An introduction to the BATC repeater controller

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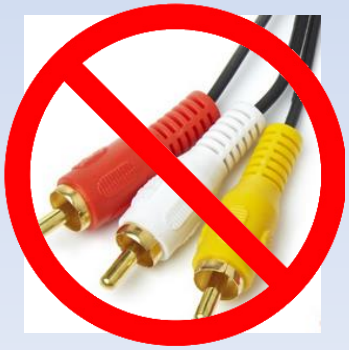
Why a BATC controller

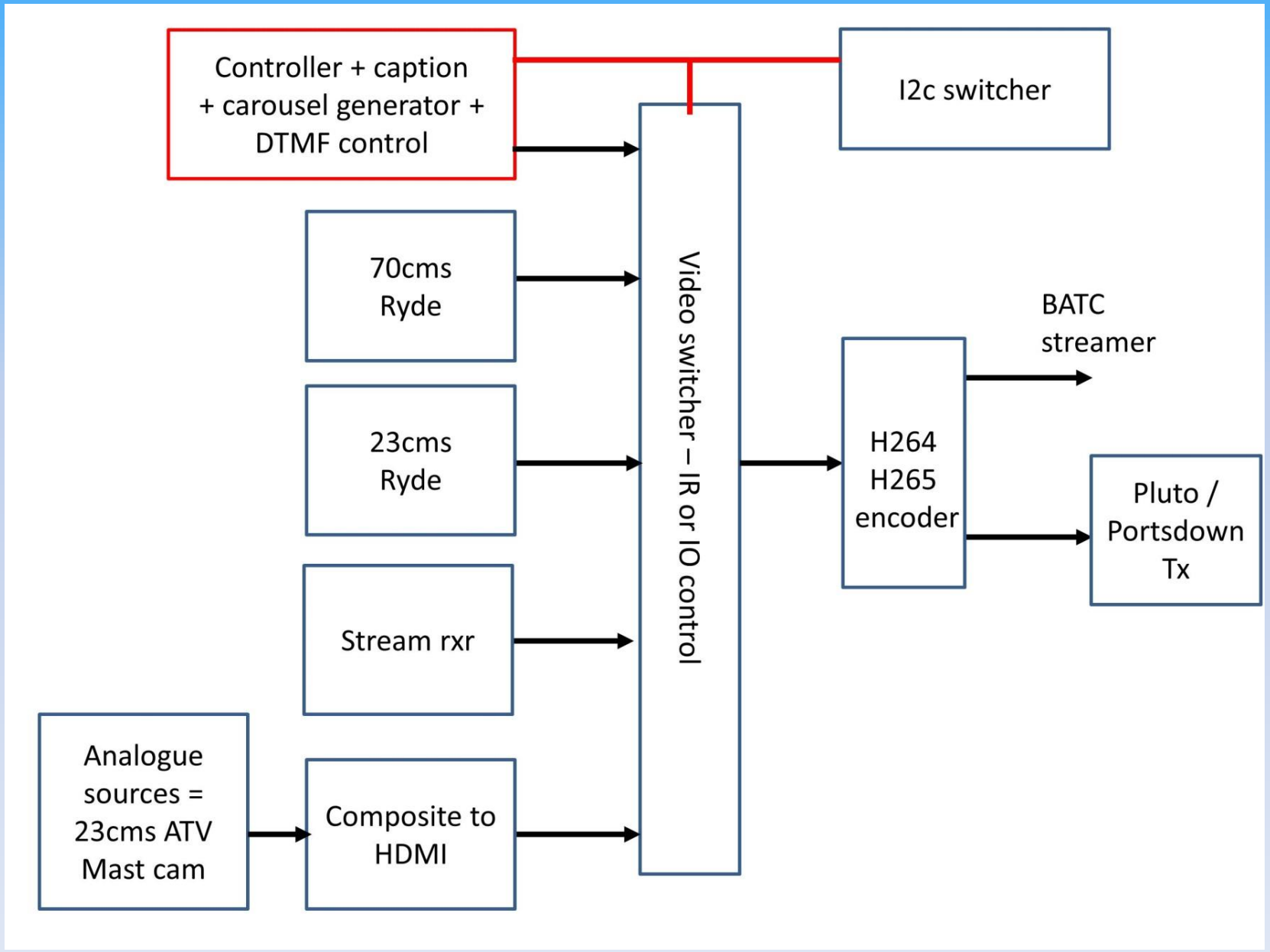
- Over the last 10 years ATV migrated to digital transmission
  - Higher resolutions than the 720 * 576 PAL standard
- But most repeaters still using PAL video switching!
  - 1920 * 1920 in > 720*578 out!
- Most controller designs are old, based around obsolete controllers



