CORIO2 Universal Scaler

User Control Specification - Protocol 2

Compatible with: C2-7000 Series units

Release 0.1 Beta*

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Brief

This control specification for protocol 2 outlines how to control a CORIO2 Universal Scaler unit via an RS232 link, using ASCII-based commands, currently only the C2-7000 series of unit supports this protocol (requiring firmware version 30 or above). It details how to send and receive serial data to perform many of the functions that a user has access to on the front panel.

(Please note that this specification applies ONLY to those units bearing the CORIO2 logo.)

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Revision history

0.1 Beta release – *The following functions will become available in the next release

Reading and Writing of the button functions

Reading Writing and Execution of macro functions

Communication standard

You should read this specification in conjunction with the User Manual.

Packets of ASCII data containing hexadecimal numbers are exchanged between the CORIO2 unit and controller via an RS232 link.

The RS232 standard is 57600 baud, 8 bits, no parity and 1 stop bit.

No flow control is used - however all control packets start with and ASCII 'F', end with carriage-return (13 decimal) and all such packets sent to the CORIO2 unit will be acknowledged (thereby provided software handshaking).

It may take around 20ms (0.02 seconds) for an RS232 command to be actioned and acknowledged.

ASCII-hex data is used where a number is encoded into its hexadecimal equivalent with leading zeros - eg. Where '00' is decimal value 0, '80' is decimal 128 and 'FF' is decimal 255.

Any gap of more than 1 second between the characters of a control command sent using the RS232 port will cause a time-out - and previous characters sent will be lost.

Write packets (sending command functions to the CORIO2 unit) are always 20 characters long (including a carriage return (EOP) at the end). The CORIO2 unit will respond with a full 20 character message indicating what has changed. This returned payload will reflect the actual value of the parameter changed, if the user requests a value out of bounds then the limit value is used, and the payload will then reflect the limit value used.

Read packets (sent to request information from the CORIO2 unit) are always 14 characters long (including a carriage return at the end), the response from the scaler will be a 20 byte message with the Write flag (since it is 'writing' the value back to the host) and the ACK flag set.

The ACK flag will be returned as 0 if the command is invalid for some reason – for example a bad FUNCTION, WINDOW, OUTPUT or PAYLOAD value. An ACK=0 message will be otherwise identical to the one you sent, so you know exactly which message has the error.

Any changes made to the unit using the front panel controls will also cause the full 20 byte message to be sent indicating the change that has occurred, thus enabling a program to stay 'in-sync' with the unit. In some cases (such as the execution of a macro) multiple 20 bytes messages will be sent indicating all the parameters that have been changed.

Only one message can be sent to the unit, another message can't be sent until a specific response is received from the scaler (the user should look for a message with the same WINDOW, OUTPUT and FUNCTION values as they sent). If no message is received back within 1 second, there is likely to be a hardware communication problems (or wrong baud rate, etc.).

Packet format

Below is a representation of data packets sent / received to / from the CORIO2 unit:

SOP	CMD	CHA	WINDOW	OUTPUT	FUNCTION	PAYLOAD x 3	CS	EOP

The table below details the function of each part of the packet:

Packet part	***Function***
SOP	This is always the ASCII letter 'F' to indicate the packet start.
CMD	ASCII-hex byte to indicate the type of command being sent. Each bit in the byte has a different function. Currently only the following bits are defined: Bit 7 = Write (0) or Read (1) request. Messages from the scaler are always Writes. Bit 6 = ACK bit. Should be set to 0 for messages to the scaler. ACK=1 returned means message was okay. ACK=0 returned means an error was present in the message. Bit 5 = 0 Reserved for future use. Bit 4 = 0 Reserved for future use. Bit 3 = 0 Reserved for future use. Bit 2 = 1 This bit *must* be set for this protocol (Protocol 2). Bit 1 = 0 Reserved for future use. Bit 0 = 0 Reserved for future use.
CHA SOURCE or MACRO NUMBER	This byte has multiple uses. When Function number is within the Adjust Sources section (see later): Byte to indicate the source channel to be altered (if appropriate). This byte should be set to 0 if the command does not relate to an input-specific parameter. 0x10 = RGB1, 0x11 = RGB2, 0x12 = RGB3 0x30 = CV1, 0x31 = CV2, 0x32 = CV3 0x40 = YC1, 0x41 = YC2, 0x42 = YC3 0x50 = SDI1, 0x51 = SDI2 0xD0 = OUT1, 0xD1 = OUT2 0xF0 = TC1, 0xF1 = TC2 Or – for Macro related commands: Bit 7..4 = 0 Reserved Bit 3..0 = Macro number Or – when not used (for the majority of commands) Bit 7..0 = 0
WINDOW / LOGO / BORDER	Bit 7 = Reserved (set to 0). Bit 6..0 = Represents the window to be adjusted. E.g. Window ‘A’ is sent as ‘41’ since 0x41 is ASCII for ‘A’. 0x61 is ASCII for ‘a’ and is sent as ‘61’.
OUTPUT & FUNC HIGH	Bit 7..4 = Number representing the window to adjust 0 = Output 1, 1 = Output 2. Bit 3..2 = Reserved (set to 0). Bit 1..0 = Bits 9 & 8 of the function code. (Remainder [7..0] are in FUNC LOW.) Eg. If the function code is 0x234, and we want to adjust Output 2, then this byte is 0x12
FUNC LOW	ASCII-hex byte to indicate the lowest 8 bits of the actual function to set or receive (e.g. change Program source). A later table details all the functions available, and each one will normally relate to an option on the CORIO2.
PAYLOAD x 3 bytes	A series of ASCII-hex bytes carrying the data to send. Read requests have no payload - the payload is in the data sent back. Write packets require a payload, and this is always in 'triple-bytes' - ie. 3 bytes are required, MSB first. eg. '000001' is 1 in decimal, '010000' is 65536 in decimal, and 'FFFFF0' is -16 in decimal.
CS	ASCII-hex byte that is the (check) sum of all previous bytes (excluding the SOP 'F' character). Eg. The command F0400410082000001 has the checksum of 04+00+41+00+82+00+00+01=C8, so the complete command to send is F0400410082000001C8. A short-cut for debugging allows the checksum to be replaced by 2 question marks, so in the previous example you could send F0400410082000001?? Instead. This is purely for test and debugging - you should normally use a checksum to ensure data validity.
EOP	This is a carriage return (no line-feed) - ASCII code 13 (decimal).

Function list

These are listed in menu-order.

A CORIO2 unit and manual should be used to determine the actual function of each code, as only the menu text is listed here.

Function codes are given in hexadecimal and adjustment range is in decimal (but always sent as hexadecimal!).

The mode of operation also restricts what Window and Output can be used the follow table show the allowed combinations:

Mode	***Allowed Window and Output combinations***
Switcher	Output 1 (0x00) and Window A (0x41) / Window Z (0x5A) / Logo a (0x61)
Independent	Output 1 (0x00) and Window A (0x41) / Window Z (0x5A) / Logo a (0x61) **OR** Output 2 (0x01) and Window B (0x42) / Window Z (0x5A) / Logo b (0x62)
Dual PIP	Any combination of Output and Window

The following table is a list of all menu functions and there related function and valid range of adjustment.

Menu text	***Channels***	***Function (Hex)***	***Range of adjustment*** **(decimal)**
Top level			
Mode		109	0 = Switcher 1 = Independent 2 = Dual PIP
Adjust outputs			
Lock source (connector)		149	0x10 = RGB1, 0x11 = RGB2, 0x12 = RGB3 0x30 = CV1, 0x31 = CV2, 0x32 = CV3 0x40 = YC1, 0x41 = YC2, 0x42 = YC3 0x50 = SDI1, 0x51 = SDI2 0xD0 = OUT1, 0xD1 = OUT2 0xF0 = TC1, 0xF1 = TC2
Lock method		10A	0..2 = Off, Genlock, Lock & Mix
Output resolution		83	1..1000
Output image type analogue		E2	0 = RGBHV 2 = RGsB 3 = YUV 4 = tlYUV 7 = tlRGB
Output image type digital		16C	0 = RGBHV 3 = YUV 9 = Not available
Background Y		13B	16..235
Background U		13C	16..240
Background V		13D	16..240
CCIR Output Standard		101	0 = NTSC/PAL, 1 = PAL-M/PAL-N
Output CV/YC IRE		133	-7.5..12.5
Output CV/YC Hue (degrees)		139	-22..22
Output SC/H Phase		85	-180..180
Output Luma Bandwidth		134	0,1,2 = Low, Medium, High
Output Chroma Bandwidth		135	0,1,2 = Low, Medium, High
Output Chroma delay		137	-4..3
PAL WSS		130	0 = Off 1 = 4:3 Full format 2 = 14:9 Letterbox centre 3 = 14:9 Letterbox top 4 = 16:9 Letterbox centre 5 = 16:9 Letterbox top

