

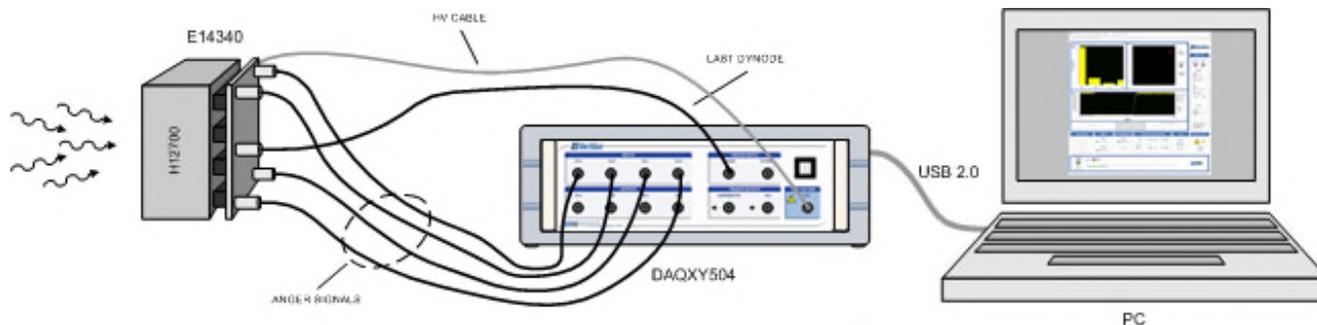
Overview

The PhotoniQ Model DAQXY504 is a stand-alone laboratory instrument with a PC interface that is used for charge integration and data acquisition (DAQ) from Anger logic-connected multianode photomultiplier tubes (MAPMTs). The use of Anger logic allows for high channel count MAPMTs to be reduced to just four channels using a simple *position of centroid* resistive network. Several Anger logic products are available from Vertilon for use with specific Hamamatsu MAPMTs. Additionally, Hamamatsu offers the E14340 Anger logic product for their H12700 and H14220 sixty-four anode photomultiplier tubes. A list of compatible Anger logic products and their associated MAPMTs is shown below. While this application note describes how to use the Vertilon DAQXY504 with the Hamamatsu E14340, other Anger logic interface boards can easily be substituted in place of the E14340.

Model #	Manufacturer	Compatible MAPMTs	# of Anodes
E14340	Hamamatsu	H12700, H14220	64
SIB064B-1018	Vertilon	H12700, H14220, H10966, H8500	64
SIB164B-1018	Vertilon	H7546B, H12428	64
SIB71256	Vertilon	H13700	256

Typical Setup

A typical setup using a DAQXY504, Hamamatsu E14340 Anger logic sensor interface board, and H12700 8 x 8 MAPMT is shown below. The Hamamatsu H12700 MAPMT is mounted to the E14340 and positioned to detect incoming light from a scintillator crystal or optical assembly. The four Anger logic outputs from the E14340 connect to four inputs on a PhotoniQ DAQXY504 four channel charge integrating MAPMT data acquisition system. The last dynode signal from the E14340 connects directly to the DAQXY504 internal discriminator that generates a trigger to the PhotoniQ. High voltage bias of up to negative 1200 volts is sent to the PMT from an SHV connector located on the front panel of the PhotoniQ. Digitized output data from the DAQXY504 is sent through a USB 2.0 connection to a PC for display, logging, or real time processing. The real time display shows signal amplitude for each Anger output, position of interaction, and time domain data from the MAPMT.



High Voltage Bias

The high voltage bias cable from the H12700 MAPMT connects to the high voltage output on the front panel of the DAQXY504. The MAPMT bias can be enabled and controlled from the GUI front panel. This feature is only available if the high voltage power supply option is installed in the unit. If not installed, the user can use an external negative high voltage supply.

