

KRAMER ELECTRONICS Ltd.

COMMUNICATION PROTOCOL “2000”

(VER-0.1)

This RS-232 / RS-485 communication protocol uses four bytes of information as defined below. For RS-232, a null-modem connection between the machine and controller is used. The default data rate is 9600 baud, with no parity, 8 data bits and 1 stop bit.

MSB

LSB

	DESTINATION	INSTRUCTION					
0	D	N5	N4	N3	N2	N1	N0
7	6	5	4	3	2	1	0

1st byte

	INPUT						
1	I6	I5	I4	I3	I2	I1	I0
7	6	5	4	3	2	1	0

2nd byte

	OUTPUT						
1	O6	O5	O4	O3	O2	O1	O0
7	6	5	4	3	2	1	0

3rd byte

			MACHINE NUMBER				
1	0	0	M4	M3	M2	M1	M0
7	6	5	4	3	2	1	0

4th byte

1st BYTE: Bit 7 – Defined as 0.
 D – “DESTINATION”: 0 - for sending information to the switchers (from the PC);
 1 - for sending to the PC (from the switcher).
 N5...N0 – “INSTRUCTION”

The function that is to be performed by the switcher(s) is defined by the INSTRUCTION (6 bits). Similarly, if a function is performed via the machine’s keyboard, then these bits are set with the INSTRUCTION NO., which was performed. The instruction codes are defined according to the table below (INSTRUCTION NO. is the value to be set for N5...N0).

2nd BYTE: Bit 7 – Defined as 1.
 I6...I0 – “INPUT”.

When switching (ie. instruction codes 1 and 2), the INPUT (7 bits) is set as the input number which is to be switched. Similarly, if switching is done via the machine’s front-panel, then these bits are set with the INPUT NUMBER which was switched. For other operations, these bits are defined according to the table.

3rd BYTE: Bit 7 – Defined as 1.
O6...O0 – “OUTPUT”.

When switching (ie. instruction codes 1 and 2), the OUTPUT (7 bits) is set as the output number which is to be switched. Similarly, if switching is done via the machine’s front-panel, then these bits are set with the OUTPUT NUMBER which was switched. For other operations, these bits are defined according to the table.

4th BYTE: Bit 7 – Defined as 1.
Bit 6, bit 5 – Defined as 0.
M4...M0 – MACHINE NUMBER.

Used to address machines in a system via their machine numbers. When several machines are controlled from a single serial port, they are usually configured together with each machine having an individual machine number.

For a single machine controlled via the serial port, always set M4...M0 = 1, and make sure that the machine itself is configured as MACHINE NUMBER = 1.

TABLE OF INSTRUCTION CODES FOR PROTOCOL “2000”

Note: All values in the table are decimal, unless otherwise stated.

INSTRUCTION		DEFINITION FOR SPECIFIC INSTRUCTION		NOTE
#	DESCRIPTION	INPUT	OUTPUT	
0	RESET VIDEO	0	0	1
1	SWITCH VIDEO	Set equal to video input which is to be switched (0 = disconnect)	Set equal to video output which is to be switched (0 = to all the outputs)	2
2	SWITCH AUDIO	Set equal to audio input which is to be switched (0 = disconnect)	Set equal to audio output which is to be switched (0 = to all the outputs)	2
3	STORE VIDEO STATUS	Set as SETUP # (0-15)	0 - to store 1 - to delete	2, 3
4	RECALL VIDEO STATUS	Set as SETUP # (0-15)	0	2, 3
5	REQUEST STATUS OF A VIDEO OUTPUT	Set as SETUP # (0-15)	Equal to output number whose status is reqd	4, 3
6	REQUEST STATUS OF AN AUDIO OUTPUT	Set as SETUP # (0-15)	Equal to output number whose status is reqd	4, 3
7	VIS SOURCE	Set as input # (for OUTPUT byte = 6) or as output # (for OUTPUT byte = 7), or set = 0.	0 - No VIS (immediate) 1 - Input # 1 2 - External digital sync 3 - External analog sync 4 - Dynamic sync 5 - Inter-machine sync 6 - Input # (INPUT byte) 7 - Output #(INPUT byte)	2, 5
8	BREAKAWAY SETTING	0	0 - audio-follow-video 1 - audio breakaway	2

