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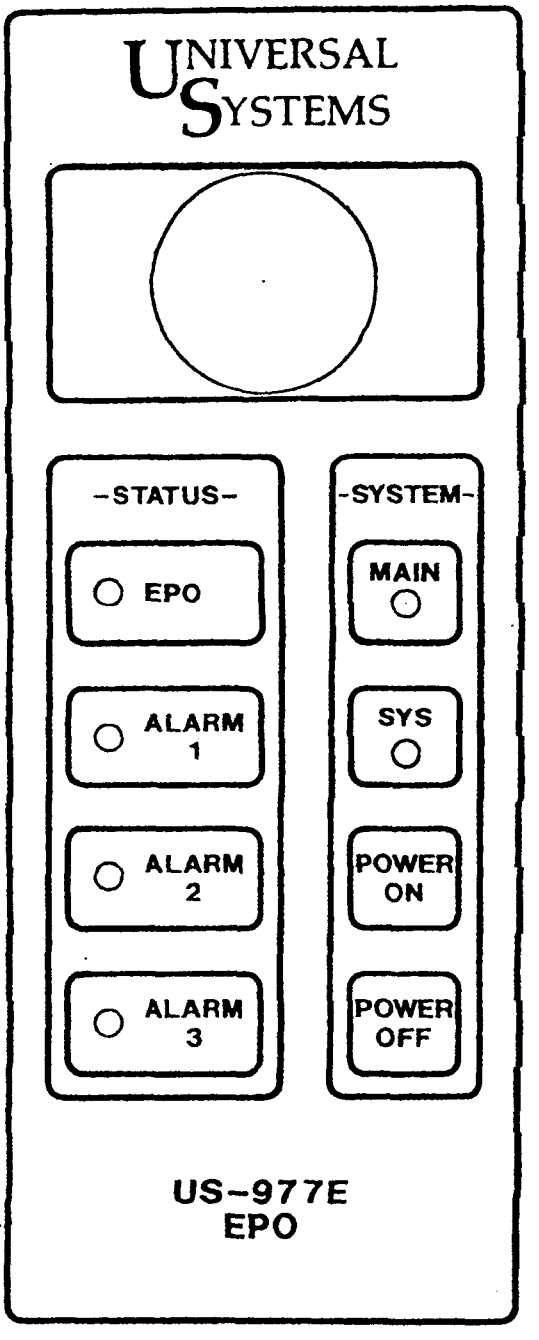
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12/8/94

UNIVERSAL SYSTEMS
MODEL 977E
EPO

The Model 977E is a low voltage EPO (Emergency Power Off) unit. It is a self-contained unit that houses the system master pilot duty relay and associated electronics.

Two light touch switches are provided on the front panel marked ON and OFF. An internal electronic latching circuit brings in the pilot duty relay that in turn brings on the master system contactor.

In addition, a large red EPO switch is provided. This is a redundant Power Off switch. It operates an independent set of contacts that deactivates the pilot duty relay. If the system is shut down by this switch, it may not be turned back on without turning off the main breaker to the equipment. It thus serves as a manual lockout for the system.

Six LEDs are provided on the face to indicate general systems status:

MAIN Indicates that the Main Line Power is on. This LED is wired to be on anytime power is applied to the EPO unit.

SYSTEM Indicates that the master contactor has been energized. This is an indication that power has been applied to the entire system.

EPO Indicates that the EPO switch has been depressed and the master system contactor is locked out for that reason. To clear condition cycle main circuit breaker located in the rear of the station.

ALARM 1 Indicates that the master system contactor is locked out due to a switch closure on the Alarm Circuit 1 EPO input terminals. This is caused by a low exhaust condition. Check the reading on the gauge and ensure the vacuum tube is connected to a sample port from the facilities exhaust. The vacuum switch can be adjusted for sensitivity from an adjustment screw located on the switch.

ALARM 2 Indicates that the second input circuit has a switch closure. This alarm is caused by depressing the E-STOP button or removing the load center cover.

ALARM 3 Indicates that the third input circuit has a switch closure. This alarm is caused by a low CDA or N2 condition. Universal Systems calibrates their CDA and N2 interlocks at 40 PSI minimum.

