



# MC4181LV SERIES MASTER CLOCKS

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THIS MANUAL COVERS THE MC4181LV RACK MOUNT

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MC4181LV is an eight-circuit master clock, with a built-in RS232 I/O port. This manual will reference this unit as the "MC4181LV" or the "Master Clock".

**INTRODUCTION**

The MC4181LV is a low voltage, 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 MC4181LV'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. The MC4181LV is an eight circuit model. Secondary clock correction modes are built-in, and can be selected from the keyboard. If a secondary clock correction mode is selected, the MC4181LV will dedicate two of its relay outputs for correction, thus the MC4181LV is now a six circuit model with correction. If the MC4181LV is not being used for correcting secondary clocks (Mode 0), then all output relays are available for timed events. The output relays are rated at 48 VAC, 15 amps resistive load. Selected outputs can be independently programmed for momentary operation such as required for ringing bells in schools, churches or industrial facilities. The RS232 I/O port is used to drive ATS CC2000 Series or AE Series Large Displays. It is also used for communications between the MC4181LV and a PC or a GPS Master Clock.

**SPECIFICATIONS**

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**PROGRAMMING CAPABILITIES**

*AUTO PROMPTING DISPLAY* - Provides display information to guide the operator during programming. From a cold start it will take the operator from setting time to 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 allows all output relays to be used for timed events.

*200 Powerful Program Steps* - The MC4181LV 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 MC4181LV. All 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 MC4181LV can be programmed to automatically adjust its time for Daylight savings time changes according to U. S. law, even if the law changes.

*Automatic Leap Year Compensation.*

*Manual Override* - The output relays can be manually energized or de-energized from the keyboard. The manual override remains in effect until the next programmed step occurs. During this period the word "manual" will be shown on the display.

*Pulsed Output* - Selected outputs 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 that is triggered at the same time as relay 2 will operate for the same duration as relay 2.

**ELECTRICAL**

Power: Standard power required is from 95 VAC to 135 VAC, 60 HZ at 10 VA maximum. A 12VAC power module is provided for the MC4181LV Series master clocks.

Outputs: Eight relays (SIX SPST, TWO SPDT) rated at 15A, 48 VAC or 12 VDC resistive. See the Mode Sheets at the back of this manual for details.

Wiring: Clearly labeled Terminal Blocks on the back panel for relay outputs. A DB9 male connector for RS232 communications.

**POWER FAIL BACKUP**

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Non-Volatile Memory keeps time and programs for extended power outages. Outputs and display are disabled during backup. The MC4181LV resumes normal operation when power returns.

**ACCURACY**

*Time Keeping* - Synchronous with the AC power line. During a power failure it is quartz crystal controlled with an accuracy of +/- .005% 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 is from 0 to 50 degrees C

**PHYSICAL**

MC4181LV                      Anodized aluminum enclosure that measures 19"W X 3.5"H X 8"D.  
  
   Rack mounts in a standard 19" equipment rack. Mounting ears are included.

**INSTALLATION**

The MC4181LV should be securely mounted in a 19" equipment rack according to any local codes using the mounting ears provided. Be sure the equipment is properly grounded to the panel or the facilities ground connection.

**ELECTRICAL CONNECTIONS**

Output relay wiring connections are made at the clearly marked terminal blocks located on the back panel of the MC4181LV enclosure. Remove the terminal block cover plate on the back panel of the MC4181LV to gain access to the terminal blocks. See the wiring diagram at the back of this manual for more detail. Be sure to replace the terminal block cover plate after making wiring connections. A 12VAC power module is provided for the AC power, with a coaxial power jack labeled on the back panel of the MC4181LV enclosure. A DB9 male connector is provided for RS232 communications.

**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 TIME DISPLAY, showing the day, time, and relays, from which you can enter the TIME SET, MANUAL CONTROL, and PROGRAMMING MODES.

