FLEX Training Manual

System Design

FSR

244 Bergen Blvd.
Woodland Park, NJ 07424

Table of Contents

Introduction

Welcome to the FLEX training program. The FLEX-LT is a self-contained control system with the capabilities of a much more expensive system and a cost that everyone can afford. The FLEX-LT mounts in a wall or sits on a desk and presents the user with an easy to use and understand color touch screen. Through the touch screen, the user can choose what source is being displayed, change the volume, control the various sources, turn lights on and off, raise or lower the shades or screen and much more.

The FLEX configuration utility features an easy to use method to get the most out of the system. The contractor is presented with an easy to follow "drag and drop" programming methodology. There is no need to learn another programming language.

FLEX Hardware

There are several models of the FLEX; the LT–200, LT-300, LT-150, LT 100, and several styles of the T6-Flex table box. Let's look at the differences between the products.

The FLEX LT–200 hardware features:

3.5" Color LCD Touch Screen

Four RS-232 serial ports

Four IR ports

Four digital GPIO ports

Analog Input (for future use)

Ethernet port with Power over Ethernet

The FLEX LT–300 hardware features:

No Touch Screen

Four RS-232 serial ports

Four IR ports

Four digital GPIO ports

Analog Input (for future use)

Ethernet port with Power over Ethernet

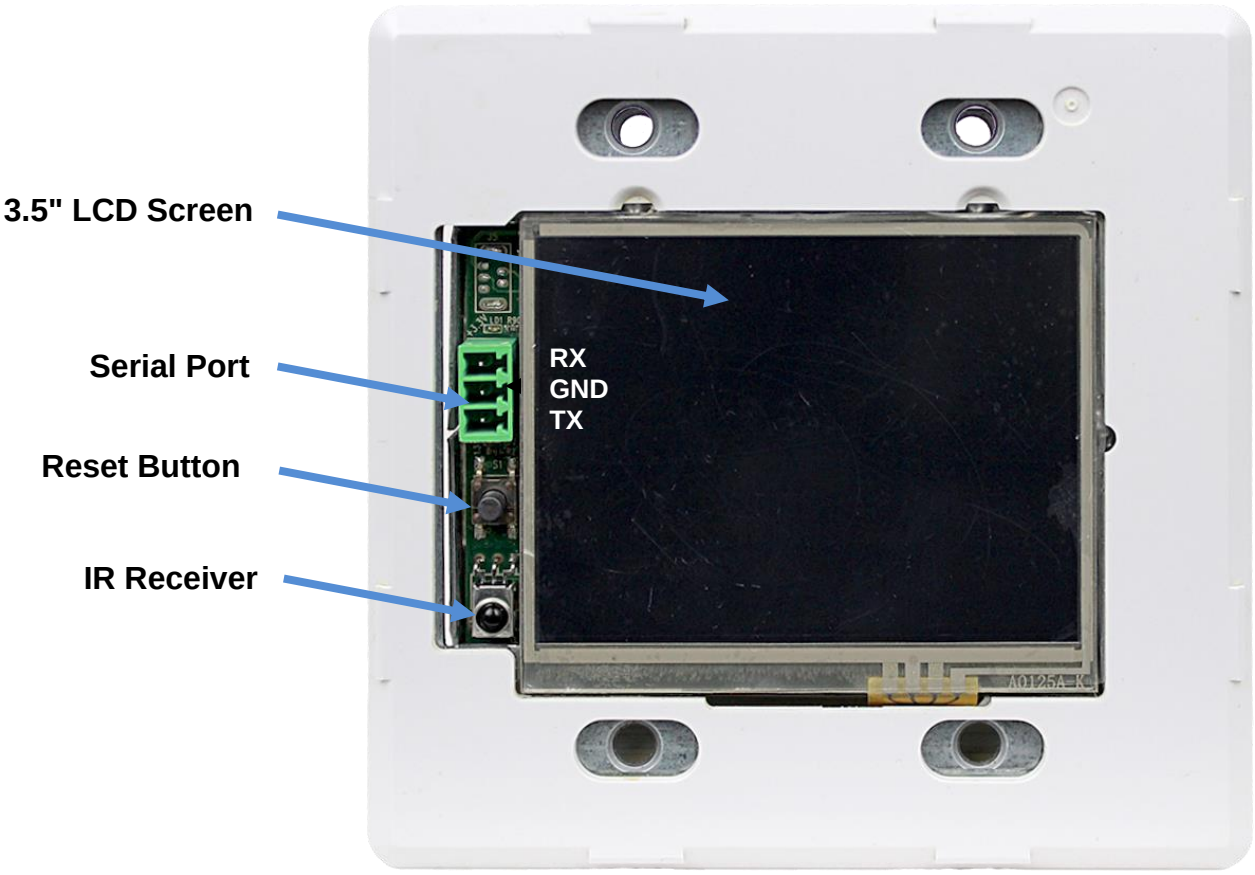
The FLEX LT–150 hardware features:

3.5” Color LCD Touch Screen

Ethernet port with Power over Ethernet

FLEX Front Panel

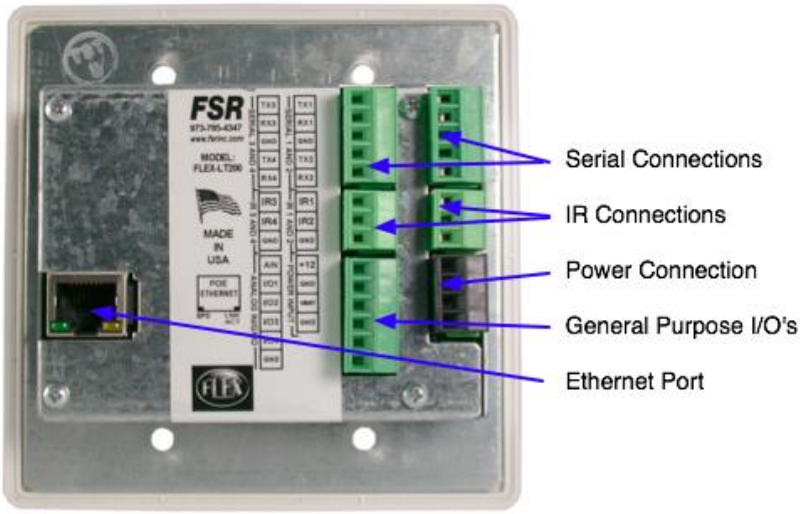
You can gain access to the FLEX front panel by removing the plastic bezel. The front panel has an RS-232 communication port. The communication port is used to load configurations into the FLEX panel. Below the communication port is the hardware reset switch. The FLEX panel also has an IR receiver that is used as a repeater. See the panel illustration below.



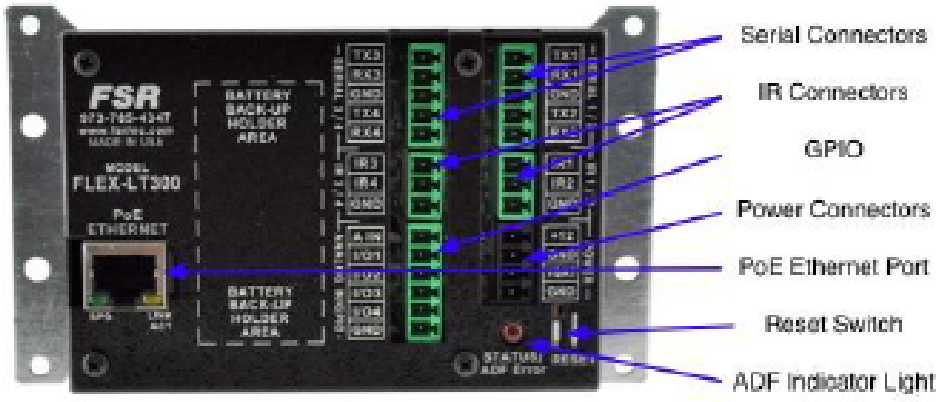
Flex Front Panel

FLEX Back Panels

The back panel of the FLEX system houses the connectors for both communication and power. The Ethernet port uses a standard RJ-45 connection. All other connections use a pluggable screw terminal style connector for device wiring. The images below illustrate the connection panels from the LT-200 and LT-300 FLEX systems.



