

MC4181NX

MASTER CLOCK



MC4181NX

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PROGRAMMING SUMMARY, MODES SHEETS, and ADDENDA

The MC4181NX Master Clock is an expanded version of the MC4181N Series Master Clocks. A computer interface (previously Option 354) and eight output circuits are standard.

1.0 INTRODUCTION

The MC4181NX is a multiple output, calendar programmable solid state master clock. It is used for synchronizing most secondary clocks and for switching electric circuits according to a preset time and date program. The MC4181NX's AUTO PROMPTING, alphanumeric display makes programming fast and simple. The outputs can be used to ring bells, to control audio/visual equipment or to control lighting, heating, ventilating, air conditioning and security systems with a variety of programming capabilities, ranging from a simple 7 day plan to a more complex plan utilizing its powerful, alternate annual programming features.

Secondary clock correction modes are built-in, and can be selected from the keyboard. If a secondary clock correction mode is selected, the MC4181NX will dedicate two of its relay outputs for correction, leaving six relay circuits. If the MC4181NX is not being used for correcting secondary clocks (Mode 0), then all output relays are available for timed events. Selected outputs can be independently programmed for momentary operation such as required for ringing bells in schools, churches or industrial facilities.

RS232 I/O Interface for driving ATS AE or CC2000 Series Large Displays or for interfacing with a computer or another master clock, etc. ATS 10-byte time code messages are automatically transmitted every minute.

Many options are available for the MC4181NX master clocks including: 220 VAC power, 50 Hz power, built-in power supplies for driving bells and secondary clocks, and time code outputs.

2.0 SPECIFICATIONS

PROGRAMMING CAPABILITIES

Auto Prompting Display - Provides display information to guide the operator during programming. From a restart it will take the operator from setting time clear through setting the basic program steps.

Programmable Secondary Clock Modes - Simple keyboard entry allows for selection of the desired secondary clock synchronization modes. Most secondary clock modes are included. Selecting Mode 0 disables secondary clock correction, allowing all output relays to be used for timed events.

200 Powerful Program Steps - The MC4181NX has a default set up of 1 Basic 7 day plan and 9 Alternate 7 day plans that can be scheduled on an annual basis for a total of 10 plans, each having 20 program steps. If more than 20-program steps are needed, they can be programmed using a keyboard-entered function. Up to 100 steps per program can be programmed for a total of 2 plans. Each step can be programmed for all or any combination of the output relays for the specific day of the week, or for all 5 weekdays, or for both weekend days, or for everyday of the week. In addition, the steps can be programmed in customized groups such as, Monday, Wednesday, and Friday only.

20 Annual Plans - Each annual plan has a starting and ending date, and an associated Alternate Plan. This feature can be used to schedule any 1 of the 1 to 9 alternate, 7 day plans to be used by the MC4181NX. Certain annual plans can be programmed to repeat on a yearly basis so that they don't have to be reprogrammed each year.

Programmable Daylight Savings Time Adjustment - The MC4181NX can be programmed to automatically adjust its time for Daylight Savings Time changes, or other seasonal changes for all locations world-wide.

Automatic Leap Year Compensation.

Manual Override - The output relays can be manually energized or de-energized from the keyboard. The word "Manual" replaces the word "Relays" in the time display until the next program step occurs.

Pulsed Output – Relays 1,3,4,5,6,7, and 8 can be programmed individually or as a group to operate as momentary contacts, programmable from 1 to 9 seconds.

Relay 2 Output – Relay 2 can be set for a different duration than the other outputs. In addition, any output triggered at the same time as relay 2 will operate for the same duration as relay 2.

Built-In I/O Interface – Provides an RS232 interface for driving AE, AN, and/or CC2000 Series Digital Clocks, or for connection to a computer or another master clock.

(Optional) Built-In Time Code Output – Factory configured for proprietary time code output, and other specified protocols.

Built-In Power Supply Interface – Provides terminal blocks and fusing for optional, built-in 24 Volt power supplies and transformers.

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ELECTRICAL

- Power: Standard power required is from 95 VAC to 135 VAC, 60 HZ at 10 VA maximum. The MC4181NX has terminal blocks for all connections. For optional powered units (220 VAC and 50 Hz), refer to the option addenda provided.
- Outputs: Eight relays (6-SPST, 2-SPDT) rated at 15A, 120 VAC or 30 VDC resistive. See the Mode Sheets at the back of this manual for details.
- Wiring: Clearly labeled Terminal Blocks on the inside panel.

POWER FAIL BACKUP

Non-Volatile Memory keeps time and programs for indefinite power outages. All outputs and the display are disabled during backup. The MC4181NX resumes normal operation when power returns. If the master clock has been without power for more than 48 hours a "Unit Power Fail" message will appear when power is restored. Times and program will be intact, however pressing the [3] key will begin the AUTO PROMPT sequence. Check time, date, day, etc. to insure accuracy, then press the [EXIT].

ACCURACY

Time Keeping - Keyboard selected - Synchronous with the 60 Hz AC power line, 50 Hz AC power line, or crystal timebase. During a power failure, or when crystal timebase is selected, it is quartz crystal controlled with an accuracy of +/- .003% throughout its full temperature range.

Programmed Events - On/Off events are programmable with a one-minute resolution and occur at the zero second of that minute.

Operating Temperature Range - 0 to 50 degrees C

PHYSICAL

- Enclosure: Painted steel enclosure that measures 12"W X 16"H X 4.5"D. For wall mounting applications. Conduit knockouts are provided on all side, top, bottom and back panels.
- Display: Two-Line Alphanumeric LCD with LED backlight.
0.3-inch high characters

FRONT PANEL DESCRIPTION

ALPHANUMERIC DISPLAY - Used for displaying time, day, date, and output status, and for displaying information during programming or reviewing stored programs. In the normal mode of operation, the display will be in the TIME DISPLAY, showing the day, time, and which relays are activated. You can enter the TIME SET, MANUAL CONTROL, and PROGRAMMING MODES from this display.

KEYBOARD - Many keys serve multiple functions. Those keys are clearly labeled with their functions to the side and top of the key. They cannot be used incorrectly, as the display will AUTO PROMPT the user as to which key to press.

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AM / ON KEY [1] - Used for setting the time to AM when in the TIME SET or PROGRAMMING MODES and for entering the MANUAL CONTROL MODE.

PM KEY [2] - Used for setting the time to PM when in the TIME SET or PROGRAMMING MODES.

TIME KEY [3] - Used for entering the TIME SET MODE.

ANNUAL KEY [A] - Used for entering the ANNUAL PROGRAMMING MODE and for stepping through the stored ANNUAL PLAN for review. The ANNUAL PLAN contains the schedule for the alternate BASIC PLANS in calendar schedule form.

BASIC KEY [B] - Used for entering the BASIC PLAN - PROGRAMMING MODE and for stepping through the stored BASIC PLANS for review. The BASIC PLANS contain the daily timed events instructions.

CLEAR KEY [C] - Used for clearing the ANNUAL PLAN and/or BASIC PLANS.

DATE KEY [D] - Used for entering the SET DATE MODE for entering date or reviewing the date.

EXIT KEY [F] - Used for exiting any of the SET TIME, SET DATE or PROGRAM MODES.

OFF KEY [0] - Used for setting the pulse to OFF when in the PULSE PROGRAMMING MODE.

ENTER KEY [E] - Used for entering all commands or for stepping through any SET TIME, SET DATE or PROGRAM data entry.

DST KEY [7] - Used for entering the SET DAYLIGHT SAVINGS TIME PROGRAM MODE.

