

6 Repton Close | Basildon  
Essex | SS13 1LE | United Kingdom  
+44 (0) 1268 904124  
info@liferacing.com  
www.liferacing.com

# PDU 2.21.x

## Feature Description

Document revision:  
V1.1

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Document Author:  
A.A. / A.S.

## Overview

Following the substantial changes and additions of earlier release (2.15 – rel19), updates on user interface functionality and features have since been improved:

- Support for new PDUXB devices
- Support PDUXB main code v.2.21.X (PduXSetup software version needs to be >= 2.15.21XX)
- Improved Custom CAN and IO summary dialogs
- Output trip auto retry
- Internal Accelerometer & Gyroscope Items
- Import / Export .csv files for Input linearisation
- Shortcut and hot-keys improved and added
- Math operator update and improvements

## Latest release updates (2.15 – rel20-23):

### IO Summary...

- Close / Maximise window buttons.
- Input / Output state, value, current **live** numbers reported when connected or simulated.
- Right click will display Item properties, allow forcing while connected or simulated.
- Double clicking on an Item takes you to the schematic position and page.

IO Summary

SOFT INPUTS

Name	Page	CAN	Default	Initial / Msg	Timeout	Timeout Behaviour
Soft I/P 1	Indicator Left	Page 1	CAN1 0x710 byte 1 of 8	0.0	2.00s / 0.25s	DEFAULT

SOFT OUTPUTS

Name	Page	CAN	
Soft O/P 1	LED Indicator	Page 1	CAN 0x718 byte 1 of 8

HARD INPUTS

Name	Page	Pull	Analogue	High Threshold	Low Threshold	Validation	Debounce	Active	
Input 1	FAN	Page 1	DOWN	YES	4.0V	1.0V	0.10s	0.10s	HIGH

HARD OUTPUTS

Name	Page	PWM	Turn-ON Mode	LS Pullup	Status Output	Main Trip / time	Retry Count / Delay	Inrush time	Inrush trip	Soft start time	Soft start current / ramp	Low Current Trip	Alarm Trip	Board Temp Max	PWR Volts Min Trip
Output 1	FAN	Page 1	NO	SOFT START (Inductive)		Duplicate Input on Trip	40.00A / 0.100s	2 / 5s		1.00s	25.00A / 0.100s	0.00A / 0.100s	655.35A / 0.100s	120.0°C	0.000V / 0.500s

Find - F5

"Output 1" Properties - F6

Close - F10

CSV Export - F11

Goto "Output 1" - F12

### Custom CAN...

- Close / Maximise window buttons.
- Offer to update entire frame's transmit rate when a change is applied on a signal.
- Right clicking on a "Soft I/O" and pressing CAN properties, directs you to Custom CAN.

## Custom CAN c'tnd...

Custom CAN communications for main code 2.19+

CAN 1/2/3 baud rate

CAN 1/2/3 termination ☐ ☐ ☐ ECU Slave Link : NONE

Frame count : 28 / 128 TX Frames : 28 / 80 RX Frames : 0 / 80

TX Signals : 188 / 256 RX Signals : 0 / 128

Processing Bandwidth : 19941 / 44800

Add Frame Duplicate Remove Frame Clear All

Group	Bus	Msg ID	<->	Name
V3 Datastream.1	CAN1	0x700	TX	Base+00
V3 Datastream.1	CAN1	0x701	TX	Base+01
V3 Datastream.1	CAN1	0x702	TX	Base+02
V3 Datastream.1	CAN1	0x704	TX	Base+04
V3 Datastream.1	CAN1	0x706	TX	Base+06
V3 Datastream.1	CAN1	0x708	TX	Base+08
V3 Datastream.1	CAN1	0x709	TX	Base+09
V3 Datastream.1	CAN1	0x70C	TX	Base+12
V3 Datastream.1	CAN1	0x70D	TX	Base+13
V3 Datastream.1	CAN1	0x70E	TX	Base+14
V3 Datastream.1	CAN1	0x70F	TX	Base+15
V3 Datastream.1	CAN1	0x710	TX	Base+16
V3 Datastream.1	CAN1	0x711	TX	Base+17
V3 Datastream.1	CAN1	0x712	TX	Base+18
V3 Datastream.1	CAN1	0x713	TX	Base+19
V3 Datastream.1	CAN1	0x714	TX	Base+20
V3 Datastream.1	CAN1	0x715	TX	Base+21
V3 Datastream.1	CAN1	0x716	TX	Base+22
V3 Datastream.1	CAN1	0x717	TX	Base+23
V3 Datastream.1	CAN1	0x718	TX	Base+24
V3 Datastream.1	CAN1	0x719	TX	Base+25
V3 Datastream.1	CAN1	0x71A	TX	Base+26
V3 Datastream.1	CAN1	0x71B	TX	Base+27
V3 Datastream.1	CAN1	0x71E	TX	Base+30
V3 Datastream.1	CAN1	0x71F	TX	Base+31
V3 Datastream.1	CAN1	0x730	TX	Base+48
V3 Datastream.1	CAN1	0x731	TX	Base+49

