EPICS

EPICS Device Support For SL1000 Digitizers

QUALITY ■ INNOVATION ■ FORESIGHT

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April 2009
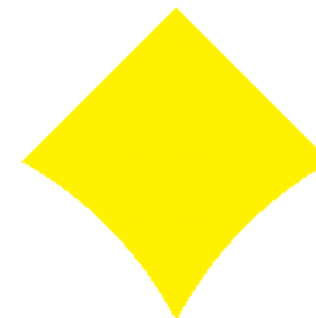
Hajime Nakamura
and
Takashi Asakawa
Yokogawa Electric Corporation, Japan

Joseph Ting
Yokogawa Corporation of America, the USA

Introduction

- The SL1000 is a data acquisition unit featuring fast data acquisition and transfer, and data storage capabilities.

- The SL1000 series has a wide and varied module lineup.

- EPICS device support for waveform digitizers including 100MS/s, 10MS/s, 1MS/s, and 100kS/s has been recently developed by Yokogawa.
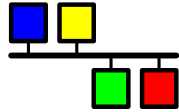

SL1000 Data Acquisition Unit   720210 100MS/s Digitizer Module

Support Modules

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Model	Sampling Rate	Resolution	Comments
720210	100MS/s	12bits	Isolation
701250	10MS/s	12bits	Isolation
701251	1MS/s	16bits	Isolation
701255	10MS/s	12bits	non-Isolation
701260	100kS/s	16bits	Isolation

These modules are supported by exactly the same (single) device support.

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Device Support

- The SL1000 is equipped with the 1000BASE-T Ethernet interface.

- The SL1000 employs the VXI-11 protocol; the device support requires the Asyn driver.

- The device support can read data during the measurement (no need to stop the acquisition).

- The following basic features of the SL1000 digitizers are supported:

  - **Data Compression**
  - **Storage of Historical Waveforms**
  - **SRQ Function (Asyn4.11 or later required)**
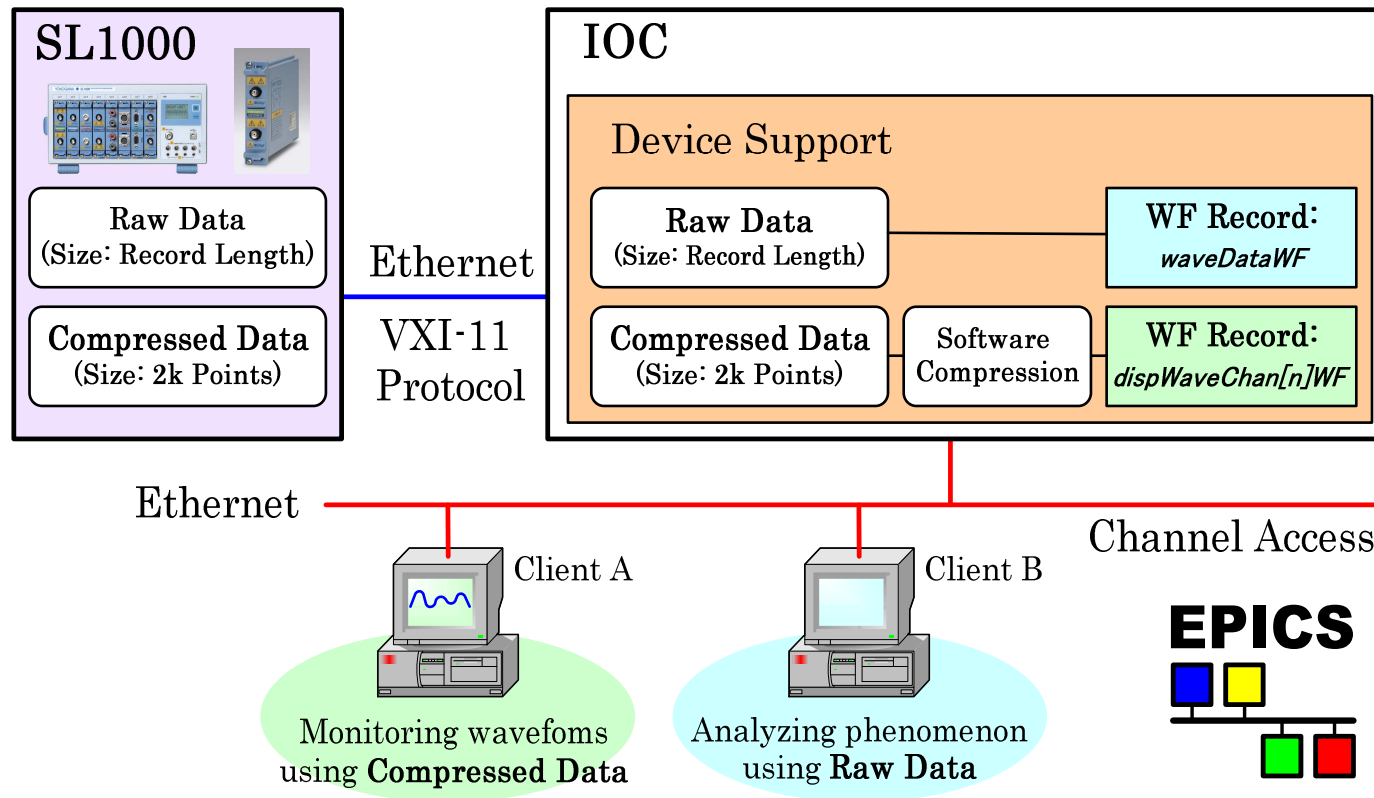
Device Support (cont.)

