C2-28/7/655
Remote Control Specification
V1.2
PDF-REMOTE-CONTROL-C2-2x55

1 REVISION HISTORY

Date	Version	Author	Comments
3rd April 2014	1.00	Bruce Meldrum	Initial draft release
26th June 2014	1.10	Bruce Meldrum	Updated for firmware release 517
4th February 2015	1.11	Bruce Meldrum	Clarified the checksum is only 1 byte
25th June 2015	1.2	Bruce Meldrum	Updated for firmware release 541 Fixed typo in Default Ethernet settings Missing FUNCTIONS 101, 146, 29E added Event information added

2 SERIAL / IP CONTROL SPECIFICATION

This section outlines how to control a unit via a Serial or Ethernet connection, using ASCII-based commands. It details how to send and receive serial data to perform many of the functions that a user has access to on the unit.

Not all units will support the full range of functions listed – this will depend on the exact model of unit you have purchased.

2.1 Communication protocol basics

Packets of ASCII data containing hexadecimal numbers are exchanged between the unit and controller via a Serial or Ethernet connection (you cannot use both at the same time).

The Serial standard is 57600 baud, 8 bits, no parity and 1 stop bit, although this can be changed by the user (see 'Setup->System->Control->Serial Port Settings…' menu). Press-and-hold the 'OK' button to save these changes to non-volatile memory otherwise they will not be retained after a power cycle.

The default Ethernet settings are;

IP Address of the unit	192.168.1.200
IP Gateway (the IP address of your router)	192.168.1.1
Ethernet mask	255.255.252.000

Ethernet settings can be changed via the 'Setup->System->Control->Ethernet Settings…' menu and then select 'Setup->System->Control->Ethernet Settings…->Save Ethernet Settings' to save these changes to non-volatile memory otherwise they will not be retained after a power cycle.

No flow control is used - however all control packets start with an ASCII 'F', end with carriage-return (13 decimal, 0x0D hexadecimal) and all such packets sent to the unit will be acknowledged (thereby provided software handshaking). Note that a line-feed (LF) should not be sent.

It may take around 30ms (0.03 seconds) for an RS232 command to be actioned and acknowledged – this will vary between different models.

ASCII-hex data is used where a number is encoded into its hexadecimal equivalent with leading zeros – e.g. Where '00' is decimal value 0, '80' is decimal 128 and 'FF' is decimal 255. In other words, two characters are sent for each byte encoded.

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

Write packets (sending command functions to the unit) are always 20 characters long (including a carriage return at the end). The 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 limited value used.

Read packets (sent to request information from the unit) are always 14 characters long (including a carriage return at the end), the response from the unit 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 should be sent to the unit, another message can't be sent until a specific response is received from the unit (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 problem (or wrong baud rate, etc.).

If absolutely required, to simplify programming the user may send packets one after the other with around 100ms (100 milliseconds) between each one. However, this will not work for all packets (such as Zooming into Still Images / Testcards or changing Logos) since this will cause the unit's micro-controller to be busy, so the user must experiment and satisfy themselves that this is possible.

2.2   Packet format

Below is a representation of data bytes in a single packet for a 'Write' to the unit to set a value:

SOP	CMD	CHA	WINDOW	OUTPUT / FUNCTION	FUNCTION	PAYLOAD x 3	CS	EOP

Below is a representation of data bytes in a single packet for a 'Read' to the unit to get a value:

SOP	CMD	CHA	WINDOW	OUTPUT / FUNCTION	FUNCTION	CS	EOP

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

Packet part	Function
SOP (Start of packet)	This is always the ASCII letter 'F' to indicate the packet start.
CMD (Command)	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 unit are always Writes. Bit 6 = ACK bit. Should be set to 0 for messages to the unit. 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. Bit 1 = 0 Reserved for future use. Bit 0 = 0 Reserved for future use.
CHA SOURCE	This byte has multiple uses, and defaults to 0 unless used for: SOURCE Byte to indicate the source channel to be altered (if appropriate). Use the same byte value as per the Primary source selection (e.g. 0x10=HDMI).

