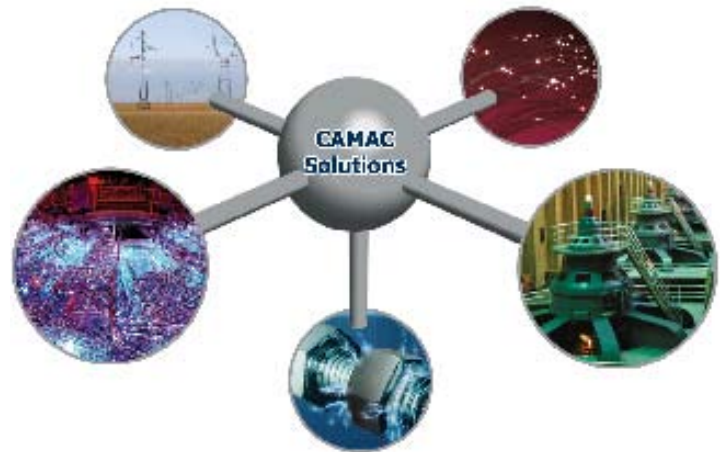


CAMAC Equipment

CAMAC, Computer Automated Measurement And Control, is an IEEE-standard (583), modular, high-performance, realtime data acquisition and control system concept.

Since 1969, CAMAC has been used in many thousands of scientific, industrial, aerospace, and defense test systems around the world.

4022/4054 8 to 64-channel Transient Recorder



The Models 4022 and 4054 are each single-width CAMAC modules. The 4022 is an 8-channel transient digitizer containing a 12-bit ADC. The 4054 is a high-capacity memory module with memory size options of one, two, or four megasamples.

FEATURES

- 12-bit resolution
- Sample rates to 250 ksamples/s (one active channel)
- Eight input channels, expandable to 64 with eight 4022s
- Active channels are programmable from the Dataway
- Options available with "D" or 2-pin LEMO input connectors
- Excellent dynamic accuracy
- Differential input for common-mode rejection
- Up to four megasamples with one memory module
- Memory expandable to 16 Msamples
- Active memory size is programmable down to 2 ksamples
- Memory data in offset binary or two's complement
- Memory readout at full Dataway speed
- Direct readout for "present value" monitoring
- Pretrigger, post-trigger intervals are programmable
- Programmable selection of internal clock (5 Hz to 250 kHz)
- External clock input connector

GENERAL DESCRIPTION

The Models 4022 and 4054 are each single-width CAMAC modules. The 4022 is an 8-channel transient digitizer containing a 12-bit ADC, a multiplexer, and eight track/hold amplifiers for simultaneous sampling. The recorder can be expanded to 64 channels by using eight 4022s. When a single 4022 is used, the number of active channels is programmable from the Dataway. This affects the maximum sample rate for each channel as shown here:

Active Channels	Maximum Sampling Rates
1	250 KHz
2	125 KHz
4	62.5 KHz
8	31.25 KHz

The 4054 is a high-capacity memory module with memory size options of one, two, or four megasamples. Up to four 4054s can be connected to one transient recorder, giving a total memory capacity of 16 megasamples.

The input signal for each channel is received on a 2-pin LEMO connector (4022-M1A) or for all channels on a 25-contact "D" connector with sockets (4022-D1A). The sample rate is controlled by a programmable internal clock that is selectable from 5 Hz to 250 kHz or by an external, TTL-level clock connected to a front-panel LEMO connector. A clock-out LEMO connector is provided.

The pretrigger and post-trigger sample sizes are programmable. The Stop (event trigger) LEMO connector accepts a TTL-level signal. When an event trigger pulse is received, the recorder continues sampling until the end of the post-trigger period is reached. A LAM can be set at that time.

For each 4054 the amount of active memory (the size of the recording "loop") is programmable down to 2 ksamples. Memory readout is strap-selectable to provide offset binary or two's complement. In the latter case, the sign is extended to 16 bits. Samples for each channel can be read out contiguously by an F(2)•A(0) command (preceded by an F(17)•A(0) channel command). Readout can also occur in a streaming fashion (channel data interleaved) by using the F(2)•A(1) command. Both single-channel and streaming readout can be at full Dataway speed.

As an aid in system setup, "present value monitoring" Read commands are included. Each 4022 contains an eight-word memory, readable from the Dataway with F(1)•A(0) through F(1)•A(7). This feature is usable in both the sample and nonsample states. The data update is controlled by the internal or external clock.

A Start Sample CAMAC command causes the digitizer to begin sampling after readout of the previous samples. Additionally, a Stop Sample CAMAC command allows a software emulation of the external event trigger. This feature is useful for system diagnostics as well as for applications where a periodic waveform is being monitored.

When more than one 4054 memory module is used, each 4054 must have four megasample capacity. The available memory per channel is the total memory divided by the number of active channels. The active memory is programmable selectable in power of 2 increments

from 2 ksamples to the maximum available memory. The ratio of active memory used for pretrigger samples is programmable from 0/8 to 8/8 in 1/8 increments.

FRONT PANEL INDICATORS (MODEL 4022)

N: Flashes when the module is addressed.
L: Indicates that a LAM request is pending.
SMP: Indicates that the digitizer is in the SAMPLE state.

CONNECTORS

Eight two-pin LEMO connectors (or optionally a 25-contact "D" socket connector) are used for the analog input. The stop trigger, clock-in and clock-out connectors are single-pin LEMOs, TTL level. Refer to ORDERING INFORMATION for the intermodule flat ribbon cables required.