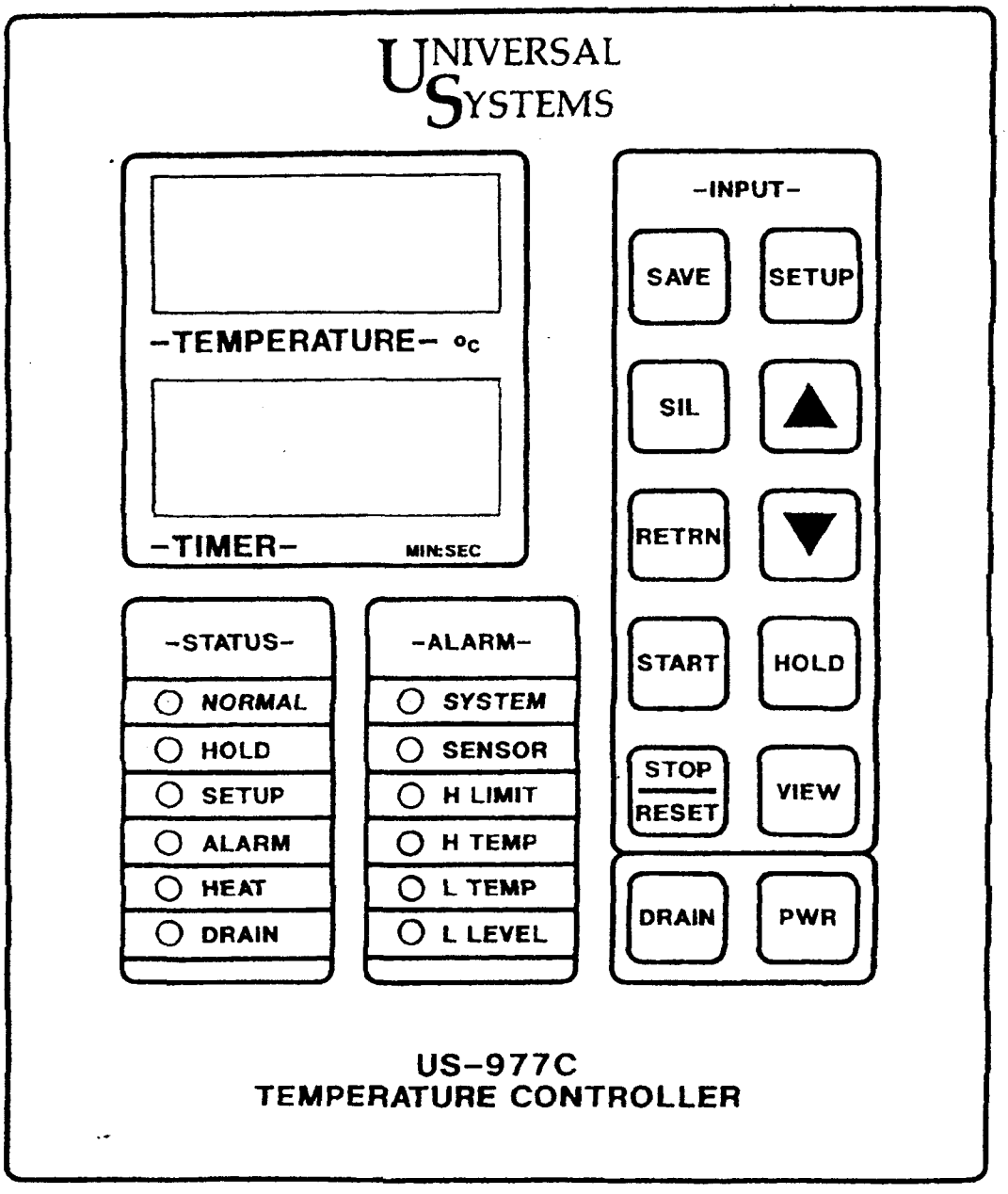
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SPECIFICATIONS

UNIVERSAL SYSTEMS
MODEL 977E
EPO

DISPLAY	Six Discrete LEDs (Red)
OPERATING RANGE	0 - 50 Degrees C
STORAGE RANGE	-40 to 60 Degrees C
CONSTRUCTION	Enclosure - Kydex Face - PVC, Back Printed
SIZE	8.25 x 3 x 6.0 inches (HxWxD) 210 x 76 x 152mm
WEIGHT	$\leq$ 2 Lbs. (.9 kg)
CONNECTION	Rear, Screw-Type, 3/8 Inch Centers
OUTPUT	Relay, Form C Contacts (N/O-C-N/C), 5 Amps, 24 VAC
POWER	3 VA, 24 VAC $\pm$10%, 50/60 HZ

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6/22/98

UNIVERSAL SYSTEMS
MODELS 977C / 977CA / 977CB
(208 VAC / 24 VAC / 120 VAC)
BATH CONTROLLER

The Models 977C/977CA/977CB are microprocessor based controllers/timers. They monitor temperature utilizing a type J thermocouple sensor and control bath temperature with a standard three mode (PID) control scheme, with anti-reset windup and Auto-Learn. Numerous status and alarm functions are incorporated to monitor various system parameters. A down-count timer with count through and pre-warn is integrated into the system.

The base 977 controller has three variants, the main difference between them being line voltage. Also, the 977C controller has a Bryant type plug to connect power while the 977CA and 977CB controllers use a terminal block. The chart below shows the differences between the controllers.

Model	Line Voltage	Power Connection	Heater Control
977C	208 VAC	Bryant Plug	15 Amp
977CA	24 VAC	Terminal Block	Pilot Duty
977CB	120 VAC	Terminal Block	Pilot Duty

The 977C model has a built-in 15 amp, photo-isolated, solid state power controller that is used to control the heater. This allows the microprocessor to maintain the most accurate temperature possible without any concern about excess cycling. The power controller contains a zero cross detection scheme. This insures that no RFI (Radio Frequency Interference) is generated when the load is switched on and off.

An independent high limit circuit is provided. It is powered by an isolation transformer that draws power from the primary side of the master relay. The sensor is a type J thermocouple. This circuit shuts off the internal master relay should an over temperature condition occur.

Twelve discrete LEDs are utilized to indicate system and display status as well as annunciate various alarms. A 12 key membrane switch is incorporated in the facepanel to allow for user setup and adjustment of the system, plus full timer control.

Two numeric displays are utilized to allow the viewing of both the process temperature and the timer simultaneously. Additionally, each of the displays have multiple diagnostic and setup functions that may be activated by the keyboard or by the microprocessor during various setup and alarm conditions.

