

## **Power-line Carrier X-10 Protocol & Hardwired I/O Control Methods**

**1-1 X-10 System Protocol:** An automated home control system is the optimal means of controlling virtually every electrical load in the home. Power-line Carrier (PLC) X-10 protocol home automation systems are relatively easy to understand and use compared to most other home automation protocols. The capability potential of this protocol is relatively high when one considers overall system practicality, low component cost, ease of installation and system modifications. System components can easily be installed in new or existing construction. Systems provide a high level of convenience, remote control capabilities, automatic system operation, energy management capabilities, safety & security features and water management benefits. Control features can be custom tailored to a home owners schedules, patterns and overall lifestyle. These are all good reasons why Power-line Carrier X-10 protocol system components are the most popular home automation devices available.

Designing an automated home control system for residential homes may at first sound far too technical and intimidating for most people; however, these inhibitions will be quickly tamed after experiencing the simplicity of this protocol as described in the following design sections.

Although X-10 components can control virtually any electrical load, some of the most common controlled devices are incandescent lighting, florescent lighting, halogen lighting, and low voltage lighting located in the home's interior and exterior. Other loads and systems that are often times controlled are ceiling fans, bathroom fans, air conditioning systems, audio/video systems, pools, spas, sprinkler systems, security systems, CCTV surveillance systems, water heaters, drapery positioners, garage doors, gates and many others. Figure 1-1 shows a diagram that visually provides most of the common electrical loads that can be controlled relatively easily when using X-10 technology. Also notice the primary methods used to access MACROS and other system features as shown at the bottom of the figure.

The primary electrical power found in USA residential homes is 120V/240V split-phase service. X-10 PLC system components are also available for 208V & 277V electrical systems; however, this manual will concentrate on residential applications only. For informational purposes, 208V electrical systems are used to power certain types of motors, while 277V electrical systems are primarily used to power commercial lighting systems.

# WHAT CAN BE AUTOMATED ?

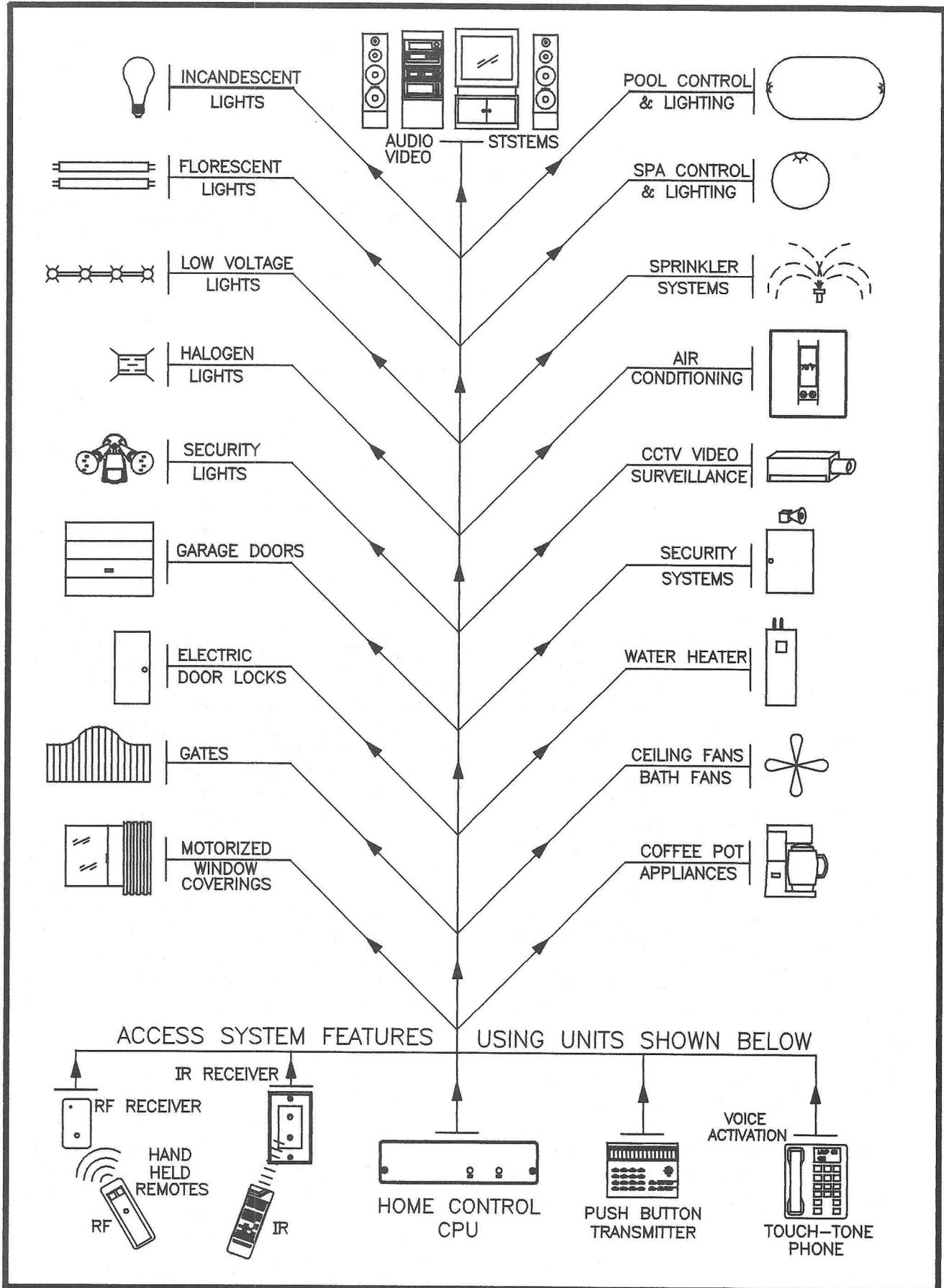


Figure 1-1 This diagram shows some of the most common electrical loads automated by a Home Control System as well as methods of accessing system features.

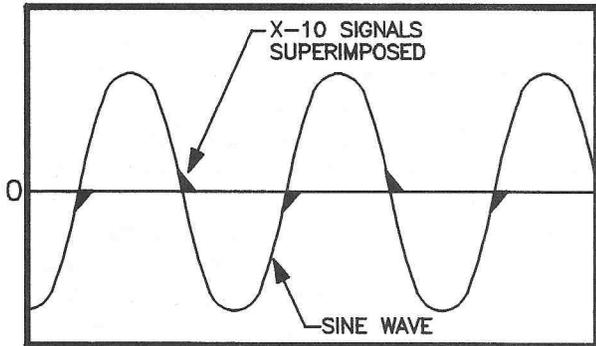


Figure 1-2 120 KHz X-10 signals carried along zero degree crossing.

Basic residential PLC system components consist of RECEIVERS & TRANSMITTERS. Any electrical load the home owner wishes to automate using X-10 technology requires a PLC RECEIVER switch. One or more TRANSMITTERS must also be incorporated into the system to control one or more RECEIVERS. RECEIVERS either plug into standard receptacles or replace standard hardwired mechanical switches and receptacles. In some cases RECEIVERS are installed inside the electrical load fixture enclosure. Most RECEIVERS that replace existing mechanical wall switches will provide both remote as well as manual control capabilities. TRANSMITTERS either plug into standard receptacles or are added to the electrical system by hardwiring these devices inside standard switch box enclosures.

There are a wide variety of RECEIVERS and TRANSMITTERS available for specific types of electrical loads and applications. Beginning in Chapter Two, selections of specific components will be made to control specific loads during the design process of the "Example Home" Automated System.

In residential homes, X-10 protocol control systems utilize the 120V & 240V power lines to transport X-10 signal sent from TRANSMITTERS to RECEIVERS in order to provide remote control of electrical loads. Additional wiring is not required when using this type of control system which is the primary advantage of this protocol. There are optional sub-systems and hardwired control systems that can be interfaced with a Power-line Carrier System; however, they will generally require routing of low voltage wiring in the attic and inside walls of the home.

X-10 protocol systems are valued much more for use in existing homes compared to new construction. This is because the replacement of existing wall switches and some receptacles or

the addition of plug-in modules does not require access to the insides of walls or above the ceiling for the purpose of routing wire. Other home automation system protocols that primarily use hardwired control of electrical loads are more time consuming and expensive to install in both existing and new construction.