**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.

**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.

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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 all ANNUAL PLANS 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 PROGRAMMINGMODE.

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 TIME and PROGRAM MODES. Also used for entering the SET DAY MODE.

**OPERATION**

**FILLING OUT THE PROGRAM RECORD SHEET**

The MC4181LV has extensive programming and control capability. In order to accurately document and enter your program the Program Record Sheet should be used. This sheet is self-explanatory. Copies are included at the back of this manual.

**AUTO PROMPT DISPLAY**

The MC4181LV 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 cold start (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. Entering a program from the Auto Prompt sequence is identical to entering one manually, except that a prompt is provided in the Auto Prompt mode.

**THE CURSOR**

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.

**ENTERING DATA**

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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.

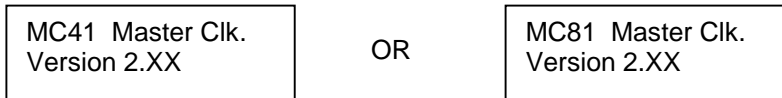
**EXITING THE AUTO PROMPT SEQUENCES**

Any time during a set time, date or programming mode, you may wish to exit the Auto Prompt sequence. Simply press the [EXIT] key. The master clock will advance to the time display. From this display you may enter any of the sequences manually. This manual will assume you have exited the Auto Prompt sequence after entering the time. If you had remained in the Auto Prompt sequence, all the sequences covered in the section on ENTERING, REVIEWING OR EDITING TIME AND PROGRAMS would automatically be invoked.

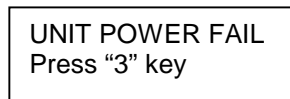
**APPLYING POWER**

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

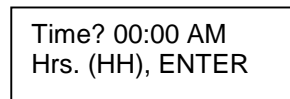
Upon first applying power the display will come up with a brief sign on message showing the model and version numbers:



After a few seconds the first Auto Prompt message will appear. If the following message does not appear, go to the ENTERING, REVIEWING OR EDITING TIME AND PROGRAMS section.



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



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. Notice that every numeric field is zero. On a cold start all memory is cleared in the master clock including time, date, and program steps. 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

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[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.

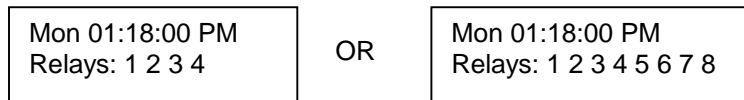
After the time is set, the display will advance to the set date display. The master clock will continue to Auto Prompt all of the programming modes as data is entered.

**ENTERING, REVIEWING OR EDITING TIME AND PROGRAMS**

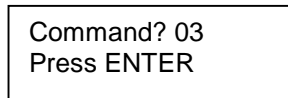
This section will explain how to change or review the existing time, date or programs previously stored, or to totally program the unit. If you have exited from the Auto Prompt sequence, it describes how to manually invoke each mode. If you did not exit the Auto Prompt sequence, ignore the first few instructions that explain how to invoke each mode.

**ENTERING, REVIEWING OR EDITING TIME [3] [ENTER]**

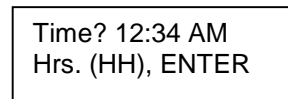
You must be in the time display before you can enter time. Press the [EXIT] key to be sure. The display should look similar to the following:



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



Press [ENTER]. The display will respond with:



It may be showing the correct time or some other incorrect time previously stored. It may even be showing all 0's if you exited the auto prompt sequence.

The cursor will be flashing in the hour's position. The bottom line will give you additional information on how to enter the data. Enter the desired two digit number for hours and press [ENTER]. If the hours are correct simply press [ENTER]. The cursor will move to the minute's position. Do not press [EXIT] part way through editing the time, date or any program steps unless you want to abort editing. If you exit part way through, any changes made prior to the current position will be ignored. Type two digits for the minutes and press [ENTER]. The cursor will move



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to the AM/PM position. Before pressing [ENTER], you may wish to synchronize this master clock to some other reference clock. The instant you press [ENTER], the time keeping will begin. Therefore, to synchronize with a reference clock, wait until that clock is ready to change to the desired time and press [ENTER] at that instant.