FLEX LT-200 Rear Panel

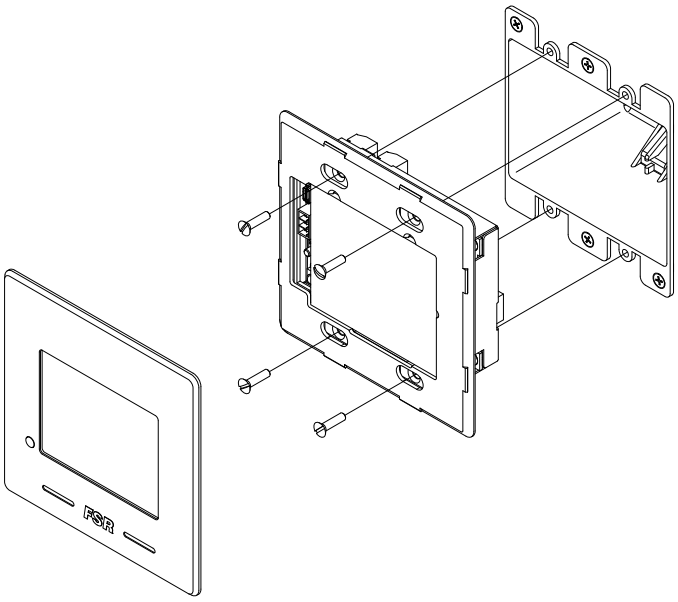


FLEX LT-300

Installing the FLEX

Mounting

The FLEX-LT should be installed in a 2-gang enclosure such as a Carlon plastic two-gang device box. The unit should be positioned so that both the user and installer can conveniently operate the LCD touch plate. This is usually a wall or a desktop. If a desktop installation is required, use an FSR DSKB-2 desktop console.



Installation of FLEX in a 2 Gang Box

FLEX Mounted in FSR DSKB-2

Check the recommendations on cable requirements and termination for any external devices connected to the Flex. Use standard approved wiring practices.

The integrity of all cables should be pretested BEFORE they are connected to the FLEX-LT. This holds true for the external cabling as well. Simply direct connect the various sources and displays to pretest the cable runs and equipment. All terminations should have "ID" cable markers to aid in cabling and troubleshooting.

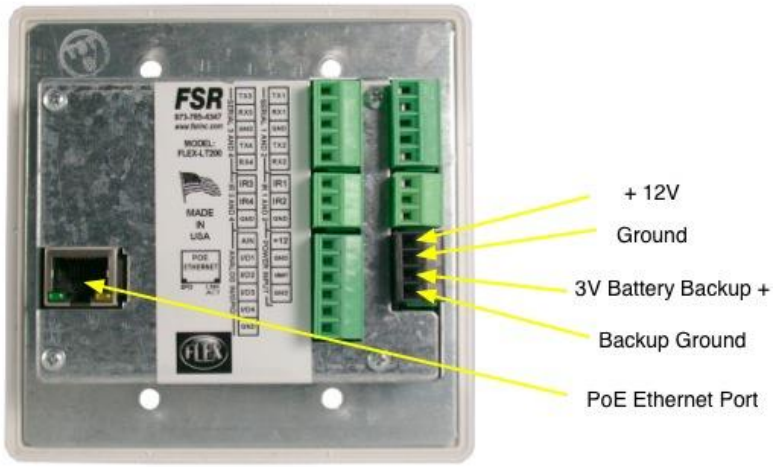
Wiring the FLEX

NOTE: The wiring for the FLEX LT-200 and the LT-300 are identical. The LT-300 does not have a separate serial port for loading projects. Connect cable provided in FLEX Programming Kit to SERIAL 2 as illustrated below to load projects to a FLEX LT-300.

Power

The FLEX control panel is powered with either a 12V power supply (included) or power over Ethernet (PoE).

To use the power supply strip both conductors back ¼" in. connect as per the instructions included with the supply. The power supply has a 6 ft cable. The power cable can be extended up to 50 feet with a 22 gauge 2-conductor cable. The FLEX system also has connectors for a 3V AAA battery backup to maintain real time clock settings in the event of a power failure on systems that do not have network connectivity. An optional battery holder kit (Flex-Batt) is available. Make all power connections as shown below.

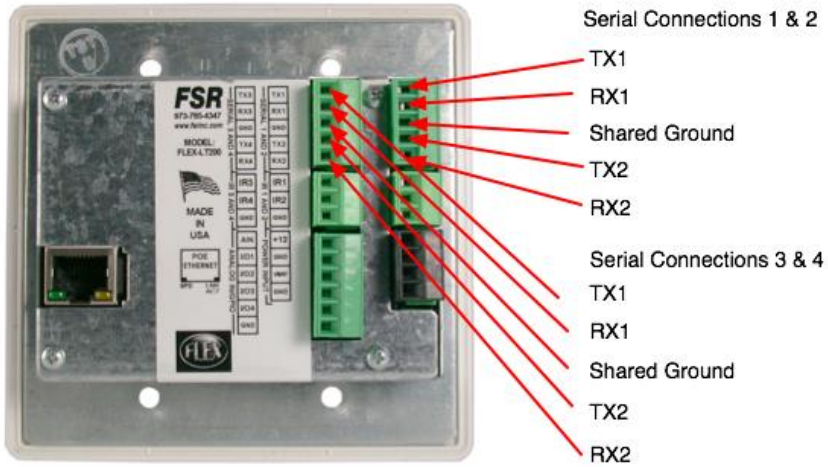


FLEX LT-200 Power Connections

The FLEX control panel is also a Class 1 POE Ethernet device. Class 1 requires a range of power with a minimum of 0.44 watts to a maximum of 3.84 watts. Be sure that the power supplied over the Ethernet network adheres to these specifications.