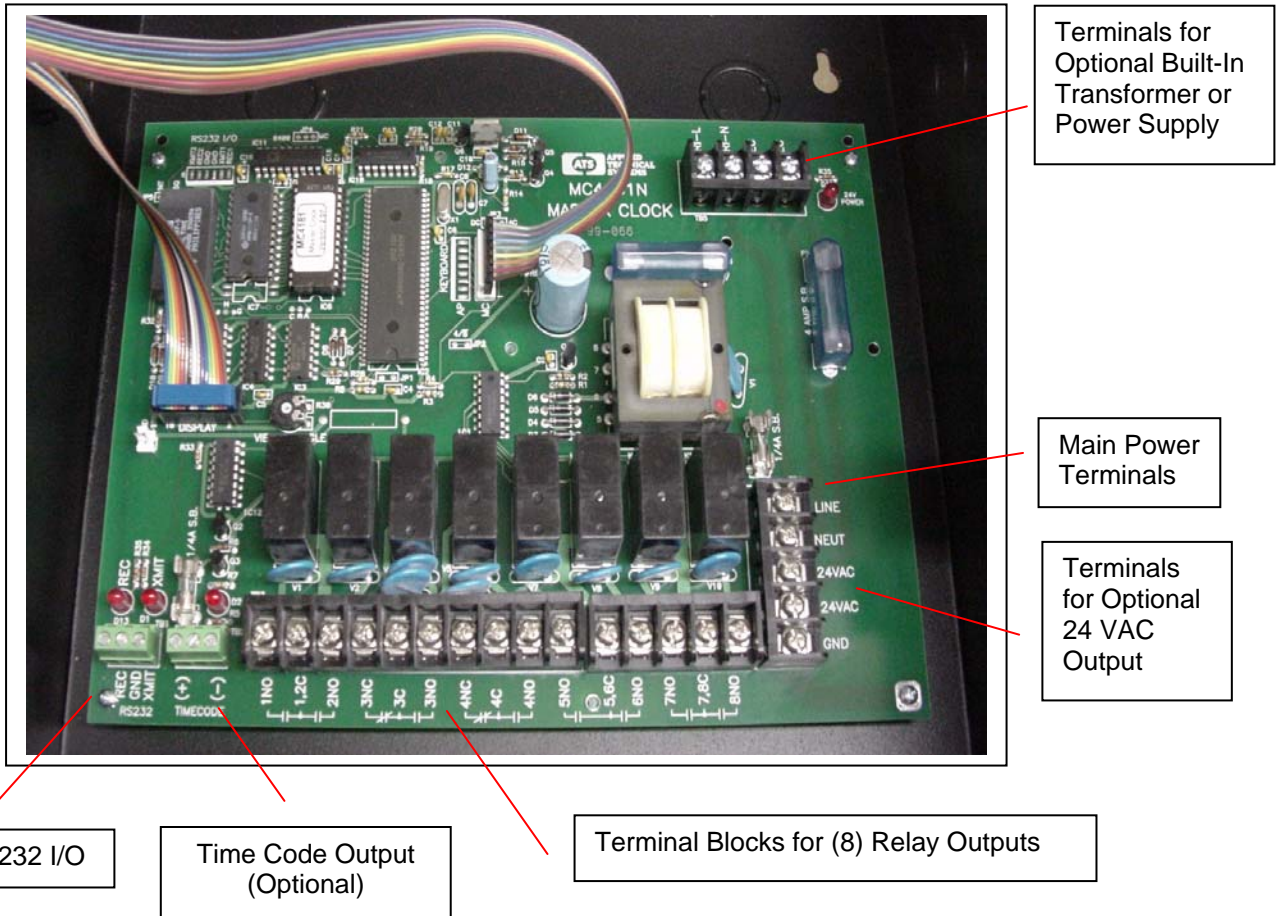
DAY KEY [4] - Used for setting the day in the SET DAY and PROGRAM MODES. Also used for entering the SET DAY MODE.

3.0 INSTALLATION

The MC4181NX should be securely mounted to a suitable mounting panel or surface according to any local codes using the mounting holes on the back panel. Be sure the equipment is properly grounded to the facilities ground connection.

ELECTRICAL CONNECTIONS

All wiring connections including the incoming AC power line connections are made at the clearly marked terminal blocks located on the inside back panel of the MC4181NX enclosure.



The RS232 I/O terminals provide a computer interface and serial data for AE and CC Series Digital Clocks. The Time Code terminals provide user specified time code outputs.

For Secondary Clock Wiring. See the mode sheets at the back of this manual for more detail.

OPTIONS

Options are available for the MC4181NX Master Clock. For details on the installation and operation of an installed option, refer to the Addenda for that option at the back of this manual.

4.0 GETTING STARTED

4.1 THE AUTO PROMPT DISPLAY

The master clock has a feature called Auto Prompt that guides the operator when programming the unit. For the most part the operator merely has to follow the display as the master clock advances through the Program Modes. On a restart (from a “power fail” condition) the master clock will advance through a sequence of all the necessary settings including the Basic Plans. You may exit this sequence if desired and enter the program manually from the time display, using the specific commands. Entering a program from the Auto Prompt sequence is identical to entering one manually.

4.2 THE CURSOR, ENTERING DATA

On many of the display messages you will see a flashing square character called the cursor. The cursor indicates that you may now enter or change the data at that position of the display. As data is entered the master clock constantly checks for a valid entry. For example, you cannot enter 13 for a month when setting the date. After entering valid data to a position on the display, the cursor will advance to the next position. If you have tried to enter invalid data, the cursor will remain at the same position, indicating you must re-enter the data. Simply re-enter the data on top of the existing data and press [ENTER]. Generally, data is entered two digits at a time and shifts left with each entry.

4.3 APPLYING POWER, ENTERING THE TIME

Before power is applied, be sure all installation and wiring is completed to all local codes.

Upon first applying power the display will come up with a brief sign on message showing the model and version numbers:

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Version 2.XX

After a few seconds the first Auto Prompt message will appear. If the following message does not appear, read Section 7.6 FORCING A RESTART.

UNIT POWER FAIL
Press “3” key

Simply press key [3]. The display will prompt with the set time display.

Time? 00:00 AM
Hrs. (HH), ENTER

It may be showing the correct time, some other time, or all “0’s”.

From this point forward you can exit the Auto Prompt sequence at any time, if desired, by pressing [EXIT]. However, the programming is simplified by staying in the Auto Prompt mode. On

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a restart all program memory is cleared in the master clock. The cursor will be flashing in the hour's digits. The bottom line is a prompt to enter 2 digits (HH) for hours. Enter the hours then press the [ENTER] key. Two digits are required for the hours. Example: 01 instead of 1. The cursor will remain flashing in the hour's digits if an invalid number is entered for the hours. Enter the correct hours. Once a valid number is entered for the hours, the cursor will advance to the minute's digits. Again, the bottom line is a prompt for entering the minutes. Type two digits for the minutes and press [ENTER]. The cursor will advance to the AM position. Press the AM or PM key then press [ENTER]. Time keeping begins the instant you press [ENTER]. Time can be accurately set to the second by pressing the [ENTER] key at the desired instant.

4.4 ENTERING THE DATE

The next step in the AUTO-PROMPT sequence is entering the date. The display will show:

```
Date? 12-29-07
Month (MM), ENTER
```

It may be showing the correct date, some other date, or all "0's".

The cursor will be flashing in the month's position. The bottom line will give you additional information on how to enter the data. Type the two digit number for the month and press [ENTER]. If the correct two digits are already there, simply press [ENTER]. The cursor will move to the day position. Type the two digits for the day and press [ENTER]. The cursor will move to the year position. Type the two digits for the year and press [ENTER].

4.5 ENTERING THE DAY

Next, we enter the day of the week. The display will show:

```
Day? Sun
DAY key, ENTER
```

It may be showing the correct day or some other day stored previously. Press the DAY key [4] until the desired day is shown on the display and then press [ENTER].

4.6 DAYLIGHT SAVINGS TIME

The default entries for daylight savings time according to current U.S. law will display as follows:

```
S DST M=03 SUN=2
F DST M=11 SUN=1
```

The master clock is pre-loaded with the current daylight savings time settings according to U.S. law. Unless the law changes or you live in an area that does not follow standard U.S. daylight savings time there is no need to change anything on the DST screen. The top line is for the Start of DST and the bottom line is for the End (Finish) of DST. The S indicates the Start of DST and the F indicates the Finish of DST. The cursor will be flashing in the month

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position. Enter the two digits for the month in which you wish the Start DST adjustment to be made (03 for current US law), then press [ENTER]. Enter 00 for the month if you do not wish to use the automatic DST feature and the master clock will advance to the next Auto Prompt display. The cursor will advance to the L in the Sunday position. Enter a 2 for the first Sunday (current US law), 2 for the second, 3 for the third, 4 for the fourth or L for the last Sunday. Use the [5] key to enter the L. The change will be made at 02:00 AM on the Sunday you choose.

After the Start DST data is entered, the cursor will advance to the Finish DST line. If you have entered a Start DST, you must enter a Finish DST as well. Failure to do so will erase the Start DST and then there will be no DST compensation.

Finish DST is entered in the same manner as the Start DST. Current US law for Finish DST is the first Sunday in November. Enter 11 for the month and 1 for the Sunday. The valid Sundays for the Finish DST are 1, 2, 3, 4 and L. Use the [5] key to enter the L. The change will be made at 02:00 AM on the Sunday you choose.

