KEITHLEY

KEITHLEY'S MODULAR INSTRUMENTATION

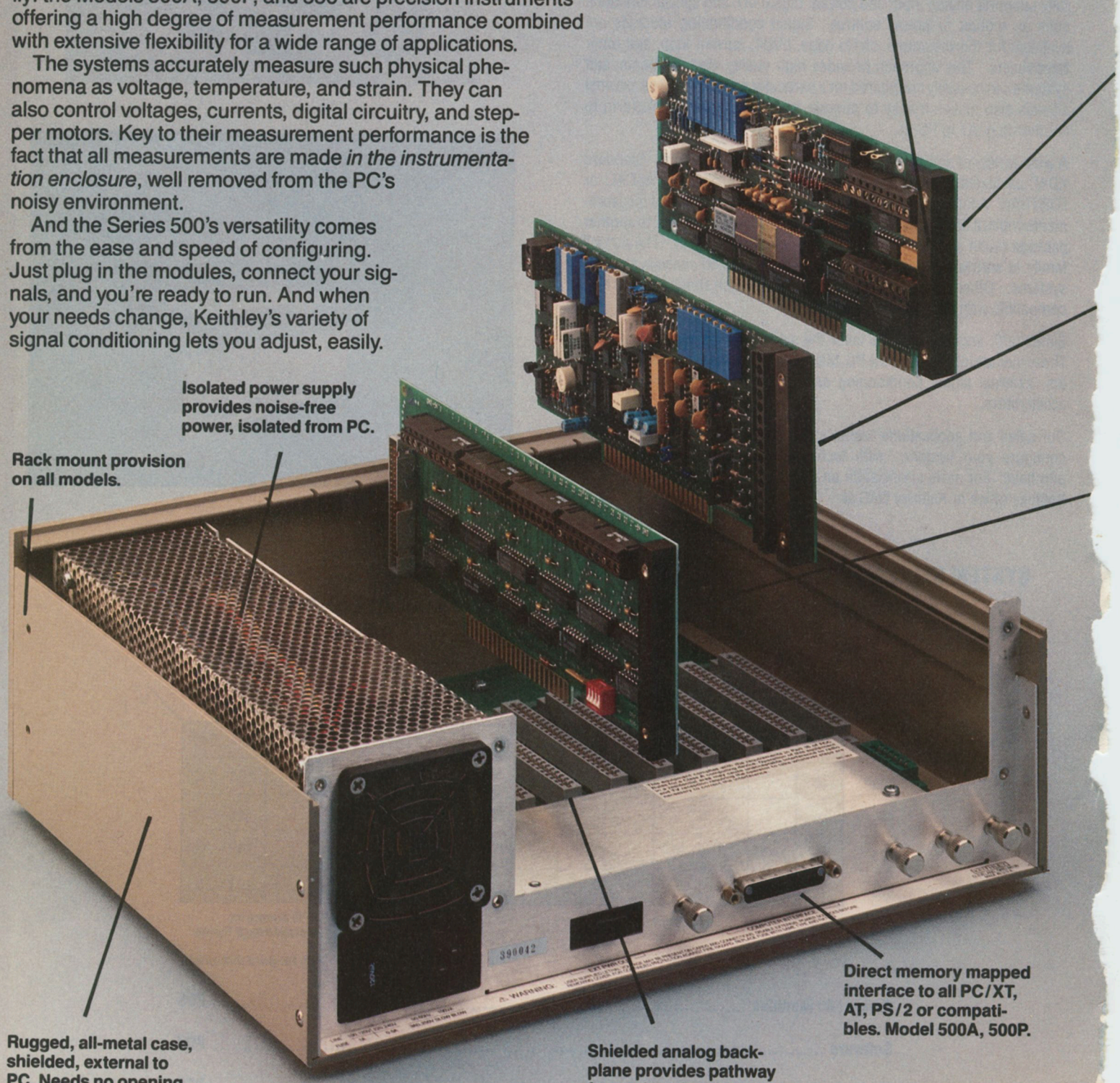
Precision • Versatility • Value

Series 500 Measurement & Control Systems

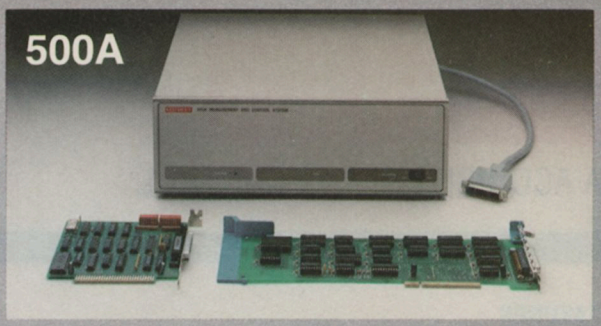
Three choices in the Series 500 Data Acquisition System family: the Models 500A, 500P, and 556 are precision instruments offering a high degree of measurement performance combined with extensive flexibility for a wide range of applications.

The systems accurately measure such physical phenomena as voltage, temperature, and strain. They can also control voltages, currents, digital circuitry, and stepper motors. Key to their measurement performance is the fact that all measurements are made *in the instrumentation enclosure*, well removed from the PC's noisy environment.

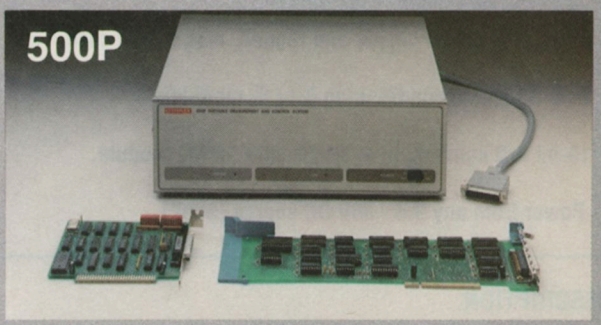
And the Series 500's versatility comes from the ease and speed of configuring. Just plug in the modules, connect your signals, and you're ready to run. And when your needs change, Keithley's variety of signal conditioning lets you adjust, easily.



Choice of 3 mainframes to match your application.



Model 500A Measurement & Control System