BATC controller

- Simple Raspberry Pi based controller controlling external A/V switches
  - Up to 8 GPIO inputs for signal lock
  - Infra Red, i2c or GPIO output to control AV switcher
  - Control of HDMI or analogue switchers
  - On board DTMF detector
  - HDMI or PAL graphics output
  - External equipment control and monitoring
- Designed for RPi4 running Buster OS lite

Typical configuration



Carousel

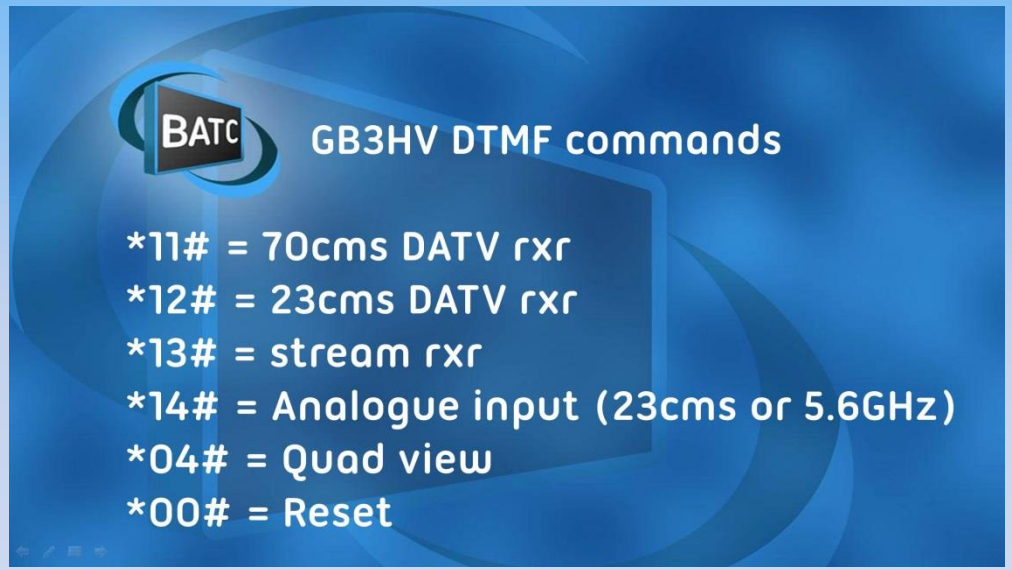
- Controller generates a rolling carousel when repeater is idle
- The carousel can show up to 99 scenes.
  - Configured in the configuration file
- Typical scenes can be:
  - jpg or png images
    - Images read before display
  - Status screen generated by the controller
  - Video files (in future release).
  - An input on the video switcher
    - mast cams, weather stations
- Timed AV Ident signals

Valid signal

- On a valid GPIO line signal from a receiver, the controller will:
  - key the transmitter,
  - play an audio beep and display an image for .5 seconds indicating which input has been activated
  - Switch controller to display the input.
- When the receiver closes,
  - Display a "K" image and plays "K" in Morse
  - Returns to the carousel.
- GPIO line can be directly from a Ryde receiver or an external source such as a sync detector.
  - Do NOT exceed 3.3 volts on the GPIO input.