Anger Signals

The four Anger outputs from the E14340 are derived from a resistor-based network on the E14340 connecting to the 64 anodes from the H12700 MAPMT. Since the MAPMT generates negative current signals on each of its 64 outputs, the four Anger outputs from the E14340 are also negative current signals. In this context, negative is assumed to mean current going into the E14340 such that if one of these signals is connected directly to a resistor to ground, a negative voltage would result. Assuming that a single event is incident on the MAPMT photocathode, the Anger network produces four *position of centroid* weighted negative current signals representing the point of interaction. These four signals connect to the four front panel inputs of the DAQXY504 and the *Input Mode* in the GUI front panel is set to *I* (current). Current mode on the DAQXY504 is used for negative Anger input signals which is normally the case with direct connection to resistive Anger networks.

Monitor Output

The *Monitor* outputs are generally used for setup diagnostic purposes and are particularly handy when aligning the DAQXY504 integration period to the Anger inputs. The outputs are also helpful to observe the effect of the *Delay* feature when it is enabled for use with the internal discriminator.

Last Dynode Signal

The last dynode from the H12700 is routed directly on the E14340 to an output connector. For self-triggering applications, the last dynode connects to the *Dynode* input on the DAQXY504. Like the Anger outputs from the E14340, the last dynode signal is also a current signal but of the opposite polarity (positive). The *Discriminator* (dynode) polarity on the GUI front panel should therefore be set to *positive* when the *Discriminator* is enabled.

Discriminator Threshold

The threshold for the discriminator in the DAQXY504 is generally determined empirically. The discriminator generates a logic signal when a current pulse on the 50 ohm terminated *Dynode* input exceeds a user-defined threshold. The DAQXY504 GUI allows the user to set this threshold between 0 and +3V. When a pulse is detected, the *Discriminator* output from the unit becomes active and the associated green LED blinks.

