ILC Apprentice II

USER GUIDE

Version 2B
6/16/14

Class A FCC Device Statement

Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

INTELLIGENT LIGHTING CONTROLS, INC.

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Overview

The ILC Apprentice II lighting controller is a microprocessor-based, programmable lighting controller capable of advanced lighting control in a master-slave application. It is an economical controller that can link up to 48 control points and has the capability of using hardwired or LightSync™ data line switches. You can program the switch inputs to control any or all of the relay outputs. The controller features ILC Softcross™ relays with true zero-cross switching. This User Guide outlines the capabilities of the controller and its add on modules. The ILC Apprentice II is UL and FCC approved for commercial applications.

Structure

The major components making up the controller are:

- enclosure
- control transformer
- CPU board with integral keypad/display
- Input board(s)
- Output board(s)
- lighting relays

Enclosure – The enclosure is rated NEMA 1. It contains a line voltage section for the control transformers and lighting relays and a low voltage section. Enclosures are available in 4 sizes to accommodate 4, 8, 16, or 32 relays.

Transformer – A 40 VA multi-tap control transformer, 120/277 VAC or optional 120/347 VAC that provides the 24 VAC input to power the controller electronics and input/output board(s).

CPU Board – The CPU board provides the controller's intelligence and memory. Major components include:

- Keypad/display – 4-line LCD display and six durable, comfortable push buttons.
- *Power Supply* – converts the 24 VAC input to the +5, -5 and +12 VDC required by the controller logic and communications circuits. A power switch provides the means of energizing/de-energizing all controller electronics.
- *Communications* – USB port, add-on card expansion socket.
- *Override Switches* – push button override switches turn relays all ON or all OFF.
- *Microprocessor* – executes the computer code and coordinates all controller functions including the controller real time clock.
- *Flash Memory* – contains the controller operating system and basic tasks.
- the *EEProm memory*– store the user-entered operating parameters.
- *Real time clock* – maintains time and date for up to 30 days without power.

Input Board(s) – Each input board provides four (4) switch inputs.
Major components include:

- *Switch Inputs* – can accept input from either 2- or 3-wire momentary or maintained dry contact devices. Each switch input features a switch pilot LED output, which can be programmed to track the state of a single relay, relay group or preset. The inputs are optically isolated, noise- and surge-resistant. A switch and pilot may be located up to 1500 feet from the controller, provided you use a minimum of 18 gauge wire.

Output Board(s) – Each output board provides four (4) relay outputs.
Major components include:

- *Relay Outputs* – Each optically isolated output switches its associated lighting relay ON and OFF. Each output has an associated LED. The LED lights when the output switches the relay ON.
- *Relay* –
  SoftCross™ Relay: Electrically held N.O or N.C. lighting relay rated for up to 277 VAC @ 20 full load amps.
  1-Pole Relay Option: Single-pole relay capable of controlling lighting loads up to 347VAC @ 20 full load amps.
  2-Pole Relay Option: Two-pole relay capable of controlling lighting loads up to 277VAC @ 20 full load amps per pole.

Section 1 Controller Description

Section 2 Installation

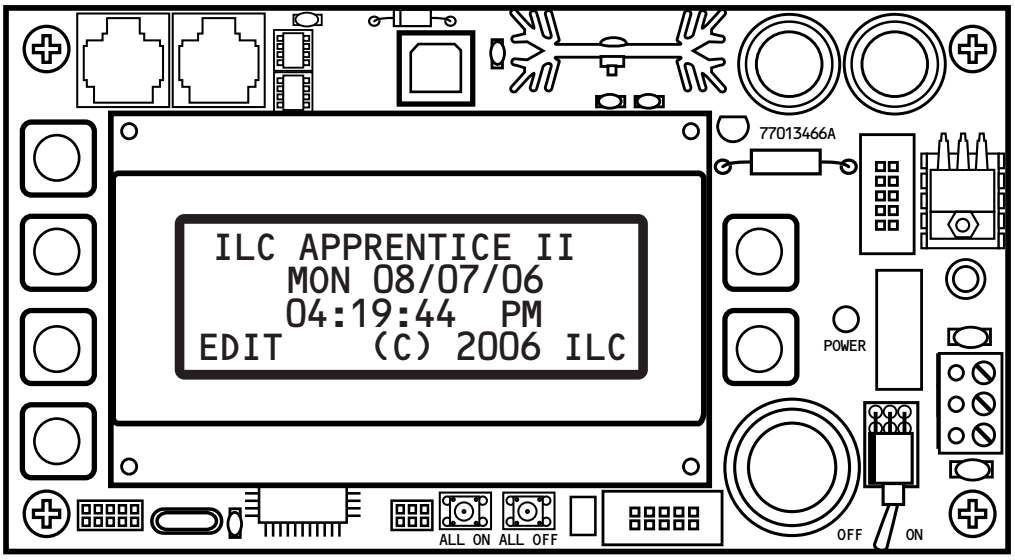
Section 2 Installation, continued

Section 3 Programming

Section 4 LightSync Device Switching

Section 5 Appendix

Section 1
Controller Description



Section 1 Controller Description

Section 1 – Controller Description

Objectives

In this Section you will learn about the structure and configuration of the ILC Apprentice II Controller.

Overview

The ILC Apprentice II is a microprocessor-based lighting controller. You can program the ILC Apprentice II to control lighting relays in response to switch signals sensed by its inputs and/or by time-based scheduling. The ILC Apprentice II is UL approved and FCC certified for commercial applications.

1.1 Controller Architecture

The major components making up the controller are: (See Figure 1.1.)

- enclosure
- control transformer
- CPU board
- input board(s)
- output board(s)
- display/keypad
- lighting relays

1.1.1 Enclosure - The enclosure is rated NEMA 1. Enclosures are available in 4 sizes to accommodate 4, 8, 16 or 32 inputs, outputs, and lighting relays. See (Table 1-1.) The ILC Apprentice II is shipped to the job-site as a complete assembly. (See Figure 1-1, which illustrates a ILC Apprentice II 4.)

1.1.2 Transformer - A multi-tap transformer, 120/277 VAC or optional 120/347 VAC that provides the 24 VAC input to power the controller electronics.

Model	# of Relays & I/O Points	Width	Height	Depth
Apprentice II 4	4	14 Inches	12 Inches	4 Inches
Apprentice II 8	8	14 Inches	16 Inches	4 Inches
Apprentice II 16	16	14 Inches	24 Inches	4 Inches
Apprentice II 32	32	16 Inches	42 Inches	4 Inches

Table 1.1 – ILC Apprentice II Configurations

1.1.3 CPU Board – (See Figure 1.2.) The CPU board provides the controller's intelligence, memory, and communications capabilities. Major components include:

- *Power Supply* – converts the 24 VAC input to the +5, -5 and +12 VDC required by the controller logic and communications circuits. A power switch provides the means of energizing/de-energizing all controller electronics.
- *Communications* – USB on-board port.
- *Micro-Processor* – executes the computer code and coordinates all controller functions including the controller real time clock.
- *Override Switches* – provided with All ON/All OFF override pushbuttons.
- *Flash Memory* – contains the controller operating system and basic tasks.
- *EEProm memory*– store the user-entered operating parameters.
- *Real time clock* – maintains time and date for up to 30 days without power.

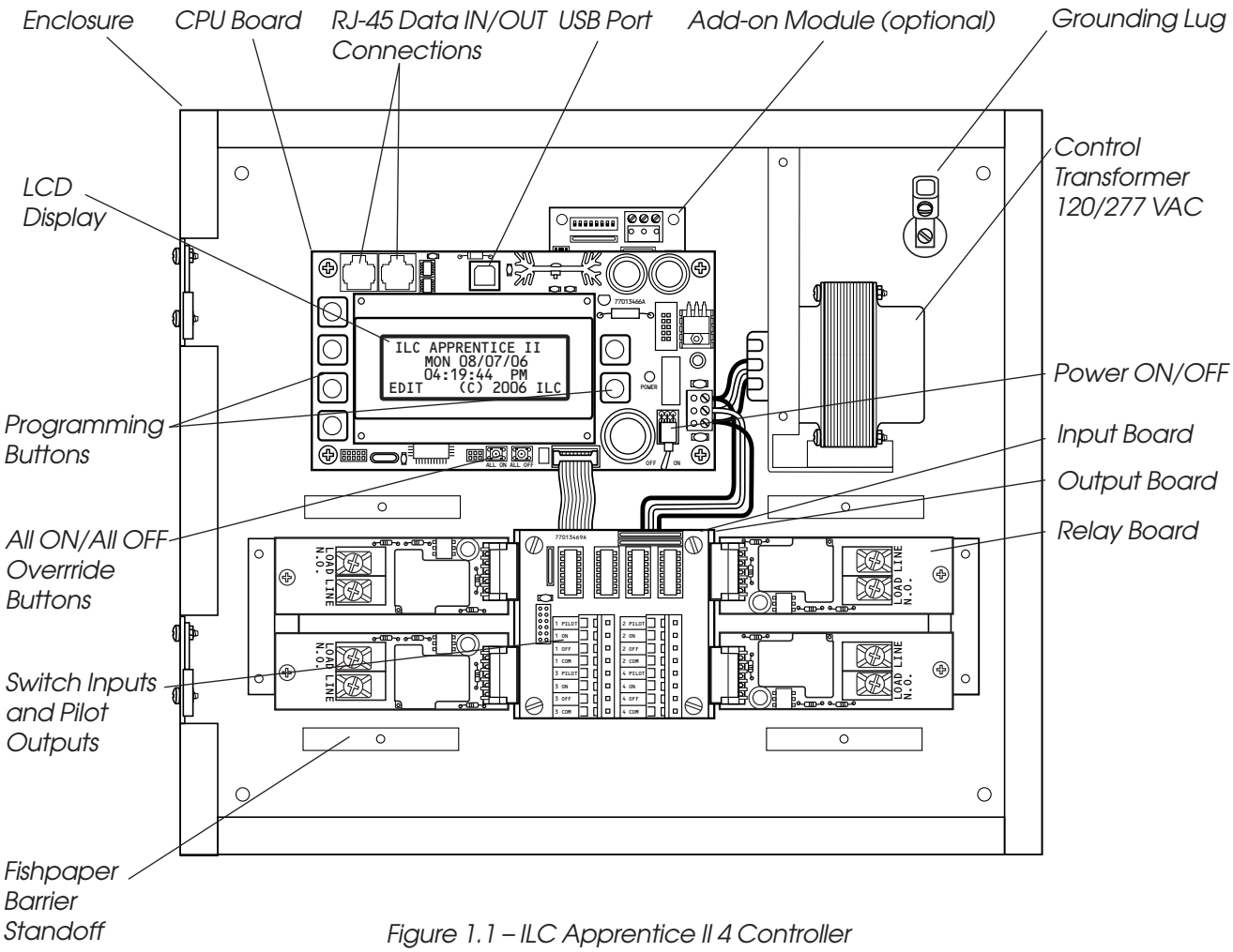


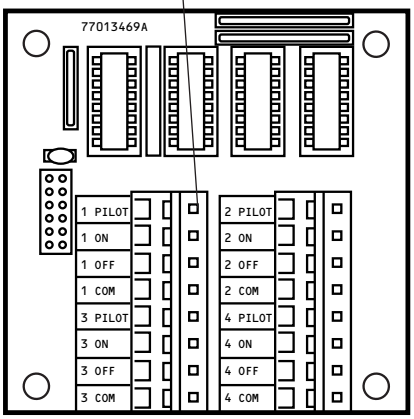
Figure 1.1 – ILC Apprentice II 4 Controller

1.1.4 Input Board(s) – Each Input board adds four (4) switch inputs and pilot outputs. The inputs are all optically isolated. Additional boards can be added to the enclosure to provide a network capacity of up to 48 switch inputs. (See Figure 1.3, which illustrates a ILC Apprentice II 8. Major components include:

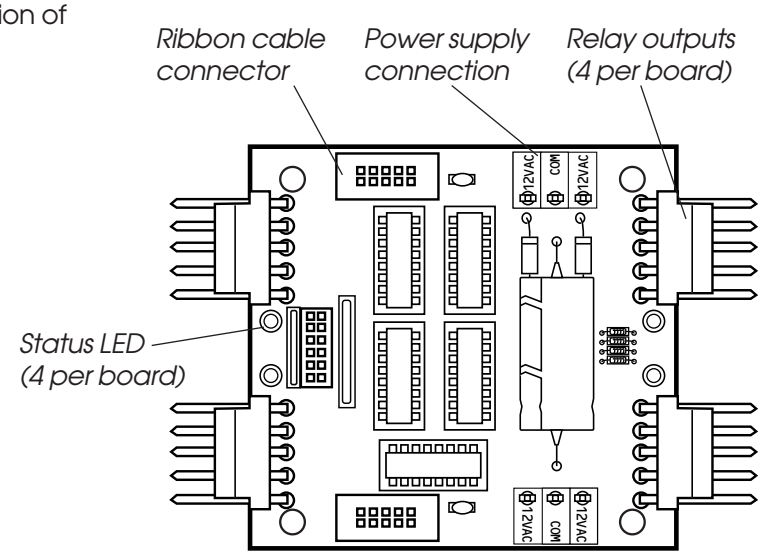
- *Switch Inputs* – The ILC Apprentice II is designed to accomplish a wide variety of switch input types. Each switch input has an associated switch pilot LED output which can be programmed to track the state of a selected relay, relay group, or preset. See the Table 1.2 (next page)for a description of switch input types.

1.1.5 Output Board(s) – Each Output board provides four (4) relay outputs that connect to ILC Softcross™ Relay boards. Major components include:

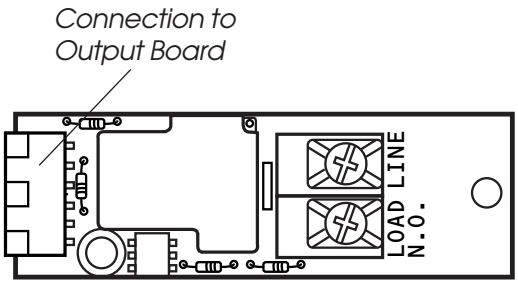
- *Relay Outputs* - each output switches its associated lighting relay ON and OFF. Each output has an associated LED (light emitting diode). The LED lights when the output switches the relay ON.



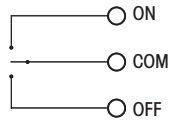
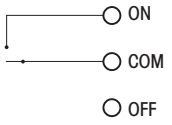
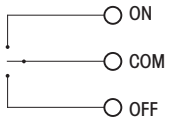
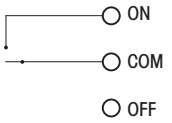
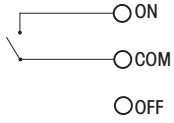
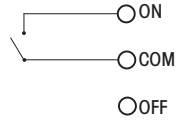
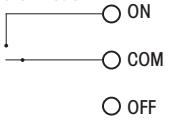
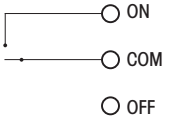
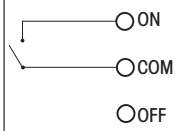
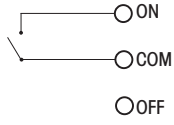
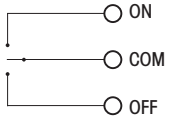
ILC Apprentice II Input Board



ILC Apprentice II Output Board



ILC Softcross™ Relay

Momentary ON/OFF: When momentary contact is made between ON and COM, relay outputs controlled by this input are turned ON. When momentary contact is made between OFF and COM relay outputs controlled by this input are turned OFF.  MOMENTARY	***Momentary Push- Button:*** When momentary contact is made between ON and COM, relay outputs controlled by this input are turned ON and OFF alternately each time contact is made.  MOMENTARY	***Maintained ON/OFF:*** When contact is made between ON and COM relay outputs controlled by this input are turned ON. When contact is broken between ON and COM, relay outputs controlled by this input are turned OFF.  MAINTAINED	***Maintained Multi-Way:*** When contact is either made or broken between the ON and COM, relay outputs controlled by this input will be toggled between ON and OFF conditions. This function is similar to that of standard 3- and 4-way switches.  MAINTAINED	***Set Preset:*** When momentary contact is made between ON and COM, the selected preset will be activated.  MOMENTARY	***Timed ON/Cleaning Switch:*** When momentary contact is made between COM and ON, relay outputs are turned ON. When contact is broken, a timed ON duration is started from 5-999 minutes. Contact between OFF and COM will turn relays OFF.  MOMENTARY
Two-Step Group: When the switch is activated, group A (relay outputs) turn ON and group B (relay outputs) turn OFF. When the input is activated again, group A turn OFF and group B turn ON. The pattern repeats with successive switch activations.  MOMENTARY	***Four-Step Group:*** The first time the switch is activated, group A (relay outputs) turn ON and group B (relay outputs) turn OFF. The second time the switch is activated, group A turn OFF and group B turn ON. The third time, both groups turn ON. The fourth time, both groups turn OFF. The fifth actuation begins a repeat of the 4 steps.  MOMENTARY	***Input Disable:*** When contact is made between ON and COM, selected input or inputs will be ignored.  MAINTAINED	***Timer Disable:*** While contact is made between ON and COM, selected timer or timers will be ignored.  MAINTAINED	***Output Override:*** While contact is made between ON and COM, relay outputs controlled by this input are turned ON, OFF or held in their current state and all other control commands are ignored. **All inputs/timers are ignored for controlled relay outputs.**  MAINTAINED	***Photo Sensor Inputs:*** ILC Apprentice controllers can be connected to either momentary or maintained output photo sensors as shown below.  MOMENTARY Programmed as "Momentary"  MAINTAINED Programmed as "Maintained ON/OFF input"
Motion Sensor Inputs: ILC Apprentice controllers can be connected to either momentary or maintained output motion sensors as shown below.  MOMENTARY Programmed as "Momentary"  MAINTAINED Programmed as "Maintained ON/OFF input"	***Fire Alarm System Inputs:*** ILC Apprentice controllers can be easily connected to building Fire Alarm Systems to force selected controlled lighting circuits to the ON, OFF or HOLD state and lock out all other forms of control when a Fire Alarm signal is present (contacts CLOSED).  MAINTAINED Programmed as "Output Override input"	***Dry Contact Interface:*** Virtually any control system or device can be interfaced to a ILC Apprentice controller through the use of a simple dry contact interface utilizing any of the available switch types. Please consult factory for any special requirements.	***Force Timer:*** A switch input can be mapped to force a ILC Apprentice Timer activation.  MAINTAINED	***HID Bi-Level:*** Operation of Bi-level HID Ballasts. First contact between COM and ON will turn ON power and High/Low relay. (High/Low relay is locked ON for 15 minutes for warm up period) Additional activations of ON terminal will toggle High/Low relay. Contact between OFF and COM will turn relays OFF.  MOMENTARY	

NOTE: Switch Enable-Disable: Inputs may be enabled or disabled based on Time of day

Table 1.2 – ILC Apprentice Switch Input Types

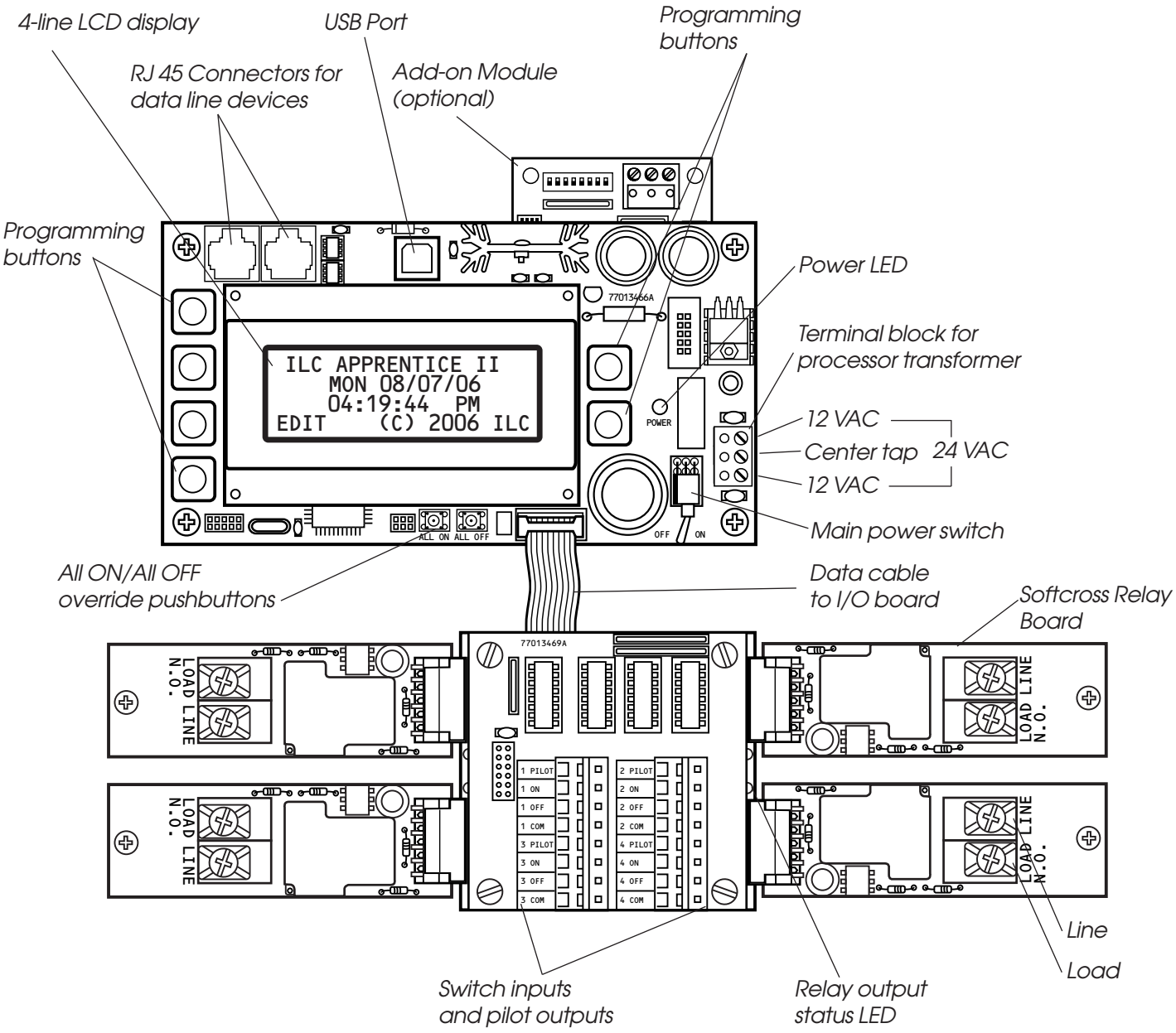


Figure 1.2 – Apprentice II CPU Board and I/O

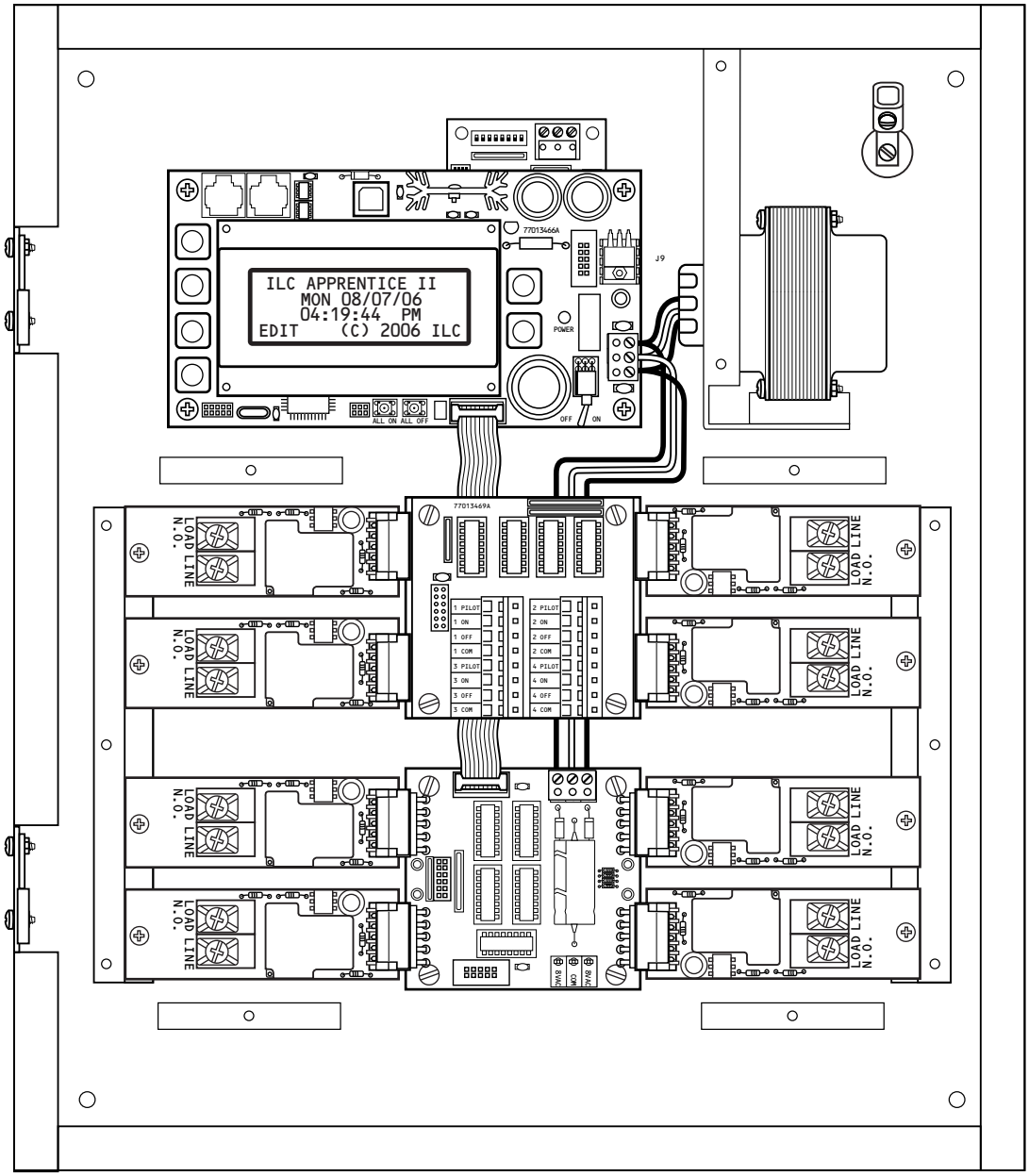


Figure 1.3 – ILC Apprentice II 08 with standard 4-inputs

1.1.6 Programming Buttons/Display - (See Figure 1.4.) The ILC Apprentice provides you with programming buttons and a LCD display to enable programming and view controller data.

1.1.7 Lighting Relays -
SoftCross™ Relay: Electrically held N.O or N.C. lighting relay rated for up to 277 VAC @ 20 full load amps.
1-Pole Relay Option: Single-pole relay capable of controlling lighting loads up to 347VAC @ 20 full load amps.
2-Pole Relay Option: Two-pole relay capable of controlling lighting loads up to 277VAC @ 20 full load amps per pole.

The relays are connected to the output board by means of a five-pin push-on connector held in place with a retaining screw.

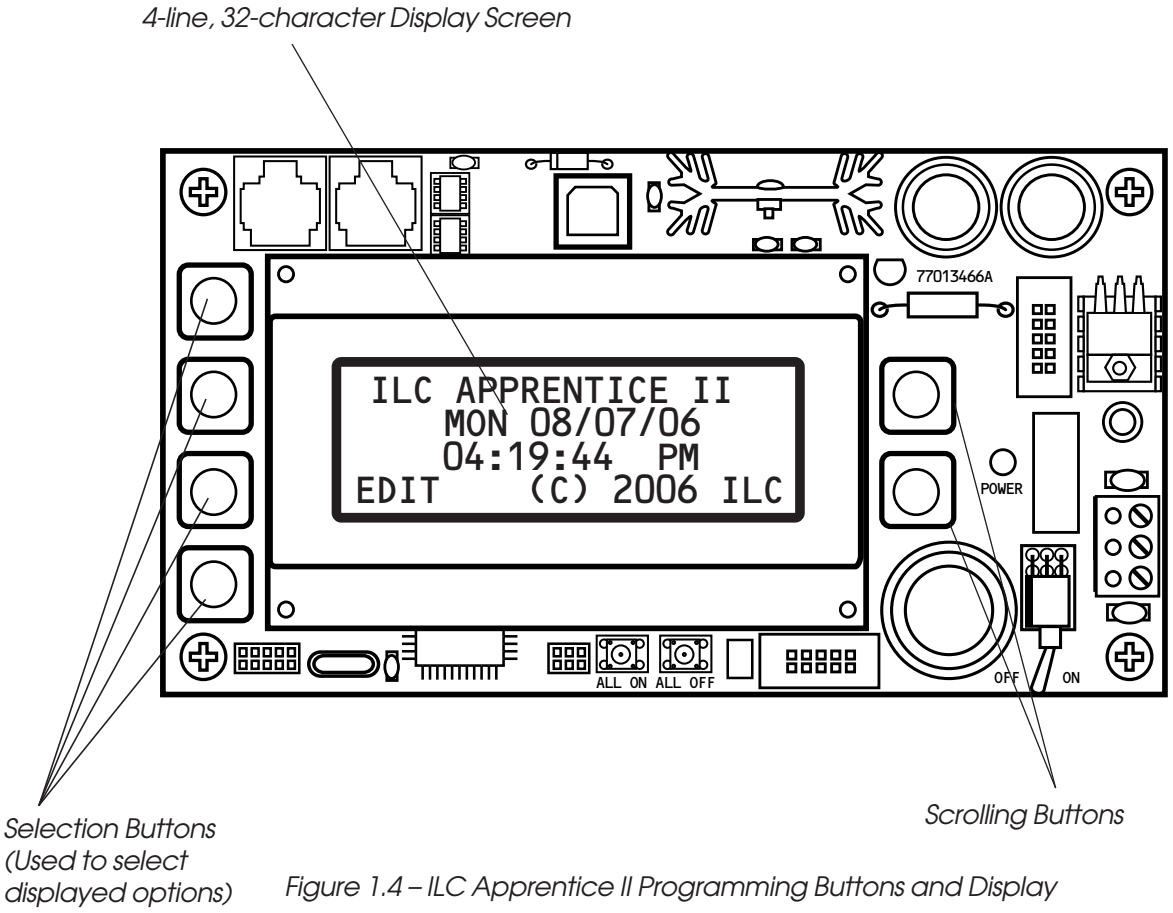


Figure 1.4 – ILC Apprentice II Programming Buttons and Display

1.2 I/O Options

The ILC Apprentice II controller can be equipped with the following add-on devices:

1.2.1 Voice/DTMF Module – You can equip the controller with a DTMF (Dual Tone Multi Frequency) interface, which allows you to activate switch inputs via commands from a touchtone telephone.
(See Appendix A.)

1.2.2 DMX 512 Module – Provides for direct control of ON/OFF lighting or other loads from any DMX 512 control device. Any of the available 512 DMX control channels may be mapped to control individual relays. (See Appendix B.)

1.2.3 N2 Module – Provides for direct control of control devices in building automation systems using N2 protocol . (See Appendix N.)

1.2.4 MODBUS Module – Provides for direct control of control devices in building automation systems using MODBUS protocol . (See Appendix M.)

1.2.5 BACnet Module – Provides for direct control of control devices in building automation systems using BACnet protocol (See Appendix B)

1.2.6 LonWorks Module – Provides for direct control of control devices in building automation systems using LonWorks protocol (See Appendix L)

1.2.7 TCP/IP Interface – Provides a TCP/IP interface with the configuration software over a LAN or WAN.

1.2.8 Modem Interface – Provides a modem interface over an analog phone line with the configuration software.

1.3 Lighting Controller Network

ILC Apprentice II controllers can be networked together in a Local Area Network (LAN) to form a comprehensive lighting control system for a faciltity.

1.3.1 Communications Protocol And Transmission Media – Devices that operate on ILC's LightSync CAT-5 data line include Apprentice II lighting controllers, LightSync switches, photocells, inputs, and occupancy sensor inputs. A standard 24 gauge CAT-5, 5E or 6 cable is used for the data line and provides both data and power to these devices. See Figure 1.5 which details cable specifications. The cable terminates to ports on each Apprentice II controller (or expansion panel) as shown in Figure 1.7. The total data line end to end distance may not exceed 3000 feet without the addition of a Power Supply Repeater (PSR) (See Figure 1.6 and 1.8) to the data line. Only a PSR will extend the data line. A PSR has one incoming and two outgoing RJ45 ports to split the line into two different directions. See Figure 1.8 for an example of possible project layout.

1.3.2 Network Architecture
The network can consist of a Master (standard) panel and a number of Expansion panels that add up to a maximum of 48 relay outputs. The Master panel is always Node 1 and controls the Expansion panels. The Expansion panels are adddressed with a unique node address ranging from 2 to C. The data line exits the Master panel's RJ-45 OUT port and enters the IN port of the Expansion panel.

As an alternative to programming from the Master Controller Keypad, programming may be done from a personal computer (PC) equipped with proprietary ILC Apprentice II Pro software. See Appendix C for details.

1.3.3 Device Nodes – Apprentice II Networks also feature Device Nodes. These are data switches, photocells and other input devices connected to the CAT-5 data line. (See Figure 1.8). There can be a maximum of up to 32 device nodes in a the lighting control network.

There are limitations to the distance data can travel over CAT-5 cable without loss, and distance limitations due to voltage drop associated with cable length and number of devices on the LightSync data line. These limitations are addressed by the addition of a Power Supply Repeater, Power Supply or LightSync Hub (see Figure 1.6), depending on the application. The specific use of these devices depends on the project layout.

Each controller will power up to 8 device nodes without a Power Supply Repeater (PSR), Power Supply (PS) or LightSync Hub (HUB). Each of these will supply power to an additional 20 devices. If "T" connections are required, or if data needs to be extended, a PSR is necessary. A LightSync Hub (See Figure 1.9) provides "home run" wiring capability. Consult factory for details.

Each device node is addressed via address dials that are part of the device. *Possible addresses for device nodes are 01-20. These are a different set of addresses from the controller node addresses.*

If your project features device nodes, consult Section 4 for details.

Data Cable Requirements

Definitions:

Category 5 Cable (UTP-Unshielded Twisted Pair)- A 4 pair high performance cable that consists of twisted pair conductors, used mainly for data transmission. Basic CAT-5 cable was designed for characteristics of up to 100 MHz. NOTE: The twisting of the pairs gives the cable a certain amount of immunity from the infiltration of unwanted interference.

Category 5E Cable (Enhanced)- Same as Category 5, except that it is made to somewhat more stringent standards (see comparison chart below). The Category 5E standard is now officially part of the 568A standard. Category 5 E is recommended for all new installations, and was designed for transmission speeds of up to 1 gigabit per second.

Below you will find a list of the required properties your selected cable must meet. You will also find a list of cables, which meet these criteria from several different manufacturers. At your option you may utilize one of the below-suggested cables or have your cable supplier provide you with a suitable alternative, which meets the listed criteria.

Category 6 Cable- Same as Category 5E, except that it is made to a higher standard (see comparison chart below). Category 6 is now part of the 568A standard.

Standard 24-gauge Data Cable Performance Specification Chart:

Parameter	Category 5	Category 5E	Category 6
Specified frequency range	1-100 MHz	1-100 MHz	1-250 MHz
Attenuation	24 dB	24 dB	36 dB
NEXT	27.1 dB	30.1 dB	33.1 dB
Power-sum NEXT	N/A	27.1 dB	30.2 dB
ACR	3.1 dB	6.1 dB	-2.9 dB
Power-sum ACR	N/A	3.1 dB	-5.8 dB
ELFEXT	17 dB	17.4 dB	15.3 dB
Power-sum ELFEXT	14.4 dB	14.4 dB	12.3 dB
Return loss	8 dB	10 dB	8 dB
Propagation delay	548 nsec	548 nsec	546 nsec
Delay Skew	50 nsec	50 nsec	50 nsec

Suggested Manufacturers and Data Cables:

Manufacturer	Part Number	Cable Type	Phone
Belden	7854A	CAT-5 non-plenum	800 235 3361
	1583A	CAT-5E non-plenum	
	7811A	CAT-5 plenum	
	1585A	CAT-5E plenum	Contact Cassidey Technolgies (800 464 9473), manufacturer, or local distributor
General	2137113	CAT-5 non-plenum	
	5133299E	CAT-5E non-plenum	
	5131413	CAT-5 plenum	
	6131278	CAT-5E plenum	
Hitachi	38696-8	CAT-5 non-plenum	
	38993-8	CAT-5E non-plenum	
	39419-8	CAT-5 plenum	
	38891-8	CAT-5E plenum	

If you have any questions or would like our engineers to approve your cable selection please feel free to contact our applications department at 1-800-922-8004.

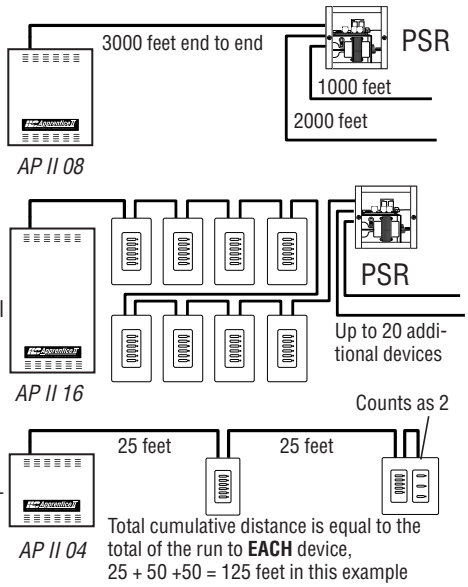
Figure 1.5 – Data Cable Requirements

LightSync™ Network Cable Run Distance Detail

Devices that operate on ILC's LightSync CAT-5 , 5E, 6 data line include LightSync switches, photocells, and interfaces like the LightSync D-6 and SIB-4. A standard CAT-5 , 5E, 6 cable is used for the data line and provides both data and power to these devices. There are limitations to the distance data can travel over CAT-5 , 5E, 6 cable without loss, and distance limitations due to voltage drop associated with cable length and number of devices on the LightSync data line. These limitations are addressed by the addition of a Power Supply Repeater, Power Supply or LightSync Hub (see chart), depending on the application. The specific use of these devices depends on the project layout.

There are four main areas of limitation to be addressed:

1. **Total Data Line Overall Distance:** The total data line end to end distance may not exceed 3000 feet without the addition of a PSR to the data line. Only a PSR will extend the data line.
2. **Total number devices (Lightmaster panels and LightSync devices):** Total number of devices without a PSR is 32. A PSR will add 31 more devices (PSRs are counted as a device).
3. **Total number of LightSync devices powered:** No Apprentice II controller panel can power more than eight (8) LightSync devices on the data line without a PS, PSR or LightSync Hub (each can power up to 20 additional LightSync devices).
4. **Total Power Cumulative Distance:** The cumulative distance from each device to its power supply may not exceed 2000 feet if powered by a Apprentice II panel, or 3000 feet if powered by a PS, PSR or LightSync Hub.



ILC Power and Data Repeating Device	Total Data (end to end) Distance	No. of LightSync Devices Powered	Cumulative Power Distance
Apprentice II Panel	3000 feet	8	2000 feet
Power Suppy (PS)	N/A	20	3000 feet
Power Supply Repeater (PSR)	3000 feet (combined)	20	3000 feet
LightSync Hub (HUB)	1500 feet per port	20 total	1500 feet per port

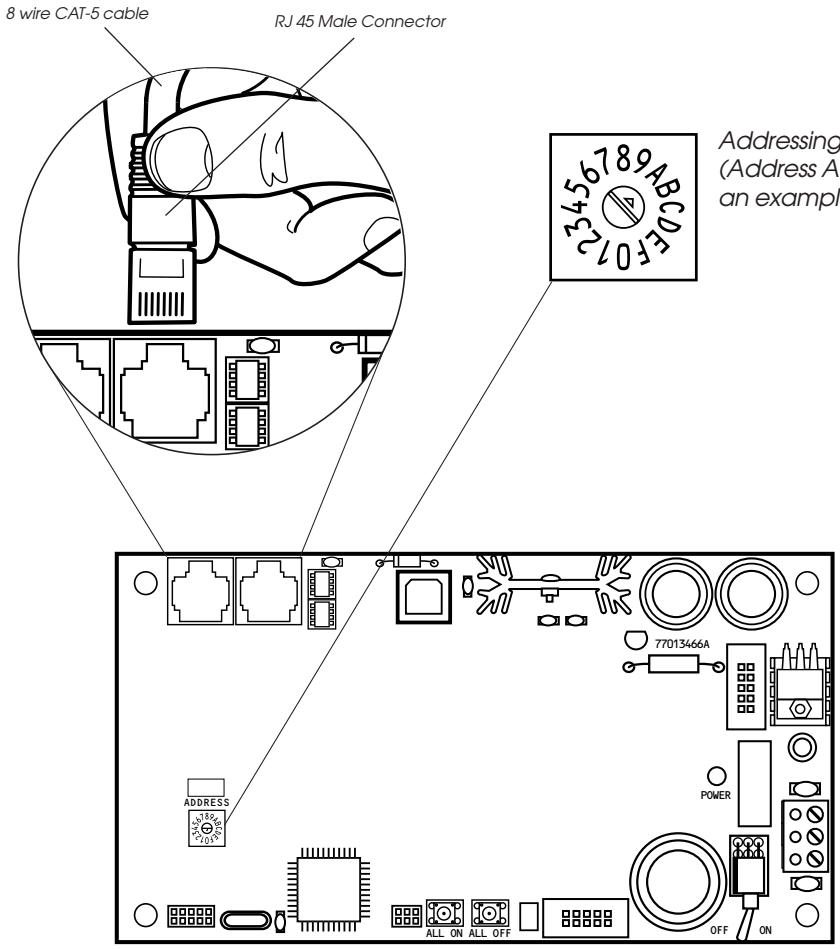
ILC Power and Data Repeating Devices

A **Power Supply Repeater** (PSR) is both a power supply and data repeater and its primary purpose is to repeat data and provide a bridge to another data line capable of 3000 feet end to end. This device also has one incoming and two outgoing RJ45 ports to split the line into two different directions. The PSR also adds power to LightSync devices for an additional 3000 cumulative feet.

A **Power Supply** (PS) provides additional power as needed to the LightSync data line. This is the most efficient option to compensate for voltage drop from multiple LightSync devices on the data line. Note that a PS provides power only and does not repeat data.

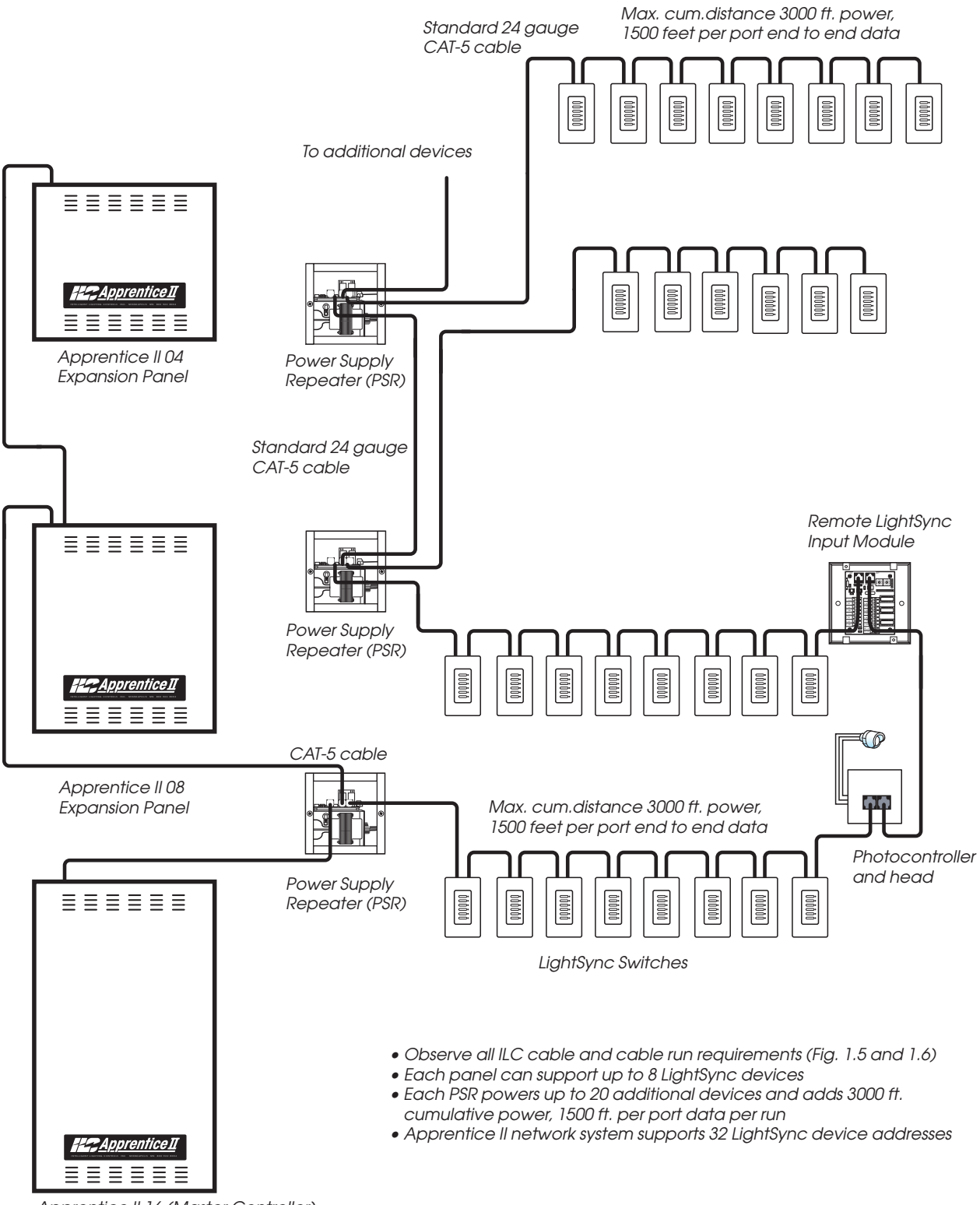
A **LightSync Hub** (HUB) is a device that allows a home run configuration by providing RJ45 ports for up to 20 LightSync devices, supplying power and data up to 1500 feet per each port.

Figure 1.6 – LightSync Network Cable Run Distance Detail



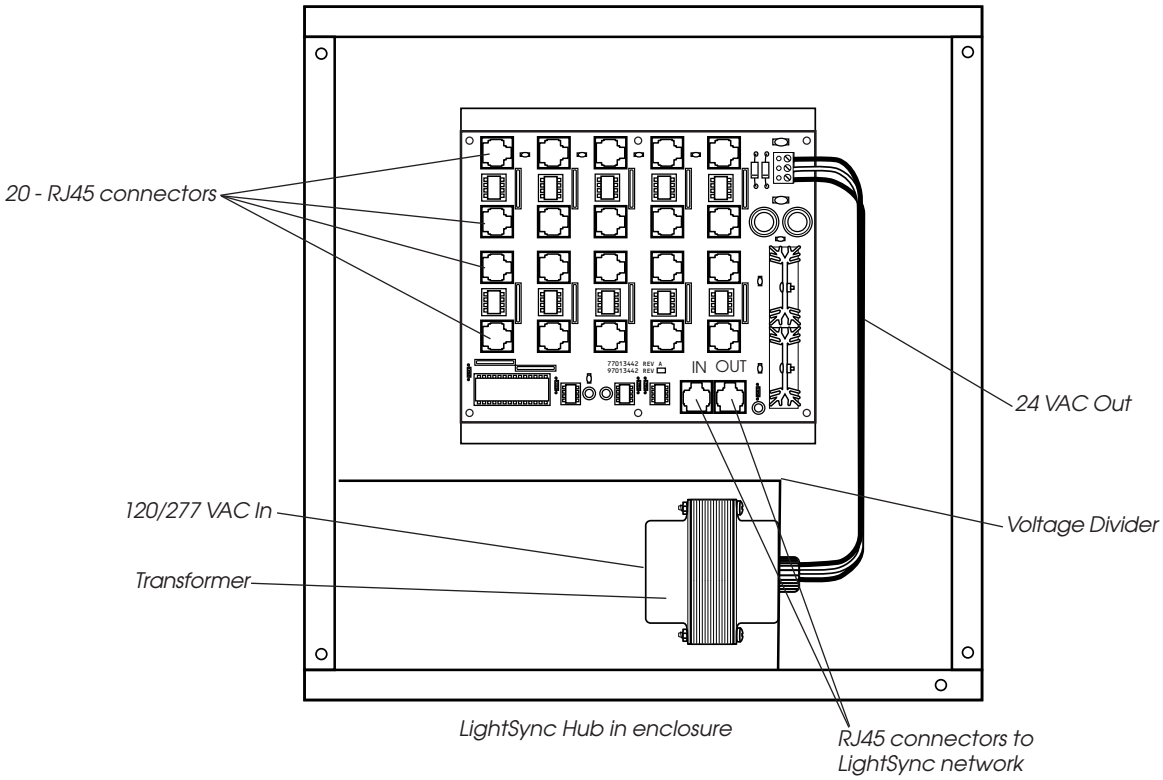
- Each networked Apprentice II expansion panel must be given a unique 1-digit node address using the addressing switch noted above. Settings from 2 to C can be used to address up to 12 panels in a network.
- A 2-digit address code system is used with LightSync data line devices.
- Apprentice II panels and LightSync device addresses are unique.
- Document and record node address in the supplied area for future reference (it will be needed for programming).

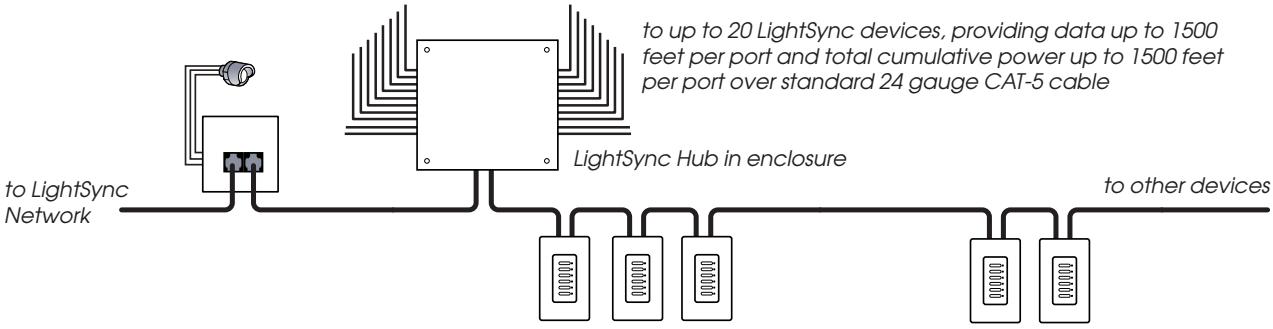
Figure 1.7 – CAT-5 Termination and Expansion Node Address Detail



- *Observe all ILC cable and cable run requirements (Fig. 1.5 and 1.6)*
- *Each panel can support up to 8 LightSync devices*
- *Each PSR powers up to 20 additional devices and adds 3000 ft. cumulative power, 1500 ft. per port data per run*
- *Apprentice II network system supports 32 LightSync device addresses*

Figure 1.8 – Example Network Riser

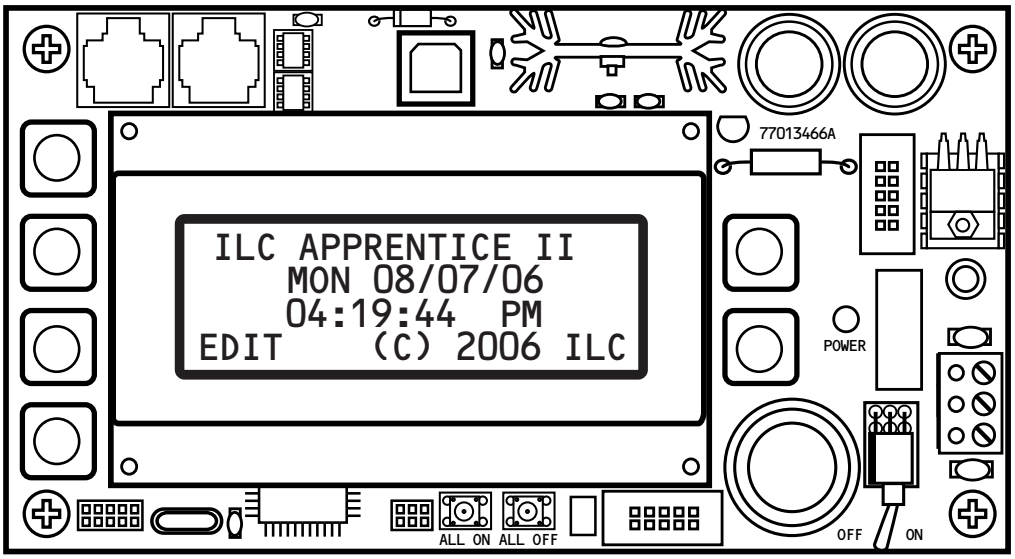




LightSync Network Example with LightSync Hub

Figure 1.9 – LightSync Hub Option

Section 2
Installation



Section 2 Installation

Objectives

This section shows you how to install the ILC Apprentice II controller and how to perform required power-up verification checks.

Overview

This section covers the following topics:

- Pre-installation checks
- Mounting the controller
- Wiring the controller
- Pre-power-up checks
- Power-up and checkout
- Troubleshooting

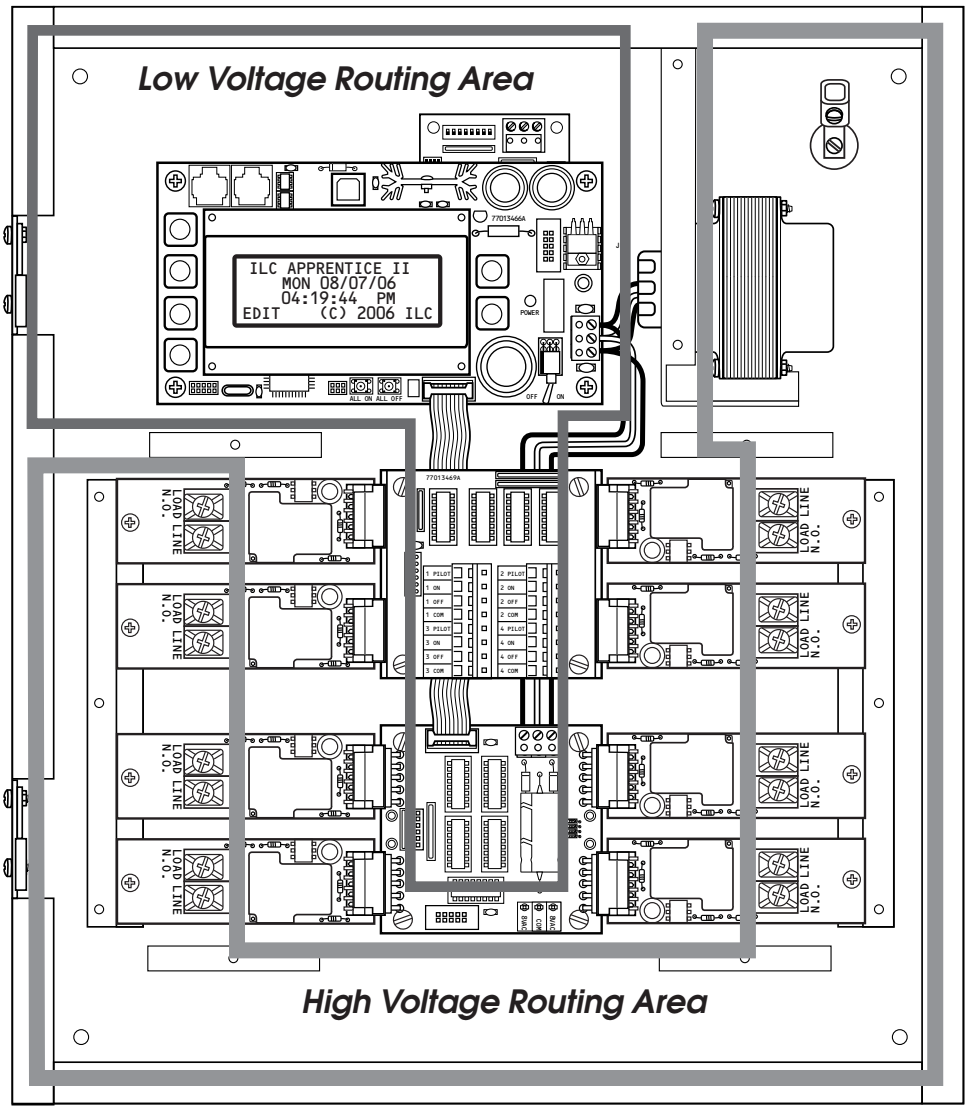


Figure 2.1 – Apprentice II Wire Routing Diagram

2.1 Pre-Installation Checks

Do the following before beginning the installation:

1. Verify that you have received the proper equipment. Check the packing slip against the materials you ordered and verify that the material is appropriate for the project. Check to ensure that the voltages of the controller(s) transformers match the available power. Report any discrepancies or visible damage at once.
2. Review electrical prints and other relevant project documentation.
3. Ensure that you have a digital multi-meter.