Group / Frame Name V3 Datastream.1 Base+08 ☐ Transmit Triggered

Bus / Message ID CAN1 0x708 ☐ 29bit ☐ 11939 ☐ Group Edit

Message Length 8

Initial Skipped frames / TX Freq 0 100Hz

Add Signal

Tag	Start	Length	Endianness	Hz	Name	Assignment
A	0	8	Big	25	AN01V	Input 01 - Volts (FAN)
B	8	8	Big	100	AN02V	Input 02 - Volts
C	16	8	Big	100	AN03V	Input 03 - Volts
D	24	8	Big	100	AN04V	Input 04 - Volts
E	32	8	Big	100	AN05V	Input 05 - Volts
F	40	8	Big	100	AN06V	Input 06 - Volts
G	48	8	Big	100	AN07V	Input 07 - Volts
H	56	8	Big	100	AN08V	Input 08 - Volts

Add Constant

This is a higher rate than the frame, do you wish to update the frame rate to match?

Start Bit < 0 >

No Of Bits < 8 >

Byte Order Big Endian

CAN signal signed ☐

Scale MUL 50 0

7 6 5 4 3 2 1 0

☒ Signal ☐ Constant ☐ Mux

Signal Name AN01V

Assignment Input 01 - Volts (FAN)

Update Rate 25Hz

OK - F10 Cancel

## Auto Retry...

- **Retry count/delay**
  - Retry – count: number of auto re-initialisations of tripped output.
  - Retry – delay: Time gap between each retry attempt. (From trip incident to activation time)

Output Properties

Output # **Output 1**

Name **FAN**

☐ PWM Frequency (Hz - 0 uses default) 0

☐ Low Side Pullup

Status Output ☒ Copy input while Tripped (default)

☐ Trip Active

☐ Alarm Active

Trip 40.00 A 0.100 s

Turn-ON Mode **SOFT START (Inductive)**

Retry - count / delay 2 5 s

Soft start time 1.00 s

Soft start current / ramp time 25.00 A 0.100 s

Low Current Trip 0.00 A 0.100 s

Alarm 655.35 A 0.100 s

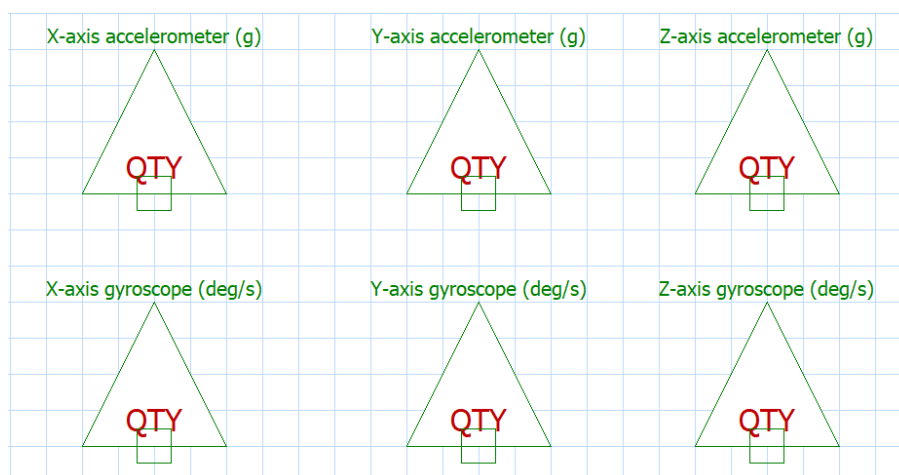
Board Temp Trip 120.0 °C

PWR Volts Min Trip 0.000 V 0.500 s

OK Cancel

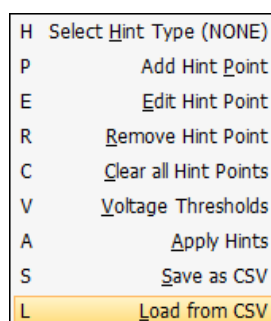
## Internal accelerometer and gyroscope...

“OUT STATE” block, “QTY” can now display PDUXB internal 3-axis accelerometer and 3-axis gyroscope in the schematic. These Items are also available for assignment in Custom CAN dialog box for transmission to any other device. This is only applicable for devices with “PDU-FEAT-IMU” feature enabled. Please contact us if you are interested in this.



## Import / Export .csv files...

Input linearisation can now be Loaded or Saved as a .csv file. To utilise this feature, the “Linearise” checkbox should be ticked.



## Counter math operator...

“MATH-OP” Counter Items now has more than one triggering option.

- COUNTER (edge): Output increases by 1 on rising edge UP, decreases on DOWN and can be ESET to 0.
- COUNTER (level): Output increases on every update while UP is TRUE, decreases on DOWN and can be RESET to 0.
- WRAP\_COUNTER (edge / level): As COUNTER but value will wrap past MAX-VALUE to 0 and vice versa.

## Shortcuts and hot-keys...

- Add "Device \ Set & Connect".
- Add "Copy label to clipboard" for right click menu on INPUTs and OUTPUTs.
- Add "Purpose or Role" string editing ("Cal" menu) and display on caption bar.
- Show CalSize in numerical value on resource bar.
- While connected, current displayed on outputs increased to 2 decimal places by default.
- New dialog to manage "File/New" and "Cal /Change Type"
  - Device:, Role/Purpose:, Voltage: and Connector:
- And more...