115/230VAC power, PC/XT, AT, PS/2. The 500A system includes cable and interface for PC/XT, AT, or Micro-channel bus. BASIC software included.

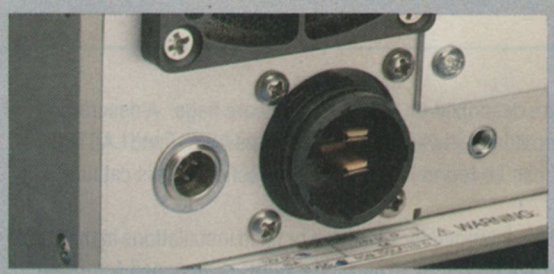


Model 500P Portable Measurement & Control System
9-18VDC or 18-36VDC, PC/XT, AT, PS/2. The 500P system for in-vehicle and other portable applications includes cable and interface for PC/XT, AT, or Micro-channel bus. Option for isolated power for lap-top is also provided.

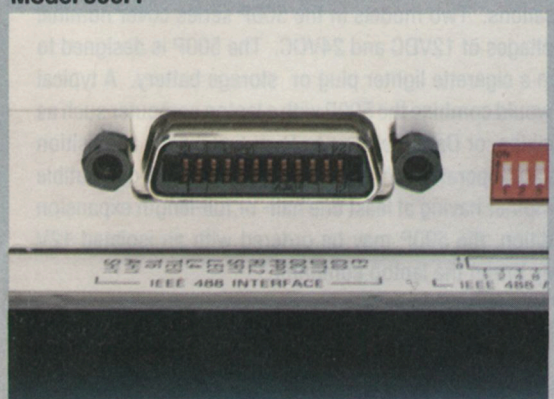
Master Measurement Module- 12-bit (AMM1A) or 16-bit (AMM2) 50kHz A-D plus 8-channel differential (16 ch. S.E.) inputs; programmable gain amplifier, programmable filters. Easy direct connection of inputs. Also provides gain and A-D for analog signals from other modules.

Add analog input modules (up to 32 channels per module), or select from a wide range of modules with various built-in signal conditioning, isolation, etc. All analog input signals are routed via mainframe backplane to Master Measurement Module in Slot 1 for additional gain, filtering, and A-D conversion. Analog modules will fit in any or all of 9 expansion slots - up to 304 analog channels per mainframe.