FUNCTION CODES

(N = module slot of 4022 Transient Recorder. See Note 6.)

COMMAND	Q	ACTION
F(0)•A(0) RD1	SAMPLE	Reads the Control register
F(1)•A(i) RD2	1	Reads the present value, selected channel. (Note 5)
F(2)•A(0) RC1	DAV	Reads the waveform data, selected channel.
F(2)•A(1) RC1	DAV	Reads the waveform data in streaming (interleaved) form for all channels.
F(3)•A(0)	SAMPLE	Reads the Module Identifier (R1-R8).
F(8)•A(0) TLM	LR	Tests whether a LAM request is present.
F(9)•A(0) CL1	SAMPLE	Starts digitizing (places in SAMPLE state) and clears the LAM Status.
F(9)•A(1) CL1	SAMPLE	Resets the address pointer to the first memory location written with data (used when memory is not completely filled).
F(10)•A(0) CLM	SAMPLE	Clears the LAM status.
F(16)•A(0) WT1	SAMPLE	Writes the Control register.
F(17)•A(0) WT2	SAMPLE	Selects the channel for waveform readout (1 to 64). Uses F(2)•A(0) for memory readout. (Note 7)
F(24)•A(0) DIS	1	Disables the LAM request.
F(25)•A(0) XEQ	SAMPLE	Stops digitizing (Places in the IDLE state after completion of the post-trigger samples).
F(25)•A(1) XEQ	SAMPLE	Places the address pointer at start-of-block for streaming (interleaved) readout. (Used if a sample block read was not completed and a re-read is desired).
F(25)•A(2) XEQ	SAMPLE	Stops digitizing (places in IDLE state immediately). (Used if waveform data is undesirable).
F(26)•A(0) ENB	1	Enables the LAM request.
F(27)•A(0) TST	LS	Tests whether the LAM status is set.
Z CZ		Places the digitizer in the SAMPLE state, clears the module.

NOTES

1. $X = 1$ for all valid addressed commands.
2. All valid addressed commands except $F(1) \bullet A(i)$, $F(24) \bullet A(0)$, $F(25) \bullet A(0)$, and $F(26) \bullet A(0)$ give a $Q=0$, $X=1$ response when the digitizer is in the digitizing (SAMPLE) state and no action is taken in response to those commands.
3. If the unit is digitizing (in the SAMPLE state), an $F(25) \bullet A(0)$ command will give a $Q=1$ response. Any subsequent $F(25) \bullet A(0)$ commands (while the unit is not sampling) will give a $Q=0$ response.
4. The $F(2) \bullet A(0)$ and $F(2) \bullet A(1)$ commands will give a $Q=1$ response provided that: the unit is not sampling; in the case of the $F(2) \bullet A(0)$ command, an $F(17) \bullet A(0)$ channel-select command has been executed; the end-of-sample has not been reached (i.e., $Q=0$ after the last word is read).
5. Subaddress i can range from 0 to 7 to select channels 1 to 8.
6. In the case of multiple 4022s, all commands except for the $F(1) \bullet A(i)$ are addressed to the "master" 4022. For $F(1) \bullet A(i)$, the 4022 containing the channel to be read is accessed.
7. Data for the $F(17) \bullet A(0)$ command can range from 0 to 63 to select channels 1 to 64.
8. The $F(9) \bullet A(1)$ command is used when it is necessary to start reading data at the first memory location written with data. One condition requiring this command is when the sampling process is terminated prior to all active memory being loaded.

SPECIFICATIONS

Item	Specifications
Number of Inputs	Eight per 4022; 64 maximum
Type	Differential
Impedance	1 Mohm, minimum
Full-scale Range	± 5 or ± 10 volts, strap-selectable
Conversion Rate	DC to 250 ksamples/s. Maximum rate depends upon the number of active channels
Internal Clock	Crystal-controlled with programmable rates of 5, 10, 25, 50, 100, 250, 500 Hz; 1, 2.5, 5, 10, 25, 50, 100, and 250 kHz
Resolution	12 bits (1 part in 4096)
Output Code	Offset binary or two's complement, strap-selectable
Aperture Uncertainty	± 150 ps, typical
Accuracy	± 1 LSB from best fit over entire range

POWER REQUIREMENTS

Model 4022-D1A/M1A

- +6 V: 1.40 A
- +24 V: 200 mA
- 24 V: 200 mA

ACCESSORIES

- Model 5910-Z1A Single-pin LEMO Connector
- Model 5911-Z1A Two-contact LEMO Connector (for Model 4022-M1A)
- Model 5933-Z1A 25-contact "D" Connector (for Model 4022-D1A)
- Model 5852-A/C/E Series Cable Assemblies

The following data bus cables must be ordered to ensure proper operation:

MODEL 5845-W000 FRONT MEMORY BUS

4054 Memory Modules	2	3	4
Suffix (-w000)	A	B	C

NOTE: The front memory bus is not required if only one 4054 is used.

MODEL 5846-W000 REAR DATA BUS

Total 4022 + 4054s	2	3	4	5	6	7	8	9	10	11	12
Suffix (-w000)	A	B	C	D	E	F	G	H	I	J	K

ORDERING INFORMATION

MODEL	DESCRIPTION
4022-D1A	12-bit, 8-channel Transient Recorder, "D" connector
4022-M1A	12-bit, 8-channel Transient Recorder, LEMO connector
4054-Z1B	Transient Memory, 1 Msample x 12-bit Capacity
4054-Z2B	Transient Memory, 2 Msample x 12-bit Capacity
4054-Z3B	Transient Memory, 4 Msample x 12-bit Capacity

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