## Earlier release notes (2.15 - rel19) still applicable :

- Support for real numbers (floating point) in schematic
- New components that can manipulate and compare real numbers
- New INPUT properties including linearisation
- New OUTPUT properties including direct control of PWM
- Custom CAN configuration
- Variable frequency schematics

## IO Summary...

PduXSetup can now present a summarised IO configuration. The IO summary indicates Input/Output Name, Type, Page and further important details. All these can be exported as a .CSV file and located in the calibration using Goto "Selected Item" function.

IO Summary

SOFT INPUTS

	Name	Page	CAN	Default	Msg Timeout
Soft I/P 1	Indicator Left	MAIN	CAN1 MSG(0x100) SIGNAL(40,8)	0.0	0.25s

SOFT OUTPUTS

	Name	Page	CAN
Soft O/P 1	LED Indicator	MAIN	CAN1 MSG(0x110) SIGNAL(56,8)

HARD INPUTS

	Name	Page	Pull	Analogue	High Threshold	Low Threshold	Validation	Debounce	Active
Input 1	FAN	MAIN	DOWN	YES	4.0V	1.0V	0.10s	0.10s	HIGH

HARD OUTPUTS

	Name	Page	PWM	Turn-ON Mode	LS Pullup	Status Output	Main Trip / time	Inrush time	Inrush trip	Soft start time	Soft start current / ramp	Low Current Trip	Alarm Trip	Board Temp Max	PWR Volts Min Trip
Output 1	FAN	MAIN	NO	SOFT START (Inductive)		N/A	40.00A / 0.100s			1.00s	25.00A / 0.100s	0.00A / 0.100s	655.35A / 0.100s	120.0°C	0.000V / 0.500s

Find - F5

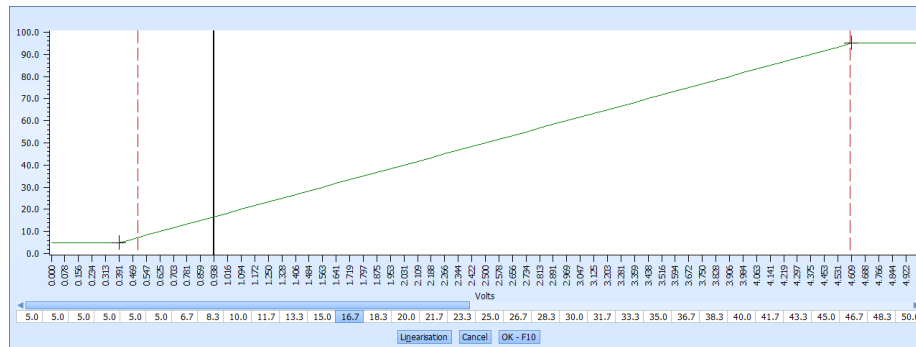
Close - F10

CSV Export - F11

Goto "Output 1" - F12

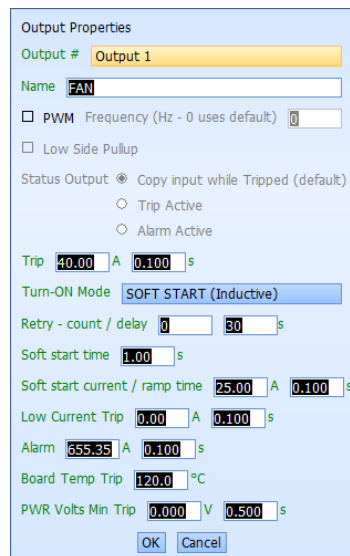
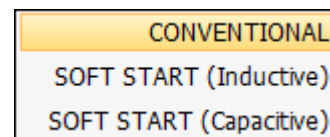
### Input Linearisation...

Input Linearisation Dialog has a grid control added with customisable values. This is addition to the existing Add Hint Points and Linearisation strategies for a more efficient user interface.



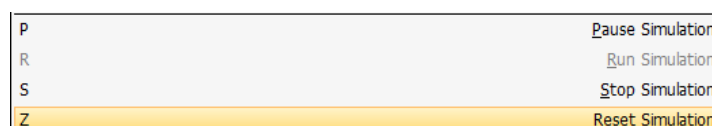
### Output PWM and Turn-On Mode...

Output Properties dialog box has been updated providing a PWM operation and Frequency configuration. “Inductive Load” and “soft start” check boxes are replaced by “Turn-On Mode” drop down menu. Short description and examples is available when hovering over the options of Turn-ON Mode drp down menu. (See datasheets for specific OUTPUTS capable of PWM and SOFT START)

### Simulation reset...

Simulation Reset has been added when running in Simulation mode. This new feature is used to simulate a power cycle.

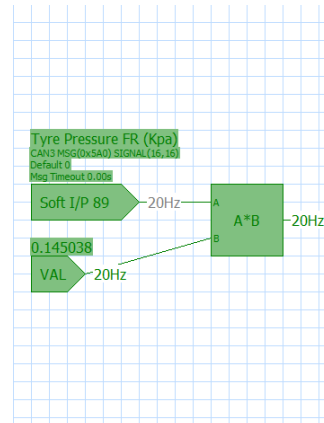
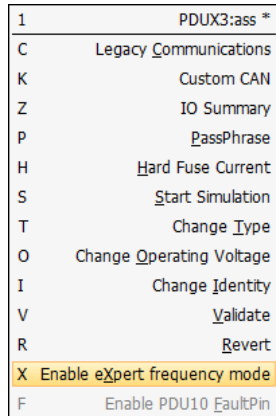


### Page ordering...

Pages within a calibration can be re-ordered by dragging the page TAB with left mouse button down. Page moves can be undone via menu Edit\Undo or Ctrl-Z.

