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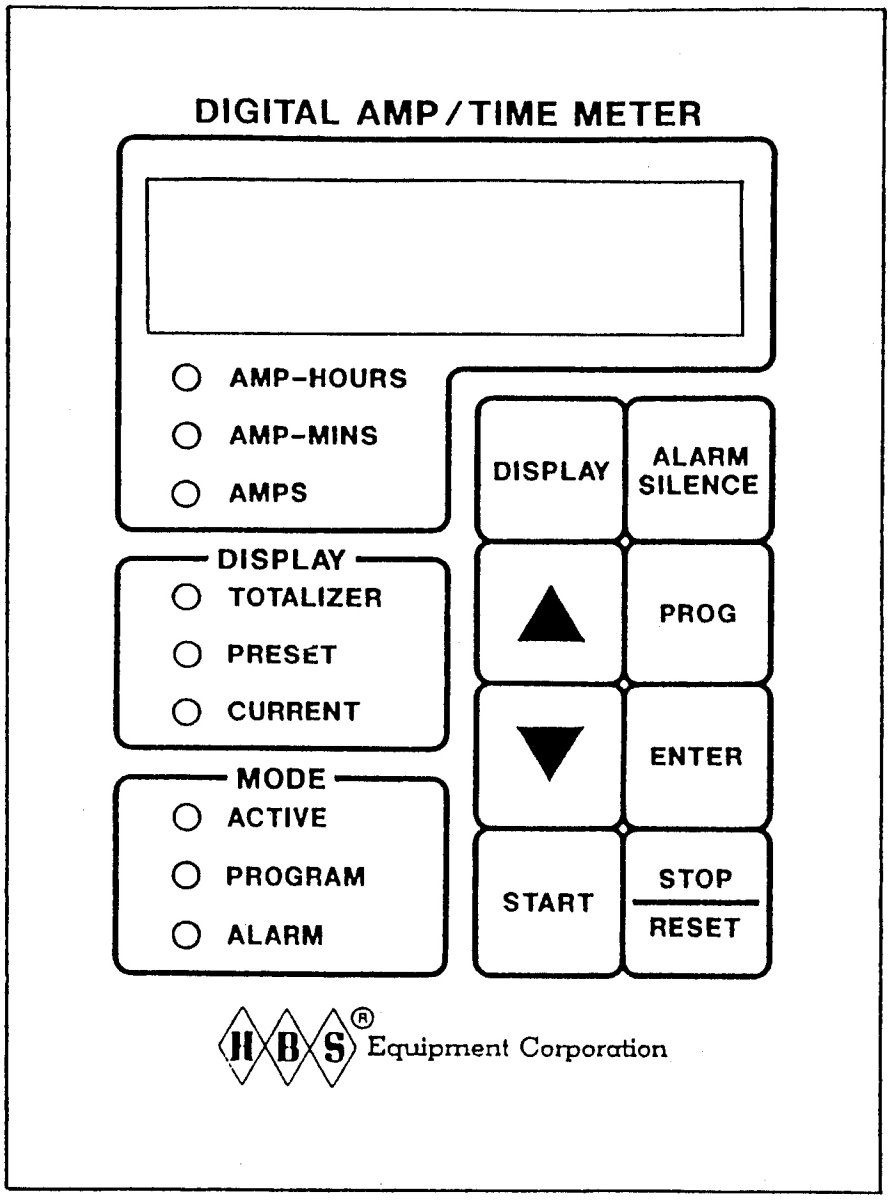
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7/6/94
Rev 4

HBS EQUIPMENT CORPORATION
MODEL 700
DIGITAL AMP/TIME METER

The Model 700 Digital Amp/Time Meter is a stand alone microprocessor based unit. It is ideally suited for precious metal plating and has a wide range of features:

* BRIGHT SIX DIGIT LED DISPLAY
* NINE DISCRETE LED INDICATOR'S
* EIGHT KEY MEMBRANE SWITCH PANEL
* INTERNAL AUDIO FOR KEY CLICKS AND ALARMS
* EXTERNAL ALARM SIGNAL
* 2 PROGRAMMABLE OUTPUT RELAYS
* FIELD SELECTABLE INPUT POWER, (120 OR 240 VAC, 50/60 HZ)
* FIELD SELECTABLE SHUNT INPUT (50, 100, 200 MV)
* HIGH IMPEDANCE SHUNT INPUT. (ALLOWS SMALLER WIRE GAUGE WIRING BETWEEN SHUNT AND METER. FOR EXAMPLE, USING 18 GA SOLID WIRE, A WIRE RUN OF 25 FT, PRODUCES AN ERROR OF LESS THAN .03%).
* ACCESS CODE PARAMETER PROTECTION
* EEPROM PARAMETER MEMORY
* ALL PARAMETERS SET IN SOFTWARE - NO POTS OR SWITCHES
* SMOOTH FACE CONSTRUCTION
* HIGH RESOLUTION A/D CONVERTOR WITH INPUT FILTERING

The controller reads current by monitoring an external shunt. Its primary function is to countdown a preselected AMP-HOURS or AMP-MINUTES value and signal the completion of the cycle.

Additionally, the unit accumulates (totalizes) the total number of AMP-HOURS or AMP-MINUTES that have been monitored.

Two Form C (N/O-C-N/C) relays are provided that may be programmed to perform a variety of control and monitoring functions.

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DISPLAYS

There is a six digit, .56 inch high, seven segment, LED display on the face. During the normal operating mode, it displays one of three parameters - TOTALIZER, PRESET OR AMPS. During the SETUP mode, the display will indicate a combination of alpha numeric characters to aid the user in correctly setting up the system.

Nine discrete LEDs are provided to provide information about the current mode of the system, status of the display and the units that are being displayed. The following is a listing of each of these LEDs and their appropriate meanings:

MODES

ACTIVE - This LED indicates that unit is running. It is counting down the value in the display and automatically updating the totalizer.

PROGRAM - This LED indicates that the unit is in the PROGRAM mode. In this mode, the unit is configured and the system parameters are set.

ALARM(Blinking) - This LED indicates that the END OF CYCLE has been reached.

DISPLAY

TOTALIZER - This LED indicates that the six digit display is showing the current totalizer value.

PRESET - This LED indicates that the six digit display is showing the preset value or the current countdown value of the preset.

CURRENT - This LED indicates that the six digit display is showing the actual amperage at the shunt.

UNITS

AMP-HOURS - This LED indicates that the value in the display is in AMP-HOURS.

AMP-MINS - This LED indicates that the value in the display is in AMP-MINUTES.

AMPS - This LED indicates that the value in the display is in AMPeres.

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KEYPAD

The eight keys marked DISPLAY,ALARM SILENCE, PROG, ENTER, UP, DOWN, START and STOP/RESET are used to operate and program the unit. All keys are accompanied by an audio 'click' to provide feedback to the operator when a key is depressed. The following is a listing of each of the keys and their functions:

DISPLAY - This key is used in the normal mode (NON-PROGRAMMING) to select what is in the display. The key will 'Scroll' through the three options: Totalizer, Preset and Amps.

ALARM SILENCE - This key is utilized to turn off the alarm audio at the completion of a cycle, but not reset the counter.

PROG - This key is used to put the system into the PROGRAM MODE and once in that mode, advance through the parameters.

Depressing the key once, will place the system into the PROGRAM mode. (Note: If Access Code protection is selected, an additional step is required - see Access Code). Depressing the key after entering the PROGRAM mode will allow the user to scroll through the PROGRAM parameters. To exit the PROGRAM mode, the ENTER key is depressed.

ENTER - This key is utilized to exit the PROGRAM mode. If any parameters were modified while in the PROGRAM mode, the depression of this key also initiates an AUTO SAVE sequence. This causes the parameters to be written into the EEPROM. This is a permanent 10 Year Minimum Life memory that does not require battery backup.

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

DOWN - In the PROGRAM mode, depressing the DOWN key will cause the display to decrease. Depressing the key once and releasing will allows 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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START - This is a multifunction key. Its function varies with the current system mode:

STANDBY - In the STANDBY mode, this key is utilized to start the cycle.

CYCLE ACTIVE - This key is ignored.

CYCLE HOLD - If the system is currently in the CYCLE HOLD mode, a single depression of this key will cause the cycle to "continue" from where it was halted.

CYCLE DONE - This key is ignored.

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

CYCLE ACTIVE - If the current cycle is active, but not complete, one depression of this key will stop the countdown process. It will, in essence, place the system into a 'CYCLE HOLD' mode from which it may either be reset or continued.

CYCLE HOLD - If the system is currently in the CYCLE HOLD mode, a single depression of this key will "cancel" the cycle and reset for the next run.

CYCLE DONE - If the cycle has been completed, a single depression of this key will reset the display in preparation for the next cycle.

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PROGRAM

The controller may be configured to implement a variety of control and monitoring functions. The PROGRAM 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 PROGRAM mode. The code will alternately flash with the selected value to indicate to the user the parameter that is currently being viewed or set.

The UP and DOWN keys are used to increment or decrement the specific values. Note: these values are permanently saved in the system EEPROM memory when exiting this mode.

CODE	DESCRIPTION	SETTING RANGE
PC	PRESET COUNT	(RESTRICTED TO PRESET RANGE)
PR	PRESET RANGE	(1) .00 TO 999.99 AMP-MIN
		(2) .0 TO 9999.9 AMP-MIN
		(3) 0 TO 99999 AMP-MIN
		(4) .000 TO 99.999 AMP-HOUR
		(5) .00 TO 999.99 AMP-HOUR
		(6) .0 TO 9999.9 AMP-HOUR
		(7) 0 TO 99999 AMP-HOUR
AR	AMPERAGE INPUT RANGE	0.0 TO 20,000 AMPS
AS	AUTO START	YES/NO
OC	OVERCOUNT	YES/NO
RL1	RELAY LOGIC RELAY 1	0 TO 8 (see RL CODE)
RL2	RELAY LOGIC RELAY 2	0 TO 8 (see RL CODE)
RT1	RELAY #1-MOMENTARY TIMEOUT	0.0 TO 999.9 SECONDS
RT2	RELAY #2-MOMENTARY TIMEOUT	0.0 TO 999.9 SECONDS
AC	ACCESS CODE	0 TO 9999

The relay logic parameters utilize the selection of a code that varies from 0 to 8 to define the specific action of the output. The Relay Logic controls the output of the two relays.

The following codes are utilized in the assignment:

RL CODE	DESCRIPTION
0	Relay Off
1	Manual: Start - Momentary
2	Manual: Start - Latching
3	Manual: Completion - Momentary
4	Manual: Completion - Latching
5	Automatic: Start - Momentary
6	Automatic: Start - Latching
7	Automatic: Completion - Momentary
8	Automatic: Completion - Latching

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The relays may be programmed to either respond in the MANUAL or AUTOMATIC modes only and respond as either MOMENTARY outputs for the period programmed into the RT parameter or as LATCHING outputs that will remain active until either the completion of the cycle or until the RESET key is depressed.

********** **ACCESS CODE** **********

In some cases it may be desirable to restrict the access to the Program function. 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 Access 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, any attempt to use the PROG key to gain access to the 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 PROG key entry is then required. Any other entry, the wrong code number, or no action for 30 seconds will return the unit to the normal operating mode.

********** **QUICKSET** **********

If Access Code protection is selected, a special QUICKSET feature is available for setting the 'PC' (Preset Count) parameter without utilizing an Access Code. Simply depressing the 'PROG' key twice will allow immediate access to the 'PC' (Preset Count) parameter.

********** **SHUNT TYPE** **********

The system is capable of handling three different shunts (50 mv., 100 mv. and 200 mv.) There are three different terminals on the back of the controllers for wiring the various shunts. The internal circuitry handles converting these various values into the appropriate internal signals. No additional settings or switches are necessary in selecting the shunt type.

NOTE: It is critical that the 'AR' (Amperage Input Range) be correctly matched to the selected shunt. This setting is to be the amperage for the selected shunt at its rated voltage. (e.g. 50 mv @ 100 amps)

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********** **PR SETTINGS** **********

The 'PR' (Preset Range) setting is a SETUP parameter for the system. It should be set once and not changed, since it determines the value of the units used in the Totalizer. Changing this after values are accumulated in the Totalizer will cause those values to be reassigned units based on the current 'PR' setting.

********** **OC SETTINGS** **********

The 'OC' (Overcount) setting is utilized to configure this system, so that it will continue to count AMP/TIME after it has reached zero. This feature allows an operator to know how much over plating has occurred, if the system is configured for a manual shutdown. The 'Overcount' value will appear in the display alternately flashing with 'DONE'. The value will be indicated as a negative to alert the operator to the fact that this is an 'Overcount' condition.

The totalizer will continue to run just as it does for all normal current inputs.

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OPERATION

The unit has two primary functions. The first function is to track Amp-Hours or Amp-Minutes in a countdown configuration as a plating process is active. When the preset value is counted down to zero, an audio alarm is activated. During the cycle, the relays respond in accordance with the settings in the 'RL1' and 'RL2' parameters.

The second function of the unit is as a TOTALIZER. It tracks the Amp-Hours or Amp-Minutes that the system has seen and maintains an on running total in the EEPROM memory.

The unit is capable of operating in a wide variety of applications due to the programming parameters that are available. The unit will operate on either 120 or 240 VAC. The voltage is selectable via the wiring on the back panel.

It will operate with one of three SHUNTS (50 mv, 100 mv or 200 mv). The selected SHUNT is wired directly to the appropriate connections on the terminal block.

The amperage associated with the SHUNTS is adjustable from 0.0 to 20,000 amps. This value is digitally selected with the 'AR' (Amperage Range) parameter.

The display and setting range for the unit is selected from one of the seven standard ranges utilizing the 'PR' (Preset Range) parameter. The following is a tabulation of those ranges:

	PRESET COUNTER RANGE		TOTALIZER LIMIT	
(1)	.00 TO 999.99	AMP-MIN	9999.99	AMP-MIN
(2)	.0 TO 9999.9	AMP-MIN	99999.9	AMP-MIN
(3)	0 TO 99999	AMP-MIN	999999	AMP-MIN
(4)	.000 TO 99.999	AMP-HOUR	999.999	AMP-HR
(5)	.00 TO 999.99	AMP HOUR	9999.99	AMP-HR
(6)	.0 TO 9999.9	AMP HOUR	99999.9	AMP-HR
(7)	0 TO 99999	AMP-HOUR	999999	AMP-HR

Once a range has been selected, the appropriate decimal point and LEDS will illuminate for the selection of the Preset Count (PC). This same range will, of course, also be utilized for all display purposes during normal operation.

The system operates on a .01 minute (.6 second) time base. Regardless of the range, it updates the internal registers and display every .01 minutes (.6 seconds).

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The system has two basic modes of operation: MANUAL and AUTOMATIC.

MANUAL MODE - If AUTO STARTUP (AS) is set to 'NO', the unit is in the MANUAL MODE. In this mode, the START key is utilized to initiate a cycle. When the START key is depressed, any relay action that is programmed will take place and the display will begin counting down the preselected AMP-HOUR or AMP-MINUTE value. Once this value has counted down to zero, the AUDIO ALARM will sound and any pre-selected relay action will take place.

Either the ALARM SILENCE or RESET key may be utilized to terminate the AUDIO. The ALARM SILENCE key will only terminate the AUDIO, while the RESET key will terminate the AUDIO and RESET the display to the pre-selected count in preparation for the next cycle.

AUTOMATIC MODE - If the AS (AUTO STARTUP) parameter is set to 'YES', the system is in the AUTOMATIC mode. In this mode, the countdown of the PRESET VALUE is initiated by the flow of current through the SHUNT. Once this is detected, the system automatically begins the countdown process and any pre-selected relay action takes place.

Once the pre-selected value has been counted down to zero, again, the alarm will sound. At this point, either the ALARM SILENCE, RESET or REMOTE RESET will terminate the audio and cause the appropriate relay action to take place.

The ALARM SILENCE key will only terminate the AUDIO, while the RESET key and REMOTE RESET will terminate the AUDIO and reset the display to the PRESET value.

RELAY LOGIC - The 'RL' (Relay Logic) parameter in the programming stack allow the assignment of specific characteristics to each of the two output relays. Each of the relays is programmable independent of the other, thus providing a wide variety of applications capabilities.

The selection of the appropriate RELAY LOGIC parameter allows the relay to either be turned off or assigned a MOMENTARY or LATCHING function. In the MOMENTARY mode, when the designated time occurs, the relay will become active for a period of time as programmed in the 'RT' (Relay Timeout) parameter. In the LATCHING modes, the relay will be activated by the appropriate event/time and will be deactivated by a second event/time.

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The relays are activated and/or deactivated either at the beginning or the end of a cycle. When the cycle is started, either MANUALLY or AUTOMATICALLY, and a relay is selected to respond to this, the appropriate closures occur. If these closures are MOMENTARY, they will then be terminated at the appropriate time. If these closures are LATCHING, they will terminate when the count reaches zero.

If the relay action is to take place at the completion of the cycle, and the relay is MOMENTARY, it will be activated when the count reaches zero for the time programmed into the RT parameter. If the relay is LATCHING, it will activate when the count reaches zero and will remain active until reset by either the RESET key or REMOTE RESET.

TOTALIZER - The TOTALIZER continuously accumulates the AMP-HOURS or AMP-MINUTES that the unit has seen during the CYCLE ACTIVE modes.

This value is stored in the EEPROM memory and may only be reset by a special factory procedure.

SHUNT RANGE - The 'AR' (Amperage Input Range) parameter sets the current rating for the specific SHUNT that is attached to the system. Hence, if a 1000 amp, 50 millivolt SHUNT is utilized, the 'AR' parameter is set to 1000 and the 50 millivolt SHUNT is attached to the appropriate terminals.

It is recommended that the system be operated, such that the current through the SHUNT always be within the SHUNT manufacturer's limitations. However, the control is capable of monitoring the output from the 50 millivolt shunt up to double its scale. Thus, in the example sited above, the unit will continue to read the 50 millivolt SHUNT input up to a full 100 millivolts. This will indicate on the display up to a full 2000 amps.

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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 700.

A special code has been incorporated into the software to reset the TOTALIZER. This code is 7777.

The totalizer is reset in the flashing mode asking for the code (flashes "CODE" then "00"). This means that there has to be an access code other than 00 for the unit to ask for the code. A sample procedure follows:

- Unit has to be ready or hold mode (active light off or flashing).
- Push program switch.
- Unit asks for code flashing "CODE" then "00".
- Advance the code to 7777 using the △ ▽ keys.
- Push program switch (not enter).
- Push "ENTER".
- Will clear totalizer.
- Program code remains the same.

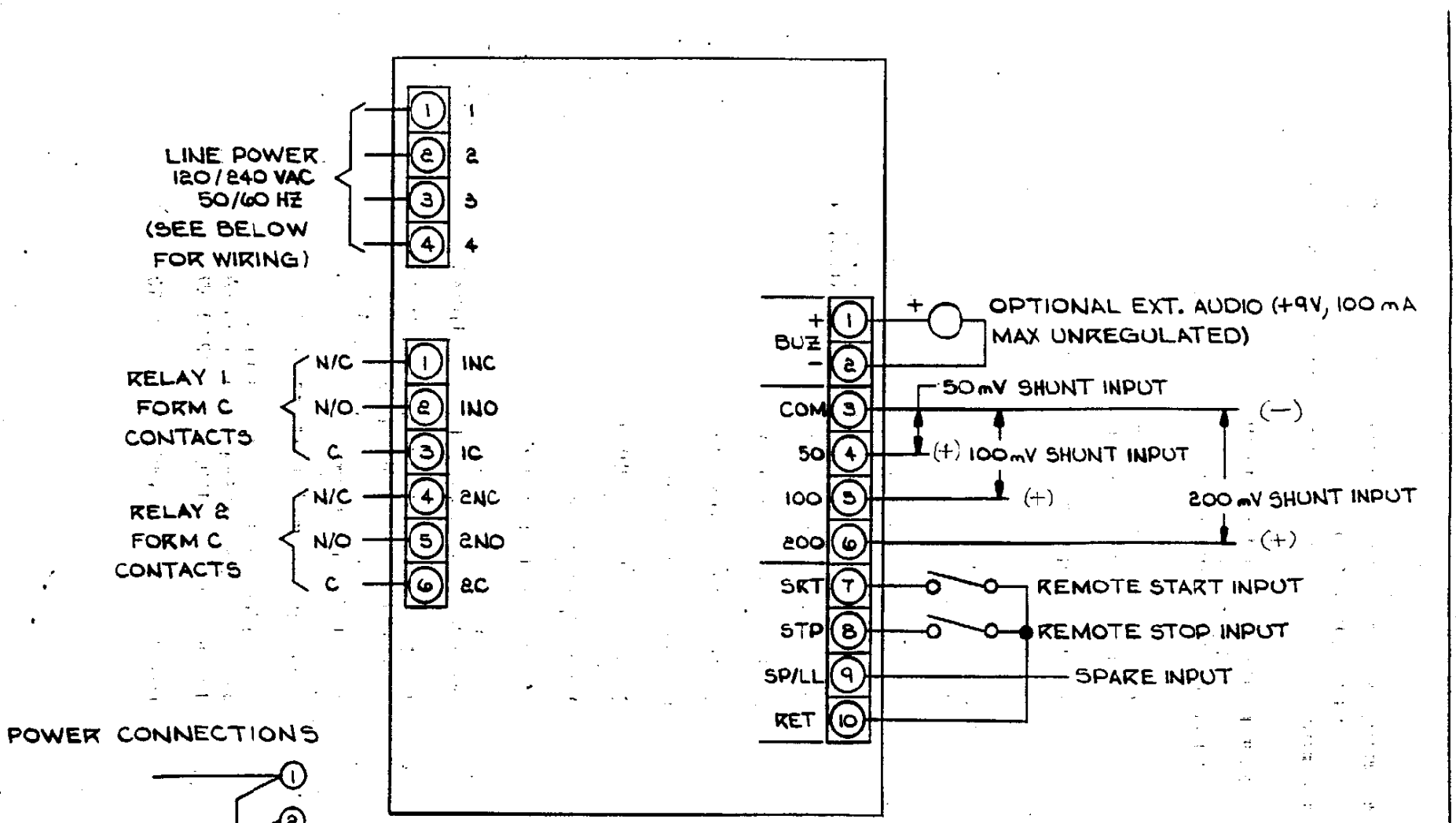
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SPECIFICATIONS

HBS EQUIPMENT CORPORATION
MODEL 700
DIGITAL AMP/TIME METER

RANGE	.01 - 9999 AMP-MINUTES .001 - 9999 AMP-HOURS
RESOLUTION	.01 AMP-MINUTES/.001 AMP-HOURS
ACCURACY	.1% FS
NOISE REJECTION	NMR - 60 db @ 60 HZ CMR -120 db @ 60 HZ
MEASURING TIME	4 Conversions/Sec
DISPLAY	Six 0.56 Inch High, Seven Segment, LED Uniplanar numerals. Nine Discrete LEDs (Red, Green, Amber).
ANNUNCIATOR	Audio Tone, ~ 2500 HZ
SETUP MEMORY	EEPROM, All Parameters
MEMORY RETENTION	10 Years w/o Power
SHUNT TYPES	50 mv, 100 mv, 200 mv
OPERATING RANGE	0 to 50 Degrees C
STORAGE RANGE	-40 to 60 Degrees C
CONSTRUCTION	Face Panel - Kydex. Faceplate - Lexan, Back Printed
SIZE	6.14 x 4.41 x 3.94 inches (HxWxD) 156 x 112 x 100 mm (HxWxD)
WEIGHT	≤ 2 Lbs. (1.8 kg).
CONNECTION	Rear, Screw Terminal Block
OUTPUT	External Audio - OTC, 100 ma. max. Relay - Two optically isolated, 5 amp., Form C (N/O-C-N/C), 120/240 VAC
POWER	10 VA, 120/240 VAC ±10%, 50/60 HZ

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NOTE: WE RECOMMEND THE USE OF A QUENCH ARC ON EVERY MECHANICAL RELAY AND SOLENOID IN THE SYSTEM. USE PAKTRON P/N 104M06QC100 OR EQUIVALENT.

TOLERANCES UNLESS OTHERWISE SPECIFIED:

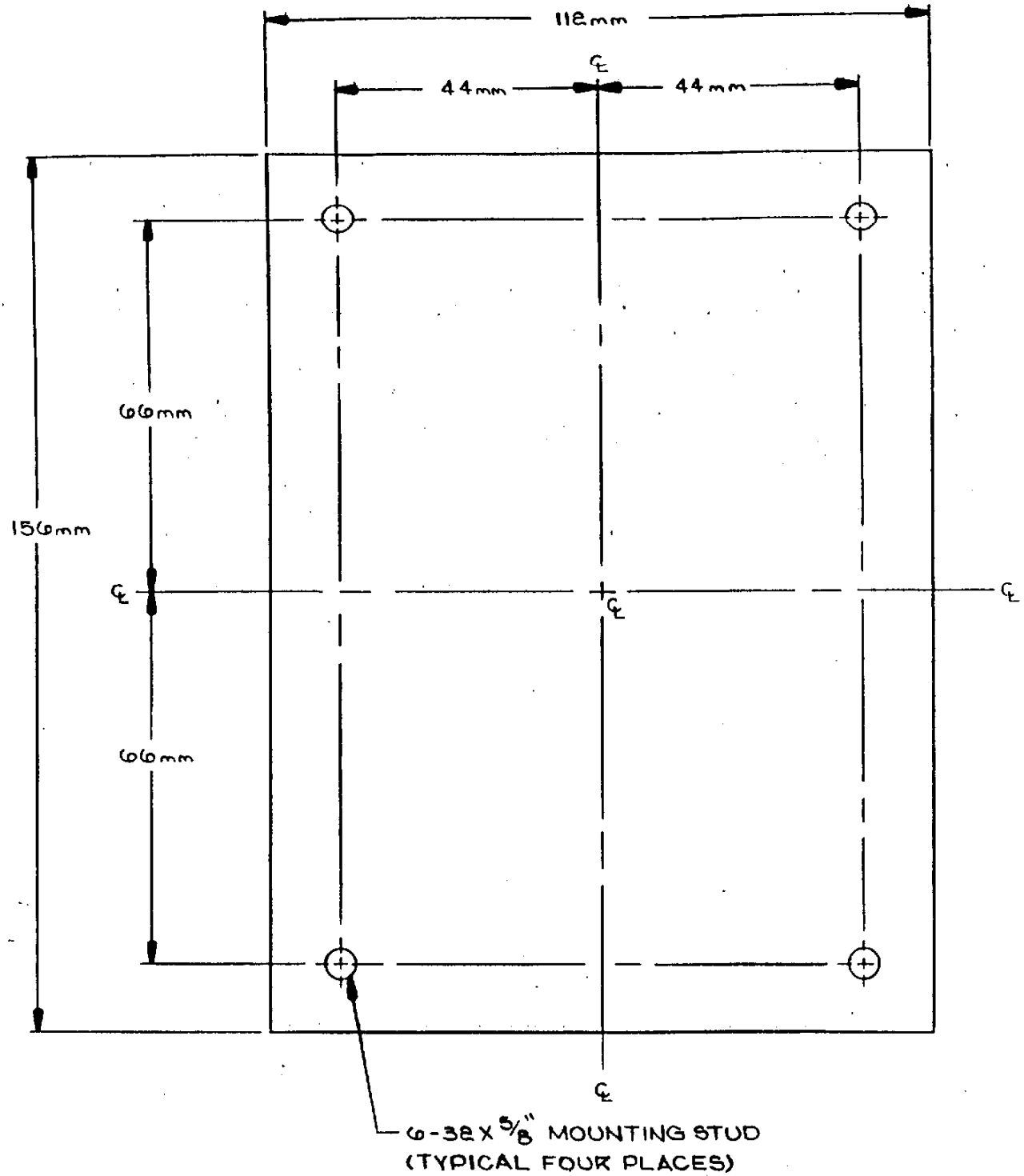
ALL DIMENSIONS ARE IN INCHES

HBS

DIGITAL AMP/TIME METER WIRING DIAGRAM

APPROVAL		DWN BY	DATE	SCALE	CHKD BY	
ENG / DATE		MPJ	1/21/93	~		
QA / DATE		SHEET 1 OF 1	12	070002	10	03

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TOLERANCES UNLESS OTHERWISE SPECIFIED:

ALL DIMENSIONS ARE IN INCHES

HBS DIGITAL AMP/TIME METER MOUNTING HOLE LOCATIONS

APPROVAL		DWN BY	DATE	SCALE	CHKD BY	
ENG	DATE	MPJ	3/21/94	~		
QA	DATE	SHEET 1 OF 1	49	070006	10	01

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