

- **6.16 FT<sup>3</sup> WORKING VOLUME**
- **INTEGRAL USER**  
Temperature Probe
- **LCO<sub>2</sub>, -73°C TO +315°C COOLING**  
Optional LN<sub>2</sub>, -184°C to +315°C
- **IEEE-488, RS232, RS422**  
Remote Communication
- **EXPANDED I/O ARCHITECTURE**  
Analog Input Ports  
Analog Output Ports  
Auxiliary I/O Drivers  
Digital Parallel Port  
High Speed Serial Link
- **LOCAL TEMPERATURE**  
Controlled Ramping



The EC16 is an advanced environmental chamber intended for automated test system and laboratory applications requiring fast temperature cycling and a large test volume. Standalone operation is supported by a full function keyboard with a 2 line, 16 character LCD display. The chamber temperature and the user temperature probe readings are normally displayed continuously. User programs are easily entered into the EC16 using a BASIC like command set programming language. In an automated test system, the EC16 functions as a remote data acquisition and control system using the capability of its expanded I/O architecture.

The electrically isolated user temperature probe allows for direct monitoring of critical temperatures on the device under test or certain areas inside the test chamber. As well as being displayed on the front panel, readings are accessible from the IEEE-488 or RS232/422 interfaces.

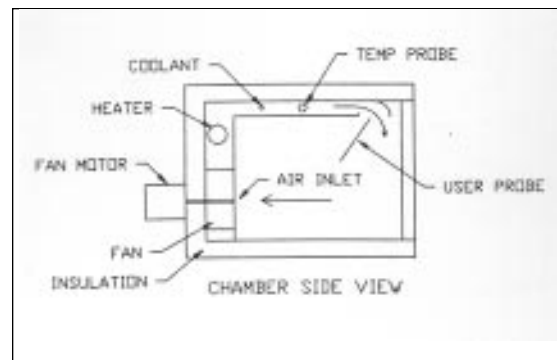
The EC16 command set, whether entered from the local keyboard or downloaded over the IEEE-488 or RS232/422 interfaces, provides for setting chamber temperature, temperature ramping rate and soak time at temperature, temperature deviation limits and temperature upper and lower limits.

Probe calibration procedures are built into the EC16 using local menu driven format. Special communication commands allow for communication to the analog I/O ports, the high speed serial port (SPI) and the parallel port. The chamber can be controlled remotely from the RS232/422 port or the IEEE-488 bus interface. When the IEEE-488 bus interface is used, transparent communication from the IEEE-488 bus to the RS232/422 port is supported. Programs and parameters are stored in battery-backed memory.

The PID coefficients used in the EC16 are user adjustable from the keyboard and remote interfaces. In addition, alarm function and sound level, BAUD rate, interrupt assignments and other communication port options are configurable from the front panel using an easy, menu driven format.

The EC16 supports several safety features including a mechanically adjustable over temperature thermostat, upper and lower software temperature limits, processor watchdog timer and open and short probe detection.

The EC16 is designed to be adaptable to your system application. If you have special requirements, call Sun Systems for solutions.



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**LOCAL AND REMOTE CONTROL INTERFACES**

The EC16 supports stand-alone operation with a full function keyboard, a 2-line LCD and a powerful programming language. For automated test systems, a complete talker/listener IEEE-488 interface is available with serial and parallel poll capability. For remote operation over long distances, RS232 and RS422 serial interfaces are provided. With few exceptions, the commands for the local keyboard and RS232/422 and IEEE-488 interfaces are identical.

**FRONT PANEL**

Application.....EC16 Local Control  
 Operator Manual Program, Parameter Input.....29 Key Keyboard  
 Operator Menu-Driven Visual Output.....2 Line Alpha-numeric LCD  
 Visual Indicators.....Cool, Heat, Failsafe, Remote, Timeout,  
 Heat Enable, Cool Enable, Power  
 Audible Alarm.....User Programmable for Volume and Function

**IEEE-488 BUS INTERFACE**

Application.....EC16 Remote Control  
 Protocol.....Talker / Listener  
 Bus Address.....0-30, Set from Keyboard  
 Interrupt Capability.....SRQ / Serial Poll and Parallel Poll

**RS232 / RS422 SERIAL INTERFACE**

Application.....EC16 Remote Control or  
 IEEE-488 Bi-directional Transparent Operation  
 Protocol.....ASCII Character Oriented  
 with Selectable XON/XOFF Protocol, Character ECHO, Parity  
 Data Rates.....300-9600 BAUD

