

# DropCam MK2

# User Manual

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## Change History

Version	Main Changes from Previous Version	Edited By
v1.0	Initial Release	MB

## About this Manual

This manual describes the operation of **domo** DropCam Transmitter. The manual is divided into three main sections.

- **Getting started and basic operation**

This section describes to users how to deploy and use a **domo** DropCam transmitter.

- **Advanced operation**

This section describes the operation of the equipment in more detail, concentrating particularly on how to store and recall configurations, with use of the PC Controller Application.

- **Technical reference**

This section provides technical specification and control protocol data and will be of interest to those integrating the DropCam into a larger system.

## Introduction

The SOL4DCAM MK2 is the second generation drop camera from Cobham. The SOL4DCAM MK2 Transmitter incorporates a COFDM digital video transmitter, battery, camera and microphone into a rapid deployment robust chassis. The integral camera can also be abstracted on a cable or used as a generic video input giving the second generation DropCam a high degree of flexibility.

The SOL4DCAM MK2 is ideal for rapid deployment tactical scenarios where video coverage is required across ranges of typically 300-500m and line of sight is not available.

The SOL4DCAM MK2 Transmitter is housed in a rugged IP66 housing and is suitable for outdoor deployment. The integral battery pack provides up to 4 hours of power and can be recharged using the DC supply provided.

The SOL4DCAM MK2 Transmitter is provided with an interface cable that provides a generic input interface for video, two audios and a data channel (can be used for sensor data or GPS typically). The SOL4DCAM Transmitter is supplied with a high resolution low light camera with interchangeable lenses, which docks directly to the transmitter body, or can be abstracted using a 3m cable. The SOL4DCAM MK2 is also compatible with the full range of dome cameras, some of which can also dock directly to make a self-contained video transmission system for rapid deployment scenarios. Cameras can also be abstracted from the transmitter body, this is sometimes more convenient in hidden situations.

Security of the link is ensured through the use of AES128/256 encryption.

The DropCam can be upgraded to a DropCam3G by the addition of an integral 3G modem for long range network monitoring and system control. This upgrade is not a field upgrade but requires the DropCam to be returned to the manufacturer.

### IMPORTANT NOTE

The SOL4DCAM2 product range has been specifically designed for government security and law enforcement users, the equipment will tune across frequencies that are only available to licensed government users. Non-government users should employ the equipment restricted to the license exempt bands only typically 1.389 to 1.399GHz, 2.400 to 2.483GHz and 5.725 to 5.875GHz, or in bands specified by the appropriate authorities.

## Warranty and Support

### 1.1 Warranty Cover

domo offers a 12 month standard product warranty. During this period, should the customer encounter a fault with the equipment we recommend the following course of action:

- Check the support section of the website for information on that product and any software/firmware upgrades. If fault persists;
- Battery replacement after the first warranty year is chargeable.
- Call our support line and report the fault. If fault persists and you are informed to return the product please obtain an RMA number from the domo support department, and ship the equipment with the RMA number displayed and a description of the fault. Please email the support section the airway bill/consignment number for tracking purposes.
- If you have extended warranty provisions then domo will send an immediate advance replacement to you. Under most circumstances this must be returned once the fault item is repaired.

Depending on the nature of the fault domo endeavor to repair the equipment and return it to the customer within 14 days of the item arriving at our workshops.

Obviously it is impossible to cater for all types of faults and to manage 100% replacement part availability, and delays are sometimes inevitable. This is why domo recommend that its customers take out an extended warranty (which includes advanced replacement of faulty items), and/or hold a basic level of spare parts, which can be held by domo on the customer's behalf.

Please contact domo for details of packages that can be tailored to meet your individual needs, whether they are service availability, technical training, local geographic support or dedicated spares holdings.

## **Safety, Compliance and Approvals**

### **1.1 Safe Operating Procedures**

- Ensure that the power supply arrangements are adequate to meet the stated requirements of the SOL4DCAM transmitter.
- Operate within the environmental limits specified for the product.
- Only authorized, trained personnel should open the product. There are no functions that required the User to gain access to the interior of the product.
- The internal battery can not be replaced by customers the unit must be returned to domo for battery replacement.

### **1.2 EMC / Safety and Radio Approvals**

The equipment has been designed to meet and has been tested against the following harmonized EMC and safety standards:

- EN 301 489-1 & EN 301 489-5
- EN 61000-3-2:2000
- EN 61000-3-3:1995
- EN 55022:1998, Class B
- EN 61000-4-2:1995
- EN 61000-4-3:1996
- EN 61000-4-4:1995
- EN 61000-4-5:1995
- EN 61000-4-6:1996
- EN 61000-4-11:1994
- EN 60950:2000

### **1.3 CE marking**

The CE mark is affixed to all SOLO4 and SOLO2 products, and the CE Declaration of Conformity, as well as the technical file are available on request.

## Getting Started and Basic Operation

### 1.1 Which Model do I have?

The DropCam is marked with a product code panel as shown below, the panel gives the product code, serial number and bar code.



The domo product code can be referenced in the table below.

Product Code	Product	Accompanying items
SOL4DCAM-P-030450 300-450MHz SOL4DCAM-P-120150 1.2 to 1.5GHz SOL4DCAM-P-2002500 2 to 2.5GHz	DropCam kit  P indicates PAL	1 x Rugged Case 1 x Operator instructions 1 x Control and DC cable 1 x AC to DC adaptors 1 x 9mm Lens 1 x 16mm Lens
SOL4DCAM-N-030040 300-450MHz SOL4DCAM-N-120150 1.2 to 1.5GHz SOL4DCAM-N-2002500 2 to 2.5GHz	N indicates NTSC	1 x Low Light Camera Head 1 x 2dBi Omni Antenna 1 x 3m Camera Interface Cable 1 x 3m Video and Audio in Cable 1 x Magnetic Bracket 1 x 3" Mounting Spike
Accessories		
SOL4DCAMIR	Additional Infra Red Camera Head	Camera Head Only

