Pi Toolset User Guide

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1. Installation

The latest versions of Toolset can be found on the Cosworth website (<u>www.cosworth.com/motorsport/products/toolset/</u>).

New firmware and included metadata require a minimum Toolset version. **Note**: Some championships are homologated to use specific versions of Toolset.

Before you install the latest version of Toolset make sure that you unplug any dongles, as the sentinel driver is updated during the process.

For versions of Toolset 10.X and above, the dongles are being deprecated. Cosworth are migrating to a software system which uses the encryption keys stored locally on the PC, rather than on the dongle.

You can continue to use dongles, but make sure that the drivers are available.

You do not need to uninstall your existing Toolset version. Any new major version of Toolset is installed separately to the previous major version. Any minor updates overwrite the last version, with the same major version.

Double click the shortcut to the installation file.

Setup Pi Toolset.exe

When prompted, click **Next**, and then read the terms and conditions. To continue click **Agree**, and then click **Install**.

Pi Toolset	Pi Toolset	Pi Toolset
Jpgrade 10.1 (Update 10)	Upgrade 10.1 (Update 10)	Upgrade 10.1 (Update 10)
ou must agree to the following License Terms before you can install the pplication.	Acquiring:	Setup Successful! All components have been installed successfully.
Cosworth Electronics Limited Software Licence Agreement IMPORTANT NOTCE: YOU SHOULD READ THE FOLLOWING TERMS AND CONDITIONS OF THIS LICINCE AGREEMENT BEFORE INSTALLING THIS SOFTWARE. ONCE YOU HAVE INSTALLED THIS SOFTWARE YOU THE EDUNG INFO WARRANTIES, IF YOU DO NOT AGREE WITH HHRS TEMMS YOU SHOULD NOT INSTALL THE SOFTWARE. Cosworth Electronics Limited owns the copyright of all software that it produces. In providing this software package, Cosworth Electronics Limited grants the user the right to use the P software by means of a software licence. Cosworth Electronics Limited specifically retains all right and title to all P software.	Applying: Pi Toolset 10.1	
Z agree to the License terms and conditions.		
♥INSTALL	Cancel	RESTART NOW

Because this a new installation, all devices seen previously by Toolset must be added to Toolset again. If the data offload file path and naming convection have been changed from the default settings, they need to be set up again.



1.1. Compatibilities

Although you can install different major Toolset versions alongside with minor versions (Toolset 7, 8, 9, 10, 11 updates), these versions are installed over the top of existing installations.

Toolset setups do not support backwards compatibility between major versions of Toolset. For example, a setup created in Toolset 10 will not open in Toolset 9.

When you export or import channels, make sure that the same (or older) version of Toolset is used before importing the same file.

If a newer version of Toolset is used, then, if you import into an older major version, the *.tlf* file is greyed out and you cannot import it.

2. Get started and connect to your device

2.1. Configure the network (Ethernet) connection

Once you have installed Pi Toolset, you need to connect to the device using the Ethernet communication lead, and then set up the network connection on the **Settings** page.

On the **Network** page, click the required adapter, confirm that it is connected (1), and then select **Use Selected Adapter** (2). If the adapter is not immediately displayed, click **Refresh Network Settings** (3).

Network Adapters										
Select the network adapter you wish to use to communicate with devices.										
Ethernet Connected Intel ⁽¹⁷⁾ Ethernet Connection (13) 1219-LM	Local Area Connection* 2 Disconnected Microsoft Wi-Fi Direct Virtual Adapter #2 169.254.110.105	Cable unplugged 0	Wi-Fi Connected Intel(R) Wi-Fi 6 AX201 160MHz CO	Bluetooth Network Connection Cable unplugged Bluetooth Device (Personal Area Network) 169.254.171.129	D					
ØUse Selected Adapter 2										
Restore										
A backup of the original network settings is made before any changes are app	lied. You should restore the original settings if you ne	eed to access another network with the current net	twork adapter after exiting the application.	Note, the backups will be lost when you ex	it the application.					
Restore Previous Settings										
					3	Refresh Network Settings				

If there is a network error (for example, multiple network adapters are found), an error message is displayed. Make sure that the ethernet adapter is connected before you continue.

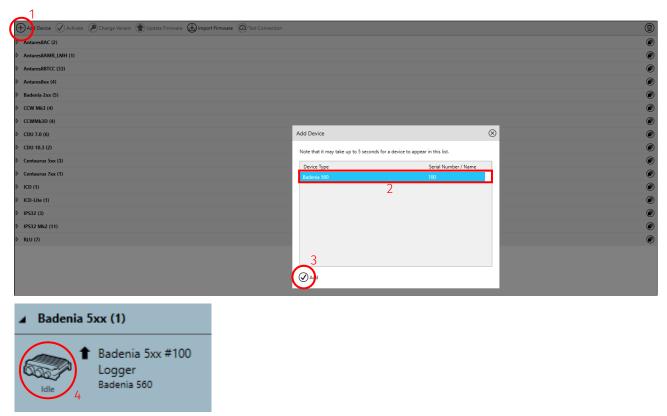
Error - Multiple Network Adapters Found											
Multiple network adapters (Ethernet, Ethernet, 4) have been found that are configured to use the IP subnet used to communicate with devices. The network adapters must be configured manually in your operating system's network settings, so only one adapter is using the IP subnet used for communication. Once the adapters have been configured, click Refresh Network Settings.											
Network Adapters	area manaany in yoar operating systems i	contractings,	, so only one adapter is using a			.c 000p	and have been compared, end hencom	ricement betangs			
Select the network adapter you wish t	o use to communicate with devices.										
Ethernet Connected Intel(R) Ethernet Connection (13) I219-LM 172.16.255.233	Convender Conversed Discoverse (1) 2115.M. Generation Conversed Uncore (1/1/4) All proc Virual Adapter (1/2) Adapt										
										Refresh Network	

When network settings are configured, return to the **Devices** page.



2.2. Add a device

On the **Devices** page, use the + button to add a new device (1). The device is displayed in the menu. Select the device (2), and then click **Add** (3). Wait for the device to initialise and reach the 'Idle' state (4).



2.3. Activate a device

To read live data and send setups to the device, the device must be activated. Select the device (1), and then click **Activate** (2). To distinguish the active device if there are multiple known devices, the active device appears in a grey box.

🕀 Add Device 🖉 Activate 🖉 Change Variant 🛞 Update Firmware 💩 Import Firmware 🚳 Test Connection	٦
> Antares8AC (2) 2	۲
Antares8AMR_LMH (1)	۲
> Antares88TCC (33)	۲
> Antares8xx (4)	۲
> Badenia 2xx (5)	۲
🖌 Badenia 5ox (1)	Ø
t Badenia 5xx #100 Logger Badenia 500	
> CCW MR3 (4)	۲
> CCWINIBD (4)	۲
> COU 7.0 (6)	۲
5 COU 18.3 (2)	۲
b Centaurus Sxx (3)	۲
b Centaurus 7xx (1)	۲
b (c0 (t)	۲
> ICD-Life (1)	۲
b 19532 (3)	۲
> IPS32 Mk2 (11)	۲
> RU(7)	۲

3. Variants

3.1. What is a variant?

Pi Toolset uses TCP communications over Ethernet to configure products (called 'devices'). This makes Toolset very versatile, but you must configure each device carefully before use.

To allow different specifications of device software, 'tokens' are used to enable or disable certain functions (such as analogue/digital inputs, CAN ports, Autocoding, and so on). Each specification of a device is called a 'variant'. The token forms part of the setup. The device variant and setup variant must match. When the setup is sent, the device variant is set.

3.2. Set the device variant

In the event of a device not having a variant, such as a new device, you must set the device variant before you send a setup. To set the device variant, activate the device, and then click **Change Variant**.



The Change Variant dialog box is displayed where you can control the tokens.

The dialog shows the available cached tokens. If there are no tokens displayed, you need to import a token file.

Click **Import** and navigate to where you downloaded and saved the token file. When the token is imported, it is stored and cached in Toolset, so you only need to do this once.

ChannelVerie					
Change Variant 🔹					
The following variants can be used with your device. Please select the variant you wish to associate with your device.					
The change v	vill occur	the next	time a setup is	sent to the device.	
Varian	t	Version		Details	\sim
<no td="" variant<=""><td>×</td><td></td><td></td><td></td><td></td></no>	×				
Badenia 560		1.6	Badenia 560		
					\sim
Show all v	ariant ve	rsions.			
				Change	Cancel

If you do not have a variant for the device, please contact: <u>sales@Cosworth.com</u> and make sure you state the serial number of the device, any developer requirements, and a specific version of variant if required.

The screenshot below shows a variant for a Badenia serial number 100.

Badenia5xx-01L-650080_1.5_Badenia540_SN0.token

Tokens are required to control the corresponding Toolset options that match that specification of device. Select a token file, select the appropriate variant (1), and then click **Change** (2). You can also edit variants to make base level products if required.

Change Variant				x
you wish to associa	te with your	device.	device. Please select the variant	
Variant	Version	une a setup is		~
<no variant=""></no>			1	
Badenia 560	1.6	Badenia 560	1	
Badenia 560	1.5	Badenia 560		
Show all variant	versions.		2	
			Change Cance	el

This sets the device variant. The small warning triangle indicates that the setup containing the token file is yet to be sent to the device.



Once a valid setup containing the token file is sent to the device, the device icon is displayed without a warning triangle.





3.3. Set the device variant in Setups

To set the setup variant to match the device variant, click the **Setups** tab (1). All device setups are displayed, with name, device type, device variant, and a last modified timestamp.

If this list is empty you need to get a setup (2), either by importing the *.toolset* file supplied by Cosworth, or by reading it from the active device.

Once you have setups (3) to work with, it is important to make sure that the setup variant matches the device variant. In the screenshot below a setup that has no variant is shown (4). This might be an imported base level setup for that device. Therefore, it is important to set the variant to enable the purchased features.

On the **Setups** page you can set the setup variant via the **Change Variant** option (5) in a similar manner as changing the device variant. A similar dialog box to the device variant selection method is displayed.

🚱 Pi Toolset			– 🗆 X
1 🐨 Badenia 5xx #100 Data (••) Liv	e Data Actions 🕇 Setups	Channels 1 Settings	
	1		$\blacksquare \ \Rightarrow $
Updates are available for your setups. Select a setup and p	ress the 'Change Metadata' button.		\otimes
ଡ ⊕ ⊕ ⊕ ⊕ ⊕ ⊕ છ			٢
Name 2 Stat	e Device 🔻 Metadata	Model Project Variant	Last Modified
Badenia 5xx 3.2.10 PreShip	Badenia 520 3.1 🕇	1.3	03/10/2024 17:29:16
Badenia 5x Emp	ty 🛛 Badenia 5xx 3.1 🕇	<no variant=""></no>	12/08/2024 16:03:05
Badenia 5xx Emp	ty Badenia 5xx 4.0	4 <no variant=""></no>	01/08/2024 19:51:24
BADENIA5			

You can also open a setup. When you send the setup, a dialog box is displayed that prompts you to update the setup to match the new firmware on the device. Select **Use Device Variant**.



On the home page of the open setup, version information is displayed. If the device variant and setup variant do not match, a warning is displayed in the **Health Check** section.

$\textcircled{1}{1}$	Nodes							
(!)	🔁 Actuato	rs	e	Buttons	0	Diagnostics		
Hz	Alarms		Hz	Channel Rates	0	Displays		
\bigcirc	Beacon:	5	()	Circuits	0	Fuelling		
Ð	Version Infor	mation						
f(x)	Device and Vari	Device and Variant version information for this Setup:						
\sim	Device	Pi Toolset Ba	Badenia 5xx Metadata					
Ð		Version 3.1 (rsion 3.1 (Build 430 - Update 10)					
(1010)	Variant	Badenia 520						
•		Badenia 520						
	This setup requ	ires Toolset vers	ion 1	0.0 or later.				
	Health Check							
	Variant mismat	ch: Setup is usin	g 'Bao	denia 520' v1.3, active	e device is	; 'Badenia 560' v1.6.		

Once the error is corrected and the device variant and setup variant match, the following screen is displayed.

t		Bade	enia 5xx #100	Data	(•) Live	Data A	ctions	Setups		Channels	🕇 Set	tings			
¢	()	9) 🕐 🛛 Ba	idenia 5xx 3.2.1) PreShip $ imes $	Analog Char	nnel Drift Be	ench Test oper	n case	× Setups				Ħ	80
	\mathbf{i}	Node	s			Setup na	ame							Button	
(!		Ð	Actuators	0	Displays	•	Logging		Ð	Sensors		•	ideo	Save	Resources
Hz		0	Alarms	•	Fuelling	Ð	Logic Cha	nnels		Shift Lights		o "	/heelspeeds	Save as	5
		0	Beacons	*	Gear Ratios	•	Lookup Ta	ables		Streams		🔁 z	eroing		
® ®)	L	Buttons	0	Hardware Sett	tings 🙉	Math Cha	nnels	%	System Status					
flx		Hz	Channel Rates		Latching	ø	NMEA 01	83 Decode	(°†))	Telemetry					
(\mathbf{F})		•	Circuits	Ĥ	LED Configura	ation O	Qualifying) Mode	0	Telltales					
		0	Diagnostics	G	LIN	→□	Send Con	ditions	3	Vehicle Overvie	ew				
		Versio	on Information	n											- 8
		Device	and Variant ver	rsion informatio	n for this Setu	🕫 Versio	on and	variant	inf	ormatior	ו				
		Device	Pi T	Toolset Badenia	5xx Metadata										
			Ver	rsion 3.1 (Build 4	130 - Update 1	0)									
		Variant	t Bac	denia 560											
			Bac	denia 560											
		This se	tup requires Too	olset version 10	.0 or later.										
		Health	h Check												
	:	Ready	to send (setup i	is currently on d	levice).	Setup	o healt	h – read	dy t	o send					~

3.4. Add a device

	Act Device 🕢 Activate 🖉 Change Variant 🍙 Update Firmware 🕒 Import Firmware 🙆 Test Connection			1
Þ	Antares8AC (2)			۲
⊳	Antares8AMR_LMH (1)			۲
⊳	Antares8BTCC (33)			۲
⊳	Antares8xx (4)			۲
⊳	Badenia 2xx (5)			۲
⊳	CCW Mk3 (4)			۲
⊳	CCWMk3D (4)			۲
⊳	CDU 7.0 (6)	Add Device	\otimes	۲
⊳	CDU 10.3 (2)	Note that it may take up to 5 seconds for a device to appe	ear in this list.	۲
⊳	Centaurus 5xx (3)	Device Type	Serial Number / Name	۲
⊳	Centaurus 7xx (1)	Badenia 560	100	۲
⊳	ICD (1)	2		۲
⊳	ICD-Lite (1)			۲
⊳	IPS32 (3)			۲
⊳	IPS32 Mk2 (11)			۲
⊳	RLU (7)			۲
		3		
		\sim		
- 11				

On the **Devices** page, use the + button to add a new device (1). The device is displayed in the menu. Select the device (2), and then click **Add** (3). Wait for the device to initialise and reach the 'Idle' state (4).



3.5. Activate a device

To read live data and send setups to the device, the device must be activated. Select the device (1), and then click **Activate** (2). To distinguish the active device if there are multiple known devices, the active device appears in a grey box.

🕀 Add Device 🖉 Activate 🖉 Change Variant 🛞 Update Firmware 🕲 Import Firmware 🕲 Test Connection	١
▷ Antares8AC (2) 2	۲
Antares8AMR_LMH(1)	۲
Antares88TCC (3)	۲
Antares8xx (4)	۲
b Badenia 2xx (5)	۲
Badenia Sxx (1)	Ø
time the second	
> CCW Mk3 (4)	۲
CCWMiad (i)	۲
٥ cu ז.٥ (۵)	۲
۵ cou 10.3 (2)	۲
Centaurus Sox (3)	۲
b Centaurus 7xx (1)	۲
ه ادن (۱)	۲
◊ ICD-Lite (1)	۲
∮ IP\$32(3)	۲
∮ IPS32 Mr2 (11)	۲
الا الا الم الم الم الم الم الم الم الم	۲



4. Device properties

You can view and configure the properties of a device on the **Devices** page. Select a device to display its properties on the right-hand side of the page.

These device properties allow you to name the device by vehicle and/or drive, and apply comments about the device, session, or day, and so on.

Badenia 5 #100 Properties			
Currently connected			
Car Name	Badenia 5xx #100		
Driver Name	Example Driver Name		
Category	Logger 🤊)	
Short Comment	Example Short Comment		
Long Comment	Example Long Comment		
Driver Comment	Example Driver Comment		
Automatic Offload	Inherited (Disabled)	~	

These details are stored in the file metadata when the data is offloaded. You can view the data in Toolbox to help distinguish between data files.

Tasks	★ ► ×
🖃 📕 General Report	t
💦 💽 Badenia 5x	x #100 : 20 : Static test
Appearance	
Color	
Data selection	Badenia 5xx #100 : 20 : S
Label	Badenia 5xx #100
Details	
ld	Badenia 5xx #100
Location	20
Name	Example Driver Name
Outing number	549
Session number	1
Static test	yes
Comments	
Long comment	Example Long Comment
Short comment	Example Short Comment
System details	Source: Offload; Device
User comment	Example Driver Comment

You can view device identity information, including the device type, IP address, serial number, and firmware details.

Identity Information				
Variant	Badenia 560			
IP Address	172.16.46.0	0		
Serial Number	100			
Firmware Inform		ader		
Operating System	kappa 6.2.24 (Release)			
Device	Badenia 5xx			
Application	3.2.8			
Analog FPGA	A 1.0.0			

4.1. Configure the device IP address

You can edit the suffix of the device IP address. Connect to the device, and then activate it. Click the pencil icon at the top-right to display the **Edit Device Properties** menu where you can edit the IP address suffix.

Edit Device Properties	x
Configure the device properties. Note, the update process will power-cycle the device.	
IP Address	
Configure the IP address of the device. Click 'Check if free' to ensure the address is not in use.	
IP Address 172.16.46. 0	
Update 🗙 Cancel	

4.2. Associate auxiliary devices and displays

Devices such as the Remote Logging Unit (RLU) and Configurable Display Unit (CDU) are Ethernet devices and need to be associated with a primary device, such as an Antares, Badenia, or Centaurus.

To associate an auxiliary device, add the device to the devices page, select the device, and then click the pencil icon at the top-right to display the **Edit Device Properties** menu where you can name the auxiliary device and select the primary device with which to associate it.

Edit Device Prop	erties
Configure the power-cycle th	device properties. Note, the update process will he device.
Device Nan	ne
	e name of the device. This should match the ig name in the setup.
Name	CDU 10.3
IP Address	
-	e IP address of the device. Click 'Check if free' to ddress is not in use.
IP Address 1	172.16.102.0
Associated	Device
Choose the C	CHP device to associate with this device.
CHP device	Badenia 5xx #100 Logger v Badenia 560
	Update 🗙 Cancel



5. Device firmware

Update device firmware to make sure that all new features and functionality of your hardware are up-todate.

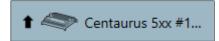
New firmware can require a minimum version of Toolset. You can find the latest versions of Toolset on the Cosworth website (<u>https://www.cosworth.com/motorsport/products/toolset/</u>).

5.1. Download firmware

You can download the latest device firmware from the **Upgrade** tab of the **Settings** page when a PC is connected to the internet.

🕇 🥽 Antares 850 AMR	Data (••) Live Data Actions 🕇 Setups Channels 🕇 Setting										
Global Settings	Update Settings										
Network	Configure th	Configure the settings that control software updates.									
Data Offload		 ✓ Check for updates on startup (once per day) ○ Only allow service releases 									
Telemetry	Check for: Devi	Check for:									
Diagnostics	A	ication updates									
1 Upgrade	Chec	Check now									
About	Device Up	dates nd import firmware up	dates, setups, an	d merge files.							
		15/10/2024 15:44:41		2							
	Bad	enia 2 Updates (4 fu	mware update(s <u>)</u>)							
	Bad	enia 5 Updates (16 †	firmware update(:	s), 1 setup(s), 1 merg	e file(s))						
		VMk2 Updates (2 fin	mware update(s))								
		VMk3D Updates (9 f	ïrmware update(s))							
		J 10.3 Updates (5 fin	mware update(s))								
		J 7.0 Updates (1 firm	ware update(s))								
		taurus 5 Updates (2		e(s))							
		Updates (11 firmwo									
		Updates (5 firmwar	e update(s))								
	Se	lect all Clear s	election								
	Down	nload and import now									

An upgrade prompt (up arrow) is displayed next to the device on the **Devices** page when new device firmware is available.



5.2. Update firmware

Download the latest firmware version, and then connect to, and activate, the device. Make sure that the device is in the 'Idle' state and active before you update the firmware.

Note: Updating firmware removes the setup from the device, together with any stored NV RAM variables (for example QM mode). Make sure that a copy of the device setup is saved, or **Read from Active Device** on the **Setups** page is selected, before you update the firmware. This saves the current setup stored on the device in your list of setups.

🕇 <> Centaurus 5xx #1	Data	(••) Live Data	Actions	Setups	Channels	1	Settings			
1 Updated firmware is available for th	e selected devi	ce(s).							(\otimes
Add Device Activate	Change Variant	Update Firmw	are 🛃 Impo	rt Firmware 🙆 Te	est Connection	Ì	Centaurus 5 #1	20 Properties	\oslash	^
▲ Centaurus 5xx (5)					۲		Currently connecte	ed		
Centaurus 5xx #120 Power Controller Centaurus 520	Disconnecte	Centaurus 5xx Power Controll Centaurus 520	er 🥖		irus 5xx #352 Controller us 520		Car Name Driver Name	Centaurus 5xx #12	0	
Centaurus 5xx #379 Disconnected Power Controller Centaurus 560						i	Category Short Comment Long Comment			
 Centaurus 7xx (1) CLU (1) 					1 1 1 1 1		Driver Comment			
CLUP (1)					۲		Automatic Offloa	d Inherited (Disable	d) ~	
▲ ICD (1)					٢		Identity Inform	ation		
Disconnected ICD Ultra					<u>A</u>	~	Variant IP Address Serial Number	Centaurus 520 172.16.50.0 120	Ø	
Group	By Product	✓ Sort By	Car Name	 Direction 	n Ascending	~				~

The following window shows the current firmware on the device.

date Firmware								
Step 1								
Import a new code packa	ge to use for this upgrade, or select an ex	visting one from the list below.						
elect Code Package Centaurus 5xx - 011-610100 - 3.2 2024-08-14 (Update 6)								
Select code Package								
Step 2								
Verify that the code file co	ontains the expected firmware and metac	lata versions.						
Component	Current Version	New Version						
Bootloader	CHP Cortex-A9 Boot Loader 0.8							
Operating System	kappa 6.2.24 (Release)	kappa 6.2.24						
Device	Centaurus 5xx							
Application	3.2.22	3.2.29						
Power FPGA	A 2.0.2	2.0.3						
✓ Force Update								
Step 3								
Perform the update.								
Updating to the selected		g the active device during the update. Ip currently on the device. If not already present in your 1 the device using 'Read from Active Device' within the						
	Update (Cancel						

Step 1. Browse to the location of the *.code* package required for the update.



Step 2. Select the package. Toolset shows the differences between the two code packages.

Step 3. Confirm, and then click **Update** to begin installation of the new package. The **Update Firmware** window shows progress of the installation. When installation is complete, click **OK**.

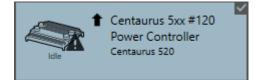
Update Firmware		x
A DO	NOT UNPLUG DEVICE	
Operating System		
Application		()
Power FPGA		
Status: Transferrin	g App. Image	

After the update, the device shows as a blank device in Toolset, indicated by the '<No Variant>' text in the device information box (1).

You now need to send the token and setup to the device. Click Change Variant (2).

🕇 🦛 Centaurus 5xx #1	Data Li	ve Data	Actions	1 Setups	Channels	t s	ettings		
1 Updated firmware is available for the	selected device(s).								8
Add Device Activate	hange Variant	Update Firm	ware 🕁 In	nport Firmware	Test Connection	٦	Centaurus 5 #1	20 Properties	Ø
∡ Centaurus 5xx (5) 2							Currently connect	ed	
Centaurus 5xx #120 Power Controller Centaurus 5xx <no variant=""></no>		1 Disconn	Powe	aurus 5xx #156 er Controller urus 520			Car Name Driver Name	Centaurus 5xx #120	
Centaurus 5xx #352 Power Controller Centaurus 520		Disconn	Powe	aurus 5xx #379 er Controller urus 560			Category Short Comment Long Comment	Power Controller	(9)
 Centaurus 7xx (1) CLU (1) 						0	Driver Comment		
CLUP (1)						۲	Automatic Offloa	d Inherited (Disabled	i) ~
ICD #1606 Display UCD Ultra						٢	Identity Inform Variant IP Address	Centaurus 5xx <no 172.16.50.0</no 	Variant>
Group B	y Product	~ Sort	By Car Nam	e ^v Dire	ction Ascending	~	Serial Number	120	

When prompted, select the required variant token, and then click **Change**. When the token is ready to be sent to the device, an exclamation mark in a warning triangle is displayed next to the device.



On the **Setups** page, open the setup, and then click **Send** to transfer the setup to the device.

A dialog box is displayed to prompt you to update the setup to match the new firmware on the device. Select **Use Device Variant**.



You can also change the setup variant on the main **Setups** page via the **Change Variant** option to avoid the 'Use Device Variant' prompt.

1	Data	(••) Live Data	Actions	Setups	Channels	1 Set	tings						
											(•	Ð
🖉 Open 💼 Rename 🕅 Copy	(+) New	Read from Active	Device 🕁 Imp	port 👚 Expo	ort 🔁 Compa	re Setups	Apply M	erge File	Change Me	etadata	Change Varia	nt	٦
Name				State	Device	Ŧ	Metadata	Model	Project	Varia	int Last Mo	dified	
Centaurus 5xx - 3.1 49-50							3.1 👚						:42 ^

When the setup is complete, the token is uploaded to the unit.

Sending Setup	Sending Setup
Sending setup	Send succeeded
949 of 2518 kilobytes sent	
OK 🛞 Cancel	OK 🛞 Cancel

After an update, the device is displayed in an 'Idle' state on the **Devices** tab. The device firmware information is updated in **Device Properties**.

6. Data

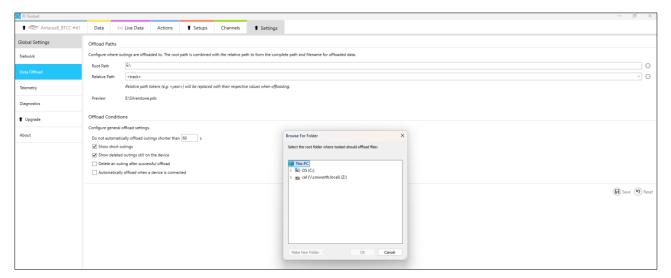
The Data page allows you to offload all logged data from the device.

6.1. Set up data offload paths

Before logged data is offloaded, you need to set up the offload paths on the Settings page.

6.2. Set the offload path

On the **Settings** page, the data offload 'Root Path' is the file storage location on your device, or on an external device. Select the three dots (...) icon to browse and select the storage folder. Or you can copy and paste the file path from Windows File Explorer into the 'Root Path'.



6.3. Set the relative path

The relative path is the naming convention used for the offloaded data. This identifies data by offloading files in a specific format or name.

🧭 Relative Offload	Location		- 0	×
in outing.	bined with the <i>relative</i> path to form the co			file for
espective values du	ename can include tokens as well as plain t ring offload. You can enter tokens by typin g the spacebar when the token is selected	g them directly into the p		ng
Property Token	Description			1
fast lap	Number of fastest lap	Insert		
first lap	Number of first lap	Insert		
car	Car name	Insert		
last lap	Number of last lap	Insert		
track	Track name	Insert		
driver	Driver name	Insert		
category	Category	Insert		
year	The year the outing was created	Insert		
month	The month the outing was created	Insert		
day	The day the outing was created	Insert		
hour	The hour the outing was created	Insert		
minute	The minute the outing was created	Insert		
second	The second the outing was created	Insert		
outing	Outing number	Insert		
session	Session number	Insert		
Relative Offload Pat	h <track/> - <car>-<session>-<day>-<mc< td=""><td>nth>-<year></year></td><td></td><td></td></mc<></day></session></car>	nth>- <year></year>		
review	C:\Downloads\Silverstone-CarA-002-11	10-24.pds		
		G		Cance



Click the three dots next to 'Relative Path' to set the naming convention to include track name, driver name, car number, session number, day, month, year, and so on.

For example, the track name and session name/number are sourced from the settings on the **Data** page or the outing properties after you select an outing when connected to the device.

Badenia 2 #108 I	Properti	es				
Last seen 19 Januar	y 2024 13	3:38				
Car Name Driver Name	Ligier Ll Bob Jor					
1 Antares8_BTCC #41	Data	(*)) Live Data	Actions		Channels	★ Settings
C Refresh Offload All	ancel Offloads (Delete All	Settings			
						C Offload Settings – 🗆 X
						General Settings Configure the default location and session number to apply to outings on offload.
						Configure the default location and session number to apply to outings on official. Track Name Donington Park V
						Session Number FP1
				No	o device connected	d. Device Settings
						To configure device specific settings go to the Devices tab.
						OK SCancel
						OK Cancel

The car and driver name are sourced from the device properties on the **Devices** page. Other parameters such as lap number, date, and time are sourced from the logged data.

Note: Make sure that you save data offload settings using the Save option before you offload data.



6.4.Set offload conditions

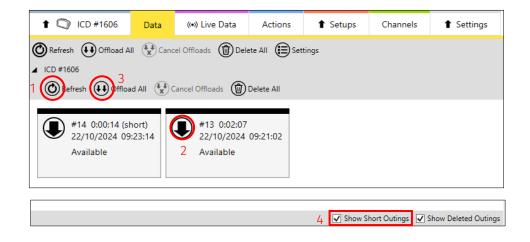
Offload conditions can be checked to automatically, hide, download, and delete outings. For example, you can configure Toolset to automatically offload data when the device is connected, and to delete the outing after a successful download.

Offload Conditions								
Configure general offload settings.								
Do not automatically offload outings shorter than 60 s								
Show short outings								
\checkmark Show deleted outings still on the device								
Delete an outing after successful offload								
Automatically offload when a device is connected								

6.5. Offload logged data

Logged data (also known as outings) is displayed on the **Data** page. Outings from each device are shown under the name of the device. If outings are not displayed, click **Refresh** (1). To offload individual outings, click **Offload** (2) on each outing file. You can also offload all outings via the **Offload All** option (3).

Note: If no outings are displayed when you log short outings, check that the **Show Short Outings** option is selected (4). You can configure the duration of a short outing on the **Settings** page.



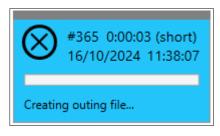
Click on an outing file (1) to display its properties on the right-hand side of the window. These include outing number, date and time, track name, driver name, car name, and comments, all of which you can edit (2). These details are stored in the outing file for reference.

	3		# 13 2 22/10/2024 09:21:02 0:02:07
		Track Name	Portimao v
#14 0:00:14 (short) #13 0:02:07		Driver Name	Bob Jones v
22/10/2024 09:23:14	:02	Car Name	32
Available Available 1		Short Comment	FP1
		Long Comment	Laps 1-6 Baseline Setup Laps 7-12 -3 Clicks on rear dampers

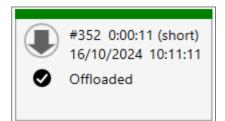


To offload multiple pieces of data with the same properties, select **Settings** (3), and then configure the relevant properties. These properties are applied to all selected offloads.

Click **Offload** to start the download from the device to a specified location. You can select multiple outings to queue for delivery. The progress and status of the download is displayed.



When successfully downloaded, the outing is marked as 'Offloaded' and highlighted in green.



If an outing offload fails, the outing is marked as 'Offload Failed' and highlighted in red. Hover over the outing to display the cause of the failure.

	#14 0:00:14 (short) 22/ The specified drive car		offload root path has been defined correctly in the settings tab.
8	Offload Failed	Available	

If errors continue, close Toolset, and then navigate to: C:\Pi Research\Toolset\[Toolset Version]\Logs\Pi Toolset\Log. Open the log file and check for specific device errors. If you cannot identify the errors, then please send a message to: <u>electronics.support@cosworth.com</u>.

From the **Outing Properties** window, you can open the outing directly in Toolbox if the application is open.

# 367 16/10/2024 11:44:21 0:00:33		
Track Name	Track Name Example	٧
Driver Name	Driver Name Example	۷
Car Name	Centaurus 5xx #120	
Short Comment	Short Comment Example	
Long Comment	Long Comment Example	
Driver Comment	Driver Comment Example	
0	C:\Pi Research\Logged Data\Track Name Example.pds	
	Delete outing	



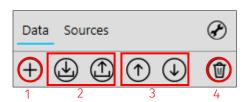
7. Live data

When connected to the device, you can view channel data in real time on the Live Data page.

7.1. Live data pages

Add and name live data pages

You use the **+** tool in the **Data** menu (1) to add live data pages. You can use the import and export tools (2) to import and export live data pages between Toolset versions and PCs. If you add multiple live data page you can use the reorder buttons to reorder items in the menu (3). Use the 'bin' tool to delete live data pages (4).

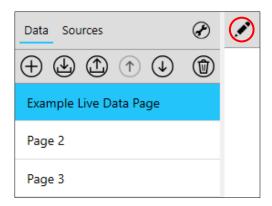


Click the name text box to rename a live data page.

Data Sources	${}^{\hspace{-1.5pt}{\circ}}$
	٦
Example Live Data Page	
Page 2	
Page 3	

Configure live data pages

To configure live data pages, click the 'pencil' icon to enable 'edit mode'.



Live data display types

In edit mode you can add four display types:

- Channel list Used to display channel values as raw values or bar graphs
- Map control Used to display a map
- Tabular outing report Used to display telltales (see Telltales)
- Chart recorder Used to display channel values as line graphs



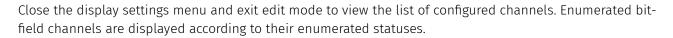
Channel List

1

Once you add a channel list, use the 'wrench' tool to open the display settings to add channels to the display (1). Use the 'bin' tool to delete the display (2)

From the display setting menu you can define the name of the display (1). A list of the available channels is displayed and can be searched (2). Double-click on a channel to add or remove it from the display or use the insert and remove tools (3). You can select the display mode (bar or value) from the dropdown menu (4). Select the orientation of standard channels and bit-field channels (horizontal or vertical) from the dropdown menus (5). Use reorder tools (6) to change the order of channels in the display You can select the display font, size, and colour from the **Font** menu (7).

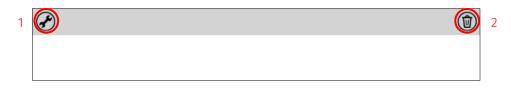
Settings	\otimes
Channels Font 7	
Name Example Channel List	Orientation Vertical *
Mode Bar 5 ~	Bit-field orientation Horizontal Y
Displayed channels: ① ① ①	Available channels: 1.5V Supply Voltage 3.3V Supply Voltage 5V Supply Voltage 6.1V Supply Voltage 13V Supply Voltage 13V Supply Voltage 13V Supply Voltage <i>start typing to filter the channels</i> I Only Show Channels From Active Device



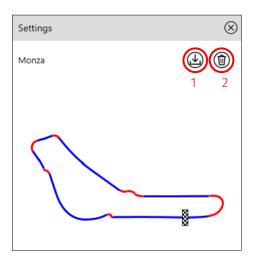
	Example Channel List	
Battery Voltage		v
12.99	13.03	13.05
Engine		
	Off	

Map control

Once a map control display has been added, use the 'wrench' tool to open the display settings to add channels to the display (1). Use the 'bin' tool to delete the display (2).



When the display setting menu is open you can import a track map (*.pxt* file format) (1). You can use the 'bin' tool to delete a track map (2).



Close the display settings menu and exit edit mode to view the Map Control display. When connected to the device via telemetry the vehicle position is displayed on the map (1).

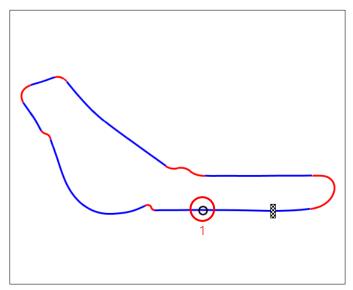
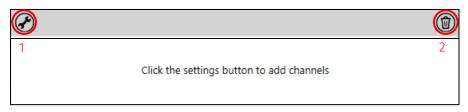
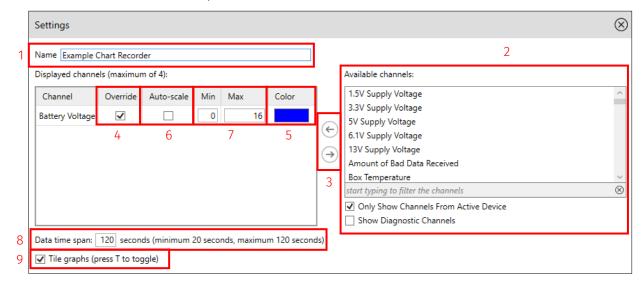


Chart recorder

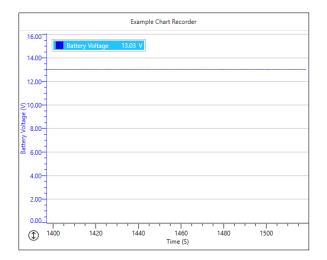
Once a chart recorder display has been added, use the 'wrench' tool to open the display settings to add channels to the display (1). Use the 'bin' tool to delete the display (2)



When the display setting menu is open, you can define the name of the display (1). A list of the available channels is displayed, and you can search specific channels (2). Double-click a channel, or use the insert and remove tools, to add or remove a channel (3). You can change the default display colour (4) and select another colour from the **Color** menu (5). You can auto-scale the display Y axis (6), specify the Y axis minimum and maximum (7), the X axis time span (8), and whether the channels are overlaid or tiled (9).



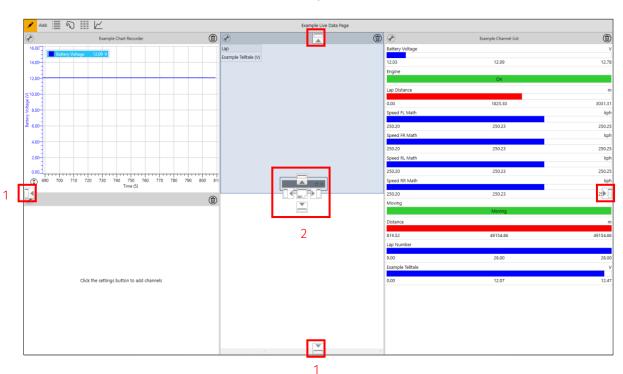
Close the display settings menu and exit edit mode to view the configured chart recorder display.



Arrange live data pages

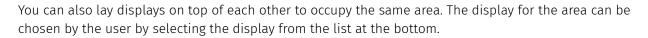
You can rearrange live data displays. In edit mode you can adjust the display width and height. Drag the edge of the displays to the required width and height (1).

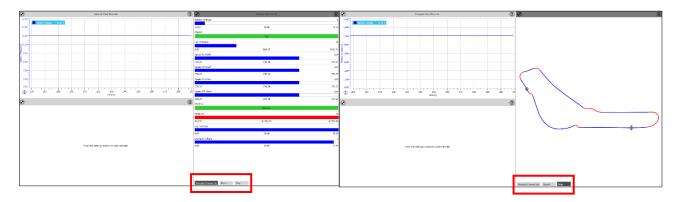
To reposition live data displays, click the top of a display and drag it to one of the available positions (2).



1

1





7.2. Sources

The **Sources** menu displays the status of the telemetry network connection and the number of clients on the telemetry network. You can check the state of the telemetry link and view the target directory for the logged telemetry data.

The **General** section shows the name of the source, the device, and the setup.

The **Connection** section shows if your source is enabled, together with a **Click to refresh connection** option.

Under the **Status** section you can see the status of your telemetry connection together with information about your connection.

Under the **Telemetry Logging** section, you can see the status and destination of the logged data.

General			
General information about this tele	metry source.		
Name	Team Telemetry		
Source	Intel(R) Active Management Technology - SOL (COM3)		
Device	No Device Connected		
Setup			
Connection			
Options for enabling and connectin	g this telemetry source.		
Enabled	V		
Reconnect	Olick to refresh connection.		
Status			
Information about the status of this	telemetry source.		
Telemetry Rx Status	Awaiting Data	Connected	
Telemetry Coverage		0%	
Number of Telemetry Packets	0		
Telemetry Rx Throughput	0 bytes/s		
Number of Bad Telemetry Packet	; 0		
Amount of Bad Data Received	0 bytes		
Telemetry Logging			
Information about logging the data	received from the radio.		
Logging Status	Disabled		
File Name		(D)	
		(🗐 Update Now	



8. Change lap numbers

You can reset outing and lap numbers on the Actions tab when connected to a device.

8.1. Actions tab

The **Lap** node on the **Actions** tab allows you to reset the lap number and the outing number on the device. Select the **Outing** and **Lap** check boxes, and then enter the required outing and lap numbers in the text boxes.

Click the **Set Next Outing and Lap Numbers** button to set the target value. The newly defined outing and lap numbers are included in the next logged outing.

Note: The action does not reset the value of the current outing. You must stop logging and restart or power cycle the device to reset the outing number.

Change Outing and Lap Numbers		
This action allows you to set the values for the next outing. and/or lap numbers. The change to the lap number will take immediate effect, while any change to the outing number will only change at the start of the next outing.		
✓ Outing 0		
✓ Lap Z Use Default		
Set Next Outing and Lap Numbers		
If the change in an outing number being used matches data already logged on the device, that data will be deleted.		
If the change in an outing number being used matches data already logged on the device, that data will be deleted.		

8.2. Circuits Node

Lap reset

In the **Circuits** node (see <u>Setups - Circuits</u>) you can create multiple conditions to reset the lap number from a button press (See <u>Setups – Buttons</u>), an event, or at the start of a new outing.

Lap Reset	Add lap reset event)
	Button V Switch 1 O Press Release Click Hold Long Hold Event	
Lap Number after Reset	Button New Outing 'e and negative numbers are permitted	
Lap Increase	💮 🖲 Press 🔿 Release 🔿 Click 🔿 Hold 🔿 Long Hold	
Lap Decrease	. Press O Release O Click O Hold O Long Hold	



9. Logging

The **Logging** node on the Actions tab allows you to manually enable and disable device logging when connected to a device. The current logging status of the device is displayed under **Logging Status**.

Select **Enable Logging** to manually start logging (1). Select **Disable Logging** to manually stop logging (2). If any override is selected, select **Revert to the Default Logging Status** to clear any manual logging overrides and use the standard logging conditions configured for the device (3).

Logging
Logging Status
Current logging status of the device.
Logging Active
Logging Override None
Override Logging
Manually override the logging status of the device.
Enable Logging Disable Logging Revert to the default device logging status
$\begin{array}{cccccccccccccccccccccccccccccccccccc$

The current **Logging** status (Active or Inactive) and **Logging Override** status (None, Force On, or Force Off) are displayed in the **Logging Status** section.



10. Beacons

The **Beacons** node is used to configure the end of lap marker. The end of lap marker is used to divide *.pds* data files into laps. The node allows simple integration of a beacon to the setup with high flexibility for a range of multiple beacon types, including infrared beacons, GPS beacons, and virtual beacons:

- Single channel beacon receiver
- 10-channel beacon receiver
- 10-channel ASL beacon receiver
- 32-channel beacon receiver
- GPS beacon receiver
- Virtual beacon receiver

Select a beacon type to display a list of compatible parts. Contact Cosworth Electronics via the **Support** page on Cosworth website or e-mail <u>electronics.support@cosworth.com</u> for copies of individual product information sheets.

10.1. Single channel beacon receiver

A simple digital input beacon set up on the Hardware Settings node.