◆Key Features

➢Data Compression

- SL1000 performs the peak-to-peak data compression.

- The device stores both raw data and compressed data (2k points fixed) in the device memory.

- The device support can access either type of data.

- The device support further compresses the transferred 2k point data to a pre-determined number of points (default is 1k points) for display use.

- It is very beneficial to use the compressed data in displaying waveforms; 1k points would be enough for display use, while we can highly reduce the network traffic load by using compressed data.
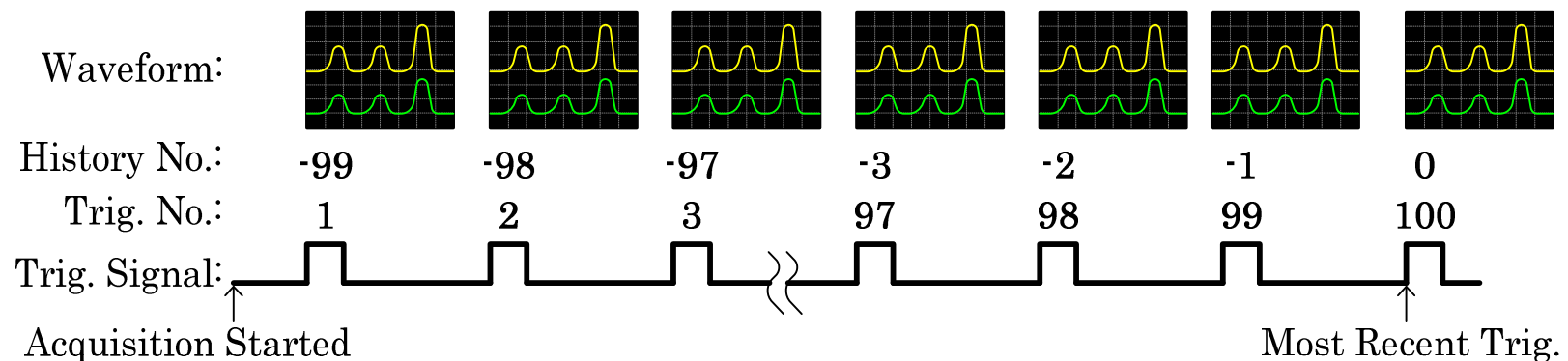
Raw Data and Compressed Data stored in SL1000

SL1000

Raw Data
(Size: Record Length)

Compressed Data
(Size: 2k Points)

Ethernet

VXI-11
Protocol

IOC

Device Support

Raw Data
(Size: Record Length)

WF Record:
waveDataWF

Compressed Data
(Size: 2k Points)

Software
Compression

WF Record:
dispWaveChan[n]WF

Ethernet

Channel Access

Client A

Client B

Monitoring wavefoms
using **Compressed Data**

Analyzing phenomenon
using **Raw Data**

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- When anomaly in a signal is detected, raw data can be used for a precise analysis of the phenomenon.

