

The Objective:

Before any significant system programming effort can begin, the programmer must know exactly what equipment exists in the system, the functions required for those devices and what touch panels, remotes and keypads will be installed. A well written scope-of-work document or SOW as it is commonly referred to, is a clear and concise plan which exactly describes the work to be done.

The Absence of a SOW:

The challenges of delivering an integrated automation system are numerous at best. Take away project documentation and the SOW and the difficulties increase exponentially. A programming project attempted with no clear SOW leaves the integrator and programmer in a very precarious position. Generally speaking, the end-user has at least some concept of what control programming is to be delivered and what features it should incorporate. Add to this, the enthusiastic accommodations of the integrator intended to close the deal and the stage is set for the typical end-user vs. integrator showdown.

As the system is nearing "completion", the end-user begins to point out features that the system was "supposed to have", or "were discussed" or should be included based on his "understanding" of the proposal. The integrator is now in a tenuous position. The end-user may or may not be correct in his recollections of promises made, but without a SOW the integrator has no mutual agreement with which to defend himself.

These situations occur more frequently than not and almost never end well for the integrator. The reason is simple; the end-user feels he has not received all he is entitled to under the terms of the contract; however the contract does not specifically detail what he will receive (and not receive) for the money paid.

Very few integrators create a detailed SOW for all their projects. Most will tell you they are too busy to create such detailed documents. However, one large project with a single page agreement promising "a fantastic system" to a sophisticated end-user who can't be satisfied may ultimately cause the integrator's business to fail. Most of these "nightmare" projects got off on the wrong foot when the integrator accepted a check before getting the end-user's signature on a detailed SOW.

Dangers of the "One Page" SOW:

Far too often, projects are sold with a simple equipment list and one or two page description. The descriptions we see at PanTech Design range from risky to downright horrifying. A common trait in these quickie proposals is to promise a "state-of-the-art" system or a system that "incorporates the latest in technology." When describing

the control system, many of these documents stop at “intuitive, easy to use, one-button functionality”. These descriptions are subjective, introduce ambiguity and leave plenty of room for interpretation.

Example - an extremely risky description of a control system PanTech received as part of an actual request for proposal:

“To insure the highest performance possible, all theater systems will be precisely calibrated. For ultimate ease of operation and simplicity of all elements of this “electronic lifestyle” system, color touchscreen wireless remotes will be programmed employing <DEALER’S NAME>’s SmartTouch[®] intuitive control, part of a professional, extremely reliable control system.”

This description establishes a concept of grand proportions but does not specifically list what equipment will be controlled and what functions will be provided for those devices. Furthermore, it does not exclude any functionality in this paragraph or anywhere else in the proposal document.

Most integrators are afraid to put limitations on the equipment or functionality included in any proposal because they feel they will lose the project. Furthermore, many do the opposite and imply that the system will incorporate everything that is good with no limitations.

In actuality, most end users would rather see a detailed proposal that stipulates exactly what will and will not be done for the contract price. If the end-user requested proposals from one or more integrators, the more detailed proposal - even if it limits or excludes certain features - will be considered more favorably than a proposal that simply promises a “fantastic state-of-the-art” system.

The Detailed SOW:

A detailed SOW is the most important element in any integrated system project. Fortunately, in its simplest form it is also easy to create.

First, begin by outlining in general terms what the scope of work covers and what is included in the project. For example, at PanTech Design we provide AutoCAD drawings of the AV and control system with every project we program, so we include that in our SOW. We also clearly state that any device or functionality NOT listed in the document is explicitly excluded from the SOW and is not covered by the contract price.

We then describe the system in very basic terms:

“This system is a multi-source, multi-zone audio video system that includes rooms with audio and video and audio-only rooms with local and global sources. General design characteristics of this system are as follows:”

Next, we list all central equipment used in the system. This includes the control processor, a lighting processor if used, all audio and video switchers and any controlled amplifiers. In short, any equipment that isn’t a source, but required to control or switch the sources. We do this to call out specifically what equipment we

are expecting and thus plan to provide programming for at the head-end location. Also notice that we use outline numbering and indentation in our SOW style format. This increases the readability of the document and the outline numbering makes it very simple to call out specific items during discussions or revisions.

1. Central Equipment:

- 1.1. PRO2 - Control Processor
- 1.2. C2N-PVID8X4 - Video processor
- 1.3. C2N-BIPAD8 #1 - Audio Processor
- 1.4. C2N-BIPAD8 #2 - Audio Processor
- 1.5. CNAMPX-16X60 #1 - Power Amplifier
- 1.6. CNAMPX-16X60 #2 - Power Amplifier
- 1.7. PAC2M - Lighting Processor (programming provided by others)

Not all control processors or audio/video switchers or processors are programmed the same. Some can be much more difficult to program, thus requiring more time and effort. By stipulating exactly the central equipment our programming quote covers, we eliminate the risk of being stuck providing a much more expensive program if the equipment changes during the installation.