The microprocessor section consists of two circuit boards, one for display and

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the other for control. The control board contains two transformers and provides the isolated DC supplies (+5 and +12 volts) necessary to run the system. In addition, it contains an instrumentation amplifier, A/D converter, EEPROM memory and the microprocessor. The display board contains all of the seven segment and LED displays as well as the audio transducer.

LEDs

The six primary status modes are indicated by LEDs on the faceplate and are marked NORMAL, HOLD, SETUP, ALARM, HEAT and DRAIN.

NORMAL This mode is the normal condition for the system. It indicates that the system is operating within the defined parameters.

HOLD This mode is a standby condition for the unit. It allows all normal monitoring and timing functions, but disables the heater. The HOLD switch toggles this mode. The 'RETURN' key may also be used to exit this mode. NOTE: For safety, the unit always starts up in this mode initially or after a power failure. When in this mode the process display reads "Hold".

SETUP This is the setup mode. When in this mode the 'Prog' key causes the controller to step through the parameters. The following is a table of the displays that will appear:

CODE	DESCRIPTION	SETTING RANGE
CS	Clock Setpoint	0:00 to 99:59 Minutes:Seconds
PA	Prewarn Offset	0 to 59 Seconds
PS	Process Setpoint	0.0 to 250.0 Degrees C
HI	High Alarm Setpoint	0.0 to 250.0 Degrees C
LO	Low Alarm Setpoint	0.0 to 250.0 Degrees C
dr	Drain Setpoint	0.0 to 250.0 Degrees C
dP	Drain Period	0:00 to 99:59 Minutes:Seconds
AC	Access Code	0 to 9999
CR	Cycle Rate	0 to 25 Seconds
Pb	Proportional Band	0 to 25.0 Degrees C
rE	Reset	0 to 25.0 Minutes
rA	Rate	0 to 25.0 Minutes
CA	Calibration Offset	+ or - 9.9 Degrees C

While in this mode, depressing either the 'up' or 'down' key will cause the display to advance or retard. Depressing the key once and releasing will allow the accurate setting of the least significant digit. Holding either key down will activate the automatic, rapid

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incrementing or decrementing of the display. To exit this mode, 'Return' is depressed.

This system may operate in either a one, two or three mode configuration. Setting the 'Rate' or 'Reset' variables to 0.0 will eliminate the respective function. It should be noted that the rate and reset settings adjust the sampling period directly in tenths of minutes. Thus, smaller numbers create more rapid sampling.

The Calibration Offset 'CA' adjustment allows the elimination of various sensor and system errors. Thermocouple sensors are manufactured within a specific tolerance. The tolerance may lead to a difference between the actual bath temperature and the temperature displayed. This error coupled with the differential error caused by sheathing the sensor in materials such as Teflon may cause a difference in the actual bath temperature and display temperature. This can simply be corrected by monitoring the bath temperature and utilizing the offset to add or subtract the appropriate number of degrees to bring the display into compliance with the actual bath temperature.

While in the SETUP mode, depressing the 'Save' key will cause the setup parameters to be written into the EEPROM memory. This is a permanent (10 year minimum life) memory that does not require battery backup. The save routine takes about two seconds to complete and is indicated by a series of dashes through the displays. This feature provides the OEM with the ability to program in initial conditions prior to shipment. It then allows the user to modify these conditions and permanently save his new parameters all from the keyboard.

ALARM The various alarm conditions are activated by many sources and annunciated by both the displays and audio tone. The mode indicator shows that an alarm has occurred and that the system is still performing under the special conditions required by that alarm. The only way to exit this mode is to clear the alarm.

HEAT This LED is illuminated whenever the heater is on. Note that when the unit is near the setpoint, the LED will continually cycle on and off.

DRAIN This LED indicates that the unit is either in DRAIN, if continuously on, or if blinking, it indicates that it is in the drain warning mode. In drain warning, the unit will activate the drain solenoid on the next depression of the DRAIN key, if all the required conditions are met.

ALARMS

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There are six alarm LEDs. They are essentially visual annunciators of system malfunctions. The first is the 'System' alarm which is a catchall indicator for the miscellaneous diagnostics. An example would be the malfunction of the EEPROM save routine. This would simply indicate to the user that something has gone wrong and he should either repeat the command or reset the unit.

The second alarm is for a defective "T/C" (Thermocouple). This indicates that the sensor is either open or not connected. Special circuitry has been incorporated to monitor the sensor for an open circuit. The processor continually monitors the input and if it detects an open sensor, it shuts the heater off and activates the "T/C" alarm. The process display will alternately flash the temperature and "OP" for open sensor.

The third alarm is the "High Limit". This LED is wired directly to the high limit circuit and lights whenever the high limit turns the master relay off. Since it is powered by the high limit power supply it remains on even after the master relay has de-energized and shut the controller off. This alerts the operator that the system has shut down and why.

The next alarm is the "High Temp" alarm. It is activated anytime the process temperature exceeds the high alarm setpoint. When activated, the process display alternately displays the process temperature and the code "HI".

The "Low Temp" alarm acts much like the "High Temp" alarm, except it compares the process temperature to the low alarm setpoint. If the process temperature drops below the setpoint once it has initially come out of the warmup mode, this alarm will be activated. No code is displayed and there is no effect on the system operation.

The sixth alarm is "Liquid Level". It monitors a remote liquid level sensing circuit and activates when a low liquid level is detected. The code "LL" is alternately flashed with the process temperature.

OPERATION

All of the alarms, except "Low Temp", activate the audio tone as well as the alarm status LED and the individual alarm annunciator. The tone and the LEDs alternate on and off to draw attention to the alarm. As has been noted above, many of the alarms have additional visual displays to further define or draw attention to them.

