MC3
Master Clock

User's Manual

Rev.J

National
Time & Signal

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Introduction

The MC3 Master Clock is a cost effective yet powerful master clock. The MC3 comes standard with three solid state 120VAC outputs to directly control clock circuits without the need for additional relays. These solid state outputs are capable of driving up to 3 amps each (7 amps combined) and incorporate zero-cross technology to handle undesirable current surges and inrush.

The MC3 uses the power-line frequency to keep accurate time eliminating the inaccuracies of crystal oscillators found in other products. The MC3 can be equipped with a GPS antenna (order separately as MC3-GPS) to keep time with the National Institute of Standards and Technology NIST satellite time base accurate to one second over a million years. The web enabled version (WeMC3) can be ordered providing PC browser based configuration and programming as well as NIST or computer network time synchronization.

The MC3 and secondary clocks combine to create a maintenance-free time system automatically synchronizing the clocks and adjusting for daylight savings and power outages. When there is a power loss, the MC3 can keep time internally for over 150 days without the need for batteries or expensive rechargeable battery packs.

The MC3 can correct the complete line of National Time & Signal clocks as well as synchronous clock systems by other manufacturers. The MC3 can even transmit National's On-demand Instant Reset over the existing clock system wiring without affecting the existing clocks.

The MC3 will also synchronize time with a sound system, paging system, phone system, media retrieval system or an existing master clock which can provide a synchronizing output. This universal system synchronization is easy with an optically isolated input capable of receiving synchronization pulses of 17-132VAC from other sources. The synchronization pulses can be a simple contact closure at 12:00 or one of many common clock reset formats using National's Automatic Protocol Detection algorithm. A serial port is also available to communicate time information with other equipment. (Consult Factory for details)

Wiring Connections

120VAC Power

The MC3 Master Clock is powered from a standard 120VAC 50 or 60 Hz power source. This connection supplies the power to run the MC3 as well as the clock circuit outputs. Refer to the Specifications section for power requirements.
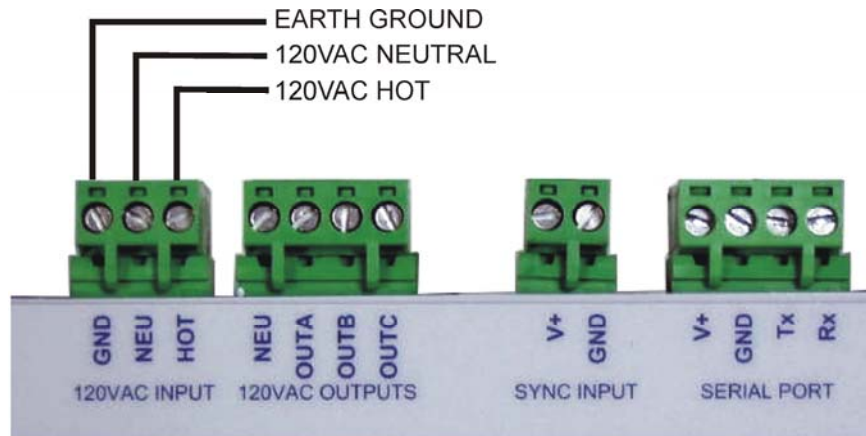

Figure 1: 120VAC Power Connections

Clock Circuit Connections

The MC3 outputs are solid-state 120VAC outputs with built-in surge and inrush protection using zero-cross sensing. Each output can drive 3 Amps of clocks up to a total of 7 Amps across all outputs. The connector includes an AC Neutral terminal to simplify wiring connections. Clock circuit 1 has two outputs used for 2-wire or 3-wire clock circuits, while clock circuit 2 has one output used for 2-wire clock circuits. National's EX series synchronous clocks are an example of a 3-wire clock system while the On-Demand Instant Reset D/DX Digital and RD2WS clocks are an example of a 2-wire system.

Clock Circuit 1

The function of outputs A and B are defined by the circuit 1 clock type selection. For 3-wire synchronous clock types, typically output A will control the motor (or RUN) power while output B controls the solenoid (or RESET) power. See Figure 1.

For low voltage clock systems, the 120V outputs are used to control a 24VAC power transformer such as National's PS-3, PS-6 and PS-12 class 2 power-limited supplies.
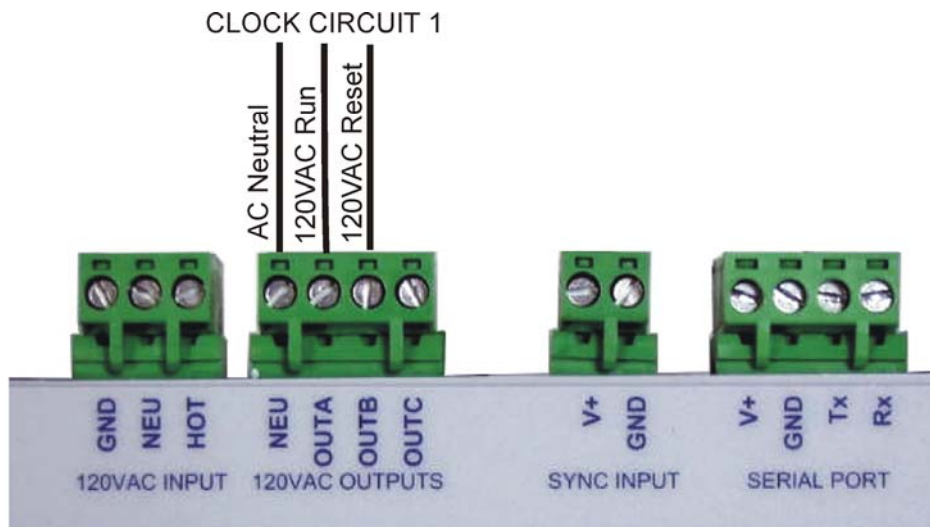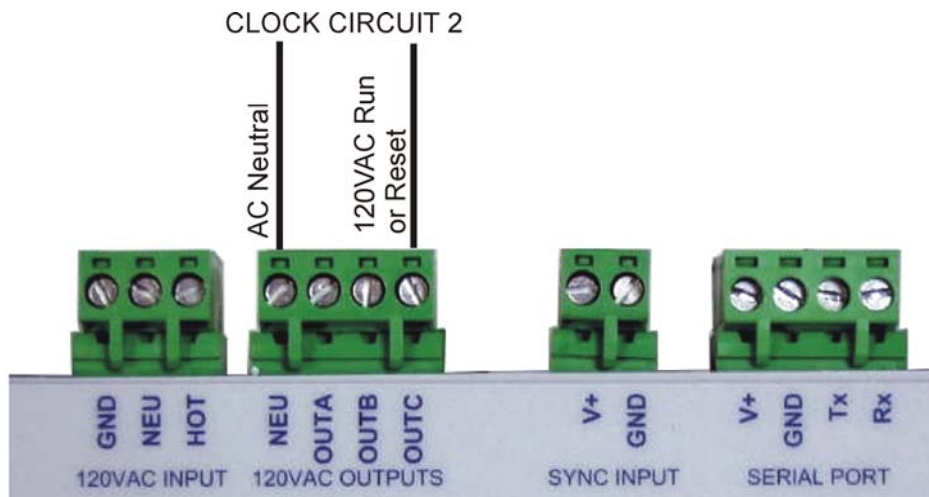

Figure 2: Clock Circuit 1 Connections

For a 2-wire clock system, only output A is used. The clock power and time data information utilize the same wiring. Depending upon model, low voltage secondary clocks may require a PS-3 power supply or a transformer at each clock (sold separately).

Clock Circuit 2

Circuit 2 has one 120VAC solid state output denoted OUTC. The function (RUN or RESET) of output C is determined by the settings of clock circuit 2. Clock circuit 2 can control a 2-wire clock system such as National Time's On-demand Instant Reset D/DX series digitals and/or RD2WS rotary drive or it may be used as a RESET output for a conventional synchronous clock circuit. If used as a RESET output, the RUN power to the clock circuit is wired directly to a constant (and fused) 120VAC source and is not controlled by the MC3.

Figure 3: Clock Circuit 2 Connections

Output Circuit Fuse

The three outputs of the MC3 are protected by a common fuse. If there is an over current condition on any of the three outputs, the fuse will blow causing all of the outputs to be disabled. The fuse is accessible by removing the MC3 main housing from the wall mounting plate. The fuse is located in the fuse holder shown in the figure. See specifications section for fuse rating.
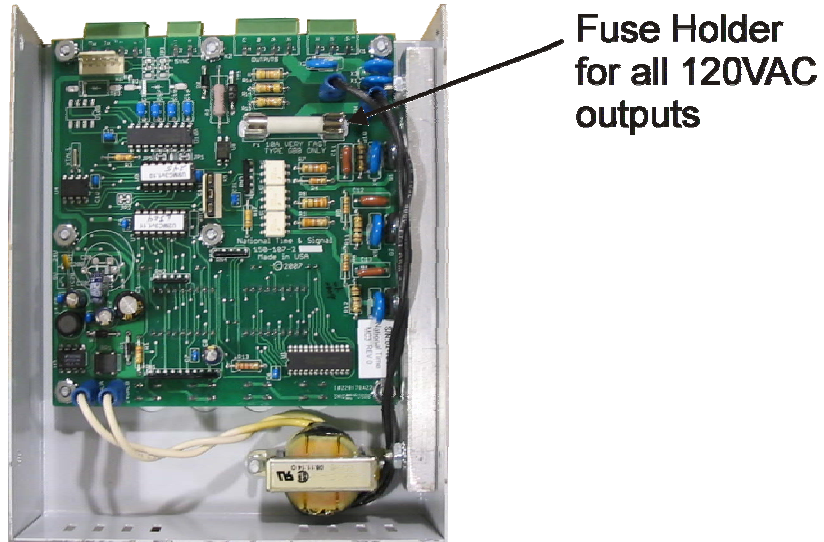
Figure 4: Output Fuse Location