DTMF control

- On-board DTMF decoder allows input selection by remote user
- GPIO pins to be toggled to enable the control of external equipment.
- Keeper functions
  - Shutdown
  - Disable Tx
  - Reboot



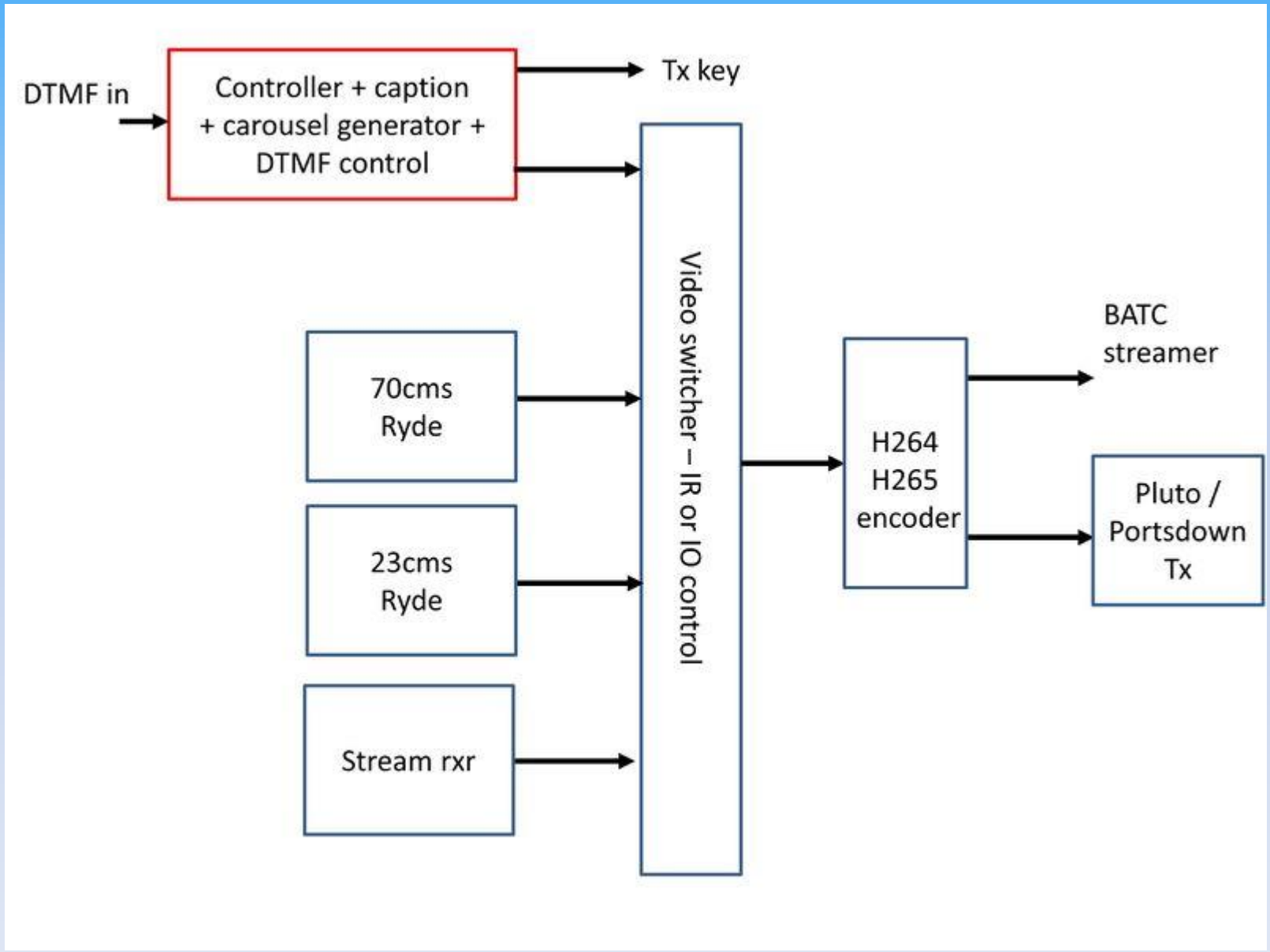
Power saving

- Number of options are available to enable power saving by turning the repeater transmitter off during quiet periods,
  - Only key the transmitter when in repeat mode
  - Do not key the transmit during the night time
  - Only key the transmitter to display the carousel for the first 30 minutes of every hour.

