MIRION TECHNOLOGIES

SIGNAL PROCESSING

# Lynx®

*Digital Signal Analyzer*


## FEATURES

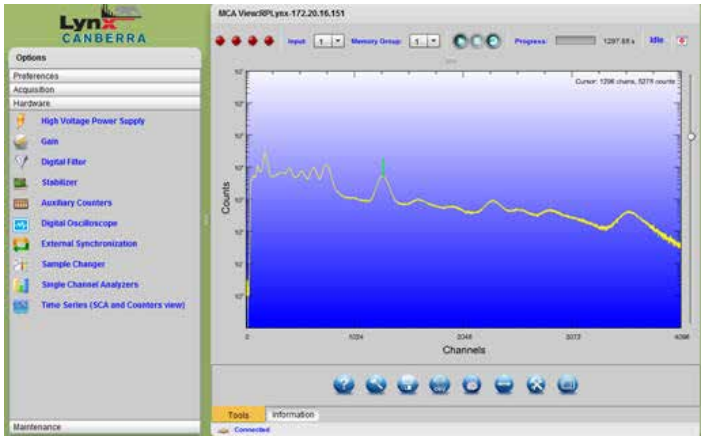
- Integrated rack mountable MCA based on Digital Signal Processing (DSP) technology
- Two groups of 32k channel conversion gain/spectral memory
- Operates in pulse height analysis (PHA), multichannel scaling (MCS), dual channel loss free counting (LFC), multispectral scaling (MSS) and time-stamped list modes
- Superior count rate and temperature stability
- Flexible range of processing time parameters for precise match to application requirements
- 10/100 Base TX Ethernet for fast, convenient industry-standard communications
- Full complement of control and signal input/output interfaces
- Three HVPS ranges to support detectors with low, medium or high bias requirements
- Advanced auto pole/zero US Patent #7725281, base line restoration and digital stabilization capability
- Adjustable digital signal delay, input signal delay, and coincidence window for advanced coincidence timing applications
- Advanced Coincidence counting modes store both original full spectrum and gated spectrum for complete traceability and data control
- Multiple trace analog and digital oscilloscope to ensure easy setup and maintenance
- Full-featured support through Genie™ 2000/Apex® spectroscopy software
- Optional software development kit with examples
- Password-protected built-in web server interface allows easy and remote access to spectral display and status, acquisition control, instrument setup, and diagnostics

## DESCRIPTION

The Lynx DSA is the most advanced, full-featured Multichannel Analyzer ever offered. It is a 32k channel integrated signal analyzer based on advanced digital signal processing (DSP) techniques. When paired with the computer of choice, the Lynx unit becomes a complete spectroscopy workstation capable of the highest quality acquisition and analysis. The instrument supports a wide range of spectroscopy detector technologies such as HPGe, Si(Li), PIPS®, X-PIPS™, CdTe, Cd(Zn)Te and virtually all scintillation detectors used for gamma spectroscopy. It also supports the unique energy ranges of all these detectors from 1 keV on up.

This highly integrated instrument incorporates front end signal conditioning, a fast digitizing analog-to-digital converter (ADC), programmable digital filters, digital oscilloscope, automatic pole/zero US Patent #7725281 and base line restorer, digital fast discriminator, two groups of 32k channel spectral memory, digital stabilizer and a triple-range HVPS – all in a small, compact package. Lighted indicators are included on the front panel to alert the user to power, acquisition, communication, high voltage and count rate status with just a quick glance.

The Lynx instrument is operated through the Mirion Genie 2000 and Apex spectroscopy software which provides the user with an extensive selection of application specific software options. The Lynx unit may also be operated via the Internet or a Local Area Network (LAN) without any spectroscopy software at all. Only a web browser is required for data acquisition display and control, system energy/shape calibration and operation of the digital oscilloscope from a Microsoft Windows, Mac OS or Linux computer. The web browser capability can be used for controlling and checking count status from any computer on the Internet if permission is granted by the system administrator. However, more involved data analysis such as nuclide identification, activity calculation, etc., requires Genie 2000 or Apex software. An OS independent software development kit (SDK) with examples is available and can be used without Genie 2000 software. The SDK is similar to the comprehensive set of programming tools available with the Mirion Osprey® Digital Tube Base MCA. It allows expert users to develop platform independent applications for instrument control and data acquisition.




With the Lynx DSA, acquisition can be configured for pulse height analysis (PHA) or multichannel scaling (MCS) modes supporting two groups of 32k or fewer channels. Simultaneous PHA and MCS data acquisition is available as well. A multispectral scaling (MSS) acquisition mode, sometimes referred to as “ping-pong” mode, is supported for rapidly collecting large numbers of PHA spectra with little-to-no data loss between acquisitions. Time-stamped list mode is also supported and will record the time and energy of each individual energy event as it occurs during a count. Energy and time-correlated spectra can then be created from the data. The Genie 2000 S560C Programming Libraries software package is required for operation in the MSS and list modes, but these modes can be set up via the web browser interface.

The Lynx DSA is equipped to handle high count rate applications with its dual channel Loss Free Counting (LFC) mode based on the Virtual Pulse Generator (VPG) method. This technology provides the ability for performing real-time correction of system counting losses and is particularly useful when measuring short-lived radionuclides or stack emissions, or any measurements where spectral distribution is changing. LFC can also be used to obtain significant improvements in the live time accuracy of the spectroscopy system by providing the capability of dynamically adding the fractional counting losses to the spectrum as they occur, rather than extending the measurement duration as in live time correction. With Dual Channel LFC, a corrected LFC READ-ADD-N histogram is collected in one memory group, while a non-corrected READ-ADD-1 PHA histogram is collected in the second memory group for ease of comparison and spectral storage. The number of counts (N) to add in LFC mode is determined by the count rate.

The excellent performance of the Lynx DSA is derived from the application of DSP technology. Earlier analog spectroscopy systems were prone to count rate and environmental instabilities that required continual adjustment of the signal processing subsystem – and often compromised analysis results. The Lynx unit digitizes the preamplifier signals at the beginning of the signal processing chain. This approach minimizes the amount of analog circuitry in the system resulting in increased stability, accuracy and reproducibility.

Compared to earlier DSP-based analyzers still available today, the Lynx DSA is able to process data faster and cleaner and provides better results even with noisy detector signals. It has a wider range of trapezoidal filter parameters and a more advanced automatic baseline restorer capability. However, the Lynx unit also shares a number of characteristics with its Mirion DSP predecessors. The digital signal processing techniques that Mirion has employed from the earliest DSP analyzers forward allow filter algorithms and pulse shapes that are not achievable using conventional analog technology. This DSP technology includes an efficient filter function which exhibits less processing time, less sensitivity to ballistic deficit, and superior resolution. With the Mirion DSP designs, the pulses are processed more rapidly and accurately resulting in better spectral resolution ***and*** better throughput.

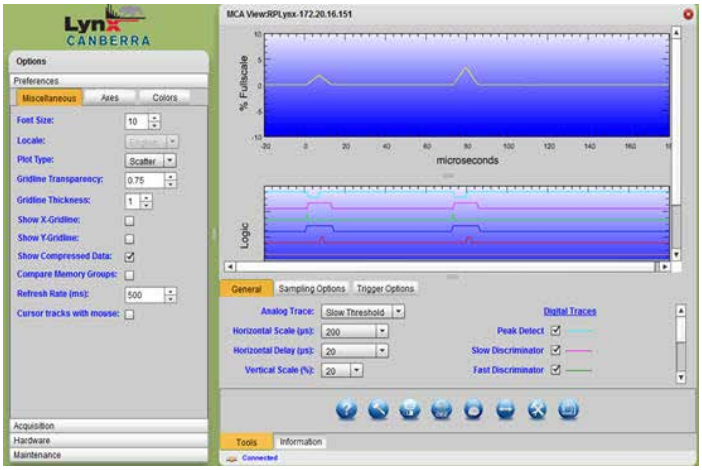
These improvements in signal processing performance provide several tangible benefits to the spectroscopist due to the significantly wider dynamic range of count rates the instrument can accommodate. The broader range allows a user to count samples of widely differing activities with less concern about spectral anomalies. Performance is also far more stable in a wide variety of environmental conditions and count times. Users with industrial applications, or applications where environmental conditions are not well controlled, experience greater stability, less frequent energy recalibrations and a smaller scatter of QA data.

The patented Automatic Pole/Zero function is implemented by using successive approximation technique which reduces the automatic adjustment time to 10-15 seconds (typically). The adjustment is accurate and independent of base-line offset and immune to rise-time variations. Therefore no inspection of the base line is needed. Thus, the pole-zero can be adjusted precisely even at relatively high counting rates.

The system's versatility is augmented by its connectivity. For fast local or remote connections, the 10/100 Base-TX Ethernet connection through the RJ-45 port is optimum. Additionally, the Lynx unit offers a USB interface and RS-232 interface for system setup and diagnostics.


The Lynx DSA is designed to do much more than just count samples in the lab. It includes a complete array of input/output control and signal connections on the rear panel – many provide features you would typically have to pay extra to receive if you could get them at all. With the Lynx unit, they are all included as BNC connections for: TRP Inhibit, HV Inhibit, MCS In, External PHA and MCS Start/Stop, External MCS Channel and Sweep Advance, Coincidence/Anticoincidence Gating, Sample Changer control, SCA and Fast Discriminator out, Synchronization control of multiple Lynx units, plus three General Purpose I/O connectors for future or custom applications.

The Lynx unit has a built-in Digital and Analog Oscilloscope (shown next column) accessible via the web browser interface which provides assistance with instrument set up, pole/zero optimization and manual reset preamp inhibit adjustments. The operator has the ability to view any one of six analog signals and any or all of eight digital signals on the oscilloscope display at the same time. Scaling and trigger functions are similar to those of an actual oscilloscope, and the displayed traces can be printed or saved to disk with scale information and recalled at a later date. Set up and optimization has never been easier!




The Lynx also offers superior coincidence gating functionality and performance. When performing a coincidence measurement, the primary detector pulse is either stored or rejected (Coincidence or Anti-coincidence modes respectively), based on the presence of an external gate signal being present when the primary detector Store pulse occurs. Typically, the external gate is another detector, such as in a Cosmic veto or Compton suppression system. The integrated digital oscilloscope can be used to align the external gating pulse with the primary detector Store pulse directly. The user can control both the width of the external gate and the relative position of the external gate with respect to the primary detector Store pulse using either the built-in oscilloscope or Genie 2000 software. In addition, the ungated spectrum is automatically saved in the second memory group allowing for easy comparison with the gated spectrum. This allows for complete record and traceability of the original unaltered spectrum and provides a convenient mechanism for assessing the system performance.

The Lynx DSA is rack mountable, but is completely enclosed and can be placed on a desktop as well. An optional Rackmount Kit is available for mounting two Lynx units side-by-side in 2 units (3.5 in. of height) in a standard 19-inch electronics cabinet or desk pedestal. The kit includes mounting hardware, rack handles and a spacer that takes the place of one Lynx unit if only one is being installed in the cabinet. Of course, the blank can easily be replaced with a second Lynx unit at any time to double the counting capacity without requiring any additional vertical space in the cabinet.

## INPUTS (Rear Panel)

**Energy in**

- Detector/preamplifier signal input connector, BNC. Accepts positive or negative signals from an associated detector preamplifier; amplitude for full scale conversion ±1 V divided by selected gain; maximum input (signal +dc) for linear operation is dependent on the Input Attenuator setting; Attenuator OFF (x1): ±4 V, Attenuator ON (x 0.25): ±12 V, dc coupled and protected to ±12 V maximum; rise time: less than the selected Rise Time + Flat Top settings; acceptable preamplifier decay time constant: 40 µs to infinity; $Z_{in}$ is 1k.

**TRP INH**

- Reset-Preamp inhibit input connector, BNC.
- TTL compatible logic signal. Software selectable polarity, functionality depends on the mode selected.
  - Norm: Signal inhibits the signal processing and extends the dead time for the duration of the inhibit signal.
  - Reset: Signal inhibits the signal processing and extends the dead time for the duration of the inhibit signal OR the duration of an internal inhibit timer. Inhibit time is the longer of these two inhibit sources.