Existing Time System Synchronization

The MC3 is capable of synchronizing the time with an existing clock or sound system. The optically isolated input can automatically decipher the clock reset protocol of other systems and automatically update the time display. This is a convenient way to achieve National's superior Instant Reset time protocol with existing systems. This connection is only required if it is necessary to synchronize the time of the MC3 with an existing system. Compatible formats include: National Time synchronous, Simplex synchronous, Faraday synchronous, Standard synchronous, and others or a simple 12:00 pulse. See Appendix D - Synchronization Input.
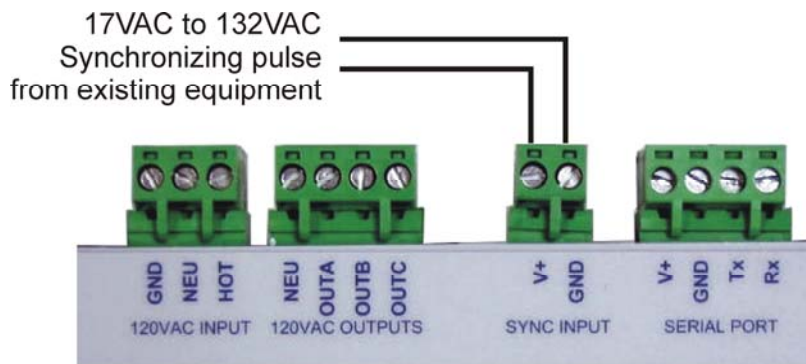
Figure 5: Synchronizing Input (Optional)

GPS Antenna

(Ordered separately as MC3-GPS) With the addition of a GPS antenna, the MC3 will receive time information from the Global Positioning Satellite network. The MC3 will automatically update its time display to atomic time base maintained by the National Institute of Standards and Technology (NIST). The standard outdoor mounting requires a 1" x 14 TPI pole (by others). An optional window mounting kit is available.

The GPS antenna comes standard with a 30' cable. Cable length may be extended to 100' with 4 conductor shielded low capacitance cable. For further distances up to 4000', RS232 to RS485 converters may be used (Telebyte 253T or equivalent).

The GPS cable connects to the Serial Input of the MC3 as shown in Figure 6. All unused wires of the GPS cable should be insulated from each other and grounded metal.

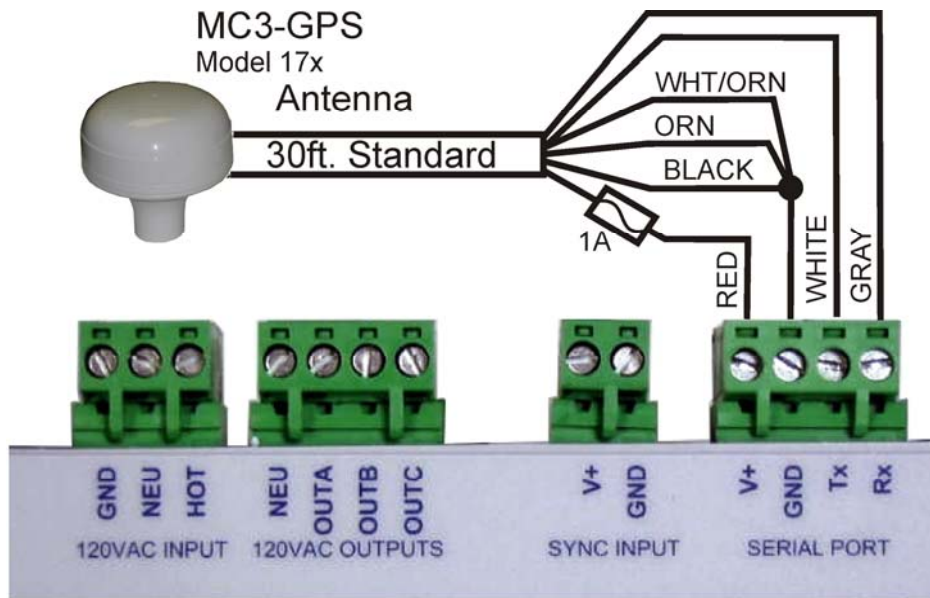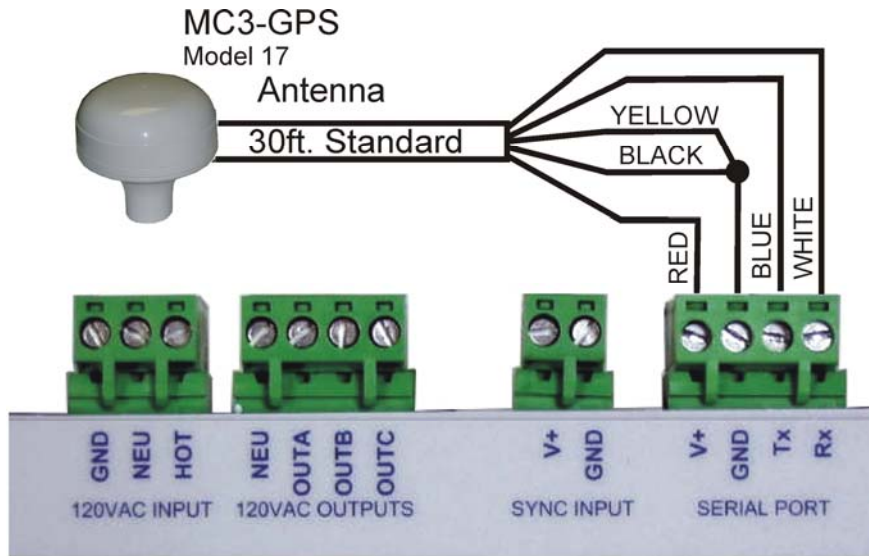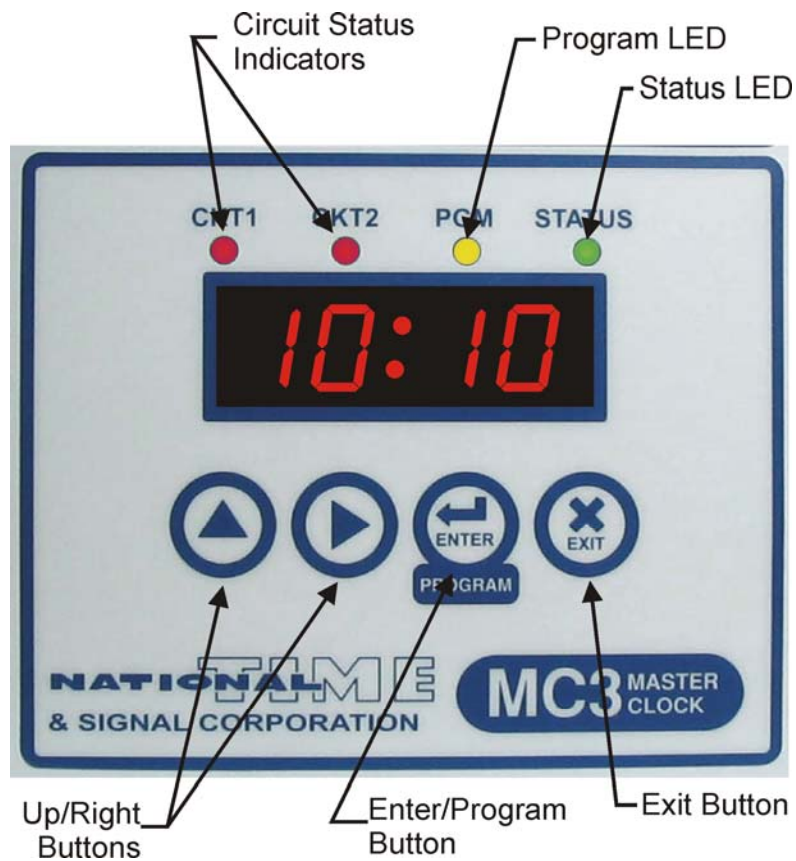The Serial Input must be programmed for "GP" in the Tech Menu.

MC3-GPS
Model 17
Antenna
30ft. Standard
YELLOW
BLACK
RED
BLUE
WHITE

GND NEU HOT
120VAC INPUT

NEU OUTA OUTB OUTC
120VAC OUTPUTS

V+ GND
SYNC INPUT

V+ GND Tx Rx
SERIAL PORT

MC3-GPS
Model 17x
Antenna
30ft. Standard
WHT/ORN
ORN
BLACK
1A
RED
WHITE
GRAY

GND NEU HOT
120VAC INPUT

NEU OUTA OUTB OUTC
120VAC OUTPUTS

V+ GND
SYNC INPUT

V+ GND Tx Rx
SERIAL PORT

Figure 6: GPS Connections

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Front Panel

Figure 7: Front Panel

Circuit Indicator LEDs

The CKT1 and CKT2 LEDs will indicate the status of the respective circuit. The meaning of the LED state is as follows:

ON Steady: The circuit is ON and will perform the automatic reset functions.

Blinking: The circuit is performing an automatic reset function. Could be the On-Demand Instant Reset or synchronous hourly/12-hr resets are in progress.

OFF: The circuit has been turned OFF manually. The clocks will be stopped and no automatic resets will occur.

Program LED

The Program LED will illuminate when the MC3 is in any programming menu such as setting the time and

date or selecting circuit functions. During normal operation, this LED is OFF.

Status LED

The Status LED will indicate the status of the GPS antenna.

On Steady: The GPS antenna is communicating properly and time is synchronized with NIST atomic time.

Blinking: The GPS antenna is communicating with the MC3 but there is no time information available. This would occur if the GPS antenna is not receiving from at least 3 satellites. Make sure the GPS antenna has an unobstructed view of the sky.

OFF: The MC3 is not configured to use a GPS antenna or there is no communication with the GPS antenna. Check wire connections.

Up/Right Buttons

These buttons are used to navigate through the setting menus and to select desired values.