Beacons			
Beacon Type		Choose a Input	– 🗆 X
Single channel bea To be used with the 01F-034119 01S-630022 01S-630001 01S-630066	con receiver 👻 below part numbers: Channel Zero Beacon Receiver IR Timing Beacon Receiver – C1 Channel Zero Beacon Receiver, IMC Connector IR Timing Beacon Receiver – C1 ASL	Digital 01 Digital 02 Digital 03 Digital 04 Digital 05 Digital 05 Digital 06 Digital 07 Digital 09 Digital 09 Digital 10	
Input Re-triggering	Θ	start typing to filter the selection	8
Do not re-trigger en	nd-of-lap beacon for 30.00 seconds.	Show All Show Diagnostic Items	Ø OK ⊗Cancel

10.2. 10-channel beacon receiver

10-channel receivers allow the flexibility to use up to ten different beacon codes to avoid conflicts with other teams using their own beacon transmitter locations. The 10-channel receiver is set up in the same way as the single channel receiver.

10.3. 10-channel ASL beacon receiver

The 10-channel ASL receiver is like the standard 10-channel beacon receiver, but you can configure the end of lap beacon code in the software.

10.4. 32-channel beacon receiver

This option allows the flexibility to select from 16 different end of lap beacon codes, to avoid conflicts with other teams using their own beacon transmitter locations, plus provision for up to 16 split beacon codes to calculate accurate split times at multiple points around the track using several C16s split beacons.



10.5. GPS beacon receiver

Beacon Type				
32-channel beacon receiv	ver Y		Choose a Input	- 🗆 ×
To be used with the below 01S-630134 01S - 630053 01S-630034 01M-034103/-C/-R Input	IR Timing Bea IR Timing Bea IR Timing Bea	con Tx C16s	Digital 01 Digital 02 Digital 03 Digital 04 Digital 05) Digital 06 Digital 07 start typing to filter the selection	é
Input End-of-lap beacon code	0	···	Show All	
			Show Diagnostic Items	✓ OK ∑Cance
		o V 1	□ 2 □ 3	
	Ĩ	0	6 7 M A B E F F eacon for 30.00 seconds.	
	C	Do not re-trigger end-on-lap of Do not re-trigger split beacons		
		-	ast received common value channel.	
		Code Value		
	(1 2	17		
	3	19 20		
	<u>e</u> 7	22		
	2 2	24		
	Æ	27		
	(28		



10.6. Standard GPS beacon

A GPS input configured in the **NMEA 0183 Decode** node can be used to configure an end of lap beacon. You can select **Latitude** and **Longitude** channels configured in the **NMEA 0183 Decode** from the browse menu for the **Latitude** and Longitude inputs (1). You must also define a strategy to indicate when the GPS position is valid (2) and enter the coordinates of the beacon location for the start/finish line (3).

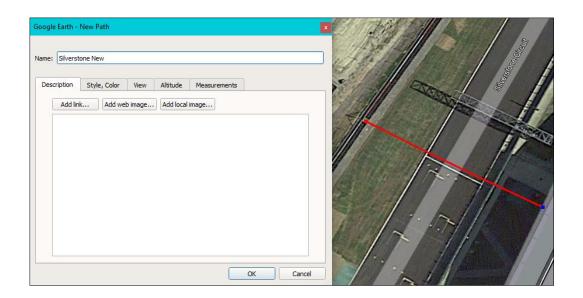
Beacons						Ð
Beacon Type						
GPS beacon receiver						
To be used with the be	elow part numbers:					
01F-050660	GPS 5Hz					
015-630090	CSG10 (CAN Serial GPS)					
Input Data						
Select the channels wh	hich will provide the current longitude and lati	titude, and optionally a channel that gives info	rmation about when the values in the l	ongitude and latitude channels contain valid information. It is recommended th	nat you obtain all of these channels from a single NMEA 0183 Sentence.	
Latitude	NMEA RX Latitude				O 1	
Longitude	NMEA RX Longitude					
Position valid when	Car				Car v is Moving	~
Beacon Location	-					
Either manually enter t	the latitude and longitude for the end points	of the line that will generate a beacon when c	crossed, or select a file that contains suc	h information and select an appropriate beacon line.		
Track Name	۵ ک	Latitude	Longitude			
Beacon	<default></default>	Start 52.07886250000000	1.015234800000000	3		
		Finish 52.07886250000000	1.015234800000000			
		Decimal degrees O Decimal d	egrees minutes and seconds			

10.7. Create a GPS beacon

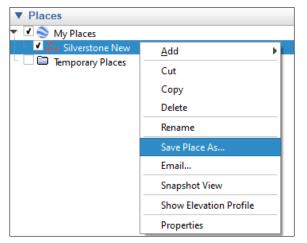
You can also use Google Earth to create a start/finish line to generate beacon events. Open Google Earth, and then right-click on **My Places > Add > Path**.

▼ Places				
📃 📚 My Places		_		
🗉 🗖 Temporary Places	<u>A</u> dd	▶	Folder	
	Сору		Placemark	
	Revert		Path	
	Save Place As		Polygon	
	Email		Model	
	Snapshot View		Tour	
			Photo	
			Image Overlay	
			Network Link	

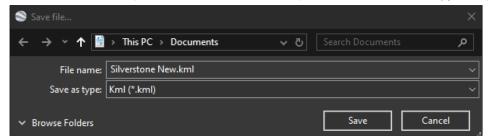
The **Edit Path** window is displayed. Enter a name for the start/finish line, and then use the mouse to draw the start/finish line on the map. This line must cross the track in the required location. A beacon is triggered every time this line is crossed.



When the new start/finish line is created, you must export it. Right-click Path, and then Save Place As....



Note: Make sure that you select the *Kml* (*.*kml*) option from the **Save as type** dropdown menu.



When you select the GPS Beacon Receiver from the **Beacon Type** drop down box in the **Beacons** node you can select the **Latitude** and **Longitude** channels configured from the **NMEA 0183 Decode** option from the browse menu for the Latitude and Longitude inputs (1). The strategy for when the GPS position is valid must also be defined (2).

Beacons	
Beacon Type	
GPS beacon receiver	v l
To be used with the below p	part numbers:
01F-050660	GPS 5Hz
015-630090	CSG10 (CAN Serial GP5)
Input Data	
Select the channels which w	vill provide the current longitude and latitude, and optionally a channel that gives information about when the values in the longitude and latitude channels contain valid information. It is recommended that you obtain all of these channels from a single NMEA 0183 Sentence.
Latitude	INMEARX Leibude
Longitude	INMEA RX Longitude
Position valid when	Car Car is Moving

Import the start/finish line file using the import tool icon (1), and then select the beacon path from the **Beacon** drop down menu (2). You use the 'bin; tool (3) to delete the start/finish line. The start/finish line coordinates are automatically populated from the *.kml* file.

Beacon Location					
	r the latitude and longitude for ect an appropriate beacon line.	the end points of the line	e that	will generate a beacon when c	rossed, or select a file that contains such
Track Name	Silverstone New.kml			Latitude	Longitude
Beacon	Silverstone New	v	Start	52° 4' 9.673" N	1° 1' 20.839" W
2		F	inish	52° 4' 9.087" N	1° 1' 19.631" W
				🔘 Decimal degrees 🖲 De	grees minutes and seconds

10.8. Virtual beacon receiver

You can configure virtual beacons in Toolset to use a user-defined channel as a beacon input. This could be a Maths, Logic or CAN channels.

Beacon Ty	/pe	
Virtual bea	acon receiver v	
End-Of-La	ap Beacon	
An end-of-	lap beacon will be generated when the condition has been met.	
Condition	CAN_Beacon	

10.9. Split beacons

There is also an option to add split beacons to the setup, triggered from a virtual source.

Split Beaco	ns											
Up to 64 split	t beacon conditions may be speci	fied. A	split beacon w	ill b	e generated with the specifie	ed beaco	n code	when the c	ondition has	been met.		
Add Spl	it Beacon										(1
Condition	Can_Beacon	•••	=	¥	4.000	Code		1				
Condition	Can_Beacon		=	×	6.000	Code		2				



11. Actuators overview

For devices such as the Badenia with High Side Driver outputs and the CCW Mk3 for Opto-Isolators, the **Actuators** node is used to configure the outputs.

11.1. Configure an actuator

Use the **Import** option to import an actuator from the Toolset library (1). You can import and export previously configured actuators between existing setups (1/2). You can use the 'bin' option to delete actuators from the setup (3).

	Output Actuator Pairs	
1.	() () 2	3. 🞯
	Digital PWM Outputs (4)	۲
	PWM Output 01 C2.16 High-side	
	PWM Output 02 C2.29 High-side	
	PWM Output 03 C3.38 High-side	
	PWM Output 04 C3.46 High-side	

Select the actuator to import from the dialog box (1), and then click Import (2).

-	ubdirectories are searched for suitable items.			
Libraries Read-Only Library	Name	Туре		
My Library	Digital PWM Actuator	Digital PWM Actuato	rs	
		1.		
	Filter: start typing to filter the selection			

When the actuator is imported, you can configure the output duty. Enter a name for the actuator (1), and an optional descriptive comment (2).

Actuator Properties				
Configure the properties of the actuator.				
Name	1.	Actuator		
Comment	2	An example actuator		

You can now configure the actuator output duty. There are three actuator configuration options:

Always On: 100% duty when the device is on.

On/Off: You can use a user defined channel (Maths, Logic, CAN, Alarm, and so on) to switch the output and configure its duty. For example, a register Maths channel or a Counter Logic channel can switch the output on, and the frequency of the channel determines the switching frequency.

PWM: You can use a user defined Maths channel with 'Proportion' units to configure the PWM duty for the output. The frequency of the output is configurable between 1 – 400Hz.

o Always On, specify a user type channel that the turns the actuator on or off or specify a proportion channel allowing PWM control.
··· Frequency 200 Hz

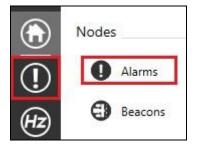


12. Alarms

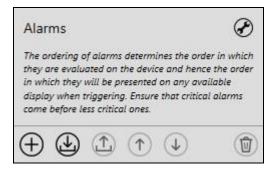
In Toolset you can use alarms to notify the driver/team when specific events or conditions are met.

12.1. Create an alarm

To create an alarm within a setup, click the **Alarms** node, or use the shortcut on the left of the screen.



Click the + button at the top left to create an alarm. You can also import, export, prioritize (top to bottom), and delete alarms.



Click the 'wrench' icon to open **Alarm Settings**. You can select the option to acknowledge alarms and the rate at which they are evaluated.

Alarm Settings		
Configure the settings that	t apply to all alarms.	
Acknowledge Button	O Press Release Click Hold Long Hold When	pressed acknowledges the highest priority alarm
Evaluation Rate	10 ~	

Currently you can only trigger an alarm acknowledgement through a button event, and not a channel.



When an alarm is created, the alarm configurations are displayed on the right.

General	
Name	Alarm 0
Short Text	Max 5 characters
Description can be used to give a b	rief overview of the purpose of the alarm and will be available throughout Toolset.
Manufacturer Description can be us	ed to provide more in depth information and is only available on this page to master users.
Description	
Manufacturer Description	
Long Text	Max 14 characters
Enabled	\checkmark
Display Channel	Channel that can be displayed when the alarm triggers
	Dps 2 Unit 4
Manufacturer Status	
Manufacturer Status	This is a normal item.
Minimum viewing user group	
Minimum editing user group	
winning aser group	
Conditions	
	on has been met for the specified guard time.
Up to four qualifying conditions may al	so be specified, each of which must be met before the main condition will be evaluated.
Condition	Channel v
Guard Time	2.000 s
Re-Trigger Guard Time	2.000 s Period that must elapse after alarm reset before it can re-trigger
Qualifiers	
	(+) Add Qualifier
Acknowledgement	
 To clear the alarm the value must ret After user acknowledgement, the the 	old adjustment value is applied as follows: turn to its normal range and the difference between the value and the current threshold must exceed twice the threshold adjustment value. reshold adjustment value is added to (or removed from) the current alarm threshold as appropriate. ailable where the alarm condition is not a bitwise operation.
Allow Acknowledge	☑ Whether the user is able to acknowledge (dismiss) this alarm
Adjust Threshold	
Threshold Adjustment	Percentage v 10.000 % v

General

Name: The name of the alarm channel. Use the format 'Alarm_Quantity_Channel_Qualifier' to group all alarms together.

Short Text: The short text used in display configurations.

Long Text: The long text used in display configurations.

Enabled: When this option is selected you can use the alarm you create in Math Channels, Displays, and so on.

Display Channel: When the alarm is on, the value of the channel is displayed on the dash. Select the decimal places (Dps) and the unit.

Manufacturer Status

Refer to **Pi Toolset – Setup Locking** for details about this option.



Conditions

Condition: This option allows you to define under which condition(s) the alarm is triggered. This can refer to a Channel (Oil Pressure, for example) or a Bitfield (Button for example). If a channel is selected, then a valued condition is required. If a bitfield is chosen, then a specific state is required.

Guard Time: The time during which a condition must be true to trigger the alarm.

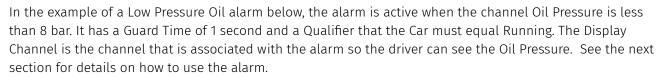
Re-Trigger Guard Time: The time that must elapse after an alarm reset before it can re-trigger.

Qualifiers: You can add qualifiers to enable or disable alarms. The strategies available are automatically created by Toolset (Car, Engine, Logging, and Moving), or can be created by the user (see **Setups – System Status** for more information).

Acknowledgement

Allow Acknowledge: If selected, the driver can acknowledge the alarm. If unselected, the alarm will always be active or inactive depending on its settings and cannot be over-ridden.

Threshold Adjustment: This option is only available when the **Allow Acknowledge** option is selected. You can change the threshold of the alarm when it is active, and the driver has acknowledged it. For example, if an alarm is set to display when Oil Pressure is low (less than 8 bar) and the **Threshold Adjustment** is Offset 2 bar, then after the alarm is acknowledged, it will not be active again until Oil Pressure is less than 6 bar. You can only reset the threshold adjustment when the car is stopped and powered off, or when the difference between the value and the current threshold is at least twice the threshold adjustment.



General		
Name	Alarm_Oil_Pres_Low	
Short Text	Oil Max 5 characters	
Description can be used to give a	a brief overview of the purpose of the alarm and will be available throughout Toolset.	
Manufacturer Description can be	used to provide more in depth information and is only available on this page to master users.	
Description		
Manufacturer Description		
Long Text	Oil Pressure Max 14 characters	
Enabled	\checkmark	
Display Channel	Oil_Pressure ⓒ Channel that can be displayed when the alarm triggers	
	Dps 2 Unit	
Manufacturer Status		
Manufacturer Status	This is a normal item.	
Minimum viewing user group		
Minimum editing user group		
Conditions		
The alarm will trigger when the cond	ition has been met for the specified guard time.	
	also be specified, each of which must be met before the main condition will be evaluated.	
Condition	Channel v Oil_Pressure · 8.000	
Guard Time	1.000 s	
Re-Trigger Guard Time	2.000 s Period that must elapse after alarm reset before it can re-trigger	
Qualifiers	Strategy v Engine 😳 = v On v 🕲	
	(+) Add Qualifier	
Acknowledgement		
When an element the three set of the three	shold adjustment value is applied as follows:	
1) To clear the alarm the value must	return to its normal range and the difference between the value and the current threshold must exceed twice the threshold	adjustment value.
	threshold adjustment value is added to (or removed from) the current alarm threshold as appropriate. available where the alarm condition is not a bitwise operation.	
Allow Acknowledge	✓ Whether the user is able to acknowledge (dismiss) this alarm	
Adjust Threshold		
Threshold Adjustment	Percentage v 10.000 % v	

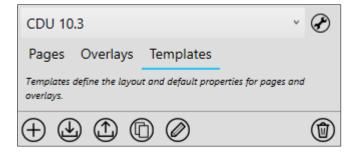
Alarms are also considered events. When you select from a list of events (for example on the **Fuelling** node, an event is selected for Reset Fuel Used, all alarms are displayed. This can be useful when a condition must be met for a Beacon, Fuelling Reset, and so on.

Use an alarm

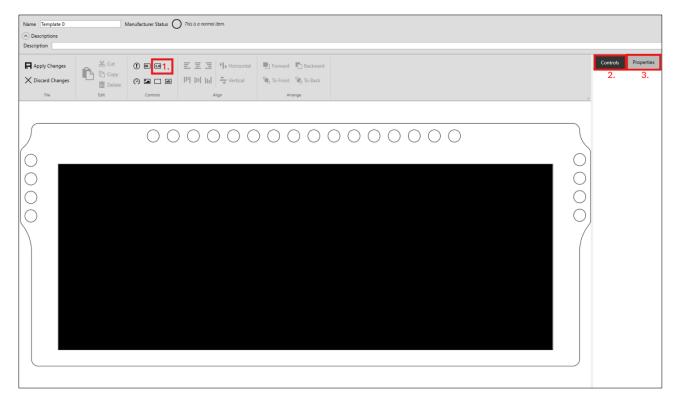
There are several ways to use an alarm on the display (CDU/CCW). You can use a Channel Control (Display Only), use an Alarm Control, or use an alarm to drive an overlay. Click **Displays (Ethernet)** or use the shortcut on the left.

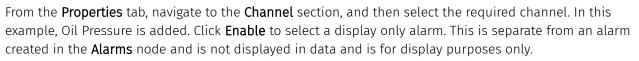
Use a channel control

Click **Templates** to create a new template.



Click the + button to open a blank display. To add a channel control, click on the box (1) in **Controls** and drag it to the screen. When you click on the new box, the **Controls** tab (2) is populated with the box name (this can be left as the default). Click **Properties** (3) to open the channel properties.





Control	I					
Name	OilPress	ure				
Layout	Тор	210	Left	560		
	Width	160	Height	60		
Channe	el					
Source		Oil_Pressu	re			
Quantity	press	ure	~ Unit	bar	~	
Decimal	Places	2	Color	•		
Display	Minimum	0	Maximum	1000		
Alarm M	linimum	0	Maximum	1000	Enabled	\checkmark
Filter Pe	riod	0	ms			
Filters ch	hannel va	lues over the	specified per	iod (0 = no ;	filtering).	
			Reset to ma	tch the disp	lay templa	te
Preview	Value	Test how t	he control wi	ill appear for	r specific vo	alues
		1000				

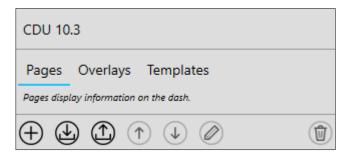
At the bottom, there is an option to select the font size, select the channel value colour, and select the alarm value colour. The text and value will flash in the alarm colour when the alarm is active. See **Displays** for more configuration details.

Value	
Alignment	E ま <mark>ヨ</mark> ☰│ 丣 ※ <mark>山</mark> Ⅲ
Font Size	21 Override
Color	Fixed Y
Alarm Color	Default ^v

Click Apply Changes to save the template. You can use the template for a page or an overlay.

Note: It is recommended that you make templates generic enough to be used more than once if required and make all changes to the page/overlay rather than the template itself, as changes to the template may not propagate to the page/overlay correctly.

To create a page from a template, click the + button on the Pages tab from the Display node.



A new window displays all the available templates. Select the required template, and then click the + button.

Add Pages	\otimes
Choose a template on which to base the new ite	ms.
Example (unused)	

Use an alarm control

Create a new template, as described above, and then add an alarm control (as described below). These are only displayed when the alarm (from the **Alarms** node) is active, effectively functioning as a pop-up alarm. To add an alarm control, click on the box (1) in **Controls**, and then drag it to the screen. When you click on the new box, the **Controls** tab (2) is populated with the box name (this can be left as the default).

Name Template 0	Manufacturer Status	This is a normal item.			
Description Apply Changes Discard Changes File	H Cut Copy Delete Est Corrols	문 표 표 비내 Horizontal	Forward The Backward		Controls Properties 2. 3.
0000	0 0	0000		000000	0000

Click **Properties** (3) to open the Alarm properties. This creates an alarm control, like a channel control. Use the + to button to add an alarm to the alarm control.

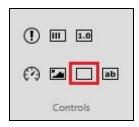
Contro	ols	Properties	
Contro	ы		
Name	Alarm	OilPresLow	
Layout	Тор	210	Left 560
	Width	160	Height 60
Alarms	;		
Select t	he aları	ms to associate	with this control.
The price alarms		der of the alarn	ns associated with this control is set in the
\oplus			٦
Alarm	1_Oil_Pi	res_Low	
Appea	rance		
Backgro	ound	Default	~
Scale		Fixed	~
Rotate		Fixed	~ 0 °
Alarm	Prope	rties	
Configu	ire the	display setting:	s for the alarms.
Display	Proper	ty Short Te	ext ~
Alarm (Color	Default	~

If the background is default, the box is hidden until the alarm is active. Under **Alarm Properties**, the **Display Property** can be the Channel (the 'Display Channel' in the **Alarms** node), Short Text, Long Text, or Channel value. These are configured on the **Alarms** node.

Alarm Properties					
Configure the displa	ay settings for	the a	larms.		
Display Property	Long Text	Ŷ			
Alarm Color	Channel				
Alarm Color	Long Text				
	Short Text				

Use an alarm to drive an overlay

An example of generic overlay is shown. Create a new template, and then add a rectangle.



Click the **Properties** tab and change the **Fill Colour** to transparent (if black is selected, it covers everything on the screen). Change the **Border Color** to the required setting. Set the **Border Thickness** to ~20.

Control				
Name AlarmOve	rlay			
Layout Top	0	Left		0
Width	1280	Height		480
Appearance				
Background	Fixed		v	•
Scale	Fixed		Ŷ	
Rotate	Fixed		Ŷ	0 °
Border Thickness	20			
Border Color	Fixed		v	•
Corner Radius X	0			
Corner Radius Y	0			

Position the rectangle to make a border around the display.

Name Example Descriptions	Manufacturer Status	This is a normal item.			
H Apply Changes Discard Changes File	() III ka (?) Ta . IM Controls	문 표 표 비 Harizontal			Control Properties Control Name AlarmOverlay
				0000	Layost Top O Left O Width 2020 Height 400 Appearance Background Fixed v Scale Fixed v Rotate Fixed v Border Tolone 20 Border Color Fixed v Correr Radus X O Correr Radus Y O

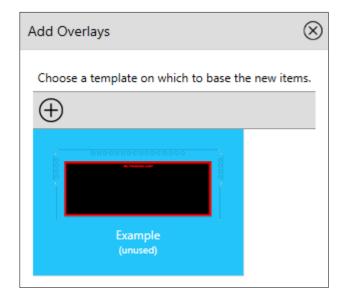
Next, you can add a text box to the screen.



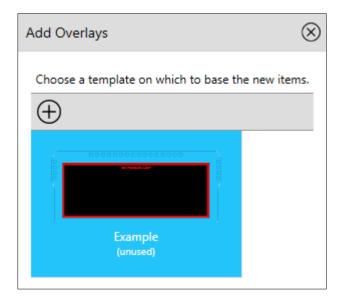
Enter 'Oil Pressure Low!' under Label on the Properties tab and position the text at the top of the screen.

	_
X Discard Changes Image: Control Image: Contro Image: Cont	Controls Properties Control Name OilPresAlarmText
	Appearance Scale Fixed V

Save the changes to the template and go to **Overlays**. Click the **+** button to add a template to overlays and select the new template.



Click the 'pencil' icon, and then select to add the alarm previously created. When the alarm is active this overlay appears on the display.





13. Allowed versions

You can use the **Allowed Versions** node to set the minimum and maximum version of Toolset allowed to modify setups. This feature is useful if a manufacturer wishes to lock the setup to a specific version (if the series/setup is homologated), so that customers can only use that version of software to modify the setup.

13.1. Setting the allowed version

You can configure the lowest and highest version of software, and then lock or hide the **Allowed Versions** node using the **Setup Locking** node to make it inaccessible to a customer.

You can also configure a message to be displayed if a customer tries to open the setup in an incorrect version of Pi Toolset.

Allowed Version	ns
Restrictions	
Define what vers	ions of the application are allowed to send this setup and what error message is presented to the user.
Lowest Version	10.0
Highest Version	10.3
Error Message	This setup is not supported in this version of the application.



14. Buttons

Configuring buttons within Toolset is one of the best ways to expand functionality and allow flexibility when you create a setup. The following shows how you can configure buttons (with an emphasis on CCW & CSB), how buttons within Toolset are structured, and some examples of how to use them.

14.1. Configure button inputs

Add buttons

By default, on the **Buttons** node there are no entries on the **Inputs** page. Unlike a Maths channel or Logic channel, which are software defined, buttons are hardware defined. On devices such as the CCW and the CSB which communicate via CAN, the button properties are imported from the associated device CAN.

Buttons	Ð
Inputs Combinations	
Configure input names and debounce timings	

When you configure a CAN device such as the CCW or CSB, it comes with an associated CAN stream to transmit data between the primary device and the CAN device. Once the device stream has been imported to Toolset (see **Streams**), it automatically updates the **Buttons** node to show the available buttons.

You can also generate your own virtual buttons via CAN streams and define any received channels as a 'Button Group'.

When the device stream is imported (a CCW stream in the example below), button inputs are shown on the **Buttons** node in the format of 'Name (Source)'.

Buttons Inputs Combinations Configure input names and debounce timings	Ø
CCW Switch1 (Stat_Switches_CCW)	CCW Switch2 (Stat_Switches_CCW)
debounced at source	debounced at source
CCW Switch3 (Stat_Switches_CCW)	CCW Switch4 (Stat_Switches_CCW)
debounced at source	debounced at source
CCW Switch5 (Stat_Switches_CCW)	CCW Switch6 (Stat_Switches_CCW)
debounced at source	debounced at source
CCW Switch7 (Stat_Switches_CCW)	CCW Switch8 (Stat_Switches_CCW)
debounced at source	debounced at source
CCW Switch9 (Stat_Switches_CCW)	CCW Switch10 (Stat_Switches_CCW)
debounced at source	debounced at source
CCW Switch11 Shift L (Stat_Switches_CCW)	CCW Switch12 Shift R (Stat_Switches_CCW)
debounced at source	debounced at source
CCW Switch13 AD L (Stat_Switches_CCW)	CCW Switch14 AD R (Stat_Switches_CCW)
debounced at source	debounced at source



Name buttons

The name of the button is configured in the **CAN Streams** node. To edit the name of the button, select the 'Button Group' packet content (1), and then click **Edit Buttons** (2).

CCW_MK2_Decode_1.2 (CAN Stream	Decode)								All streams
Packets	General								
+	Configure the basic proper	ties that define this packet.							
Analogue 1-3 0::C1	Name / CAN ID	Board Status	0xC0	Standard ~					
Analogue 10-12	Length		bits						
0rC4	Bit Numbering / Endianne	ss Follows Endianness v	Big (Motorola)	0					
Analogue 4-6 0xC2	Rate	1.00	Hz						
Analogue 7-9	Timeout Status Channel		Ø						
0xC3	Comment								
Board Status 0xC0	Enabled	Always ~							
	Content								
	Configure the content that	makes up this packet.							
	\oplus						1	Configure the buttons group.	of the selected button
1	Name Stat_Switches_CCW	უ	pe Button Group	Start Bit 0	Length 22			Timeout Behavior	Hold
	Name Stat_CAN Term_CCW	ту	rpe Channel	Start Bit 23	Length 1		2	C Edit Buttons	
	Name Temp_Box_CCW	Ту	rpe Channel	Start Bit 24	Length 8			Comment	
	Name V_Battery_CCW	Ту	rpe Channel	Start Bit 32	Length 8				
	Name Stat_Device ID_CCW	Ty	rpe Channel	Start Bit 40	Length 4				
	Name Stat_Software Ver_CO	W Ty	pe Channel	Start Bit 44	Length 4				
	Name Stat_CVW Switches_0	CCW Ty	pe Channel	Start Bit 48	Length 16				
	Preview Packet Layout.								

StatSwitches_CCW Buttons	\otimes
Edit the buttons within this group. Buttons are allocated one bit each, starting at the first bit configured for the content.	
$(+)$ (\uparrow) (\downarrow)	Ŵ
CCW Switch1	
CCW Switch2	
CCW Switch3	
CCW Switch4	
CCW Switch5	
CCW Switch6	
CCW Switch7	
CCW Switch8	
CCW Switch9	
CCW Switch10	
CCW Switch11 Shift L	
CCW Switch12 Shift R	
CCW Switch13 AD L	
CCW Switch14 AD R	

If a pre-compiled CAN stream for a device (that has been locked) is imported, you cannot edit the default button name, and it is greyed-out.

If a new CAN stream is compiled, you can add buttons by clicking the + icon (1), and then enter the button name (2).

StatSwitches_CCW Buttons	\otimes
Edit the buttons within this group. Buttons are allocated one bit each, starting at the first configured for the content.	t bit
1 🕀 ᠿ ④	1
2 Example Button 1	
Example Button 2	
Example Button 3	
Example Button 4	
Example Button 5	
Example Button 6	

Configure button properties

From the **Buttons** node, the **Button Configuration** option is displayed. Here the name of the button is displayed, and you can define the **Timing configuration**. Select or unselect the **Use default timings** option (1).

	General configuration Name CCW Switch1	
1	Timing configuration ☑ Use default timings	
		75 s 50 s
	In a second s	<u> </u>

Click the 'Wrench' icon on the **Buttons** node to configure default timings.

Click the 'wrench' icon to display a dialog box where you can configure the default timing configuration.

Buttons Inputs Combinations Configure input names and debounce timings	(
CCW Switch1 (Stat_Switches_CCW)	CCW Switch2 (Stat_Switches_CCW)
debounced at source	debounced at source
CCW Switch3 (Stat_Switches_CCW)	CCW Switch4 (Stat_Switches_CCW)
debounced at source	debounced at source
CCW Switch5 (Stat_Switches_CCW)	CCW Switch6 (Stat_Switches_CCW)
debounced at source	debounced at source
CCW Switch7 (Stat_Switches_CCW)	CCW Switch8 (Stat_Switches_CCW)
debounced at source	debounced at source
CCW Switch9 (Stat_Switches_CCW)	CCW Switch10 (Stat_Switches_CCW)
debounced at source	debounced at source
CCW Switch11 Shift L (Stat_Switches_CCW)	CCW Switch12 Shift R (Stat_Switches_CCW)
debounced at source	debounced at source
CCW Switch13 AD L (Stat_Switches_CCW)	CCW Switch14 AD R (Stat_Switches_CCW)
debounced at source	debounced at source

You can configure timing configuration settings such as 'On', 'On Hold', 'Off, and 'Ignore' times under **Debounce**. 'Click', 'Hold', and 'Long Hold' timings are configurable under the **Timings** section.

he default configuration applied to all items.	
Note that: An individual item may override the default configuration. In addition, some items may not support some or all of the settings pr	ovided here, in which case the settings provided here will not apply.
Debouncing	Timings
On Time The time for which the input signal must be active and 0.02 s stable before a press is registered.	Click A click is triggered if the debounced input is pressed for less than the Hold time.
On Hold Time The minimum length of time for which a press will be 0.02 s generated regardless of the input signal.	Hold The minimum time for which the debounced input must 0.75 s remain pressed before a 'hold' condition is detected.
Off Time The time for which the input signal must be inactive and 0.02 s stable before the signal is considered to be released.	Long Hold The minimum time for which the debounced input must remain pressed before a 'long hold' condition is
Ignore Time The minimum length of time which must elapse 0.05 s	detected.

For most functions, the default values should work well.

Note: These settings are for all buttons on the **Inputs** tab. If you need to edit button settings, unselect the 'use default settings option.

Configure button combinations

On the **Combinations** tab, you can configure channels that react from combinations of button inputs. For example, you can configure a channel to be triggered when two buttons are pressed simultaneously. This channel can be used to drive miscellaneous functionality within the setup.

To create a new button combination channel, click the **Combinations** tab (1), and then click the **+** button (2). Combinations can be deleted with the 'bin' icon (3).



You can configure the new button combination. Name the combination (1), and then provide an optional description (2). You can select if the combination is enabled in the setup (3). You can then use the **Choose a Strategy** option to select the strategy condition (4/5.).

	General			Choose a Strategy	_		×
1	Name	Example Combination		Car			^
2	Description	Example button combination for User Guide		Engine			
-				Logging			
	Enable		5 🔫	Moving			\sim
3	Enabled			start typing to filter the selection			\otimes
5	Dynamically e		4	This channel indicates the state of the engine.			
							- 1
			\mathbf{U}	Show Diagnostic Items		(\otimes)	Cancel

You can then define the button combination with options for the **Ordered** or **Unordered** button inputs:

• **Ordered**: the button needs to be pressed first, and then the second button to trigger the output channel.

Combinati	on		
Mode	 Ordered Unordered 		
Input	CCW Switch1		
then input	CCW Switch2		
anen input	CON SWICIE		

• **Unordered** – Two buttons must be pressed to trigger the output channel but a time threshold 'pressed within' must be defined to trigger the channel.

Combinatio	n
Mode	○ Ordered ● Unordered
Input	CCW Switch1
and input	CCW Switch2
pressed withir	n 0.400 s

Configure a digital button

A button can also be configured from a digital input rather than from a CAN device. This is useful if you need an additional button in the setup which is separate to any CAN devices.

To configure a digital button, go to the **Sensors** node, and navigate to the available digital inputs. Click a digital input (1), click the import tool (2), select 'Digital Push Button Sensor' (3), and then click **Import** (4).

Input Sensor Pairs							
	Ŵ						
Analog Inputs (40)	۲						
▲ Digital Inputs (10)	Attach Sensor				-		×
Digital 01 C2.17	The selected directory	y and all subdirectorie	es are searched for suitable items.				
C2.17 Digital Level Input	 Libraries Read-Only Libra 	_	Name	Туре			
P: 7: 102	A My Library		DF11i Rotational Sensor	Digital Pulse Sensors			
Digital 02 C2.18	2024 AC INF		Digital Push Button Sensor	Digital Level Sensors	3		
Digital Level Input	2024 Bat Lin 2024 CAN	nitation Math	Rotational Sensor	Digital Pulse Sensors			
Digital 03	2024 Firefly						
C2.36	2024 Led Co 2024 Logic (
Digital Level Input	2024 Logic 0 2024 SC3	Channels					
Digital 04	2024 Toca S						
C2.30	AliveDrive P AMR GT3	DR 2.0					
Digital Level Input	Auto Backup	p l					
Digital 05	CAN Stream						
C2.35 Digital Level Input	Display Sim Ethan	Channels					
Digital Level input	MUX Examp	oles					
Digital 06	NM Frame						
C3.9 Digital Level Input	Ronge Slider						
	✓ Update Files						
Digital 07	2024 SC		start typing to filter the selection				\otimes
C3.8 Digital Level Input		7 The	start typing to fater the selection				、 、
					4 🕢	iport 🗙) Cancel
Digital 08							
C3.3 Digital Level Input							
Distriction							
Digital 09 C3.7							
Digital Level Input							
Digital 10							
C3.2							
Digital Level Input							



You can now configure the digital button. Enter a **Sensor Name** (1) and an optional comment about the digital button in the **Details** section (2). The actual button **Name** is configurable (3), as is the 'mode' (4), in the **Button** section. The 'mode' allows the user to configure if the button triggers on the rising or falling edge of the digital input channel.

	Details	
1	Sensor Name	Digital Push Button
2	Comment	Example digital push button for User Guide
	Manufacturer Statu	
	Button	
3.	Name	Example Digital Push Button
	Trigger button pres	s on the Rising vedge of the input channel. 4 Falling Rising

Return to the **Buttons** node and acknowledge the creation of the digital button. The default button settings apply to this button, but default timings can be deselected. You can use the digital button in button combinations and in conjunction with CAN buttons.

Buttons	Ð	General confi	guration	
Inputs Combinations		Name	Example Digital Push Button	
Configure input names and debounce timings				
Example Digital Push Button (Digital Push Button on Digital 01) default debouncing		Debounce co		
default debouncing		Use default t	imings	0.02 s
		Hold time		0.02 s
		Off time		0.02 s
		Ignore time		0.05 s
		Timing config		
		Use default t	imings	0.75
		Long hold time		0.75 s
		cong noid time		- 1.50



Button structure and examples

The CSB or CCW buttons consist of an 8-bit output to determine what type of button press is commanded. These are configured as bit-fields by default with bit 0 to the left, and bit 7 to the right. You might need to acknowledge specific buttons press types and ignore others. The table below shows the press type and the output bit number and decimal value:

Press Type	Bit Number	Decimal Value
Raw	0	1
Debounced	1	2
Clicked	2	4
Held	3	8
Long Held	4	16
Click Latched	5	32
Latched Held	6	64
Latched Long Held	7	128

For example, to command a Maths channel to enable on a 'Latched Long Hold', the channel syntax is configured as shown below:

For this channel, when the button value is both equal to 128 (the '& 128' portion of the equation) **and** equal to 128 (the '== 128' portion), then the button output is acknowledged. Therefore, there is no chance that an intermediary button state triggers the channel output. The computed Maths Channel generates a value of 1 or 0.

Equat	tion	
Edit th	e equation that determines the value of this math channel.	
1	[Button 1] & 128 == 128	



15. Channel rates

The **Logging Rate** node is used to define the frequency at which channels are logged. Before you set channel rates, a logging table must be defined (see **Setups - Logging**). You can access the **Channel Rates** node from the home page, the quick tabs on the left of the screen, and the **Logging** node.

15.1. Get started with logging rates

When you first open the **Channel Rates** node, a list of all the default/native channels is displayed in the default logging table. These channels are all set to 'Off' by default. The name of the logging table is configured in the **Logging** node.

Channel Rates		
	SS HS	0
Acceleration X		Off
Acceleration Y		Off
Acceleration Z		Off
Battery Voltage		Off
Box Temperature		Off
Car		Off
Day Night		Off
Digital 01		Off
Digital 02		Off
Digital 03		Off
Digital 04		Off
Digital 05		Off
Digital 06		Off
Digital 07		Off
Digital 08		Off
Digital 09		Off
Digital 10		Off
Display Brightness		Off
Distance		Off
Engine		Off
Error Code Trigger Count		Off
EtherCAT Time High		Off
EtherCAT Time Low		Off
Flashing Shift Lights		Off
Flashing Shift Lights Mk2		Off
Free CPU		Off
Global Alarm		Off
Input 01 Voltage		Off
Input 02 Voltage		Off
Input 03 Voltage		Off

Click 'Off' for any entry, and then select one of the available rates from the dropdown menu to set the channel rate.

Channel Rates			
Channels	4	Logger 0 : Rate Group 0 SS HS	0
Acceleration X			Off ∽
Acceleration Y			Off
Acceleration Z			1 Hz
Battery Voltage			2 Hz
			5 Hz
Box Temperature			10 Hz
Car			20 Hz
Day Night			50 Hz
Digital 01			100 Hz

15.2. Search channels

When you work with large setups with many channels, you can search the channels through the search bar at the bottom of the screen.

start typing to filter the selection

Standard Search

Type in the node to filter the channel. By typing the channel name, the exact channel can be filtered. This search method must match the channel name exactly to show the result.

Channel Rates		
Channels	Logger 0 : Rate Group 0 SS HS	0
Battery Voltage		Off
Box Temperature		Off
В		



Magic search

If the exact name of the channel is not known, you can use the magic search function. Magic search is a 'broad' search tool, which can display results that contain any string. Press **CTRL + Shift + 8** simultaneously. A highlighted star indicates that the magic search is active. Type a specific word or phrase, and then press **CTRL + Shift + 8** again to close the search. An example is shown below.

Channel Rates		
Channels	Logger 0 : Rate Group 0 SS HS	0
Box Temperature		Off
TEMP		

You can also combine multiple terms to search for multiple parts of a channel name in a single search.

Channel Rates			
Channels	4	Logger 0 : Rate Group 0 SS HS	0
PWM Output 01 Voltage			Off
PWM Output 02 Voltage			Off
PWM Output 03 Voltage			Off
PWM Output 04 Voltage			Off
*PW**VOLT*			



Set multiple channel rates

To define the same rate for multiple channels, select the first channel in the list and shift-click the last channel in the list to highlight all channels in between. Select a logging rate for one of the channels highlighted to apply it to all selected channels.

Channel Rates		
Channels -	Logger 0 : Rate Group 0	
Input 01 Voltage	Off	
Input 02 Voltage	Off	
Input 03 Voltage	Off	
Input 04 Voltage	Off	
Input 05 Voltage	Off	
Input 06 Voltage	Off	
Input 07 Voltage	Off	
Input 08 Voltage	Off	
Input 09 Voltage	Off	
Input 10 Voltage	Off ✓	
Input 11 Voltage	Off	
Input 12 Voltage	Off	
Input 13 Voltage	Off	
Input 14 Voltage	Off	
Input 15 Voltage	Off	

Channel origins

Like the **Resources** menu, the channel rates list is an easy method to locate and find the origin of each channel. Double-click on a channel name to automatically direct you to the origin of the channel, where you can make edits.

Channel rates from non-native sources

You can configure the logging rate for channels originating from Alarms, Maths channels, Logic channels, and CAN channels on the **Channel Rates** node.

Channel Rates	
Channels 🔺	Logger 0 : Rate Group 0
1. Alarm	2 Hz
2. Maths Channel	100 Hz
3. Logic Channel	20 Hz
4. CAN Channel	500 Hz 💙



High speed logging

On devices such as the Antares, Badenia and Centaurus with high-speed logging capability, the rates can be set for High Speed inputs. High speed rates are marked 'HS'.

Channel Rates		
Channels 🔺	Logger 0 : Rate Group 0 SS HS	0
Input 01 Voltage		Off ~
Input 02 Voltage		Off
Input 03 Voltage		1 Hz
Input 04 Voltage		2 Hz
Input 05 Voltage		5 Hz
. 2		10 Hz
Input 06 Voltage		20 Hz 50 Hz
Input 07 Voltage		100 Hz
Input 08 Voltage		200 Hz
Input 09 Voltage		500 Hz
Input 10 Voltage		1 kHz
Input 11 Voltage	нѕ	2 kHz
Input 12 Voltage	нs	5 kHz
Input 13 Voltage	HS	10 kHz
Input 14 Voltage	HS	20 kHz



16. Displays overview

The **Displays** node is used to configure what is shown on display devices such as the CDU range and the CCW Mk2 and CCW Mk3. Toolset offers flexible display customisation with possible displays only limited by your imagination.

16.1. Get started with displays

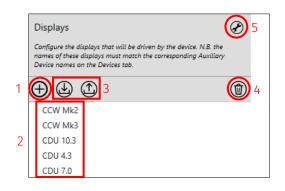
Add a display

When you add a display for the first time you are prompted to select a display theme from the **Display Settings** menu.

Use the 'import' tool to import a new display theme (1). You can use the 'bin' tool to delete a theme (2). Select an overlay to display all active overlays or display the highest priority overlay (see Overlays) (3). You can also select whether an alarm control within a display can override the priority order of alarms on the **Alarms** node (See **Templates – Alarm Controls**) (4).

	Display Settings 🛞
	Theme
	Choose the theme to apply to the displays. This must be configured before you can modify the displays collections.
1	
	Overlays
	Choose which of the active overlays will be displayed.
3	O All active
	 Highest priority
	Alarms
	Choose whether or not the alarm controls used on templates, overlays and pages can override the priority set in the Alarms
	node.
4	Alarm controls override alarm node priority

To add a new display, click the + tool (1), and then select the required display from the dropdown menu (2). You can import and export display configurations between existing setups (3). Use the 'bin' tool to delete unwanted configurations (4). Use the wrench tool to open display settings (5).



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General display configuration

You can name the display configuration (1), enable/disable the display without deleting the display from the setup (2.), and select the type of display (3). For example, if you are only using a CDU 7.0, then this option is not used. However, if a display is configured for a CDU 7.0, but you need to change the display type to a CCW Mk3, select CCW Mk3 from the **Type** menu to change the configuration with no other changes required.

You can set any channels used on a display page to automatically log, if they are not already assigned a logging rate (4). When a display channel is automatically logged, a new logging table is automatically generated, and the display channels are assigned a base logging rate that you cannot edit. This feature is useful for logging display channel items to help when diagnosing display configuration issues.

You can select whether the display configuration is 'hot swappable', which allows you to change the display in a car without re-sending the setup (5). This feature is useful if a steering wheel display such as the CCW Mk3, with different hand grips for different drivers, needs to be swapped during a driver change without the need to re-send the setup.