X-10 signals are transmitted over the power lines superimposed and carried by the AC sine wave at a frequency of 120 kHz. These signals travel along the zero degree crossing of the sine wave since this portion of the sine wave receives the least amount of electrical noise for the purpose of avoiding X-10 signal disruption as illustrated in Figure 1-2.

TRANSMITTERS send digital signals over the power lines for specific RECEIVERS to accept in order to perform the desired control functions. TRANSMITTERS do not directly switch loads ON & OFF or perform dimming & brighten functions. These end functions are performed by RECEIVERS only after receiving the proper series of codes from a TRANSMITTER.

All system RECEIVERS have two rotary dials each having 16 positions. One of the dials displays letter codes A thru P, and the other dial displays numbers codes 1 thru 16. Figure 1-3 illustrates both dials located under the wall

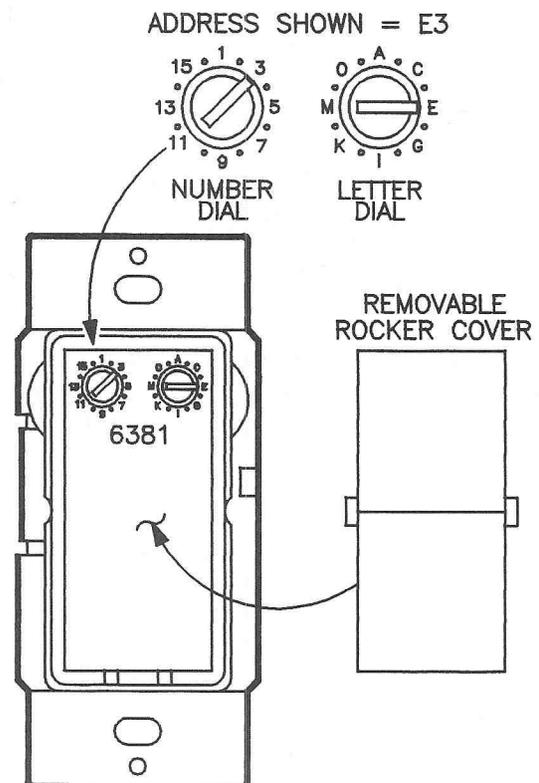


Figure 1-3 RECEIVER ADDRESS DIALS

RECEIVER's rocker cover. Dial positions are selected by using a blade screwdriver to set each RECEIVER to a specific address. Addresses for example, can be A4, D8, P14, E1 and so on, offering 256 possible address combinations.

Some TRANSMITTERS have both a **letter** code dial and a **number** code dial while others have only a **letter** code dial. Wall TRANSMITTERS have both **letter & number** code dials. On a 4-button wall TRANSMITTER as shown in Figure 1-4, a code of J1; for example, assigns J1 to the top button, J2 to the second button, J3 to the third and J4 to the bottom button. A TRANSMITTER code setting of J5 will assign the other 3 buttons to J6, J7 & J8. 8-button & 16-button table top TRANSMITTERS only have a **letter** code dial. The **number** portion of the code is associated with the button number on the face of the TRANSMITTER. For example, if a 16-button TRANSMITTER is set to **letter** code E, button #1 is assigned to an address of E1 and will control any RECEIVER(s) in the system set to E1. The second button on the TRANSMITTER is assigned to E2 and so on up to button E16. More than one RECEIVER can be set to the same address code. If a RECEIVER is coded E7 and the home owner pushes button E7-ON, the TRANSMITTER will send E7-ON signals over the power lines and only RECEIVERS set to E7 will respond.

A TRANSMITTER is generally set to the same address as the RECEIVER it intends to control. This is the coding method used to address RECEIVERS and assign to TRANSMITTERS when a "direct" transmission is intended. This is called a "direct" transmission because signals are sent directly from the TRANSMITTER for the intended RECEIVER without any assistance from other control equipment. There are also "indirect" transmissions. This type of transmission is not intended to be accepted by RECEIVERS. These transmissions are intended to be received by the Home Control CPU instead. After receiving the correct X-10 signals the CPU will transmit one command or a string of X-10 commands and potentially other types of control signals in order to provide what is called a MACRO or mode.

RECEIVERS used to control most types of lighting loads respond to ON & OFF commands as well as to 16 levels of Dim & Brighten commands. RECEIVERS used to control appliances, motors and florescent lights respond only to ON & OFF commands.

Most TRANSMITTERS incorporate All Lights ON & All Units OFF buttons to control RECEIVERS set to the same letter code as the TRANSMITTER.

When controlling electrical loads using a 16-button table top TRANSMITTER; for instance, an individual can push buttons E1, E4, E5, & E7 in succession followed by a push of the ON button to turn all of these electrical loads ON at once. Pushing the OFF button will then turn OFF all of these loads at once. Pushing the Dim & Brighten buttons will also control these four loads (lighting loads) at the same time. When dimming a light using a standard X-10 type PLC RECEIVER, the light will need to turn ON to full bright before the dimming function can be performed. There are also advanced RECEIVERS manufactured by X-10 (USA) and *Powerline Control Systems (PCS)* that dim up from an OFF state to the desired brightness level (Soft Start). When these RECEIVER switches are turned ON they will resume back to their previous brightness level (Resume Dim). See Chapter Seven specifications for additional component features.

Other features that improve X-10 systems offered by X-10 (USA) are two-way RECEIVER modules that acknowledge ON/OFF commands and respond to status requests. Select modules also incorporate Automatic Gain Control (AGC) circuits. AGC technology helps to discriminate between higher levels of electrical noise and X-10 signals to increase control reliability.

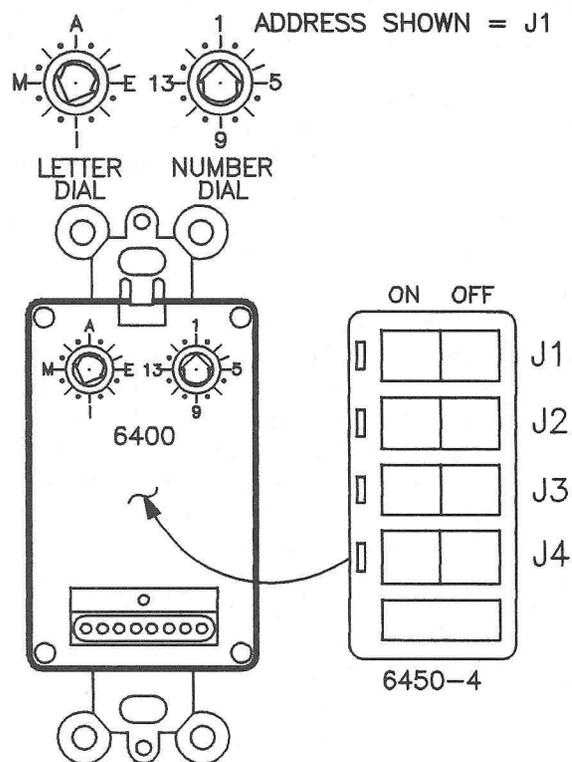


Figure 1-4 4-BUTTON TRANSMITTER DIALS

To furnish an example of how a portion of a system can operate, the following description is provided. If an occupant wants to remotely control a lamp, she/he would simply set the dials on the RECEIVER and TRANSMITTER to the same X-10 code, plug the lamp into the RECEIVER and plug the RECEIVER into a standard receptacle. The TRANSMITTER would then be plugged into a receptacle in a remote location of the home. Now the occupant can turn the lamp ON & OFF as well as Dim and Brighten the lamp to one of 16 levels from a remote location.

A Home Control System can consist of one RECEIVER and one TRANSMITTER to a couple of hundred RECEIVERS and a dozen or more TRANSMITTERS. Even if a system is comprised of 60 RECEIVERS and 10 TRANSMITTERS, the RECEIVERS and transmitting devices work as simply as the single lamp previously described. A number of RECEIVERS and TRANSMITTERS develop an Automated Home Control System designed to provide desired features and benefits tailored specifically for the families lifestyle. A stand alone Home Control CPU can also be incorporated into the system to provide advanced control features.