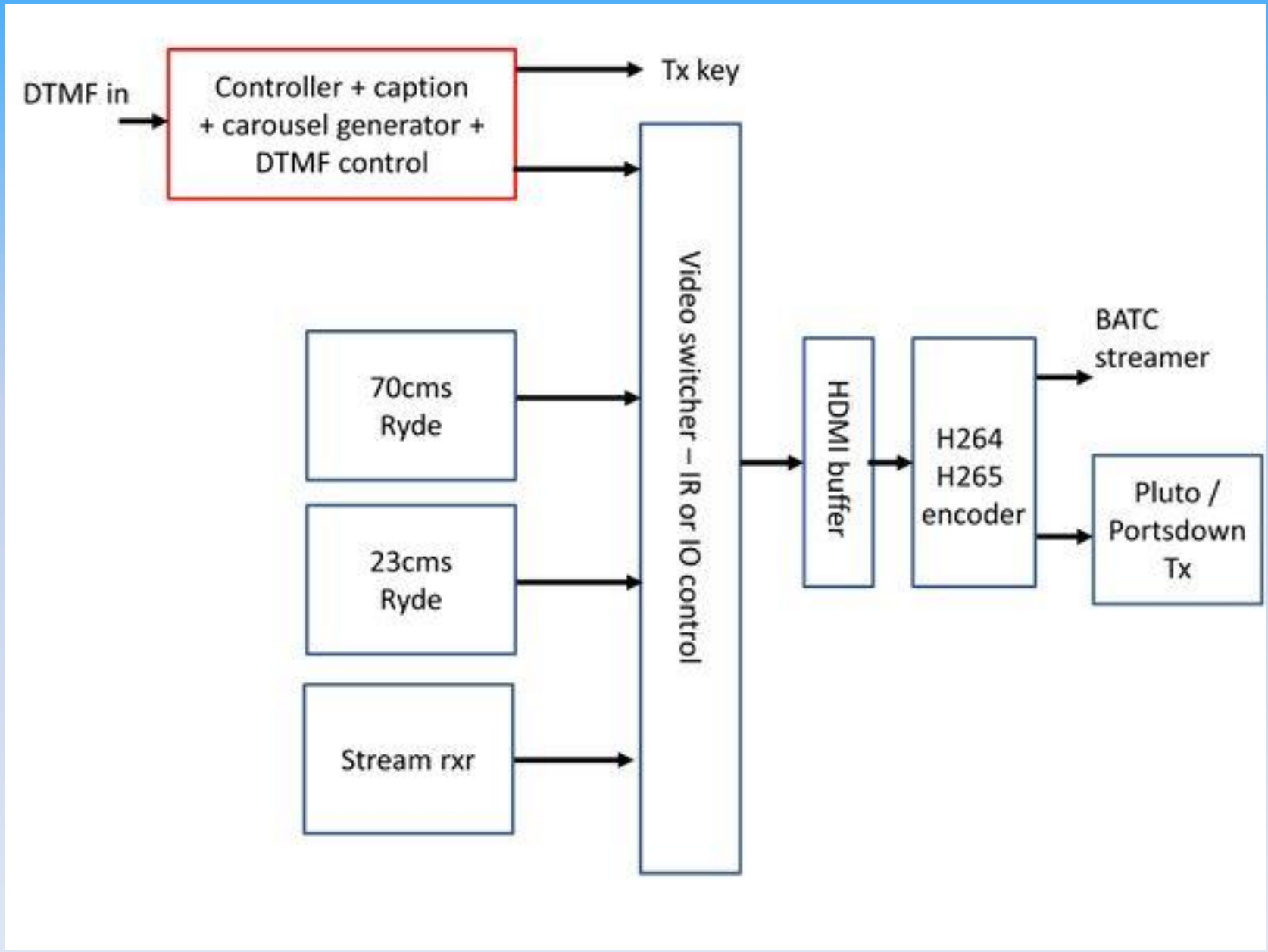
Switcher control

- Video switches controlled via IR transmitters
  - Up to 2 IR transmitters can be configured separately allowing multiple video switches to be cascaded.
- Video switchers via hardware lines driven from the RPi GPIO lines (note 3.3v logic output)
- Limited i2c control is available
- Limited webhooks
  - eg Bitfocus companion commands
- The switching commands for each input are set in the config file.