ENTERING, 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? 12-29-99  
Month (MM), ENTER

It may be showing the correct date or some other date stored previously. It may even be showing all 0's if you exited from the auto prompt sequence.

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]. The master clock will go back to the time display. To review your entry press the DATE key [D] and [ENTER]. The date display will appear. You can edit the date again if you wish or press [EXIT] to return to the time display. Remember that if you edit any part of the time, date or any program steps, you must not exit. Press [ENTER] until all positions of the display have been edited or you have accepted the default information in each display.

ENTERING, REVIEWING OR EDITING THE DAY [4] [ENTER]

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

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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]. The display will return to the time display.

ENTERING, 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]. The display will respond with the default entries for the current U.S. law as follows:

S DST M=04 SUN=1  
F DST M=10 SUN=L

The top line is for the Spring DST and the bottom line is for the Fall DST. The S indicates the Spring DST and the F indicates the Fall DST. The cursor will be flashing in the month position. Enter the two digits for the month in which you wish the Spring DST adjustment to be made (04 for current US law), then press [ENTER]. The valid Spring months are 00, 03, 04, and 05. Enter 00 for the month if you do not wish to use the automatic DST feature and the master clock will return to the time display. After a valid month is entered, the cursor will advance to the L in the Sunday position. Enter a 1 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 Spring DST data is entered, the cursor will advance to the Fall DST line. If you have entered a Spring DST, you must enter a Fall DST as well. Failure to do so will erase the Spring DST and then there will be no DST compensation.

Fall DST is entered in the same manner as the Spring DST. Current US law for Fall DST is the last Sunday in October. Enter 10 for the month and L [5] for the Sunday. The valid months for the Fall DST are 09, 10, and 11. The valid Sundays for the Fall 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.

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

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.

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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. 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: - - - -

OR

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 return to the time 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

OR

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.

**ENTERING, 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

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 return to the time 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

The master clock will return to the time display.

**ENTERING, REVIEWING OR EDITING THE SECONDARY CLOCK MODE [2] [0] [ENTER]**

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

MODE=0, DISABLED

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See the MODE SUMMARY at the back of this manual for more details.

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. 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 return to the time display. Please note that relays 3 and 4 are dedicated to secondary clock correction and will no longer be available for timed events.

**ENTERING, REVIEWING OR EDITING THE BASIC PLAN PROGRAM [B] [ENTER]**

If the basic program was not entered during the cold start 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. You may need to change the size of your basic program. See CHANGING THE BASIC PROGRAM SIZE section for more detail. Press BASIC [B]. The display will respond with:

Command? 0B  
Press ENTER

Press [ENTER]. The display will respond with:

BASIC Plan #0  
Step #00

The cursor will be flashing on the zero for Plan #0. Plan #0 is the first of 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 the Annual Programming sections). 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. Press [ENTER] to select step #00 and the display will read as follows:

If you have selected correction OR other  
#00 WDY 00:00 AM Relays: - - - - OR #00 WDY 00:00 AM Relays: - - - - - - - - and 4 will not be available for timed event functions.

The #00 indicates that this is step 00 being displayed. The cursor will be flashing on the W of WDY (weekday). Program steps may be programmed for individual days, such as Mon or Tue, or for groups of days such as WDY for weekdays (Mon through Fri), EDY for everyday (Sun through Sat.) or WND for weekends (Sat & Sun). "Special Weeks" (Wk0 thru Wk9) can be created for your specific needs. For example, a Mon, Wed, Fri week. See the ADVANCED PROGRAMMING Section 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

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displayed, press [ENTER]. The display will advance to the hour's position. 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. Enter two digits for the minutes and press [ENTER]. The display will advance to the AM/PM position. Press the [AM] [1] or [PM] [2] key, then [ENTER]. The display will advance to the first position after the word RELAY. Enter the number of the relays you wish to be energized by this program 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]. 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	OR	#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: - - - -	OR	#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 default last step. 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 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.

