- **0.37 ft³ WORK VOLUME**
- **-100ºC to +300ºC RANGE**
- **IEEE-488 BUS**
  GPIB Remote Control
  Any number of TIME-TEMP Segments
- **RS232 PORT**
  Use with PC or Data Terminal
- **LOCAL CONTROL**
  16 Key Keyboard
- **PROGRAMMABLE SCAN MODE**
  Automatic Execution of:
  - 10 Temperatures
  - 10 Times
  - 1800 Cycles
- **AUXILIARY I/O**
  1 Input, 2 Outputs
- **ADJUSTABLE PID COEFFICIENT**
- **TC01 SOFTWARE COMPATIBLE**
- **19" STANDARD RACKMOUNT**

The EC0A is a high performance environmental chamber that offers integral IEEE-488/RS232/Keyboard control as standard features. The EC0A was expressly designed to work with computer controlled test setups without the need for the addition of "outside boxes" and attending wiring/cabling to configure a computer-controllable environmental system. In addition, the EC0A can be used as a complete stand-alone environmental system that does not require a host computer.

Features of the EC0A include a 0.37 cubic foot working volume, 1200 Watt heating, LCO_2 cooling (LN_2 optional), and a -100ºC to +300ºC temperature range.

The temperature controller used in the EC0A supports a manual mode of operation wherein the user can program the execution of up to 10 time/temperature segments via the 16 key keyboard. Automatic cycling and audio-visual indicators complete the package so that a separate computer or "programmer" is not required for automatic scanning operation.

The remote mode offers unlimited time and temperature combinations via the IEEE-488 bus and RS232 port in addition to the 10 time/temperature scan mode.

Operation through the RS232 port permits any personal computer to control the EC0A via BASIC or other programs. Alternately, a data terminal could be used for control without the need for a computer. A personal computer with installed IEEE-488 card can exercise full control of the EC0A and any other test equipment on the IEEE-488 bus. The EC0A command structure fully supports control of timing, temperature, safety limits, heat/cool enable, auxiliary outputs(2), and auxiliary input. A special command set is supported allowing bi-directional RS232 to IEEE-488 transparent communication, often used for special test fixture communication requirements. Additionally, the PID coefficients used in the EC0A temperature control algorithm are user adjustable via RS232 or IEEE-488. The EC0A is software compatible with the Sun Systems TC01 Retrofit Temperature Controller.

Safety features include a hardware watch-dog timer to protect against EC0A microprocessor malfunction and other forms of loss-of-program control, short/open probe detection, IEEE-488 bus time-out, setable user software Upper Temperature Limit and a user-adjustable, bi-metal mechanical failsafe mechanism.
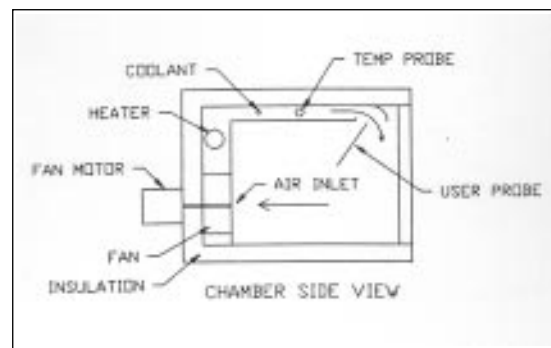
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SPECIFICATIONS *(specifications subject to change without notice)*

MECHANICAL

Internal Dimensions ....(25.4cmW x 20.3cmH x 20.3cmD)....................10.0"W x 8.0"H x 8.0"D
Test Volume ....(0.010m³)...0.3 ft³
Overall Dimensions ....(44.5cmW x 33.7cmH x 50.8cmD).............17.5"W x 13.25"H x 50.8"D
Exterior Construction ....Painted Aluminum Alloy
Door (see options) ....Blank door supplied with chamber
Interior Construction ....Stainless Steel, with exhaust port
Weight ....(17kg typical; 25kg shipping)..................38lbs typical; 55lbs shipping