Complete your test system capabilities with a wide selection of:
- **Analog I/O Modules**
- **Digital I/O Modules**
- **Pulse & Frequency Measurement Modules**
- **Stepper Motor Control Modules**



Battery-power input. Isolated output for lap-tops. Model 500P.



IEEE interface to any IEEE controller. Model 556.

Model 556 GPIB Data Acquisition System
115/230VAC power. The Model 556 includes its own microprocessor with up to 1Mbytes of data memory, and operates from any PC, computer, workstation or controller with an IEEE-488 interface. On-board program memory can store test programs for *independent* measurement and control.

Use Keithley's modular Measurement & Control Systems with a wide variety of software, including:

KDAC500 measurement and control software for BASIC, C, PASCAL, FORTRAN.
ASYST language-oriented acquisition and analysis software.
LABTECH NOTEBOOK menu-driven data acquisition software.
ASYSTANT GPIB menu-driven acquisition and analysis software for IEEE-488 systems.

KEITHLEY

DATA ACQUISITION AND CONTROL

MODEL 500A, 500P MEASUREMENT AND CONTROL SYSTEMS

FEATURES

- **For multi-channel data acquisition and control.**
- **Ten-slot data acquisition chassis.**
- **Low-noise power supply and rugged, rack mount case.**
- **Over 25 signal conditioning & I / O modules.**
- **16-bit A/D conversion at 50kHz with AMM2 module.**
- **Power from any 9.5 - 36V DC source (500P).**

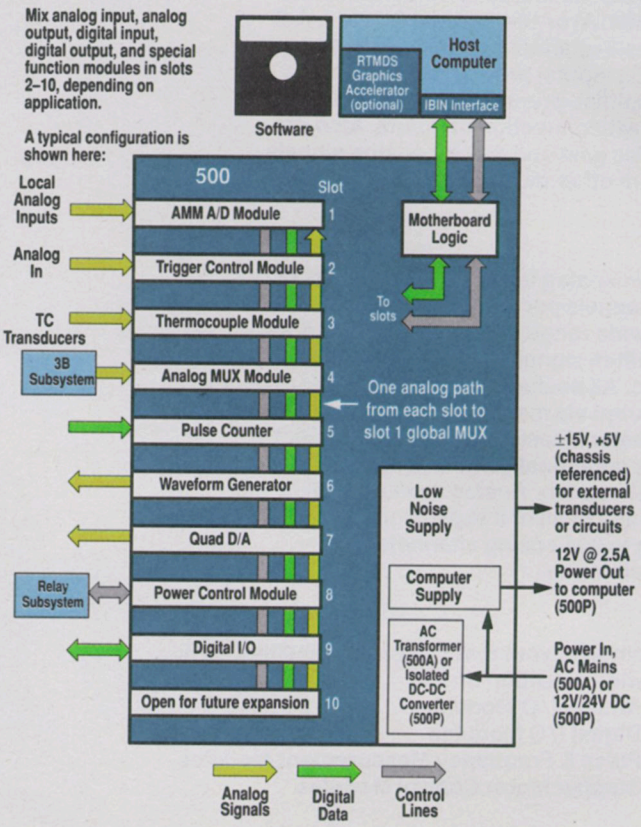
DESCRIPTION

The 500A and 500P are data acquisition and control mainframes for bench, portable, or rack mounted applications. This data acquisition platform consists of a ten-slot motherboard, power supply, and interface logic housed in a rugged case. Over 25 different signal conditioning modules allow the user to tailor the measurement and control system to specific applications.

Modules are available for A/D conversion, multiplexing, analog and digital input and output, and other functions. A further advantage of the external mainframe is that sensitive measurements can be performed in a shielded, low noise environment. For instance, the AIM7 thermocouple module provides sixteen channels of thermocouple input. It incorporates an isothermal block and accurate cold junction reference circuitry to assure the user of stable and repeatable temperature measurements. Thermocouples may be mixed on each channel. Temperature resolution using the AMM2 A/D converter module is 0.01°C at -25 and 100°C and 0.04°C at 700°C.

The Series 500 Measurement and Control System is built around the memory architecture of the IBM PC, XT, AT, 386, PS/2, and 100% compatible computers. The system is linked to the computer via a specialized bus extension interface which resides in the host computer. Through this approach, all functions within the data acquisition and control system appear to the computer as memory locations, and high rates of data transfer between the 500 and host computer are achieved.