Serial connections

The FLEX LT–200 has four serial connectors on the back panel. The connections are made using plug-able screw terminal connectors. To make the connection, strip the wires as needed. The FLEX control panel has a wiring diagram on the rear panel. Wire each pluggable screw terminal connector as illustrated below. Each pair of serial connections share the center connector as ground with RX and TX connected as illustrated below.

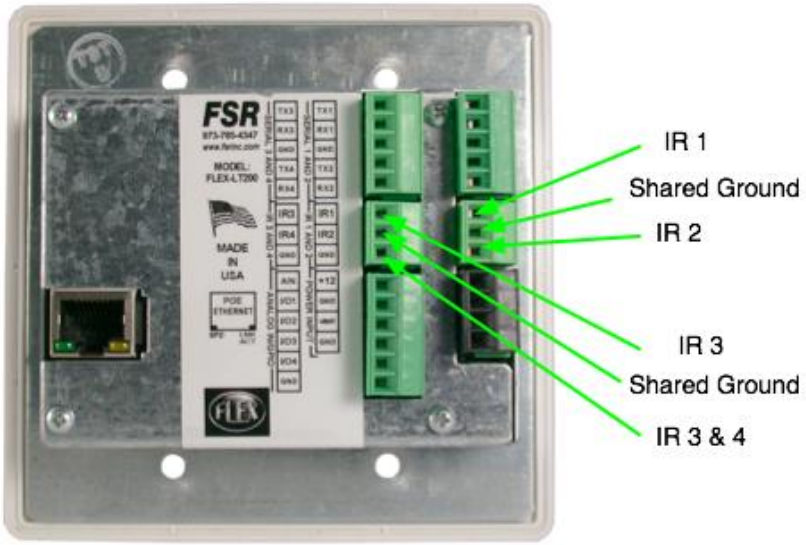


FLEX LT-200 Serial Connections

The FLEX serial control ports follow the RS-232C standards. The standard implies a distance limit of 50 feet at 19200 baud, and a capacitance limit of 2500 pf. Greater distances are possible when using lower data rates or low capacitance cable. FSR recommends the use of West Penn 230 series communications wire or similar to ensure proper signal transmission.

IR Connections

The FLEX system ships with two IR emitter "buds." The FLEX LT-200 system has four IR output ports and the LT-100 has two. Using 22-gauge two-conductor wire the IR emitters can be placed 100 feet away from the FLEX panel. Emitter buds should be placed in front of the IR receiving window of the device to be controlled. Each of the 3 position pluggable screw terminals provides connections for 2 IR emitters. Separate connections are provided for the (+) side of each IR emitter and the ground connections are shared.