Enter/Program Button

This button is used to enter the various program menus of the MC3 as well as functioning as the Enter button for selecting appropriate values. The Program button will enter 4 levels of menus depending upon how long the button is held. See Programming the MC3 for details.

Exit Button

This button will return the MC3 to normal operation at any time. However, any values modified and followed with the Enter button will take effect.

Programming the MC3

Selecting Menus

The MC3 has 4 levels of menus that are accessed by pressing and holding the ENTER/PROGRAM button. The duration that the button is held determines which menu is activated. All menus must be accessed from the normal time display. If it is currently in a different menu, press EXIT first.
The menu structure is as follows:

Manual Control Menu:

Press PROGRAM once:

This menu is used to manually turn on or off the clock circuits or to activate a reset sequence. See the Manual Circuit Control section for details.

Set Time and Date Menu:

Press and Hold PROGRAM for 5 seconds:

When pressed and held for at least 5 seconds, the set time/date menu is entered. See the Setting Time and Date section for details.

Tech Menu:

Press and Hold PROGRAM for 10 seconds:

When pressed and held for at least 10 seconds, the technician level programming menu is entered. This menu selects installation specific operating parameters of the MC3. See the technician level programming section.

Factory Menu:

Press and Hold PROGRAM for 15 seconds:

Pressing and holding the button for 15 seconds will enter the factory menu. This menu allows alteration of the memory values to create custom clock reset protocols and are beyond the scope of this manual. Consult the factory for customization since changes to values in this menu may adversely affect clock operation.

Setting Time and Date

CKT1 CKT2 PGM STATUS **12:00**	(ENTER / PROGRAM button)	From the normal time display, Press and hold the PROGRAM button.
CKT1 CKT2 PGM STATUS **c 1:**	Hold 5sec.	The display will first enter the MANUAL CONTROL Menu, Keep holding until the display changes to the Set Time and Date Menu.
CKT1 CKT2 PGM STATUS **10:A**	(UP arrow) (ENTER)	Select the proper HOUR by pressing the UP arrow. Press Enter.
CKT1 CKT2 PGM STATUS **10:10**	(UP arrow) (ENTER)	Select the MINUTE by pressing the Up arrow. Press Enter when seconds are :00
CKT1 CKT2 PGM STATUS **n7: 3**	(UP arrow) (ENTER)	Select the MONTH by pressing the UP arrow. Press Enter.
CKT1 CKT2 PGM STATUS **dt:19**	(UP arrow) (ENTER)	Select the DATE using the UP arrow. Press Enter.
CKT1 CKT2 PGM STATUS **dy:05**	(UP arrow) (ENTER)	Select DAY of week using the UP arrow. 1:Sunday 2: Monday 3: Tuesday 4: Wednesday 5: Thursday 6: Friday 7: Saturday Press Enter.
CKT1 CKT2 PGM STATUS **yr:06**	(UP arrow) (ENTER)	Select the YEAR using the UP arrow. Press Enter.
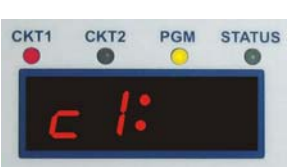
Pressing the EXIT button at any time will return to the MC3 to the main time display without continuing through all available settings.

Tech Menu

The technician menu is used to configure the clock
circuit and timekeeping functions of the MC3.
These functions would include:

        Clock types for circuits 1 and 2
        AC Power frequency (50/60Hz)
        Daylight Savings (enable/disable)
        Serial Port selections (GPS/LAN)
        Time Zone selection

Display	Button	Instruction
CKT1 CKT2 PGM STATUS — 12:00	(PROGRAM/ENTER button)	From the normal time display, Press and hold the PROGRAM button for **10 seconds**.
CKT1 CKT2 PGM STATUS — c 1:	Hold 5sec.	The display will first enter the MANUAL CONTROL Menu, Keep holding until the display changes to the Set Time and Date Menu.
CKT1 CKT2 PGM STATUS — 10:A	Hold 5sec. more	The display will enter the SET TIME and DATE MENU, Keep holding until the display changes to the TECH MENU (c1:xx).
CKT1 CKT2 PGM STATUS — c 1:02	(UP arrow) (ENTER)	Select the Clock Type for Circuit 1. See Appendix A for details. Press ENTER.
CKT1 CKT2 PGM STATUS — c2:00	(UP arrow) (ENTER)	Select the Clock Type for Circuit 2. See Appendix A for details. Press ENTER.
CKT1 CKT2 PGM STATUS — C4:60	(UP arrow) (ENTER)	Select 50Hz or 60Hz to reflect the 120VAC power frequency. Press Enter.

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	▲ 〔ENTER〕	Enable or Disable DAYLIGHT SAVINGS adjustments by selecting 'E' or 'd' respectively. Press Enter.
	▲ 〔ENTER〕	Select SERIAL PORT setting. nA=Not Applicable (none), GP=GPS Antenna, Ln=LAN Press Enter.
	▲ 〔ENTER〕	Select TIME ZONE using UP arrow. 05=-5 GMT (Eastern Time). See Appendix C for other time zones. Press Enter.

Manual Circuit Control

The manual circuit control menu is used to override the automatic operation of the MC3 or to manually correct the clocks should they differ from the time as shown on the MC3. The options available in the Manual Circuit Control Menu depend upon the circuit type selection. The menu selections and their functions for each circuit type are described in Appendix A - Circuit Types.

To enter the Manual Circuit Control Menu:

		From the normal time display, Press and release the PROGRAM button.
		Choose the desired circuit by pressing the UP arrow. When the desired circuit number is displayed, Press ENTER.
		The current ON or OFF status of the circuit is shown. Choose the desired function by pressing the UP arrow.
		The OFF selection will turn off the circuit and inhibit any automatic resets. If OFF is desired, press ENTER. Otherwise press UP arrow.
		The ON selection will turn ON the circuit and return the circuit to normal operation. IF ON is desired, press ENTER. Otherwise press UP arrow.
		The On-Demand Reset selection will turn the output ON and transmit time-data information to the RDS/D/DX clocks resetting them to the actual time. (Depends on circuit type selection.) If this is desired, press ENTER. Otherwise press UP arrow.

CKT1 CKT2 PGM STATUS r5:t	ENTER	The RESET selection will allow manual correction of the clock circuit. This will continuously advance the clocks at fast speed. When the clocks are at the desired location, enter the Manual Control Menu again and select ON to return to NORMAL operation. (Not available for all clock types.)
CKT1 CKT2 PGM STATUS HH:HH	ENTER	The HH:HH menu will allow you to enter a time location for certain types of clock circuits. Press ENTER. The clocks will stop allowing you to note their location.
CKT1 CKT2 PGM STATUS 10:50	▲ (UP)	Press the UP arrow to select the HOURS as shown on the secondary clock.
	▶ (RIGHT)	Press RIGHT arrow.
CKT1 CKT2 PGM STATUS 9:50	▲ (UP)	Press the UP arrow to select the MINUTES as shown on the secondary clock.
	▶ (RIGHT)	Press RIGHT arrow.
CKT1 CKT2 PGM STATUS Sc:15	▲ (UP)	Press the UP arrow to select the SECONDS as shown on the secondary clock. (Does not apply for impulse type clocks)
	ENTER	Press ENTER. The clocks will begin advancing to the correct time then return to NORMAL automatically.

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Appendix A - Circuit Types

The type for circuits 1 and 2 are configured in the TECH MENU. Circuits 1 and 2 can simultaneously control clocks of different types.
Additional circuit types and custom operation can be created by modifying memory values in the FACTORY Menu. Contact Factory for details.

00-Disabled

When selected as disabled, the output will be OFF and no automatic resets will be transmitted.
Circuit 1 programmed Disabled:
OUTA and OUTB will be turned OFF and disabled.

Circuit 2 programmed as Disabled:
OUTC will be turned OFF and disabled.

01-Auxiliary

Used when it is desired to activate bells, chimes, tones etc. at scheduled times.
NOTE - This output can be utilized for custom carillon or bell strikes for clock towers etc. Consult factory for field changes to memory locations of the FACTORY Menu.
The web-browser user interface for event programming is only available in the WeMC3.

02-On Demand Instant Reset Clocks

This selection will control National's Rotary Drive analog clocks (RD2WS/RD3WS Series) as well as National's digital clocks (D/DX/DU Series). Power to the clocks and time data share the same wires and provide instant resets to the exact time of day. When using circuit 1, OUTB will output National's EX Series (SRAX) reset protocol so they may share the same circuit.

Operation:
Circuit 1 programmed as Type 02
OUTA: Will provide 'RUN' power to clocks and transmit Instant Reset time data upon power-up,

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during daylight savings correction and each 12:00am.

OUTB: Will output 25 second hour reset pulse each xx:00:00. Will also output 25 minute 12-hour reset pulse each 6:00:00.

Circuit 1 Manual Control: (Refer to Manual Control Menu for details)

OFF: Will turn off power to OUTA and inhibit pulses on OUTB.

ON: Will turn ON power to OUTA and enable pulses on OUTB.

On-d: Will transmit On-Demand Instant Reset time data on OUTA to reset all clocks to correct time.

Circuit 2 programmed as Type 02

OUTC: Will provide 'RUN' power to clocks and transmit Instant Reset time data upon power-up, during daylight savings correction, each 12:00am.

Circuit 2 Manual Control:

OFF: Will turn off power to OUTC.

ON: Will turn ON power to OUTC.

On-d: Will transmit On-Demand Instant Reset time data on OUTC to reset all clocks to correct time.

Resetting On-Demand Instant Reset Clocks

The On-Demand Instant Reset time data is automatically transmitted following power outages, daylight savings adjustments, and each midnight. If it is desirable to transmit the time data at other times, follow these steps:

		From the normal time display, Press and release the PROGRAM button.
	 	Choose the desired Circuit by pressing the RIGHT Arrow button. Press ENTER

		Press the UP Arrow until the On-d Menu is displayed.
CKT1 CKT2 PGM STATUS `On:-d`	▲ ↵	Then press ENTER. The clocks will reset to the time of day.