Keithley's data acquisition software (KDAC500) handles all foreground/background acquisition, engineering units conversion, memory management, and array management. It also provides real-time graphing. File management routines permit easy export of data to other packages for analysis. The interpreted BASIC version of KDAC500 is supplied with these systems. Versions for other languages are described on the KDAC software page. A description of other compatible software packages such as ASYST and LABTECH NOTEBOOK can be found in the software section of this catalog.



The **500A** is intended for benchtop or fixed installations in the lab or on the production floor. The Model **500P** is designed for in-vehicle, aeronautical, marine, and other mobile or portable data acquisition applications. Two models in the 500P series cover nominal operating voltages of 12VDC and 24VDC. The 500P is designed to operate from a cigarette lighter plug or storage battery. A typical application would combine the 500P with a laptop computer such as the Grid, Toshiba, or DataVue Snap to form a complete acquisition system. It will operate with virtually any 100% IBM-compatible portable computer having at least one half- or full-length expansion slot. In addition, the 500P may be ordered with an isolated 12V power supply to run the laptop computer.

SPECIFICATIONS

ARCHITECTURE: 10-slot expansion mainframe, accepts a 16-bit or 12-bit Analog Measurement Module and 9 other modules.
INTERFACE: Keithley IBIN memory-mapped interface, available for PC/XT/AT/386 and PS/2 architectures.
SYSTEM REQUIREMENTS: 100% IBM-compatible computers having at least one half-length expansion slot, or microchannel computers with one expansion slot.
SOFTWARE REQUIREMENTS: DOS 3.0 or above.
SOFTWARE SUPPLIED: KDAC500/I data acquisition and control software for interpreted BASIC.
CASE: Ruggedized steel and aluminum extrusion. Rack kit available.
FRONT PANEL: On/Off switch, power and status indicators.
REAR PANEL: Power input, auxiliary power output, interface connector, fuse, connector patch panel.
POWER OUTPUT: +5V @1A, ±15V @ 0.8A available from rear panel DB9S connector.*
DIMENSIONS, WEIGHT: 118mm high x 327mm wide x 281mm deep (4.6 x 12.9 x 11.1 in.). Net weight 5.5kg (12lbs.).

500A
POWER REQUIREMENT: 100/120/220/240 VAC ±10% switch selectable, 50-60Hz,90W(max.). Fused at 1.0A @ 100/120VAC, 0.5A @ 220/240 VAC.
OPERATING TEMPERATURE RANGE: 0° to 50°C, up to 80% RH (non-condensing). 18 CFM fan with filter.

500P
POWER REQUIREMENT: 500P1 and 500P2: 9.5-18VDC (12V nominal) @ 10A maximum.* 500P3: 18-36VDC (24V nominal) @ 5A maximum.*
OVERLOAD PROTECTION: Up to 60V for one second. Up to 5 Joules above 60V. Fused and reverse-polarity protected.
COMPUTER SUPPLY (500P2 and 500P3 only): Isolated and conditioned 12V±2% @ 2.5A. Adds 35W to input power requirements.
OPERATING TEMPERATURE: -20° to +50°C at up to 85% RH (non-condensing). Thermostatically controlled 12 CFM fan with filter.

*Depends on modules and external loads.