**CLEARING PROGRAM STEPS**

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].

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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 the section on CLEARING THE ANNUAL AND BASIC PROGRAMS.

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

The annual program allows the master clock to be programmed to select any 1 of the 9 alternate basic 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 Basic Plan. The selected alternate plan will begin at 12:00 AM on the start date and will end at 12:00 AM on the day after 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

There may be a date already in the start and end date fields of the program. It is not necessary to erase this old date. Simply enter new data in each field. To erase an annual plan see the section titled CLEARING THE ANNUAL AND BASIC PROGRAMS. 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 press [XX] to repeat the Annual program each year. See the ANNUAL REPEAT PROGRAMS instructions in the ADVANCED PROGRAMMING section 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.

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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.

**CLEARING THE ANNUAL AND BASIC PROGRAMS**

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? 12-19-00  
End? 01-01-01

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 cold start, the annual and basic program steps will be cleared already. 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

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.

## **SPECIAL FUNCTIONS**

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.

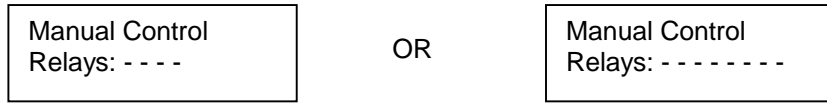
To manually control the output relays from the keyboard, press the MANUAL [1] key. The display will respond with:

Command? 01 Press ENTER
----------------------------

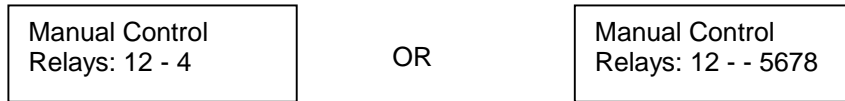


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Press [ENTER]. The display will respond with:



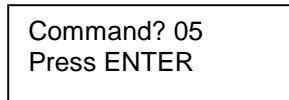
Key in the number(s) of the relay(s) that you would like to manually control. The numbers of the relays chosen will be seen on the bottom line of the display. To turn a relay off, press its number again.



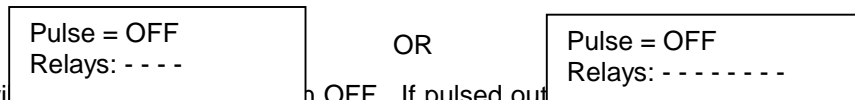
After selecting the relays, press [ENTER]. The output relays chosen will be energized and the Master Clock will return to the time display. The relays will remain on for the duration of their respective pulse length, or until the next program step instructs them to turn off, or until they are manually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

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

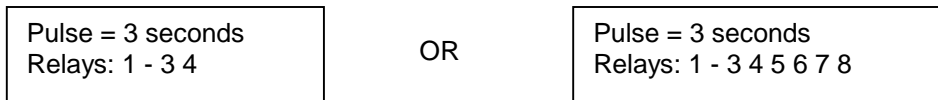
The pulse is normally set to zero for programming steady state ON and OFF events. A pulsed output may be needed for applications requiring a momentary output such as ringing school bells. A second momentary output of a different duration may be required for late bells or warning bells. Relay 2 is reserved for the second pulsed output. Start from the time display.



Press [ENTER].



The cursor will be positioned on OFF. If pulsed output is desired, press [0], then [ENTER]. The master clock will return to the time 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].



The cursor will move to the first position after the word relay. 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 preceding displays show examples of all relays except relay 2 set to pulse for 3 seconds.