### 'Expert Frequency Mode'...

Before PDU main code 2.19 every component in the schematic was evaluated at 100Hz. This can now be fine-tuned if "Expert Frequency Mode" is enabled in the calibration menu. Circuits of components can now be configured to run at anything between 1Hz and 1000Hz. There is an overall budget but "Expert Frequency Mode" allows the user to choose where to spend that budget



### Latch component...

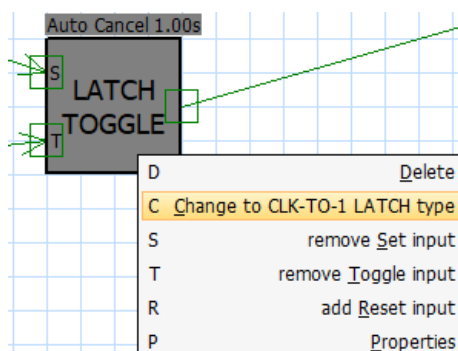
There are now 2 versions of the LATCH component. They behave in the same way apart from where the toggle (or clock) input is concerned.

#### TOGGLE-LATCH

The existing LATCH is renamed to a TOGGLE-LATCH if it has a toggle input. The functionality of the LATCH has been modified very slightly with respect to the toggle input. If at start-up there is a 1 (true) on the toggle input, it is not seen as a positive edge and ignored. This new behaviour is implemented in PDU main code 2.19.12.

#### CLK-TO-1-LATCH

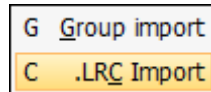
The new latch is named CLK-TO-1-LATCH if it has a clock input. This clock input is in the same position as the toggle input on the TOGGLE-LATCH. The new LATCH will output a 1 (true) on a positive edge on the clock input. In all other respects it acts in the same way as the existing LATCH. PDU main code 2.19.12 is also required for this new LATCH functionality.



## Custom CAN...

Custom CAN, also found in the Cal menu, allows high levels of complexity to be configured. As this complexity can quickly stack up, there are limits on both computation and transmission. These are displayed in the top right corner including a visual representation of how much is in use.

.LRC CAN setup can now be imported in custom CAN directly from a LifeCal Calibration through Import/.LRC Import.



Individual bus speed and termination can be selected in the top left. Individual frames can be added, duplicated and removed from the relevant buttons with the option of “grouping” frames together, typically per device. This allows easier management and the ability to export and import between calibrations.

When the “Group Edit” box is checked, any changes to the bus or message ID will affect the group as a whole, moving all frames to the same bus or shifting the frame addresses by the same amount. Coupled with the duplicate group ability, this makes adding multiples of the same device (such as multiple keypads) fast and simple.

Basic frame types supported:

- (RX) : receive frame with option for single MUX item
- (TX): Standard Transmit frame that has configurable frequency options.
- (TXT): Triggered frame will only be sent when schematic logic component is used. This can be toggled from a standard TX with a tick box.
- (TXG): Transmitted gate frame will retransmit a received frame to another frame with custom message ID and bus at time of reception
- (TxC): Transmit copy frame will duplicate either a received or transmitted frame but may define its own transmission rate, address and bus.

Custom CAN communications for main code 2.19+

CAN 1/2/3 baud rate

CAN 1/2/3 termination ☒ ☐ ☐

Add Frame Duplicate Remove Frame Clear All

Group	Bus	Msg ID	<->	Name
V3 Datastream.1	1	0x700	TX	Base+00
V3 Datastream.1	1	0x701	TX	Base+01
V3 Datastream.1	1	0x702	TX	Base+02
V3 Datastream.1	1	0x704	TX	Base+04
V3 Datastream.1	1	0x706	TX	Base+06
V3 Datastream.1	1	0x708	TX	Base+08
V3 Datastream.1	1	0x709	TX	Base+09
V3 Datastream.1	1	0x70C	TX	Base+12
V3 Datastream.1	1	0x70D	TX	Base+13
V3 Datastream.1	1	0x70E	TX	Base+14
V3 Datastream.1	1	0x70F	TX	Base+15
V3 Datastream.1	1	0x710	TX	Base+16
V3 Datastream.1	1	0x711	TX	Base+17
V3 Datastream.1	1	0x712	TX	Base+18
V3 Datastream.1	1	0x713	TX	Base+19
V3 Datastream.1	1	0x714	TX	Base+20
V3 Datastream.1	1	0x715	TX	Base+21
V3 Datastream.1	1	0x716	TX	Base+22
V3 Datastream.1	1	0x717	TX	Base+23
V3 Datastream.1	1	0x718	TX	Base+24
V3 Datastream.1	1	0x719	TX	Base+25
V3 Datastream.1	1	0x71A	TX	Base+26
V3 Datastream.1	1	0x71B	TX	Base+27
V3 Datastream.1	1	0x71E	TX	Base+30
V3 Datastream.1	1	0x71F	TX	Base+31
V3 Datastream.1	1	0x730	TX	Base+48
V3 Datastream.1	1	0x731	TX	Base+49