## Controls

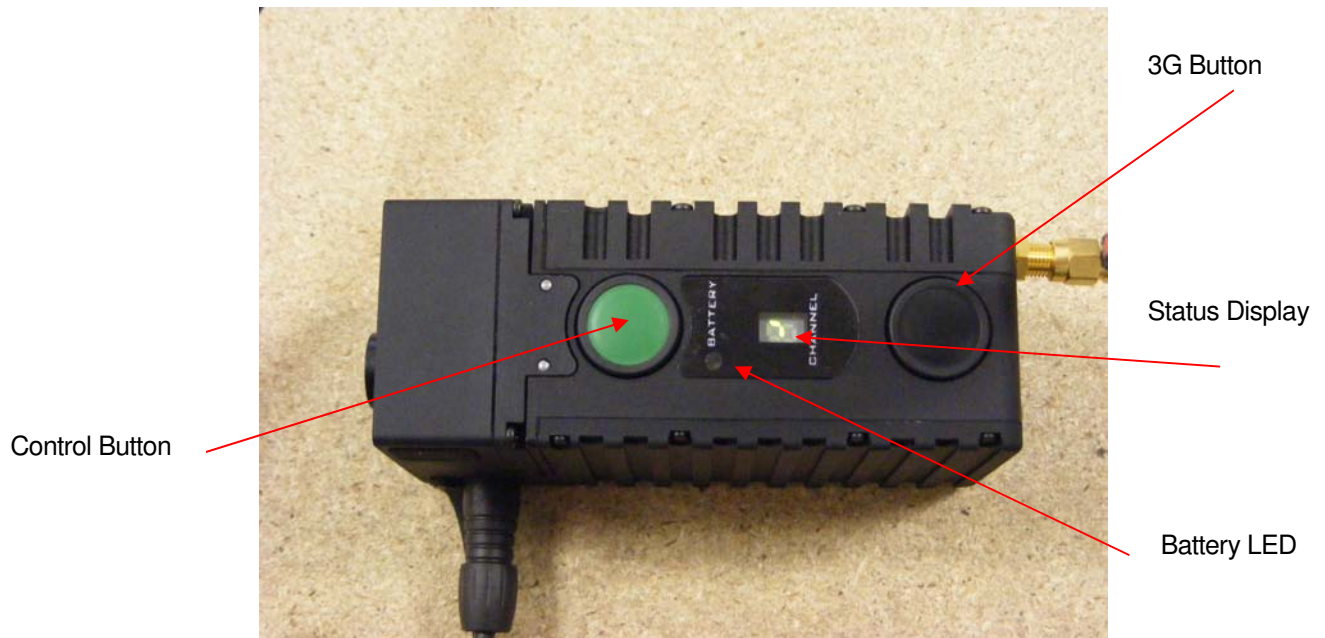
The DropCam has dual button control panel, a seven segment display indicator and LEDs.

Button 1 is the Control Button and is coloured green. The control button is used to enable the DropCam and allows users to cycle between 8 internally stored configurations. The internal configurations can be programmed by connecting a local PC and using the domo PC control GUI application, or alternatively by using the separate domo 'Field Gun' controller.

Button 2 is unused in normal operation, unless the unit is upgraded to have internal 3G capability.

The use of the domo PC GUI application is described fully in section 3 'Advanced Operation'.

The picture below shows the DropCam control panel.



### Button 1 – Control Button Functions (Green Button)

Current State	Action	Next State
Off	Press and Hold for 3 seconds	On
On	Press and Hold for 3 seconds	Off
On	Press Briefly	Config number is incremented

### Button 2 – 3G Button Functions – unused

(will become used when 3G upgrade is available)

Current State	Action	Next State
N/A	No Action	N/A

## Status Display

Current State	Display	Meaning
Off	Chasing display	DropCam is charging
Off	'C' displayed	DropCam is fully charged
On	Number 1-8 displayed	Current configuration number
On	Decimal point displayed	External control connected

## Battery LED

Current State	LED Colour	Meaning
Not Charging	Flashing Green	Normal Operation
	Flashing Orange	Battery Low
Charging	Flashing Orange	Fast Charge
	Flashing Green	Trickle Charge
	Green	Charged

## Battery Charging and Powering On

The SOL4DCAM is designed as an integrated camera, microphone, transmitter and battery solution. It has a single control button which is used for on, off and configuration selection purposes. On the left hand side of the unit is the external connector. The purpose of this is to allow external charging (from a supply of 12-18VDC, 2A), and communications with Solo4 Transmitter controller software running on a host PC.

### Charging the unit.

From the off condition (Display and LED off), insert the external connector and apply external power. The seven segment display will show a 'chase' display, the LED will give an indication of the charge status, based on current drawn by the battery. Flashing orange indicates the battery is in boost charge mode, flashing green indicates trickle charge mode and solid green indicates fully charged. When fully charged the seven segment display will show 'C'. It is possible to turn on the unit whilst it is being charged (see 'Powering on the unit (on external power)' below).

Typical charge time from fully empty to fully charged is 150 min.

### Powering on the unit (on internal battery).

Press and hold the button until the turns on, then release the button. The unit will power on in the last configuration it was used on. To change the configuration, repeatedly press button, the configuration number will cycle from 1 to 8 and then back to 1, release the button when you have reached the desired configuration. After approximately 10 seconds the display will shut off, the LED will continue to flash briefly once per second to show battery status. To turn off the unit, press and hold the button, the display will show the configuration number and then turn off, as will the LED.

### Powering on the unit (on external power).

Press the button, the display will show the last configuration used. To change the configuration, repeatedly press button, the configuration number will cycle

from 1 to 8 and then back to 1, release the button when you have reached the desired configuration. After approximately 10 seconds the display will shut off, the LED will continue to flash once per second to show charging status. To turn off the unit, press and hold the button, the display will show the configuration number and then turn off, as will the LED.

### **Setting the configuration.**

Connect a PC serial port to the 9 way d-type connector on the external lead, use the Solo4 Transmitter controller software (downloadable from the link below). When external comms are connected the decimal point on the seven segment display will light. With external comms active the button ceases to function.

### DC Power Source

The transmitter unit can be powered from a nominal 12V DC supply or an AC to DC adapted supply.

The connected 12V DC input should have the following characteristics.

- Input Voltage Range – 6V to 16V, reverse voltage protected. The internal battery will charge on 12.5V and above.
- Current draw - 0.45A at 12V (mode dependant)

### The domo 'Field Gun' controller

The domo 'Field Gun' controller is an in-line controller designed specifically for field use. The controller can be connected directly to the DropCam transmitter (when the appropriate cable is used), and used to set frequency, encryption key and other commonly configured items. The use of the 'Field Gun' controller will be explained in more detail in the Field Gun manual. If the combination of the Field Gun controller and DropCam is of interest, contact domo for access to the appropriate cable.

### DC Power Source

The transmitter unit can be powered from a nominal 12V DC supply or an AC to DC adapted supply.

The connected 12V DC input should have the following characteristics.

- Input Voltage Range – 6V to 18V, reverse voltage protected. (Battery Charging above 13V only)
- Current draw - 0.5 to 0.45A at 12V (mode dependant)

## Connecting the Antennas

The DropCam is supplied with flexible omni directional antennas with a nominal gain of 2dBi.