**ENTERING, REVIEWING OR EDITING THE RELAY 2 PULSE (MOMENTARY OUTPUT) – [5] [A] [ENTER]**

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

Pulse = OFF  
For Relay 2

The cursor will be flashing on the "O" in OFF. If pulsed output is not desired, press OFF [0], then [ENTER]. The master clock will return to the time display. If pulsed output is desired, enter the number of seconds duration for this pulse from 1 to 9 seconds and press [ENTER].

Pulse = 3 seconds  
For Relay 2

The master clock will return to the time display.

**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 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 (STATUS) to verify which plan is running.

**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.

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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. If your application requires 26 Steps, enter 25 for the maximum Step number, then 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 26 Steps. To go back to the time display, press [EXIT].

DISPLAY BLANKING [9] [8] [ENTER]

The master clock display will automatically blank if the keyboard has not been used for 5 minutes. To override this feature press [9] [8] and [ENTER]. To change it back press [9] [8] and [ENTER] again.

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

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“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.

**FORCING A RESTART [7] [7] [ENTER]**

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

UNIT POWER FAIL  
Press “3” key

**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:

MC41 Master Clk.  
Version 2.XX

OR

M841 Master Clk.  
Version 2.XX

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

**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] after 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 the mode 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 the press [ENTER]. Press [EXIT] after reviewing the display.

**ENTERING THE BASIC PLAN PROGRAM** - Press the BASIC [B] key then [ENTER]. Enter the desired step number, press [ENTER]. Press the DAY [4] key until desired day or group of days is displayed, press [ENTER]. Press [AM] or [PM], press [ENTER]. Enter the desired relays to turn

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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 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.

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

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**ADVANCED PROGRAMMING**

**CUSTOM WEEKS (Wk0 – Wk9)**

Up to ten custom weeks can be user defined for the MC4181LV. 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. Now when prompted for the Day or days of the week for a given Step these new custom weeks will appear as choices along with the standard Days.

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

OR

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

**ANNUAL REPEAT PROGRAMS**

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

To create these special Annual Plan programs, use the same procedure as entering standard Annual Plans. 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. The following Annual Plan Program will begin December 19<sup>th</sup> and end January 1<sup>st</sup> every year.

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

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**RS232 I/O INTERFACE**

An RS232 interface is provided for communicating with the MC4181LV. With this interface complete master clock programs can be uploaded or downloaded using the MC Programming Software (MC-DISK1). For details on the MC Programming Software refer to the MC-DISK1 User's Manual.

In addition Time, Date and Day of the Week can be sent to and from the MC4181LV for synchronizing computers, other master clocks and digital clocks.

The MC4181LV receives a series of 10-Byte messages via RS232 from a computer or another master clock such as the AE Series of GPS Master Clocks. These 10-Byte messages can include Time in 12 or 24-Hour format, Date, Day of the Week, and other control functions.

In addition the MC4181LV will automatically transmit the 10-Byte messages for time (in 12 Hour format), Date, and Day of the Week for use by ATS Displays. This information will be sent once each minute at the top of the minute.

All remote ATS Displays must be set for address 15 to display Time, to address 13 to display Date or to address 12 to display day of the week. The Day of the Week is simply a number from 1 to 7 with 1 = Sunday.

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. See the Application Note ANAE13 at the back of this manual.

Depending on your application, a specific signal cable will be required. Refer to the system block diagram for your system to determine the required cable. The MC4181LV Master Clock uses a DB9 male connector on the back panel for the RS232 I/O Port.





**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 | STATUS                |
| 05 | PULSE 1     | 21 | SELECT ALTERNATE PLAN |
| 5A | PULSE 2     | 22 | DEFINE CUSTOM WEEKS   |
| 20 | MODE SELECT | 31 | SET PROGRAM SIZE      |

**TECHNICAL SUPPORT**

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

**PHONE (800) 444-7161**  
**OR**  
**FAX (318) 797-4864**

**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.