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## CAMAC Equipment

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

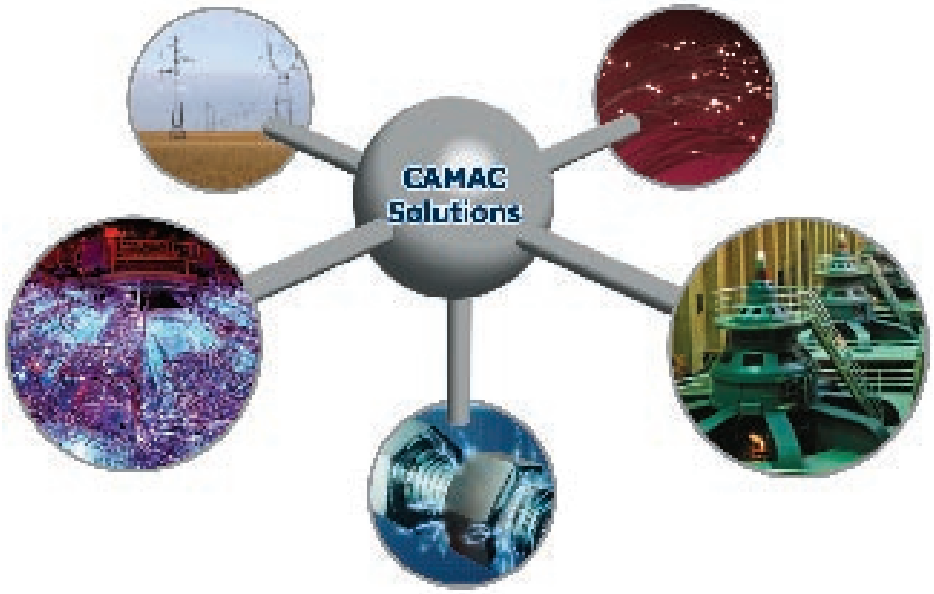
Since 1969, CAMAC has been used in many thousands of scientific, industrial, aerospace, and defense test systems around the world.

## APPLICATIONS

Temperature measurement
Pressure measurement
4-20 mA control loop monitoring
General analog monitoring

# 3516

## 32-channel Scanning A/D Converters




The Model 3516 is a single-width CAMAC module which converts 32 analog voltages into their equivalent digital values.

## FEATURES

- 32-channel capability
- 16-bit resolution (one part in 65,536)
- Programmable gain from 1 to 1024
- Programmable number of active channels
- Self-scanning
- External trigger
- Internal buffer memory
- Differential inputs
- High-frequency noise filtering on inputs
- Optional 6Hz lowpass filter available
- Unipolar and bipolar operation
- Strap-selectable inputs for temperature references

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## GENERAL DESCRIPTION

The 3516 is a single-width CAMAC module that converts 32 analog voltages into their equivalent digital values. This module contains a high-resolution analog-to-digital converter capable of resolving one part in 65,536. The inputs are scanned, and the results are stored in a 32-word memory, which can be read via the Dataway. The number of active (scanned) channels is software programmable. There are two software-selectable scan modes: Continuous and Single-scan. In Continuous mode, CAMAC Read cycles are asynchronous with the conversion process, eliminating overhead due to testing for converter busy. If it is desirable to synchronize scanning and reading, Single-scan mode can be used. In Single-scan mode, a LAM status is set after the last channel has been converted. In addition, the external trigger input can be used to synchronously trigger a single scan on multiple 3516s.

The 3516 contains a 4-bit, 32-word memory that can be loaded, on a channel-by-channel basis from the Dataway, with an appropriate gain factor for each differential input channel. Eleven gain values, from one to 1024, are available in binary progression. This allows one 3516 to measure a wide variety of input signal types (such as thermocouples, RTDs, high-level inputs, etc.). The C1B option features a single-pole, lowpass filter at the input of each channel. These filters provide a –3dB cutoff frequency of 6Hz. When channel scanning is initiated, channel inputs are selected in succession.

When a channel is selected, the preloaded gain factor is applied to the input signal, the amplified signal is converted, and the resultant binary information is stored in the on-board memory. Conversions take place at the rate of one every 250 microseconds (all 32 channels require eight milliseconds). The memory is configured in a dual-port fashion to facilitate retrieval of data with CAMAC block transfer operations. The 3516 is factory calibrated for inputs of ±10 volts.

All input signals are brought to the module through a 68-position high density SCSI connector mounted on the front panel. The external trigger can be brought in through a single-pin LEMO connector. Alternately, the 3516 may be strapped to accept an external trigger from the Dataway P1, P2, or P3 lines. An N LED flashes whenever the module is addressed, and an ACTIVE light indicates when the module is powered and scanning is activated. A LAM LED is illuminated when a LAM request is pending.

To facilitate the use of this module in temperature monitoring systems, Channel 1 can be strapped to receive an isothermal reference from a V792-ZA11 Isothermal Termination Panel. Alternatively, this channel may be used to monitor any analog data.

For monitoring 4-20 mA control loop signals, standard practice is to mount a precision 250-ohm resistor external to the module (usually at the termination panel). This allows the 3516 to be removed from the circuit without disturbing the current loop. The V765- ZA11 Termination Panel can be used for this purpose.