A typical X-10 based Automated Home Control System for a home with 120V/240V split-phase electrical service is shown in Figure 1-5. This type of electrical service is identifiable by the two 120V power lines labeled **Line A** & **Line B**. For simplicity purposes the dashed lines represent the power wiring connected to each RECEIVER and TRANSMITTER along with the electrical loads. **Line A** powers a portion of the 120V electrical loads in the home while **Line B** serves the other portion of 120V electrical loads. 240V electrical loads are powered by utilizing both 120V lines which are 180 degrees out of phase from each other. 240V power is normally used by clothes dryers, water heater, stoves as well as other loads. Notice the assorted TRANSMITTERS & RECEIVERS shown in Figure 1-5 along with their associated electrical loads connected to both **Line A** & **Line B**. Also notice the Home Control CPU, telephone controller, surge suppressor and signal bridge. When the home owner pushes the top button on the 4-button TRANSMITTER coded **J1** as shown connected to **Line B**, **J1-ON** signals are sent to all locations along **Line B** and will travel towards the main distribution panel. When the signals reach the panel they will find a path through the

signal bridge in order to travel onto **Line A** to be received by the florescent light RECEIVER also coded **J1**. When the florescent light RECEIVER receives the **J1-ON** command the light turns ON.

X-10 signals can also travel a path through 240V electrical loads when they are ON. This is represented by the 240V RECEIVER located below the main distribution panel. This path of course cannot be relied upon since these load types are not ON all the time. The only other possible course for the signals to take is through the utility transformer located in the street. This path however, is often times unreliable due to high impedance and electrical noise on the power line. This is why a signal bridge should be installed in any system with serious control intentions.

When a Home Control CPU is utilized as part of a Home Automation System, the overall system will become dramatically more powerful and moderately more complex. Now this should not intimidate anyone who is thinking about incorporating a Home Control CPU into an X-10 Protocol or hardwired I/O system because the CPU communicates in a language that mimics the way people naturally think. The *TimeCommander* or *HomeBase* (Home Control CPU) programming utilizes what is called an **If-Then-Else/And-Or** control logic. Anyone can use this logic to write powerful MACROS by selecting a series of electrical loads along with the desired control functions to be performed. For example, "If" she pushes TRANSMITTER button 2 and it is before sunset "Or" after 9:00 PM Sun - Sat, "Then" turn ON three different lights to 50% bright. A wide variety of programming examples will be demonstrated in the design sections of this manual. These examples will include MACROS and other programming capabilities that provide powerful automation features.

Being able to remotely control electrical loads from a TRANSMITTER placed on the other end of the home is both powerful and convenient; however, the dominate features available from a Home Control System are provided by MACROS. As previously mentioned, a MACRO is a series of commands transmitted by the CPU to control one or more RECEIVERS. A MACRO can be initiated by the push of a TRANSMITTER button, scheduled time events, telephone push button command, infrared (IR) signal, radio frequency (RF) signal, motion detector or other contact closures, voice command, sunset or sunrise times, Analog Input, Digital Input, and ascii communications.

# POWER-LINE CARRIER AUTOMATED HOME CONTROL SYSTEM

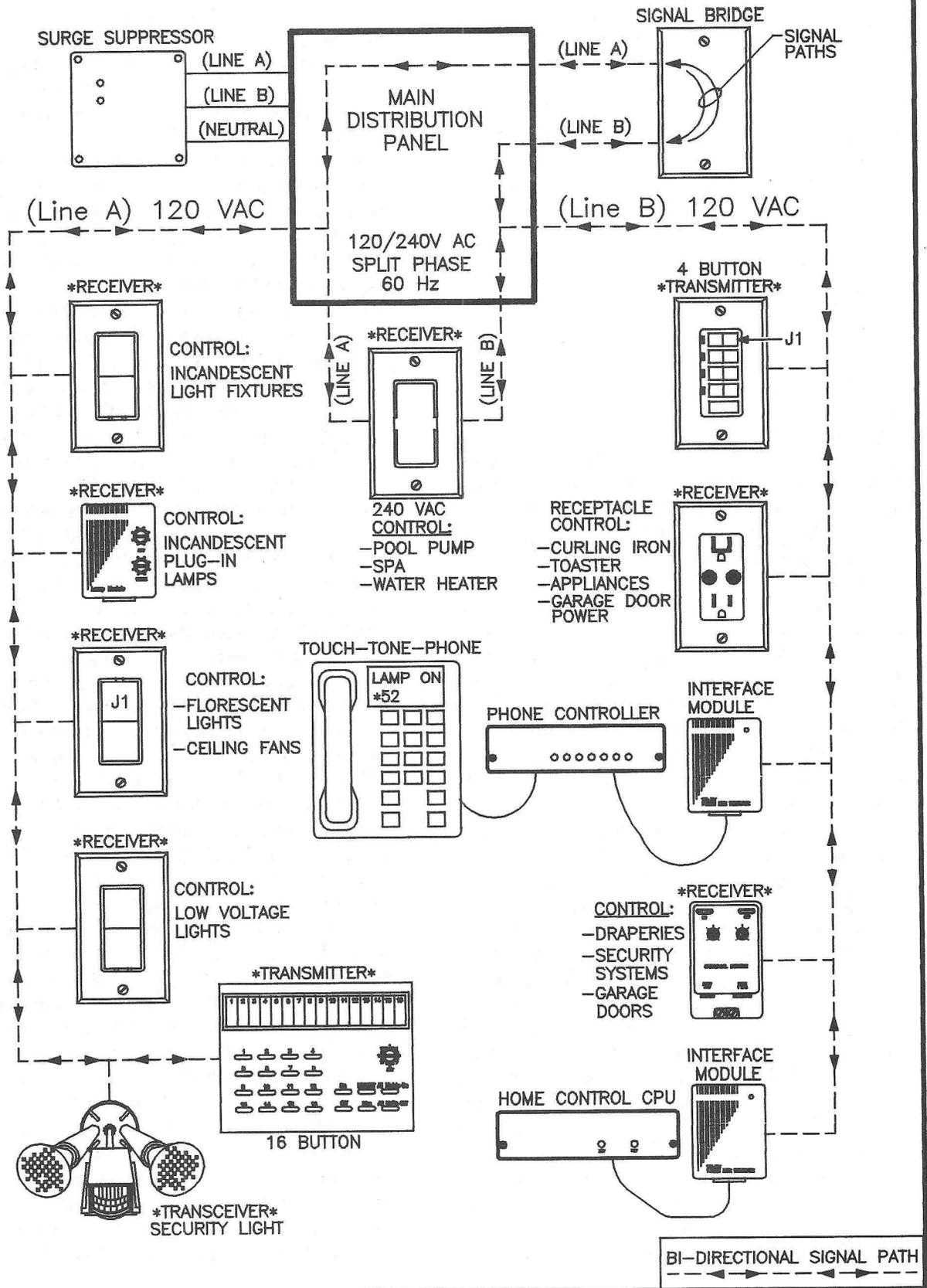


Figure 1-5 This diagram shows how a typical Automated Home Control System is configured with Receivers and Transmitters wired on both Line A & Line B.

An example of a fairly common MACRO is the LEAVING HOME MODE. This MODE is generally initiated by pushing a TRANSMITTER button when the occupants exit the home. This TRANSMITTER; for example, may transmit J4-OFF signals over the power lines for the CPU to receive. After receiving this X-10 command which makes the programming "If" statement true, the CPU will transmit the "Then" statement portion of the programming known as the MACRO. This MACRO may control; for instance, a total quantity of 100 electrical loads in order to set each load in a state that the home owner wishes to have them in when away from the home. The LEAVING HOME MODE can also be initiated automatically due to a lack of motion within the home after a delayed period of time and before the GOOD NIGHT MODE Runs.