The antenna should be connected to the SMA female connector on the rear of the unit, care should be taken to not over tighten the SMA.

The supplied antennas are suitable for all general purpose transmissions, however for longer range transmissions customers may choose to connect higher gain antennas, and domo has a range of suitable high gain antennas to offer.

Note: The LBand antenna covers 1.2 to 1.5GHz, which is a subset of the whole possible transmitter tuning range of 1 to 1.5GHz, if other LBand antennas are required to cover the wider range contact domo.

## Range of Operation

The 100mW COFDM output available from the DropCam will typically achieve a range of 200 – 500m in a non line of sight urban environment, and a range of 5km where line of sight is available.

Greater ranges can be achieved by the use external power amplifiers or directional antennas, for details of this contact domo.

## The Camera

The DropCam is equipped with a camera module, the module can be connected directly to the DropCam body, or remotely using a cable.

DropCam with camera connected directly.



DropCam with remote camera



The camera head can be removed from the body, by gripping the camera head and pulling firmly away from the body.

The standard camera is either PAL or NTSC depending on the model number of the DropCam.

Camera Type: 1/4" CMOS Fixed Focal 3.4mm (56deg H-FOV), F2.0  
Interchangeable Lenses: 9mm and 16mm  
Pixels: 640\*480  
Resolution: >460 TVL

Sensitivity: 0.05Lux  
Signal to noise: >46dB

The 3.4mm Lens fitted as standard offers a wide field of view, suitable for surveying a room. However the standard camera accepts M12 lenses and is supplied with additional lenses for longer range surveillance.

### Changing the Lens

Interchanging lenses is a user operation, and there is no need to return the equipment to domo to do this.

Simply un-screw the Lens on the front of the camera and screw in the alternatives provides. They are standard 12mm lenses.

Lens colour scheme:

3.4mm Lens: Black

8mm Lens: Blue

16mm Lens: Red



*Camera with Lens removed*

### Accessory Camera Heads

The SOL4DCAM is supplied with a single general purpose low light camera head and two interchangeable lenses, but specialist accessory heads are available.

1) SOL4DCAMIR – Infra Red Illuminated Camera Head.

5m Flood range 940nm IR LED and camera head.

### The Microphone

The standard DropCam camera is equipped with an internal microphone.

Microphone Type: Omni 50-13KHz

Sensitivity: 60dB +/-3dB

## Mounting the DropCam

The DropCam is a rugged device designed for out door deployment in adverse conditions.

The DropCam unit is supplied with a range of mounting options to facilitate easy deployment.

- 1) 1/4" threaded tripod mount in the base of the DropCam facilitates the connection to general purpose tripods and camera mounts.
- 2) Magnetic base strip and right angle magnetic bracket, allow the DropCam to attach to metal surfaces in various orientations.
- 3) A threaded spike is provided for spiking the DropCam into soft surfaces.

The remote camera can also be mounted as follows.

- 1) 1/4" threaded tripod mount in the base of the DropCam facilitates the connection to general purpose tripods and camera mounts.
- 2) A threaded spike is provided for spiking the DropCam into soft surfaces.

## Advanced Operation

### 1.1 SOLO System PC Controller Application Software

Advanced control of the SOLO4 DropCam system is available by using PC control applications.

Typically users may want to customize the default configurations to control settings such as frequency, scrambling keys, modulation parameters, and video resolution.

- The SOLO4 DropCam transmitter products are controlled by the `solo_tx_ctrl.exe` application available on the CD delivered with the product.

Note that exact file names may change as software version information is a part of **demo** file names.

A PC is required with two RS232 Serial COM ports to control both a transmitter and receiver simultaneously. Where changes are to be made to either a transmitter, or a receiver, at different times, a PC with a single RS232 Serial COM port can be used.

Installation of the two control programs is as simple as copying them from the CD to a suitable location on the PC. No install shield routine is launched. Note that the controllers generate their own log and initialisation files, so it is best to create a dedicated directory for these applications, perhaps with links to the applications from the desktop of the PC.

Use the supplied cables to connect the chosen COM port(s) of the PC to unit(s) to be configured.

Launch each application in turn by double clicking or using the run command.

Connection with a SOLO product should be automatic, but the user can force selection of the correct COM port using the drop down, followed by the "Connect" button.

Errors such as the following may appear during the connection process if the PC is unable to automatically ascertain which unit is connected to which COM port.

- Error attempting to read invalid address
- Error has occurred during polling, polling has been disabled

For both controllers, changes can be made to the unit configuration using the drop down and data entry fields.

