNIQUES DIGITIZER BOARD SPECIFICATIONS

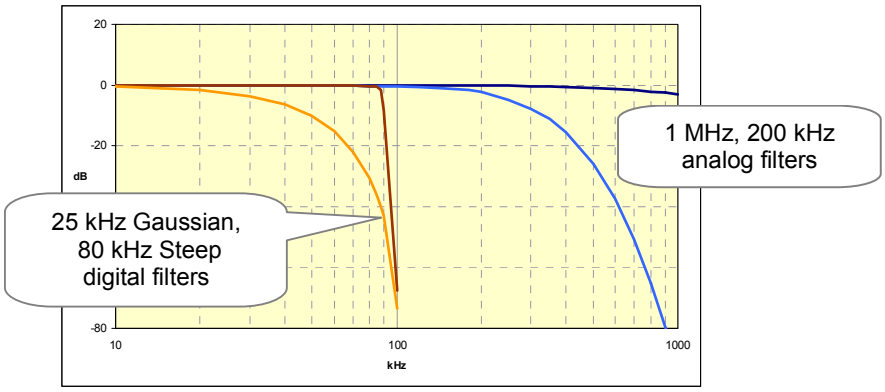
# 2 MSps Synergy SY6216-4D-VC

**Acquisition Specifications**

| | | |
|---|---|---|
| Sample Rates | : | Decimal rates 2 MS/s to 0.5 S/s in 1, 2, 5 steps, Binary rates 1.024 MS/s to 0.512 S/s. |
| | | External Clock up to 2 MS/s (>33,000 RPM at 3600 ppr), Synchro feature multiplies Ext. Clk. by 1 - 65,535 |
| Sample Rate Accuracy | : | <25 ppm |
| Abs. Time Accuracy | : | With IRIG/GPS option <1 µs, PC time accuracy without |
| Transient Memory | : | Standard: 64 MS per 4-channel module, shared across enabled channels. Optional: 128 MS per module. |
| Sweep Length | : | 64 samples to max transient memory in scope mode, unlimited length in recorder mode |
| Pre-trigger | : | 1 sample to 100% sweep length in scope mode, up to full disk in recorder mode |
| Post-trigger delay | : | 1 – 1E9 samples, 1 – 64K trigger events |
| Triggering | : | Any input channel, +/-/dual slope with variable hysteresis; DSP measurements from any channel, or External |
| Logical Trigger | : | OR of all channels, plus separate Gate input |
| Trigger Sequences | : | Up to 65,536 segments with time stamps |
| Signal Averaging | : | Up to 65,536 sweeps, selectable artifact rejection |
| ClearVU | : | Max/Min, other statistical information saved in real time for accurate live displays and fast review |

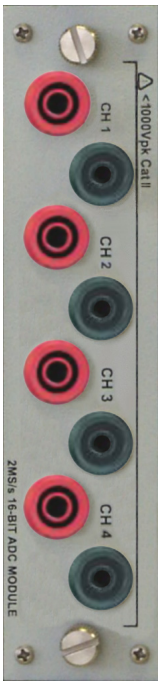
**Performance Specifications**

| | | | |
|---|---|---|---|
| DC Accuracy | : | < 0.10% Maximum Static Error (Gain + Offset + Static Integral Non-Linearity) | |
| | | Offset drift automatically zeroed with each sweep | |
| CMV Range | : | 20 – 200mV ranges : | ±10 V |
| | | 500mV – 2V ranges: | ±100 V |
| | | 5V – 20V ranges : | ±500 V |
| CMRR | : | 20 – 200mV ranges : | > 90 dB @ 50 Hz and 10 kHz |
| | | 500mV – 2V ranges: | > 80 dB @ 50 Hz, >60 dB @ 10 kHz |
| | | 5V – 20V ranges : | > 60 dB @ 50 Hz, >50 dB @ 10 kHz |
| Noise, rms % of FS | : | < 0.01% All ranges, Recorder Mode, Steep Filter, 80 kHz bandwidth, 200 kS/s | |
| | | < 0.002% Typical, 200 mV range at 80 kHz bandwidth | |
| | | < 0.02% Scope Mode, Filters Off, 2 MS/s, 1 MHz bandwidth, 50 mV range and higher | |
| | | < 0.04% Scope 20 mV Range only | |
| Channel Matching | : | Phase Match: <0.5 degree to 80 kHz, <1 degree to 200 kHz | |
| | | Amplitude Match: <0.1 dB to 80 kHz, <0.2 dB to 200 kHz | |
| Analog Filters | : | Selectable, 1 MHz Wideband or 200 kHz Anti-alias | |
| Wideband | : | 4-pole Gaussian filter, -3 dB ±0.25 dB at 1 MHz | |
| Anti-alias | : | 10-pole Linear Phase filter, -3 dB at 200 kHz, -90 dB at 1 MHz | |
| Digital Anti-alias Filter | : | Selectable: Steep-slope for best frequency response, Gaussian for best time-domain step response | |
| Filter Bandwidth | : | 80 kHz maximum, user-selectable lower frequencies. Auto mode tracks 0.4x sample rate. | |