Frame count : 28 / 128 TX Frames : 28 / 80 RX Frames : 0 / 80

TX Signals : 175 / 256 RX Signals : 0 / 128

Processing Bandwidth : 1007 / 44800

☐ Disable

Group / Frame Name V3 Datastream.1 Base+00 ☐ Transmit Triggered

Bus / Message ID 1 0x700 ☐ 29bit ☐ J1939 ☐ Group Edit

Message Length 8

Initial Skipped frames / TX Freq 0 5Hz

Tag	Start	Length	Endianness	Hz	Name	Assignment
A	8	16	Big	5	bt1	Board Temperature 1
B	24	16	Big	5	bt2	Board Temperature 2
C	40	16	Big	5	powerV	Power Supply Volts
D	56	16	Big	5	logicV	Logic Supply Volts

Add Signal Add Constant Remove Lock Signal ☐

Start Bit < 8 > No Of Bits < 16 > Byte Order Big Endian CAN signal signed ☒

Scale MUL 10 0

Signal Name bt1 Assignment Board Temperature 1 Update Rate 5Hz

OK - F10 Cancel



## Custom CAN c'tnd...

Once signals are added to a frame, they may be assigned to a component or monitoring value. For soft inputs and outputs, once the first signal is assigned, the rest will preselect the next available soft input or output from the list. The signal name will be copied to the input/output component in the schematic. Any assigned signal must have its corresponding component exist in the schematic but signals may be left as unassigned if they are not yet needed.

A completed frames content will be locked to “read only” to avoid any accidental changes. To edit an existing frame simply uncheck the “lock signal” box.

**\*Please note\*** Devices with firmware prior to 2.19.X cannot be programmed using PduXSetup. However, ‘legacy’ .pdu files relating to devices with firmware up to and including 2.18.X can be loaded and viewed using PduXSetUp. The legacy CAN dialogue has been retained for this functionality, and should not be used to modify CAN settings in any way.

Legacy Communications for 2.17 and 2.18 main code

☐ Mil CAN

Mil CAN Source Address

Mil CAN Tx Priority

Serial Baud Rate

CAN 1/2/3 Baud Rate

CAN 1/2/3 termination ☐ ☐ ☐

Datastream TX Rate (pre 2.17)  Hz

Currents TX Rate (pre 2.17)  Hz

☐ 29bit CAN IDs

☒ 0.2A CAN Resolution ☒ 0.02V ANxV CAN Resolution

Soft I/P Base (pre V2.9)

Datastream Base id  Datastream Version

Fault Reset id

☐ Grayhill Switch Panels

☐ Switch Panel 1 ☐ Switch Panel 2

V1 CAN Datastream configuration

base+0 : input pre/post states	2Hz	CAN#1
base+1 : output state 1..8	10Hz	CAN#1
base+2 : output state 9..16	10Hz	CAN#1
base+3 : output state 17..24	5Hz	CAN#1
base+4 : output state 25..32	5Hz	CAN#1
base+5 : output current 1..8	5Hz	CAN#1
base+6 : output current 9..16	5Hz	CAN#1
base+7 : output current 17..24	5Hz	CAN#1
base+8 : output current 25..32	5Hz	CAN#1
base+9 : temperature and voltage	2Hz	CAN#1
base+10 : total current	5Hz	CAN#1
base+11 : output state and current 33..36	5Hz	CAN#1
base+12 : output state and current 37..40	5Hz	CAN#1
base+13 : output state and current 41..44	5Hz	CAN#1
base+14 : output state and current 45..48	5Hz	CAN#1

## Legacy CAN c'tnd...

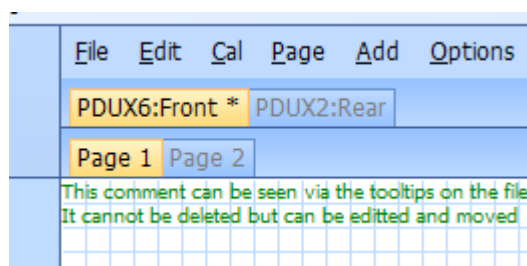
Soft Input/Output configuration

#1-8 I/P	710	CAN#1	#65-72 I/P	000	CAN#1	#1-8 O/P	718	1Hz	CAN#1
#9-16 I/P	711	CAN#1	#73-80 I/P	000	CAN#1	#9-16 O/P	719	1Hz	CAN#1
#17-24 I/P	712	CAN#1	#81-88 I/P	000	CAN#1	#17-24 O/P	71A	1Hz	CAN#1
#25-32 I/P	713	CAN#1	#89-96 I/P	000	CAN#1	#25-32 O/P	71B	1Hz	CAN#1
#33-40 I/P	714	CAN#1	#97-104 I/P	000	CAN#1	#33-40 O/P	71C	1Hz	CAN#1
#41-48 I/P	715	CAN#1	#105-112 I/P	000	CAN#1	#41-48 O/P	71D	1Hz	CAN#1
#49-56 I/P	716	CAN#1	#113-120 I/P	000	CAN#1	#49-56 O/P	71E	1Hz	CAN#1
#57-64 I/P	717	CAN#1	#121-128 I/P	000	CAN#1	#57-64 O/P	71F	1Hz	CAN#1