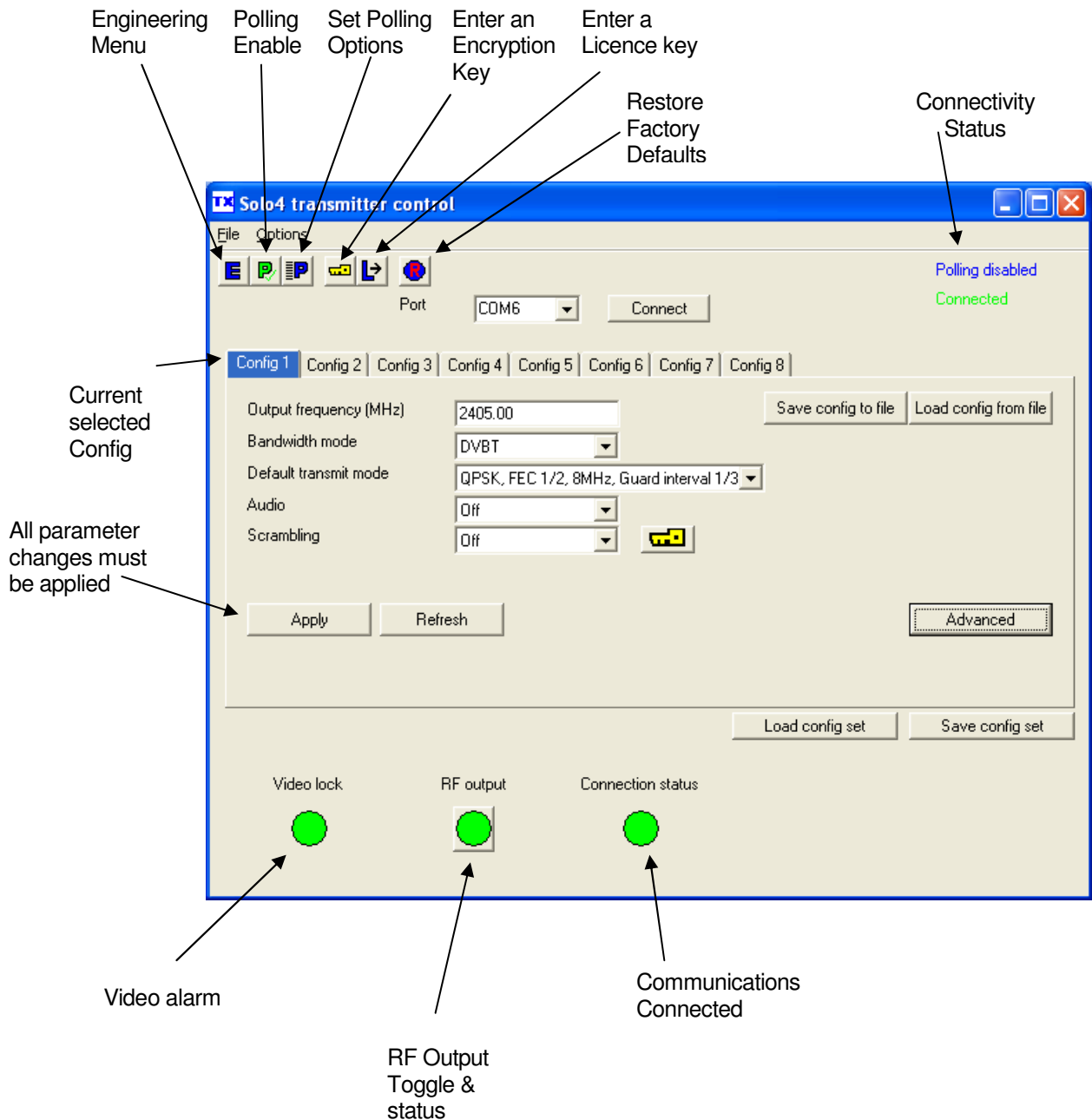
Changes are only applied to the unit when the “Apply” button is clicked.

Current values, as running in the unit, can be read using the “Refresh” button.

Parameters that are status information only appear in greyed in the application.

Further engineering and configuration controls can be found within the “Options” and “File” drop down menus in the application title bars.

## 1.2 Transmitter Control Application



The 'Advanced' button allows the user to navigate to the controller page which exposes all available Transmitter settings.

### Output Frequency (MHz)

The transmit frequency can be changed by entering the new desired frequency in this field. Values outside the range supported by a particular transmitter type will be rounded to the highest or lowest supported frequency as appropriate.

The transmit frequency can be set in step sizes of 250kHz.

## Bandwidth Mode

The Bandwidth Mode switches the unit between either narrowband (2.5MHz or 1.25MHz channel bandwidths) or DVB-T 8MHz bandwidth. To select 6MHz and 7MHz DVB-T modes the user must first click on 'Advanced' to enter the Advanced setting page.

## Audio

Turns 'On' or 'Off' a basic audio setting – the audio settings are optimised considering the bit-rate of the selected Transmit mode. The user can set their own audio settings using the 'Advanced' page, if required.

## Default Transmit Mode

In Narrowband the user has the following pre-defined modes available from the main window. Note that the Ultra Long Range Mode is only available to users who have purchased the SOLO4TXUP option (1.25MHz and MPEG-4 modes). The user can of course define their own specific FEC, bandwidth and modulation requirements from the 'Advanced' page.

Ultra Long Range:	1.25MHz QPSK FEC 1/3 (optional)
Long Range:	2.5MHz QPSK FEC 1/3
Medium Range:	2.5MHz QPSK FEC 2/3
Short Range:	2.5MHz 16QAM FEC 2/3

In DVB-T the available modes are

QPSK  $\frac{1}{2}$  FEC 8MHz 1/32 Guard Interval

QPSK  $\frac{3}{4}$  FEC 8MHz 1/32 Guard Interval

16QAM  $\frac{1}{2}$  FEC 8MHz 1/32 Guard Interval

## Scrambling

If the AES scrambling option has been purchased for the SOLO4 DropCam system in use, then it is possible to encrypt the link. Scrambling must be enabled at the transmitter by selecting either AES128 or AES 256 in the scrambling field. The actual scrambling key can then be entered by clicking on the yellow 'key' icon.

## File Options

**Load Config** – used for loading a single configuration data from text file.

**Save Config** - used for saving configuration data to text file.

**Load Config Set** – used for loading all 8 configurations from a text file

**Save Config Set** - used for saving all 8 configurations to a text file

## Advanced TX Controller Window

Unit information	
Video locked	Yes
Software version	1.1a
FPGA version	8f0
Serial number	0eda1928
License mask	0000fc73
Chaining	Not active

Unit parameters	
Output frequency (MHz)	2405.00
Modulation bandwidth	8MHz
Modulation output	On
Narrowband FEC	2/3
Narrowband guard interval	1/16
Narrowband modulation	QPSK
DVBT service name	Unit 1
DVBT FEC rate	1/2
DVBT guard interval	1/32
DVBT modulation	QPSK
DVBT spectrum inversion	Normal
DVBT 4KHz offset	None
Preset transmit mode	None selected
Output power	High
Output attenuation high (dB)	0.00
Output attenuation low (dB)	32.00

Video input	PAL
MPEG mode	MPEG2
MPEG4 encoding mode	Low delay interlace
MPEG4 frame rate	Full
Video bitrate (Mbit/s)	5.8366
Horizontal resolution	528
Video sharpness	Normal
Video profile	4:2:0
Audio encoder	Off
Audio input level	0dB
MPEG Audio rate	256kbits/s
Unit name	Solo-01
Sleep mode	No
Data	Off
Data baud rate	1200
Chaining input	Off
Chain no.	0
Chaining output	Off
Current config	1
Scrambling	Off
Heartbeat enable	Off

### Output Frequency (MHz)

The transmit frequency can be changed by entering the new desired frequency in this field. Values outside the range supported by a particular transmitter type will be rounded to the highest of lowest supported frequency as appropriate.

The transmit frequency can be set in step sizes of 250kHz.

### Modulation Bandwidth

For the SOLO2 transmitter products, the modulation bandwidths 8, 7 or 6MHz can be selected.

For the SOLO4 transmitter products, the modulation bandwidths 8, 7, 6 or 2.5MHz can be selected. If the Ultra Narrow band upgrade has been purchased the 1.25MHz will also be available to select.

The normal mode of operation is 2.5MHz.

### Modulation Output

This control is used to turn on and off the RF output. After a configuration change, the output always reverts to OFF.