**4.7 ENTERING PULSE (MOMENTARY OUTPUT) FOR RELAYS 1,3,4,5,6,7,8
(NOT RELAY 2)**

The pulse is normally set to zero for programming steady state ON and OFF events. A pulsed output may be needed for applications requiring a momentary output such as ringing school bells. **If a relay is turned on without a PULSE SETTING. The relay will stay on until programmed to turn off. This means the bells, buzzers, etc. will continue to ring until programmed to turn off.** A second momentary output of a different duration may be required for late bells or warning bells. Relay 2 is reserved for the second pulsed output.

Pulse = OFF
Relays: - - - - -

The cursor will be flashing on the "O" in OFF. If pulsed output is not wanted, press OFF [0], then [ENTER]. The master clock will advance to the next Auto Prompt display. To program pulsed output on 1 or more output relays, enter the duration for the pulse from 1 to 9 seconds and press [ENTER].

Pulse = 3 seconds
Relays: 1 - 3 4 5 6 7 8

Enter the number of the relay or relays to pulse. Relay 2 will not be available for this pulse. **Also, if you are using any of the built-in correction modes, relays 3 and 4 will not be available for this pulse.** The examples above show all relays except relay 2 set to pulse for 3 seconds.

4.8 ENTERING THE PULSE FOR RELAY 2

Next the display will read:

Pulse = OFF
For Relay 2

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The cursor will be flashing on the "O" in OFF. If pulsed output is not wanted, press OFF [0], then [ENTER]. The master clock will advance to the next Auto Prompt display. To program pulsed output on relay 2, enter the number of seconds duration for this pulse from 1 to 9 seconds and press [ENTER].

Pulse = 3 seconds
For Relay 2

4.9 ENTERING THE SECONDARY CLOCK MODE

Display will read:

MODE=0, DISABLED

If you are not correcting secondary clocks, you can set the mode to 0. In this mode all outputs are available for timed events. Simply press [ENTER] to select mode 0, and the master clock will advance to the next Auto Prompt display. See the MODE SUMMARY SHEETS at the back of this manual for more details. To select a specific mode, press any key except [ENTER] or [EXIT]. This will advance the display through the secondary clock modes. Once the desired secondary clock name and model number is displayed, press [ENTER] to select that model. For the Simplex Series 77 the display will be:

MODE = 2, Simplex
Series 77

After pressing [ENTER] the master clock will advance to the next Auto Prompt display. Please note that relays 3 and 4 are dedicated to secondary clock correction and will no longer be available for timed events.

4.10 BASIC PLAN

The next step of the AUTO-PROMPT sequence is basic plan programming. Refer to Section 6.0 PROGRAMMING for details on entering your basic plan.

Note: Setting Annuals is not included in the auto prompt sequence. See ENTERING, REVIEWING OR EDITING THE ANNUAL PROGRAM (Section 6.3).

5.0 OPERATION

This section will explain how to change or review the existing time, date or programs previously stored, how or to totally program the unit after exiting the AUTO-PROMPT sequence. It describes how to manually invoke each mode from the command line. You must be in the time display before you can enter a command. Press the [EXIT] key to be sure. The display should look similar to the following:

```
Mon 01:18:00 PM
Relays: - - - - -
```

5.1 REVIEWING OR EDITING TIME [3] [ENTER]

Press the TIME key [3]. The display will respond with:

```
Command? 03
Press ENTER
```

Press [ENTER]. The display will respond with:

```
Time? 12:34 AM
Hrs. (HH), ENTER
```

Now you may enter the time as you would during the AUTO-PROMPT sequence. (see Section 4.3 APPLYING POWER, ENTERING THE TIME)

5.2 REVIEWING OR EDITING THE DATE [D] [ENTER]

You must be in the time display in order to enter the date. Press the DATE key [D]. The display will respond with:

```
Command? 0D
Press ENTER
```

Press [ENTER]. The display will respond with:

```
Date? 12-29-07
Month (MM), ENTER
```

Enter the date as described in Section 4.4 ENTERING THE DATE.

5.4 REVIEWING OR EDITING THE DAY [4] [ENTER]

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You must be in the time display. Press the DAY key [4]. The display will respond with:

```
Command? 04  
Press ENTER
```

Press [ENTER]. The display will respond with:

```
Day? Sun  
DAY key, ENTER
```

The day of the week may now be entered in the same manner as in the AUTO-PROMPT sequence. (Section 4.5)

5.4 REVIEWING OR EDITING DAYLIGHT SAVINGS TIME [7] [ENTER]

You must be in the time display. Press the DST key [7]. The display will respond with:

```
Command? 07  
Press ENTER
```

Press [ENTER]. If daylight savings time not previously set, the display will respond with the default entries for the current U.S. law as follows:

```
S DST M=03 SUN=2  
F DST M=11 SUN=1
```

You may now enter the new daylight savings time settings as outlined in Section 4.6.

**5.5 REVIEWING OR EDITING THE RELAY PULSE (MOMENTARY OUTPUTS)
FOR RELAYS 1,3,4,5,6,7,8 [5] [ENTER]**

The pulse is for applications in which only a momentary contact is required (i.e. ringing bells). See Section 4.7 for more information on pulse settings. Start from the time display. Press key [5]. The display will respond with:

```
Command? 05  
Press [ENTER].
```

Press [ENTER]. The display will respond with:

```
Pulse = OFF  
Relays: - - - - -
```

The pulse settings for relays 1,3,4,5,6,7, and 8 may now be set as outlined in Section 4.7.

5.6 REVIEWING OR EDITING THE RELAY 2 PULSE (MOMENTARY OUTPUT)
[5] [A] [ENTER]

To enter the pulse for relay two you must be at the time display. Press [5] [A] [ENTER]. The display will respond with:

Pulse = OFF
For Relay 2

Once you have entered the pulse for relay 2 (Section 4.8) the master clock will return to the time display.

5.7 REVIEWING OR EDITING THE SECONDARY CLOCK MODE [2] [0]
[ENTER]

Use mode 0 (disabled) if you are not correcting secondary clocks.

Type [2] [0] [ENTER]. Display will read:

MODE=0, DISABLED

See the MODE SUMMARY at the back of this manual as well as Section 4.9 for more details.

5.8 REVIEWING OR EDITING THE BASIC PLAN PROGRAM [B] [ENTER]

If the basic program was not entered during the restart Auto Prompt sequence, it can be entered by entering the basic program mode. This mode allows the operator to program the daily timed events. Before entering your program be sure to write it out on a program record sheet. Copies of the program record sheet are located at the back of this manual. You may need to change the size of your basic program if it requires more than 20 steps. See SETTING THE MAXIMUM NUMBER OF STEPS PER PLAN (Section 7.3) for more detail.

Press BASIC [B]. The display will respond with:

Command? 0B
Press ENTER

The master clock will now advance to the programming sequence.

6.0 PROGRAMMING

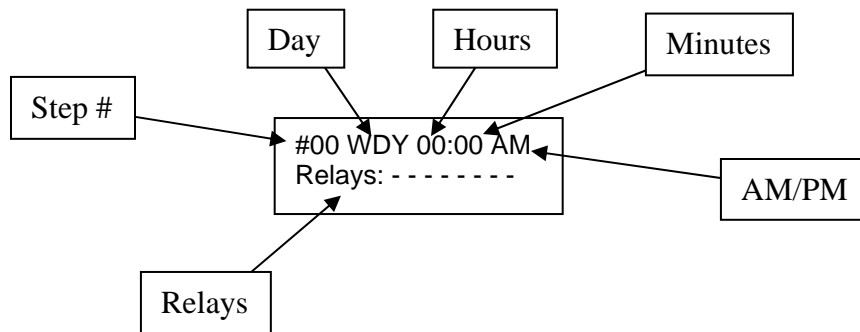
6.1 ENTERING THE BASIC PLAN PROGRAM

Before you begin programming your MC4181NX you should complete the MC SERIES PROGRAM RECORD SHEET included at the back of this manual. Be sure to enter pulse lengths if required for all relays (Sections 5.5, 5.6). You may need to change the size of your basic program. See Section 6.3 for more detail.

See Section 5.8 for information on starting the programming sequence. The display should be showing:

BASIC Plan #0
Step #00

The cursor will be flashing on the zero for Plan #0. Plan #0 is the first of up to 10 Basic Plans, each of which contains a 7-day plan. **Plan #0 is the main 7 day plan and plans 1 through 9 are alternate 7 day plans.** Alternate plans can be scheduled on an annual basis (more on this in ENTERING, REVIEWING OR EDITING THE ANNUAL PROGRAM Section 6.3). Press [ENTER] to select plan #0. The cursor moves to the Step #00 position. Step #00 is the first step of 20 steps in plan #0 by default (Section 7.3). Press [ENTER] to select step #00 and the display will read as follows:



The cursor will be flashing on the W of WDY (weekday).

Step # - The #00 indicates that this is step 00 being displayed.