9	VIDEO / AUDIO TYPE SETTING	0 - for video	0 - CV 1 - YC 2 - YUV	3 - RGBS 4 - SDI	2
		1 - for audio	I0=0 – Unbalanced audio I0=1 – Balanced audio I1=0 – Digital audio I1=1 – Analog audio I4=0, I3=0, I2=0 – Mono I4=0, I3=0, I2=1 – Stereo		
10	REQUEST VIS SETTING	Set as SETUP # (0-15), or set to 126 or 127 to request if machine has this function	0 - VIS souce 1 - Input # or output # of source 2 - Vertical sync freq (Hz)		3, 4, 6, 7
11	REQUEST BREAKAWAY SETTING	Set as SETUP # (0-15), or set to 126 or 127 to request if machine has this function	0		3, 4, 6
12	REQUEST VIDEO / AUDIO TYPE SETTING	Set as SETUP # (0-15), or set to 126 or 127 to request if machine has this function	0 - for video 1 - for audio		3, 4, 6
13	SET HIGHEST MACHINE NUMBER	0 - for video 1 - for audio	Set equal to highest machine number		2
14	REQUEST HIGHEST MACHINE NUMBER	0 - for video 1 - for audio	0		4
15	REQUEST WHETHER SETUP IS DEFINED	Set as SETUP # (0-15)	0		8
16	ERROR / BUSY	0	0 - error 1 - invalid instruction 2 - out of range 3 - machine busy		9
17	RESERVED	----	----		10
18	RESET AUDIO	0	0		1
19	STORE AUDIO STATUS	Set as SETUP #(0-15)	0 - to store 1 - to delete		2, 3
20	RECALL AUDIO STATUS	Set as SETUP #(0-15)	0		2, 3
21	SET VIDEO GAIN	Equal to output number whose gain is to be set (0 = all)	Set as gain value (dB)		2, 6, 11
22	SET AUDIO GAIN	Equal to output number whose gain is to be set (0 = all)	Set as gain value (dB)		2, 11
23	INCREASE / DECREASE VIDEO GAIN	Equal to output number whose gain is to be increased (0 = all)	0 - increase gain 1 - decrease gain		2
24	INCREASE / DECREASE AUDIO GAIN	Equal to output number whose gain is to be increased (0 = all)	0 - increase gain 1 - decrease gain		2
25	REQUEST GAIN	Equal to output number whose gain is requested (set to 126 or 127 to request if machine has this function)	0 - video gain 1 - audio gain		3, 6

57	SET AUTO-SAVE	0 - no save 1 - auto-save	0	12, 2
58	RESERVED	----	----	10
59	RESERVED	----	----	10
60	RESERVED	----	----	10
61	IDENTIFY MACHINE	1 - video machine name 2 - audio machine name 3 - video software version 4 - audio software version 7 - remote control name 8 - remote software version	0	13
62	DEFINE MACHINE	1 - number of inputs 2 - number of outputs	1 - for video 2 - for audio 3 - for SDI 4 - for remote panel	14

NOTES on the above table:

NOTE 1 - When the master switcher is reset, (e.g. when it is turned on), the reset code is sent to the PC. If this code is sent to the switchers, it will reset according to the present power-down settings.

NOTE 2 - These are bi-directional definitions. That is, if the switcher receives the code, it will perform the instruction; and if the instruction is performed (due to a keystroke operation on the front panel), then these codes are sent. For example, if the HEX code

01 85 88 83

was sent from the PC, then the switcher (machine 3) will switch input 5 to output 8. If the user switched input 1 to output 7 via the front panel keypad, then the switcher will send:

41 81 87 83

to the PC.

When the PC sends one of the commands in this group to the switcher, then, if the instruction is valid, the switcher replies by sending to the PC the same four bytes that it was sent (except for the first byte, where the DESTINATION bit is set high).

NOTE 3 - SETUP # 0 is the present setting. SETUP # 1 to SETUP # 15 are the settings saved in the switcher's memory, (i.e. those used for Store and Recall).

NOTE 4 - The reply to a "REQUEST" instruction is as follows: the same instruction and INPUT codes as were sent are returned, and the OUTPUT is assigned the value of the requested parameter. The replies to instructions 10 and 11 are as per the definitions in instructions 7 and 8 respectively. For example, if the present status of machine number 5 is breakaway setting, then the reply to the HEX code

0B 81 80 85

would be

4B 81 81 85

NOTE 5 – For the OUTPUT byte set as 6, the VIS source is the input selected using the OUTPUT byte. Similarly, for the OUTPUT byte set as 7, the VIS source is the output selected using the OUTPUT byte. Note also, that on some machines the sync source is not software selectable, but is selected using switches, jumpers, etc!