The alarm silence key is provided to allow for the elimination of the audio portion of the alarm as well as the portion of the alarm display that effects the process display. This essentially allows the unit to be returned to a functional condition where setpoints can be examined and reset without the interference of the

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special alpha displays. However, the alarm status and alarm annunciator LEDs continue to flash to indicate the alarm and, where applicable, the output to the heater is turned off to protect the equipment from any potential damage.

In some cases it may be desirable to restrict access to the tune and program functions. Thus an "Access Code" system is incorporated in the design. In the program mode, AC may be set. If the code is set to 0000, the function is eliminated and the system operates as previously described.

The security code is simply any number from 0001 to 9999 as programmed into the system by the customer's authorized personnel. Once this code is entered into the EEPROM using the "Save" command, any attempt to use the SETUP key to gain access to the control and setup functions will cause "Code" to appear in the process display. The up and down keys are then used to set the proper code number. A second mode key entry is then required. Any other entry or the wrong code number will return the unit to the normal operating mode.

The process display shows the sensor temperature at all times during normal operation, except when the 'VIEW' key is depressed, when it displays the process setpoint.

The timer display shows the current count of the timer at all times during normal operation, except when the 'VIEW' key is depressed, when it displays the timer preset value.

The down count timer is a presettable timer that will count down from a preset time. It has the additional feature of counting through zero. Once it counts down to zero, it begins counting back up to record the time that has elapsed past the preset time.

The 'View' key may be used to examine the Preset time. This value and the initial preset time are stored in the EEPROM memory. Thus they automatically are ready when initially powered up.

The "START" key is used to start the timer. When this key is depressed, the timer will begin counting down if the unit is in the normal mode and the timer has been reset. The "STOP/RESET" key is used to stop the timer. Anytime the timer is in the RUN mode, this key will halt its operation. The display will be frozen on the current timer value. If the count is "over", the display will flash. A second depression of this key will cause the timer to reset. This will place the preset value in the timer display, stop the display flashing and cancel any timer audio tones. If the START key is hit when the timer is in the HALT mode, the timer will continue from its current count.

The prewarn tone has a 50/50 duty cycle and a ½ second period. After the preset time has elapsed, it turns into a continuous tone. The timer must be

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stopped to enter the Program Mode. In the Program Mode the preset time and prewarn time are entered (see Program section).

DRAIN

The 'DRAIN' key is used to control the timed, temperature interlocked automatic draining of the bath. When this key is depressed, the system responds with 5 audio beeps and begins to flash the drain LED. This is taken by the controller as a request to drain. A second depression of the 'DRAIN' key is required to actually activate the drain solenoid. This is done to alert the operator that he is about to drain the bath, and help prevent accidentally opening the drain.

There are two safety checks that are made prior to the activation of the solenoid. When the key is depressed for the first time, the unit will check for alarms. If any alarms are present it will ignore the key. If there are no alarms, a second depression of the key will then compare the current process temperature with the "DR" drain temperature setting that has been placed into the programming stack. The unit will ignore the key unless the bath temperature is below the drain temperature setting.

The length of the DRAIN period (DP) may be programmed. The DRAIN key may be used to start the DRAIN cycle and also to stop it. If the cycle is not manually stopped before the timer elapses, the Timer will automatically stop the DRAIN.

TIMER QUICKSET

A special feature is incorporated in the controller that allows the user to set and save the Clock Setpoint (CS) without entering the Program mode.

This is accomplished by utilizing the VIEW, UP and DOWN keys in the normal operating mode. When the VIEW key is depressed and held, the 'CS' parameter appears in the timer display. The UP and DOWN keys may then be utilized to adjust this parameter.

If it is desirable to permanently save this adjusted parameter, the SAVE key may be depressed while holding the VIEW key. This will permanently save the revised parameter in the EEPROM memory.

UNIVERSAL SYSTEMS BACKDOOR CODE

A special code has been incorporated into the software to insure factory access to all functions no matter what the customer has done with the access codes. This code is 977.

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SPECIFICATIONS

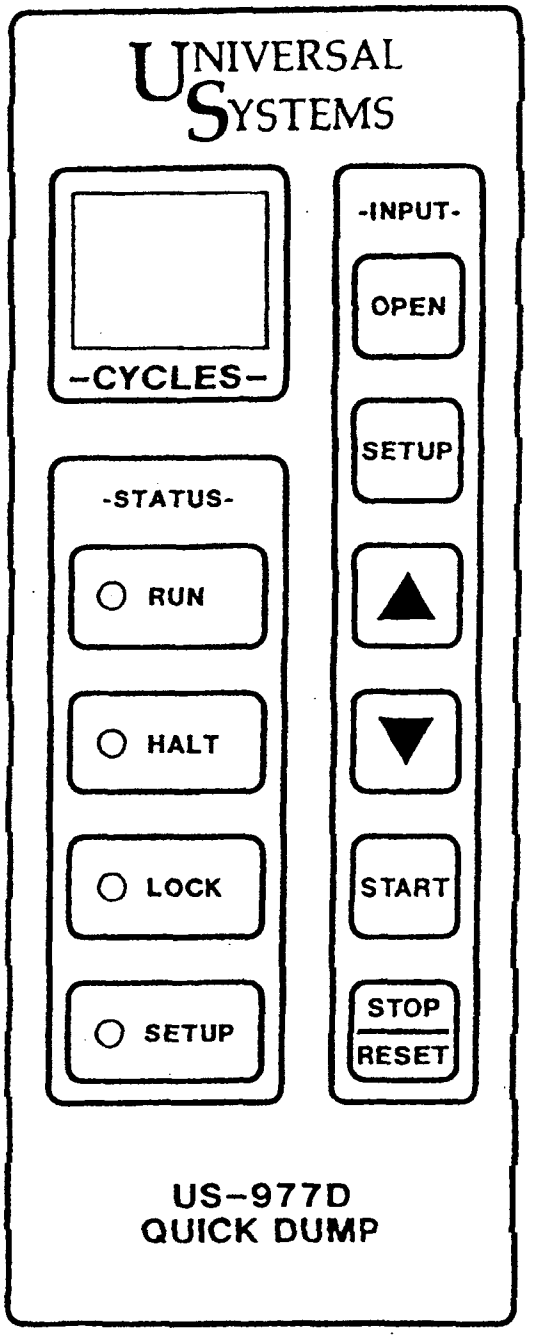
UNIVERSAL SYSTEMS
MODEL 977C/CA/CB
BATH CONTROLLER