Day - Program steps may be programmed for individual days, such as Mon or Tue, or for groups of days such as WDY for weekdays. See below for the step abbreviations, and what they mean. "Special Weeks" (Wk0 thru Wk9) can be created for your specific needs. For example, a Mon, Wed, Fri week. See ADVANCED PROGRAMMING (Section 7.1) for more details. Press the DAY [4] key to advance to the chosen day or group of days. The display will update as you press the DAY[4] key. Once the preferred day or group is displayed, press [ENTER]. The display will advance to the hour's position.

STEP DAY	MEANS...
EDY	step occurs everyday
WDY	step occurs every weekday
WND	step occurs every weekend day
MON	step occurs every monday
TUE	step occurs every tuesday
WED	step occurs every wednesday

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THU	step occurs every thursday
FRI	step occurs every friday
SAT	step occurs every saturday
SUN	step occurs every sunday
WK0-WK9	step occurs on days designated by custom week (see Section 8.1)

Hours - Enter the two digit hour at which this step is to be activated and press [ENTER]. The display will advance to the minute's position.

Minutes - Enter two digits for the minutes and press [ENTER]. The display will advance to the AM/PM position.

AM/PM - Press the [AM] [1] or [PM] [2] key, then [ENTER]. The display will advance to the first position after the word RELAY.

Relays - Enter the number of the relays you wish to be energized by this program step. If a step is entered and a relay that is already energized should stay energized until the next step, it is necessary to enter the relay number again for this step. The relay settings show the state of the relays at the programmed time of the step. The relay numbers will appear on the bottom line as you press the appropriate number. Pressing the same number again will remove the relay number from the bottom line. Once the relays are set, press [ENTER]. **If you have selected a secondary clock correction mode other than mode 0, relays 3 and 4 will not be available for timed event functions.** The first step (00) is programmed. The following display shows an example of all relays being activated on Weekdays at 10:00 AM.

```
#00 WDY 10:00 AM
Relays: 1 2 3 4 5 6 7 8
```

The Auto Prompt display will advance to the next step (01).

```
#01 WDY 00:00 AM
Relays: - - - - -
```

Subsequent steps are entered the same way as the first. Continue until the last step of Basic Plan #0 is entered. Step 19 (the 20th step) is the last step if you are using the default setting of 20 steps per plan. After entering the last step, the master clock will advance to Basic Plan #1:

```
BASIC Plan #1
Step # 00
```

The master clock is now prompting you to enter the first of up to 9 alternate plans, plan #1. Plans 1 through 9 are entered the same as plan 0. If you are not using alternate plans 1 through 9, or if you have just entered your last alternate plan, press [EXIT]. The master clock will return to the time display.

6.2 CLEARING A PROGRAM STEP

To clear a program step, press BASIC [B], then [ENTER].

BASIC Plan #0
Step # 00

The display will prompt you for a plan #(cursor on 0). Choose the basic plan in which the step to be cleared is located, then press [ENTER].

The display will then prompt for a step #(cursor on 00). Choose the # of the step to be cleared, then press [ENTER]. The chosen step and its program contents will be displayed.

The cursor will be on the first letter of the day of the week. Press [ENTER]. The cursor will go to the hour's position. Enter 00 for the hours. This will clear this specific step. Press [ENTER]. The display will advance to the next step. If you are finished, press [EXIT]. The display will read:

BASIC Plan #1
Step # 00

Choose another plan to edit or press [EXIT] again to return to the time display.

If you wish to erase all the program steps see CLEARING THE ANNUAL AND BASIC PROGRAMS (Section 6.5).

6.3 ENTERING, REVIEWING OR EDITING THE ANNUAL PROGRAM [A] [ENTER]

The annual program allows the master clock to be programmed to select any 1 of up to 9 alternate plans. This feature is useful for applications that require a different 7-day plan at different times in the future. There are 20 Annual Program Plans, each of which has a starting and ending date, and an associated, alternate plan. The selected alternate plan will begin at 12:00 AM on the start date and will end at 11:59:59 PM on the day of the end date. Basic Plan 0 takes over at the end of any Alternate Plan. To enter the annual program mode, press the ANNUAL [A] key. The display will respond with:

Command? 0A
Press ENTER

Press [ENTER]. The display will respond with:

ANNUAL #00
BASIC #1

The cursor will be prompting for an Annual Plan number. #00 is the first Annual Plan. Press [ENTER]. The cursor will then prompt for the Basic Plan to select with this Annual. Enter the Basic Plan number, then press [ENTER]. The display will read:

Start? 00-00-00
End? 00-00-00

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There may be a date already in the start date from a previous program. It is not necessary to erase this old date. Simply enter new data in each field. To erase an annual plan see CLEARING AN ANNUAL PLAN (Section 6.4). The cursor will be flashing in the month's position. Type the two digits for the month at which this Annual Plan will start and press [ENTER]. The display will advance to the day's position. Type the two digits for the day and press [ENTER]. The display will advance to the years position. Type the two digits for the year and press [ENTER] or enter [XX] to repeat the Annual program each year. See the ANNUAL REPEAT PROGRAMS instructions in ADVANCED PROGRAMMING (Section 8.2) for details. The cursor will advance to the end date line. Enter the end date in the same manner as the start date. If your Annual Plan is only for one day, do not enter an end date. Just press [ENTER] to put "00" in the months and the display will advance to the next Annual Plan.

ANNUAL #01
BASIC #1

Repeat the same procedure for Annual 01 as you did for Annual 00, or press [EXIT] to return to the time display.

6.4 CLEARING AN ANNUAL PLAN

To clear an Annual Plan, press the ANNUAL [A] key, then [ENTER]. The display will respond with:

ANNUAL #00
BASIC #1

Enter the Annual Plan number to be cleared and press [ENTER] twice. The display will show the contents of that Annual Plan.

Start? 12-19-07
End? 01-01-08

Enter 00 for the Start month and press [ENTER]. The plan will be cleared. There is no need to clear the end date once the start date has been cleared. If you are programming the clock from a restart, the annual and basic program steps will be cleared already.

6.5 CLEARING THE ANNUAL AND BASIC PROGRAMS [C] [ENTER]

If you are re-programming a previously programmed clock you will need to erase any previous programs as they could conflict with your new program. To clear all program steps, press the CLEAR [C] key. The display will respond with:

Command? 0C
Press ENTER

Press [ENTER]. The display will respond with:

Clear buffers:
A=ANNUAL B=BASIC

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To clear the Annual program, press [A]. The display will return to the time display. To clear the Basic program instead, press [B].

Press 0-9 or "A"
for all sets

Choose a Basic Plan number to clear or press [A] to clear all Basic Plans.

If you wish to clear both the annual and basic programs, repeat the process a second time. Only one can be cleared at a time.

7.0 SPECIAL FUNCTIONS

7.1 MANUAL OPERATION OF THE OUTPUT RELAYS [1] [ENTER]

WARNING!! Manually controlling the relays will affect the loads connected to the Master Clock. Operating these loads at the wrong time may cause damage, injury or disruption of activities. Be aware of what is being operated by the relays and let others know that this is about to take place.

To manually control the output relays from the keyboard, press the MANUAL [1] key. The display will respond with:

Command? 01
Press ENTER

Press [ENTER]. The display will respond with:

Manual Control
Relays: - - - - -

Key in the number(s) of the relay(s) that you would like to manually control. The numbers of the relays chosen will be seen on the bottom line of the display. To remove a relay from the bottom line, press its number again.

Manual Control
Relays: 12 - - 5678

After selecting the relays, press [ENTER]. The output relays chosen will be energized and the Master Clock will return to the time display. The relays will remain on for the duration of their respective pulse length, or until the next program step instructs them to turn off, or until they are manually operated again. If the Master Clock is using a secondary clock mode, relays 3 and 4 will not be controlled by the Manual command as they will be dedicated to controlling secondary clocks.

7.2 MANUAL SELECTION OF ALTERNATE PLANS [2] [1] [ENTER]

Alternate Plans can be selected from the keyboard in addition to being selected by the ANNUAL PROGRAM.

To select an Alternate Plan type [2] [1] [ENTER]. The display will respond with:

Select
New Basic: 0

Enter the desired Basic Plan number, then press [ENTER]. The master clock will now run the Basic Plan you have selected. The master clock will automatically go back to Basic Plan 0 after 12:00 AM. Also, if any of the following changes are made, the master clock will return to Basic Plan 0:

- Entering a new time.
- A power failure of any duration.
- Entering a new date.
- Modifying the Annual programs.
- Clearing the Annual programs.

Use special function 90 (See STATUS Section 7.5) to verify which plan is running.