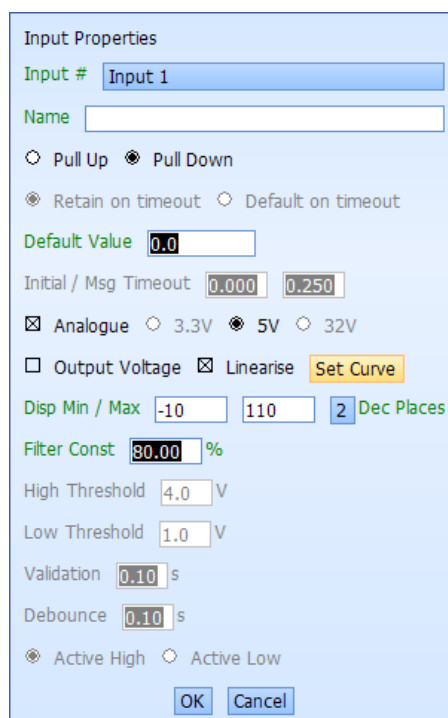
OK Cancel

## Earlier release notes (2.15 - rel17) still applicable :

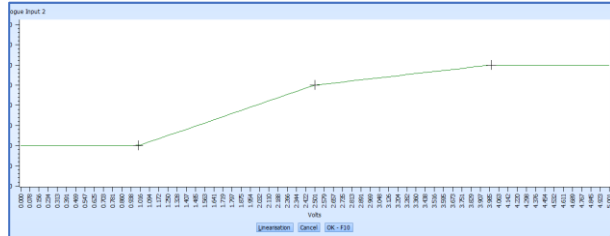
PduXSetup can now support loading multiple calibrations or connecting to multiple devices simultaneously that can be switched between using tabs. Each tab will be labelled with the device type, calibration name and file path. If the calibration has not yet been saved then the device “role”, defined when selecting “new”, will be used. An asterisk marks when a calibration has been edited from the version on file.



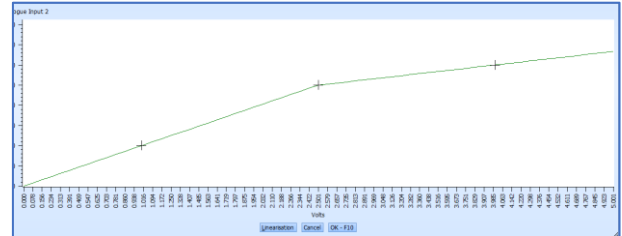
Inputs can be used as before as simple Boolean switches or even as analogue switches with voltage thresholds but may also now feed the raw voltage or a linearised value into the schematic with the relevant check boxes. To linearise a sensor, set the minimum and maximum unit values (this defines the Y-axis) then select “Set Curve”. Add “hint points” of voltage against value under the linearisation menu, choose the type of linearisation and select **Apply Hints**. Voltage thresholds can be applied that will cause the input to adopt its default value when exceeded. These are displayed as red vertical lines.



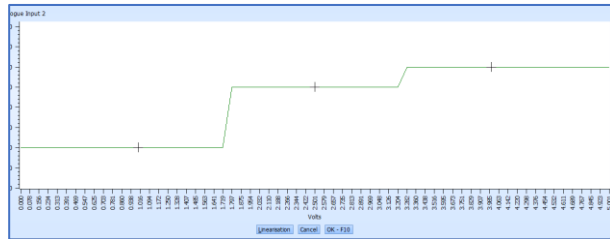
## INTERPOLATE



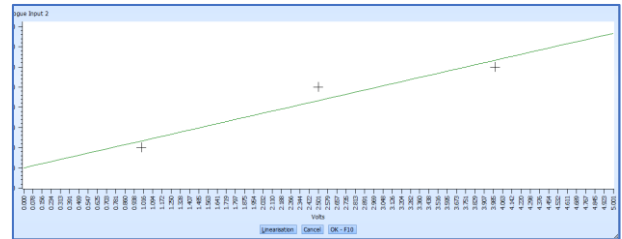
## EXTRAPOLATE



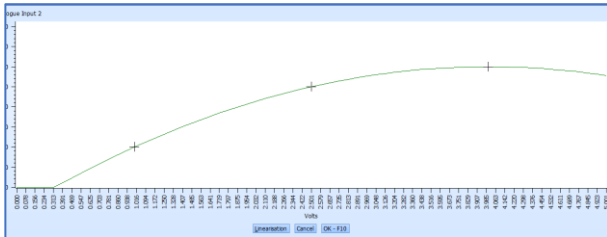
## GEAR



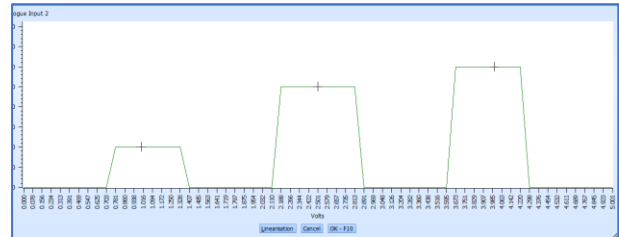
## LINEFIT



## CURVEFIT



## KEYPAD



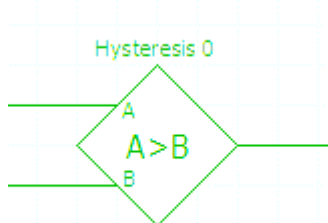
As well as forcing input and output states, it is now also possible to force a value in both simulation and **when live connected**. Components with output values other than zero or one will be coloured blue.