### Narrow Band FEC

This option applies to SOLO4 transmitters only. The default FEC is 2/3, however improved range operation can be achieved by selecting FEC 1/3. FEC 1/3 will improve signal range by 3dB. However FEC 1/3 reduces link capacity to 1.2Mb/s therefore reducing picture quality.

FEC	Link Bitrate	Sensitivity
2/3	2.4Mb/s	-99dBm
1/3	1.2Mb/s	-102dBm

### Narrow Band Guard Interval

This option applies to SOLO4 transmitters only. The Guard Interval defaults to 1/16. Interval 1/8 is also available for very long range (aircraft downlinks) applications.

### Narrow Band Modulation

This option applies to SOLO4 transmitters only. The COFDM mode can be changed between QPSK and 16QAM. QPSK is the default mode and will give the strongest most rugged RF link performance. Selecting 16QAM reduces the link performance by 5dB but improves the link data throughput, giving significantly better video quality.

Note: The terminology DVB-T refers to the 8,7,6MHz wide bandwidth modulation employed in the SOLO2 products. The SOLO4 product is also capable of DVB-T, but this mode is not recommended for normal operation

### DVB-T Service Name

Applicable in DVB-T mode only, defaults to Unit 1. This should not be changed in normal operation

### DVB-T FEC

Applicable in DVB-T mode only, the default FEC is 1/2. Other FEC rates will all reduce the range of the product, but will improve image quality and capacity of the link.

### DVB-T Guard Interval

Applicable in DVB-T mode only. The Guard Interval defaults to 1/32. Other guard intervals such as 1/16 or 1/8 are available for very long range (aircraft downlinks) applications.

### DVB-T Modulation

Applicable in DVB-T mode only, the COFDM mode can be changed between QPSK, 16QAM and 64QAM. QPSK is the default mode and will give the strongest most rugged RF link performance. Selecting 16QAM reduces the link performance by 5dB but improves the link data throughput, giving significantly better video quality.

## Output Attenuation

This control can be used to make minor adjustments to the output power level, but in normal operation should be disregarded.

## Video Input

This control is used to select the composite video input standard. Options are PAL, and NTSC both with and without 7.5 IRE pedestal.

The licensed SDI digital video input can also be selected.

## MPEG Mode

The default encoding mode is MPEG2, however for SOLO4 products if the Ultra Narrow Band upgrade has been purchased, then MPEG4 will also be available. It is recommended that MPEG4 be employed when the unit is operating at low bitrates (2.5MHz bandwidth FEC1/3 or 1.25MHz bandwidth FEC1/3).

## MPEG2 GOP Length

By default MPEG2 GOP length is set to a low delay stripe refresh mode. This option allows the user to set the GOP length for a standard GOP structure at the expense of an additional delay.

## MPEG4 Encoding Mode

This option is only available on SOLO4 products installed with the Ultra Narrow Band Upgrade. This defaults to low delay interlace. Other modes are available but advice should be sought from domo before selection.

## MPEG4 Frame Rate

This option is only available on SOLO4 products installed with the Ultra Narrow Band Upgrade. This option allows the user to select lower frame rate encoding (1/2 frame rate, 1/4, 1/8 etc) It is recommended that MPEG4 reduced frame rates be employed when the unit is operating at low bitrates (1.25MHz bandwidth FEC1/3).

## Video Bitrate

This control can be used to set the video bitrate within the constraints of capacity available in the channel, but only when "Chaining Input" is set to ON.

When the Manual radio button is enabled, the user can manually set a video bitrate upto the maximum value. When manual bitrate is selected, the user is in control of the video bitrate, this can be usefull when configuring chaining systems.

## Horizontal resolution

The video coding resolution can be selected from 704, 528, 480 and 352 pixels. Changing the horizontal resolution to lower values will make the coded picture softer.

Care should be taken to match the horizontal resolution to the resolution of the camera connected to the transmitter; this will give best image results.

## Video Profile

This allows the user to select between the default 4:2:0 profile and the ultra high quality 4:2:2 profile (only of interest to Broadcast customers). Note 4:2:2 is a licensed feature.

## Audio Encoder

The Audio can be turned on and off with this control. Audio is OFF by default, but there are several audio modes that vary from very high quality to speech grade that can be selected with this control. Enabling audio will degrade the video quality, because some of the available data capacity is diverted away from video to audio. Selecting high fidelity audio modes will degrade the video quality more than lower fidelity audio modes. The Audio encoder can also be switched to 32 kHz and 48 kHz MPEG Layer 1/2 modes.

Note: The Solo4 receiver only supports 48 kHz sampling in MPEG Audio mode and bit-rates in the range 192 to 448kbts/s.

## Audio Input Level

This control is used to define the audio gain to be applied to the audio input signal. 0dB is used for line level audio and various options up to 48dB of gain can be applied for microphone inputs.

## Unit Name

This field allows the user to enter an identifier for the service that they wish to transmit. This must match that selected at the receiver for the service to be decoded. The unit name can be constructed of any eight ASCII characters.

## Sleep Mode

This control allows the unit to be forced into a Sleep Mode where main functions are disabled, and the power consumption is significantly reduced.

## Data

With this ON / OFF control the user can select whether the transmitter passes serial RS232 data across the RF link to the receiver.

## Data Baud Rate

This field is used to select the baud rate of any RS232 serial data component to be passed from the transmitter to the receiver across the RF link.

## Chaining Input

This control is not used in current SOLO products.

## Chain Number

This control is not used in current SOLO products.

## Current Config

This field reports the last loaded configuration number. Note that for the SOLO transmitter, changes applied after the configuration has been loaded are saved immediately into the current configuration.

## Scrambling

If the AES scrambling option has been purchased for the SOLO2 or SOLO4 system in use, then it is possible to encrypt the link. Scrambling must be enabled at the transmitter by selecting either AES128 or AES 256 in the scrambling field. At this point the user will need to ensure that the correct key is in use and this is done by using **Options / Write AES Key**.

The key is a 128bit key for AES128 and a 256bit key for AES256 and is entered as either 32 or 64 ASCII hexadecimal characters (0..F).

## Video Locked (Status Only)

This status information indicated whether the transmitter is successfully locked to the incoming composite video signal. Unlocked status may indicate cabling faults, or poor quality incoming video feeds to the unit.

## Software Version (Status Only)

This status information describes the version of the software running the SOLO transmitter product.

## FPGA Version (Status Only)

This information is for **domo** engineering use only.