TEMPERATURE CONTROLLER

TEMPERATURE

Set Temperature Range (LCO$_2$) ....(-100ºF to +570ºF).............-73°C to +300°C
    With LN$_2$ Option ....(-150ºF to +570ºF)...............-100°C to +300°C
Number of Scan Set Temps..10
Absolute Error Over Temp Range (not including probe error)..............(±0.9ºF)..±0.5°C
Resolution (approx.)...(0.2ºF)..0.1°C
Long Term Stability (per month)..(±0.5ºF)..±0.3°C
Line Voltage Sensitivity ....(±0.4ºF)........±0.2°C for 105 VAC to 125 VAC
Temp Control Technique ....PID Algorithm/Pulse Width Modulation
Ambient Temperature Operating Range ....(32ºF to 120ºF).........0°C to 50°C

TIME

Set Time Range ....0.1-1800 minutes+cont.
    With Hours Option ....0.1-1800 hours+cont.
Number of Scan Set Times..10
Time-at-Temp Resolution ....0.1 minute
Time-at-Temp Expiration ....audible tone, LED, SRQ interrupt, ASCII"I"

CONTROL

Local ....Via 16 Key Keyboard
Remote ....RS232/IEEE-488 bus
Auto Cycle..1-1800 cycles+cont.
IEEE-488 to RS232 ....Software/Bidirectional

MISCELLANEOUS

COOLING

Input ....LCO$_2$, 37° male fitting, 1/4" tube
(optional) LN$_2$, 45° male fitting, 1/2" tube
Exhaust ....3/8" NPT, male
Rate ....(55ºF/min (0.9ºF/sec))..........30°C/min (0.5°C/sec) typical

HEATING

Input..1200 Watts
Rate ....(55ºF/min (0.9ºF/sec))..........30°C/min (0.5°C/sec) typical
Air Circulation ....60 CFM, vertical
Fail Safe ....open/short probe detection, watch dog timer,
software temp limit, overtemp thermostat
Power Requirements ....1600 Watts max, 120 VAC, 50/60 Hz, 1 phase
optional 208 VAC, 100 VAC (50 Hz) and 240 VAC (see Options)

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COMMAND SUMMARY

FUNCTION	KEYBD/DISPLAY	RS232	IEEE-488
SINGLE TEMP MODE			
SET Chamber Temp	nn TEMP	nn.nC	nn.nC
SET Time-at-Temp	n TIME	nM	nM
SET Deviation Limit	(n/a)	EDInn	EDInn
OUTPUT Chamber Temp	automatic	T	T
OUTPUT Current Set Temp	TEMP	C	C
OUTPUT remaining Time-at-Temp	TIME	M	M
SCAN MODE			
SET Scan Temp m	nn SCANTEMP m	nn.nAm	nn.nAm
SET Scan Time m	nSCANTIME m	nBm	nBm
SET # Cycles	nSCANTIME-	nB-	nB-
SET Deviation Limit	(n/a)	EDInn	EDInn
OUTPUT Scan Temp m	SCANTEMP m	Am	Am
OUTPUT Scan Time m	SCANTIME m	Bm	Bm
OUTPUT Current Cycle #	SCANTIME -	B-	B-
OUTPUT Chamber Temp	automatic	T	T
OUTPUT Current Set Scan Temp	TEMP	C	C
OUTPUT Current remaining Scan Time	TIME	M	M
DELETE Scan Temp m	-SCANTEMP m	-Am	-Am
DELETE Scan Time m	-SCANTIME m	-Bm	-Bm
START Scan Mode	SCANTEMP SCANTIME	AB	AB
STOP Scan Mode	SCANTIME SCANTEMP	BA	BA
CONTROL GROUP			
Reset (Clear)	C	R	R
ENABLE Local Control	(n/a)	Press Key	lcl 7**
ENABLE Remote Control	(n/a)	automatic	rem703**
ENABLE RS232 Echo	(n/a)	H	H
ENABLE Heat/Cool Out	H/C switches ON	ON	ON
ENABLE Auxiliary #1 Out	(n/a)	OUT1ON	OUT1ON
ENABLE Auxiliary #2 Out	(n/a)	OUT2ON	OUT2ON
ENABLE Scan Interrupts	(n/a)	ESI	ESI
ENABLE Deviation Interrupts	(n/a)	EDInn	EDInn
DISABLE Local Control	(n/a)	(n/a)	llo7**
DISABLE RS232 Echo	(n/a)	R	R
DISABLE Heat/Cool Out	H/C switches OFF	OFF	OFF
DISABLE Auxiliary #1 Out	(n/a)	OUT1OFF	OUT1OFF
DISABLE Auxiliary #2 Out	(n/a)	OUT2OFF	OUT2OFF
DISABLE Scan Interrupts	(n/a)	DSI	DSI
DISABLE Deviation Interrupts	(n/a)	DDI	DDI
SPECIAL			
TRANSFER GPIB to RS232	(n/a)	(n/a)	!sss
TRANSFER RS232 to GPIB	(n/a)	(n/a)	S
PID COEFFICIENTS CHANGE	(n/a)	PID=n,n,n	PID=n,n,n
OUTPUT Probe Option	(n/a)	OPT	OPT
OUTPUT Aux Input State	(n/a)	INI	INI
SET UTL	(n/a)	nnUTL	nn UTL
OUTPUT UTL	(n/a)	UTL	UTL
INIT	(n/a)	INITn,...	INITn,...