RANGE (Temperature)	0.0 - 250.0 Degrees C.
RESOLUTION (Temperature)	0.1 Degrees C.
NOISE REJECTION	NMR - 60 dB @ 60 HZ CMR -120 dB @ 60 HZ
RANGE (Time)	0:00 - 99:59 Min:Sec
RESOLUTION (*Time*)	1 Sec.
MEASURING TIME	4 Conversions/Sec
DISPLAY	Eight, 0.56 inch high, seven segment, LED uniplanar numerals. Twelve discrete LEDs (Red, Green, Amber).
ANNUNCIATOR	Audio Tone, ~ 2500 HZ
SETUP MEMORY	EEPROM, All Parameters
MEMORY RETENTION	10 Years w/o Power
SENSOR	Standard - Type J Thermocouple, Cold Junction Compensation, Up Scale Break Protection.
CONTROL	PID with Anti-Reset Windup.
ADJUSTMENT	Cycle Rate: 0 - 25 Sec. Proportional Band: .1 - 25.0 Deg. C Reset (Integral): .1 - 25.0 Sec. Rate (Derivative): .1 - 25.0 Sec. Calibration Offset: $\pm$ 9.9 Deg. C
OPERATING RANGE	0 to 50 Degrees C
STORAGE RANGE	-40 to 60 Degrees C
CONSTRUCTION	Enclosure - Kydex.

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	Face - PVC, Back Printed
SIZE	8.25 X 6 X 6 inches (HxWxD) 210 x 152 x 152mm
WEIGHT	≤ 4 Lbs. (1.8 kg)
CONNECTION	977C Screw-Type, 3/8 Inch Centers; T/C - Miniature, Type J, Jack. Power-Bryant, 7486-MB Heater-Bryant, 7487-ER 977CA/CB Screw-Type, 3/8 Inch Centers; T/C - Miniature, Type J, Jack.
OUTPUT Triac, Optically isolated, zero cross,	977C 15 Amp, 208 VAC Relay: 1HP, 250 VAC Solenoid: 100 PSI 977CA
Triac, Optically isolated, zero cross,	1 Amp, 24 VAC Solenoid: 100 PSI 977CB
Triac, Optically isolated, zero cross,	1 Amp, 120 VAC Solenoid: 100 PSI
POWER	977C: 11 VA, 208 VAC ±10%, 50/60 Hz 977CA: 11 VA, 24 VAC ±10%, 50/60 Hz 977CB: 11 VA, 120 VAC ±10%, 50/60 Hz

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UNIVERSAL SYSTEMS
MODEL 977DS
DUMP RINSER

The Model 977DS is a microprocessor based Quick Dump Rinser controller. It is a self-contained unit that is capable of implementing several different dump rinsing techniques. It contains all of the necessary pneumatics to directly operate a standard system. Both single door and double door configurations are available.

Four standard programs are incorporated in the system. The program to be run is selected by the setup procedure (discussed below) and will operate under time, liquid level, resistivity or combinations thereof. This allows flexibility for mating the device to the system requirements.

The solenoids are internal to the device and are powered by the internal system power supply. The user need only provide 24 volts AC to the power terminals and the pneumatic hookups to the color coded tubing to allow the system to function. Additional features such as liquid level, resistivity, interlocks and remote Start/Stop may be wired into the terminal block as desired.

There is a two digit display on the face. During the run mode, it displays the remaining cycles. During the setup mode, the display will indicate a combination of alpha numeric characters to aid the user in correctly setting up the system.

LEDs

Four discrete LEDs are provided to indicate the current system status. They are labeled RUN, HALT, LOCKOUT and SETUP:

RUN Indicates that the system is in the RUN mode and implementing the selected program. The display will indicate the number of cycles remaining.

HALT Indicates the system has been temporarily stopped.

LOCKOUT Indicates that a switch closure has occurred on one of the two interlock circuits. This will terminate the Dump Rinser cycle prematurely and stop the system irregardless of the current conditions.

SETUP Indicates that the system is in the SETUP mode. In this mode the system parameters are selected. (see below)

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KEYS

The six keys marked: START, STOP/RESET, SETUP, OPEN, UP AND DOWN are used to operate and program the unit. The following is a listing of each of the keys and their functions:

START This key is used to activate the Dump Rinser. It will start the system if it is reset, or it will continue if the system has been placed in HALT (see STOP/RESET).