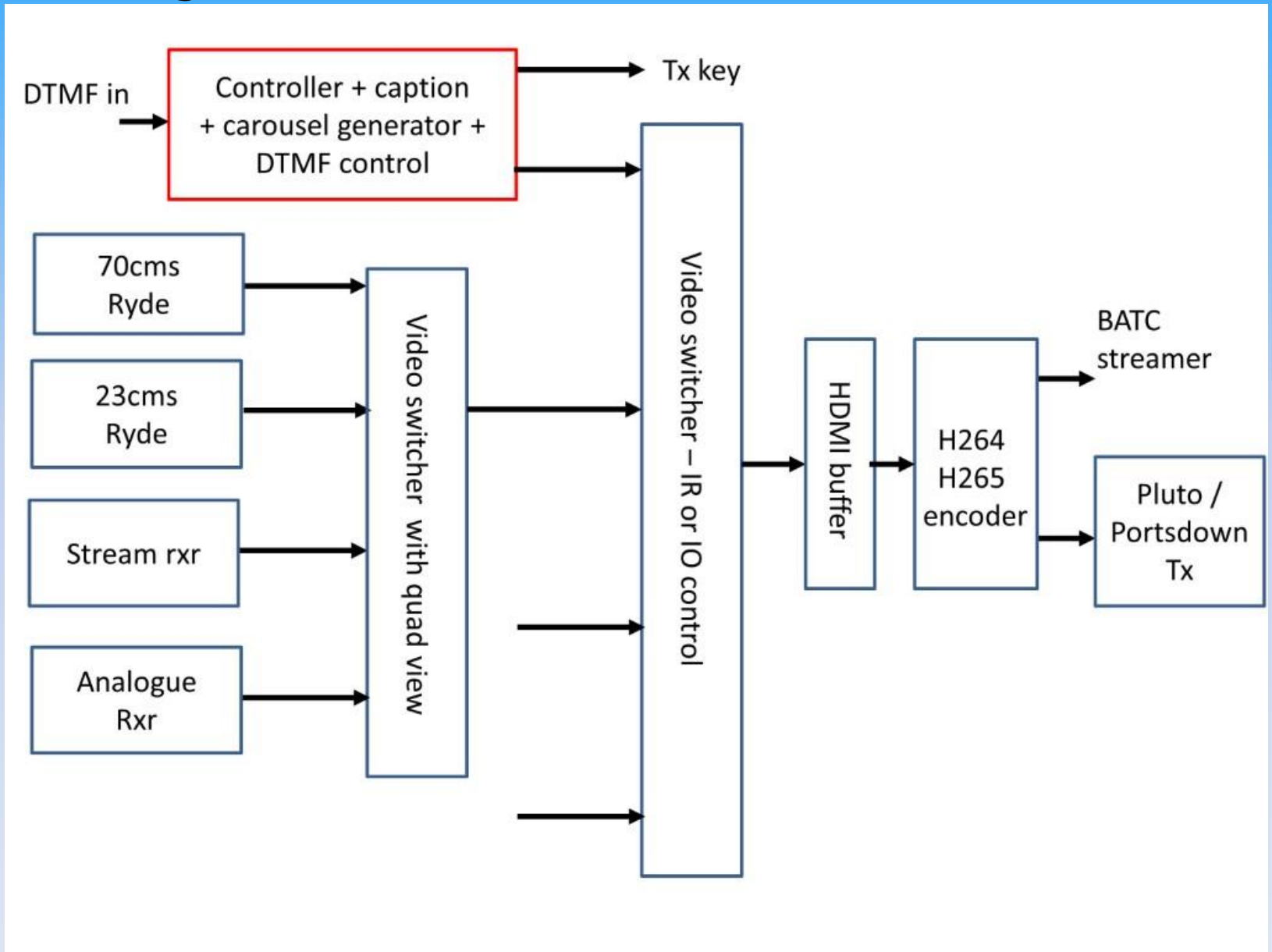
Basic system



HDMI buffer


DTMF in
Controller + caption + carousel generator + DTMF control
Tx key
70cms Ryde
23cms Ryde
Stream rxr
Video switcher – IR or IO control
HDMI buffer
H264 H265 encoder
BATC streamer
Pluto / Portsdown Tx

Quad view and buffer



Controller configuration

- Controller parameters can be changed by editing a text file
  - Repeater callsign and locator
  - Power saving
  - DTMF commands
  - K image and audio select
  - Ident period and duration
  - Input source configuration
  - Carousel scenes and duration