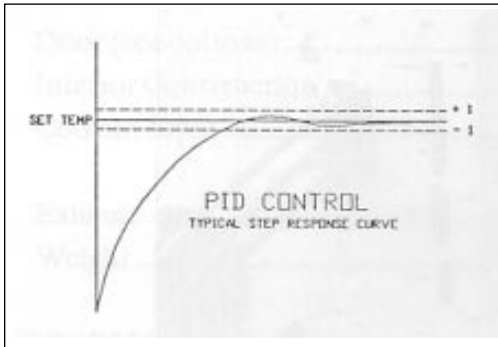
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**TEMPERATURE CHAMBER FEATURES**

**PID CONTROL**

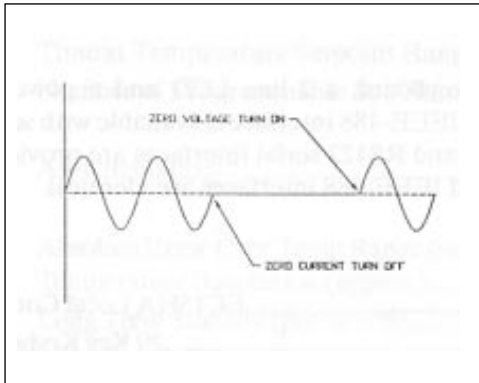


Optimum accuracy and stability in the test environment are ensured by the use of Proportional, Integral and Derivative (PID) control algorithms for both heating and cooling.

The PID coefficients define system response to the difference between set temperature and actual chamber temperature, the length of time that a difference in temperature may exist and the rate of change of the error temperature.

The default settings for the PID coefficients are generally suitable for most uses but, if necessary, each can be tailored to a particular application.

**ZERO VOLTAGE SWITCHING**



Control of power to the heaters and cooling solenoid is provided by zero voltage switching solid state relays to provide reliability and to reduce electrical noise.

**SPECIAL FEATURES**



*Chart Recorder*



*Custom Fixturing*

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**EXPANDED I/O ARCHITECTURE**

The expanded I/O architecture provides for easy test fixture interfacing, strip chart recorder drive and additional sensor interfacing. Each interface is accessed by using the device IN and OUT commands.

**ANALOG INPUT/OUTPUT INTERFACE**

Input Channels.....	4 Channel, 8 Bit A/D Converter
Applications.....	Analog Data Acquisition
Input Range.....	0 to +5 VDC (0 or 4 to 20 mA Input Jumper Selectable for Channel 0)
Input Leakage.....	1 $\mu$ A
Conversion Time.....	26 $\mu$ sec
Output Channels.....	4 Channel, 8 Bit D/A Converter
Applications.....	Chart Recording and Analog Data Control
Output Ranges (Software Selectable)	
UniPolar Voltage.....	0 to +5 VDC
BiPolar Voltage.....	-5 to +5 VDC
Current (Channel 3 Only).....	0 to 20 mA
Settling Time.....	10 $\mu$ sec
Common Specifications	
Non-Linearity.....	1/2 LSB
Absolute Accuracy.....	$\pm$ 1 LSB
Conversion Rate.....	I/O Limited
Device Address.....	DEV#3
Connector.....	15 Pin D Type

**USER PARALLEL PORT**

Applications.....	Local Automated Switch and Test Accessories
Protocol.....	16 Bit Address / 8 Bit Bi-Directional Data Multiplexed, Byte Oriented
Interface Voltage.....	TTL Levels
DC Supply Voltage Provided to User.....	+12 VDC Unregulated
DC Supply Current (fuse protected).....	1.0 Amp max.
Device Address.....	DEV#1
Connector.....	26 Pin Flat Cable Header

**HIGH SPEED SYNCHRONOUS SERIAL PORT**

Applications.....	Distributed Processor Communication Link
Protocol.....	Byte Oriented, Master
Data Rate.....	56K BAUD
Interface Voltage.....	RS422 Levels
Device Address.....	DEV#2
Connector.....	9 Pin D Type

**AUXILIARY I/O INTERFACE**

Applications.....	Relay Drive
Protocol.....	Bit SET/RESET/SENSE
Interface Voltage.....	High Current Open Collector Drive / TTL Sense
Device Address.....	DEV#4
Connector.....	Terminal Block or 26 Pin Flat Connector (located internal to the unit)

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**MENU-DRIVEN CONTROLLER SETUP (Front Panel)**