## Serial Number (Status Only)

This status information is the electronic serial number of the transmitter PCB. This number can be exchanged with **domo** to purchase extra licensable features, such as upgrades to support AES encryption.

## Chaining (Status Only)

This field reports the status of the chaining input to the SOLO transmitter, and is not active in current units.

## Options

**Engineering** – provides access to further diagnostic and calibration features. The **Diagnostic** and **Power calibration** pages must not be altered. The **Advanced Options** under the Engineering menu allow the user to **Change RS232 address**, which can be useful when connecting multiple units together via a multi drop RS485 bus for control purposes. The **Serial control** dialogue box allows the user to change timeouts used during the serial communications between the unit and the controller.

**Enable Polling** – selecting this option makes the control application automatically refresh the data presented to the user every few seconds.

**Polling Options** – selecting this option allows the user to define parameters to be regularly polled.

**Write Encryption Key** – opens a dialogue box for entering an ABS or AES scrambling key, as 32 ASCII hexadecimal characters (0...F)

**Write License Code** – open a further box for entering license codes for the activation of licensable features (e.g. AES scrambling) in the transmitter. Contact **domo** for support in applying new licenses as required.

**Restore Defaults** – restores factory default settings in the transmitter.

## File

**Set Icon Source, Set logo source, Set logo size and Set application title** – allow the user to define a controller branding

**Exit** – exits the SOLO receiver control application

## Fault Finding

Symptom	Suggested Action
No RF Link	Check a suitable transmitter RF source is active, on correct frequency. Ensure Downconverters are connected. Ensure antennas are connected to downconverters. Ensure there is no interfering signal.
Poor link performance	<p>Poor performance of the link can occur for the following reasons.</p> <ul style="list-style-type: none"> <li>• Interference. Should an interfering RF signal occur on the same frequency the performance of the link will be affected. Remove the interferer or move to an alternative frequency.</li> <li>• Unsuitable antennas, or out of band antennas. See the antenna sections for guidance on antenna selection and use.</li> <li>• Reduced transmit power, ensure that the attenuation setting on the transmitter is appropriate for direct output, or for amplifiers connected.</li> <li>• Receive antenna positioning, where possible mount the receive antennas away from other objects, unobstructed and as high as possible. Poor alignment of directional antennas.</li> <li>• No Diversity operation. Ensure both down converters are operational.</li> </ul>
Blue screen at receiver	<p>Receiver RF LED not lit - see "No RF Link" section</p> <p>Receiver RF LED lit. Check video is enabled at the transmitter. Check correct unit name is selected at the receiver to match the transmitter. Check scrambling keys are matched.</p>
Reduced Image quality	<p>Image quality is affected by the selected horizontal resolution. The image will become progressively softer for each horizontal resolution below the sharpest resolution of 704 pixels. It is advisable to select a horizontal resolution that matches the resolution of the camera.</p> <p>Image quality is also affected by the video bit rate which can be read from the video bit rate field of the SOLO transmitter controller). The standard setting is 2.3Mb/s. However enabling audio, particularly the high quality audio modes, will reduce the video bit rate substantially. Therefore ensure an appropriate audio mode is selected or audio is fully disabled if not required.</p>
No audio	Ensure audio is enabled at the transmitter (disabled by default).

## Connector Pin Outs

### 1.1 Power and Control – 12 Pin

Male Cable - Binder 9991330212, RS 469-086

Female Cable - Binder 9991340212, RS 468-932

Pin No	Function
1	+12V Out
2	0V
3	CVBS/Luma
4	VGnd
5	Chroma
6	+5V
7	Camera RS232 TX
8	Camera RS232 RX
9	Microphone
10	Microphone GND
11	Ext Trig 1
12	Ext Trig 2

### 1.2 Power and Control – 8 Pin

Mating cable connector – Binder 9992260008, FEC 1778693

Pin No	Function
1	VCharge In (6-16V charges above 13V)
2	VBat Out
3	GND
4	External RS232 Comms In
5	External RS232 Comms Out
6	External Trigger In 1
7	External Trigger In 2
8	User Data In

## Control Protocols

The following section describes the control protocol employed on the RS232 link for controlling the SOLO transmitters and receiver equipment.

Connection details are detailed in previous sections.

Note that only features that are licensed for use in the SOLO units can be controlled. The protocols listed here cover all possible features. Attempting to activate an unlicensed feature will simply result in the command being ignored by the SOLO unit.

### 1.1 RS232 Control – General Principles

The physical interface is RS232 but this can be converted to RS 485 with an external adapter where multiple units are controlled over one RS 485 bus.

Normal operation involves sending a packet from the control device (normally a PC) to the device being controlled. If the packet satisfies an address integrity check, then the controlled device will action the command and send a reply.

For compatibility with modems an ASCII style protocol is used.

Ports are set for 8 bits, No parity, 1 stop

### 1.2 Packet Structure Sending (from PC)

ASCII	Value	
STX	02h	Start byte
0-9	30h-39h	4 byte unit address. In range 0-9999
R m misc	20h-7Eh	1 byte command type. <b>r</b> read, <b>w</b> write or
I	20h-7E	1 byte indicator of internal data block
ABC	20h-7Eh	Command –three byte mnemonic
;	3Bh	Separator
PQR	20h-7Eh	Data –Optional, variable length
;	3Bh	Separator
X	20h-7Eh	Sum Check
ETX	03h	End byte

### 1.3 Packet Structure Reply (from controlled device)

ASCII	Value	
STX	02h	Start byte
0-9	30h-39h	4 byte unit address. In range 0-9999
Z	20h-7Eh	Status BYTE
PQR	20h-7Eh	Data –Optional, variable length
;	3Bh	Separator
X	20h-7Eh	Sum Check
ETX	03h	End byte

The Sum check byte is the summation of all bytes in the packet, not including the start and end bytes. Higher order bytes are ignored and the final byte result is modified to prevent ASCII control characters being sent. Bit 7 (highest) is forced high.

Status byte will indicate command performed OK, or indicate an error.

ASCII	Meaning
1	All OK
E	General error, Command could not be actioned

Typically E will be returned if the message is formatted incorrectly (separators in wrong place) or if commands are in upper case, or if commands do not match against the allowed list of commands, or if the checksum is wrong.

Addresses in the range 0001 to 9998 are for general use. Address 0000 is reserved and 9999 is a broadcast address. i.e. any device will reply to this address. Its reply will contain its own specific address.

All data in the transmitter and receiver is stored as one of 5 data types, Double, String, List, Integer or HexInteger. The data type dictates the contents of the data section of the reply.