At this point, we are ready to list all ROOMS in the system that include equipment we are responsible for controlling. Even if the "room" is a hallway and even if the only controlled device is a thermostat.

We list the rooms by name and all known devices to be installed that room including all user interfaces installed in or assigned (in the case of wireless user interfaces) to that room.

By doing this, we exclude any equipment not yet included in the design. The programming for Bedroom 1 will specifically require head-end switching and volume control for head-end amplified ceiling speakers. If an AV Receiver suddenly appears in Bedroom 1 sometime during the installation, it is not covered by this scope and consequently we may require additional money to include it in the program.

2. Rooms:

- 2.1. Bedroom 1 (ML-600) - contains an LCD display, a local satellite receiver and game console connected directly to the display and Crestron lighting loads:
 - 2.1.1. LG 32LG40 LCD display
 - 2.1.1.1. Power on/off
 - 2.1.1.2. Input selection
 - 2.1.1.3. Volume up/down
 - 2.1.2. DirecTV HR21 satellite receiver
 - 2.1.2.1. Standard channel, navigation and DVR functions
 - 2.1.2.2. (8) channel "favorites" list (channels to be provided by owner)
 - 2.1.3. Xbox 360 game console
 - 2.1.3.1. No control provided - source selection only
 - 2.1.4. User Interface - Crestron ML-600 with CNRFGWA-418 RF Gateway
 - 2.1.4.1. Room on/off

- 2.1.4.2. Volume up/down
- 2.1.4.3. Source selection
- 2.1.4.4. Sleep Timer feature with buttons for 10, 20, 30, 60 Minutes - pressing one of these buttons will cause the room to power off in the selected time
- 2.1.4.5. Lighting System - connection to Virtual Keypad (VKP) for up to (8) buttons for lighting control - on, off, (6) presets to be defined in lighting system program (not included in this scope)

The room description details the equipment types included in the room. The equipment is then listed by make and model along with the functions provided for each device. These are equipment specific functions only. The display's built-in television tuner is not being used because the room has a dedicated satellite receiver. Therefore, you will not see "Channel up/down" functions listed for the display.

The first three functions listed for the ML-600 remote control are very straightforward and require no explanation. The "Sleep Timer" function is not as obvious and warrants a brief description detailing exactly how it will operate. Room lighting also needs a brief description of how many buttons will be used and what they will do when pressed. In this case, the lighting system is programmed separately and the presets have not been defined yet. It is not possible to provide more detail on the presets, but this SOW defines the number of presets, (6), that will be called from the remote.

Now that the exact equipment and functionality have been defined for "Bedroom 1", continue moving through the project room by room until all areas with controlled equipment have been documented.

Many rooms contain similar equipment and have similar control requirements. Of course copying and pasting the information for similar rooms saves time, but be sure to review the list carefully since equipment makes and/or models and required functionality may change from room to room. Copy and paste errors may commit you to programming and equipment features you aren't prepared to deliver.

Rooms with touch panels may have substantially more global control functionality. In the next example, we'll look at a typical SOW for a room that includes a touch panel and wireless remote.

- 2.2. Family Room (TPS-12L, ML-600) - contains a CNXRMCLV, a plasma display, an AV Receiver with surround sound speaker system, local satellite receiver, a local Blu-ray disc player, a local game console and Crestron lighting loads:

- 2.2.1. Pioneer PRO-150FD
 - 2.2.1.1. Power on/off
 - 2.2.1.2. Input selection
- 2.2.2. Pioneer SC-07 AV receiver
 - 2.2.2.1. Power on/off
 - 2.2.2.2. Input selection
 - 2.2.2.3. Volume up/down/mute
- 2.2.3. DirecTV HR21 satellite receiver