If the occupants of the home consider all the electrical loads manually controlled each day, they will better understand the benefits of an Automated Home Control System. Electrical loads the occupants manual control on a daily bases usually include ON and OFF lighting functions along with Dimming and Brightening functions. Other manual functions may include control of ceiling fans, single & multi-zone HVAC systems, garage doors, gates, security system ARM/DISARM functions, audio/video system control, drapery positioning, spa control as well as many others. If the occupants could some how control these loads automatically in groups when needed or initiate control of electrical loads from a remote push button

TRANSMITTER, they would most certainly find these features to be convenient. For instance, when waking-up in the morning a home owner without an automated control system will first have to manually turn OFF the alarm clock, turn ON lighting in the Bathroom, Dressing Room, Hallway and Foyer which will all seem way too bright at first. The home owner would also need to manually DISARM the security system and open the drapes before making her way to the Kitchen to make coffee after switching ON the 'under the counter TV' for the morning news. Now since the home owner and other family members go through this routine of manually controlling electrical loads day in and day out, wouldn't it be quite convenient to have all the electrical loads previously mentioned controlled automatically or by the push of one button. Not only will the appropriate lighting be turn ON, but they would also be dimmed initially to a comfortable level of brightness. As the morning progressed the lighting would brighten gradually. After the morning lighting and other electrical loads are no longer needed, another mode called the DAY MODE would automatically Run to turn OFF select electrical loads and to control other electrical loads for use during the day.

MACROS or modes included in the "Example Home" are listed below. Each mode will be discusses in the appropriate design section along with the actual lines of programming required to operate each mode. Anyone can create a mode that will make daily living far more convenient.

### Macros designed & programmed for the "Example Home"

- |                             |                                   |
|-----------------------------|-----------------------------------|
| 1. GOOD MORNING MODE        | 14. PANIC MODE                    |
| 2. STUDENT MORNING MODE     | 15. GARAGE DOOR CHECK MODE        |
| 3. BUS IN 10 MINUTES MODE   | 16. SCENE LIGHTING MODES          |
| 4. DAY MODE                 | 17. CCTV VIEWING MODES            |
| 5. LEAVING HOME MODE        | 18. SPA MODE                      |
| 6. ARRIVING HOME MODE       | 19. POOL MODE                     |
| 7. SNACK MODE               | 20. SUNRISE/SUNSET MODES          |
| 8. ENTERTAINMENT MODE       | 21. AUTOMATIC LIGHTING CONTROL    |
| 9. GOOD NIGHT MODE          | 22. FLASH LIGHTS WHEN PHONE RINGS |
| 10. ALL LIGHTS ON/OFF MODES | 23. LIGHTED PATH TO BATHROOM      |
| 11. IN BED MODE             | 24. ALL SECURITY LIGHTS ON        |
| 12. VACATION MODE           | 25. TOMORROW UP EARLY             |
| 13. DETERRENT MODE          | 26. TOMORROW HOLIDAY              |
|                             | 27. WHOLE HOUSE AUDIO - MUSIC     |

## HARDWIRED INPUT/OUTPUT (I/O) OPTION

**1-2 Hardwired I/O Option:** When designed and installed properly, Power-line Carrier Systems can be a dependable means of controlling approximately 90% of residential electrical loads when considering whole house automation systems. Power-line Carrier Systems can at times experience signal collision and changes in the level of electrical noise on the power lines even in the best of systems. These factors can cause RECEIVER response problems or the premature activation of electrical loads on rare occasions. For this reason, there are some electrical loads that can benefit from an increase in control reliability. By utilizing the hardwired option to control loads considered to be most critical in conjunction with the Power-line Carrier sub-system used to control less critical loads, the overall home control system will become a well rounded means of controlling virtually all electrical loads.

The Home Control CPU used in the "Example Home" is the *TimeCommander* or *HomeBase*. This advanced Controller is connected to an I/O that offers 8 Analog Inputs, 16 Digital Inputs and 8 Relay Outputs. The I/O is used to establish hardwired connections and control of select electrical loads. The I/O is hardwired to receive Digital Inputs and Analog Inputs from sensory components in order to base control decisions on. After receiving the proper input, the *TimeCommander* or *HomeBase* will process this information and respond by initiating I/O Relay Outputs, IR signals or by transmitting X-10 signals to perform intended control functions.

I/O Relay Outputs are connect to low voltage control circuits < 24V DC. These control circuits can be used to start and stop motors, control air conditioning equipment, turn ON water heaters, and open & close control valves as well as provide many other control functions.

An **Analog Input** from a temperature sensor; for instance, sends a 0-5V signal to the I/O which communicates changing conditions to the Home Control CPU. As the temperature increases the Analog Input voltage will increase linearly. When

the temperature rises to 100°F; for instance, a decision by the CPU can be made to control draperies closed in order to help reduce heat gain by the home.

A **Digital Input** can be initiated by a contact closure from a motion detector or other sensory devices. This closure completes a control circuit to provide a 4 to 24V DC differential across the I/O Digital Input terminals. Digital Inputs can be used to activate automatic lighting control, the vehicle detection system, or the ARRIVING HOME MODE to mention a few.

Electrical loads controlled by the "Example Home" automation system utilizing hardwired I/O control include the security system, vehicle detection system, lawn sprinkler system, HVAC, automatic drapery positioners, electric water heater, CCTV surveillance, garage door, automatic lighting control and the automatic activation of the ARRIVING HOME MODE.

The security system is a good application for hardwired I/O control to provide the highest level of control reliability which is essential for this particular system. Hardwired control is normally used to perform the security system ARM & DISARM functions.

I/O hardwiring is often times used for sprinkler system control applications when a higher degree of reliability is desired in order to decrease the possibility of over watering or under watering the lawn when away on vacation. A standard sprinkler controller or an X-10 compatible sprinkler controller could be used; however, there are already available I/O inputs & outputs for the designer to use in the "Example Home" which will provide all the necessary lawn sprinkler control functions and more.

Automatic activation of the ARRIVING HOME MODE using a Digital Input is described as follows. The *TimeCommander/HomeBase* receives a Digital Input from the I/O as a means of initiating this mode. By utilizing (N.O.) magnetic switches on the front door & garage door or by using a radio frequency (RF) receiver to produce a low voltage circuit closure, a control circuit wired to the I/O will initiate a Digital Input.

**Mode Description: SCENE LIGHTING - *Master Bedroom***

**2-29 Scene lighting:** Scene lighting sets the mood on desired occasions by dimming numerous lighting elements to predetermined brightness levels. This mode is activated by pushing button **D1-ON** from the bedside Master Bedroom 8-button TRANSMITTER shown in Figure 2-28.

**PROGRAMMING:**

**Description:**

**BUTTON D1-ON: (MASTER BEDROOM 8-button transmitter)**

EVENT: SCENE LIGHTING MODE

*Mode name*

**If**

*if*

(XSEQ: D-1 D-ON ) Received within 4 seconds

*If button D1-ON is pushed*

**Then**

*then*

(X: LIGHT MS BED D-5 ) Set Level 30 %

*Turn lights ON to 30% bright*

(X: LIGHT MS DRESS D-7 ) Set Level 30 %

*Turn Dressing Rm light ON to 30% bright*

End

**Note:** An initial OFF command before the % bright command line is not required when using the PCS Smart Switch because this RECEIVER can; for instance, receiver Preset Dim commands from a Home Control CPU to brighten lights directly to a 30% level.

**Mode Description: - ALL LIGHTS ON - from the *Master Bedroom***

**2-30 All Lights ON from the *Master Bedroom* :** The ALL LIGHTS ON MODE from this location is initiated by pushing button **D1-OFF** on the Master Bedroom 8-button TRANSMITTER. This mode is generally used for safety and security purposes if a suspicious noise is heard during the night or if an occupant simply wants to light up the home when receiving guests. The designer could program this mode to turn ON all RECEIVERS with letter codes **A, B, C, D** and so on instead of entering each individual RECEIVER code; however, since there are more than lights set to these letter codes, some appliances would also turn ON. This is because the designer needs to select RECEIVER switches (ACT RS-121 OR LEVITON 6291) wired to ceiling fans which respond to the ALL LIGHTS ON command. This is a disadvantage of the "Zone Coding" method; however, the advantages far out way the disadvantages. To help maximize the number of available TRANSMITTER buttons on this 8-button TRANSMITTER, the designer uses the OFF side of button **D1** to perform the ALL LIGHTS ON MODE instead of tying up another button. Turning OFF all the lights can be accomplished by activating the IN BED MODE. It will take the home owner a little more time to get to know the TRANSMITTER button functions; however, this does avoid having to pickup the phone to initiate this command.