WINDOW / LOGO	Bit 7 = 0 (Reserved). Bit 6..0 = Represents the window to be adjusted (for multi-channel units only). Leave as 0x41 for controlling Primary image and 0x61 for controlling Logo (e.g. Logo border).
OUTPUT & FUNCTION HIGH	Bit 7..4 = Number representing the output to adjust 0 = DVI-U, 1 = HDMI. Bit 3..2 = Reserved (set to 0). Bit 1..0 = Bits 9 & 8 of the function code. (Remainder of bits [7..0] are in FUNC LOW.) E.g. If the function code is 0x234, and we want to adjust HDMI, then this byte is 0x12
FUNCTION LOW	ASCII-hex byte to indicate the lowest 8 bits of the actual function to set or receive (e.g. change Zoom value). A later table details all the functions available.
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' - i.e. 3 bytes are required, MSB first. e.g. '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). E.g. The command F0400410082000001C8 has the checksum of 04+00+41+00+82+00+00+01=C8, so the complete command to send is F0400410082000001C8. The checksum evaluate to be more than 0xFF, but the CS is only ever 1 byte. In such cases CS should be the lowest 8 bits. 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).

2.3   Function list

These are grouped together into their associated on-screen menus.

Your unit and this manual should be used to determine the actual function of each of the following, as only the menu text is listed here. Where an equivalent menu item does not exist on your unit, then that feature is not supported on.

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

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

Menu text	CHA (Hex) see command 082	WIN (Hex)	FUNC (Hex)	Range of adjustment (decimal)
Preset number	-	41	225	1 to 12
Preset load	-	41	226	Set to 1 to load – automatically resets to 0.
Preset store	-	41	227	Set to 1 to store – automatically resets to 0.
Preset erase	-	41	228	Set to 1 to erase – automatically resets to 0.
Output enable	-	41	170	0=Blanked (Background Color visible), 1=Active
Background source (connector)	-	41	149	0x10 = HDMI 0x11 = DVI-U 0x12 = PC/HD 0x30 = CV 0x40 = YC 0x50 = SDI
Background View Mode	-	41	10A	0x00 = None (Scaler) 0x01 = Hidden (Genlock) 0x02 = Full Screen (Genlock) 0x04 = Hidden (Framelock)
Background H Shift	-	41	14A	-4096..4096
Background V Shift	-	41	14B	-4096..4096
Output resolution	-	41	083	1 onwards, for a full list of supported resolutions refer to the User Manual
Output image type (HDMI only)	10	41	29E	0 = RGB(HV shown on unit display) 3 = YUV

Output image type (DVI-U only)	11	41	0E2	0 = RGBHV 1 = RGBS 2 = RGsB 3 = YUV 4 = tlYUV 5 = CV/YC
HDCP enabled	10	41	233	0..1, Off, On (if display supports it) *This command MUST have OUTPUT bits = 1 for HDMI* *Ie, F44114102330000001??*
HDCP enabled	11	41	233	0..1, Off, On (if display supports it) *This command MUST have OUTPUT bits = 0 for DVI-U* *Ie, F44104112330000001??*
HDCP status	10 11	41	234	Read only 0=Unavailable 1=Supported 2=Active 3=Repeater supported 4=Repeater active 5=No display 6=EDID read 7=Wait HDCP 8=Wait secure 9=KSV FIFO Rd 10=Setup video 11=Display on
Background color R	-	41	13D	0..255
Background color G	-	41	13B	0..255
Background color B	-	41	13C	0..255
Allow HDMI output	11	41	288	0=DVI only, 1=Use HDMI if supported
YC/CV Output Standard	11	41	101	0=NTSC-M/PAL-BDGHI 1=PAL-M/PAL-N

Audio	-	41	269	0x10 = HDMI 0x11 = DVI-U 0x50 = SDI 0x70=3.5mm Jack 0x71=Analog in 1 0x72=Analog in 2 0x73=Analog in 3 0xA0=Follow primary 0xA1=Follow background 0xA2=Mute
Primary source	-	41	082	0x10=HDMI 0x11=DVI-U 0x12=PC/HD 0x30=CV 0x40=YC 0x50=SDI 0xF0=Still#1 0xF1=Still#2 0xF2=Still#3 0xF3=Still#4 0xF4=Still#5
Primary source resolution	-	41	0F8	Read only returns # of resolution
Auto Switch	-	41	2B0	0..1 = Off, On *Added in firmware 541, not available in previous versions*
Auto Switch Logo	-	41	2B1	0=None 1=Logo #1 2=Logo #2 3=Logo #3 4=Logo #4 5=Logo #5 6=Default ("Scanning…") *Added in firmware 541, not available in previous versions*