- 2.2.3.1. Standard channel, navigation and DVR functions
- 2.2.3.2. (8) channel "favorites" list (channels to be provided by owner)
- 2.2.4. Sony BDP-S550 Blu-ray disc player
 - 2.2.4.1. Standard transport and navigation functions
- 2.2.5. Xbox 360 game console
 - 2.2.5.1. No control provided - source selection only
- 2.2.6. User Interface - Crestron TPS-12L
 - 2.2.6.1. Room on/off
 - 2.2.6.2. Head-end source selection and control
 - 2.2.6.3. Local source selection and control (game console not controlled)
 - 2.2.6.4. Volume up/down/mute
 - 2.2.6.5. Camera System - view any camera connected to CNX-PVID8X4 on touch panel video window
 - 2.2.6.6. Security System - keypad emulation and arm/disarm functions for GE NX8E security system
 - 2.2.6.7. Lighting System - connection to Virtual Keypad (VPK) for up to (12) buttons for lighting control - on, off, (10) presets to be defined in lighting system program (not included in this scope)
 - 2.2.6.8. Sleep Timer feature with buttons for 10, 20, 30, 60 Minutes - pressing one of these buttons will cause the room to power off in the selected time
 - 2.2.6.9. Room Control Functions - operate other Crestron-controlled rooms and areas from this touch panel
- 2.2.7. User Interface - Crestron ML-600 with CNRFGWA-418 RF Gateway
 - 2.2.7.1. Room on/off
 - 2.2.7.2. Head-end source selection and control
 - 2.2.7.3. Local source selection and control (game console not controlled)
 - 2.2.7.4. Volume up/down/mute
 - 2.2.7.5. Lighting System - connection to Virtual Keypad (VPK) for up to (8) buttons for lighting control - on, off, (6) presets to be defined in lighting system program (not included in this scope)
 - 2.2.7.6. Sleep Timer feature with buttons for 10, 20, 30, 60 Minutes - pressing one of these buttons will cause the room to power off in the selected time

In the Family Room example we detail every feature and function provided on both user interfaces. Once again our goal is to eliminate any ambiguity. By defining every aspect of every room and user interface, we remove any opportunity for misunderstanding or misinterpretation of our intended deliverables. A good example is found in line 2.2.6.5. where we specify that the user will be able to view any camera "connected to the CNX-PVID8X4". Other cameras may exist in the home but if they are not connected to the CNX-PVID8X4, they won't be available to the video window on the Family Room TPS-12L touch panel.

A key feature generally employed by PanTech Design on large format touch panels is our Room Control feature (line 2.2.6.9.) whereby the user may operate any other Crestron-controlled room or area from touch panels located elsewhere in the house.

Rather than assuming this feature will be provided on every touch panel, we specifically call out the panels that will have Room Control capability. As a result, the absence of the feature from a touch panel description means the feature is NOT provided there. No misunderstanding, no ambiguity.

It may be tempting to skip rooms that only have a touch panel or thermostat, but detailing the functionality required for these rooms is what makes an otherwise good SOW great.

2.3. Garage (TPS-6L):

2.3.1. User Interface - Crestron TPS-6L

2.3.1.1. Camera System - view any camera connected to CNX-PVID8X4 on touch panel video window

2.3.1.2. Security System - keypad emulation and arm/disarm functions for GE NX8E security system

2.3.1.3. Lighting System - connection to Virtual Keypad (VPK) for up to (12) buttons for lighting control - on, off, (10) presets to be defined in lighting system program (not included in this scope)

Now that we have listed the central equipment devices and documented all the rooms with controlled equipment, it is time to focus on the head-end sources. Generally speaking, there will be source devices located at the head-end or central equipment area that act as "whole house" sources available to all rooms with head-end connections. These sources are usually located where ever you find the central equipment switchers and amplifiers. In our SOW format, we list all these shared audio and video sources and call out any special features or limitations relating to their operation:

3. Whole House Audio Sources - Discrete audio sources connected to central equipment and available to any head-end connected audio zone: (Standard PanTech Design control functionality provided for all sources listed unless otherwise noted)

3.1. CEN-TRACK-AMFMXM Ch. 1 - AM/FM radio

3.2. CEN-TRACK-AMFMXM Ch. 2 - XM radio

3.3. DirecTV H21 - (Music-only) satellite receiver

3.4. CEN-IDOC #1 - iPod interface (located at main equipment)

3.5. CEN-IDOC #2 - iPod interface (located at Kitchen)

3.6. DirecTV HR21 #1 - Satellite receiver / DVR (His)

3.7. DirecTV HR21 #2 - Satellite receiver / DVR (Hers)

3.8. DirecTV HR21 #3 - Satellite receiver / DVR (Kids)

3.9. DirecTV HR21 #3 - Satellite receiver / DVR (Guest)

3.10. Kaleidescape KPLAYER-5000 #1

3.11. Kaleidescape KPLAYER-5000 #2

4. Whole House Video Sources - Discrete video sources connected to central equipment and available to any head-end connected video display. (Touch panels in the Family Room, Kitchen and Master Bedroom are only able to view composite video sources and cameras): (Standard PanTech Design control functionality provided for all sources listed unless otherwise noted)