Controller Configuration

```
# Station Details
callsign=GB3HV
locator=IO91LD

# Video output: hdmi720, hdmi1080, pal, ntsc
# Used to size captions and layout display.  NOT to set output
vidout=hdmi1080

# Ident and K CW audio output: hdmi, jack or usb
# This IS used to set the output port (but not the hdmi keep-alive)
audioout=usb

# Turn on low level audio noise to keep hdmi audio active? yes/no
# Level %
audiokeepalive=yes
audiokeepalivelevel=85

# Enable/disable transmit ptt active? yes/no
transmitenabled=yes

# Beacon mode only transmits carousel with ident.  Set to no for rptr operation. yes/no
beaconmode=no

# Continuous TX or power-saving.  no/yes
transmitwhennotinuse=yes

# Continuous operation or active hours only. yes/no
24houroperation=yes

# Power save during second half hour in active hours?  Default no.
# Repeat and Ident are available/active during this time
halfhourpowersave=no

# Operating times are UTC.  Ignored for 24/7 operation
operatingtimestart=1000
operatingtimefinish=2330

# Quiet hours behaviour:
repeatduringquiethours=no
identduringquiethours=no
```

```
# Transmit PTT Demand physical pin (recommended 40)
pttgpiopin=40

# Front Panel Shutdown Enabled? and physical GPIO Pin (recommended 26)
fpshutdown=no
fpsdgpiopin=26

# DTMF control - uses white "Portsdown/Langstone" USB dongle input
# Control is on/off.  Gain is %.  Timeout is in seconds
# All dtmf codes are of the format *xx#.  Only xx are defined below.  Examples:
dtmfcontrol=on
dtmfaudiogain=62
dtmfactiontimeout=600
dtmfreset=00
dtmfstatusview=01
dtmfquadview=04
dtmftalkbackaudioenable=07
dtmftalkbackaudiodisable=08

# Keeper codes are 5 digit and must start with 9 (*9xxxx#)
dtmfkeepertxoff=97350
dtmfkeepertxon=97351
dtmfkeeperreboot=97359

# User codes for direct input select (use dtmfreset to seselect)
dtmfselectinput0=10
dtmfselectinput1=11
dtmfselectinput2=12
dtmfselectinput3=13
dtmfselectinput4=14
dtmfselectinput5=15
dtmfselectinput6=16
dtmfselectinput7=17

# RPi GPIO Accessory DTMF Control examples
# Outputs:  dtmfoutputs defines number of outputs.  Subsequent 4 lines can be repeated
dtmfoutputs=1
dtmfgpiooutlpin=15
dtmfgpiooutllabel=shack_light
dtmfgpiooutlon=31
dtmfgpiooutloff=41
```


```
# i2c Accessory DTMF Control examples.  MCP23017. Max 16 lines either in or out
i2cioaddress=0

i2cdtmfoutputs=1
i2cdtmfgpiooutlpin=a0
i2cdtmfgpiooutllabel=shack_heater
i2cdtmfgpiooutlon=5l
i2cdtmfgpiooutloff=6l

i2cdtmfinputs=1
i2cdtmfgpioinlpin=b0
i2cdtmfgpioinllabel=cabinet_lid

# Background image for Caption Slides
backimage=/home/pi/atv-rptr/media/batc_background.jpg

# Ident info (audio is on/off) Pitch in Hz, speed in wpm, level is %
# Set identinterval to 0 for no ident.  Set identmediatype to none for no ident video
identinterval=900
identmediatype=jpg
identmediaduration=3
identmediafile=/home/pi/tmp/ident.jpg
identcwaudio=on
identcwspeed=15
identcwpitch=800
identcwlevel=50
identcwfile=/home/pi/tmp/ident.wav

# K info.  Pitch in Hz, speed in wpm, level is %
kmediatype=jpg
kmediaduration=5
kmediafile=/home/pi/tmp/k.jpg
kcwaudio=on
kcwspeed=12
kcwpitch=800
kcwlevel=85
kcwfile=/home/pi/tmp/k.wav
```


```
# Carousel info.  Max 99 scenes
# options for type are jpg, (mp4 not implemented yet), status or source.  For source, file is source number
# which can be a virtual source such as a grid of 4 images

carouselscenes=8
carousel01mediatype=jpg
carousel01file=/home/pi/custom_media/HVtest.jpg