			6 = >16:9 Letterbox centre 7 = 14:9 Full format 8 = 16:9 Full format
Take		11E	0->1 = Perform a Preview -> Program transition
Adjust Windows			
Program source / Window source (connector)		82	0x10 = RGB1, 0x11 = RGB2, 0x12 = RGB3 0x30 = CV1, 0x31 = CV2, 0x32 = CV3 0x40 = YC1, 0x41 = YC2, 0x42 = YC3 0x50 = SDI1, 0x51 = SDI2 0xD0 = OUT1, 0xD1 = OUT2 0xF0 = TC1, 0xF1 = TC2
Window Enable		12B	0..1 = Off, On
Zoom level %		86	100..1000
Zoom level H %		103	100..1000 (only used in Advanced A/R mode)
Zoom level V %		105	100..1000 (only used in Advanced A/R mode)
Aspect ratio in		107	0.1:1..9.99:1
H/V zoom pan % (H)		9F	0..100
H/V zoom pan % (V)		A0	0..100
Freeze		9C	0..1 = Off, On
H/V out shift (H)		AD	-100..100
H/V out shift (V)		AE	-100..100
Lock pixel offset		14A	-2047..2047
Lock line offset		14B	-2047..2047
Shrink level %		87	10..100
Shrink level H %		104	10..100 (only used in Advanced A/R mode)
Shrink level V %		106	10..100 (only used in Advanced A/R mode)
H/V shr. pos.% (H)		DA	0..100
H/V shr. pos.% (V)		DB	0..100
Aspect Adjust		102	0..1 = Simple, Advanced
Flicker reduction		92	0..3 = Off, Low, Med, High
Image smoothing		A1	0..2 = Off, Med, High
Image flip		95	0..3 = Off, Horiz., Vertical, H & V
De-glitch		A3	0..1 = Off, On
Max fade level		10F	0..100 = Fade level %
Layer priority		144	0..5 = Layer priority
Headphone volume		FD	-16..15 (-16=Mute)
Adjust keyers			
Keyer enable		127	0.. 1 = Off, On
Y key min/max (min)		AF	0..255
Y key min/max (max)		B2	0..255
Y key Softness		121	0..255
Y key Invert		122	0..1 = Off, On
U key min/max (min)		B0	0..255
U key min/max (max)		B3	0..255
U key Softness		123	0..255
U key Invert		124	0..1 = Off, On
V key min/max (min)		B1	0..255
V key min/max (max)		B4	0..255
V key Softness		125	0..255
V key Invert		156	0..1 = Off, On
Logos			
Logo enable		12B	0..1 = Off, On
Logo number		143	0..9 Logo selection
H/V out shift (H)		AD	0..100 %
H/V out shift (V)		AE	0..100 %
Max fade level		10F	0..100%
Layer priority		144	0..5
Borders			
Border enable		150	0..1 = Off, On