nn.n- Refers to a temperature or time setting.
m-   Refers to temperature segment definition in SCAN mode, 0-9

INTERRUPT CHARACTERS

Condition	RS232(ASCII)	IEEE-488(HEX)
No Interrupt	(n/a)	00
Single Temp Mode time-out	I	41
Command Error	CMD ERROR!!	42
SCAN Temp Point time-out	P	43
SCAN Temp Cycle time-out	L	44
SCAN Temp End of Run	E	45
DEVIATION Alarm	D	46
Chamber Temp - UTL	0	47
GPIB Lock-up time-out	(n/a)	4F

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Command Summary cont.

KEYBOARD CONVENTIONS
1. "n" or "m" refers to any numeric key (a single keystroke).
2. "-" refers to the minus key.
3. Items enclosed in parentheses are optional. Thus n(n(n)) means that at least one numeric key has to be depressed. Two additional numeric keystrokes are optional.
4. "A = > B" is read as "A equal to or greater than B."
5. All temperatures referred to are in the units of "degrees centigrade."
6. Keystrokes are noted as a sequence of numbers and words that define each entry. "n(n(n)) TEMP" means "press 1, 2, or 3 numeric keys, then press the TEMP key." "SCAN TEMP m" means "press the key marked 'SCAN TEMP' followed by a numeric entry."

RS232 CONVENTIONS
1. "n" or "m" refers to any numeric character 0 through 9.
2. Items enclosed in parentheses "( )" are optional. Thus n(n(n(.(n)))) means that at least one numeric character has to be sent. Optionally, one or two additional numeric characters to the left of a decimal and one character after a decimal is allowed.
3. All times referred to are in the units of "minutes."
4. All temperatures referred to are in the units of "degrees centigrade."
5. Commands sent to the controller, and data sent from the controller are in the form of "ASCII character strings." Commands sent to the controller are masked to 7 bits and may contain space characters (blanks). The controller ignores all received ASCII characters with a value of less than HEX 10. Therefore, carriage return, line feed, and null characters can be used at will. Data sent from the controller are 8 bits long with the most significant bit a 0 and the rest defining an ASCII character.
6. Data sent from controller are followed by carriage return and line feed characters.
7. RS232-C CONTACT ASSIGNMENTS are shown in TABLE 3-1 in the User Manual.
8. The command processor software ignores leading zero's and trailing digits on all numeric data received. For example: -0000025.32 C will set the single mode temperature to -25.3 deg.
9. **BOLD** type in the Terminal Examples indicates keystrokes required from the terminal keyboard.
10. When a 'dumb terminal' is used for the RS232 interface, any TC01 output will automatically be displayed on the terminal. When using a computer, any TC01 output must be read through some form of 'INPUT' or 'READ' statement - usually a part of an application program written in a language such as BASIC.
11. Computer Examples are written in BASIC. In these BASIC statements, the variables X, Y and A$ are assumed to be defined somewhere else in the BASIC program and contain the proper values for desired results. The BASIC program statements: PRINT#1 and INPUT #1 are assumed to output RS232 data to the TC01 and input RS232 data from the TC01, respectively.
12. The RS232 encoding format used is: 7 bits data, even parity, 2 stop bits.