NOTE 6 – If INPUT is set to 127 for these instructions, then, if the function is defined on this machine, it replies with OUTPUT=1. If the function is not defined, then the machine replies with OUTPUT=0, or with an error (invalid instruction code).

If the INPUT is set to 126 for these instructions, then, if possible, the machine will return the current setting of this function, even for the case that the function is not defined. For example, for a video switcher which always switches during the VIS of input #1, (and its VIS setting cannot be programmed otherwise), the reply to the HEX code

4A FE 80 81 (ie. request VIS setting, with INPUT set as 126_{dec})
would be

4A FE 81 81 (ie. VIS setting = 3, which is defined as VIS from input #1).

NOTE 7 – Setting OUTPUT to 0 will return the VIS source setting as defined in instruction #7. Setting to 1 will return the input # or output # of the sync source (for the case where the VIS source is set as 3 or as 6 in instruction #7). Setting to 2 returns the vertical sync frequency (0 for no input sync, 50 for PAL, 60 for NTSC, 255 for error).

NOTE 8 - The reply to the "REQUEST WHETHER SETUP IS DEFINED" is as in TYPE 3 above, except that here the OUTPUT is assigned with the value 0 if the setup is not defined; or 1 if it is defined.

NOTE 9 - An error code is returned to the PC if an invalid instruction code was sent to the switcher, or if a parameter associated with the instruction is out of range (e.g. trying to save to a setup greater than 15, or trying to switch an input or output greater than the highest one defined). This code is also returned to the PC if an RS-232 instruction is sent while the machine is being programmed via the front panel. Reception of this code by the switcher is not valid.

NOTE 10 – This code is reserved for internal use.

NOTE 11 – For machines where the video and / or audio gain is programmable. The value of the gain is represented in twos complement form to allow for negative values (attenuation).

NOTE 12 - Under normal conditions, the machine's present status is saved each time a change is made. The "power-down" save (auto-save) may be disabled using this code. Note that whenever the machine is turned on, the auto-save function is set.

NOTE 13 - This is a request to identify the switcher/s in the system. If the INPUT is set as 1 or 2, the machine will send its name. The reply is the decimal value of the INPUT and OUTPUT. For example, for a 2216, the reply to the request to send the audio machine name would be (HEX codes):

7D 96 90 81 (i.e. 128_{dec}+ 22_{dec} for 2nd byte, and 128_{dec}+ 16_{dec} for 3rd byte).

If the request for identification is sent with the INPUT set as 3 or 4, the appropriate machine will send its software version number. Again, the reply would be the decimal value of the INPUT and OUTPUT - the INPUT representing the number in front of the decimal point, and the OUTPUT representing the number after it. For example, for version 3.5, the reply to the request to send the version number would be (HEX codes):

7D 83 85 81 (i.e. 128_{dec}+ 3_{dec} for 2nd byte, 128_{dec}+ 5_{dec} and 3rd byte).

NOTE 14 - The number of inputs and outputs refers to the specific machine which is being addressed, *not* to the system. For example, if six 16X16 matrices are configured to make a 48X32 system (48 inputs, 32 outputs), the reply to the HEX code

3E 82 81 82 (ie. request the number of outputs)
would be

7E 82 90 82

ie. 16 outputs

7 Communication Protocol¹

Table 5: VP-24 Hex Table

Inputs		Switcher Mode			Scaler Mode
		Composite Video OUT and Audio OUT CV	s-Video OUT and Audio OUT s-Video	VGA OUT and Audio OUT VGA	Scaler OUT (VGA) and Audio Master OUT
Group	#				
Composite Video	In 1	01 81 81 81			01 81 84 81
	In 2	01 82 81 81			01 82 84 81
	In 3	01 83 81 81			01 83 84 81
	In 4	01 84 81 81			01 84 84 81
s-Video	In 1 (In 5)*		01 81 82 81		01 85 84 81
	In 2 (In 6)*		01 82 82 81		01 86 84 81
	In 3 (In 7)*		01 83 82 81		01 87 84 81
	In 4 (In 8)*		01 84 82 81		01 88 84 81
VGA	In 1 (In 9)*			01 81 83 81	01 89 84 81
	In 2 (In 10)*			01 82 83 81	01 8A 84 81
	In 3 (In 11)*			01 83 83 81	01 8B 84 81
	In 4 (In 12)*			01 84 83 81	01 8C 84 81