**CALIBRATION**

[GREEN SHIFT] [CAL] [ENTER]  
 Calibrate Probes? [Yes/No]  
 CAL Access Code? {Access Code}  
 Calibrate Chamber Probe? [Yes/No]  
 {Selection of Probe Types, V or A}? [Yes/No]  
 {Temperature Set Points and Units}? [Yes/No]  
 {Scale Inputs and Values}? [Yes/No] or [Value]  
 Calibrate User Probe? [Yes/No]  
 Modify Chamber Scale? [Yes/No]  
 Desired Scale? 1=°C, 2=°F, 3=°K  
 Modify User Scale? [Yes/No]

Enter CAL Mode.  
 Enter YES if you really want to calibrate probes. Enter NO if you only desire to set units .  
 Enter Access Code. (Set Access Code in Interrupts Menu.)  
 Enter YES to calibrate Chamber Probe. Enter NO to modify Chamber and User display units (°C,°F,°K).  
 Select Probe type, Voltage or Current.  
 If Probe selected, set 0°C and 100°C and select display units (°C, °F, °K).  
 If Voltage or Current selected, set Inputs and Values.  
 Repeat calibration procedure for User Probe.  
 Enter YES to modify display units for Chamber Probe.  
 Enter preferred scale.  
 Repeat selection procedure for User Probe display units.

**DEFAULT VALUES**

[GREEN SHIFT] [SDEF] [ENTER]  
 Set Up Defaults? [Yes/No]  
 GPIB Address? [0-30]  
 GPIB Lockup Time? [0, 2-59 sec]  
 Timeout Pre\_Time? [0 to 59 sec]  
 Power Down Restart? [0-59 min]  
 D/A Output {A, B, C, D}? {Voltage Range}  
 Serial Port Mode? {RS232 or RS422}  
 RS Char Echo On? [Yes/No]  
 Baud Rate? {Required Baud Rate}  
 RS DTR-CTS On? [Yes/No]  
 Buzzer Volume? {Desired Volume}  
 Line Frequency? {60Hz or 50Hz}  
 Chart CHAM On A? [Yes/No] {Select Values}  
 Chart USER On B? [Yes/No] {Select Values}  
 PID to D/A C? [Yes/No]  
 +/- AT SET TRIG?  
 Auto Cool Off? [Yes/No]

Enter SET DEFAULT Mode.  
 Enter YES if you really want to modify defaults.  
 Enter GPIB Address.  
 Enter GPIB Interface maximum lockup time (0 to disable).  
 Enter GPIB SRQ or Serial Interface advanced interrupt generation before actual wait period timeout.  
 Disables automatic restart of controller above set minutes.  
 Select 0 to +5 V or -5 to +5V for channels A, B, C and D.  
 Select Serial Port.  
 Enter YES for serial port character echo.  
 Select Baud rate from 300 to 9600 Baud.  
 Enter YES for hardware handshake.  
 Select buzzer volume.  
 Set correct line frequency.  
 Chart chamber temperature on D/A channel A. If YES, enter High/Low values.  
 Chart user probe on D/A channel B. If YES, enter High/Low values.  
 Enter YES to output PID control to D/A channel C.  
 Enter tolerance at which controller detects that the temperature setpoint is reached.  
 Enter YES to turn off cool enable when expectorant tank becomes empty.

**INTERRUPTS**

[GREEN SHIFT] [SINT] [ENTER]  
 Set up Interrupts? [Yes/No]  
 BUZZ LP Timeout? [Yes/No]  
 BUZZ LP Done? [Yes/No]  
 BUZZ Single T.O.? [Yes/No]  
 INT LP Timeout? [Yes/No]  
 INT LP Done? [Yes/No]  
 INT Single T.O.? [Yes/No]  
 DEVIATION INT? [Yes/No]  
 CMD ERROR INT's? [Yes/No]  
 BKPNT INTERRUPT? [Yes/No]  
 P\_POLL{1-8} 0=NO  
 CAL Menu Access Code?

Enter SET INTERRUPT Mode.  
 Enter YES if you really want to modify interrupts.  
 Enter YES to enable BUZZER after each temperature segment timeout during local program execution.  
 Enter YES to enable BUZZER when the end of a local program is encountered.  
 Enter YES to enable BUZZER at the end of each temperature segment timeout in single temp. mode.  
 Enter YES to enable Timeout Interrupts after each temp. segment timeout during local program execution.  
 Enter YES to enable LP Done Interrupt when the end of a local program is encountered.  
 Enter YES to enable Single Temp. Timeout Interrupt at end of each temp. segment in single temp. mode.  
 Enter YES to enable Deviation Interrupts.  
 Enter YES to enable Command Error Interrupts.  
 Enter YES to enable Breakpoint Interrupts.  
 Enter 0 to disable Parallel Poll or 1 thru 8 to set bit position for Parallel Poll.  
 The number that is entered will become the code that the CAL menu will expect to grant access. 0 to disable.



**COMMAND SUMMARY**

nn.n = Any fixed or floating point number  
 hh:mm:ss = Hours:Minutes:Seconds  
 [ ] = Optional  
 In = One of the ten global I variables

**SINGLE COMMANDS**

**SET**

**EXAMINE**

Segment Temperature	SET = nn.n [C, F, K]	SET? or C
Read Current Chamber Temperature	(n/a)	TEMP? or T
Read Current Set Temperature During Ramping	(n/a)	CSET?
Read Current User Probe Value	(n/a)	UCHAN?
Temperature Soak Period	WAIT = hh:mm:ss or WAIT = mm or mmM or WAIT = Forever	WAIT? OR M
Temperature Ramping Rate	RATE = nnn.n	RATE?
Upper Temperature Limit	UTL = nnn.n or nnnUTL	UTL?
Lower Temperature Limit	LTL = nnn.n	LTL?
Deviation Limit	DEVL = nn.n TC01 DEVL	DEVL?
Heating PID Adjust	PIDH = nn.n, nn.n, nn.n	PIDH?
Cooling PID Adjust	PIDC = nn.n, nn.n, nn.n	PIDC?
Pulse Width Modulation Adjust	PWMP = nn	PWMP?
Device I/O Commands	OUT (dev. no.):(addr.),(data)	IN (dev. no.):(addr.),In
Time of Day	TIME = hh:mm:ss	TIME?
Read Units of Temperature	(n/a)	Scale#n? (n=1 or n=2)
Controller Power On/Off	ON or OFF	(n/a)
Heater Enable On/Off	HON or HOFF	(n/a)
Coolant Enable On/Off	CON or COFF	(n/a)

**PROGRAM COMMANDS**

Execution Commands	STOP; RUNn; RUNn TIME=hh:mm:ss (Start RUN at Time of Day)
Edit Commands	EDITn; INS; DELL; DELPn; LISTn; STOREn
Control Commands	FOR In; NEXT In; GOSUBn; END
Debug Commands	BKPNTn



**Standard Options**

- 220 VAC, 50/60 Hz \*
- 240 VAC, 50 Hz (International) \*
- LCO<sub>2</sub>, 850psi (hose supplied) \*
- LCO<sub>2</sub>, 300psi
- LN<sub>2</sub>, 100psi
- LN<sub>2</sub>, 25psi
- 3-Tank LCO<sub>2</sub> Manifold
- Ambient Air Blower
- Blank Door \*
- Door with 1" Dia Access Port
- Door with 2" Dia Access Port
- Door with 1" Dia Port & 6" x 8" Window
- Door with 2" Dia Port & 6" x 8" Window
- Hinge Option for Door
- 1", 2", 3" or 4" Dia Left Side Access Port
- 2 Year Warranty \*
- Custom Work §
- Fast Delivery

( All dimensions nominal. )

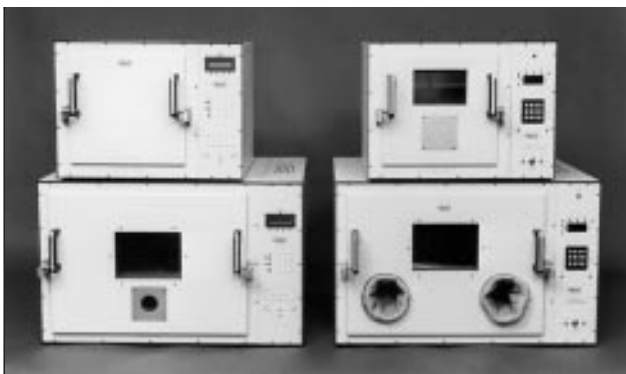
\* no charge items

§ Due to the variety of applications, Sun Systems provides Custom Work per your specification.

Call Sun Systems for solutions to your custom temperature testing requirements.

*(Data subject to change)*

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**Accessories**

Sun Systems can provide a wide variety of test system accessories in support of your temperature testing requirements. Blank doors and doors specifically modified for component temperature cycle testing are available along with switch matrix cards that can be tailored to your test fixture requirements. Extra LCO<sub>2</sub> and LN<sub>2</sub> hoses and fittings, equipment racks and temperature probes can be provided at your request.

We want to work with you.

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