	General				
1	Name Exa	ample CDU 7.0 Display			
2	Enabled 🗹				
3	Type CDU 7.0 Y				
4	Auto Log 🗹	Automatically log display channels			
5	Hot Swappable 🔽	his allows the display to be changed without needing re-se			

Display brightness channels

You can configure the channels for 'Night Mode', screen brightness, and LED brightness in the **Brightness Channels** section. Use the 'browse' tool to select from the available channels. These channels can be Maths Channel, Logic Channels, CAN channels, Sensors, or Buttons.

Night mode is a 'digital' channel where '0' is night mode OFF and, '1' (or above) is night mode ON.

Screen and LED brightness are controlled by 'Proportion' channels, where no display is '0' and full brightness is '100' (or above).

Brightness Channels			
Configure the channels that will drive the brightness of the screen and LEDs.			
Night Mode	Day Night	<mark></mark>	Non-zero value indicates night mode
Screen	Display Brightness	···	Proportion
LEDs	Led Brightness		Proportion
			-



When multiple pages are added to a display, you must configure buttons to select to move up and down between pages (see **Setups – Buttons**). This can be a digital button input, a rotary switch, or a virtual button via CAN. Click the 'browse' tool to select from the available buttons (1). You can select the button press type (Click, Held, and so on) from the dropdown menus (2).

Buttons			
Configure the	buttons that will drive page navigation.		
Page Up	Page Up Button	Press 🗸	
Page Down	Page Down Button	Press ~	

Display generated channels

When a display is added (such as the CDU10.3 or CCW Mk3), display channels are automatically generated. These channels include device information such as temperatures, software versions, free CPU, and serial number.

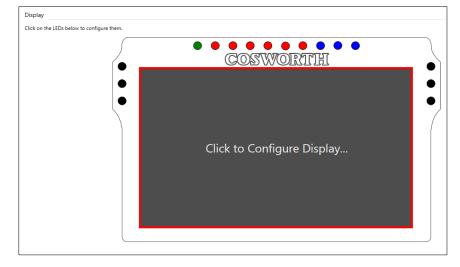
Note: These channels are not automatically logged. You must set logging rates on the **Channel Rate** node to capture and offload these channels.

Channel Rates			
Channels .	ss HS	Logger 0 : Rate Group 0	0
CCWMk3D CPU Temperature			Off
CCWMk3D Device Present			Off
CCWMk3D Display Version Build			Off
CCWMk3D Display Version Major			Off
CCWMk3D Display Version Minor			Off
CCWMk3D Display Version Update			Off
CCWMk3D Free Cpu1			Off
CCWMk3D Free Cpu2			Off
CCWMk3D Module Temperature			Off
CCWMk3D Serial Number			Off
CCWMk3D Total Memory			Off
CCWMk3D Used Memory			Off
CCWMk3D Version Build			Off
CCWMk3D Version Major			Off
CCWMk3D Version Minor			Off
CCWMk3D Version Update			Off

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17. Configure a display



Click on the centre of the display to configure the display.

17.1. Templates

Get started with templates

You must first create a display template. All pages and overlays are derived from templates. It is recommended that you to create an individual template for each page/overlay and to make changes to each template rather than to make changes to individual pages/overlays using the same template. This makes sure that each page reflects its own template to help diagnose any configuration issues.

Click the + tool (1) to add a new template. You can import and export templates between existing setups (2), either individually, or multiply as part of a group. Use the 'duplicate' tool (3) to duplicate a template. This can save time when creating multiple similar templates. Use the 'pencil' tool to edit templates (4). You can delete templates using the 'bin' tool (5).

CDU	7.0					
Page	s C)verla	ys 1	[emplates		
Templat overlays		ine the l	ayout a	nd default pro	operties for pages and	1
\oplus		(\uparrow)	6			
1	2)	З	4		5

Template editor

When a new template is added the template editor window is displayed. You can name the template (1) and add a brief description (2).

1	Name Example Template Manufacturer Status O This is a normal item.
	Descriptions
2	Description Example Template for User Guide

At the top of the template editor window is the template editor menu where you can select functions to configure the template.

Name Example Template Manufacturer Status O This is a normal item.				
Description Example Te Apply Changes X Discard Changes	Hemplate for User Guide	() III 1.0 (?) III 🗆 add	토 프 프 바 Horizontal	Forward Backward
File	Edit	Controls	Align	Arrange
1	2	3	4	5

1. File

- Apply Changes: Saves your changes.
- Discard Changes: Discards your changes.

2. Edit

• Cut/Paste/Copy/Delete: Click on the required option.

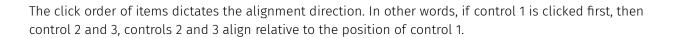
3. Controls

More information about display controls is available in the <u>Controls</u> section.

- Alarm: Use to display an alarm box. This box is only displayed when a specified alarm configured on the Alarms node is active.
- **Bar**: This control is used to display a channel value as bar.
- **Channel**: This control is used to display a channel value in a box.
- **Dial**: This control is used to display a channel value on a dial.
- **Image**: This control is used to display an Image. Takes a channel as an input and can change images based on the channel value.
- **Rectangle**: This control is used to display a rectangle. Useful for more efficient CPU usage compared to using an image. Takes no channel inputs.
- **Textbox**: This control is used to display a textbox. Displays user-defined text.

4. Align

When you select two or more controls (by clicking CTRL and control items), the **Align** menu is displayed. Use these to align controls on the display to the left, right, and centre of another control, and to space controls in the horizontal and vertical directions.



5. Arrange

Used to layer controls and to bring a control forwards and backwards relative to each other on the display.

Controls list and properties

The **Controls** list allows you to visualise all the display controls on a template as a list and select controls here rather than from the template. This allows for easier selection of controls.

Controls	Properties		
ChannelContro	ChannelControl		
TextBlockCont	TextBlockControl		
DynamicImage	DynamicImageControl		
DialControl			
BarControl			
RectangleControl			

When you select a control, you can use the **Properties** menu to configure the control name, position, channel input, units, decimal places, displayed text, colour, size, and so on.

Controls Properties			
Control			
Name ChannelControl			
Layout Top 147 Left 269			
Width 160 Height 60			
Channel			
Source Channel			
Quantity user type Vnit			
Decimal Places 0 Color			
Display Minimum 0 Maximum 1000			
Alarm Minimum 0 Maximum 900 Enabled 🗹			
Filter Period 0 ms			
Filters channel values over the specified period (0 = no filtering).			
Reset to match the display template			
Preview Value Test how the control will appear for specific values			
1000			
Bit-fields			
Configure the bit-fields for this control.			
Bitmask Name Abbr Default Text 🕀			
Appearance			
Background Default ~			
Scale Fixed ~			
Rotate Fixed ~ 0 °			



17.2. Controls

The properties of controls are mainly common between control types, as indicated below.

Alarm

This control is used to display an alarm box. This box is only displayed when a specified alarm configured on the **Alarms** node is active.

Add an alarm control (common)

To add an alarm control, drag and drop the alarm control from the **Controls** section of the **Template Editor** menu onto the page. By default, the box is blank. Click, drag, and drop to move the display. Click the tabs on the edges and corners of the control to resize it.

Click on the alarm control on the display, or from the **Controls** list menu, to edit the control **Properties**.

Control (common)

You can define the name of the control (1) and use the **Layout** options to enter values for the position and size of the control (2).

	Contro					
1	Name	Exampl	eAlarmContro	I		
2	Layout	Тор	287	Left	81	
2		Width	139	Height	44	

Alarms (alarm specific)

You can then add configured alarm channels from the **Alarms** node to the alarm control (1). You can add multiple alarms to the same alarm control. Use the 'bin' tool (2) to delete unwanted alarm controls.

Alarms	
Select the alarms to associate with this control.	
The priority order of the alarms associated with this alarms node.	control is set in the
\oplus	
ECT Alarm	\odot
EQP Alarm	0

Note: The priority order of the displayed alarms is derived from the hierarchy set in on the **Alarms** node, unless the **Alarm control priority overrides alarm node priority** checkbox is selected in the display settings.

Appearance (common)

You can set the control background (1) to one of four options:

- **Default** Black to silver gradient
- None Transparent/No background
- Fixed Select an RGB colour
- Channel Value Dynamic RGB colour driven from the Maths Channel (see Maths Channels Color Control)

You can set the scale (size) of a control to a fixed size specified by the control width and height or use the **Scale** option to set the size with units of proportion (2). The channel value scale resizes the control between its original size (100%) and shrinks the control down to hidden (0%), based on the channel value.

You can set the control to a user-defined fixed angle of rotation or dynamically rotate it through an angle based on a channel value (3). The value must be in units of angle and rotates the control through 0°-360° based on the channel value input.

Note: The channel value input can be in radians and the conversion to degrees takes place automatically.

	Appearance		
1	Background	None v]
2	Scale	Fixed v	
3	Rotate	Fixed v	0 °

Channel / Alarm Properties (common)

The **Alarm Properties** section is where you configure the displayed information for an alarm control. The **Display Property** can either be the Short Text or Long Text configured on the **Alarms** node, or a channel value. (1)

You can set the Alarm Color for a triggered alarm to default (red) or user-defined fixed colour (2).

If 'Channel' is selected as the **Display Property**, then you can configure the channel units, decimals places, minimum and maximum values, and alarm trigger. You can apply a filter to remove noise from the channel that can cause the alarm control to trigger (3).

	Alarm Properties		
	Configure the display settings for the alarms.		
1	Display Property Channel ~		
2	Alarm Color Fixed 🗸		
	Quantity temperature ~ Unit C ~		
	Decimal Places 0 Color		
3	Display Minimum 0 Maximum 150		
	Alarm Minimum 0 Maximum 100 Enabled 🗹		
	Filter Period 10 ms		
	Filters channel values over the specified period (0 = no filtering).		



Label (common)

This is where you configure the label for the control. The **Text** box is used to configure the displayed label for the Control (1). You can insert text manually for a user-defined name or it can use <name> to display the channel name and <unit> to display the unit. Delete all text to display no label.

Use the alignment tools to align the label to the left, right, centre, top, middle, or bottom of the control (2).

The default font size is set to 12. Select **Override** to set the font size manually (3).

The label colour is set to white by default (using the default theme), but you can select the label colour (select fixed and an RGB colour). Select a Maths Channel using colour names (Channel) or a Maths Channel using an RGB value (Channel Value) to dynamically control the label colour (4).

	Label		
1	Text	<name> (<unit>)</unit></name>	~
2	Alignment	E <mark>北</mark> 크 트 파 🛗 山 III	
3	Font Size	12 Override	
4	Color	Fixed Y	

Value (common)

This is where you configure the value of the control.

Use the alignment tools to align the value to the left, right, centre, top, middle, or bottom of the control (1).

The default font size is set to 21. Select **Override** to set the font size manually (2).

The label colour is set to white by default (using the default theme), but you can select the label colour (select fixed and an RGB colour). Select a Maths Channel using colour names (Channel) or a Maths Channel using an RGB value (Channel Value) to dynamically control the label colour (3).

	Value	
1	Alignment	E ま <mark>∃</mark> ☰ 丣 ∺ <mark>山</mark>
2	Font Size	21 Override
3	Color	Default ~

Bar

This control is used to display a channel value as bar.

Appearance (bar specific)

Under the **Appearance** section, you can set the orientation of the bar control to horizontal or vertical (1). The bar control can also be set to be display as a 'fill up to' value. Use the **Fill Relative To** option to set a value. Alternatively, you can configure the bar to display as a floating 'needle' over the current value (2).

	Appearance	
	Background	Default Y
	Scale	Fixed ~
	Rotate	Fixed ~ 0 °
1	Orientation	≓ Iî
	Text	<name> (<unit>)</unit></name>
	Font Size	12 Override
2	Fill Mode	Fill Relative To
-		O Needle
	Label Color	Default ~

Ticks (common)

Here you can configure the tick markers for the channel value. You can select the colour of the ticks from five options: Default, Fixed, Channel, Channel Value, or Gradient (see the <u>Gradient</u> section) (1).

You can select whether the tick mark breakpoints are generated automatically or manually. Select either the 'Automatic' or 'Manual' Generation tick boxes (2).

	Ticks		
1	Color	Default	~
2	Generation	Automatic O	Manual



If automatic generation is selected, you can configure the major and minor breakpoints (1) and select whether to display major and/or minor tick labels (2) The User can rename the automatically generated label names, but cannot change the value, percentage or tick type.

	Ticks						
	Color Gradient ~						
	Generation						
,	Major Increment 1 🗹 Show Major Labels				2		
1	Minor Increme	nt 0.5	Show Minor Labels		2		
	Value -	Percentage	Туре		Label		^
	0	0	Major	~	0.000		
	0.5	5	Minor	~			
	1	10	Major	~	1.000		
	1.5	15	Minor	~			
	2	20	Major	~	2.000		
	2.5	25	Minor	\vee			\sim

If manual generation is selected, the User can configure the tick mark breakpoints. Use the + tool to add tick breakpoints. Reorder them using the reorder tools (2). Use the 'bin' tool to delete unwanted breakpoints (3).

You can select linear incremental proportions or custom incremental proportions (4). Selecting **Linear** prevents the percentage values from being configured. Selecting **Custom** allows you to configure the percentage values (5). You can adjust the tick mark value, type, and label via the text boxes.

	Ticks				
	Color	Gradient	¥		
4	Generation	🔾 Automa	tic 💿 Manual		
	Proportions	🔿 Linear	Custom		
1		2			
	Value -	Percentage	Туре	Label	^
	0	0	Major	× 0.000	
	0.5	5	Minor	~	
	1	10	Major	× 1.000	
	1.5	15	Minor	~	
	2	20	Major	× 2.000	~
L		5			

You can select to 'snap' values from four modes: Off, Closest, Floor, or Ceiling via the check boxes:

- Off Tick mark displays the current channel value
- Closest Tick mark rounds up or down to the nearest whole number
- Floor Tick mark rounds down to the nearest whole number
- **Ceiling** Tick mark rounds up to the nearest whole number

Snap Values	Off	Closest	⊖ Floor	Ceiling	
-------------	-----	---------	---------	---------	--

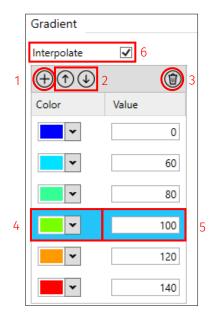
Gradient - Common

The Gradient function is used to set a colour gradient for the control. For example, this is useful for controls displaying a channel like temperature, where the working window can be shown in green, too hot could be shown in red and too cold shown in blue.

Click + to add a new gradient break point (1). Use the reorder tools to reorder breakpoints (2). Use the 'bin' tool to delete gradient breakpoints (3)

Select the colour and value for each breakpoint from the dropdown menu (4) and enter a value in the **Value** boxes. (5)

A colour gradient is displayed on the control as discrete breakpoints. Alternatively, select the **Interpolate** check box to blend colours between breakpoints (6).



Channel

This control is used to display a channel value in a box and supports both standard channel values and bit-fields.

Bit-Fields – Channel specific

To configure a Bit-field to display, select the required input channel in the **Channel** section.

Channel		
Source	Gear_Position	
Quantity user ty	pe · Unit	
Decimal Places	2 Color 💌	
Display Minimum	0 Maximum 1000	
Alarm Minimum	0 Maximum 1000 Enal	oled 🗸
Filter Period	0 <i>ms</i>	
Filters channel val	ies over the specified period (0 = no filterin	ng).

In the **Bit-fields** section, add a new bitmask (1) and set a value for it. This determines which bits are on/being monitored (masking on) (2). You can enter a name and abbreviated name for the bitmask and the default text to be displayed if a bit value input does not have an enumerated status (3). Use the 'bin' tool to delete an unwanted bitmask (4).

Bit-fields						
Configure the bit-fields for this control.						
E	Bitmask	Name	Abbr	Default Text	(+)	1
	255	Gear Pos	Gear	Unknown		4
	2 3					
M	Masked Bits: 00000000 00000000 00000000 11111111					



Next set the enumeration of the bitfield channel. Use the + tool to add a new bitfield entry (1), set the bit value (2), and then define the text displayed when that value is active (3). Use the 'bin' tool to delete a bitfield entry (4).

Bit-fields	Bit-fields						
Configure the b	Configure the bit-fields for this control.						
Bitmask	Name	Abbr	Default Text	\oplus			
255	Gear Pos	Gear	Unknown	٦			
Configure the	entries for the selec	ted bit-fiel	d.				
Masked Bits: 00	0000000 0000000	00000000	1111111				
Value	Text	1					
2 255	R 3	(1) 4					
0	Ν	١					
1	1	١					
2	2	١					
3	3	١					
4	4	١					
5	5	١					
6	6	١					



Dial

This control is used to display a channel value on a dial.

Appearance – Dial specific

The dial sweep angle and sweep radius is configurable. Use the **Min Angle** option to enter the starting angle for the dial start angle (1) and then use the **Max Angle** option to enter the dial end angle (2). Use the **Tick Radius** option to define the position of the tick marks (3.) and the **Tick Label Radius** option to position the labels on the dial (4). If an alarm value and colour is configured under the **Control Channel** section, then alarm regions can be displayed on the dial (5).

ſ	Appearance								
	Configure the general appearance of the dial. N.B. Dimensions are relative to a size of 300x300.								
	Background	Default 🗸							
	Scale	Fixed	v .						
	Rotate	Fixed	V	0 °					
1	Min Angle	-180	Max Angle	90	2				
3	Tick Radius	132.5	Tick Label Radius	105	4				
	Alarm Color	Default	v .						
	Show Alarm Regions 🖌								

Ticks – Dial specific

Tick labels are displayed horizontally by default. Select the **Rotate Labels** check box to force the tick labels to follow the curvature of the dial

Ticks					
Color	Default	ılt v			
Generation	Automa	atic 🔿 Manual			
Major Increment	100	🗹 Show Major La	bels		
Minor Increment	50	✓ Show Minor Labels			
Value · P	ercentage	Туре	Label		
0	0	Major 👋	0		
50	5	Minor	50		
100	10	Major ~	100		
150	15	Minor	150		
200	20	Major	200		
250	25	Minor	250	\sim	
Precision	0	dps - used when co with ticks or the gro			
Snap Values	● Off 〇	Closest 🔿 Floor	Ceiling		
Rotate Labels	✓ Force la	abels to follow the c	urve of the dial		

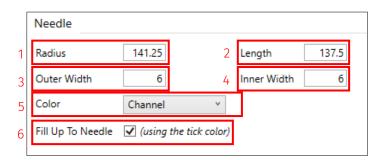


You can configure the needle size. The needle radius is the distance to outer tip of needle (1). The needle length the length from outermost tip to the centre (2). This allows you to configure a short needle that hovers over the ticks, rather than a needle that originates from the dial centre.

The outer width is the width of the needle tip (3) and the inner width is the width at the centremost tip (4).

You can set the needle colour to be fixed or dynamic from a channel or gradient. Select from the following options: Fixed, Channel, Channel Value, or Gradient (5).

Use **The Fill Up To Needle** option to create a unique look for the dial control (6). The fill colour matches the needle colour. For example, you can create a dial control for RPM with a needle that dynamically changes colour from green to red as it approaches the RPM limit. You can use the fill as a shift light to create a unique appearance.



Image

This control is used to display an Image. It takes a channel as an input and changes images based on the channel value. For example, battery voltage status can be displayed as an image driven from a battery status channel. Images can be used to make more interesting display backgrounds and to create 3D effects.





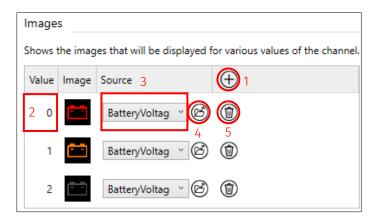
Images - Image specific

Select the channel to drive the image selection in the channel under the **Channel** section

Channel		
Source	Battery Status	

In the **Images** section use the + tool to add a new image entry (1). Set the channel value for the required image (2), and then select the image to be displayed (3). A range of default images is available to select from the dropdown menu, but you can import your own .PNG and .GIF images using the browse tool (4). Use the 'bin' tool to delete an image entry (5).

Allow Sending: When this option is selected, you can send an image on the **Actions** tab to replace the current image.



Rectangle

This control is used to display a rectangle. Rectangles can create coloured borders, banners, and backgrounds since they are more efficient on CPU usage compared to using an image. The Rectangle control requires no channel inputs.

Appearance – Rectangle specific

The rectangle background (1) can be set to one of four options: Default, Fixed, Channel or Channel Value

- **Default** Transparent/No background
- Fixed Select an RGB colour
- **Channel** Dynamic RGB colour driven from a Maths Channel with named colours (see Maths Channels Color Control)
- **Channel Value** Dynamic RGB colour driven from Maths Channel with RGB values (see Maths Channels Color Control)

The border thickness (2) and border colour can also be selected as Default, Fixed, Channel, or Channel Value (3).

The corners of the rectangle can be radiused. Configure the radius using the X and Y boxes (4).

[Appearance				
1	Background	Fixed	Ŷ		•
	Scale	Fixed			
	Rotate	Fixed		0	0
2	Border Thickness	20			
3	Border Color	Fixed	v		•
,	Corner Radius X	20			
4	Corner Radius Y	20			

For example, you can use a rectangle control for a warning overlay to make the warning stand out for the driver.

	OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO	
0		\sim

<u>Text</u>

The **Text** control is used to display a textbox with your defined text. This allows for messages and instructions to be displayed in the content box (1). The colour of the text can be to one of four options: Default, Fixed, Channel or Channel Value (2).

	Content	
1	Text	Switch to Engine Map 2
2	Color	Fixed ~

You can change the font size (1), set the alignment to left, centre, right, or justify (2) and make the text bold (3) or italic (4).

	Appearance	
	Scale	Fixed Y
	Rotate	Fixed Y 0
1	Font Size	24
2	Text Alignment	는 긬 <mark>#</mark> =
3	Bold	
4	Italic	

17.3. Save a template

You must save configuration changes for a template before you can add the template to a page. Use the 'Apply Changes' tool to save any changes and the 'Discard Changes' tool to discard any changes.

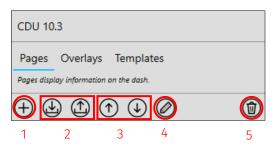
You must apply any changes to a template before you can send the setup. If a setup has unapplied changes an error is raised and displayed in the **Errors** menu.

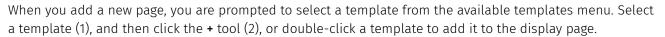
17.4. Add a page

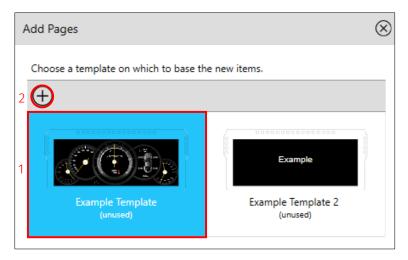
To add a new display page, navigate to the **Pages** tab and click the **+** button (1). Use the 'import' and export' tools to import and export pages from existing setups (2). You can import and export multiple display pages as groups for convenience.

Use the 'reorder' tools to sort the ordering of pages (3). The page hierarchy in the dash is ordered with the highest priority page at the top of the list and the lowest priority page at the bottom. When a new page is added, it is placed at the bottom of the list and lowest in the hierarchy. Use the 'reorder' tools to rearrange the list of pages to change the relative position of each individual page within the overall display hierarchy.

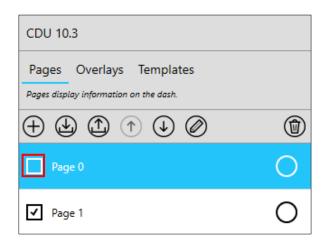
Use the 'pencil' tool to open the display page properties (4) (see Display properties and qualifiers). Use the 'bin' tool to delete an unwanted display page (5).







When you add pages, the tick boxes next to each page in the **Pages** menu allow you to enable or disable pages without having to delete the page from the setup. Select the tick box the enable or disable the display page. Any page that is unselected is not displayed until the setup is re-sent with the 'Enable' box selected.



Display properties and qualifiers

In the **Page Properties** menu, you can name the page (1) and add an optional description (2). You can also enable or disable a page (3).

Click the 'pencil' tool to change the template for the page (4).

You can define qualifiers for each page to determine when the page is made available to view on the display. If the qualifying conditions are met, the page is made available to view. Otherwise, the page is hidden and is not available to be displayed.

If multiple pages are enabled the device decides which page to display by first choosing which pages have their qualifying conditions met and then displaying the highest page in the hierarchy.



Click the + tool to add a new qualifier (5). You can add multiple qualifiers can be added. Select the channel type (bit-field, channel, or strategy) to configure the qualifying conditions from the available channels and define the condition to display when true (6). You can use the 'bin' tool to delete unwanted qualifiers (7).

	Pa	ge Properties 🛞		
1	N	ame Safety Car Page		
2	0	escription Display When Safety Car Deployed		
3	E	abled 🔽		
	т	mplate Example Template 🕢 4		
		Nanufacturer Status O This is a normal item. Display Qualifiers		
Manufacturer Status Manufacturer Status This is a normal item. Display Qualifiers Configure the qualifiers that determine when the page is available on the CDU 10.3. 5 Bit-field Channel Safety Car				
	 Description Display When Safety Car Deployed Enabled Image Template Example Template Image 4 Manufacturer Status Manufacturer Status Image 7 This is a normal item. Display Qualifiers Configure the qualifiers that determine when the page is available on the CDU 10.3. Template Template Templa			
	6	Bit-field Channel Y Safety Car 😳		
		Safety Car × is × Deployed ×		

17.5. Add an overlay

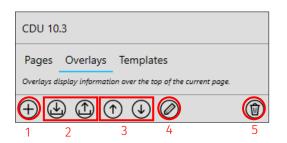
Overlays are like a page but can be used to display information over the top of the current displayed page. Unlike pages, multiple overlays can be displayed at the same time.

Overlays are used to create small, temporary items such as dialog boxes, displaying text instructions such as 'Change engine map' or information such as 'Pit Limiter Active'. Overlays are created and added in the same way as pages by using templates.

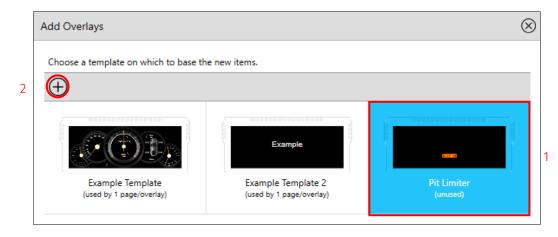
To add a new overlay, navigate to the Overlays tab and click the **+** button (1.). Use the 'import' and 'export' tools to import or export overlays from existing setups using the import and export tools (2). You can import and export overlays as groups for more efficient setup changes.

Use the 'reorder' tools to sort the order of overlays (3). The page hierarchy in the dash is ordered with the highest priority page at the top of the list and the lowest priority page at the bottom. When a new overlay is added, it is placed at the bottom of the list and lowest in the hierarchy. You can rearrange the list of overlays to change their relative positions in the overall display hierarchy with the 'reorder' tools.

Use the 'pencil' tool to open **Overlay Properties** (4) (see Overlay properties, qualifiers and alarms). Use the 'bin' tool to delete unwanted overlays (5).



When a new overlay is added, you are prompted to select a template from the available templates menu. Click a template (1), and then click the + tool (2), or simply double-click a template, to add the template to the **Overlay** page.



When overlays are added, the tick boxes next to each page in the overlays **Pages** menu allow you to quickly enable or disable overlays from a setup without having to delete the entire overlay. Select the box to enable or disable the overlay. Any unselected overlay is not displayed until the setup is re-sent with the 'Enable' box selected.

CDU 10.3	
Pages Overlays Templates	
Overlays display information over the top of the current page.	
\oplus $$ $$ $$	٦
Overlay 0	0
✓ Overlay 1	Ο



Overlay properties, qualifiers and alarms

In the **Overlay Properties** menu, you can name the overlay (1) and add an optional description (2). You can also enable or disable the overlay from this menu (3). Click the 'pencil' tool to change the template used for the overlay (4).

You can define qualifiers for each overlay to determine when the page is made available to view on the display. If the qualifying conditions are met, the page is available to view. Otherwise, the page is hidden and is not displayed.

You can also use alarms to drive overlays. When an alarm is triggered, the overlay is displayed.

Select Qualifiers or Alarms for the required overlay mode (4).

All overlays with their qualifying conditions or alarm triggers active are displayed.

Click the + tool to add a new qualifier or alarm (5). You can add multiple qualifiers or alarms. Select the channel type (bit-field, channel or strategy), by browsing from the available channels and define the condition to display when true (6). If using alarms, select the required alarm(s) from the 'browse' menu. You can delete unwanted qualifiers with the 'bin' tool (7).

	0	verlay Pro	perties						\otimes
1	N	lame	Pit Limiter						
2	D	escription	Overlay Act	ive Whe	n Pit Lim	iter A	ctive		
3	E	nabled	✓						
	Te	emplate	Pit Limiter						
		Manufact	turer Status						
	1	Manufactur	rer Status 🤇	This i	s a norma	ıl item.			
		Mode							
4		Select whe	ther qualifier	s or alar	ms shou	ld be	used to drive	e this overla	y.
		Qualifie	ers 🔿 Alarm	s					
		Qualifiers							
		Configure	the qualifiers	that def	ermine	when	the overlay i	s visible.	_
	5	\oplus) 7
	6	Bit-fiel	d Channel	v	Pit Lin	nit But	ton	\odot	
	Ŭ	Raw		Ŷ	is	~	Active	Ý	



18. ECU

The **ECU** node is available in **Setups** for Cosworth ECU devices running CHP 2 (Metadata 3+). The **ECU** node is the interface for the exchange of channels between the ECU side (also known as the Pectel side) of the device and the logger side (also known as the Common Hardware Platform (CHP) side).

18.1. ECU channels

The **ECU Channels** menu is prepopulated with all the channels from the ECU side in the list of channels to be exchanged in the setup metadata. Click on the list of channels in the **ECU Channels** menu (1) to see a brief description about the channel (2). The setup owner (Manufacturer) can select whether to apply channel protection (see Setup Locking – Channel Protection) (3). For convenience, there is the option to apply and remove channel protection from all ECU channels (4).

Note - Some channels may automatically be protected from an unlicensed user in the setup metadata. This is because the Pectel produced metadata contains protection at the point of build.

ECU ECU Channels ECU Channel Mapping		
Protect all Remove protection from all ACIN_switch9 ACIN_switch10	4 �^ �	ACT Description Air Temperature Quantity temperature 2 Data Type F32
ACT 1 ACT_Offset	0	Protection Protecting the channel prevents users without an appropriate license from viewing channel data. Protect Remove protection
ACT_rocDeltaCnt	0	
ACT2_Offset	v	



18.2. ECU channel mapping

The **ECU Channels Mapping** menu is prepopulated with all the channels that are produced from the control side (ECU) and can then be logged on the CHP side. This list contains Autocoding actuators for the ECU side, which enable control over ECU applications such as CalPots.

You can configure which CHP channel is mapped to be exchanged to the ECU side. Click on the list of channels in the **ECU Channels Mapping** menu (1), to see a brief description about the channel (2). To select a channel to be mapped, click the 'browse' icon (3), and then select an available channel from the Channels list (4).

ECU	
ECU Channels ECU Channel Mapping	
ACOUT_ABV_Demand	ACOUT_CalPot
ACOUT_alsDisable	Description ACOUT CalPot 2
ACOUT_Beacon	Channel Mapping
ACOUT_BumpStart	Optionally select a source channel to control this ECU channel. If a channel is selected its values will be supplied to the ECU. Source channel
ACOUT_CalPot 1	Choose a Channel – 🗆 X
ACOUT_CalPotB	ACOUT_BumpStart
ACOUT_CalPotC	ACOUT_CalPotC
ACOUT_CalPotD	System Channel
ACOUT_CalPotE	Show All



19. Fuelling

The fuelling node is used to as an interface to configure fuel usage calculations and fuel level reset events. This node is particularly useful for configuring setups for endurance racing vehicles where it is important to monitor and analyse fuel usage. The fuelling node automatically generates fuel usage channels including:

- Fuel Consumption
- Fuel Lap Economy
- Fuel Level
- Fuel Remaining
- Fuel Used Last Lap

19.1. Configure fuel usage channels

Select the **Enable** check box to enable the **Fuelling** node (1), and then select the **Fuel Count Channel** (2). For example, this can be a channel from the ECU via ECU node, CAN streams, or a Math Channel.

Note: You must configure the fuel count channel with Units of Volume.

You can apply a fuel count adjustment factor to convert the units of volume to cubic metres (3). You must also specify the vehicle fuel tank volume (4).

Finally, select the fuel tank direction (**Down** or *Up*) (5):

- **Down** The generated fuel remaining channel provides the amount of fuel left in the tank.
- Up The generated fuel remaining channel provides the amount of fuel used since the last fill.

	Fuelling		
1	Enabled	Check to include fuelling in the setup sent to the device.	
	Inputs		
2	Fuel Count Channel	fuel_used	
3	Fuel Count Adjustment		1.000
4	Fuel Tank Capacity	120.000	ltr 👻
5	Fuel Tank Direction	 Down - the Fuel Remaining generated channel provides the amount of fuel left in the tank. Up - the Fuel Remaining generated channel provides the amount of fuel used since the last tank fill. 	



19.2. Configure fuel level reset events

To reset the generated fuel used channels to 0, you can configure two reset events (1). These can be an event (see Setups – System Status) or a button (see Setups – Buttons). The fill tank event is used to reset the generated fuel remaining channel to the maximum fuel tank capacity configured in the inputs, and can be either an event or a button trigger (2).

	Events	
	Reset Fuel Used 1	Select the button or event that resets the Fuel Used 1 channel to 0 (Fuel Used 2 and Fuel Remaining are not affected).
		Event Fuel Stop
		O Button 😳 🖲 Press 💿 Release 💿 Click 💿 Hold 💿 Long Hold
'	Reset Fuel Used 2	Select the button or event that resets the Fuel Used 2 channel to 0 (Fuel Used 1 and Fuel Remaining are not affected).
		○ _{Event} …
		● Button Fuel Level Reset
ſ	Fill Tank	Select the button or event that resets the Fuel Remaining channel to the Tank Capacity (Fuel Used 1 and Fuel Used 2 are not affected).
2		Event Fuel Stop
		O Button 💮 💿 Press 💿 Release 💿 Click 💿 Hold 💿 Long Hold

19.3. Generated channels

When you enable the **Fuelling** node, eight channels are automatically generated that you can use to monitor and analyse fuel usage. The channel rates for these generated channels must be set on the **Channel Rates** node (see Setups – Channel Rates) to be logged and displayed in the offloaded data.

Channel Rates				
Channels .	Logger 0 : Rate Group 0	0		
Fuel Consumption		Off		
Fuel Lap Economy		Off		
Fuel Level Reset Button		Off		
Fuel Predicted Laps		Off		
Fuel Remaining		Off		
Fuel Used 1		Off		
Fuel Used 2				
Fuel Used Last Lap		Off		



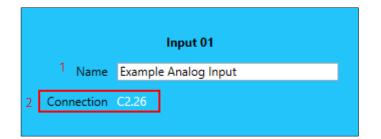
20. Hardware settings

The **Hardware Settings** node allows you to configure the settings for the hardware on the local device as well as any remote/secondary devices, such as an SJU.

20.1. Analog inputs

You can configure the name of analog inputs on the **Hardware Settings** node (1). Underneath each input label is a connection identifier in the format 'CX.Y', where X and Y are values that identify the connector and the pin of the device, respectively (2).

Hardware Settings	Local (Badenia 5) - Analog Inputs						
Configure the hardware settings for the local and any remote devices. The order of any enabled remote devices must match the order in	Configure the analog inputs for the device.						
which they are connected to the device or they will not function.	Input 01	Input 02	Input 03	Input 04			
	Name Example Analog Input	Name Input 02	Name Input 03	Name Input 04			
▲ Local Badenia 5	Connection C2.26	Connection C2.12	Connection C2.25	Connection C2.11			
Analog Inputs (40)	Input 05	Input 06	Input 07	Input 08			
CAN Ports (8)	Name Input 05	Name Input 06	Name Input 07	Name Input 08			
Digital Inputs (10)	Connection C2.9	Connection C2.10	Connection C2.8	Connection C2.24			
Digital PWM Outputs (4)							
Excitations (10)	Input 09 Name Input 09	Input 10 Name Input 10	Input 11 Name Input 11	Input 12 Name Input 12			
LIN Ports (2)	Connection C2.7	Connection C2.23	Connection C2.22	Connection C2.6			
Serial Ports (2)							
	Input 13	Input 14	Input 15	Input 16			
	Name Input 13	Name Input 14	Name Input 15	Name Input 16			
	Connection C2.21	Connection C2.5	Connection C2.20	Connection C2.4			

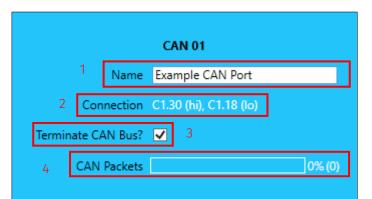




20.2. CAN ports

You can configure the name of the CAN ports on the **Hardware Settings** node (1). Underneath each CAN port label is a connection identifier in the format 'CX.Y', where X and Y are values that identify the connector and the pin of the device respectively (2). You can enable a selectable 120 Ohm CAN termination (3). The bar display shows the consumed bandwidth of the CAN port (4). This consumed bandwidth only represents the bandwidth allocation that Toolset can identify (configured in the CAN streams). Other messages on the bus are only visible to an external bus listener for the external devices.

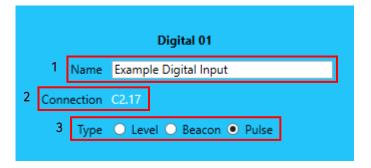






20.3. Digital inputs

You can configure the name of digital inputs on the **Hardware Settings** node (1). Underneath each input label is a connection identifier in the format 'CX.Y', where X and Y are values that identify the connector and the pin of the device respectively (2). There are three digital input types (**Level**, **Beacon**, and **Pulse**) selected from the **Type** check boxes (3).



Types of digital inputs

When you configure the **Hardware** settings of a digital input, you can select from three options based on the application type. You can define sensors as shown below, but within the **Hardware** settings you can also configure the debug channels created.

Level: Used for simple, digital push button, On/Off inputs. A standard configuration that allows you to generate channels to view the output level of the digital sensor.

Channel Rates		
Channels 🔺	Logger 0 : Rate Group 0 SS	0
Digital 01		Off

Beacon: Used when you configure an end of lap timing beacon (see **Beacons**). You can generate multiple channels for debug from the digital pulse duration and start time. This is useful when you use an IR beacon to detect the start finish line, as a standard pulse time of ~12ms is usually required.

Channel Rates			
Channels 🔺	Logger 0 : Rate Group 0 SS HS	0	
Digital 01 Count		Off	
Digital 01 Pulse Duration		Off	
Digital 01 Signal Level		Off	
Digital 01 Start Time		Off	

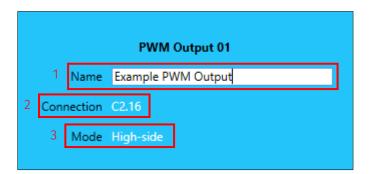
Pulse: Used when you configure rotational or DF11i wheel speed inputs where the number of pulses correlates to the number of revolutions. This generates frequency channels for rotational sensors and the time between teeth.

Channel Rates		
Channels *	Logger 0 : Rate	e Group 0
Digital 01		Off
Digital 01 Count		Off
Digital 01 Last Edge Time		Off

20.4. Digital PWM outputs



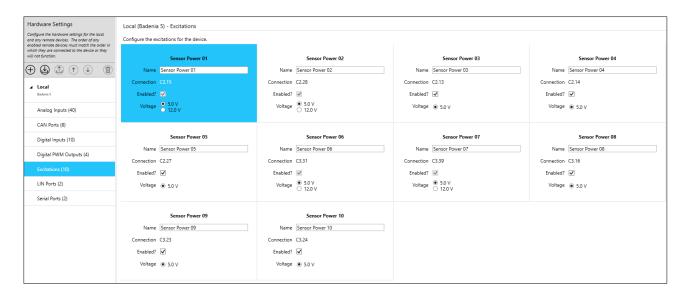
For devices with Digital PWM Output capability, you can configure the name of the Digital PWM Outputs on the **Hardware Settings** node (1.). Underneath each PWM Output label is a connection identifier in the format 'CX.Y', where X and Y are values that identify the connector and the pin of the device respectively (2). The PWM output **Mode** (high-side or low-side) is displayed (3).

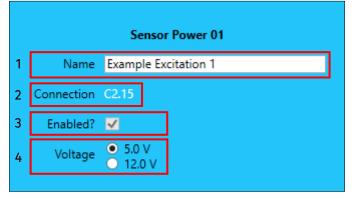




20.5. Excitations

You can configure the name of power supplies (known as 'excitations') on the **Hardware Settings** node (1). Underneath each **Excitation** label is a connection identifier in the format 'CX.Y', where X and Y are values that identify the connector and the pin of the device, respectively (2). Select the **Enabled?** checkbox (3) to enable or disable the excitation by selecting the Some excitations offer variable output voltage capability. For these variable excitations you can click the required checkbox to set the output voltage (4).







20.6. LIN ports

You can configure the name of the LIN ports on the **Hardware Settings** node (1). Underneath each LIN port label is a connection identifier in the format 'CX.Y', where X and Y are values that identify the connector and the pin of the device respectively (2).

Hardware Settings Configure the hardware settings for the local and any remote devices. The order of any enabled remote devices must match the order in which they are connected to the device or they will not function.	Local (Badenia 5) - LIN Ports Configure the LIN ports for the device.	LIN 02
Local Badenia 5	1 Name LIN 01 2 Connection C1.10	Name LIN 02 Connection C1.9
Analog Inputs (40) CAN Ports (8)		
Digital Inputs (10) Digital PWM Outputs (4) Excitations (10)		
LIN Ports (2) Serial Ports (2)		

20.7. Serial Ports

On the **Hardware Settings** node, underneath each **Serial Port** label is a connection identifier in the format 'CX.Y', where X and Y are values that identify the connector and the pin of the device, respectively (1). You can configure the names of the **Serial Rx** and **Tx Ports** (2).

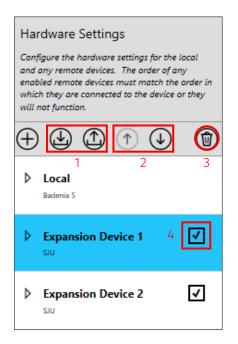
Hardware Settings Configure the hardware settings for the local	Local (Badenia 5) - Serial Ports		
and any remote devices. The order of any enabled remote devices must match the order in which they are connected to the device or they will not function.	Configure the serial ports for the device. Serial 01	Serial 02	
	1 Connection C1.37 (nx), C1.36 (tx)	Connection C1.31 (rx), C1.32 (tx)	
▲ Local	Interface 💿 RS232	Interface 💿 RS232	
Badenia S	2 Serial 01 (Rx) Serial 01 (Rx)	Serial 02 (Rx) Serial 02 (Rx)	
Analog Inputs (40)	Serial 01 (Tx) Serial 01 (Tx)	Serial 02 (Tx) Serial 02 (Tx)	
CAN Ports (8)			
Digital Inputs (10)			
Digital PWM Outputs (4)			
Excitations (10)			
LIN Ports (2)			
Serial Ports (2)			

20.8. Configure an EtherCat expansion device

To add an EtherCat expansion device such as the EAI32 or SJU click the + button (1), and then select the device from the dropdown menu (2)

	Hardware Settings Configure the hardware settings for the local and any remote devices. The order of any enabled remote devices must match the order in which they are connected to the device or they will not function.		
1			
	EAI32		
	ESG16-4-4		
2	ESG16-4-8	puts (40)	
	ESG16-8-8		
	SJU	(8)	
	Digital Inputs (10)		

You can add multiple expansion devices and import and export previously configured expansion devices between existing setups (1). The order of the devices in the list must match the order in which they are physically connected on the EtherCat bus. Use the reorder tools (2) to change the order of the devices in the list up or down (2). Use the 'bin' option (3) to delete expansion devices from the list. If an expansion device is removed from the vehicle but you do not want to delete the device configuration from the list, deselect the 'enable' box (4).