STOP/RESET This is a multifunction key. Its function varies with the current system mode.

RUN MODE If the system is in the RUN mode, but has not completed all of the cycles, depressing STOP/RESET will place the system in the HALT condition. This simply stops the program and holds it until restarted by the START key or Reset key, as described below.

HALT MODE If the system has been placed in the HALT mode by a single depression of the STOP/RESET key, depressing the key again will reset the system.

SETUP MODE If the system is in the SETUP mode, depressing the key will cause the system to return to the RESET state in preparation for a new cycle run.

SETUP This key is used to put the system into the SETUP mode and advance through the parameters.

Depressing the key once will place the unit in the SETUP mode. (Note: If Access Code Protection is selected, an additional step is required. See Access Code). *Depressing the key after entering the SETUP mode will allow the user to* scroll through the setup parameters. (see SETUP).

UP In the SETUP mode, depressing the UP key will cause the display to advance. Depressing the key once and releasing will allow the accurate setting of the least significant digit. Holding the key down will activate the automatic, rapid incrementing of the display.

DOWN In the SETUP mode, depressing the DOWN key will cause the display to decrease. Depressing the key once and releasing will allow the accurate setting of the least significant digit. Holding the key down will activate the automatic, rapid decrementing of the display.

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OPEN This key is used to manually dump the tank. When it is depressed, the appropriate solenoid is activated and the tank is dumped. The door is closed by depressing the RESET key.

SETUP MODE

The controller may be configured to implement various dump rinsing techniques. The SETUP mode allows the user to both adjust and program the unit. The following is a listing of the code prompts that will appear in the display when in the SETUP mode. The code will alternately flash with the selected value to indicate to the user the parameter that is currently being viewed or set.

CODE	DESCRIPTION	SETTING RANGE
CY	Number of cycles	0 TO 99 cycles
RC	Number of reclaimed cycles (double door only)	0 TO 99 cycles
FP	Fill Period (Time programs only)	0 to 99 seconds
DP	Drain Period	0 to 99 seconds
DD	Dump Delay	0 to 99 seconds
SD	Start Delay	0 to 99 seconds
AD	Auto Dump Period	0 to 99 seconds
N2	Bubbler	Y=Yes / N=No
AC	Access Code	0 to 99
PC	Period Count	L=Long (min); S=Short (sec)
PN	Program Number	0 to 3

All of the codes do not appear on every unit. If the item does not apply, it is automatically removed from the stack. For example, FP is only used with Programs 0 and 1. Thus, when PN is selected as 2 or 3, the FP setting disappears from the stack.

The 'PC' selection will determine whether the Fill Period (FP) and Start Delay (SD) are counted in minutes or seconds. If it is set to "L" (LONG) it will count in minutes. If it is set to "S" (SHORT) it will count in seconds.

The 'RP' selection will determine the placement of the Reclaim Cycles in a double door unit. If the parameter is set to 'F", the reclaim door will be open for the first 'RC' cycles. If the parameter is set to last 'L', the reclaim door will be closed for the first 'CY/RC' cycle and open for the last 'RC' cycle.

To exit the SETUP mode, the RESET key is depressed. When exiting, the unit automatically enters a SAVE mode. This causes the parameters to be written into the EEPROM memory. This is a permanent (10 year minimum life) memory

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that does not require battery backup.

OPERATION

The Dump Rinser functions are directly controlled by the SETUP parameters and the program selected. All of the programs use a DUMP period. This is the amount of time that the dump door is open. The technique used to determine when the tank is full varies between the programs.

Programs 0 to 1 use a timed fill. In this case the FP (FILL PERIOD) parameter is set to a specific number of minutes or seconds. The program will then activate the fill valve for that period of time and then proceed into the DUMP cycle. (Note: the FILL solenoid remains on throughout the complete run.)

When using Programs 2 and 3, a liquid level signal is used to terminate the FILL cycle. In these programs, the unit will go into the FILL cycle and remain in FILL until a closure occurs on the liquid level input.

A resistivity override may be used with either the TIME FILL or LIQUID LEVEL FILL Program. Programs 1 and 3 are special versions of the TIME and LIQUID LEVEL routines just described, with the additional feature that the resistivity input is examined at the end of each FILL period. If there is a closure on the resistivity input at this time, the system stops the cycle and indicates to the operator that rinsing is complete.

PROGRAM NUMBER	FUNCTION
0	Timed Fill
1	Timed Fill with Resistivity Override
2	Liquid Level Fill
3	Liquid Level Fill with Resistivity Override

With any of the programs, the 'N2' option may be selected. When 'N2' is selected, the 'N2' bubbler solenoid will be activated during the entire cycle run.

There are two programmable delays that may affect the system operation. In the SETUP mode, the DUMP delay may be used to add a fixed amount of time to the end of the FILL period. The system would operate as described above, except that the dump would not be immediately initiated, but would be delayed by a preset number of seconds.

Additionally, a delay may be inserted via the SD (Start Delay) parameter. When the START key is first depressed, the controller will enter the RUN mode, but the RUN LED will flash to indicate that there is a start delay being counted down. Once the delay has been completed, the RUN LED will go fully on and the system will proceed to operate as described above.

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If a time other than 00 is programmed into the AD (Automatic Dump) parameter, an internal timer will automatically accumulate the time that has elapsed since the last run. If this time accumulates to the programmed number of minutes, the unit will automatically perform one dump cycle.

In some cases it may be desirable to restrict access to the SETUP mode. Thus, an Access Code System is incorporated. If the AC (access code) parameter is set to 00, the function is eliminated and the system operates as previously described.

The Access code is simply any number from '1 to 99', as programmed into the system by the customer's authorized personnel. Once this code is entered into the EEPROM, any attempt to enter the SET mode will cause 'CD' to appear in the data display. The UP and DOWN keys are then used to enter the Access Code. Once the proper code has been selected, the user simply depresses the SET key once again to gain entry into the SETUP stack. Any other entry, the wrong code number, or no action for 30 seconds will return the unit to the normal mode.

UNIVERSAL SYSTEMS BACKDOOR CODE

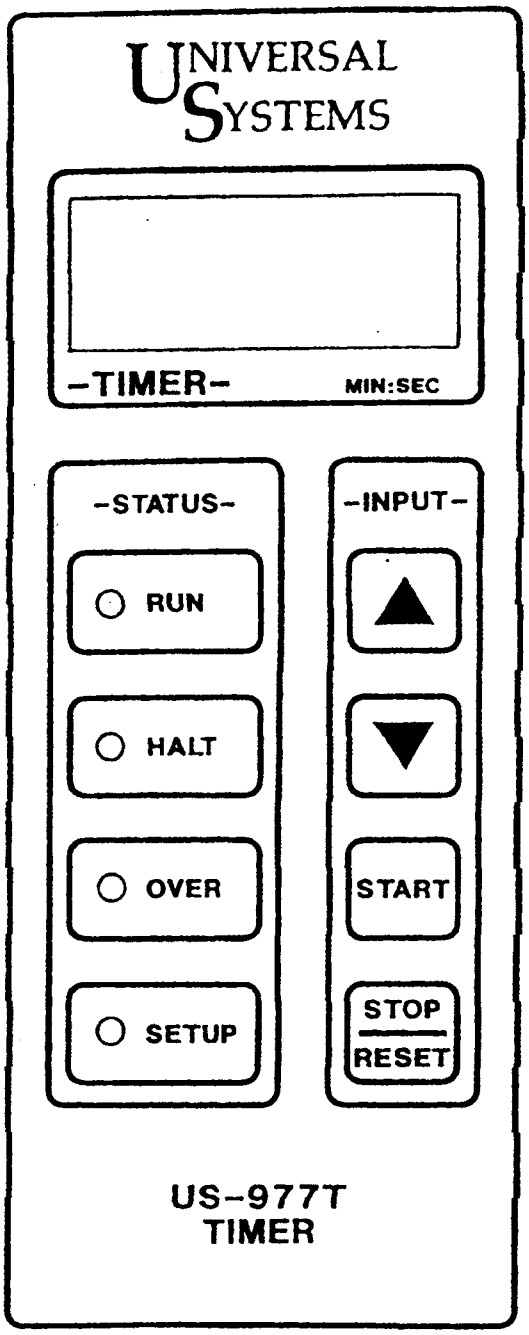
A special code has been incorporated into the software to insure factory access to all functions no matter what the customer has done with the access codes. This code is '99'.

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SPECIFICATIONS
UNIVERSAL SYSTEMS
MODEL 977DSA/DS
QUICK DUMP RINSER

RANGE		0 - 99 Cycles
RESOLUTION		1 Cycle
DISPLAY		Two, 0.8 Inch High, Seven Segment, LED Uniplanar numerals. Four discrete LEDs (Red, Green, Amber).
ANNUNCIATOR		Audio Tone, ~ 2500 HZ
SETUP MEMORY		EEPROM, All Parameters
MEMORY RETENTION		10 Years w/o Power
OPERATING RANGE		0 to 50 Degrees C
STORAGE RANGE		-40 to 60 Degrees C
CONSTRUCTION		Enclosure - Kydex. Face - Lexan, Back Printed
SIZE		8.25 x 3 x 5.25 inches (HxWxD) 210 x 76 x 133mm
WEIGHT		$\leq$ 4 Lbs. (1.8 kg)
CONNECTION	Pneumatic -	Rear, 1/16" ID PVC tubing, color coded with 1/16"-3/32" barbed fitting.
		Electrical - Rear, Screw-type, 3/8 inch centers
OUTPUT		Pneumatic solenoid, internal, 100 PSIG Max.
		Done - Transistor, Open Collector, 100 MA, 12VDC.
POWER		10 VA, 24 VAC +10%, 50/60 Hz (977DSA) 10 VA, 120 VAC +10%, 50/60 Hz (977DS)

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UNIVERSAL SYSTEMS
MODEL 977T/TA
TIMER

The Model 977T/TA is a microprocessor based stand alone timer. It is programmed to perform a standard countdown and/or countup timer routine with cumulative over timer and Pre-Alarm. A Form C (N/O-C-N/C) relay output is provided that may be programmed to be active either during or after the time period.

The four digit display is scaled in 'minutes and seconds' and allows a maximum '99 minutes 59 seconds' preset. The pre-alarm is scaled in seconds and is settable to a maximum of 59 seconds.

LED INDICATORS

Four discrete LEDs are provided to indicate the current system status. They are labeled RUN, HALT, SETUP and OVER:

RUN Indicates that the timer is running.

HALT Indicates that the system is in the HALT mode.

OVER Indicates that the timer has counted the preset time and is now accumulating the amount of time that has passed, since the completion of the preset count.