Border H size		152	0..99
Border V size		151	0..99
Border H offset		153	0..99
Border V offset		154	0..99
Border Opacity		158	0 (fully transparent) ..100 (solid)
Border Y		155	16..235
Border U		156	16..240
Border V		157	16..240
Adjust sources			
Source to adjust		0x116	0x10 = RGB1, 0x11 = RGB2, 0x12 = RGB3 0x30 = CV1, 0x31 = CV2, 0x32 = CV3 0x40 = YC1, 0x41 = YC2, 0x42 = YC3 0x50 = SDI1, 0x51 = SDI2 0xD0 = OUT1, 0xD1 = OUT2 0xF0 = TC1, 0xF1 = TC2
Testcard	0..10	DC	0..10
TL pos. adj. (left)	0..9	B6	-100..100
TL pos. adj. (top)	0..9	B7	-100..100
BR size adj. (right)	0..9	DE	-100..100
BR size adj. (bottom)	0..9	DF	-100..100
Audio input	0..10	D0	0..9 = Channels 1 .. 10 on A2-2000
Audio vol	0..10	CF	-16..15 (-16=Mute)
Bal	0..10	D1	-15..15
Input pixel phase	0..2	91	0..31
RGB input type	0..2	C1	0 = Auto 1 = D-RGB 2 = D-YUV 3 = A-RGB 4 = A-YUV
RGB contr. (red)	0..2	C5	75..150
RGB contr. (green)	0..2	C6	75..150
RGB contr. (blue)	0..2	C7	75..150
De-int.	0..9	B8	0..5 = Normal, Auto, Film 3:2, M.comp.low, M.comp.med., M.comp.high
(Film mode detected)	0..9	E3	0..1 = Not detected, Detected
Bright	3..8	BB	0..180
Contrast	3..8	BC	0..180
Saturation	3..8	B9	0..180
Hue	3..8	BA	-180..180
Sharpness	3..8	80	-7..+7
Luma delay	3..8	BD	-4..3
Transitions			
Transition type		112	0..2 = Cut, fade, wipe
Switching fade time		F5	0 (off) to 50 (5.0 seconds)
Wipe type		145	0 = Left -> Right 1 = Right -> Left 2 = Up -> Down 3 = Down -> Up 4 = Diagonal 5 = Diamond
Wipe Size		146	10..2000
Adjust resolutions *Note: You MUST set the 'Image to adjust' value to the correct value first, and only then change the other values - otherwise you may be adjusting the wrong entry.* The user should not adjust the 'Image to adjust' entry using the front panel whilst also accessing it via RS232			
Image to adjust		81	1..1000
Interlaced		CA	0..1 = Off, On
H.freq.crse		BE	10000..200000
H.freq.fine		BF	10000..200000
H/V active (H)		96	64..2047

H/V active (V)		97	64..2047
H/V start (H)		8B	0..1023
H/V start (V)		8C	0..1023
Clks/l		8D	64..4095
Lines/f		8E	64..2047
H/V sync (H)		8F	8..1023
H/V sync (V)		90	1..1023
Sync polarity		94	0..3 = ++, +-, -+, --
System			
SW (Software version)		D2	Read only
PT (Product type)		C4	Read only
BT (Board type)		C2	Read only
Advanced menus		11D	0..1, Off, On
Store		C8	Set to 1 to store
Buzzer		CB	0..1 = Off, On
Power cycles		D6	Read only
Firmware updates		DD	Read only
Hours in use		D7	Read only
Resolutions		D8	Read only
Number of testcards		D9	Read only
Number of logos		14F	Read only
Board temp. (deg.C)		CD	Read only
Air temp. (deg.C)		148	Read only
Regulators temp.(deg.C)		147	Read only
PLD temp. (deg.C)		111	Read only
Fan speed (rpm)		CE	Read only
Led brightness		12C	0..100
RS232 Baud rate		AB	0..5 = 9600, 19200, 28800, 33600, 38400, 57600
TAC number 0		15D	Read only
TAC number 1		15E	Read only
TAC number 2		15F	Read only
TAC number 3		160	Read only
TAC number 4		161	Read only
TAC number 5		162	Read only
Hidden			
Front panel lock		FC	0 = unlocked, 1 = locked

Examples

Each example show the packet send to the unit and its response. When a byte is not required to be sent it is indicated by a '- 'in the table below. Each character shown below is sent as a ASCII character so F0400 is sent as 'F' '0' '4' '0' '0'.

Packet sent / ***Packet returned***

SOP	CMD	CHA	WIN	OUT	FUN	PAY	CS	EOP	SOP	CMD	CHA	WIN	OUT	FUN	PAY	CS	EOP
Set 1B Source to RGB2																	
F	04	00	42	00	82	000011	D9	CR	F	44	00	42	00	82	000011	19	CR
Set 1A Enable advanced aspect control																	
F	04	00	41	01	02	000001	??	CR	F	44	00	42	01	02	000001	8A	CR
Set 1A Shrink to 110 – invalid max for shrink is 100																	
F	04	00	41	00	87	**00006E**	??	CR	F	44	00	41	00	87	**000064**	70	CR
Read 1C Zoom level – invalid as window C does not exist																	
F	84	00	**43**	00	86	-	??	CR	F	04	00	**43**	00	86	000000	CD	CR
Read 1B Zoom level																	
F	84	00	42	00	86	-	??	CR	F	44	00	42	00	86	000064	70	CR

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