The inputs and outputs for the expansion device appear in **Hardware Settings** in the same format and are configured in the same way as the local device hardware settings.

Hardware Settings	SJU 0 (SJU) - Excitations			
Configure the hardware settings for the local and any remote devices. The order of any	Configure the excitations for the device.			
enabled remote devices must match the order in which they are connected to the device or they will not function.	SJU 0 - Exc 01	SJU 0 - Exc 02	SJU 0 - Exc 03	SJU 0 - Exc 04
	Name SJU 0 - Exc 01	Name SJU 0 - Exc 02	Name SJU 0 - Exc 03	Name SJU 0 - Exc 04
▲ Local Badenia S	Connection Yellow 16 Off Voltage 5.00V	Connection Yellow 9 Off Voltage 5.00V	Connection Yellow 8 © Off Voltage 0500V	Connection Yellow 3 Off Voltage 5.00V
Analog Inputs (40)	0 12.00V	0 12.00V	0 12.00V	○ 12.00V
CAN Ports (8)	SJU 0 - Exc 05	SJU 0 - Exc 06	SJU 0 - Exc 07	SJU 0 - Exc 08
Digital Inputs (10)	Name SJU 0 - Exc 05	Name SJU 0 - Exc 06	Name SJU 0 - Exc 07	Name SJU 0 - Exc 08
Digital PWM Outputs (4)	Connection Yellow 54	Connection Yellow 55	Connection Yellow 51	Connection Yellow 52
Excitations (10)	Voltage	Voltage	Voltage	Voltage
LIN Ports (2)				
Serial Ports (2)	SJU 0 - Exc 09	SJU 0 - Exc 10	SJU 0 - Exc 11	SJU 0 - Exc 12
▲ SJU 0	Name SJU 0 - Exc 09 Connection Yellow 46	Name SJU 0 - Exc 10 Connection Yellow 39	Name SJU 0 - Exc 11 Connection Yellow 31	Name SJU 0 - Exc 12 Connection Yellow 24
Analog Inputs (24)	Voltage	Voltage () 5.00V	Voltage	Voltage
Digital Inputs (4)	Totage @ 500T	totage () stort	rolage () soor	totage C Slott
Digital PWM Outputs (6)				
Excitations (12)				

Note: When an expansion device is enabled, the expansion device channels are automatically populated on the **Channel Rates** node, but the logging rates must be set.

Channel Rates		
Channels -	Logger 0 : Rate Group 0 SS HS	0
Expansion Device 1 - D 01		5 Hz 🗵
Expansion Device 1 - D 02		Off
Expansion Device 1 - D 03		1 Hz
Expansion Device 1 - D 04		2 Hz
Expansion Device 1 - D Out 01 Current		5 Hz 10 Hz
Expansion Device 1 - D Out 01 Voltage		20 Hz
Expansion Device 1 - D Out 02 Current		50 Hz
· Expansion Device 1 - D Out 02 Voltage		100 Hz
Expansion Device 1 - D Out 03 Current		200 Hz
		500 Hz
Expansion Device 1 - D Out 03 Voltage		1 kHz
Expansion Device 1 - D Out 04 Current		Off



21. Latching

The **Latching** node in Toolset setups allows a device to retain a value over a power cycle after a specified event. You can create these events on the **System Status** node or use default events that are calculated on the device.

21.1. Latching values

Generating custom events

You can create custom events on the System Status node. Click + to create a custom event (1). You can import and export custom events between existing setups using the import and export tools (2). You can delete custom events with the 'bin' tool. To disable a custom vvent without deleting it from the setup, deselect the 'enable' box (4).

System Status			
Moving			
Speed Channel Spee	ed		
Threshold	20.0		kph *
Guard Times:			
Start after		1.00 sec	conds
Stop after		5.00 sec	conds
Custom 2			
	3		
4 System Status			

Multiple custom events can be added. In the example below, a custom event is created based on a Maths channel counter, so that repeatable events are present in the data (that is every 10 seconds). The channel used 'Latching Counter', simply generates value between 0-10 (1). On a vehicle, other events can be used such as 'Drive Out' or 'Car Halt', if more applicable.

General					
Configure the b	pasic properties that define this	math channel.			
Name	Latching Counter	Quantity/Unit	user type v]	
		Data Type	F32 ~		
Comment					
Manufacturer S	Status O This is a normal item.				
Protection					
Protecting the	channel prevents users without	an appropriate dongle f	rom viewing channel data.		
Protect	Remove protection				
	0				
Equation					
1 ·	on that determines the value of	this math channel.			
Edit the equation	on that determines the value of hoose (@a0 < 10, @a0 +				Function: "@a0"

You can name the custom event (1) and add an optional description for the event (2). You can also name the bit-field definition states, apply a colour for each state (3), and define a trigger condition (4).

Custom				
$\oplus $ $\oplus $ $\oplus $	٦	System State		
Latch Event		Name	Latch Event	1
		Enabled	\checkmark	
🧭 Choose a Channel 🛛 —		Description	Example Latch Event for User Guide	2
lap_time_sim	^			
Latching Counter		Definition		
LED 1	~			
start typing to filter the selection	\otimes	Start in a state named	Default	
Sourced from Logic Channels node.		Change to a state named	Set when the followi	ng condition becomes true:
Show All		change to a state named		
Show Diagnostic Items	K 🗙 Cancel		Channel	is ~ 10.000
		4		

You need to supply a name for the 'transition' between 'Default to Set' and 'Set to 'Default'. The events channels are then generated.

In the example below, when the latching counter reaches 10, an event called 'Set Latch' is generated when the transition from 'Default to Set' occurs as the latch conditions become true. Conversely, an event called

Transition: Default to Set		
Optionally, define an event to be raised when transitioning to Set		
Name	Set Latch	
Description	When Latching Counter = 10	
Transition: Set to Default		
Optionally, define an event to	o be raised when transitioning to Default	
Name	Reset Latch	
Description	When Latching Counter ≠ 10	
beschption	When Eatening counter # 10	

'Reset Latch' is generated when the latch conditions become untrue as the transitions from 'Set to Default' occurs.

Add a latching channel

Once an event is being generated, you can create the latching channel. On the **Latching** node, click the **+** tool (1). Use the import and export tools (2) to import and export latching channels between existing setups. Use the 'bin' tool (3) to delete latching channels.

Latching	Ð
Latched channels provide a method of persi over a power cycle. When the trigger occurs input's value.	
1 2	3



You can define a name for the latching channel (1) and add an optional description of it (2). Click the **Browse** menu to select an input channel for the latch trigger from the available channels (3). Select the required trigger (Button or Event) from the dropdown menu (4). From the **Browse** menu, select the latching event from the available events (5).

	General		
	Define the properties of this channel latch.		
1	Name	Latching Example	
2	Description	Example latched channel for User Guide	
		Manufacturer Status O This is a normal item.	
	Latch Trigger		
	Configure the trigger that will cause the latch to be updated to the input's value.		
3	Input Late	ching Counter	
4	Trigger Eve	ent Y Set Latch 😳 5	

The latched value is updated at a maximum rate of 1Hz. Once the device is power cycled the non-volatile memory checks that the channel is equal to the latched channel value. If these values are different then the channel retrieves the latched channel value.

When the device is power cycled, the latching node retains the last latched value for each defined channel.

The Latch Status is a bit-field channel with the following definitions.



Note: The current max number of latched channels is 42. The logging rate is capped at 1hz, but the calculation rate is driven from the source channel.



22. LED configuration

The **LED Configuration** node is used to configure the LEDs which are part of the Cosworth range of displays and steering wheels. You can use LEDs to alert drivers to system alarms, to display vehicle information like battery state of charge, or to feedback information like if turn signals are on.

22.1. Add an LED configuration

Click the + button, to open the **LED Configuration** window, and then select the required LED cluster.

LED Configuration Define the LED configurations that are used by the device.				
Add Configuration				
Add LED Configuration				\otimes
Choose the type of LED cluster for which to create a configuration. It will not be possible to change t	his after the configuration has been created.			
\oplus				
CCW M42 Alarm LEDs	nay LEDs CCW Mk3 Left Body LEDs	CDU Alarm LEDs CDU	J 7.0 Alarm LEDs	CDU 10.3 Alarm LEDs

Enter a name and optional description for the configuration, and then select the **Default Colors** to be used if none of the conditions for the patterns are met.

General	
Configure th	e name for this configurati
Name	CDU 10.3 Alarm LEDs
Туре	CDU 10.3 Alarm LEDs
Description	
Default Co	lors
	s to be used in the case th
Name Co	olor Brightness (%)
Led 1	100
Led 2	100
Led 3	
	100
Led 4	100
Led 4	
	100
Led 5	100

22.2. Import and export an LED configuration

You can import and	ៅ export an LED	configuration	between	setups,	either	individually	or as	multiples	within a
group.									

LED Configuration Define the LED configurations that are used by the device.	
Declip D	1

22.3. Configure display LEDs

When you select a display device, click + to add a new LED configuration.

LED Configuration	
Define the LED configurations that are used by the device.	General
+ & D	Name Pattern 0
CDU 10.3 Alarm LEDs	Description
Define the prioritized list of patterns for the selected configuration. When	
more than one pattern is active, each LED is driven by the highest priority pattern for which that LED has been configured.	Enabled 🗹
	Flash 2 on for 0.5 s off for 0.5 s
	Primary Color / Brightness 100 %
	Secondary Color / Brightness 100 %
	Manufacturer Status
	_
	Manufacturer Status O Tris is a normal item.
	LEDs
	Click on the LEDs below to toggle which are driven by this pattern and the color mode to use when flashing.
	Conditions
	The pattern will become active when any one of the following conditions has been met.
	Add Condition
	Type Channel V
	Condition vertype v = v 0.000

Set up an LED configuration, as shown below:

- 1. Enter the name of the LED configuration.
- 2. Enter an optional description for the LED configuration.
- 3. Select to either enable or disable the configuration in the setup.
- 4. Configure the LEDs to flash, and then set the flash rate.
- 5. Configure the LED colours.
- 6. Click the LEDs to configure the LEDs that are active on the display. When you select the **Flash** option, you can click the LED to select whether it is active on the primary or secondary flash.
- 7. Configure the conditions to drive the LEDs Alarm, Bit-field channel, Channel. or Strategy. You can add multiple conditions.

LED Configuration	General		
Define the LED configurations that are used by the device.	Name	Alarm Oil Pres, Low	
$\oplus \oplus \oplus$	Description	LED alert when Alarm, Oil Pres_Low is ON	
CDU 10.3 Alarm LEDs			
Define the prioritized list of patterns for the selected configuration. more than one pattern is active, each LED is driven by the highest priority pattern for which that LED has been configured.	Enabled	2	
	Flash	✓ on for 0.5 s off for 0.5 s	
Alarm Oil Pres Low	Primary Color / Brightness	100 %	
	Secondary Color / Brightne	ss 100 %	
	Manufacturer Status		
	Manufacturer Status	This is a normal item.	
	LEDs		
	Click on the LEDs below to t	oggle which are driven by this pattern and the color mode to use when flashing.	
		(\otimes)	
	Conditions		
	Conditions	ive when any one of the following conditions has been met.	
	Add Condition		٦
	Type Alarm		
	Condition Alarm_Oil_Pres	Lew Stagerd	

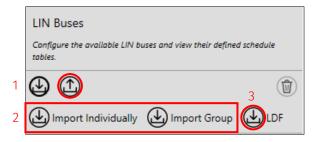


23. LIN

All Cosworth LIN-capable devices have LIN functionality to allow you to fully configure LIN buses and device behaviour through Toolset. The **Configurable LIN** node is compatible with LIN 2.0 and higher versions which require an *.ldf* file which matches this standard.

23.1. Configure a LIN bus

To configure a LIN bus, click import (1), and then select a Toolset Library File (*.tlf*) (2) or LIN Description File (*.ldf*) (3). You can use using the import and export tools (1 & 4) to import and export LIN buses between existing setups as a *.tlf* file.



If the LDF import tool is enabled, you can browse to the file from any location on the PC (1).

	mport noose the LDF file to import.	
File		

When you select the *.ldf* or *.tlf* file, Toolset checks the file to make sure it adheres to the LIN standard. Critical errors are displayed with their line position within the LDF. You must correct the errors to be able to import the LDF.

LDF Import Analysis Results Shows the results of analyzing the LDF file.
The following errors were produced during analysis: Failed to import LDF file 'C-\Users\bperenye\Documents\00 - Work\01 Internal Projects\CLU\Configurabel LIN\SCM_L1_CGEA13wipersHUD11Mar16.ldf. Parse error: 'Line 218: Error response signals must be 1-bit'.
It will not be possible to import this file. Please correct the error(s) and try again.

The LDF analysis also shows any warnings. Unlike errors, warnings do not stop the file from being imported into the setup, but can result in inconsistencies with the channel.

LDF Import Analysis Results Shows the results of analyzing the LDF file.	
The following warnings were produced during analysis:	
Signal name 'SCMSpeedDependentEnable_Cfg' exceeds 25 characters and will be truncated.	
Signal name 'SCMNeutralDisableAutoWipe_Cfg' exceeds 25 characters and will be truncated.	
Signal name 'SCMInit_AutoWipeOnReset_Cfg' exceeds 25 characters and will be truncated.	
Signal name 'SCMR/WipeLiftgateAjarEnable_Cfg' exceeds 25 characters and will be truncated.	
Signal name 'SCMTransmissionShifterStatus' exceeds 25 characters and will be truncated.	
Signal name 'SCMTransmissionReverseStatus' exceeds 25 characters and will be truncated.	
Multiple signal encoding values are named 'Reserved', the duplicates will be renamed.	
Multiple signal encoding values are named 'UNUSED', the duplicates will be renamed.	

Click **Next** to display the **LDF Import Component** selection list. You can select/deselect schedule tables, frames, and channels here.

	Name	Start Bit	Length (bits)	Publisher	Subscribers			
1	SCM_L31_M1							
\checkmark	SCM_L1_P00 Id: 0 Length (bytes)	: 7 Published	By: SCM					
v	SCMFtWiperSwitch_Status	0	4	SCM	SFWM, RSM			
	SCMFtWasher_Rqst	4	1	SCM	SFWM			
	SCMLowBeamOn_Stat	5	1	SCM	SFWM			
	SCMFtWasherMist_Ev	6	1	SCM	SFWM			
	SCMRrWiperSwitch_Status	8	2	SCM	SFWM			
	SCMLiftgateAjar_Status	10	1	SCM	SFWM			
	SCMHdlpWashOnTime_Cfg	11	3	SCM	SFWM			
	SCMHdlpWashOffTime_Cfg	14	2	SCM	SFWM			
	SCMCourtesyWipeEnable_Cfg	16	1	SCM	SFWM			
	SCMSpeedDependentEnable_Cfg	17	1	SCM	SFWM			
	SCMRainSensingEnable_Cfg	18	1	SCM	SFWM			
	SCMNeutralDisableAutoWipe_Cfg	19	1	SCM	RSM			
	SCMInit_AutoWipeOnReset_Cfg	20	1	SCM	SFWM			
	SCMInit_OfftoAutoWipe_Cfg	21	1	SCM	SFWM			
	SCMRrWipeLiftgateAjarEnable_Cfg	22	1	SCM	SFWM			

You can also set the unit mapping of each channel if required.

Channels:						Unit Mapping		
Name	Start Bit	Quantity	Unit	Mapping Type			t string for the chan	nel maps to
SCM_L3	_M1					a quantity and unit		
SCM_L1	P00 Id: 0 Length (bytes): 7	Published By: SC	м	Unit string scalar value				
SCMFtWi	perSwitch_Status	0	scalar valu	e None		Quantity u	ser type 🔻	
						Gain/Offset	1.00000	0.00000
						Apply to selec	ted channel	
						Apply to all ch	annels with this unit	string
							ll channels with the	
						2	g resets them to use	r type units.
start typin	g to filter			⊗ Set default				
	tandard units Show m					(X) Clear default		

Once imported, the LIN schedule tables are displayed on the **LIN** node and you can select the required LIN port (1).

	LIN Buses	General	
	Configure the available LIN buses and view their defined schedule tables.	Configure the basic	properties that define this LIN bus.
		Name	Test
Hz		Enabled	
\bigcirc	✓ Test	Port	
Ð		Version	Protocol 1.0 Language 1.0
		Speed	10.42kbps
(f(x)		Timebase	10ms

Imported schedule tables are assigned an ID number (1) by Toolset, starting from zero. The **Selection Channel** (2) controls which schedule table is sent out on the LIN bus.

	le tab npare nel	oles and configure the channel used to determine which schedule table is active. Schedule ad against the selection channel value to determine which should be active.
Name	Id	Number of Frames
SCM_131_M1	0	3
SCM_L31_M2	1	1

The selection channel should be configured as a maths channel within the setup (See Maths Channels). The maths channel intended to control the selection must be assigned as a U32 **Data Type** (1).

General				
Configur	e the basic properties that defi	ne this math channel		
Name	LIN Selection Channel	Quantity/Unit	user type	2
		Data Type	U32	2

You can view each schedule table to show each frame contained within it.

	Test								All LIN Buses
	Test Schedule Tables View the properties of the selected schedule table and its defined frames. The schedule table ID is compared against the selection channel value to determine if the table is active.	General Configure the ba Name SCM_L		operties that defir 1	ne this schedu	le table.			
00	SCM_L31_M1	ID 0							
	SCM_L31_M2		Frames View the frames that make up this schedule table.						
€		Name	Id	Length (bytes)	Delay (ms)	Rate (Hz)	Direction	Checksum Method	Number of Channels
		SCM_L1_P00	0	7	20	20	Encode	Classic	1
•		RSM_L1_P00	24	2	10	20	Decode	Classic	2
		RSM_L1_P01	25	2	10	10	Decode	Classic	1

You can also view each frame to show the individual channels present within it.

(f)	Test - SCM_L31_M1							All LIN Buses (Sche	dule Tables	
	Test SCM_L31_M1 Frames View the properties of the selected frame and its defined channels.	General View the basic proper	rties tha	t define this t	frame.						
Hz	SCM_L1_P00 0	Name ID	SCM_L 0	.1_P00							
0 (†	RSM_L1_P00	Length (bytes)	7								
	RSM_L1_P01	Rate Data Direction Checksum Method	20 Hz Encode Classic	e							
		Channels									
		View the channels that	at make	up this frame Type	e. Start Bit	Length (bits)	Quantity	Unit	Scaled Data Type	G	Offset
		SCMFtWiperSwitch_	_Status	Calibrated	0	4	user type	scalar value	F32	1	0

Channels that are encoded within the LIN bus also need to be defined within the setup as maths channels.



24. Logging overview

By default, all Cosworth logging devices are configured with one continuous logging table. The following explains how to configure and modify logging tables, configure logging and offload conditions, and configure remote logging devices.

The **Logging** node is used to define the frequency at which channels are logged. Before you set channel rates, you must first define a logging table.

24.1. Configure a logging table

On the **Logging** node, all existing logging tables are shown on the left of the screen. One continuous logging table (Logger 0) is enabled as default. Click + (1) to add a new logging table. You can also import and export logging tables from existing setups using the import and export tool (2). You can delete logging tables with the 'bin' icon (3).

	Logging		
	Logging Tables Global Logging Condition Offload	Remote Logging	
1 (⊕ ⓓ û 2 3 ⓓ	General	
	Logger 0	Configure the general setting	s for this logging table. Note that continuous logging tables will be amalgamated into a single table when sent to the device.
		Name	Logger 0
	Continuous	Description	
	Define the groups of channel rates that are to be used in this logging table.	Туре	Continuous *
	(\div)	Enabled	
	Rate Group 0	Rates	Hz Edit Channel Rates
		Logging Conditions	
		Continuous logging tables ar	e wholly controlled by the global logging condition.
		Bandwidth Utilization	
		View consumed bandwidth in	nformation for the standard-speed (up to 1kHz) and high-speed (2kHz to 20kHz) channels logged by this table.
		Standard-Speed 0 bytes/s of	
		High-Speed No high-sp	eed channels are being logged

Enter a name for the logging table (1) and an optional description (2). Select the required type of logging table from the **Type** dropdown menu (3).

General	
Configure the general se	gs for this logging table. Note that continuous logging tables will be amalgamated into a single table when sent to the device.
Name	1 Logging Table 1
Description	2 Continuous Base Logging Table
Туре	Continuous 💙 3
Enabled	Continuous
_	Burst Conditions
Rates	Burst Events Rates
	Fastest Laps
Logging Conditions	
Continuous logging tabl	are wholly controlled by the global logging condition.

You can then configure the channel rates (1) for this logging table (see Channel Rates). The percentage bandwidth utilization is displayed in a bar graph (2).

Configure the gener	al settings for this logging table. Note that continuous logging tables will be amalgamated into a single table when sent to the devi
Name	Logging Table 1
Description	Continuous Base Logging Table
Туре	Continuous Y
Enabled	
Rates	1 (Hz) Edit Channel Rates
Kates	Edit Channel Kates
Logging Conditio	
Logging Conditio	
Logging Conditio	ns
Logging Conditio	nstables are wholly controlled by the global logging condition.
Logging Conditio Continuous logging Bandwidth Utiliza	nstables are wholly controlled by the global logging condition.
Logging Conditio Continuous logging Bandwidth Utiliza View consumed ban	nstables are wholly controlled by the global logging condition.

Logging resources

2

You can view the total logging resource utilization at the bottom left of the page. The **Logging Resources** section shows information about the bandwidth usage and the estimated time capacity available for continuous logging. This provides an estimate of the time that the device can log with the selected table. Make sure the available logging time is greater than your session time to collect all data.

Note: If the logger runs for longer than its capacity, then the earliest data logged is over-written.

Logging Resources Summary of logging resource utilization across the	system
Total Available Memory	11 GiB
Estimated Memory consumed by Bursts	0 KiB
Consumed Standard-Speed Bandwidth	150 kbytes/s (30%)
Consumed High-Speed Bandwidth	400 kbytes/s (25%)
Estimated Continuous Logging Capacity	6 hours, 14 minutes



24.2. Types of logging table

There are four types of logging table: Continuous, Burst Conditions, Burst Events, and Fastest Laps.

Continuous

All channels in a continuous logging table are logged whilst the global logging condition is true. Continuous logging tables are wholly controlled by the global logging condition.

Burst conditions

Ideal for short-term high-speed logging, burst condition logging is activated when a channel or bit-field channel meets the specified conditions.

Note: The global logging condition (for example, 'Engine ON') must also be satisfied before any logging takes place.

Burst events

Ideal for short-term logging based on a specific event, such as an alarm being triggered. Logging can then stop 'based on' time from the start of logging or 'based on' a second event such as the alarm being reset.

Note: The global logging condition (for example, 'Engine ON') must also be satisfied before any logging takes place.

Fastest laps

Stores data from the fastest lap(s) when the global logging condition is met to reduce memory usage. You can configure the number of fastest laps to store.

An estimated memory consumption is given from the configured number of fastest laps to store (1) and an estimated lap time (2).

Logging Conditions
Log data for the fastest 6 lap(s) when the global logging conditions are met.
Bandwidth Utilization
View consumed bandwidth information for the standard-speed (up to 1kHz) and high-speed (2kHz to 20kHz) channels logged by this table.
Standard-Speed 150 kbytes/s of 500 kbytes/s (30%)
High-Speed 400 kbytes/s of 1600 kbytes/s (25%)
Estimated Memory Consumption
Based on 6 lap(s), with an estimated lap time of 96,00 s
Standard-Speed 82 MiB 2
High-Speed 220 MiB



24.3. Rate groups

Channels within the same logging table can be logged at different rates by adding rate groups. This is particularly useful when a manufacturer employs user groups (see Setup Locking – User Groups), or for viewing CAM & Crank data at high speed whilst cranking, but then reducing after idle, to optimise the logger capacity.

Click the + icon within a logging table to add a new rate group (1). You can name the rate group (2), enable or disable it (3), and add a brief description (4). After user groups are configured, you can define the minimum editing user group (5).

	Logging		
	Logging Tables Global Logging Condition Offload	d Remote Logging	
	+ +	General	
	Example Logging Table	Configure the general settings for this rate group.	
		Name Engine Builder Rates	2
	Continuous	Enabled 3	
	Define the groups of channel rates that are to be used in this logging table.		4
1		Manufacturer Description	4
	Administrator Rates	Manufacturer Status	
	Engine Builder Rates	Manufacturer Status O This is a normal item. Minimum editing user group O	
	Scrutineer Rates	🔇 Choose a UserGroup - 🗆 X	
	Unlicensed Rates	Engine Builder August Aug	5
		start typing to filter the selection 🛞	
		Show Diagnostic Items	

You can then configure the channel rates for each rate group on the **Channel Rates** node.

24.4. Generated channels

When you enable a logging channel, Toolset automatically generates five logging 'status' channels. These channels record:

- Available Logging Time
- Available Logging Memory
- Outing Number
- Outing Time
- Logger Status

Click the 'wrench' icon at the top right of the window to change the names of these channels.

Generated Channels	
Define the names of the channe	els generated by the logger.
Available Logging Time	Logging Time Remaining
Available Logging Memory	Logging Memory Remaining
Outing Number	Outing Number
Outing Time	Outing Time
Logger Status	Logger Status

24.5. Global logging condition

The global logging condition is used to define the conditions that must be met before any logging starts and when all logging stops. By default, the global logging condition is set to start logging when 'Engine is ON' and stop logging when 'Engine is OFF'.

You can also configure the global logging conditions to start/stop based on another Strategy, Channel, or Bit-

field Channel selectable from the dropdown menu (1). You can use the 'restore' tool (2) to reset the global logging conditions to the default.

Logging
Logging Tables Global Logging Condition Offload Remote Logging
Global Logging Condition
Configure the global logging conditions. The start conditions must be met before any logging will begin. When the stop conditions are met all logging will cease
2 conditions
Start Logging
Start logging when all of the following conditions are met:
\oplus
Strategy 1 Engine 😳 Engine is 🗸 On 🗸
Channel Strategy Stop cogging
Stop logging when all of the following conditions are met:
\oplus
Strategy × Engine · Engine is v Off ×

24.6. Offload

Synchronized offload

If you enable synchronized offload (1) you can offload data from a secondary device with the data from the primary device. When you offload data from the primary device, both sets of channels are included, with those from the secondary device specified by a user-defined prefix.

For example, if you configure a setup for a Badenia as the secondary device and an Antares as the primary device, the Antares IP address is inserted in the primary address box (2). This allows the Badenia channels to be offloaded with the Antares channels with those from the Badenia device specified by a user-defined tag (for example, 'Badenia-' (3).

Configure whether this device's data is offloaded and combined when outings Enabled 1. Main device IP address 2. 172.16.64.3 Prefix 3. Badenia-	are offloaded from the main device.
Main device IP address 2. 172.16.64.3	
Prefix 3. Badenia-	
Use legacy channel name shortening	

No channel data is sent between the devices, they both log locally, using their own logging conditions. It is only during data offload that the devices are 'synchronized' together. Toolset offloads from both devices individually and then combines the data in the .*pds* file.

24.7. Remote logging

Enable remote logging

To log data remotely from a device, you must enable remote logging in the setup.

Logging			
Logging Tables	Global Logging Condition	Offload	Remote Logging
General			
Configure the send	ding of data to a remote loggir	ng device.	
Enabled			
	M		



Select remote logging device

When you enable remote logging, you can select the remote logging device (1). If you have modified the remote logging device IP address in **Device Properties** (see Devices – Device Properties) you can choose whether to retain the logged data on the primary device (2) and whether high speed channels are transmitted to the remote logging device (3).

Logging			
Logging Tables	Global Logging Con	dition Offload	Remote Logging
General			
Configure the send	ding of data to a remot	e logging device.	
Enabled	\checkmark		
Retain Data Loca	illy 2		
IP Address		172.16.97.0	(9)
	O CDU 10	0.3 172.16.102.0	(19)
Transmit High Sp	peed Data 🕢 3		

Optional stop logging on remote logging device

There is an option to stop remote logging, separate from the logging on the primary device. Click the three dots icon to open the dialog box (1), and then select a channel (2) to stop the remote logging.

Logging				
Logging Tables Global L	ogging Condition Offload Remote Logging			
General				
Configure the sending of dat	ta to a remote logging device.			
	_	🧐 Choose a Channel	– 🗆 ×	
Enabled	\checkmark	Shift Lights	^	
Retain Data Locally	\checkmark	Shift Lights Mk2		
		Stop Logging Channel		
IP Address	RLU 172.16.97.0 9 2	System Time High	~	
	CDU 10.3 172.16.102.0	start typing to filter the selection	\otimes	
		Sourced from Math Channels node.		
Transmit High Speed Data				
		Show Diagnostic Items	OK Cancel	
Stop Remote Logging				
Optionally, stop remote logg	ing of the current outing when the following condition is true. Note	e, if the global stop logging condition is satisf	ied, then remote logging will stop, overriding this setting.	
Condition Stop Logging	g Channel 🕖 = 🗸 1.000			
When this condition becomes true the remote logger will not log any further data for the duration of the outing.				
N.B. No further data will	be sent to the remote logger until a new outing is started. O	n starting a new outing remote logging v	will resume until the condition is retriggered.	



Configure remote logging USB

You can use any USB stick to log data on a remote logging device such as the RLU or CDU10.3, but make sure the stick has sufficient storage capacity, otherwise data will be lost.

Plug the USB into a port on the PC, and then navigate to the **Data** tab in Toolset. Click **Configure RLU** at the top right (1), and then select the required device (2).

1 C Antares8_BTCC # Data	(*) Live Data Actions	1 Setups Channels	★ Settings	1
Refresh () Offload All	ads 🔞 Delete All 📵 Settings			Configure RLU
Cancel Off	dds 👿 Delete All 连 Settings	Configure RLU Storage Device Subfolder		Configure RLU
			Configure Cancel	

A warning dialog is displayed 'Formatting the USB for remote logging will erase all information currently on the USB.' Click **Yes** to proceed.

Erase files on D:	
All existing files on this storage device (D:) will be erased when the configuration is written. Please copy any files you need, before continuing with the configuration process. Are you sure that you want to continue?	
Yes 🛞 No	

To add a new remote logging configuration, click + (1), and then use the dropdown menu to select the primary device (2).

Storage Device D: V 14.8 Subfolder D:	GiB Integral Courier USB Device	 Either edit the path or select 	t an existing one
(+) (1) (1) Read	from Storage Device		1
Device	IP Address	Storage Allocation	
2	172.16.0.0	Auto ~	14.7 GiB
Antares8xx Antares8_AC Antares8_AMR_LMH Antares8_BTCC Badenia 2xx Badenia 5xx CCW Mk3 Centaurus 5xx Centaurus 5xx Centaurus 7xx CLU CLU_P ICD ICD-Lite IPS32 IPS32 Mk2 MQ12Di_LMP2 Omega D4	vice selected. vice selected. Configure \bigotimes Ca	ancel	

When you select the primary device, you are prompted to select the matching device variant (1). Make sure that the device IP address is correct for the primary device (2), select the storage allocation type – Auto, Fixed, or Percentage (3), and then click **Configure** (4).

🥝 Configure RLU			×
Storage Device D:	 14.8 GiB Integral Courier USB Device 	Either edit the path or select	an existing one.
(+)	Read from Storage Device	-	1
Device	IP Address	Storage Allocation	
Badenia 560	1 (<u>172.16.46.0</u> 2	Auto ~ 3 Auto Fixed Percentage	14.7 GiB
	4 Configure 🛞	Cancel	

Toolset starts to format the USB device for remote logging.

Г

Configure RLU		×
Formatting		
	🕢 ОК	

Once the USB device is formatted it is ready for remote logging.

Configure RLU	×
The removable storage device was successfully configured.	
О К	

Remote logging status channels

When a remote logging device is enabled, Toolset automatically generates 9 logging 'status' channels.

Channel Rates		
Channels 🔺	Logger 0 : Rate Group 0	0
Remote Bad Packets		Off
Remote Disk Write Failures		Off
Remote Disk Writes		Off
Remote Ignored Packets		Off
Remote Missing Packets		Off
Remote Packet Retries		Off
Remote Packets Received		Off
Remote Status		Off
Remote USB Driver Resets		Off

Depending on the remote logging device selected (RLU or CDU10.3), device specific channels are also automatically generated.

Channel Rates		
Channels .	Logging Table 1: Rate Group 0	0
RLU Device Present		Off
RLU Free CPU		Off
RLU OS Version Build		Off
RLU OS Version Major		Off
RLU OS Version Minor		Off
RLU OS Version Update		Off
RLU Serial Number		Off
RLU Total Physical Memory		Off
RLU Used Physical Memory		Off
RLU Version Build		Off
RLU Version Major		Off
RLU Version Minor		Off
RLU Version Update		Off

Channel Rates		
Channels -	Logger 0 : Rate Group 0	0
CDU 10.3 CPU Temperature		Off
CDU 10.3 Device Present		Off
CDU 10.3 Display Version Build		Off
CDU 10.3 Display Version Major		Off
CDU 10.3 Display Version Minor		Off
CDU 10.3 Display Version Update		Off
CDU 10.3 Displayed Page		Off
CDU 10.3 Free Cpu1		Off
CDU 10.3 Free Cpu2		Off
CDU 10.3 Module Temperature		Off
CDU 10.3 Serial Number		Off
CDU 10.3 Total Memory		Off
CDU 10.3 Used Memory		Off
CDU 10.3 Version Build		Off
CDU 10.3 Version Major		Off
CDU 10.3 Version Minor		Off
CDU 10.3 Version Update		Off

Note: You must select the channel rates to enable the channels to be logged



25. Logic channels

The **Logic Channels** node offers an alternative approach to configuring control channels, simplifying the creation of control channels that are complex to create in maths channels. The following covers the two features of the **Logic Channels** node – condition and counter logic.

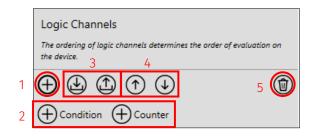
Note: Logic channels are limited to a fixed rate of 50Hz computation, but you can configure the computation rate of maths channels.

25.1. Add a logic channel

To add a new logic channel, hover over the + icon (1), and then click the required channel, either 'Condition' or 'Counter' (2). Use the 'import' and 'export' icons (3) to import and export logic channels between existing setups. If you add multiple logic channels, they can be reordered (4).

Note: - Logic channels are ordered in priority, so high priority and protected logic channels (see **Setup locking – channel protection**) must be at the top of the hierarchy.

Use the 'bin' tool to delete logic channels (5).



Enter a name for the channel (1) and an optional description and comment (2). Channel descriptions are used to provide a brief overview of the channel and are available to view when the logic channel is used elsewhere in Toolset. Channel comments are used to give more in-depth information about the channel and are only available to view on the **Logic Channels** node.

	General	
	Configure the bas	ic settings that define this condition channel.
1	Name	Example Logic Channel
		be used to give a brief overview of the purpose of the channel and will be available throughout Toolset. It used to provide more in depth information and is only available on this page.
2	Description	Example logic channel for User Guide
2	Comment	Created on the 23/10/2024 to explain logic channels

Conditional logic

In each conditional logic channel there are two main elements - logic groups and logic gates. Conditional logic passes input channels through 'logic groups' of 'logic gates' (also known as conditions). When the groups of conditions are true, the output is true.



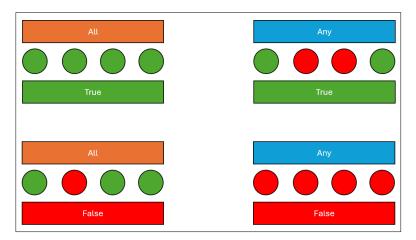
Generated channels

When you configure the conditional logic channel, an enumerated bit-field channel is generated. You can rename the true/false enumerated states for the bit-field channel (1) and set a colour for the true/false states (2).

Output		
Configure the output	states for this condi	tion channel.
Configure the text and	d colors for the char	nnel.
when True	On	2
when False	Off	

Logic groups

Logic groups group conditions into 'All' or 'Any' to decide if all the conditions within a group must be met, or if only one condition within the group must be met, for the output to be true. In the logic tree, 'All' groups are highlighted in orange and 'Any' groups are highlighted in blue.



For example, the following logic channel is true when:

'Battery voltage >=13.5V' OR 'Switch 1 is pressed And Switch 2 is not pressed'.

"Ba	ttery Voltage" > 13.500V
All	
	"Switch 1" is True
	"Switch 2" is False
	+



Logic conditions

These are the channel conditions that must be true for the output to be true.

There are many types of condition, summarised in the table below. In the logic 'tree', logic conditions are highlighted in green.

Condition	Inputs	Description
Alarm Triggered	1x Alarm	A logical output based on an alarm state (see Alarms)
Bitfield Comparison	1x Bit-field Channel	A logical output based on a bit-field channel condition
Channel Comparison	1x Channel	A logical output based on a channel condition
Strategy Comparison	1x System State	A logical output based on a system state (see System States)
Logical AND	2x Channels or System States	Comparing 2 channels (If Chan1 AND Chan2)
Logical OR	2x Channels or System States	Comparing 2 channels (If Chan1 OR Chan2)
Logical XOR	2x Channels or System States	Comparing 2 channels (If Chan1 XOR Chan2)
Bitwise AND	1x Channels or System States	Compare a channel to a present hexadecimal value as either a binary or hexadecimal value
Flash	1x Channels or System States	While a channel is active the output flashes (on/off) at a preset rate
Hysteresis	1x Channels/ System States	Active when a set value is exceeded and deactivated when another different limit is reached
Pulse	1x Channels or System States	On a channel edge the output will pulse for a pre- set time
Set/Reset	2x Channels or System States	A channels edge drives this high and another drives this low
Toggle	1x Channels or System States and 2 Override Channel inputs	A channel changes this state on each pulse. Channels can be reset to override this value

Conditional logic channel example

The following example of a conditional logic channel is used to control a reserve fuel pump.

It is activated if ANY of these conditions are met:

- The Ignition is pressed AND runs for 5 seconds.
- The Engine is running AND Fuel Pressure is less than 3 bar.

OR

• The Engine is running AND the Main Fuel Pump Current is less than 7 amps.

OR

• The Pump Out switch is pressed.

Name	Reserve Fuel Pump Control					
Comment						
Configure th	he text and colors for the channel.					
when True	True					
when False	False					
Logic						
	ne logic that determines the output of this condition ch	annel.				
(\uparrow)						
Any		DESCRIPTION				
All		"Ignition Sw" is True				
	"Ignition Sw" is True	AND				
	"Ignition Sw" rising edge? Pulse True for 5.00s	"Ignition Sw" rising edge? Pulse True for 5.00s				
	+	OR				
All		"Engine" is On				
	"Engine" is On	AND				
	"Fuel Pressure" < 3.000bar	"Fuel Pressure" < 3.000bar				
	+	OR				
All		"Engine" is On				
	"Engine" is On	AND				
	"Main Fuel Pump Current" < 7.000A	"Main Fuel Pump Current" < 7.000A				
	+	OR				
"Pur	mp Out Sw" is True	"Pump Out Sw" is True				

25.2. Counter logic

Counter logic channels offer an alternative approach for you to create a numerical counter and avoid register-based maths channels, which can be complex for new users. Counter logic channels allow you to define a counter to be incremented or decremented based on either the rising or falling edge of a channel, or system state inputs.



To configure a counter, you need to set minimum and maximum limits (0 to 65535) for the counter (1). You also need to see the initial starting value of the counter (2). You can choose to increment and/or decrement the counter by selecting either or both increment and decrement check boxes (3). Configure the counter to increment or decrement on the rising or falling edge of the channel or system state from the dropdown menu (4). You can then select the channel or system state from the 'channel browse' menu (5). Finally, you can configure the counter **Wrap At Limit** (to roll over the counter to minimum or maximum value when the maximum or minimum limit is reached), or **Hold At Limit** (hold the counter at the minimum or maximum limit when the limit is reached) (6).

	Counter			
	Configure the set	tings that define the counter.		
1	Min / Max	0 100		
2	Initial	50		
3	✓ Increment	4 on Rising v edge of Switch 1		1
		○ Wrap At Limit		
	Decrement	on Falling v edge of Switch 2	\odot	
		Wrap At Limit Hold At Limit		

You can configure force counter values if defined conditions are met. Select the two from the **Set** check box (1). You can set the value to override the counter (2), and then define the channel condition when the override happens (3).

	Overrid	es	
	Configure	e any overric	des to apply to the counter value.
1	🖌 Set	2	to 0 when
		3	Reset Counter user type * = * 0.000
	√ Set		to 100 when Speed velocity * > * 150.000 kph *

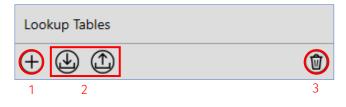


26. Lookup tables overview

Lookup Tables (LUTs) are a useful way to use one or two input values to reference an output value. LUTs can then be used elsewhere in the setup through maths channels (see Setups – Maths Channels).

26.1. Add a lookup table

Click the + tool to add a LUT (1). Use the 'import' and 'export' tools to import and export LUTs between existing setups (2). Use the 'bin' tool to delete LUTs (3).



Once a LUT is added, you can configure the general settings. Add a name for the LUT (1) and an optional comment (2). Select the number of dimensions (inputs) for the LUT (either 1 or 2) from the check box (3). Select the output quantity (4) and units (5).

	General	
	Configure the prope	rties of the lookup table.
1	Name	Example Lookup Table
2	Comment	Example Lookup Table for User Guide
3	Dimensions	● 1D ○ 2D
4	Output Quantity	proportion
5	Output Unit	%

26.2. Interpolation mode

The interpolation mode determines how Toolset outputs a value when the input falls between specified discrete values. There are three options:

- **Extrapolate** Used to estimate the output value when the input exceeds the limits of the specified input values, assuming a linear transition between after the last value.
- Interpolate Used to estimate the output value when the input falls between specified discrete input values, assuming a linear transition between input values.
- Sample & Hold Used to hold the output value until the next discrete input value is met.

26.3. One-dimensional tables

A one-dimensional table is used when one input channel is used to reference one output value.

For example, this could be rotary switch position (Volts) on a device such as the CCW Mk3, correlating to a screen brightness (%) setting.

Set the input value units (1) and then the interpolation mode (2). Enter the required number of rows in the box (3). Finaly, fill in the input (4) and output (5) axis increments.

	Input	ts							
1	Quantity		voltag	voltage ~					
	Unit		V	· · · · · · · · · · · · · · · · · · ·					
2	Inter	polation Mo	ode Samp	vie & Hold v					
	Input and Output Values Configure the input and output values for the lookup table.								
3	Size	10	Rows						
	Input 1 Axis	0	10						
	put 1	0.45	20						
	⊑ ⊕	0.9	30						
	•	1.35	40						
	U	1.8	50						
		2.25	60						
		2.7	70						
		3.15	80						
		3.6	90						
		4.05	100						
L	•	4	5						

26.4. Two-dimensional tables

A two-dimensional table is used when two input channels are used to reference one output value.

For example, this could be used to control cooling fan duty (%) where ambient temperature (°C) is on input axis 1 and speed (kph) is on input axis 2.

		Input 1								Input 2
Unit										
Interpo	lation Mod	le Interpol	late							 Interpol
	9	t and outpu Rows ×	8	the lookup	table.					
	Inp	out 2 Axis								
		0	20	40	80	120	180	240	300	5
Axis	0	0	20	40	80 0	120	180 0	240	300 0	5
ut 1 Axis	0	0	0	0	0	0	0	0	0	5
) Input 1 Axis	5	0	0	0	0	0	0	0	0	5
	5 10	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	5
	5 10 15	0 0 0 25	0 0 0 25	0 0 0 25	0 0 0 20	0 0 0 20	0 0 0 15	0 0 0 10	0 0 0 5	5
	5 10 15 20	0 0 25 50	0 0 25 50	0 0 25 50	0 0 20 40	0 0 0 20 35	0 0 15 20	0 0 10 15	0 0 0 5 10	5
	5 10 15 20 25	0 0 25 50 75	0 0 25 50 75	0 0 25 50 75	0 0 20 40 65	0 0 20 35 50	0 0 15 20 25	0 0 10 15 20	0 0 5 10 15	5
📵 🕂 Input 1 Axis	5 10 15 20 25 30	0 0 25 50 75 100	0 0 25 50 75 90	0 0 25 50 75 85	0 0 20 40 65 65	0 0 20 35 50 55	0 0 15 20 25 30	0 0 10 15 20 20	0 0 5 10 15 20	5
	5 10 15 20 25	0 0 25 50 75	0 0 25 50 75	0 0 25 50 75	0 0 20 40 65	0 0 20 35 50	0 0 15 20 25	0 0 10 15 20	0 0 5 10 15	5

Set the input value units for the two input axes (1),and then set the interpolation mode (2). Enter the required number of rows and columns in the boxes (3) Fill in the input axis 1 (4) and input axis 2 (5) increments. Finally, fill in the output values (6).