# 1 MSps Synergy *SY6216-4D-VI*

**Hi-Techniques Synergy Isolated Amplifier**
**SY6216-4D-VI**
**Last update : Rev. F, November 2007**




**High Voltage Isolated Signal Conditioning**

All channels provide isolated voltage inputs. Additionally, all channels may be set to measure Frequency, Mean or RMS value of their inputs in real time for storage as a trace and/or for triggering.

| | | |
|---|---|---|
| Number of Channels | : | 4 individually isolated channels |
| Input Connector | : | 4 mm safety-shrouded banana pair per channel |
| Input Ranges | : | ±50 mV to ±1000 V in 1-2-5 sequence |
| Input Impedance | : | 10 MΩ |
| Isolation | : | 1000 Vpk channel to ground, 2000 Vpk channel to channel |
| Coupling | : | DC, Ground, AC @ 1.5 Hz |
| Calibration Wizard | : | Measure physical input or enter datasheet sensitivity |

**Acquisition Modes**

| | | |
|---|---|---|
| Scope/Transient | : | 200 kHz bandwidth, 1 MS/s 16-bit digitizer per channel. For single-shot or repetitive high-speed events. Data is saved to high-speed transient RAM. |
| Recorder | : | 80 kHz bandwidth, streaming to disk at up to 200 kS/s per channel (all channels) or 1 MS/s (1/4 channels). For continuous streaming acquisition. Data may be saved to Windows hard disk at full rate: to USB flash modules, RAID, server, other Windows-supported storage devices at media-dependent rates. |
| Frequency Analyzer | : | Real-time FFT analysis up to 500 kHz, with or without simultaneous time-domain displays. |

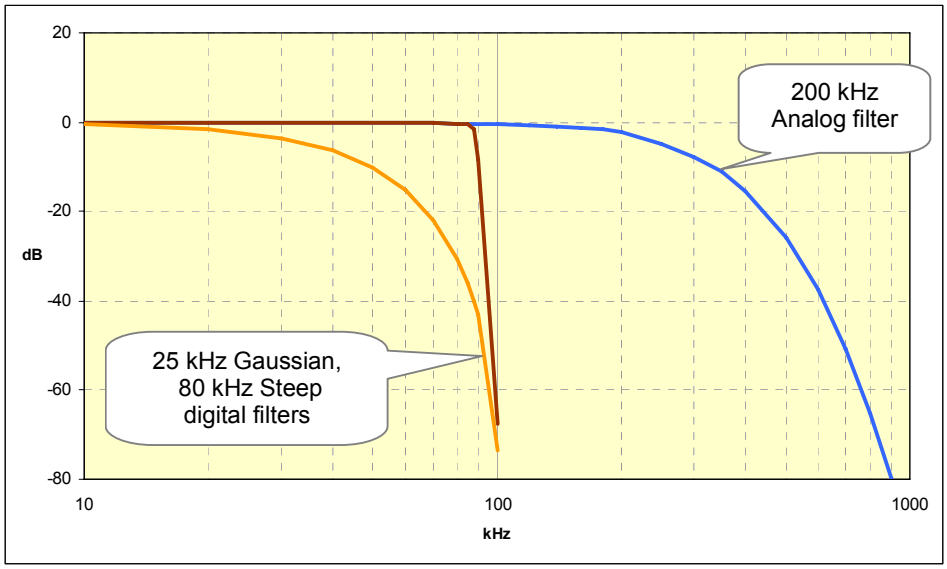
**Acquisition Specifications**

| | | |
|---|---|---|
| Sample Rates | : | Decimal rates 1 MS/s to 0.5 S/s in 1, 2, 5 steps<br>Binary rates 1.024 MS/s to 0.512 S/s<br>External Clock up to 1 MS/s (>16,000 RPM at 3600 ppr)<br>Synchro: Multiply External Clock by any integer 1 - 65,535 |
| Sample Rate Accuracy | : | <25 ppm |
| Abs. Time Accuracy | : | With IRIG/GPS option <1 µs, PC time accuracy without |
| Transient Memory | : | Standard: 64 MS per 4-channel module, shared across enabled channels. Over 16 seconds storing all ch at 1 MS/s.<br>Optional: 128 MS per module |
| Sweep Length | : | 64 samples to max transient memory in scope mode, unlimited length in recorder mode |
| Pre-trigger | : | 1 sample to 100% sweep length in scope mode, up to full disk in recorder mode |
| Post-trigger delay | : | 1 – 1E9 samples, 1 – 64K trigger events |
| Triggering | : | Any input channel, +/-/dual slope with variable hysteresis; DSP measurements from any channel, or External |
| Logical Trigger | : | OR of all channels, plus separate Gate input |
| Trigger Sequences | : | Up to 65,536 segments with time stamps |
| Signal Averaging | : | Up to 65,536 sweeps, selectable artifact rejection |
| ClearVU | : | Max/Min, other statistical information saved in real time for accurate live displays and fast review |

**Performance Specifications**

| | | |
|---|---|---|
| DC Accuracy | : | < 0.1% Maximum Static Error (Gain + Offset + Static Integral Non-Linearity)<br>Offset drift automatically zeroed with each sweep |
| CMV Range | : | ±500 V all ranges |
| CMRR | : | > 80 dB @ 60 Hz, all ranges |
| Noise, rms % of FS | : | < 0.1%, ranges 200 mV or greater |

| | | |
|---|---|---|
| Analog Anti-alias Filter | : | 8-pole Linear Phase, -3 dB at 200 kHz, -90 dB at 1 MHz |
| Digital Anti-alias Filter | : | Selectable: Steep-slope for best frequency response, Gaussian for best time-domain step response |
| Filter Bandwidth | : | 80 kHz maximum, user-selectable lower frequencies. Auto mode tracks 0.4x sample rate. |



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HI-TECHNIQUES DIGITIZER BOARD SPECIFICATIONS

# 1 MSps Synergy SY6216-4D- MV

**Hi-Techniques Synergy Isolated Amplifier**
**SY6216-4D-MV**
**Last update : Rev. A July 2009**

**Medium Voltage Isolated Signal Conditioning**

All channels provide isolated voltage inputs. Additionally, all channels may be set to measure Frequency, Mean or RMS value of their inputs in real time for storage as a trace and/or for triggering.

| | | |
|---|---|---|
| Number of Channels | : | 4 individually isolated channels |
| Input Connector | : | BNC |
| Input Ranges | : | ±50 mV to ±200 V in 1-2-5 sequence |
| Input Impedance | : | 10 MΩ |
| Isolation | : | 42V RMS Agency Rating, 1000V Transient |
| Coupling | : | DC, Ground, AC @ 1.5 Hz |
| Calibration Wizard | : | Measure physical input or enter datasheet sensitivity |

**Acquisition Modes**

| | | |
|---|---|---|
| Scope/Transient | : | 200 kHz bandwidth, 1 MS/s 16-bit digitizer per channel. For single-shot or repetitive high-speed events. Data is saved to high-speed transient RAM. |
| Recorder | : | 80 kHz bandwidth, streaming to disk at up to 200 kS/s per channel (all channels) or 1 MS/s (1/4 channels). For continuous streaming acquisition. Data may be saved to Windows hard disk at full rate: to USB flash modules, RAID, server, other Windows-supported storage devices at media-dependent rates. |
| Frequency Analyzer | : | Real-time FFT analysis up to 500 kHz, with or without simultaneous time-domain displays. |