Auto Switch Delay Start	-	41	2B2	0=1 second 1=2 seconds 2=5 seconds 3=10 seconds 4=20 seconds *Added in firmware 541, not available in previous versions*
Auto Switch Dwell Time	-	41	2B3	0=1/2 second 1=1 second 2=2 seconds 3=3 seconds 4=4 seconds *Added in firmware 541, not available in previous versions*
Zoom level %	-	41	086	100..1000
H/V zoom pan % (H)	-	41	09F	0..100
H/V zoom pan % (V)	-	41	0A0	0..100
Image freeze	-	41	09C	0..1 = Off, On
H/V crop % (H)	-	41	223	0..100
H/V crop % (V)	-	41	224	0..100
PIP size %	-	41	087	10..100
PIP/Logo H Placement %	-	41, 61	0DA	0..100
PIP/Logo V Placement %	-	41, 61	0DB	0..100
Primary view mode	-	41	18E	0=Full Screen 1=PIP 2=Hidden
Primary Sizing mode	-	41	102	0=Percent 2=Pixel
In (size H) (Pixel size mode equivalent of Zoom and Crop	-	41	21C	Defines the width of the incoming image you want to see from the top left defined above (range depends upon resolution 0..1200)
In (size V) Pixel size mode equivalent of Zoom and Crop	-	41	21E	Defines the height of the incoming image you want to see from the top left defined above (range depends upon resolution 0..1200)
In (top left H) Pixel size mode equivalent of Zoom and Crop	-	41	21B	Defines the top left corner of the incoming image you want to see (range depends upon resolution 0..1600)

In (top left V) Pixel size mode equivalent of Zoom and Crop	-	41	21D	Defines the top left corner of the incoming image you want to see (range depends upon resolution 0..1200)
Out (size H) Pixel size mode equivalent of Placement and Size	-	41	220	Defines the size of the Primary image when placed on the output resolution (range depends upon resolution 0..1200)
Out (size V) Pixel size mode equivalent of Placement and Size	-	41	222	Defines the size of the Primary image when placed on the output resolution (range depends upon resolution 0..1200)
Out (top left H) Pixel size mode equivalent of Placement and Size	-	41	21F	Defines the top left corner where the Primary is placed on the output resolution (range depends upon resolution 0..1200)
Out (top left V) Pixel size mode equivalent of Placement and Size	-	41	221	Defines the top left corner where the Primary is placed on the output resolution (range depends upon resolution 0..1200)
Flicker reduction	-	41	092	0..3 = Off, Low, Med, High
Image smoothing	-	41	0A1	0..3 = Off, Med, High, Auto
Image flip	-	41	095	0..3 = Off, Horiz., Vertical, H & V
Temporal interpolation	-	41	229	0..1 = Off, On
Primary/Logo Opacity	-	41,61	10F	0..100 = Fade level %
Fade out / in	-	41	29D	0 = Primary Fades In 1 = Primary Fades Out
Swap primary/background	-	41	29A	0=P/B 1=B/P
EDID Capture To	10,11	41	29C	0=Inactive 1=#1 2=#2 3=#3 4=#4 Auto-resets back to 0 after capture.
Keyer enable	-	41	127	0..1 = Off, On
Y key min/max (min)	-	41	0AF	0..255
Y key min/max (max)	-	41	0B2	0..255
Y key Softness	-	41	121	0..255
Y key Invert	-	41	122	0..1 = Off, On
U key min/max (min)	-	41	0B0	0..255
U key min/max (max)	-	41	0B3	0..255

U key Softness	-	41	123	0..255
U key Invert	-	41	124	0..1 = Off, On
V key min/max (min)	-	41	0B1	0..255
V key min/max (max)	-	41	0B4	0..255
V key Softness	-	41	125	0..255
V key Invert	-	41	126	0..1 = Off, On
Logo number	-	61	143	0=None 1=#1 2=#2 3=#3 4=#4 5=#5
PIP/Logo H Placement %	-	41,61	0DA	0..100
PIP/Logo V Placement %	-	41,61	0DB	0..100
Primary/Logo Opacity	-	41,61	10F	0..100%
Border enable	-	41,61	150	0..1 = Off, On
Border H size	-	41,61	152	0..99
Border V size	-	41,61	151	0..99
Border H offset	-	41,61	153	0..99
Border V offset	-	41,61	154	0..99
Border Opacity	-	41,61	158	0 (fully transparent) ..100 (solid)
Border R	-	41,61	157	0..255
Border G	-	41,61	155	0..255
Border B	-	41,61	156	0..255
Calibrate	10,11	41	0FE	1= Start Calibrate procedure
Aspect correct	10..F4	41	240	0=Fill (default) 1=Aspect, 2=H-fit, 3=V-fit, 4=1:1

EDID to use	10,11	41	243	0=Pass Through DVI-U 1=Pass Through HDMI 2=Default DVI 3=Default HDMI 4=#1 5=#2 6=#3 7=#4
HDCP	10,11	41	237	0=Off, 1=On
HDCP status	10,11	41	238	0=Inactive, 1=Active
Align TL pos. adj. (left)	10..50	41	0B6	-100..100
Align TL pos. adj. (top)	10..50	41	0B7	-100..100
Align BR size adj. (right)	10..50	41	0DE	-100..100
Align BR size adj. (bottom)	10..50	41	0DF	-100..100
Audio input source	10..F4	41	242	0x10=HDMI 0x11=DVI-U 0x50=SDI 0x70=3.5mm Jack 0x71=Analog in 1 0x72=Analog in 2 0x73=Analog in 3 0xA2=Mute
On source loss	10..50	41	0A3	0=Show 1=Freeze 2=Blue 3=Black 4=Remove
Source stable	10..50	41	22A	Read Only 0=Unstable, 1=Stable
Input pixel phase	11,12	41	091	0..31

RGB input type	11,12	41	0C1	8 = Auto 6 = D-RGB 11 = D-YUV 10 = A-RGB 12 = A-YUV 13 = CV (only for DVI-U) 14 = YC (only for DVI-U)
RGB/YUV contr. (red,V)	11,12	41	0C5	75..150
RGB/YUV contr. (green,Y)	11,12	41	0C6	75..150
RGB/YUV contr. (blue,U)	11,12	41	0C7	75..150
YUV setup level	11,12	41	23E	0=0 IRE 1=7.5 IRE
De-interlace	10..50	41	0B8	0=Weave 1=Auto 2=Film 3:2 3=Motion Compensation low 4= Motion Compensation med. 5=M Motion Compensation high 6=Frame/bob
Film mode detected	10..50	41	0E3	Read only 0..1 = Not detected, Detected
Diagonal interpolation	10..50	41	22B	0..1 = Off, On
Noise reduction	10..50	41	23F	0..1 = Off, On
Bright	11,12,30,40	41	0BB	10..180
Contrast	11,12,30,40	41	0BC	0..180
Saturation	11,12,30,40	41	0B9	0..180
Hue	11,12,30,40	41	0BA	-90..90
Sharpness	11,12,30,40	41	080	-60..+60
Field swap	10..50	41	0C9	0..1 = Off, On (swaps odd/even fields)
Field Offset	10..50	41	196	0..7 = -4..+3 (defaults to 4 = 0)
Transition duration	-	41	0F5	0 to 9999 (999.9 seconds)

| Transition type | - | 41 | 112 | 0=Cut
1=Fade
2=Push Right
3=Push Left
4=Push Up
5=Push Down
6=Wipe Right
7=Wipe Left
8=Wipe Up
9=Wipe Down
10=Wipe Diagonal
11=Wipe Diamond |
| Transition Wipe size | - | 41 | 146 | 10..2000 pixels |

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.

Image to adjust	-	41	081	1..800
Interlaced	-	41	0CA	0..1 = Off, On
H.freq.crse	-	41	0BE	10000..200000
H.freq.fine	-	41	0BF	10000..200000
H/V active (H)	-	41	096	64..2047
H/V active (V)	-	41	097	64..2047
H/V start (H)	-	41	08B	0..1023
H/V start (V)	-	41	08C	0..1023
Clks/l	-	41	08D	64..4095
Lines/f	-	41	08E	64..2047
H/V sync (H)	-	41	08F	8..1023
H/V sync (V)	-	41	090	1..1023
Sync polarity	-	41	094	0..3 = ++, +-, -+, --

System

| SW (Software version) | - | 41 | 0D2 | Read only |

PT (Product type)	-	41	0C4	Read only
BT (Board type)	-	41	0C2	Read only
API Version	-	41	2AA	Read only
Calibrate Sense	-	41	0FF	0..3 = Low, medium, high, v.high
Store	-	41	0C8	Set to 1 to store
Buzzer	-	41	0CB	0..1 = Off, On
Power cycles	-	41	0D6	Read only
Firmware updates	-	41	0DD	Read only
Hours in use	-	41	0D7	Read only
Resolutions	-	41	0D8	Read only
Number of Stills	-	41	0D9	Read only
Number of Logos	-	41	14F	Read only
RS232 Baud rate	-	41	0AB	0..5 = 9600, 19200, 28800, 33600, 38400, 57600
System STANDBY	-	41	281	0 = Operating, 1 = In STANDBY mode
Front panel lock	-	41	0FC	0..1 = unlock, lock
Lock front panel after inactivity timeout	-	41	2A4	0..5 = never, 1 minute..5 minutes
Adjust front panel brightness	-	41	2A5	0..6 = 100%, 90%, 80%, 70%, 60%, 50%, 40%, 30%, 20%
Dim front panel after period of inactivity	-	41	2A7	0..5 = never, 1 minute..5 minutes
Turn off front panel after period of inactivity	-	41	2A8	0..6 = never, 1, 2, 5, 10, 30, 60 minutes
Allow menus to wrap	-	41	2A3	0..1 = no, yes
Display "Settings…" menu entries in Live side menu	-	41	2AB	0..1 = no, yes
Display "►" shortcut to settings in Live Side Menu	-	41	2AC	0..1 = no, yes
Lock unit interface to only allow access to Presets	-	41	2AD	0..1 = no, yes
Define the startup-up menu location	-	41	29F	0..6 = Home, Setup, Live, Primary, Background, Preset, Shortcuts *6 added in firmware 541, not available in previous versions*
Demo mode cycle time	-	41	2A9	0..5 = Off, 5, 10, 20, 30, 60 seconds

2.3.1 Reset command

This is a special command to reset a unit (as if power had been removed and re-applied). Note that unlike the above commands, this is sent as binary (i.e. not as ASCII text).

0x53, 0x06, 0x04, 0x01, 0x55, 0xAA, 0x55, 0xB2

E.g. In Visual Basic, send the string:
Chr$(&H53) + Chr$(&H6) + Chr$(&H4) + Chr$(&H1) + Chr$(&H55) + Chr$(&HAA) + Chr$(&H55) + Chr$(&HB2)

2.3.2 Event Messages

As well as API commands which allow the user to configure and interrogate the unit, there is an additional set of 'Event Messages'. These are broadcast by the unit describing events which have not meant a setting has been changed. For example, key press events or the information on the unit display changing.

These messages follow the same syntax as described previously. They all return with the FUNCTION code 2A6

The following table details many of the DATA values for different events. It is not exhaustive, you may see codes which are not in the table. These are undocumented for tvONE use only, and subject to change.

OLEDChangedEvent	0x010000	ButtonEvent_Left_Pressed	0x020000	ButtonEvent_B5_Pressed	0x020022
Entering Standby	0x030000	ButtonEvent_Right_Pressed	0x020008	ButtonEvent_B6_Pressed	0x02002A
Preset#Loaded (LSB=Preset#)	0x040001	ButtonEvent_OK_Pressed	0x020020	ButtonEvent_Up_Released	0x020050
Preset#Saved (LSB=Preset#)	0x050002	ButtonEvent_Back_Pressed	0x020001	ButtonEvent_Down_Released	0x020058
Preset#Erased (LSB=Preset#)	0x060001	ButtonEvent_Alt_Pressed	0x020009	ButtonEvent_Left_Released	0x020040
Logo#Erased (LSB=Logo#)	0x070001	ButtonEvent_Preset_Pressed	0x02000F	ButtonEvent_Right_Released	0x020048
Still#Erased (LSB=Still#)	0x080001	ButtonEvent_Power_Pressed	0x020007	ButtonEvent_OK_Released	0x020060
PanelLocked	0x090001	ButtonEvent_B1_Pressed	0x020002	ButtonEvent_Back_Released	0x020041
PanelUnlocked	0x090000	ButtonEvent_B2_Pressed	0x02000A	ButtonEvent_Alt_Released	0x020049
ButtonEvent_Up_Pressed	0x020010	ButtonEvent_B3_Pressed	0x020012	ButtonEvent_Preset_Released	0x02004F
ButtonEvent_Down_Pressed	0x020018	ButtonEvent_B4_Pressed	0x02001A	ButtonEvent_Power_Released	0x020047

ButtonEvent_B1_Released	0x020042	ButtonEvent_B3_Released	0x020052	ButtonEvent_B5_Released	0x020062
ButtonEvent_B2_Released	0x02004A	ButtonEvent_B4_Released	0x02005A	ButtonEvent_B6_Released	0x02006A