ORDERING INFORMATION

500A-MAIN	500A Mainframe chassis only. Does not include KDAC500/I software or computer interface.
500-500A	500A with interface for PC/XT/AT/386,PS/2 25 & 30 and compatibles; and KDAC500/I software for interpreted BASIC.
500-500APS2	500A with interface for PS/2 Models 50,60, 70, 80 and compatibles; and KDAC500/I software for interpreted BASIC.
500-500P-2	500P (9.5 - 18vdc operation) with isolated computer supply; low power interface for PC/XT/AT/386 and compatible laptops; and KDAC500/I software for interpreted BASIC.
500-500P-3	500P (18 - 36vdc operation) with isolated computer supply, low power interface for PC/XT/AT/386 and compatible laptops; and KDAC500/I software for interpreted BASIC.
500-500P-1	500P (9.5 - 18vdc operation) with non-isolated computer supply, low power interface for PC/XT/AT/386 and compatible laptops; and KDAC500/I software for interpreted BASIC.
500-IBIN-A	Interface for PC/XT/AT/386, PS/2 25 & 30 and compatible computers.
500-IBIN-LP	Low power interface for PC/XT/AT & 386 and compatible laptop computers.
500-IBIN-PS2	Interface for PS/2 Models 50,60, 70, 80 and compatible computers.
500-PANEL	Rear Panel Thermocouple Connection Kit. Includes: Punched rear panel, four DB50 connectors, 4 DB50 thermocouple connector housings, 100 each thermocouple pins and sockets, 100 feet of thermocouple wire, connector hoods, crimp tool, pin extractor and mounting hardware. Specify -E, -J, -K, -T to select the proper thermocouple pins and wire. Order general purpose cables and additional pin/socket assemblies separately.
500-CABL15	Interface cable to computer, 15 feet. (Cable supplied with unit is 5 feet)
500-5009	5.25" slide rack kit for 500A and 500P, & 556.

See DAC Module Selector Guide for available modules. See DAC Software Guide for compatible software.

Systems are supplied with hardware and software manuals, power cord, power output mating connector, and software on 5.25" & 3.5" disks unless otherwise stated.

KEITHLEY

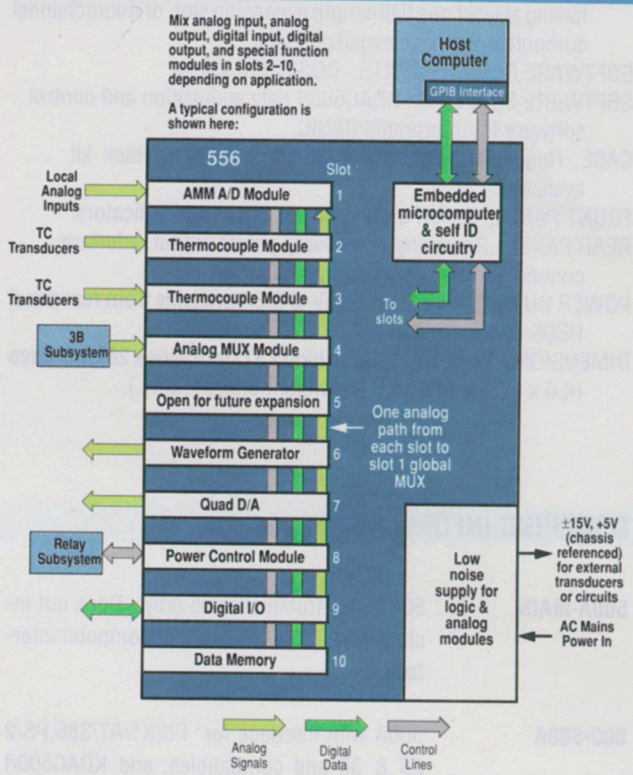
IEEE-488

DATA ACQUISITION AND CONTROL

MODEL 556 GPIB MEASUREMENT AND CONTROL SYSTEM

FEATURES

- **Modular GPIB Data Acquisition & Control.**
- **Device Dependent Command Programming.**
- **Interfaces a wide range of transducers to the IEEE-488 Bus.**
- **Includes looping and conditional triggering for alarms and datalogging.**
- **Allows remote data acquisition with RS-232/RS-422 to 488 converters such as 500-Serial.**



DESCRIPTION

The Model 556 GPIB Measurement & Control System combines Keithley's data acquisition technology with the IEEE standard 488 bus. The 556 offers a versatile solution to data acquisition and process control from a wide range of personal, mini and mainframe computers as well as dedicated IEEE-488 controllers and workstations. The 556 has a microprocessor, on-board memory with battery backup, and circuitry which manage all measurement, control and bus communication tasks. In addition, the microprocessor allows independent and remote program execution.

The instrument contains 5kBytes of user program memory. Commands that are downloaded to the Model 556 are immediately compiled into machine code, permitting large measurement and control loops to be executed by the instrument with no intervention by the system controller. The data memory of the Model 556 can store up to 10,000 analog or 20,000 digital readings. This memory is dynamically segmented in up to 10 internal buffers. The optional MEM1 memory expansion stores an additional 512k analog readings (with 2 MEM1 modules max) in up to 8 additional buffers. This permits the instrument to operate for an extended period without service from the system controller. However this expansion memory does not have battery backup.