- 4.1. DirecTV HR21 #1 (YPbPr) - Satellite receiver / DVR (His)
- 4.2. DirecTV HR21 #2 (YPbPr) - Satellite receiver / DVR (Hers)
- 4.3. DirecTV HR21 #3 (YPbPr) - Satellite receiver / DVR (Kids)
- 4.4. DirecTV HR21 #3 (YPbPr) - Satellite receiver / DVR (Guest)
- 4.5. Kaleidescape KPLAYER-5000 #1 (YPbPr)
- 4.6. Kaleidescape KPLAYER-5000 #2 (YPbPr)
- 4.7. DirecTV HR21 #3 (composite) - Satellite receiver / DVR (Kids)
- 4.8. Kaleidescape KPLAYER-5000 #1 (composite)
- 4.9. Camera 1 - Driveway
- 4.10. Camera 2 - Motorcourt
- 4.11. Camera 3 - Pool/Gazebo
- 4.12. Camera 4 - Side Yard

Note that we underline the caveat concerning what video sources will be available to the large touch panels. By specifically stating that the touch panels are only able to view composite video sources to the CNX-PVID8X4, we eliminate any confusion on the part of the end user as to which sources they can view on the video touch panels. Furthermore, since the sources have a mix of signal formats, we define the formats within the source list to clarify the situation even further.

Also note that the DirecTV H21 (line 3.3.) is a music-only receiver. We call this out so that no one is surprised when it doesn't show up in the list of available video sources on touch panels and remotes.

Lastly, we list all subsystems for which control is provided. To this point, they have been referenced only with respect to functionality provided on touch panels. A definitive list of all subsystems and the functions provided for them ensures that no chance remains for interpretation.

Sub-systems should be described using only relevant features. If the security system has the ability to perform a self-test, but that function is not going to be incorporated into the control system programming, we don't list it. Likewise, if certain functions of the security system are available only on certain touch panels or in certain locations, that should be clearly defined.

5. HVAC Control - standard PanTech Design control of (4) Crestron CHV-TSTATs from large touch panels (TPS-6X, TPS-6L) includes heat and cool set-points and HVAC scheduling - control from small touch panels (TPS-4L) does not include scheduling functions (although the schedule may be activated or de-activated from small touch panels).
 - 5.1. Downstairs Hall
 - 5.2. Master Suite
 - 5.3. Upstairs Hall
 - 5.4. Family Room

In this example, we clearly limit our programming to (4) thermostats and give their locations. We also indicated what functions we provide for large touch panels (TPS-6X and TPS-6L) and that some of those functions are not available on the smaller TPS-4L touch panels. Moving forward, if a thermostat is added, it falls outside this SOW

and is subject to additional programming charges. Likewise, if the end user requests an additional feature not described in this section after the SOW has been signed, additional programming charges may apply.

6. Security System Control - standard PanTech Design control of GE NX8E control system panel including keypad emulation and arm/disarm functions from Kitchen, Master Bedroom, Family Room and Garage touch panels only.

Here we state what functions are provided for the security system. But furthermore, we clearly state that the security system can only be controlled from (4) touch panels. Again, this simple paragraph protects us from an end user who is indecisive or argumentative. If the end user has signed this SOW and suddenly decides that it is necessary to control the security system from the Gameroom, additional programming charges will apply.

Conclusion:

A detailed SOW provides a clear description of the work to be done but it is also provides much more than that. As we have shown, a comprehensive SOW also protects both the integrator or software provider and the end user by eliminating ambiguity.

If you leave room for interpretation in any agreement, you can be sure that your client will try very hard to make that work to his or her advantage. Likewise, the client is protected by the agreement since he or she knows exactly what to expect for the money paid.

For this reason, given a choice between working with an integrator who provides no documentation and a single page proposal and one who provides a comprehensive SOW, potential clients tend to prefer working with the integrator who clearly spells out what will be done and for how much.

At PanTech Design, we rarely get a SOW from our clients. Most of the time, we receive a list of equipment and a brief description of the system if any. That is not a problem for us though, since we are experienced in generating SOW documents, we simply create the scope ourselves and include it as part of our contract.

Many of our clients have come to appreciate this extra step we take and view it as a service rather than a limitation. They understand clearly by our SOW what software features and capabilities we intend to provide for the money we charge. They also know that if a change is made after the SOW has been signed, we may require additional programming money. As all of this is understood up front, there are no surprises and our business is generally transacted without the unpleasantness which can arise from attempting a project with no agreement.

In short, no one should enter into a contract to provide an integrated system without a detailed scope-of-work agreement in place. To do so puts your reputation and your business at risk.