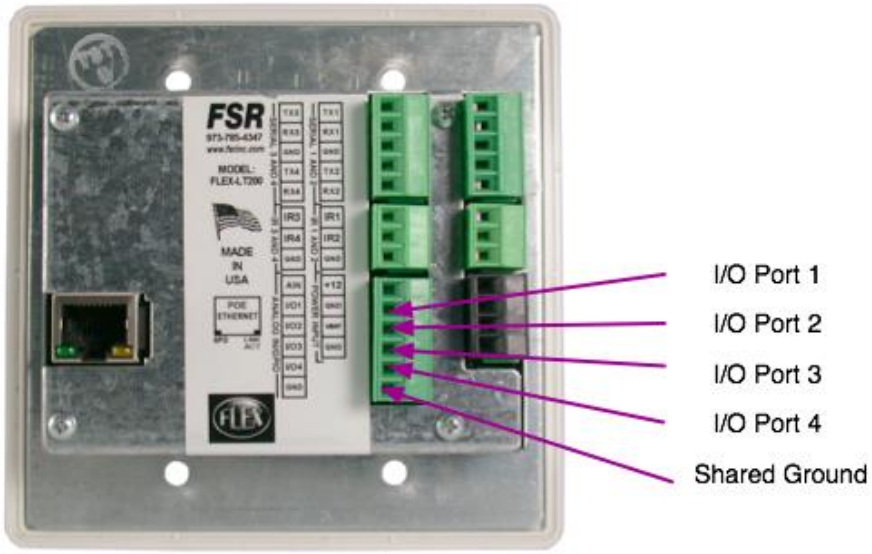


FLEX LT-200 IR Connections

General Purpose I/O

The Flex LT-200 and LT-300 have 4 GPIO ports. It is important to note that these are different from dry contact closures and do not have the same functionality. The GPIO ports can be configured as Inputs or Outputs. As an Input, a voltage of 2.4 VDC to 24 VDC will read as a 1 while a voltage below +1.0 VDC will read as a 0. When interfaced to TTL or CMOS logic, the Flex inputs are directly compatible. When interfaced to an "open collector" type output or normally open contact closure that is active high, make sure that it is at least 2.4VDC and does not exceed 24VDC when "on". Additionally, if using an "open collector" type output that "leaks" more than 0.1 mA, a pull-down resistor may be required to keep the Flex input below the 1.0 VDC when the source is "off" . If you are interfacing to an "open collector" or normally open contact closure that is active low, attach a "pull-up" resistor of 1K to 10K ohms

between your GPIO pin and the V+ input of the Flex. This will hold the pin high until your trigger pulls it low. When operating as an output, the GPIO pin is a current limited, open collector output. When "off", the output will "leak" about 0.3 mA to ground if connected to a positive voltage. When "on" it can sink 100 mA to ground, with a saturation voltage of approximately 0.2 volts. This makes the output ideal for driving relay coils or TTL inputs, but not any device that has an AC voltage present or otherwise requiring dry contact closures. If you are unsure or if your device is compatible or if it requires a "dry" contact closure, you should interface your device through an IT-R4S serial relay module, the K-10D relay module or one of the other K Series relay modules. The IT-R4S will interface to the Flex via one of the serial ports while the relay module will interface through the GPIO ports. The IT-R4S has a serial pass-through port to allow another device to be connected to it. This allows 2 devices to share 1 serial port on the Flex. The I/O Ports are to be wired as shown below:

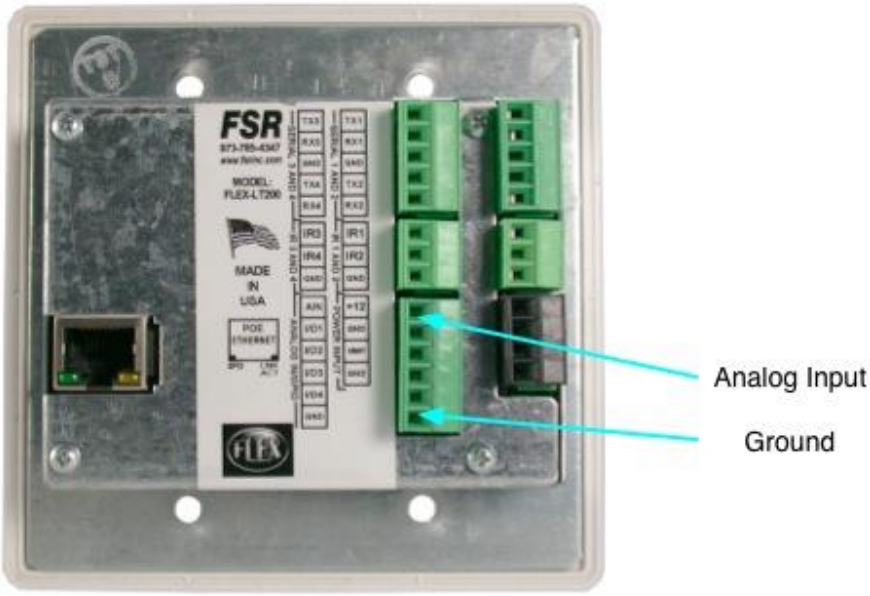


FLEX LT-200 GP I/O Connections

Analog Input

The FLEX panel has one analog input. This input will receive a 0 to 10 volt DC range signal.

NOTE: The analog input is designed for future use.



FLEX LT-200 Analog Input (Future Use)

Designing a System

When designing a system there are a number of considerations that need to be addressed for proper system functionality. In this section we will look at all the typical pieces of a system and what is required for the system to function properly.

Hardware considerations

When choosing hardware for control-based systems there are number of questions that need to be addressed. What type of protocol is used to communicate with the hardware? What device will handle audio and video switching? How will volume control be handled? These questions will all need to be considered when looking at the hardware used in the system. Let's look at some of the considerations for each type of hardware.