**PROGRAMMING:**

**Description:**

**BUTTON D1-OFF: (MASTER BEDROOM 8-button transmitter)**

EVENT: ALL LIGHTS ON

*Mode name*

**If**

*if*

(XSEQ: D-1 D-OFF ) Received within 4 seconds

*If button D1-OFF is pushed*

**Then**

*then*

(X: LIGHT MS BED D-5 ) ON

*Turn Master Bedroom lights ON*

(X: LIGHT MS DRESS D-7 ) ON

*Turn Dressing Rm light ON*

(X: LIGHT MS BATH K-1 ) ON

*Turn Master Bath light ON*

(X: LIGHT HALL C-5 ) ON

*Turn Hall lights ON*

(X: LIGHT BATH ZN3 C-6 ) ON

*Turn Bath Zone 3 light ON*

(X: LIGHT LOW-V A-5 ) ON

*Turn Living Rm low voltage lights ON*

**: continued :**

(X: LIGHT LV RM POLE A-4 ) ON  
 (X: LIGHT LV HAL A-6 ) ON  
 (X: LIGHT DINING B-5 ) ON  
 (X: LIGHT LAUNDRY B-7 ) ON  
 (X: LIGHT BED Z5 E-5 ) ON  
 (X: LIGHT OFFICE F-5 ) ON  
 (XCMD: H - All lights ON )  
 (XCMD: I - All lights ON )  
 (XCMD: J - All lights ON )

*Turn Living Rm pole lights ON*  
*Turn Living Rm halogen light ON*  
*Turn Dining Rm lights ON*  
*Turn Laundry Rm light ON*  
*Turn Bedroom Zone 5 lights ON*  
*Turn Office lights ON*

*Turn all Receivers set to letter code H ON*  
*Turn all Receivers set to letter code I ON*  
*Turn all Receivers set to letter code J ON*

End

**BUTTON D2-OFF: (MASTER BEDROOM 8-button transmitter)**

EVENT: LIGHT KIT OFF/BATH LIGHT ON

If

(XSEQ: D-2 D-OFF ) Received within 4 seconds

Then

(X: LIGHT MS BATH K-1 ) ON

End

*Feature name*

*if*

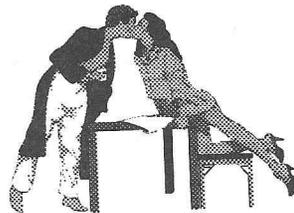
*If button D2-OFF is pushed*  
*then*

*Turn Master Bath light ON*

**NOTE:** The light-kit lamp is not required as part of the "Then" statement because D2 is a "direct" transmission to control the light-kit.

**Mode Description: GOOD MORNING MODE**

**2-31 Good Morning Mode:** With a scheduled time event or by pushing TRANSMITTER button **D4-ON** from bedside the GOOD MORNING MODE will activate. The GOOD MORNING MODE begins the day by turning ON desired music in the Master Bedroom. This music is provided by the Whole House Audio/Video System through the in-wall speakers at a predetermined volume level. The Master Bedroom & Dressing Room lights will brighten from an "OFF state" to a desirable morning brightness levels for the trip to the Bathroom or Hallway. Over the next 30 minutes these lights will brighten 1 Micro-Brighten step every 10 seconds as shown in the programming on page 70. This mode will also DISARM the security system, the air conditioning will be set to satisfy the morning temperature set-point, and the programming Flags are cleared to begin the day. A dimmed lighted path is created to the Hallway & Dining Room for the walk to the Kitchen for breakfast. When the occupants enter the Kitchen the coffee is brewing while the morning news is displayed on the 'under-the-counter TV'. After 30 minutes, the Hall and Dining Room lights brighten to a 70% level for the occupants trip back to Zone 4 to



get ready for the day. The GOOD MORNING MODE programming utilizes an option called a "Then" Macro. "Then" Macros are written when a "Then" statement is used in more than one Event of the home's programming. By writing a GOOD MORNING MODE "Then"

Macro, the designer can use this MACRO at 5:00 AM or 6:00 AM times while minimizing the total number of programming lines and writing time. See the '5:00 AM' & '6:00 AM' GOOD MORNING MODE "Then" MACRO programming lines shown on page 69. When the home owner wishes to get up at 5:00 AM instead of the normal time of 6:00 AM, he would push TRANSMITTER button **D8-ON** the night before in order to Set the '5:00 AM' Flag. This Flag is confirmed Set by activating a PLC chime that has an address of **D2**. See the '5:00 AM' Flag shown in the "If" statement of the GOOD MORNING MODE programming. This Flag is used to initiate the mode at 5:00 AM and to keep the mode from re-running at 6:00 AM.

The OFF side of button **D8** allows the home owner to cancel the activation of the GOOD MORNING MODE scheduled time event when the next day is a Holiday and the home owner wishes to sleep in. This option is

initiated by pushing button **D8-OFF** the evening before the **GOOD MORNING MODE** Runs. See the programming of buttons **D8-ON** & **D8-OFF** shown on page 72. Also notice the sequence of electrical loads turned **ON** by the **GOOD MORNING MODE** programming to create lighted paths to areas of the home that occupants normally travel during the morning.

**PROGRAMMING:**

*Descriptions:*

**EVENT: GOOD MORNING 6:00 AM**

*Mode name*

**If**

*if*

Time is 6:00 AM .MTWTF.  
and (F: HOLIDAY ) is CLEAR  
and (F: 5:00 AM ) is CLEAR  
and (F: AWAY ) is CLEAR

*If it is 6:00 AM on Mon - Fri  
and "Holiday" Flag is clear  
and "5:00 AM" Flag is clear  
and "Away" Flag is clear*

- OR -

*or*

(SEQ: A-16 A-ON ) Received within 4 seconds

*If buttons A16-ON in Living Rm are pushed*

- OR -

*or*

(SEQ: D-4 D-ON ) Received within 4 seconds

*If button D4-ON in Master Bedroom is pushed*

**Then**

*then*

(THEN MACRO: GOOD MORN )

*Activate Good Morning Mode (see "Then" Macro below)*

**End**

**EVENT: GOOD MORNING 5:00 AM**

*Mode name*

**If**

*if*

Time is 5:00 AM .MTWTF.  
and (F: 5:00 AM ) is SET

*When the time is 5:00 AM Mon - Fri  
and the "5:00 AM" Flag is Set*

**Then**

*then*

(THEN MACRO: GOOD MORN )

*Activate the Good Morning Mode shown below*

DELAY 1 : 02 : 00

*1 hour & 2 minute after running mode, perform next line*

(F: 5:00 AM ) CLEAR

*Clear the "5:00 AM" Flag*

**End**

**NOTE:** Notice that the delay of 1 hour and 2 minutes is used to **Clear** the Flag after 6:00 AM to allow the mode to activate at 6:00 AM the next day.

**THEN MACRO:**

**THEN Macro: GOOD MORNING MODE**

*Mode name*

MACRO BEGIN

*Start Macro*

(IR: REC #2 POWER ) play 1 time(s) [Master Bedroom]

*Turn Master Bedroom stereo Rec #2 ON*

DELAY 0 : 00 : 02

*2 second delay to allow Rec #2 to except function change*

(IR: VOLDN ) play 15 times

*Volume turned all the way OFF*

(IR: VOLUP ) play 4 times

*Volume level up to home owner's desired level*

(IR: CD POWER ) play 1 time(s) [Master Bedroom]

*Turn Living Rm CD player in ON*

(IR: DISK 1 ) play 1 time(s) [Master Bedroom]

*Select CD player disk 1*

(IR: TRACK 4 ) play 1 time(s) [Master Bedroom]