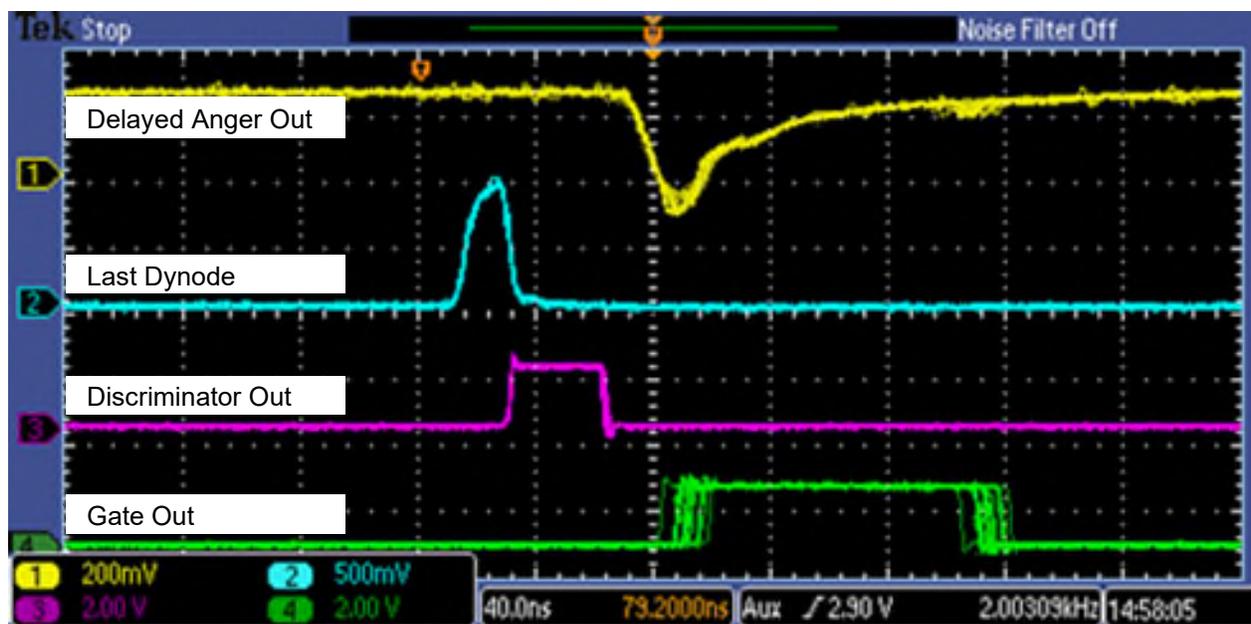
Trigger and Integration

When using the MAPMT last dynode as a trigger source, the *Trigger Type* of the DAQXY504 is set to *Discriminator*. This configuration internally connects the unit's discriminator output to the trigger input of the DAQ such that each time the last dynode signal crosses the user-set threshold, the DAQXY504 is triggered and collects the integrated signals from the four Anger inputs. The integration window is set and positioned to encompass the incoming signals by setting the GUI front panel's *Integration Period* and *Integration Delay* parameters. Additionally, the *Holdoff* should be enabled so that noisy last dynode signals do not contribute inadvertent triggers to the system.

Timing Adjustment

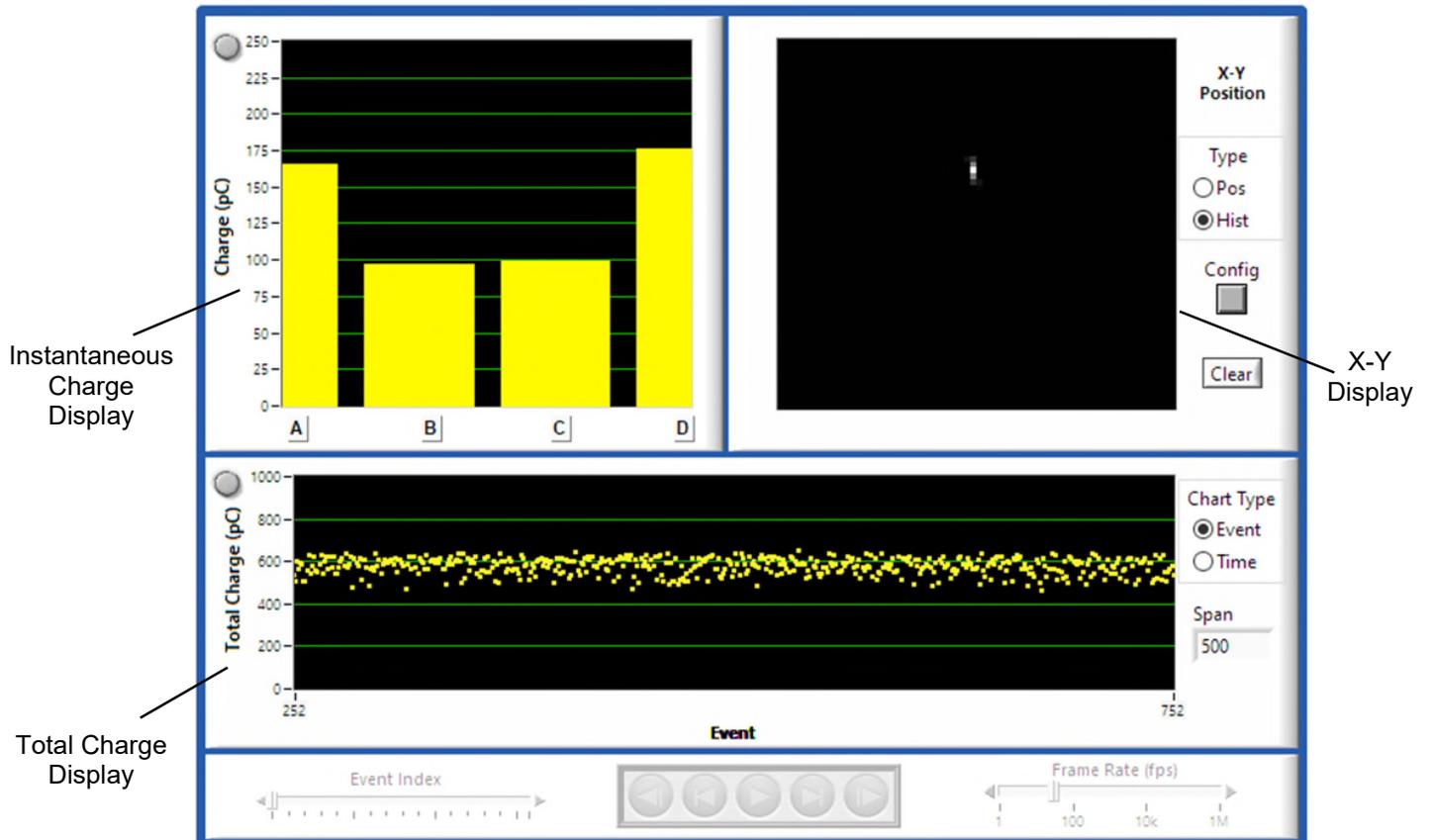
Optimum performance is achieved when the integration window is closely positioned around the entire pulse from each Anger output. Since the trigger to the DAQXY504 is generated by the discriminator when the last dynode (which is coincident with the four Anger signals) crosses the user-set threshold, the trigger and integration window will always lag the Anger signals. As a result, the leading portion of the charge pulse on the Anger signals will not be integrated. This situation is averted by enabling the *Delay* feature on the DAQXY504 which adds a fixed delay to each Anger signal so that the leading portion of the *delayed* Anger signals lags the trigger signal. By monitoring the delayed Anger signal(s) and the *Gate* from the *Auxiliary* output, the *Integration Period* and *Integration Delay* parameters can be adjusted to optimally position the integration window.