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Device Support (cont.)

➤ Storage of Historical Waveforms

- Since SL1000 is equipped with a large acquisition memory of 128MP, multiple waveforms can be stored.

- The device support can access historical waveform data stored in the device memory (by specifying a trigger number of the waveform).

Data Storage of Historical Waveforms

Waveform:							
History No.:	-99	-98	-97	-3	-2	-1	0
Trig. No.:	1	2	3	97	98	99	100

Trig. Signal:

↑ Acquisition Started   ↑ Most Recent Trig.

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Device Support (cont.)

- The maximum number of waveforms which can be stored in the device depends on the number of channels and the record length:

Record Length	Number of Channels				
	1	2	3, 4	5 to 8	9 to 16
10k	5000	5000	3275	1637	818
100k	1309	654	326	162	80
1M	127	63	31	15	7

The maximum number of waveforms which can be stored in the device.
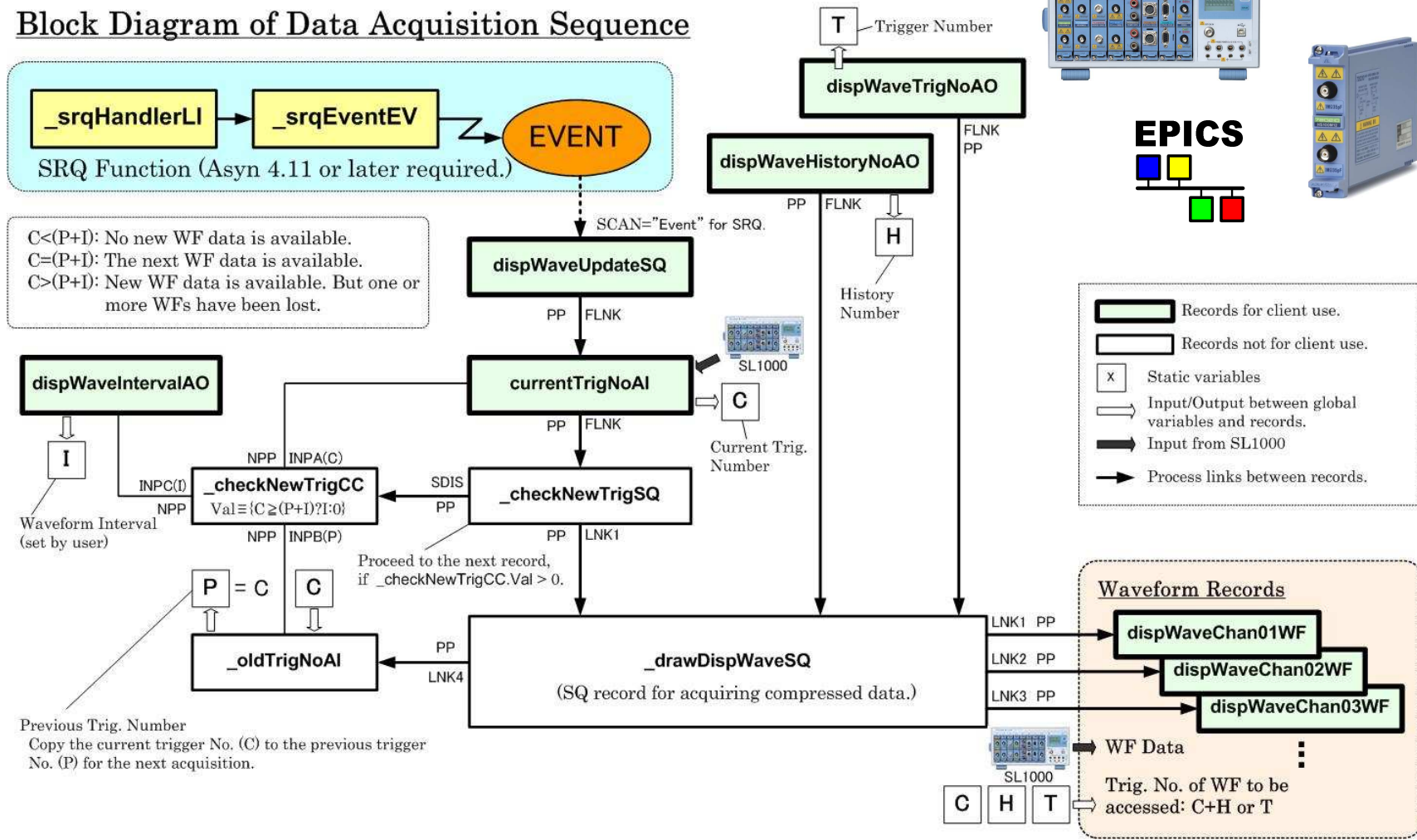
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Device Support (cont.)