26.5. Create lookup tables in Excel

For large LUTs or complex LUTs that require calculations to define the inputs, it is possible to create the LUT in Excel and then copy and paste it Toolset. This can save a lot of time and makes creating LUTs simpler.



27. Maths channels

Maths channels allow you to configure mathematical inputs, together with mathematical manipulation of channels using mathematical functions. The following provides a generic overview and some examples of various typical maths channels.

27.1. Add a maths channel

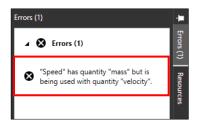
To create a new maths channel, click the + button (1). Use the 'import' and 'export' tools to import and export maths channels between existing setups. You can import and export multiple channels as a group (2). Copy and paste maths channels with the copy and paste tools (3.). You can add math channels to groups to aid setup organisation and structuring (4). Use the 'bin' tool to delete maths channels (5).

Math	Channels			
Ð[٩	6		
1	2	3	4	5

Once a maths channel is added you can configure the name of the channel (1), the units of the channel (2), select the data type (3), and add an optional comment about the channel (4).

	General						
	Configure the basic p	roperties that define this math ch	annel.				
1	Name	Example Maths Channel	Quantity/Unit	mass	~	kg ~	2
		3	Data Type	F32	~		
4	Comment	Example Maths Channel for Use	r Guide				

Note 1: If maths channels are used for system channels, they may be required to have specific units or a specific data type. See the **Errors** menu to check for unit and data type errors.



Note 2: If the **Data Type** menu is not shown, make sure that the **Show Advanced** check box at the bottom right is selected.



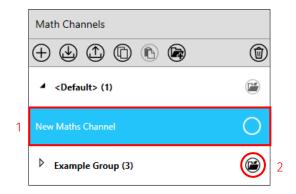


27.2. Group maths channels

When a maths channel is created, it is put in the <Default> group. To rename the group, click the group name (1) and enter a new name (2).

	Math Channels		General
(1	Set the name for this group of math channels.
1	Example Group (3)		Name Example Group
	Distance	0	
	RPM	0	
	Speed	0	

Select a maths channels (1) and use the 'Add to group' tool (2) to move that channel.

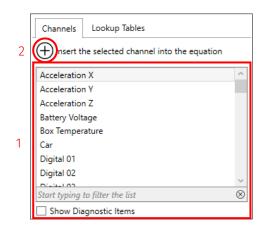


27.3. Maths channel equation

The equation box is where you enter channels equations. All the calculations are performed here. Equations can be as simple as a single value or a channel reference, or as complicated as several choose statements and registers with mathematical functions.

Channels

You can add channels to the equation from the available channels list (1) and search a channel with the standard or magic search functions. Click the + tool to add the channel (2) or double-click a channel from the list.



Tip: You can type '[]', and click 'CTRL + Space' and enter an equation within the brackets to add and search for a channel via the channel search menu. Enter a channel name to filter the search.

Digital 04	\sim
Digital 05	
Distance	
Engine	
Error Code Trigger Count	
EtherCAT Data Errors	
EtherCAT Time High	
EtherCAT Time Low	
Free CPU	
Global Alarm	\sim

Lookup tables

Lookup tables (LUTs) can be added to the equation from the available LUTs list (1). You can search for LUTs with the standard or magic search functions. Click the + tool to add the LUT (2) or double-click from the LUT list.

2	Channels Lookup Tables	on
	Example Lookup Table	
1		
		~
	Start typing to filter the list	\otimes

A LUT must be written in the following syntax:

lut('LUT Name', 'First dimension reference', 'Second dimension reference*')

*If using a 2D LUT.



Functions

The **Functions** menu lists all the available mathematical operators to be used in the equation. The list of functions is extensive and includes general mathematical, logical, bitwise operators, and trigonometric operators.

Hover over a function in the menu to display a brief description about the function. Click the function to add it to the equation. You can also type functions into the equation.

Functions
Click on a function to insert it into the equation.
Math
+ - * / min max pow sqrt
Comparison
> >= < <= != == choose
Logical
8x8x ^^ !
Trigonome x y
cos sin Returns 1 if u32('x') or u32('y') are nonzero, else returns 0.

Function help

Function help can help you to configure maths channels in the correct format and to help diagnose any syntax errors in the equation. The help displays a small description about the selected function in the equation and provides an example and breakdown of how the function syntax format (1).

Note: The yellow highlight next to the line number indicates a change since the maths channel was last opened.

Equation	
Edit the equation that determines the value of this math channel.	
<pre>pow([Battery Voltage],2)</pre>	Function: "pow(x, y)" Returns 'x' raised to power 'y'. x The base, any real number. y The exponent, to which the base is raised.

27.4. Rates

The **Rate** section is used to configure the calculation rate of the maths channel. There are two settings:

- Inherit Rate From The calculation rate is set by the rate of the selected channel.
- Fixed Rate At You can define the calculation rate from a list of the available rates.

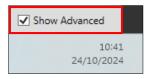
The **Consumption Rates** section is used to configure the maximum rates at which the **input** channel(s) are consumed. There are three key options:

• My Rate – Uses the calculation rate of the maths channel set in Rate.

- Auto Uses the maximum rate of the input channel.
- 1Hz-20khz You can select the input channel(s) at 1Hz-20kHz.

Note 1: If the **Inherit Rate From** input channel option is selected for the calculation rate, then the consumption rate for the input channel is automatically set to 'My Rate'.

Note 2: If the **Data Type** menu is not shown, make sure that the **Show Advanced** check box at the bottom right is selected.



Tip: If for example, you want to log the Maths channel at 20Hz, containing an input channel that is being produced elsewhere on the device at 50Hz, then the calculation rate needs to be set to 100Hz (to satisfy both requirements). Set the calculation rate to be a common (or least common) multiple of all uses of the channel.

27.5. Registers

Registers act as short-term memory variables, enabling you to produce channels dependent on historic values.

In the **Functions** menu there is the option to add in up to seven 'read' and 'write' registers named from a0 to a6. These registers have a default value of zero whenever the device is reset (power cycle, new setup sent, and so on). The registers are evaluated at the calculation rate of the channel. For example, if a channel is set to 100Hz, the registers are updated every 10ms.

Regi	sters (Read)					
@a()al	@a2	@	a3	@a4	@a5	@a6
Regi	sters (Write	:)					
a0	a1	a2	a3	a4	a5	a6		

27.6. Choose statements

Choose statements are an 'if/else' statement. In other words, 'If' something is true, do X, otherwise do Y. Multiple choose statements can be 'nested' to support more complex comparison functions. The 'Choose' function is in the **Comparison** section of the **Functions** menu.



27.7. Color control

You can configure a maths channel can be configured for dynamic colour control of a display item or for shift lights. From the colour function in the equation, a colour can be referenced by its name (for example, cyan).

Note: The data type must be U32.

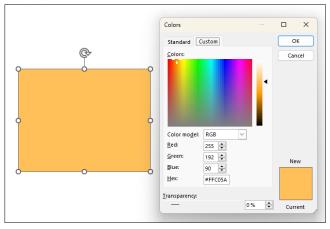
	on
dit the	e equation that determines the value of this math channel.
1	Choose([Wet Mode] == 1, color(cyan), color(yellow)

You can also select a colour by its RGB value as a U32 decimal number, where blue is the first byte, green is the second byte, red is the third byte, and brightness is the fourth byte.

For example, pure red at full brightness would equal 4,294,901,760

1	1	1	1 28	1	1	1	1 24	1	1	1	1 20	1	1	1	1 16
0	0	0	0 12	0	0	0	0 8	0	0	0	0 4	0	C	0	0 0

The following peach colour combining all three R, G and B portions at 50% brightness would equal 268,419,162.



0	1	1	1 28	1	1	1	1 24	1	1	1	1 20	1	1	1	1 16
1	1	0	0 12	0	0	0	0 8	0	1	0	1 4	1	0	1	0 0

You can also write the colour in bit-wise format where:

color = (("BRIGHTNESS VALUE" << 24) | ("RED VALUE" << 16) | ("GREEN VALUE" << 8) | ("BLUE VALUE"))

color = (("127"<< 24) | ("255" << 16) | ("192" << 8) | ("90"))

27.8. Example maths channels

Example 1 – Static value

A maths channel can be a static value. This channel can be referenced and always outputs the configured number. A fixed rate of 1Hz is recommended for this type of channel because there is no computation, thus saving logger CPU processing.

Equat	on
Edit th	equation that determines the value of this math channel.
1	314

Example 2 – Channel reference

A maths channel can be another channel or event. You can type the channel name or select it from the list below. The syntax for using a channel is as follows: **[Channel Name]**. This type of maths channel can be used to rename native device channels to User defined name. It can also be used to increase the rate of logic channels (Logic Channels are calculated at a maximum of 50Hz).

it the equa	tion that determines	the value of t	his math c
1 [Ac	celeration X]		
Channels	Lookup Tables		-
	Lookup Tables he selected channel		tion
➡ Insert ti Acceleration	he selected channel		tion
Insert t Acceleration Acceleration	he selected channel n X n Y		tion
Insert to Acceleration Acceleration Acceleration	he selected channel n X n Y n Z		tion
Hinsert to Acceleration Acceleration Acceleration Acceleration Battery Volt	he selected channel n X n Y n Z		tion
Hinsert t Acceleration Acceleration Acceleration Acceleration Battery Volt Boost	he selected channel n X n Y n Z tage		tion ^
Hinsert to Acceleration Acceleration Acceleration Acceleration Battery Volt	he selected channel n X n Y n Z tage		tion 🔨
Hinsert t Acceleration Acceleration Acceleration Acceleration Battery Volt Boost	he selected channel n X n Y n Z tage		ion ^
Hinsert t Acceleration Acceleration Acceleration Battery Volt Boost Box Temper	he selected channel n X n Y n Z tage		tion A



Example 3 – Bitwise channel

You can use a maths channel to 'Shift' and 'AND' a bit-field channel and return the value. For a button where a 'Click-Latched' option is bit 5 (see <u>Setups – Buttons</u>), it can be 'shifted right' by 5 and 'ANDed' with 1, to return a value of 1 when the 'Click-Latched' button is true.

Equat	ion
Edit th	e equation that determines the value of this math channel.
1	[Example Button] >> 5 & 1

Example 4 – Choose statement

You can configure a maths channel to complete an 'If' statement decision, like a logic channel. Use the 'Choose' function to test a statement to output a value if true, and then output another if false.

Equat	ion
Edit the	e equation that determines the value of this math channel.
1	Choose([Battery Voltage]<10.5, 1, 0)

Example 5 – Registers – simple filter

You can use a maths channel to apply an average filter to a noisy channel by using registers.

Equation									
Edit th	e equi	ation tha	t deter	mines	the v	alue of	this m	ath c	hannel
1	a4	(@a3)	;						
2	a3	(@a2)	;						
3	a2	(@a1)	;						
4	a1	(@a0)	;						
5	a0	([Exa	nple	hanı	nel]);			
6	(@a	a4 + @a	a3 +	@a2	+ @	a1 +	(a0)	1 5	5

When this math channel is evaluated, it reads the functions from top to bottom, so register **a4** is evaluated first, then **a3**, and so on. The register name is given first, followed by the equation or value that sets the register value in parentheses. If you need to read the value of a registers value once it has been defined, the register name must be preceded by an **@**. The register name then turns green to show that it has been used. For example, the first line of this channel equation defines register **a4** as the previous value of register **a3**.

The fundamental function within this channel is line 5, **a0 ([ExampleChannel])**, where **[ExampleChannel]** represents the channel that requires filtering. This function sets **a0** as the instantaneous sample of the channel **[ExampleChannel]**. On the next channel sample, **a1** is populated with this first channel value and **a0** is replaced with a new channel value. Each channel value then propagates up the registers from **a0** to a4, where **a0** holds the most recent value and **a4** holds the most historic value (which in this case is four samples before **a0**). If this channel is calculated at 100Hz, then the filter response is like a 20Hz roll off but with a time (phase) delay of approximately 4ms, which, incidentally, may affect dynamic data analysis. Finally, the contents of the registers are summated, and divided by the number of registers used, to produce an average value.



Example 6 – Registers - counter

An alternative approach to a logic channel counter is to create a counter with registers in a maths channel. The following channel counts from 0 to 100 and resets to 0 when it reaches at 100.

Edit the equ	ation t	hat det	ermin	es t	he va	lue	of this	s m	ath c	hanne	el.
1 a0	(cho	oose (@a0	<	100	,	@a0	+	1,	0))	;
2 @a	0										

When this maths channel is first evaluated, **a0** is equal to 0. In other words, the 'choose' statement means that, if **a0** is less than 100, then increment **a0** by 1, otherwise set **a0** to 0. If the rate of this channel is set to 1Hz, then the output increments by 1 each second until it reaches 100 and then resets to 0. If the rate of this channel is set to 100Hz, then the output increments by 1 each 10ms second until it reaches 100 and then resets to 0.

Example 7 – Registers – last beacon code seen

This channel captures the last valid code seen by the beacon input. The following equation is used.

Equation												
Edit the equ	ation tha	at det	ermines	s th	e value of	this m	ath cha	nne	d.			
			(@a3	>	65000)) +	(@a3	*	(@a3 <	65000)))	;

The variable 'F' is the channel **Beacon Raw**. In this instance. **a2** has two possible values in this function. If 'F' is greater than 65000, **a2** remains at its original value. If **a3** is greater than 65000, **a2** is set to output the value of F' which is the new beacon code.

Example 8 – Registers – beacon counter

This is a monotonic count of all the beacons seen since the last logger reset. It can be easily modified to give just the number of end of laps beacons or the number of split beacons. The following equation is used where '**F**' is again **Beacon Raw**.

Equa	ation	
Edit t	he equa	ation that determines the value of this math channel.
1	a4 ((@a4 + (@a4!=0)) * (@a4 < 100));
2	a1 (@a1 + (@a4==2)) ;
3	a4 ((@a4 + ((@a4==0) * (F < 65000)));
4	@a1	

This can be thought of as a 'state engine' with 101 states. **a4** holds the state (between 0 and 100) and **a1** holds the beacon count. This channel creates the following state operation:

Do nothing. If 'F' is a valid code (<65000), then increment **a4**.

Increment **a4.** If **a4** is greater than 100, set **a4** = 0.

Increment **a1**, increment **a4**. If **a4** is greater than 100, set **a4** = 0.

Increment **a4**, if **a4** is greater than 100, set **a4** = 0.

Increment **a4**, if **a4** is greater than 100, set **a4** = 0 (which in this state is true so we return to state 0, that is **a4** is only incremented when **a4** is non-zero, or when **a4** is zero AND '**F**' is a valid code).

27.9. Advice For registers

Synchronization

Maths channels are sampled sync executed channels which operate in a standard from top to bottom. Therefore, sampling the same channel at different functions (different lines of the equation) may produce different answers. This is because the functions are calculated as they are read, from top to bottom; they are not all calculated at the same time. As a result, cumulative channels can be influenced by a different start point for each sample.

Input channel sampling multiple time per output channel

Sampling the same channel in more than one function (different lines of the equation) may produce different answers. This is because the functions are calculated as they are read, from top to bottom. In other words, they are not all calculated at the same time. As a result, cumulative channels can be influenced by a different start point for each sample.

Equat	ion		
Edit th	e equ	ation that determines the val	ue of this math channel.
1	a0	([ExampleChannel])	;
2	a1	([ExampleChannel])	;

Any input that changes its value midway through the calculation of the output channel can cause a problem. Careful consideration of the phase between channels must be taken when the sampling rates of the inputs and outputs are different. For example, **a0** and **a1** are not necessarily the same, as **[ExampleChannel]** may have been resampled between the calculation of **a0** and **a1** if the sampling rates are different. Whereas, the following equation ensures that all the registers hold the same value.

Equation							
Edit th	e equa	ation that determines the value of this math channel.					
1	a2	([ExampleChannel]) ;					
2	a1	(@a2) ;					
3	a0	(@a1) ;					

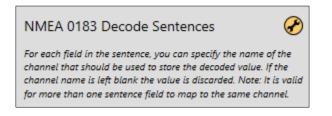
This is because once the value of **[ExampleChannel]** is assigned to **a2**, the values of the following registers take their value from **a2** rather than the channel itself. As the sampling rate of all the registers are held at the same rate defined by the output channel, this prevents the value of **[ExampleChannel]** being used throughout an equation from changing.

28. NMEA 0183

The NMEA 0183 Decode node is used to configure a GPS input.

28.1. Configure a GPS Input

Open the NMEA 0183 Decode node and the 'wrench' tool to setup the GPS input



Select the Serial Port to which the GPS is connected.

NMEA 0183 Decode Settings	Choose a Serial Port Serial 01 (Rx) Serial 02 (Rx)	-		×
Serial Port				
	start typing to filter the selection			\otimes
	Sourced from Hardware Settings node.			
	Show All	Ø	к 🛞	Cancel

Next, select the **Baud Rate** for the GPS input from the dropdown menu.

NMEA 0183 De	code Settings
Configure the sett	ings that apply to all sentences.
Serial Port	Serial 01 (Rx)
Baud Rate	115200 ~
	1200
	2400
	4800
	9600
	19200
	38400
	57600
	115200
	115200

You can then click the check boxes to select the NMEA sentences to be decoded (1). You can edit the channel names as required (2).

NMEA 0183 Decode Sentences	Decode GLL - Geographic Position?	
For each field in the sentence, you can specify the name of the channel that should be used to store the decoded value. If the	Latitude	NMEA RX GLL Latitude
channel name is left blank the value is discarded. Note: It is valid for more than one sentence field to map to the same channel.	Longitude	NMEA RX GLL Longitude
DBT - Depth Below Transducer	Time (UTC)	NMEA RX GLL UTC Time
DPT - Depth	GPS status GPS mode	NMEA RX GLL Status
	or o mode	TIMER TO CEE MODE
GGA - Global Position Fix		
GLL - Geographic Position		
HDG - Heading, Deviation & Variation		
HDM - Heading, Magnetic		
HDT - Heading, True		
MTA - Air Temperature		
MTW - Water Temperature		
MWD - Wind Direction & Speed		
MWV - Wind Speed & Angle		
RMB - Navigation Information		
RMC - Recommended Minimum GNSS Data		
VHW - Water Speed & Heading		
VLW - Dual Ground & Water Distance		
VPW - Speed Parallel To Wind		
VTG - Ground Course & Speed		
VWR - Apparent Wind Speed & Direction		
VWT - True Wind Speed & Direction		
XTE - Measured Cross Track Error		
ZTG - Time To Destination Waypoint		

Once you select the NMEA sentences, the channels are displayed on the **Channel Rates** node. You must set the channel logging rate for the data to be logged (1).



Channel Rates				
Channels 🔺	Logger 0 : Rate Group 0	0		
NMEA RX GLL Latitude		Off 🖌		
NMEA RX GLL Longitude		Off		
NMEA RX GLL Mode		1 Hz		
NMEA RX GLL Status		2 Hz 5 Hz		
NMEA RX GLL UTC Time		10 Hz		
NMEA RX HDM Heading		UT		
NMEA RX HDT Heading		Off		
NMEA RX VTG Course		Off		
NMEA RX VTG Course Mag		Off		
NMEA RX VTG Mode		Off		
NMEA RX VTG Speed Ground		Off		



29. Power outputs

The **Power Outputs** node is used to configure the power outputs for Power Box devices. Refer to the relevant PIS sheet for your Power Box device to find the ratings for each pin.

Centaurus : Centaurus Product Information Sheet

29.1. General Tips

Before you configure the power outputs pay attention to the following tips:

Output type – Check if the output is a high-side drive (HSD - switches the positive line) or a low-side (LSD - switches the ground line) output. On the Centaurus, CN1-4, CN1-11, CN1-12, CN1-19, and CN1-20 are low power low-side outputs.

Current rating – Each output has a maximum current rating. Overloading an output can damage the device. Choose outputs rated adequately for the devices they control. Group output pins to increase current rating if required (see Configuring a Grouped Pin Output)

Continuous vs. Peak Current – Some outputs can handle larger inrush current and longer surge times than others. Ensure the continuous and peak current consumption of the powered device is known before you configure outputs.

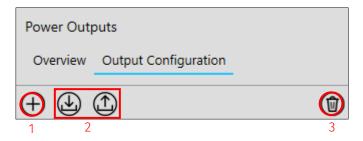
Heat Dissipation – Install the Power Box in a location with adequate ventilation and consider ambient temperature limits to avoid thermal shutdowns.

Fail-safe Configurations – For critical functions (for example., engine cooling fans or fuel pumps) consider adding redundant circuits or configuring fail-safes to make sure that these devices remain functional even if one output fails.

29.2. Output configuration

Add a new output

To configure a new power out, navigate to the **Output Configuration** menu. Click the **+** tool to add a new output (1). You can use the 'import' and 'export' tools to import and export configurations between existing setups (2). Use the 'bin' tool to delete unwanted outputs (3).





Once an output is created you can name it (1) and add a brief description about the output (2).

	General	
1	Name	Example Output
2	Description	Example Output Configuration for User Guide

Configure an output

To configure an output, select which connector to use (1), and then click the + tool to add a new output pin (2). Use the 'bin' tool to delete unwanted pins (3).

Connector 1 CN1 (Low Current) : 1	6x 2.5A outputs
	5x LSD outputs
Connector 2 CN2 (Medium Current) :	32x 7.5A outputs
Connector 3 CN3 (High Current) :	5x 12A outputs
	2x 25A 'wiper' outputs
	7x 25A 'standard' outputs
	2x 25A 'high surge'

Configuration	
Click on the pins below to toggle which are included in this group or add them to the table.	
Connector CN1 - AS218-35SN-9438 V	
1 CN1 - AS218-35SN-943B CN2 - AS218-32SA-943B 2 ①	
CN3 - AS220-16SN-943B Pin Name Description	



You can then select a pin from the **Add Pins** menu. A description about each pin is shown. Click a pin in the menu (1), and then click the 'tick' tool to add (2), or alternatively double-click the pin name.

Pin Name	Description	^
4	Low Power LSD 488Hz PWM	
11	Low Power LSD 488Hz PWM	
12	Low Power LSD 488Hz PWM	
19	Low Power LSD 488Hz PWM	
20	Low Power LSD 488Hz PWM	_
51	488Hz PWM	
52	488Hz PWM	
53	488Hz PWM	
54	488Hz PWM	
55	488Hz PWM	

You can also click on pins in the displayed connector to select/deselect them. Selected pins are highlighted in blue.

Configuration		-
Click on the pins below to toggle which are included in this group or add them to the ta	ble.	
Connector CN1 - AS218-35SN-943B ~		
	\oplus	Ŵ
	Pin Name Description	
	51 488Hz PWM	



Grouped pin outputs

You can select multiple pins to form grouped pin outputs. Grouped pins outputs enable increased output current rating by sharing current between pins. In other words, you can group 2x 2.5A pins to make a 1x 5A output and group 4x 7.5A pins to make a 1x 30A output.

Pin Name	Description	^
	244Hz PWM	
т	244Hz PWM	
c	244Hz PWM	
С	244Hz PWM	
L	244Hz PWM	
f	244Hz PWM	
а	244Hz PWM	
D	244Hz PWM	
К	244Hz PWM	
	244Hz PWM	~

In the **Output Pins** menu, click pins + Shift to select multiple pins.

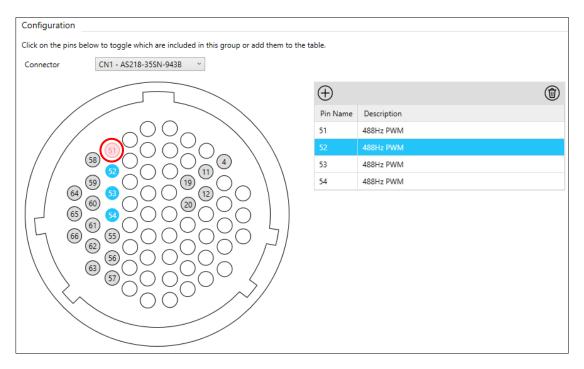
You can also click on pins in the displayed connector to select/deselect them. Selected pins are highlighted blue.

Configuration				
Click on the pins bel	low to toggle which are included in this group or add them to	the table.		
Connector	CN2 - AS218-32SA-943B ~			
		\oplus		1
	5	Pin Name	Description	
	A	244Hz PWM		
	В	244Hz PWM		
	С	244Hz PWM		
	D	244Hz PWM		
	(W) (f) (d) (P)			
E E				
14				
F				
$ \setminus \rangle$				



Note 1: Pins can only be grouped within a connector. Pins cannot be grouped between connectors.

Note 2 – A pin can only be used in one configured output. A pin cannot be used in more than one output. If a pin is used in more than one output, an error is raised, and the pin is highlighted in red.



Note 3: Grouped pins must have the same current rating. In other words, a 12A pin and 25A pin cannot be grouped together.

Power output LED

The **Power Output LED** section is used to configure which of the LEDs on the display are used to display the output status. When the LED is illuminated, this signals that the output is on. When the LED is not illuminated this signals that the output is off.

Click on an output LED from the displayed numbered LEDs (1) or type the LED Id number in the **Id** box to select the LED to display the output status. The selected LED is highlighted in blue.

ſ	Power	Outpu	t Led													
2	ld				23											
	1	2	3	4	5	6	7	8	9	10	(1)	12	13	14	15	(16)
	17	18	19	20	21	22	(2)	24	25	26	27	28	29	30	31	32
	33	34	35	36	37	38	39	40	(41)	42	43	44	45	46	(47)	(48)
	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64



29.3. Output overview

An overview of all the configured outputs is displayed on the **Overview** page.

By default, the **Overview** page is show in 'Grid' mode. This mode displays all the configured properties of the output(s).

Po	Power Outputs														
_	Overview Output Configura	ation													
ld	Name	Description	Rating	No	PWM	Ltc	Htc	Ltt	Htt	Tre	Trc	Trd	Doc	Oic	MS
1	Example Single Pin Output		2.5		•	1.5	2.0	5.0	1.0	•		2.0	•	•	0
2	2 Example Grouped Pin Output		48.0	4		8.0	10.0	5.0	1.0		3	2.0			Ο

The Grid Overview Page displays:

- Id Output LED ID number
- Name Output name
- Description Output description
- Rating Current rating (will update for grouped pin outputs)
- No Number of output pins assigned to this output
- PWM PWM output enabled (Blue enabled, White disabled) *
- Ltc Low trip current setting **
- Htc High trip current setting **
- Ltt Low trip time setting **
- Htt High trip time setting **
- Tre Trip retry enabled (Blue enabled, White disabled) **
- Trc Trip retry count setting **
- Trd Trip retry delay time setting **
- Doc Default output condition (Blue ON, White OFF) *
- Oic Output is controlled by a control channel (Blue true, White false) *
- MS Manufacturer status (see Setups Setup Locking)
- * (see Control Menu section)
- ** (see Trips Menu section)



You can change the 'Display Mode' to 'Compact' to display information in a reduced format from the **Display mode** dropdown menu.

P	ower Outpu	ts											
_	Overview 0	Output Configu	uration										
ld	Name	Description	Rating	No	PWM	Ltc	Htc	Ltt	Htt	Tre	Trc	Trd	Doc
	1 Example Sin		2.5		•	1.5	2.0	5.0	1.0	•		2.0	•
	2 Example Gro	3	48.0	4		8.0	10.0	5.0	1.0		3	2.0	

The 'Compact' display mode only shows the output name and its current rating.

Power Outputs			
Overview Output Configuration			
01 Example Single Pin Output 2.5A	0	02 Example Grouped Pin Output 48.0A	0

You can change the name and description of the output from the **Overview** page under the **General** section.

Power Outputs Overview Output Configuration					Display mode Compact 🝸 🔗
01 Example Single Pin Output 2.5A	0	02 Example Grouped Pin Output 48.0A	0	General Name	Example Single Pin Output
				Description	Single Pin



Outputs menu

The **Outputs** menu displays the allocated connector number and pin name(s) for the selected output.

General	General						
Name Example Grouped	Name Example Grouped Pin Output						
Description	Description						
Manufacturer Status							
Outputs Control Trips	Outputs Control Trips						
Power Outputs							
Connector	Pin Name						
3	М						
3	N						
3	Р						
3	S						

Control menu

The **Control** menu is where the PWM configuration and output control channels are configured.

PWM configuration

To enable PWM for an output select the **Use Duty Cycle** check box (1). You can then set the requested PWM frequency (2).

Note: The actual frequency is capped at the maximum frequency of the pin(s). Use the 'browse' tool to select a channel with units of proportion to control the PWM duty cycle (3), and then select an available channel from the channels list (4). Click **OK** to confirm your selection (5). If required, select the **Polarity** check box to invert the polarity (6).

		_	Outputs Control	Trips
	🚱 Choose a Channel — 🗆 🗙		PWM configuration	on
	Example Duty Channel	1	Use Duty Cycle	✓ Enabled
		2	Requested Frequence	ry 122.000 Hz *
5	start typing to filter the selection \otimes	3	Actual Frequency	122.07 Hz
	Sourced from Math Channels node.	4	Duty cycle	
	Show All	6	Polarity	Inverted
	Show Diagnostic Items OK OK Cancel			
			Output Control C	hannels
			In order of preceder	ice
			Force off	
			Force on	
			Use default	
			Control output)
			Default output cond	ition Off On

You can set the output to Off or On by default. Select the required **Default Output Condition** check box.

Outputs Control	Trips
PWM configuration	1
Use Duty Cycle	✓ Enabled
Requested Frequency	122.000 Hz ×
Actual Frequency	122.07 Hz
Duty cycle	Example Duty Channel 💮
Polarity	Inverted
Output Control Cha	annels
In order of precedence	2
Force off 1	\Box
Force on 2	
Use default 3	
Control output	
Default output conditi	on Off On

Trips menu

In the **Trips** menu, you can configure 'High' and 'Low' trip definitions. To set the high and low trip definitions, type the current trip rating in the **Current** box (1) and the t ime duration during which the current must be greater or equal than for the trip to occur (2). Select the **Time units** (seconds or milliseconds) from the check boxes (3).

You can also configure a voltage drop to cause the output to trip.

Outputs Control	Trips	
Trip definition		
Time unit	● s ○ ms	
	Current	Time
High trip	10.00	A 1.00 s
Low trip	8.00	A 5.00 s
	Voltage	Time
Delta voltage drop limit	1.00	V 0.50 s

The hard trip time is fixed by Cosworth but can be changed to suit specific applications. Contact the Electronics Support team (<u>electronics.support@cosworth.com</u>) for more information.

If the output trips, you can enable an optional 'Retry' to restart the output. You can configure up to nine attempted retries, with up to 30 seconds between each. Select a channel to trigger the trip reset from the 'browse' menu

Note: The trip reset channel must be a U8 data type.



29.4. Generated channels

Seven channels are automatically generated on the **Power Outputs** node and you can edit their names.

- Min Vbat Monitor:
- Max Vbat Monitor:
- Brownout:
- High Current Temperature 1:
- High Current Temperature 2:
- Low Current Temperature 1:
- Low Current Temperature 1:

These channels are not automatically logged but you can set a logging rate for these channels in the Channel Rates node.

29.5. Soft starts

It is possible to create a maths channel or logic channel with conditions that enable a device to slowly ramp up to the required output. This can reduce wear on components like lights and motors and avoid sudden inrush currents.

Create a maths channel that has the units of 'proportion' (1), and then create a counter as shown below (2).

Ge	neral									
Co	onfigu	re the basic p	properties that o	define this math cł	nannel.					
Na	ame		Duty_Counter	r	Quantity/Unit	proportion	~	%	~ 1	
					Data Type	F32	~			
Сс	omme	nt								
м	anufa	cturer Status	This is a r	normal item.						
			\bigcirc							
Eq	uatio	n								
Ec	lit the	equation tha	t determines th	ne value of this ma	th channel.				_	
	1	a0 (choos	e(@a0<100,	choose ([Out	put Conditi	on]==1, @a0+1	, 0), :	100));	Function: "@	⊉a0"
	2 3	@a0							Returns the	value of register a0.
i L										

This counter is enabled only once the **[Output_Condition]** is true (that is, the switch to activate the output is enabled). This channel needs to be named according to your switch/button that controls the output. Once the condition is met, the counter increments until it reaches 100 (100% duty).

The counter can be set to sped up/slowed down by modifying the evaluating rate of the 'Duty Counter' (for example, 1hz = 100 seconds, 100hz = 1 second, or 200hz = 0.5 seconds).



Select the configured output requiring 'soft start' and enable PWM (1). Set the **Requested Frequency** to the required frequency at 100% duty cycle (2). You can then select the new soft start '100% Duty Cycle' channel (3).

16 C-S	Power Output 16				1.0 •	3 20	• (PWM configuration		
		1.5	 5.0	1.0 5.0		5 2.0			Use PWM	✓ Enabled	
17 C-XY	Power Output 17 Slow Wiper	15.0	8.0 1	3.0 5.0	1.0	3 2.0	• (0	Requested Frequency	200.000 Hz ¥	2
18 C-ab	Power Output 18 Fast Wiper	15.0	8.0 1	3.0 5.0	1.0	3 2.0	- (С	Actual Frequency	244.14 Hz	1
19 C-Zh	Power Output 19	15.0	8.0 1	3.0 5.0	1.0	3 2.0	(\supset	Duty cycle	Duty_Counter	3
20 C-cj	Power Output 20	15.0	8.0 1	3.0 5.0	1.0	3 2.0	• () C	Polarity	Inverted	

30. Resources overview

The **Resources** menu allows you to quickly navigate setups, allowing:

- Navigation to item sources
- Identification of item consumers

The resources menu is found on the right side of the Toolset window and is permanently displayed. Click the **Resources** menu (1) and use the 'pin' tool to keep the menu open (2).

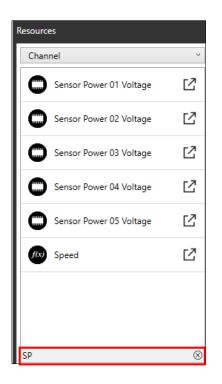
B	adenia 2xx* ×	Badenia 5xx*	× 🕇 Setups	€	₽	\ominus
0	Telltales	() w	heelspeeds			Resources
5	Vehicle Overview	ze	eroing			
0	Video					

30.1. Navigate to item sources

When the **Resources** menu is open, use the dropdown menu to search by item type.

Resources		
Channel		v
CAN Port		
Channel		
DC Excitation		
Event		
Input		
Latch		
LIN Port		
Lookup Table		
Output		
Rate Table		
Serial Port		
Strategy		
🚱 Car	Ľ	
Digital 01	ß	
Digital 02	ß	~
start typing to filter the selection		\otimes

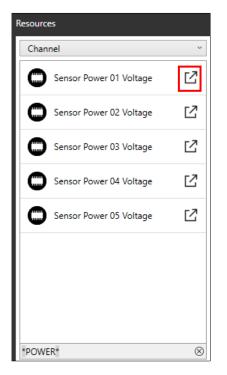
With the item type selected, you can use standard or 'magic' search tools to search or filter the item.



To use magic, press **CTRL + Shift + 8** simultaneously. A highlighted star indicates that the search is active. Type a specific word or phrase, and then press **CTRL + Shift + 8**. to close the magic search.

Resource	es	
Chan	nel	~
0	Sensor Power 01 Voltage	☑
0	Sensor Power 02 Voltage	☑
0	Sensor Power 03 Voltage	☑
0	Sensor Power 04 Voltage	☑
0	Sensor Power 05 Voltage	☑
POWE	R	\otimes

To navigate to the channel source, click the 'Navigate to resource' tool.



30.2. Identify item consumers

Click on an item to identify the consumers of an item (1). The consumers are displayed at the bottom of the **Resources** menu (2). Click the 'Navigate to resource' tool to go the consumer location in the setup (3). If there are many consumers, you can filter them with the standard search and 'magic' search functions (4).

Resources Channel v ☑ Sensor Power 03 Voltage Sensor Power 04 Voltage ☑ Z Sensor Power 05 Voltage Serial Number Ľ f(x) Speed 1 ß Status Channel Input Z Supply Voltage 12V6 Supply Voltage 1V1 ☑ start typing to filter the selection \otimes Consumers of: Speed 3 🖸 Example CAN Stream Speed Ľ 2 System Status ß 4 \otimes start typing to filter the selection Show Diagnostic Items



31. Send conditions

The **Send Conditions** node is used to configure any conditions that trigger a warning if send conditions have not been met before a setup is sent. If the send conditions are not met a pop-up warning is displayed. You can view details of the error and either cancel or proceed with the send.

31.1. Configure send conditions

To add a new send condition, click the + tool (1), and then select the type of condition (Bit-field Channel, Channel, or Strategy) from the dropdown menu (2). You can add multiple send conditions.

Send Conditions										
Conditions										
Configure the send con	ditions. If	f any of the sen	d conditions are n	net, then	the defined war	ning messa	ge wi	ll be c	lispl	ayed when sending to the device.
1										
	_	1								
Channel	2 👻			\odot	user type	Ŷ	=		~	0.000
Bit-field Channel										
Channel										
Strategy										

Once you select a condition type, click the 'browse' icon (1), select the channel from the dialog box (2), and click **OK** (3) to select the channel.

Send Conditions			
Conditions			
Configure the send conditions. If any of the send con	ditions are met, then the defined warning message will be displayed	when sending to	the device.
\oplus	Choose a Channel	- 0	×
	1 P2PSecsRemain		^
Channel ~	Prevent Send Condition		
	Previous Lap Time		\sim
	start typing to filter the selection		\otimes
	Sourced from Math Channels node.		
	Show All		
	Show Diagnostic Items 3	ок 🛇	Cancel

You can configure the condition that triggers a prevent send condition (1) and configure a custom warning message (2). Use the 'bin' tool to delete a send condition (3).

Send Conditions		
Conditions		
Configure the send conditions. If any of the send conditions are met, then the defined warning message will be displayed when sending to the device.		
\oplus	3	1
Channel v Prevent Send Condition 😳 user type v = v 1.000 Warning Message User Configurable N	1essage	
1 2 *Prevent Send Cond	ition Trigg	

If you attempt to send a setup when one of the send conditions is true, a warning box is displayed with the warning message from the triggered send condition (see above). Make sure that this message suggests a solution so that the error can be corrected before you attempt to send the setup again. You can cancel the setup send (1.) or **Show Additional Options** (2).



If you select **Show Additional Warnings,** you have the option to 'Override Warning(s) and Continue Sending' (1).





32. Sensors

Configuring sensors within Toolset is an essential part of monitoring vital data imported from a car. The following provides an overview of how to configure analogue and digital sensors, and various configuration options.

Note: Refer to Beacons for configuring a digital beacon input.

32.1. Analog sensors

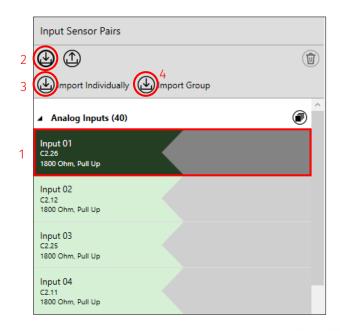
Identify an analog input

You can configure the name of the analog inputs on the **Hardware Settings** node (1). Underneath each input label is a connection identifier in the format 'CX.Y', where X and Y are values that identify the connector and the pin of the device, respectively (2).

Hardware Settings	Local (Badenia 5) - Analog Inputs			
Configure the hardware settings for the local and any remote devices. The order of any enabled remote devices must match the order in	Configure the analog inputs for the device.			
which they are connected to the device or they will not function.	Input 01	Input 02	Input 03	Input 04
	1 Name Example Analog Input	Name Input 02	Name Input 03	Name Input 04
▲ Local Badenia 5	Connection C2.26 2	Connection C2.12	Connection C2.25	Connection C2.11
Analog Inputs (40)	Input 05	Input 06	Input 07	Input 08
CAN Ports (8)	Name Input 05	Name Input 06	Name Input 07	Name Input 08
Digital Inputs (10)	Connection C2.9	Connection C2.10	Connection C2.8	Connection C2.24
Digital PWM Outputs (4)				
Excitations (10)	Input 09 Name Input 09	Input 10 Name Input 10	Input 11 Name Input 11	Input 12 Name Input 12
LIN Ports (2)	Connection C2.7	Connection C2.23	Connection C2.22	Connection C2.6
Serial Ports (2)				

Add an analog sensor

You can now configure the analog input on the **Sensors** node. To specify the desired sensor input, select an analog input (1), click the 'import' icon (2), and then click **Import Individually** (3). You can import multiple sensors as a group (4). You can import and export sensors between existing setups.





When you click the 'import' icon a popup is displayed that shows the Toolset sensor library. This allows you to select the required sensors. Select the required sensor (1), and then click **Import** (2).

G Attach Sensor						
he selected directory and all s	subdirectorie	es are searched for suitable items.				
Libraries		Name	Туре			
Read-Only Library ▷ My Library	\sim	Analog Push Button Sensor	Analog Voltage Sensors			
	\sim	Analog Voltage Sensor	Analog Voltage Sensors		1	
	\sim	Switch Sensor	Analog Voltage Sensors			
	Filter	start typing to filter the selection				(
	rinter.	start typing to futer the selection		\bigcirc		
			2	() mp	ort (X	Cance

Configure an analog voltage sensor

Sensor properties

Once the sensor is imported, a new window is displayed to the right of the screen to allow you to configure the sensor.

Enter a name for the sensor (1), add an optional comment about the sensor (2), and specify the termination type if required (3).

Configure the	e properties of the sensor.		
Name 1	Analog Sensor		
Comment 2	Example analog sensor fo	^r User Guide	
Termination	Pull-up 🗸	Value	1800 Ohms
	None		
3	Pull-down		
	Pull-up		

Terminations are available on specific inputs. You can see which inputs feature software selectable termination in the **Input Sensor Pairs** menu. The available termination for the input is denoted under the connector/pin identifier (1).



If no termination is available, 'No Termination' is displayed (2). If a 'Pull Up' termination is selected, the resistor must be specified to match the value in the **Sensor Pairs** menu.

The Pull Up termination is not available on all inputs. The Pull Down termination is not available on all analog inputs.

1	Input 08 C2.24 1800 Ohm, Pull Up	
2	Input 09 c2.7 No Termination	

Calibrated channel

Enter the calibrated channel name for the sensor (1), the units for the output quantity (2), and specify the data type (3). You can set an optional uncalibrated channel name to generate a raw uncalibrated voltage channel (4).

Calibrated	Calibrated Channel		Uncalibrated Channel	
Configure the calibrated sensor channel.			Optionally set the name to generate an uncalibrated voltage channel.	
Name	Calibrated Analog Sensor	1	Name Analog Input Raw Voltage 4	
Quantity	pressure v	2		
Data Type	F32 ×	3		



Sensor calibration

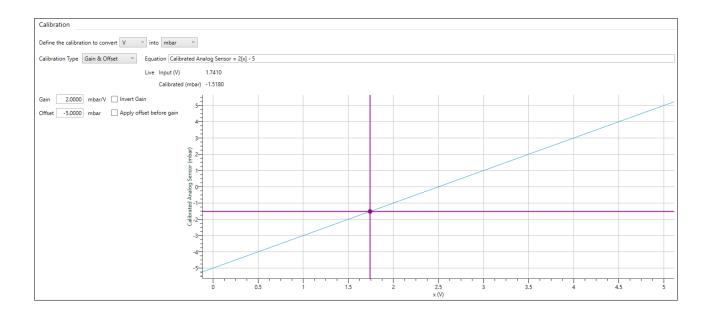
You can now calibrate the analog sensor input. You can define the conversion between voltage units (µV, mV, kV) (1) and the units of the selected output quantity (in this case the units of the selected quantity (pressure) are in bar) (2).