2.2 Mounting the Controller

Consider the following when selecting a site for the ILC Apprentice II.

2.2.1 Location – Typically, the Apprentice II controller is mounted near the lighting breaker panel containing the circuits to be controlled by the lighting relays. The enclosure is manufactured with pre-drilled mounting holes located near the four corners of the rear wall of the enclosure. Secure the enclosure to the mounting surface with hardware appropriate for the application.

2.2.2 Environmental Considerations – The ILC Apprentice II is designed to operate in temperatures between 0 and 40 degrees C (32°-104°F) and10%-90% humidity non-condensing.

2.2.3 Distance From Hardwired Control Devices Hardwired switches, pilots and other control devices can be located up to 1500 feet from the ILC Apprentice II controller using 18 gauge wire. See LightSync section for data line devices.

2.3 Wiring the Controller

Perform the following procedures to wire the line and control circuits of the ILC Apprentice II. Do ***NOT*** apply power to any circuits until instructed to do so. Document all terminations. Remove fish paper voltage barriers prior to any wiring. Ensure all barriers are replaced prior to powering up the controller.

2.3.1 Wire the Control Transformer
Run a dedicated 120. 277, or 347 VAC circuit, including grounding conductor, and terminate it to the primaries of the ILC Apprentice processor transformer and grounding lug. Cap the unused lead. (See Figure 2.1.)

VERY IMPORTANT: Keep all Class 2 (low voltage) wiring separated from the high voltage wiring and routed as shown in Fig. 2.1. Failure to follow this procedure may interfere with the operation of the controller.

2.3.2 Connect Line and Load –

Warning: The relays in this controller contain a solid-state device that may be damaged from a high fault short circuit if the following steps are not completed. Failure to follow the procedure below may damage a relay or the electronics in the panel. This will void the warranty and the panel may need to be replaced.

Run the wires through the High Voltage Routing Area and temporarily connect the line and load wires for each circuit **to the line terminal of the relay**.

- Once all of the loads are terminated on the circuit, power-up and verify the circuit is void of any short circuits. Clear any shorts found and re-test.
- Power down circuits and remove the line and load wires from the temporary connection and connect the wires to the proper line and load connections as shown in figure 2.1.
- Power-up circuit tested.

2.3.3 Wire Switch Inputs - Wire the Class 2 Switch Circuits. (See Figure 2.3.)

1. Run the required wiring between the controller and the field-installed switches. Consult project documentation to determine the type and quantity of required switch circuits. Check each switch run to ensure that there are no shorts between conductors or to ground. Also verify that there are no opens.
2. Make the connections at the switch end.
3. Make the connections to the controller switch input terminals.

If your installation involves LightSync data line switches, see Section 4.

NOTE: Hardwire input numbers correlate to the Output board that it is attached to. For example, an Input board associated with an Output board controlling relays 5 to 8 would contain inputs 5 to 8. Numbering convention is from left to right, then drop down and go left to right.

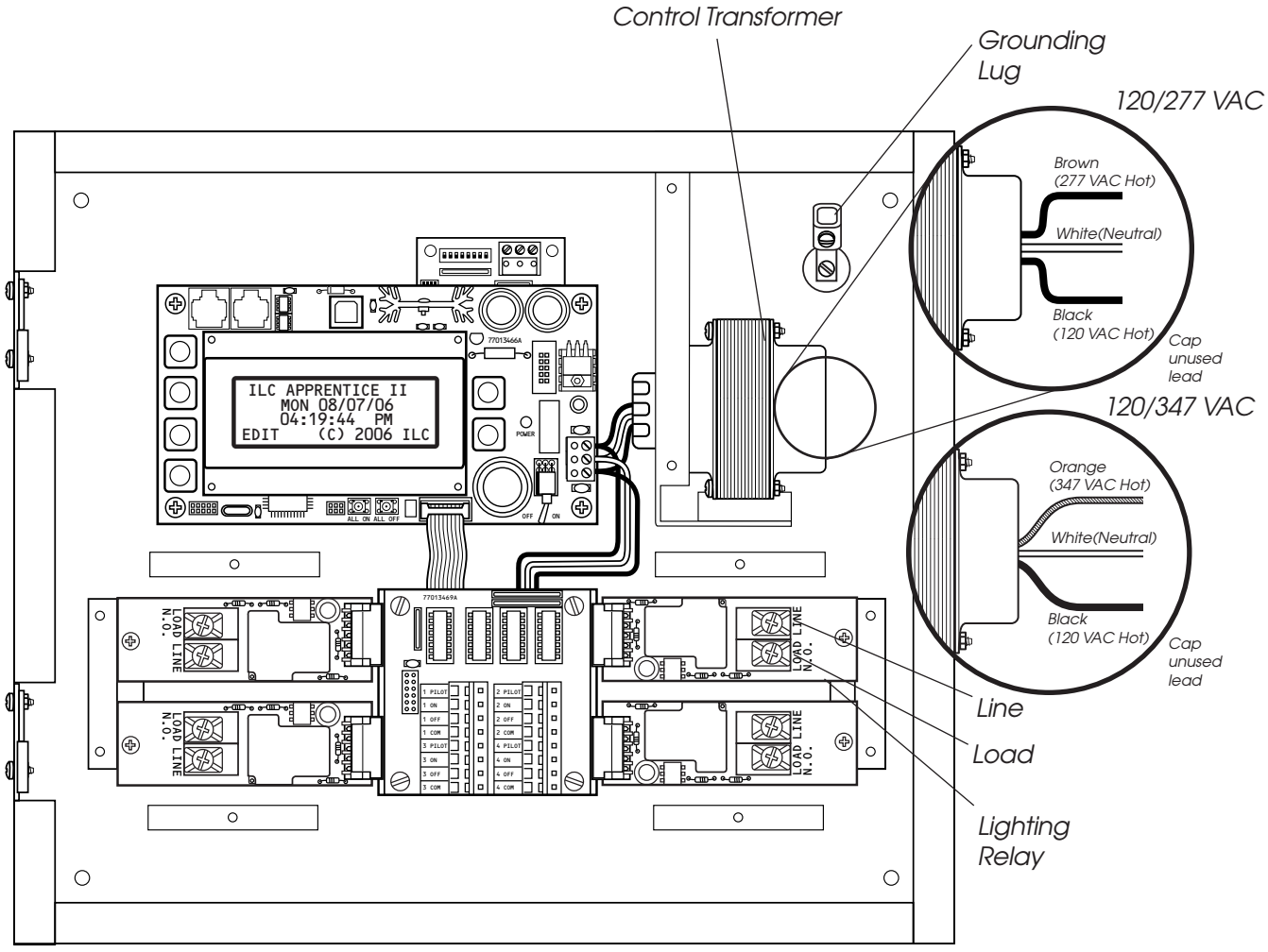


Figure 2.1 – Terminate Control Transformer Primary

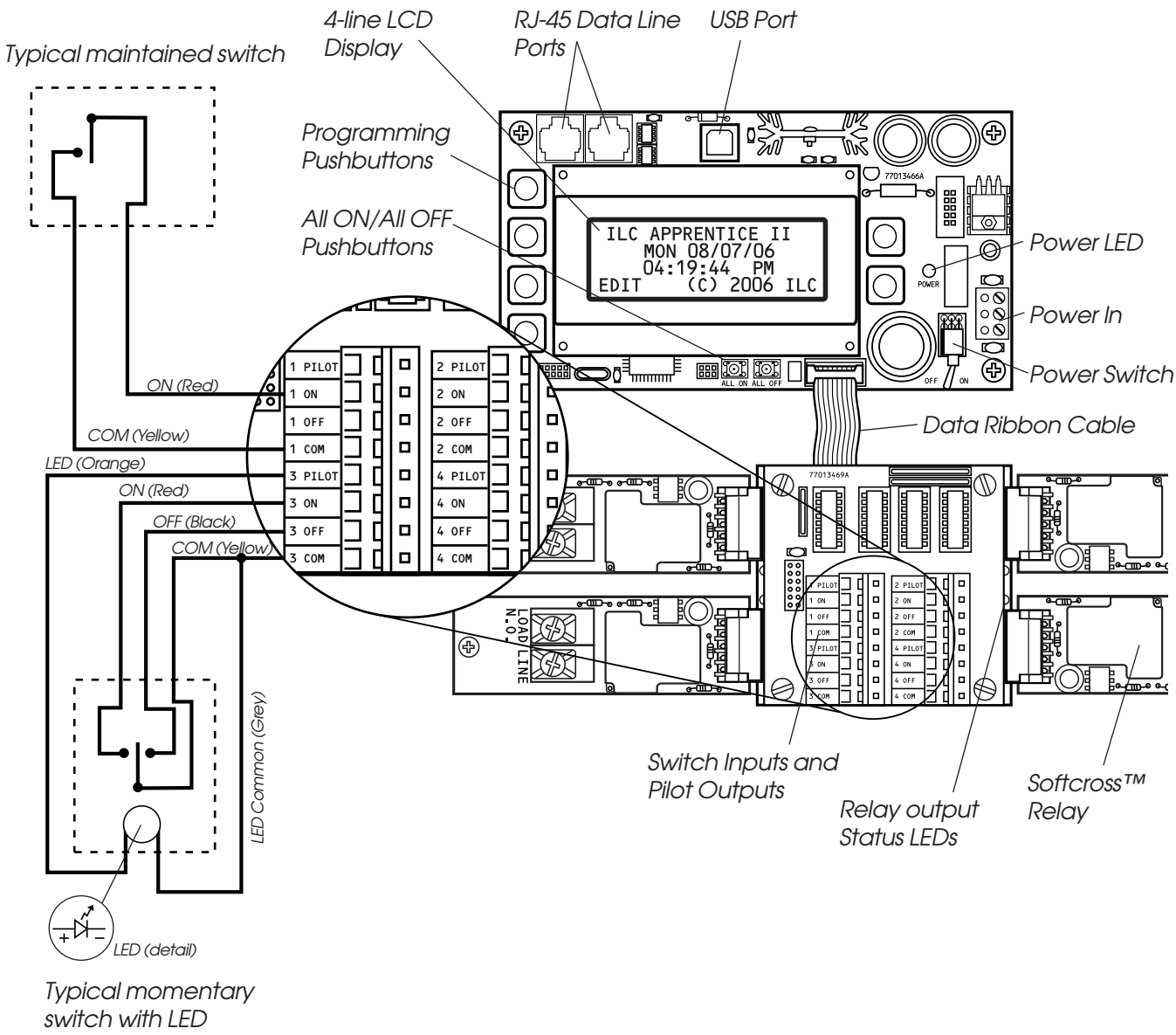


Figure 2.2 – Wire Class 2 Switch Circuits

2.4 Pre-Power Checks

Complete the following checks BEFORE applying power to the ILC Apprentice II controller.

2.4.1 Check Controller Power Input

1. Verify that the controller power switch is OFF.
2. After verifying that the transformer source voltage is 120, 277 or 347 VAC (whichever is appropriate), power-up the circuit.
3. Verify correct line voltage on the primary of the transformer.

2.4.2 Verify Supply Voltage

Verify that there is 24 VAC on the transformer secondary and 12 VAC between each leg and the center tap (see figure 1.2).

2.4.3 Double-Check Connections

1. Verify integrity of I/O connections.
2. Verify integrity of all internal and external wire/cabling.

2.4.4 External Monitoring and Control

If panel control via Apprentice II Pro software and a PC is desired, consult the appendix for instructions regarding the USB port.

2.5 Power-Up and Check Out

Complete the following procedures to power-up and checkout the ILC Apprentice II controller.

2.5.1 Power-Up the Controller

1. Turn the power switch located on the CPU board ON. (See Figure 1.2.)
2. Verify that the controller keypad screen displays the default time and date.

2.5.2 Verify the Lighting Relays

Switch all relays ON and OFF, using the All ON/All OFF override pushbuttons located on the CPU board. Verify that the relay status LED goes ON and OFF and that the relay itself changes state. Verify that the relay controls the proper circuit.

2.5.3 Perform Initial Programming Procedures

(See Section 3.)

1. Clear memory.
2. Configure the system nodes (Master and Expansion panel(s) size and function).
3. Set the correct date and time on the controller.
4. Program the switch inputs and timers.

2.5.4 Verify the Switching Function

1. Operate each switch.
2. Verify that each switch controls the correct lighting relays in the manner you have programmed.

2.5.5 Verify the Timer Functions

Using Demo Clock x10 feature (see Section 3),

1. Verify that the relays respond as programmed.
2. Reset the controller clock to the correct date and time.

2.6 Troubleshooting

In the event of trouble, use the following procedures to identify the problem.

2.6.1 Controller Will Not Power-Up

1. Verify that there is 120, 277 or 347 VAC on the primary and 24 VAC on the secondary of the control transformer.
2. Verify that the power LED on the CPU is lit.
3. If there is proper primary and secondary voltage on the transformer but the power LED is not lit and the LCD screen doesn't come up, consult the factory.

2.6.2 Lighting Relay(s) Will Not Function

1. Verify that there is 24 VAC to the terminal block on the output board from the transformer.
2. Make sure that the Softcross™ relays are landed properly on the relay output board(s).
3. Override the affected relay ON/OFF with the override switches located on the controller board. (See Figure 1.2.)
4. If the relay doesn't respond, consult the factory.

2.6.3 Switch Input Will Not Function

1. Check your programming.
2. Verify proper connections at field and controller end.
3. Verify that there is only one maintained switch connected per input.
4. Unhook field connections from affected input. Connect test switch of same type as field switch.
5. Work the test switch and verify that the CPU is seeing the switch input by *viewing the current switch status*. This can be done with the keypad by going to the *Switch Status* screen and scrolling to the individual input or scanning all of the inputs to verify that a switch closure is being seen by the controller (See Section 3-4). Also the output board(s)s can be tested through the keypad. Relays can be forced individually or all swept ON or OFF using the keypad (See Section 3-3).
6. If the switch input or affected relay doesn't respond (or no response is viewed through the keypad), consult the factory.

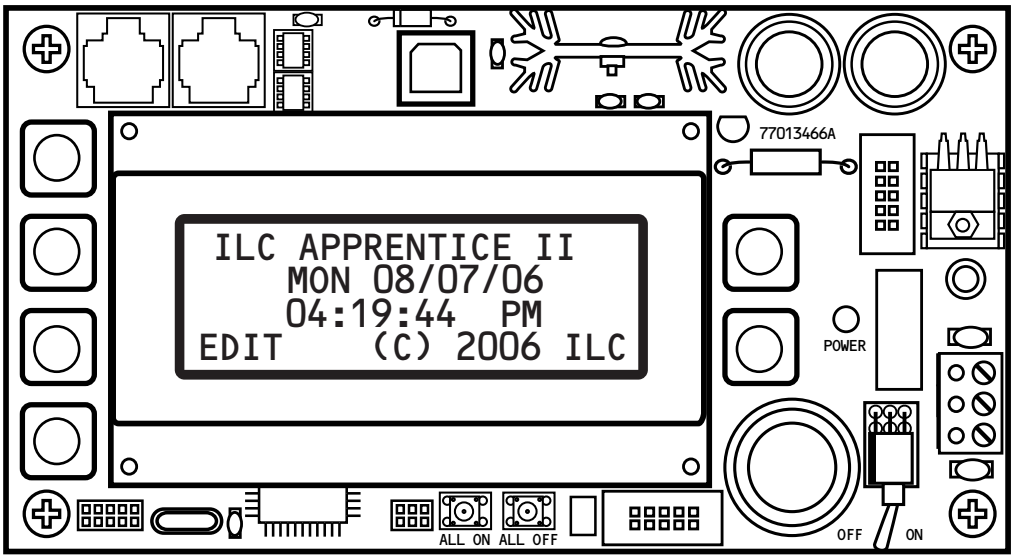
2.6.4 Timers Will Not Function Properly

1. Check your programming.
2. Force the Timer using the keypad under Force Timers in the Timer section. If the relay doesn't react, consult the factory.

2.6.5 Entire Input or Output Board(s) Will Not Function

1. Check to ensure that the data and power cables linking the I/O boards are connected properly and are free of opens and shorts.
2. Verify that the CPU sees the expansion input or Output boards using the keypad. This can be done by going to the Relay Output Status screen and forcing each relay ON or OFF (See Section 3-3).
3. If the I/O boards do not operate properly, consult the factory.

Section 3
Programming



Section 3 Programming

Objectives

In this section you will learn how to program the ILC Apprentice II controller.

Conventions/Definitions

Actual key strokes/entries appear as arrows: for example, ▶ followed (if applicable) by the appropriate keyword. For example, to leave the Home screen, the entry is ▶ EDIT. Each button to the left controls a line on the LCD display. The two buttons on the right control up and down scrolling when those arrows appear on the screen. (See the figure below.)

The term default appears in this section. **Default** means the value or entry preprogrammed at the factory. In many cases the default may be appropriate for your application, making field programming unnecessary. For example momentary ON/OFF is the default switch type; therefore, if 3 wire momentary switches are used exclusively at your facility, you may not need to make entries defining the SWITCH OPTION.

Another term used often is **Home screen.** The Home screen is the top level screen of the controller. It features the controller name, the date and the time. (See Figure 3.1.) The controller displays this screen on power-up and at times when you are not programming or checking input/output status.

Information Presentation

The information for each programming task is presented in the following way: First, a screen flow diagram or diagrams illustrating the relevant data entry screens. (This may be all the information that is required by the experienced user.) Second, a more detailed explanation of the relevant concepts and programming procedures will be presented. Third, specific sample operations will be displayed.

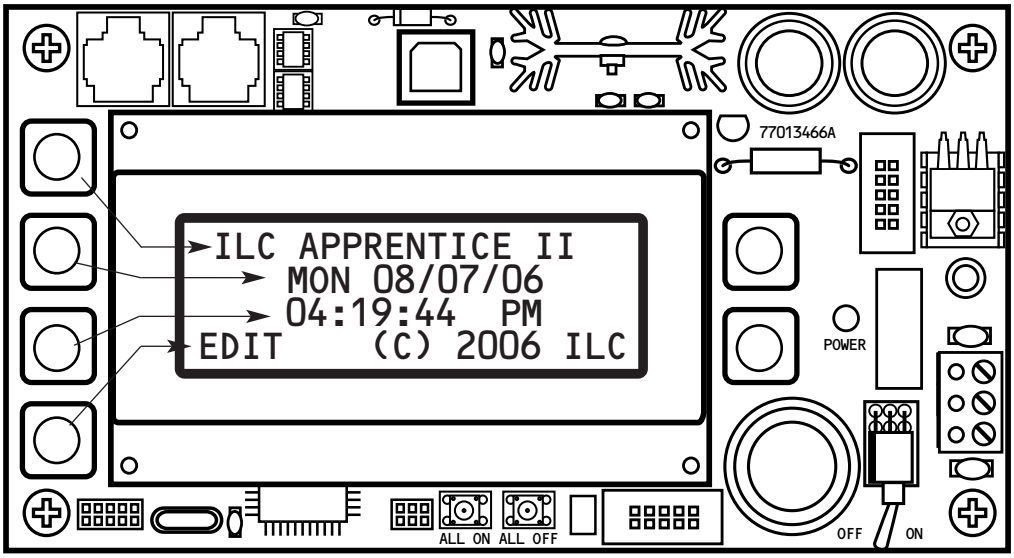


Figure 3.1 - ILC Apprentice II Home Screen

Automatic Timeout/Data Saving

If you do not press any keys for 5 minutes while you are programming, the controller will automatically return to the Home screen. To ensure programming is properly saved, enter the proper keyword – usually ▶ EXIT or ▶ SAVE.

3.1 "Hidden" Menu Choices

There are two operations you can perform from the "Hidden" Menu: **CLEAR ALL MEMORY** and **DEMO CLOCK (10X). CLEAR ALL MEMORY** allows you to clear the programmed memory that has been entered and resets the parameters to their default values. **DEMO CLOCK (10X)** speeds up the controller clock to run 10 times faster than normal and can be used to test the operation of time based operations. **To reset the clock to normal operation power down the controller.**

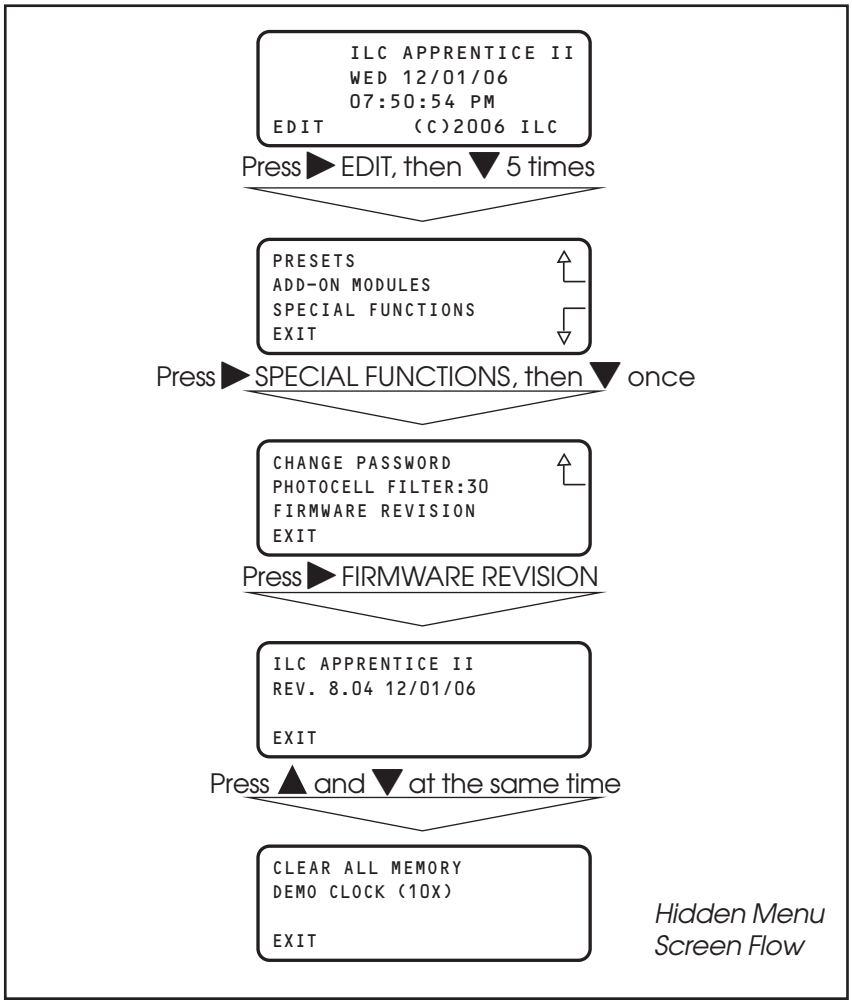
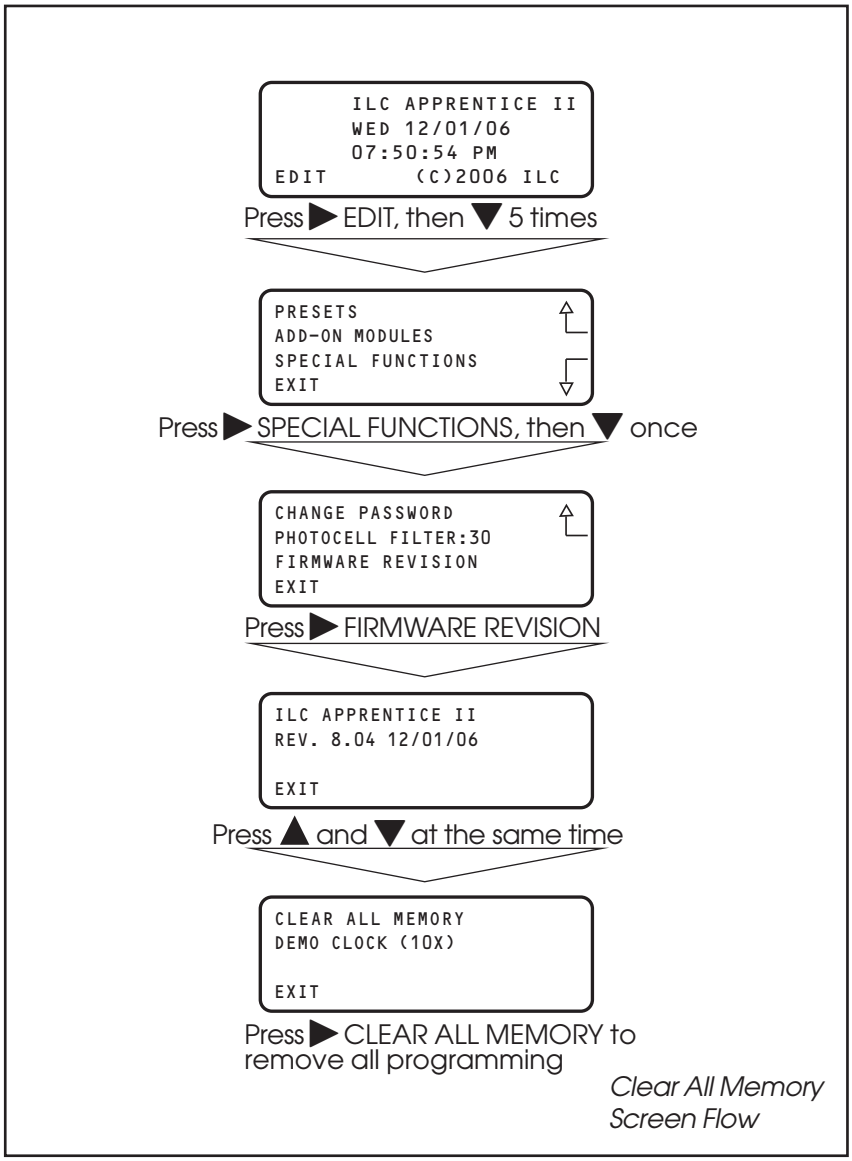


Figure 3.2

3.2 Clear All Memory – Fast Track



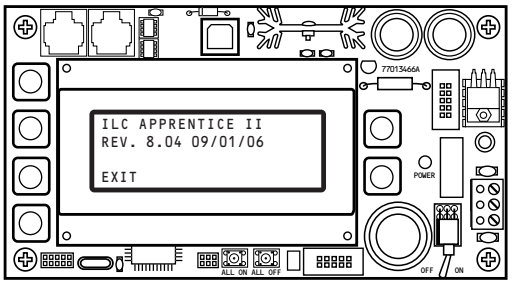
Clear All Memory Screen Flow

How to Clear All Memory

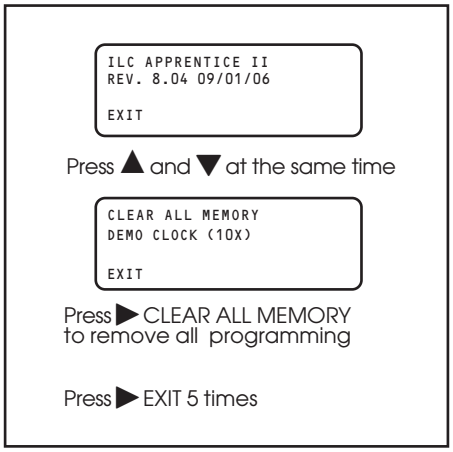
Prior to programming the Apprentice II controller it is very important to clear the memory.

SAMPLE OPERATION:
Clear All Memory

1. From the Firmware Revision screen, press ▲ and ▼ at the same time to access the Hidden Screen
2. Press ▶ CLEAR ALL MEMORY to remove all programming
3. Press ▶ EXIT 5 times to leave the Hidden Menu Screen and return to the Home Screen



Firmware Revision Screen



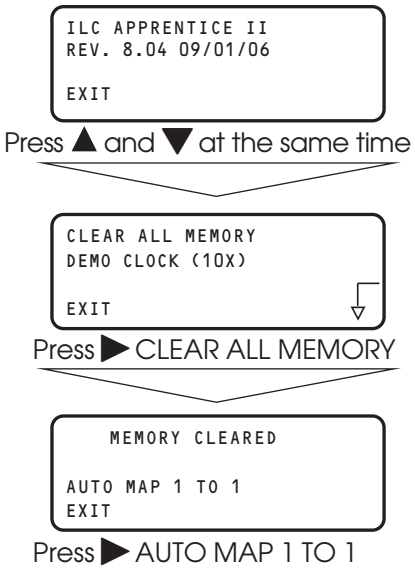
Clear All Memory Screen

Figure 3.3

How to Auto-Map Inputs to Outputs

After clearing memory you have the option to auto-program all of the hardwired inputs. This option will map Input #1 to Relay #1, Input #2 to Relay #2, etc.

1. Clear memory following the procedure above
2. Press ▶ AUTO MAP 1 TO 1
3. Press ▶ EXIT 5 times to return to the Home Screen



3.3 Configuring the Apprentice II Network

CONCEPTS AND PARAMETERS

The Apprentice II controller may be connected with Apprentice II expansion panels to form a Master/Slave network. Each expansion panel is configured with a unique address by means of a rotary switch. From the Display/Keypad of the Master, the controllers must be configured with the address of each panel and the number of relay outputs each contains.

SAMPLE OPERATION:

Configure the Network System Panels

1. From the Home screen, press ▶ EDIT; then press ▼ 6 times.

2. Press ▶ CONFIGURE SYSTEM.

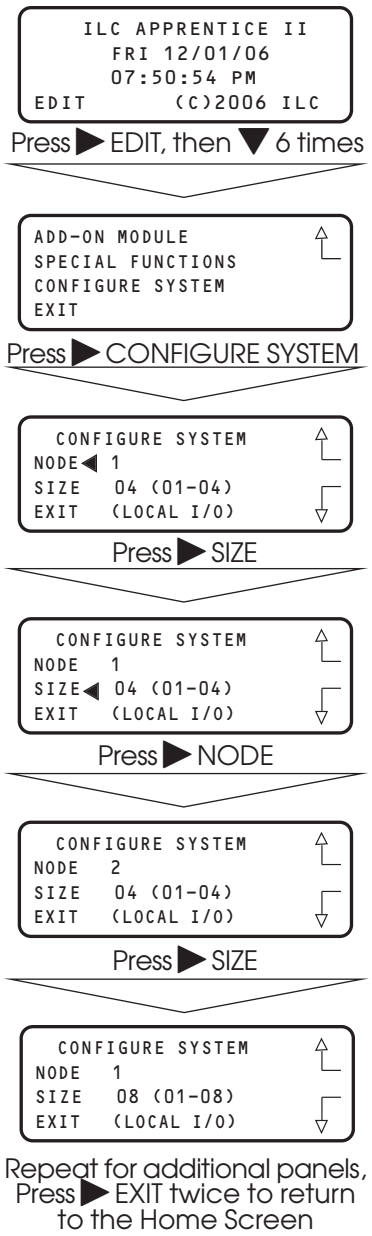
3. From the Configure System screen, start with Node 1 (the Master Node). Press ▶ SIZE

4. Press ▲ or ▼ until to select the number of relay outputs in the Master.

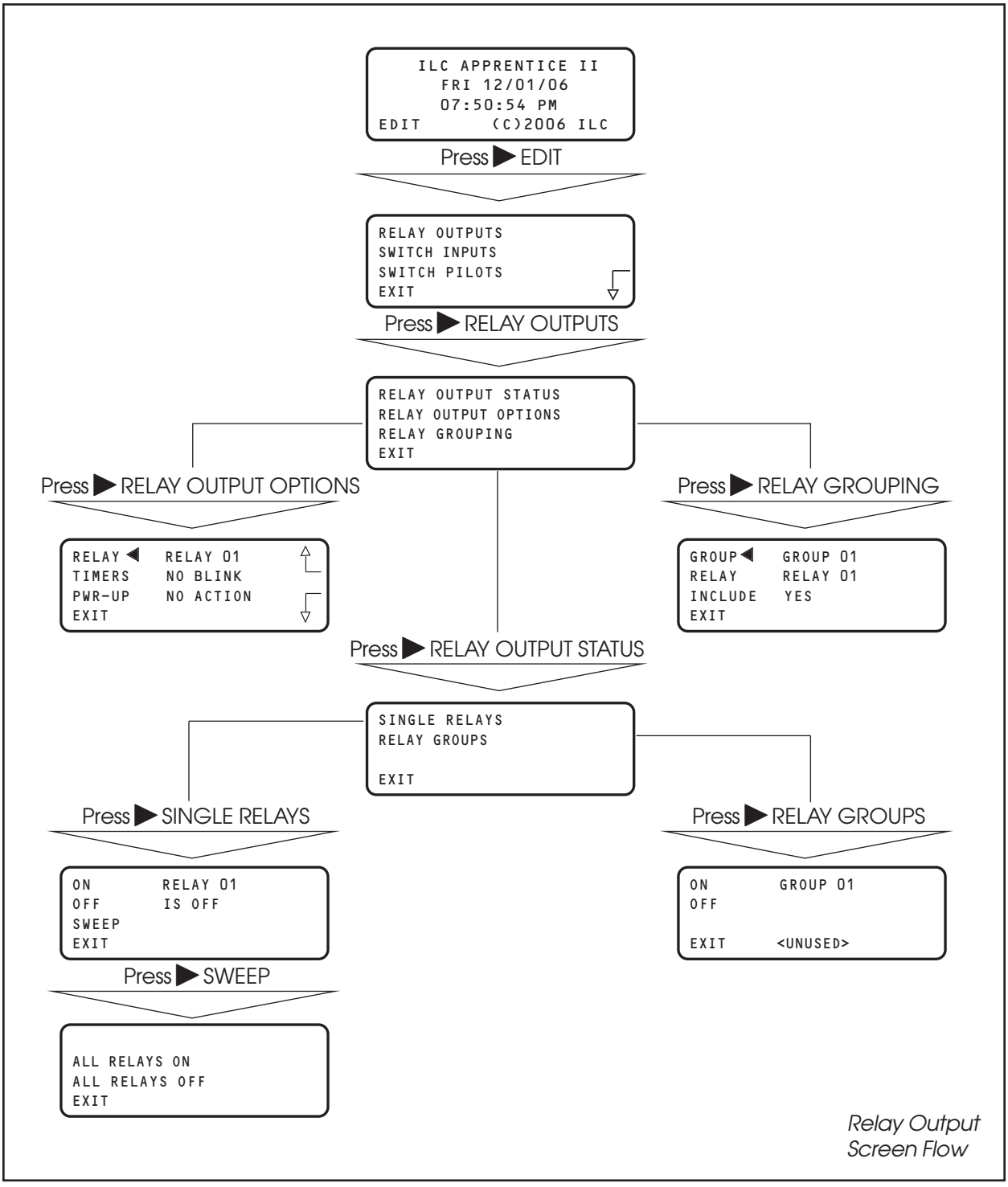
5. Press ▶ NODE then press ▲ or ▼ to select the Slave node number (determined by the rotary switch in the Slave panel).

6. Press ▶ SIZE then press ▲ or ▼ to select the number of relay outputs in that panel.

7. Repeat the above steps to configure any other panels in the network.



3.4 Relay Output Operations Overview – Fast Track



Relay Output Screen Flow

Relay Output Operations

CONCEPTS AND PARAMETERS

You can use RELAY OUTPUTS to view the current ON/OFF Status of the relay outputs. You also have the option of switching individual relays, user defined relay groups or all the controller relay outputs ON/OFF from the keypad. In addition you can define certain relay output parameters (See Tables 3.1, 3.2) and form relay groups.

Parameter Key:

RELAY: One of a possible 48 Relay Outputs

RELAY OUTPUT STATUS:

ON = Turn Relay Output or Relay Group ON
OFF = Turn Relay Output or Relay Group OFF
SWEEP = Turn all of the controller relays ON or OFF

RELAY OUTPUT OPTIONS:

TIMERS = how relay output will react to an OFF Timer. (The default is NO BLINK)
PWR-UP = how relay output will react when the controller is powered up. The default is NO ACTION
RELAY GROUP = a user defined group of relay outputs that will react as a group to a switch or timer signal.

Table 3.1

TIMERS Choice	Definition
NO BLINK (default)	The relay will not blink prior to an OFF Timer
BLINK	The relay output blinks and postpones the OFF timer for a user defined time (2-99 minutes) The default alert time is 5 minutes. If a switch controlling the relays is turned ON during this time, the OFF Timer is again postponed for a user defined period (5-999 minutes) or until the switch is turned OFF. The default override is 120 minutes.
HID DELAY	Same as BLINK (the OFF timer is postponed) except that there is NO blink warning.
ALARM ON PLS	During the ON pulse period (1-99 seconds programmable) the relay is cycled ON and OFF at 1 second intervals. The relay returns to OFF when complete. Used to alarm or buzzer signal applications
ALARM OFF PLS	During the OFF pulse period (1-99 seconds programmable) the relay is cycled OFF and ON at 1 second intervals. The relay returns to ON when complete . Used in settable blink alert applications.
ALARM ON	Relay will turn ON for a programmed duration (1-99 seconds) and then return to the OFF state. Used for mechanically latching contactor control.
ALARM OFF	Relay will turn OFF for a programmed duration (1-99 seconds) and then return to the ON state. Used with sentry switch or Watt Stopper 110.
Note: *how to change blink alert, override, and alarm pulse times defaults is done by selecting BLINK ALERT/ALARMS from the TIMER menu.*	

Table 3.2

PWR-UP Choices	Definition
LAST STATE	Controller will force the relay output to the last state they were in prior to the power outage.
TURN ON	The relay output switches ON when power is applied or reapplied to the controller.
TURN OFF	The relay output switches OFF when power is applied or reapplied to the controller
ON/IN:1	The relay output switches ON when power is applied or reapplied to the controller if Input 1 is closed at the time of power-up.
OFF/IN:1	The relay output switches OFF when power is applied or reapplied to the controller if Input 1 is closed at the time of power-up.

SAMPLE OPERATION:
How to Turn a Relay ON from the Keypad

1. From the Home screen, press ▶ EDIT

2. When the MAIN menu appears, press ▶ RELAY OUTPUTS.

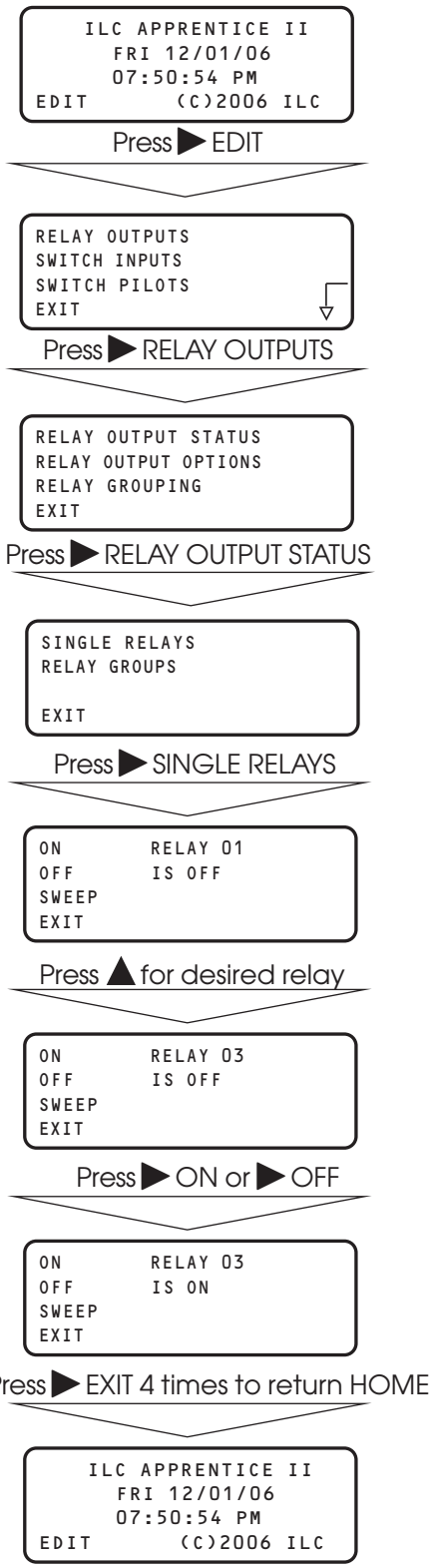
3. When the RELAY OUTPUTS menu appears, press ▶ RELAY OUTPUT STATUS.

4. When the Single Relay/Group Menu appears, press ▶ SINGLE RELAYS.

5. When the Relay Status menu appears, press ▲ or ▼ until the relay you want to control appears.

6. Press ▶ ON to switch ON the relay or ▶ OFF to switch OFF the relay.

7. Press ▶ EXIT 4 times to return to the Home Screen.



SAMPLE OPERATION:

How To Program a Relay To Perform a Blink Alert

1. From the Home screen, press ▶ EDIT.

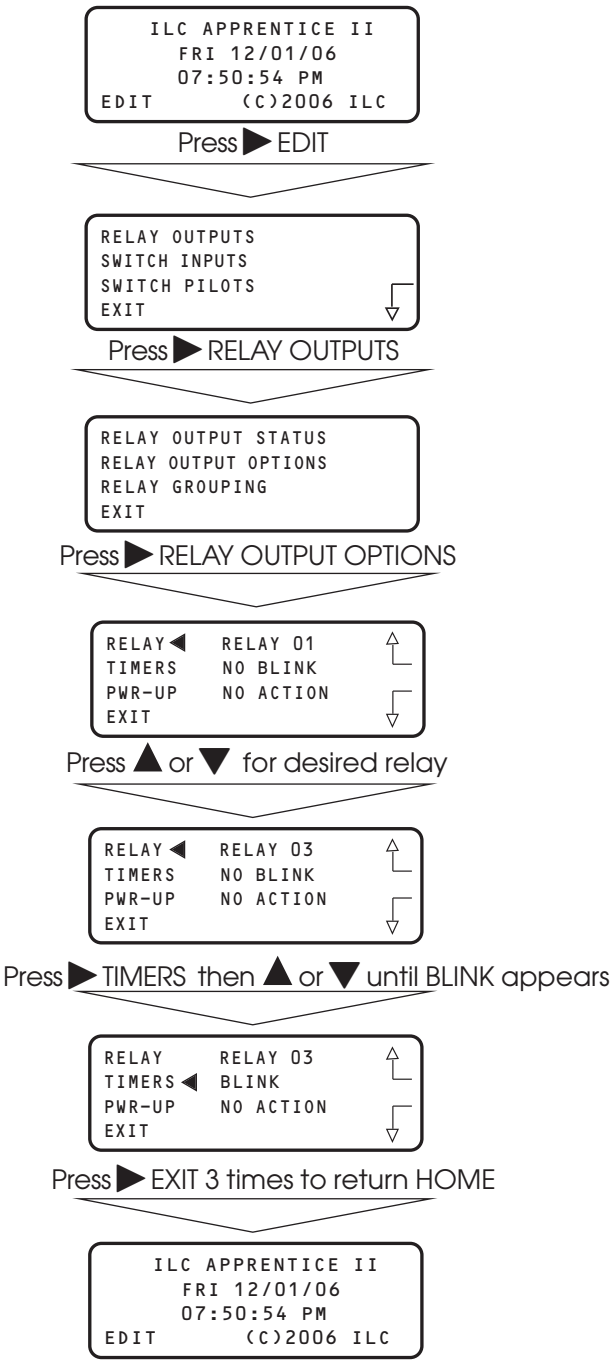
2. When the MAIN menu appears, press ▶ RELAY OUTPUTS.

3. Press ▶ RELAY OUTPUT OPTIONS.

4. When the Relay Options screen appears, press ▲ or ▼ until the Relay you want to perform the blink alert appears.

5. Press ▶ TIMERS; then ▲ or ▼ until BLINK appears in the timer field.

6. Press ▶ EXIT 3 times to return to the Home screen.



SAMPLE OPERATION:

How To Define a Relay Group

1. From the Home screen, press ▶ EDIT.

2. When the MAIN menu appears, press ▶ RELAY OUTPUTS.

3. Press ▶ RELAY GROUPING

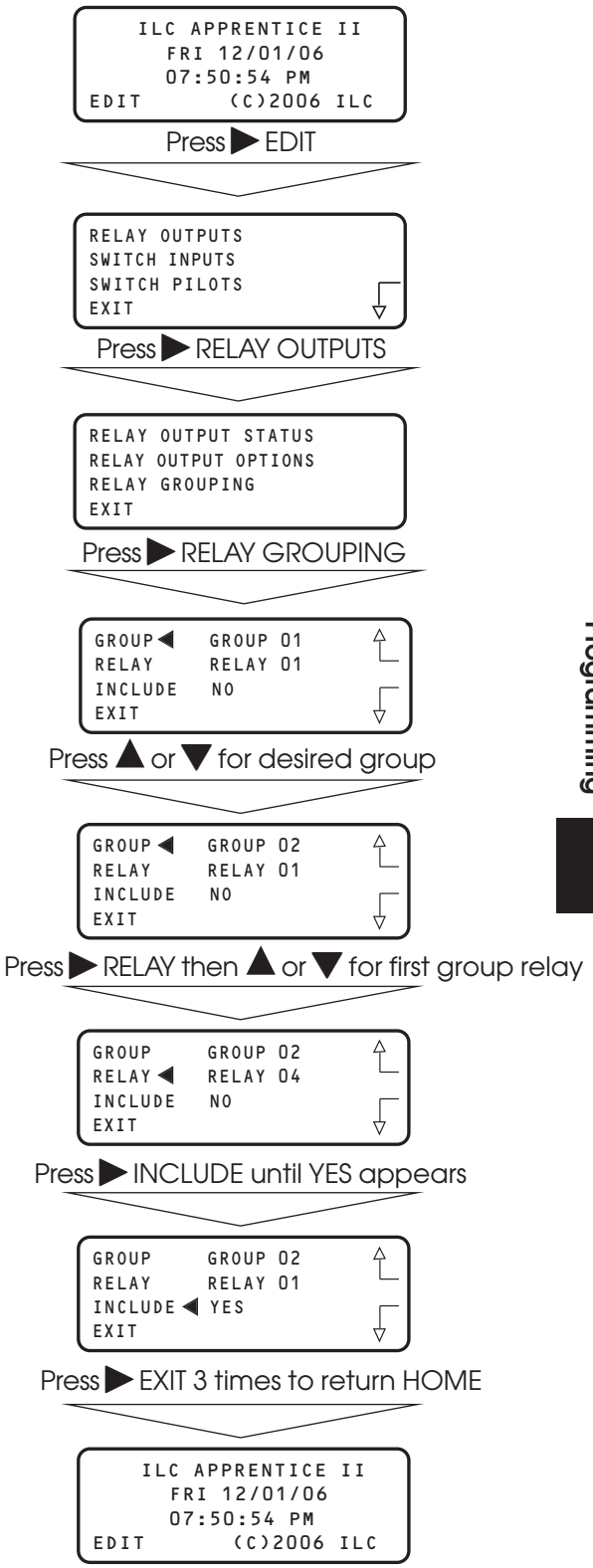
4. When the Relay Grouping screen appears, press ▲ or ▼ to select the relay group number.

5. Press ▶ RELAY then ▲ or ▼ until the first relay to be part of the group appears.

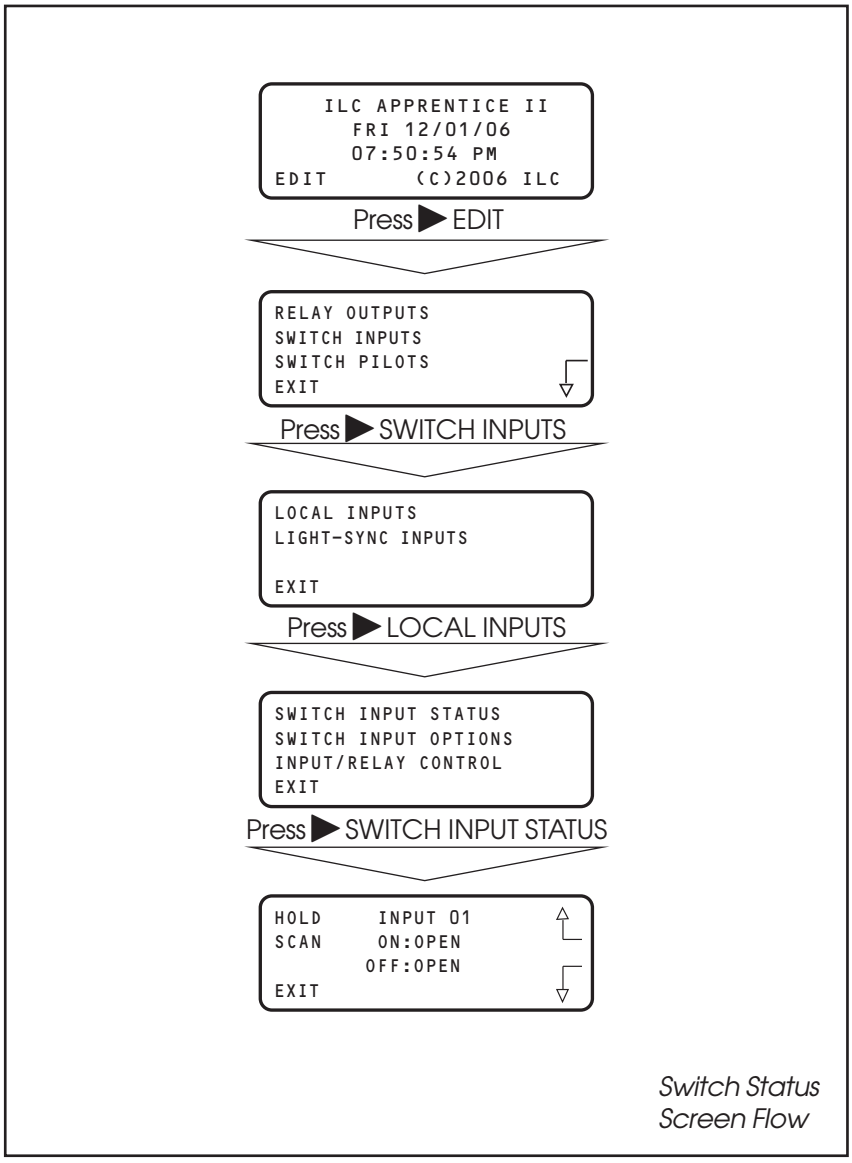
6. Press ▶ INCLUDE until YES appears in the entry field.

7. Repeat steps 5 and 6 to include additional relays.

8. Press ▶ EXIT 3 times to return to the Home screen.

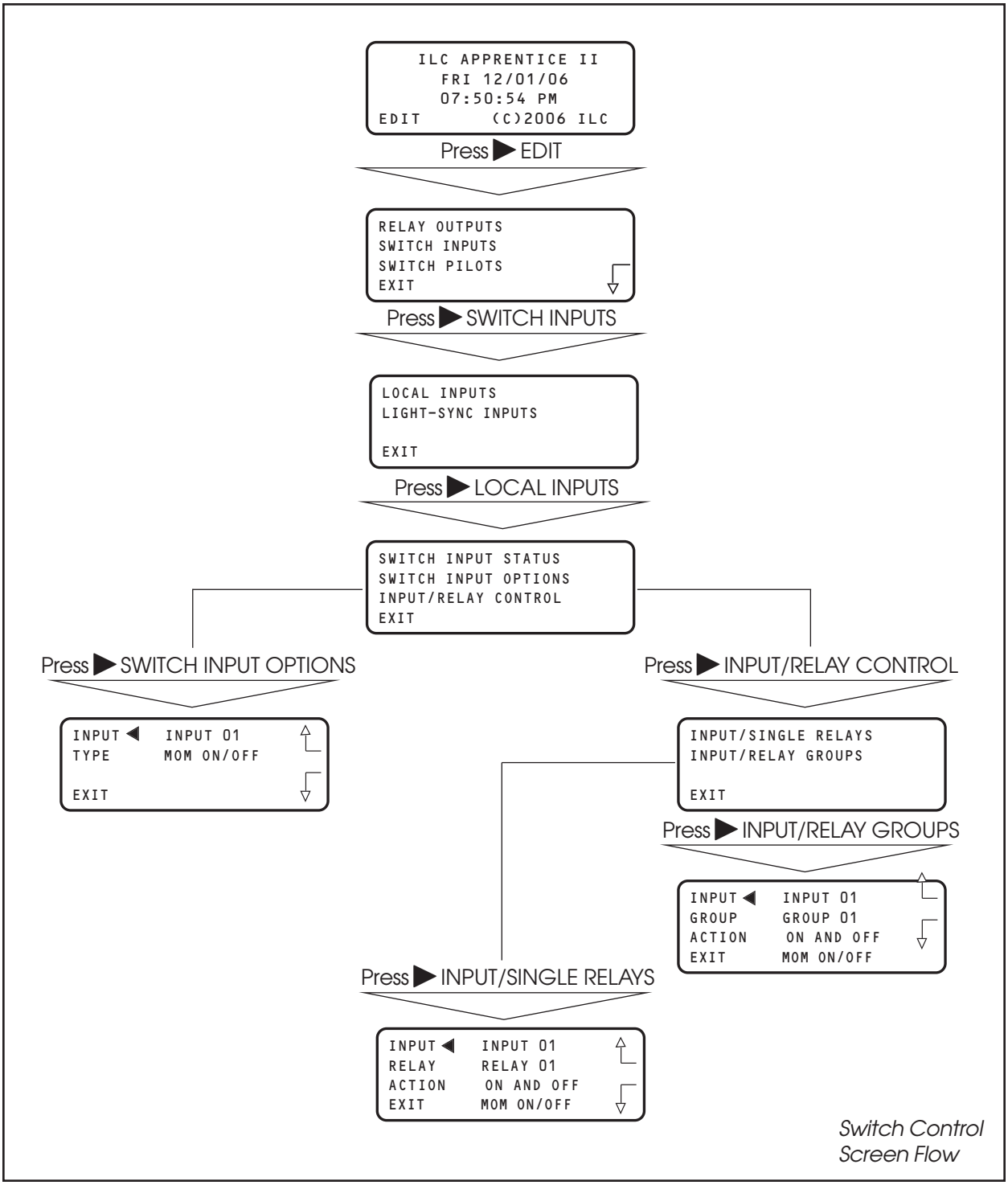


3.5 Switch Operations: Status – Fast Track



Switch Status Screen Flow

Switch Operations: Controlling Relays with a Switch – Fast Track



Switch Control Screen Flow

Switch Status

CONCEPTS AND PARAMETERS

This function allows you to view the current status of each switch input attached to the the ILC Apprentice II controller.

Parameter Key:

INPUT = One of a possible 48 switch inputs

HOLD ▼ or ▲ = access the input you want to view.

SCAN = scans all output for an ON or OFF closure and displays most recent input that has changed

OPEN = maintained switch is OPEN; momentary switch is in neutral position.

CLOSED = maintained switch is closed; momentary switch is currently closing

SAMPLE OPERATION:

Check the current status of a Switch Input

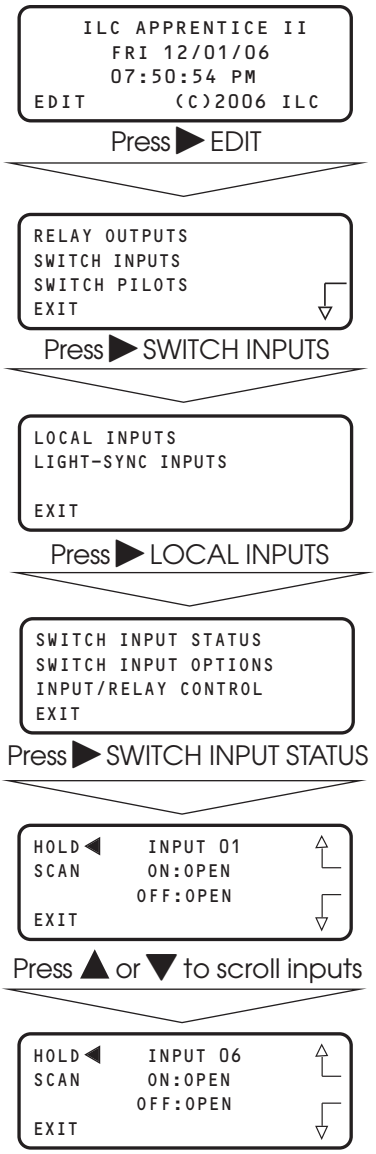
1. From the Home screen. Press ▶ EDIT.

2. From the Main Menu, Press ▶ SWITCH INPUTS.

3. From the Switch Input Menu, press ▶ LOCAL INPUTS then press ▶ SWITCH INPUT STATUS.

4. When the Switch Input Status screen appears, press ▲ or ▼ until the switch you want to check appears.

5. Press ▶ EXIT four times to return to the Home screen



How To Control A Relay or Relay Group of Relays With a Switch

CONCEPTS AND PARAMETERS

To control a relay with a switch you must:

1. Define the selected switch input
2. Select the relay output or relay group that the switch controls
3. Define how the switch will control the relay.

NOTE: The ILC Apprentice II controller input can accept dry contact inputs from 3 wire SPDT momentary contact switches or 2 wire momentary and maintained contact switches. (See Figure 3.2)

NOTE: Hardwire input numbers correlate to the Output board that it is attached to. For example, an Input board associated with an Output board controlling relays 5 to 8 would contain inputs 5 to 8. Numbering convention is from left to right, then drop down and go left to right.

Parameter Key:

SWITCH INPUT OPTIONS:

INPUT = 1 of 48 possible controller switch inputs

TYPE = switch type (Default is MOM. ON/OFF; see Table 3.3 for a list of possible switch types.)

RELAY = 1 of 48 possible controller relay outputs

RELAY GROUP = a user defined group of relay outputs that will react as a group to a switch or timer signal.

ACTION = How the switch actuation will effect the relay. (Default is NO ACTION). Other possible responses ON ONLY, OFF ONLY, ON AND OFF, BLINK ALERT

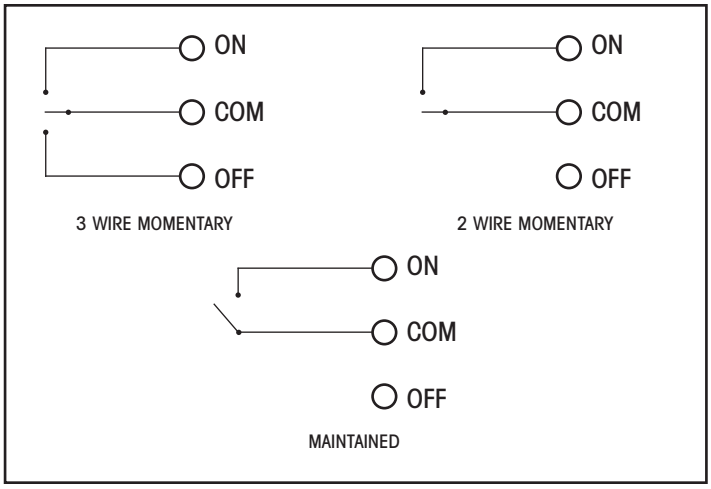


Figure 3.2

Type	Physical	Operation
Momentary ON/OFF (default type)	3-wire momentary	Momentary contact between ON and Common turns controlled relay outputs ON. Momentary contact between OFF and Common turns controlled relay outputs OFF.
Momentary Pushbutton	2-wire momentary	Momentary contact between ON and Common turns controlled relays ON and OFF alternately each time contact is made.
Maintained ON/OFF	2-wire maintained	When contact between ON and Common are made, controlled relays turn ON. When contact is broken, controlled relays turn OFF.
Maintained Multi-way	2-wire maintained	When contact is made or broken between ON and Common, the controlled relays will toggle from ON to OFF or OFF to ON; similar to conventional 3-way switching.
Set Preset	2-wire Momentary	When momentary contact between ON and Common is made, the controlled relay outputs will go to their programmed states.
Timed ON	2 or 3 wire momentary	Contact between ON and Common will turn relay outputs on for a programmed time. At the end of this time the controlled relays will turn OFF. Contact between OFF and Common will turn relays OFF.
HID BI-LEVEL	3 wire momentary	The first contact between ON and Common, turns the ON/OFF ballast relay ON and the HIGH/LOW ballast relay HIGH (NC default) or Low (NO default) and locks them in this position for a 15 minute warm up period. Subsequent contact closures between ON and Common toggle between HIGH and LOW. Contact between OFF and COMMON locks both the ON/OFF and HIGH/LOW ballast relays OFF for 15 minutes.
Two-Step Group	2-wire momentary	Upon switch activation, Group A relays turn ON and Group B turn OFF. The following activation causes Group A to turn OFF and Group B to turn ON. The pattern repeats with each switch activation.
Four-Step Group	2-wire momentary	On the first activation, Group A relays turn ON and Group B turn OFF. On the second activation, Group A turns OFF and B turns ON. The third activation causes both A and B to go ON. On the fourth activation, both A and B go OFF. Then the pattern repeats.
Input Disable	2-wire maintained	As long as the switch is closed, other selected inputs are disabled.
Timer Disable	2-wire maintained	As long as the switch is closed, selected timers are disabled.
Output Override	2-wire maintained	When the switch is closed, selected relay(s) will go to the programmed ON, OFF, or No Control status, other signals are ignored until switch is open.
FORCE TIMER	2 wire maintained	The switch closure will trigger the selected timer.

Table 3.3 – ILC Apprentice Switch Types

SAMPLE OPERATION:

Control a single Relay Output with a Switch

Define the Switch Input:

1. From the Home screen, press ▶ EDIT.

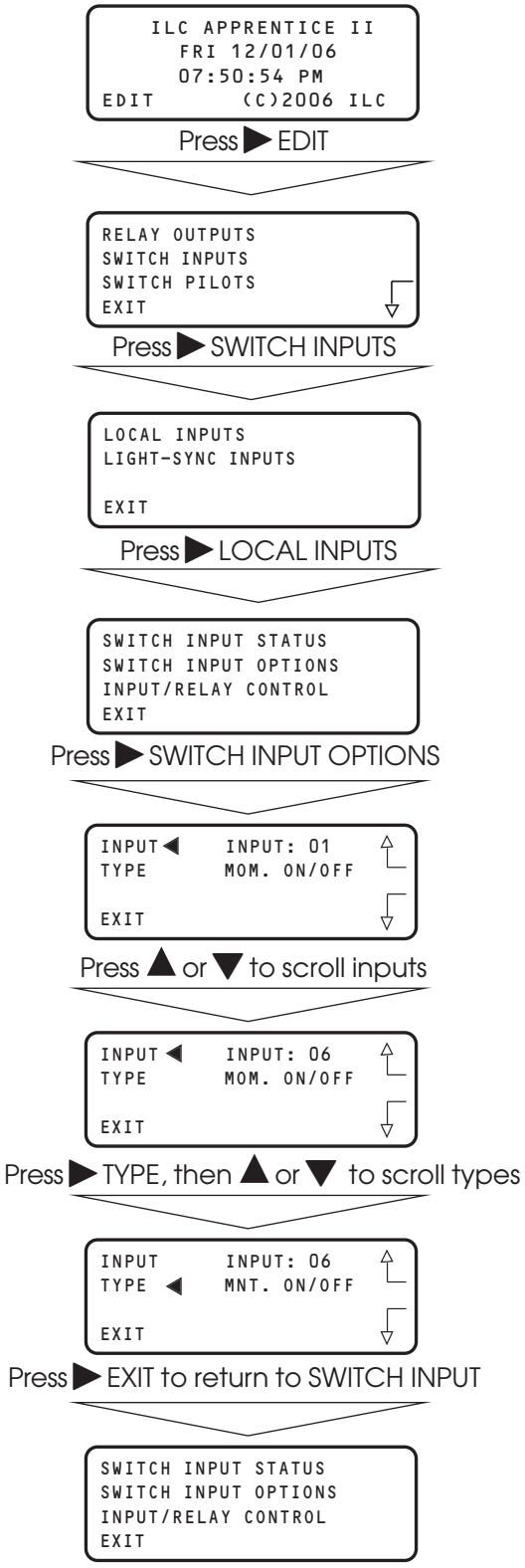
2. When the MAIN menu appears, press ▶ SWITCH INPUTS then press ▶ LOCAL INPUTS.

3. From the Switch Input Menu, press ▶ SWITCH INPUT OPTIONS.

4. When the Switch Input options screen appears, press ▲ or ▼ until the switch input you want to define appears.

5. Press ▶ TYPE; then ▲ or ▼ until the desired switch type appears.

6. Press ▶ EXIT to return to the Switch Input menu.



SAMPLE OPERATION:

Control a single Relay Output with a Switch

Select the relay to be controlled:

1. From the Local Switch Input Menu, press ▶ INPUT/RELAY CONTROL.

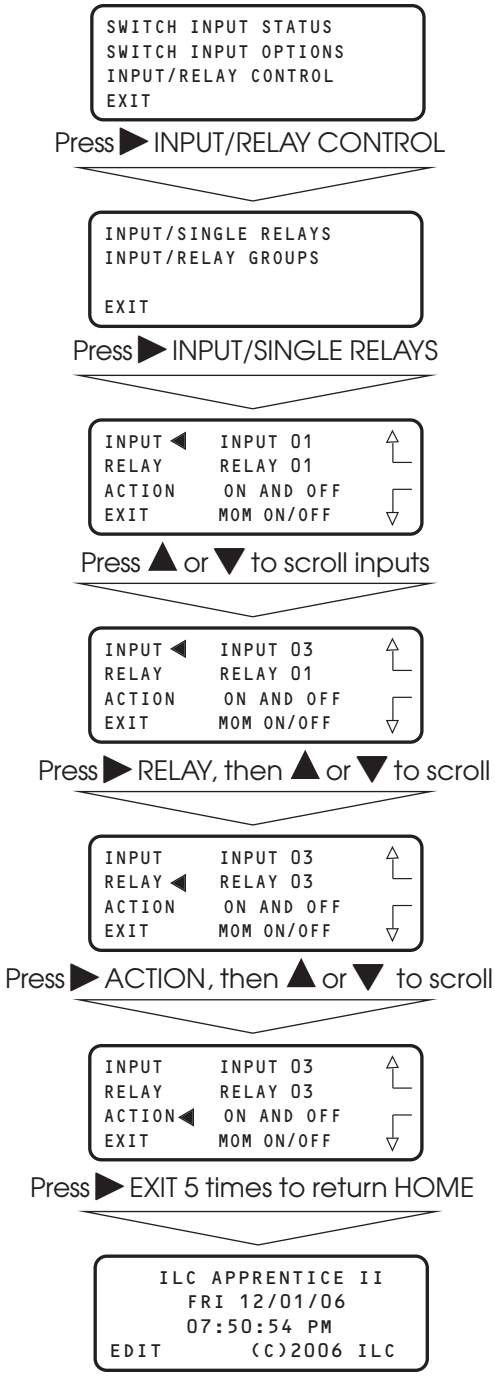
2. When the Single Relay/Relay Group Control menu appears, press ▶ INPUT/ SINGLE RELAYS.

3. When the Input/Relay Control Screen appears press ▲ or ▼ until the input you are programming appears in the INPUT field.

4. Press ▶ RELAY; then press ▲ or ▼ until the relay to be controlled appears in the RELAY field.

5. Press ▶ ACTION; then ▲ or ▼ until the desired switch action appears.

6. Press ▶ EXIT 5 times to return to the Home screen.



SAMPLE OPERATION:

Control a Relay Group with a Switch

Define the Switch Input:

1. From the Home screen, press ▶ EDIT.

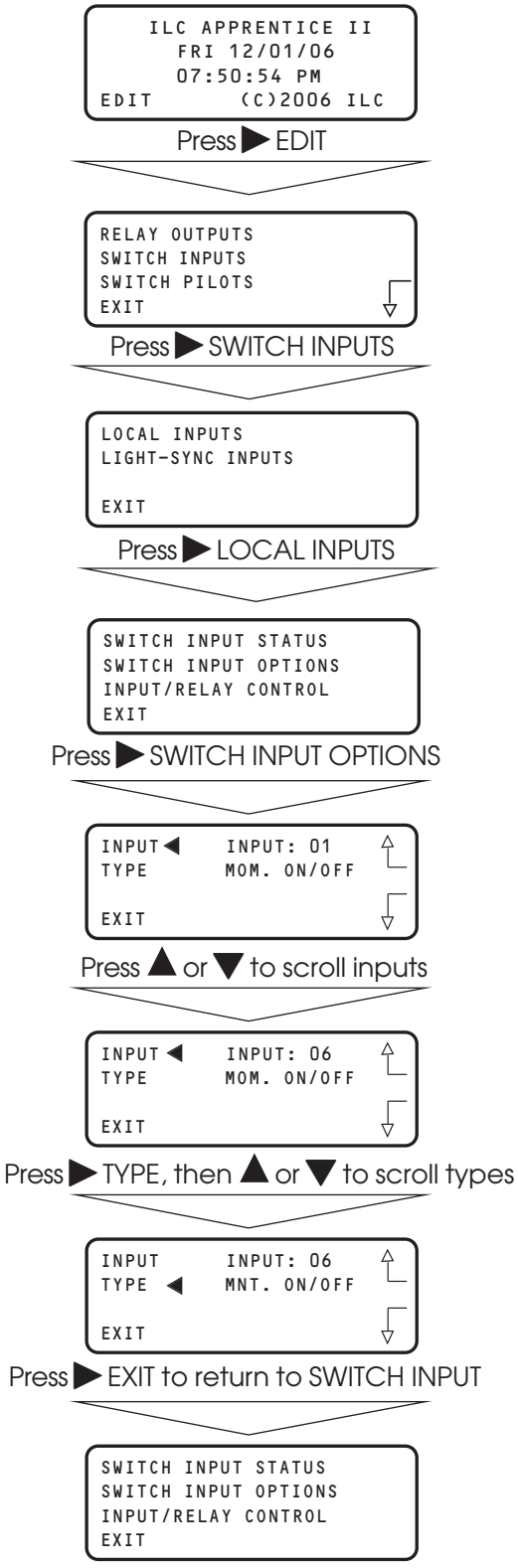
2. When the MAIN menu appears, press ▶ SWITCH INPUTS then press ▶ LOCAL INPUTS.

3. From the Switch Input Menu, press ▶ SWITCH INPUT OPTIONS.

4. When the Switch Input options screen appears, press ▲ or ▼ until the switch input you want to define appears.

5. Press ▶ TYPE; then ▲ or ▼ until the desired switch type appears.

6. Press ▶ EXIT to return to the Switch Input menu.



SAMPLE OPERATION:

Control a Relay Group with a Switch

Select the relay group that you want the switch to control. Note : Be sure the relay group you wish to control has been previously defined. (See Sample Operation – How to Define a Relay Group.)

1. From the Local Switch Input Menu, press ▶ INPUT/RELAY CONTROL.

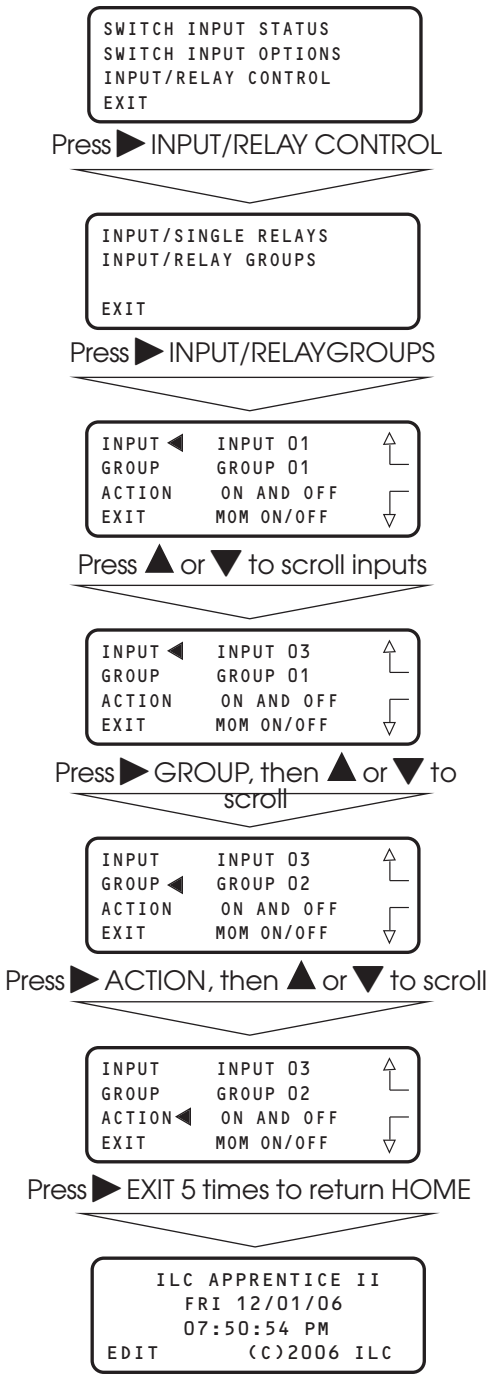
2. When the Single Relay/Relay Group Control menu appears, press ▶ INPUT/RELAY GROUPS.

3. When the Input/Relay Group Control Screen appears press ▲ or ▼ until the input you are programming appears in the INPUT field.

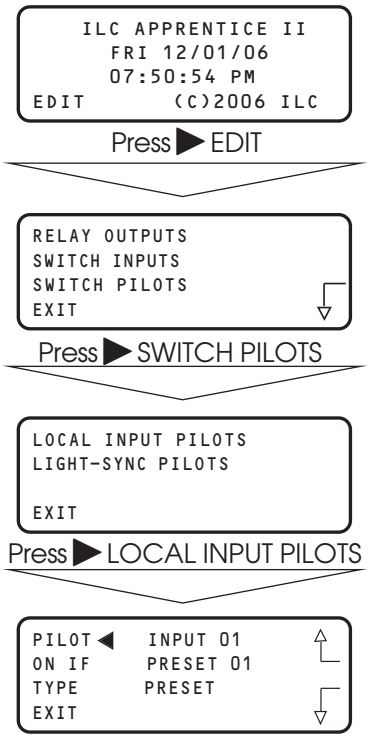
4. Press ▶ GROUP; then press ▲ or ▼ until the relay to be controlled appears in the GROUP field.

5. Press ▶ ACTION; then ▲ or ▼ until the desired switch action appears.

6. Press ▶ EXIT 5 times to return to the Home screen.



3.6 Switch Pilot Operation: – Fast Track



Switch Pilot Screen Flow

How to Define a Switch Pilot

CONCEPTS AND PARAMETERS

To Define a Switch Pilot you must:

1. Select the input whose Input Pilot status LED is to light.
2. Select the relay output, relay group or preset that is to light the selected status LED.

NOTE: Switch Pilots refer to switch pilot light output that is located on the I/O board(s)

Parameter Key:

PILOT= The number of the switch input pilot (1-48)

ON IF= The number of the relay, relay group, or preset which will actuate the switch pilot (1-48)

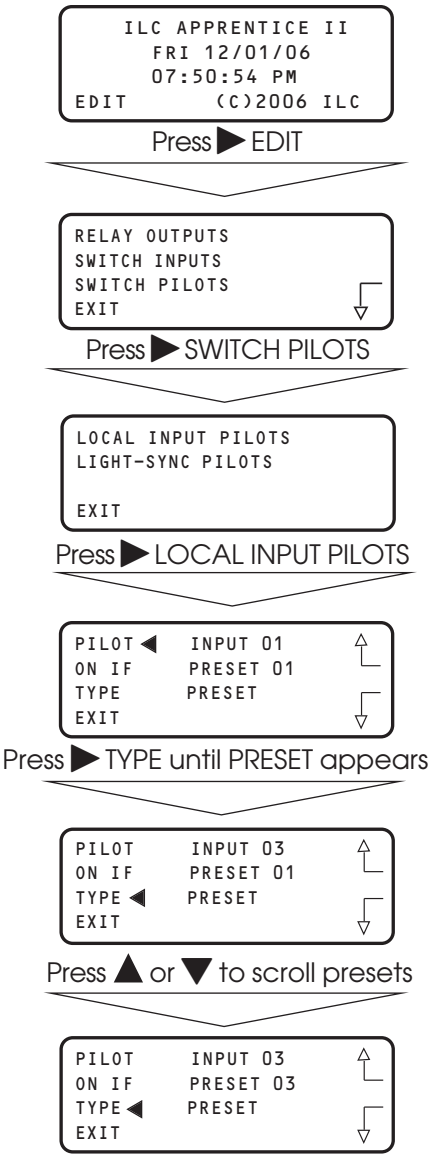
TYPE= the type of actuator: relay output, group, or preset

Note: The default is for the switch pilot to light with the corresponding relay status output LED lights

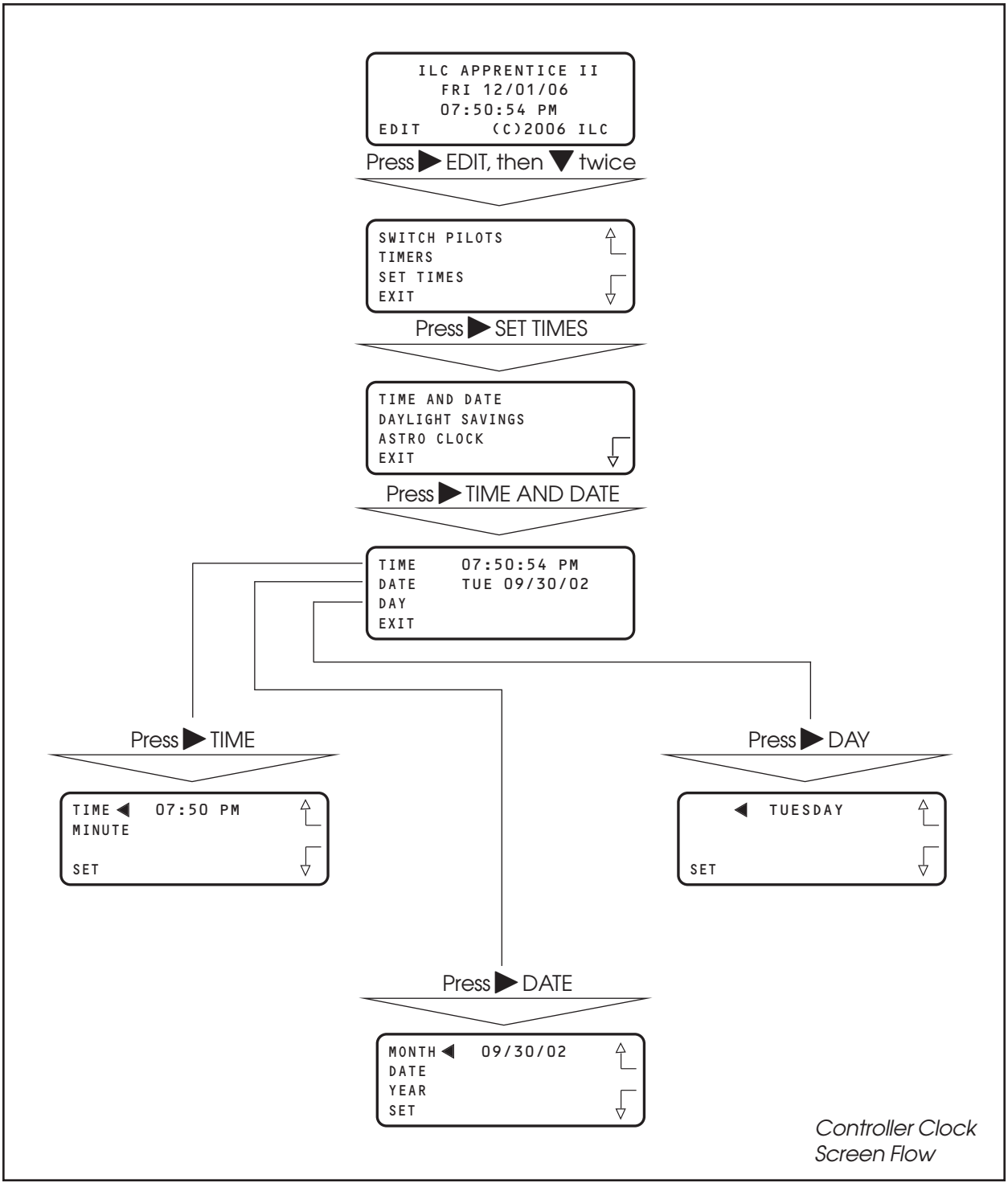
SAMPLE OPERATION:

Program a Status LED to Light when a Preset is ON

1. From the Home screen, press ▶ EDIT.
2. When the MAIN menu appears, press ▶ SWITCH PILOTS then press ▶ LOCAL INPUT PILOTS.
3. From the Status Definition Screen, press ▲ or ▼ to select the Input.
4. Press ▶ TYPE until PRESET appears.
5. Press ▲ or ▼ until the desired preset appears.
6. Press ▶ EXIT three times to return to the Home Screen.



3.7 How to Set the Controller Clock – Fast Track

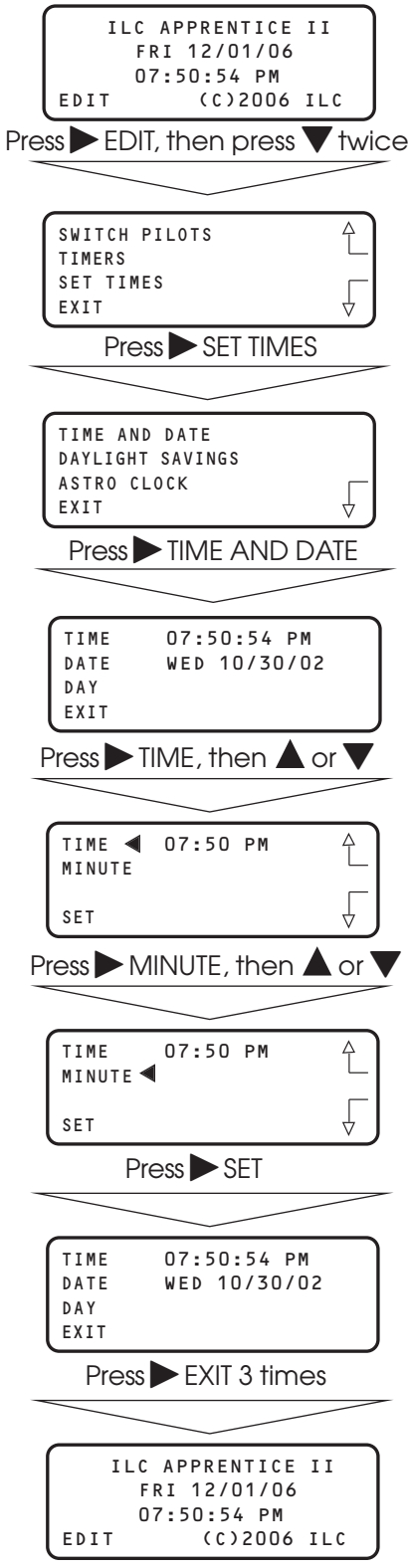


Controller Clock Screen Flow

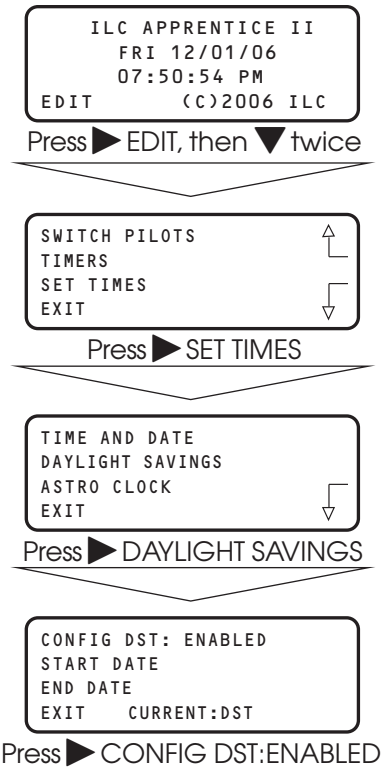
How to Set the Controller Clock

Setting the controller clock to the proper time and date is fundamental to the execution of all time based operations.

1. From the Home screen, press ▶ EDIT, then press ▼ twice.
2. From the main menu, press ▶ SET TIMES.
3. From the Set Times menu, press ▶ TIME and DATE.
4. From the Time/Date menu, press ▶ TIME.
5. When the Time Setting screen appears, press ▲ or ▼ until the proper hour is displayed. Be sure that AM/PM setting is correct.
6. Press ▶ MINUTE; then press ▲ or ▼ until the correct minute is displayed.
7. Press ▶ SET to return to the Time/Date menu.
8. Press ▶ DATE.
9. MONTH is displayed; then press ▲ or ▼ until the correct month is displayed.
10. Press ▶ DATE; then press ▲ or ▼ until the correct day of the month is displayed.
11. Press ▶ YEAR; then press ▲ or ▼ until the correct year is displayed.
12. Press ▶ SET to return to the Time/Date menu.
13. Press ▶ DAY; then press ▲ or ▼ until the correct day of the week is displayed.
14. Press ▶ SET to return to the Time/Date menu.
15. Press ▶ EXIT 3 times to return to the Home screen.



3.8 Disable Daylight Savings Time: – Fast Track

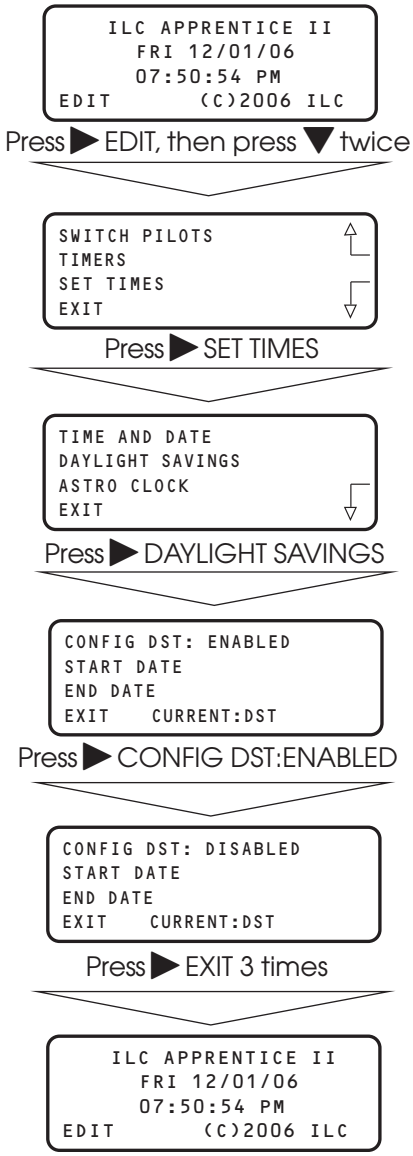


Daylight Savings Screen Flow

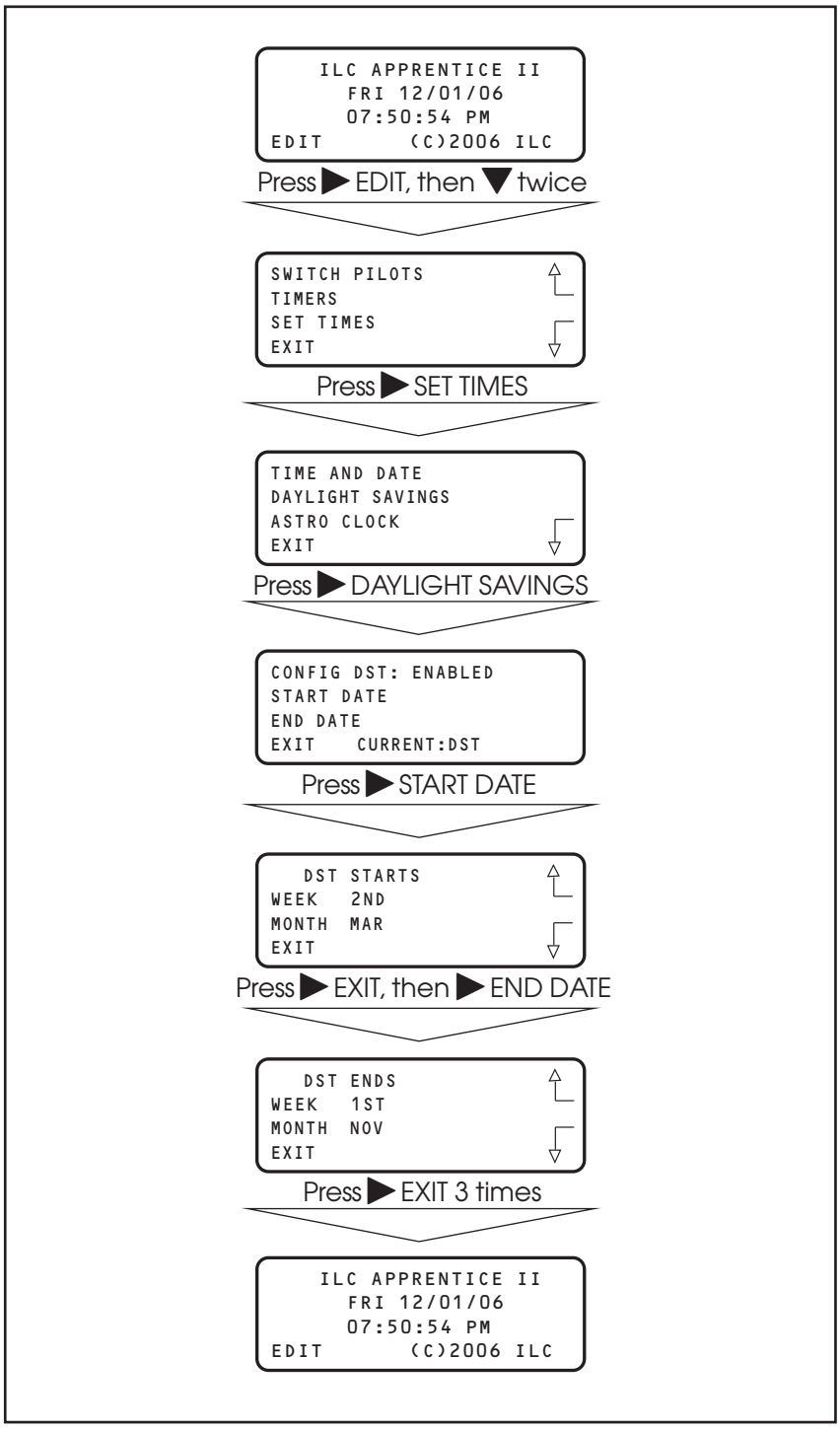
How to Enable and Disable Day Light Savings

The ILC Apprentice II is defaulted for automatic change over between standard and day light savings time. If the controller is in an area that doesn't observe day light savings you can disable this feature.

1. From the Home screen, press ▶ EDIT, then press ▼ twice.
2. From the main menu, press ▶ SET TIMES.
3. From the Set Times menu, press ▶ DAYLIGHT SAVINGS.
4. When the Day Light Savings screen appears, press ▶ DISABLE.
5. Press ▶ EXIT 3 times to return to the Home screen.



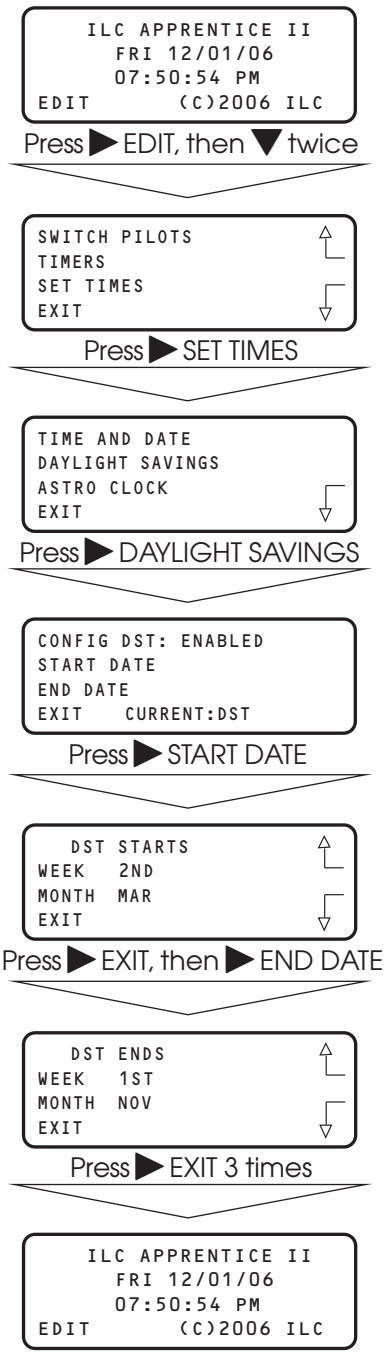
3.9 Adjust Daylight Savings Time Settings: – Fast Track



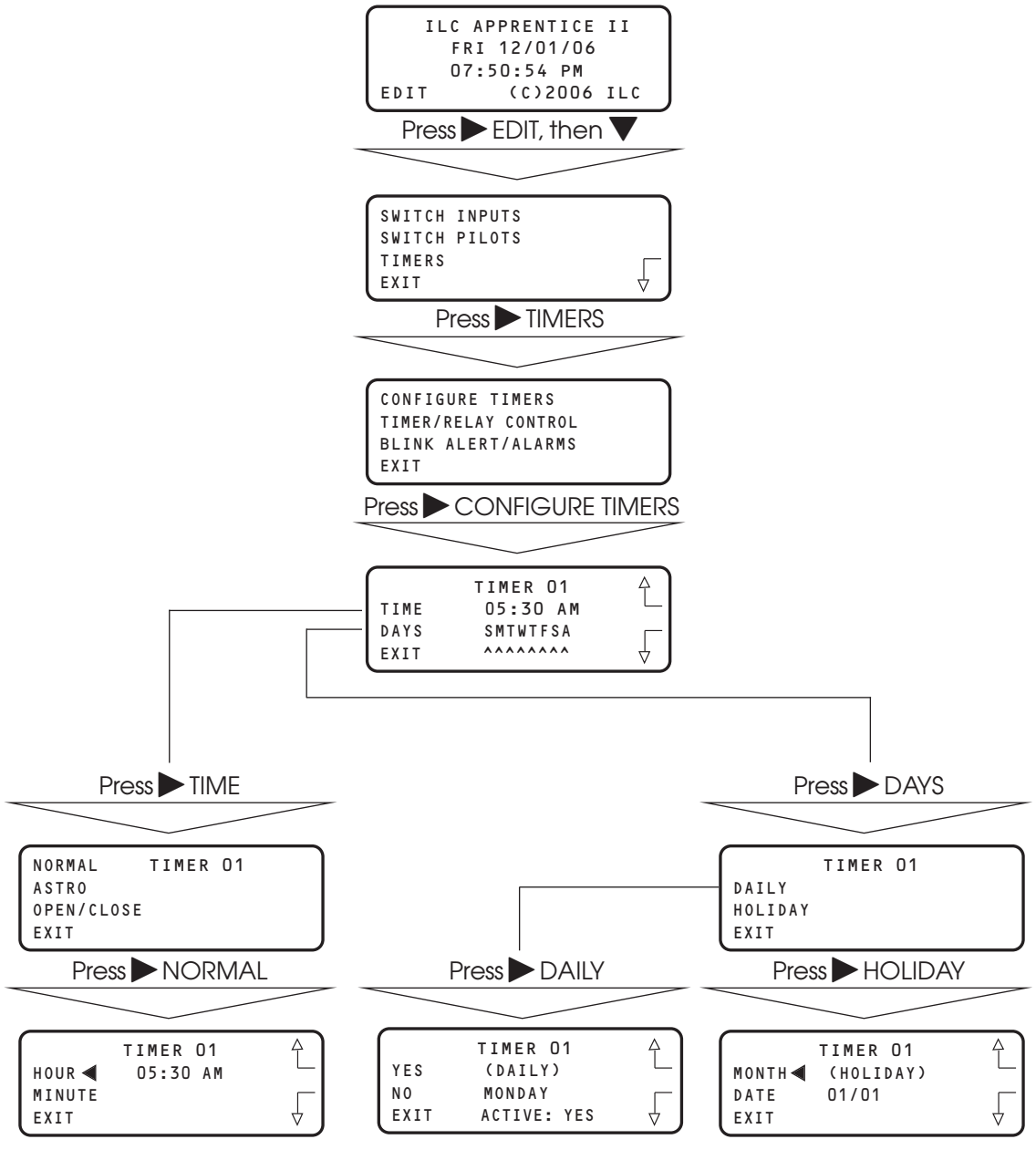
How to Adjust Day Light Savings Settings

The ILC Apprentice II controller allows you to adjust the start and end date settings for Day Light Savings Time. The times are adjustable for any week in any month.

1. From the Home screen, press ▶ EDIT, then press ▼ twice.
2. From the main menu, press ▶ SET TIMES.
3. From the Set Times menu, press ▶ DAYLIGHT SAVINGS.
4. When the Day Light Savings screen appears, press ▶ START DATE.
5. When the Start Date screen appears, press ▶ WEEK then press ▲ or ▼ until the required week appears.
6. Press ▶ MONTH then press ▲ or ▼ until the required month appears.
7. Press ▶ EXIT then press ▶ END DATE.
8. When the End Date screen appears, press ▶ WEEK then press ▲ or ▼ until the required week appears.
9. Press ▶ MONTH then press ▲ or ▼ until the required month appears.
10. Press ▶ EXIT 3 times to return to the Home screen.

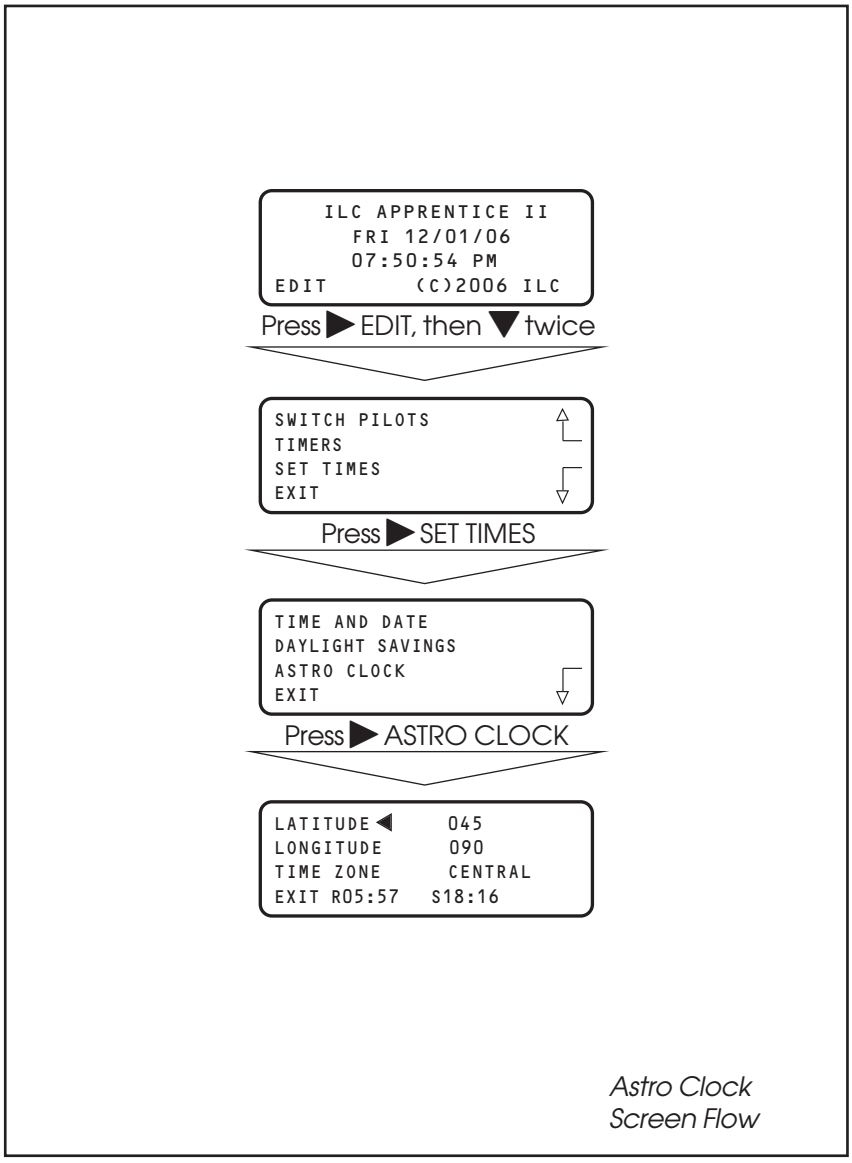


3.10 Time Based Operations: How to Define a Normal Timer – Fast Track



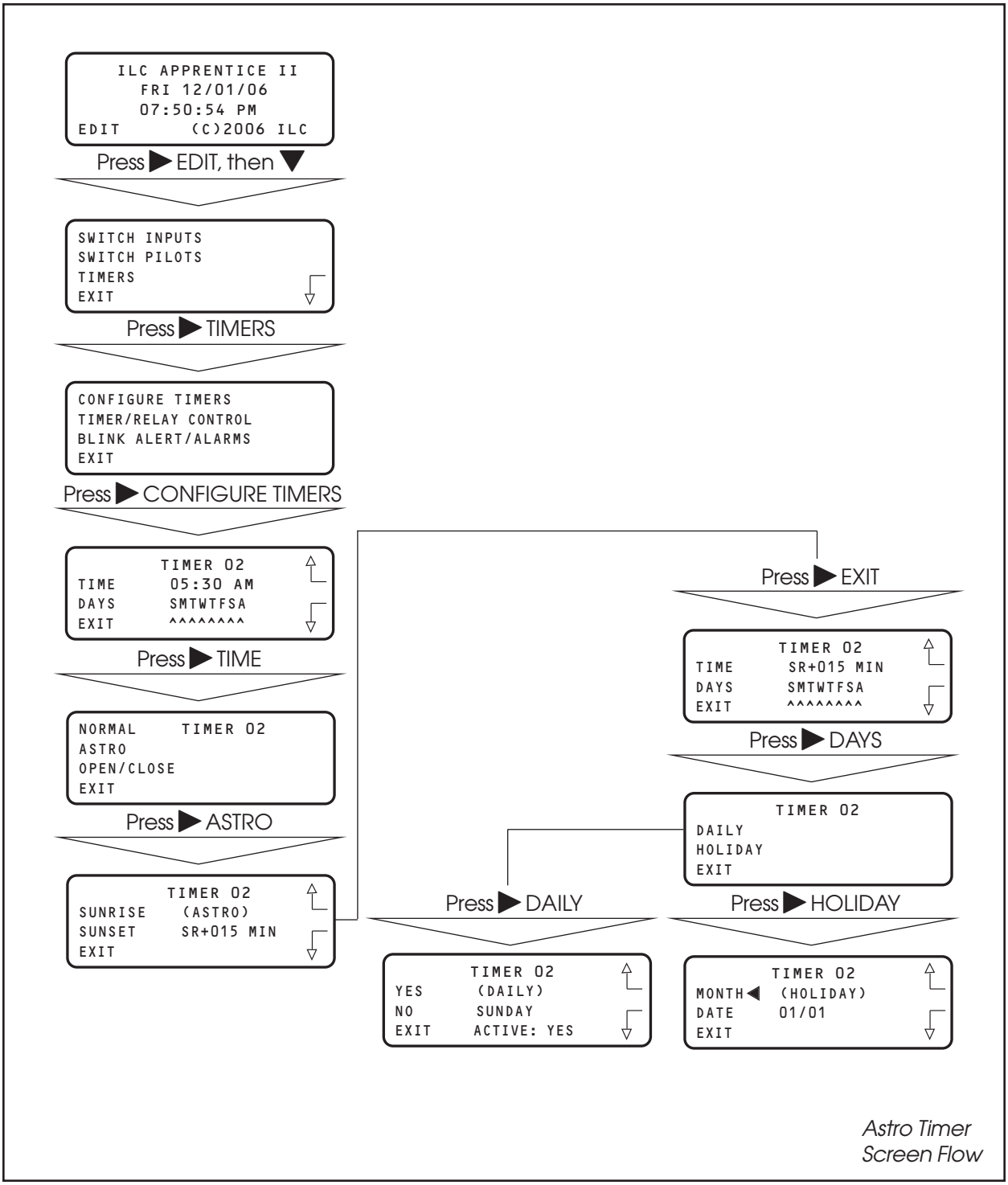
Time Based Operations Screen Flow

3.10 Time Based Operations: How to Set the Astro Clock Parameters – Fast Track



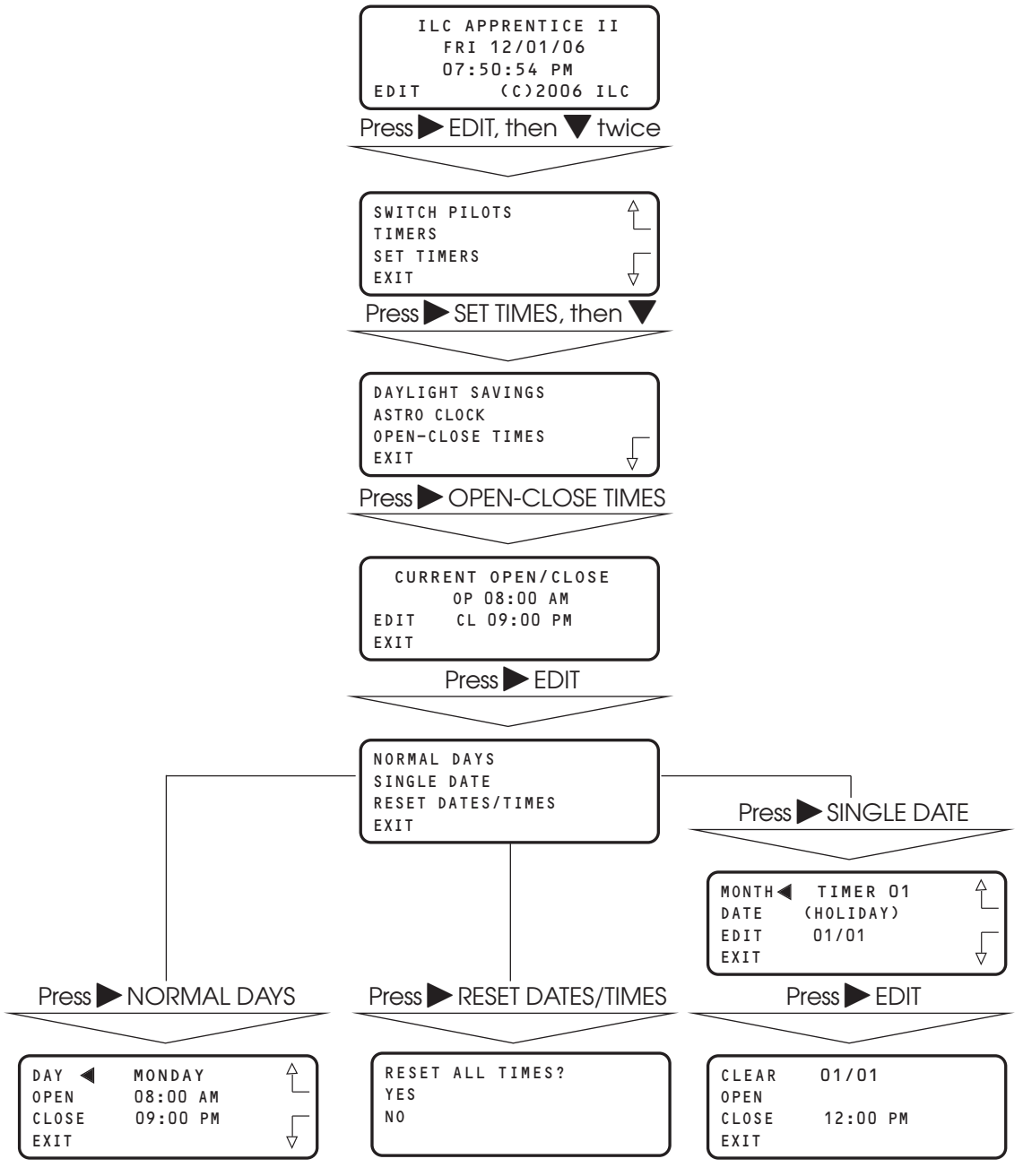
Astro Clock Screen Flow

3.10 Time Based Operations: How to Define an Astro Timer – Fast Track



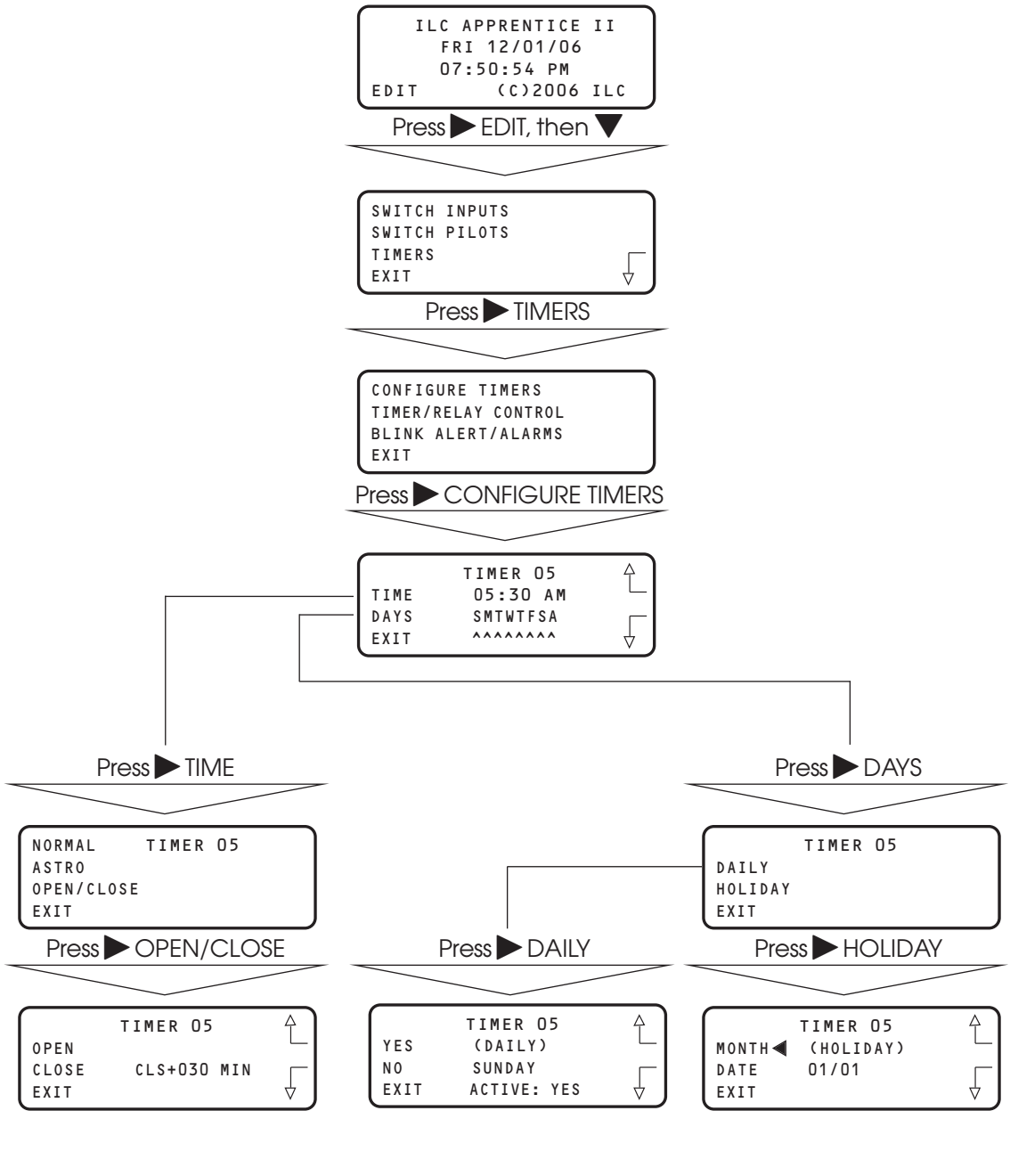
Astro Timer Screen Flow

3.10 Time Based Operations: How to Set Open/Closed Parameters – Fast Track



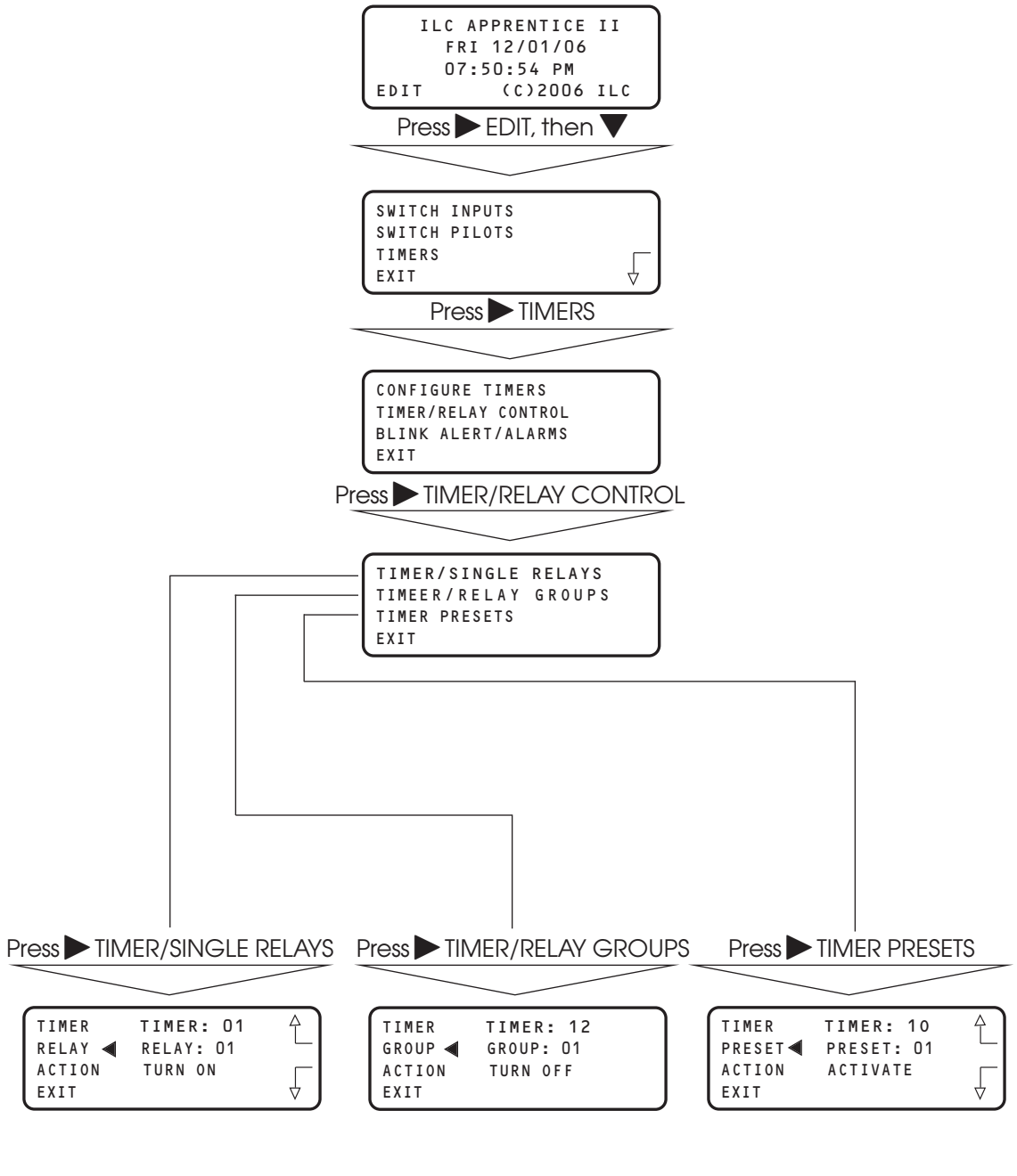
Open/Close Parameters Screen Flow

3.10 Time Based Operations: How to Define an Open/Close Timer – Fast Track



Open/Close Timer Screen Flow

3.10 Time Based Operations: How to Control a Relay, Relay Group or a Preset with a Timer – Fast Track



Timer Control Screen Flow

Time Based Operations

CONCEPTS AND PARAMETERS

You can program the ILC Apprentice II controller to control a single relay output, a relay group, or a preset according to a time based schedule. (A preset is user defined group of relays programmed to assume a pre-determined ON/OFF pattern when invoked. Presets will be discussed later in more detail.)

Time based control involves:

1. Defining the timer and any associated parameters.
2. Programming how the timer impacts the selected relay, relay group, or preset.

NOTE: You will need the latitude and longitude for your location in order to define an Astro Timer. A listing of latitudes and longitudes for many major US cities is provided in the Appendix O.

Parameter Key:

TIMER = 1 of up to 48 time based events that impact relays, relay groups, or presets. A NORMAL timer executes its function according to standard AM/PM time. This the default timer type. An ASTRO timer operates in relation to sunrise or sunset. An OPEN/CLOSE timer is keyed to user entered facility open and close times. (Both ASTRO and OPEN/CLOSE timers can be programmed to occur at exactly sunrise/sunset open/close or offset either before or after these times.) Open/Close Timers can be keyed to different open/close times. For example weekday hours as opposed to weekend hours. An Open/Close timer can also be programmed to execute on a specific date.

RELAY = one of 48 available relay outputs impacted by the timers

RELAY GROUP = one of 48 available user defined groups of relay outputs that respond as a group to a timer

PRESET = one of 48 available user defined ON/OFF relay output patterns activated by a timer.

ACTION = How the timer will impact the relay output, relay group, or preset. The default is NO ACTION (The timer has no effect on the relay, relay group, or preset.) Other possible entries are:

TURN ON (used with relays and relay groups)
TURN OFF (used with relays and relay groups)
ACTIVATE (used with presets)

SAMPLE OPERATION:
Program a Normal Timer

Define the Normal Timer:

1. From the Home screen, press ▶ EDIT; then ▼.

2. From the Main Menu press ▶ TIMERS.

3. When the Timer menu appears, press ▶ CONFIGURE TIMERS.

4. When the Timer Definition screen appears, press ▲ or ▼ until the timer you want to program appears in the timer field.

5. Press ▶ TIME; then when the Timer type menu appears, press ▶ NORMAL.

6. When the Set Time screen appears, press ▶ HOUR, then ▲ or ▼until the hour for the timer to occur appears.

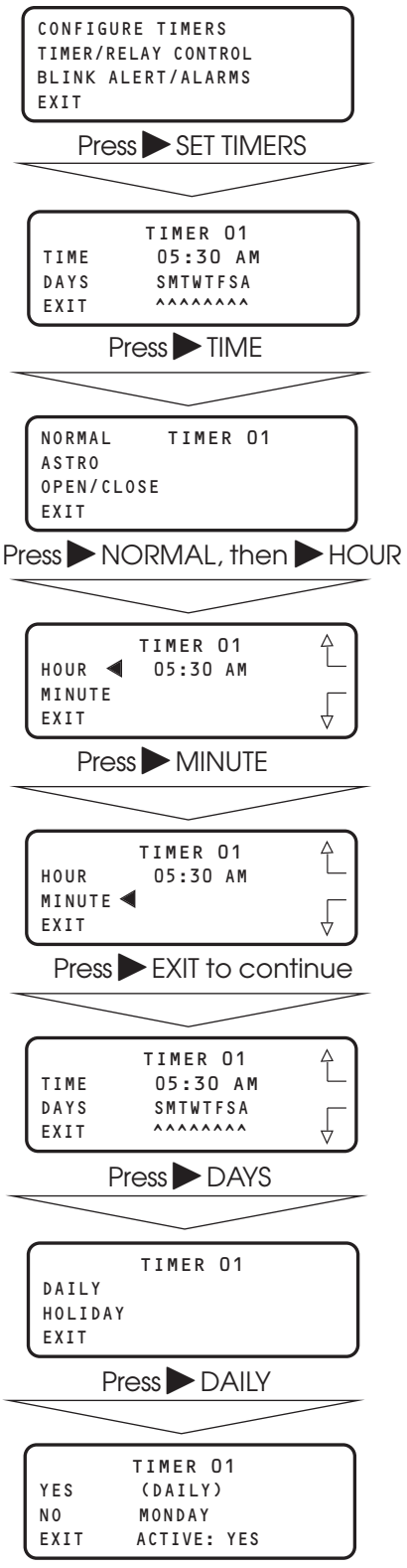
7. Press ▶ MINUTE, then ▲ or ▼ until the correct time appears on the screen.

8. Press ▶ EXIT to return to the Timer Definition screen.

9. Press ▶ DAYS; when the Day menu appears press ▶ DAILY.

10. Day Choice screen appears, press ▲ or ▼ and then ▶ YES or ▶ NO to include or exclude each day from the timer operation.

11. Press ▶ EXIT 2 times to return to the TIMER menu.



SAMPLE OPERATION:
Program an Astro Timer

Step 1: Enter The Astro Clock Parameters:

1. From the Home screen, press ▶ EDIT; then press ▼ twice.

2. From the Main Menu press ▶ SET TIMES.

3. From the Set Times Menu, press ▶ ASTRO CLOCK.

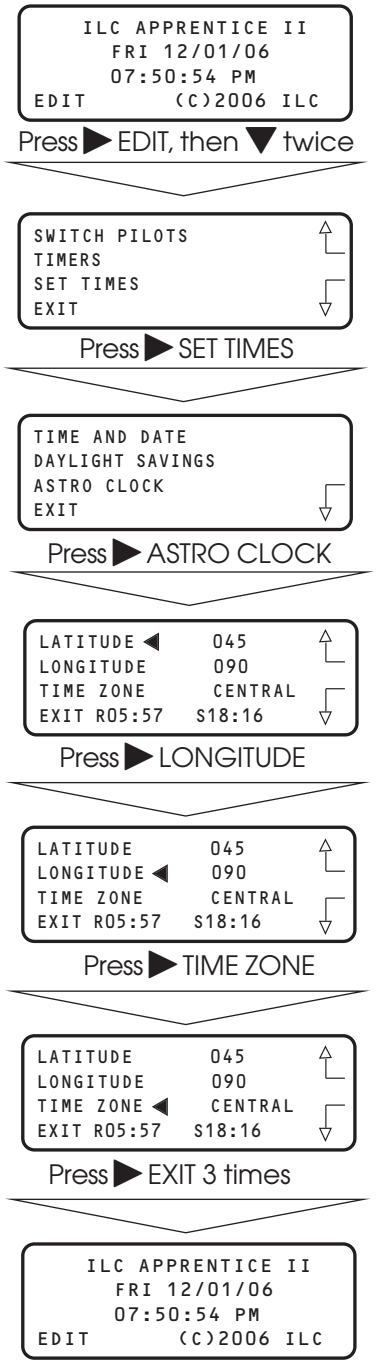
4. When the Astro Clock screen appears, press ▲ or ▼ until the proper latitude appears.

5. Press ▶ LONGITUDE; then ▲ or ▼ until the proper longitude appears.

6. Press ▶ TIME ZONE then ▲ or ▼ until the proper time zone appears.

7. Press ▶ EXIT 3 times to return to the Home screen.

Note: The current sunrise and sunset times for the global coordinates selected appear at the bottom of the Astro Clock screen (R and S). (The default coordinates are for Minneapolis Minnesota.)



SAMPLE OPERATION:
Program an Astro Timer

Step 2: Define the Astro Timer:

1. From the Home screen, press ▶ EDIT; then ▼.

2. From the Main Menu press ▶ TIMERS.

3. When the Timer menu appears, press ▶ CONFIGURE TIMERS.

4. When the Timer Definition screen appears, press ▲ or ▼ until the timer you want to program appears in the timer field.

5. Press ▶ TIME; then when the Timer type menu appears, press ▶ ASTRO

6. When the Astro Time Set screen appears press either ▶ SUNRISE(to set the time in relation to sunrise) or ▶ SUNSET (to key the timer to sunset). If you want to offset the time press either ▲ or ▼ until the desired offset appears on the screen. Then press ▶ EXIT to return to the Timer Definition screen.

7. Press ▶ DAYS; when the Day menu appears press ˜ DAILY.

8. Day Choice screen appears, press ▲ or ▼ and then ▶ YES or ▶ NO to include or exclude each day from the timer operation.

9. Press ▶ EXIT 2 times to return to the TIMER menu.

SAMPLE OPERATION:
Program an Open/Close Timer

Step 1: Define the Open/Close Parameters:

1. From the Home screen, press ▶ EDIT; the press ▼.

2. From the Main Menu press ▶ SET TIMES.

3. From the Set Times Menu, press ▼; then press ▶ OPEN-CLOSE TIMES.

4. When the top level Open/Close screen appears, press ▶ EDIT

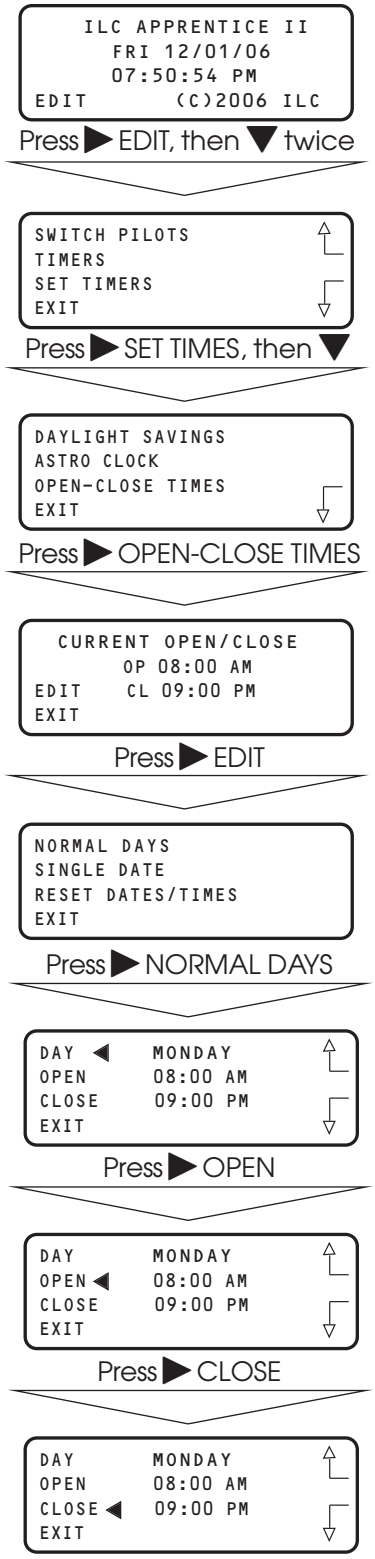
5. When the Open/Close Day menu appears, press ▶ NORMAL DAYS

6. When the Open/Close Time Setting screen appears, press ▶ OPEN; then press ▲ or ▼ to set the open time of the facility for the day that appears in the day field.

7. Press ▶ CLOSE; then press ▲ or ▼ to set the close time of the facility for the day that appears in the day field.

8. Press ▶ DAY to access the next day; the repeat steps 5 and 6 for that day.

9. After finishing setting all the open and close times for the facility, press ▶ EXIT 5 times to return to the Home screen.



SAMPLE OPERATION:
Program an Open/Close Timer

Step 2: Define the Open/Close Timer:

1. From the Home screen, press ▶ EDIT; then ▼.

2. From the Main Menu press ▶ TIMERS.

3. When the Timer menu appears, press ▶ CONFIGURE TIMERS.

4. When the Timer Definition screen appears, press ▲ or ▼ until the timer you want to program appears in the timer field.

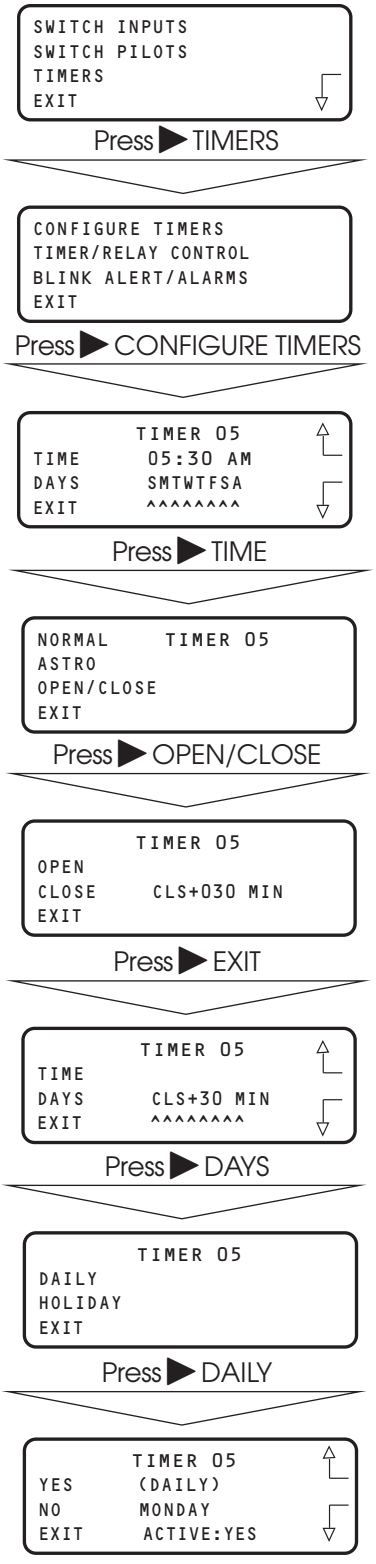
5. Press ▶ TIME; then when the Timer Type menu appears, press ▶ OPEN/CLOSE.

6. When the Open/Close Set screen appears, press either ▶ OPEN or ▶ CLOSE to tie the timer to either the facility open or closing time. If you desire to offset the time press ▲ or ▼ until the correct offset appears on the screen. Then press ▶ EXIT to return to the Timer Definition screen.

7. Press ▶ DAYS; when the Day menu appears press ▶ DAILY.

8. Day Choice screen appears, press ▲ or ▼ and then ▶ YES or ▶ NO to include or exclude each day from the timer operation.

9. Press ▶ EXIT 2 times to return to the TIMER menu.



SAMPLE OPERATION:
Program a Timer to Control a Single Relay

Program a Timer to Control a Relay:

1. From the Timer menu, press ▶ TIMER/RELAY CONTROL.

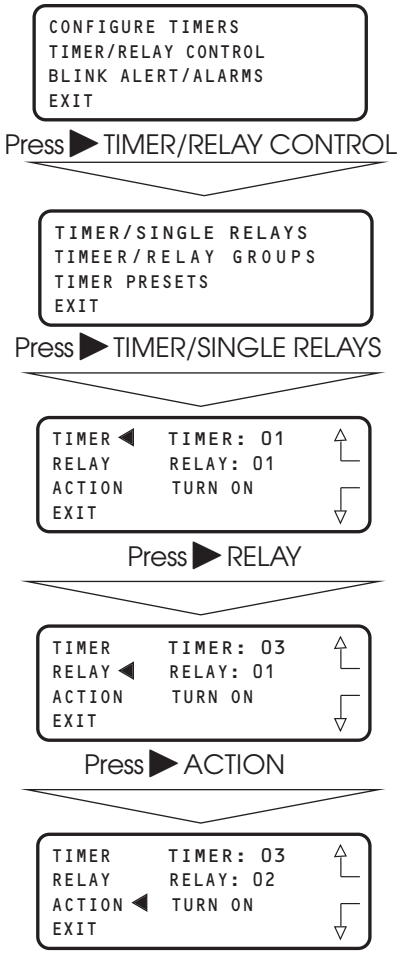
2. From the Timer Control menu, press ▶ TIMER/SINGLE RELAYS.

3. When the Timer/Relay Control screen appears, press ▲ or ▼ until the timer that you want to control the relay appears in the timer field.

4. Press ▶ RELAY; then ▲ or ▼ until the relay you want to be controlled by the timer appears in the relay field.

5. Press ▶ ACTION; then ▲ or ▼ until the the way you want the timer to control the relay appears.

6. Press ▶ EXIT 4 times to return to the Home screen.



SAMPLE OPERATION:
Program a Timer to Control a Relay Group

Program a Timer to Control a Relay Group:

1. From the Timer menu, press ▶ TIMER/RELAY CONTROL.

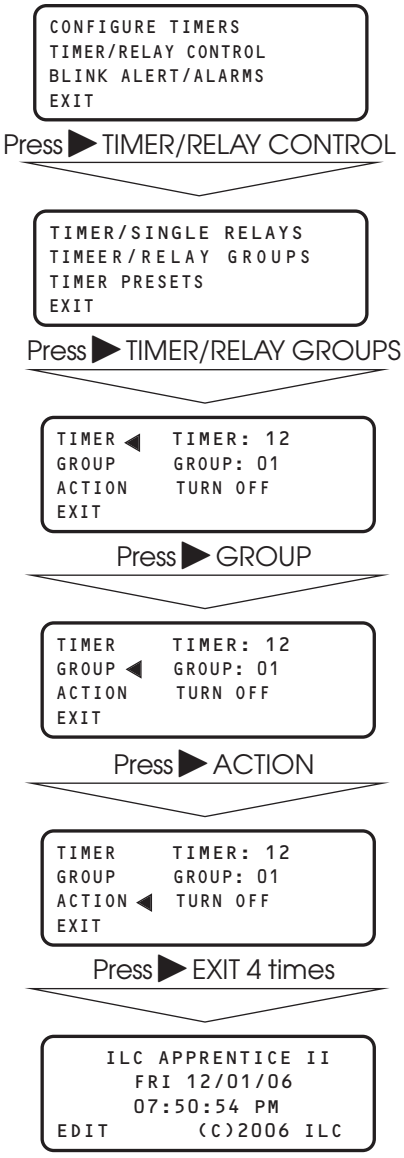
2. From the Timer Control menu, press ▶ TIMER/RELAY GROUPS

3. When the Timer/Relay Group Control screen appears, press ▲ or ▼ until the timer that you want to control the relay group appears in the timer field.

4. Press ▶ GROUP; then ▲ or ▼ until the relay group you want to be controlled by the timer appears in the relay field.

5. Press ▶ ACTION; then ▲ or ▼ until the way you want the timer to control the relay group appears.

6. Press ▶ EXIT 4 times to return to the Home screen.



SAMPLE OPERATION:
Program a Timer to Control a Preset

Program a Timer to Control a Preset:

1. From the Timer menu, press ▶ TIMER/RELAY CONTROL.

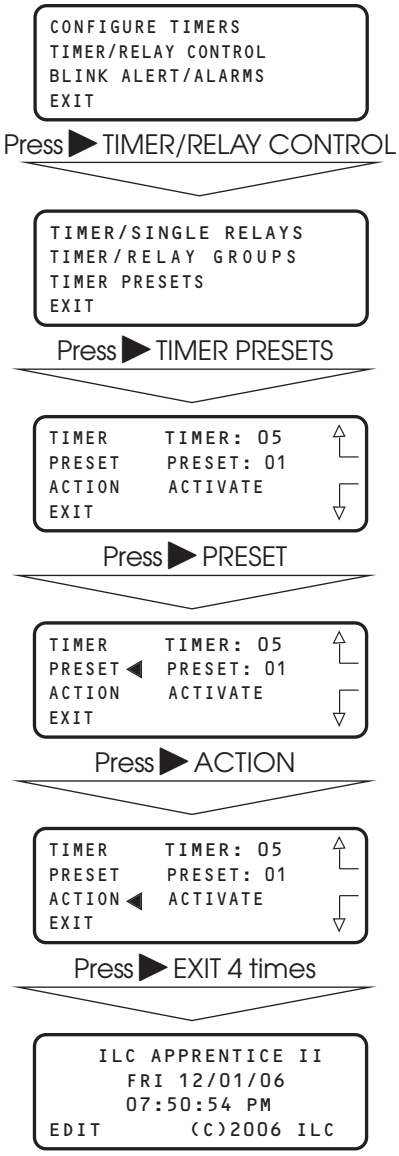
2. From the Timer Control menu, press ▶ TIMER/PRESETS

3. When the Timer/Preset Control screen appears, press ▲ or ▼ until the timer that you want to control the preset appears in the timer field.

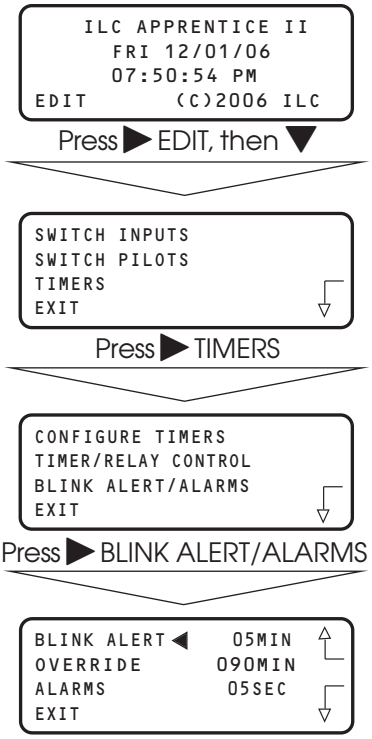
4. Press ▶ PRESET; then ▲ or ▼ until the preset you want to be controlled by the timer appears in the relay field.

5. Press ▶ ACTION; then ▲ or ▼ until the way you want the timer to control the preset appears.

6. Press ▶ EXIT 4 times to return to the Home screen.



3.11 Blink Alert/Alarms – Fast Track



Blink Alert/Alarms Screen Flow

Blink Alert/Alarms

CONCEPTS AND PARAMETERS

If the default timing parameters for the *optional* blink alert, HID delay and alarm relay output timer options are not appropriate for your application, you can change them. If the defaults are appropriate you need not conduct operations in this area.

Parameter Key:

BLINK ALERT = The length of time between a blink alert, HID delay or alarm and the execution of an OFF timer or blink alert switch signal, that has not been overridden by a switch closure. The default is 5 minutes. Other choices are from 2-99 minutes.

OVERRIDE = The amount of time a switch closure can be programmed to postpone the execution of an OFF timer or blink alert switch signal. The default is 120 minutes. Other choices are from 5 minutes to 999 minutes.

ALARMS = The length of the pulse for momentary alarm signals. The default is 5 seconds. Other choices are from 1--99 seconds.

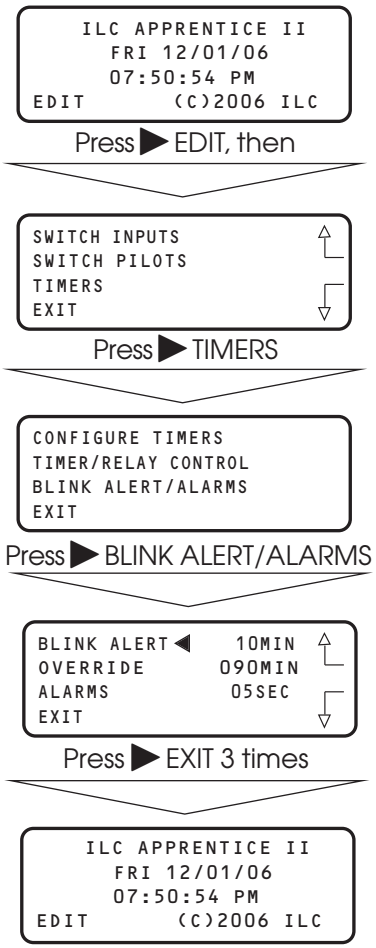
CONFIGURE TIMED-ON = Whether the timed on period is invoked by a switch opening or closing

FORCE TIMERS = Execute the selected timer

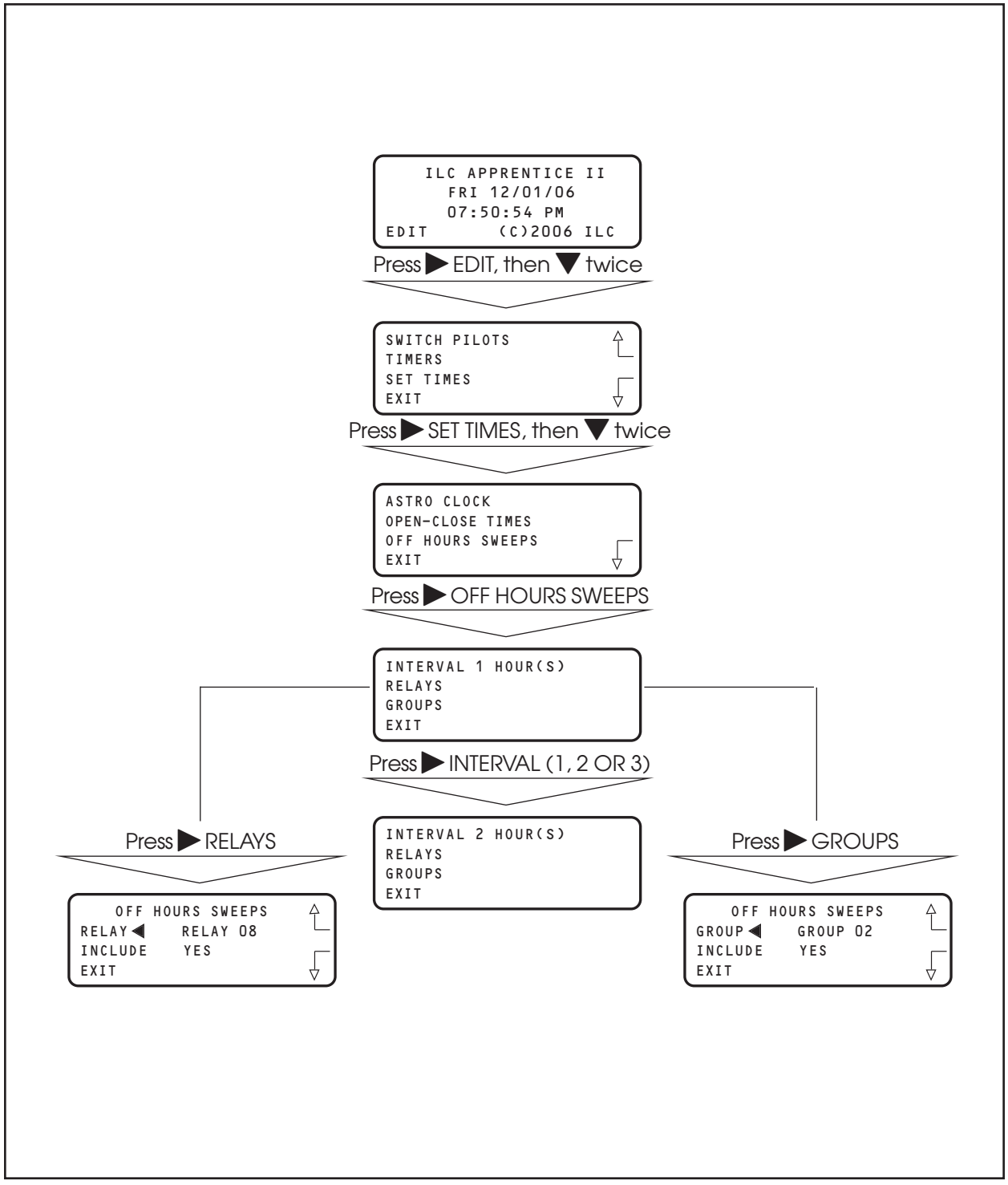
SAMPLE OPERATION:

Change the Blink Alert from the Default

1. From the Home screen, press ▶ EDIT; then ▼.
2. When the Main menu appears, press ▶ TIMERS.
3. When the Timer menu appears, press ▶ BLINK ALERT/ALARMS.
4. When the Blink Alert/Alarms screen appears, press ▲ or ▼ until the desired Blink Alert time appears in the Blink Alert field.
5. Press ▶ EXIT three times to return to the Home screen.



3.12 Off Hours Sweeps – Fast Track



Off Hours Sweeps

CONCEPTS AND PARAMETERS

You can program the controller to execute OFF sweeps to insure that single relay outputs and relay groups will be turned OFF at regular intervals outside of normal business hours. (NOTE: This is used in conjunction with Open/Close Times - see Page 3-28 and 3-35.)

Parameter Key:

INTERVAL = time between OFF sweeps (1, 2, 3 hours).

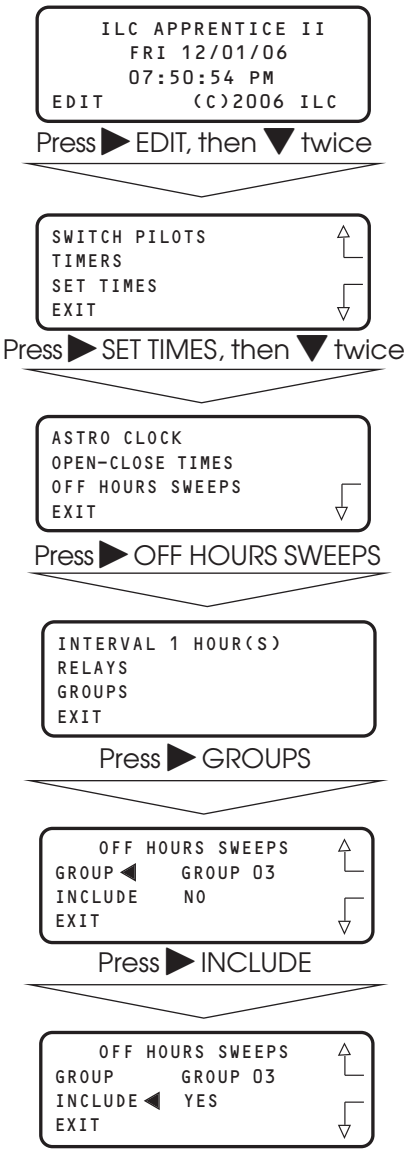
Relays = individual relays subject to the OFF sweeps

Groups = relay groups subject to the OFF sweeps

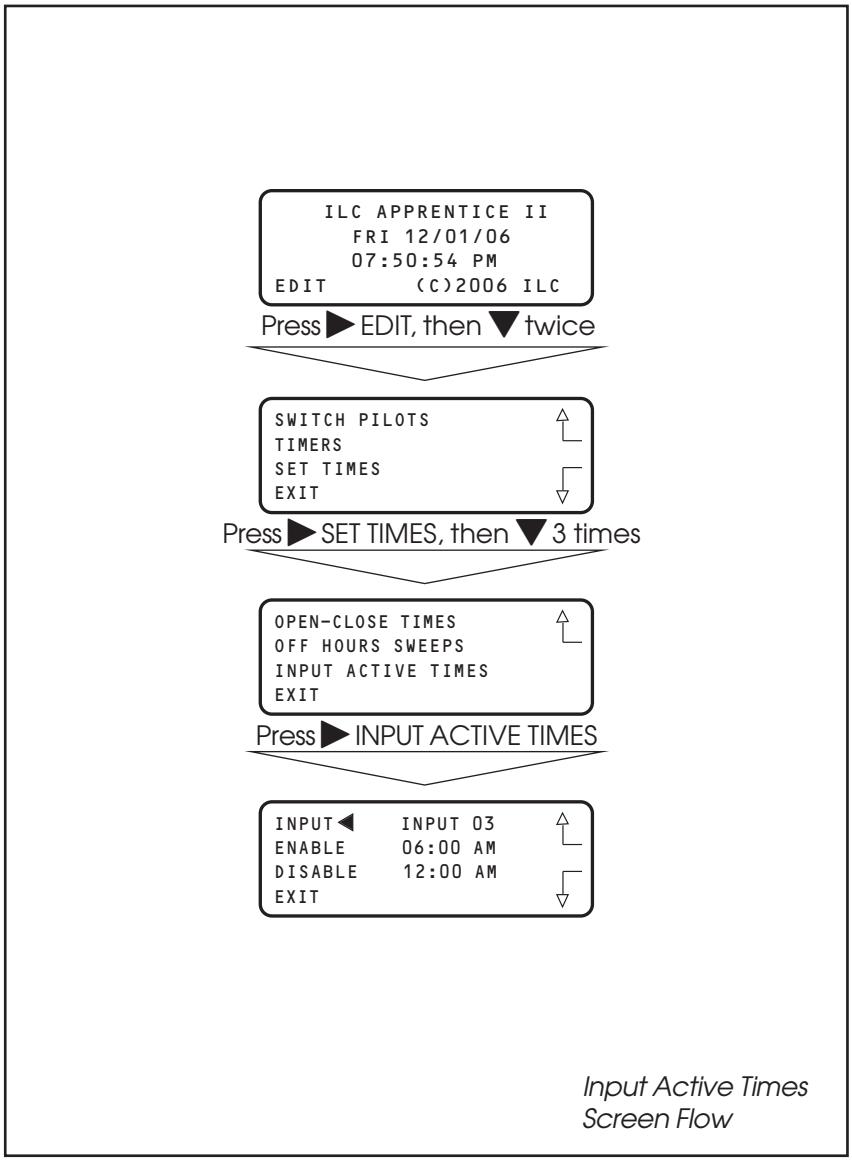
SAMPLE OPERATION:

Program a Relay Group for Off Sweeps

1. From the Home screen, press ▶ EDIT; then press ▼ twice.
2. When the Main menu appears, press ▶ SET TIMES; then ▼ twice.
3. When the SET TIMES Menu appears, press ▶ OFF HOURS SWEEPS
4. When the Off Hours Sweep menu appears, press ▶ GROUPS
5. When the Off Sweep Group screen appears, press ▲ or ▼ to select the relay group subject to the Off sweep.
6. Press ▶ INCLUDE until YES appears.
7. Press ▶ EXIT 4 times to return to the Home screen.



3.13 Input Active Times – Fast Track



Input Active Times Screen Flow

Input Active Times

CONCEPTS AND PARAMETERS

You can program the controller to enable/ disable selected input(s) during certain hours. During the enable time, the input will function normally. During the disable hours, the input will not function

Parameter Key:

Input = one of up to 48 possible controller switch inputs

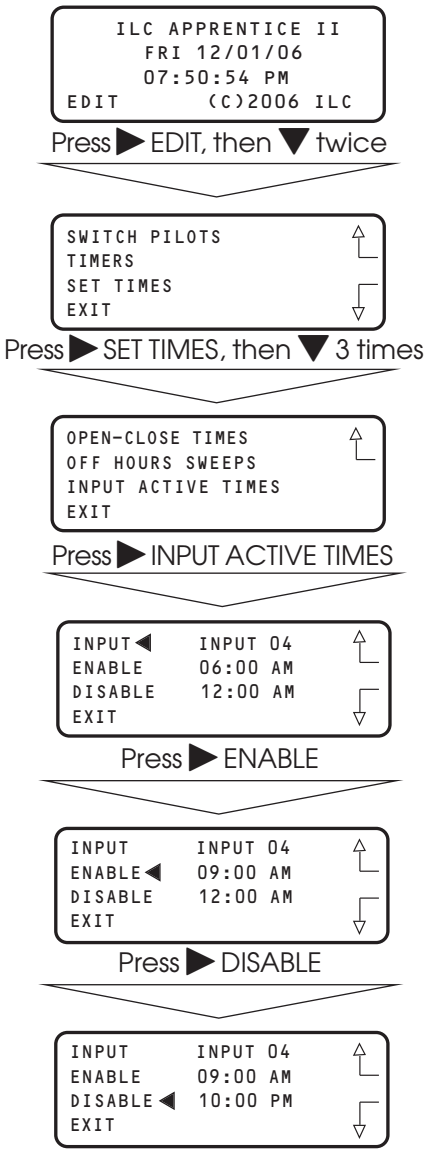
Enable = the input will function from the entered enable time to the entered disable time

Disable = the input will NOT function from the entered disable time to the entered enable time

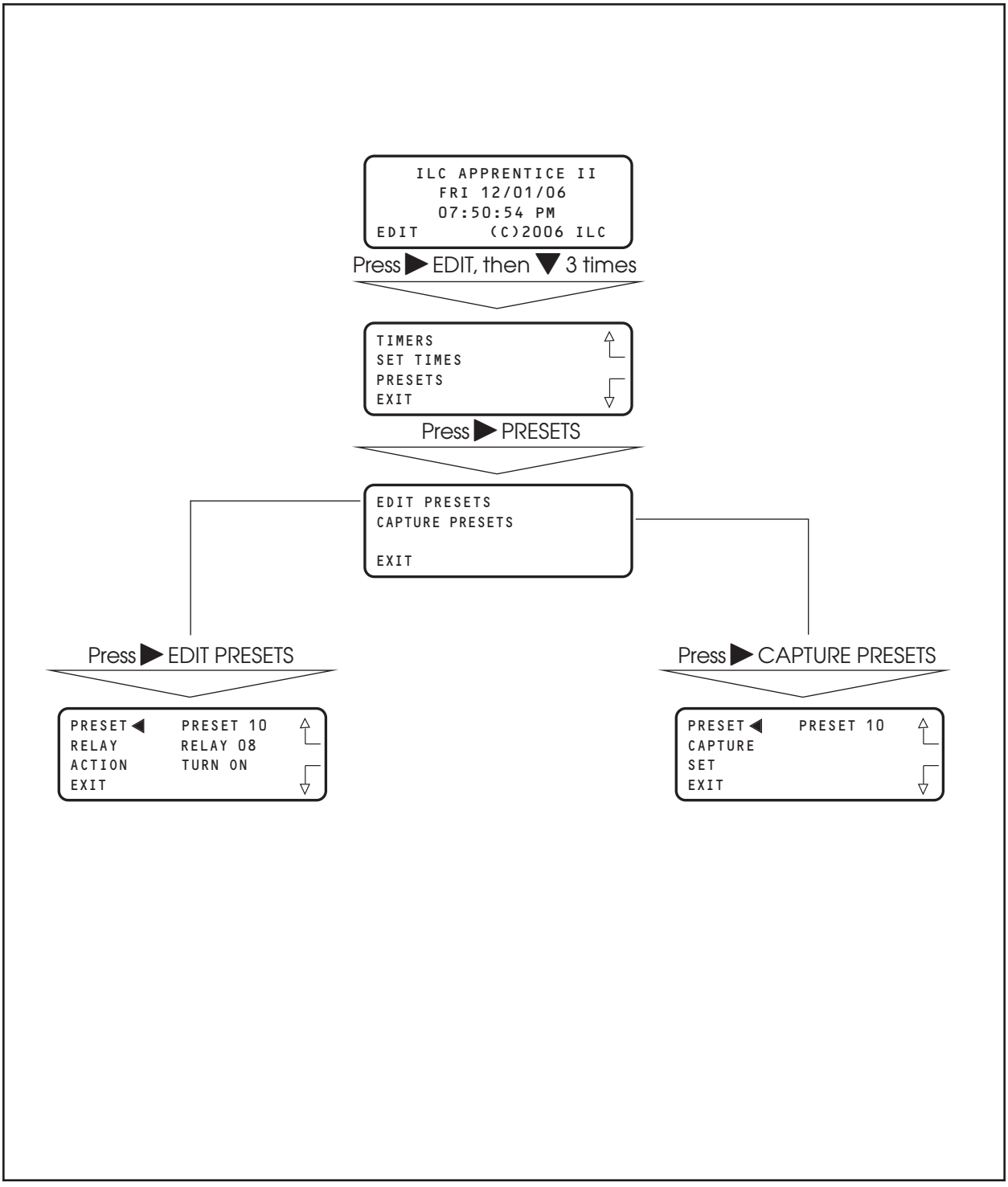
SAMPLE OPERATION:

Program a Switch Input for Input Active Times

1. From the Home screen, press ▶ EDIT; then press ▼ twice.
2. When the Main menu appears, press ▶ SET TIMES; then ▼ 3 times.
3. When the SET TIMES Menu appears, press ▶ INPUT ACTIVE TIMES.
4. When the Input Active Times screen appears press ▲ or ▼ until the input you want to program appears in the input field.
5. Press ▶ ENABLE; then press ▲ or ▼ until the desired enable time appears.
6. Press ▶ DISABLE; then press ▲ or ▼ until the desired disable time appears.
7. Press ▶ EXIT three times to return to the Home screen.



3.14 Preset Operations – Fast Track



Preset Operations

CONCEPTS AND PARAMETERS

The ILC Apprentice II supports the ability to save the current relay output ON/OFF states in a preset scene. You can program the controller to execute this scene by keyboard command, a signal from a Set Preset switch type, or timer signal. You also have the ability to edit the preset if you need to change the ON/OFF pattern

Parameter Key:

CAPTURE PRESETS:

PRESET = one of a possible 48 ON/OFF relay output patterns.

CAPTURE = save the current relay ON/OFF states to a preset scene

SET = a keyboard command to invoke a captured preset

EDIT PRESETS:

RELAY = one of 48 possible relay outputs making up the preset

ACTION = The state you want the relay output to assume when the preset is invoked.

SAMPLE OPERATION:

Capture, EDIT, and Invoke a Preset

1. From the Home screen, press ▶ EDIT; then press ▼ three times.

2. When the Main menu appears press ▶ PRESETS.

3. When the Presets menu appears, press ▶ CAPTURE PRESETS.

4. When the Preset Capture screen appears, press ▲ or ▼ until the preset you want to capture appears in the preset field.

5. Press ▶ CAPTURE to save the current ON/OFF relay pattern as the preset.

6. Press ▶ EXIT to return to the Preset Menu.

7. Press ▶ EDIT PRESETS

8. When the Edit Presets screen appears, press ▲ or ▼ until the preset you previously captured appears in the preset field.

9. Press ▶ RELAY; then press ▲ or ▼ until the relay whose preset ON/OFF state you want to change appears.

10. Press ▶ ACTION; the press ▲ or ▼ until the desired relay state appears in the action field.

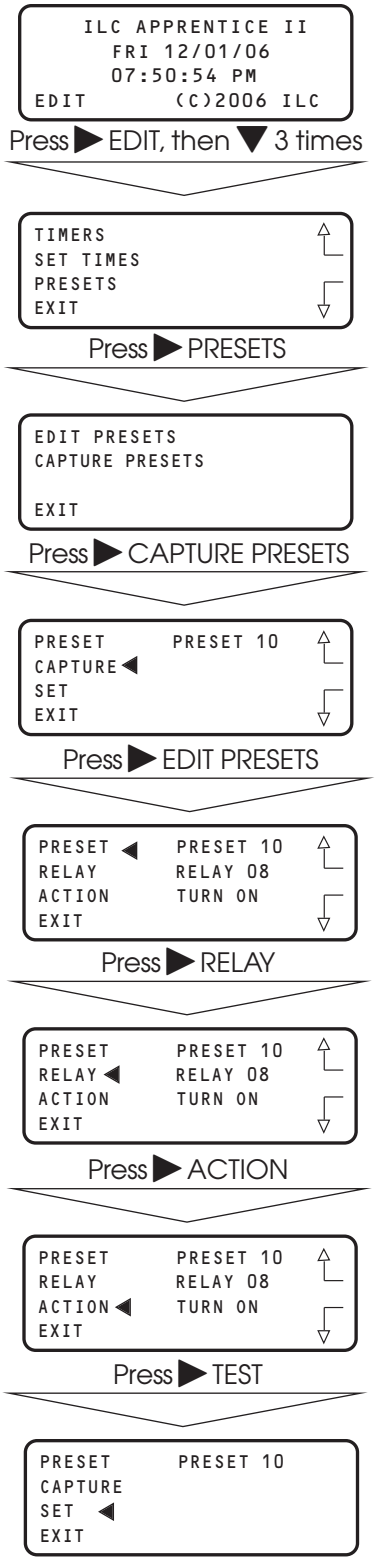
11. Repeat steps 9 and 10 for any additional relays you want to change.

12. Press ▶ EXIT to return to the Presets menu; then press ▶ CAPTURE PRESETS

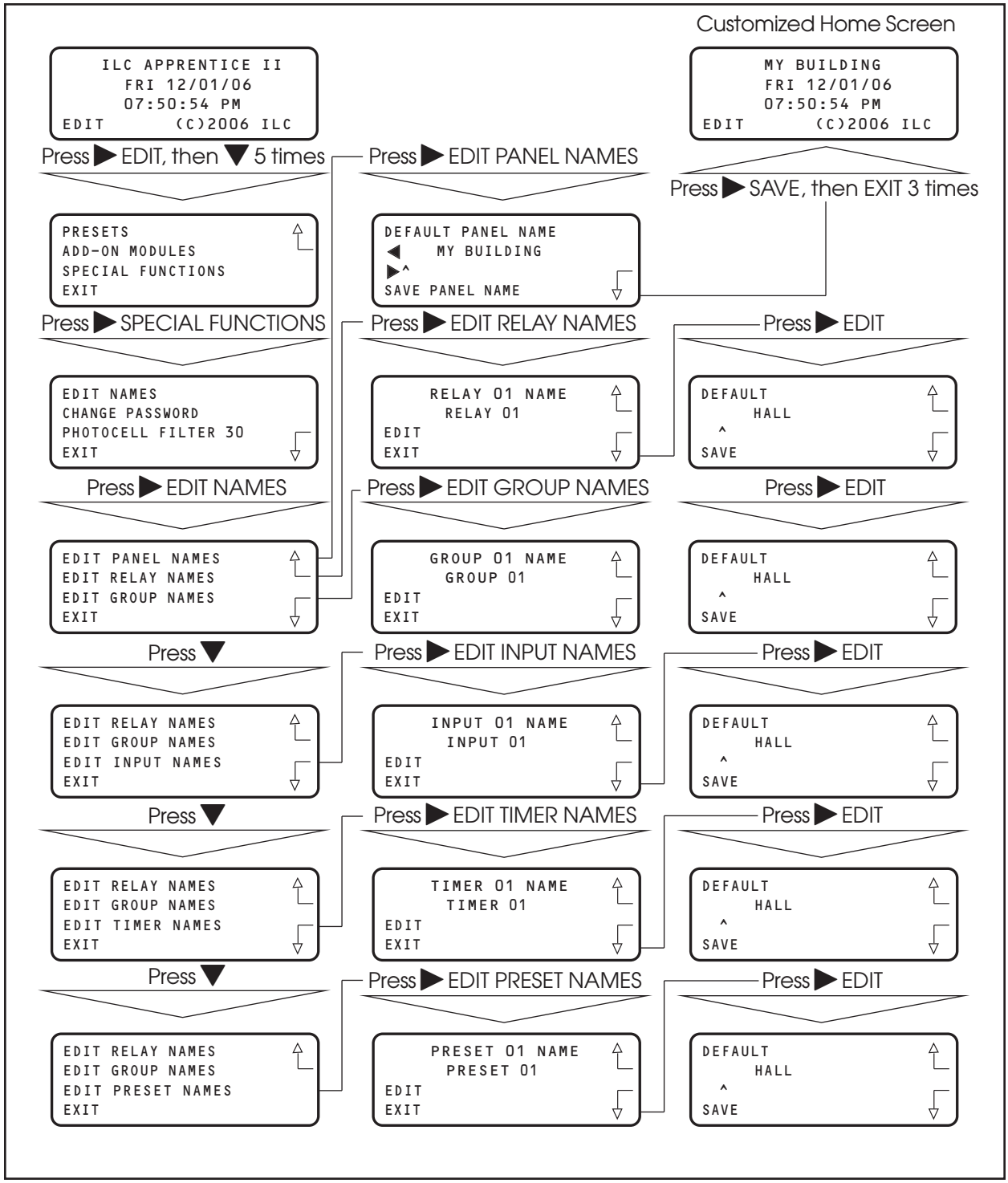
13. Press ▶ to select the preset you have just edited.

14. Press ▶ SET to invoke the preset.

15. Press ▶ EXIT 3 times to return to the Home screen.



3.15 Edit Names – Fast Track



How to Customize the Name(s) of the ILC Apprentice II Controller, Relays, Groups, Inputs (LightSync and hardwired), Timers, and Presets

You have the option of assigning customized names to the controller and the other major components/features of the lighting control system. The customized names will appear on the screens featuring that component/feature.

SAMPLE OPERATION:
Customize The Name Of a Relay Output

1. From the Home screen, press ▶ EDIT; then press ▼ 5 times.

2. When the Main menu appears, press ▶ SPECIAL FUNCTIONS.

3. When the Special Functions menu appears, press ▶ EDIT NAMES.

4. When the Edit Names menu appears, press ▶ EDIT RELAY NAMES.

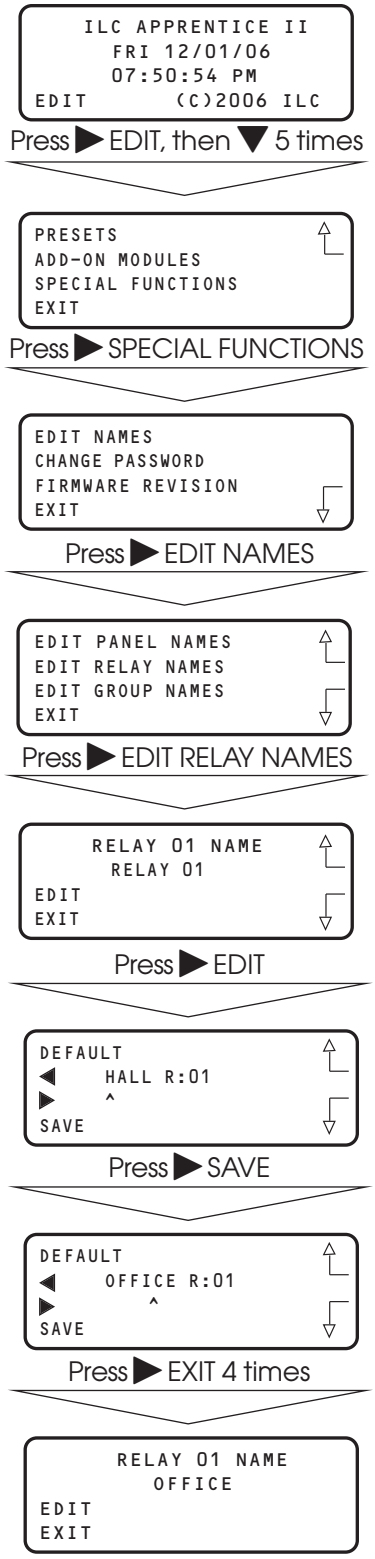
5. When the Relay Naming screen appears press ▲ or ▼ until the relay that you want to name appears.

6. Press ▶ EDIT

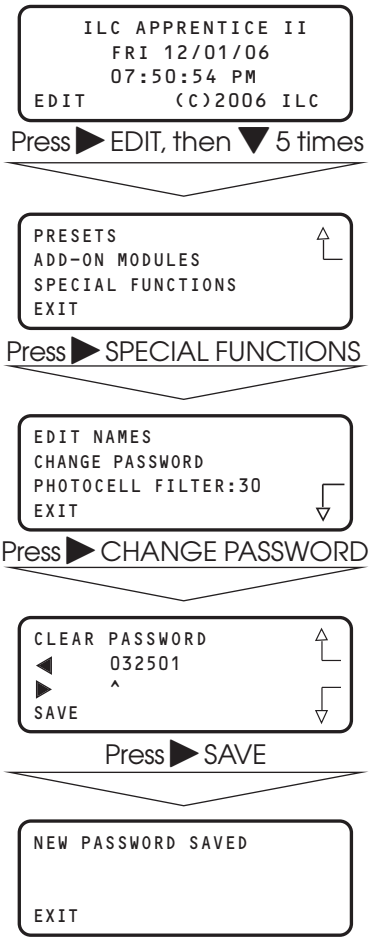
7. When the Relay Name Editing screen appears, press ▶ until the cursor is positioned under the first character of the default name. The press ▲ or ▼ until the first character of the customized name appears.

8. Repeat step 7 until the customized name has completely overridden the default name.

9. Press ▶ SAVE



3.16 How to Enter or Change a Password – Fast Track



Change Password Screen Flow

Entering/Changing a Password

CONCEPTS AND PARAMETERS

If you want, you can enter a 6 digit password to restrict unauthorized access to the controller.

Caution: Memorize and write down the password. Store it in a secure place. Once you have saved the password, you will need to enter it or be denied access to the controller.

SAMPLE OPERATION:

Enter a Password For the Controller

1. From the Home screen, press ▶ EDIT; then press ▼ 5 times.

2. When the Main menu appears, press ▶ SPECIAL FUNCTIONS.

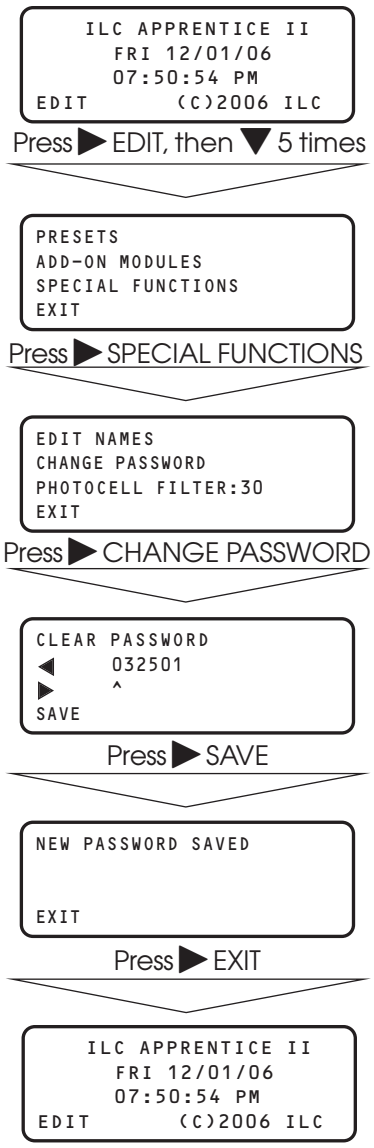
3. When the Special Functions menu appears, press ▶ CHANGE PASSWORD

4. When the Password Editing screen appears, press ▶ until the cursor is positioned under the first digit in the password field. The press ▶ or ▼ until the first digit of the password appears

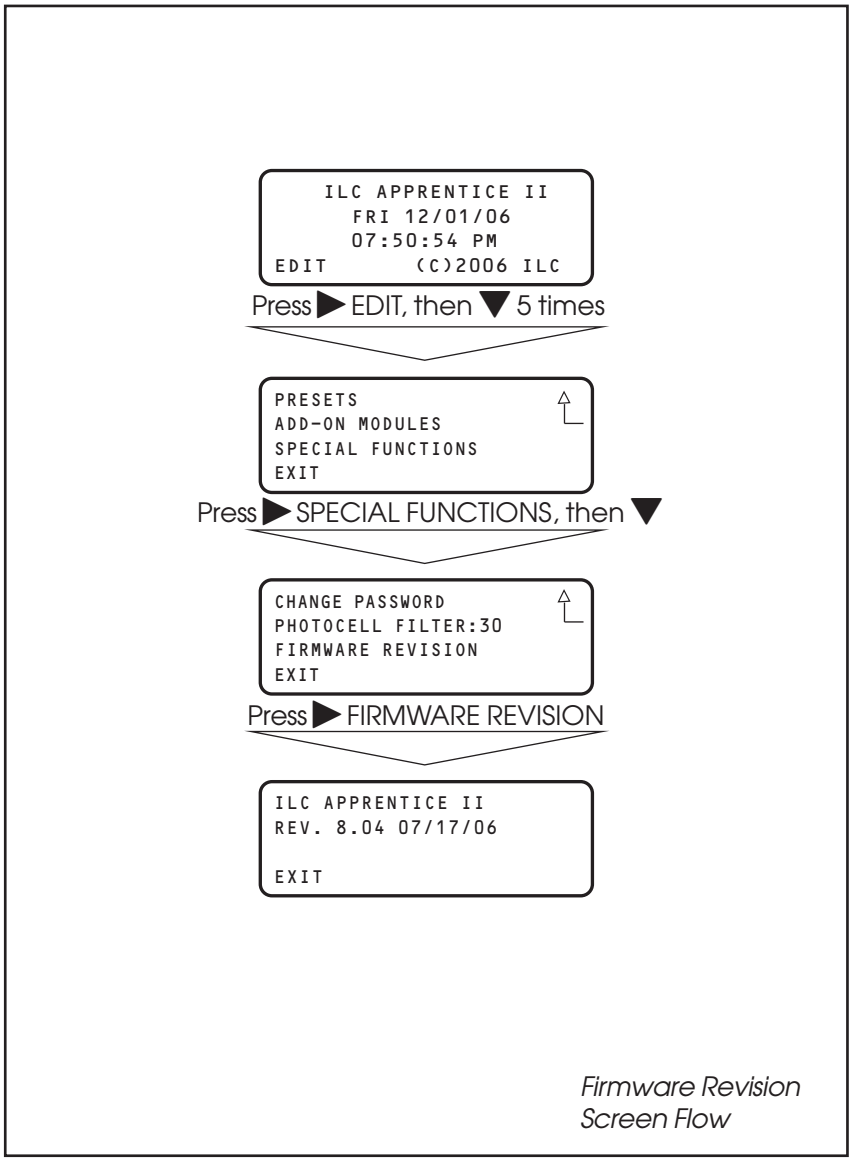
5. Repeat step 7 for the remaining digits.

6. Press ▶ SAVE. A message will appear saying NEW PASSWORD SAVED

7. Press ▶ EXIT to return to the Home screen



3.17 How to View the Firmware Revision– Fast Track



Firmware Revision Screen Flow

How to View The Controller Firmware Revision

The Firmware Revision screen list the firmware currently in the controller. This information may be useful when requesting advice or repair components. This screen also serves a gateway to a "Hidden" screen used to perform certain operations. *(Note: See Hidden Menu Choices near the beginning of this section.)*

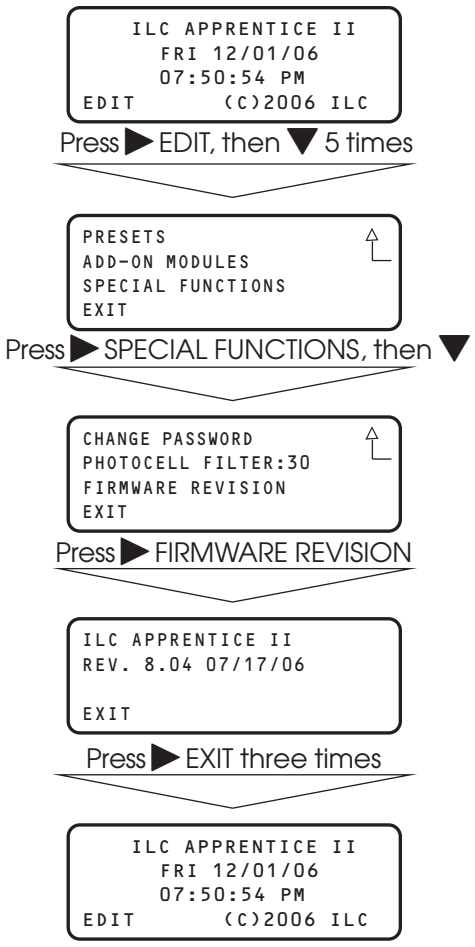
SAMPLE OPERATION:
View The Controller Firmware Revision

1. From the Home screen, press ▶ EDIT; then press ▼ 5 times.

2. When the Main menu appears, press ▶ SPECIAL FUNCTIONS ; then press ▼.

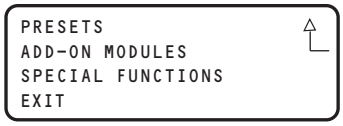
3. When the Special Functions menu appears, press ▶ FIRMWARE REVISION to view the Firmware Revision screen.

4. Press ▶ EXIT three times to return to the Home screen.

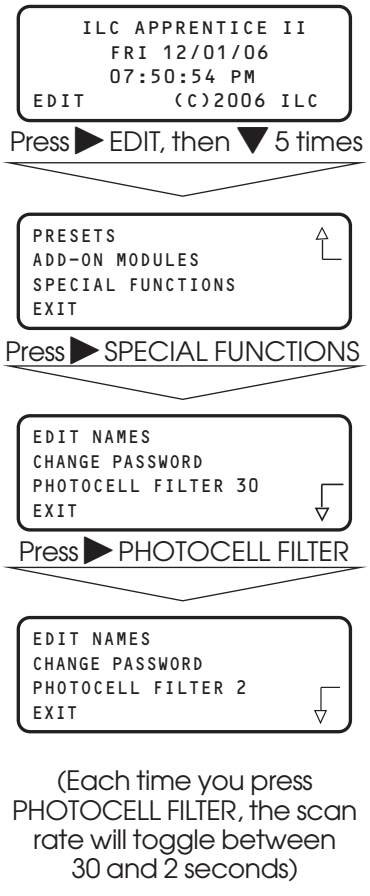


3.18 Add-On Modules

ADD-ON MODULES is a choice on the Main menu. It is of interest only if the controller is equipped with optional serial communications and/or telephone interface cards. Details of these options are discussed in the relevant appendix.



3.19 How to Enter the Photocell Filter (Scan Rate) – Fast Track



Photocell Filter (Scan Rate) Screen Flow

How to Change the LightSync™ Photocell Filter

CONCEPTS AND PARAMETERS

The controller reacts to a change of state seen by the photo sensor. To ensure switching accuracy, the controller will react only when the change of state is observed for a pre-established default duration time of 30 seconds. You may change the default duration time (30 seconds) to 2 seconds.

SAMPLE OPERATION:

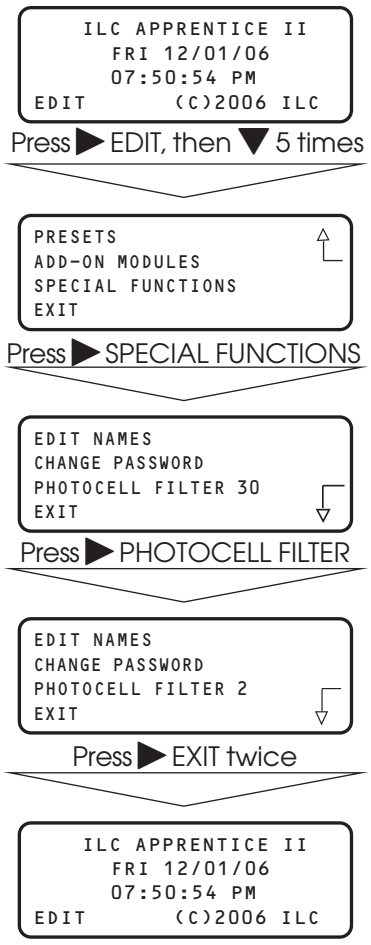
Change the Photocell Filter to 2 Seconds

1. From the Home screen, press ▶ EDIT; then press ▼ 5 times.

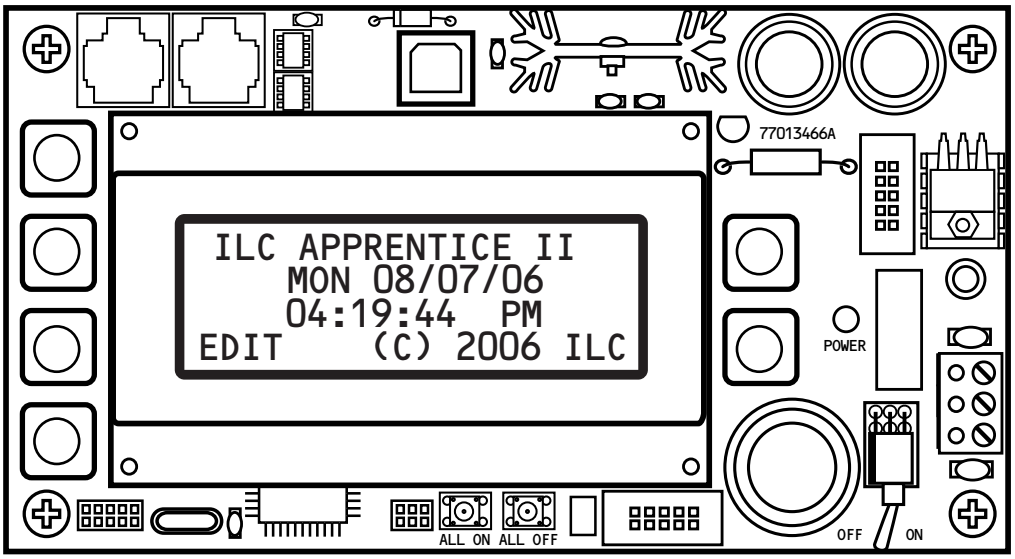
2. When the Main menu appears, press ▶ SPECIAL FUNCTIONS.

3. When the Special Functions menu appears, press ▶ PHOTOCELL FILTER to change the scan rate from 30 to 2 seconds.

4. Press ▶ EXIT twice to return to the Home screen.



Section 4
LightSync™ Switching



Section 4 LightSync Device Switching

4.0 Section Overview

This section covers installation and programming procedures required to implement LightSync™ switching via a Apprentice II controller. You should be equipped with the following tools (available from ILC):
CAT-5 Terminal Crimping Tool –
ILC Part No. (1 ea): 93000801
LanRover Pro CAT-5 Tester –
ILC Part No. (1 ea): 93000811

System Overview/Guidelines

You can control relay outputs and monitor switch and switch pilot status over the controller's communications bus. Most switch functions available via hardwired connection to the switch inputs are also available for LightSync™ switching. The Apprentice II Network supports up to 32 LightSync™ switch nodes. ***Note:*** *These addresses are separate set of addresses from the Apprentice II Expansion Panel (slave) node addresses.*

The communications media is an 8-wire 24-gauge CAT-5 cable terminated at the controller CPU Board RJ-45 female connectors. (See Figures 4.1a and 4.1b.) Run the CAT-5 cable between the controller and specially designed LightSync™ devices installed throughout the facility. (See Figure 4.4b.) There are limitations to the distance that data can travel over CAT-5 cable without loss, and distance limitations due to voltage drop associated with cable length and number of devices on the LightSync™ data line. (See Figure 4.2b for detail.) The devices are equipped with two RJ-45 connectors. Each switch must have a unique node address (01-20). (See Figure 4-5.) **NOTE**: LightSync™ switch node addresses are preset at the factory.

LightSync™ switches are available in momentary pushbutton, maintained, or key switch configurations. Switches are available with up to 6 pushbuttons mounted on a single gang plate. Key switch nodes are limited to one per gang. In addition to the switches, a LightSync™ photocell node (Figure 4.6), a 4-input switch input module (Figure 4.7), and a occupancy sensor input module (Figure 4.8) are also available. Each Apprentice II controller or expansion panel controller may power up to 8 LightSync™ switch nodes. No Apprentice II controller panel can power more than eight (8) LightSync™ devices on the data line without a Power Supply (PS), Power Supply Repeater (PSR) or LightSync Hub (each can power up to 20 additional LightSync devices). (See Figures 4.2a, b and c). PSRs are also required if the installation layout requires "T" connections (one incoming and two outgoing lines). (See Figure 4.9.)

4.1 Installation

1. Check the electrical prints and other job documentation to determine the most efficient way to route the CAT-5 cable as well as the number and location of any required repeaters.
2. Run the cable between the Apprentice II and all the LightSync™ node locations. Observe all guidelines detailed in Figure 4-2a.
3. Install the male RJ-45 connectors on the cable ends and verify the integrity of cable runs with a CAT-5 cable tester.

Note*: The Apprentice II expansion panel controller and device node address are separate sets. Therefore it is possible, for example, to have a slave node 03 and a device node 03.*

4. Set each node address and plug the cables into the appropriate controllers and device nodes.
5. Power-up the Apprentice II controller and expansion nodes. (If necessary, see Section 2 for required guidance.)
6. Program the switches and define the relay outputs/relay groups that each switch controls. (See programming information later in this section.)
7. Actuate each switch to verify correct operation.

Data Cable Requirements

Definitions:

Category 5 Cable (UTP-Unshielded Twisted Pair) – A 4 pair high-performance cable that consists of twisted pair conductors, used mainly for data transmission. Basic CAT-5 cable was designed for characteristics of up to 100 MHz. **NOTE**: The twisting of the pairs gives the cable a certain amount of immunity from the infiltration of unwanted interference.

Category 5E Cable (Enhanced) – Same as Category 5, except that it is made to somewhat more stringent standards (see comparison chart below). The Category 5E standard is now officially part of the 568A standard. Category 5 E is recommended for all new installations, and was designed for transmission speeds of up to 1 gigabit per second.

Below you will find a list of the required properties your selected cable must meet. You will also find a list of cables, which meet these criteria, from several different manufacturers. At your option you may utilize one of the below-suggested cables or have your cable supplier provide you with a suitable alternative, that meets the listed criteria.

Category 6 Cable – Same as Category 5E, except that it is made to a higher standard (see comparison chart below). Category 6 is now part of the 568A standard.

Standard 24-gauge Data Cable Performance Specification Chart:

Parameter	Category 5	Category 5E	Category 6
Specified frequency range	1-100 MHz	1-100 MHz	1-250 MHz
Attenuation	24 dB	24 dB	36 dB
NEXT	27.1 dB	30.1 dB	33.1 dB
Power-sum NEXT	N/A	27.1 dB	30.2 dB
ACR	3.1 dB	6.1 dB	-2.9 dB
Power-sum ACR	N/A	3.1 dB	-5.8 dB
ELFEXT	17 dB	17.4 dB	15.3 dB
Power-sum ELFEXT	14.4 dB	14.4 dB	12.3 dB
Return loss	8 dB	10 dB	8 dB
Propagation delay	548 nsec	548 nsec	546 nsec
Delay skew	50 nsec	50 nsec	50 nsec

Suggested Manufacturers and Data Cables:

Manufacturer	Part Number	Cable Type	Phone
Belden	7854A	CAT-5 non-plenum	800 235 3361
	1583A	CAT-5E non-plenum	
	7811A	CAT-5 plenum	
	1585A	CAT-5E plenum	Contact Cassidey Technolgies (800 464 9473), manufacturer, or local distributor
General	2137113	CAT-5 non-plenum	
	5133299E	CAT-5E non-plenum	
	5131413	CAT-5 plenum	
	6131278	CAT-5E plenum	
Hitachi	38696-8	CAT-5 non-plenum	
	38993-8	CAT-5E non-plenum	
	39419-8	CAT-5 plenum	
	38891-8	CAT-5E plenum	

If you have any questions or would like our engineers to approve your cable selection, please feel free to contact our applications department at 1-800-922-8004.

Figure 4.1a – Data Cable Requirements

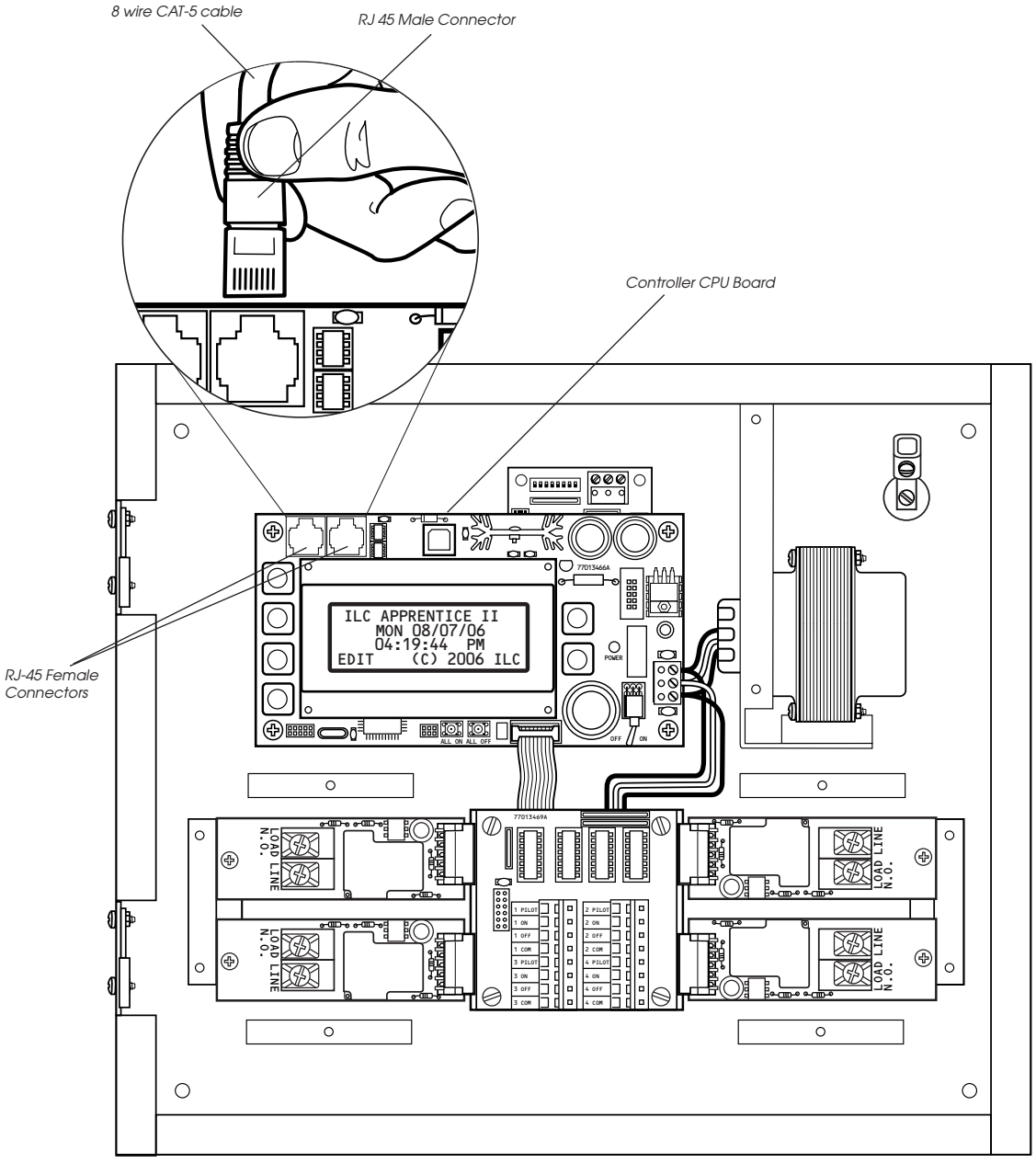


Figure 4.1b – CPU Board LightSync™ Connection Detail

ILC Power and Data Repeating Devices Overview

A **Power Supply Repeater** (PSR) is both a power supply and data repeater and its primary purpose is to repeat data and provide a bridge to another data line capable of 3000 feet end to end. This device also has one incoming and two outgoing RJ-45 ports to split the line into two different directions. The PSR also adds power to LightSync™ devices for an additional 3000 cumulative feet.

A **Power Supply** (PS) provides additional power as needed to the LightSync™ data line. This is the most efficient option to compensate for voltage drop from multiple LightSync™ devices on the data line. Note that a PS provides power only and does not repeat data.

A **LightSync™ Hub** (HUB) is a device that allows a home run configuration by providing RJ-45 ports for up to 20 LightSync™ devices, supplying power and data up to 1500 feet.

CAT-5 Data Cable and Class 2 Switch Wiring Installation Guidelines

- Observe all ILC Data Cable Requirements and LightSync™ Cable Run Distance requirements as they pertain to your project in laying out the cable runs.
- Maintain the twists of the pairs all the way to the point of termination, or no more than 1" untwisted.
- Make gradual bends of the cable, where necessary. No sharper than a 1" radius.
- Dress the cables neatly with cable ties. Use low to moderate pressure.
- Use low to moderate force when pulling cable.
- Use cable pulling lubricant for cable runs that may otherwise require great force to install.
- Keep cables away from potential sources of EMI (electrical cables, transformers, light fixtures, etc.).
- Install proper cable supports, spaced no more than 5 feet apart.
- Always label every termination point. Use a unique number for each cable segment. This will make moves, adds, changes and troubleshooting as simple as possible. Document these onto a riser.
- Always test every installed segment with a CAT-5 cable tester.
- Always leave extra slack in the cable run, neatly coiled up in the ceiling or nearest concealed place.
- Always use grommets to protect the cable when passing through metal studs or anything that can possibly cause damage to them.
- Always follow all local and national building and fire codes. Be sure to "firestop" all cables that penetrate a firewall. Use plenum rated cable where it is mandated.
- Do not pull ANY data cable or switch wires with high voltage wires.
- Keep all low voltage totally separate from ALL high voltage. Failure to do so will void the ILC warranty.
- Always contact ILC on installations between buildings or cable pulled underground. Special considerations may be needed.

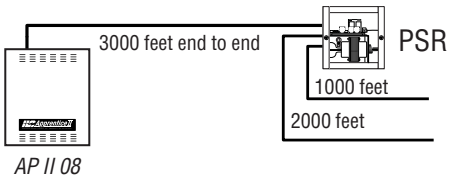
Figure 4.2a – Device Overview and Wiring Guidelines

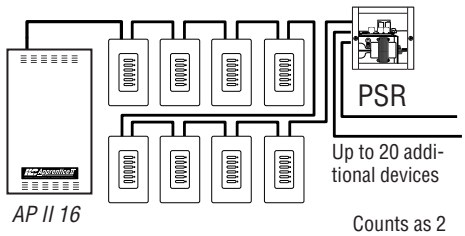
LightSync™ Network Cable Run Distance Detail

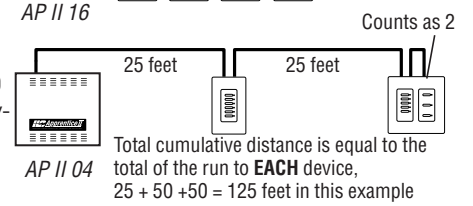
Devices that operate on ILC's LightSync CAT-5 , 5E, 6 data line include LightSync switches, photocells, and interfaces like the LightSync D-6 and SIB-4. A standard CAT-5 , 5E, 6 cable is used for the data line and provides both data and power to these devices. There are limitations to the distance data can travel over CAT-5 , 5E, 6 cable without loss, and distance limitations due to voltage drop associated with cable length and number of devices on the LightSync data line. These limitations are addressed by the addition of a Power Supply Repeater, Power Supply or LightSync Hub (see chart), depending on the application. The specific use of these devices depends on the project layout.

There are four main areas of limitation to be addressed:

1. **Total Data Line Overall Distance:** The total data line end to end distance may not exceed 3000 feet without the addition of a PSR to the data line. Only a PSR will extend the data line.
2. **Total number devices (Lightmaster panels and LightSync devices):** Total number of devices without a PSR is 32. A PSR will add 31 more devices (PSRs are counted as a device).
3. **Total number of LightSync devices powered:** No Apprentice II controller panel can power more than eight (8) LightSync devices on the data line without a PS, PSR or LightSync Hub (each can power up to 20 additional LightSync devices).
4. **Total Power Cumulative Distance:** The cumulative distance from each device to its power supply may not exceed 2000 feet if powered by a Apprentice II panel, or 3000 feet if powered by a PS, PSR or LightSync Hub.







ILC Power and Data Repeating Device	Total Data (end to end) Distance	No. of LightSync Devices Powered	Cumulative Power Distance
Apprentice II Panel	3000 feet	8	2000 feet
Power Suppy (PS)	N/A	20	3000 feet
Power Supply Repeater (PSR)	3000 feet (combined)	20	3000 feet
LightSync Hub (HUB)	1500 feet per port	20 total	1500 feet per port

ILC Power and Data Repeating Devices

A **Power Supply Repeater** (PSR) is both a power supply and data repeater and its primary purpose is to repeat data and provide a bridge to another data line capable of 3000 feet end to end. This device also has one incoming and two outgoing RJ45 ports to split the line into two different directions. The PSR also adds power to LightSync devices for an additional 3000 cumulative feet.

A **Power Supply** (PS) provides additional power as needed to the LightSync data line. This is the most efficient option to compensate for voltage drop from multiple LightSync devices on the data line. Note that a PS provides power only and does not repeat data.

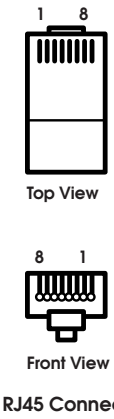
A **LightSync Hub** (HUB) is a device that allows a home run configuration by providing RJ45 ports for up to 20 LightSync devices, supplying power and data up to 1500 feet per each port.

Figure 4.2b – LightSync Network Cable Run Distance Detail

Field RJ-45 Connector Termination Detail

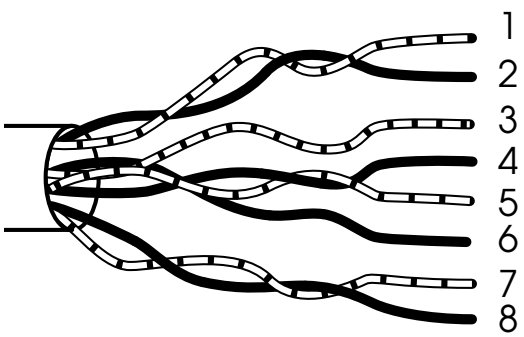
Termination instructions for RJ-45 connector to CAT-5 (or CAT-6) cable.

1. Strip cable jacket back about 2" from the end of the cable.
2. Sort the pairs so they fit into the connector in the following order.



RJ45 Connector

RJ-45 Connector Pinouts



Pin	Color
1	White /Orange
2	Orange
3	White / Green
4	Blue
5	White / Blue
6	Green
7	White / Brown
8	Brown

3. Insert the pairs through the connector.
4. Crimp the pins with a crimp tool.
5. Repeat for other end and test cable for wiring faults with a cable tester.

NOTE: DO NOT UNTWIST ANY PAIR MORE THAN ½ INCH.

To purchase industry standard CAT-5 RJ-45 Connectors, Crimp Tools and Testers, contact your local Electrical Distributor or ILC at 800 922-8004.

RJ-45 Crimping Tool: ILC Part No. (1 ea): 93000801
Cat-5 Connectors: ILC Part No. (10/pk): 56801415

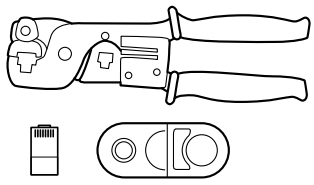


Figure 4.2c – Field RJ-45 Connector Termination Detail

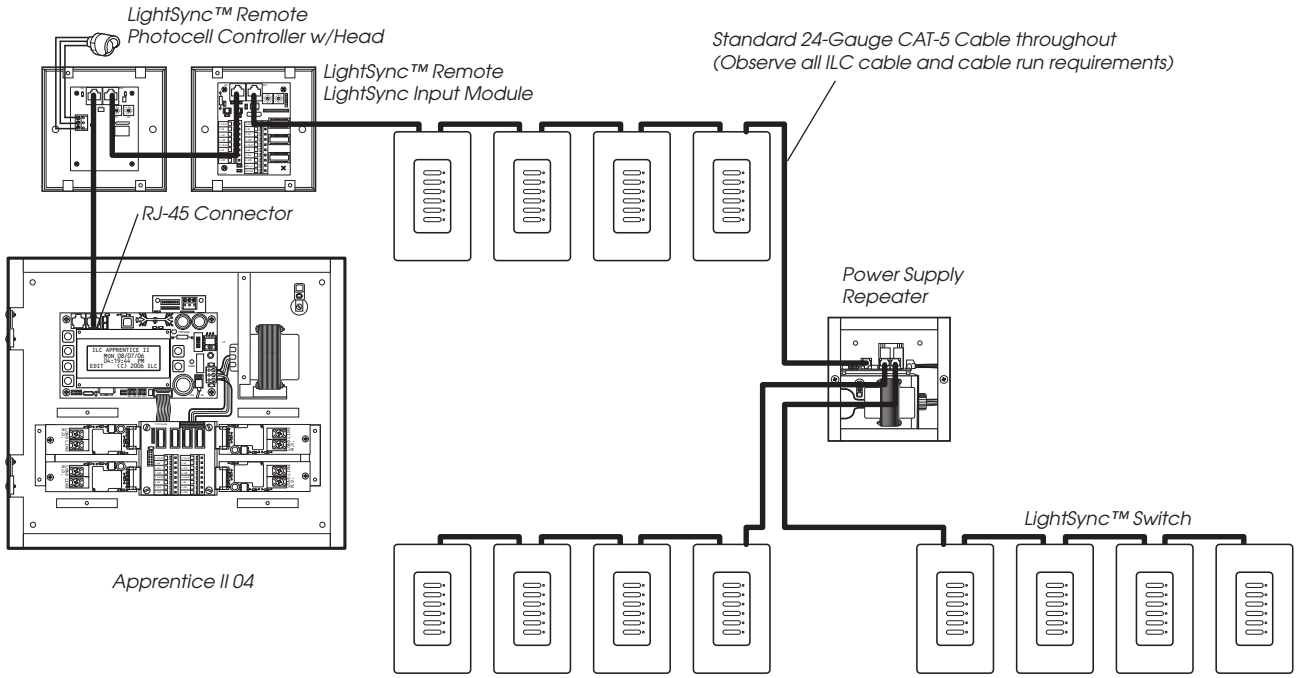


Figure 4.4a – Single Controller LightSync™ Cable Network Example

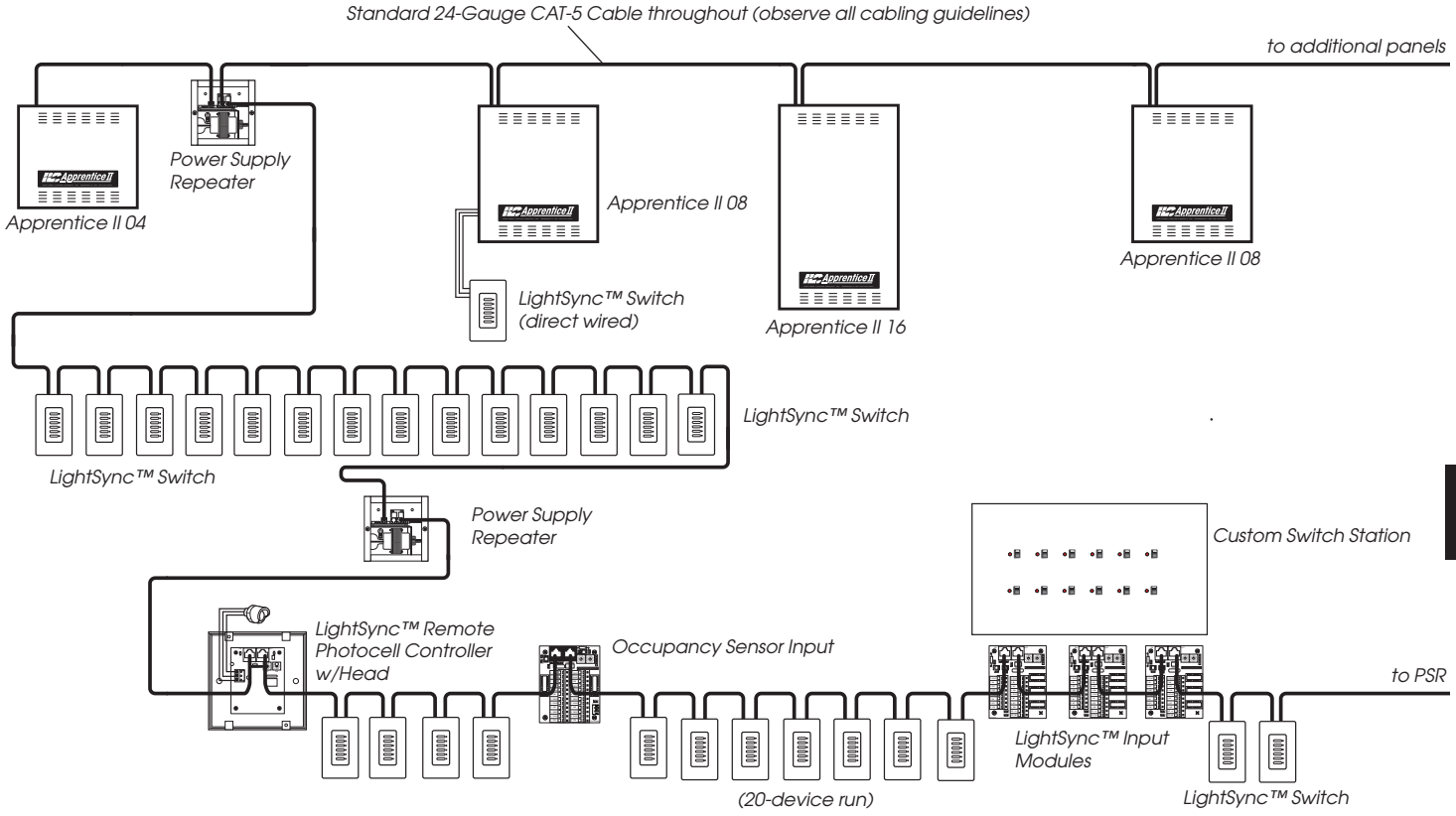
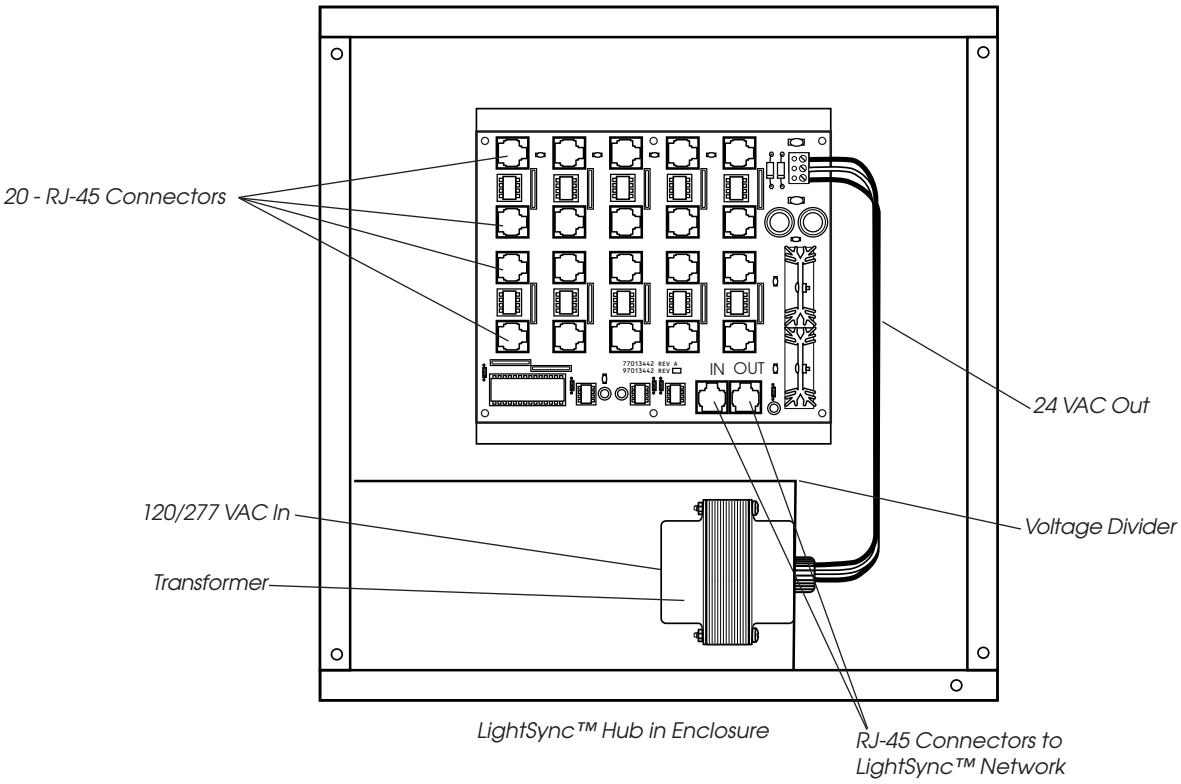
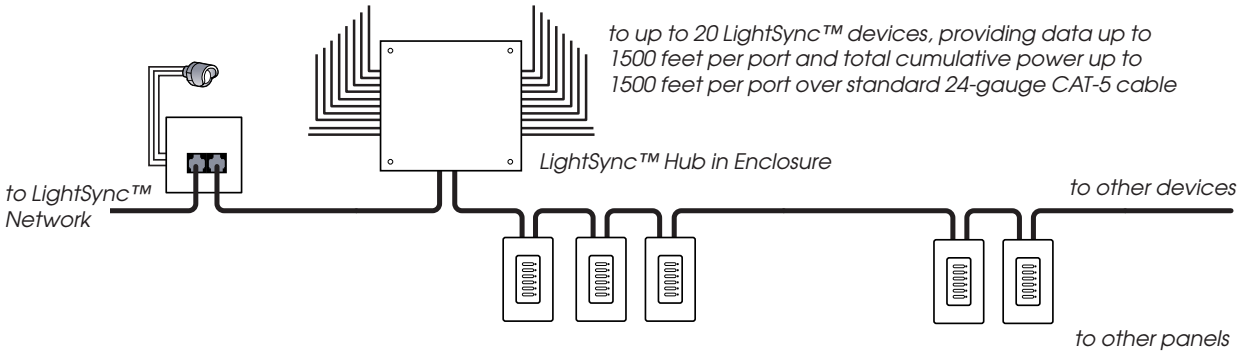


Figure 4.4b – Multiple Controller LightSync™ Cable Network Example





LightSync™ Network Example with LightSync Hub

Figure 4.4c – LightSync™ Hub Option

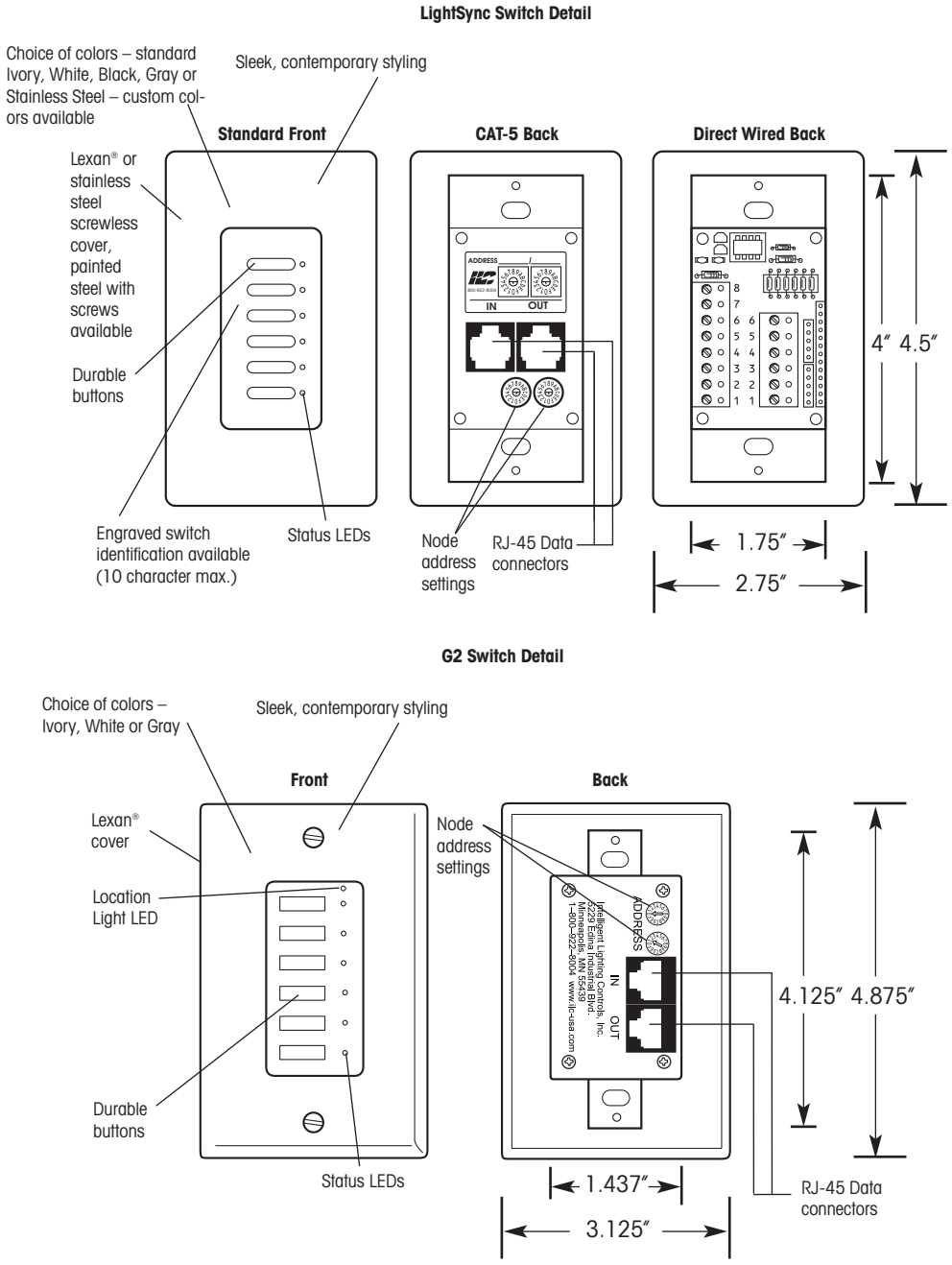


Figure 4.5 – LightSync™ Switch and G2 Switch Detail

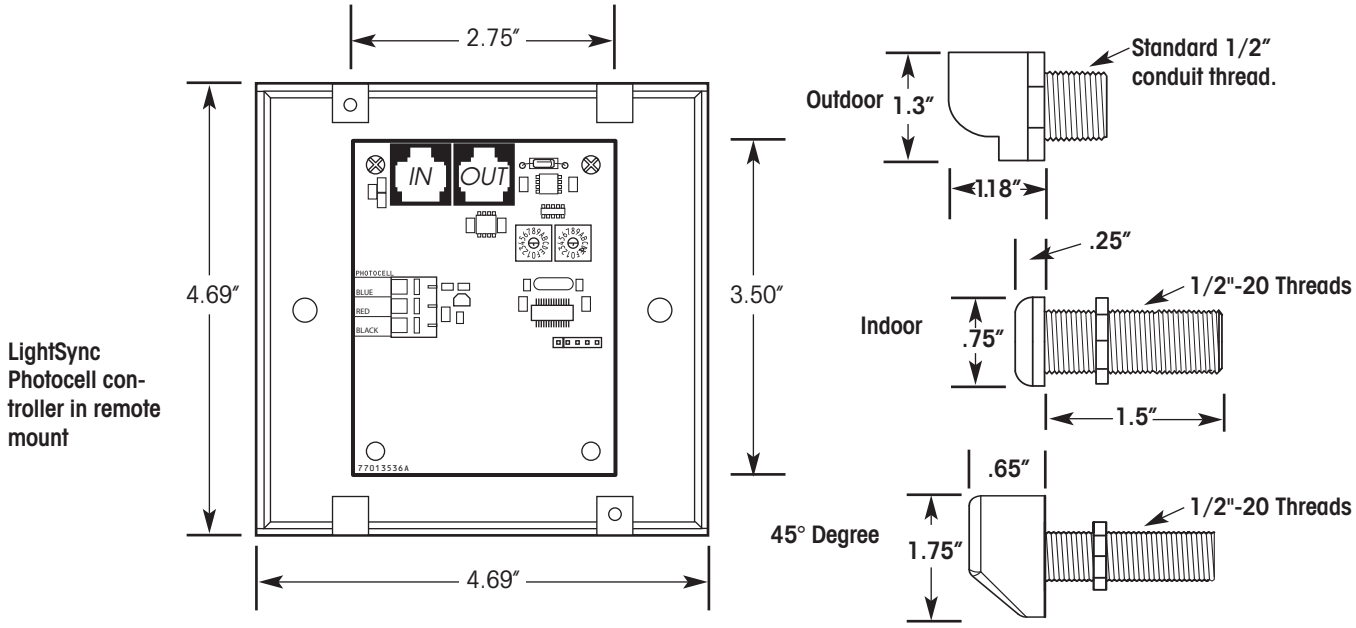


Figure 4.6 – LightSync™ Photocell Controller and Heads Detail

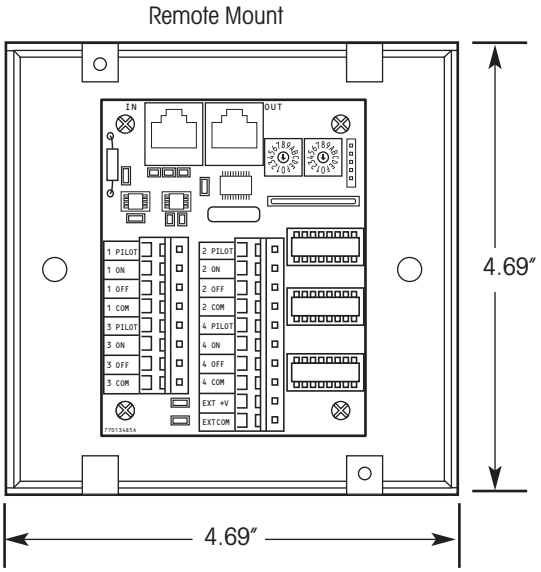


Figure 4.7 – LightSync™ Input Module

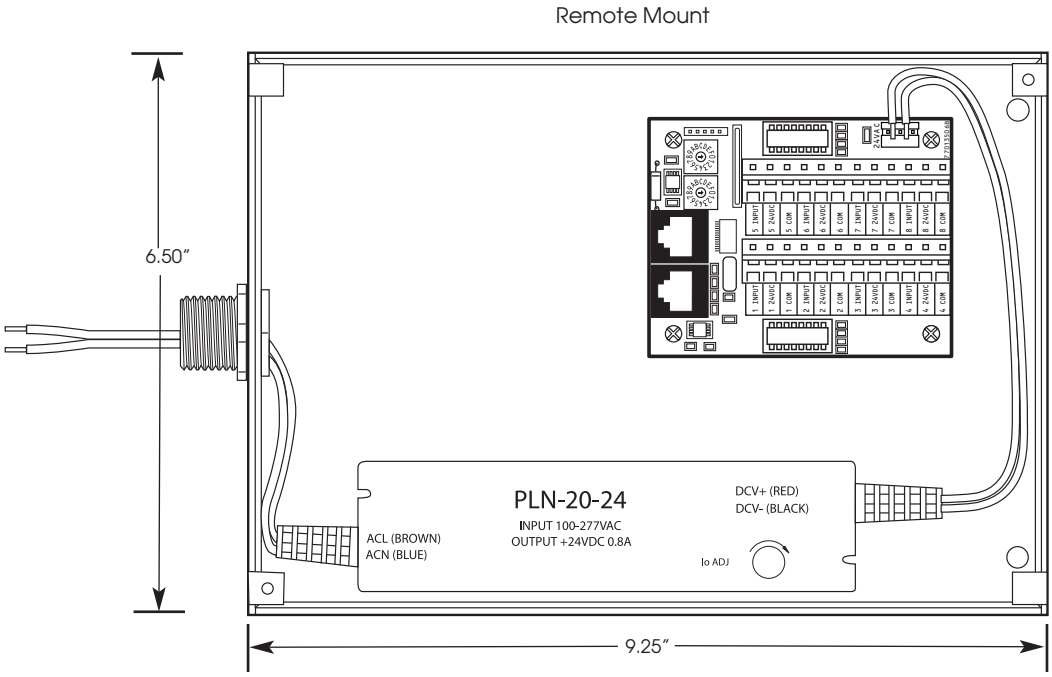


Figure 4.8 – LightSync™ Occupancy Sensor Input Module

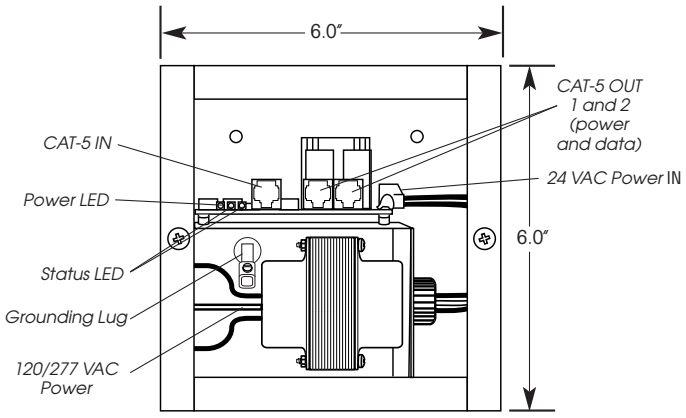


Figure 4.4 – LightSync™ Power Supply Repeater (PSR) Detail

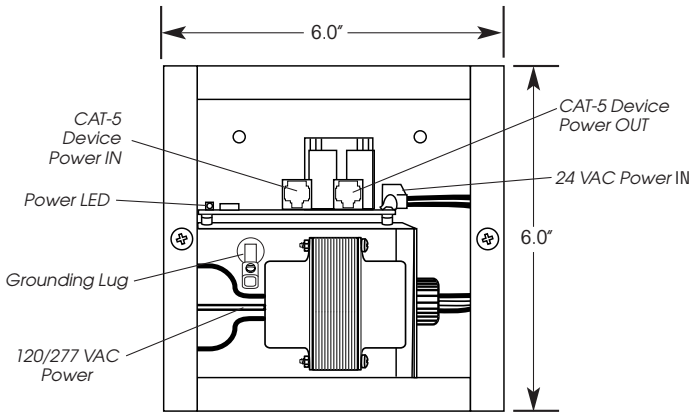


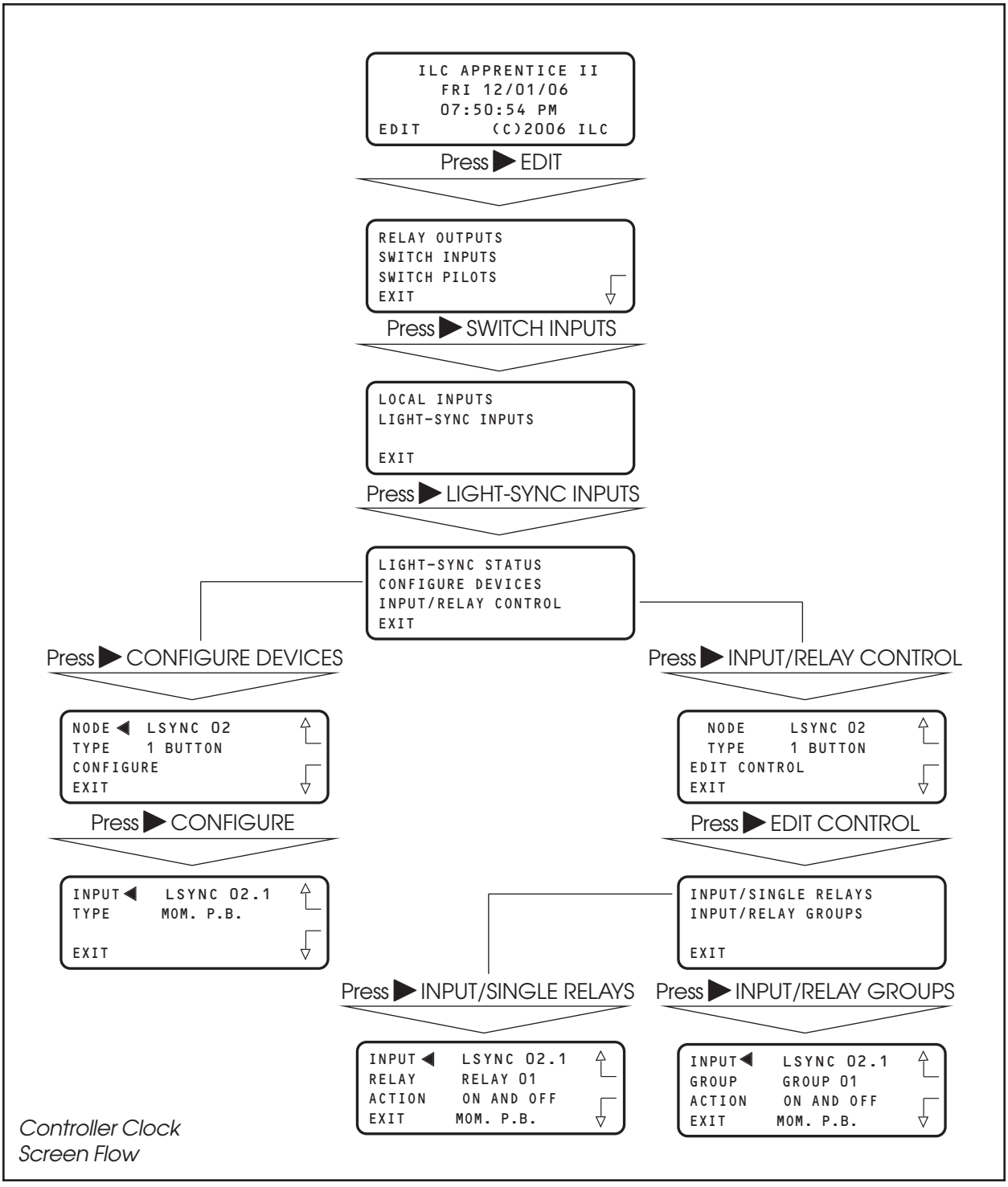
Figure 4.4a – LightSync™ Power Supply (PS) Detail

Figure 4.9 – LightSync™ Power Supply Repeater

Type	Physical	Operation
Momentary ON/OFF	LightSync Input	Momentary contact between ON and COMMON turns controlled relay outputs ON. Momentary contact between OFF and COMMON turns controlled relay outputs OFF.
Momentary Pushbutton	LightSyncSwitch, LightSync Input	Momentary contact between ON and COMMON turns controlled relays ON and OFF alternately each time contact is made.
Maintained ON/OFF	LightSync Input	When contact between ON and COMMON is made, controlled relays turn ON. When contact is broken, controlled relays turn OFF.
Photocell	LightSync Photocell Controller	Relays go ON and OFF at user-entered approximations of foot candle levels.
Set Preset	LightSync Switch, LightSync Input	When momentary contact between ON and COMMON is made, the controlled relay outputs will go to their programmed states.
HID BI-LEVEL	LightSync Input	The first contact between ON and COMMON turns the ON/OFF ballast relay ON and the HIGH/LOW ballast relay HIGH (NC default) or Low (NO default) and locks them in this position for a 15-minute warm-up period. Subsequent contact closures between ON and COMMON toggle between HIGH and LOW. Contact between OFF and COMMON locks both the ON/OFF and HIGH/LOW ballast relays OFF for 15 minutes.
Two-Step Group	LightSync Switch, LightSync Input,	Upon switch activation, Group A relays turn ON and Group B turn OFF. The following activation causes Group A to turn OFF and Group B to turn ON. The pattern repeats with each switch activation.
Four-Step Group	LightSync Switch, LightSync Input	On the first activation, Group A relays turn ON and Group B turn OFF. On the second activation, Group A relays turn OFF and B turns ON. The third activation causes both A and B to go ON. On the fourth , activation both A and B go OFF. Then the pattern repeats.
Timer Disable	LightSync Input	As long as the switch is closed, selected timers are disabled.
Timed ON	LightSync Switch, LightSync Input	When momentary contact is made between COMMON and ON, relay outputs are turned ON. When contact is broken, a timed ON duration is started from 5-999 minutes. Contact between OFF and COMMON will turn relays OFF.
Output Override	LightSync Input	As long as the switch is closed, selected relay output(s) will ignore all input, timer, or network commands.

Figure 4.10 – LightSync™ Device Types

4.2 How to Control Relays With a LightSync™ Switch – Fast Track



Controller Clock Screen Flow

How To Control a Relay or Relay Group From a LightSync™ Switch Node

CONCEPTS AND PARAMETERS

To control a relay or relays from a LightSync™ line switch node, you must:

1. Define the selected switch node.

2. Select the relay output or relay group that the switch node controls.

3. Define how the switch node will control the relay.

LIGHTSYNC NODE CONTROL: PARAMETERS/OPTIONS:

NODE = 1 of 32 possible controller switch node addresses. (01-20 Hex.) Note that nodes containing more than one device have address hard encoded suffixes to differentiate the devices. For example, the third pushbutton of a 6 pushbutton station you address as node 06 would be 6.3.

TYPE (node) = the physical configuration of the node – 1-6 pushbutton station, 4 input switch station (SIB-4), 6 unit I/O unit (D-6), data line photocell.

CONFIGURE = the process of defining the parameters of each device making up the switching node.

INPUT = the node address of the device, which is to control the Relay or Relay group.

TYPE (functional) = the operational characteristics of the input. (See Table 4-10 for possible choices.)

RELAY = 1 of 48 possible controller relay outputs.

RELAY GROUP = a user-defined group of relay outputs that will react as a group to a switch or timer signal.

ACTION = how the switch actuation will affect the relay. (Default is NO ACTION.) Other possible responses are ON ONLY, OFF ONLY, ON AND OFF, BLINK ALERT.

SAMPLE OPERATION:
Control a Single Relay Output From a Switch Node

Define the LightSync™ Switch Node:

1. From the Home screen, press ▶ EDIT.

2. When the Main menu appears, press ▶ SWITCH INPUTS; then press ▶ LIGHT-SYNC INPUTS.

3. From the Switch Input menu, press ▶ CONFIGURE DEVICES.

4. When the top level configuration screen appears, press ▲ or ▼ until the switch node address you want to define appears.

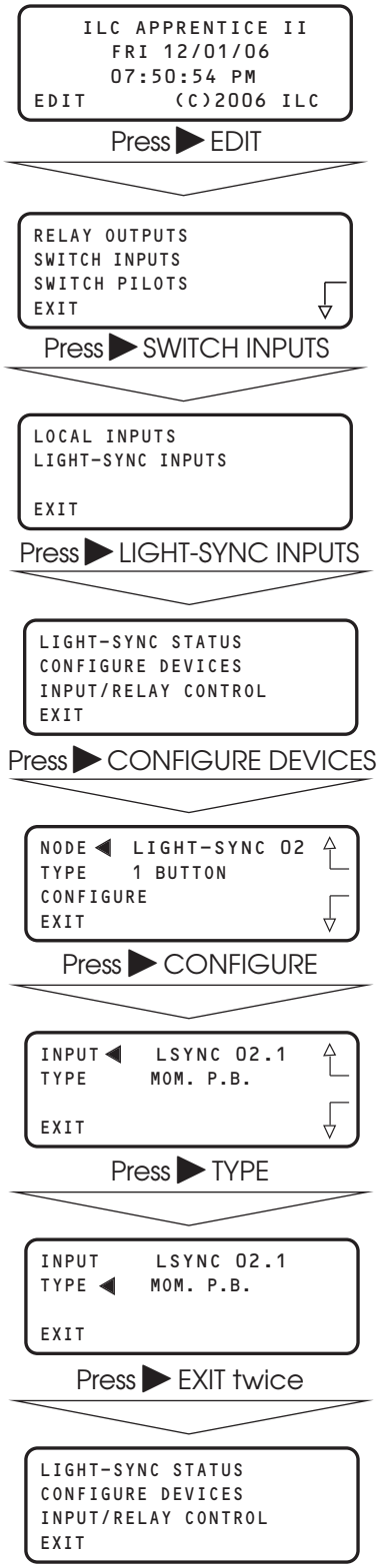
5. Press ▶ TYPE; then press ▲ or ▼ until the physical switch node type appears.

6. Press ▶ CONFIGURE to access the second configuration screen.

7. If necessary, press ▲ or ▼ until the sub-address of the device you want to define appears. ***NOTE****: On multi-device nodes, each device will have a distinct sub-address, which can be assigned its own function switch type. For example: in a 3-button pushbutton addressed as 06, the buttons would be 06.1, 06.2, and 06.3, respectively.*

8. Press ▶ TYPE; then press ▲ or ▼ until the desired functional switch type appears. Note: Functional switch types are limited by the physical node type. (See Table 4-10.)

9. Press ▶ EXIT twice to return to the LightSync™ Input menu.



SAMPLE OPERATION:
Control a Single Relay Output From a Switch Node

Select the Relay That the Switch Node Controls:

1. From the LightSync Input menu, press ▶ INPUT/RELAY CONTROL; press ▲ or ▼ to select device; then press ▶ EDIT CONTROL. On the next screen, press ▶ INPUT/SINGLE RELAYS.

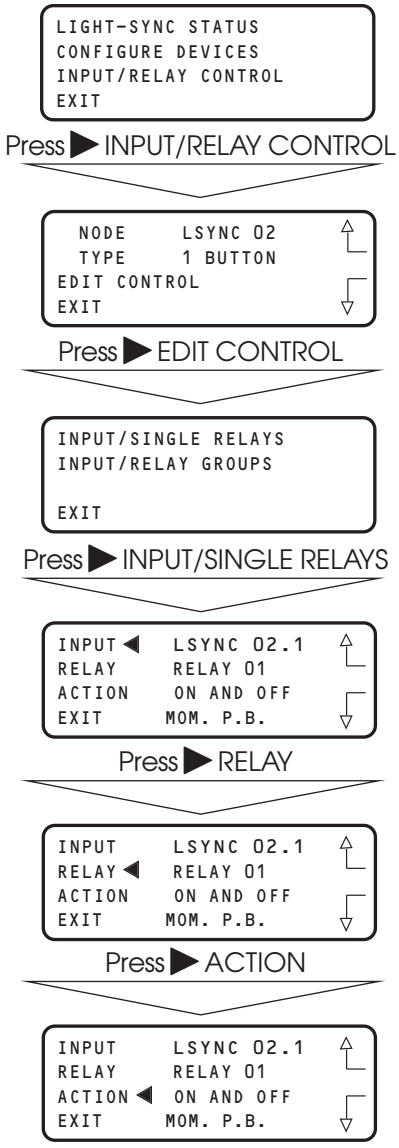
2. Press ▲ until the input that controls relay(s) appears.

3. Press ▶ RELAY; then press ▲ or ▼ until the relay to be controlled appears.

4. Press ▶ ACTION; then press ▲ or ▼ until the desired relay action appears.

5. Repeat steps 3 and 4 for any additional relays controlled by the input.

6. Press ▶ EXIT 6 times to return to the Home screen.



SAMPLE OPERATION:

Control a Relay Group From a LightSync™ Switch Node

Define the LightSync switch node as already described; then select the relay group that the switch node controls. NOTE: Be sure the relay group you wish to control has been previously defined. (See Sample Operation – How to Define a Relay Group in Section 3)

1. From the LightSync Input menu, press ▶ INPUT/RELAY CONTROL; press ▲ or ▼ to select device, then press ▶ EDIT CONTROL.

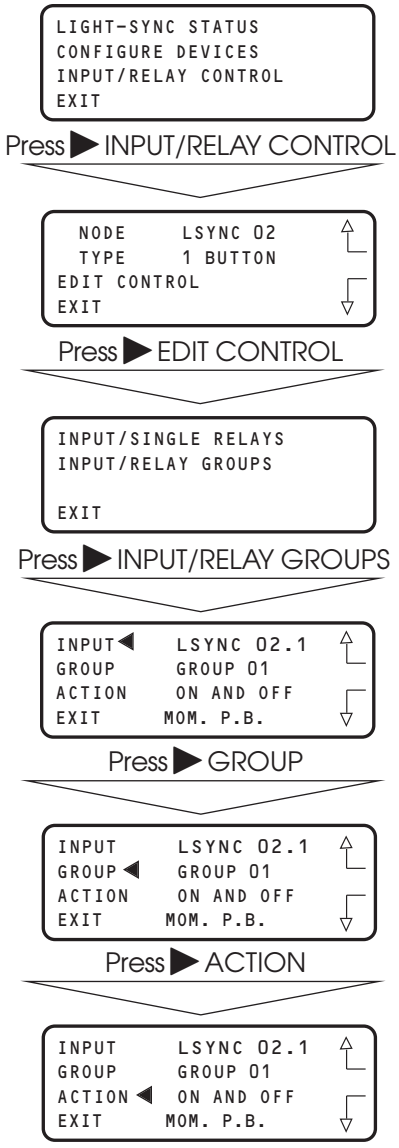
2. When the Single Relay/Relay Group Control menu appears, press ▶ INPUT/ RELAY GROUPS.

3. Press ▲ or ▼ until the input that controls relay(s) appears.

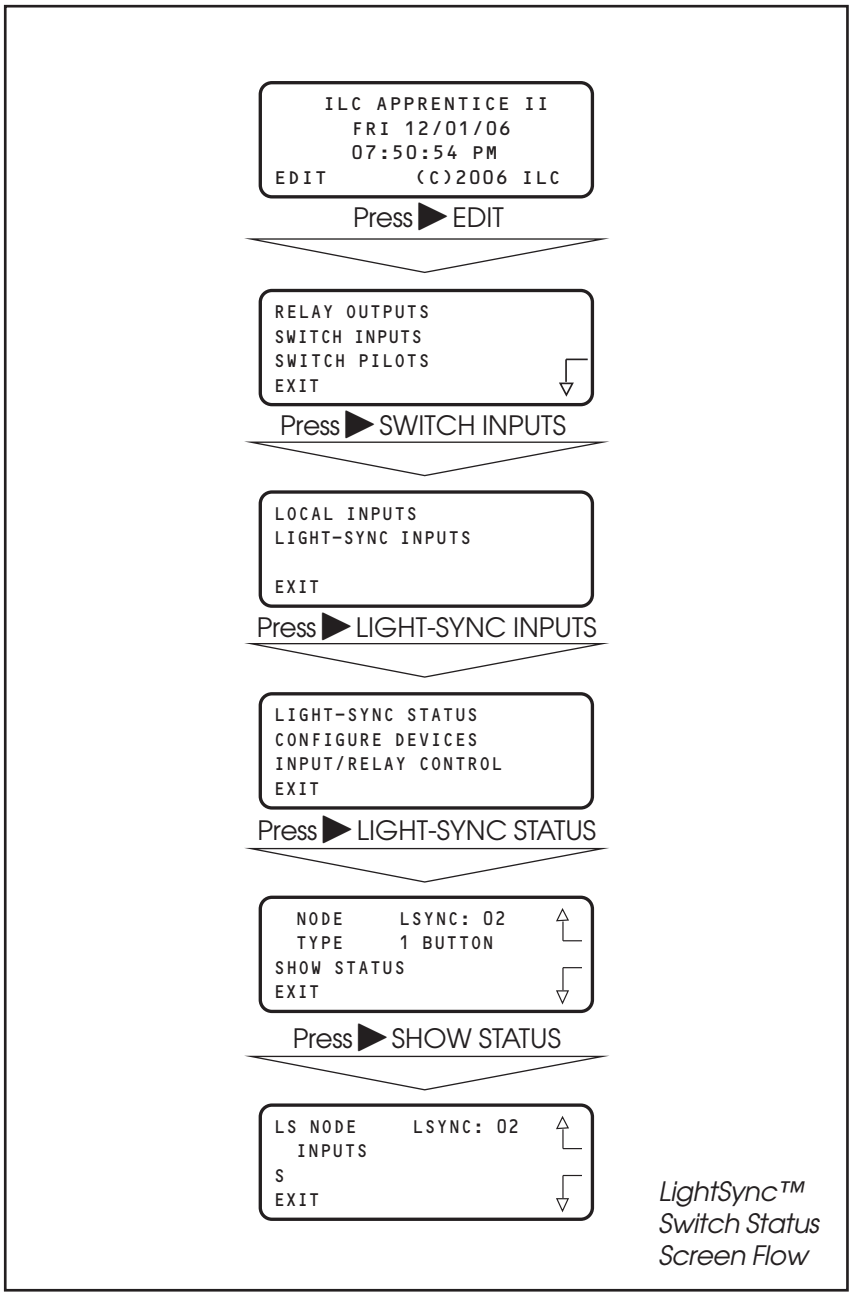
4. Press ▶ GROUP; then press ▲ or ▼ until the relay group to be controlled appears.

5. Press ▶ ACTION; then press ▲ or ▼ until the desired relay group action appears.

6. Repeat steps 3 and 4 for any additional relay groups controlled by the input.



4.3 LightSync™ Switch Status – Fast Track



LightSync™ Switch Status Screen Flow

LightSync™ Switch Status

CONCEPTS AND PARAMETERS

You can view the current status of each switch input.

Parameter Key:

NODE = 1 of 32 possible switching nodes.

SHOW STATUS = display the status of the selected switch node.

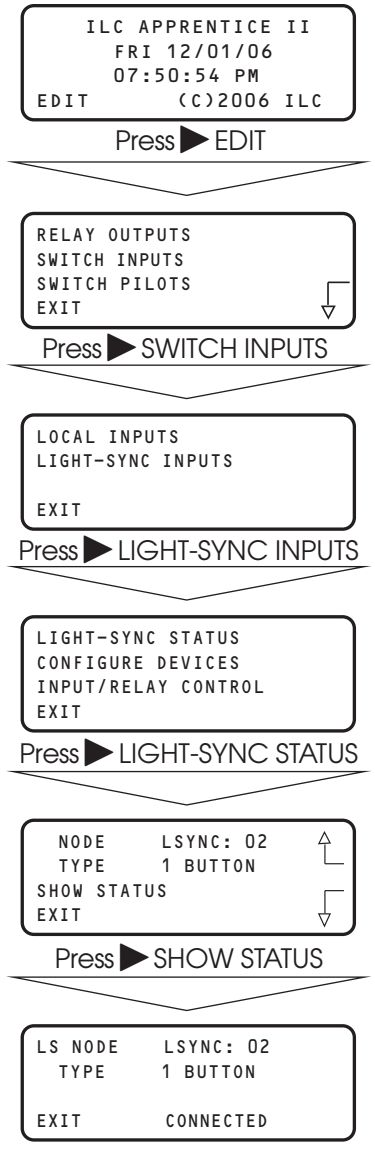
CONNECTED = the switch is on the RJ-45 data line and capable of activation.

SAMPLE OPERATION:

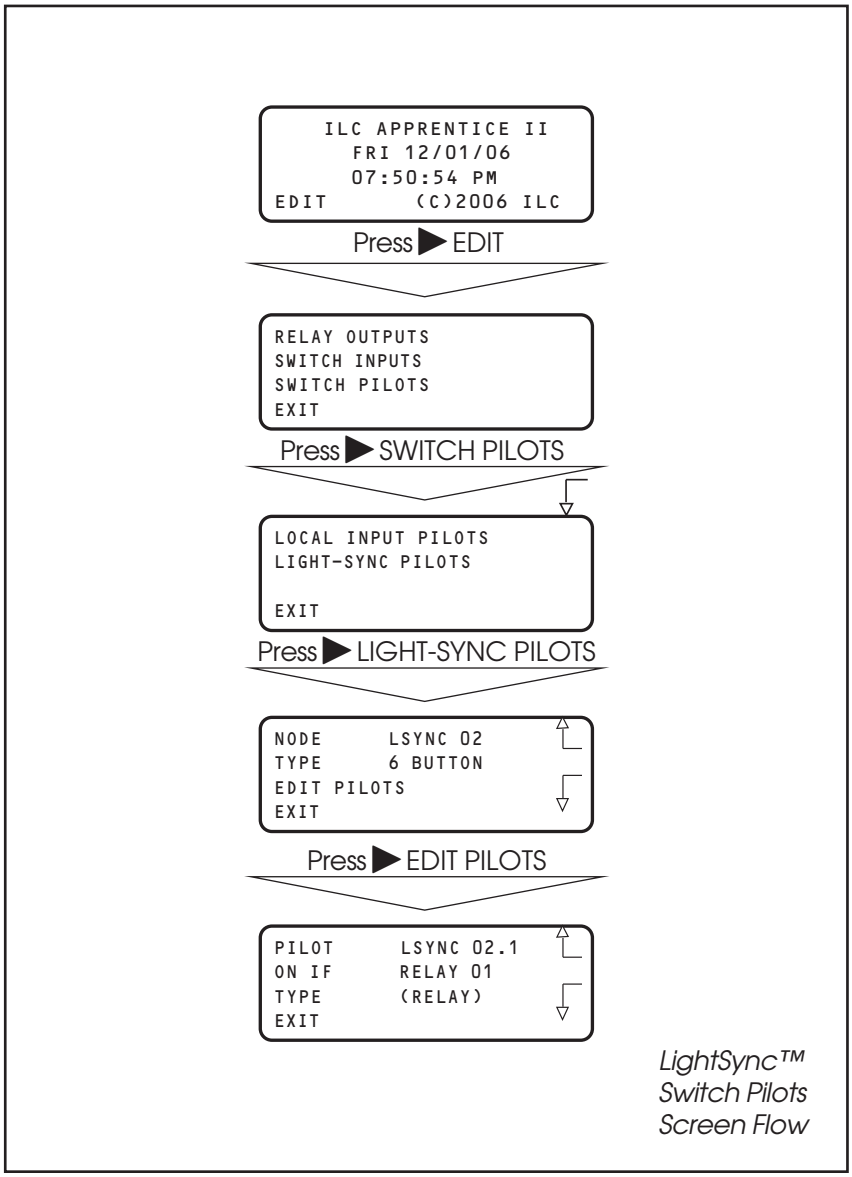
Check the Current Status of a Switch Input

1. From the Home screen, press ▶ EDIT.
2. From the Main menu, press ▶ SWITCH INPUTS; then press ▶ LIGHT-SYNC INPUTS.
3. From the Switch Input menu, press ▶ LIGHT-SYNC STATUS.
4. When the Switch Input Status screen appears, press ▲ or ▼ until the LightSync™ node you want to check appears.
5. Press ▶ SHOW STATUS to check the status of the node.
6. Press ▶ EXIT 5 times to return to the Home screen.

NOTE: For a momentary pushbutton switch, the screen momentarily displays the switch number when the button is pushed.



4.4 LightSync™ Switch Pilots – Fast Track



LightSync™ Switch Pilots Screen Flow

How to Define a LightSync™ Switch Pilot

CONCEPTS AND PARAMETERS

You can program how the pilot lights located on the LightSync™ switches react or operate.

Some users prefer the switch pilots to be ON all the time (example: location light). Some users prefer that the pilot LED be ON only when the load or group switched has been switched ON.

To define a switch pilot, you must:

1. Select the LightSync™ switch pilot.
2. Select the relay output, relay group or preset that is to light the selected switch pilot.

Parameter Key:

PILOT = the number of the switch input pilot (1-6) located on a LightSync™ switch.

ON IF = the number of the relay, relay group, or preset that will actuate the switch pilot (1-48).

TYPE = the type of actuator: relay output, group, preset or static. *(Relay is the default.)*

STATIC = the user has the option of locking the switch pilots into either Always ON or Always OFF. *(Always OFF is the default condition.)*

SAMPLE OPERATION:

Program a Status LED to Light When a Preset Is ON

1. From the Home screen, press ▶ EDIT.

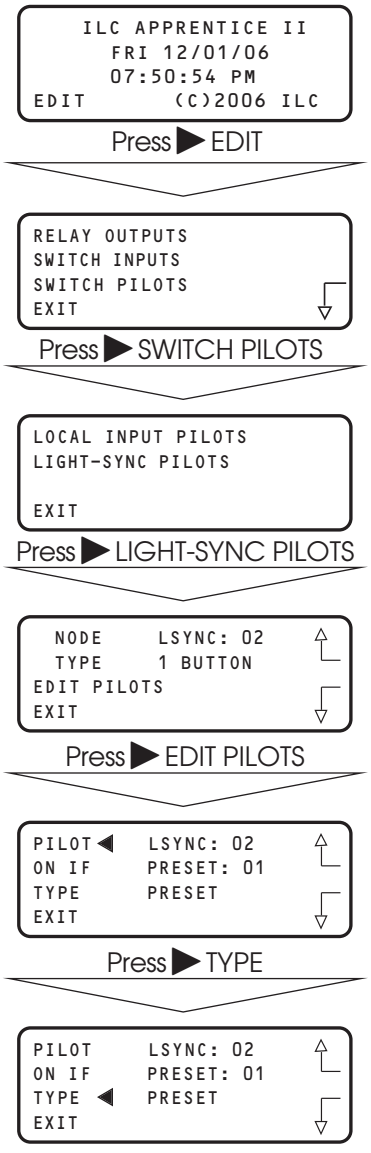
2. When the Main menu appears, press ▶ SWITCH PILOTS; then press ▶ LIGHT-SYNC PILOTS; then press ▲ or ▼ to select device.

3. When the top level Pilot definition screen appears, press ▶ EDIT PILOTS

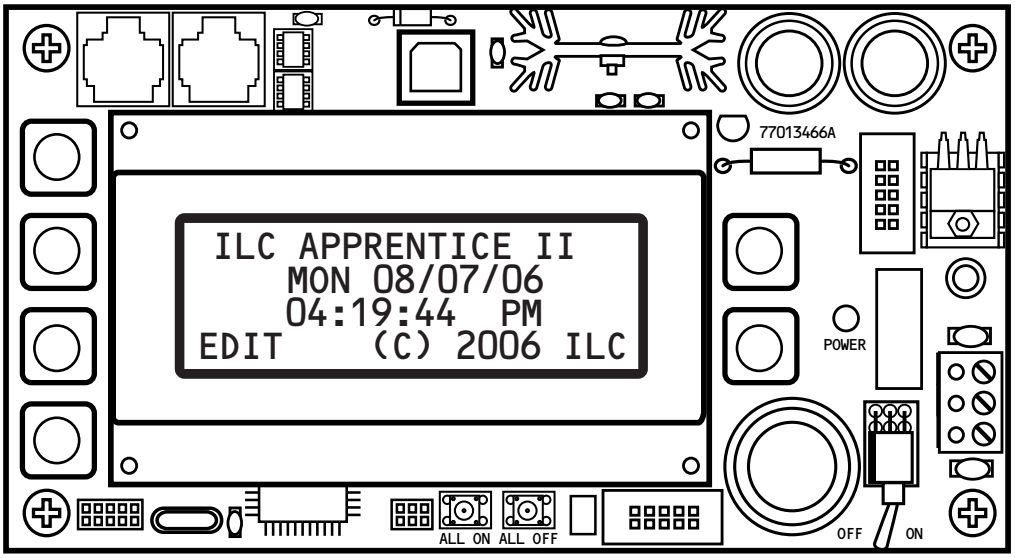
4. From the Pilot Edit Screen, press ▲ or ▼ to select the Input.

5. Press ▶ TYPE until PRESET appears.

6. Press ▲ or ▼ until the desired preset appears.



Section 5
Appendix



Section 4 Appendix

The FCC requires that the following statement be included in this manual.
FCC Registration #6TP USA-35522-DM-N
Ringer Equivalence 0.4B

Connecting to the telephone company

This equipment complies with Part 68 of the FCC rules. On the back plate near the RJ 11 jack of this equipment is a label that contains, among other information, the FCC registration number and ringer equivalence (REN) for this equipment. If requested, provide this information to your telephone company.

The REN is useful to determine the quantity of devices that may be connected to the telephone line. Excessive RENs on the telephone line may result in devices not ringing in response to an incoming call. In most, but not all areas, the sum of RENs of all devices should not exceed five (5). To be certain of the number of devices that may be connected to a line, as determined by the total RENs, contact the local telephone company.

If your telephone equipment causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But if advance isn't practical, you will be notified as soon as possible. You will be advised of your right to file a complaint with the FCC if you believe it is necessary.

Your telephone company may make changes in your facilities, equipment, operations, or procedures that could affect he operation of your equipment. If they do, you will be given advance notice so as to give you an opportunity to maintain uninterrupted service.

If you experience trouble with this telephone equipment, please contact: Intelligent Lighting Controls, Inc./Reliant Relay Co., Technical Support Department at 1-800-922-8004 for repair and warranty information. If your equipment is causing harm to the telephone network, the telephone company may request that you disconnect the equipment until the problem is resolved.

This equipment may not be used on public coin service provided by the telephone company. Connection to party lines is subject to state tariffs. (Contact your local state public utility commission or corporation commission for information.)

NOTICE: The Industry Canada label identifies certain equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. The Industry Canada does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local t elecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line of individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designed by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

CAUTION: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

The Ringer Equivalence Number (REN) assigned to each terminal device provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the Ringer Equivalence Numbers of all the devices does not exceed 5.

A.1 Overview

The telephone Add-On Module is an optional board that is easily added to the ILC Apprentice II controller. This module supports dual-tone multi-frequency (DTMF) touchtone telephone control and monitoring. The module plugs into the expansion port provided on the ILC Apprentice II controller CPU board. (See Figure A-2.)

A.2 Voice/DTMF Control Features

This Add-On Module supports the following touchtone telephone control features:

- Get the current status of the controller's relay outputs
- Turn ON or OFF single relays or groups of relays
- Get the current status of the controller's switch inputs
- Activate preset scenes

DTMF commands and control functions are supported by voice prompts that guide you through operational commands and give you instructions on how to use the system.

A.3 Voice/DTMF Control Setup

1. The ILC Apprentice II must be equipped with a Voice/DTMF Add-On Module. Locate the card on the controller's processor board. (See Figure A.2.)
2. Connect a phone cord to the module's RJ11 jack and connect the other end to the telephone outlet. **The telephone line must be an analog line and have its own phone number. The line must be direct and not switched through a PBX or any type of extension system.**
3. Dial the telephone number of the controller.
4. When the controller answers, follow the voice prompts that will guide you through the operations you can perform.

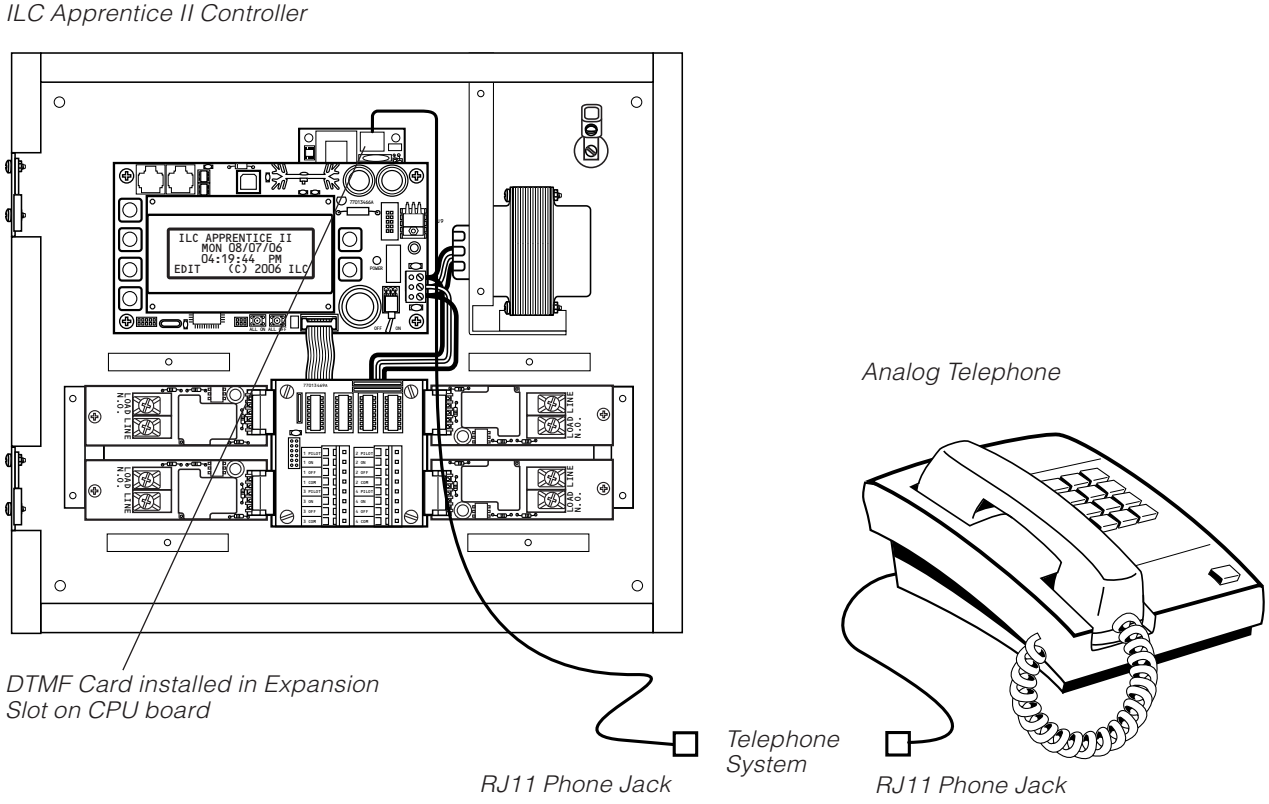


Figure A.1 – DTMF Phone Control

A.4 Voice Prompts for Standalone DTMF Control

When you dial in to the controller you will hear the following voice prompts (prompts in bold):

ILC Elite press 1 (press 1)

(Main Menu)

For relay status and control press 1
(Enter the relay number follwed by the # key or press * to return to the main menu)
For presets press 3
(Enter the preset number follwed by the # key or press * to return to the main menu)
For group control press 4
(Enter the group number follwed by the # key or press * to return to the main menu)
To end this call press #
To repeat this menu press *

(Sub Menus)
(If "1" is pressed on the Main Menu):

Enter the relay number followed by the # key or press * to return to the Main Menu
(Press 01-48 for relays 1-48. The current status of the cosen relay will then be stated.)

Relay __ is ON, to turn OFF Relay __ Press 2. To return to the main menu, press 9

Relay __ is OFF, to turn ON Relay __ Press 1. To return to the main menu, press 9

(If "3" is pressed on the Main Menu):

Enter the preset number followed by the # key
(Press 01-48 for the desired preset)
Preset __ has been activated
(It will then automatically go back to the Main Menu)

(If "4" is pressed on the Main Menu):

Enter the group number followed by the # key
(Press 01-48 for the desired group)
To turn ON Group press 1, to turn OFF Group press 2, to return to the Main Menu press 9.

A.4.1 Control Codes

Use the telephone keypad to enter the following control codes:

- Relay Codes (2 digits)
  Code designates which relay in the panel you want to control (01-48)
  Sample: Enter code 12 to control relay 12
- Preset codes (2 digit)
  (see Page 3-57 for information on how to define a preset)
  01-48
  Sample: Enter code 31 to set Preset 31
- Group codes (2 digit)
  (see Page 3-20 for information on how to define a relay group)
  01-48
  Sample: Enter code 22: you will be prompted to push 1 to turn ON Group 22 or push 2 to turn OFF group 22

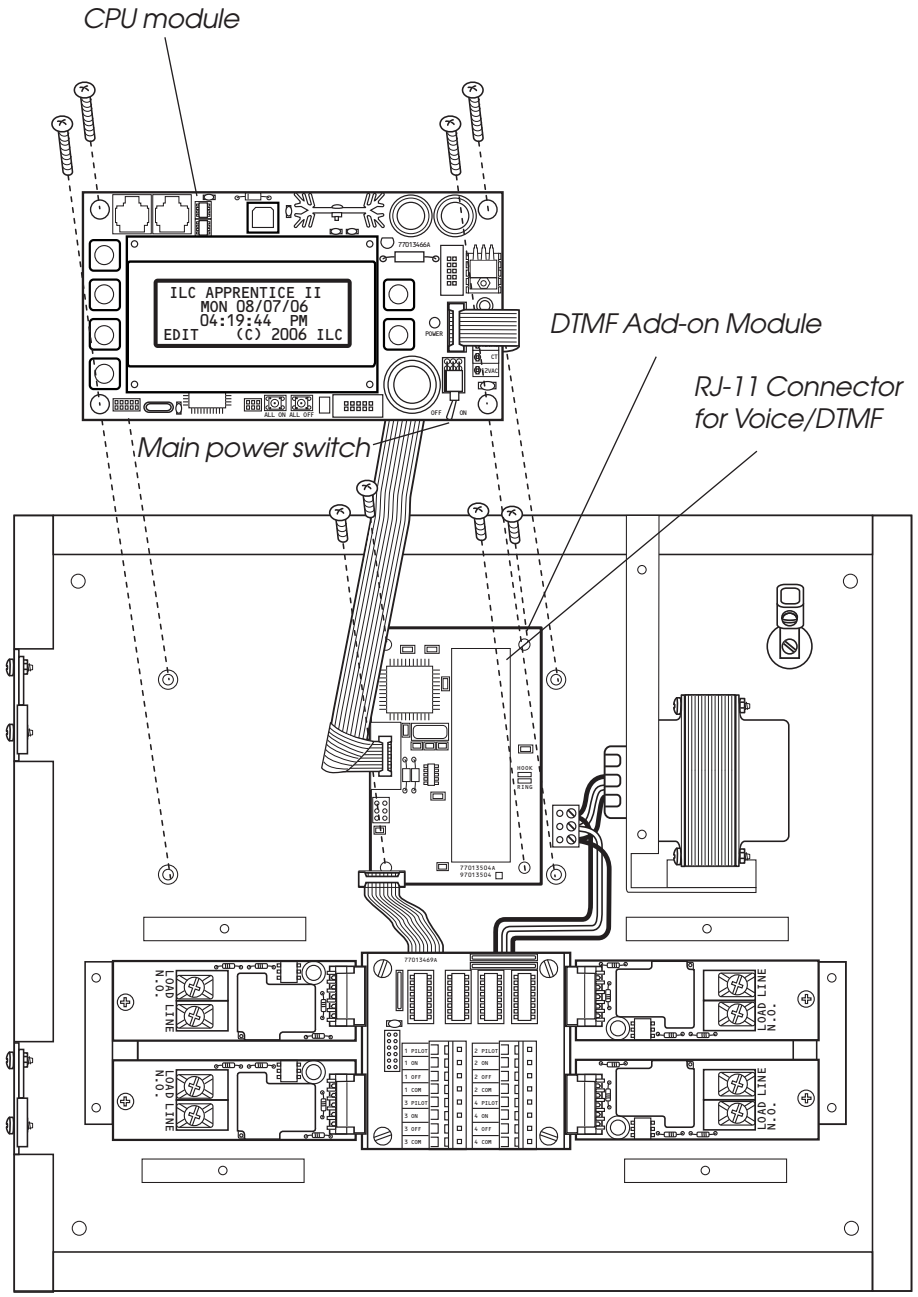


Figure A.2 – Voice/DTMF Module Installation

Overview

B.1 Overview

BACnet is an open protocol developed by Ashrae for building automation and control systems. Apprentice II BACnet MSTP or IP modules give you direct control of all of the panels on the network. With this module, commands can be sent to the panel to force relays On and OFF, force relays On and OFF with a timer option (blink, double blink, HID delay, Alarm On, Alarm OFF, Pulse On, and Pulse OFF), monitor relay status, monitor input status, and enable/disable inputs.

B.2 Hardware

The Apprentice II BACnet module consists of a FieldServer ProtoCessor module that directly connects to the main processor via a ribbon cable and multi-pin connector. This interface is provided with a 5VDC power supply that derives its power from the 24VAC control transformer. The module is provided with connectors for interfacing the IP or MSTP communications. See Figure B.1

B.3 Hardware Setup

The controller will automatically sense and enable communication for the system. To verify that the interface is communicating to the panel follow the menu shown in figure B.2

B.4 Configuration

The BAS interface may desire a specific node address, IP address. Please refer to the BACnet configuration file supplied for more information on adjusting these settings.

B.5 Point Map

Refer to Table B.1 for the points that the BAS system can read or write. These points read the entire network of panels as if it is a single panel.

ILC Apprentice II BACnet Communications

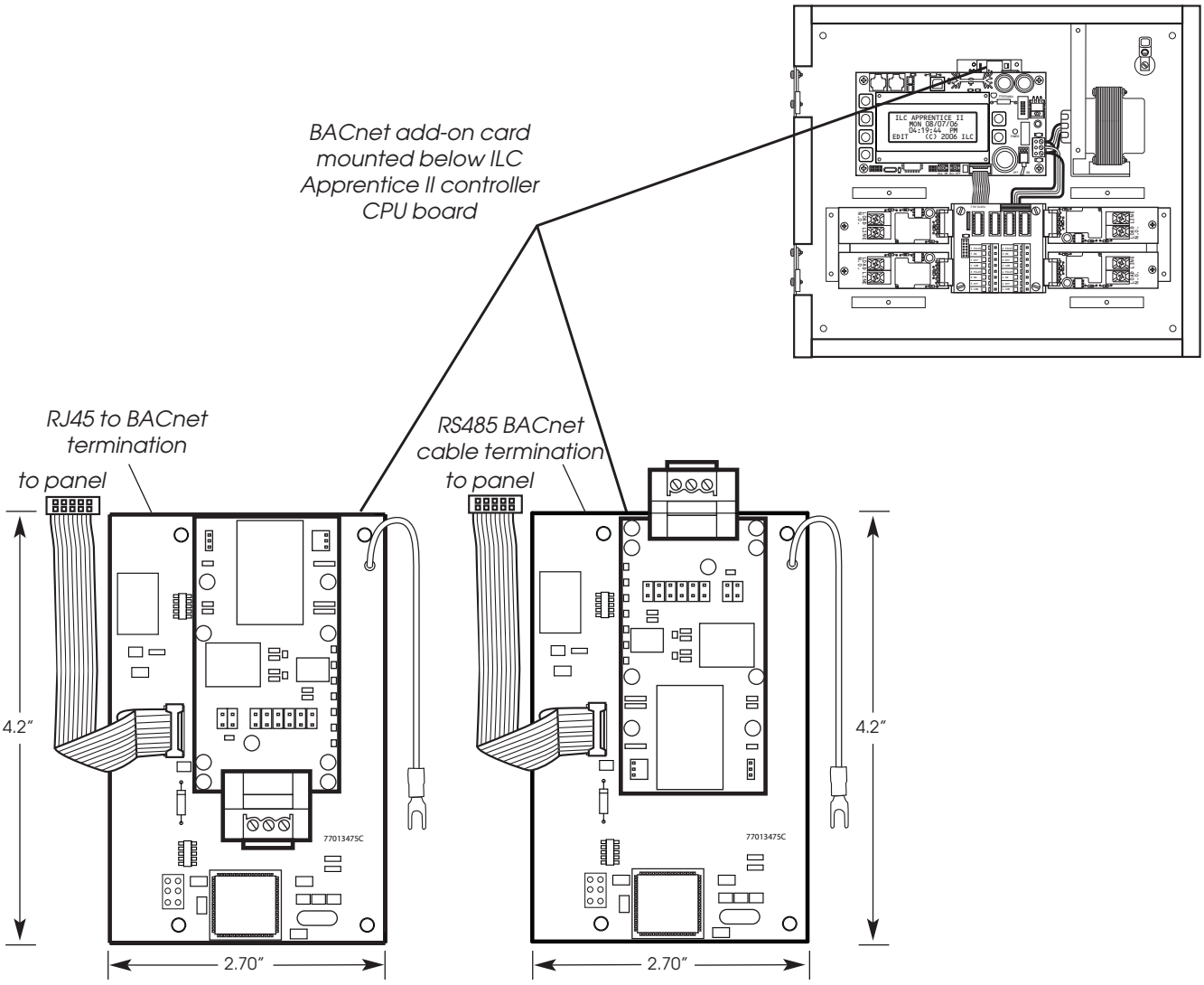


Figure B.1

BACnet – Fast Track

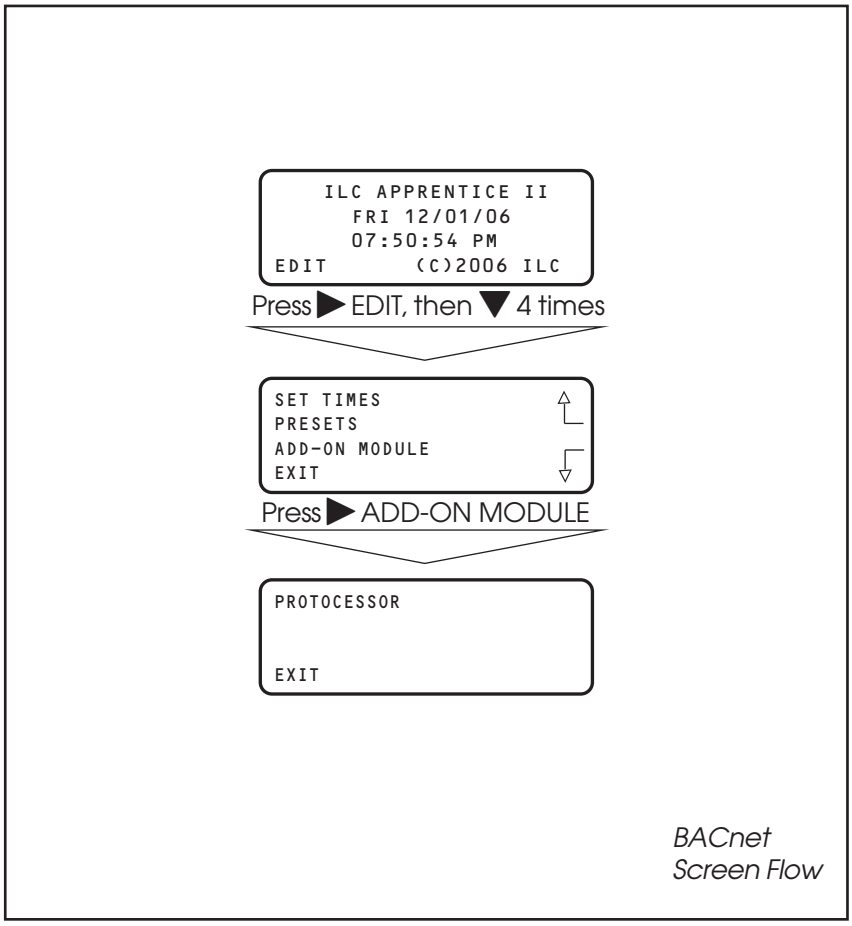


Figure B.2

Apprentice II Input	ON Point	OFF Point		
1	SMD_DI_10001	SMD_DI_10049	1 = Input Closed	0= Input Open
2	SMD_DI_10002	SMD_DI_10050	1 = Input Closed	0= Input Open
3	SMD_DI_10003	SMD_DI_10051	1 = Input Closed	0= Input Open
4	SMD_DI_10004	SMD_DI_10052	1 = Input Closed	0= Input Open
5	SMD_DI_10005	SMD_DI_10053	1 = Input Closed	0= Input Open
6	SMD_DI_10006	SMD_DI_10054	1 = Input Closed	0= Input Open
7	SMD_DI_10007	SMD_DI_10055	1 = Input Closed	0= Input Open
8	SMD_DI_10008	SMD_DI_10056	1 = Input Closed	0= Input Open
9	SMD_DI_10009	SMD_DI_10057	1 = Input Closed	0= Input Open
10	SMD_DI_10010	SMD_DI_10058	1 = Input Closed	0= Input Open
11	SMD_DI_10011	SMD_DI_10059	1 = Input Closed	0= Input Open
12	SMD_DI_10012	SMD_DI_10060	1 = Input Closed	0= Input Open
13	SMD_DI_10013	SMD_DI_10061	1 = Input Closed	0= Input Open
14	SMD_DI_10014	SMD_DI_10062	1 = Input Closed	0= Input Open
15	SMD_DI_10015	SMD_DI_10063	1 = Input Closed	0= Input Open
16	SMD_DI_10016	SMD_DI_10064	1 = Input Closed	0= Input Open
17	SMD_DI_10017	SMD_DI_10065	1 = Input Closed	0= Input Open
18	SMD_DI_10018	SMD_DI_10066	1 = Input Closed	0= Input Open
19	SMD_DI_10019	SMD_DI_10067	1 = Input Closed	0= Input Open
20	SMD_DI_10020	SMD_DI_10068	1 = Input Closed	0= Input Open
21	SMD_DI_10021	SMD_DI_10069	1 = Input Closed	0= Input Open
22	SMD_DI_10022	SMD_DI_10070	1 = Input Closed	0= Input Open
23	SMD_DI_10023	SMD_DI_10071	1 = Input Closed	0= Input Open
24	SMD_DI_10024	SMD_DI_10072	1 = Input Closed	0= Input Open
25	SMD_DI_10025	SMD_DI_10073	1 = Input Closed	0= Input Open
26	SMD_DI_10026	SMD_DI_10074	1 = Input Closed	0= Input Open
27	SMD_DI_10027	SMD_DI_10075	1 = Input Closed	0= Input Open
28	SMD_DI_10028	SMD_DI_10076	1 = Input Closed	0= Input Open
29	SMD_DI_10029	SMD_DI_10077	1 = Input Closed	0= Input Open
30	SMD_DI_10030	SMD_DI_10078	1 = Input Closed	0= Input Open
31	SMD_DI_10031	SMD_DI_10079	1 = Input Closed	0= Input Open
32	SMD_DI_10032	SMD_DI_10080	1 = Input Closed	0= Input Open
33	SMD_DI_10033	SMD_DI_10081	1 = Input Closed	0= Input Open
34	SMD_DI_10034	SMD_DI_10082	1 = Input Closed	0= Input Open
35	SMD_DI_10035	SMD_DI_10083	1 = Input Closed	0= Input Open
36	SMD_DI_10036	SMD_DI_10084	1 = Input Closed	0= Input Open
37	SMD_DI_10037	SMD_DI_10085	1 = Input Closed	0= Input Open
38	SMD_DI_10038	SMD_DI_10086	1 = Input Closed	0= Input Open
39	SMD_DI_10039	SMD_DI_10087	1 = Input Closed	0= Input Open
40	SMD_DI_10040	SMD_DI_10088	1 = Input Closed	0= Input Open
41	SMD_DI_10041	SMD_DI_10089	1 = Input Closed	0= Input Open
42	SMD_DI_10042	SMD_DI_10090	1 = Input Closed	0= Input Open
43	SMD_DI_10043	SMD_DI_10091	1 = Input Closed	0= Input Open
44	SMD_DI_10044	SMD_DI_10092	1 = Input Closed	0= Input Open
45	SMD_DI_10045	SMD_DI_10093	1 = Input Closed	0= Input Open
46	SMD_DI_10046	SMD_DI_10094	1 = Input Closed	0= Input Open
47	SMD_DI_10047	SMD_DI_10095	1 = Input Closed	0= Input Open
48	SMD_DI_10048	SMD_DI_10096	1 = Input Closed	0= Input Open

Table B.1.1 – ILC Apprentice II Data Field Input Point Designators

AP II Output	Point		
1	SMD_DO_00001	1=Output Closed	0=Output Open
2	SMD_DO_00002	1=Output Closed	0=Output Open
3	SMD_DO_00003	1=Output Closed	0=Output Open
4	SMD_DO_00004	1=Output Closed	0=Output Open
5	SMD_DO_00005	1=Output Closed	0=Output Open
6	SMD_DO_00006	1=Output Closed	0=Output Open
7	SMD_DO_00007	1=Output Closed	0=Output Open
8	SMD_DO_00008	1=Output Closed	0=Output Open
9	SMD_DO_00009	1=Output Closed	0=Output Open
10	SMD_DO_00010	1=Output Closed	0=Output Open
11	SMD_DO_00011	1=Output Closed	0=Output Open
12	SMD_DO_00012	1=Output Closed	0=Output Open
13	SMD_DO_00013	1=Output Closed	0=Output Open
14	SMD_DO_00014	1=Output Closed	0=Output Open
15	SMD_DO_00015	1=Output Closed	0=Output Open
16	SMD_DO_00016	1=Output Closed	0=Output Open
17	SMD_DO_00017	1=Output Closed	0=Output Open
18	SMD_DO_00018	1=Output Closed	0=Output Open
19	SMD_DO_00019	1=Output Closed	0=Output Open
20	SMD_DO_00020	1=Output Closed	0=Output Open
21	SMD_DO_00021	1=Output Closed	0=Output Open
22	SMD_DO_00022	1=Output Closed	0=Output Open
23	SMD_DO_00023	1=Output Closed	0=Output Open
24	SMD_DO_00024	1=Output Closed	0=Output Open
25	SMD_DO_00025	1=Output Closed	0=Output Open
26	SMD_DO_00026	1=Output Closed	0=Output Open
27	SMD_DO_00027	1=Output Closed	0=Output Open
28	SMD_DO_00028	1=Output Closed	0=Output Open
29	SMD_DO_00029	1=Output Closed	0=Output Open
30	SMD_DO_00030	1=Output Closed	0=Output Open
31	SMD_DO_00031	1=Output Closed	0=Output Open
32	SMD_DO_00032	1=Output Closed	0=Output Open
33	SMD_DO_00033	1=Output Closed	0=Output Open
34	SMD_DO_00034	1=Output Closed	0=Output Open
35	SMD_DO_00035	1=Output Closed	0=Output Open
36	SMD_DO_00036	1=Output Closed	0=Output Open
37	SMD_DO_00037	1=Output Closed	0=Output Open
38	SMD_DO_00038	1=Output Closed	0=Output Open
39	SMD_DO_00039	1=Output Closed	0=Output Open
40	SMD_DO_00040	1=Output Closed	0=Output Open
41	SMD_DO_00041	1=Output Closed	0=Output Open
42	SMD_DO_00042	1=Output Closed	0=Output Open
43	SMD_DO_00043	1=Output Closed	0=Output Open
44	SMD_DO_00044	1=Output Closed	0=Output Open
45	SMD_DO_00045	1=Output Closed	0=Output Open
46	SMD_DO_00046	1=Output Closed	0=Output Open
47	SMD_DO_00047	1=Output Closed	0=Output Open
48	SMD_DO_00048	1=Output Closed	0=Output Open

Table B.1.2 – ILC Apprentice II Data Field Output Point Designators

AP II Output	Point		
1	SMD_DO_00101	1=Output Closed/Timer Option	0=Output Open/Timer Option
2	SMD_DO_00102	1=Output Closed/Timer Option	0=Output Open/Timer Option
3	SMD_DO_00103	1=Output Closed/Timer Option	0=Output Open/Timer Option
4	SMD_DO_00104	1=Output Closed/Timer Option	0=Output Open/Timer Option
5	SMD_DO_00105	1=Output Closed/Timer Option	0=Output Open/Timer Option
6	SMD_DO_00106	1=Output Closed/Timer Option	0=Output Open/Timer Option
7	SMD_DO_00107	1=Output Closed/Timer Option	0=Output Open/Timer Option
8	SMD_DO_00108	1=Output Closed/Timer Option	0=Output Open/Timer Option
9	SMD_DO_00109	1=Output Closed/Timer Option	0=Output Open/Timer Option
10	SMD_DO_00110	1=Output Closed/Timer Option	0=Output Open/Timer Option
11	SMD_DO_00111	1=Output Closed/Timer Option	0=Output Open/Timer Option
12	SMD_DO_00112	1=Output Closed/Timer Option	0=Output Open/Timer Option
13	SMD_DO_00113	1=Output Closed/Timer Option	0=Output Open/Timer Option
14	SMD_DO_00114	1=Output Closed/Timer Option	0=Output Open/Timer Option
15	SMD_DO_00115	1=Output Closed/Timer Option	0=Output Open/Timer Option
16	SMD_DO_00116	1=Output Closed/Timer Option	0=Output Open/Timer Option
17	SMD_DO_00117	1=Output Closed/Timer Option	0=Output Open/Timer Option
18	SMD_DO_00118	1=Output Closed/Timer Option	0=Output Open/Timer Option
19	SMD_DO_00119	1=Output Closed/Timer Option	0=Output Open/Timer Option
20	SMD_DO_00120	1=Output Closed/Timer Option	0=Output Open/Timer Option
21	SMD_DO_00121	1=Output Closed/Timer Option	0=Output Open/Timer Option
22	SMD_DO_00122	1=Output Closed/Timer Option	0=Output Open/Timer Option
23	SMD_DO_00123	1=Output Closed/Timer Option	0=Output Open/Timer Option
24	SMD_DO_00124	1=Output Closed/Timer Option	0=Output Open/Timer Option
25	SMD_DO_00125	1=Output Closed/Timer Option	0=Output Open/Timer Option
26	SMD_DO_00126	1=Output Closed/Timer Option	0=Output Open/Timer Option
27	SMD_DO_00127	1=Output Closed/Timer Option	0=Output Open/Timer Option
28	SMD_DO_00128	1=Output Closed/Timer Option	0=Output Open/Timer Option
29	SMD_DO_00129	1=Output Closed/Timer Option	0=Output Open/Timer Option
30	SMD_DO_00130	1=Output Closed/Timer Option	0=Output Open/Timer Option
31	SMD_DO_00131	1=Output Closed/Timer Option	0=Output Open/Timer Option
32	SMD_DO_00132	1=Output Closed/Timer Option	0=Output Open/Timer Option
33	SMD_DO_00133	1=Output Closed/Timer Option	0=Output Open/Timer Option
34	SMD_DO_00134	1=Output Closed/Timer Option	0=Output Open/Timer Option
35	SMD_DO_00135	1=Output Closed/Timer Option	0=Output Open/Timer Option
36	SMD_DO_00136	1=Output Closed/Timer Option	0=Output Open/Timer Option
37	SMD_DO_00137	1=Output Closed/Timer Option	0=Output Open/Timer Option
38	SMD_DO_00138	1=Output Closed/Timer Option	0=Output Open/Timer Option
39	SMD_DO_00139	1=Output Closed/Timer Option	0=Output Open/Timer Option
40	SMD_DO_00140	1=Output Closed/Timer Option	0=Output Open/Timer Option
41	SMD_DO_00141	1=Output Closed/Timer Option	0=Output Open/Timer Option
42	SMD_DO_00142	1=Output Closed/Timer Option	0=Output Open/Timer Option
43	SMD_DO_00143	1=Output Closed/Timer Option	0=Output Open/Timer Option
44	SMD_DO_00144	1=Output Closed/Timer Option	0=Output Open/Timer Option
45	SMD_DO_00145	1=Output Closed/Timer Option	0=Output Open/Timer Option
46	SMD_DO_00146	1=Output Closed/Timer Option	0=Output Open/Timer Option
47	SMD_DO_00147	1=Output Closed/Timer Option	0=Output Open/Timer Option
48	SMD_DO_00148	1=Output Closed/Timer Option	0=Output Open/Timer Option

Table B.1.3 – ILC Apprentice II with a Timer Option (Blink/Alarm) Output Point Designators

AP II Output	Point		
1	SMD_DO_00201	1=Input Disable	0=Input Enable
2	SMD_DO_00202	1=Input Disable	0=Input Enable
3	SMD_DO_00203	1=Input Disable	0=Input Enable
4	SMD_DO_00204	1=Input Disable	0=Input Enable
5	SMD_DO_00205	1=Input Disable	0=Input Enable
6	SMD_DO_00206	1=Input Disable	0=Input Enable
7	SMD_DO_00207	1=Input Disable	0=Input Enable
8	SMD_DO_00208	1=Input Disable	0=Input Enable
9	SMD_DO_00209	1=Input Disable	0=Input Enable
10	SMD_DO_00210	1=Input Disable	0=Input Enable
11	SMD_DO_00211	1=Input Disable	0=Input Enable
12	SMD_DO_00212	1=Input Disable	0=Input Enable
13	SMD_DO_00213	1=Input Disable	0=Input Enable
14	SMD_DO_00214	1=Input Disable	0=Input Enable
15	SMD_DO_00215	1=Input Disable	0=Input Enable
16	SMD_DO_00216	1=Input Disable	0=Input Enable
17	SMD_DO_00217	1=Input Disable	0=Input Enable
18	SMD_DO_00218	1=Input Disable	0=Input Enable
19	SMD_DO_00219	1=Input Disable	0=Input Enable
20	SMD_DO_00220	1=Input Disable	0=Input Enable
21	SMD_DO_00221	1=Input Disable	0=Input Enable
22	SMD_DO_00222	1=Input Disable	0=Input Enable
23	SMD_DO_00223	1=Input Disable	0=Input Enable
24	SMD_DO_00224	1=Input Disable	0=Input Enable
25	SMD_DO_00225	1=Input Disable	0=Input Enable
26	SMD_DO_00226	1=Input Disable	0=Input Enable
27	SMD_DO_00227	1=Input Disable	0=Input Enable
28	SMD_DO_00228	1=Input Disable	0=Input Enable
29	SMD_DO_00229	1=Input Disable	0=Input Enable
30	SMD_DO_00230	1=Input Disable	0=Input Enable
31	SMD_DO_00231	1=Input Disable	0=Input Enable
32	SMD_DO_00232	1=Input Disable	0=Input Enable
33	SMD_DO_00233	1=Input Disable	0=Input Enable
34	SMD_DO_00234	1=Input Disable	0=Input Enable
35	SMD_DO_00235	1=Input Disable	0=Input Enable
36	SMD_DO_00236	1=Input Disable	0=Input Enable
37	SMD_DO_00237	1=Input Disable	0=Input Enable
38	SMD_DO_00238	1=Input Disable	0=Input Enable
39	SMD_DO_00239	1=Input Disable	0=Input Enable
40	SMD_DO_00240	1=Input Disable	0=Input Enable
41	SMD_DO_00241	1=Input Disable	0=Input Enable
42	SMD_DO_00242	1=Input Disable	0=Input Enable
43	SMD_DO_00243	1=Input Disable	0=Input Enable
44	SMD_DO_00244	1=Input Disable	0=Input Enable
45	SMD_DO_00245	1=Input Disable	0=Input Enable
46	SMD_DO_00246	1=Input Disable	0=Input Enable
47	SMD_DO_00247	1=Input Disable	0=Input Enable
48	SMD_DO_00248	1=Input Disable	0=Input Enable

Table B.1.4 – ILC Apprentice II Input Enable/Disable Point Designators

Overview

C.1 USB Programming Control and Monitoring

You can link a personal computer (PC) equipped with a USB 2.0 port and Apprentice II Pro software to the ILC Apprentice II controller's USB port and perform all the control and programming operations supported by Apprentice II Pro, including:

- Check the status of the controller's relay outputs and switch inputs
- Turn ON/OFF individual relay outputs
- Sweep ON/OFF all the relay outputs
- Define switch inputs and map them to relay outputs
- Define timers and map them to relay outputs
- Define and invoke preset scenes
- Upload and download data between the controller and your PC.

C.1 USB Setup

1. Install the Apprentice II Pro software onto the PC prior to connecting the USB cable. The USB driver will install at the end of the software install.
2. Connect a USB A to B cable to the ILC Apprentice II's USB port and connect the other end to the computer.
3. Finish.
4. Start the Apprentice II Pro program.

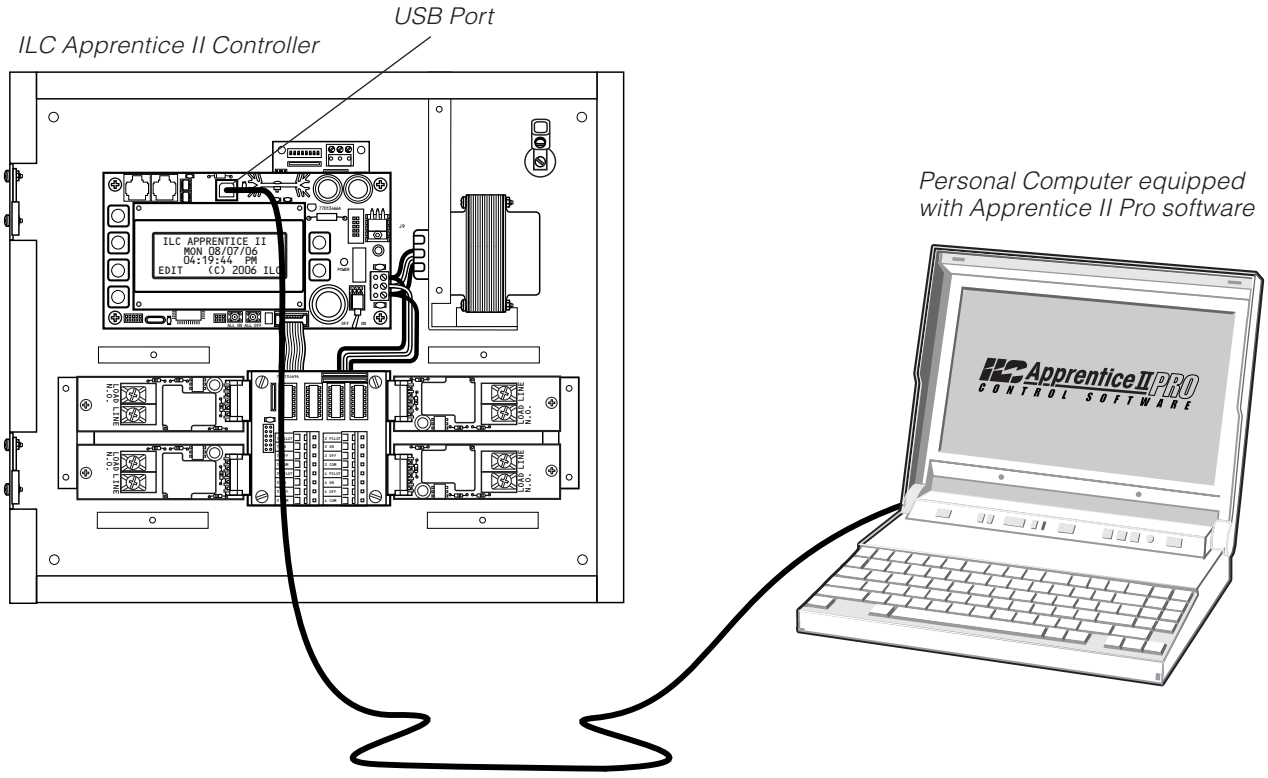


Figure B.1 – Programming the Controller from a PC

E.1 Overview

- With the addition of a DMX 512 interface card, the ILC Apprentice II controller supports the control of non-dimmed loads via standard USITT DMX 512 communications protocol.
- The physical link is a standard USITT DMX 512 control cable (18 gauge, shielded twisted pair) that runs from the DMX output of the theatrical lighting controller to the ILC Apprentice II DMX communications port. The DMX 512 interface mounts below the ILC Apprentice II CPU board. (See Figure D-1.)
- You can program the ILC Apprentice II with desired ON and OFF DMX signal levels and then select how the ILC Apprentice II relay outputs will respond.
- You set common ON and OFF DMX signal levels for all DMX 512 channels (1 to 512 channels). However, you can program relay action on an individual channel basis.

DMX ON and DMX OFF Levels:
Any time a DMX channel is at or above the ON level, the relay(s) mapped to that channel will be forced ON regardless of any switch input or timer control. Any time a DMX channel is at or below the OFF level, the relay(s) mapped to that channel will be forced OFF regardless of any switch input or timer control. While a DMX channel is below the ON level and above the OFF level, the relay(s) mapped to that channel are able to be controlled by switch inputs and timers.

EXAMPLE 1: To lock out all control other than DMX, set the DMX ON level to 90% and the OFF level to 10%. By setting the DMX signal level to 100% or 0%, the relay(s) will turn ON or OFF and also revert to the desired position after any change due to a switch input or timer.

EXAMPLE 2: To control relays via DMX and also allow switch inputs or timers to change the position, set the DMX ON level to 90% and the OFF level to 10%. By momentarily setting the DMX signal level to 100% and then setting it to 50%, the relay(s) will be turned ON and local control will return. By momentarily setting the DMX signal level to 0% and then setting it to 50%, the relay(s) will be turned OFF and local control will return.

DMX Filter:
The Filter setting determines the number of times the ILC Apprentice II must receive a constant value on a DMX channel prior to performing the control mapped to that channel. The Filter may be set from 1 to 16. Lower Filter settings make the ILC Apprentice II respond faster to DMX commands. Higher Filter settings prevent undesired relay control due to momentary zero levels on DMX channels. The Filter setting does not directly correspond to DMX frame counts due to the ILC Apprentice II not reading each frame.

E.2 Objectives

After reading Appendix D, you will be able to program the ILC Apprentice II to implement DMX control.

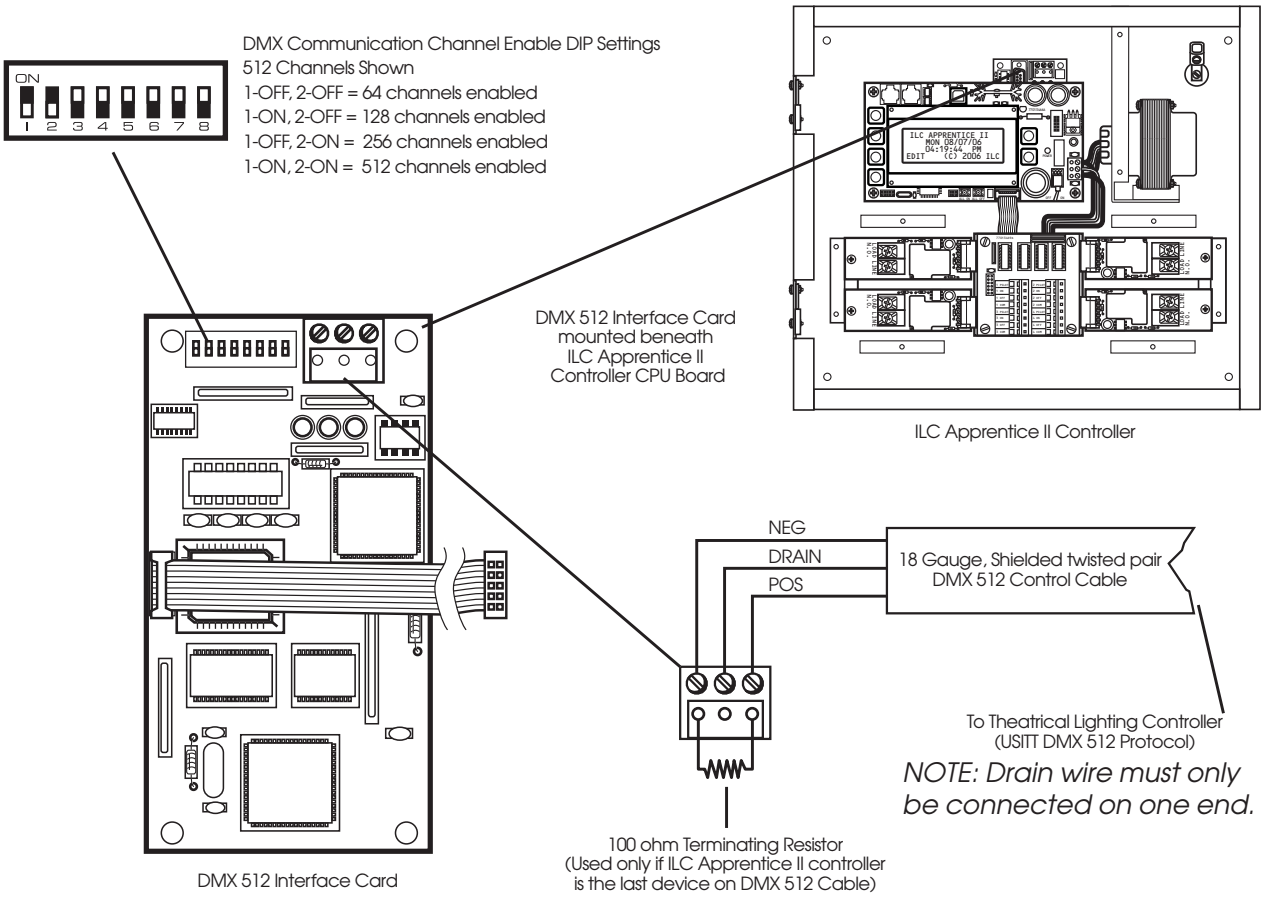
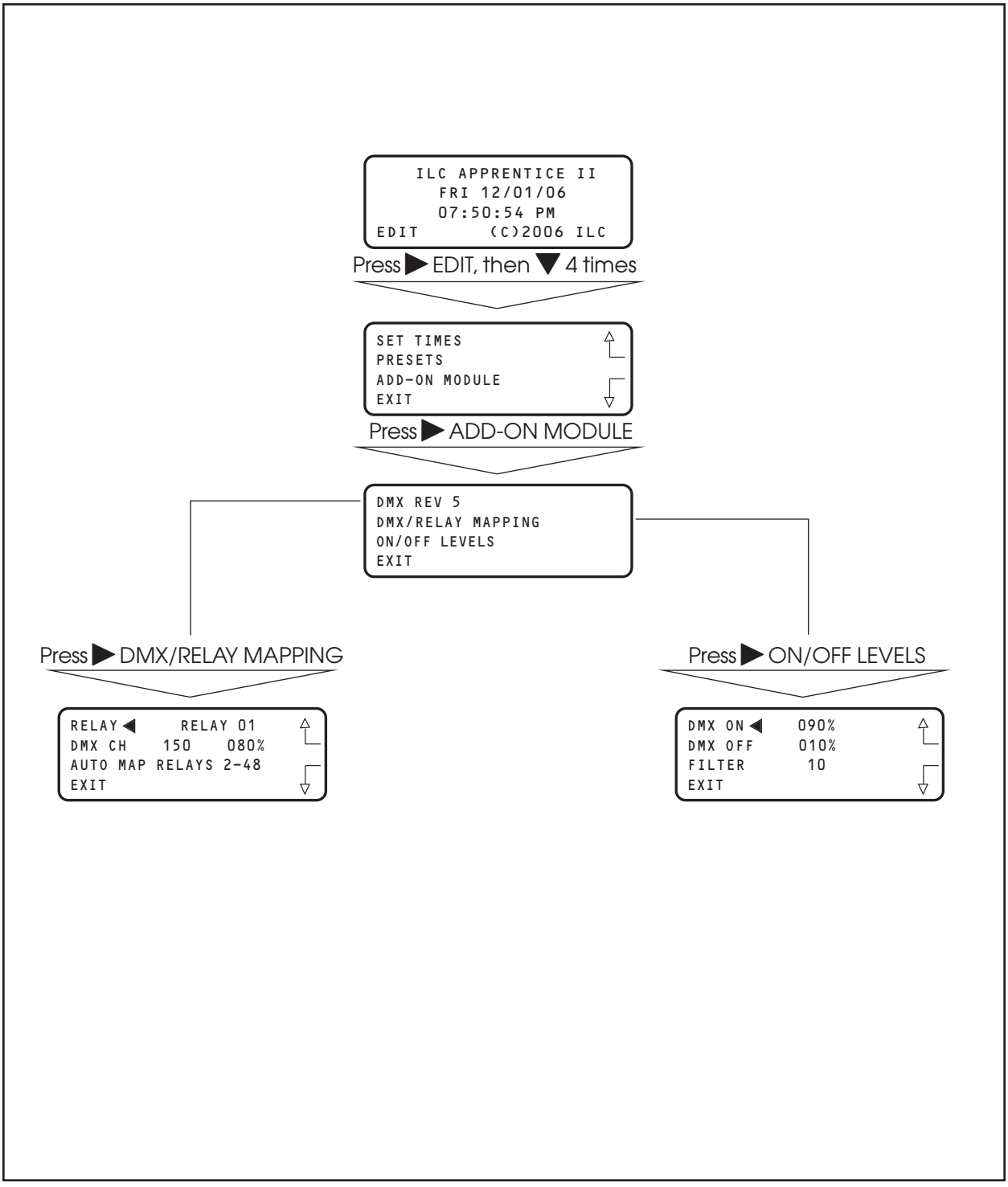


Figure D.1 – DMX Interface Hardware Features

DMX Control – Fast Track



E.3 Programming Example

Set the DMX signal ON level at 92% and the OFF level at 15%. Program relay output 1 to respond by switching ON at 92% and OFF at 15% on channel 200. (The default values are 90% and 10%, respectively.)

NOTE: If programming relays 1-48 you can enter the relay channel for relay 01 – then press Auto Map Relays 2-48, and the controller will automatically assign relays 2-48 to the channels in ascending order.

Example: If you program Relay 01 to channel 200, relay 2 will be assigned to channel 201, relay 3 to channel 202, and so on in ascending order.

Note also that the DMX/Relay Control screen displays the current level.

1. From the Home screen, press ▶ EDIT; then press ▼ 4 times to access the ADD-ON MODULE screen.
2. Press ▶ ADD-ON MODULE.
3. Press ▶ ON/OFF LEVELS.
4. When the Level screen appears, press ▲ or ▼ until 92% appears in the ON field.
5. Press ▶ DMX OFF, then ▲ or ▼ until 15% appears in the OFF field.
6. Press ▶ FILTER, then ▲ or ▼ to select a filter value.
7. Press ▶ EXIT to return to the DMX menu.
8. Press ▶ DMX/RELAY MAPPING.
9. Press ▶ DMX CH; then press ▲ or ▼ until channel 200 appears.
10. If you want to Auto program the rest of the channels, press ▶ AUTO MAP RELAYS 2-48.
11. Press ▶ EXIT 3 times to return to the Home screen.

Overview

L.1 Overview

Devices in a LonWorks network communicate through a control network specific protocol originally created by echelon. The protocol was ratified as an official standard by a number of national and international standards setting bodies, including ANSI, IEEE, CEN, and EN. In January 2009, the protocol underlying the LonWorks platform was ratified as a global standard for building controls. It is now formally known as ISO/IEC 14908-1. With the panel module, commands can be sent to the panel to force relays On and OFF, force relays On and OFF with a timer option (blink, double blink, HID delay, Alarm On, Alarm OFF, Pulse On, and Pulse OFF), monitor relay status, monitor input status, and enable/disable inputs.

L.2 Hardware

The Apprentice II LonWorks module consists of a FieldServer ProtoCessor module that directly connects to the main processor via a ribbon cable and multi-pin connector. This interface is provided with a 5VDC power supply that derives its power from the 24VAC control transformer. The module is provided with a connector for data communications. See Figure L. 1

L.3 Hardware Setup

The controller will automatically sense and enable communication for the system. To verify that the interface is communicating to the panel follow the menu shown in figure L.2

L.4 Point Map

Refer to Table L.1 for the points that the BAS system can read or write. These points read the entire network of panels as if it is a single panel.

ILC Apprentice II LonWorks Communications

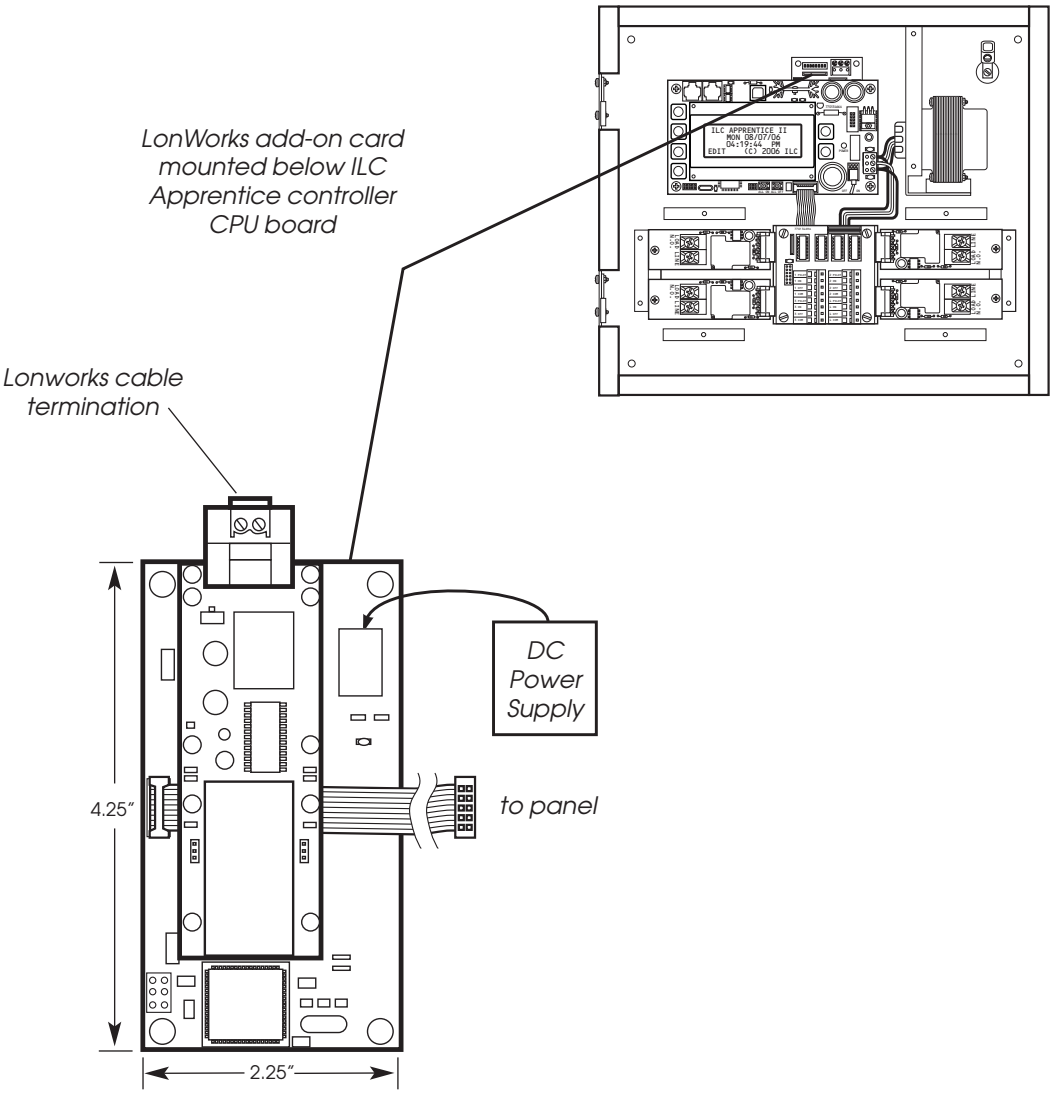


Figure L.1

LonWorks – Fast Track

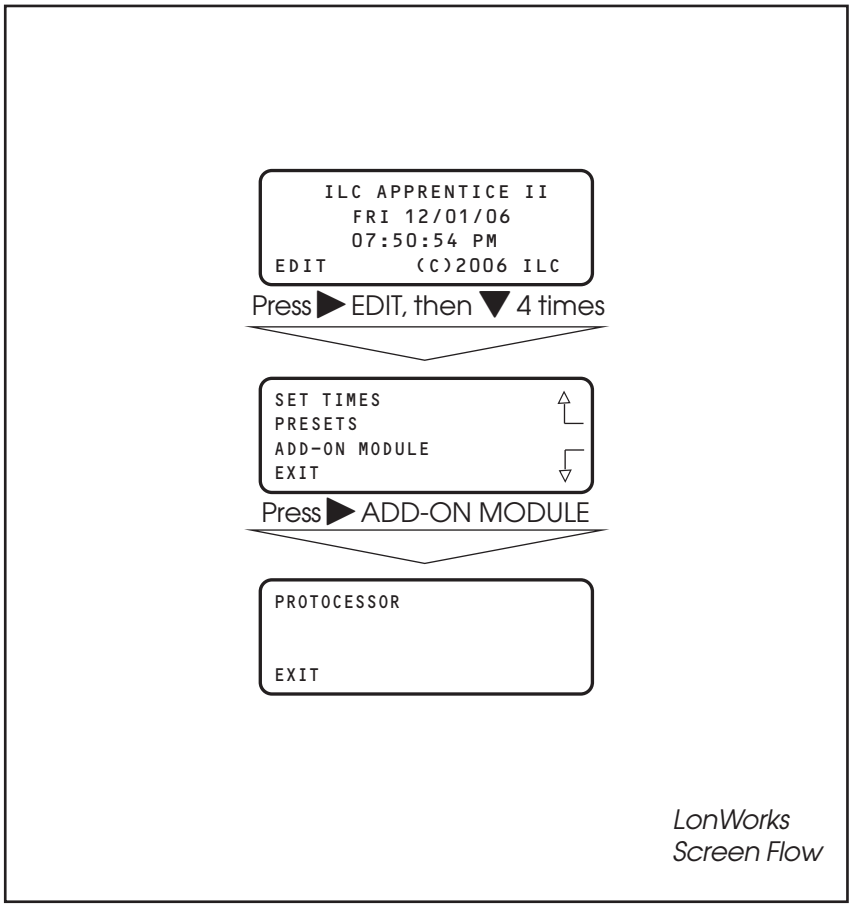


Figure L.2

AP II Input	Read ON	Read OFF	SVNT_Switch	
1	nvoSMD_DI_10001	nvoSMD_DI_10049	1 = Input Closed	0= Input Open
2	nvoSMD_DI_10002	nvoSMD_DI_10050	1 = Input Closed	0= Input Open
3	nvoSMD_DI_10003	nvoSMD_DI_10051	1 = Input Closed	0= Input Open
4	nvoSMD_DI_10004	nvoSMD_DI_10052	1 = Input Closed	0= Input Open
5	nvoSMD_DI_10005	nvoSMD_DI_10053	1 = Input Closed	0= Input Open
6	nvoSMD_DI_10006	nvoSMD_DI_10054	1 = Input Closed	0= Input Open
7	nvoSMD_DI_10007	nvoSMD_DI_10055	1 = Input Closed	0= Input Open
8	nvoSMD_DI_10008	nvoSMD_DI_10056	1 = Input Closed	0= Input Open
9	nvoSMD_DI_10009	nvoSMD_DI_10057	1 = Input Closed	0= Input Open
10	nvoSMD_DI_10010	nvoSMD_DI_10058	1 = Input Closed	0= Input Open
11	nvoSMD_DI_10011	nvoSMD_DI_10059	1 = Input Closed	0= Input Open
12	nvoSMD_DI_10012	nvoSMD_DI_10060	1 = Input Closed	0= Input Open
13	nvoSMD_DI_10013	nvoSMD_DI_10061	1 = Input Closed	0= Input Open
14	nvoSMD_DI_10014	nvoSMD_DI_10062	1 = Input Closed	0= Input Open
15	nvoSMD_DI_10015	nvoSMD_DI_10063	1 = Input Closed	0= Input Open
16	nvoSMD_DI_10016	nvoSMD_DI_10064	1 = Input Closed	0= Input Open
17	nvoSMD_DI_10017	nvoSMD_DI_10065	1 = Input Closed	0= Input Open
18	nvoSMD_DI_10018	nvoSMD_DI_10066	1 = Input Closed	0= Input Open
19	nvoSMD_DI_10019	nvoSMD_DI_10067	1 = Input Closed	0= Input Open
20	nvoSMD_DI_10020	nvoSMD_DI_10068	1 = Input Closed	0= Input Open
21	nvoSMD_DI_10021	nvoSMD_DI_10069	1 = Input Closed	0= Input Open
22	nvoSMD_DI_10022	nvoSMD_DI_10070	1 = Input Closed	0= Input Open
23	nvoSMD_DI_10023	nvoSMD_DI_10071	1 = Input Closed	0= Input Open
24	nvoSMD_DI_10024	nvoSMD_DI_10072	1 = Input Closed	0= Input Open
25	nvoSMD_DI_10025	nvoSMD_DI_10073	1 = Input Closed	0= Input Open
26	nvoSMD_DI_10026	nvoSMD_DI_10074	1 = Input Closed	0= Input Open
27	nvoSMD_DI_10027	nvoSMD_DI_10075	1 = Input Closed	0= Input Open
28	nvoSMD_DI_10028	nvoSMD_DI_10076	1 = Input Closed	0= Input Open
29	nvoSMD_DI_10029	nvoSMD_DI_10077	1 = Input Closed	0= Input Open
30	nvoSMD_DI_10030	nvoSMD_DI_10078	1 = Input Closed	0= Input Open
31	nvoSMD_DI_10031	nvoSMD_DI_10079	1 = Input Closed	0= Input Open
32	nvoSMD_DI_10032	nvoSMD_DI_10080	1 = Input Closed	0= Input Open
33	nvoSMD_DI_10033	nvoSMD_DI_10081	1 = Input Closed	0= Input Open
34	nvoSMD_DI_10034	nvoSMD_DI_10082	1 = Input Closed	0= Input Open
35	nvoSMD_DI_10035	nvoSMD_DI_10083	1 = Input Closed	0= Input Open
36	nvoSMD_DI_10036	nvoSMD_DI_10084	1 = Input Closed	0= Input Open
37	nvoSMD_DI_10037	nvoSMD_DI_10085	1 = Input Closed	0= Input Open
38	nvoSMD_DI_10038	nvoSMD_DI_10086	1 = Input Closed	0= Input Open
39	nvoSMD_DI_10039	nvoSMD_DI_10087	1 = Input Closed	0= Input Open
40	nvoSMD_DI_10040	nvoSMD_DI_10088	1 = Input Closed	0= Input Open
41	nvoSMD_DI_10041	nvoSMD_DI_10089	1 = Input Closed	0= Input Open
42	nvoSMD_DI_10042	nvoSMD_DI_10090	1 = Input Closed	0= Input Open
43	nvoSMD_DI_10043	nvoSMD_DI_10091	1 = Input Closed	0= Input Open
44	nvoSMD_DI_10044	nvoSMD_DI_10092	1 = Input Closed	0= Input Open
45	nvoSMD_DI_10045	nvoSMD_DI_10093	1 = Input Closed	0= Input Open
46	nvoSMD_DI_10046	nvoSMD_DI_10094	1 = Input Closed	0= Input Open
47	nvoSMD_DI_10047	nvoSMD_DI_10095	1 = Input Closed	0= Input Open
48	nvoSMD_DI_10048	nvoSMD_DI_10096	1 = Input Closed	0= Input Open

Table L.1.1 – ILC Apprentice II Data Field Input Point Designators

AP II Output	Read	Write	SVNT_Switch Closed	Open
1	nvoSMD_DO_00001	nviSMD_DO_00001	1=Output Closed	0=Output Open
2	nvoSMD_DO_00002	nviSMD_DO_00002	1=Output Closed	0=Output Open
3	nvoSMD_DO_00003	nviSMD_DO_00003	1=Output Closed	0=Output Open
4	nvoSMD_DO_00004	nviSMD_DO_00004	1=Output Closed	0=Output Open
5	nvoSMD_DO_00005	nviSMD_DO_00005	1=Output Closed	0=Output Open
6	nvoSMD_DO_00006	nviSMD_DO_00006	1=Output Closed	0=Output Open
7	nvoSMD_DO_00007	nviSMD_DO_00007	1=Output Closed	0=Output Open
8	nvoSMD_DO_00008	nviSMD_DO_00008	1=Output Closed	0=Output Open
9	nvoSMD_DO_00009	nviSMD_DO_00009	1=Output Closed	0=Output Open
10	nvoSMD_DO_00010	nviSMD_DO_00010	1=Output Closed	0=Output Open
11	nvoSMD_DO_00011	nviSMD_DO_00011	1=Output Closed	0=Output Open
12	nvoSMD_DO_00012	nviSMD_DO_00012	1=Output Closed	0=Output Open
13	nvoSMD_DO_00013	nviSMD_DO_00013	1=Output Closed	0=Output Open
14	nvoSMD_DO_00014	nviSMD_DO_00014	1=Output Closed	0=Output Open
15	nvoSMD_DO_00015	nviSMD_DO_00015	1=Output Closed	0=Output Open
16	nvoSMD_DO_00016	nviSMD_DO_00016	1=Output Closed	0=Output Open
17	nvoSMD_DO_00017	nviSMD_DO_00017	1=Output Closed	0=Output Open
18	nvoSMD_DO_00018	nviSMD_DO_00018	1=Output Closed	0=Output Open
19	nvoSMD_DO_00019	nviSMD_DO_00019	1=Output Closed	0=Output Open
20	nvoSMD_DO_00020	nviSMD_DO_00020	1=Output Closed	0=Output Open
21	nvoSMD_DO_00021	nviSMD_DO_00021	1=Output Closed	0=Output Open
22	nvoSMD_DO_00022	nviSMD_DO_00022	1=Output Closed	0=Output Open
23	nvoSMD_DO_00023	nviSMD_DO_00023	1=Output Closed	0=Output Open
24	nvoSMD_DO_00024	nviSMD_DO_00024	1=Output Closed	0=Output Open
25	nvoSMD_DO_00025	nviSMD_DO_00025	1=Output Closed	0=Output Open
26	nvoSMD_DO_00026	nviSMD_DO_00026	1=Output Closed	0=Output Open
27	nvoSMD_DO_00027	nviSMD_DO_00027	1=Output Closed	0=Output Open
28	nvoSMD_DO_00028	nviSMD_DO_00028	1=Output Closed	0=Output Open
29	nvoSMD_DO_00029	nviSMD_DO_00029	1=Output Closed	0=Output Open
30	nvoSMD_DO_00030	nviSMD_DO_00030	1=Output Closed	0=Output Open
31	nvoSMD_DO_00031	nviSMD_DO_00031	1=Output Closed	0=Output Open
32	nvoSMD_DO_00032	nviSMD_DO_00032	1=Output Closed	0=Output Open
33	nvoiSMD_DO_00033	nviSMD_DO_00033	1=Output Closed	0=Output Open
34	nvoSMD_DO_00034	nviSMD_DO_00034	1=Output Closed	0=Output Open
35	nvoSMD_DO_00035	nviSMD_DO_00035	1=Output Closed	0=Output Open
36	nvoSMD_DO_00036	nviSMD_DO_00036	1=Output Closed	0=Output Open
37	nvoSMD_DO_00037	nviSMD_DO_00037	1=Output Closed	0=Output Open
38	nvoSMD_DO_00038	nviSMD_DO_00038	1=Output Closed	0=Output Open
39	nvoSMD_DO_00039	nviSMD_DO_00039	1=Output Closed	0=Output Open
40	nvoSMD_DO_00040	nviSMD_DO_00040	1=Output Closed	0=Output Open
41	nvoSMD_DO_00041	nviSMD_DO_00041	1=Output Closed	0=Output Open
42	nvoSMD_DO_00042	nviSMD_DO_00042	1=Output Closed	0=Output Open
43	nvoSMD_DO_00043	nviSMD_DO_00043	1=Output Closed	0=Output Open
44	nvoSMD_DO_00044	nviSMD_DO_00044	1=Output Closed	0=Output Open
45	nvoSMD_DO_00045	nviSMD_DO_00045	1=Output Closed	0=Output Open
46	nvoSMD_DO_00046	nviSMD_DO_00046	1=Output Closed	0=Output Open
47	nvoSMD_DO_00047	nviSMD_DO_00047	1=Output Closed	0=Output Open
48	nvoSMD_DO_00048	nviSMD_DO_00048	1=Output Closed	0=Output Open

Table L.1.2 – ILC Apprentice II Data Field Output Point Designators

AP II Output	Read	Write	SVNT_Switch Closed	SVNT_Switch Open
1	nvoSMD_DO_00101	nviSMD_DO_00101	1=Output Closed/Timer Option	0=Output Open/Timer Option
2	nvoSMD_DO_00102	nviSMD_DO_00102	1=Output Closed/Timer Option	0=Output Open/Timer Option
3	nvoSMD_DO_00103	nviSMD_DO_00103	1=Output Closed/Timer Option	0=Output Open/Timer Option
4	nvoSMD_DO_00104	nviSMD_DO_00104	1=Output Closed/Timer Option	0=Output Open/Timer Option
5	nvoSMD_DO_00105	nviSMD_DO_00105	1=Output Closed/Timer Option	0=Output Open/Timer Option
6	nvoSMD_DO_00106	nviSMD_DO_00106	1=Output Closed/Timer Option	0=Output Open/Timer Option
7	nvoSMD_DO_00107	nviSMD_DO_00107	1=Output Closed/Timer Option	0=Output Open/Timer Option
8	nvoSMD_DO_00108	nviSMD_DO_00108	1=Output Closed/Timer Option	0=Output Open/Timer Option
9	nvoSMD_DO_00109	nviSMD_DO_00109	1=Output Closed/Timer Option	0=Output Open/Timer Option
10	nvoSMD_DO_00110	nviSMD_DO_00110	1=Output Closed/Timer Option	0=Output Open/Timer Option
11	nvoSMD_DO_00111	nviSMD_DO_00111	1=Output Closed/Timer Option	0=Output Open/Timer Option
12	nvoSMD_DO_00112	nviSMD_DO_00112	1=Output Closed/Timer Option	0=Output Open/Timer Option
13	nvoSMD_DO_00113	nviSMD_DO_00113	1=Output Closed/Timer Option	0=Output Open/Timer Option
14	nvoSMD_DO_00114	nviSMD_DO_00114	1=Output Closed/Timer Option	0=Output Open/Timer Option
15	nvoSMD_DO_00115	nviSMD_DO_00115	1=Output Closed/Timer Option	0=Output Open/Timer Option
16	nvoSMD_DO_00115	nviSMD_DO_00115	1=Output Closed/Timer Option	0=Output Open/Timer Option
17	nvoSMD_DO_00117	nviSMD_DO_00117	1=Output Closed/Timer Option	0=Output Open/Timer Option
18	nvoSMD_DO_00118	nviSMD_DO_00118	1=Output Closed/Timer Option	0=Output Open/Timer Option
19	nvoSMD_DO_00119	nviSMD_DO_00119	1=Output Closed/Timer Option	0=Output Open/Timer Option
20	nvoSMD_DO_00120	nviSMD_DO_00120	1=Output Closed/Timer Option	0=Output Open/Timer Option
21	nvoSMD_DO_00121	nviSMD_DO_00121	1=Output Closed/Timer Option	0=Output Open/Timer Option
22	nvoSMD_DO_00122	nviSMD_DO_00122	1=Output Closed/Timer Option	0=Output Open/Timer Option
23	nvoSMD_DO_00123	nviSMD_DO_00123	1=Output Closed/Timer Option	0=Output Open/Timer Option
24	nvoSMD_DO_00124	nviSMD_DO_00124	1=Output Closed/Timer Option	0=Output Open/Timer Option
25	nvoSMD_DO_00125	nviSMD_DO_00125	1=Output Closed/Timer Option	0=Output Open/Timer Option
26	nvoSMD_DO_00126	nviSMD_DO_00126	1=Output Closed/Timer Option	0=Output Open/Timer Option
27	nvoSMD_DO_00127	nviSMD_DO_00127	1=Output Closed/Timer Option	0=Output Open/Timer Option
28	nvoSMD_DO_00128	nviSMD_DO_00128	1=Output Closed/Timer Option	0=Output Open/Timer Option
29	nvoSMD_DO_00129	nviSMD_DO_00129	1=Output Closed/Timer Option	0=Output Open/Timer Option
30	nvoSMD_DO_00130	nviSMD_DO_00130	1=Output Closed/Timer Option	0=Output Open/Timer Option
31	nvoSMD_DO_00131	nviSMD_DO_00131	1=Output Closed/Timer Option	0=Output Open/Timer Option
32	nvoSMD_DO_00132	nviSMD_DO_00132	1=Output Closed/Timer Option	0=Output Open/Timer Option
33	nvoiSMD_DO_00133	nviSMD_DO_00133	1=Output Closed/Timer Option	0=Output Open/Timer Option
34	nvoSMD_DO_00134	nviSMD_DO_00134	1=Output Closed/Timer Option	0=Output Open/Timer Option
35	nvoSMD_DO_00135	nviSMD_DO_00135	1=Output Closed/Timer Option	0=Output Open/Timer Option
36	nvoSMD_DO_00136	nviSMD_DO_00136	1=Output Closed/Timer Option	0=Output Open/Timer Option
37	nvoSMD_DO_00137	nviSMD_DO_00137	1=Output Closed/Timer Option	0=Output Open/Timer Option
38	nvoSMD_DO_00138	nviSMD_DO_00138	1=Output Closed/Timer Option	0=Output Open/Timer Option
39	nvoSMD_DO_00139	nviSMD_DO_00139	1=Output Closed/Timer Option	0=Output Open/Timer Option
40	nvoSMD_DO_00140	nviSMD_DO_00140	1=Output Closed/Timer Option	0=Output Open/Timer Option
41	nvoSMD_DO_00141	nviSMD_DO_00141	1=Output Closed/Timer Option	0=Output Open/Timer Option
42	nvoSMD_DO_00142	nviSMD_DO_00142	1=Output Closed/Timer Option	0=Output Open/Timer Option
43	nvoSMD_DO_00143	nviSMD_DO_00143	1=Output Closed/Timer Option	0=Output Open/Timer Option
44	nvoSMD_DO_00144	nviSMD_DO_00144	1=Output Closed/Timer Option	0=Output Open/Timer Option
45	nvoSMD_DO_00145	nviSMD_DO_00145	1=Output Closed/Timer Option	0=Output Open/Timer Option
46	nvoSMD_DO_00146	nviSMD_DO_00146	1=Output Closed/Timer Option	0=Output Open/Timer Option
47	nvoSMD_DO_00147	nviSMD_DO_00147	1=Output Closed/Timer Option	0=Output Open/Timer Option
48	nvoSMD_DO_00148	nviSMD_DO_00148	1=Output Closed/Timer Option	0=Output Open/Timer Option

Table L.1.3 – ILC Apprentice II with a Timer Option (Blink/Alarm) Output Point Designators

AP II Output	Read	Write	SVNT_Switch Closed	Open
1	nvoSMD_DO_00201	nviSMD_DO_00201	1=Output Disable	0=Output Enable
2	nvoSMD_DO_00202	nviSMD_DO_00202	1=Output Disable	0=Output Enable
3	nvoSMD_DO_00203	nviSMD_DO_00203	1=Output Disable	0=Output Enable
4	nvoSMD_DO_00204	nviSMD_DO_00204	1=Output Disable	0=Output Enable
5	nvoSMD_DO_00205	nviSMD_DO_00205	1=Output Disable	0=Output Enable
6	nvoSMD_DO_00206	nviSMD_DO_00206	1=Output Disable	0=Output Enable
7	nvoSMD_DO_00207	nviSMD_DO_00207	1=Output Disable	0=Output Enable
8	nvoSMD_DO_00208	nviSMD_DO_00208	1=Output Disable	0=Output Enable
9	nvoSMD_DO_00209	nviSMD_DO_00209	1=Output Disable	0=Output Enable
10	nvoSMD_DO_00210	nviSMD_DO_00210	1=Output Disable	0=Output Enable
11	nvoSMD_DO_00211	nviSMD_DO_00211	1=Output Disable	0=Output Enable
12	nvoSMD_DO_00212	nviSMD_DO_00212	1=Output Disable	0=Output Enable
13	nvoSMD_DO_00213	nviSMD_DO_00213	1=Output Disable	0=Output Enable
14	nvoSMD_DO_00214	nviSMD_DO_00214	1=Output Disable	0=Output Enable
15	nvoSMD_DO_00215	nviSMD_DO_00215	1=Output Disable	0=Output Enable
16	nvoSMD_DO_00216	nviSMD_DO_00216	1=Output Disable	0=Output Enable
17	nvoSMD_DO_00217	nviSMD_DO_00217	1=Output Disable	0=Output Enable
18	nvoSMD_DO_00218	nviSMD_DO_00218	1=Output Disable	0=Output Enable
19	nvoSMD_DO_00219	nviSMD_DO_00219	1=Output Disable	0=Output Enable
20	nvoSMD_DO_00220	nviSMD_DO_00220	1=Output Disable	0=Output Enable
21	nvoSMD_DO_00221	nviSMD_DO_00221	1=Output Disable	0=Output Enable
22	nvoSMD_DO_00222	nviSMD_DO_00222	1=Output Disable	0=Output Enable
23	nvoSMD_DO_00223	nviSMD_DO_00223	1=Output Disable	0=Output Enable
24	nvoSMD_DO_00224	nviSMD_DO_00224	1=Output Disable	0=Output Enable
25	nvoSMD_DO_00225	nviSMD_DO_00225	1=Output Disable	0=Output Enable
26	nvoSMD_DO_00226	nviSMD_DO_00226	1=Output Disable	0=Output Enable
27	nvoSMD_DO_00227	nviSMD_DO_00227	1=Output Disable	0=Output Enable
28	nvoSMD_DO_00228	nviSMD_DO_00228	1=Output Disable	0=Output Enable
29	nvoSMD_DO_00229	nviSMD_DO_00229	1=Output Disable	0=Output Enable
30	nvoSMD_DO_00230	nviSMD_DO_00230	1=Output Disable	0=Output Enable
31	nvoSMD_DO_00231	nviSMD_DO_00231	1=Output Disable	0=Output Enable
32	nvoSMD_DO_00232	nviSMD_DO_00232	1=Output Disable	0=Output Enable
33	nvoiSMD_DO_00233	nviSMD_DO_00233	1=Output Disable	0=Output Enable
34	nvoSMD_DO_00234	nviSMD_DO_00234	1=Output Disable	0=Output Enable
35	nvoSMD_DO_00235	nviSMD_DO_00235	1=Output Disable	0=Output Enable
36	nvoSMD_DO_00236	nviSMD_DO_00236	1=Output Disable	0=Output Enable
37	nvoSMD_DO_00237	nviSMD_DO_00237	1=Output Disable	0=Output Enable
38	nvoSMD_DO_00238	nviSMD_DO_00238	1=Output Disable	0=Output Enable
39	nvoSMD_DO_00239	nviSMD_DO_00239	1=Output Disable	0=Output Enable
40	nvoSMD_DO_00240	nviSMD_DO_00240	1=Output Disable	0=Output Enable
41	nvoSMD_DO_00241	nviSMD_DO_00241	1=Output Disable	0=Output Enable
42	nvoSMD_DO_00242	nviSMD_DO_00242	1=Output Disable	0=Output Enable
43	nvoSMD_DO_00243	nviSMD_DO_00243	1=Output Disable	0=Output Enable
44	nvoSMD_DO_00244	nviSMD_DO_00244	1=Output Disable	0=Output Enable
45	nvoSMD_DO_00245	nviSMD_DO_00245	1=Output Disable	0=Output Enable
46	nvoSMD_DO_00246	nviSMD_DO_00246	1=Output Disable	0=Output Enable
47	nvoSMD_DO_00247	nviSMD_DO_00247	1=Output Disable	0=Output Enable
48	nvoSMD_DO_00248	nviSMD_DO_00248	1=Output Disable	0=Output Enable

Table L.1.4 – ILC Apprentice II Input Enable/Disable Point Designators

M.1 Overview

MODBUS protocol is an industrial communications and distributive control system developed by Gould-Modicon to integrate programmable logic controllers (PLCs), computers, terminals and other monitoring, sensing, and control devices. With the addition of a ILC MODBUS Add-On Module, and setting a unique address via the mudule's address DIP switches, the ILC Apprentice II lighting controller can become a Slave NODE on the MODBUS Network. (See Figure M-1.)

M.2 Structure

MODBUS is a Master/Slave communications protocol. One device (the Master) controls all serial activity by selectively polling one or more of the slave devices. The maximum number of slave devices is 247 per network. Each device (node) is assigned a unique address to distinguish it from all the other nodes.

Only the Master initiates a transaction. Transactions are either a query/response (only a single slave is addressed), or a broadcast/no response (all slaves are addressed). A transaction comprises a single query and single response frame or a single broadcast frame.

Certain characteristics of the MODBUS protocol are fixed: frame format, frame sequences, communications error handling, exception conditions, and the functions performed. Other characteristics are selectable: transmission media, baud rate, character parity, number of stop bits, communications error handling, exception conditions, and functions performed.

M.3 Transmission Modes

The transmission mode is the structure of the individual units of information within a message, and the numbering system used to transmit the data. Two transmission modes are available. Both provide the same communication capabilities. The mode slected depends on the equipment used as the MODBUS master. Only one transmission mode may be selected per network. Mixing modes on a single network is not allowed. The two available tranbsmission modes are ASCII (American Standard Code For Information Interchange) and RTU (Remote Terminal Unit)

M.3.1 ASCII

Coding System – ASCII (7 Bit); hexadecimal uses ASCII printable characters (0-9, A-F)
Start Bits – 1
Data Bits (least significant first) – 7
Parity (optional) – 1 (1 Bit set for even or odd, no Bits for no parity)
Stop Bits – 1 or 2
Error Checking – LRC (Longitudinal Redundancy Check)

M.3.2 RTU

Coding System – 8 Bit Binary
Start Bits – 1
Data Bits (least significant first) – 8
Parity (optional) – 1 (1 Bit set for even or odd, no Bits for no parity)
Stop Bits – 1 or 2
Error Checking – CRC (Cyclical Redundancy Check)

ILC Apprentice II MODBUS Communications Example – See Termination Detail Below

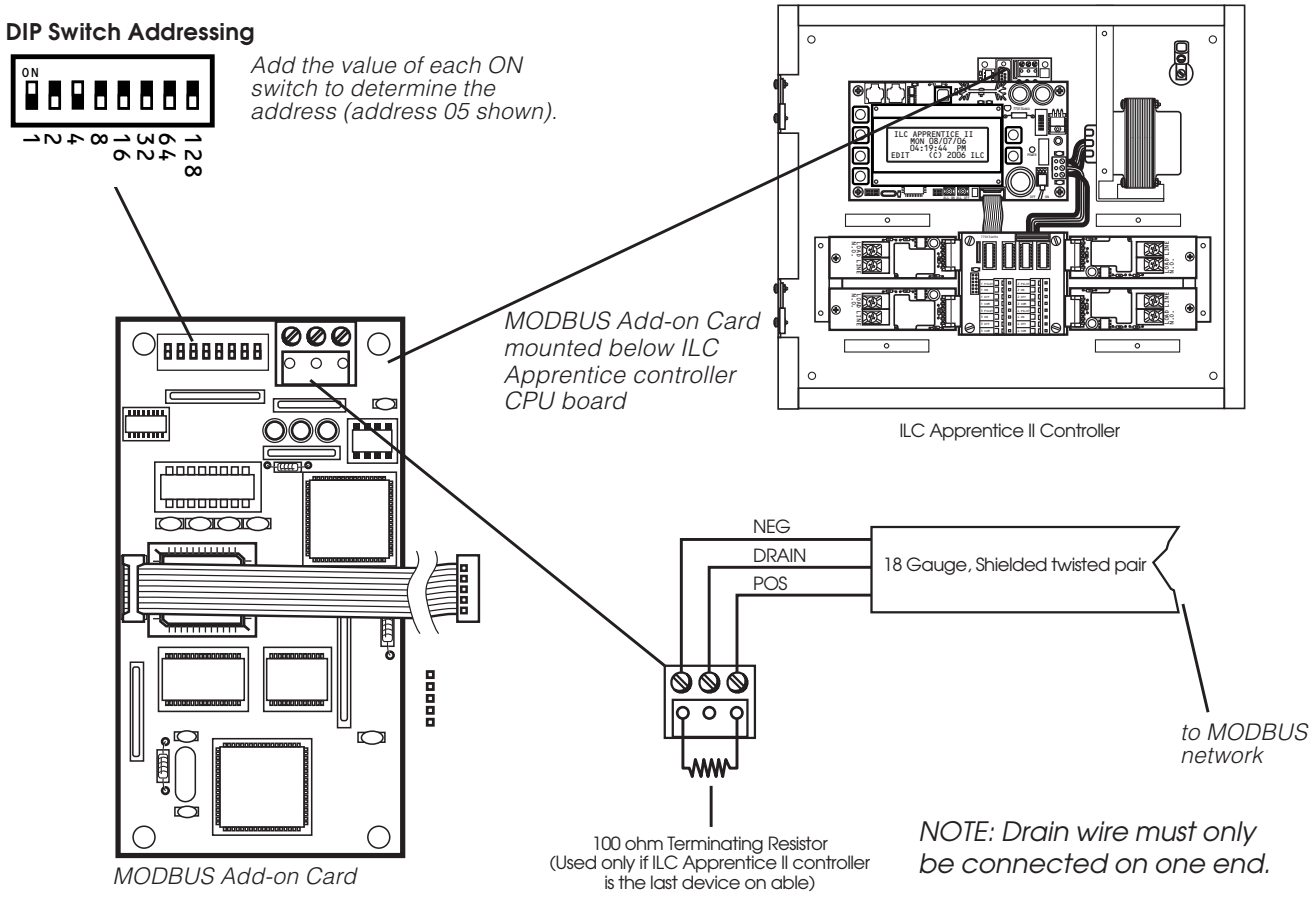


Figure M-1 MODBUS Set-Up

M.4 Transmission Mode Characteristics

ASCII printable characters are easy to view when trouble shooting and this mode is suited to PLC masters and computer masters programmed in a high level language, such as VISCOM BASIC.

In RTU mode, data is sent in 8-bit binary characters. In ASCII mode, data is divided into two 4 bit parts and then represented by the hexadecimal equivalent. ASCII mode uses twice as many characters as RTU mode but decoding is easier.

In RTU mode data must be transmitted in a continuous stream. In ASCII mode breaks of up to one second can occur between characters to allow for a relatively slow master.

M.5 Hardware Setup

The ILC Apprentice II must be equipped with a MODBUS add-on card and addressed with a unique node address (See Figure M-1). The network cable is a two wire shielded twisted pair. Consult the Automation system provider for the exact specifications. Terminate the cable as shown in Figure M.1.

M.6 Required Parameter Entries

After setting the MODBUS card address DIP switches, you must power up the ILC Apprentice II controller and define certain operational parameters for MODBUS communication. (See Fast Track diagram on next page.)

M.7 Framing

Both ASCII and RTU transmission modes feature mechanisms to indicate the beginning and end of a frame, the node address, a function code (the type of information sought/command signal), a data field indicating the particular point or register accessed. See Table M-1 for data field I/O point designators for a ILC Apprentice node.

M.8 Supported Commands

01 Read coil status
02 Read input status
05 Force singe coil
15 Force multiple coils
For more information refer to Modicon Modbus Protocol Reference Guide (PI-MBUS-300)

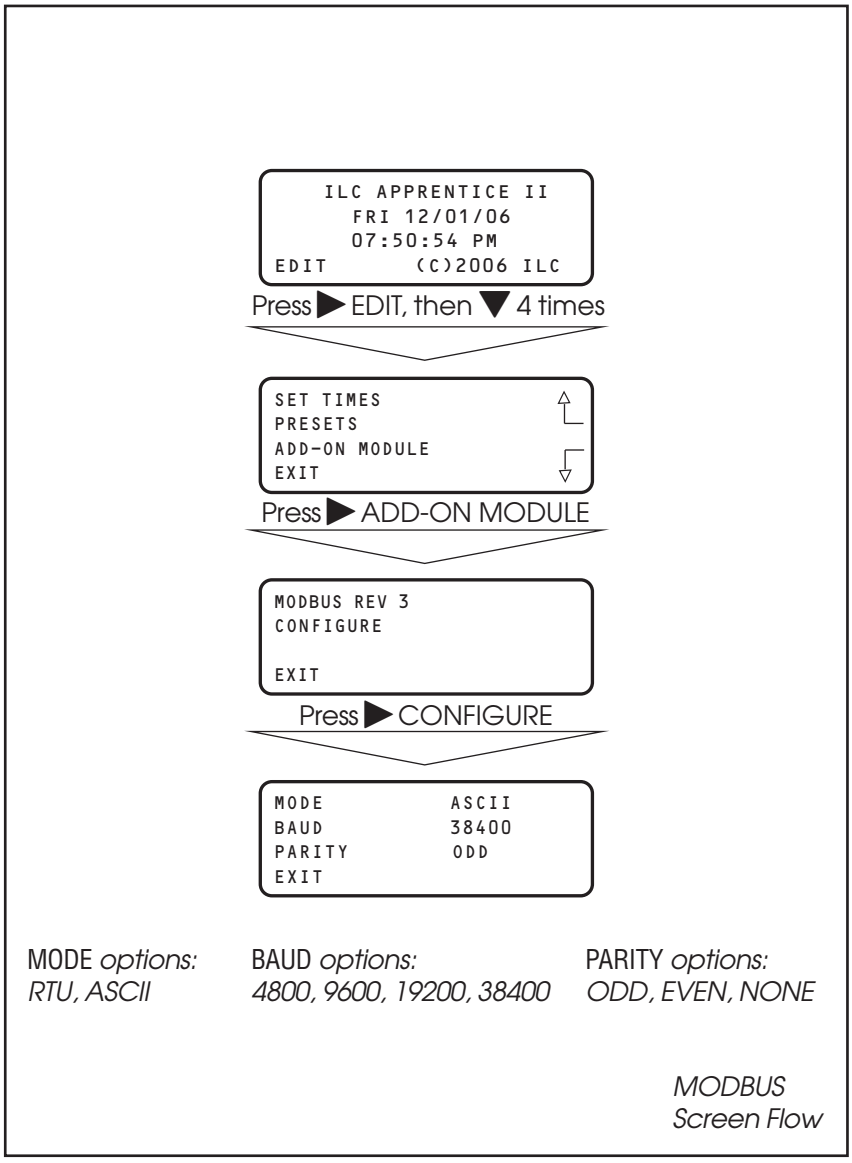
M.9 Additional Functions

- On/OFF with Time options (Blink/Alarm) See Table M.1.2
- Input Enable/Disable. See Table M.1.3

M.10 Additional Information

Contact Modicon Inc. if you would like more detailed information on MODBUS protocol.

MODBUS – Fast Track



MODE *options:* *RTU, ASCII*

BAUD *options:* *4800, 9600, 19200, 38400*

PARITY *options:* *ODD, EVEN, NONE*

MODBUS Screen Flow

Apprentice II Input	ON	OFF	Closed	Open
1	1	49	1 = Input Closed	0= Input Open
2	2	50	1 = Input Closed	0= Input Open
3	3	51	1 = Input Closed	0= Input Open
4	4	52	1 = Input Closed	0= Input Open
5	5	53	1 = Input Closed	0= Input Open
6	6	54	1 = Input Closed	0= Input Open
7	7	55	1 = Input Closed	0= Input Open
8	8	56	1 = Input Closed	0= Input Open
9	9	57	1 = Input Closed	0= Input Open
10	10	58	1 = Input Closed	0= Input Open
11	11	59	1 = Input Closed	0= Input Open
12	12	60	1 = Input Closed	0= Input Open
13	13	61	1 = Input Closed	0= Input Open
14	14	62	1 = Input Closed	0= Input Open
15	15	63	1 = Input Closed	0= Input Open
16	16	64	1 = Input Closed	0= Input Open
17	17	65	1 = Input Closed	0= Input Open
18	18	66	1 = Input Closed	0= Input Open
19	19	67	1 = Input Closed	0= Input Open
20	20	68	1 = Input Closed	0= Input Open
21	21	69	1 = Input Closed	0= Input Open
22	22	70	1 = Input Closed	0= Input Open
23	23	71	1 = Input Closed	0= Input Open
24	24	72	1 = Input Closed	0= Input Open
25	25	73	1 = Input Closed	0= Input Open
26	26	74	1 = Input Closed	0= Input Open
27	27	75	1 = Input Closed	0= Input Open
28	28	76	1 = Input Closed	0= Input Open
29	29	77	1 = Input Closed	0= Input Open
30	30	78	1 = Input Closed	0= Input Open
31	31	79	1 = Input Closed	0= Input Open
32	32	80	1 = Input Closed	0= Input Open
33	33	81	1 = Input Closed	0= Input Open
34	34	82	1 = Input Closed	0= Input Open
35	35	83	1 = Input Closed	0= Input Open
36	36	84	1 = Input Closed	0= Input Open
37	37	85	1 = Input Closed	0= Input Open
38	38	86	1 = Input Closed	0= Input Open
39	39	87	1 = Input Closed	0= Input Open
40	40	88	1 = Input Closed	0= Input Open
41	41	89	1 = Input Closed	0= Input Open
42	42	90	1 = Input Closed	0= Input Open
43	43	91	1 = Input Closed	0= Input Open
44	44	92	1 = Input Closed	0= Input Open
45	45	93	1 = Input Closed	0= Input Open
46	46	94	1 = Input Closed	0= Input Open
47	47	95	1 = Input Closed	0= Input Open
48	48	96	1 = Input Closed	0= Input Open

Table M.1 – ILC Apprentice II Data Field Input Point Designators

Apprentice II Output	Closed	Open
1	1=Output Closed	0=Output Open
2	1=Output Closed	0=Output Open
3	1=Output Closed	0=Output Open
4	1=Output Closed	0=Output Open
5	1=Output Closed	0=Output Open
6	1=Output Closed	0=Output Open
7	1=Output Closed	0=Output Open
8	1=Output Closed	0=Output Open
9	1=Output Closed	0=Output Open
10	1=Output Closed	0=Output Open
11	1=Output Closed	0=Output Open
12	1=Output Closed	0=Output Open
13	1=Output Closed	0=Output Open
14	1=Output Closed	0=Output Open
15	1=Output Closed	0=Output Open
16	1=Output Closed	0=Output Open
17	1=Output Closed	0=Output Open
18	1=Output Closed	0=Output Open
19	1=Output Closed	0=Output Open
20	1=Output Closed	0=Output Open
21	1=Output Closed	0=Output Open
22	1=Output Closed	0=Output Open
23	1=Output Closed	0=Output Open
24	1=Output Closed	0=Output Open
25	1=Output Closed	0=Output Open
26	1=Output Closed	0=Output Open
27	1=Output Closed	0=Output Open
28	1=Output Closed	0=Output Open
29	1=Output Closed	0=Output Open
30	1=Output Closed	0=Output Open
31	1=Output Closed	0=Output Open
32	1=Output Closed	0=Output Open
33	1=Output Closed	0=Output Open
34	1=Output Closed	0=Output Open
35	1=Output Closed	0=Output Open
36	1=Output Closed	0=Output Open
37	1=Output Closed	0=Output Open
38	1=Output Closed	0=Output Open
39	1=Output Closed	0=Output Open
40	1=Output Closed	0=Output Open
41	1=Output Closed	0=Output Open
42	1=Output Closed	0=Output Open
43	1=Output Closed	0=Output Open
44	1=Output Closed	0=Output Open
45	1=Output Closed	0=Output Open
46	1=Output Closed	0=Output Open
47	1=Output Closed	0=Output Open
48	1=Output Closed	0=Output Open

Table M.1.1 – ILC Apprentice II Data Field Output Point Designators

Apprentice II Output	Coil Point	Closed	Open
1	101	1=Output Closed/Timer Option	0=Output Open/Timer Option
2	102	1=Output Closed/Timer Option	0=Output Open/Timer Option
3	103	1=Output Closed/Timer Option	0=Output Open/Timer Option
4	104	1=Output Closed/Timer Option	0=Output Open/Timer Option
5	105	1=Output Closed/Timer Option	0=Output Open/Timer Option
6	106	1=Output Closed/Timer Option	0=Output Open/Timer Option
7	107	1=Output Closed/Timer Option	0=Output Open/Timer Option
8	108	1=Output Closed/Timer Option	0=Output Open/Timer Option
9	109	1=Output Closed/Timer Option	0=Output Open/Timer Option
10	110	1=Output Closed/Timer Option	0=Output Open/Timer Option
11	111	1=Output Closed/Timer Option	0=Output Open/Timer Option
12	112	1=Output Closed/Timer Option	0=Output Open/Timer Option
13	113	1=Output Closed/Timer Option	0=Output Open/Timer Option
14	114	1=Output Closed/Timer Option	0=Output Open/Timer Option
15	115	1=Output Closed/Timer Option	0=Output Open/Timer Option
16	116	1=Output Closed/Timer Option	0=Output Open/Timer Option
17	117	1=Output Closed/Timer Option	0=Output Open/Timer Option
18	118	1=Output Closed/Timer Option	0=Output Open/Timer Option
19	119	1=Output Closed/Timer Option	0=Output Open/Timer Option
20	120	1=Output Closed/Timer Option	0=Output Open/Timer Option
21	121	1=Output Closed/Timer Option	0=Output Open/Timer Option
22	122	1=Output Closed/Timer Option	0=Output Open/Timer Option
23	123	1=Output Closed/Timer Option	0=Output Open/Timer Option
24	124	1=Output Closed/Timer Option	0=Output Open/Timer Option
25	125	1=Output Closed/Timer Option	0=Output Open/Timer Option
26	126	1=Output Closed/Timer Option	0=Output Open/Timer Option
27	127	1=Output Closed/Timer Option	0=Output Open/Timer Option
28	128	1=Output Closed/Timer Option	0=Output Open/Timer Option
29	129	1=Output Closed/Timer Option	0=Output Open/Timer Option
30	130	1=Output Closed/Timer Option	0=Output Open/Timer Option
31	131	1=Output Closed/Timer Option	0=Output Open/Timer Option
32	132	1=Output Closed/Timer Option	0=Output Open/Timer Option
33	133	1=Output Closed/Timer Option	0=Output Open/Timer Option
34	134	1=Output Closed/Timer Option	0=Output Open/Timer Option
35	135	1=Output Closed/Timer Option	0=Output Open/Timer Option
36	136	1=Output Closed/Timer Option	0=Output Open/Timer Option
37	137	1=Output Closed/Timer Option	0=Output Open/Timer Option
38	138	1=Output Closed/Timer Option	0=Output Open/Timer Option
30	139	1=Output Closed/Timer Option	0=Output Open/Timer Option
40	140	1=Output Closed/Timer Option	0=Output Open/Timer Option
41	141	1=Output Closed/Timer Option	0=Output Open/Timer Option
42	142	1=Output Closed/Timer Option	0=Output Open/Timer Option
43	143	1=Output Closed/Timer Option	0=Output Open/Timer Option
44	144	1=Output Closed/Timer Option	0=Output Open/Timer Option
45	145	1=Output Closed/Timer Option	0=Output Open/Timer Option
46	146	1=Output Closed/Timer Option	0=Output Open/Timer Option
47	147	1=Output Closed/Timer Option	0=Output Open/Timer Option
48	148	1=Output Closed/Timer Option	0=Output Open/Timer Option

Table M.1.2 – ILC Apprentice II with a Timer Option (Blink/Alarm) Output Point Designators

Apprentice II Intput		Coil Point	Closed Open
1	201	1=Input Disable	0=Input Enable
2	202	1=Input Disable	0=Input Enable
3	203	1=Input Disable	0=Input Enable
4	204	1=Input Disable	0=Input Enable
5	205	1=Input Disable	0=Input Enable
6	206	1=Input Disable	0=Input Enable
7	207	1=Input Disable	0=Input Enable
8	208	1=Input Disable	0=Input Enable
9	209	1=Input Disable	0=Input Enable
10	210	1=Input Disable	0=Input Enable
11	211	1=Input Disable	0=Input Enable
12	212	1=Input Disable	0=Input Enable
13	213	1=Input Disable	0=Input Enable
14	214	1=Input Disable	0=Input Enable
15	215	1=Input Disable	0=Input Enable
16	216	1=Input Disable	0=Input Enable
17	217	1=Input Disable	0=Input Enable
18	218	1=Input Disable	0=Input Enable
19	219	1=Input Disable	0=Input Enable
20	220	1=Input Disable	0=Input Enable
21	221	1=Input Disable	0=Input Enable
22	222	1=Input Disable	0=Input Enable
23	223	1=Input Disable	0=Input Enable
24	224	1=Input Disable	0=Input Enable
25	225	1=Input Disable	0=Input Enable
26	226	1=Input Disable	0=Input Enable
27	227	1=Input Disable	0=Input Enable
28	228	1=Input Disable	0=Input Enable
29	229	1=Input Disable	0=Input Enable
30	230	1=Input Disable	0=Input Enable
31	231	1=Input Disable	0=Input Enable
32	232	1=Input Disable	0=Input Enable
33	233	1=Input Disable	0=Input Enable
34	234	1=Input Disable	0=Input Enable
35	235	1=Input Disable	0=Input Enable
36	236	1=Input Disable	0=Input Enable
37	237	1=Input Disable	0=Input Enable
38	238	1=Input Disable	0=Input Enable
30	239	1=Input Disable	0=Input Enable
40	240	1=Input Disable	0=Input Enable
41	241	1=Input Disable	0=Input Enable
42	242	1=Input Disable	0=Input Enable
43	243	1=Input Disable	0=Input Enable
44	244	1=Input Disable	0=Input Enable
45	245	1=Input Disable	0=Input Enable
46	246	1=Input Disable	0=Input Enable
47	247	1=Input Disable	0=Input Enable
48	248	1=Input Disable	0=Input Enable

Table M.1.3 – ILC Apprentice II Input Enable/Disable Point Designators

N.1 Overview

The ILC Apprentice II controller can be integrated into a Building Automation System (BAS) that uses the N2 communications protocol. The host system can then poll the status of the ILC Apprentice II controller inputs and outputs and issue ON/OFF commands to the ILC Apprentice II's relay outputs.

N.2 Hardware Setup

The ILC Apprentice II must be equipped with a N2 add-on module that is addressed with a unique node address. (See Figure N-1.) The network cable is a two wire shielded twisted pair. Consult the BAS system documentation for the exact specifications. Terminate the cable as shown in Figure N-1.

N.3 Point Map

Fill out the point map for the ILC Apprentice II controller. Note that only BI and BO point types are used. The completed point map will serve as the control schedule used to determine how ILC Apprentice II relay outputs will be controlled.

ILC LightMaster N2 Rev 1 Unsupported Attributes

All attributes in the following regions

Analog Input
Analog Output
Internal Float
Internal Integer
Internal Byte

Binary Input Unsupported Attributes

Attribute 1		
Bit 0	COS _enabled	Always 1 (COS is always enabled)
Bit 1	Normal state	Always 0
Bit 3	Alarm_enabled	Always 0 (disabled)
Attribute 2		
Bit 0	Always reliable (0)	
Bit 1	Override active	Always 0 (not active)
Bit 4	Normal (0)	
Bit 5	JCI use only	
Attribute 3	JCI use only	
Attribute 4	JCI use only	

Binary Output Unsupported Attributes

Attribute 1		
Bit 0	COS _enabled	Always 0 (COS is always enabled)
Bit 1	Normal state	Always 0
Attribute 2		
Bit 0	Always reliable (0)	
Bit 1	Override active	Always 0 (not active)
Bit 4	JCI use only	
Bit 5	JCI use only	
Attribute 3	Minimum ON time	Always 0
Attribute 4	Minimum OFF time	Always 0
Attribute 5	Maximum Cycles/Hour	Always 0
Attribute 6	JCI use only	
Attribute 7	JCI use only	

ILC Apprentice II N2 Network Example – See Termination Detail Below

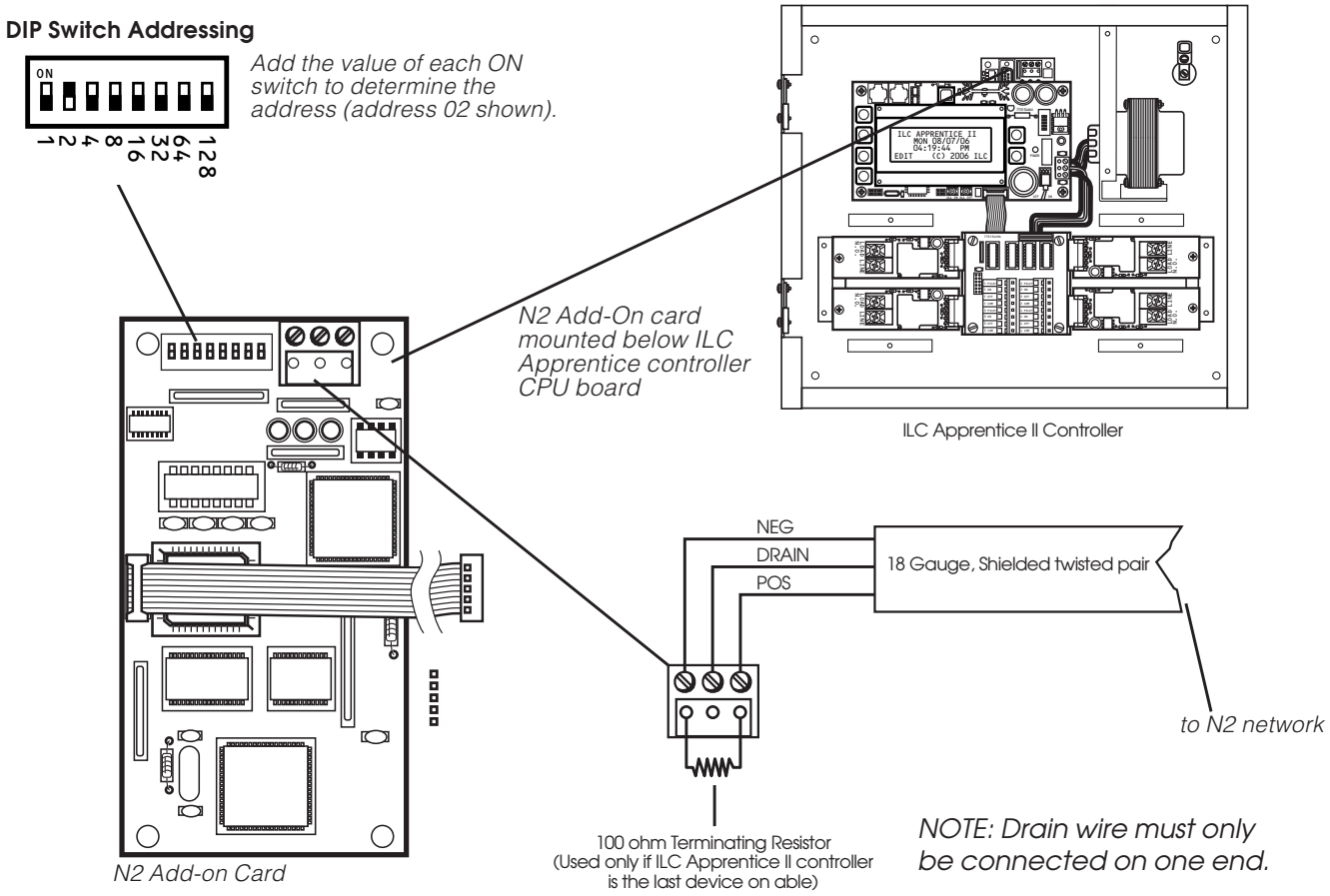
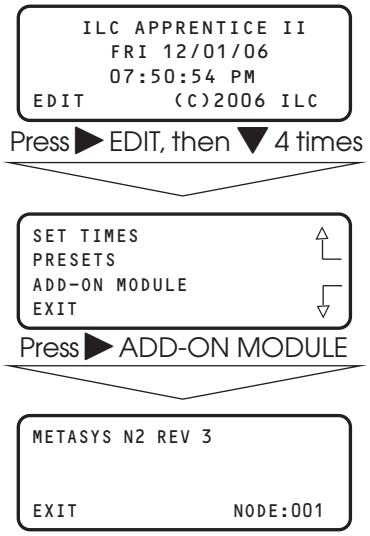


Figure N-1 N2 Set-Up

N2 – Fast Track



N2
Screen Flow

NETWORK POINT TYPE	NETWORK POINT ADDRESS	UNITS	POINT DESCRIPTION	RANGE/VALUE	NOTES
BI	1		SWITCH INPUT #1 OFF	0-OPEN 1-CLOSED	
BI	2		SWITCH INPUT #1 ON	0-OPEN 1-CLOSED	
BI	3		SWITCH INPUT #2 OFF	0-OPEN 1-CLOSED	
BI	4		SWITCH INPUT #2 ON	0-OPEN 1-CLOSED	
BI	5		SWITCH INPUT #3 OFF	0-OPEN 1-CLOSED	
BI	6		SWITCH INPUT #3 ON	0-OPEN 1-CLOSED	
BI	7		SWITCH INPUT #4 OFF	0-OPEN 1-CLOSED	
BI	8		SWITCH INPUT #4 ON	0-OPEN 1-CLOSED	
BI	9		SWITCH INPUT #5 OFF	0-OPEN 1-CLOSED	
BI	10		SWITCH INPUT #5 ON	0-OPEN 1-CLOSED	
BI	11		SWITCH INPUT #6 OFF	0-OPEN 1-CLOSED	
BI	12		SWITCH INPUT #6 ON	0-OPEN 1-CLOSED	
BI	13		SWITCH INPUT #7 OFF	0-OPEN 1-CLOSED	
BI	14		SWITCH INPUT #7 ON	0-OPEN 1-CLOSED	
BI	15		SWITCH INPUT #8 OFF	0-OPEN 1-CLOSED	
BI	16		SWITCH INPUT #8 ON	0-OPEN 1-CLOSED	
BI	17		SWITCH INPUT #9 OFF	0-OPEN 1-CLOSED	
BI	18		SWITCH INPUT #9 ON	0-OPEN 1-CLOSED	
BI	19		SWITCH INPUT #10 OFF	0-OPEN 1-CLOSED	
BI	20		SWITCH INPUT #10 ON	0-OPEN 1-CLOSED	
BI	21		SWITCH INPUT #11 OFF	0-OPEN 1-CLOSED	
BI	22		SWITCH INPUT #11 ON	0-OPEN 1-CLOSED	
BI	23		SWITCH INPUT #12 OFF	0-OPEN 1-CLOSED	
BI	24		SWITCH INPUT #12 ON	0-OPEN 1-CLOSED	

Table N.1 – ILC Apprentice II Input N2 Point Map

NETWORK POINT TYPE	NETWORK POINT ADDRESS	UNITS	POINT DESCRIPTION	RANGE/VALUE	NOTES
BI	25		SWITCH INPUT #13 OFF	0-OPEN 1-CLOSED	
BI	26		SWITCH INPUT #13 ON	0-OPEN 1-CLOSED	
BI	27		SWITCH INPUT #14 OFF	0-OPEN 1-CLOSED	
BI	28		SWITCH INPUT #14 ON	0-OPEN 1-CLOSED	
BI	29		SWITCH INPUT #15 OFF	0-OPEN 1-CLOSED	
BI	30		SWITCH INPUT #15 ON	0-OPEN 1-CLOSED	
BI	31		SWITCH INPUT #16 OFF	0-OPEN 1-CLOSED	
BI	32		SWITCH INPUT #16 ON	0-OPEN 1-CLOSED	
BI	33		SWITCH INPUT #17 OFF	0-OPEN 1-CLOSED	
BI	34		SWITCH INPUT #17 ON	0-OPEN 1-CLOSED	
BI	35		SWITCH INPUT #18 OFF	0-OPEN 1-CLOSED	
BI	36		SWITCH INPUT #18 ON	0-OPEN 1-CLOSED	
BI	37		SWITCH INPUT #19 OFF	0-OPEN 1-CLOSED	
BI	38		SWITCH INPUT #19 ON	0-OPEN 1-CLOSED	
BI	39		SWITCH INPUT #20 OFF	0-OPEN 1-CLOSED	
BI	40		SWITCH INPUT #20 ON	0-OPEN 1-CLOSED	
BI	41		SWITCH INPUT #21 OFF	0-OPEN 1-CLOSED	
BI	42		SWITCH INPUT #21 ON	0-OPEN 1-CLOSED	
BI	43		SWITCH INPUT #22 OFF	0-OPEN 1-CLOSED	
BI	44		SWITCH INPUT #22 ON	0-OPEN 1-CLOSED	
BI	45		SWITCH INPUT #23 OFF	0-OPEN 1-CLOSED	
BI	46		SWITCH INPUT #23 ON	0-OPEN 1-CLOSED	
BI	47		SWITCH INPUT #24 OFF	0-OPEN 1-CLOSED	
BI	48		SWITCH INPUT #24 ON	0-OPEN 1-CLOSED	
BI	49		SWITCH INPUT #25 OFF	0-OPEN 1-CLOSED	

Table N.1 – ILC Apprentice II Input N2 Point Map

NETWORK POINT TYPE	NETWORK POINT ADDRESS	UNITS	POINT DESCRIPTION	RANGE/VALUE	NOTES
BI	50		SWITCH INPUT #25 ON	0-OPEN 1-CLOSED	
BI	51		SWITCH INPUT #26 OFF	0-OPEN 1-CLOSED	
BI	52		SWITCH INPUT #26 ON	0-OPEN 1-CLOSED	
BI	53		SWITCH INPUT #27 OFF	0-OPEN 1-CLOSED	
BI	54		SWITCH INPUT #27 ON	0-OPEN 1-CLOSED	
BI	55		SWITCH INPUT #28 OFF	0-OPEN 1-CLOSED	
BI	56		SWITCH INPUT #28 ON	0-OPEN 1-CLOSED	
BI	57		SWITCH INPUT #29 OFF	0-OPEN 1-CLOSED	
BI	58		SWITCH INPUT #29 ON	0-OPEN 1-CLOSED	
BI	59		SWITCH INPUT #30 OFF	0-OPEN 1-CLOSED	
BI	60		SWITCH INPUT #30 ON	0-OPEN 1-CLOSED	
BI	61		SWITCH INPUT #31 OFF	0-OPEN 1-CLOSED	
BI	62		SWITCH INPUT #31 ON	0-OPEN 1-CLOSED	
BI	63		SWITCH INPUT #32 OFF	0-OPEN 1-CLOSED	
BI	64		SWITCH INPUT #32 ON	0-OPEN 1-CLOSED	
BI	65		SWITCH INPUT #33 OFF	0-OPEN 1-CLOSED	
BI	66		SWITCH INPUT #33 ON	0-OPEN 1-CLOSED	
BI	67		SWITCH INPUT #34 OFF	0-OPEN 1-CLOSED	
BI	68		SWITCH INPUT #34 ON	0-OPEN 1-CLOSED	
BI	69		SWITCH INPUT #35 OFF	0-OPEN 1-CLOSED	
BI	70		SWITCH INPUT #35 ON	0-OPEN 1-CLOSED	
BI	71		SWITCH INPUT #36 OFF	0-OPEN 1-CLOSED	
BI	72		SWITCH INPUT #36 ON	0-OPEN 1-CLOSED	
BI	73		SWITCH INPUT #37 OFF	0-OPEN 1-CLOSED	

Table N.1 – ILC Apprentice II Input N2 Point Map

NETWORK POINT TYPE	NETWORK POINT ADDRESS	UNITS	POINT DESCRIPTION	RANGE/VALUE	NOTES
BI	74		SWITCH INPUT #37 ON	0-OPEN 1-CLOSED	
BI	75		SWITCH INPUT #38 OFF	0-OPEN 1-CLOSED	
BI	76		SWITCH INPUT #38 ON	0-OPEN 1-CLOSED	
BI	77		SWITCH INPUT #39 OFF	0-OPEN 1-CLOSED	
BI	78		SWITCH INPUT #39 ON	0-OPEN 1-CLOSED	
BI	79		SWITCH INPUT #40 OFF	0-OPEN 1-CLOSED	
BI	80		SWITCH INPUT #40 ON	0-OPEN 1-CLOSED	
BI	81		SWITCH INPUT #41 OFF	0-OPEN 1-CLOSED	
BI	82		SWITCH INPUT #41 ON	0-OPEN 1-CLOSED	
BI	83		SWITCH INPUT #42 OFF	0-OPEN 1-CLOSED	
BI	84		SWITCH INPUT #42 ON	0-OPEN 1-CLOSED	
BI	85		SWITCH INPUT #43 OFF	0-OPEN 1-CLOSED	
BI	86		SWITCH INPUT #43 ON	0-OPEN 1-CLOSED	
BI	87		SWITCH INPUT #44 OFF	0-OPEN 1-CLOSED	
BI	88		SWITCH INPUT #44 ON	0-OPEN 1-CLOSED	
BI	89		SWITCH INPUT #45 OFF	0-OPEN 1-CLOSED	
BI	90		SWITCH INPUT #45 ON	0-OPEN 1-CLOSED	
BI	91		SWITCH INPUT #46 OFF	0-OPEN 1-CLOSED	
BI	92		SWITCH INPUT #46 ON	0-OPEN 1-CLOSED	
BI	93		SWITCH INPUT #47 OFF	0-OPEN 1-CLOSED	
BI	94		SWITCH INPUT #47 ON	0-OPEN 1-CLOSED	
BI	95		SWITCH INPUT #48 OFF	0-OPEN 1-CLOSED	
BI	96		SWITCH INPUT #48 ON	0-OPEN 1-CLOSED	

Table N.1 – ILC Apprentice II Input N2 Point Map

NETWORK POINT TYPE	NETWORK POINT ADDRESS	UNITS	POINT DESCRIPTION	RANGE/VALUE
BO	1		RELAY OUTPUT #1	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	2		RELAY OUTPUT #2	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	3		RELAY OUTPUT #3	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	4		RELAY OUTPUT #4	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	5		RELAY OUTPUT #5	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	6		RELAY OUTPUT #6	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	7		RELAY OUTPUT #7	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	8		RELAY OUTPUT #8	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	9		RELAY OUTPUT #9	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	10		RELAY OUTPUT #10	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	11		RELAY OUTPUT #11	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	12		RELAY OUTPUT #12	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	13		RELAY OUTPUT #13	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	14		RELAY OUTPUT #14	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	15		RELAY OUTPUT #15	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	16		RELAY OUTPUT #16	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	17		RELAY OUTPUT #17	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	18		RELAY OUTPUT #18	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	19		RELAY OUTPUT #19	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	20		RELAY OUTPUT #20	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	21		RELAY OUTPUT #21	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	22		RELAY OUTPUT #22	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	23		RELAY OUTPUT #23	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	24		RELAY OUTPUT #24	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option

Table N.1 – ILC Apprentice II Relay Output N2 Point Map

NETWORK POINT TYPE	NETWORK POINT ADDRESS	UNITS	POINT DESCRIPTION	RANGE/VALUE
BO	25		RELAY OUTPUT #25	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	26		RELAY OUTPUT #26	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	27		RELAY OUTPUT #27	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	28		RELAY OUTPUT #28	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	29		RELAY OUTPUT #29	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	30		RELAY OUTPUT #30	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	31		RELAY OUTPUT #31	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	32		RELAY OUTPUT #32	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	33		RELAY OUTPUT #33	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	34		RELAY OUTPUT #34	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	35		RELAY OUTPUT #35	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	36		RELAY OUTPUT #36	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	37		RELAY OUTPUT #37	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	38		RELAY OUTPUT #38	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	39		RELAY OUTPUT #39	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	40		RELAY OUTPUT #40	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	41		RELAY OUTPUT #41	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	42		RELAY OUTPUT #42	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	43		RELAY OUTPUT #43	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	44		RELAY OUTPUT #44	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	45		RELAY OUTPUT #45	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	46		RELAY OUTPUT #46	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	47		RELAY OUTPUT #47	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	48		RELAY OUTPUT #48	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option

Table N.1 – ILC Apprentice II Relay Output N2 Point Map

NETWORK POINT TYPE	NETWORK POINT ADDRESS	INPUTS	RANGE/VALUE	NOTES
BO	201	01	0- Input Enable 1- Input Disable	
BO	202	02	0- Input Enable 1- Input Disable	
BO	2 03	03	0- Input Enable 1- Input Disable	
BO	204	04	0- Input Enable 1- Input Disable	
BO	205	05	0- Input Enable 1- Input Disable	
BO	206	06	0- Input Enable 1- Input Disable	
BO	207	07	0- Input Enable 1- Input Disable	
BO	208	08	0- Input Enable 1- Input Disable	
BO	209	09	0- Input Enable 1- Input Disable	
BO	210	10	0- Input Enable 1- Input Disable	
BO	211	11	0- Input Enable 1- Input Disable	
BO	212	12	0- Input Enable 1- Input Disable	
BO	213	13	0- Input Enable 1- Input Disable	
BO	214	14	0- Input Enable 1- Input Disable	
BO	215	15	0- Input Enable 1- Input Disable	
BO	216	16	0- Input Enable 1- Input Disable	
BO	217	17	0- Input Enable 1- Input Disable	
BO	218	18	0- Input Enable 1- Input Disable	
BO	219	19	0- Input Enable 1- Input Disable	
BO	220	20	0- Input Enable 1- Input Disable	
BO	221	21	0- Input Enable 1- Input Disable	
BO	222	22	0- Input Enable 1- Input Disable	
BO	223	23	0- Input Enable 1 -Input Disable	
BO	224	24	0- Input Enable 1- Input Disable	

Table N.1 – ILC Apprentice II Input Disable/Enable N2 Point Map

NETWORK POINT TYPE	NETWORK POINT ADDRESS	INPUTS	RANGE/VALUE	NOTES
BO	225	25	0- Input Enable 1- Input Disable	
BO	226	26	0- Input Enable 1- Input Disable	
BO	227	27	0- Input Enable 1- Input Disable	
BO	228	28	0- Input Enable 1- Input Disable	
BO	229	29	0- Input Enable 1- Input Disable	
BO	230	30	0- Input Enable 1- Input Disable	
BO	231	31	0- Input Enable 1- Input Disable	
BO	232	32	0- Input Enable 1- Input Disable	
BO	233	33	0- Input Enable 1- Input Disable	
BO	234	34	0- Input Enable 1- Input Disable	
BO	235	35	0- Input Enable 1- Input Disable	
BO	236	36	0- Input Enable 1- Input Disable	
BO	237	37	0- Input Enable 1- Input Disable	
BO	238	38	0- Input Enable 1- Input Disable	
BO	239	39	0- Input Enable 1- Input Disable	
BO	240	40	0- Input Enable 1- Input Disable	
BO	241	41	0- Input Enable 1- Input Disable	
BO	242	42	0- Input Enable 1- Input Disable	
BO	243	43	0- Input Enable 1- Input Disable	
BO	244	44	0- Input Enable 1- Input Disable	
BO	245	45	0- Input Enable 1- Input Disable	
BO	246	46	0- Input Enable 1- Input Disable	
BO	247	47	0- Input Enable 1 -Input Disable	
BO	248	48	0- Input Enable 1- Input Disable	

Table N.1 – ILC Apprentice II Input Disable/Enable N2 Point Map

Alabama,Birmingham,33,87
Alabama,Gadsden,34,86
Alabama,Huntsville,34,86
Alabama,Mobile,30,88
Alabama,Montgomery,32,86
Alaska, Anchorage, 61,150
Alaska, Fairbanks, 65,148
Alaska, Juneau, 58,135
Arizona,Flagstaff,35,111
Arizona,Phoenix,33,112
Arizona,Tucson,32,111
Arizona,Yums,32,114
Arkansas,Fort Smith,35,94
Arkansas,Little Rock,34,92
California,Bakersfield,35,119
California,Berkeley,38,122
California,Eureka,41,124
California,Fresno,36,120
California,Los Angeles,34,118
California,Oakland,37,122
California,Pasadena,34,118
California,Sacramento,38,121
California,San Bernandio,34,117
California,San Diego,32,117
California,San Francisco,38,122
California,San Jose,37,122
California,Santa Barbara,34,119
California,Santa Cruz,37,122
California,Stockton,38,121
Colorado,Colorado Springs,39,105
Colorado,Denver,39,105
Colorado,Grand Junction,39,108
Colorado,Pueblo,38,104
Connecticut,Bridgeport,41,73
Connecticut,Hartford,42,72
Connecticut,Meriden,41,73
Connecticut,New Britain,41,73
Connecticut,New Haven,41,73
Connecticut,Stanford,41,73
Delaware,Wilmington,39,75
District of Columbia,
Washington,39,77
Florida,Daytona Beach,29,81
Florida,Gainesville,29,82
Florida,Jacksonville,30,81
Florida,Key West,24,82
Florida,Miami,26,80
Florida,Orlando,28,81
Florida,Penescola,30,87
Florida,Sarasota,27,82
Florida,St. Petersburgh,28,82
Florida,Tallahassee,30,84
Florida,Tampa,28,82
Florida,West Palm Beach,26,80
Georgia,Atlanta,34,84
Georgia,Augusta,33,82
Georgia,Columbus,32,85
Georgia,Macon,33,83
Georgia,Savannah,32,81
Idaho,Boise,43,116
Idaho,Pocatello,43,112
Illinois,Bloomington,40,89
Illinois,Champaign,40,88
Illinois,Chicago,42,87
Illinois,Decatur,40,89
Illinois,Peoria,40,89
Illinois,Rockford,42,89
Illinois,Springfield,40,89
Illinois,Urbana,40,86
Indiana,Evansville,38,87
Indiana,Ft. Wayne,41,85
Indiana,Gary,41,87
Indiana,Indianapolis,40,86
Indiana,Lafayette,40,87
Indiana,Muncie,40,85
Indiana,South Bend,41,86
Indiana,Terre Haute,39,87
Iowa,Cedar Rapids,42,91
Iowa,Des Moines,41,93
Iowa,Dubuque,42,90
Iowa,Iowa City,41,91
Iowa,Sioux City,43,96
Iowa,Waterloo,42,92
Kansas,Dodge City,38,100
Kansas,Kansas City,39,94
Kansas,Salina,39,97
Kansas,Topeka,39,95
Kansas,Wichita,37,97
Kentucky,Ashland,38,82
Kentucky,Bowling Green,37,86
Kentucky,Lexington,38,84
Kentucky,Louisville,38,86
Kentucky,Paducah,37,88
Louisiana,Baton Rouge,30,91
Louisiana,New Orleans,30,90
Louisiana,Shreveport,32,93
Maine,Augusta,44,70
Maine,Bangor,45,69
Maine,Lowell,42,71
Maine,Portland,43,70
Maryland,Baltimore,39,76
Maryland,Springfield,42,72
Massachusetts,Boston,42,71
Massachusetts,Brockton,42,71
Massachusetts,Cambridge,42,71
Massachusetts,Fall River,41,71
Massachusetts,Lawrence,42,71
Massachusetts,Plainfield,42,73
Massachusetts,Worcester,42,72
Michigan,Ann Arbor,42,83
Michigan,Battle Creek,42,85
Michigan,Bay City,43,84
Michigan,Detroit,42,83
Michigan,Flint,43,83
Michigan,Grand Rapids,43,85
Michigan,Jackson,42,84
Michigan,Kalamazoo,42,85
Michigan,Lansing,42,84
Michigan,Saginaw,43,84
Minnesota,Duluth,47,92
Minnesota,Minneapolis,45,93
Minnesota,Rochester,44,92
Minnesota,St. Cloud,45,94
Minnesota,St. Paul,45,93
Mississippi,Biloxi,30,89
Mississippi,Gulfport,30,89
Mississippi,Jackson,32,90
Mississippi,Natchez,31,91
Missouri,Columbia,38,92
Missouri,Joplin,37,94
Missouri,Kansas City,39,94
Missouri,Springfield,37,93
Missouri,St. Joseph,40,95
Missouri,St. Louis,38,90
Montana,Billings,46,108
Montana,Butte,46,112
Montana,Great Falls,47,111
Montana,Helena,46,112
Nebraska,Lincoln,41,96
Nebraska,Omaha,41,96
Nevada,Carson City,39,120
Nevada,Las Vegas,36,115
Nevada,Reno,39,120
New Hampshire,Concord,43,71
New Hampshire,Manchester,43,71
New Hampshire,Portsmouth,43,71
New Jersey,Atlantic City,39,74
New Jersey,Elizabeth,40,74
New Jersey,Jersey City,40,74
New Jersey,Newark,40,74
New Jersey,Peterson,41,74
New Jersey,Trenton,40,75
New Mexico,Albuquerque,35,106
New Mexico,Gallup,35,108
New Mexico,Santa Fe,35,106
New York,Albany,42,74
New York,Binghamton,42,76
New York,Buffalo,43,79
New York,Central Islip,41,73
New York,New York,41,74
New York,Rochester,43,77
New York,Schenectady,43,74
New York,Syracuse,43,76
New York,Troy,42,73
New York,Utica,43,75
New York,White Plains,41,74
North Carolina,Asheville,35,82
North Carolina,Charlotte,35,81
North Carolina,Durham,36,79
North Carolina,Greensboro,35,80
North Carolina,Raleigh,36,78
North Carolina,Wilmington,34,78
North Carolina,Winston-
Salem,36,80
North Dakota,Bismarck,47,101
North Dakota,Fargo,37,97
North Dakota,Minot,48,101
Ohio,Akron,41,81
Ohio,Canton,41,81
Ohio,Cincinnati,39,84
Ohio,Cleveland,41,81
Ohio,Columbus,40,83
Ohio,Dayton,40,84
Ohio,Hamilton,39,84
Ohio,Lima,40,84
Ohio,Springfield,40,84
Ohio,Staubenville,40,80
Ohio,Toledo,41,83
Ohio,Youngstown,41,80
Ohio,Zanesville,40,82
Oklahoma,Enid,36,98
Oklahoma,Oklahoma City,35,97
Oklahoma,Tulsa,38,96
Oregon,Salem,45,123
Oregon,Eugene,44,123
Oregon,Portland,45,122
Pennsylvania,Allentown,40,75
Pennsylvania,Erie,42,80
Pennsylvania,Harrisburg,40,77
Pennsylvania,Johnstown,40,79
Pennsylvania,Lancester,40,76
Pennsylvania,Philadelphia,40,75
Pennsylvania,Pittsburgh,40,80
Pennsylvania,Reading,40,76
Pennsylvania,Wilkes-Barre,41,76
Rhode Island,Providence,42,71
South Carolina,Charleston,33,80
South Carolina,Columbia,34,81
South Carolina,Greenville,35,82
South Carolina,Spartanburg,35,82
South Dakota,Pierre,44,100
South Dakota,Rapid City,44,103
South Dakota,Sioux Falls,43,96
Tennessee,Chattanooga,35,85
Tennessee,Knoxville,36,84
Tennessee,Memphis,35,90
Tennessee,Nashville,36,87
Texas,Abilene,32,99
Texas,Amerillo,35,102
Texas,Austin,30,97
Texas,Beaumont,30,94
Texas,Corpus Christi,28,97
Texas,Dallas,33,97
Texas,El Paso,32,106
Texas,Fort Arthur,30,94
Texas,Fort Worth,32,97
Texas,Galveston,29,95
Texas,Houston,30,95
Texas,Laredo,27,99
Texas,Lubbock,33,102
Texas,Marshall,32,94
Texas,San Antonio,29,95
Texas,Texakana,33,94
Texas,Waco,31,97
Utah,Opden,41,112
Utah,Provo,40,111
Utah,Salt Lake City,41,112
Vermont,Brattleboro,43,72
Vermont,Burlington,44,73
Vermont,Montpellier,44,72
Virginia,Norfolk,37,76
Virginia,Portsmouth,37,76
Virginia,Richmond,37,77
Virginia,Roanoke,37,80
Washington,Bellingham,49,122
Washington,Seattle,47,122
Washington,Spokane,47,117
Washington,Tacoma,47,122
Washington,Walla Walla,46,118
Washington,Yakima,46,120
West Virginia,Charleston,38,81
West Virginia,Wheeling,40,80
Wisconsin,Eau Claire,45,91
Wisconsin,Green Bay,44,88
Wisconsin,Kenosha,42,88
Wisconsin,Madison,43,89
Wisconsin,Milwaukee,43,88
Wisconsin,Racine,42,88
Wisconsin,Sheboygan,44,87
Wisconsin,Superior,46,92
Wyoming,Cheyenne,41,105
Wyoming,Sheridan,45,107

LightSync™ Photocell

The LightSync™ photo controller is installed as a LightSync™ device node and communicates with the Apprentice II Controller over the CAT-5 data cable. The LightSync™ photo controller features 8 sets of independently adjustable ON/OFF set points each with 256 possible set point steps. Each step equates on average to the foot candle levels shown in Table P.1 (Component and environmental variables may require adjustments from these settings to attain a desired foot candle level.) Either an indoor or an outdoor photo eye is available. The photo eye may be installed up to 5000 ft. from the photo controller using 18-gauge wire. The settings are programmed at the Apprentice II Controller. See Figures P.3 for Installation detail.

Table P.1– LightSync™ Photocell Set Points

Foot Candle	Avg. Settings
1	18
2	27
3	37
4	47
5	56
6	61
7	65
8	71
9	74
10	80
11	84
12	87
13	90
14	93
15	96
20	108
30	112
40	115
50	126
60	131
70	135
80	139
90	146
100	167
150	179
200	192
300	202
400	207
500	213
600	216
700	220
800	223
900	226
1000	229
1200	231
1400	233
1600	235
1800	236

Note: Typical ON/OFF set points for an outdoor application are 25 fc (110) ON and 75 fc (137) OFF.

P.5 Installation

1. Route the CAT-5 cable to the photo controller from the nearest device node or from the Apprentice II.
2. Crimp male ends on the cable and check the cable integrity with a CAT-5 cable tester.
3. Install the photo sensor and terminate the conductors to the controller board.
4. Set the node address.
5. Plug the incoming CAT-5 cable into the "IN" photo-controller RJ-45 connector. Plug the other end of the CAT-5 into the "OUT" connector on the upstream LightSync™ node. (This node could be the Apprentice II expansion controller or a LightSync™ device like a LightSync™ pushbutton switch.

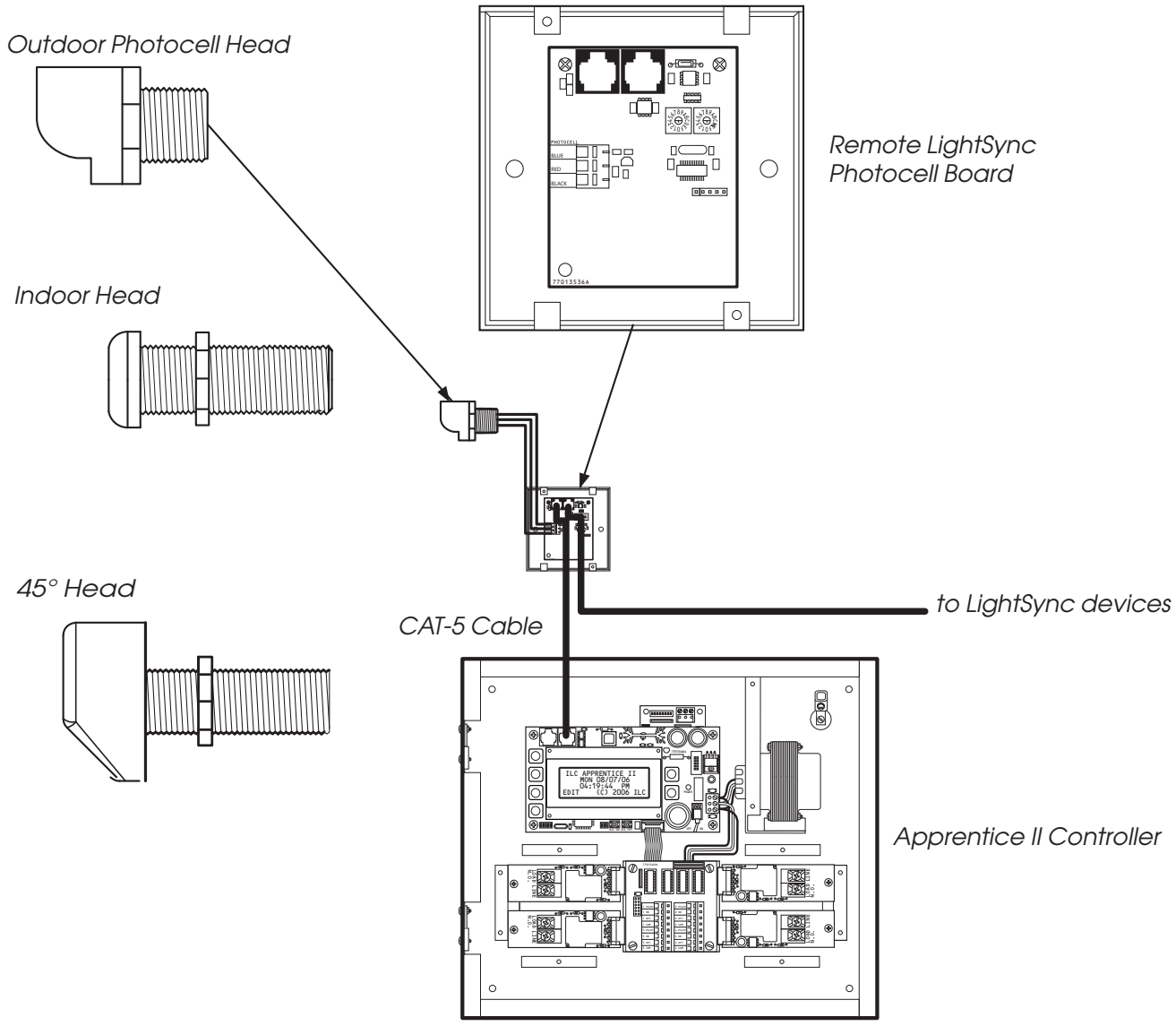


Figure P.3 – LightSync Photocell Installation Overview

LightSync Ramote Mount Photocell Controller Board and Heads

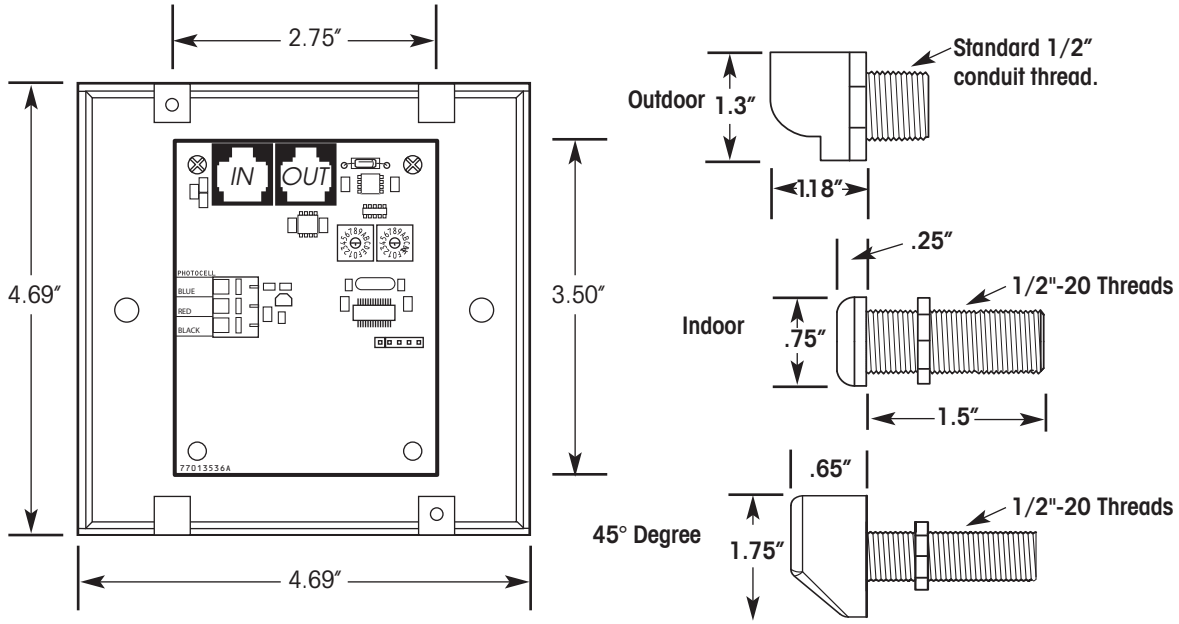


Figure P.4 – LightSync Remote Mount Photocell

P.6 Programming Example

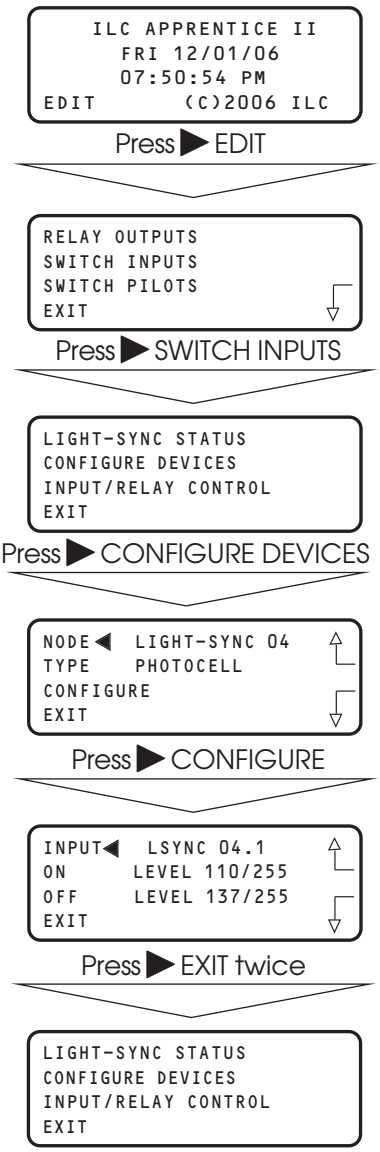
How to Program a LightSync™ Photocell to Control Relay Outputs

You have to perform two essential and possibly one optional tasks to control relays from a LightSync™ photocell.

- Define the photocell operational parameters.
- Select the relays to be controlled and define how they will react.
- If desired, change the photocell filter rate from its default of 30 seconds to 2 seconds. The filter is a delay period applied to the photocell controller to prevent nuisance switching (30 is generally used).

Define the Photocell Node:

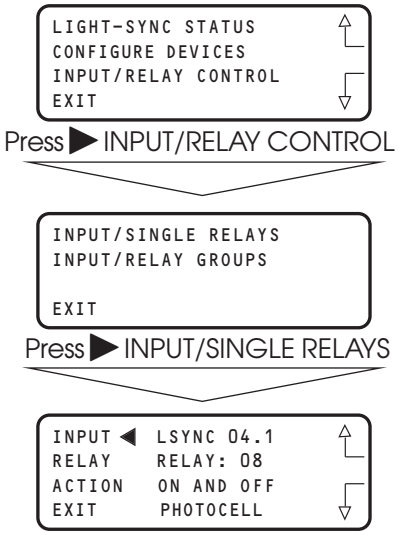
1. From the Home screen, press ▶ EDIT.
2. When the Main menu appears, press ▶ SWITCH INPUTS; then press ▶ LIGHT-SYNC INPUTS.
3. From the Switch Input menu, press ▶ CONFIGURE DEVICES.
4. When the top level Configuration screen appears, press ▲ or ▼ until the node address of the photocell appears.
5. Press ▶ TYPE; then press ▲ or ▼ until PHOTOCELL appears.
6. Press ▶ CONFIGURE to access the second Configuration screen.
7. If necessary, press ▲ or ▼ until the sub-address of the device appears (there will be eight possible sub-addresses: 01.1, 01.2, etc.). Each sub-address can be assigned its own set point values.
8. Press ▶ ON; then press ▲ or ▼ until the desired ON set point appears.
9. Press ▶ OFF; then press ▲ or ▼ until the desired OFF set point appears.
10. To define additional sub-addresses, press ▶ INPUT; then press ▲ or ▼ to select another sub-address and repeat steps 8 and 9.
11. Press ▶ EXIT twice to return to the Switch Input menu.



P.6 Programming Example, continued

Select the Relay That the Switch Node Controls:

1. From the Light-Sync Input menu, press ▶ INPUT/RELAY CONTROL; then when the next screen appears, press ▶ EDIT CONTROL. Then on the next screen, press ▶ INPUT/ SINGLE RELAYS.



2. Press ▲ until the input that controls relay(s) appears.

3. Press ▶ RELAY; then press ▲ until the relay to be controlled appears.

4. Press ▶ ACTION; then press ▲ until the desired relay action appears.

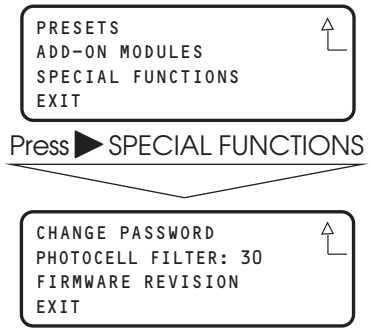
5. Repeat steps 3 and 4 for any additional relays controlled by the input.

6. Press ▶ EXIT 3 times to return to the Switch Input menu.

If desired, change the photocell filter.

1. From the Home screen, press ▶ EDIT; then press ▼ 5 times.

2. When the Main menu appears, press ▶ SPECIAL FUNCTIONS.



3. When the Special Functions menu appears, press ▶ PHOTOCELL FILTER to change the filter from 30 to 2 seconds.

4. Press ▶ EXIT twice to return to the Home screen.