IEEE-488 CONVENTIONS
1. "n" or "m" refers to any numeric character 0 through 9.
2. Items enclosed in parenthesis "( )" are optional. Thus n(n(n(.(n)))) means that at least one numeric character has to be sent. Optionally, one or two additional characters to the left of a decimal are allowed and one character after the decimal is allowed.
3. The sample 9825 commands assume that the calculator's IEEE-488 interface card is set to select code 7; and that the temperature controller's address has been set to binary 3.
4. Blanks are ignored. The controller ignores all received ASCII characters with a value less than HEX 10. Therefore, carriage return, line feed and null characters can be used at will.
5. "X" and "Y" are variables assumed to be defined elsewhere in the 9825 controlling program.
6. IEEE-488 CONTACT ASSIGNMENTS are shown in TABLE 3-2 in the User Manual.
7. IEEE-488 BUS ADDRESS SWITCH SETTINGS are shown in TABLE 3-3 in the User Manual.
8. The command processor software ignores leading zero's and trailing digits on all numeric data received. For example: -0000025.321000C will set the single mode temperature to -25.3 deg.

EXAMPLE: To set/delete a SCAN TEMPERATURE.
  RS232
   TERMINAL
    -30A3 sets SCAN TEMP #3 to -30ºC
    50.2A0 sets SCAN TEMP #0 to +50.2ºC
    100.5A8 sets SCAN TEMP #8 to +100.5ºC
    The above sequence will be executed , +50.2º first, -30º second and +100.5º third.
    -A3 deletes SCAN TEMP #3. With SCAN TEMP#3 deleted, execution will start with +50.2º & end with 100.5º.
    150.5A8 sets SCAN TEMP #8 to 150.5ºC.
     Note that the new SCAN TEMP of 150.5 writes over the old one of 100.5º.
  COMPUTER
        PRINT #1, "-30A3"
    or   PRINT #1, X, "A", Y
  IEEE-488
      wrt703, "50.2A3" or fxd0;wrt703, X, "A", Y sets SCAN TEMP #3 to +50.2ºC.

EXAMPLE: To set the DEVIATION LIMIT and ENABLE DEVIATION INTERRUPTS.
  RS232
    TERMINAL
        EDI5.3 Enables interrupts and sets limit to +/- 5.3ºC.
  COMPUTER
        PRINT #1, "EDI5.3"
    or   PRINT #1, "EDI", X
  IEEE-488
      wrt703, "EDI10.2" or fxd0;wrt703, "EDI", X enables deviation interrupts & sets deviation limit to +/- 10.2ºC.

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Standard Options

- 115 VAC, 50/60 Hz *
- 220 VAC, 50/60 Hz *
- 100 VAC, 50 Hz (International) *
- 240 VAC, 50 Hz (International) *
- LCO2, 850psi (hose supplied) *
- LCO2, 300psi
- LN2, 100psi
- LN2, 25psi
- Blank Door (supplied) *

- Hinge Option for Door
- Door with 4" x 6" Window
- 1", 2" or 3" Diameter Access Port
- Time set in Minutes * (factory default)
- Time set in Hours *
- 2 Year Warranty *
- Custom Work §
- Fast Delivery

(All dimensions nominal.)

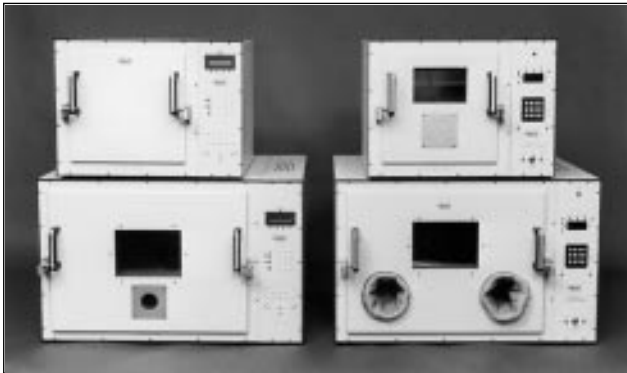* no charge items

§ 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.

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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_2 and LN_2 hoses and fittings, equipment racks and temperature probes can be provided at your request.

We want to work with you.

07/02

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