## FUNCTION CODES

| Command | Q | Description |
|---|---|---|
| F(0) A(0) RD1 | 1 | Reads the Converted Data Memory, then increments the memory address |
| F(1) A(0) RD2 | $\overline{\text{SCAN}}$ | Reads the Control Memory, then increments the memory address |
| F(8) A(0) TLM | LR | Tests if a LAM request is set (Note 4) |
| F(9) A(0) CL1 | $\overline{\text{SCAN}}$ | Stops channel scanning immediately and initializes the Converted Data Memory Address and Control Memory Address registers to zero. |
| F(10) A(0) CLM | 1 | Clears the LAM status bit |
| F(11) A(0) CL2 | 1 | Clears the Control Memory Address register |
| F(11) A(1) CL2 | 1 | Clears the Converted Data Memory Address register |
| F(16) A(0) WT1 | $\overline{\text{SCAN}}$ | Writes the Control Memory, then increments the memory address |
| F(16) A(1) WT1 | $\overline{\text{SCAN}}$ | Writes the Last Channel register (data = 0 to 31 for address of last channel) |
| F(17) A(0) WT2 | $\overline{\text{SCAN}}$ | Writes the Control Memory Address register. (Note 5) |
| F(17) A(1) WT2 | 1 | Writes the Converted Data Memory Address register. (Note 6) |
| F(24) A(0) DIS | 1 | Disables the LAM request |
| F(24) A(1) DIS | 1 | Disables continuous scanning |
| F(25) A(0) XEQ | $\overline{\text{SCAN}}$ | Initiates a single scan operation, clears the LAM bit |
| F(26) A(0) ENB | 1 | Enables the LAM request |
| F(26) A(1) ENB | 1 | Enables continuous scanning, clears the LAM bit |
| F(27) A(0) TST | LS | Tests if a LAM status is set. (Note 3) |
| Z S1 ZED | | Stops channel scanning and initializes the Converted Data Memory and Control Memory Address registers |

Notes:
1. $\overline{\text{X}}$ = 1 for all valid addressed commands
2. $\overline{\text{SCAN}}$ = channel scanning not in progress
3. LS = LAM status set
4. LR = LAM request set
5. For control Memory Address register valid addresses are 0 – 31, to represent Channels 1 – 32
6. For Converted Data Memory Address register valid addresses are 0 – 31, to represent Channels 1 – 32

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| Item | Specification | | | |
|---|---|---|---|---|
| General | | | | |
| Number of Channels | 32 differential analog input channels | | | |
| Gain Ranges | 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, and 1024 | | | |
| Input | | | | |
| Input range | ±10.5 V | | | |
| Common-Mode | ±10 V | | | |
| Differential | ±35 V continuous (C1B option), ±25 V continuous (C1A/S100 options) | | | |
| Input protection | 22MΩ | | | |
| Input impedance | | | | |
| Resolution | 16-bit, no missing codes | | | |
| Data Format | Two's complement (when configured for ±10 V bipolar range)<br>Straight binary (when configured for 0-10 V unipolar range) | | | |
| ADC Conversion Rate | 4 kHz | | | |
| External Trigger Source | Front panel single-pin LEMO connector, falling-edge TTL level<br>CAMAC Dataway P1, P2, or P3 lines, falling-edge TTL level | | | |
| Accuracy | Gain | Full-Scale Range (FSR) | 3516-C1B Accuracy (%FSR) | 3516-S100 Accuracy (%FSR) |
| | 1 | ±10.000V | 0.035% | 0.020% |
| | 2 | ±5.000V | 0.050% | 0.020% |
| | 4 | ±2.500V | 0.070% | 0.030% |
| | 8 | ±1.250V | 0.080% | 0.030% |
| | 16 | ±625.000 mV | 0.080% | 0.040% |
| | 32 | ±312.500 mV | 0.090% | 0.040% |
| | 64 | ±156.250 mV | 0.090% | 0.050% |
| | 128 | ±78.125 mV | 0.100% | 0.065% |
| | 256 | ±39.0625 mV | 0.120% | 0.100% |
| | 512 | ±19.531 mV | 0.200% | 0.200% |
| | 1024 | ±9.766 mV | 0.300% | 0.250% |
| Noise (@ gain of 1024) | (C1B 11µV rms) (S100 7µV rms) | | | |
| Crosstalk | (C1B 0.018% of OFF channel signal) - (S100 0.09% of OFF channel signal) | | | |
| I/O Connector Types | One 68P High Density, one single-pin LEMO | | | |
| Power Requirements | | | | |
| + 6 V | 1.5 A | | | |
| +24 V | 80 mA | | | |
| -24 V | 70 mA | | | |

**RELATED PRODUCTS**

| | |
|---|---|
| V765-ZA11 | Rack-mount Termination Panel |
| V792-ZA11 | Rack-mount Isothermal Termination Panel |
| 5868-Dxyz | Cable: 68S High Density to 68P High Density |

**ORDERING INFORMATION**

| MODEL | DESCRIPTION |
|---|---|
| 3516-C1A | 32-channel, 16-bit A/D Converter without filter |
| 3516-C1B | 32-channel, 16-bit A/D Converter with 6 Hz filter |
| 3516-S100 | 32-channel, 16-bit A/D Converter with 100 Hz filter |

Updated February 14, 2007



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