7.3 SETTING THE MAXIMUM NUMBER OF STEPS PER PLAN [3] [1] [ENTER]

The master clock has a default setup of 10 Basic Plans with 20 Program Steps each for a total of 200 steps. These plans are numbered Plan 0 through Plan 9. Plan 0 is the main Plan that will repeat itself every 7 days. Plans 1 through 9 are Alternate Plans that can be scheduled by the Annual Program, or they can be called up manually using the MANUAL SELECTION function as described above.

The master clock can be reconfigured to allow more than 20 Steps per Plan. Special function Command 31 is used to adjust the number of Steps per Plan from 20 to 100. The number of Alternate Plans will automatically be adjusted to fit the maximum number of 200 Steps available. **Changing the maximum number of Steps per Plan should be done prior to entering your program.**

To set the number of Steps type [3] [1] [ENTER]. The display will read:

Max. Step No: 19
(0-99), ENTER

The cursor will be flashing on the maximum Step number. Since all Step numbers begin with 0, a maximum number of 19 represents 20 Steps. Refer to the chart below to determine your Max. Step No

# Steps	# Alternate Plans	Max. Step No.
1-20	9	19 (default)

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21-25	7	24
26-28	6	27
29-33	5	24
34-40	4	39
41-50	3	49
51-66	2	65
67-100	1	99

If your application requires 26 steps, enter 27 as the Max. Step No.

Press [ENTER]. The display will respond as follows:

Max. Buffer No.
= 6 (Press EXIT)

Since the Basic Plans begin with Plan 0, this means there are a total of 7 Plans available. Each will have 28 Steps. To go back to the time display, press [EXIT].

7.4 DISPLAY BLANKING [9] [8] [ENTER]

The master clock's default setting is no DISPLAY BLANKING. To set DISPLAY BLANKING press [9] [8] and [ENTER]. The master clock display will automatically blank if the keyboard has not been used for 5 minutes. To change it back press [9] [8] and [ENTER] again.

7.5 STATUS [9] [0] [ENTER]

The master clock has a status check capability. Press [9] [0] [ENTER]. The display will show:

Unit Status: T=N
B=0 A=XX BK=N

"T" status is for factory use only. It should always be "N". "B" status indicates which Basic Plan is in effect. "A" status indicates which Annual Plan is in effect. "XX" indicates no Annual Plan in use at this time. "BK" status indicates whether the display blanking is on or off.

7.6 FORCING A RESTART [7] [7] [ENTER]

For training purposes or clearing all programming information from the master clock, a restart is recommended. Press [7] [7] [ENTER]. The display will show the UNIT POWER FAIL message.

UNIT POWER FAIL
Press "3" key

7.7 SOFTWARE VERSION [9] [9] [ENTER]

To check the version of the software installed in your master clock press [9] [9] [ENTER]. The display will read:

MC81 Master Clk.
Version 2.XX

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After 5 seconds the display will return to the time display.

7.8 SELECTING THE TIMEBASE [3] [0] [ENTER]

The default Timebase setting for the MC4181NX is for 60 HZ AC line synchronization. This is the preferred setting installations in North America and other countries where 60 HZ power is available.

For countries where 50 HZ AC power is available, the MC4181N can be set to synchronize with the 50 HZ AC power line.

For areas where the AC line frequency is not accurate, or in applications where an AC generator is used for power, the MC4181NX can be set for an internal crystal time base.

To check or change the timebase setting for the MC4181NX master clock press [3] [0] [ENTER]. The display will read:

Timebase=
60Hz Line

The cursor will be on the 6. If this is correct for your application press [EXIT].

To select a different timebase, do not press [EXIT]. Instead, press any key while the cursor is on the 6 and the display will advance to the next timebase selection. Other selections are:

Timebase=
50Hz Line

Timebase=
Crystal

Once the desired timebase is shown on the display, press [ENTER].

8.0 ADVANCED PROGRAMMING

8.1 CUSTOM WEEKS (Wk0 – Wk9) [2] [2] [ENTER]

Up to ten custom weeks can be user defined for the master clock. This is useful for applications that require the same events on various groups of days of the week. For example: custom week Wk0 could be defined for Mondays, Wednesdays, and Fridays.

To define Wk0 through Wk9 press [2] [2] [ENTER]

Set Days for Wk0
Days: -M-W-F-

The numbers 1 through 7 correspond to the days of the week. Press [1] for Sunday, [2] for Monday, etc. Press [A] to enter and advance to the next custom week. Press [EXIT] to return to the time display.

To review the custom weeks, press [2] [2] [ENTER], then [A] to cycle through Wk0 to Wk9. Press [EXIT] to return to the time display.

To create Basic Plan Steps with this feature, use the same procedure as entering standard Basic Plan Steps. (See ENTERING BASIC PLAN PROGRAM Section 6.1) When prompted for the Day or days of the week for a given Step the custom weeks will appear as choices along with the standard Days.

00 Wk0 08:30 AM
Relays: 1 2 - - - - -

8.2 ANNUAL REPEAT PROGRAMS

Some Annual Plan programs may have the same Start and End dates every year, such as Christmas, July 4th, and New Years Day. Instead of creating multiple Annual Programs for each year, special Annual Programs can be created to cover every year into the future.

To create these special Annual Plan programs, use the same procedure as entering standard Annual Plans. (See ENTERING, REVIEWING OR EDITING THE ANNUAL PROGRAM Section 6.3) When prompted for the year (YY) for the Start and End dates, press the "A" key instead of entering two digits for the year. Pressing the "A" key will insert XX for the year. For example, the following Annual Plan Program will begin December 19th and end January 1st every year:

Start 12-19-XX
End 01-01-XX

8.3 BUILT-IN RS232 I/O INTERFACE

An RS232 interface is provided for communicating with the MC4181NX. With this interface, complete master clock programs can be uploaded or downloaded using the MC Programming Software (9800-1010). For details on the MC Programming Software refer to the MC Programming User's Manual.

The MC4181NX can synchronize with other MC4181NX's, MC4181N's, and MC4181LV's. The MC4181NX can be used to update ATS AE, AN, and CC Series Displays. The Time, Date, and

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Day of the Week of the MC4181NX can synchronize to the GPS system's atomic clock via an AE Series GPS Master Clock, or GPS-TR3 GPS Master Clock Interface. Time, Date, and Day of the Week of a Master Clock can also be synchronized with computers using MCPCSet and PCMCSet Software also on (9800-1010).

The MC4181NX can receive 10-Byte messages via RS232 from a computer or another master clock such as the AE Series GPS Master Clock. These 10-Byte messages can include Time in 12 or 24-Hour format, Date, and Day of the Week.

In addition the MC4181NX will automatically transmit 10-Byte messages for time, in 12 Hour format, for use by other Master Clocks and ATS AE, AN, and CC Series Displays. This information will be sent once each minute at the top of the minute (00th second). ATS Displays must be set for address 15 (standard for CC Series Displays) to display received Time.

The RS232 output can drive up to 50 ATS Displays at a distance up to 2000 feet away (each display requires local power). For additional displays and additional distance, AE-455DR6 RS232 Drivers can be added to the system. Application Notes are available.

A DB9 female to 3 pigtailed cable (ATS P/N 9110-1115) is provided. Terminal blocks are provided for the RS232 I/O Port.

8.4 BUILT-IN TIME CODE OUTPUT

An optional built-in time code output is provided for proprietary OEM applications. Contact the factory for your specific time code output.

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PROGRAMMING SUMMARY

Read the sections on Programming Instructions before using the PROGRAMMING SUMMARY.

SET TIME - Press TIME [3] key then [ENTER]. Enter the hours, press [ENTER]. Enter the minutes, press [ENTER]. Press [AM] or [PM], press [ENTER]. Timing begins the instant you press [ENTER] on entering the [AM] or [PM].

SET DATE - Press DATE [D] key then [ENTER]. Enter month, press [ENTER]. Enter day, press [ENTER]. Enter year, press [ENTER].

SET DAY - Press the DAY [4] key then [ENTER]. Press the DAY [4] key until desired day is displayed, then press [ENTER].

SET DST DATES - Press DST [7] key then [ENTER]. Enter month for Spring DST, press [ENTER]. Enter the desired Sunday for Spring DST, press [ENTER]. Enter month for Fall DST, press [ENTER]. Enter the desired Sunday for Fall DST, press [ENTER].

ENTERING THE SECONDARY CLOCK MODE - Press keys [2] [0] then [ENTER]. Press any key to advance to the desired mode, then press [ENTER].

SETTING THE MAXIMUM NUMBER OF STEPS PER PLAN - Press [3] [1] then [ENTER]. Enter the desired number of steps per plan, up to 99 then press [ENTER]. Press [EXIT] after reviewing the display.