Display

The primary thing to look at when selecting the display is how will it be controlled. The typical display has either IR or serial control. There are several advantages to having serial control. Devices using serial control have the advantage of being able to switch to distinct inputs. This makes source selection much easier. If you need to page through several menus to switch inputs, the display is not ideal for a control system. If you choose a display with IR control make sure it has the ability to select distinct output sources.

Switchers
You may elect to use a separate switching device for source selection. Typically a switcher will have serial control. This simplifies setup of your display. Many switchers will switch both audio and video. This needs to be taken into consideration when you are designing the audio portion of your system.

Audio control
In a simple AV system, there are many options for audio output. Many systems use the audio output from the display in conjunction with an external amplifier and speakers. This simplifies audio control. In this design be sure the display has the ability to control any outputs to the amplifier.

There are other hardware devices in a typical A/V system where the audio levels can be controlled. A typical example of this is through an amplifier, switcher or mixer. The decision on which device controls the audio levels, is important to the design of the control system. Again be sure the device you choose to adjust audio levels has the appropriate control capabilities.

Screen Control
Screen manufacturers have many options available for control. When designing screen control into an AV system there are many methods to choose from. Many manufacturers provide the option of either serial, IR, or contact closure control for the screen. If you elect to use contact closure check the specifications from the manufacture. You may require an external serial to relay converter such as the FSR Intelli-tools ITR4S to control your screen. Check the voltage requirements from the screen manufacture.

Distance Limitations
When designing a system it is important that the wiring for communications does not exceed the published distance limitations. The distance limitations for the FLEX hardware are listed above in the hardware section of this manual.

IR Considerations
One of the challenges when using IR in AV system is syncing the different devices to ensure when a power button is pressed the system actually comes on. You may want to add a separate on/off button to any IR device screen to ensure they can be powered to the desired state.

Serial Considerations
Manufacturer's serial command sets differ greatly. It is important to be sure that the device drivers are readily available. Serial commands also vary greatly in complexity. Here are two examples of the "Power On" command"

Power On C00

Power On 02H 00H 00H 00H 00H 02H

A complex serial command set increases the potential for communication issues.

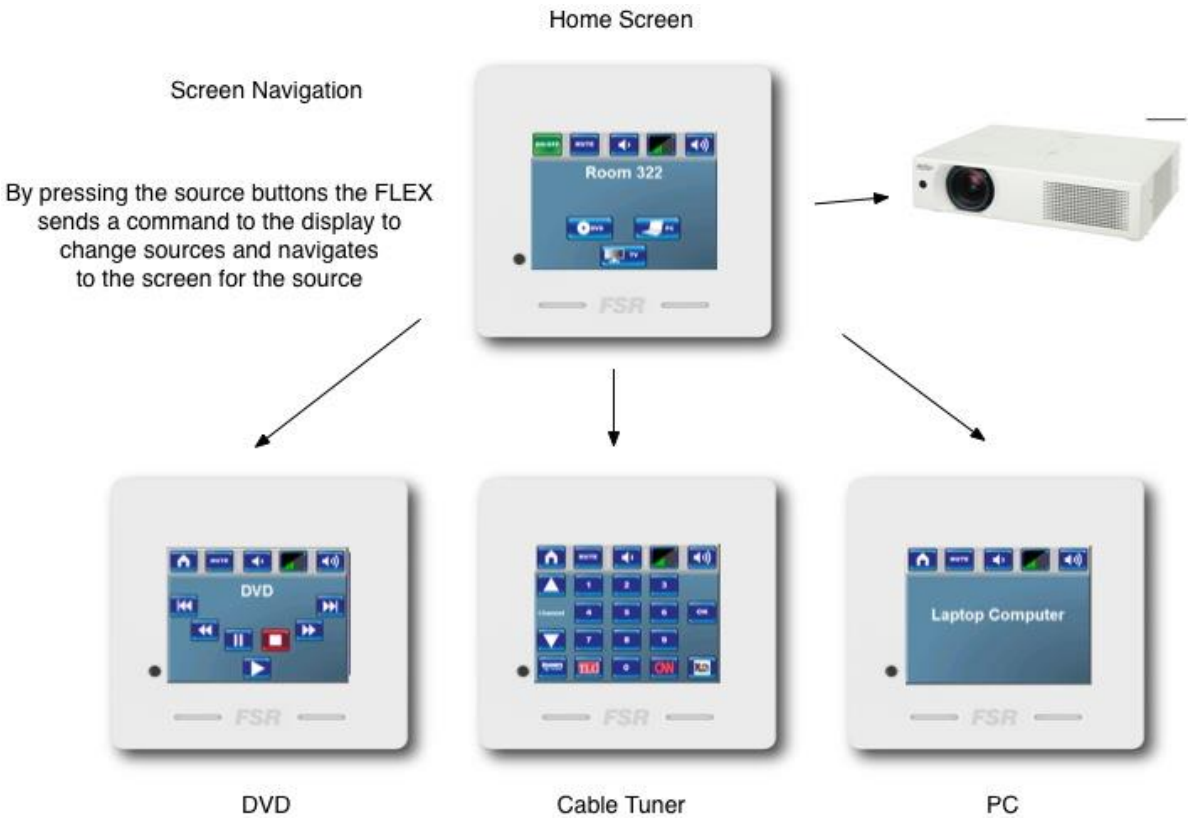
Ethernet Considerations

Ethernet enabled A/V devices are becoming a standard in most larger installation. Frequently A/V devices share a network with more traditional network devices. It is important to work with the IT manager to insure there are no address conflicts between devices.

Designing a System Using FLEX

It is very simple to design a system with FLEX. The FLEX is based on a system of buttons when pressed either navigates the user to a different screen or performs an action.

Any button press can perform multiple actions including navigating to other screens. FLEX gives you the option of navigating to screens in any manner you choose.

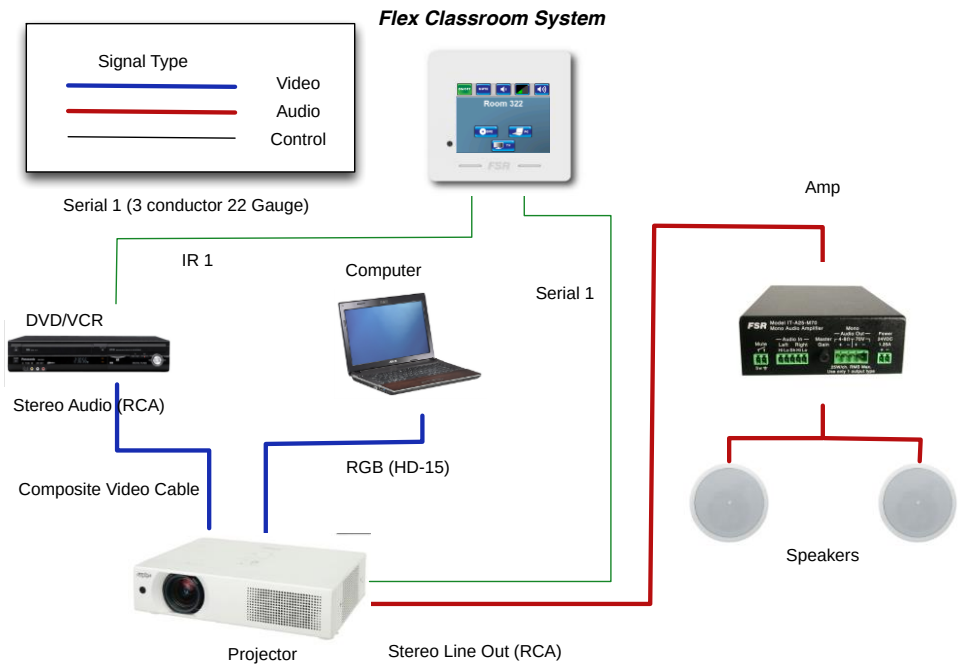


In this system we have a projector DVD/VCR and a PC. The FLEX will switch sources on the projector and control volume levels.

Designing the system

STEP ONE: Devices to Control

The first step in designing a system is determining what devices are to be controlled. In the system below we have a projector a DVD/VCR and a computer. On the projector we will switch sources and control volume levels. We will also provide transport controls for the DVD VCR. Next step is to determine any additional screens we may desire. You may want a separate screen for the DVD menu. You could have a wait screen to indicate your system is in the power up mode. These are all capabilities of the FLEX control systems.



STEP TWO: Functions to Control

The next step is to decide what functions we want to control. Many devices have functions we may not want to control with the FLEX system. For example you may want to make focus adjustments on a projector with the remote and not use your control system for this. It is important to determine the functions that we want to use the control system for.

For the projector we want to control:

Source Selection Volume up

Volume down Volume mute

For the DVD we want to control:

Play Stop

Pause Fast-forward

Reverse Chapter forward

Chapter back

For the VCR we want to control:

Play Stop

Pause Fast-forward

Reverse

As we create our screens we will want to designate a button for each one of these functions you will see a sample screen for the DVD below.

Typical DVD Screen

In the screen above, you will see buttons for volume and mute. These are global buttons. With the FLEX we can have functions work on multiple screens.

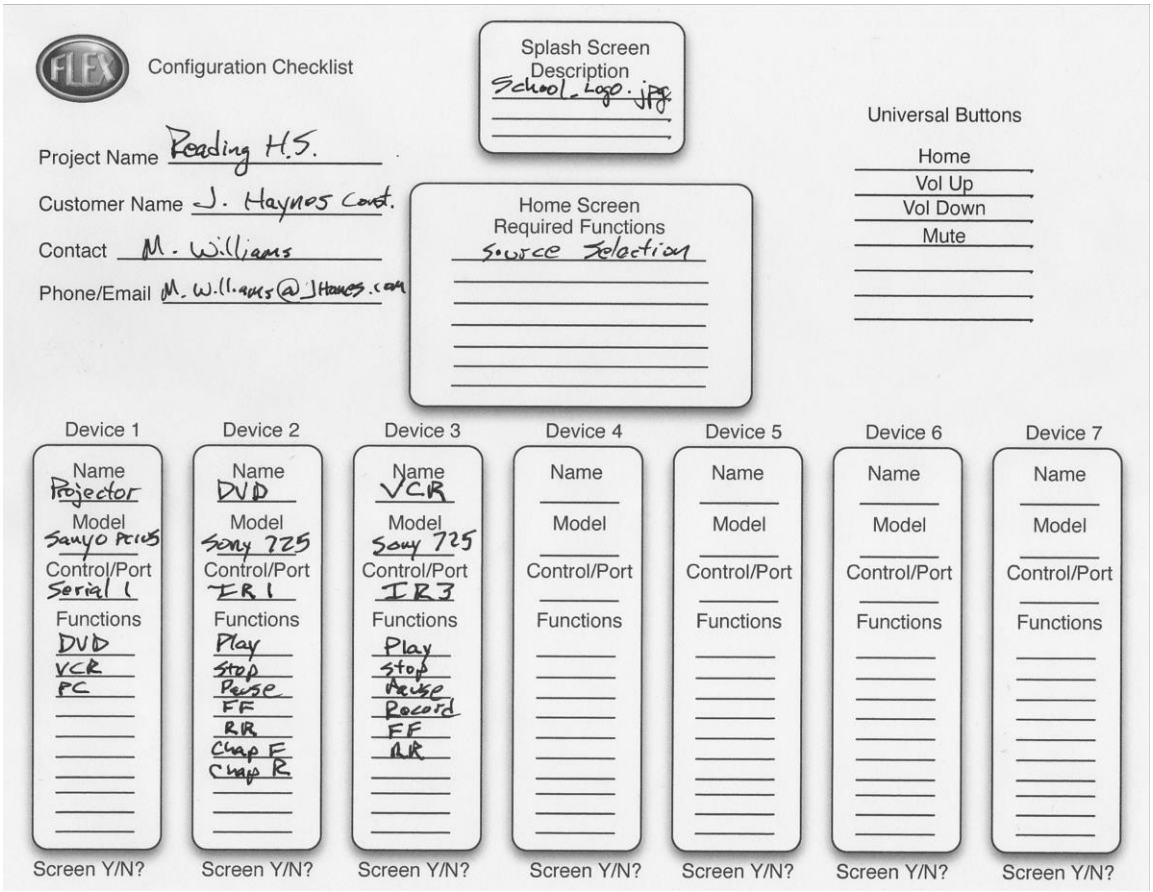
STEP THREE: Screens

The next step is to determine what screens we want in our control system. In a typical system we want a screen for every group of functions we are going to control. For example we will have a screen for input selection. We may not have a screen for every device. For example if we're using a switcher for source selection we may not have a screen for our display.

We also need to determine if we need additional screens for a device. For example you may want two screens for DVD control. The first screen is for transport controls and a second screen for menu navigation. An example of this is shown below.

DVD Transport and Menu Screens

Below is an example of our checklist, which illustrates the devices we're going to control, and the functions of each device. This is a useful tool in evaluating what screens the project requires.



STEP FOUR: Project Building

The next step is the building of the project. This portion of the training is covered in the hands on exercise. You will learn how to use the FLEX Control Builder. In the exercise you will build a complete project and load the project in the FLEX. You will also learn the advance features of the FLEX.

How to Contact FSR:

FSR Inc.
244 Bergen Blvd.
Woodland Park, NJ 07424
(973) 785-4347
(800) 332-3771
After Hours Tech Support (973)-580-0522