03-National EX Series Synchronous Clocks

This selection will control National's EX Series (SRAX) synchronous clocks.

Operation:
Circuit 1 programmed as Type 03
OUTA: Will provide 'RUN' power to clocks. Will provide drift compensation each hour at each xx:59:00 by removing power for 1 second.
OUTB: Will output 25 second hour reset pulse each xx:00:00. Will also output 25 minute 12-hour reset pulse each 6:00:00.

Circuit 1 Manual Control: (Refer to Manual Control Menu for details)
    OFF: Will turn off power to OUTA and inhibit all pulses on OUTB.
    ON: Will turn ON power to OUTA and enable pulses on OUTB.

Circuit 2 programmed as Type 03
OUTC: Will output 25 second hour reset pulse each xx:00:00. Will also output 25 minute 12-hour reset pulse each 6:00:00.

Circuit 2 Manual Control: (Refer to Manual Control Menu for details)
    OFF: Will inhibit all pulses on OUTC.
    ON: Will enable pulses on OUTC.

04-National 10x Correction MR Series

Type 04: This clock type will correct National's MR series outdoor clocks with 10 times correction speed (i.e. 2MR, 3MR, HMR, 4MR, 7MR etc.). The clocks will be automatically corrected for power outages as well as daylight savings corrections. There is also an automated manual correction menu to quickly synchronize the clocks to the correct time.

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Operation:
Circuit 1 programmed as type 04
To select type 04 for circuit 2 requires that circuit 1 also be programmed for type 04. Therefore, circuit 1 must be used to control a single clock.

OUTA: Will be energized whenever the clock is in the NORMAL timekeeping mode.

OUTB: Will be energized whenever the clock is in RESET mode advancing at 10 time rate of speed. Depending upon the model of the clock, this may either be a separate 10 times speed motor or reversing the direction of the main drive motor which will advance the hands at a 10 times rate.

Circuit 1 Manual Control: (Refer to Manual Control Menu for details)

OFF: Will remove power from OUTA and inhibit any resets on OUTB (and OUTC if circuit 2 is programmed as type 04).

ON: Will turn on OUTA to return circuit 1 and 2 clocks to normal speed and enable any automatic resets on both circuits.

HH:HH: Will turn off power to OUTA and allow the user to enter the position of the clocks. This will advance the clocks to the actual time and return the circuits to normal operation.

Circuit 2 programmed as type 04
To use circuit 2 as type 04 requires that circuit 1 is also used. The clock of circuit 2 shares the RUN power of OUTA. When either clock is being advanced at fast speed, the other clock is either also in fast speed or OFF. This is only mentioned for troubleshooting purposes and is handled automatically by the MC3.

Circuit 2 Manual Control: (Refer to Manual Control Menu for details)

HH:HH: Will turn off power to OUTA (both clocks will stop) and allow the user to enter the position of the clock on circuit 2. This will advance the clocks to the actual time and return the circuits to normal operation.

Manual Correction of 10x Clocks

First, make sure the time and date is set correctly on the MC3 by following the Set Time and Date section of this manual.

CKT1 CKT2 PGM STATUS `12:00`	(ENTER/PROGRAM button)	From the normal time display, Press and release the PROGRAM button.
CKT1 CKT2 PGM STATUS `c 1:`	(ENTER button)	Choose Circuit 1 by pressing the ENTER button.
CKT1 CKT2 PGM STATUS `HH:HH`	(UP Arrow) (ENTER button)	Press the UP Arrow until the HH:HH Menu is displayed. Then press ENTER. The clocks will stop.
		Observe the position of the clocks on circuit 1 and circuit 2 in hours, minutes, and seconds (if it is not exactly on a minute mark, estimate the number of seconds)
CKT1 CKT2 PGM STATUS `10:50`	(UP Arrow) (RIGHT Arrow)	Select the HOURS to match the position of Clock 1 using the UP Arrow. Then press RIGHT Arrow.
CKT1 CKT2 PGM STATUS `9:50`	(UP Arrow) (RIGHT Arrow)	Select the MINUTES to match the position of Clock 1 using the UP Arrow. Then press RIGHT Arrow.
CKT1 CKT2 PGM STATUS `Sc:15`	(UP Arrow)	Select the SECONDS to match the position of Clock 1 using the UP Arrow.
	(ENTER button)	Press ENTER. If only circuit 1 is programmed as type 04, the clock will automatically advance to the correct time. If there is a clock on circuit 2…
CKT1 CKT2 PGM STATUS `9:50`	(UP Arrow) (RIGHT Arrow)	Select the HOURS to match the position of Clock 2 using the UP Arrow. (The time of circuit 2 will default to the settings you selected for circuit 1) Then press RIGHT Arrow.
CKT1 CKT2 PGM STATUS `9:50`	(UP Arrow) (RIGHT Arrow)	Select the MINUTES to match the position of Clock 2 using the UP Arrow. Then press RIGHT Arrow.

	▲	Select the SECONDS to match the position of Clock 2 using the UP Arrow.
	↵	Press ENTER. The clock furthest behind will advance at 10x speed while the other remains off. When the two clocks are equal, they will both advance to the correct time and return to normal.

06-National 120V Resetting Minute Impulse

Type 06: This clock type will correct National's large outdoor minute impulse clocks. (i.e. 3MIR, 4MIR, HMIR etc.)

These clocks will reset hourly and 12 hourly as well as correct for power outages and daylight savings adjustments. Many clocks can share same wiring. Only Circuit 1 can be used for this type.

NOTE - The type 06 operation can be modified in the FACTORY Menu to be compatible with impulse systems by other manufacturers. Consult Factory for specific memory values.

Circuit 1 programmed as type 06
OUTA: Each minute,
xx:00:00 to xx:04:00 : pulse for 59 seconds (hour reset)
xx:05:00 to xx:59:00: pulse for 3 seconds
06:00:00 to 07:15:00 : pulse for 59 seconds (12 hour reset)

OUTB: Each minute,
xx:00:00 to xx:50:00 : pulse for 3 seconds
6:00:00 to 07:50:00 : pulse for 3 seconds

The clocks will also correct for power outages and daylight savings adjustments by advancing at an accelerated speed. During accelerated advancement, OUTA and OUTB will pulse for 3 seconds each 10 seconds.

Circuit 1 Manual Control: (Refer to Manual Control Menu for details)

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OFF: Will inhibit all pulses on OUTA and OUTB.

ON: Will enable automatic pulses on OUTA and OUTB.

HH:HH: Will allow the user to enter the position of the clocks (assuming they are all synchronized). This will advance the clocks to the actual time without waiting for the 12 hour reset period.

07- Synchronous Clocks by others

This selection will control synchronous clocks common to other manufacturers. Refer to Appendix B - Clock Types for specific models.

Operation:
Circuit 1 programmed as Type 07
OUTA: Will provide 'RUN' power to clocks.
OUTB: Will output an 8 second hour reset pulse each xx:57:54. Will also output a 14 second 12-hour reset pulse each 5:57:54.

Circuit 1 Manual Control: (Refer to Manual Control Menu for details)

OFF: Will turn off power to OUTA and inhibit all pulses on OUTB.

ON: Will turn ON power to OUTA and enable pulses on OUTB.

Circuit 2 programmed as Type 07
Power to run the clocks is provided by a direct connection to a 120VAC source. Refer to wiring diagrams for details.
OUTC: Will output an 8 second hour reset pulse each xx:57:54. Will also output a 14 second 12-hour reset pulse each 5:57:54.

Circuit 2 Manual Control: (Refer to Manual Control Menu for details)

OFF: Will inhibit all pulses on OUTC.

ON: Will enable pulses on OUTC.

08- Synchronous Clocks by others

This selection will control synchronous clocks common to other manufacturers. Refer to Appendix B - Clock Types for specific models.

Operation:
Circuit 1 programmed as Type 08
OUTA: Will provide 'RUN' power to clocks.
OUTB: Will output a 55 second hour reset pulse each xx:58:05. Will also output 95 second 12-hour reset pulses every other minute between 5:05:00 and 5:21:00.

Circuit 1 Manual Control: (Refer to Manual Control Menu for details)
> OFF: Will turn off power to OUTA and inhibit all pulses on OUTB.
> ON: Will turn ON power to OUTA and enable pulses on OUTB.

Circuit 2 programmed as Type 07
Power to run the clocks is provided by a direct connection to a 120VAC source. Refer to wiring diagrams for details.
OUTC: Will output a 55 second hour reset pulse each xx:58:05. Will also output 95 second 12-hour reset pulses every other minute between 5:05:00 and 5:21:00.

Circuit 2 Manual Control: (Refer to Manual Control Menu for details)
> OFF: Will inhibit all pulses on OUTC.
> ON: Will enable pulses on OUTC.

09- Digital Clocks

Not standard as shipped from factory. This type can be enabled by modifying memory locations. Consult factory.
This selection will control digital clocks common to other manufacturers. Refer to Appendix B - Clock Types for specific models.
For National Time D/DX/DU Series digital clocks, refer to Type 02 - On Demand Instant Reset Clocks.

Operation:
Circuit 1 programmed as Type 09
OUTA: Will provide 'RUN' power to clocks.
Each 12:00 midnight, power will be removed for 2 seconds causing clocks to reset to 12:00.
OUTB: No output.

Circuit 1 Manual Control: (Refer to Manual Control Menu for details)
> OFF: Will turn off OUTA.

ON: Will turn ON power to OUTA and enable pulses on OUTA.

Circuit 2 programmed as Type 09
OUTC: Will provide 'RUN' power to clocks.
Each 12:00 midnight, power will be removed for 2 seconds causing clocks to reset to 12:00.