SETUP Indicates that the system is in the SETUP mode. In this mode the system parameters are selected. (see below)

KEYS

The four keys marked: START, STOP/RESET, UP and DOWN are used to operate and program the unit. The following is a listing of each of the keys and their functions:

START This is a multifunction key that is used in both operation and setup. Its primary function is to start the timer. It may start the timer either from a reset or halted condition.

The second function for this key is in the SETUP mode.

STOP/RESET This is also a multifunction key. Its primary functions are to stop the timer and then reset it for another run. If the timer is

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in the RUN mode, depressing the STOP/RESET key once will place it in the HALT mode. If the timer is in the HALT mode, depressing the key once will place it in the RESET mode.

The key is also used in entering the SETUP mode.

SETUP SETUP is actually a combination key. The SETUP mode is entered by depressing and holding the STOP/RESET key and then depressing the START key. While in this mode, the START key is used to step through the parameters. The following is a listing of the code prompts that will appear in the display, when in the SETUP mode. The code will alternately flash with the selected value to indicate to the user the parameter that is currently viewed or set.

CODE	DESCRIPTION	SETTING RANGE
CS	Clock Setpoint	0:00 to 99:59 Min:Sec
PA	Pre-Alarm	0 to 59 Seconds
CD	Clock Count Direction	UP/DN (Up or Down)
RL	Relay Logic	0 or 1 (0=After, 1=During)

To exit the SETUP mode, the RESET key is depressed. When exiting, the unit automatically enters a SAVE mode. This causes the parameters to be written into the EEPROM memory. This is a permanent (10-year minimum life) memory that does not require battery backup.

UP In the SETUP mode, depressing the UP key will cause the display to advance. Depressing the key once and releasing will allow the accurate setting of the least significant digit. Holding the key down will activate the automatic, rapid incrementing of the display.

DOWN In the SETUP mode, depressing the DOWN key will cause the display to decrease. Depressing the key once and releasing will allow the accurate setting of the least significant digit. Holding the key down will activate the automatic, rapid decrementing of the display.

OPERATION

This unit may be configured as either a presettable countdown or countup timer. The direction of count is programmable.

In the SETUP mode, the timer is programmed to a specific time, a specific pre-

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alarm offset and a count direction. Once the START key is depressed:

DOWN COUNT TIMER

The timer will begin to countdown in seconds. It will continue this process until it reaches the pre-alarm time setting. At this point, an audio tone that has a 50/50 duty cycle and a ½ second period will sound. Once the unit has counted down to 0:00, the audio will change to a continuous tone and the display will begin to flash. If the timer is not stopped, it will begin to count backup, accumulating the time that has elapsed.

UP COUNT TIMER

The timer will begin to count up in seconds. It will continue this process until it reaches the set time minus the pre-alarm setting. At this point, an audio tone that has a 50/50 duty cycle and a ½ second period will sound. Once the unit has counted up to the preset time, the audio will change to a continuous tone and the display will begin to flash. If the timer is not stopped, it will reset to zero and count backup, accumulating the time that has elapsed.

The START key may be used as an audio silence without stopping the timer. Depressing the START key once will silence the audio and the timer will continue to count.

Depressing the STOP/RESET key will stop the timer and freeze the display. Depressing the STOP/RESET key for a second time will reset the timer and display the pre-programmed setpoint and ready the timer for another cycle. If in the DOWN COUNT mode, the pre-programmed setpoint will be inserted in the display. If in the UP COUNT mode, the display will be set to 0:00. In both cases, the timer is then ready for another cycle.

A relay output is provided for simple interfacing. The relay has a standard Form C (N/O-C-N/C) set of contacts brought out to the rear panel. The 'RL' parameter allows the output relay to be setup, such that it is active either during the timing cycle or at the completion of the timing cycle. In both conditions, the relay is OFF when the timer is reset. If zero (0) is set, the relay will be active after the timing period has elapsed and prior to the RESET key being depressed. If one (1) is selected, the relay will be active from the time the START key is depressed, until the period has timed out.

If the continuous tone, signaling the end of the timer cycle is not silenced or the timer is not stopped within 30 seconds, the buzzer will go into an unattended alarm mode. In this mode, the buzzer will shift from a continuous tone to a 50/50 duty cycle with a ½ second period.

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SPECIFICATIONS

UNIVERSAL SYSTEMS
MODEL 977T, TA
TIMER

RANGE	0:00 - 99:59 Min:Sec
RESOLUTION	1 Sec
DISPLAY	Four, 0.56 Inch High, Seven Segment, LED Uniplanar numerals. Four Discrete LEDs (Red, Green, Amber).
ANNUNCIATOR	Audio Tone, ~ 2500 HZ
SETUP MEMORY	EEPROM, All Parameters
MEMORY RETENTION	10 Years w/o Power
OPERATING RANGE	0 to 50 Degrees C
STORAGE RANGE	-40 to 60 Degrees C
CONSTRUCTION	Enclosure - Kydex Face - Lexan, Back Printed
SIZE	7 x 3 x 5.25 inches (HxWxD) 178 x 152 x 133mm
WEIGHT	< 3 Lbs. (1.4 kg)
CONNECTION	Rear, Screw-Type, 3/8 Inch Centers
OUTPUT	Relay, Form C Contacts (N/O-C-N/C), 5 Amps, 24 VAC
POWER	7 VA, 24 VAC ±10%, 50/60 HZ (977TA) 7 VA, 120 VAC ±10%, 50/60 HZ (977T)

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