Calibration					
	1		_		2
Define the calibration to convert	۷	Ŷ	into	bar	Ŷ

There are three calibration types available to select from the **Calibration Type** dropdown menu:

Gain & Offset

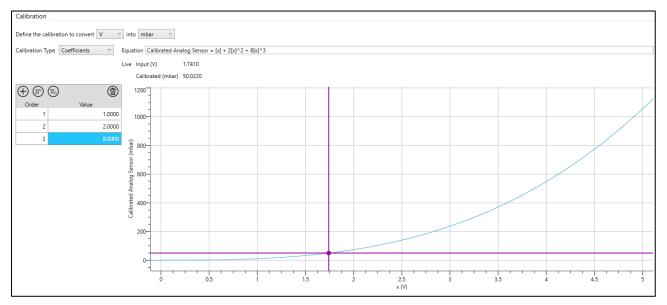
Used for proportional calibrations. You can apply a gain and offset to the raw analog voltage input to generate the calibrated output channel. You can insert the required gain and offset, invert the gain and the offset applied before the gain if required. The sensor curve is displayed on the X/Y chart and the equation of the line is displayed in the equation box. When connected to the device, the current sensor readout is displayed on the X/Y chart.





Coefficients

Used for exponential sensor curves. You can add and remove the number of orders from the equation with the = and 'bin' icons. Use the 'insert entry' tools to add orders before or after entries in the table. The sensor curve is displayed on the X/Y chart and the equation of the line is displayed in the equation box. When connected to the device, the current sensor readout is displayed on the X/Y chart.

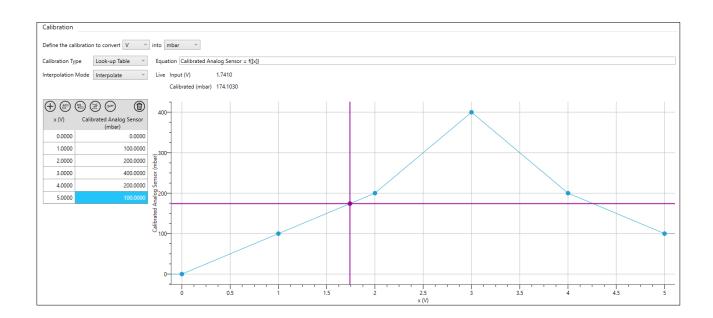


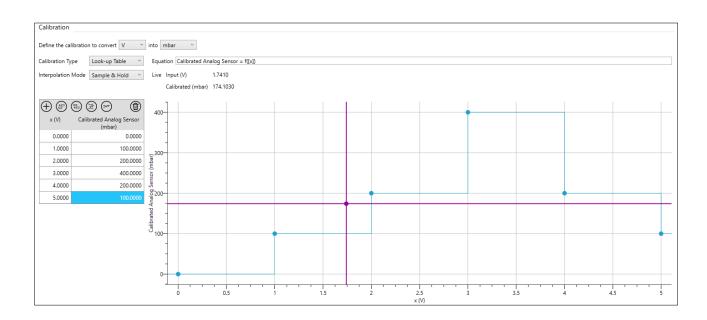
Look-up Table

Used to configure a sensor when the sensor curve is known from a datasheet or look-up table. In the look-up table you can associate certain values of the input channel to a corresponding output value. Toolset then offers three modes to interpolate input/output points in the look-up table:

- Extrapolate Toolset estimates output values given an input value outside the defined range.
- Interpolate Toolset calculates the output values between defined input value and corresponding output values.
- Sample & Hold Toolset holds the output value of its corresponding input until the next defined input value is reached and the output is then updated

By default, the interpolation mode is set to Interpolate.





Note: The **Equation** display is a display of the mathematical function of the sensor curve only. The equation of the sensor curve cannot be written in the field. If you need to copy in a known equation, transfer that equation into a coefficient or table form, and then copy those values into Toolset. You can copy tables from external sources and then copy them into Toolset. Once the table is copied, the corresponding equation will match.

Enabling Greatness for over 65 years



Configure an analog push button sensor

The push button sensor provides a way to use the analog input as a push button/switch input. The AIN input has a maximum input range of 0-30V 'to battery'. However, if you select 'switch to ground' an external pull up resistor is required to generate the switch to the input logic.

Details				
Sensor Name	Analog Sensor			
Comment	Example analog sensor for User Guide			
Manufacturer State	15			
Manufacturer Status	This is a normal item.			
	-			
Button				
Name	Analog Push Button Sensor			
Threshold	2.500	V ~		
T				
Irigger button press o	gger button press on the Rising 👻 edge of the input channel.			
	Falling			
	Rising			
1				

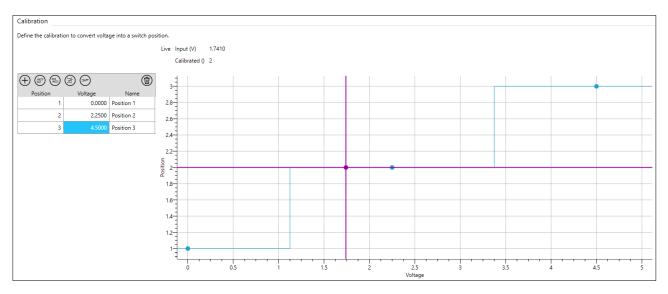
Configure an analog switch sensor

Add a name for the switch sensor (1) and an optional comment about the sensor (2) in the **Details** section. The actual switch sensor name is configurable in the **Switch** section (3).

	Sensor Pro	operties		
	Configure the properties of the sensor.			
1	Name	Analog Sensor		
2	Comment	Example analog sensor for User Guide		
	Manufacturer Status Manufacturer Status This is a normal item.			
	Switch			
3		the name of the switch. Nalog Switch Sensor		

This sensor type enables a user-defined number of switches at various voltages. To modify these values, simply add additional rows to the table or change the existing values. The graph changes based on the number of positions and voltage set.

The order of the positions must be respective to the voltages, such that the voltages increase from 0V to 5V. If this condition is not satisfied, then Toolset displays an error and highlights the boxes in red.



32.2. Digital sensors

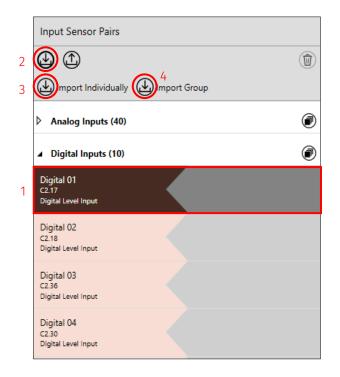
Identify a digital input

You can configure the names of digital inputs on the **Hardware Settings** node, depending on the sensor configuration required.

Hardware Settings Configure the hardware settings for the local and any remote devices. The order of any	Local (Badenia 5) - Digital Inputs Configure the digital inputs for the device.			
enabled remate devices must match the order in which they are connected to the device or they will not function.	Digital 01	Digital 02	Digital 03	Digital 04
	Name Example Digital Input	Name Digital 02	Name Digital 03	Name Digital 04
▲ Local Badenia 5	Connection C2.17 Type • Level • Beacon • Pulse	Connection C2.18 Type : Level () Beacon () Pulse	Connection C2.36 Type : Level O Beacon O Pulse	Connection C2.30 Type ● Level ○ Beacon ○ Pulse
Analog Inputs (40)				
CAN Ports (8)	Digital 05	Digital 06	Digital 07	Digital 08
Digital Inputs (10)	Name Digital 05	Name Digital 06	Name Digital 07 Connection C3.8	Name Digital 08 Connection C3.3
Digital PWM Outputs (4)	Type Level Beacon Pulse	Type Level Beacon Pulse	Type Level Beacon Pulse	Type Level Beacon Pulse
Excitations (10)				
LIN Ports (2)	Digital 09	Digital 10		
Serial Ports (2)	Name Digital 09	Name Digital 10		
	Connection C3.7	Connection C3.2		
	Type 💿 Level 🔿 Beacon 🔿 Pulse	Type 💿 Level 🔿 Beacon 🔿 Pulse		
		·		

Add a digital sensor

You can then configure the digital input on the **Sensors** node. To specify the desired sensor input, select a digital input (1), click the 'Import' icon (2), and then click **Import Individually** (3). You can import multiple sensors as a group (4) and import and export sensors between existing setups.



When you click the 'import' icon a popup is displayed that shows the Toolset sensor library. This allows you to select the required sensors. Select the required sensor (1), and then click **Import** (2).

Libraries		Name	Туре			
Read-Only Library	7.	DF11i Rotational Sensor	Digital Pulse Sensors			
 My Library 			-		1	
2024 AC INPUTS 2024 Bat Limitation Math		Digital Push Button Sensor Rotational Sensor	Digital Level Sensors			
2024 CAN 2024 Firefly 2024 Led Configuration 2024 Logic Channels 2024 SCA 2024 Toca Scrutineering AliveDrive PDR 2.0 AMR GT3 Auto Backup CAN Streams PDR 2.0 Display Sim Channels Ethan MUX Examples NM Frame Ronge Slider 2024 SC3			Digital Pulse Sensors			
>	Filter:	start typing to filter the selection		_		



Configure a digital push button sensor

Add a name for the sensor (1) and an optional comment about the digital button (2) in the **Details** section. The actual button channel name is configurable (3), together with the 'mode' (4) in the **Button** section. The 'mode' allows you to configure if the button triggers on the rising or falling edge of the digital input channel.

Details	
Sensor Name	Digital Push Button
Comment	Example digital push button for User Guide
Manufacturer St Manufacturer Stat Button	
Name	Example Digital Push Button
Trigger button pre	ess on the Rising vedge of the input channel.

Configure a DF11i rotational sensor

If a DF11i wheel speed sensor is attached to a digital input, you can configure the number of pulses that occur in a revolution of the sensor trigger wheel.

Note: For a 48 tooth reluctor wheel, the total number of pulses per revolution is 96.

You can enter a name for the sensor (1) and add an optional comment (2) about it in the **Details** section. You can configure the **Calibrated Channel** name (3) and set the number of pulses per revolution (4).

	Details	
1	Sensor Name	DF11i Rotational Sensor
2	Comment	Example DF11i rotational sensor for User Guide
	Manufacturer Stat	US This is a normal item.
	Uncalibrated Inpu	t
	Input Type	 DF11i
	Calibrated Channe	.l
3	Output	Front Right DF11i Wheel Speed
	4	One revolution occurs every 8 pulses



Configure a rotational sensor

If another type of wheel speed or rotational sensor is used, then you must import the rotational sensor. There are four different options:

Sensor Type	Specification	Description
Active	Hall effect – Driven Low	Low would assert an output of 1 when the input signal is Low
Active	Hall effect – Driven High	High would assert an output of 1 when the input signal is High
Passive	Variable Reluctance Sensor	Uses a two-wire sensor and magnetic pickup
Passive	Crankshaft Position	Uses a two-wire sensor and magnetic pickup

You can enter a name for the sensor (1) and add an optional comment (2) about it in the **Details** section. Select the uncalibrated input type (3). You can configure the calibrated output channel name (4) and set the number of pulses per revolution (5). This is determined by the tooth count of the trigger wheel used to drive the digital input.

Note: If you create an input for a wheel speed sensor, the sensor is not defined internally as a wheel speed until it is set up within the **Wheel Speed** node. Until this is done, Toolset only recognizes it as a rotational sensor.

	Details		
1	Sensor Name	Rotational Sensor	
2	Comment Example rotational sensor for User Guide		
	Manufacturer Stat	0	
	Uncalibrated Input		
3	Input Type	 Active (Hall Effect - Driven Low) Active (Hall Effect - Driven High) Passive (Variable Reluctance Sensor) Passive Crankshaft Position 	
	Calibrated Channe	el	
4	Output	Calibrated Rotational Sensor Output	
	5	One revolution occurs every 8 pulses	

Digital input information

Maximum input voltage

The table below shows the maximum input voltage for the different sensor types:

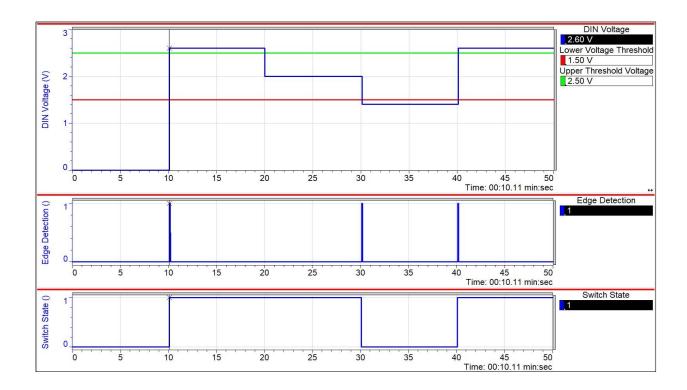
Input type	Maximum input voltage
Digital Push Button Sensor	Battery voltage (up to 32V)
Rotational Sensor	Battery voltage (up to 32V)
DF11i Rotational Sensor	Only to be used with a DF11i Sensor. Any over-voltage could cause damage to the pull down resistor.

Threshold voltages

The table below shows the threshold voltages for the signal edge detection. Both the upper and lower thresholds must be passed for an edge to be detected. The input remains registered until both the upper and lower threshold have been passed back through again.

Mode	Pull	Lower voltage threshold (V)	Upper voltage threshold (V)
OFF	None	0	0
Beacon/Level/Hall Effect	Pull Up	1.5	2.5
VRS	None	-0.5	0.5
Current (DF11i)	Pull Down	2.25	3.25

The diagram below shows the digital input edge detection logic. Both the lower and upper thresholds must be passed, in either direction, for an edge to be detected by the device.



32.3. Virtual sensors

You can configure CAN channels (see **Setups - Streams**) to be an analog voltage input or a digital level input from the **Type** dropdown menu.

Input Sensor Pairs						
	Ŵ					
Analog Inputs (40)	۲					
Digital Inputs (10)	۲					
Expansion Device 1 Analog Inputs (24)	۲					
Expansion Device 1 Digital Inputs (4)	۲					
Expansion Device 2 Analog Inputs (24)	۲					
Expansion Device 2 Digital Inputs (4)	۲					
Virtual Analog Inputs (1)	۲					
Virtual Digital Inputs (1)	۲					

When you select an analog voltage input or a digital level input type, a virtual sensor is generated on the **Sensors** node.

Con	ent								
Conf	Configure the content that makes up this packet.								
\oplus				٦					
Name	Virtual Analog Input	Туре	Analog Voltage Input v Start Bit 0 Length 1						
Name	Virtual Digital Input	Туре	Digital Level Input Start Bit 0 Length 1 Channel Bit-Field Channel Indexor Analog Voltage Input Digital Level Input Button Group Multiplexed Region						

A virtual sensor is configured in the same way as a standard analog or digital sensor.



33. Setup locking

When a device is supplied as a series specified component, the championship organiser or a manufacturer to lock setup items and channels for a team, customer, or other user groups. The **Setup Locking** node is used to configure what is hidden from the end user.

The **Setup Locking** node is made available with a manufacturer 'key' – a software license or a physical dongle. Contact <u>sales@cosworth.com</u> to request a quote.

The Setup Locking node contains two menus: Setup Locking and User Groups.

33.1. Setup Locking menu

The **Setup Locking** menu allows a manufacturer to select which nodes are available to the end user when the manufacturer key is not present. Unselected nodes are hidden from users without the manufacturers key and cannot be edited.

A manufacturer can view all the available nodes in the **Setup Locking** menu. Click on the node in the menu to unlock the node (1), and then select the check box (2).

Setup Locking User Groups	
Actuators	Channel Rates 2 This enables the ability to define and edit channel rates, even when the setup is locked.
Alarms	
Auto-Coding	
Beacons	
Hz Channel Rates 1	
Circuits	
Displays	
CU ECU	



There are two distinct parts to setup locking: 'Manufacturer Status' and 'Channel Protection'.

Manufacturer status

In some instances where a node contains items that a customer might need to edit, such as Maths channels, you can leave specific manufacturer items unmarked ('**None**'), marked as '**Recommended**', made '**Read-only**', or totally '**Hidden**' from the customer.

- None The item is unmarked and is completely unprotected from an unlicensed user in the setup.
- **Recommended** The manufacturer has recommended that the item is left in the setup, but the item is completely unprotected from an unlicensed user.
- **Read-Only** The manufacturer has protected the item from one or more user groups so that it cannot be edited, but you can still view the item in the setup.
- **Hidden** The manufacturer can completely hide the item from one or more user groups so that the item cannot be seen in the setup.

Click in the circle to select the Manufacturer Status from the dropdown menu (1)

configure the basic propertie	es that define this math cha	annel.			
Name	Example Item	Quantity/Unit	user type	~	
		Data Type	F32	v	
Comment	Example Item for Setup	Locking for User Guide			
Manufacturer Description					
Manufacturer Status					
Manufacturer Status Manufacturer Status 1	This is a normal iter	2			
	This is a normal iter	n			
		n.			
	None	1			

A manufacturer can also select the minimum viewing and editing user group for an item. Click the 'browse' icon (1), and then select the user group from the dropdown menu (2).

Manufacturer Status	Choose a UserGroup	- 0	×
Manufacturer Status	Example User Group		A
Animum viewing user group 1	start typing to filter the selection		\otimes
Ainimum editing user group	Sourced from Setup Lockina node.		
	Show Diagnostic Items	🕢 ок (Cancel

Channel Protection

Channel Protection allows a manufacturer to hide channel data from one or more user groups. This means that when the data is opened by an unlicensed user, the channel is not shown.

Click Protect (1) to enable channel protection or Remove Protection to disable it (2).

Protection	
Protecting the channel prevents users without an appropriate license from viewing channel dat	a.
Protect Remove protection	

User Groups

The **User Groups** menu on the **Setup Locking** node allows a manufacturer to configure the setup editing restrictions for one or more user groups.

By default there are two user groups: Administrator and Unlicensed User. The following restrictions apply:

	Administrator	Unlicensed User
Can protect channels	 	×
Can edit manufacturer items	 	×
Can import LDF	 	×
Can edit Send Conditions	 	×
Can edit Setup Locking	 	×

A summary of the restrictions is shown at the top of the User Groups menu.

Click the + button (1) to create additional user groups. You can name the new user group (2) and set restrictions from the dropdown menus (3). You can import and export user groups between existing setups (4). You can use the 'bin' tool (5) to delete user groups.

	5. General	
Administrator	Name Example Use	r Group 2
Example User Group	Level 1	
Unlicensed User	Restrictions	
	Configure the restric	tions placed on users with this license level
	Channel Protection	Cannot view protected channel definitions
	Manufacturer Items	Cannot edit manufacturer items
	LDF Import	Cannot import LDF
	Send Conditions	Cannot view send conditions node
	Setup Locking	Cannot view setup locking
	L	

The user group 'Level' is used to define the hierarchy of user groups when a manufacturer has added one or more groups.

Setup Locking User Groups								
Summary								
Administrator Unlicensed User								
Channel Protection	Can protect channel definitions	Cannot view protected channel definitions						
Manufacturer Items	Can edit manufacturer items	Cannot edit manufacturer items						
LDF Import	Can import LDF	Cannot import LDF						
Send Conditions Can edit send conditions node Cannot view send conditions node								
Setup Locking	Can edit setup locking	Cannot view setup locking						

The example below shows additional 'Scrutineer' and 'Engine Builder' user groups with different restrictions applied. The Administrator is assigned 'Level 0' by default. A manufacturer can define the hierarchy for any new user groups. In this example 'Scrutineer' is assigned 'Level 1' and 'Engine Builder' is assigned 'Level 2'. Therefore 'Scrutineering' is placed higher in the hierarchy.

Note: If a user group lower in the hierarchy is unrestricted from an item, then user groups higher in the hierarchy are automatically unrestricted too.

	General
Administrator	Name Scrutineer
Scrutineer	Level 1
Engine Builder	Restrictions
Unlicensed User	Configure the restrictions placed on users with this license level
	Channel Protection Can view protected channel definitions
	Manufacturer Items Can edit manufacturer items
	LDF Import Cannot import LDF
	Send Conditions Cannot view send conditions node
	Setup Locking Can view setup locking
	General
Administrator	Name Engine Builder
Scrutineer	Level 2
Engine Builder	Restrictions
Unlicensed User	Configure the restrictions placed on users with this license level
	Channel Protection Can view protected channel definitions
	Manufacturer Items Cannot edit manufacturer items
	LDF Import Cannot import LDF
	Send Conditions Cannot view send conditions node
	Setup Locking Cannot view setup locking

The summary of the restrictions for the user groups is updated and displayed at the top of the **User Groups** menu.

ietup Locking User Groups									
Summary									
	Administrator	Scrutineer	Engine Builder	Unlicensed User					
Channel Protection	Can protect channel definitions	Can view protected channel definitions	Can view protected channel definitions	Cannot view protected channel definitio					
Manufacturer Items	Can edit manufacturer items	Can edit manufacturer items	Cannot edit manufacturer items	Cannot edit manufacturer items					
LDF Import	Can import LDF	Cannot import LDF	Cannot import LDF	Cannot import LDF					
Send Conditions	Can edit send conditions node	Cannot view send conditions node	Cannot view send conditions node	Cannot view send conditions node					
Setup Locking	Can edit setup locking	Can view setup locking	Cannot view setup locking	Cannot view setup locking					

When user groups are configured, you can log channels in different tables and at different rates depending on the user group. See **Logging Tables – Rate Groups and Channel Rates – Multiple Rate Groups** for more information.



34. Setups page

The **Setups** page is the main hub of Toolset. From here you can find and configure all device setups.

34.1. Create a setup

To create a new blank setup, click **New** to open the **Create Setup** dialog box.

🐡 Badenia 5x	<#100	Data	(••) Live Data	Actions	Setups	Channels	↑ Settings			
$\boldsymbol{\in} \boldsymbol{\ominus} \boldsymbol{\Theta}$	🖗 s	etups								
🖉 Open 💼 Ren	ime 🕼	Copy 🕀	lew 🕞 Read from	Active Device		Export (2)	Compare Setups	Apply Merge File	Change Metadata	Change Variant

Select the device type (1) and metadata version for the setup (2). If the device type or specific metadata version is not shown, use the 'import' tool to import device metadata (see Import and Export a Setup).

You can locate device metadata in Settings – Upgrade or contact <u>electronics.support@cosworth.com</u>. Click **Create setup** (3) to create the new blank setup.

Cı	reate Setup		x
	Create Se	tup	
		ct the device and metadata version like to create a setup for.	_
1	Device	Badenia 2xx v	
2	Metadata	4.0 ~	
		Create setup 🗙 Close	_

34.2. Open a setup

In the **Setups** menu, select a setup from the list and click **Open**, or double-click the setup.

Badenia 5xx #100	Data	(••) Live Data	Actions	Setups	Channels	1 Settings			
	etups								
Den 🗊 Rename 🕼	Copy 🕀	New 🕞 Read from	Active Device	Import	Export 😫	Compare Setups	Apply Merge File	Change Metadata	Change Variant

34.3. Rename a setup

Select a setup from the list and click **Rename**.

🐡 Badenia 5xx #100	Data	(••) Live Data	Actions	Setups	Channels	1 Settings			
	etups								
Dpen Rename	Сору 🕀	New 🕞 Read from	Active Device	Import	Export (2) Compare Setups	Apply Merge File	Change Metadata	Change Variant



In the **Rename Setup** window enter a new setup name (1), and then click **OK** to confirm (2).

Rename Setup	x
Original Name	Badenia 2xx
New Name 1	New Setup Name
	2 OK Cancel

34.4. Copy a setup

This is useful for duplicating a setup to modify so that the original setup is preserved. Select a setup from the list and click **Copy**.

🐼 Badenia 5xx #	100 [Data ((••) Live Data	Actions	Setups	Channe	ls 🕇 Setti	ngs		
\leftrightarrow \Rightarrow \otimes $($	Setups									
🖉 Open 💼 Rename	Сору	New	Read from	Active Device		Export	(₴) Compare Set	ups 🕒 Apply Merge File	Change Metadata	Change Variant

34.5. Delete a setup

Select a setup and click the 'bin' tool.



34.6. Search a setup

If there are many setups on the **Setups** page, you can search and filter them with the standard search and 'magic' search functions.

Standard search

To use standard search, click in the **Setups** area and start to enter the setup name. The setups are filtered by the exact entered text. This search method must match the channel name exactly to show the result.

🐡 Badenia 5xx #100	Data	(•)) Live Data	Actions	Setups	Channels	1 Settings			
	etup Compar	ison × Setups							
🖉 Open 🗊 Rename 🕼	Сору	New Read from	Active Device	Import (Export	Compare Setups	Apply Merge File	Change Metadata	Change Variant
Name									
Antares8xx									
ANTARES8X									

Magic search

If the exact channel name is unknown, you can use the magic search function. Magic search is a 'broad' search tool, which can display results containing any string. Press **CTRL + Shift + 8** simultaneously. A highlighted star shows the search is active. Type a specific word or phrase, and then press **CTRL + Shift + 8** to close the search. An example is shown below.

🐡 Badenia 5xx #100	Data	((*)) Live Data	Actions	Setups	Channels	1 Settings			
	etup Comp	oarison × Setups							
🖉 Open 🗊 Rename 🕼	Сору (New Read from	Active Device		Export 🗦	Compare Setups	Apply Merge File	Change Metadata	Change Variant
Name									
Antares8xx									
8XX									

You can also combine multiple terms in the search, to find multiple parts of a setup name in a single search.

🐡 Badenia 5xx #100	Data	((*)) Live Data	Actions	Setups	Channels	1 Settings			
	etup Compari	ison × Setups							
🖉 Open 🗐 Rename 🕕	Сору 🕀	New (Active Device	(Import	Export 🔁	Compare Setups	Apply Merge File	Change Metadata	Change Variant
Name									
Badenia 5xx v4.0									
*BAD**V4*									

34.7. Read a setup from an active device

When connecting to a device with a setup already loaded, it is possible to read the setup from the device. This is useful for when the setup on the device is not already stored in the User setups page.

Tip: Always read the setup from the device to store an original copy of the setup before overwriting the setup, modifying the setup or updating device firmware and setup metadata.

🐡 Badenia 5xx #100	Data	(••) Live Data	Actions	Setups	Channels	1 Settings			
	tups								
🖉 Open 🗐 Rename 🕼 C	Copy 🕀	New Read from	Active Device	(Import	Export (Compare Setups	Apply Merge File	Change Metadata	Change Variant

34.8. Import and export a setup

You can use the 'import' and 'export' tools to import and export setup files (*.toolset*) between PCs and versions of Toolset.

Badenia 5xx #100) Data	a ((•)) Live Data	Actions	Setups	Channe	els	Settings			
$\textcircled{\ }\textcircled{\ }\textcircled{\ }\textcircled{\ }\textcircled{\ }\textcircled{\ }\textcircled{\ }\textcircled{\ }$	Setups										
🖉 Open 🗊 Rename (Сору (New	Read from	Active Device		Export	(≠) c	ompare Setups	Apply Merge File	Change Metadata	Change Variant

Note: Some versions of setup metadata are only compatible with specific versions of Toolset. If an incompatible setup is imported an error message is displayed.

34.9. Compare and merge setups

Toolset can compare setups which can be useful for identifying differences between setups. The **Compare Setups** tool also allows you to merge the setup differences from one setup to another, allowing efficient updating of setup configurations between setups.

To enable the **Compare Setups** tool, select two setups in the setup library and use the **Ctrl** key to highlight them.

Centaurus 4.0	Centaurus 560	4.0	1.2	17/10/2024 10:02:23
Centaurus 3.2.448	Centaurus 560	3.2 👚	1.2	17/10/2024 10:02:38

Select the Compare Setups tool.

🐡 Badenia 5xx #100	Data	(••) Live Data	Actions	Setups	Channels	↑ Settings			
	etups								
🖉 Open 🗊 Rename 🕅	Copy (+)	New 🕞 Read from	Active Device	(Import	Export 🕞	Compare Setups	Apply Merge File	Change Metadata	P Change Variant

This opens a new tab on the **Setups** page where the difference between setups is displayed by node.

🐡 Badenia 5xx #100 Data (••) Live Data	Actions Setups Channels	1 Settings		
C I Show merging options	Badenia 5xx v4.0	₽	Badenia 5xx v3.2	^
▶ 🛃 Alarms	Replace in target	I		Ľ
► ≢ Allowed Versions	Replace in target	Ľ		Ľ
▶ ≢ Beacons	Replace in target	Ľ		Ľ
▶ ≢ Buttons	Replace in target	Ľ		Ľ

Click on a 'top level entry' (node) to open a lower level of 'children' (a list of items within the node that are different between setups) (1). You can open and collapse all entries with the 'Expand' and 'Collapse All' tools (2). Click on an 'child' item to view the individual item and its differences (3).

If an item exists in the target setup you can select the **Replace in Target** option (4). If an item does not exist in the target setup, then select the **Add to Target** option (5). If the no merging options are displayed make sure that the **Show merging options** box is selected (6). Use the **Select all children of this item** tool to select all merging options for an item (7).

The 'base' setup is displayed on the left of the **Compare** tool, with the target setup displayed on the right. If the home and target setups are not in the correct position, use the 'invert' tool to switch the home and target setups (8). Use the 'navigate' tools to explore setup items (9). This is useful for inspecting items before selecting them to merge.

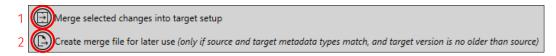
2 6			8	
💭 🗊 🗊 🗹 Show merging options		Badenia 5xx v4.0	=	Badenia 5xx v3.2
▼ 🛃 Alarms		Replace in target	7 💿 🖻	E
Priorities 3	1 - ECT Alarm 2 - EOP Alarm 3 - VBAT Alarm		Ŭ	
		Add to target 5	₽ 9	
Comment Comment Comment	Allowed			
Condition Description	"ECT_sim" > 100.000 °C for 0.000s			
DisplayChannel	"ECT_sim" Dps 0K			
HiddenManufacturerPropertiesHash	A89FEEAD2C15015			
ISEnabled	True			
	ECT High			
Qualifiers				
RetriggerGuardTime	0.000s			
ShortText	ECT			
EOP Alarm		Add to target	Ľ	
VBAT Alarm		Add to target	Ľ	
Allowed Versions		Replace in target	Ľ	Ľ
▶ 🛃 Beacons		Replace in target	Ľ	Ľ
▶ 🛃 Buttons		Replace in target	Ľ	12

The 'navigate to item' tool opens the setup in a new tab. You can open setups in compare setups, but if any changes are made, use the 'refresh' tool (1) to update merging options. A warning message is displayed to remind you (2). You must close the setup after any changes are made to allow merging options to be redisplayed. Again, a warning message is displayed to remind you (3).

Changes have been made to at least one of the setups in this comparison report, refresh the report to allow merging.
At least one of the setups in this comparison report is open in Toolset, close it to allow merging.
Image: Ima

Select the required merging options. There are two options:

- Merge Merge all the selected items now (1)
- Create merge file you can create a file containing the changes and apply it later (2)



If Merge selected changes into target setup is selected, you are prompted to accept the merge.

Click **Accept Merge** (1) to update the target setup with the changes. It is recommended that you make copies of setups when merging, so that the original setups are saved. Click **Cancel Merge** to cancel the merge if an error is identified in the preview (2).

🕑 Merge Preview	—		×									
Review the changes to "Centaurus 4.0", and choose whether to accept or cancel the merge. Only changes that you have permission to view will be shown.												
✓ → Switches → C1.25												
Accept Me	erge 🗭	Cancel 1	Иerge									

If you select **Create merge file for later use** you are prompted to add a comment (1). Click **Create** to display a window that allows you to save the *.merge* file (2). You can cancel the creation of the merge file if an error is identified (3).

🚱 Create Merge File 🛛 🗙														
Create a merge file containing the selected differences. This file can later be used to apply the differences to another setup.														
Comment	Comment Modified Setup													
1														
	Create Cancel													



When you need to use the merge file, click on the target setup and select the **Apply Merge File**.

🐡 Badenia 5xx #100	Data	(••) Live Data	Actions	Setups	Channels	1 Settings						
🖉 Open 🗊 Rename 🕼	Copy 🕀	New 🕞 Read from	Active Device	Import (€xport	Compare Setups	Apply Merge File Change Metadata	Change Variant				

A popup window opens where you can search for the required *.merge* file. When selected the window displays the comment added during the merge creation.

Click **Merge** to display a preview which summarises the setup changes.

🔇 Apply M	lerge File	×											
Select a merge file to apply to "Centaurus 4.0".													
Merge File Centaurus 5.merge													
Created	reated 17/10/2024 09:36:03												
Comment	Modified Setup												
	Merge 🗙 Cancel												

Click Accept Merge to add the changes to the target setup.

G Merge Preview		—		×								
Review the changes to "Centaurus 4.0", and choose whether to accept or cancel the merge. Only changes that you have permission to view will be shown.												
✓ → Switches → C1.25												
	Accept Mer	rge 🗙	Cancel	Merge								



34.10. Change setup metadata

The setup metadata version must match the device firmware. If the device firmware is updated, then then you must also update the setup metadata before the setup can be sent. To change setup metadata, use the **Change Metadata** option.

Badenia 5xx #100	Data	(••) Live Data	Actions	Setups	Channels	s 🕇 Settings					
🖉 Open 💼 Rename 🕼	Copy (New Read from	n Active Device	Import	Export	← Compare Setups	Apply Merge File	Change Metadata	Change Variant		

The Change Metadata Version menu allows you to select from the available metadata versions (1).

If the required metadata version is not shown, you can use the 'import' tool (see Import and export a setup). Device metadata is located in Settings – Upgrade, or contact <u>electronics.support@cosworth.com</u>.

Make sure that you create a backup of the original setup before changing metadata versions. Select the **Create backup before changing metadata version** option to automatically make a save a copy of the original setup (2). The setup metadata history of the setup is stored so you can view the update history (3). Click **Apply** (4) to change the setup metadata version.

Current Metadata Version: 3.1	
Version	Minimum Toolset Version
4.0	10.0
3.0	9.0
2.0	8.0
Create backup before changing metada	ta version.
listory: 2024-10-25 13-46 Changed from Badenia 5 2024-10-25 13-46 Changed from Badenia 5 2024-10-25 13-47 Changed from Badenia 5	v2.0 to Badenia 5 v3.1

34.11. Changing setup variant

Like firmware and metadata versions, the setup variant must match the device variant. If a new setup is created, or a blank metadata file is imported, the setup variant must be selected before the setup can be sent.

To select the setup variant, use the Change Variant tool.

🔊 Ba	adenia 5xx #10	0 Da	ata (v	•)) Live Data	Actions	Setups	Channe	els	1 Settings			
\bigcirc \bigcirc \bigcirc \bigcirc \bigcirc Setups												
Open	Rename	Сору	New	Read from	Active Device	Import	Export	(7)	Compare Setups	Apply Merge File	Change Metada	ata OChange Variant

If the setup variant is not set before you attempt to send a setup, or the setup variant is different from the device variant, you are prompted to select 'Use Device Variant' or 'Use Setup Variant'.



35. Shift lights

The **Shift Lights** node is used to configure the shift lights on display devices such as the CDU range and the CCW Mk2 and CCW Mk3.

35.1. Add a new shift light pattern

The first step to add a new shift light configuration is to add a new shift light pattern group. Use the + tool to add a new shift light pattern group (1). You can import and export shift light pattern groups between existing setups (2). Use the 'bin' tool to delete an unwanted shift light pattern group (3).

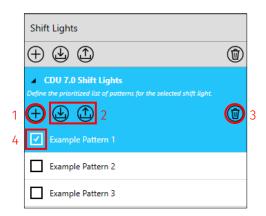
Shift Lights	
	()
1 2	3

You can enter a name for the new group (1) and add an optional comment about the group (2).

The number of LEDs for the pattern group must be set (3). For example, a pattern group for CDU 7.0 with 10 shift lights is set to 10 LEDs. You can select an option to **Flash if all LEDs are lit** (4). This is useful for alerting the driver to shift gear.

	General		
1	Name	CDU 7.0 Shift Lights	
2	Description	Example Shift Light Pattern for User Guide	
3	Number of LEDs	10	
4	Flash if all LEDs are lit	\checkmark	

You can then add shift light patterns. Click the + tool within the pattern group to add a new pattern (1). You can import and export patterns between existing setups (2). Use the 'bin' tool to delete a pattern (3). Enable or disable patterns from the setup using the 'Enable' check box (4).





35.2. Configure shift light patterns

To configure a shift light pattern, click the shift light pattern group to select the input channels to drive the shift light pattern.

Two channels are required for the 'Row Selector Channel' and 'Threshold Channel'. The 'Row Selector' channel is most likely to be the 'Gear' channel (1) and the 'Threshold' channel is most likely to be RPM (2). Click on the 'browse' buttons to select another channel. You must configure the units for the Threshold Channel value (3).

	Inputs													
	Configure the channels used to drive the shift lights.													
1	Row Selector Channel	Gear												
2	Threshold Channel	RPM ····												
3	Threshold values in:	angular velocity ~ rpm ~												

To configure the shift light pattern, select the new pattern from the menu (1). You can name the pattern (2) and add an optional comment (3).

The pattern is configured using the pattern table (4). Configure the table with the required number of rows (for example, gears) and thresholds/columns (for example, RPM breakpoints) (5). You can add rows and thresholds and delete them with the + and 'bin' tools (6). You can import and export Pattern tables between existing setups (7).

Note: You can create shift light pattern tables in Excel and copy and paste them into Toolset. This allows you to create complex tables that require calculations to define the thresholds, saving time and simplifying the process.

	Shift Lights		Gen	eral														
	$\oplus $	١	Nam	Name Example Pattern 1					2	2								
	CDU 7.0 Shift Lights		Desc	riptio	ption Example Pattern for User Guide 3							3						
	Define the prioritized list of patterns for the selected shift light.		Enabled 🔽															
		1	Thresholds and Patterns															
1	Example Pattern 1		Conf	Configure the thresholds above which each LED pattern configuration should illuminate.														
	Example Pattern 2		Dim	ensio	ins	10 Colu	umns ×	. 7	Rows	5								
	Example Pattern 3		Ð	٢	7		6											
					Pattern C	onfiguratio	on 🕂 (Ì										
					0	1	2	3	4	5	6	7	8	9				
			(±)	0	4500	4750	5000	5250	5500	5750	6000	6000	6000	6000				
			١	1	5500	5666	5832	5998	6164	6330	6496	6662	6828	6994				
				2	5500	5666	5832	5998	6164	6330	6496	6662	6828	6994				
			4	3	5650	5800	5950	6100	6250	6400	6550	6700	6850	7000				
				4	5750	5885	6020	6155	6290	6425	6560	6695	6830	6965				
				5	5800	5933	6066	6199	6332	6465	6598	6731	6864	6997				
				6	5800	5933	6066	6199	6332	6465	6598	6731	6864	6997				

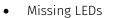


Click a cell in the table to configure the LED pattern (1). Select which LEDs are on for the cell by clicking LEDs within the LED strip (2). The LED strip shows a preview of how LEDs light up based on the thresholds. Green circles indicate LEDs that will be lit. Click them to toggle them on/off.

		0	1	2	3	4	5	6	7	8	9
⊕ @	0	4500	4750	5000	5250	5500	5750	6000	6000	6000	600
٦	1	5500	5666	5832	5998	6164	6330	6496	6662	6828	699
	2	5500	5666	5832	5998	6164	6330	6496	6662	6828	699
	3	5650	5800	5950	6100	6250	6400	6550	6700	6850	700
	4	5750	5885	6020	6155	6290	6425	6560	6695	6830	696
	5	5800	5933	6066	6199	6332	1 6465	6598	6731	6864	699
	6	5800	5933	6066	6199	6332	6465	6598	6731	6864	699

This allows you to configure various LED patterns. For example:

- LED Pattern Configuration 🕀 🍿 1 2 3 4 5 6 7 8 9 \oplus The LEDs will be lit as below for the selected threshold and pattern. Click an LED to switch it On/Off. (On = green, Off = black). LED Pattern • Increment to centre LED Pattern Configuration (+) (1) 0 1 2 3 4 5 6 7 8 \oplus The LEDs will be lit as below for the selected threshold and pattern. Click an LED to switch it On/Off. (On = green, Off = black). LED Pattern
- Left to right increment



~		0	1	2	3	4	5	6	7	8	9
Ð	0	4500	4750	5000	5250	5500	5750	6000	6000	6000	60
1	1	5500	5666	5832	5998	6164	6330	6496	6662	6828	69
	2	5500	5666	5832	5998	6164	6330	6496	6662	6828	69
	з	5650	5800	5950	6100	6250	6400	6550	6700	6850	70
	4	5750	5885	6020	6155	6290	6425	6560	6695	6830	69
	5	5800	5933	6066	6199	6332	6465	6598	6731	6864	69
	6	5800	5933	6066	6199	6332	6465	6598	6731	6864	69



35.3. Multiple shift light patterns

You can add multiple shift light patterns to a shift light pattern group. If you add multiple shift light patterns, then you must configure the shift light pattern selector on the **Shift Lights** pattern group page. Click the shift light pattern group (1), select whether a Bit-field Channel, Strategy, or Switch is used to select the pattern (2), and the select an available channel from the 'browse' menu (3).

	Shift Lights		General	
	\oplus	١	Name	CDU 7.0 Shift Lights
	CDU 7.0 Shift Lights		Description	Example Shift Light Pattern for User Guide
1	Define the prioritized list of patterns for the selected shift light.		Number of LEDs	10
	$\oplus \oplus \oplus$	Ŵ	Flash if all LEDs are lit	
	Example Pattern 1			
			Inputs	
	Example Pattern 2		Configure the channels use	d to drive the shift lights.
	Example Pattern 3		Row Selector Channel	Gear
			Threshold Channel	RPM
			Threshold values in:	angular velocity v rpm v
			Pattern Selector	
			If multiple patterns are ena	bled select the bit-field channel, strategy or switch used to select the active pattern configuration.
			Strategy V	Moving
			Bit-field Channel	3
			Strategy Switch	- Č
			2	

When you configure the pattern selector, the **Condition** box is displayed on the **Shift Lights** pattern page. You can the select the condition that triggers the shift light pattern.

	Shift Lights		Gene	eral										
	\oplus $$		Name	2	Example	Pattern 1]				
	CDU 7.0 Shift Lights Define the prioritized list of patterns for the selected shift light.		Descr Enabl	÷	Example	e Pattern fo	or User Gui	de]				
	$\oplus $ \oplus \oplus	1	Cond		Moving	I	v							
1	Example Pattern 1		These		Station Moving			2						
	Example Pattern 2	·					which each	LED patter	n configura	tion should	illuminate.			
	Example Pattern 3		Dime	ensior	ns	10 Colu	imns ×	7	Rows					
				٢										
				LED	Pattern Co	onfiguratio	on 🕀 (۱						
			\oplus		0	1	2	3	4	5	6	7	8	9
			-	0	4500	4750	5000	5250	5500	5750	6000	6000	6000	6000
			٦	1	5500	5666	5832	5998	6164	6330	6496	6662	6828	6994
				2	5500	5666	5832	5998	6164	6330	6496	6662	6828	6994
				3	5650	5800	5950	6100	6250	6400	6550	6700	6850	7000
				4	5750	5885	6020	6155	6290	6425	6560	6695	6830	6965
				5	5800	5933	6066	6199	6332	6465	6598	6731	6864	6997
				6	5800	5933	6066	6199	6332	6465	6598	6731	6864	6997



35.4. Apply shift lights to a display device

Once you configure a shift light pattern you can apply it to the display device. On the Displays node, use the + tool to add a display (1), and then select the required device from the menu (2).

	Displays		Ø
		rs that will be driven by the device. N.B. the ays must match the corresponding Auxiliary Devices tab.	
1)	1
	CCW Mk2		
	CCW Mk3		
2	CDU 10.3		
	CDU 4.3		
	CDU 7.0		

Click the shift lights at the top of the display to open the **Shift Lights Control Properties** menu.