Circuit 2 Manual Control: (Refer to Manual Control Menu for details)
OFF: Will turn off OUTC.
ON: Will turn ON power to OUTC and enable pulses on OUTC.

Note - If it is desirable to have an output that is normally OFF and pulses ON for 2 seconds at midnight, a simple change to the FACTORY Menu can be made. Consult Factory for details.

12-National 120V Minute Impulse

Type 12: This clock type will control National's large outdoor minute impulse clocks. (i.e. 3MI, 4MI, 7MI, 13MI, HMI etc.)
These clocks require a pulse each minute from the MC3. Only Circuit 1 can be used for this type.

NOTE - The type 12 pulse durations and correction speed can be modified in the FACTORY Menu to be compatible with impulse systems by other manufacturers. Consult Factory for specific memory values.

Circuit 1 programmed as type 12
OUTA: Continuous 120VAC output provided to MI clock. This steady 120VAC power is required at the clock for normal operation. When CKT1 is turned off, OUTA output turns off.

OUTB: Each minute, 120VAC pulse for 3 seconds.

The clocks will also correct for power outages and daylight savings adjustments by advancing at an accelerated speed.   During   accelerated advancement, OUTB will pulse for 3 seconds each 10 seconds.

Circuit 1 Manual Control: (Refer to Manual Control Menu for details)

OFF: OUTA will turn off, all pulses on OUTB will stop.

ON: Will enable automatic pulses on OUTB. OUTA steady 120VAC.

HH:HH: Will allow the user to enter the position of the clock. This will advance (or stop) the clock to the actual time.

See Manual Circuit Control section for instructions.

Appendix B - Clock Types

Secondary Clock Type	Circuit No.	Voltage	Type Code	Wiring Fig.
National Time RD2WS, D/DX Digital	1	120	02	1
National Time RD2WS, D/DX Digital	2	120	02	2
National Time RD2WS, D/DX Digital	1	24	02	3
National Time RD2WS, D/DX Digital	2	24	02	4
National Time EX (SRAX) Synchronous	1	120	03	5
National Time EX (SRAX) Synchronous	2	120	03	6
National Time EX (SRAX) Synchronous	1	24	03	7
National Time EX (SRAX) Synchronous	2	24	03	8
Combination EX and RD2WS, D/DX	1	120	02	9
Combination EX and RD2WS, D/DX	1	24	02	10
National Time 2MR (single clock)	1	120	04	11
National Time 2MR (two clocks)	1,2	120	04	12
National Time 3MR,HMR,4MR etc. (single)	1	120	04	13
National Time 3MR,HMR,4MR etc. (two)	1,2	120	04	14
National Time 120V Resetting Minute Impulse (3MIR, HMIR, 4MIR, 7MIR etc.)	1	120	06	16
Simplex 2310-92XX,57, 77,93-9,91-9,941-9,943-9	1,2	120	07	5,6

Secondary Clock Type	Circuit No.	Voltage	Type Code	Wiring Fig.
Series				
IBM 57,62,67,77,82 and 87 Series	1,2	120	07	5,6
Cincinnati D10 and D12	1,2	120	07	5,6
Lathem SS12 Types	1,2	120	07	5,6
Edwards 010 Synchronous, 2400 Series	1,2	120	07	5,6
Rauland 2460 Series	1,2	120	03	5,6
Rauland 2460 Series Low Voltage	1,2	24	03	7,8
Dukane 24030, 24023, 24050, 24060,24010	1,2	120	03	5,6
Dukane 24030, 24023, 24050, 24060,24010 Lv	1,2	24	03	7,8
Honeywell St402,403,404,410-413,802-804,810-813	1,2	120	08	5,6
Faraday 1310,1311,1320,1321	1,2	120	08	5,6
Cincinnati D8	1,2	120	08	5,6
Standard/Faraday New Types 2310, 2331	1,2	120	08	5,6
Standard Electric Time 2370, 2380 Series	1,2	120	07	5,6
ATS CC2000 Series Digital System Clocks	1,2	120	07	5,6
Stromberg 3000	1,2	120	07	5,6
American A4015D10	1,2	120	07	5,6
Combine National RDS/D/DX with any conventional synchronous on same wires. Ckt1 as type 02, Ckt2 as 07,08 etc.	1,2	120	02,xx	15
National Time MI Series Impulse	1	120	12	17

Appendix C - Time Zones

When using the NIST time bases such as a LAN time server, NIST website, or a GPS antenna, the WeMC3 uses the Universal Coordinated Time (UTC) standard (formerly known as Greenwich Mean Time). To acquire the local time in your area, this time must be adjusted based upon the time zone. The time zone number may be designated either through the WeCAN™ interface or through the WeMC3 Tech Menu.

Zone Number	Description
00	UTC (Universal Coordinated Time)
01	UTC -1:00
02	UTC -2:00
03	UTC -3:00
04	UTC -4:00
05	UTC -5:00 (U.S. Eastern Time)
06	UTC -6:00 (U.S. Central Time)
07	UTC -7:00 (U.S. Mountain Time)
08	UTC -8:00 (U.S. Pacific Time)
09	UTC -9:00 (Alaska)
10	UTC -10:00 (Hawaii)
11	UTC -11:00
12	UTC -12:00
13	UTC +1:00
14	UTC +2:00
15	UTC +3:00
16	UTC +4:00
17	UTC +5:00
18	UTC +6:00
19	UTC +7:00
20	UTC +8:00
21	UTC +9:00
22	UTC +10:00
23	UTC +11:00
24	UTC +12:00
25	UTC +13:00
26	UTC -3:30 (Newfoundland)

Appendix D – Synchronization Input

The synchronization input will automatically adjust the time of the MC3 to match an existing system. The input is wired to the existing system as if it were a secondary clock correction coil. Since many protocols do not identify am or pm, it is wise to disable the daylight savings adjustments of the MC3 and allow the time source master to make the adjustments. See Tech Menu for details.
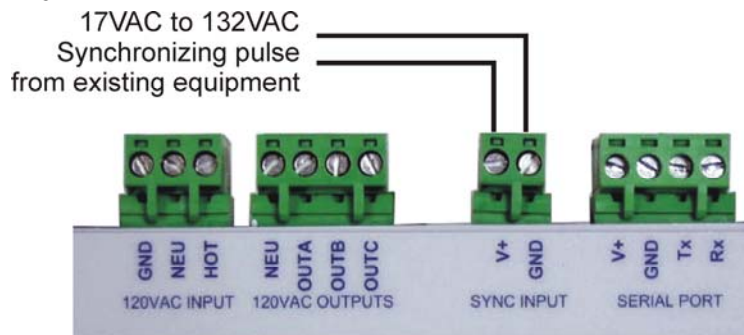

Figure 8

The protocol will automatically be deciphered from the following protocols:

Format 1: 25 second pulse each hour at xx:00:00. 25 minute pulse each 6:00:00.

Format 2: 8 second pulse each hour at xx:57:54. 14 second pulse each 5:57:54.

**Format 3**: 2 second pulse each 12:00 am and/or pm.

Format 4: 55 second pulse each xx:58:05. 95 second pulse every other minute starting at 5:05:00 and ending 5:22:00.
Variations of the 12 hour pulses are allowed. Any pulse 55 seconds to 100 seconds any minute between 4:59 and 5:40.

Format 5: On-Demand Instant Reset time data from another National Time master or URT.

Appendix E - Firmware Upgrade

The latest version of operating firmware may be field upgraded by replacing one or both (if required) processor chips on the MC3 main board.
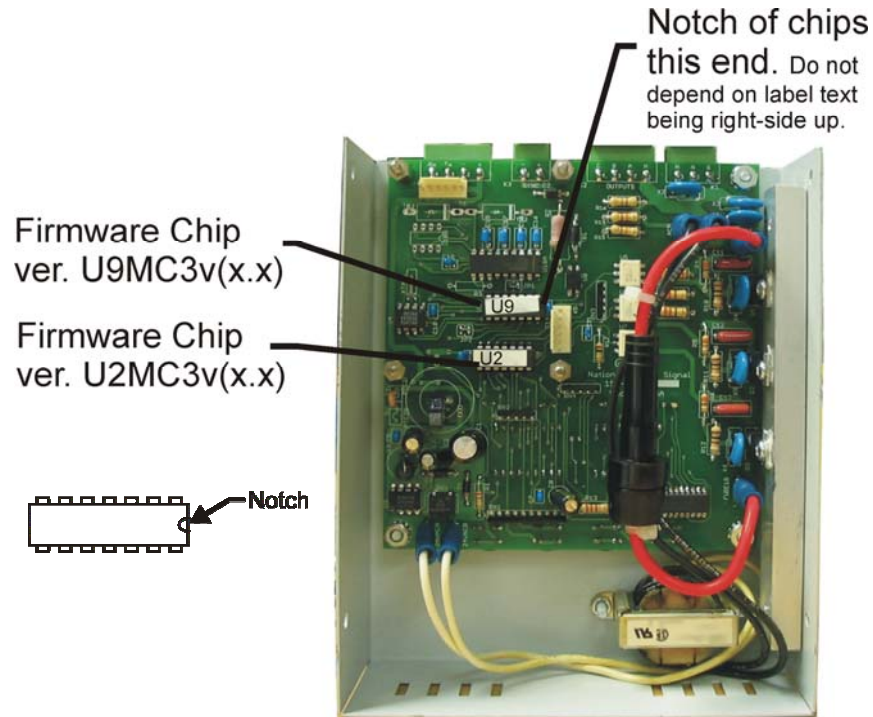
Before replacing the chips, record all circuit and timekeeping settings in the Tech Menu. Refer to the Tech Menu section of the Manual.

To replace the firmware,

1. Turn off the circuit breaker providing power to the MC3 and clock circuits.

2. Un-plug all wire connections to the MC3.

Remove the main housing be removing the four screws on the side of the unit. Do not remove the socket head screws attaching the heat sink.