**HV INH**

- Preamp high voltage inhibit input connector, BNC.
- Accepts input from the detector preamplifier to shut down the HVPS in the event of a detector warm-up above its safe operating temperature; polarity is software selectable to match the preamplifier.
  - Positive polarity: (for Mirion preamplifiers); Enable condition (cold detector) is an open circuit or active high = +1.2 V to +24 V; Inhibit condition (warm detector) is –24 V to <+1.2 V or ground.
  - Negative polarity: for preamplifiers and LN monitors where enable condition (cold detector) is –24 V to <+1.2 V; Inhibit condition (warm detector) is open circuit or active high = +1.2 V to +24 V. With Negative polarity selected an open input will disable the high voltage.

**MCS in**

- MCS input connector, BNC. TTL compatible. Minimum pulse width is 25 ns.

**PHA acquire start/stop**

- External PHA Start/Stop input connector, BNC. TTL compatible, software selectable polarity.
- Acquisition must first be armed. Once armed, the external start/stop control setting dictates the behavior of the acquisition.
- Pulse mode and Level mode are supported. Mode is programmable via software
  - Pulse Mode includes Start, Stop, and Start and Stop functions. Functions are triggered by pulses >25 ns.
  - Level Mode includes Suspend/Resume. Active signal will resume acquisition; inactive signal will suspend acquisition.

**MCS acquire start/stop**

- External MCS Start/Stop input connector, BNC. TTL compatible, software selectable polarity.
- Acquisition must first be armed. Once armed, the external start/stop control setting dictates the behavior of the acquisition.
- Pulse mode and Level mode are supported. Mode is programmable via software
  - Pulse Mode includes Start, Stop, and Start and Stop functions. Functions are triggered by pulses >25 ns.
  - Level Mode includes Suspend/Resume. Active signal will resume acquisition; inactive signal will suspend acquisition.

**MCS channel advance**

- External MCS Channel Advance input connector, BNC.
- TTL compatible, Software selectable polarity.
- Pulse >25 ns advances the current MCS channel.

**MCS sweep advance**

- External MCS Sweep Advance input connector, BNC.
- TTL compatible, software selectable polarity. Pulse >25 ns resets the current sweep in progress. The next sweep will begin. This will occur with each pulse until the preset sweeps is reached.

**Gate – coincidence anticoincidence logic modes**

- Coincidence/anti-coincidence input connector, BNC.
- TTL compatible; software polarity selectable.
- Legacy Coincidence/anti-coincidence modes: Signal active at the pulse processing time allows storage/blocks storage of the event.
- Combined advanced coincidence/anti coincidence: Storage of an event occurs (coincidence gating) or is blocked (anti-coincidence gating) when the event's pulse processing/storage time occurs within the storage window. Simultaneous storage of both non-gated and gated events in Lynx memory groups.
- User adjustable storage window by user adjustable Gate Delay, Input Gate Delay and Input Pulse Width parameters.
- The pulse processing time occurs at 1.1x(rise time + flat top).

**Changer ready**

- Sample Changer Ready input connector, BNC.
- TTL compatible, software selectable polarity.
- Active signal allows acquisition. Inactive signal will delay the start of acquisition.

**SYNC**

- Synchronization input/output signal connector, BNC. For multiple Lynx running concurrent acquisitions.
- TTL compatible; Signal operation and direction are software selectable as Master or Slave.
  - PHA mode: The Master produces a sync signal at the programmed rate. The Slave synchronizes the acquisition to the sync signal.
  - List mode: Master instrument: Signal is an output and provides an output pulse every time the DSA internal 1 µs time base timer overflows. Pulse width >100 ns.
    Slave mode: Signal is an input. Each time the signal pulses >25 ns, the 1 µs internal time base timer will reset.

**General purpose inputs/outputs – GP I/O ports**

- Buffered input/output signal connectors, three BNC's. For connections to processing electronics with TTL compatible signals.
- GP I/O ports 1 and 2 are configured as counter inputs for external TTL signals. Minimum pulse width is 25 ns; maximum input rate is 20 MHz.
- The third GP I/O port is available for future use.

**DC power in**

- 12 V (10-15 V) dc power jack (mechanically lockable to prevent accidental disconnection).
- Current 1.0 A max.

## OUTPUTS (Rear Panel)

**Monitor out**

- Shaper monitor output connector, BNC. This signal is the reconstructed energy shaper signal, and it may be observed by connecting it to an external oscilloscope. The signal range is ±2 V.

**ICR (Incoming Count Rate)**

- Fast discriminator output connector, BNC. TTL compatible. Produces a positive pulse 100 ns wide for each incoming event above the instrument's threshold setting.

**Changer ADV**

- Sample Changer Advance output connector, BNC.
- TTL compatible; Software selectable polarity.
- Pulses for ~140 ms for each sample advance command the instrument receives.

**SCA**

- Single Channel Analyzer output connector, BNC.
- Pulses for each event with an energy between the lower and upper level discriminators.

**Preamp power**

- Preamp power connector, 9-pin female D-connector. Provides ±12 V (±3%), ±24 V (±3%) and ground for standard preamplifiers; overload protected.
  - +12 V @ 100 mA
  - –12 V @ 100 mA
  - +24 V @ 50 mA
  - –24 V @ 50 mA
  - Includes Pin for NAID™ Detector Thermistor Monitor In.

**HV+**

- Positive High Voltage output connector, SHV.
- Software selectable range of 150 – 1500 V dc or 1500 – 5000 V dc.

**HV–**

- Negative High Voltage output connector, SHV.
- Software selectable negative ranges of 150 – 1500 V dc or 1500 – 5000 V dc.

**+/-200 V**

- ±200 V dc voltage output connector, SHV.
  Note: For the three SHV connectors (Positive, Negative and ±200 V output), only a single SHV connector can be used at any one time.

## COMMUNICATION PORTS (Rear Panel)

**10/100 BASE-TX Ethernet**

- Female RJ-45 connector for connection to an Ethernet network or directly to a host computer (with crossover cable) for all data acquisition and application set-up needs.

**USB**

- USB B connector. USB support for direct connection to a host computer or USB hub for system setup purposes or diagnostics. Not recommended for data acquisition.

**RS-232**

- RS-232 9-pin male D-connector for diagnostics using Remote Access Services (RAS). Can be reconfigured through software to support PPP connection for instrument control. Modem support is included for dial-in remote access.

## FRONT PANEL INDICATORS

**Power**

Multi-color LED to indicate instrument status as follows:

- Green Blinking: Instrument is powered on and in the process of initialization.
- Green Steady On: Instrument is powered on and in operating mode.
- Red Steady On: Instrument has some type of self diagnostic error. The reason for the error may be confirmed through the appropriate control software (Genie 2000 software or the web browser).

**Acquire**

- Green LED that illuminates Steady On when the instrument is acquiring data.

**COMM**

- Green LED that illuminates each time the instrument has received a command over any supported communications interface.

**HV**

Green LED that indicates the state of the selected high voltage power supply:

- Off: High voltage supply is off.
- Green blinking: High voltage supply is ON and ramping to its programmed voltage.
- Green steady on: High voltage supply is ON and has reached its programmed voltage.

**ICR**

- Green LED that illuminates each time the instrument processes a nuclear event. The intensity of the LED will vary in proportion to the incoming count rate.

## PROGRAMMABLE CONTROLS

**Gain**

The combination of Coarse Gain and Fine Gain set the overall system gain to match the requirements of the detector and energy range for the application; overall gain is continuously adjustable from x1.6 to x516.3 based on a 2 V full scale. Upper gain adjustment is comparable to a x2581.5 setting on a traditional analog amplifier with 10 V full scale.

- Coarse gain: Range is x2 to x430 in 19% increments.
- Fine gain: Range is x0.8 to x1.2 in ~0.001% increments.
- Gain attenuator: ON/OFF; When ON (selected) enables a divide by four input attenuator to minimize overload due to preamp signals with large dc offsets and Reset Preamps with large output ramp dynamic range. When OFF is selected the signal attenuation is removed.
- Conversion gain: Selections of 256, 512, 1024, 2048, 4096, 8192, 16384 or 32768 channels. Support for two memory groups of 32768 or less channels.
- LLD mode: Selects Automatic or Manual Lower Level Discriminator (LLD) mode; AUTOMATIC: the LLD cutoff is automatically set just above the spectral noise threshold; MANUAL: allows the LLD cutoff to be set manually as a percentage of the full scale spectral size or range.
- LLD setting: Active when the Manual LLD mode is selected, sets the minimum input acceptance level, range is 0 to 100%.
- ULD setting: Sets the maximum input acceptance level for the Upper Level Discriminator (ULD), range is 0 to 110%.
- Input polarity: Selects either POSITIVE or NEGATIVE input polarity.
- TRP inhibit mode: Selects AUTO or MANUAL Reset Preamp Inhibit Modes; disables pulse processing, extends the system dead time, reinitializes the pileup rejector and gates off the baseline restorer. AUTO: System is gated off for the greater of the external RESET signal "OR" the Internal Inhibit Time. MANUAL: Functionality same as Auto mode except the signal processor is inhibited for the greater of the user selected Inhibit Setting "OR" the external RESET signal "OR" the Internal Inhibit Time.
- TRP inhibit setting: Active when the MANUAL Reset Preamp Inhibit Mode is selected, sets the Inhibit Time, range 0 to 160 µs in increments of 1 µs.
- TRP gate polarity setting: Sets the TRP input polarity to POSITIVE or NEGATIVE.

**Digital filter**

Note: Filter output (Trapezoid Signal) may be displayed on the Host computer using the digital oscilloscope feature.

- Rise time: 255 settings for rise and fall times from 0.2 to 51 µs in 0.2 µs increments.
- Flat top: 33 settings for flat top times from 0 to 3.2 µs in 0.1 µs increments.
- PUR guard: Selects Guard Time (GT) multiplier in increments of 1.1, 1.3, 1.5, 1.7, 1.9, 2.1, 2.3, and 2.5 to reject trailing edge pile-up in the event of detector/preamp anomalies.
- Fast disc shaping: Selects NORMAL or LOW ENERGY to optimize the fast discriminator shaping for the selected detector type; NORMAL: The Fast Discriminator shaping is optimized for Ge detectors and general gamma spectroscopy; LOW ENERGY: The Fast Discriminator filter rise time is set proportional to the slow shaping rise time selection.
- Fast disc mode: Sets the Fast Discriminator Threshold mode. AUTO: the threshold is optimized automatically above the system noise level; MANUAL: allows threshold to be adjusted manually.
- Fast disc setting: Active when manual FAST DISC MODE is selected; sets the Fast Discriminator threshold level, range is 0 to 100%; the front panel ICR LED serves as a user aid when manually setting the Fast Discriminator threshold.
- PUR/LTC mode: ON/OFF; ON: Enables pileup rejector and live time corrector (LTC). LTC generates dead time to extend the acquisition time to compensate for events that are piled up and rejected; OFF: pileup rejector and LTC disabled.
- LT trim: Allows adjustment of the trapezoidal pulse evolution time or dead time to optimize Live Time Correction (LTC) performance. The adjustment range is 0 to 1000; the default value of 500 provides good LTC performance for a wide range of applications.
- BLR mode: AUTO, HARD, MEDIUM, SOFT; AUTO: The baseline restorer is automatically optimized as a function of trapezoid shaping time and count rate; HARD, MEDIUM, or SOFT: Sets the baseline restorer to fixed rates as selected.
- Auto pole/zero: Pole/zero is adjusted by computer control; range: 40 µs to infinity; a digital oscilloscope is provided as a user aid when optimizing the pole/zero setting. The oscilloscope measures and analyzes the tail of the trapezoid signal and provides visual feedback showing the quality of the pole/zero adjustment.
- Preamp type: RC, RESET; selects the pole/zero mode; RC: pole/zero can be adjusted manually by computer command; range: 40 µs to infinity; RESET: Sets pole/zero at infinity for use with pulsed charged restoration (RESET) preamplifiers.

**Mixed signal oscilloscope**

- Allows examination of the digital signal reconstructed in time to assist and verify instrument setup, pole/zero optimization and manual reset preamp inhibit adjustments. The operator has the ability to view any one of six analog signals on the same screen as any or all of eight digital signals.

**Stabilizer**

- Gain mode: ON, OFF, HOLD; ON/OFF: enables or disables the Gain Mode; HOLD: disables the stabilizer Gain Mode, but maintains the current Gain correction factor; Centroid (10 to 32752 channels), Window (1 to 128 channels), Spacing (2 to 512 channels), Ratio (0.01 to 100), Correction Divider (0 to 9); Correction Range is selectable at 1% for Ge and 10% for NaI detectors.

**Sample changer control**

- Sample changer advance and ready signal polarities may be set separately for positive and negative. The changer may be manually advanced via an ADVANCE CHANGER button in the software.

**Synchronization**

- External SYNC status: Disables or Enables the synchronization of multiple Lynx units.
- External SYNC mode: Sets a particular Lynx as MASTER to control other units or as a SLAVE to be controlled by another Lynx.
- External SYNC pulse/timeout: Separately sets the duration of a SYNCH pulse and the timeout if no pulse is received in the selected amount of time, settings in µs.
- Ext SYNC polarity: Sets the polarity of the SYNC signal as positive or negative.

## PERFORMANCE

**Signal processing**

- Spectrum broadening: The FWHM of $^{60}$Co 1.33 MeV gamma peak for an incoming count rate of 2 kcps to 100 kcps will typically change less than 6% for 2.8 µs rise/fall time, 0.8 µs flat top and proper P/Z matching. These results may not be reproducible if the associated detector exhibits an inordinate amount of long rise time signals.
- Integral nonlinearity: <±0.025% of full scale over the top 99% of selected range.
- Differential nonlinearity: <±1% over the top 99% of the range including the effects from integral nonlinearity.
- Gain drift: <35 ppm/°C after 15 minutes of operation.
- Zero drift: <3 ppm/°C after 15 minutes of operation. Typically, less than 1 channel over full temperature range (8K Spectrum).
- Overload recovery: Recovers to within 1% of full scale output from x1000 overload in 2.5 non overlapped pulse widths at full gain, at any shaping (processing time), and with pole/zero properly set.

**Pileup rejection/live time correction**

- Pulse pair resolution: Better than 500 ns with NORM Detector Type selected.
- Dead time correction: Extended live time correction, accuracy of reference peak area changes 5% (3% typical) at up to 50% system dead time with a setting of 5.6 µs rise time and 0.8 µs flat top.

**Data acquisition modes**

All device settings are retained during power down until power is restored. Spectral data retention is for a minimum of 5 years in the event of power loss.

**PHA mode**

- Channels: Selections of 256, 512, 1024, 2048, 4096, 8192, 16384, or 32768 channels. Support for two memory groups of 32768 or less channels.
- Digital offset (zero to full scale): Specifies a number of channels to offset the data. The offset shifts the memory assignments of the device's conversion to the left (e.g. an offset of 4096 would shift channel 4096 down to correspond with channel zero of the memory).
- Preset: Real or Live Time timers with range of 0.01 s to 11930 hr with 0.01 s resolution.
- Control: Internal or External Start/Stop control.
- Digital delay: An adjustable digital signal delay for timing applications (coincidence counting) is supported. This feature is used in place of a delay amplifier and supports a wide range of delay times (0 to 160 µs in 0.2 µs steps).

**Dual LFC mode**

- Two memory groups of equal size are available for PHA storage. The corrected spectrum is stored in the first group and the uncorrected spectrum in the second group.
- The time indication for each group is as follows:
- The time for the corrected spectrum (group 1) indicates the real measurement time value for both Real and Live timers.
- The time for the uncorrected spectrum (group 2) indicates the system live value (system not busy) for the Live Timer and the real measurement time for the Real Timer.

**MCS mode**

- Input source: ROI, Fast Discriminator, or TTL IN.
- Channels: Selections of 256, 512, 1024, 2048, 4096, 8192, 16384, or 32768 channels. Support for two memory groups of 32768 or less channels.
- Dwell time: 1 to 999 in units of µs, ms or s. Minimum dwell time is 2 µs; maximum dwell time is 999 s.
- Preset sweep counter: 0 to 232-1 sweeps.
- Control: Internal or External Start/Stop control.

**Time stamped list mode**

- ADC events stored sequentially in the buffer memory. The time of arrival of each event is tagged with the current value of a 1 µs time counter. Maximum throughput is 100k events per second.

**Multispectrum Scaling (MSS) mode**

- If configured for MSS data acquisition, the Lynx unit acquires data into its two PHA memory groups in a "ping-pong" fashion – acquiring alternately into one group while the other group is stored to computer and cleared. If a group has not finished clearing when it is time to switch groups, acquisition continues in the first group until the second group is ready to receive data.
- Minimum count time with no data loss between acquisitions is 100 ms limited by the host computer's ability to process and store the data such that it can be cleared from Lynx memory and the memory reused for the next acquisition.

**High voltage power supplies**

- All outputs are current limited and short circuit protected.
- HV Inhibit input, two modes:
  - Positive polarity: (for Mirion preamplifiers); Enable condition (cold detector) is an open circuit or active high = +1.2 V to +24 V; Inhibit condition (warm detector) is –24 V to <+1.2 V or ground.
  - Negative polarity: for preamplifiers and LN monitors where enable condition (cold detector) is –24 V to <+1.2 V; Inhibit condition (warm detector) is open circuit or active high = +1.2 V to +24 V. With Negative polarity selected an open input will disable the high voltage.
- Note: After Inhibit is removed the high voltage remains inhibited until the user acknowledges the fault condition via a reset of the high voltage supply.
- Separate SHV connectors for positive and negative high range outputs.
- Single SHV connector for ±200 V output.
- HVPS Range 1: ±200 – 1500 V @ 1 mA max.
  - Ripple: 5 mV P-P.
  - Temperature coefficient: ±50 ppm/°C.
  - Stability: 0.01%/h, 0.02%/8 h.
  - Accuracy: ±5%. ±2.5% Typical.
  - Load regulation: 1%.
  - Setting resolution: 12-bit (1/4096).
- HVPS Range 2: ±1500 – 5000 V @ 1 µA max.
  - Ripple: 10 mV P-P.
  - Temperature coefficient: ±50 ppm/°C.
  - Stability: 0.01%/h, 0.02%/8 h.
  - Accuracy: ±5%. ±2.5% Typical.
  - Load regulation: 1%.
  - Setting resolution: 12-bit (1/4096).
- HVPS Range 3: ±200 V @ 100 nA max.
  - Ripple: 10 mV P-P.
  - Temperature coefficient: ±50 ppm/°C.
  - Stability: 0.01%/h, 0.02%/8 h.
  - Accuracy: ±5% ±5 V. ±2.5% ±3 V Typical.
  - Load regulation: 1%.
  - Setting resolution: 12-bit (1/4096).

## CHARACTERISTICS

**Physical**

- Metal enclosure.
- Size: Half a 19-in. electronics cabinet wide by 2U high – 8.9 x 21.3 x 27.4 cm (3.5 x 8.4 x 10.8 in.) (H x W x D).
- Weight: 2.6 kg (5.7 lb).
- System components
  - Lynx Digital Signal Analyzer.
  - Operator's manual.
  - 3 m (10 ft) CAT 5 Crossover UTP Ethernet cable.
  - 3 m (10 ft) CAT 5 Straight-thru UTP Ethernet cable.
  - 3 m (10 ft) USB A-B cable.
  - 3 m (10 ft) RS-232 9-pin serial interface cable.

**Environmental**

- Operating temperature range: 0 to 50 °C.
- Humidity: Up to 80% non-condensing.

## ORDERING INFORMATION

- LYNX-MCA – Digital Signal Analyzer.
- Compatible with Genie 2000 V3.1a or later.

## OPTIONS

- LYNX-SDK – OS independent Software Development Kit.
- LYNX-MOUNTKIT LYNX-19" RACK MOUNT KIT.
  - Includes mounting hardware, rack handles and a spacer to allow mounting of one or two Lynx units in a cabinet.

ISO 9001 SYSTEM CERTIFIED
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