Engineering units conversion is provided from raw A/D counts to volts, mA, degrees C, and Hz. Fourth-order polynominals are used for thermocouple linearization over these spans, using the AIM7 card:

J:	0 to 760C	T:	-200 to 400C
K:	-200 to 1370C	B:	0 to 1820C
R:	0 to 1768C	E:	-200 to 1000C
S:	0 to 1768C		

Automatic cold junction compensation is provided. With the AIM6 card, RTDs (alpha = 0.00385 or 0.00392) are supported over a -200 to +700C span. Formats for data transfer to the computer are ASCII with engineering units prefix, ASCII without prefix, binary with high byte first, and binary with low byte first.

The Model 556 is programmed through the use of Device Dependent Commands (DDC), much the same as a digital multimeter. The embedded programming and DDC set for the 556 support programming of all software-settable parameters in the Keithley modules. The unit automatically identifies the type of module in each slot. Hardware switch or jumper settings are loaded by the user during system configuration. Various levels of the SAVE command allow the 556 to remember this configuration information, plus stored data, program, and program execution state after a power interruption.

Two conditional structures allow flexibility in creating programs for execution in the 556. The loop construct does FOR, NEXT, n times. The conditional trigger construct does IF, THEN program sequences. Conditional triggering for analog signals can be set ABOVE, BELOW, BETWEEN, or NOT BETWEEN programmed levels. Conditional triggering or digital signals can be set EQUAL, NOT EQUAL, ALL ON, ALL OFF, ANY ON, ANY OFF. Software triggering is provided on GET or X. The system can request service from the computer (SRQ) on one or more of these conditions: RATE OVERRUN, HALT, BUFFER FULL, DATA READY, NOT BUSY. In addition, the External Trigger input of the AMM1A and AMM2 allows the data acquisition to be synchronized to external events.

The Model 556 is ideal for cost-effective, high performance measurement and control functions. An AMM1A or AMM2 Master Measurement Module in slot 1 allows 12- bit or 16-bit A/D conversions and multi-channel scan rates up to 7000/second. The AMM's provide 16 single ended or 8 differential channels and seven, software selectable, full scale input ranges from ±100mV to ±10V. There is also software selectable single-pole low pass filter of 100 kHz or 2kHz. Transducer signal conditioning modules include thermocouple input with isothermal block and cold junction compensation, strain gage input with on-board excitation and bridge completion circuitry, LVDT/RVDT input & excitation, carrier amplification, and additional general-purpose and isolated analog input. Other modules compatible with the 556 provide pulse or frequency counting, analog output, digital input and output, and power control (see the Module Selector Guide for a complete list). With 10 slots available the 556 capacity is 304 annalog input channels or 320 digital inputs or outputs. Modules may be mixed in combinations to accomplish specific tasks. Multiple cards of most types can also be used. However, the TRG1 and GPIB modules are not compatible with the 556.

The 556 can be programmed from the computer through the user's software language and the GPIB interface driver. For PC/XT/AT & PS/2 computers running DOS, ASYST software provides data acquisition and analysis in a language style user interface. ASYSTANT GPIB is a menu-driven package for data acquisition and analysis. All A/D, analog input, analog output, and digital I/O modules are supported by these two packages through the 556 DDCs. For other computers, controllers, or operating systems, the 556 can be programmed directly from any language or software package which supports the computer's GPIB interface.

SPECIFICATIONS

Architecture:	10-slot mainframe, accepts 16- or 12-bit Analog Master Measurement Module.
Self Test:	Digital RAM, ROM upon power ON.
Program Storage:	One program, up to 5,000 bytes.
Data Storage: (w/o MEM1)	Up to 20,480 bytes available for use in up to ten (10) user specified buffers
Front Panel:	Remote, SRQ, Talk, and Power ON/OFF Indicator. Power Switch.
Rear Panel:	Power Input, IEEE Interface Cable Connector, Auxillary Power Output, Fuse, Power Line Selector Switch and Grounding Posts.
Case:	Ruggedized steel/aluminium extrusion. Rack mount kit available.
Warm-up:	15 minutes to rated accuracy using AMM1A or AMM2 Analog Master Measurement Modules.
Environment:	Operating: 0 - 50°C 80% R.H. non-condensing at up to 35°C. Storage : -25°C to +65°C.
Cooling:	Internal fan for forced air cooling.
Power:	105 - 125 or 210 - 250 VAC selectable from rear panel power connector, 50 - 60 Hz, 100W (max). 90 - 105 or 180 - 210 VAC operation available as a factory installed option. Fuse: 1.5A @ 90 - 120 VAC, 0.75A @ 210 - 250 VAC.
Dimensions:	11.76 cm (H) x 32.72 cm (W) x 28.11 cm (D) [4.63" x 12.88" x 11.07"].
Net Weight:	5.5 kg [12 lbs].