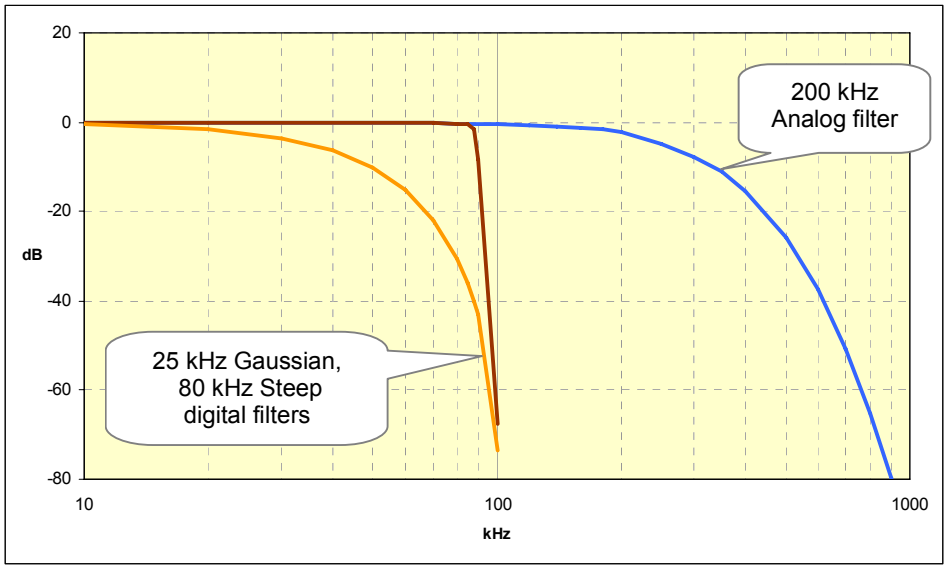
**Acquisition Specifications**

| | | |
|---|---|---|
| Sample Rates | : | Decimal rates 1 MS/s to 0.5 S/s in 1, 2, 5 steps<br>Binary rates 1.024 MS/s to 0.512 S/s<br>External Clock up to 1 MS/s (>16,000 RPM at 3600 ppr)<br>Synchro: Multiply External Clock by any integer 1 - 65,535 |
| Sample Rate Accuracy | : | <25 ppm |
| Abs. Time Accuracy | : | With IRIG/GPS option <1 µs, PC time accuracy without |
| Transient Memory | : | Standard: 64 MS per 4-channel module, shared across enabled channels. Over 16 seconds storing all ch at 1 MS/s.<br>Optional: 128 MS per module |
| Sweep Length | : | 64 samples to max transient memory in scope mode, unlimited length in recorder mode |
| Pre-trigger | : | 1 sample to 100% sweep length in scope mode, up to full disk in recorder mode |
| Post-trigger delay | : | 1 – 1E9 samples, 1 – 64K trigger events |
| Triggering | : | Any input channel, +/-/dual slope with variable hysteresis; DSP measurements from any channel, or External |
| Logical Trigger | : | OR of all channels, plus separate Gate input |
| Trigger Sequences | : | Up to 65,536 segments with time stamps |
| Signal Averaging | : | Up to 65,536 sweeps, selectable artifact rejection |
| ClearVU | : | Max/Min, other statistical information saved in real time for accurate live displays and fast review |

**Performance Specifications**

| | | |
|---|---|---|
| DC Accuracy | : | < 0.1% Maximum Static Error (Gain + Offset + Static Integral Non-Linearity) |
| | | Offset drift automatically zeroed with each sweep |
| CMV Range | : | ±42 V RMS, 60V Pk |
| CMRR | : | > 80 dB @ 60 Hz, all ranges |
| Noise, rms % of FS | : | < 0.1%, ranges 200 mV or greater |

| | | |
|---|---|---|
| Analog Anti-alias Filter | : | 8-pole Linear Phase, -3 dB at 200 kHz, -90 dB at 1 MHz |
| Digital Anti-alias Filter | : | Selectable: Steep-slope for best frequency response, Gaussian for best time-domain step response |
| Filter Bandwidth | : | 80 kHz maximum, user-selectable lower frequencies. Auto mode tracks 0.4x sample rate. |



# 100 KSps Synergy *SY5116-16D-V*

**Hi-Techniques Synergy Non-Isolated Amplifier**
**SY5116-16D-V**
**Preliminary Specifications**

**Single-Ended or Differential Non-Isolated Voltage**

All channels may be software selected for single-ended or differential voltage. Additionally, all channels may be set to measure Frequency, Mean or RMS value of their inputs in real time for storage as a trace and/or for triggering.

| | | |
|---|---|---|
| Number of Channels | : | 16 |
| Input Connector | : | 78-pin D connector, +/-/gnd pins for each channel plus accessory power |
| Input Ranges | : | ±100 mV to ±10 V in 1-2-5 sequence |
| Input Impedance | : | Single-ended: 1 MΩ to ground<br>Differential: inputs each 1 MΩ to ground; 2 MΩ from (+) to (-) |
| Signal Conditioning | : | Thermocouple types B, C, E, J, K, N, R, S, T (requires breakout card option with CJC)<br>Accessory power +5 V, +/-12 V, up to 100 mA provided for user circuits |
| Coupling | : | DC Single-ended, DC Differential, Ground |
| Calibration Wizard | : | Measure physical input or enter datasheet sensitivity |

**Acquisition Modes**

| | | |
|---|---|---|
| Scope/Transient | : | 100 kHz bandwidth, 100 kS/s 16-bit digitizer per channel. For single-shot or repetitive high-speed events. Data is saved to high-speed transient RAM. |
| Recorder | : | 100 kHz bandwidth, streaming to disk at up to 100 kS/s per channel. For continuous streaming acquisition. Data may be saved to Windows hard disk at full rate: to USB flash modules, RAID, server, other Windows storage devices at media-dependent rates. |
| Frequency Analyzer | : | Real-time FFT analysis up to 50 kHz, with or without simultaneous time-domain displays. |

**Acquisition Specifications**

| | | |
|---|---|---|
| Sample Rates | : | Decimal rates 100 kS/s to 0.5 S/s in 1, 2, 5 steps.<br>Binary rates 102.4 kS/s to 0.512 S/s.<br>External Clock up to 100 kS/s (>16,000 RPM at 360 ppr.) Synchro feature multiplies Ext Clk by 1 - 65,535 |
| Sample Rate Accuracy | : | <25 ppm |
| Abs. Time Accuracy | : | With IRIG/GPS option <1 µs, PC time accuracy without |
| Transient Memory | : | Standard: 64 MS per 16-channel module, shared across enabled channels. (40 sec storing all ch at 100 kS/s)<br>Optional: 128 MS per module |
| Sweep Length | : | 64 samples to max transient memory in scope mode, unlimited length in recorder mode |
| Pre-trigger | : | 1 sample to 100% sweep length in scope mode, up to full disk in recorder mode |
| Post-trigger delay | : | 1 – 1E9 samples, 1 – 64K trigger events |
| Triggering | : | Any input channel, +/-/dual slope with variable hysteresis; DSP measurements from any channel, or External |
| Logical Trigger | : | OR of all channels, plus separate Gate input |
| Trigger Sequences | : | Up to 65,536 segments with time stamps |
| ClearVU | : | Max/Min, other statistical information saved in real time for accurate live displays and fast review |

# 100 KSps Synergy *SY5116-16D-V*

**Performance Specifications**

| | | |
|---|---|---|
| DC Accuracy | : | < 0.25% Maximum Static Error (Gain + Offset + Static Integral Non-Linearity) |
| | | Offset drift automatically zeroed with each sweep |
| CMV Range | : | All ranges ±10 V |
| CMRR | : | All ranges > 80 dB @ 50 Hz and 1 kHz |
| Noise, rms % of FS | : | < 0.02% All ranges, Filter Off, 100 kHz bandwidth, 100 kS/s |
| | | < 0.002% Typical, 1 V range at 10 kHz bandwidth |
| Channel Matching | : | Phase Match: <0.5 degree to 1 kHz, <1 degree to 10 kHz |
| | | Amplitude Match: <0.1 dB to 1 kHz, <0.2 dB to 10 kHz |
| Analog Filters | : | Selectable, 100 kHz Wideband (Off) or 10 kHz Anti-alias |
| Wideband (Off) | : | 1-pole Gaussian filter, -3 dB at approximately 150 kHz |
| | | Use for minimum rise time and group delay, no anti-aliasing function. |
| Anti-alias | : | 4-pole Linear Phase Equiripple 0.05 degree filter, -3 dB at 10 kHz, -80 dB at 100 kHz |
| | | Use when high-frequency noise may be present and aliasing is a concern. |
| Digital Filters | : | Selectable: Steep-slope for best frequency response, Gaussian for best time-domain step response |
| Filter Bandwidth | : | 10 kHz maximum, user-selectable lower frequencies. Auto mode tracks sample rate. |

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