carousel01mediaduration=10

carousel02mediatype=jpg
carousel02file=/home/pi/custom_media/GB3HV1.JPG
carousel02mediaduration=15

carousel03mediatype=jpg
carousel03file=/home/pi/atv-rptr/media/75cbw.jpg
carousel03mediaduration=5

carousel04mediatype=jpg
carousel04file=/home/pi/custom_media/GB3HV2.JPG
carousel04mediaduration=15

carousel05mediatype=jpg
carousel05file=/home/pi/custom_media/GB3HV3.JPG
carousel05mediaduration=15

carousel06mediatype=jpg
carousel06file=/home/pi/custom_media/GB3HV4.JPG
carousel06mediaduration=15

carousel07mediatype=jpg
carousel07file=/home/pi/custom_media/GB3HV5.JPG
carousel07mediaduration=10

carousel08mediatype=source
carousel08file=5
carousel08mediaduration=30
```


```
# Input config
# Recommended gpio pins for "input active" are 32, 35, 18, 22, 16, 19 and 21

# announcemediatype determines the player used

# Switcher can use "ir" or "gpio" "html" or "i2c"
# IR uses a TX on GPIO pin 12
# GPIO uses pins 36, 37, 38, 33, 31, 29, 23, 24.  Can be enabled with ir or i2c
# i2c uses FMS6501A on Output channel 1
# activeinputhold (yes/no) means that lower priority inputs do not get replaced by higher priority
(except pri 1)
# Show Quad is yes/no and overides activeinputhold

availableinputs=5
activeinputhold=no
showquadformultipleinputs=yes
cascadedswitches=no

outputswitchcontrol=ir
showoutputongpio=yes
outputhdmiresetcode=nec:0x19
output2ndhdmicode=nec:0x1b
outputhdmiquadcode=nec:0x18
outputi2caddress=3
outputi2cquadchannel=9

# Bitfocus Companion (html) server address & port (no trailing slash)
networkctrlurl=http://192.0.1.176:8888
# Other net commands have leading slash
outputquadnetcommand=/press/bank/1/11

input0name=Controller
output0code=nec:0x19
#output0code=2nec:0x17 (daisy chain)
output0hdmiswitchpin=36
output0i2cchannel=1
output0netcommand=/press/bank/1/8
output0audioi2cbit=0
```


```
input1name=70cms Ryde
input1prioritylevel=1
input1activegpiopin=32
output1code=2nec:0x17
output1hdmiswitchpin=37
output1i2cchannel=2
output1netcommand=/press/bank/1/1
output1audioi2cbit=1
input1announcemediatype=jpg
input1announcemediafile=/home/pi/tmp/input1.jpg
input1announcemediaduration=3

input3name=Stream Rxr
input3prioritylevel=3
input3activegpiopin=18
output3code=nec:0x59
output3hdmiswitchpin=33
output3i2cchannel=4
output3netcommand=/press/bank/1/3
output3audioi2cbit=3
input3announcemediatype=jpg
input3announcemediafile=/home/pi/tmp/input3.jpg
input3announcemediaduration=3

input5name=Quad view
input5prioritylevel=7
input5activegpiopin=16
output5code=2nec:0x08
output5hdmiswitchpin=29
output5i2cchannel=6
output5netcommand=/press/bank/1/5
output5audioi2cbit=5
input5announcemediatype=jpg
input5announcemediafile=/home/pi/tmp/input5.jpg
input5announcemediaduration=10
```

Digital challenges

- HDMI transmitters
  - Chinese encoder box is not CBR
  - Portsdown does not have HDMI input yet….
- Talkback audio insertion
  - At GB3HV HDMI audio is extracted by switcher
  - Feed to “Chinese encoder” analogue right channel and Talkback audio on left
- HDMI switch must be seamless
  - 2nd switcher required as a buffer

Summary

- Time to move away from the yellow phono connector!
- Simple but flexible ATV controller
  - Control of Digital (or analogue) switchers
- Software is supported by BATC
- Download from BATC github
- Preprogramed SD cards may be available
- See BATC wiki for more details
  - https://wiki.batc.org.uk/Repeater_Controller