The Anger outputs from the front panel of the DAQXY504 are normally coincident with the last dynode output, but in the figure below, the Anger outputs lag the last dynode by about 70 nsec because the *Delay* feature is enabled. The importance of using the delay can be seen by noting how the rising edge of the discriminator output, which is derived directly from the last dynode, precedes the beginning of the delayed Anger signal by about 40 nsec. This provides ample time for the integration gate to capture the beginning of the Anger signals. While in the figure it appears that the gate arrives too late, the actual gate which is internal to the DAQXY504, begins about 30 nsec before the version available from the unit's *Aux* output.



Real Time Display

The display data shown in the figure below is from a radioactive source / scintillator located near the center of the 8 x 8 multianode PMT. The X-Y display is in *Histogram* mode and shows the position histogram collected from 500 events. The *Instantaneous Charge* display shows the output from the four Anger signals for the most recent data point (which in this case is point 752). The *Total Charge* display shows a rolling display of the sum of the four Anger signals for the last 500 data points.



Related Documents

[DAQXY504 Four Channel DAQ Product Sheet](#)

[DAQXY504 Four Channel DAQ User Manual](#)

[Hamamatsu H12700 / H14220 8 x 8 MAPMT Datasheet](#)

[SIB064B-1018 Anger Logic PCB Hamamatsu H12700 / H10966 / H8500 PMT Product Sheet](#)

[SIB064B-1018 Anger Logic PCB Hamamatsu H12700 / H10966 / H8500 PMT User Guide](#)

[SIB164B-1018 Anger Logic PCB Hamamatsu H7546B / H12428 PMT Product Sheet](#)

[SIB164B-1018 Anger Logic PCB Hamamatsu H7546B / H12428 PMT User Guide](#)

[SIB71256 Anger Logic PCB Hamamatsu H13700 256 Anode PMT Product Sheet](#)

[SIB71256 Anger Logic PCB Hamamatsu H13700 256 Anode PMT User Guide](#)



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AN3331.1.0 Dec 2022

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