Several new components have been added to take advantage of the new decimal system. These include Maths Op, Comparator and Value. Both the comparator and the Maths Op components have multiple types which are described below.

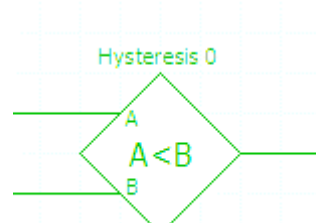
**Value – A fixed number that can be used as an input to another component such as a comparator.**



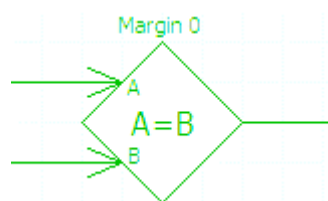
**Comparators – Compare 2 inputs and output TRUE (1) or FALSE (0) depending on the type**



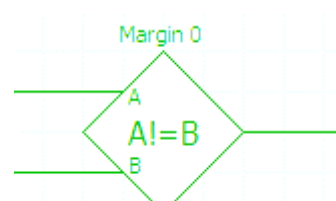
Is A more than B with optional hysteresis



Is A less than B with optional hysteresis

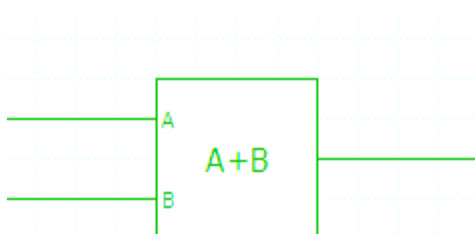


Is A equal to B with optional hysteresis

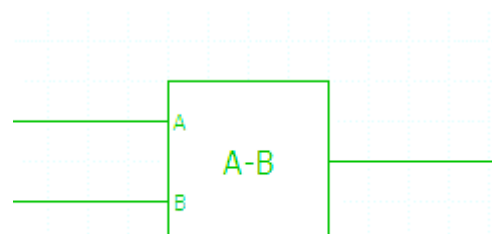


Is A not equal to B with optional hysteresis

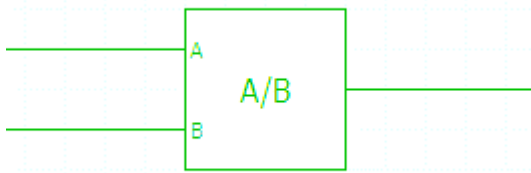
**MathOp – Mathematical operation, depending on the type, applied to two inputs**



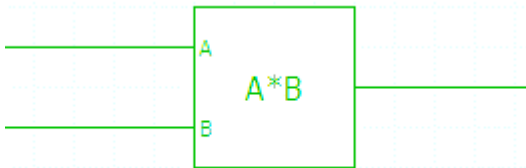
The value of A plus the value of B



The value of A minus the value of B



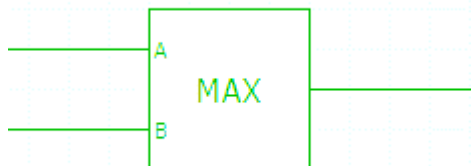
The value of A divided by the value of B



The value of A multiplied by the value of B



The lowest value of A and B



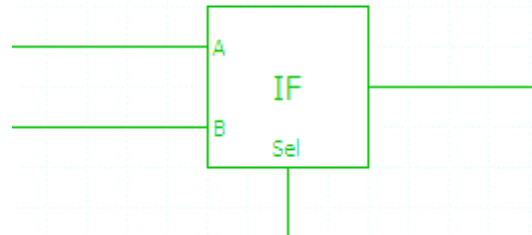
The highest value of A and B



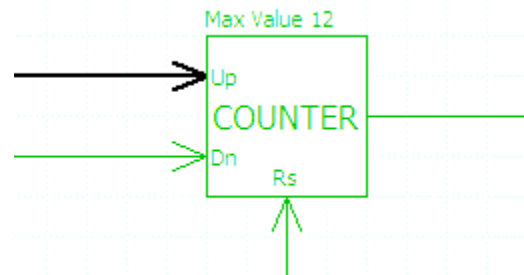
An “off time” has been added to the delay allowing it to also be used as a timed latch.



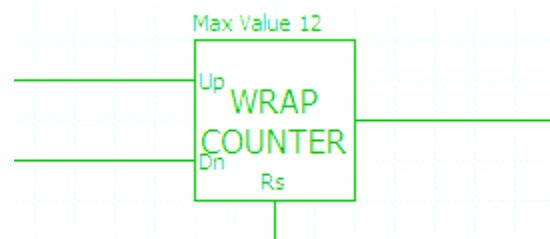
The absolute value of the input (makes negative numbers positive while leaving positive values alone)



An IF statement – If “Sel” is true (not zero) then output value of A else output value of B.

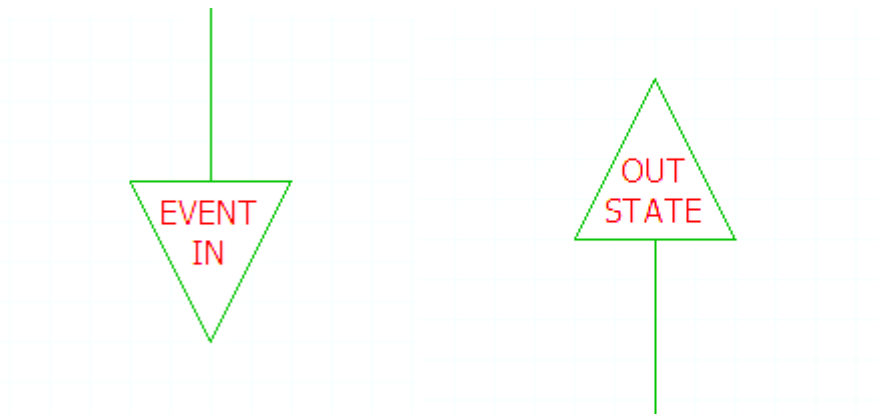


A counter that will increase the output by 1 on every rising edge of the “Up” input (up to the configurable maximum value) and decrease the output by 1 on every rising edge of the “Dn” input (down to zero). Reset to zero on the rising edge of the “Rs” input.



An alternative counter that works in the same way but rather than stay at the maximum value, another “Up” would wrap the counter back around to zero.

There are now just 2 event components (In and Out) which can have their type selected rather than having multiple fixed type events.



The EVENT IN component expects an input that will trigger a selected action. These actions include:

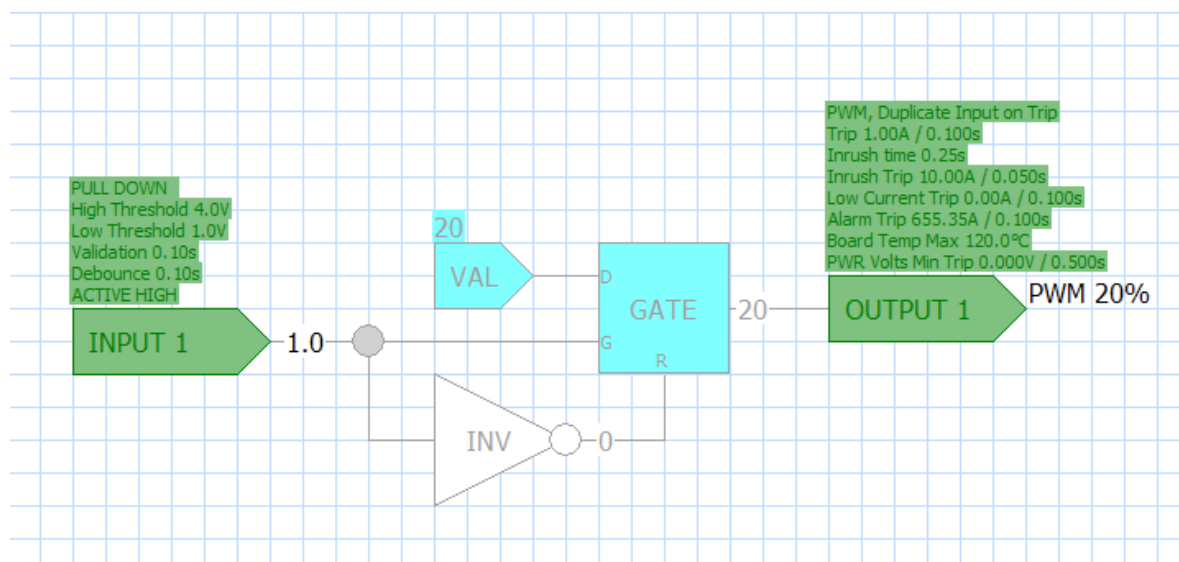
- RESET to reset all fused outputs
- LAMP to activate the fault pin (normally automatic with any trip)
- POWER HOLD to keep the pdu out of sleep state
- CAN\_TX to trigger transmission of a specific CAN frame
- CAN\_VER\_TX is only used with a V3 DataStream to send the device information frames when needed rather than at a fixed frequency.

The STATE OUT component will output the selected value of internally monitored items such as:

- FAULT – whether or not an output has been tripped
- RESET\_SW – the state of the reset input pin
- WAKE – the status of the wake pin
- TOT\_CURR – total measured current
- POWER\_V – the measured voltage on the power stud
- LOGIC\_V – the measure voltage on the logic pin
- BT – the maximum measure board temperature
- CAN-RX – notification of CAN frame reception
- QTY – any other internally monitored item

## Obsolete components

The PWM component is now redundant. Instead, a numerical value between 0 and 100 can be fed into an output which will translate into a duty percentage(see example). Note that for now PWM frequency is fixed at 20kHz on the flexible outputs and 125kHz on the fixed low side outputs. The PWM component is still available for compatibility with existing calibrations.



The KP DIM component is now redundant. Instead, values can be fed into numerous if functions providing many settings of brightness. The message can then be transmitted via CAN to the keypad used (see example).