3. Identify the firmware chips as shown in the figure.

With a small screw driver, carefully pry the old firmware chips from their sockets.

4. Insert the new firmware chips into their appropriate sockets. Make sure the notch in the top of the chip is to the right, matching the notch in the chip socket. **Do not rely on the label of the chip to determine the proper orientation.**

5. Make sure all of the leads of the chip are properly seated into the socket.

6. Assemble the MC3 by replacing the screws and the wire connections.

7. Apply power to the MC3.

8. Enter the Tech Menu and verify the circuit and timekeeping settings.

9. Enter the Set Time menu to set the current time, day, and date.

10. Refer to the section pertaining to your particular clocks to return the secondary clocks to the proper time.
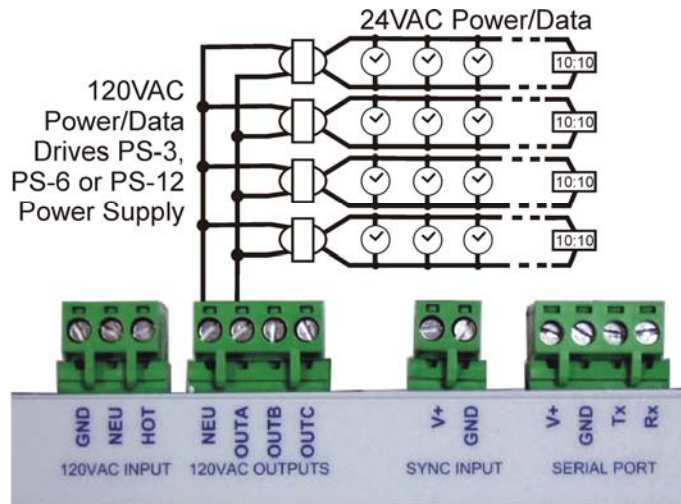
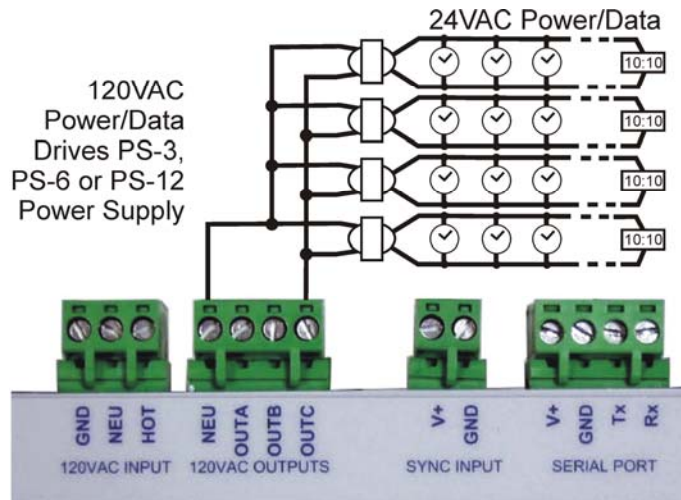# Appendix F -Wiring Diagrams
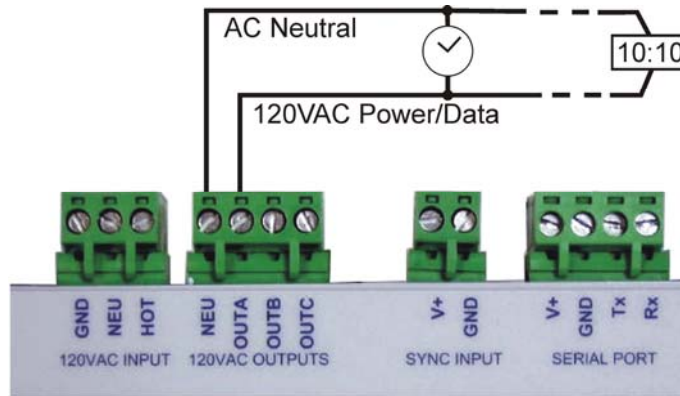
Wiring Figure 1: Circuit 1 two-wire clocks
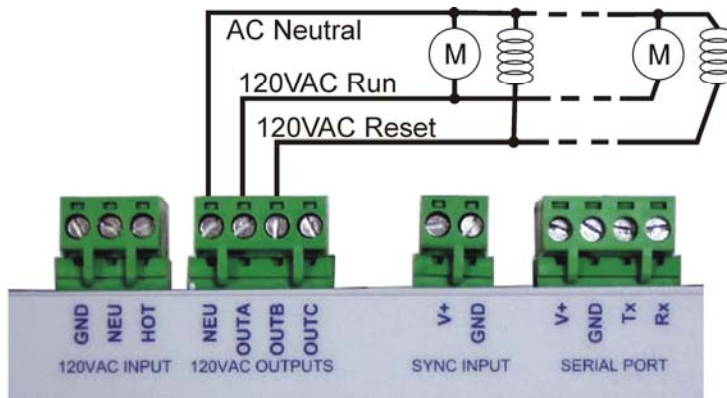(Clocks may require appropriate transformer for 120V operation)
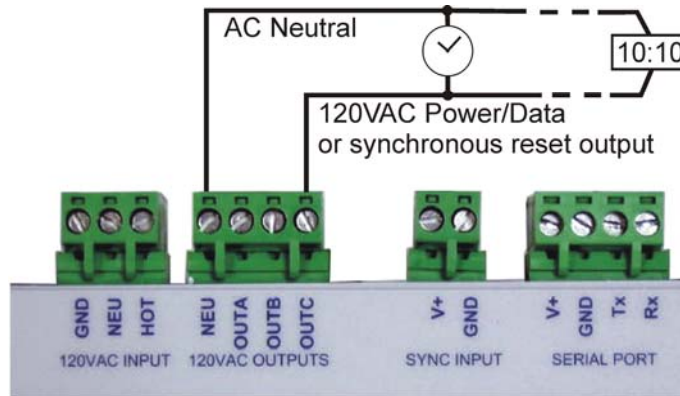
Wiring Figure 2: Circuit 2 two-wire clocks
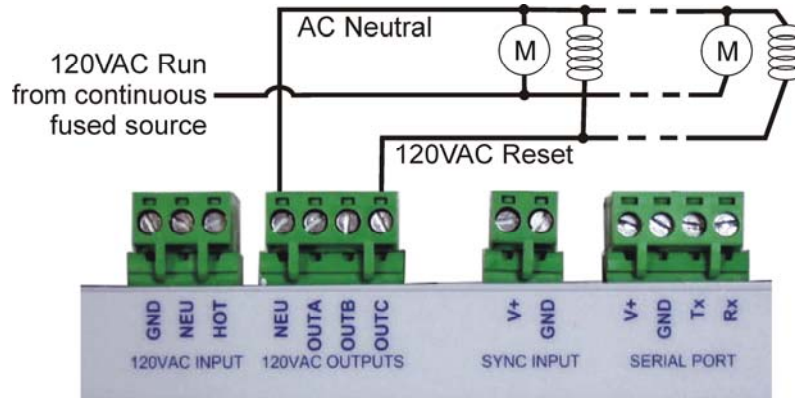(Clocks may require appropriate transformer for 120V operation)

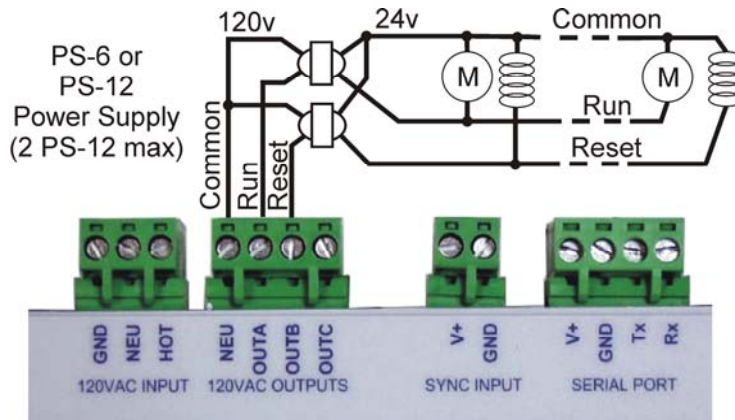**Wiring Figure 3: Circuit 1 two-wire clocks 24V**
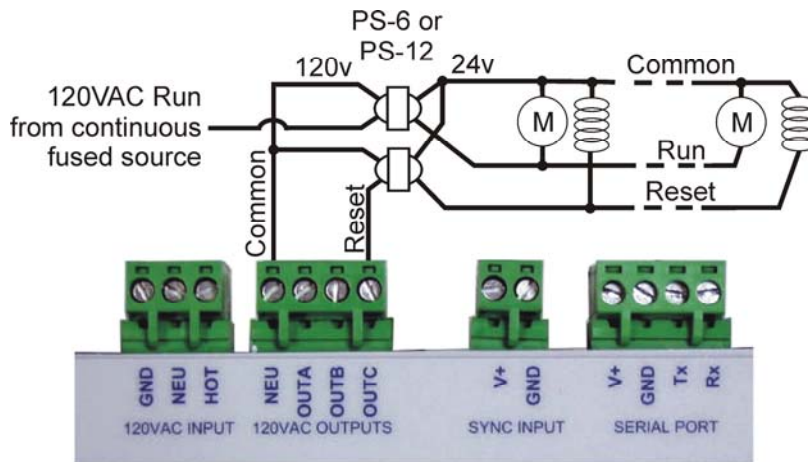

Wiring Figure 4: Circuit 2 two-wire clocks 24V

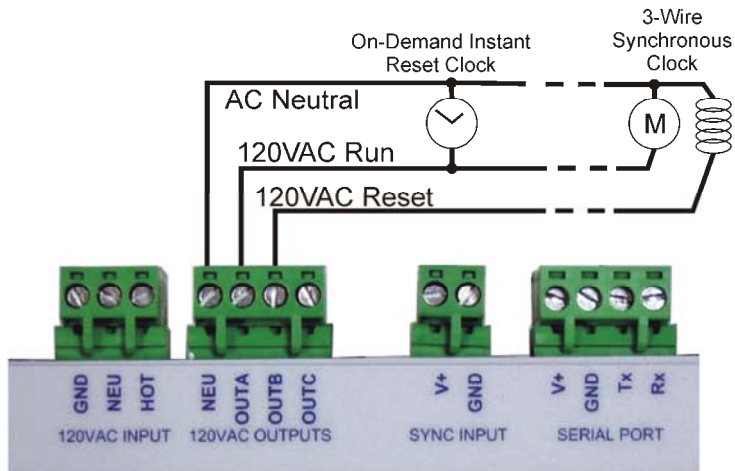**Wiring Figure 5: Circuit 1 three-wire synchronous clocks**

AC Neutral

120VAC Run
from continuous
fused source

120VAC Reset

M M

GND NEU HOT
120VAC INPUT

NEU OUTA OUTB OUTC
120VAC OUTPUTS

V+ GND
SYNC INPUT

V+ GND Tx Rx
SERIAL PORT

Wiring Figure 6: Circuit 2 three-wire synchronous clocks

PS-6 or
PS-12
Power Supply
(2 PS-12 max)

120v   24v   Common

M M

Run

Reset

Common
Run
Reset

GND NEU HOT
120VAC INPUT

NEU OUTA OUTB OUTC
120VAC OUTPUTS

V+ GND
SYNC INPUT

V+ GND Tx Rx
SERIAL PORT

Wiring Figure 7: Circuit 1 three-wire sync. clocks 24v

PS-6 or
PS-12

120v   24v   Common

120VAC Run
from continuous
fused source

M M

Run

Reset

Common
Reset

GND NEU HOT
120VAC INPUT

NEU OUTA OUTB OUTC
120VAC OUTPUTS

V+ GND
SYNC INPUT

V+ GND Tx Rx
SERIAL PORT

Wiring Figure 8: Circuit 2 three-wire sync. Clocks 24v
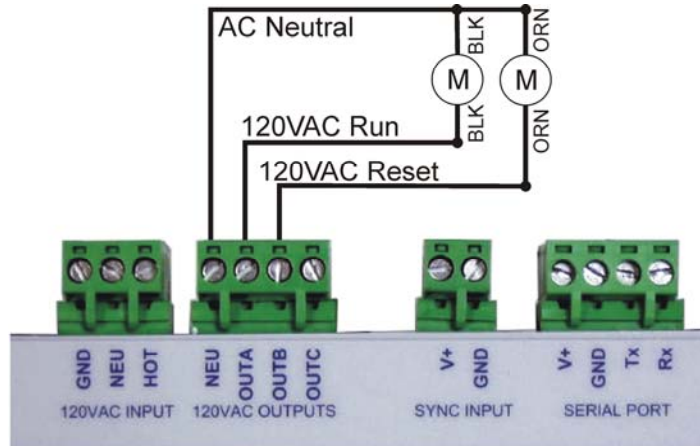
Wiring Figure 9: Circuit 1 On-Demand and EX Sync. Combination 120V
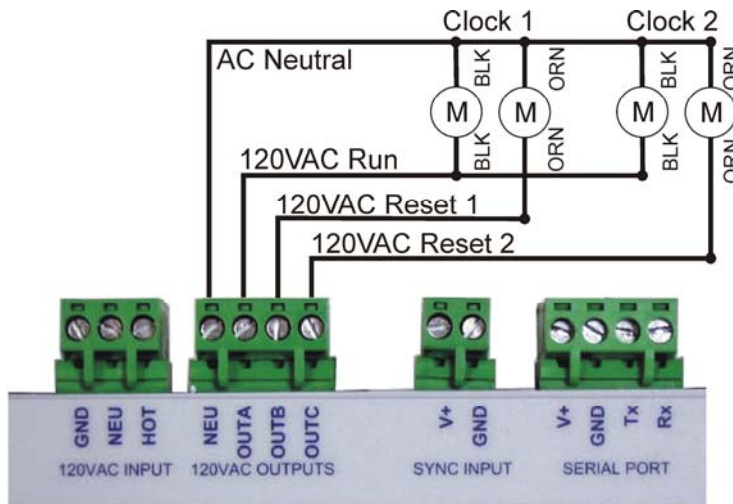(On-Demand clocks may require appropriate transformer)
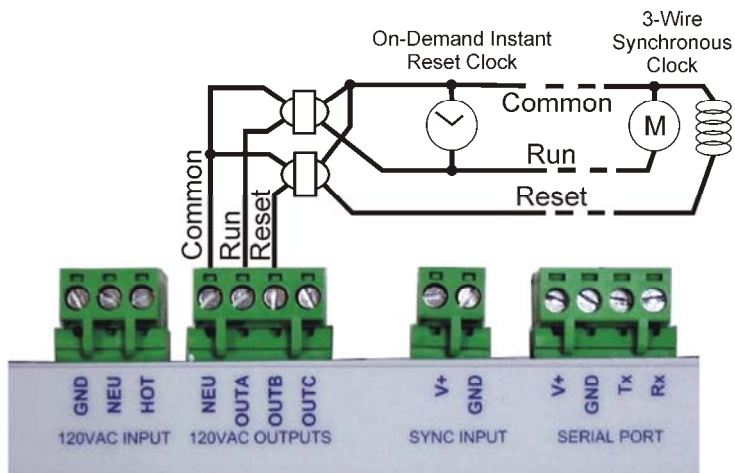
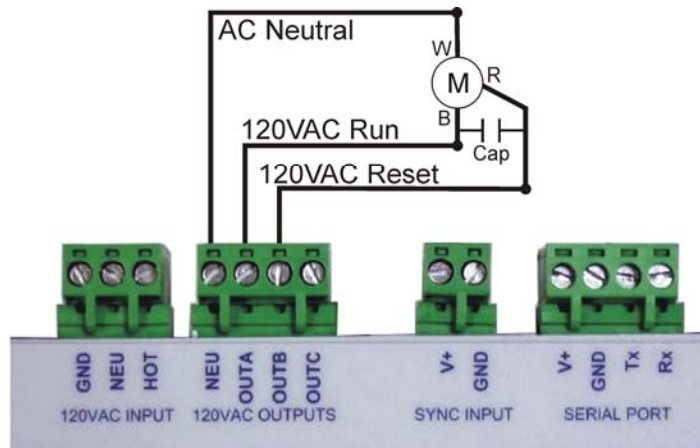**Wiring Figure 10: Circuit 1 On-Demand and EX Sync. Combination 24V**

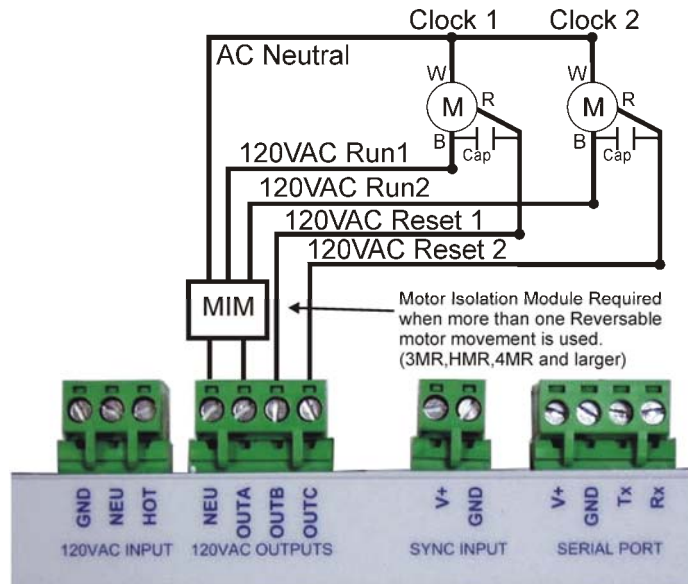**Wiring Figure 11: Single Dual Motor clock**

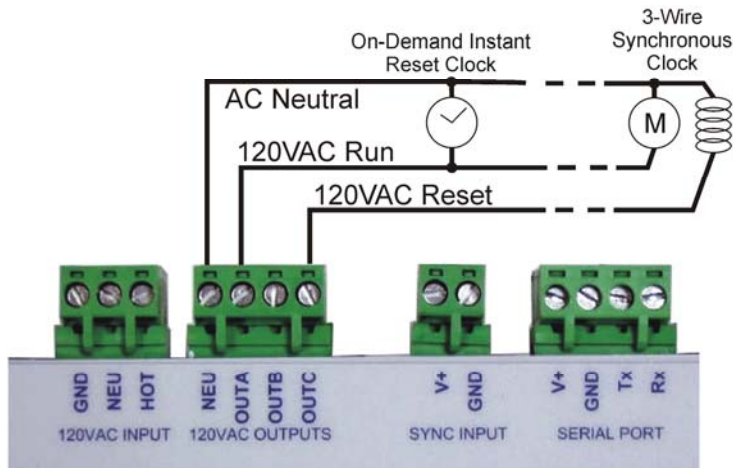**Wiring Figure 12: Two Dual Motor Clocks**

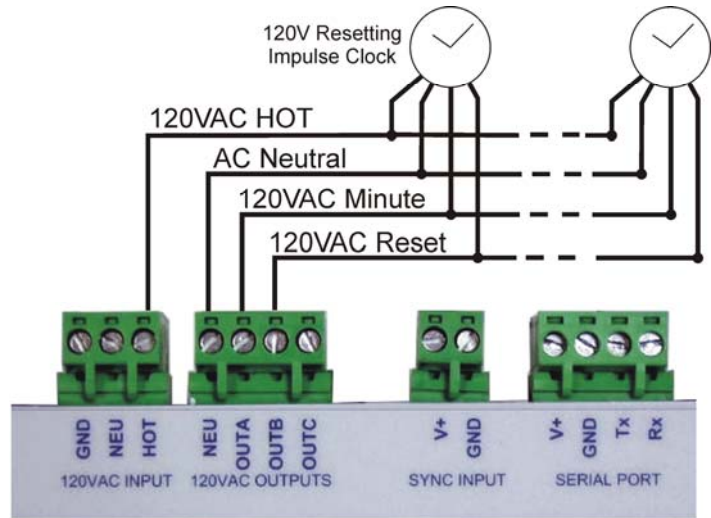**Wiring Figure 13: Reversible Motor Clock**

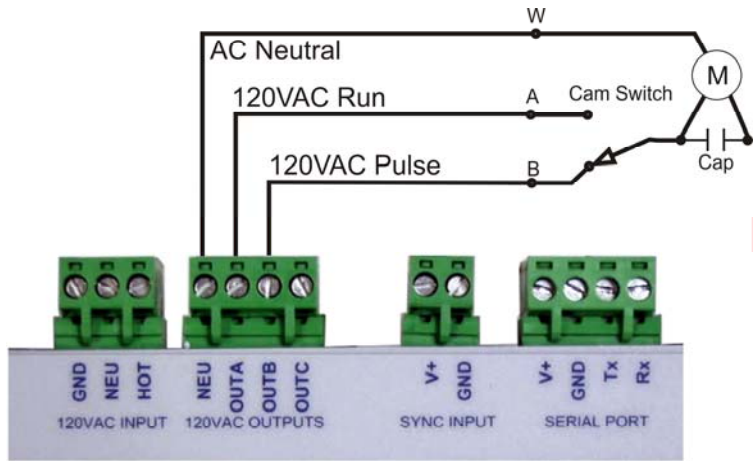**Wiring Figure 14: Two Reversible Motor Clocks**

Wiring Figure 15: Ckt 1 Instant Reset Clocks combined with conventional synchronous on Ckt 2.
(Instant Reset Clocks may require transformer)

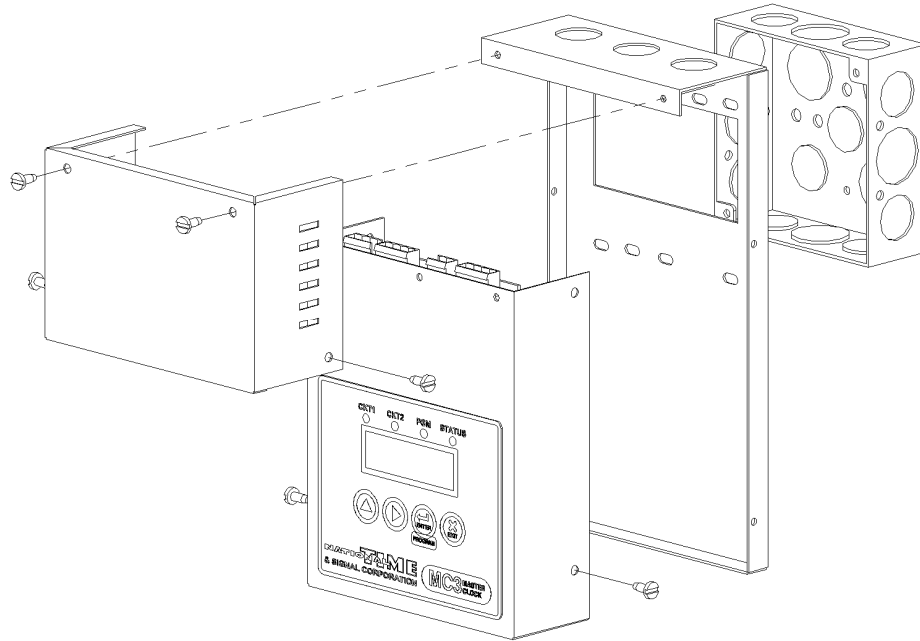**Wiring Figure 16: 120V Resetting Impulse Clock**

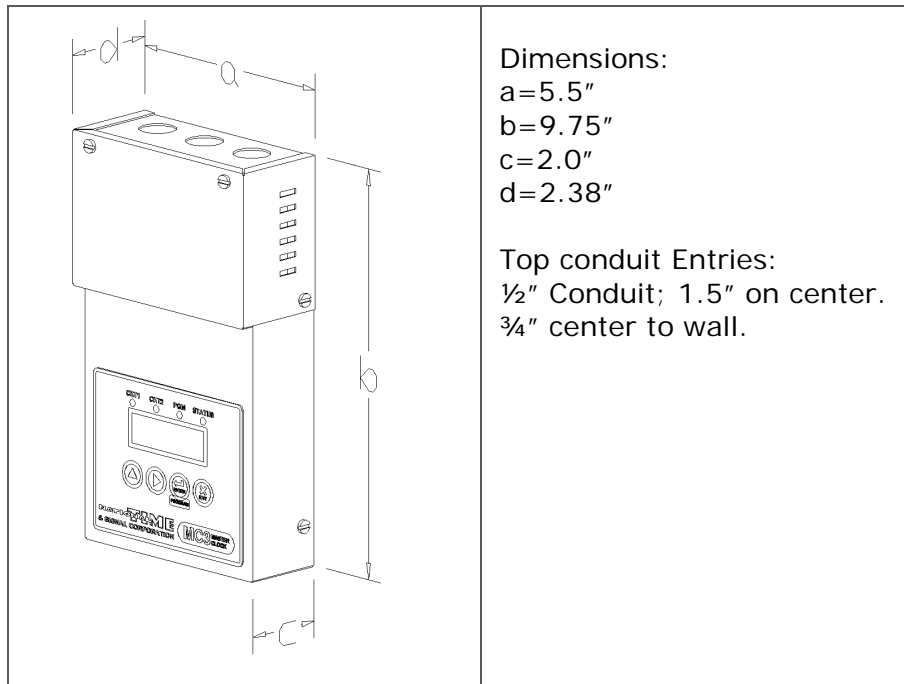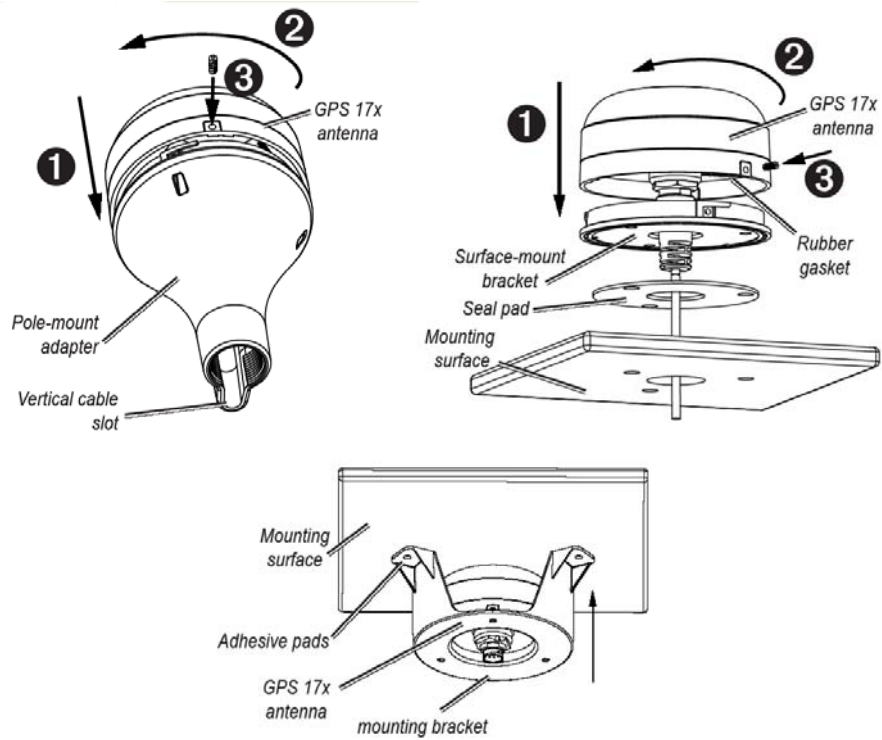**Wiring Figure 17: 120V Resetting Impulse Clock**

Appendix G - Specifications

Primary Voltage:	120VAC @ 60Hz or 50Hz
Primary Current:	
Full Load (max. devices)=	7.025A @ 120VAC/60Hz
No Load (no devices)=	0.025A @ 120VAC/60Hz
Typical Load=	0.025A+Ckt Load @120VAC/60Hz
Sync. Input Voltage:	17 to 132VAC
Sync. Input Current:	22mA @ 120VAC; 3mA @ 24VAC
Primary Fuse:	10A 250VAC. **Must be Ultra-Fast Type GBB ONLY**
Circuit Output Rating:	
Per circuit=	3A @ 120VAC
3 circuit total=	not to exceed 7A@120VAC combined
Serial Port 24VDC:	100mA @ 24VDC Nominal
RS232 wiring distance:	
MC3-GPS=	30 Ft. (Standard)
MC3-GPS=	100 Ft. using shielded low capacitance cable
LAN Connector:	RJ45
Ambient Temp. Range:	32 to 95 Degrees Fahrenheit
Humidity:	85% Non-condensing max.
Mounting:	
Semi-Flush Mount=	Mounts to a flush mounted 4″ Square, Double-Gang, Handy box, or Single-Gang
Surface Mount=	Mounts to wall with surface Conduit entry
Conduit Entry:	
Semi-Flush=	Conduit enters flush mounted Standard Electrical boxes
Surface Mount=	3 Knockouts of ½″, top entry
Dimensions:	5.5″W x 9.75″ H x 2.38″D

Appendix G - Mounting

Figure 9: Semi-Flush Assembly

Dimensions:
a=5.5″
b=9.75″
c=2.0″
d=2.38″

Top conduit Entries:
½″ Conduit; 1.5″ on center.
¾″ center to wall.

Figure 10: GPS Mounting