- List – 1 byte for sending. Value is hexadecimal coded as ASCII. 2 byte reply. Reply represents index into original choice list. e.g. Reply 02 indicates entry 2 in original list.
- Double - variable length. Reply always contains decimal point and 4 decimal places. Can have 1 to 3 digits before decimal.
- Integer - 6byte reply. integer value with stuffed with preceding zeros. e.g. GOP reply 000012 = GOP length 12
- String - Variable length. Reply is string excluding null terminator
- HexInteger – 8byte Hex reply

## 1.4 Transmitter Command List

### Type 'o' messages for Modulation commands

Function	R/W	Block	Command	Data	Type
Set Modulation IF output	r/w	o	out	1 byte 0 OFF 1 COFDM	int
Set Narrow Band Modulation FEC	r/w	o	fec	1 byte 1 = 2/3 2 = 1/3	int
Set Narrow Band Modulation Guard Interval	r/w	o	gua	1 byte 1 = 1/16 2 = 1/8	int
Set Narrow Band COFDM mode	r/w	o	mod	1 byte 0 = QPSK 1 = 16 QAM	int
Set Modulation Freq	r/w	o	fre	Set Frequency in MHz, decimal point allowed.	double
Spectrum Inversion	r/w	o	spe	1 byte 0 = Normal 1 = Inverted	int
COFDM Bandwidth	r/w	o	wid	0 = 6MHz 1 = 7MHz 2 = 8MHz 3 = 2.5MHz 4 = 1.25MHz	list
Output level attenuation high	r/w	o	lev	Default level is 0 Value 0 to 32 1dB steps	int
Output High Low switch	r/w	o	hls	0 = low level 1 = high level (default)	int
Output level attenuation low	r/w	o	llv	Default level is 32 Value 0 to 32 0.25dB steps	int
DVB-T FEC	r/w	o	dfe	0 = 1/2 1 = 2/3 2 = 3/4 3 = 5/6 4 = 7/8	int
DVB-T Guard	r/w	o	dgu	0 = 1/32 1 = 1/16 2 = 1/8 3 = 1/4	int
DVB-T mode	r/w	o	dmo	0 = QPSK 1 = 16QAM 2 = 64QAM	int
DVB-T 4K Offset	r/w	o	4ko	0 = none 1 = +4KHz 2 = -4KHz	Int
Range Mode Preset	r/w	o	txm	0 = none selected(default) 1 = short range 2 = medium range 3 = long range 4 = ultra long range	int

### Type 'z' messages for Scrambling commands

Function	R/W	Block	Command	Data	Type
Scrambling	r/w	z	scr	1 byte 0 = Off 1 = ABS 4 = AES128 6 = AES256 8 = Bcrypt128 10 = Bcrypt256	int
AES Key lower 128	w	z	kez	Encryption key for AES lower 128	Hex string (32 characters)
AES Key upper 128 used in AES 256 only	w	z	kex	Encryption key for AES upper 128	Hex string (32 characters)
ABS key	w	z	key	Encryption key for ABS	Hex string (12 characters)

### Type 'v' and 'e' messages for Video commands

Function	R/W	Block	Command	Data	Type
Video Input	r/w	v	inp	1 byte 0 = Off 2 = PAL 3 = NTSC 4 = NTSC No Pedestal 5 = PAL S-vid 6 = NTSC S-vid 7 = NTSC S-Vid No pedestal 8 = SDI PAL 9 = SDI NTSC	int
Video Locked	r	v	loc	1 byte 0 = No 1 = Yes	int
Video Bitrate (Only applicable when chain in enabled)	r/w	e	vid	Value in Mbps	double
Video Horizontal resolution	r/w	e	hor	1 byte 0=704 1=528 2=480 3=352	int
Sleep if no video lock	r/w	v	sle	0 = normal 1 = sleep if no video	int
MPEG mode	r/w	e	enc	0 = MPEG2 1 = MPEG4	int
MPEG2 GOP length	r/w	e	gop	0 = stripe refresh mode (default) 1 = intra only 2-100 = GOP length in frames	int
MPEG4 frame rate	r/w	e	frm	0 = full 1 = 1/2 2 = 1/4 3 = 1/8 4 = 1/24	int
MPEG4 encoding option	r/w	e	cmd	0 = low delay interlaced (default) 1 = standard delay interlaced 2 = low delay progressive 3 = standard delay progressive	
MPEG4 video sharpness	r/w	e	sha	0 = normal (default) 1 = sharp	int
Manual Video Bitrate	r/w	e	vbr	Video bitrate manual over ride 0 = no override (default) Non-zero (sets the video bit-rate in kbps)	int
Video Profile	r/w	e	pro	0 = 4:2:0 1 = 4:2:2	int
Video PID	r/w	v	pid	0 = default Other = value	int

**Type 'a' messages for Audio commands (applies to audio channel 1 and audio channel 2)**

Function	R/W	Block	Command	Data	Type
Audio Encoder	r/w	a	enc	1 byte 0 = Off 1 = 32kHz, 12cbit, S 2 = 32kHz, 12cbit, M 3 = 32kHz, 8cbit, S 4 = 32kHz, 8cbit, M 5 = 16kHz, 8cbit, S 6 = 16kHz, 8cbit, M 7 = 8kHz, 8cbit, S 8 = 8kHz, 8cbit, M 9 = 32kHz MPEG Layer1 stereo 10 = 32kHz MPEG Layer1 mono 11 = 48kHz MPEG Layer1 stereo 12 = 48kHz MPEG Layer1 mono 13 = 32kHz MPEG Layer2 stereo 14 = 32kHz MPEG Layer2 mono 15 = 48kHz MPEG Layer2 stereo 16 = 48kHz MPEG Layer2 mono	int
Audio Input Level	r/w	a	lev	1byte 0 = 0dB (line level) 1 = 12dB (mic level) 2 = 24dB (mic level) 3 = 36dB (mic level) 4 = 48dB (mic level) and 4 also enables ALC	int
MPEG Layer 1 Audio Bitrate	r/w	a	mpr	1byte 2 = 64kbit 3 = 96kbit 4 = 128kbit 5 = 160kbit 6 = 192kbit 7 = 224kbit 8 = 256kbit 9 = 288kbit 10 = 320kbit 11 = 352kbit 12 = 384kbit 13 = 416kbit 14 = 448kbit	int
MPEG Layer 2 Audio Bitrate				2 = 48kbit 3 = 56kbit 4 = 64kbit 5 = 80kbit 6 = 96kbit 7 = 112kbit 8 = 128kbit 9 = 160kbit 10 = 192kbit 11 = 224kbit 12 = 256kbit 13 = 320kbit 14 = 384kbit	
Audio PID 1	r/w	a	pd1	0 = default Other = value	int
Audio PID 2	r/w	a	pd2	0 = default Other = value	int
Audio DID SDI Data Identifier	r/w	a	did	DID value	int
Audio 2 enable	r/w	a	en2	0 = disabled 1 = enabled	int