* Scaler Mode

Master Audio Selector (Group Audio OUT)	Audio Master OUT Mode	
	Switcher	Scaler
Composite Video Audio OUT	02 81 81 81	02 81 84 81
s-Video Audio OUT	02 82 81 81	02 82 84 81
VGA Audio OUT	02 83 81 81	02 83 84 81
Microphone	02 84 81 81	02 84 84 81
Disconnect All	02 80 81 81	02 80 84 81

Communication Protocol

Table 6: Instruction Set for the VP-24 (according to Protocol "2000")

INSTRUCTION #	DESCRIPTION	MODE	INPUT	OUTPUT	GROUP	NOTE
1	Switch Video	Switcher	0 - 4	1	CV	Ø - Disconnect
			0 - 4	2	SV	
			0 - 4	3	VGA	
		Scaler	0 - 12	4	All Groups	Scaler Out; Audio follow video
2	Switch Audio	Switcher	1	1	CV - Audio	To Master Audio Out
			2	1	SV - Audio	
			3	1	VGA - Audio	
			4	1	Microphone	
			0	1		
		Scaler	1	4	CV - Audio	Toggle ON / OFF according to the separate video group or Microphone to Master Audio Out
			2	4	SV - Audio	
			3	4	VGA - Audio	
			4	4	Microphone	
			0	4		
5	Request Status Of A Video Output	Switcher	0	1	CV	
			0	2	SV	
			0	3	VGA	
		Scaler	0	4		
6	Request Status Of An Audio Output	Switcher	0	1	CV - Audio	
			0	2	SV - Audio	
			0	3	VGA - Audio	
		Scaler	0	4		
22	Set Audio Gain Of Master Audio Output	Switcher	1	Switcher Gain Value	All groups	Gain Value = 0 - Mute Adjust the audio Level knob
		Scaler	4	Scaler Gain Value		Gain Value = 115 Vout / Vin = 1:1 Gain Value = 127 Vout / Vin = 2:1
24	Increase/Decrease Audio Gain	Switcher	1	0 – increase gain 1 – decrease gain	All groups	One step = 0.5db
		Scaler	4			
25	Request Gain	Switcher	1	1	All Groups	Answer – Current audio Gain
			126	1		
			127	1		
		Scaler	4	1		Answer – Current audio Gain
			126	1		
			127	1		
30	Lock Front Panel		0 - Panel Unlocked 1 - Panel Locked	0 0		
31	Request Whether Panel Is Locked		0	0		
57	Set Auto-Save		0 – No Save 1 - Save			
61	Identify Machine		1, 2 – Machine Name 3,4 – Software Version	0		
62	Define Machine		1 – Number of Inputs 2 – Number of Outputs	1, 2		

Hex Table For Audio Gain Settings

Set audio gain max (6dB)	16 81 FF 81
Set audio gain = 5.5dB	16 81 FE 81
Set audio gain = 5.0dB	16 81 FD 81
:	:
Set audio gain = 1.0dB	16 81 F5 81
Set audio gain = 0.5dB	16 81 F4 81
Set audio gain = 0dB (unity gain)	16 81 F3 81
Set audio gain = -0.5dB	16 81 F2 81
Set audio gain = -1.0dB	16 81 F1 81
Set audio gain = -1.5dB	16 81 F0 81
:	:
Set audio gain = -46.5dB	16 81 A2 81
Set audio gain = -47.0dB	16 81 A1 81
Set audio gain = -47.5dB	16 81 A0 81
Set audio gain = -48.0dB	16 81 9F 81
Set audio gain = -49.0dB	16 81 9E 81
Set audio gain = -50.0dB	16 81 9D 81
:	:
Set audio gain = -76.0dB	16 81 83 81
Set audio gain = -77.0dB	16 81 82 81
Set audio gain = -78.0dB	16 81 81 81
Mute audio	16 81 80 81
Increase audio gain by 0.5dB	18 81 80 81
Decrease audio gain by 0.5dB	18 81 81 81
Request audio gain	19 81 81 81

Note: For VP-24 this table relates to the switcher mode. For scaler mode the second byte should be 84.