IEEE-488 Bus Implementation

Interface:	IEEE-488-1978 standard
Multiline Commands:	DCL, SDC, GET, GTL, UNT, UNL, SPE, SPD.
Uniline Commands:	IFC, REN, EOI, SRQ, ATN.
Interface Functions:	SH1, AH1, T6, TE0, L4, LE0, SR1, RL0, PP0, DC1, DT1, E1.
Progr. Parameters:	Read, Write, Buffer, Filter, Gain, Offset, Range, Units, Format, Loop, If, Else, Time, Interval, Trigger, Wait, Test, Peek/Poke, Reset, Halt, SRQ, ID, Terminator, Save, EOI, Status.

Maximum Rates:

	Execution Time	Typical Rate (rdg/sec)
Analog Input (to Buffer):		
Read Set-up:	398µs	
Channel-to Channel Scan:	138µs	7,000*
Scan-to-Scan (add):	68µs	
Analog Output:		
Write Set-up:	318µs	
Channel-to Channel Scan:	82µs	10,100**
Scan-to-Scan (add):	66µs	
Digital Input/Output:		
Read/Write Set-up:	378µs	
Channel-to Channel Scan:	66µs	12,100**
Scan-to-Scan (add):	62µs	
Buffer-to-Host:		4.9 kB/sec
Infinite Loop (add):	2µs†	
Indexed Loop (add):	83µs†	

†Plus Read Set-up
*16 channels, 100 samples per channel
**4 channels, 100 sample per channel

ORDERING INFORMATION

500-556-PC
556 for PC/XT/AT/386, PS/2 Model 25 & 30, and 100% Compatibles. Includes: 556-MAIN Chassis, IEEE-488 Interface Card, 2-meter GPIB Cable and ASYSTANT GPIB software.

500-556-MAC
556 for Macintosh II, Plus or SE. Includes: 556-MAIN Chassis, MACSCSI 488 IEEE Controller with MacDriver 488 and MacDA488 Software, 2-meter GPIB Cable.

556-MAIN
Includes Mainframe Chassis, Manual and & Power Cord. Order IEEE interface, cable, and software separately.

556-MEM1
Memory Expansion Module for Model 556 GPIB measurement and control system. The MEM1 provides 512k bytes of memory for analog and digital data storage. Analog data requires two bytes per point; while digital data requires one byte.

556- PROG
556 pocket programming guide.

500-SERIAL
RS-232 to IEEE-488 Converter with 15' cable for connection to 9 or 25 pin Serial Ports

Personal488 GPIB board and driver software for PC/XT/AT 386, PS/2 25& 30, and compatibles.
Personal488/2 GPIB board and driver software forPS/2 50, 60, 70, 80 and compatibles.
Power 488 High Speed GPIB board & software for AT computers
MacII488 GPIB board and software for Macintosh II.
7008-3 IEEE-488 Extension Cable (3ft/0.9m)
7008-6 IEEE-488 Extension Cable (6ft/1.8m)
7008-13 IEEE-488 Extension Cable (13ft/4m)

500-PANEL
Rear Panel Thermocouple Connection Kit. Includes: Punched rear panel, four DB50 connectors, 4 DB50 thermoucouple connector housings, pins and sockets for 100 thermocouples, 100 feet of thermocouple wire, crimp tool, and hardware. Specify -E, -J, -K, -T to select the proper thermocouple type.

500-5009
5.25" slide rack kit for 500A and 500P, & 556.

For DC operation, the 556 maybe special ordered with the same power supplies listed with 500P. Contact factory.

See Series 500 Compatibility Chart for Modules and Software.