*Select CD track 4*

(X: LIGHT MS BED D-5 ) Set Level 25 %

*Brighten Master Bedroom lights to 25%*

(X: LIGHT MS DRESS D-7 ) Set Level 25 %

*Brighten Dressing Rm light to 25%*

(X: LIGHT MS BATH K-1 ) ON

*Turn Master Bath light ON*

(X: LIGHT HALLWAY C-5 ) OFF

*Turn Hall lights OFF for 0% start point*

(X: LIGHT HALLWAY C-5 ) Set Level 40 %

*Turn Hall lights ON to 40% brightness*

(X: LIGHT DINING B-5 ) OFF

*Turn Dining Rm lights OFF for 0% start point*

(X: LIGHT DINING B-5 ) Set Level 25 %

*Turn Dining Rm lights ON to 25% brightness*

(X: LIGHT KITCHEN J-9 ) ON

*Turn Kitchen light ON*

(X: COFFEE/TOAST B-2 ) ON

*Turn coffee maker & toaster receptacles ON*

(IR: TV ) play 1 time(s) [Kitchen]

*Select Kitchen TV*

(IR: POWER ) play 1 time(s) [Kitchen]

*: continued :*

*Turn Kitchen TV ON*

(X: ZONE 1 N-7) OFF	Turn HVAC Zone 1 receptacle OFF (will <b>not</b> receive X-10 commands)
(X: ZONE 2 N-8) ON	Turn HVAC Zone 2 receptacle ON (will receive X-10 commands)
(X: AUTO MODE L-3) OFF	Select HVAC auto-changeover mode (See HVAC Chapter)
(X: COOLING MODE L-4) ON	Select a temperature set-point of 75°F (See HVAC Chapter)
* (T: TIME 9) LOAD with 0:30:00	In 30 minutes Timer 9 functions are activate
(F: HOLIDAY) CLEAR	Clear "Holiday" Flag
(F: BED EARLY ALL) CLEAR	Clear "Bed Early All" Flag
(F: TEMP 1 & 2) CLEAR	Clear "Temp 1 & 2 Flag" (See page 108)

End

EVENT: * TIME 9	Timer name
<b>If</b>	if
(T: TIME 9) is Expiring	When 30 minute Timer has expired
<b>Then</b>	then
(X: LIGHT HALL C-5) BRI 4 Steps	Brighten Hall lights 25%
(X: LIGHT DINING B-5) BRI 6 Steps	Brighten Dining Rm lights about 37%

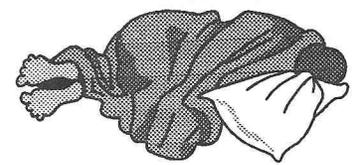
End

EVENT: PCS MICRO BRIGHTEN	Feature name
<b>If</b>	if
(T: TIME 9) is Running	Timer 9 has <b>not</b> expired
<b>Then</b>	then
(XCMD: LIGHT MAS BED D-5) Micro BRI 1	Brighten Mas Bed Rm lights 1 Step
(XCMD: LIGHT DRESS RM D-7) Micro BRI 1 Step	Brighten Dressing Rm lights 1 Step
DELAY 0:00:10	10 second delay between changes in brightness level

End

**Mode Description: IN BED Mode**

**2-32 In Bed Mode:** By pushing TRANSMITTER button **D4-OFF** when getting into bed, the IN BED MODE performs the final events of the evening. Lighting and other controlled devices that were turned ON by the GOOD NIGHT MODE to get ready for bed are now turned OFF for the night. Controlled devices in several letter codes are also turned OFF in case any electrical loads besides the loads turned ON by the GOOD NIGHT MODE were turned ON before Running the IN BED MODE. Notice that the designer used (letter codes All Units OFF) programming lines here because both lights and appliances need to be turned OFF. Many other modes and system features are accessible from the Master Bedroom TRANSMITTER location as shown in the Master Bedroom 8-button TRANSMITTER "direct" & "indirect" function assignments shown on page 66.



<b>PROGRAMMING:</b>	<b>Description:</b>
<b>BUTTON D4-OFF: (MASTER BEDROOM 8-button transmitter)</b>	
EVENT: IN BED MODE	Mode name
<b>If</b>	if
(XSEQ: D-4 D-OFF) Receiver within 4 seconds	If button D4-OFF is pushed
<b>Then</b>	then
(XCMD: D - All Units OFF)	Turn all Receivers set to letter code D OFF
(X: LIGHT BATH K-1) OFF	Turn Master Bath light OFF
(X: LIGHT HALLWAY C-5) OFF	Turn Hall lights OFF
(X: LIT/FAN BATH ZN3 C-6) OFF	Turn Bathroom light & fan OFF
(X: LIGHT FOYER J-1) OFF	Turn Foyer light OFF
(XCMD: A - All Units OFF) : continued:	Turn all Receivers set to letter code A OFF

(XCMD : B - All Units OFF )  
(XCMD : C - All Units OFF )  
(XCMD : E - All Units OFF )  
(XCMD : F - All Units OFF )  
(XCMD : I - All Units OFF )  
(XCMD : J - All Units OFF )  
(X : LIGHT GARAGE H-5 ) OFF  
(X : LIGHT ENTRY H-4 ) OFF

*Turns all Receivers set to letter code B OFF*  
*Turn all Receivers set to letter code C OFF*  
*Turn all Receivers set to letter code E OFF*  
*Turn all Receivers set to letter code F OFF*  
*Turn all Receivers set to letter code I OFF*  
*Turn all Receivers set to letter code J OFF*  
*Turn Garage lights OFF*  
*Turn Entry light OFF*

End

---

**BUTTON D6-ON (MASTER BEDROOM 8-button transmitter) or Phone Command**

EVENT: MASTER DRAPES - Open

*Feature name*

**If**

(XSEQ: D-6 D-ON ) Received within 4 seconds  
- OR -

*if*  
*If button D6-ON is pushed*

(XSEQ: D-9 D-ON ) Received within 4 seconds

*or*  
*If phone keys \*49 are pressed*

**Then**

(X: MSR DRAPES O-11

*then*  
*Open the Master Bedroom drapes*

\* (T: TIME 10 ) LOAD with 2: 00 : 00

*After 2 hours perform Timer 10 function below*

End

**NOTE:** Open drapes using the Phone by dialing \*49 = D9-ON.

---

EVENT: \* TIME 10

*Timer name*

**If**

(T: TIME 10 ) is Expiring

*if*  
*When 2 hour Timer has expired*

**Then**

(F: MST CLOSE ) Set

*then*  
*"Master Bedroom close " Flag Sets to enable "auto close drapes"*

End

---

**BUTTON D6-OFF (MASTER BEDROOM 8-button transmitter) or Phone Command**

EVENT: MASTER DRAPES - Close

*Feature name*

**If**

(XSEQ: D-6 D-OFF ) Received within 4 seconds  
- OR -

*if*  
*If button D6-OFF is pushed*

(XSEQ: D-9 D-OFF ) Received within 4 seconds  
- OR -

*or*  
*If keying #49 by phone*

(A/D: TEMP DR 1 ) > 100  
and (F: MST CLOSE) is Set  
- OR -

*or*  
*If the temp is more than 100°F*  
*and "Master Bed Close" Flag is Set*

(A/D: TEMP DR 1 ) < 58  
and (F: MST CLOSE) is Set

*or*  
*If the temp is less than 58°F*  
*and "Master Bed Close" Flag is Set*

**Then**

(X: MSR DRAPES O-12 ) OFF

*then*  
*Close the Master Bedroom drapes*

(F: LIV CLOSE FLAG) Set Set "Master Bedroom close" Flag to keep Event from re-running

End

---

**NOTE:** If an occupant wants to leave the drapes open after they have automatically closed due to high or low temperatures at the window, the occupant would re-open the drapes by pushing TRANSMITTER button **D6-ON** or by keying \*49 by phone. This would also start Timer 10 which allows the drapes to remain open for a minimum of 2 hours. When the "If" statement becomes true after 2 hours, the drapes will automatically close if high or low temperatures occur. There are other methods of setting this up; however, this is one way to work with the "extreme temperature automatic drapes close" feature when the occupants wish to override the function.

**BUTTON D8-ON: ( MASTER BEDROOM 8-button transmitter)**

EVENT: TOMORROW UP EARLY

If

(XSEQ: D-8 D-ON ) Received within 4 seconds

Then

(F: 5:00 AM ) SET

(X: CHIME MS BED D-2 ) ON

End

**NOTE :** This Event Sets the "5:00 AM" Flag which is part of the GOOD MORNING MODE "If " statement that allows the mode to Run at 5:00 AM instead of 6:00 AM.