➢ SRQ Function

- The function is supported. At present (May/2009), the Asyn driver in the CVS repository at ANL is required.

- Hopefully, the next version (Asyn4.11) or later will officially support this function.

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Device Support (cont.)

◆Data Acquisition Sequence

Block Diagram of Data Acquisition Sequence

SRQ Function (Asyn 4.11 or later required.)

C<(P+I): No new WF data is available.
C=(P+I): The next WF data is available.
C>(P+I): New WF data is available. But one or more WFs have been lost.

SCAN="Event" for SRQ.

$Val \equiv \{C \geq (P+I)?I:0\}$

Proceed to the next record, if _checkNewTrigCC.Val > 0.

Waveform Interval (set by user)

Current Trig. Number

History Number

Previous Trig. Number
Copy the current trigger No. (C) to the previous trigger No. (P) for the next acquisition.

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Records for client use.
Records not for client use.
Static variables
Input/Output between global variables and records.
Input from SL1000
Process links between records.

Waveform Records

WF Data
Trig. No. of WF to be accessed: C+H or T

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◆Performance

The system works properly in the following conditions:

Evaluation Evironment

SL1000 w/ digitizer modules   Linux PC

Ethernet 1000BASE-T

Hub

IOC w/ device support and MEDM are running on the same PC.

Modules
Slot 1 to Slot 4 (8 channels):
720210, 100MS/s, 12bits
Slot 5 to Slot 8 (8 channels):
701250, 10MS/s, 12bits

PC Specifications
OS: Linux (CentOS 5)
CPU: Intel Core 2 Dua
          E7200 (2.53GHz)
Memory: 2GB
Network: 1000BASE-T

Transferred Data: Compressed Data (2k points/wave fixed.)

	Sampling Rate	Record Length (points)	Trigger Rate	No. of Channels	Data Size (points)	
					Device->IOC	IOC->MEDM
1	100MS/s	1M	50Hz	16	2k fixed	1k
2	100MS/s	100k	50Hz	4	2k fixed	1k
3	10Ms	100k	50Hz	16	2k fixed	1k
4	1MS/s	10k	50Hz	14	2k fixed	1k
5	100kS/s	2k	25Hz	16	2k fixed	1k

Note 1: The SRQ function is enabled.
Note 2: The performance limit is affected by the record length and the number of channels. Since the SL1000 is optimized for transferring long data (e.g. 500k and 1M), the dependency of the performance on the record length might be complicated. See the documentation on the device support for more details.

Note that these results do not warrant the performance.

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Sample MEDM Viewer

Main Display (Controller/Viewer)

Channel Settings

Current Value Measurement

Trigger Parameters

DAQ Menu

Timing Parameters

Sampling Parameters

Module number and trigger number of waveforms to be displayed.

This is for controlling the device and displaying compressed waveforms.
The number of modules equipped in the SL1000 unit is automatically detected.
Waveforms of the selected module (2 channels) are displayed at a time.

Sample MEDM Viewer (cont.)

Raw Waveform Viewer
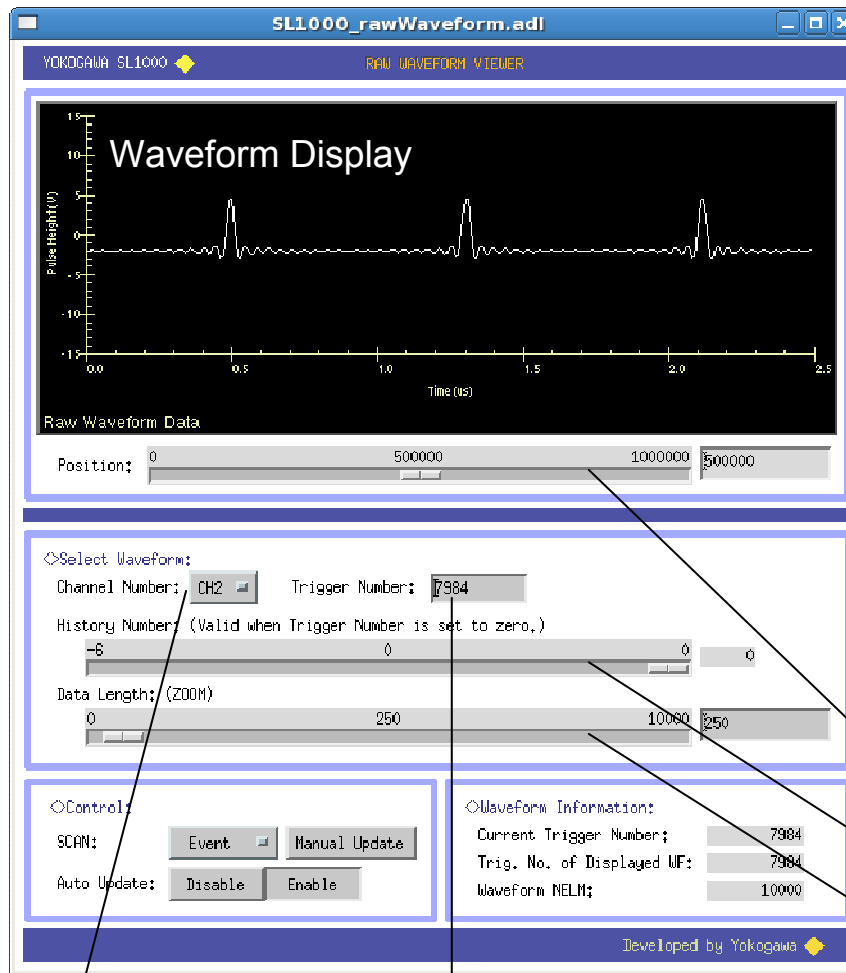
The region of interest can be zoomed up by specifying a start position and a data length (span) for the selected waveform.
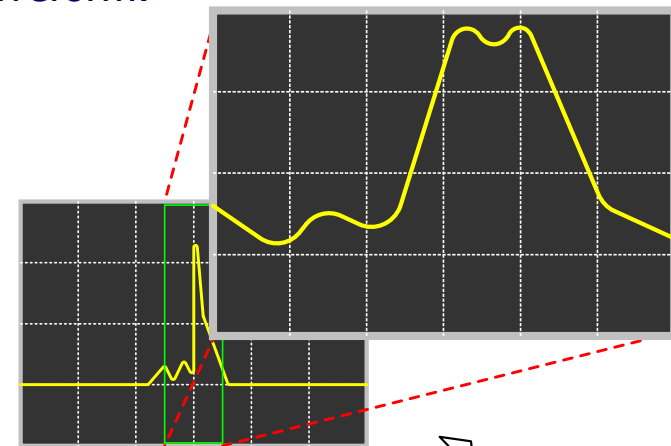
Channel Number   Trigger Number

Start Position (point number)

History Number

Data Length (Span = No. of points)

Summary

- Device support for SL1000 digitizer modules has been developed by Yokogawa.

- The digitizer modules including 100MS/s, 10MS/s, 1MS/s, 100kS/s work properly with exactly the same device support.

- Basic features of the SL1000 digitizers:

    - **Data Compression,**

    - **Storage of Historical Data, and**

    - **SRQ Function**

    are supported by this device support.

Note: Our device support is of a sample and is supplied "**AS IS**" without warranty of any kind.

Thank you.