Audio Source	r/w	a	src	0 = analogue 1 = aes/ebu digital 2 = embedded	int
MPEG Audio Offset	r/w	a	pts	PTS offset for MPEG Audio	int

### Type 'g' messages for Unit Level commands

Function	R/W	Block	Command	Data	Type
Software Version	r	g	ver	Software version number	Hex string
FPGA Version	r	g	fpg	FPGA version number	Hex string
Serial Number	r	g	ser	Hex based serial number	Hex string
License Code	w	g	lic	License number for software facilities	Hex string
Narrow band Service Name	r/w	g	nam	Unit Name String	string
Set Unit address	r/w	g	add	Unit Address 0001 - 9998	int
Load Configuration Number	r/w	g	lod	Config Number	int
Restore Default Build	w	g	def	0 = No 1 = Yes	int
Sleep Mode	r/w	g	sle	0 =No 1 = Yes	int
Front Panel Lock	r/w	g	fpl	0 = unlocked 1 = locked	int
DVB-T Service name	r/w	g	dna	Unit Name String	string
Heart beat enable	r/w	g	blo	0 = off 1 = on	int
License Mask	r	g	lma	Returns hex value with bits as follow 0 – Video 1 – 4:2:2 2 – Set to 0 3 – Set to 0 4 – Ultra Narrowband and MPEG4 5 – Narrowband 6 – DVB-T 7 – License Exempt 8 – SDI 9 – Set to 0 10 – AES128 11 – AES256 12 – Bcrypt128 13 – Set to 1 14 – Bcrypt256 15 – Set to 1	hex
Board Type	r	g	bty	Returns D550	string
Unit Type	r	g	uty	12 = D550 13 = D551	integer
Turn LEDs Off	r/w	g	lof	0 = LEDs on 1 = LEDs off	integer
Core Temperature	r	g	tmp	Temperature in degrees C	Integer
VCC Int	r	g	vnt	Voltage	Integer
VCC Aux	r	g	vax	Voltage	Integer
Charger Status	r	g	cst	Address 5001 only 1 = idle 1 = charging	integer

				2= discharging 3=temp fault 4=bad battery	
Drop cam voltage	r	g	vch	Voltage in multiples of 100mV	
Drop Cam charger current	r	g	Ccu	Current in multiples of 10mA	

### Type 'p' messages for SI

Function	R/W	Block	Command	Data	Type
PCR PID	r/w	p	cpd	0 = default Other = value	int
PMT PID	r/w	p	mpd	0 = default Other = value	int
Video Stream ID	r/w	e	sid	0 = default Other = value	int
Audio Stream ID	r/w	a	sid	0 = default Other = value	int
Transport Stream Version	r/w	t	svr	0 = default Other = value	int
Provider Name	r/w	g	pro	0 = default Other = value	string

### Type 'd' messages for Data commands

Function	R/W	Block	Command	Data	Type
Data On/Off	r/w	d	inp	1 byte 0 = Off 1 = On 2 = On (even parity) 3 = On (odd parity)	int
Input Data Baudrate	r/w	d	bau	1 byte 0 = 1200 baud 1 = 2400 baud 2 = 4800 baud 3 = 9600 baud 4 = 19200 baud 5 = 38400 baud 6 = 57600 baud (note 57600 is not supported in DVB-T modes) 7 = 115200 baud	int
Data PID	r/w	d	pid	0 = default Other = value	int
Metadata Enable	r/w	m	eta	1 byte 0 = Off 1 = On	int
Metadata PID	r/w	m	pid	0 = default Other = value	int

### Type 'c' messages for Chaining commands

Function	R/W	Block	Command	Data	Type
Chaining Input	r/w	c	inp	0 = Off 1 = On 2 = Relay	int
Chaining Output	r/w	c	out	0 = Off 1 = On	int
Chaining Loop	r/w	c	hio	0 = Off 1 = output loop to input for external encryption	int
Chaining status – describes if chaining input is active	r	c	sta	0 = Not Active 1 = Active 2 = Overflow	int
Chain Number	r/w	c	cha	0 - 9	int
Transport Stream Switch	r/w	g	osw	Bit 2 Input Switch (0=ASL,1=Chaining) Bit 3 Output Switch (0=ASL,1=Chaining) Eg 0 = ASL in and out, 12 = Chaining in and out	int

### Type 'c' messages for Calibration commands

Function	R/W	Block	Command	Data	Type
Lowest Operating Frequency	r/w	c	flo	Frequency in MHz	double
Highest Operating Frequency	r/w	c	fhi	Frequency in MHz	double
Intermediate Operating Frequency 1	r/w	c	fi1	Frequency in MHz	double
Intermediate Operating Frequency 2	r/w	c	fi2	Frequency in MHz	double
Calibration point lowest	r/w	c	pl1	0 – 32 in 0.25dB steps	int
Calibration point intermediate 1	r/w	c	pl2	0 – 32 in 0.25dB steps	int
Calibration point intermediate 2	r/w	c	pl3	0 – 32 in 0.25dB steps	int
Calibration point highest	r/w	c	pl4	0 – 32 in 0.25dB steps	int
RF level vs temperature offset gradient	r/w	c	rtg	0 – 8 (default 4) = -1dB / 10°C to 1dB / 10°C gain in 0.25dB steps	Int
RF level vs temperature offset mid point	r/w	c	rtm	0 - 100°C mid point for RF level temperature gradient	int

## Default Configurations

This section tabulates the default configuration settings for **domo** SOLO products.

Item	DROPCAM-x-200250 (2.0 to 2.5GHz)	DROPCAM-x-100150 (1.0 to 1.5GHz)
RF Output	OFF	OFF
Frequency	2405MHz	1395MHZ
Modulation	QPSK	QPSK
Power	Maximum	Maximum
Standby	OFF	OFF
Unit Address	0001	0001
Unit name	Solo-01 (SOLO4) Unit 1 (SOLO2)	Solo-01 (SOLO4) Unit 1 (SOLO2)
Horizontal Resolution	528	528
Video Input	X= P= PAL X= N= NTSC	X= P= PAL X= N= NTSC
Audio	OFF	OFF
Data	OFF	OFF
Audio Input	Line level	Line level
Scrambling	OFF	OFF
AES Key	None	None