*Feature name*

*if*

*If button D8-ON is pushed*

*then*

*Set the "5:00 AM" Flag*

*Activate the chime to indicate "Early Up" Flag is Set*

**BUTTON D8-OFF: ( MASTER BEDROOM 8-button transmitter)**

EVENT: TOMORROW HOLIDAY

If

(XSEQ: D-8 D-OFF ) Received within 4 seconds

Then

(F: HOLIDAY ) SET

(X: CHIME MS BED D2 ) ON

End

**NOTE :** The "Holiday Flag" is Set which is part of the GOOD MORNING MODE "If " statement to keep the mode from Running when the home owner wants to sleep in.

*Feature name*

*if*

*If button D8-OFF is pushed*

*then*

*Set the "Holiday" Flag*

*Activate the sounder to indicate "Holiday" Flag is Set*

**FLASH LIGHT D2 WHEN PHONE RINGS FOR THE HEARING IMPAIRED:**

EVENT: FLASH LIGHT - PHONE

If

(XSEQ: P-10 P-ON ) Received within 4 seconds

Then

(X: LIGHT- KIT D-2 ) ON

(X: LIGHT- KIT D-2 ) OFF

(X: LIGHT- KIT D-2 ) ON

End

**NOTE :** Each time the phone rings the phone controller will transmit a P10-ON & P10-OFF to notify the CPU to flash the lights ON & OFF. A light Receiver coded P10 could also be used if a "direct" transmission is desired.

*Mode name*

*if*

*If phone rings & transmits a P10-ON signal*

*then*

*Turn Master Bedroom light-kit ON*

*Turn Master Bedroom light-kit OFF*

*Turn Master Bedroom light-kit ON*

**MAXIMIZING TRANSMITTER BUTTON FUNCTIONS:**

**2-33 Maximizing Transmitter Button Functions:** The designer needs to maximize the Master Bedroom 8-button TRANSMITTER functions by assigning the Master Bathroom light ON function to the OFF side of button D2. This will allow the home owner to turn ON the bathroom light before getting out of bed while also having the ability to turn the light OFF by using the IN BED MODE since this mode essentially turns OFF all lighting and specific ceiling fans. See the IN BED MODE shown on page 70. The designer could also control the Master Bathroom light ON & OFF by using **only the D2-OFF** side of the button as shown.

If

(XSEQ: D-2 D-OFF ) Received within 4 seconds  
and (F: LIGHT FLAG ) is Clear

Then

(X: LIGHT MAS BATH K-1 ) ON

(F: LIGHT ) SET

If

(XSEQ: D-2 D-OFF ) Received within 4 seconds  
and (F: LIGHT FLAG ) is Set

Then

(X: LIGHT MAS BATH K-1 ) OFF

(F: LIGHT ) CLEAR

End

*if*

*If button D2-OFF is pushed  
and the "Light" Flag is Clear*

*then*

*Turn Master Bathroom light ON*

*Set "Light" Flag*

*if*

*If button D2-OFF is pushed  
and the "Light" Flag is Set*

*then*

*Turn Master Bathroom light OFF*

*Clear "Light" Flag*

## MASTER BATHROOM: Zone 4

**2-34 Master Bathroom:** The Master Bathroom has only two electrical loads to automate. This bathroom is different than the other bathroom because there are individual mechanical wall switches used to control each load. One of the loads is a 75 watt incandescent light and the other load is a 1/20 HP ventilation fan. Based on the home owner's requirements, the designer needs to control both the light and fan ON together by pushing one button. He also needs to push the other side of the button to have the light turn OFF while allowing the fan to run for 5 minutes before turning OFF in order to provide sufficient ventilation. The designer also needs to have a separate button to control just the light ON & OFF without the short response delay associated with an "indirect" transmission. To accomplish these requirements, the designer has selected a 2-button wall TRANSMITTER and has set the code to **K1** as shown in Figure 2-29. This TRANSMITTER is a PLC (LEVITON 6400/6450-2). The **K2-ON** side of the bottom button transmits signals to the Home Control CPU to turn both the light & fan ON together. The **K2-OFF** side of the bottom button transmits signals to the

Home Control CPU to turn the light OFF while starting Timer 11 which will turn the fan OFF after 5 minutes. The top TRANSMITTER button coded **K1** transmits "direct" X-10 signals to the Bathroom light RECEIVER also set to an address of **K1**. This will allow the light to be turned ON & OFF without the approximate 1 ½ second delay.

Instead of having to replace the existing 2-gang switch box with a 3-gang switch box to provide space for the 2-button wall TRANSMITTER, the designer decides to apply the same method used to control the Foyer light. As previously mentioned, a PLC RECEIVER is required for each automated electrical load when using X-10 technology. To fulfill this requirement a RECEIVER is installed inside or near the light fixture similar to the method shown in Figure 2-24. This RECEIVER is a fixture module PLC (LEVITON 6376 OR ACT RD-110). The existing fan mechanical wall switch needs to be replaced with a PLC RECEIVER (ACT RD-141 OR LEVITON 6381-U). Now that both electrical loads have a RECEIVER and the 2-button TRANSMITTER is installed within the existing switch box, the designer can now program convenient MACROS as shown on page 74.

### Master Bathroom: 2-Button TRANSMITTER direct & indirect control functions:

*K1 - ON side of button = BATH LIGHT ON - direct*

*K1 - OFF side of button = BATH LIGHT OFF - direct*

*K2 - ON side of button = BATH LIGHT & FAN ON - indirect*

*K2 - OFF side of button = BATH LIGHT OFF, BATH FAN 5 minute delay before turning OFF - indirect*

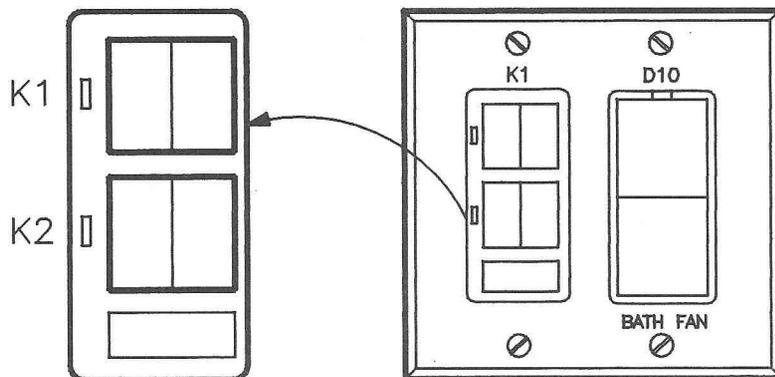


Figure 2-29 MASTER BATHROOM 2-BUTTON WALL TRANSMITTER & RECEIVER

**PROGRAMMING:**

*Description:*

**Mode Description: MASTER BATH LIGHT & FAN - ON**

**BUTTON K2-ON: ( MASTER BATHROOM 2-button wall transmitter)**

EVENT: LIGHT & FAN - ON MODE

*Feature name*

If

*if*

(XSEQ: K-2 K-ON ) Received within 4 seconds

*If button K2-ON is pushed*

Then

*then*

(X: LIGHT MS BATH K-1 ) ON

*Turn Master Bath light ON*

(X: FAN MS BATH D-10 ) ON

*Turn Master Bath fan ON*

End

**Mode Description: MASTER BATH FAN 5-minute delay - OFF**

By pushing the OFF side of the bottom button on this 2-button TRANSMITTER, the Bathroom light is immediately turned OFF and Timer 11 starts while the bathroom fan continues to run. After 5 minutes Timer 11 will expire and the fan will be turned OFF as shown in the programming below.