ENTERING THE BASIC PLAN PROGRAM - Press the BASIC [B] key then [ENTER]. Enter the desired plan number, press [ENTER]. Enter the desired step number, press [ENTER]. Press the DAY [4] key until desired day or group of days is displayed, press [ENTER]. Enter the desired hour, press [ENTER]. Enter the desired minute, press [ENTER]. Press [AM] or [PM], press [ENTER]. Enter the desired relays to turn ON, press [ENTER]. The step is now programmed and ready for the next step. Repeat this process until entire program is entered then press [EXIT].

ENTERING THE ANNUAL PLAN PROGRAM - Press the ANNUAL [A] key then [ENTER]. Enter the desired Annual Plan number, press [ENTER]. Enter the desired Alternate Plan number, press [ENTER]. Enter the start month, press [ENTER]. Enter the start day, press [ENTER]. Enter the start year, press [ENTER]. Or press [A] to enter "XX" for the year and make the plan an Annual Repeat Plan. Enter the end month, press [ENTER]. Enter the end day, press [ENTER]. Enter the end year, press [ENTER]. Or press [A] to enter "XX" for the year and make the plan an Annual Repeat Plan. The first Annual Plan is programmed. The menu will now advance to the next Annual Plan. Press [ENTER] to continue programming Annual Plans or press [EXIT] to return to the time display.

MANUAL SELECTION OF ALTERNATE PLANS - Press [2] [1] then [ENTER]. Select alternate plan (Basic Plan 1 to 9) then press [ENTER].

MANUAL OPERATION - Press MANUAL [1] then [ENTER]. Enter relays to manually control then press [ENTER]. The chosen relays will energize.

CLEARING THE ANNUAL AND BASIC PROGRAMS - Press CLEAR [C] then [ENTER]. Press ANNUAL [A] to clear annual program or BASIC [B] to clear the basic program. Choose the sets buffer to clear.

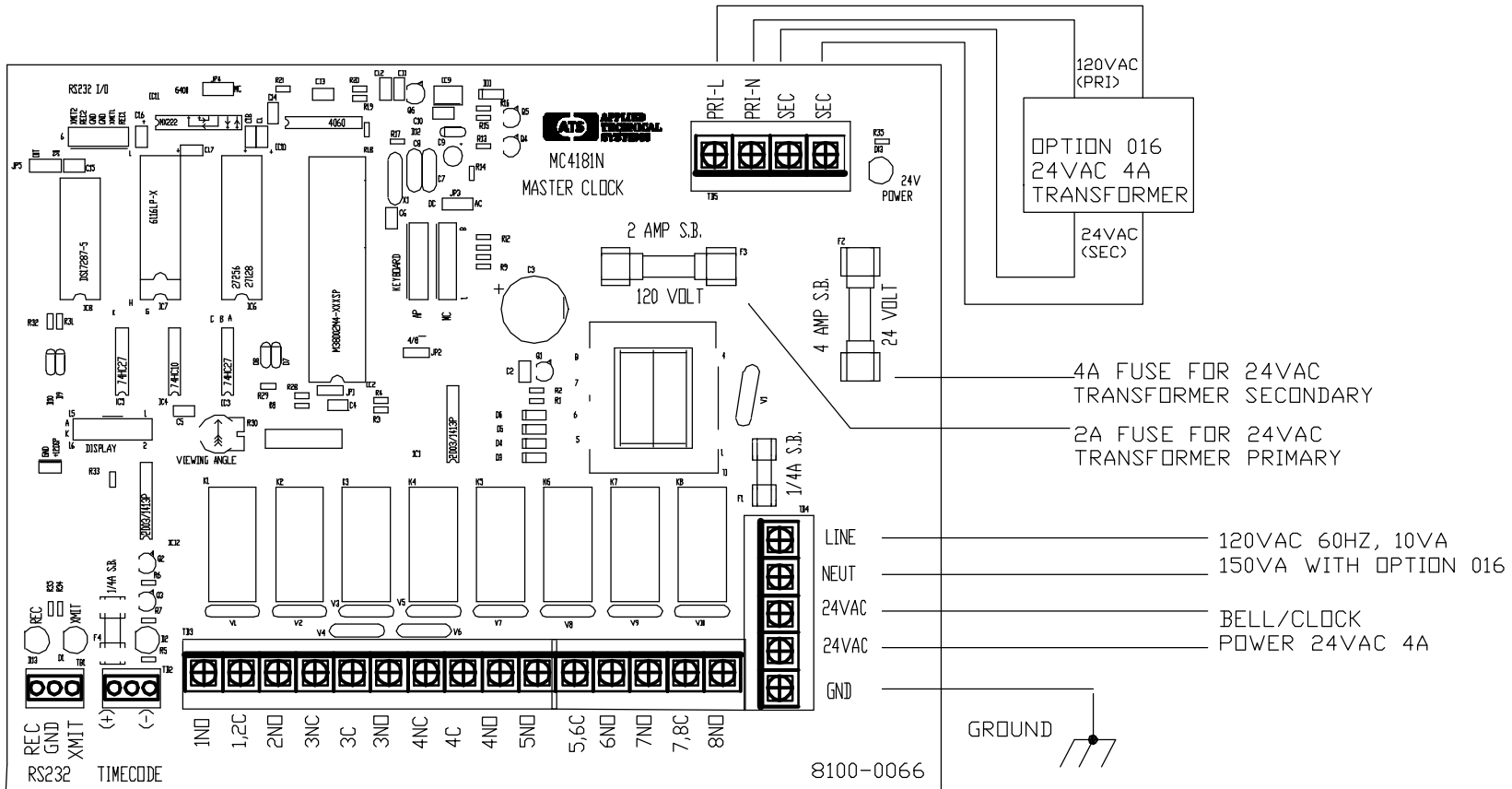
REVIEWING BASIC PLAN PROGRAM - Press BASIC [B] key then [ENTER]. Press BASIC [B] key again repeatedly to review each step. Press [EXIT] when done.

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REVIEWING THE ANNUAL PLAN PROGRAM - Press ANNUAL [A] key then [ENTER]. Press ANNUAL [A] key again repeatedly to review each Annual plan.

SETTING THE OUTPUT PULSE – Press [5] then [ENTER]. Enter a pulse length from 1 to 9. Press [ENTER]. Enter the number of the relay(s) the pulse is to be applied to. Exclude relay 2. Press [ENTER].

SETTING THE RELAY 2 PULSE – Press [5][A]. Press [ENTER]. Enter a pulse length from 1 to 9. Press [ENTER].



TIMECODE OUTPUT
(SEE MANUFACTURER)

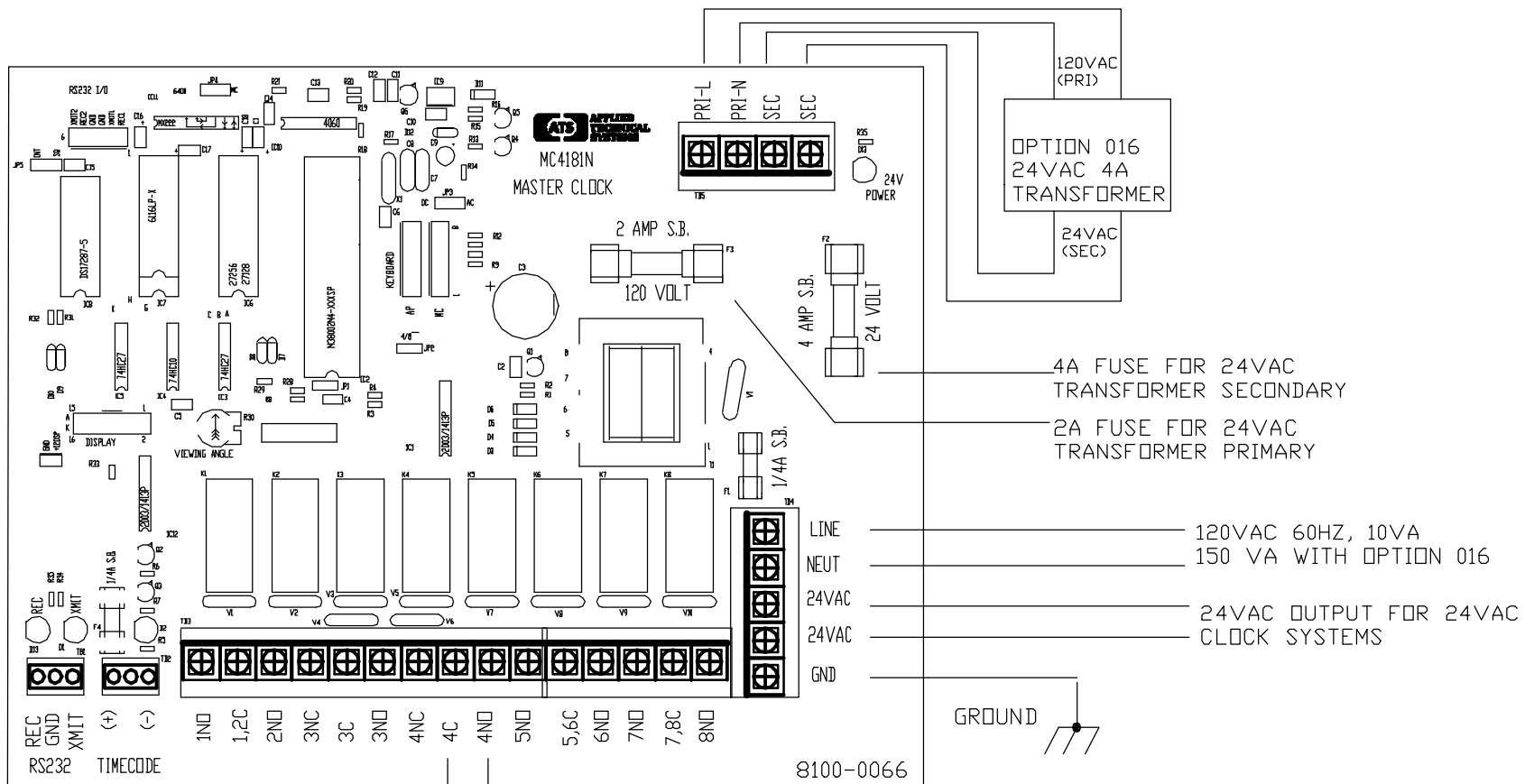
RELAY OUTPUTS
RATED AT 15A,
120VAC OR 30VDC
RESISTIVE