Displays	Ð	General
Configure the displays that will be driven by the device. N.B. th names of these displays must match the corresponding Auxilian	e D/	Name CDU 7.0
Device names on the Devices tab.		Enabled
\oplus $$	٢	Type CDU 7.0 Y
🖌 CDU 7.0		Auto Log Automatically log display channels
		Hot Swappable 🗌 This allows the display to be changed without needing re-sending the setup. Note: This will increase the time taken to send the setup to the device (requires display application version 4.0 or above).
		Display
		Click on the LEDs below to configure them.
		Click on the LEUs below to compare them.
		Click to Configure Display

Select the shift light pattern from the menu (1) and configure the colour for each shift light (2).

Displays	Ø	General					Shift Lights Control (Shift Lights) Properties ($\widehat{\times}$
Configure the displays that will be driven by the device. N.B. th names of these displays must match the corresponding Auxilian Device names on the Devices tab.	ne 197	Name	CDU 7.0				Shift Lights	
\oplus $$	٦	Enabled					Select the Shift Lights channel.	
		Туре	CDU 7.0	~			Shift Lights CDU 7.0 Shift Lights	1 1
CDU 7.0		Auto Log						4'
		Hot Swappabi	e 📋 This allows the display to be ch	angea witnout neeaing .	re-sending the setup. Note: This will increas	se the time taken to send the	LEDs	_
		Display					Configure the LED colors	
		Click on the LE	Ds below to configure them.				Index Color Source Color	
							4 Color	
					CONTROD	ारणमा	5 Ochannel Solor	
							6 Channel Color	
			•				7 ⊙ Channel ▼ Ø Color	
							8 O Channel	
							9 ○ Channel	
							10 Ochannel 📕 🖌	
					Click to Configu	re Display	11	
							12 Ochannel Scolor	
							13 Ochannel	
								1

35.5. Shift light colours (static and dynamic)

You can select the colour of a shift light to be a static colour. Select the source as 'Color' and select the required colour from the **Standard** or **Advanced** colour menus.

Index	Color Source	olor	
	○ Channel● Color	•	
5	○ Channel● Color	Standard Advanced	
6	⊖ Channel ● Color		
7	⊖ Channel ● Color		
8	⊖ Channel ● Color		+002000
9	⊖ Channel ● Color		
10	⊖ Channel ● Color	G	11) 🗢
11	⊖ Channel ● Color		
12	○ Channel ● Color	•	
13	⊖ Channel ● Color	•	

You can also set a dynamic shift light colour where the colour changes according to one or more condition(s). Select 'Channel' as the source and a configured colour channel (see **Maths Channels – Color Control** for more information).

For example, the following maths channel sets a shift light to cyan if 'Wet Mode' is active, and yellow if 'Wet Mode' is not active.

Equati	tion	
Edit the	e equation that determines the value of this math channel.	
1	Choose([Wet Mode] == 1, color(cyan), color(yellow))	

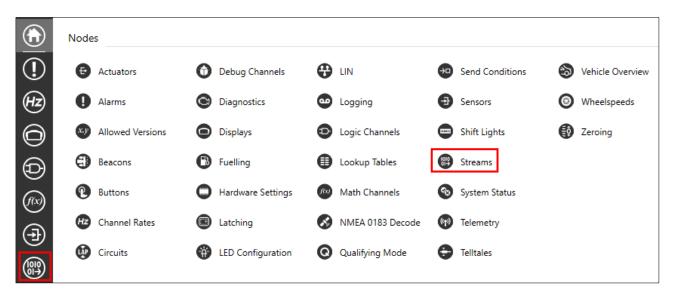


36. CAN streams

Control Area Network (CAN) is a widely used communication protocol for system integration. Most Cosworth devices support CAN communication and interfacing with both Cosworth and third-party CAN devices. The **Streams** node is used to configure CAN streams.

Create a CAN stream

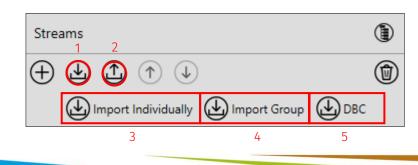
Within a setup, click on the 'Streams' option on the left side or use the **Streams** node to access all the CAN streams. The hierarchy of a CAN steam is as follows: Stream, Packets, Bytes, and Bits. Channels can be multiple Bytes or Bits.



To create a new stream, hover over the + button (1) and select either CAN Decode or CAN Encode (2). Use the 'bin' tool to delete unwanted streams (3).

Streams	(1)
	3 🔞
\bigoplus CAN Decode \bigoplus CAN Encode ²	

You can import (1) and export (2) streams either individually (3) or in multiples within a group (4) between existing Toolset setups in Toolset Library File (*.tlf*) format and import and export in the standard CAN DBC (*.dbc*) format (5).





When you add a new stream, the stream appears in the streams list. Configure the stream at the right in the main window. In the General section you can configure the stream name (1), CAN Port allocation (2), Baud Rate (3) and a description (4).

General		
Configure the bas	ic properties that define this stream.	
Name	CAN Stream 1	
Direction	Encode	
CAN Port	CAN 01 2	
Baud Rate	1000000 v 3	
Description	Example CAN stream for User Guide	

Note: You can configure the CAN Port name on the Hardware Settings node.

If you configure multiple streams, you can select the 'display view' option to display the **Streams** list in groups linked to the CAN port allocation for each stream.

Streams	
\oplus $$	١
∠ CAN 01 (1)	1
CAN Stream 1 CAN Stream Encode	0
▲ CAN 02 (1)	۲
CAN Stream 2 CAN Stream Encode	0
▲ CAN 03 (1)	۲
CAN Stream 3 CAN Stream Encode	0



Protection	
	stream prevents users without an appropriate license from editing or tream and from viewing the stream's contents.
License	Unprotected v

The **Packets** section hosts each packet in the stream. Click **Edit Packets** to begin to create a packet.

Packets				
View the packets	s that make up th	nis stream.		
🖉 Edit Packe	ts			
	-			
Name	CAN ID	Length (bits)	Bit Numbering	Endianness

Click the + button at the top left to create a new packet. This populates the list below with a new packet. Use the 'bin' icon to remove a selected packet Click the + button (1) to add a new packet. Use the 'bin' tool to delete an unwanted packet (2).

Packets	
1	2 ወ

Once a packet is added, you can complete configuration from the main window. In the **General** section you can edit the **Name/CAN ID**, **Length**, **Bit Numbering/Endianness**, **Rate**, **Timeout**, **Timeout Status Channel**, and **Comment**. The **CAN ID** needs to be unique on for that specific CAN Port.

The **Length** has a maximum of 64 bits. You can change **Endianness** according to preference, but it needs to correspond to the opposing Encode/Decode. For more information about Endianness/Bit Numbering methodologies click the **i** option.

The **Rate** selected is the limit for all channels in that packet.

The **Timeout** option is used to set an interval after which the Encode/Decode triggers the Timeout Behaviour (explained later in this section). You can use the **Timeout Status Channel** to generate a channel that records the status of a timeout.

General			
Configure the basic properties	that define this packet.		
Name / CAN ID	CAN Packet 1	0x100	Standard ×
Length	64	bits	
Bit Numbering / Endianness	Follows Endianness v	Big (Motorola) ×	0
Rate	500 ~	Hz	
Timeout	1.00	s	
Timeout Status Channel		\oslash	
Comment	Comment example		
Enabled	Always v		

To add a channel to the packet, click the + icon (1) in the **Channels** section. This adds a channel to the list (2) and populates the channel configurations (3) to the right. The channel list contains the following information: **Name**, **Type**, **Start Bit**, and **Length**.

Note 1: Channel names are limited to 24 characters, including spaces.

Note 2: It is best to use a math channel when dealing with complex order of operations for Gain/Offset.

	Content		
	Configure the content that makes up this packet.	3	
1	(D)	Quantity	user type ~
2	Name CAN Channel 0 Type Channel ~ Start Bit 0 Length 1 🗘	Unit	
2		Data Type	U32 ×
		Gain	1
		Offset	0
		Scaled Data Type	F32 ~
		Default Value	0.000
		Timeout Behavior	Hold Y
		Is Protected	
	4	Comment	
	Preview Packet Layout		



Click **Preview Packet Layout** (4), a visual representation of the packet layout is displayed. This enables an easier visualisation of the bit allocation of items within the packet. LSB means least significant bit and MSB means most significant bit (see below).

	7	6	5	4	3	2	1	0
0	63	62	61	60	59	58	57	56
1	55	54	53	52	51	50	49	48
2	47	46	45	44	43	42	41	40
3	39	38	37	36	35	34	33	32
4	31	30	29	28	27	26	25	24
5	23	22	21	20	19	18	17	16
	15 CAN Chan MSB	14	13	12	11	10	9	8
7	7 CAN Chan	6	S	4	3	2	1	0
								LSB

Hardware limitations

Each CAN Bus has a limit to the number of messages it can send or receive. Click on the Hardware Settings node to see details about CAN bus usage.

On the left side, a list is populated. Select **CAN Ports > Local** to view information about port usage.

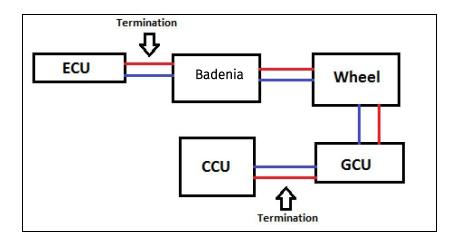
4	Local Badenia 2
	Analog Inputs (20)
	CAN Ports (4)

This displays each CAN Port and its usage. It is recommended that you keep the utilization at 80% or below. Oversaturating the CAN bus can lead to CAN errors and potentially missed data.

	CAN 01
Name	CAN 01
Connection	C1.30 (hi), C1.18 (lo)
Terminate CAN Bus?	\checkmark
Used Message Objects	5% (6)

You can use the **Terminate CAN Bus** option to apply a software selectable CAN bus termination. This acts as a physical termination for that bus, if required.

This is a complete CAN Bus setup that has two physical terminations.



Implement a Bit-masked CAN channel

Bit-masking a CAN channel can be useful when information from each bit is beneficial.

When you create a CAN Channel there is an option to add a Bitmask. The Bitmask ANDs with the channel and returns the bit entries that are true. To create a Bit-masked CAN Channel, create a normal channel as described above, but set the **Type** to *Bit-Field Channel*.

Cont	ent								
Confi	Configure the content that makes up this packet.								
\oplus							1		
Name	CAN Bit-Field Channel 1	Туре	Bit-Field Channel 🛛 👻	Start Bit	0	Length	16 👽		
Name	CAN Channel 2	Туре	Channel ~	Start Bit	0	Length	16 👽		

Select Edit Bit-fields to edit the Bit-fields.

Configure the bit-fie	lds of the selecte	d channel.
Default Value		0
Timeout Behavior	Hold	v
Is Protected		
Ø Edit Bit-fields		
Comment		

A window is displayed where you can click the + icon to add a Bitmask. The top section relates to the Bitmask and the bottom section relates to bit-specific actions.

CAN Bit-Fiel	d Channel 1 E	Bit-fields				8	
Bitmask	Name		Abbr	Default Color	Default Text	\oplus	
OxFFFFFFFF	Bit-field 0		Bit-field 0	•	Unknown	٦	
Configure the entries for the selected bit-field. Masked Bits: 11111111 11111111 11111111							
Value	Color	Text				\oplus	

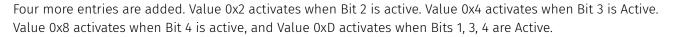
The top section shows the actual **Bitmask**, **Name**, **Abbr**(eviation), **Default Color**, and **Default Text**. The Bitmask is in Hexadecimal. In the bottom section there is each entry for the specified bits. There are two ways to configure Bit-fields and each depend on which view you want to see in live data (see examples below).

Example 1

In this example, a 4 Bit-masked channel is created, consisting of 1 Bitmask and 5 entries. Click the + button (1) to create a Bitmask and change it to the desired value (here 0xF (2)). Click the lower + button to add a bit entry (3). The value (4) needs to equal the bit value being requested.

Note: The value needs to be in Hexadecimal. The first entry added is active when bit 1 in the channel is 1.

4	l Bit Channe	el Ex1 Bit-field	s Bit-fields					\otimes
	Bitmask	Name		Abbr	Default Color	Default Text	1	\oplus
2	0xF	Example 1		Ex 1	•	Off		
	2		selected bit-field. 00000 00000000	00001111				
	Value	Color	Text				3	\oplus
4	0x1		Bit 1 is Active					



Value	Color	Text	\oplus
0x1		✓ Bit 1 is Active	٢
0x2		✓ Bit 2 is Active	٢
0x4		✓ Bit 3 is Active	٢
0x8		✓ Bit 4 is Active	٢
0xD		Bits 1, 3, 4 are Active	1

You can view the output of this channel on the **Live Data** tab.

	Data	(••) Live Data	Actions	Setups	Channels	Settings
--	------	----------------	---------	--------	----------	----------

Add the channel 4 Bit Channel Ex1 Bit-fields (from above) to the **Live Data** page. The channel is displayed as seen below. The default value of this channel is set to 13 (0xD). Since there is no data coming across, the value reverts to the default.

4 Bit Channel Ex1 Bit-fields
Bits 1, 3, 4 are Active

Example 2

In this example, a 4 Bit-masked channel is created. There are 4 Bitmasks and 1 entry per Bitmask. Create 4 Bitmasks, but make each of them specific to each bit. The first mask (1) has a value of 0x1. This creates a mask for bit 1. (2)

Note: No Bitmasks can overlap.

	4 Bit Chanr	nel Ex2 Bit-field	s Bit-fields				\otimes
	Bitmask	Name	A	bbr	Default Color	Default Text	\oplus
1	0v1	Bit 1	1		•	Off	
1	0x2	Bit 2	2		•	Off	١
	0x4	Bit 3	3		•	Off	٢
	0x8	Bit 4	4		•	Off	١
	Configure t	he entries for the	selected bit-field.				
	Masked Rits	. 00000000 000	000 0000000 000	00001			
2.	Value	Color	Text				\oplus



For each mask, you must dd an entry that has the same value as the mask. For the first mask, an entry with the value of 0x1 is added.

Value	Color Text	\oplus
0x1	Bit 1 is Active	١

Do this for each corresponding Bitmask. Go to the **Live Data** tab to view the channel. The channel is displayed as seen below. This method of Bit-masking is useful when several bits in a channel have independent importance. The default value of this channel is set to 1 (0x1). Since there is no data coming across, the value reverts to the default.

4 Bit Channel Ex2 Bit-fields			
Bit 1	Bit 2	Bit 3	Bit 4

Implement multiplexed CAN channels

You can use multiplexed CAN Channels to compress additional data into a single CAN packet/stream CAN packet.

To create a Multiplexed CAN Encode, two math channels are needed to locate and associate the CAN Channels in the packet. The first math channel is the Indexor. To create a math channel, click on the **Math Channels** node.

Click the + button (1) at the top left to create a new math channel. By default, this is added to the <Default> group of channels. To add channels to a group, highlight the required channels, click 'add group' (2), and name the group.



The first math channel is named Indexor. This is a counter and records the number of channels being multiplexed. In this example, three channels are being multiplexed. The equation required is:

a) (choose	(@a0 <	< 3,	@a0+1,	0));
@	a0				

Set the rate to 100Hz and this channel counts to 2 from 0 at 100 increments per second.

Configure the	basic properties that define	this math channel.	
Name	Indexor	Quantity/Unit	user type V
		Data Type	F32 ~
Comment			
Equation	ion that determines the valu	ue of this math channel.	

The second channel needed is used to correlate the value from the Indexor to the channel being sent. In the example code below, when the Indexor is equal to 0, the output is Channel 1. When it is 1, the output is Channel 2, and so.

a0 (choose ([Indexor]==0, [Channel 1], choose ([Indexor]==1, [Channel 2],

choose ([Indexor]==2, [Chani	nel 3], 0))));
------------------------------	----------------

@a0

General						
Configure the	e basic properties that define t	this math channel.				
Name	Data	Quantity/Unit	user type	~		
		Data Type	F32	Ŷ		
Comment						
Manufactur	er Status					
Manufacture	er Status 🔘 This is a normal	item.				
	er Status O This is a normal					
Equation Edit the equa 1 a0 2 cho	0	e of this math channel. =0, [Channel 1], [Channel 2],		unction: "a0(x)" Assigns value 'x' t	to register 'a0'.	
Equation Edit the equa	tion that determines the value (choose ([Indexor]== ose ([Indexor]==1, ose ([Indexor]==2,	e of this math channel. =0, [Channel 1], [Channel 2],		Assigns value 'x' t	to register 'a0'. assign to register 'a	a0'.



Set the rate to 'Inherit rate from Indexor' and this math channel uses the same rate as the channel Indexor. The channels that are requested need to match the rate of the Indexor/Data channels.

Create a new CAN Stream Encode and add two channels to the packet. The source for the channels is the two math channels created above. In this example, data starts at 0 and is 8 bits long. The Indexor starts at 8 and is 2 bits long. The **Length** needs to be long enough to support the number of states. If the number of states is 3, then the length needs to be 2 bits (3 in binary is 11).

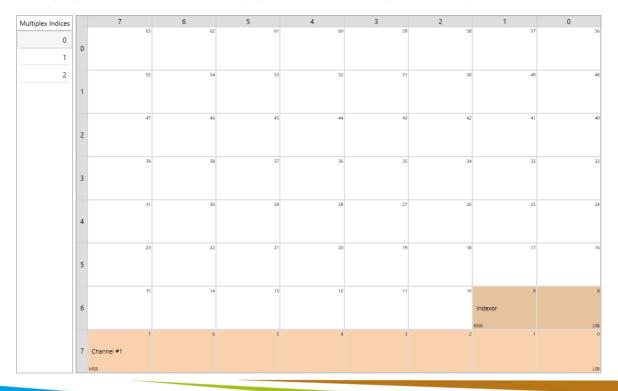
Con	ent									
Confi	gure the content that makes up this packet.									
\oplus							٦	Configure the proper	ties of the selected c	:hannel.
	[1		_				Source	Indexor	\odot
Name	Data	Туре	Channel	Start I	it	0 Length	8	Quantity	user type	~
Name	Indexor	Туре	Channel .	Start I	it	8 Length	2	Data Type	U32	~
								Gain		1
								Offset		0
<							>	Comment		
Ø	review Packet Layout									

When this is done, the channels added to the Data math channel are transmitted across CAN in a multiplexed message.

To create a Multiplexed CAN Decode, create a CAN packet and add an Indexor channel. Under channel type, select 'Indexor'. To the right, enter the **Number of States**. For this example, this 3. Select the **Start Bit** and the **Length**.

Next add the required channels. Create a new channel and set its type as 'Multiplexed Region'. In this example, add Channel #1, Channel #2, and Channel #3. The **Start Bit** and **Length** are the same for all three. Each channel will have its own Mux Index (0-2).

Click on **Preview Packet Layout** in the **Channels** section to view the packet layout. On the left, the Mux Indices are displayed. Click on an index to display each Mux and the layout for that packet.





Virtual analog and digital inputs

You can use CAN messages as virtual analog and digital sensor inputs. In other words, when the message within a packet is configured as either an 'Analog Voltage Input' or 'Digital Level Input' then the value transmitted over CAN is interpreted as an analog or digital input, respectively.

Cont	ent					
Confi	gure the content that makes up this packet.					
\oplus						
Name	CAN Analog Input 1	Туре	Analog Voltage Input 🛛 👻	Start Bit	0 Lei	ngth 8
			Channel			
			Bit-Field Channel			
			Indexor			
			Analog Voltage Input			
			Digital Level Input			
			Button Group			
			Multiplexed Region			

Once the CAN message is configured as either an 'Analog Voltage Input' or 'Digital Level Input', they appear as a virtual input on the Sensors node. You can then configure the virtual sensor and calibrate it like a standard analog or digital input (see Setups – Sensors).

Input Sensor Pairs	
	1
Analog Inputs (40)	۲
Digital Inputs (10)	۲
Virtual Analog Inputs (1)	۲
CAN Analog Input 1 Virtual Analog Voltage Input No Termination	
✓ Virtual Digital Inputs (1)	۲
CAN Digital Input 1 Virtual Digital Level Input Digital Level Input	



Buttons groups

You can also configure CAN messages to be interpreted as button presses. For example, bits within an 8-bit message can be configured to act as different button press types (for example clicked, click latched, held, and so on).

\oplus					
Name CAN Button Group 0	Туре	Button Group 🗸 🗸	Start Bit	0 Length	8
		Channel			
		Bit-Field Channel			
		Indexor			
		Analog Voltage Input			
		Digital Level Input			
Preview Packet Layout		Button Group			
		Multiplexed Region			

Once a CAN message is configured to be a 'Button Group', click **Edit Buttons...** to add buttons.

\oplus		1	Configure the buttons of the selected button group.
Name CAN Button Group	Type Button Group ~	Start Bit 0	Timeout Behavior Hold *
K		>	Is Protected dit Buttons Comment
Preview Packet Layout			

You can then use the + button (1) to add button inputs and name them in the text box (2.) Use the 'reorder arrows' (3) to change the button order, Use the 'bin' tool to delete buttons (4).

CAN Button Group Buttons	(\otimes
Edit the buttons within this group. Buttons are allocated one bit each, starting at the first bit configured for the content.		
		4
2 CAN Button 0		
CAN Button 1		
CAN Button 2		
CAN Button 3		
CAN Button 4		
CAN Button 5		
CAN Button 6		
CAN Button 7		
		·

Refer to Setups – Buttons for more information about how to configure a CAN button.

36.1. CAN CHP2 debug channels

<can device="" name="">_RxPackets</can>	Increments by one when a packet received is read (that is, at the receive rate)	
<can device="" name="">_TxPackets</can>	Increments by one when a packet being sent is written (that is. at the transmit rate)	
<can device="" name="">_BusOffCount</can>	Increments each time a device is detected in the bus off state and is restarted	
<can device="" name="">_BusState</can>	 Bit encoded see below: Bit 0 : Error State - Set when the device is ERROR_ACTIVE (as per the CAN specification) Bit 1 : Bus Warn - Set when bus is heavily disturbed (as per CAN spec one of the CAN Error counters exceeds 96) Bit 2 : Bus Off - Module is in the bus off state Cleared when the device is ERROR_PASSIVE (as per the CAN specification) 	

<can device<="" th=""><th>Numerically encoded see below:</th></can>	Numerically encoded see below:
Name>_LastErrorCode	 Value = 0 - Received or transmitted a packet successfully Value = 1 - Bit Stuff Error - More than 5 equal bits in sequence received where this is not allowed Value = 2 - Format Error - A fixed format part of a received frame has the wrong format Value = 3 - No ACK - A frame transmitted has not been acknowledged by another node Value = 4 - Dominant Bit Error - During the transmission of a packet (except for the arbitration field) the device wanted to send a recessive level, but the monitored bus level was dominant Value = 5 - Recessive Bit Error - During the transmission of a packet, or acknowledge, or active error flag, or overload flag the device wanted to send a dominant bit, but the monitored bus level was recessive Value = 6 - Received CRC error - The CRC of the packet received does not match the calculated CRC Value = 7 - No CAN Bus errors detected since last update

Debug channels setup

To enable these channels first create them in the setup. On the **Debug Channels** node, select **Advanced**.



Note: If this node is not available on the setup, enable it on the Settings tab under Setup Diagnostics.

Setup Diagnostics
Configure how diagnostic information is made available within setups.
✓ Display diagnostic resources
✓ Display Cosworth only resources
Display UI for configuring debug channels

Click the + button to create a channel. The **Name** must match the name used in the above table (<CAN Device Name> = can.0 (for CAN port 1), <CAN Device Name> = can.1 (for CAN port 2), and so on).

Set Quantity/User to 'user type', Data Type to'U32', and Rate to '5Hz', as shown below.

eneral			
Name	can.0_TxPackets		
Description			
Quantity/Unit	user type	Ŷ	
Data Type	U32	Ŷ	
Rate	50	v	Hz

For two CAN ports there should be these channels.

Debug Channels	
Predefined Debug Channels	Advanced
\oplus	٢
can.0_BusOffCount	
can.0_BusState	
can.0_LastErrorCode	
can.0_RxPackets	
can.0_TxPackets	
can.1_BusOffCount	
can.1_BusState	
can.1_LastErrorCode	
can.1_RxPackets	
can.1_TxPackets	

The channels are then available to log:

Channel Rates		
Channels .	Logger 0 : Rate Group 0	0
can.0_BusOffCount		5 Hz
can.0_BusState		5 Hz
can.0_LastErrorCode		5 Hz
can.0_RxPackets		5 Hz
can.0_TxPackets		5 Hz
can.1_BusOffCount		5 Hz
can.1_BusState		5 Hz
can.1_LastErrorCode		5 Hz
can.1_RxPackets		5 Hz
can.1_TxPackets		5 Hz

Note: When You create the channel, it might display as empty. To save the setup, close it, and then re-open it.



Allowable rates

When multiplexing, only certain rates are allowed for the packet. This value is dependent on the number of multiplexing states. This table defines what is allowed in Toolset for all of Cosworth devices.

	The chart below details allowable channel rates for multiplexed CAN streams. The individual channels must be sent at legal rates, defined by dividing the packet rate by the number of channels. Only certain integers are allowed for the channel rates.																				
	Green is an allowable rate Red is an illegal rate.																				
_																					
										Number	of Chan	nels in Pa	acket								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	1	1.00	0.50	0.33	0.25	0.20	0.17	0.14	0.13	0.11	0.10	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.06	0.05	0.05
L	2	2.00	1.00	0.67	0.50	0.40	0.33	0.29	0.25	0.22	0.20	0.18	0.17	0.15	0.14	0.13	0.13	0.12	0.11	0.11	0.10
L	5	5.00	2.50	1.67	1.25	1.00	0.83	0.71	0.63	0.56	0.50	0.45	0.42	0.38	0.36	0.33	0.31	0.29	0.28	0.26	0.25
Rate	10	10.00	5.00	3.33	2.50	2.00	1.67	1.43	1.25	1.11	1.00	0.91	0.83	0.77	0.71	0.67	0.63	0.59	0.56	0.53	0.50
r Ra	20	20.00	10.00	6.67	5.00	4.00	3.33	2.86	2.50	2.22	2.00	1.82	1.67	1.54	1.43	1.33	1.25	1.18	1.11	1.05	1.00
Packet	50	50.00	25.00	16.67	12.50	10.00	8.33	7.14	6.25	5.56	5.00	4.55	4.17	3.85	3.57	3.33	3.13	2.94	2.78	2.63	2.50
Pac	100	100.00	50.00	33.33	25.00	20.00	16.67	14.29	12.50	11.11	10.00	9.09	8.33	7.69	7.14	6.67	6.25	5.88	5.56	5.26	5.00
	200	200.00	100.00	66.67	50.00	40.00	33.33	28.57	25.00	22.22	20.00	18.18	16.67	15.38	14.29	13.33	12.50	11.76	11.11	10.53	10.00
	500	500.00	250.00	166.67	125.00	100.00	83.33	71.43	62.50	55.56	50.00	45.45	41.67	38.46	35.71	33.33	31.25	29.41	27.78	26.32	25.00
	1000	1000.00	500.00	333.33	250.00	200.00	166.67	142.86	125.00	111.11	100.00	90.91	83.33	76.92	71.43	66.67	62.50	58.82	55.56	52.63	50.00



37. Telemetry

Within Toolset you can configure a telemetry stream to allow a proper connection to the car.

37.1. Configure device telemetry transmit (Tx)

For telemetry to be supported, you must enable it via the **Telemetry** node. Click + to add a new telemetry table. You can use the import and export tools to import and export existing telemetry tables between setups (2). Use the 'bin' tool to delete unwanted telemetry tables (3). When a telemetry table is added, channels are automatically generated to report the telemetry transmission status. Click the 'wrench' tool to configure these generated channels (4).

Telemetry Tables	4 🕜
\oplus $$	
1 2	3

This allows you to configure the automatically generated transmission and reception status channels. Here you can modify the interval before EOL information is transmitted (this is useful if you know there is poor reception at the EOL, allowing you to postpone the transmission until you are in a better reception area.) The EOL repeat count and interval are fixed at 4s and 0.5s respectively.

Transmission Information		Reception Information				
Define the names of the channels telemetry data. These channels are	generated for the transmission of available on the device.	Define the names of the channels generated for the reception of telemetry data. These channels will be added to the telemetry data when is received. They are not available for use on the device.				
Transmission Throughput Prefi	x Tel Tx Throughput	interno received mey are not and				
Amount of Data Sent Prefix	Tel Tx Bytes	Coverage	Tel Rx Coverage			
Transmission Status	Tel Tx Status	Number of Packets	Tel Tx Packets			
	econds before transmitting	Reception Throughput	Tel Rx Throughput			
end of lap information.		Number of Bad Packets	Tel Rx Bad Packets			
Telemetry Logging		Amount of Bad Data Received	Tel Rx Bad Bytes			
Update the contents of any log	ged telemetry data whenever a	Reception Status	Tel Rx Status			
End of lap	• event is received.					



Configure PC telemetry receive (Rx)

You must define the source used, together with where the data is downloaded via **Settings > Telemetry**. Click **Add telemetry source** (1), rename the telemetry source (2) and select the telemetry source type from the dropdown menu (3).

🕇 🥽 Antares8xx #198	Data	$\langle (*) \rangle$ Live Data	Actions	↑ Setups	Channels	Settings			
Global Settings	Telemet	ry Source Configur	ation						
Network	Configure your sources of telemetry data.								
Data Offload	Name	ld telemetry source	le Telemetry Sour	~	2				
Telemetry*	Туре		orth P192S	v					
Diagnostics	Port		orth P192S orth P900		3				
1 Upgrade	Baud	Etherr	m Serial let (TCP) let (UDP)		5				
About		Toolse	t Server Serial Radio						

When a source type is added, you are prompted to configure the telemetry port settings. Some telemetry source type settings are predefined, such as the Cosworth P192. You can configure custom serial and Ethernet ports. Select the required port to connect to your pit stand receiver. Select a telemetry source, and then click the 'bin' icon to delete it.

🕇 🥽 Antares8xx #198	Data	((*)) Live Data	Actions	1 Setups	Channels	1 Settings		
Global Settings	Telemetry S	Source Configura	ation					
Network		our sources of telem	ietry data.					
Data Offload	+ Add telemetry source							
	Name	Exampl	e Telemetry Sour	ce				
Telemetry*	Туре	Coswo	rth P192S	v				
Diagnostics	Port	Intel(R)	Active Manager	nent Technolo 🔻				
1 Upgrade	Baud Rat	te 19200						
					-			

If you need to allow others to connect to your machine to view telemetry, select the **Share telemetry** option in the **Telemetry Sever Configuration** section. Keep the default values for both ports.

Telemetry Server Configurat	tion	
Configure how telemetry data is	s to be sha	ared from this machine.
Share telemetry on port	51413	(Toolset clients)

You can add several telemetry sources with a single machine as the server PC (see **Error! Reference source not found.**). You can choose to log the data that is received from the telemetry stream as well as the frequency at which it is updated. Select the **Update logged data every...** option and enter a value between 20 and 900 seconds.

	Telemetry Logging
	Configure how logged data should be generated from received telemetry.
1	✓ Log telemetry data
2	✓ Update logged data every 20 s (min 20, max 900)

Once sources are configured you must save the configuration. Click **Save**. You can also select **Reset** to return to the default configuration.



Configure logged telemetry data

To change the relative path of logged telemetry data, select the **Settings** tab and click **Data Offload**. Look in the **Offload Paths** section to find the **Relative Path**. At the beginning of the path add '<source>\'. This creates a specific folder for telemetry data and logged data. For more information about saving logged data, see the Settings guide.

Offload Paths	
Configure where o offloaded data.	outings are offloaded to. The root path is combined with the relative path to form the complete path and filename for
Root Path	C:\Pi Research\Logged Data
Relative Path	<source/> \ <track/> \ <type>\<driver>-<session>.<outing>.<first lap="">.pds</first></outing></session></driver></type>
	Relative path tokens (e.g. <year>) will be replaced with their respective values when offloading.</year>

Once a telemetry table is added on the **Telemetry** node of the device setup, enter a name for the table (1) and select **Enabled** (2). Deselect this option to disable a table without deleting it.



Note: You must configure the channel rates for the channels within the telemetry table to allow them to be transmitted and received. Click **Edit Channel Rates** to navigate to the **Channel Rates** node (3). You can enter a description of the table (4). Multiple telemetry tables can be added to a setup.

	General
	Configure the general settings for this telemetry table.
1	Name Example Telemetry Tables
2	Enabled 🗹
	Rates 3 Hz Edit Channel Rates
4	Description An example telemetry table for User Guide

You can then configure the type of telemetry from the **Output** dropdown menu. If a Cosworth serial telemetry system is selected, you only need to configure the serial port. If custom serial telemetry is selected, then additional information such as the transmission baud rate and data bits need to be configured. Cosworth devices also support ethernet (UDP) telemetry, which you can configure using the remote IP address and remote port.

The consumed bandwidth of the telemetry table based on the usage of the telemetry logging table is also displayed.

Output	
Configure how data	should be transmitted for this table.
Output	Ethernet (UDP) Telemetry ~
Bandwidth	12 kbytes/s of 29 kbytes/s (40%)
Remote IP Address	50010
Remote Port	2

Once the setup is sent to the device, the telemetry key is written to the Toolset app data folder: C:Users**[YourAccount]**\AppData\Roaming\Cosworth\Toolset\[Toolset Version]"\TelemetryKeys.

	Conference of the Conference of the Conference	ASIA36 - SOIC	
🎉 Cached Setups	10/12/2017 3:20 PM	File folder	
📙 CapabilitiesTokenCache	9/26/2017 11:26 AM	File folder	
📔 Metadata	10/12/2017 3:33 PM	File folder	
PCPrivateDataSets	10/12/2017 3:33 PM	File folder	
📙 TelemetryKeys	10/12/2017 3:20 PM	File folder	
ChannelDatabase.tcl	10/16/2017 11:05	TCL File	649 KE
CommsManager.bin	10/16/2017 11:05	BIN File	1 KE
DeviceNameCache.bin	9/26/2017 11:26 AM	BIN File	4 KE
Diagnostics.bin	10/16/2017 11:05	BIN File	1 KE
EthernetService.bin	10/16/2017 11:05	BIN File	5 KB
OffloadOptions.bin	10/16/2017 11:05	BIN File	1 KB
] Telemetry.bin	10/16/2017 3:30 PM	BIN File	1 KB

Configure telemetry channel logging rates

After you configure your PC telemetry Rx and Toolset telemetry Tx, you must assign rates to the channels transmitted over telemetry. This is done on the **Channel Rates**_node.

The telemetry table is identified by its user-defined name and the 'radio' icon, rather than the device onboard logging 'tape' icon.

Channel Rates		
Channels 🔺	(1) Example Telemetry Tables : Example Rate Group On Board Logging : Example Rate Group SS HS	0
Acceleration X	50 Hz	100 Hz
Acceleration X Offset	1 Hz	1 Hz
Acceleration Y	50 Hz	100 Hz
Acceleration Y Offset	1 Hz	1 Hz

Watch telemetry channels

To watch telemetry channels, select the **Live Data** tab, and then **Data**. Click **Sources** to check the telemetry connection and information.

Note: the 'radio icon' next to **Live Data** changes from grey to black when there is a working telemetry connection.



Click the + button to add and populate a page. Click on a page name to rename the page. Click the 'pencil' icon to display more buttons (from left to right):

- Add Channel List
- Add Map Control
- Add Tabular Outing Report.

Use the 'Add Channel List' option to add telemetry channels. When you add a page, click the 'wrench' icon to add required channels by selecting them from the **Available channels:** and moving them to the **Displayed channels:** section.

Settings		\otimes
Name	Orientation	•
Mode Bar 💌	Bit-field orientation Horizontal	•]
Displayed channels:	Available channels:	
	1.5V Supply Voltage 1Hz Overruns 1Hz Utilization 1kHz Overruns 1kHz Utilization 2Hz Overruns 2Hz Utilization 3.3V Supply Voltage 5Hz Overruns	*
	start typing to filter the channels	\otimes
2	✓ Show All✓ Show Diagnostic Channels	

In the **Sources** section you can check the state of the telemetry link and view the target directory for the logged telemetry data.

In the General section you can view the name of the source, the device, and the setup.

In the **Connection** section you can see if your source is enabled and have the option to refresh the connection.

In the Status section you can view status of the telemetry connection and information about the connection.

In the Telemetry Logging section, you can view the status and destination of the logged data.

General		
General information about this tel	emetry source.	
Name	Team Telemetry	
Source	Intel(R) Active Management Technology - SOL (COM3)	
Device	No Device Connected	
Setup		
Connection		
Options for enabling and connecti	ng this telemetry source.	
Enabled		
Reconnect	Olick to refresh connection.	
Status		
Information about the status of th	s telemetry source.	
Telemetry Rx Status	Awaiting Data	Connected
Telemetry Coverage		0%
Number of Telemetry Packets	0	
Telemetry Rx Throughput	0 bytes/s	
Number of Bad Telemetry Packe	ts 0	
Amount of Bad Data Received	0 bytes	
Telemetry Logging		
Information about logging the dat	a received from the radio.	
Logging Status	Disabled	
File Name		
		(Update Now

Use Cosworth Live On Air (LOA) as a telemetry source

It is recommended that you use the pit stand as a common connection point for all connected users on Toolset. Point the pit stand to Cosworth to establish connection to the stream, configure it as a Toolset server connection, and then point the stream to each engineer connected and using telemetry. This allows connected users to receive telemetry through the desktop.

With the pit stand configured, the DAG points to Cosworth to establish the initial telemetry connection (if a telemetry key is available). The DAG then connects to the pit stand as a Toolset server. This distributes the telemetry key to the pit stand and provides it to connected engineers to avoid loss in telemetry if the DAG disconnects. Finally, each engineer can point their device to Cosworth directly to make sure that they also have a direct connection to the stream in case other devices disconnect or fail.

On the pit stand desktop, go to **Settings > Telemetry**. Click **Add telemetry source** and select 'Custom Ethernet' from the **Type** dropdown box. The **Location** is 'Cosworth's IP Address', and the **Port** is '74', followed by the 'Car Number'.

Next, add a new source for each engineer on the team who use telemetry. Each of these sources is a Toolset server connection. The **Location** for each engineer is their IP address, and the **Port** is '51413'. This completes the desktop setup and the configuration is saved for future use.

	e Configuration urces of telemetry data.		
Add teleme	etry source Set default		
Name	LOA	Name	Engineer #1
Туре	Custom Ethernet 🔹	Туре	Toolset Server 🔹
Location	Cosworth's IP Address	Location	Engineer #1 IP Address
Port	74(Car Number)	Port	51413
	🗸 Default		

The DAG also needs a custom ethernet connection to Cosworth. The **Location** is 'Cosworth's IP Address' and the **Port** is '74', followed by the 'Car Number'. The DAG also points a Toolset server connection to the pit stand desktop. The **Location** is the 'Desktop's IP Address' and the **Port** is '51413 (Default)'. This pushes the telemetry key to the desktop, and then to each engineer.

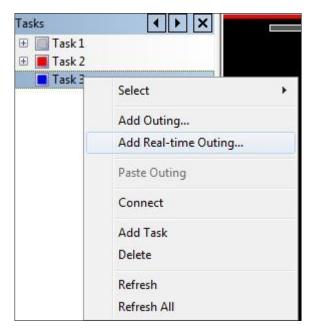
	e Configuration urces of telemetry data. try source ØSet default		
Name	LOA	Name	Pit Stand
Туре	Custom Ethernet 🔹	Туре	Toolset Server 🔹
Location	Cosworth's IP Address	Location	Pit Stand IP Address
Port	74(Car Number)	Port	51413
	🗸 Default		

Each engineer only needs a 'Custom Ethernet' connection to Cosworth. The Location is 'Cosworth's IP Address' and the **Port** is '74', followed by the 'Car Number'. There is no need for a server connection because the pit stand pushes the key to each engineer.

nfigure your so Add teleme	urces of telemetry data. try source Ø
Name	LOA
Туре	Custom Ethernet
Location	Cosworth's IP Address
Port	74(Car Numbe
	🗸 Defau

Add a real-time outing to Toolbox

With an active telemetry connection open Toolbox and create a new task. Right-click the task and select **Add Real-time Outing**.



If you have telemetry via Toolset, the default settings will work. The **Server** is your own machine (localhost) and the **Port** is 51414 (the default).

Outing Typ	De
Oirect	t connection to server (use to connect to a Toolset server).
🔘 Broad	lcast (use to connect to one or more Sigma servers).
Server —	
Specify t	he host name or IP address and port number of the server.
Server	localhost
Port	51414 9
Source	
	he real-time data source. You can choose a specific source if your upports multiple sources.
Туре	Oefault One Named
Source	- Z
	OK Cancel Help

Once this is complete, a real-time outing is created and Toolbox telemetry established.



38. Telltales overview

Telltales are channel statistics that are published at end of a lap over telemetry. You can add telltales to the **Tabular Outing Report** display on the **Live Data** page (see Live Data).

Note: To view the telltale over telemetry you must add the output channel named after the telltale to the telemetry table (see Telemetry).

38.1. Add a telltale

Click the + tool to add a new telltale (1). You can import and export telltales between existing setups with the 'import' and 'export tools' (2). Use the 'bin' tool to delete telltales (3). Use the channel rates shortcut (4) and the telemetry shortcut (5) to quickly navigate to the **Channel Rates** and **Telemetry** nodes. Use the 'wrench' tool (6) to configure telltale reset events.



38.2. Configure a telltale

Add a telltale and enter a name and optional description (1/2). Click the 'browse' icon (3) to select the input channel from the available channel list (4). Select the channel statistic (minimum, maximum, mean, difference, or end) from the **Statistic** dropdown menu (5) and the telltale calculation rate from the **Rate** dropdown menu (6). Select 'Auto' to use the rate from the input channel.

	General		
	Define the properties of this telltale.		
1	Name Example Telltale		
2	Description Example Telltale for User Guide		
5	Configuration Configure the settings that will define the telltale's value. Input Battery Voltage Statistic Minimum × 3 Rate Auto ×	Choose a Channel Battery Voltage BATT Sourced from Hardware Settings node. Show Diagnostic Items	- C X



39. Wheelspeeds overview

Distance is one of the most important channels used in Toolbox and Toolset and is fundamental for features like **Qualifying Mode**. The value of distance is derived from the integral of speed. Therefore, the setup of wheelspeed strategies is critical to make sure that the speed and distance values generated are consistent and correct.

The Wheelspeed node is used to configure the wheelspeed inputs and the speed and distance outputs.

39.1. Select wheelspeed input type

First, configure the wheelspeed inputs. Select the source of speed for each wheel from either a Channel or Digital Input, or vehicle speed from GPS data.

- **Channel** Use for a channel with units of 'speed', such as a channel being received over CAN from an ECU or other device.
- **Digital Inputs** Use if rotational sensors or DF11i wheelspeed sensors are configured on the Sensors node.
- **GPS Data** Use if speed is being decoded from GPS data sourced from the NMEA 0183 Decode node.

39.2. Channel inputs

Configure inputs

If you use channel inputs, click the 'browse' tool to select the channel inputs (1), and then select the required channel from the menu (2).

Front Left Front Right Rear Left	Speed FL CAN		
Rear Right	Speed FR CAN Speed RL CAN Speed RR CAN		
	2 - start typing to filter the selecti	ion 🛞	

Note: – You must configure the channel with units of 'speed'. Channels with other units are not available to select.

Processing

Next, select how the individual wheelspeed inputs are combined to calculate the vehicle speed and distance. Individual wheelspeeds are first combined to produce front and rear axle speeds. The front and rear axle speeds are combined to produce overall speed and distance channels.

See Wheelspeed strategy for more information about wheelspeed processing strategy.

Select the chassis strategy (the values from which the front and rear axles are averaged) from the **Chassis Strategy** dropdown menu.

Chassis Strategy	Axle Average 🗸 🗸	The values from the front and rear axles will be averaged.
Front Axle Strategy	Axle Average	The values from the left and right wheels will be averaged.
Rear Axle Strategy	Front Axle Only	The values from the left and right wheels will be averaged.
, iter , the other gy	Rear Axle Only	
	Fastest Axle	
	Slowest Axle	
	Front Wheel Drive	
	Rear Wheel Drive	
		-

Then select the front and rear axle strategies from the dropdown menus.

