Chapter

4

Communication Protocol

Introduction

The protocol uses the 8-bit ASCII character set, usually sent over an RS232-C or RS422 serial link — 9600 bps is recommended. The high order data bit is ignored on all received characters, and is 0 on all transmitted characters.

The protocol should be used over a reliable channel. Noisy channels such as modem connections over the telephone network should use an error-checking and/or error-correcting protocol, including such things as packet checksums or CRSs. Newer modems include communication schemes as part of their normal operation, and are recommended for these applications.

The protocol is compact, with few characters required to cause switch changes to occur. It is also human-readable and thus easy to understand and use. Finally, it is a modified superset of the existing host protocol, allowing a degree of compatibility with those existing systems.

Several different switch request commands are defined, so that the one that is most compact for any given switcher and application can be chosen.

The protocol is useful with both very small and very large routing switchers. The sizes of the numbers representing inputs, outputs, and levels are not fixed, but can be as large or small as necessary. Special provisions allow numbers to be packed one after another with no intervening delimiter character, in order to make the protocol compact, as long as each number is the largest size necessary for that particular switcher.

All input, output, and level numbers begin at number 1, not 0.

Generic Protocol

Commands are sent to a routing switcher in a group called a command string. A command string can contain zero or more commands, limited only by the size of the receive buffer of the switcher, which should be large enough to hold a command string for setting the state of the entire switcher matrix.

A command string consists of a leader, zero, or more commands, and a trailer. If a leader character is encountered within the command string, the command string up to that point is discarded and a new command string is started. Once a complete command string, up to the trailer character is received, the routing switcher executes the commands within it.

Within the command string, certain ASCII characters may be present and are ignored — any ASCII character whose code is less than or equal to the "SPACE" character, and any whose code is greater than the "~" (tilde) character. Alphabetic characters within the command string may be in either UPPER CASE or lower-case letters.

Just before the switcher begins executing a command string, it sends a leader character to the host. As it executes the commands, some of the commands may generate additional output back to the host. After the command string has been executed, the routing switcher returns the string "OK" (with a single space character before and after the word "OK"), followed by a trailer character (~) and a CR character, to the host. This indicates that the command has executed successfully. If an error occurs within any command of a command string, the remainder of the command string is ignored and the switcher returns the string "ERROR," followed by a trailer character and CR character to the host. An error consists of an unknown command name or bad arguments to a command.

Leader and Trailer

For small routers it is desirable to keep the required serial string short. In larger systems where positive identification of the start and end of a command are very important, a more secure leader and trailer is required. The "**" is used as the leader and "!!" as the trailer.

The simplest possible command string would be "**!!" which consists of the leader and trailer characters but no command between them. This command string would generate the response "**OK!!" followed by "CR". This can be useful for verifying that the serial link to the switcher is operational.

The following is the complete command set, a subset of which may be implemented in any given routing switcher.

Syntax	Example	Description
I	I	Capabilities inquiry
L	L	Matrix size and level names inquiry
S	S	Status inquiry
CLEAR	CLEAR	Clear matrix
U {0｜1}	U0	Update request on/off
V out,in,in…	V3,1,2,2	Connect levels
W lvl,in,in…	W1,4,19	Connect outputs
X out,in,lvl	X12,9,2	Connect crosspoint
Y out,in	Y1,7	Connect AFV
Z in in…	Z13,12,8	Connect AFV
D numsyncs	D300	Delay vertical sync intervals
P {A-Z}	PBY1,7~	Preset a connect sequence
T {A-Z}	TB	Trigger a preset sequence

All routing switchers implement the "I", "L", "S", and "X" commands. This chapter defines the X, Y, S, and C commands.

"X": Connect Crosspoint

Use command **X** to request that a connection be made. It must be followed by an output number, a comma, an input number, a comma, and a level number. For example:

> ****X24, 13, 2!!**

This string says that a connection is to be made between output 24 and input 13 on level 2. If the level number is specified as "0", this means that the connection is to be made on all levels (AFV). For example, the command:

> ****X8, 3, 0!!**

This string says that a connection is to be made between output 8 and input 3 on all levels.

"Y": Connect AFV

Use command **Y** to request that a connection be made. It must be followed by an output number, a comma, and an input number. The connection is made on all levels (AFV). For example, the command:

> ****Y2, 29!!**

This string says that input 29 is to be connected to output 2 on all levels.

"S": Status Inquiry

Use command **S** to request that status information be returned to the host. The status information is sent as a string of L x O substrings, where L = number of levels and O = number of outputs. Each level/output combination generates a single substring of status. Thus, a 21-level 16 output router would generate 2x16 = 32 substrings of status command output. The length of each substring depends on the size of the particular switcher involved. Larger switchers use bigger numbers for inputs, outputs, and levels.

The first substring of status is for level 1 output 2, etc.; however, each substring contains the level and output numbers, so the sequence in which the data is sent is not important). The first characters of each substring are a space followed by "X", then the output number, a comma character, the input number connected to the output (or 0 if no connection exists), another comma, and finally the level number at which the input-output pair is connected. For example, the command:

> ****S!!**

might have the following two substrings at the beginning of its response:

> ****x01, 23, 1 x02, 02, 1!!**

This indicates that output 1 is connected to input 23 on level 1, and that output 2 is connected to input 2 on level 1.

The number of digits used for each number is generally the maximum number of digits ever required for that particular switcher. Thus, a switcher with between 10 and 99 inputs would use two digits for the input number, and a switcher with less than 10 levels would use one digit for the level number.

"C": Clear Matrix

Use command **C** to request that the switcher matrix be cleared so that all outputs are disconnected from inputs (in switchers where this is possible) or else all outputs at all levels have input 1 as their source. This command can take several seconds to execute (depending on the size of the switcher matrix). In order to help ensure that this command isn't accidentally executed, it requires four additional characters following the "C" character, to spell out the word "CLEAR" in full. For example, the command:

**CLEAR!!

would clear the matrix and when finished — the following response would be generated:

**OK!!<CR>