RS232 I/O FOR CLOCK
CORRECTION AND
COMPUTER INTERFACE

NOTES:

MC4181NX MASTER CLOCK WITH OPTION 16, 24VAC 4A OUTPUT.
SEE MC4181NX-WD2.DWG FOR MODE 2 SECONDARY CLOCK WIRING DATA.
SEE MC4181NX-WD3.DWG FOR MODE 8 SECONDARY CLOCK WIRING DATA.
SEE MC4181NX-WD4.DWG FOR RS232 I/O DATA AND BELL SYSTEM WIRING.

		P.O. BOX 5705 SHREVEPORT, LA 71135
DRAWN BY BAL	PROJECT MC4181NX MASTER CLOCK SHOWN WITH OPTION 16. 24VAC 4A OUTPUT	SCALE SC
REVISIONS	DESCRIPTION WIRING DIAGRAM	JOB # SHEET # REVISION FILENAME: MC4181NX-WD1 DRAWING #
DATE 4/14/09		

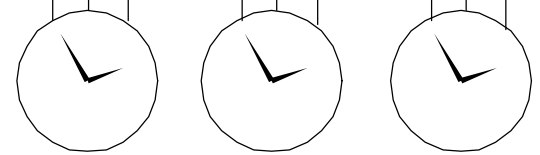


24VAC/*

* FOR 120VAC
CLOCK SYSTEMS,
USE LOCAL 120VAC
POWER

CORRECTION COIL
RUN MOTOR
RETURN

TO OTHER
CLOCKS

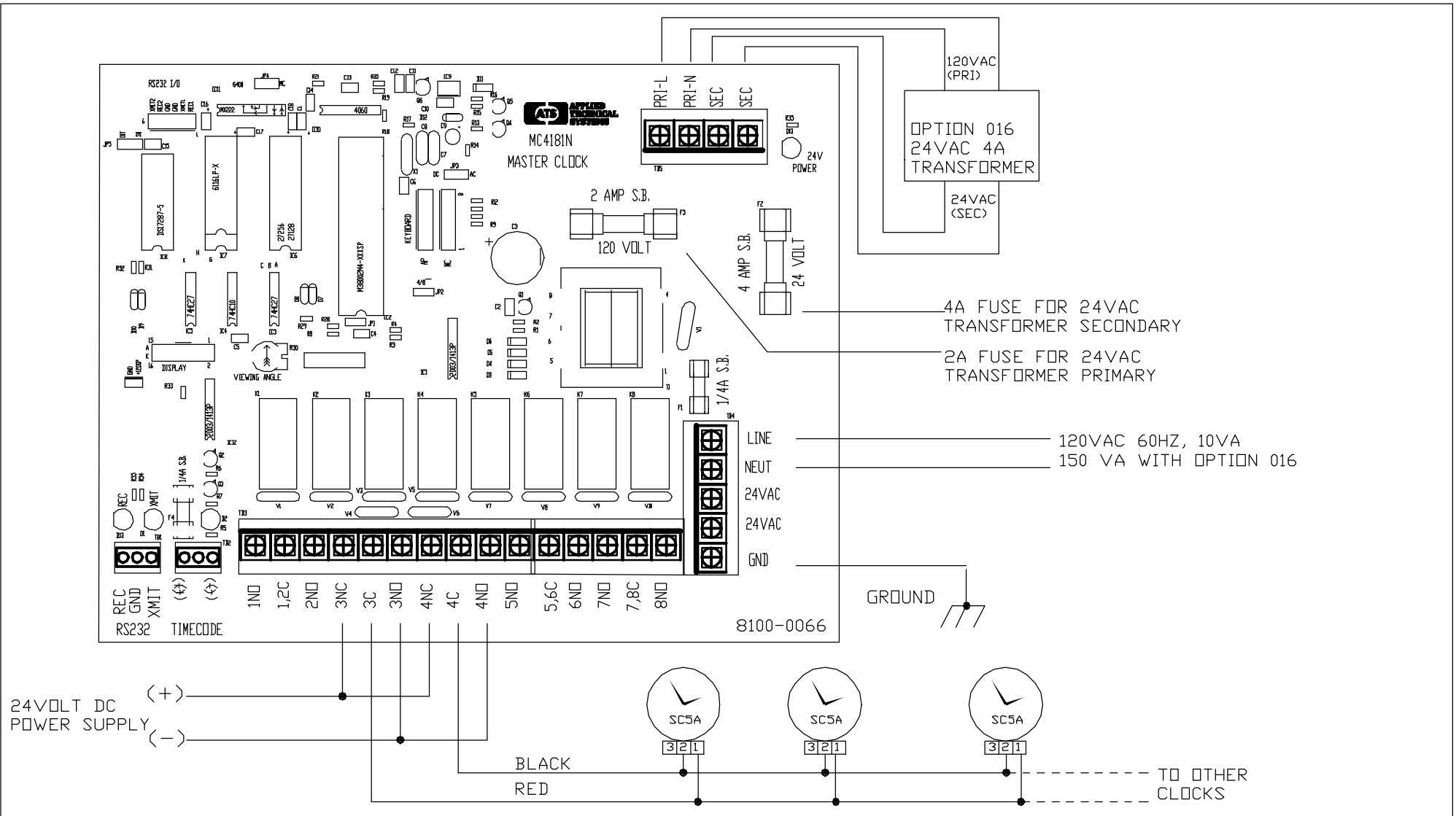


NOTES:

AN 8-SECOND COMMAND SIGNAL ON THE CORRECTIVE LINE AT X:57:54 WILL CAUSE AN HOURLY CORRECTION.
A 6-SECOND COMMAND SIGNAL ON THE CORRECTIVE LINE AT 5:58:02 IN ADDITION TO THE HOURLY CORRECTIVE COMMAND WILL CAUSE A 12-HOUR CORRECTION. (14 SECONDS TOTAL)

MC4181NX MASTER CLOCK WITH OPTION 16, 24VAC 4A OUTPUT.
SEE MC4181NX-WD3.DWG FOR MODE 8 SECONDARY CLOCK WIRING DATA.
SEE MC4181NX-WD4.DWG FOR RS232 I/O DATA AND BELL SYSTEM WIRING.
SEE MC4181NX-WD1.DWG FOR POWER AND OPTION 016 DATA.

		P.O. BOX 5705 SHREVEPORT, LA 71135
DRAWN BY BAL 4/14/09	PROJECT MC4181NX MASTER CLOCK SHOWN WITH OPTION 16. 24VAC 4A OUTPUT MODE 2 WIRING	SCALE SC JOB # SHEET # REVISION FILENAME: MC4181NX-WD2 DRAWING #
REVISIONS	DESCRIPTION WIRING DIAGRAM	

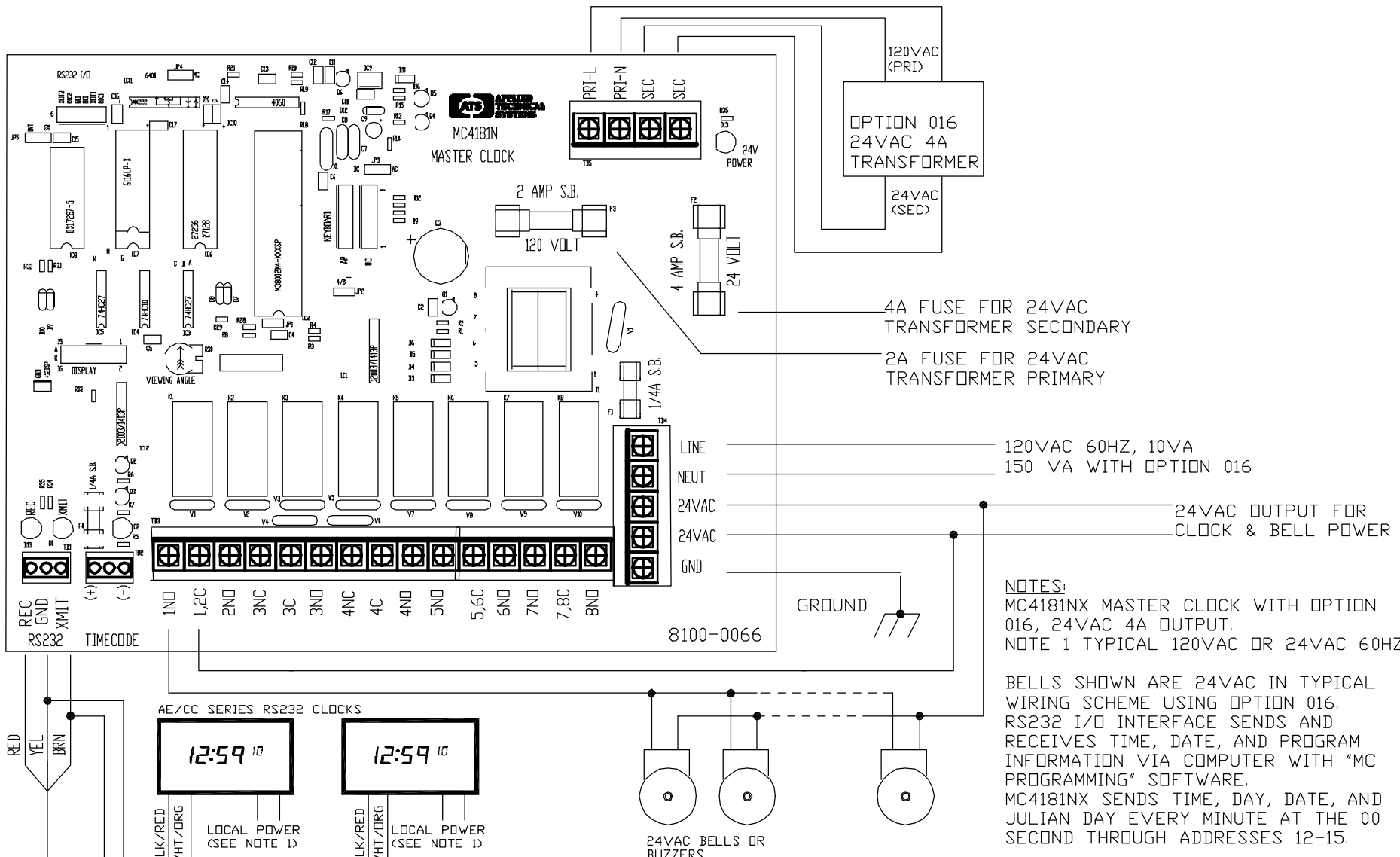


NOTES:

MODE 8
 24VDC BI-POLAR MINUTE IMPULSE (100mA, 1-SEC PULSE) CORRECTION

MC4181NX MASTER CLOCK WITH OPTION 16, 24VAC 4A OUTPUT.
 SEE MC4181NX-WD2.DWG FOR MODE 2 SECONDARY CLOCK WIRING DATA.
 SEE MC4181NX-WD4.DWG FOR RS232 I/O DATA AND BELL SYSTEM WIRING.
 SEE MC4181NX-WD1.DWG FOR POWER AND OPTION 016 DATA.

		PROJECT MC4181NX MASTER CLOCK SHOWN WITH OPTION 16, 24VAC 4A OUTPUT MODE 8 WIRING		P.O. BOX 5705 SHREVEPORT, LA 71135
		DRAWN BY BAL	DATE 4/14/09	SCALE SC
REVISIONS		DESCRIPTION WIRING DIAGRAM		SHEET #
				REVISION FILENAME: MC4181NX-WD3
				DRAWING #



4A FUSE FOR 24VAC TRANSFORMER SECONDARY
 2A FUSE FOR 24VAC TRANSFORMER PRIMARY

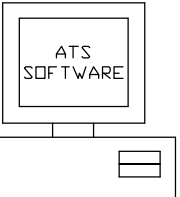
120VAC 60HZ, 10VA
 150 VA WITH OPTION 016

24VAC OUTPUT FOR CLOCK & BELL POWER

NOTES:
 MC4181NX MASTER CLOCK WITH OPTION 016, 24VAC 4A OUTPUT.
 NOTE 1 TYPICAL 120VAC OR 24VAC 60HZ.

BELLS SHOWN ARE 24VAC IN TYPICAL WIRING SCHEME USING OPTION 016.
 RS232 I/O INTERFACE SENDS AND RECEIVES TIME, DATE, AND PROGRAM INFORMATION VIA COMPUTER WITH "MC PROGRAMMING" SOFTWARE.
 MC4181NX SENDS TIME, DAY, DATE, AND JULIAN DAY EVERY MINUTE AT THE 00 SECOND THROUGH ADDRESSES 12-15.

CABLE ASSEMBLY PN: 9110-1115
 DB9 FEMALE



		P.O. BOX 5705 SHREVEPORT, LA 71135
PROJECT MC4181NX MASTER CLOCK SHOWN WITH OPTION 16. 24VAC 4A OUTPUT RS232 I/O WIRING BELL/HORN WIRING		SCALE SC JOB # SHEET # REVISION FILENAME: MC4181NX-WD4 DRAWING #
DESCRIPTION WIRING DIAGRAM		

DRAWN BY	
BAL	4/14/09
REVISIONS	

ANNUAL PLAN PROGRAM RECORD SHEET

LOCATION _____

DATE _____

ANNUAL #	BASIC #	START DATE	END DATE
		MM-DD-YY*	MM-DD-YY*
00			
01			
02			
03			
04			
05			
06			
07			
08			
09			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			

* NOTE: TO HAVE ANNUAL PROGRAMS REPEAT EACH YEAR AUTOMATICALLY, PRESS "A" WHEN PROMPTED FOR THE YEAR. THIS WILL INSERT "XX" FOR THE YEAR PORTION OF THE DATE.

****** SPECIAL FUNCTIONS ******

- | | | | |
|----|-----------------|----|-----------------------|
| 01 | MANUAL | 90 | UNIT STATUS |
| 05 | PULSE | 21 | SELECT ALTERNATE PLAN |
| 5A | PULSE 2 | 22 | DEFINE CUSTOM WEEKS |
| 20 | MODE SELECT | 31 | SET PROGRAM SIZE |
| 30 | SELECT TIMEBASE | | |

TECHNICAL SUPPORT

For any questions concerning installation and operation of this product, contact our factory at:

PHONE (800) 444-7161

FAX (318) 797-4864

See our website at www.ats-usa.com

SERVICE POLICY

It is recommended that all service for this product be done by the factory or by a factory authorized service representative. Applied Technical Systems will provide ongoing service support in and out of warranty. Send your repairs to:

**APPLIED TECHNICAL SYSTEMS
849 KING PLACE
SHREVEPORT, LA 71115**

APPLIED TECHNICAL SYSTEMS WARRANTY POLICY

ATS warrants its products to be free of defects in material and workmanship for a period of 24 months from the date of purchase. ATS will repair or replace any product returned to its authorized factory service center within the warranty period so long as there is no evidence that the product has been abused, misused, damaged by lightning, overloads of any kind or water, or altered in any way.

Products returned for warranty must be returned with freight prepaid. ATS will pay normal freight charges to return the product to the customer. Special premium freight requested by the customer will be charged to the customer.

ATS disclaims any warranties expressed or implied, including merchantability and/or fitness for a particular purpose. In no event shall ATS be held liable for incidental or consequential damages.

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