Chassis Strategy	Axle Average 🗸 🗸	The values from the front and rear axles will be averaged.
Front Axle Strategy	Average 🗸 🗸	The values from the left and right wheels will be averaged.
Rear Axle Strategy	Average	The values from the left and right wheels will be averaged.
	Left Wheel Only	
	Right Wheel Only	
	Fastest Wheel	
	Slowest Wheel	

Generated channels

Enter a name for the distance and speed channels generated from the processed inputs in the text boxes.

39.3. Digital inputs

Configure inputs

If you use digital inputs, you must select the inputs for each wheel (1), specify the sensor type (2), the number of triggers per rotation (3), and the tire diameter (4). If digital inputs are not configured, you can use the shortcut to the **Hardware Settings** node (5) (see Hardware Settings).

Input Mode	🔿 Channels 🖲 Digital Inputs 🔿 GPS Data	1	2	3	4
			Sensor Type	Triggers	Tire Diameter
Front Left	Digital 01		Active (Hall Effect)	8	0.66
Front Right	Digital 02		Active (Hall Effect)	8	0.66
Rear Left	Digital 03		Active (Hall Effect)	8	0.66
Rear Right	Digital 04		Active (Hall Effect)	8	0.66
					m ~
	\bigcirc Configure Digital Inputs 5				

Processing

Next select how the individual wheelspeed inputs are combined to calculate the vehicle speed and distance. Individual wheel speeds are first combined to produce front and rear axle speeds. The front and rear axle speeds are combined to produce overall speed and distance channels.

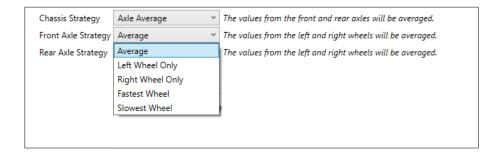


See Wheelspeed strategy for more information about wheelspeed processing strategy.

Select the chassis strategy (the values from which the front and rear axles are averaged) from the **Chassis Strategy** dropdown menu.

Chassis Strategy	Axle Average 🗸 🗸	The values from the front and rear axles will be averaged.
Front Axle Strategy	Axle Average	The values from the left and right wheels will be averaged.
Rear Axle Strategy	Front Axle Only	The values from the left and right wheels will be averaged.
	Rear Axle Only	,
	Fastest Axle	
	Slowest Axle	
	Front Wheel Drive	
	Rear Wheel Drive	

Then select the front and rear axle strategies from the dropdown menus.



Generated channels

You can then name the channels generated from the processed inputs. When you use digital inputs, there is greater functionality and, therefore, more generated channels. Enter names for the output channels for the wheel speed, angular velocity, triggers, and tire diameter of all wheel inputs.

39.4. GPS data

Configure inputs

If you use GPS data, select the GPS speed channel (sourced from the NMEA 0183 Decode) (1) and configure the strategy for when the speed is valid (2).

Input Mode	🔿 Channels 🔿 Digital Inputs 🖲 GPS Data		
Speed	NMEA RX Speed	0	1
Speed valid when	Car · is Moving	~	2

Processing

When the GPS signal is invalid, use the **Maintain last value** option to determine whether the speed value is held at the last known value, or select zero speed with the **Assume zero** option.

Processing	
Select how the speed data is to be processed in the cases where the value of th	e speed channel is not valid.
Strategy	



Generated channels

You can then name the distance and speed channels generated from the processed inputs.

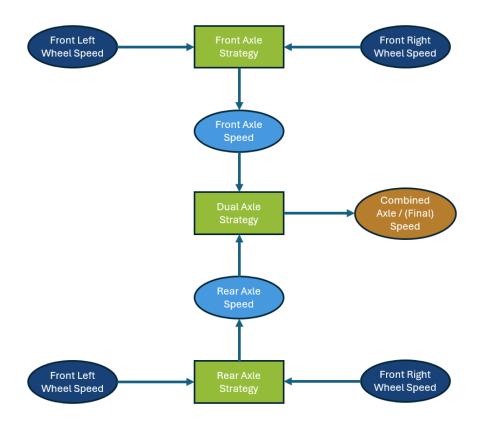
39.5. Odometer

An odometer channel (a total distance channel stored in non-volatile memory) is also generated. Enter a name for the odometer (1). Click **Add Trip** to add a 'trip meter' channel (2 and add a name for the channel (3). You can also use a to reset the trip meter (see Buttons) (4). Use the 'bin' tool to delete a trip meter channel (5).

	Odometer						
	Provide a channel	name for the odometer.					
1	Channel Name	Odometer					
2	dd Trip						5
3	Channel Name	Trip Distance					
4	Reset Button	Odometer Button	💮 🖲 Press 🔵 Release	O Click	O Hold	O Long Hold	

39.6. Wheelspeed strategy

The following flow chart shows how the wheel speed strategies are combined to output the final speed value. Ellipses represent a true, measured, speed and rectangular shapes represent numerical processing or a calculation.



Description Strategy Left Wheel Uses the value of the axle left wheel only Right Wheel Uses the value of the axle right wheel only Single axle strategy Fastest Wheel Uses the axle fastest wheel Uses the axle slowest wheel Slowest Wheel Wheel Average Uses the average of the two wheels Front Axle Uses the value of the front axle only Rear Axle Uses the value of the rear axle only Fastest Axle Uses the fastest axle value Slowest Axle Uses the slowest axle value Dual axle strategy Axle Average Uses the average of the two axles Uses the front axle value under a specified condition Front Wheel Drive (braking), then the rear axle value at all other times Uses the rear axle value under a specified condition Rear Wheel Drive (braking), then the front axle value at all other times

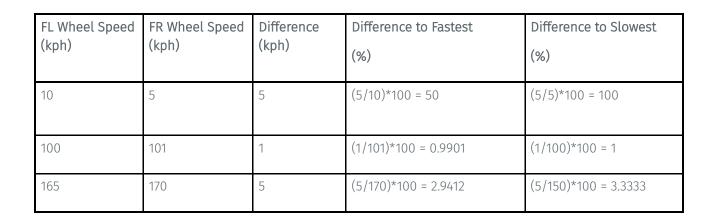
A table of the processing strategies available in Toolset is shown below:

Switch strategies

Some older versions of setup metadata allow switching between strategies (for example, between the left and right wheel on an axle, or between the two axle speeds). In these versions of metadata there is a section to set the switching thresholds.

Switch between left and right wheels when speeds differ by more than			% for more than	0.05	seconds.	
Use the front axle when the	velocity v	Speed	⊖is more than	0.000		kph ×

The percentage difference in speed is the percentage difference between the fastest and slowest wheel. The percentage difference to the fastest wheel is chosen and not percentage different to slowest wheel because this provides greater accuracy (see the table below):



The time factor is the duration for which the difference statement must be true before the speed channel switches. It is advisable to set the time factor quite low. A good starting setting is below 1-2% and below 0.2 seconds and then amend the settings as required.

Select a strategy

The optimal wheelspeed strategy for a vehicle varies depending on many different variables, and there is no suggestion for the best all round strategy.

The table below outlines some vehicle characteristics together with a suggested approach (actual optimal strategies may vary).

Vehicle Characteristic	Description	Suggested Approach
Rear wheelspin likely	Rear Wheels could spin to a value higher than the vehicle speed	Try to use front wheels, depending on Front locking likelihood. Fastest Front Wheel will account for single wheel lockups but not two wheel lockups.
Front wheelspin likely	Front Wheels could spin to a value higher than the vehicle speed	Try to use rear wheels, depending on Rear locking likelihood. Fastest Rear would account for rear jacking / single rear wheel lockups.
Front locking	Front wheels could drop below representative vehicle speed	If single lockups, can use fastest front wheel, however for double front lockups, the rear wheels should be used if possible.
Rear locking / jacking under braking	Rear wheels could drop below representative vehicle speed	If single lockups, can use fastest rear wheel, however for double front lockups, the front wheels should be used if possible.

Double lockup events tend to affect the speed trace more than wheelspin events, so for a car with both lockups and wheelspin, it can be better to select the axle with wheelspin rather than lockups.



40. Wipers

Windshield wipers are a crucial part of a race car and cannot afford to fail when rain falls during a race. You can configure the wiper control output from a power box, such as the Centaurus, or an older device such as the IPS, in many ways. This guide provides an overview of how to configure a wiper control output from the **Wipers** node, as well as other 'traditional' methods using maths and logic channels.

40.1. Wipers node

You can configure wiper control outputs from the **Wipers** node. Enable the wiper control output in the **Wipers** node (1), and then select the **LIN Port** to which the wiper is connected (2). Select the **LIN Bit Rate** from the dropdown menu to match the LIN bus bit rate (3.). You can select one of three common wiper models from the dropdown menu (4).

Finally, use the 'browse' button to specify the channel to drive the control (5).

Note: The wiper control channel can be a logic channel, a Maths channel, or a channel received over CAN, but the data type must be in U32 format.

Wipers	
General	
Configure the	settings for the wiper motor.
Enabled	1 🔽
LIN Port	2 LIN 01
LIN Bit Rate	3 19200 ~
Wiper Model	4 F 02U V00 838-03 Lin ID: 0x31 ~
Control Chanr	Wiper Control Channel
	5

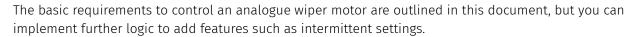
40.2. Manual configuration of wiper output control

Wiper basic

Analog wipers usually require a minimum of four wires to be connected to control individual motor windings. These wires normally consist of:

- Power
- GND
- Slow coil
- Fast Coil

Unlike LIN wipers, where the logic is controlled on the wiper motor itself, the logic to control the wiper motor needs to be integrated into the setup of the device controlling the motor. In this case, a Centaurus 5 is being used as an example.



In this example, the control logic is written on the **Logic Channels** node to create a simple setup, but this logic can also be written in the maths channels if required.

The logic for the wiper is triggered on the button press of a switch panel. This can be via an RSP or CAN input from external devices.

Maths channels

POC Enable LSD 51

The 'Park' feature of the Centaurus (the LSD) needs to be activated via the maths channel **POC Enable LSD 51** option. This channel name must match to invoke the LSD.

Ð	Math_Pump_Soft_Start	0	Equation
(f(x)	Math_TPS	0	Edit the equation that determines the value of this math channel. 1 ([Cnt_Wiper_Speeds]== 0 && [Switch 3 Park Button]==0)
(\mathbf{F})	Math_Up_Shift	0	
(Math_Washer_SS	0	
	POC Enable LSD 51	0	

The example maths above show, the two conditions of the wiper speeds and the switch park. These conditions are fully customisable but, in this case, a physical button press is being used. These messages can come from anywhere, for example from the CAN bus or from digital inputs.

Logic channels

Wiper button press

This channel receives the input from the physical button. When the button is pressed, the logic channel returns 'True'.

General		
Configure the basic settings that define this condition channel.		
Name Lgk_Wiper_Click		
Comment		
Manufacturer Status O This is a normal item.		
Output		
Configure the output states for this condition channel.		
Configure the text and colors for the channel.		
when True		
when False		
Logic		
Configure the logic that determines the output of this condition channel.		
1		
All	Group	
"RSP Switch7 Button" "De-bounced" is Active		
+		

Wiper counter

This channel is a counter which determines how many times the button has been pressed. It is set to increase on each button press and determines at which speed to run the wipers.

General	
Configure the basic	settings that define this counter channel.
Name	Cnt_Wiper_Speeds
Comment	
Manufacturer State	us 🔘 This is a normal item.
Counter	
Configure the settir	ngs that define the counter.
Min / Max	0 3
Initial	
✓ Increment	on Rising Y edge of Lgk_Wiper_Click
	\odot Wrap At Limit \bigcirc Hold At Limit
Decrement	on Falling 👻 edge of 💮
	◎ Wrap At Limit ⑧ Hold At Limit
0.11	
Overrides	
Configure any over	rides to apply to the counter value.
Set	to 0 when
	user type 🗸
	= 0.000
Set	to 0 when
	user type v
	= ~ 0.000

In this example you can only press the button three times for the three different states:

- 1. Intermittent Wiper
- Slow Wiper
 Fast Wiper

Intermittent wiper

To control the intermittent setting, a timer needs to be used to set the active high status. You can define the timer, specific to your requirements.

Slow wiper

When this logic returns 'True', the wipers activate in slow mode. This is controlled by the counter and by setting it to return 'True' when 'Cnt_Wiper_Speeds' is equal to 1. Other conditions can be added to make sure that wipers do not run when the kill switch is active and when the car is powered off.

Alternatively, if you press the washer button this automatically enables the 'Slow wipe' and bypasses the other parameters.

General			
Configure the basic settings that define this condition channel.			
Name Lgk_Slow_Wipe			
Comment			
Manufacturer Status O This is a normal item.			
Output			
Configure the output states for this condition channel.			
Configure the text and colors for the channel.			
when True			
when False False			
Logic			
Configure the logic that determines the output of this condition channel.			
(\uparrow) (\downarrow)			
Any	Group		
All	Type Any ~		
"Lgk_Ignition" = 1.000			
"Cnt_Wiper_Speeds" = 2.000			
"Cnt Kill" = 0.000			
+			
"Lgk_Washer" = 1.000? True after 0.75s, False after 2.00s			
+			

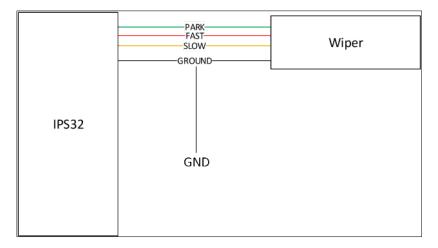
Wipers advanced 40.3.

Note: This guide describes how you can configure analogue wipers for a IPS32 or IPS48 device. These are only guidelines on how to set up your IPS32 with wipers and the precautions to take. You can modify these guidelines to meet customer requirements, but setups should always be tested before being implemented on a car.



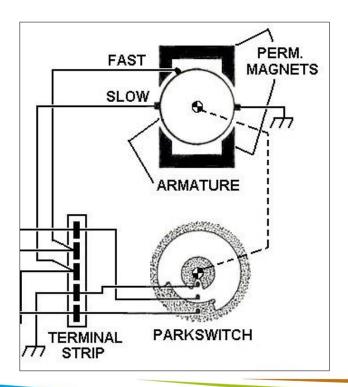
General principle

Unlike the LIN wiper, the analogue wiper does not have any inbuilt 'intelligence'. The controller (in this case the IPS) must tell the wiper when to go slow, go fast, or stop. The loom between the IPS and the wiper is usually composed of 4 wires.



The ground link is usually already routed directly to the chassis. The FAST and SLOW lines are the 'power' lines which supply 12V to the fast and slow motors, respectively. The SLOW line supplies current to the full length of the motor windings, whereas the FAST line supplies current to half the length of the motor windings. This is how the two different wipers speeds are controlled.

The PARK signal is a signal from the wiper system that the IPS uses to calculate when to stop and apply the brake. It is usually either a tooth or missing tooth on the wiper motor track. As the motor rotates it passes this (missing) tooth once a rotation and a mechanical switch linked to this track outputs a digital signal depending on whether a contact is registered.





Precautions when you connect to the power box

To stop the wipers in a controlled and accurate manner, the motor can be 'braked' by removing the live current supply to the motor and connecting it directly to ground. Outputs 1 and 17 on the IPS have this feature, so it is recommended that these outputs are used to supply the slow motor. To apply this brake, either the channel '[POC Enable LSD 1]' or the channel '[POC Enable LSD 17]' must output 1.

Without this feature you can only supply live current to the wiper, so stopping the wiper in the correct position is difficult to do accurately, relying on the friction applied to the wipers and the inertia of the motor to slow it to a halt. With the added complication of varying inertia on the wipers themselves (depending on the condition of the surface of the windscreen and the speed of the vehicle), an active stopping mechanism is required to make sure that the wipers stop in the 'park' position.

Note: You must take care when you apply the 'brake' as the IPS is not protected against accidentally supplying live current to the output and connecting it to ground at the same time. This could cause serious damage to both the IPS and the wiper.

Control the wipers

In this example, five math channels control analogue wipers. Below is an explanation of the function of these five math channels and the names assigned to them:

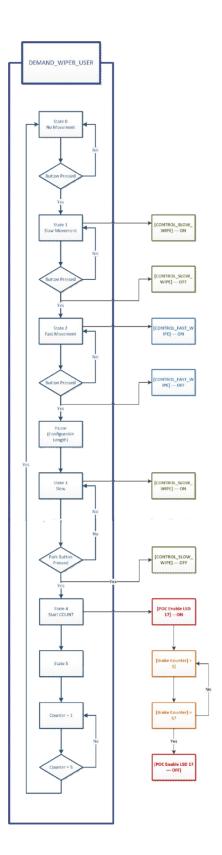
- 1. One master channel runs as a 'state machine' and controls the state of the system [DEMAND_WIPER_USER]
- 2. One that controls the 'Slow' wipe [CONTROL_SLOW_WIPE]
- 3. One that controls the 'Fast' wipe [CONTROL_FAST_WIPE]
- 4. One that controls the 'Brake' [POC Enable LSD 17]
- 5. One to run as a counter for the duration that the 'Brake' is applied [Brake Counter]

The driver in this example has one button (usually on the steering wheel) enables them to switch between SLOW/FAST/OFF.

Note: This is only an example, and might not suit every customer (for example, the sequence means that the wiper operates in the following order to be turned off, which may not suit some applications): SLOW > FAST > OFF.

When the system is running Fast and a Stop is requested, it returns to Slow before stopping at the park signal. This means that the process sequence is: SLOW > FAST > (SLOW > BRAKE > OFF).

The flowchart below explains the state machine process that the system follows, with conditions for each change. 'State' represents the value of the output from the channel 'DEMAND_WIPER_USER':





Link to the outputs

The output channels to power the two speeds are '[CONTROL_SLOW_WIPE]' and '[CONTROL_FAST_WIPE]'.

Allocate '[CONTROL_SLOW_WIPE]' to either output 1 or 17 (the channels in this example are set up to use output 17).

Allocate '[CONTROL_FAST_WIPE]' to output 18. The loom should have pins connected from these sockets to the power inputs on the wiper motor.

Set up the Park signal, received as a digital input from the wiper motor, as a button named '[WIPER_PARK Button]'.

Set the wiper control button as a button named '[WIPER Button]'. The ground for the wiper must go directly to ground.

Appendix

Master wiper channel - DEMAND_WIPER_USER

This is the channel that controls the changing state of the wiper system, on which output functions rely and into which other channels feed information. To keep all these synchronised, it is recommended that all wiper channels are calculated at the same rate (for example, 50Hz).

DEMAND_WIPER_USER

```
a5 ([WIPER_PARK Button] & 1);
a6 ( choose ( ( @a5 > @a4 ), 1, ( choose ( (@a5 < @a4 ), 2, 0 ) ) ) );
a4 ( @a5 );
a2 ( choose ( @a2 == 4, 5, @a2 ) );
a0 ( choose(((shr([WIPER Button], 1) ) & 1) > @a1, 1, 0 ) );
a1 ( (shr ( [WIPER Button], 1) & 1 ) ) & 1 ) > @a1, 1, 0 ) );
a1 ( (shr ( [WIPER Button], 1) & 1 ) );
a2 ( choose ( ( @a0 ) == 1 ), choose ( @a2 == 3, 3, choose ( @a2 < 4, @a2 + 1, 4 ) ), @a2 ) );
a2 ( choose ( ( @a2 == 3 ) & & ( @a6 == 2 ), 4, @a2 ) );
a3 ( choose ( ( @a2 == 4 ), 0, @a3 ) );
a3 ( choose ( ( @a3 < 6 ), @a3 + 1, 6 ) );
a2 ( choose ( ( @a3 == 5 ), 0, @a2 ) ) ;
@a2
```

There are seven registers in this channel (a0, a1, a2, a3, a4, a5, a6, a7). Each of these has a different function in the calculation of the channel output. To explain the purpose of each register, from the start of the channel:

- a4, a5, and a6 are all used to calculate whether a rising or falling edge has been received from the 'WIPER_PARK Button'.
- **a5:** This register takes the value of the wiper park button. When the system is in the park position (once per revolution) the value of a5 is 1. At all other times it is zero.
- **a4:** This register displays the value of a5 from the previous cycle to allow the two to be compared by a6.
- **a6:** This register detects whether a rising edge or falling edge of the WIPER_PARK Button is received. This is done by comparing a4 and a5: if a5 is larger than a4 (as this is a digital signal, this means that as a5 is 1 and a4 is 0), then a rising edge is detected, as the current value is 1 and the previous value is 0. Conversely, if a4 is larger than a5, then a falling edge is detected. a6 displays 1 for a rising edge, 2 for a falling edge, and 0 if no change is seen.
- a0 and a1 are used to recognise a rising edge of the WIPER Button.
- **a0**: This register compares the current value from the WIPER Button (1 or 0) with the previous value (held by a1). If a rising edge is detected, the current value is greater than the previous value and a0 outputs a 1, otherwise 0.
- **a1**: This register holds the previous state of the WIPER Button for comparison with a0.
- **a2: This** is the final output from the channel, which has six states.
- **a2 = 0:** Initial state of the system, no power applied until a button is pressed.
- **a2 = 1:** Button has been pressed once, power applied to slow motor.
- **a2 = 2:** Button has been pressed again, power applied to fast motor and not to slow motor.
- **a2 = 3**: Button has been pressed again and a stop requested. This button press sets in motion the remaining states. The system returns to powering the slow motor only and remains in this state until a rising edge of the WIPER_PARK Button is detected (a6 = 1).
- **a2 = 4**: WIPER_PARK Button rising edge is detected, power is removed from slow motor, brake applied, counter is started, and state moves to a2 = 5.
- **a2 = 5**: Brake is held on for set duration, then a2 moves back to state 0, with wipers stopped and no power to any motors or brakes.
- a3 is a counter to keep track of whether the brake is on or off.
- **a3:** This register counts from 0 to 6. It starts from a3 = 0 and a2 shifts to 0 when it detects that a3 = 5; a3 resets to 0 once it reaches a3 = 6. This register is required to make sure that the brake is not applied at the same time as power is applied to one of the motors.

Initially the channels were set up so that the brake came on once it detected that '[DEMAND_WIPER_USER]' was at state 4, stayed on for a set amount of time, and then '[DEMAND_WIPER_USER]' moved to state 5 once it detected that the brake was off. However, this was not possible because the two maths channels could not both be dependent on each other. Therefore, two counters were created which worked simultaneously. They both start when they detect that '[DEMAND_WIPER_USER]' is at state 4, but one turns off the brake when it reaches a certain value, and the other moves '[DEMAND_WIPER_USER]' from state 5 to state 0 when it reaches that same value. Register a3 is the counter which controls the change of state from 5 to 0. A separate channel, 'Brake Counter' controls turning off the brake. '[Brake Counter]' is displayed below:

Brake Counter

```
a1 ( choose ( ( [DEMAND_WIPER_USER] == 4 ), 0, choose ( ( @a1 < 6 ), @a1 + 1, @a1 ) ) );
@a1
```

This counter is reset to zero when it detects that DEMAND_WIPER_USER = 4, then increments up by one each cycle until it reaches 6, then rests at 6 until it detects DEMAND_WIPER_USER = 4 again.

The brake is controlled by the channel 'POC Enable LSD 17' (shown below):

POC Enable LSD 17 (Alternatively 'POC Enable LSD 1' if using output 1)

```
a1 (choose (([DEMAND_WIPER_USER] == 4), 1, (choose (([Brake Counter] < 5), 1, 0))));
@a1
```

This channel applies the brake whenever it detects that either DEMAND_WIPER_USER = 4 or Brake Counter is below 5. Therefore, as soon as Brake Counter = 6, the brake is off.

Power Outputs

The remaining two channels are the outputs from the IPS to control the slow and fast motion of the wipers. These are CONTROL_SLOW_WIPE and CONTROL_FAST_WIPE: **CONTROL_SLOW_WIPE**

a0 (choose ([DEMAND_WIPER_USER] == 1), 1, 0)); a1 (choose ([DEMAND_WIPER_USER] == 3, choose (@a1 == 5, 5, @a1 + 1), 0));

a2 (choose ((@a0 == 1 || @a1 == 5) && ([POC Enable LSD 17] == 0) , 1 , 0)) ;

@a2

This channel engages the slow mode of the wiper motor when DEMAND_WIPER_USER = 1 and when DEMAND_WIPER_USER = 3 (after a delay of 5 cycles). In both cases, POC Enable LSD 17 must be zero for the motor to be engaged.

CONTROL_FAST_WIPE

choose (([DEMAND_WIPER_USER] == 2) && ([CONTROL_SLOW_WIPE] == 0) && ([POC Enable LSD 17] == 0) , 1, 0)

This channel engages the fast mode of the wiper whenever all of the following conditions are met: DEMAND_WIPER_USER = 2, CONTROL_SLOW_WIPE is off and POC Enable LSD 17 is off.

Note: Some logical AND (&&) and logical OR (||) functions are used in these math channels. Care must be taken when you use these. It is strongly recommended that parenthesis are used wherever appropriate to separate each member of a logical operation to avoid miscalculations:

(xxxxxx > 1) && (yyyyyy == 2) ((xxxxxx == 0) || (yyyyyy > 4)) && (zzzzzz != 0)

Function explanations

Function	Description	Syntax
choose	The choose function is a logical 'if', which gives one output if the statement is true, and another output if the statement is false.	choose('Statement' , Output if statement true , Output if statement false)
Registers	Variables to which values can be set. Up to 7 registers can be used in any channel, identified by their number (ranging from 0 - 6)	To set register value: a1(<i>value</i>) To reference register in other function: @a1 Available registers: a0 /@a0 a1 / @a1 a2/ @a2 a3 /@a3 a4 /@a4 a5 /@a5 a6 /@a6

		Example:
		a2(7);> set a2 value to 7
		choose (@a2 == 7 , 1 , 0) ;> If a2 is equal to 7, output 1, otherwise output 0
==	Logical 'is equal to'	choose (@a4 == 1 , 3 , 4) ;> If register @a4 is equal to 1 then output 3, otherwise output 4
<	Logical 'is less than'	choose (@a1 < @a5 , 9 , 2) ;> If register @a1 is less than the register @a5, then output 9, otherwise output 2

Logical 'is greater than'	choose (@a1 > @a5 , 9 , 2) ;> If register @a1 is greater than the register @a5, then output 9, otherwise output 2
Mathematical 'plus'	(@a6 + 1);
Logical 'and'	choose ((@a2 == 3) && (@a4 == 4) , 6 , 2) ;> If register @a2 is equal to 3 and register @a4 is equal to 4, then output 6, otherwise output 2
Logical 'or'	choose ((@a3 == 3) (@a3 == 4) , 8 , 5) ;> If register @a3 is equal to 3 or register @a3 is equal to 4, then output 8, otherwise output 5
Shifts byte right by X bits, inserting zeroes to the left	shr ([Input 4] , 3) ;> Shifts the input from [Input 4] right by 3 bits, with 3 zeroes inserted to the left
Returns a U32 'ANDed' with another	[Input 7] & [Input 6] ;> Returns 1 if [Input 7] and [Input 6] have the same value
	Mathematical 'plus' Logical 'and' Logical 'or' Logical 'or' Shifts byte right by X bits, inserting zeroes to the left Returns a U32 'ANDed' with

41. Zeroing

The **Zeroing** node enables you to configure channels to be zeroed. You can zero channels individually or in groups.

41.1. Create a zeroing group

Use the + tool to add a new zeroing group (1). You can import and export zeroing groups from existing setups (2).

	Zeroing Groups	General		
1 (Name	Group 0]
	Group 0	Offset Description		. ● Press ○ Release ○ Click ○ Hold ○ Long Hold
		Allow Zeroing from Toolset	Yes No	
		Manufacturer Status		
		Manufacturer Status	This is a normal item.	
		Zeroing Channels		
		Configure the channels to b	e zeroed in this group.	
		Add Channel		

You can name the zeroing group (1) and add an optional description (4). Use the 'browse' tool to select offset buttons (see Setups - Buttons) (2), and then the button click type (3). Select the **Allow Zeroing from Toolset** option (5) to enable zeroing from a PC from the **Actions** tab in Toolset (see Actions - Zeroing).

General	
Name	1 Flat Patch 2
Offset	O Press Release Click Hold Long Hold
Description	4 Used to zero all acceleromets, damper potentiometers and steering angle sensor when on the flat patch.
Allow Zeroing from	polset Ves No 5

You can then add channels populated from the **Sensor** node (see Setups - Sensors) to the zeroing group (1) by selecting available sensor channels from the dialog box (2/3). You can also set the target value and unit for the channel (4).

						<i>c</i>		
General						🚱 Choose a Channel	- 🗆 X	
Name Offset Description Allow Zeroing from Toolset	Used to zero accelerometers, dam	-	○ Click ○ Hold ○ Long Hold		3 -	Acceleration X Acceleration Y Acceleration Z Damper FL Damper FL Damper RR Steering Angle		
Manufacturer Status Manufacturer Status	O This is a normal litem.					start typing to filter the selection Sourced from Sensors node.	×	
Zeroing Channels	e zeroed in this group.					Show All Show Diagnostic Items	OK Cancel	
And Channel								(
Acceleration X				··· Tar	get Value 0.00	0		G
Acceleration Y				Targ	get Value 0.00	0		G
Acceleration Z				↔ Targ	get Value 0.00	0		G
Damper FL				Targ	get Value 0.00	0		m v
Damper FR				··· Targ	get Value 0.00	0		m ¥
Damper RL				↔ Tar	get Value 0.00	0		m
Damper RR				··· Targ	get Value 0.00	0		m v
					get Value			
				2				

You can add multiple zeroing groups to zero sensors exclusive of each other. See Actions - Zeroing for more information about how to set the zero from Toolset.

4

Zeroing Groups		General	
+ + +	١	Name Dampers	
Flat Patch	0	Offset	
Dampers	0	Allow Zeroing from Toolset 🔹 Yes 🔘 No	
Accelerometers	0	Manufacturer Status	
Steering Angle	0	Manufacturer Status O Titis is a normal lam.	
		Zeroing Channels	
		Configure the channels to be zeroed in this group.	_
		Add Channel	١
		Damper FL 💬 Target Value 0.000 mm	v
		Damper FR 💬 Target Volue 0.000 mm	v
		Damper RL O Target Value 0.000 mm	v
		Damper 8R Otto Target Value 0000 mm	



42. Channels configuration overview

The **Channels** page displays all the channels created or used in Toolset. It enables you to customise the display and alert settings for each channel display for efficient monitoring. For example, you can convert channels displayed in live data between units using the **Channels** page.

1 Centaurus 5xx	#4 Data	(🕬 Live Data	Actions	1 Setups	Channels	Settings	
Revert to Defaults	lelete 🕁 Import 🛈	Export Selected Cl	nannels				
Amps Amps Comp Amps Comp Amps Peak Control Error PWO Duty PWO Freq Retry State Status Trip Retries Trip State Volts _Parking Brake Status Event + Telemetry_V1.8.0 00 Switch States Info 0_DKR Config Version 0_XC Ano_01_thru_04 Tim 0x3D Ano_05_thru_08 Tim 0x3E Ano_09_thru_12 Time	0X81 FAULT INFO Timeo 0X81 FAULT INFO Timeo 0x81_CANopenErrorCod 0x81_CANopenErrorCod 0x81_CANopenErrorReg 0x81_EM_FaultCode 0X81_Sevcon_Fault_Data 1.5V Supply Voltage 1Hz Overruns 1Hz Utilization 1kHz Overruns 1kHz Utilization 1st Gear 1stGear_Status 1V1 INTPSU 1V5 INTPSU 1V37 INTPSU 02 Logging when Movin 2GK Sleep Request Dela 2Hz Overruns 2Hz Utilization	le 3.3V Supply le 3rd Gear 3V3 INTPSU 3V3 PWR_1 a 3V3_LAM II 4 4 Bit Chanr 4 Bit Chanr 5 Hz Flasher 5 Hz Flasher 5 Hz Overru	y Voltage J NTPSU NTPSU nel Ex1 nel Ex1 Bi nel Ex1 Bit-Fields nel Ex1 Bit-fields nel Ex2 Bit-fields	5V EXTPSU5 5V EXTPSU6 5V EXTPSU7 5V EXTPSU9 5V EXTPSU9 5V EXTPSU1 5V PSU1 5V PSU2 5V PSU3 5V PSU3 5V PSU3 5V PSU4 5V PSU5 5V PSU6 5V PSU6 5V PSU6 5V PSU8 5V PSU9 5V PSU9 5V PSU9 5V PSU10 5V Supply V 5V0 PWR_IN 5V0_PU INTI	Quantity <u>C</u> olor	Amps Peak current 1000 0 1000 0 2 amps	
0x3F Ano_13_thru_16 Time 0x40 Ano_17_thru_20 Tim 0x41 Ano_21_thru_24 Tim	2nd Gear 2V5 INTPSU 2V5_ETH INTPSU	5V EXTPSU 5V EXTPSU 5V EXTPSU	3	5V1 INTPSU 5V12 EXTPS 5V12 EXTPS			

42.1. Toolbar options

- **Revert to Defaults**: Resets all settings to their default values.
- **Delete**: Removes the selected channel.
- **Import/Export Selected Channels**: Allows you to import or export configurations for specific channels in *.tcl* format (Toolset **Channel List**).



42.2. Channel list

The list on the left displays available channels. Whenever a new channel is created or imported, they are listed in this section. You can perform a magic search (ctrl+shift+8) to find any specific channels, as shown in the example below:

AC_a_lambda	inj_m_lambda2
Alarm_Lambda_Bank_Err	inj_m_lambda3
AVLDYNO_LambdaAbs	inj_m_lambda4
AVLDYNO_LambdaActivati	IPS15 Lambda Amps
BrLambdaLActive	IPS15 Lambda Amps Comp
BrLambdaLInError	IPS15 Lambda Amps Peak
BrLambdaRActive	IPS15 Lambda Control
BrLambdaRInError	IPS15 Lambda Error
closed_loop_lambda	IPS15 Lambda Retry State
dis_lambda_tmr	IPS15 Lambda Status
ecu_lambda	IPS15 Lambda Trip Retries
ECU_lambda_target_base	IPS15 Lambda Trip State
ecu_lambda2	IPS15 Lambda Volts
FIA_rLambda1.	IPS19 Lambdas Amps
FIA_rLambda1.lbd	IPS19 Lambdas Control
FIA_rLambda2.	IPS19 Lambdas Error
FIA_rLambda2.lbd	IPS19 Lambdas Trip
I_Lambda_PCM	Lam_Lambda 1_ECU
inj_m_lambda	Lambda_1_Neg_Trim_Error
inj_m_lambda_base	Lambda_1_Pos_Trim_Error
inj_m_lambda_base2	Lambda_2_Neg_Trim_Error
inj_m_lambda1	Lambda_2_Pos_Trim_Error
<	
LAMBDA	

In this example, any channel that contains 'LAMBDA' in its name is shown, making it easier to search large sets of data.

Select a channel to display its configuration options on the right.

Channel configuration options

For the selected channel (for example., Amps Peak):

- **Name**: Displays the name of the channel.
- Quantity: Defines the measured type (for example, Current).
- Color: Sets the display colour for the channel (for example, *Blue*).
- Autoscale: Automatically scales the display for data values.
- Display Maximum/Minimum: Sets upper and lower display limits.
- Alarm Enabled: Toggles alarm notifications for the channel.
- Alarm Maximum/Minimum: Sets alarm threshold values.
- Decimal Places: Defines the number of decimal places for displayed values.
- Unit: Specifies the unit of measurement (for example, *Amps*).

Name	Amps Peak
Quantity	current
Color	
Autoscale	
Display Maximum	1000
Display Minimum	0
Alarm Enabled	
Alarm Maximum	1000
Alarm Minimum	0
Decimal Places	2
Unit	amps v



43. Settings

43.1. Network

The **Network** page is used to configure the connection to the device. All PC network connections are displayed in the menu. Click the required network adaptor and confirm that it is connected (1). Select **Use Selected Adaptor** to confirm the chosen network adaptor (2). If your network adaptor is not displayed, select the **Refresh Network Settings** option (3).

Network Adapters						
Select the network adapter you wish to use to communicate with devices.						
Ethermet 1 Connection 1 Connected Intel® Ethermet Connection (13) 1219-LM C 4 Connected Intel® (13) 1219-LM C 4 Connection (13) 1219-LM C 4 Connected Intel® (13) 1219-LM C 4 Co	Local Area Connection* 2 Disconnected Microsoft Wi-Fi Direct Virtual Adapter #2 169.254.110.105	Ethernet 2 Cable unplugged Fortinet Virtual Ethernet Adapter (NDIS 6 169.254.79.135	Connected	Bluetooth Network Connection Cable unplugged Bluetooth Device (Personal Area Network) 169.254.171.129	D	
Subscription Use Selected Adapter						
Restore						
A backup of the original network settings is made before any changes are applied. You	should restore the original settings if you need	to access another network with the current r	etwork adapter after exiting the application	n. Note, the backups will be lost when you	exit the application.	
Restore Previous Settings						
					3	Refresh Network Settings

If there is a network error, for example, multiple network adaptors are found, an error is displayed with a brief description of the error. Make sure that the ethernet adapter shows as **Connected** before you try to connect to a device.

43.2. Data offload

On this page you can configure the root path to where outings are offloaded, as well as the name of the PDS file for the outing. You can copy the file location from the file explorer or select it via the browse button (1). You can configure this filename with property tokens, which are automatically replaced by their respective values during offload. Use the 'token browse' option to select relative path tokens (2).

Offload Paths	
Configure where offloaded data.	outings are offloaded to. The root path is combined with the relative path to form the complete path and filename for
Root Path	C:\Pi Research\Toolset\10.3\Library
Relative Path	<year>\<track/>\<driver>\<session>.pds</session></driver></year>
	Relative path tokens (e.g. <year>) will be replaced with their respective values when offloading.</year>
Preview	C:\Pi Research\Toolset\10.3\Library\24\Silverstone\John Smith\002.pds

On the same page you can also configure further offload settings, such as automatic offloading and deletion, to enable a more efficient workflow.

Offload Conditions
Configure general offload settings.
Do not automatically offload outings shorter than 60 s
✓ Show short outings
\checkmark Show deleted outings still on the device
Delete an outing after successful offload
Automatically offload when a device is connected

Note: Save any changes for them to take effect (1). Click Reset to restore the default settings (2).

Offload Paths	
Configure where offloaded data.	outings are offloaded to. The root path is combined with the relative path to form the complete path and filename for
Root Path	C:\Users\Rhopper10251\Downloads
Relative Path	<track/> ~
	Relative path tokens (e.g. < year>) will be replaced with their respective values when offloading.
Preview	C:\Users\Rhopper10251\Downloads\Silverstone.pds
Offload Condit	
Configure genera Do not automat	ically offload outings shorter than 60 s
✓ Show delete	d outings still on the device
Delete an o	uting after successful offload
Automatica	ly offload all available outings after a connection is established with the device (does not apply to short outings)
	Bave Reset
	1 2

43.3. Telemetry

This page allows you to configure telemetry data sources, telemetry server settings, and telemetry logging options.

Telemetry source configuration

This section is where you can add and configure telemetry data sources.

- Add telemetry source: Click the + button to add a new telemetry source.
- **Name**: The name assigned to the telemetry source.
- **Type:** Select the type of telemetry device from the dropdown list.
- **Port**: Enter the communication port to which the device is connected.
- Baud Rate: The baud rate for the connection.

Telemetry Source Configuration				
Configure your sources of telemetry data.				
	Name	Source Example		
	Туре	Cosworth P192S	¥	
	Port	Intel(R) Active Management Technolo	¥	
	Baud Rate	19200		

Telemetry server configuration

This section allows you to configure how the telemetry data is shared over a network.

- Share telemetry on port:
 - Toolset clients: Specify the port number for toolset clients (for example, 51413).
 - Data Analysis clients: Specify the port number for data analysis clients (for example, 51414).
- **Reset Data Analysis data when the outing number changes**: Enable this option if you want to reset data analysis after each new outing.
- Route telemetry data over Ethernet when the device is connected: Select this option to enable telemetry data transmission via Ethernet where the device supports it.

Telemetry Server Configuration				
Configure how telemetry data is to be shared from this machine.				
Share telemetry on port	51413	(Toolset clients)		
and port	51414	(Data Analysis clients)		
Reset Data Analysis data when the outing number changes				
Route telemetry data over Ethernet when device is connected (when supported by the device)				



Telemetry logging

This section allows you to configure how logged data is handled.

- Log telemetry data: Select this option to enable logging of telemetry data.
- Update logged data every X seconds: Specify the interval in seconds at which the logged data is updated (for example, 300 seconds). The minimum value is 20 seconds, and the maximum is 900 seconds.

Telemetry Logging		
Configure how logged data should be generated from received telemetry.		
Log telemetry data		
Update logged data every 300 s (min 20, max 900)		

43.4. Diagnostics

This page allows you to configure the diagnostics display and rendering options for the application.

Setup diagnostics

- **Display diagnostic resources**: Enable to show general diagnostic tools.
- Display Cosworth only resources: Display diagnostics specific to Cosworth devices.
- **Display UI for configuring debug channels**: Enable this option to show the interface to set up debug channels.

 Setup Diagnostics

 Configure how diagnostic information is made available within setups.

 Image: Display diagnostic resources

 Image: Display Cosworth only resources

 Image: Display UI for configuring debug channels

Rendering options

• **Disable GPU hardware acceleration**: Turn off hardware acceleration to improve stability, especially if there are issues with the graphics card. Note that this might affect application performance.

Rendering Options

Problems with certain graphics cards may result in instability when running the application.

Hardware acceleration of the application can be disabled to improve reliability. This may affect performance.

Disable GPU hardware acceleration



43.5. Upgrade

This page allows you to manage software updates and migrate settings from a previous version of the toolset.

Update settings

- Check for updates on startup: Enable this to automatically check for updates once a day.
- Only allow service releases: Limit updates to stable service releases.
- Check for: Select whether to check for device or application updates.
- Check now: Manually trigger a check for updates.

Update Settings		
Configure the settings that control software updates.		
✓ Check for updates on startup (once per day)		
Only allow service releases		
Check for:		
Device updates		
✓ Application updates		
Check now		

Device updates

- View and select firmware updates, setups, and merge files for various devices.
- Last check: Shows the date and time of the last update check.
- Use the checkboxes to select updates for specific devices.
- Select all or Clear selection: Select all updates or reset the selections.
- Download and import now: Click to download and save selected updates.

Device Updates		
Download and import firmware updates, setups, and merge files.		
Last check: 25/10/2024 10:58:05		
Badenia 2 Updates (5 firmware update(s))		
Badenia 5 Updates (16 firmware update(s), 1 setup(s), 1 merge file(s))		
CCWMk2 Updates (3 firmware update(s))		
CCWMk3D Updates (11 firmware update(s))		
CDU 10.3 Updates (7 firmware update(s))		
CDU 7.0 Updates (3 firmware update(s))		
CDU Updates (1 firmware update(s))		
Centaurus 5 Updates (22 firmware update(s))		
CLU Updates (11 firmware update(s))		
ICD Updates (5 firmware update(s))		
Select all Clear selection		
Download and import now		



Application updates

- Last check: Shows the last time application updates were checked.
- If updates are found, this section provides the option to download and install them.

Application Updates
Download and install application updates.
Last check: 25/10/2024 10:58:05
No updates found

Migrate previous settings

• Migrate previous settings: Import settings, setups, and tokens from an older version of Toolset.

Migrate Previous Settings
Migrate settings, setups and tokens from a previously installed version of Toolset.
Migrate previous settings

43.6. About

Version Information

On this page, the current versions of Toolset and Data Access are displayed. If there is an active license, it is shown on this page.

Version Information		
Pi Toolset	Version 10.3 (Build 4908 - Update 7)	
Pi Data Access	Version 10.1 (Build 1557 - Update 8)	

Note: If an asterisk is displayed next to the page title (for example, **DataOffload***), it indicates that some settings have been changed without being saved.



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Rev: 1.0 - Released

All Information in this document is correct as of 23/07/2025

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