**BUTTON K2-OFF: ( MASTER BATHROOM 2-button wall transmitter)**

EVENT: LIGHT & FAN - OFF MODE

*Feature name*

If

*if*

(XSEQ: K-2 K-OFF ) Received within 4 seconds

*If button K2-OFF is pushed*

Then

*then*

(X: LIGHT MS BATH K-1 ) OFF

*Turn Master Bath light OFF*

\* (T: TIME 11 ) LOAD with 0 : 05 :00

*After 5 minutes, activate Timer 11 function*

End

EVENT: \* TIME 11

*Timer name*

If

*if*

(T: TIME 11 ) is Expiring

*When 5 minute Timer has expired*

Then

*then*

(X: FAN MS BATH D-10 ) OFF

*Turn Master Bath fan OFF*

End

**BEDROOM: Zone 5**

**2-35 Bedroom Zone 5:** In this bedroom the designer needs to control two 60 watt incandescent end table lamps, a ceiling fan, and a portable stereo unit as shown in Figure 2-6. Each electrical load is controlled by its own mechanical wall switch except the stereo. An existing wall switch manually controls both lamps which are powered by standard receptacles wired in a switched configuration. In this case, the designer again replaces the existing mechanical wall switch with a PLC RECEIVER switch (ACT RD-131 or Leviton 6381). This RECEIVER is rated for 500W of power for incandescent loads which is sufficient capacity for 120 watts of lighting.

This RECEIVER is coded **E5** because it is the dominate light within the Zone, and **5** corresponds to **L** = Light as shown on the phone keypad. The existing mechanical wall switch that controls the ceiling fan is replaced with a PLC RECEIVER (Leviton 6291 or ACT RS-121) latching relay. This RECEIVER is coded **E3** because **3** corresponds to **F** = Fan shown on the phone key.

The portable stereo unit does not have IR control capability to turn this unit ON & OFF. ON & OFF control functions are the only automated functions for this particular device. The designer can simple plug this portable stereo into an appliance module PLC AM466. This

RECEIVER coded E7 plugs into a standard non-switched receptacle. To turn the stereo ON & OFF the power to the stereo is simply turned ON & OFF by the PLC RECEIVER while the switch on the stereo itself is always left in the ON position.

For most stereo receivers, unplugging the unit from the wall receptacle will not provide the minimal power required to maintain programmed stations in memory. Since this portable stereo has a manual dial type tuner, it does not need to remain plugged-in because there are no memory features available.

The PLC 8-button TRANSMITTER is located next to the bed in a similar fashion as the unit in the Master Bedroom. This TRANSMITTER really

has only 4 buttons; however, there is a slide switch on the face of the unit that changes the transmission number codes for the 4 buttons from 1-4 to 5-8 which provides a total of 8 control button functions. This TRANSMITTER only has a letter code dial, so the first button is assigned to number code 1 or 5 depending on which way the slide switch is positioned.

Since this particular room is occupied by an adolescent, the designer needs to offer this member of the family a level of control tailored to their specific needs. The adolescent will be able to access control features assigned to the TRANSMITTER buttons as shown in the control function descriptions that follow:

### Bedroom Zone 5: 8-Button TRANSMITTER direct & indirect control functions:

- E1 - ON side of button = Scene Lighting 50% Bright - indirect*
- E1 - OFF side of button = Scene Lighting 25% Bright - indirect*
- E2 - ON side of button = Not used*
- E2 - OFF side of button = Chime activated in Living Room - indirect*
- E3 - ON side of button = Ceiling Fan - ON - direct*
- E3 - OFF side of button = Ceiling Fan - OFF - direct*
- E4 - ON side of button = Snack Mode - ON - indirect*
- E4 - OFF side of button = Snack Mode - OFF - indirect*
- E5 - ON side of button = Lamp - ON - direct*
- E5 - OFF side of button = Lamp - OFF - direct*
- E6 - ON side of button = Bathroom Zone 3 light & Hallway lights - ON - indirect*
- E6 - OFF side of button = Bathroom Zone 3 light & Hallway lights - OFF - indirect*
- E7 - ON side of button = Stereo - ON - direct*
- E7 - OFF side of button = Stereo - OFF - direct*
- E8 - ON side of button = TV - ON - indirect*
- E8 - OFF side of button = TV - OFF - indirect*

**NOTE:** By keying \*59 by phone the night before, the "Holiday" Flag will Set to keep the STUDENT MORNING MODE from Running the next day. See programming on page 77.

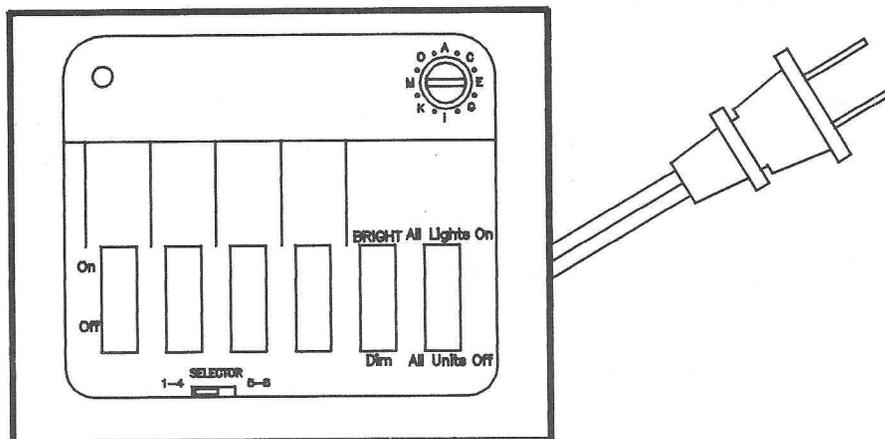


Figure 2-30 BEDROOM 8-BUTTON TRANSMITTER X-10 MC460

## Mode Description: SCENE LIGHTING - *Bedroom Zone 5*

**2-36 Scene Lighting:** Scene lighting sets the mood on desired occasions by dimming numerous lights to a predetermined brightness levels. This mode is initiated by pushing button **E1-ON** or **E1-OFF** on the Bedroom Zone 5 - 8-button TRANSMITTER. In the 'Scene Lighting 50%' programming "Then" statement shown below, an OFF command is incorporated before the 50% programming line. This OFF command is used to assure that the light is fully OFF and not 95% OFF which will appear as OFF. This is required to end up with a true 50% bright function.

### **PROGRAMMING:**

### **Description:**

#### **BUTTON E1-ON: ( BEDROOM 8-button transmitter)**

EVENT: SCENE LIGHTING 50%

If

(XSEQ: E-1 E-ON ) Received within 4 seconds

Then

(X: LIGHT BED RM Z5 E-5 ) OFF

(X: LIGHT BED RM Z5 E-5 ) Set Level 50 %

End

Mode name

if

If button E1-ON is pushed

then

Turn light OFF for 0% start point

Turn lights ON to 50% bright

---

#### **BUTTON E1-OFF: ( BEDROOM 8-button transmitter)**

EVENT: SCENE LIGHTING 25%

If

(XSEQ: E-1 E-OFF ) Received within 4 seconds

Then

(X: LIGHT BED RM E-5 ) OFF

(X: LIGHT BED RM Z5 E-5 ) Set Level 25 %

End

Mode name

if

If button E1-OFF is pushed

then

Turn lights OFF for 0% start point

Turn lights ON to 25% bright

---

#### **BUTTON E2-OFF: ( BEDROOM 8-button transmitter)**

EVENT: ACTIVATE LIV RM CHIME

If

(XSEQ: E2 E-OFF ) Received within 4 seconds

Then

(X: CHIME LIV RM A-2 ) ON

End

Mode name

if

If button E2-OFF is pushed

then

Sound Living Room chime

## Mode Description: SNACK MODE

**2-37 Snack Mode:** The SNACK MODE allows an occupant to create a dimmed lighted path to the Kitchen or any location of the home to avoid having to maneuver through the home feeling around for light switches or to avoid stubbing a toe. Once the occupant has returned to bed, the **E4-OFF** TRANSMITTER button can be pushed to turn the lights OFF.

#### **BUTTON E4-ON: ( BEDROOM 8-button transmitter)**

EVENT: SNACK MODE

If

(XSEQ: E-4 E-ON ) Received within 4 seconds

Then

(X: LIGHT BED RM E-5 ) OFF

(X: LIGHT BED RM Z5 E-5 ) Set Level 25 %

(X: LIGHT HALL C-5 ) OFF

Feature name

if

If button E4-ON is pushed

then

Turn bedroom lights OFF for 0% start point

Turn bedroom lights ON to 25% bright

Turn Hallway lights OFF for 0% start point

: continued: