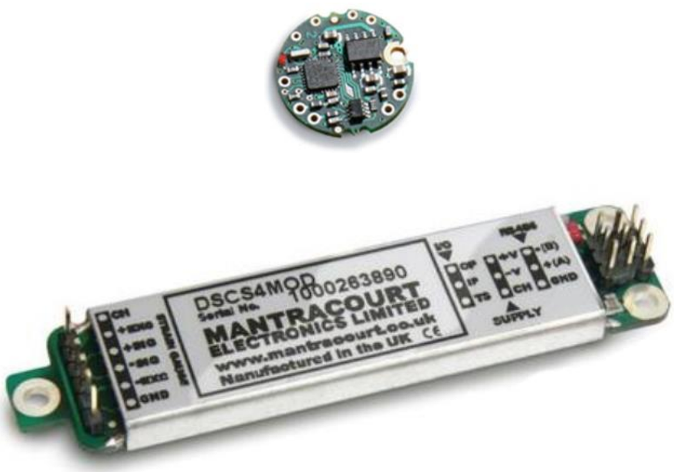
DSC/DLC User Manual

mantracourt.com



DSC/DLC

mantracourt

Introduction

Navigating This Manual

When viewing this PDF manual the following tips will help you navigate.

Viewing bookmarks (or) to the side of the page, in the PDF viewer, will allow easy navigation to the relevant chapters of this manual. Alt-left arrow is a useful shortcut back to the last page viewed after a hyperlink is clicked. Hyperlinks are coloured purple and are underlined.

General features

Mantracourt's DSC/DLC is a range of products for digitizing a strain-based bridge input such as a load cell. The DSC is a card type with pins for easy installation while the DLC is a disc designed to be fitted inside the pocket of a load cell or other sensor.
Accessories available include an external temperature sensor (DTEMP), one- and four-way mounting boards with two-part connectors (DSJ1 and DSJ4) and a display unit for use with the Mantrabus versions (DS485DIS). These are detailed later.
Setup and configuration is made easier with the free Toolkit software but can be achieved via comms if necessary.

Product codes explained

DSC	H	4	ASC

Form factor		
DLC	=	Disc type
DSC	=	Card type

Noise free stability		
H	=	High Stability
S	=	Industrial Stability

Communication interface (Not an option for DLC or CAN products)		
2	=	RS232
4	=	RS485

Communication protocol		
ASC	=	ASCII
MAN	=	MANTRABUS
MOD	=	Modbus RTU
MCAN	=	MantraCAN
COP	=	CANopen

See Appendix D for full list of available types.
Different stabilities are detailed in the specification.
The implementation of the communication interfaces and protocols are detailed here.

Which version do I need?

The choice of hardware interface, RS232, RS485 or CAN, is dependent on the interface available at the other end, whether it's a single or multiple units required as RS232 is only suitable for one-to-one connections and RS485 and CAN are suitable for single and multi-drop applications. Another factor is length of cables required as RS232 is typically used for cable lengths of approx. 25m. RS485 has a differential topology and is better for noise immunity.

The choice of protocol is normally based on what master/controller is to be used which may also depend on other third party devices on the bus. Modbus is a standard protocol so multi vendor devices can all work happily using this standard protocol. Mantrabus is a hex based protocol which has fewer packet overheads. It is a proprietary protocol so only Mantracourt products can operate on the bus. ASCII may be chosen as it may seem easier to write software for and debug. When ASCII is used in a streaming mode then this can feed directly into an ASCII display terminal or viewed directly on a PC using a terminal/teletype software tool.

Again, CAN based systems will depend on what you already have. CANopen is a well established protocol administered by the CiA. MantraCAN is a proprietary CAN protocol that can be made to mimic other protocols such as J1939 by setting up custom messages. If you are creating your own stand alone system MantraCAN may be easier to implement than CANopen.

Installation

Mounting

General

It is advisable to follow the below installation practice where possible

- Minimise vibration
- Do not mount next to strong electrical or magnetic fields (transformers, power cables)
- Always ensure the device is secure and protected from damage

DLC

The **DLC** is designed to be sealed in the pocket of the sensor, which provides electrical shielding for EMC and noise as well as mechanical and moisture protection. If mounting outside the sensor, then it is unlikely to achieve specified performance.
The DLC must be mounted using a 2 mm screw to the body of the sensor. This should be a good electrical connection to obtain optimal performance.

> ! The 2 mm mounting hole accepts M2 screw or American equivalent #0-80.
>
> Important Note: DO NOT USE #2 screw size.

Additional moisture protection can be obtained using a potting compound such as a two-part epoxy. Care must be taken to avoid any gaps as the resulting mechanical stresses could damage the device. The compound chosen must be specified for electrical use and have enough thermal conductivity for the heat generated by the device. (Up to 1 W with a 15 V supply).

DSC

The **DSC** is normally installed in a protective enclosure, such as a metal box.
The pins can be plugged into standard (2.54 mm pitch) PCB header sockets or soldered directly into a host board or to connecting wires.
It can be mounted either way up. Unwanted pins projecting on one side may be cropped off (carefully!)
For extra vibration resistance and grounding, the 3 mounting holes provided can be used.
If necessary, the protruding end with single hole can be cut off to make board smaller. However this needs to be done with great care so that damage does not occur.

Wiring

General

All the sensor wires should be kept as short as feasible.
The EXC+/– wires should be a twisted pair, also the SIG+/– pair, and the two pairs kept apart. It is also recommended to secure the wires from moving due to shock or vibration.
The cable must enter the load cell via an EMC cable gland, which connects the cable shield to the load cell body. This must be a 360-degree connection.
To obtain the best EMC results, wire as shown in wiring examples below. However, this has the potential to create earth loops.
Devices are protected against shorting of communications lines to power supply and shorting of sensor inputs. There is no over current protection in case of faults so power limiting or fusing should be provided.
Power and **communication** should use twin (or triple for RS232) twisted pair cable with independent shields. Characteristic impedance should be 50-150 ohms and core to core/shield to core capacitance should be below 300 pF/m. (EG Belden type 8723 or 8777)

Soldering

! Use a temperature controlled soldering iron set to a maximum of 330 °C, for no longer than 2 seconds per pad. Excessive heat transferred to the PCB will result in damage.

! Do not use solder with a water soluble flux. This can leave a surface film which attracts moisture and degrades measurement performance.

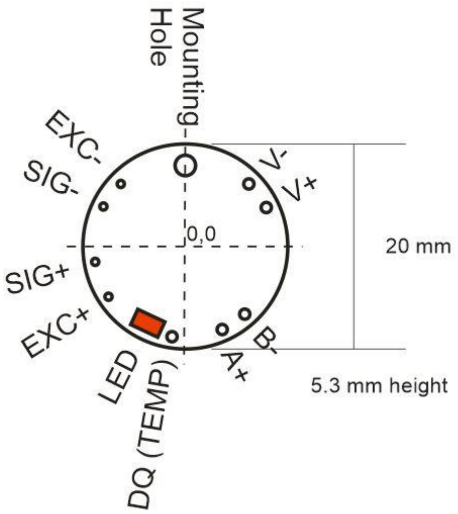
DLC Wiring

Connecting wires are soldered directly to the pads on the top and/or bottom of the PCB. Care must be taken to electrically insulate the connection pads from the surrounding metal.
The wiring on the load cell side should ideally be kept to less than 20 cm.

RS485

For products DLCHASC, DLCHMAN, DLCHMOD, DLCSASC, DLCSMAN, DLCSMOD.

Pinout



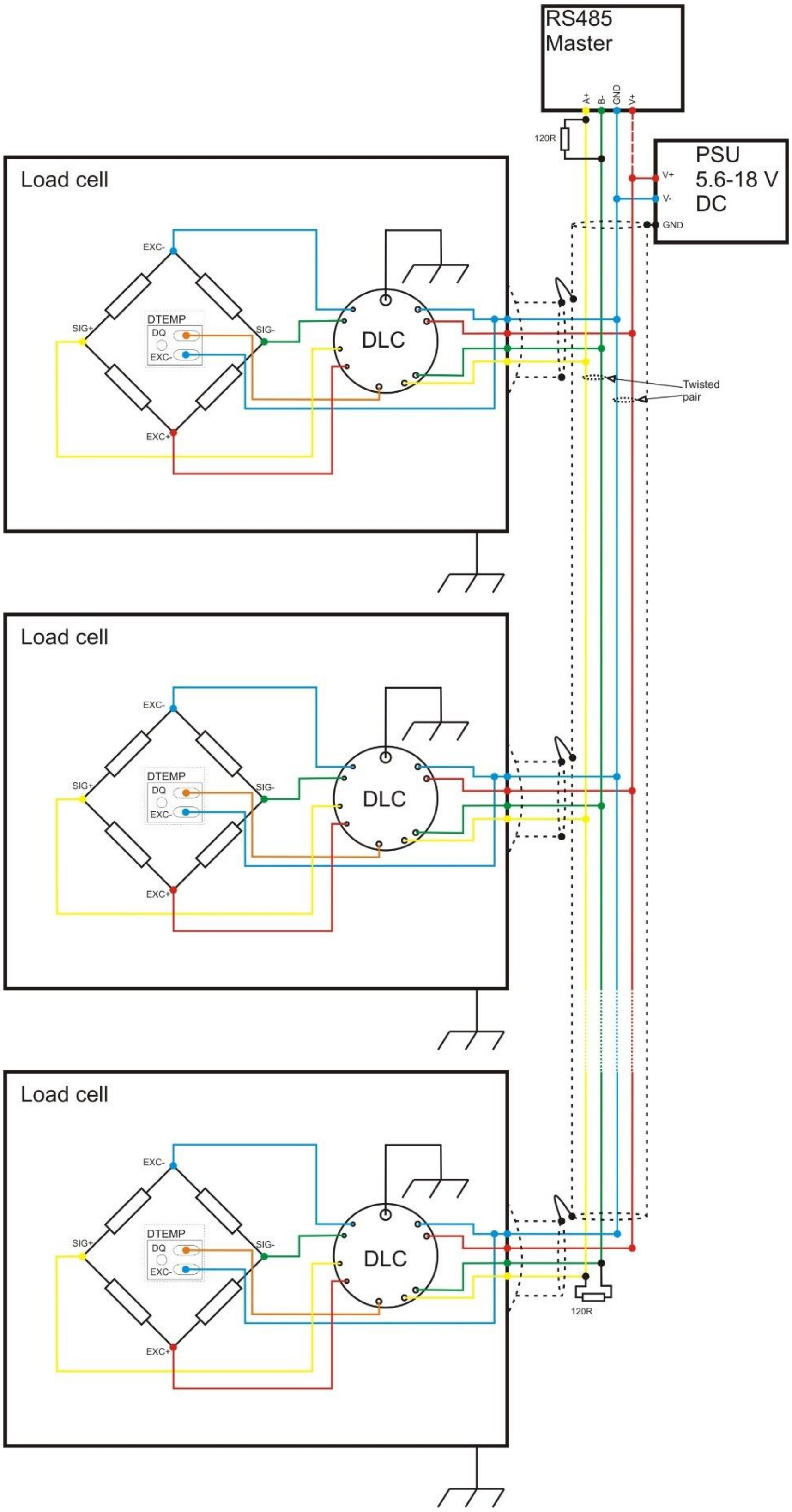
Item	Description
Mounting hole	For mounting and grounding (see mounting above)
EXC+/-	Excitation for bridge sensor
SIG+/-	Signal from bridge sensor
V+/-	Power supply for DLC (5.6-18 VDC)
A+/B-	RS485 connections (note these can be referred to in several different ways, depending on the manufacturer)
DQ (TEMP)	Connection for DTEMP device (EXC- of DTEMP should be connected to V-)
LED	Status LED. (see troubleshooting)

There **MUST** be a common connection from the PSU V- and the RS485 master's ground to ensure the RS485 stays within the required common mode voltage of +/-7 V.
The shield should be connected to the grounded enclosure of the power supply.
120 ohm termination resistors should be used at either end of the bus to stop reflections.

Pad Positions

(mm from 0,0)	x	y	Hole diameter
Mounting hole	0.0	+7.9	2.0
-V	+6.2	+6.1	1.0
+V	+7.9	+3.8	1.0
RS485-(B)	+5.8	-6.6	1.0
RS485+ (A)	+3.6	-8.1	1.0
Temp sensor DQ	-1.3	-8.8	1.0
+EXC	-7.5	-4.9	0.7
+SIG	-8.8	-1.5	0.7
-SIG	-8.0	+3.9	0.7
-EXC	-6.3	+6.1	0.7

Wiring Example

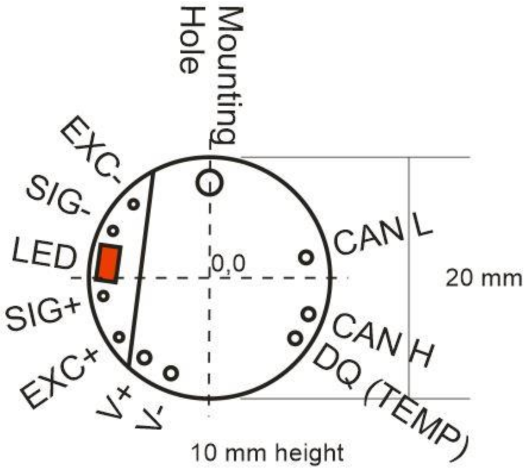


CAN

For products DLCHCAN, DLCHCOP, DLCSCAN, DLCSCOP.

Pinout

(note: stacked PCB assembly)



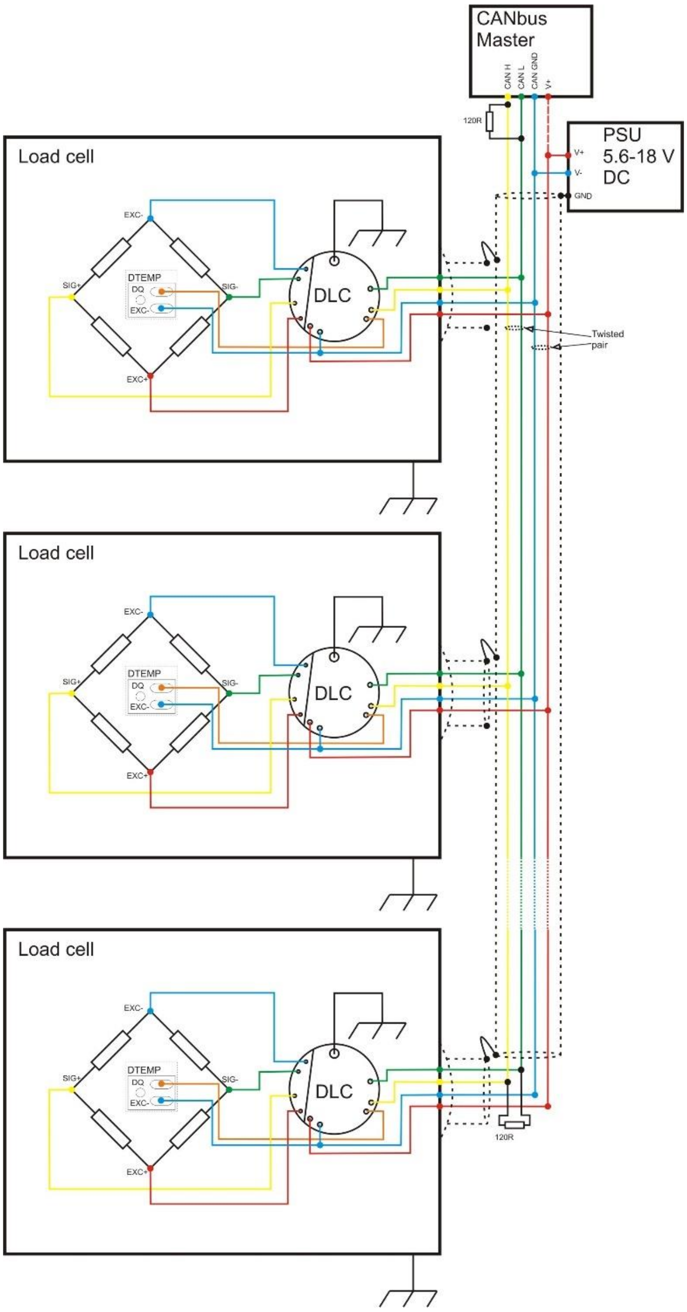
Item	Description
Mounting hole	For mounting and grounding (see mounting above)
EXC+/-	Excitation for bridge sensor
SIG+/-	Signal from bridge sensor
V+/-	Power supply for DLC (5.6-18 VDC)
CAN L/H	CANbus connections
DQ (TEMP)	Connection for DTEMP device (EXC- of DTEMP should be connected to V-)
LED	Status LED. (see troubleshooting)

There MUST be a common connection from the PSU and the CAN ground to ensure the CAN stays within the required common mode voltage of -2v (CANL) to +7v (CANH).
The shield should be connected to the grounded enclosure of the power supply.
120 ohm termination resistors should be used at either end of the bus to stop reflections.
For bus rates greater than 500 kbps cable such as Belden 8132 is recommended.

Pad Positions

(mm from 0,0)	x	y	Hole diameter
Mounting hole	0.0	8.1	2.0
-V	-3.2	-7.9	1.0
+V	-5.4	-6.6	1.0
CAN L	8.0	1.7	1.0
CAN H	8.2	-3.0	1.0
Temp sensor DQ	7.1	-5.0	1.0
+EXC	-7.5	-4.9	0.7
+SIG	-8.8	-1.5	0.7
-SIG	-8.0	3.9	0.7
-EXC	-6.3	6.1	0.7

Wiring Example



DSC Wiring

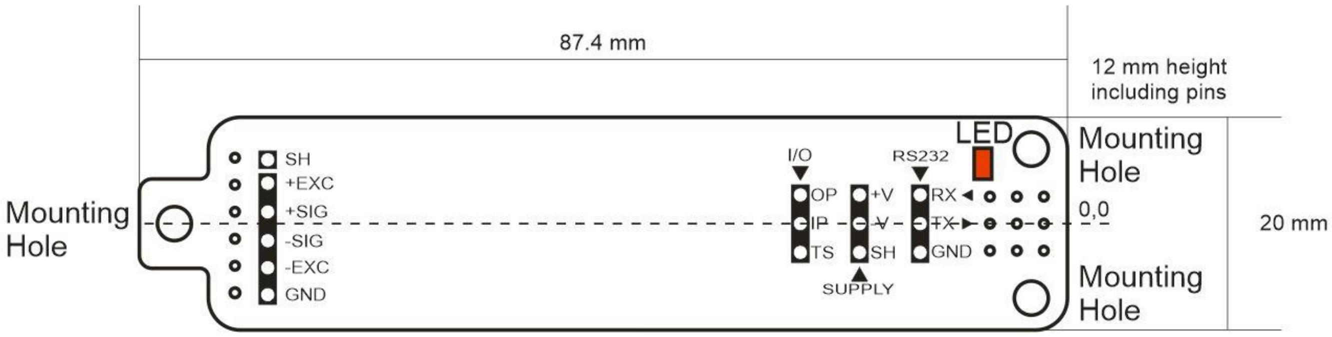
The pins can be plugged into standard (2.54 mm pitch) PCB header sockets or soldered directly into a host board or to connecting wires.

RS232

For products DSCH2ASC, DSCH2MAN, DSCH2MOD, DSCS2ASC, DSCS2MAN, DSCS2MOD.

Pinout

Front



Item	Description
Mounting holes	For mounting and grounding (see mounting above)
SH (x2)	Shield connection for cable screen
EXC+/-	Excitation for bridge sensor
SIG+/-	Signal from bridge sensor
GND (x2)	Ground for DTEMP and RS232
IP/OP	Digital In/Out
TS	Connection for DTEMP device (EXC- of DTEMP should be connected to GND or V-)
V+/-	Power supply for DSC (5.6-18 VDC)
RX/TX	RS232 receive and transmit connections
LED	Status LED. (see troubleshooting)

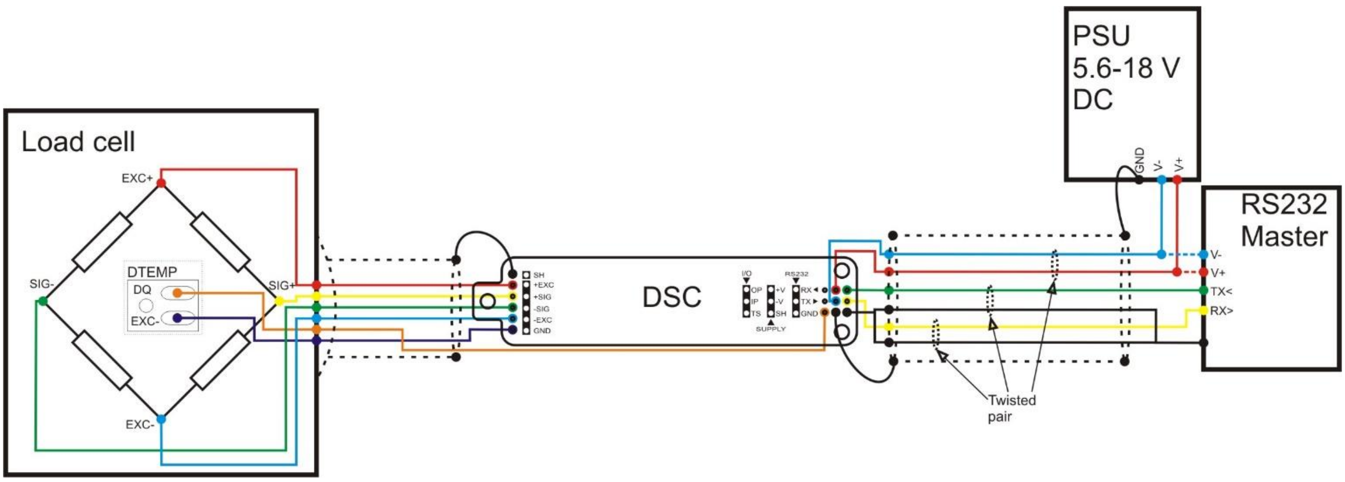
Rear

Item	Description
LED	Status LED is visible through the board
Reset comms	RS232 and RS485 versions of the DSC have the ability to reset the communication settings to defaults (station number 1 and baud rate 115200) by shorting the reset comms pads together whilst powering up the DSC. You will then need to power cycle the DSC for the changes to be applied.
LINK	If you are changing the gain of the device, this link may need to be cut if (see later)
Rg	If changing the gain of the device the new gain resistor should be mounted here (see later)

Pin positions

(mm from 0,0)	x	y	Hole diameter/pin size
Mounting hole 1	-84.1	0.0	3.2
Mounting hole 2	-7.3	7.0	3.2
Mounting hole 3	-7.3	-7.0	3.2
SH	-78.4	6.2	0.9
+EXC	-78.4	3.7	0.9
+SIG	-78.4	1.1	0.9
-SIG	-78.4	-1.4	0.9
-EXC	-78.4	-4.0	0.9
GND	-78.4	-6.5	0.9
OP	-7.3	2.5	0.9
IP	-7.3	0.0	0.9
TS	-7.3	-2.5	0.9
+V	-4.8	2.5	0.9
-V	-4.8	0.0	0.9
SH	-4.8	-2.5	0.9
RX	-2.2	2.5	0.9
TX	-2.2	0.0	0.9
GND	-2.2	-2.5	0.9

Wiring Example

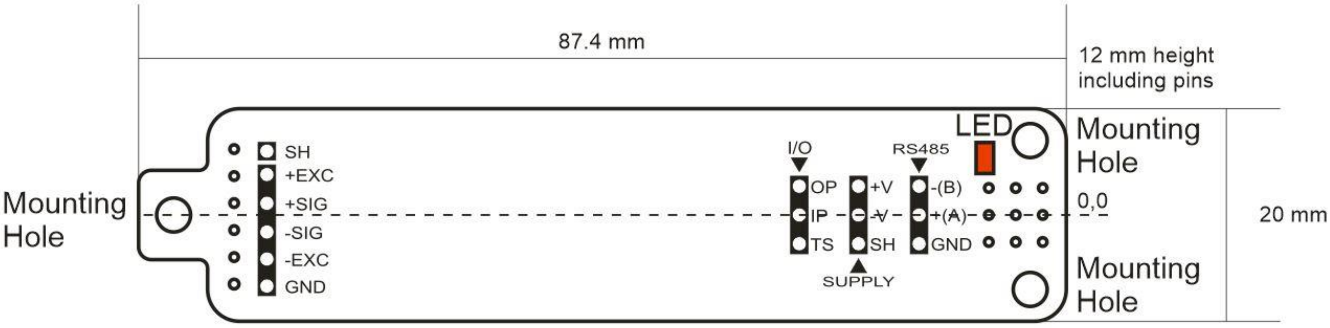


RS485

For products DSCS4ASC, DSCS4MAN, DSCS4MOD, DSCH4ASC, DSCH4MAN, DSCH4MOD.

Pinout

Front



Item	Description
Mounting holes	For mounting and grounding (see mounting above)
SH (x2)	Shield connection for cable screen
EXC+/-	Excitation for bridge sensor
SIG+/-	Signal from bridge sensor
GND (x2)	Ground for DTEMP and RS485
IP/OP	Digital In/Out
TS	Connection for DTEMP device (EXC- of DTEMP should be connected to GND or V-)
V+/-	Power supply for DSC (5.6-18 VDC)
+(A)/-(B)	RS485 connections (note these can be referred to in several different ways, depending on the manufacturer)
LED	Status LED. (see troubleshooting)

Rear

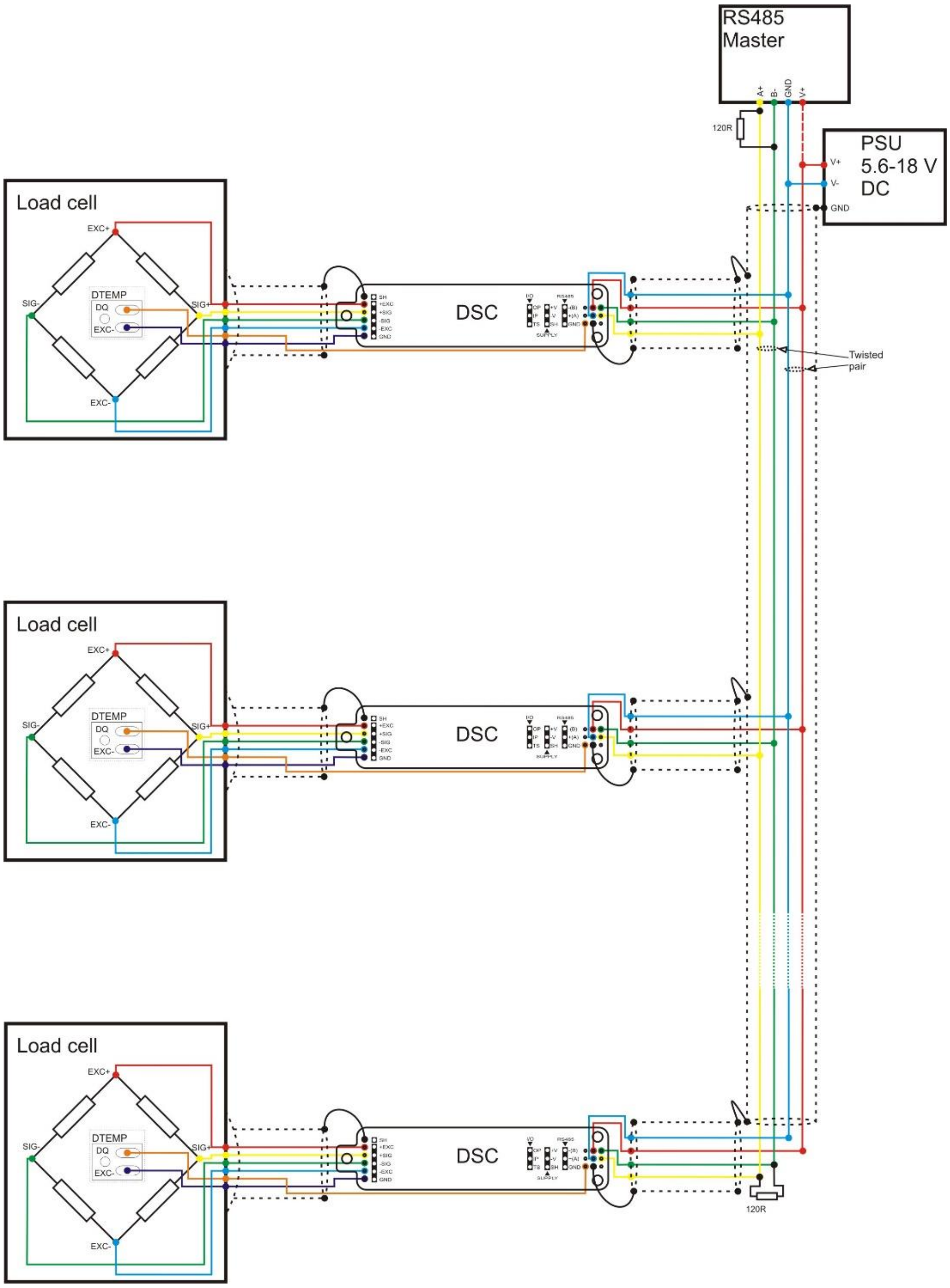
Item	Description
LED	Status LED is visible through the board
Reset comms	RS232 and RS485 versions of the DSC have the ability to reset the communication settings to defaults (station number 1 and baud rate 115200) by shorting the reset comms pads together whilst powering up the DSC. You will then need to power cycle the DSC for the changes to be applied.
LINK	If you are changing the gain of the device, this link may need to be cut if (see later)
Rg	If changing the gain of the device the new gain resistor should be mounted here (see later)

Pin positions

(mm from 0,0)	x	y	Hole diameter/pin size
Mounting hole 1	-84.1	0.0	3.2
Mounting hole 2	-7.3	7.0	3.2
Mounting hole 3	-7.3	-7.0	3.2
SH	-78.4	6.2	0.9

+EXC	-78.4	3.7	0.9
+SIG	-78.4	1.1	0.9
-SIG	-78.4	-1.4	0.9
-EXC	-78.4	-4.0	0.9
GND	-78.4	-6.5	0.9
OP	-7.3	2.5	0.9
IP	-7.3	0.0	0.9
TS	-7.3	-2.5	0.9
+V	-4.8	2.5	0.9
-V	-4.8	0.0	0.9
SH	-4.8	-2.5	0.9
-(B)	-2.2	2.5	0.9
+(A)	-2.2	0.0	0.9
GND	-2.2	-2.5	0.9

Wiring Example

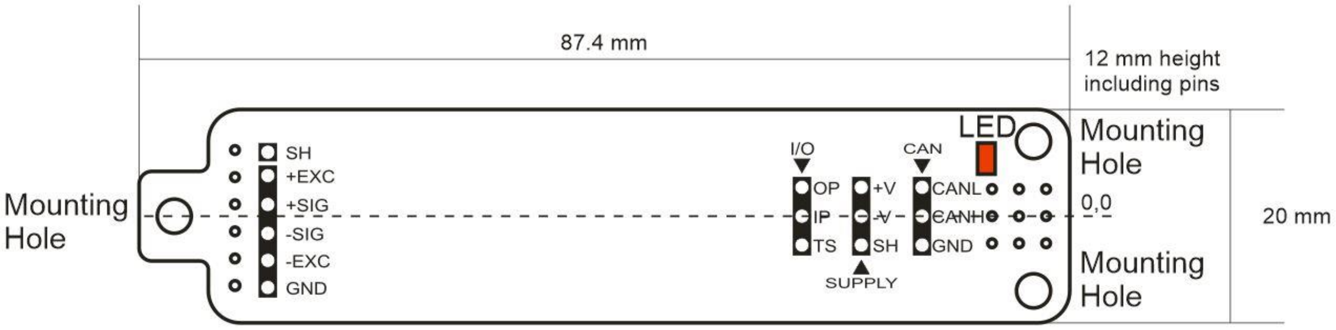


CAN

For products DSCSCOP, DSCSMCAN, DSCHCOP, DSCHMCAN.

Pinout

Front



Item	Description
Mounting holes	For mounting and grounding (see mounting above)
SH (x2)	Shield connection for cable screen
EXC+/-	Excitation for bridge sensor
SIG+/-	Signal from bridge sensor
GND (x2)	Ground for DTEMP and CAN
IP/OP	Digital In/Out
TS	Connection for DTEMP device (EXC- of DTEMP should be connected to GND or V-)
V+/-	Power supply for DSC (5.6-18 VDC)
CANL/CANH	CANbus connections
LED	Status LED. (see troubleshooting)

Rear

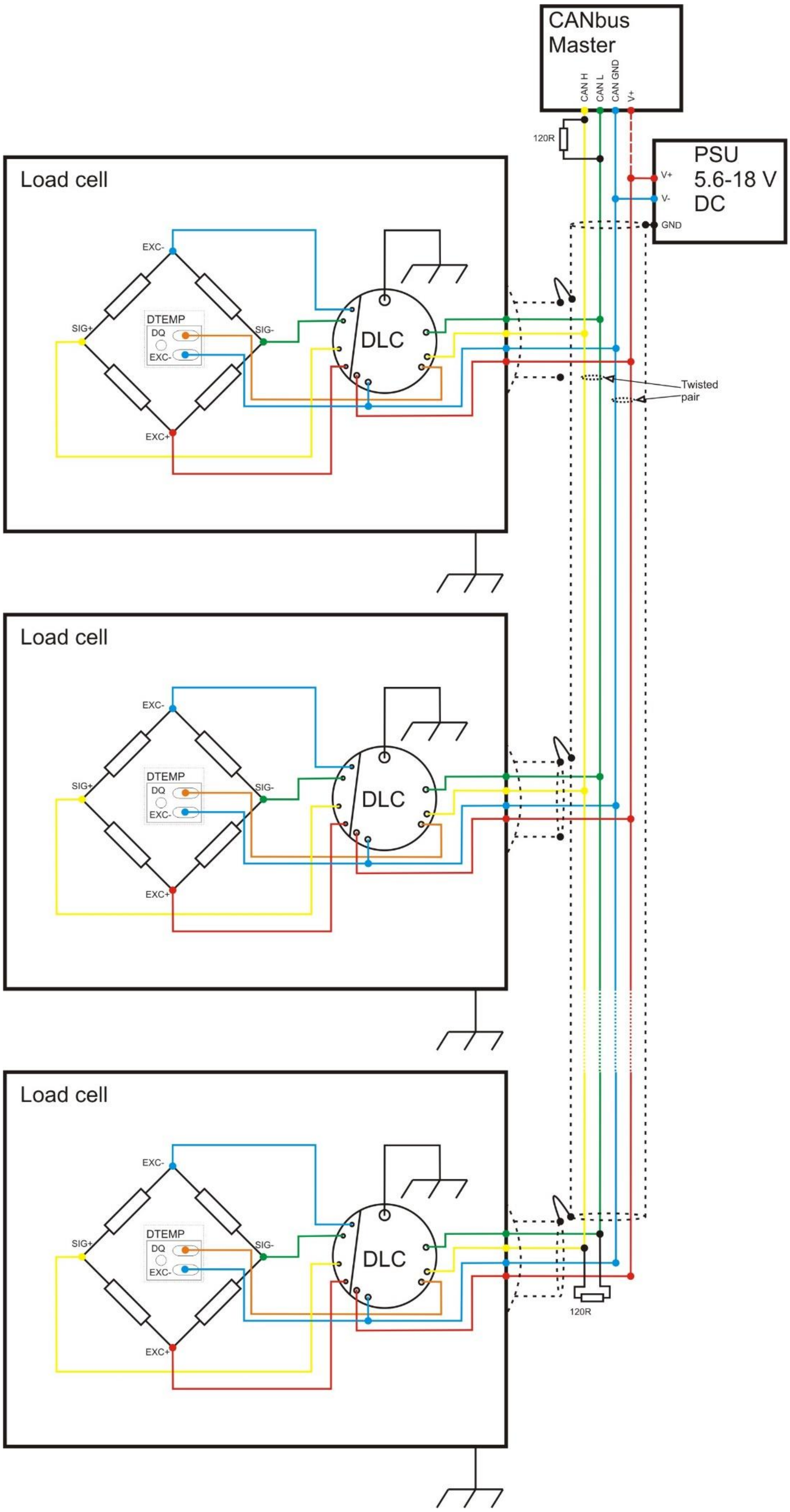
Item	Description
LED	Status LED is visible through the board
LINK	If you are changing the gain of the device, this link may need to be cut if (see later)
Rg	If changing the gain of the device the new gain resistor should be mounted here (see later)

Pin positions

(mm from 0,0)	x	y	Hole diameter/pin size
Mounting hole 1	-84.1	0.0	3.2
Mounting hole 2	-7.3	7.0	3.2
Mounting hole 3	-7.3	-7.0	3.2
SH	-78.4	6.2	0.9
+EXC	-78.4	3.7	0.9
+SIG	-78.4	1.1	0.9
-SIG	-78.4	-1.4	0.9
-EXC	-78.4	-4.0	0.9
GND	-78.4	-6.5	0.9

OP	-7.3	2.5	0.9
IP	-7.3	0.0	0.9
TS	-7.3	-2.5	0.9
+V	-4.8	2.5	0.9
-V	-4.8	0.0	0.9
SH	-4.8	-2.5	0.9
CANL	-2.2	2.5	0.9
CANH	-2.2	0.0	0.9
GND	-2.2	-2.5	0.9

Wiring Example



DSC Toolkit

Overview

The DSC Toolkit is a simple configuration tool specifically designed for configuring all DSC/DLC modules. The DSC Toolkit allows configuration, calibration, logging and parameter management of the modules.
Although it is possible to fully configure the DSC/DLC over the com port using the correct protocol, Mantracourt recommend that the user carries out the vast majority of the configuration using the DSC Toolkit. The DSC Toolkit allows configuration without needing to understand how calibration etc needs to be applied.

What can the Toolkit do?

The toolkit communicates with a **single** module at a time to do the following:

- Viewing of input with enunciators for integrity and range errors.
- Two point auto calibration by application of known weight.
- Setting System Zero and under and over range limits.
- Select measurement rate and filter settings.
- Save module settings including user calibration and ability to restore to same or different DSC/DLC modules.
- View and log input values at up to 100 Hz (dependant on PC and latency of USB port) to a CSV file which can be analysed in a spreadsheet application.
- Easily switch to alternative engineering units (If module has been previously calibrated)
- Advanced Calibration including:
    - 5 point temperature compensation
    - 7 point linearization
    - Lockable calibration

Installing the DSC Toolkit

The DSC Toolkit is available to download from mantracourt.com
Launch the toolkit to connect.

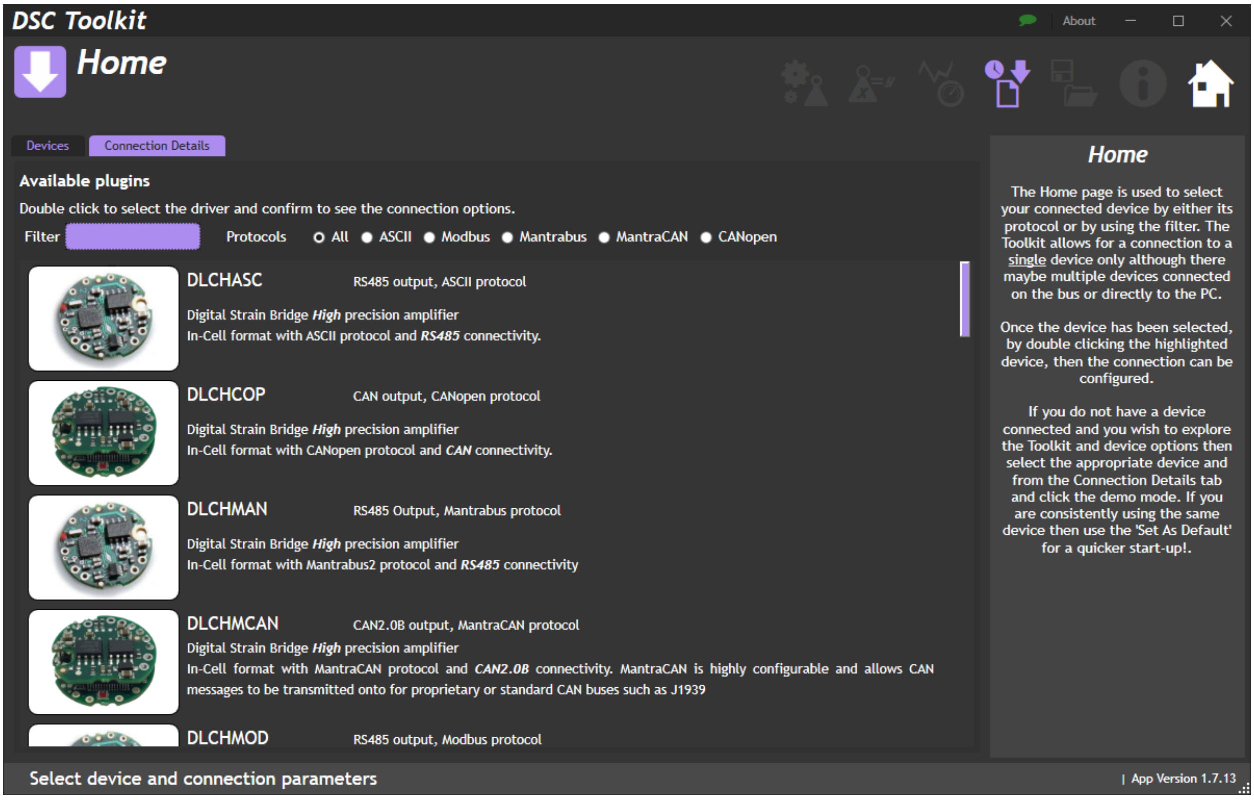
> ! You will need to have the correct com port or USB convertor for the hardware protocol of the device that you are connecting.

> ! For the best results for communications, ensure that the latency of the com port is set to 1 millisecond. See Troubleshooting for more details.

Toolkit Details

Home

Devices

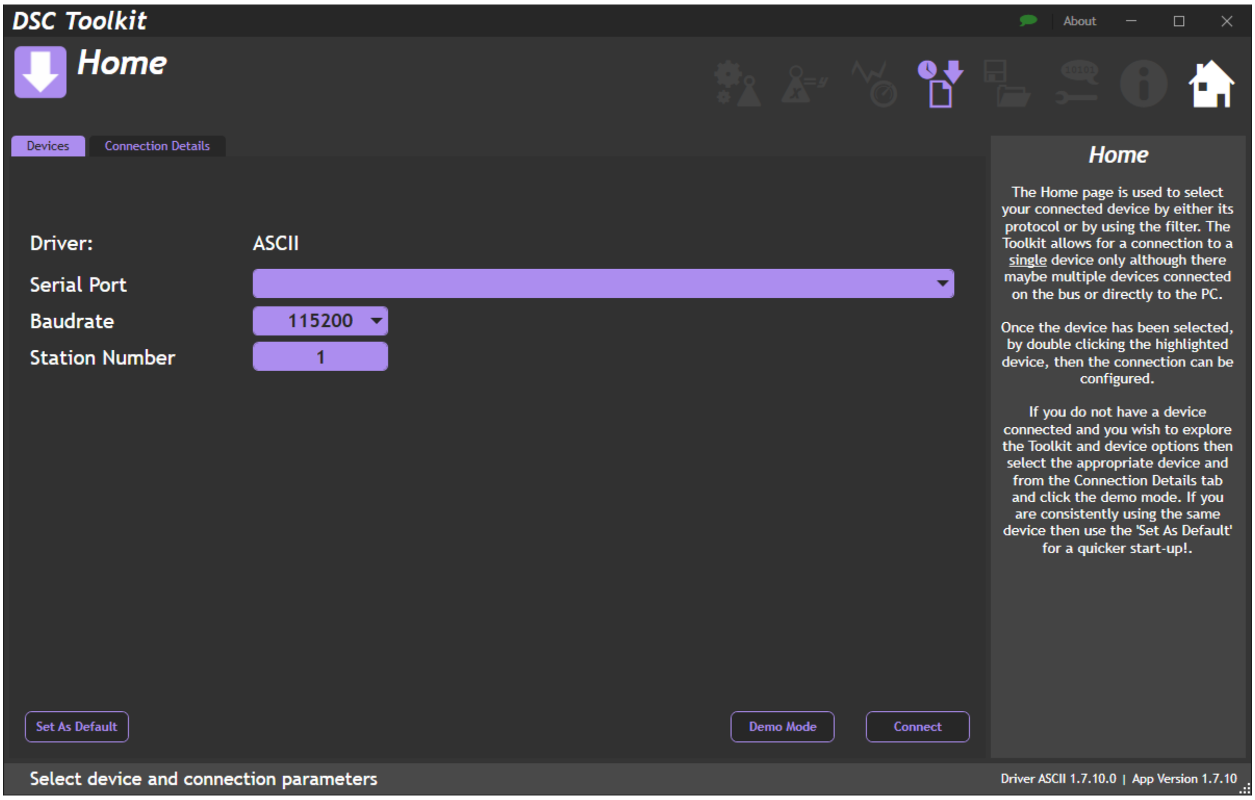


Here you can select the device that you wish to connect to. The full DSC/DLC product list is quite long so you can reduce it either by manually applying a text **filter** or selecting the required **protocol** at the top.
Double click on the required device and you then move to the relevant **Connection Details** tab. (See below)

Connection Details

There are five different communication protocol types: ASCII, Modbus, Mantrabus, MantraCAN and CANopen. Once you have selected you correct product (see above) you will go to the relevant connection page.

ASCII



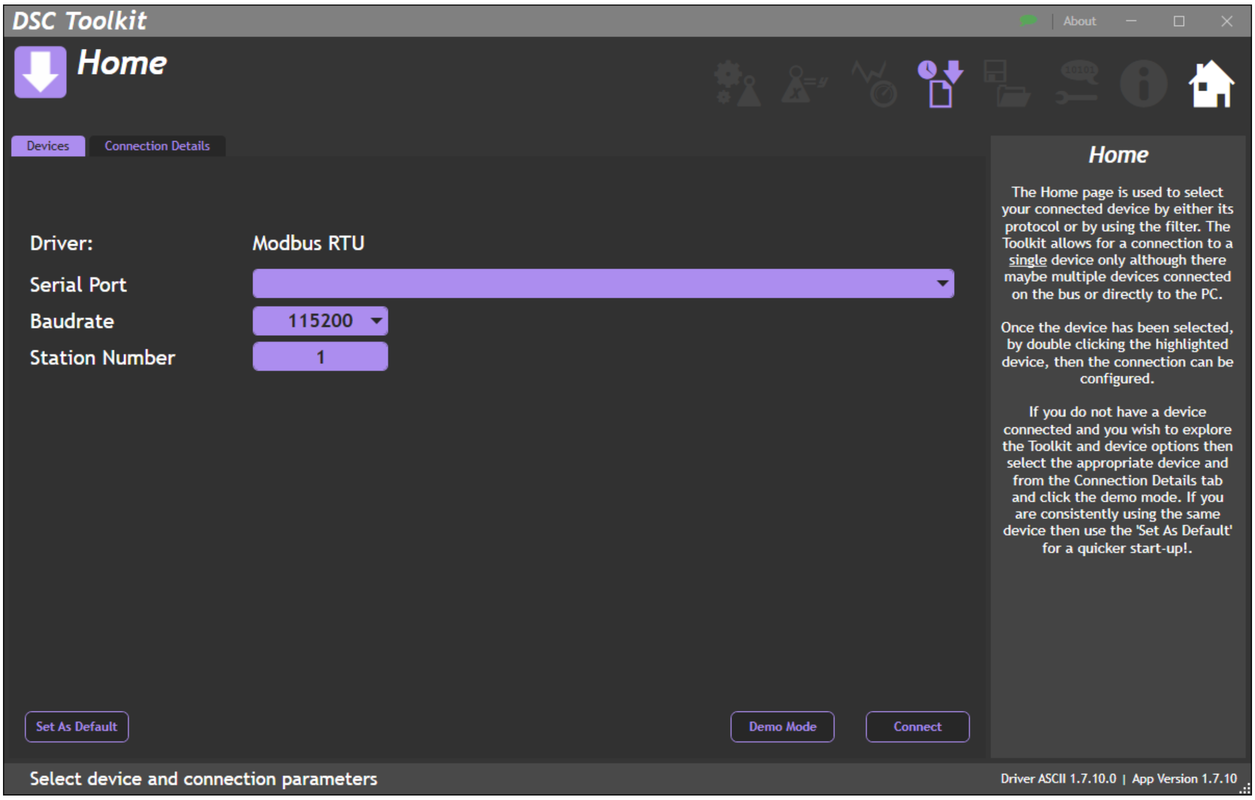
Select the **Serial Port** that the device is connected to.
Select the **Baud rate** of the DSC/DLC device that is connected. (Factory default 115200)
Select the **Station Number** of the connected DSC/DLC device. (Factory default 1)

> *Make sure that there are **no** other devices connected to the bus with the same station number as this will make communications difficult at best.*

Then click **Connect** to connect to the device.
If you have no device connected but wish to experiment with the Toolkit, click **Demo Mode**.
If this is the usual device that you will be connecting to, click **Set As Default** and these settings will be remembered next time you start the Toolkit.

Item	Description
Serial Port drop-down	Select from the list of detected serial ports (You may need to find the right one with Windows Device Manager)
Baud rate drop-down	Select from the list of available baud rates
Station number entry field	Enter the Station Number of the device you want to connect to
Set As Default button	Remember current Connection Details and use them next time toolkit is run
Demo Mode button	Click here to explore with the Toolkit without a device
Connect button	Connect to the device using the selected settings

Modbus RTU



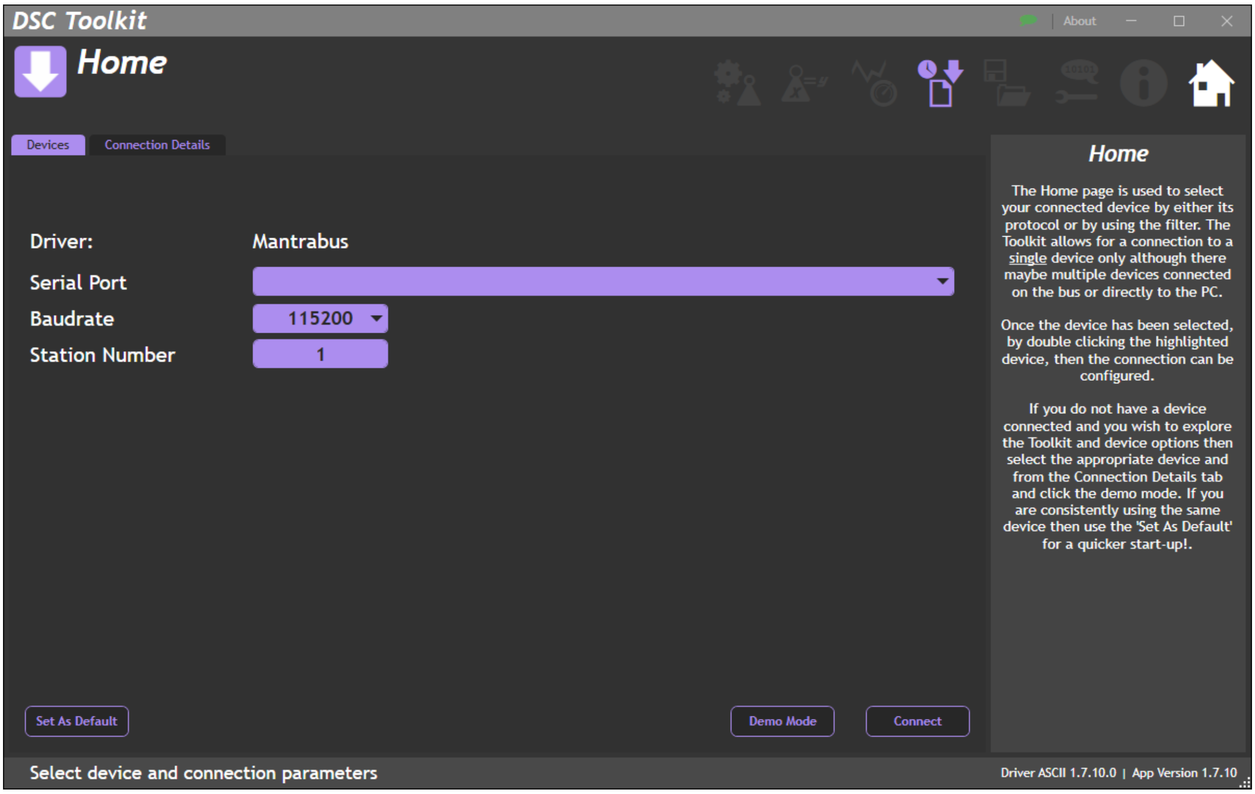
Select the **Serial Port** that the device is connected to.
Select the **Baud rate** of the DSC/DLC device that is connected. (Factory default 115200)
Select the **Station Number** of the connected DSC/DLC device. (Factory default 1)

> *Make sure that there are **no** other devices connected to the bus with the same station number as this will make communications difficult at best.*

Then click **Connect** to connect to the device.
If you have no device connected but wish to experiment with the Toolkit, click **Demo Mode**.
If this is the usual device that you will be connecting to, click **Set As Default** and these settings will be remembered next time you start the Toolkit.

Item	Description
Serial Port drop-down	Select from the list of detected serial ports (You may need to find the right one with Windows Device Manager)
Baud rate drop-down	Select from the list of available baud rates
Station number entry field	Enter the Station Number of the device you want to connect to
Set As Default button	Remember current Connection Details and use them next time toolkit is run
Demo Mode button	Click here to explore with the Toolkit without a device
Connect button	Connect to the device using the selected settings

Mantrabus



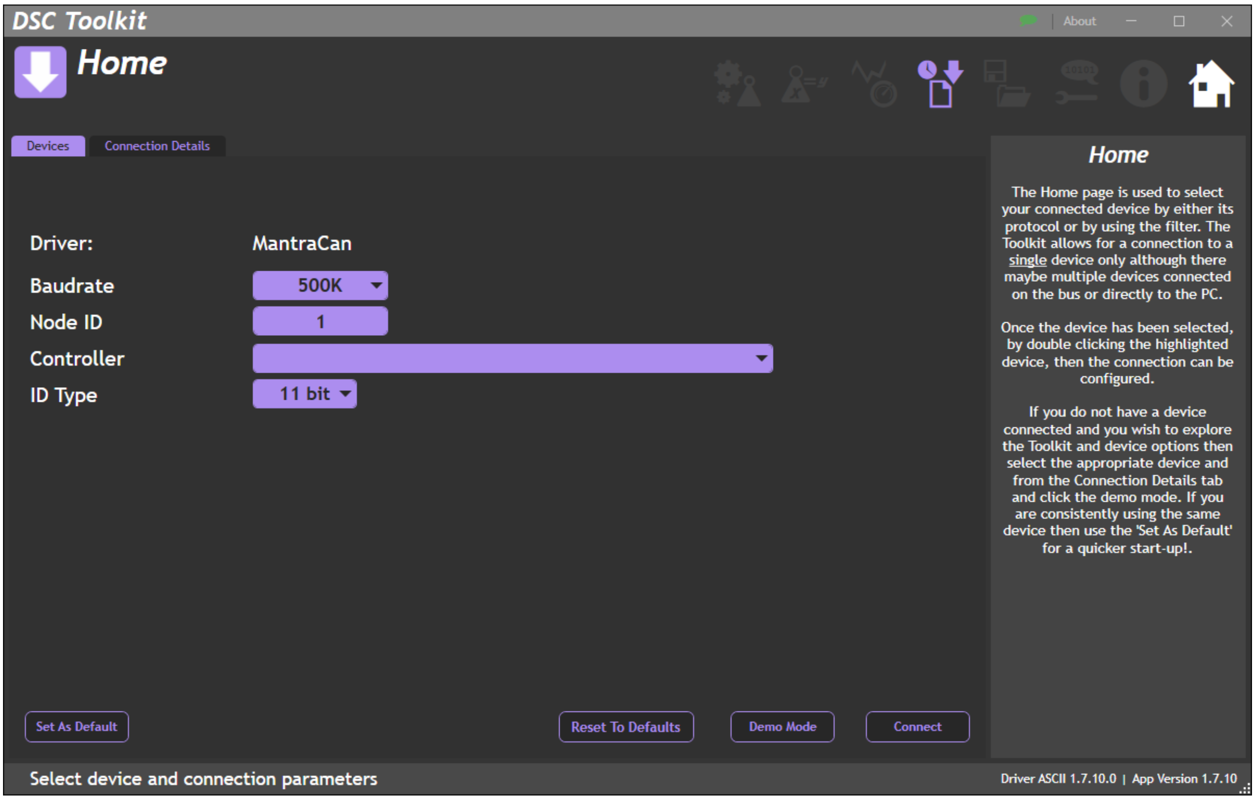
Select the **Serial Port** that the device is connected to.
Select the **Baud rate** of the DSC/DLC device that is connected. (Factory default 115200)
Select the **Station Number** of the connected DSC/DLC device. (Factory default 1)

> *Make sure that there are **no** other devices connected to the bus with the same station number as this will make communications difficult at best.*

Then click **Connect** to connect to the device.
If you have no device connected but wish to experiment with the Toolkit, click **Demo Mode**.
If this is the usual device that you will be connecting to, click **Set As Default** and these settings will be remembered next time you start the Toolkit.

Item	Description
Serial Port drop-down	Select from the list of detected serial ports (You may need to find the right one with Windows Device Manager)
Baud rate drop-down	Select from the list of available baud rates
Station number entry field	Enter the Station Number of the device you want to connect to
Set As Default button	Remember current Connection Details and use them next time toolkit is run
Demo Mode button	Click here to explore with the Toolkit without a device
Connect button	Connect to the device using the selected settings

MantraCAN



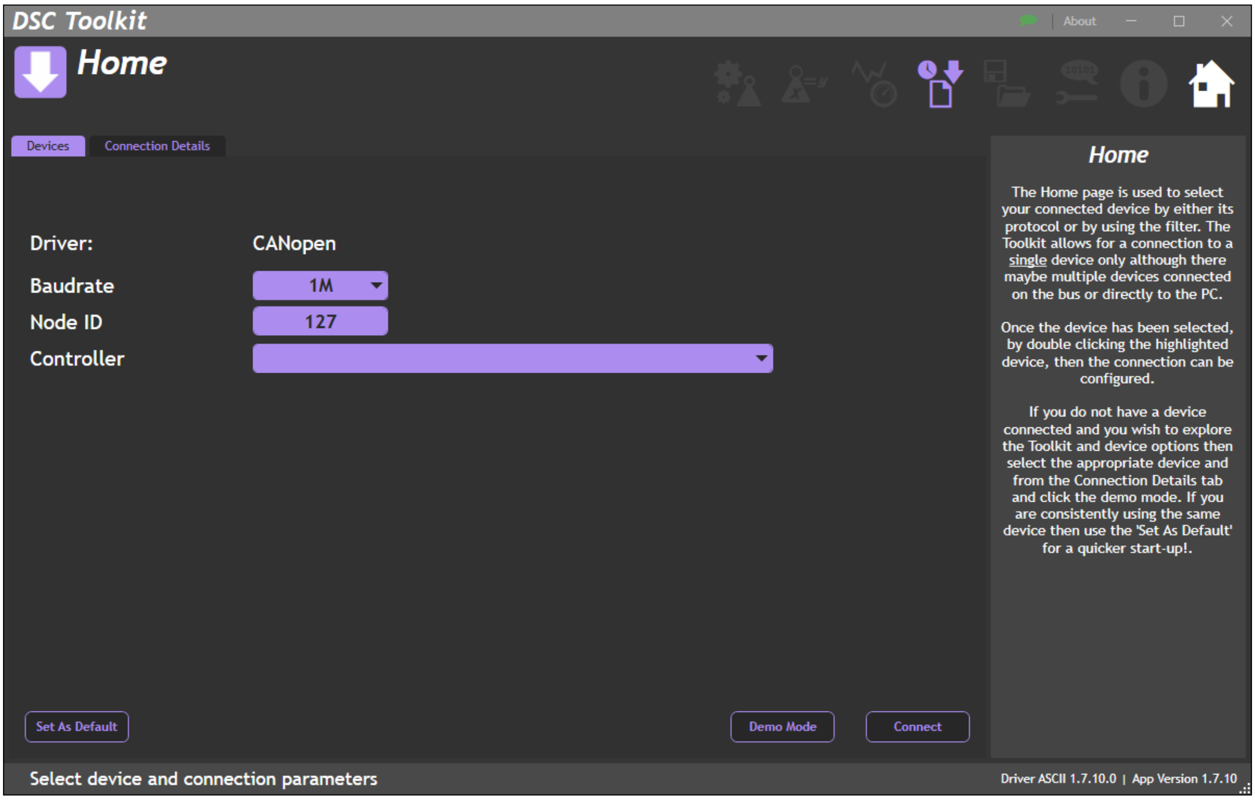
Select the **Baud rate** of the DSC/DLC device that is connected. (Factory default 500K)
Select the **Node ID** of the connected DSC/DLC device. (Factory default 1)
Select the connected CAN **Controller**. (Currently supported controllers shown in Appendix G)
Select the **ID Type** (Factory default 11 bit)

> *Make sure that there are **no** other devices connected to the bus with the same node ID as this will make communications difficult at best.*

Then click **Connect** to connect to the device.
If you have no device connected but wish to experiment with the Toolkit, click **Demo Mode**.
Click **Reset To Defaults** to change the settings on this page back to factory defaults.
If this is the usual device that you will be connecting to, click **Set As Default** and these settings will be remembered next time you start the Toolkit.

Item	Description
Baud rate drop-down	Select from the list of available baud rates
Node ID entry field	Enter the ID of the device you want to connect to
Controller drop-down	Choose the correct CAN controller
ID Type drop-down	Select 11 or 29 bit
Set As Default button	Remember current Connection Details and use them next time toolkit is run
Reset To Defaults button	Change connection details to factory defaults
Demo Mode button	Click here to explore with the Toolkit without a device
Connect button	Connect to the device using the selected settings

CANopen



Select the **Baud rate** of the DSC/DLC device that is connected. (Factory default 125K)
Select the **Node ID** of the connected DSC/DLC device. (Factory default 127)
Select the connected CAN **Controller**. (Currently supported controllers shown in Appendix G)

> *Make sure that there are **no** other devices connected to the bus with the same node ID as this will make communications difficult at best.*

Then click **Connect** to connect to the device.
If you have no device connected but wish to experiment with the Toolkit, click **Demo Mode**.
If this is the usual device that you will be connecting to, click **Set As Default** and these settings will be remembered next time you start the Toolkit.

Item	Description
Baud rate drop-down	Select from the list of available baud rates
Node ID entry field	Enter the ID of the device you want to connect to
Controller drop-down	Choose the correct CAN controller
Set As Default button	Remember current Connection Details and use them next time toolkit is run
Reset To Defaults button	
Demo Mode button	Click here to explore with the Toolkit without a device
Connect button	Connect to the device using the selected settings

Information

This shows the live **SYS** output from the connected device. (More details on how SYS is defined here) If the DTEMP is connected then the **TEMP** value will also be shown.
There will also be some details about the connected device such as serial number and Firmware version.

Click the **Hold** switch to pause the display on the current reading. Click again to get live readings.
Click the **Net** switch to zero the current value. Click again to return to a Gross reading.
Click the **Format** drop down to select the number of decimal places and/or leading zeroes to display.

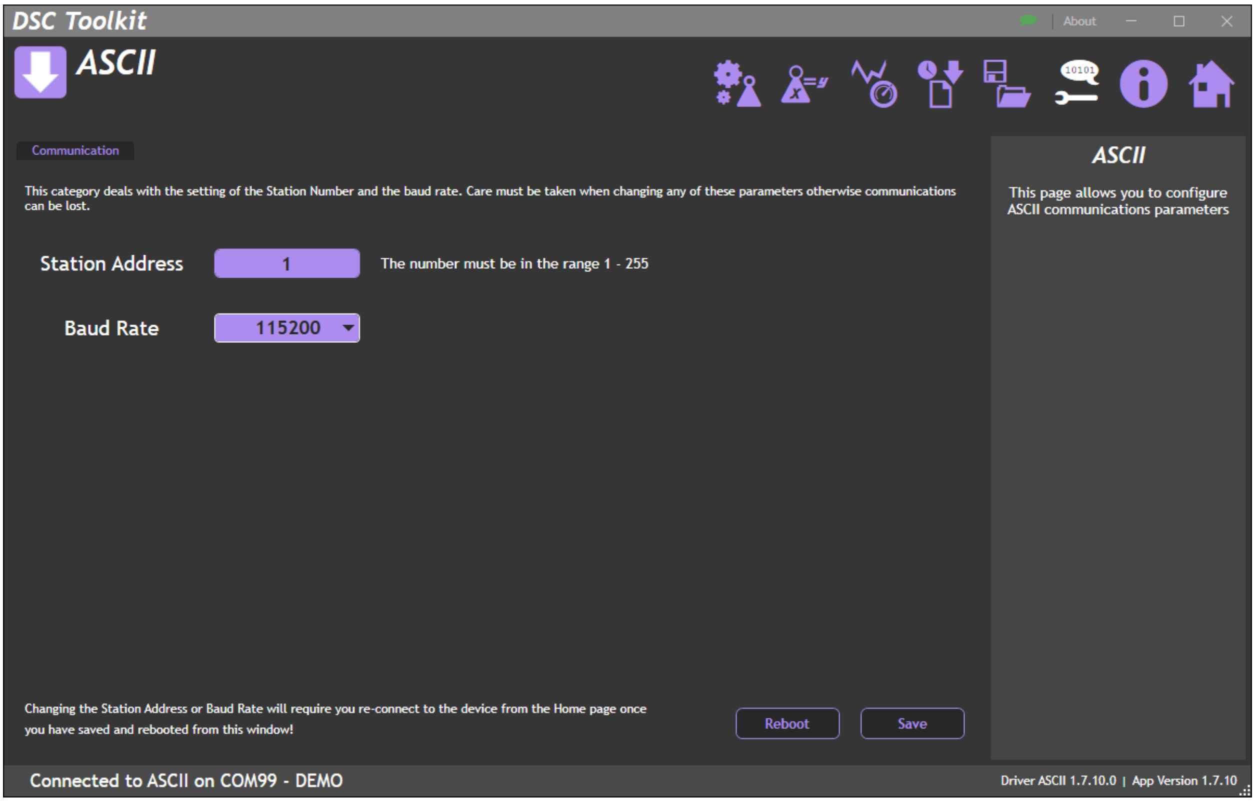
The **Dynamic Errors** tab shows any live errors the device has detected.
The **Latched Errors** tab shows any errors that have happened since they were last reset.

Item	Description
Serial Number information	
Hold switch	Stop/restart the display
Net switch	Apply/remove the current value as a tare, zeroing the display. (this is not stored in the device, only applied to this display)
Format drop-down	Number of decimal places for this display
Dynamic Errors tab	Live errors from the STAT parameter
Latched Errors tab	Latched errors from the FLAG parameter

Communication

Product Specific Pages

ASCII



Here you can change the **Station Address** and **Baud Rate** of the connected device.

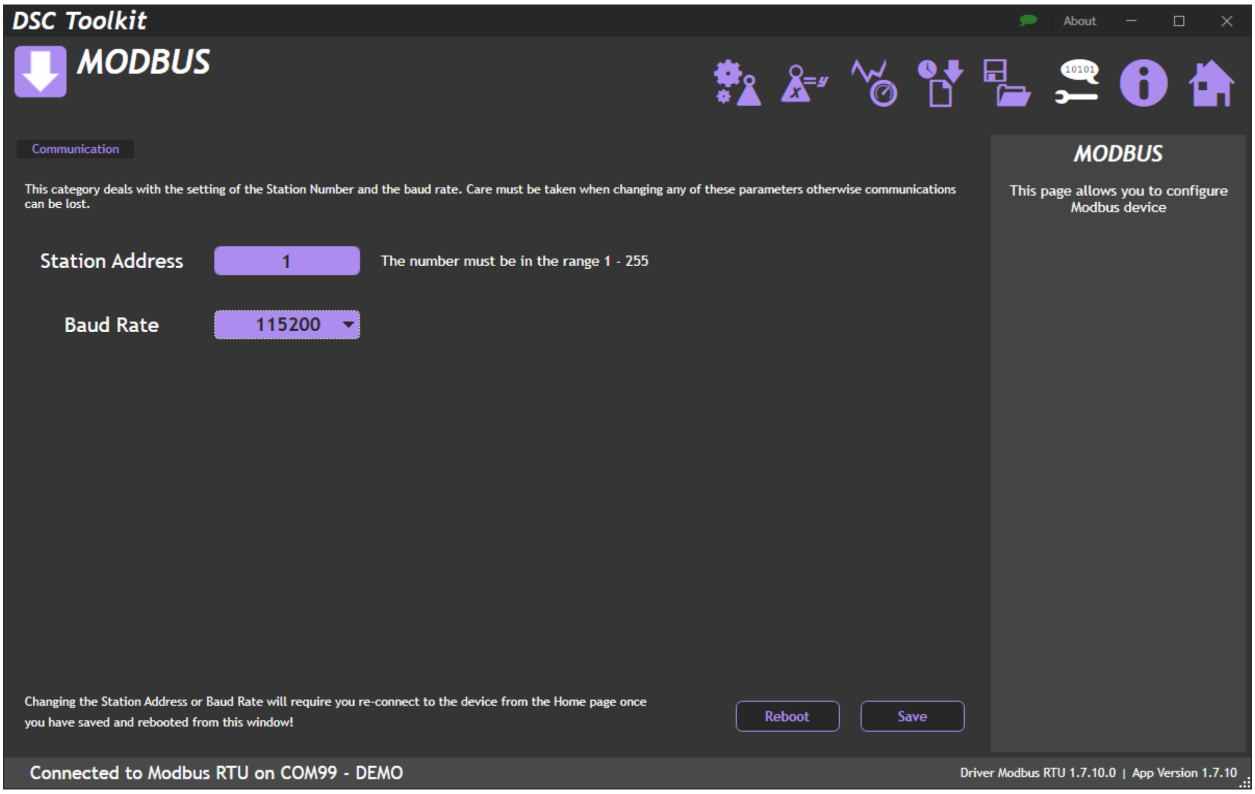
> ! Please ensure that you record any settings that you change as you will not be able to connect to the device again without them.

Once you have the required settings, click **Save** then **Reboot** to commit them to memory. You will then need to reconnect to the device from the **Home** page using the new communication settings.

Item	Description
Station Address entry field	Enter the required Station Address. It must be a number in the range 1-255
Baud Rate drop-down	Enter the required Baud Rate from the list: 2400 4800 9600 19200 38400 57600 76800 115200 (factory) 230400 460800 **(Ensure that the selected baud rate is available on the PC com port)**
Reboot button	Restart device once the new communication settings have been applied

Save button	Save the new communication settings

Modbus



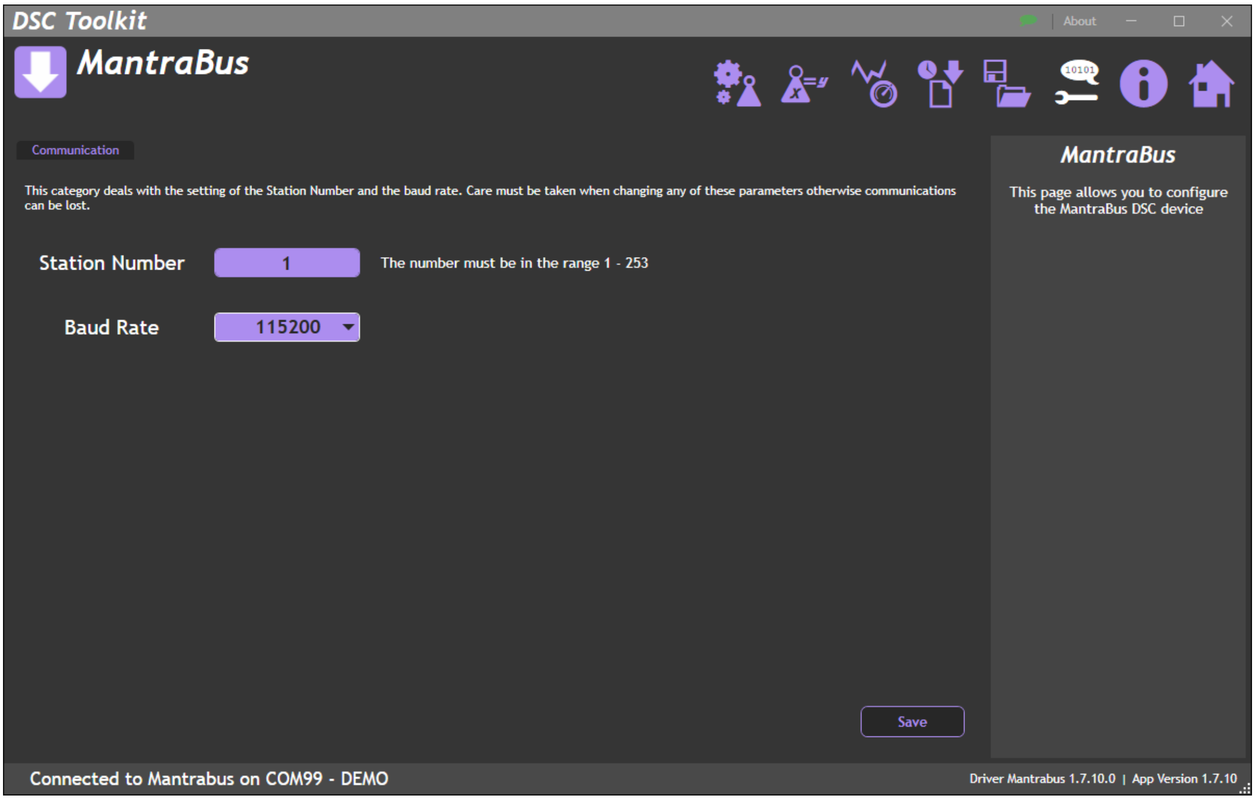
Here you can change the **Station Address** and **Baud Rate** of the connected device.

> Please ensure that you record any settings that you change as you will not be able to connect to the device again without them.

Once you have the required settings, click **Save** then **Reboot** to commit them to memory. You will then need to reconnect to the device from the **Home** page using the new communication settings.

Item	Description
Station Address entry field	Enter the required Station Address. It must be a number in the range 1-255
Baud Rate drop-down	Enter the required Baud Rate from the list: 2400 4800 9600 19200 38400 57600 76800 115200 (factory) 230400 460800 **(Ensure that the selected baud rate is available on the PC com port)**
Reboot button	Restart device once the new communication settings have been applied
Save button	Save the new communication settings

Mantrabus



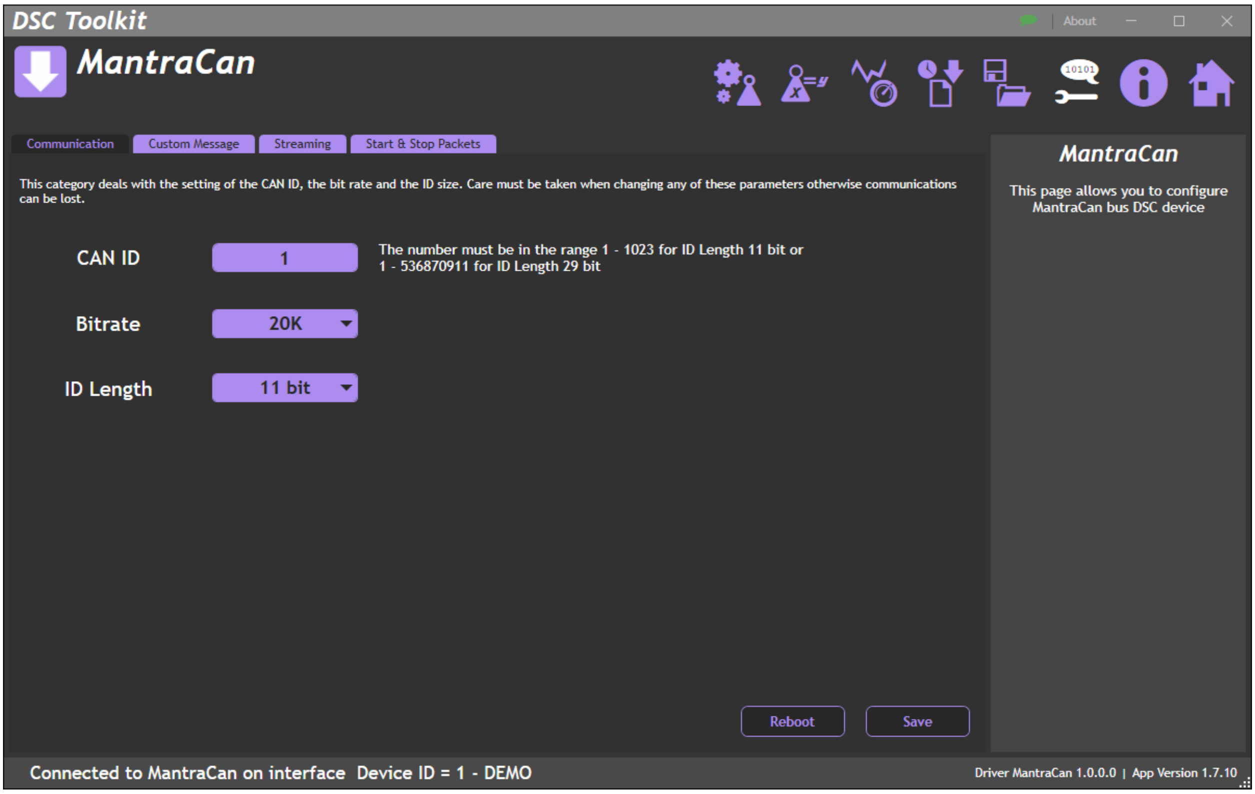
Here you can change the **Station Address** and **Baud Rate** of the connected device.

> Please ensure that you record any settings that you change as you will not be able to connect to the device again without them.

Once you have the required settings, click **Save** then **Reboot** to commit them to memory. You will then need to reconnect to the device from the **Home** page using the new communication settings.

Item	Description
Station Address entry field	Enter the required Station Address. It must be a number in the range 1-253
Baud Rate drop-down	Enter the required Baud Rate from the list: 2400 4800 9600 19200 38400 57600 76800 115200 (factory) 230400 460800 **(Ensure that the selected baud rate is available on the PC com port)**
Reboot button	Restart device once the new communication settings have been applied
Save button	Save the new communication settings

MantraCAN



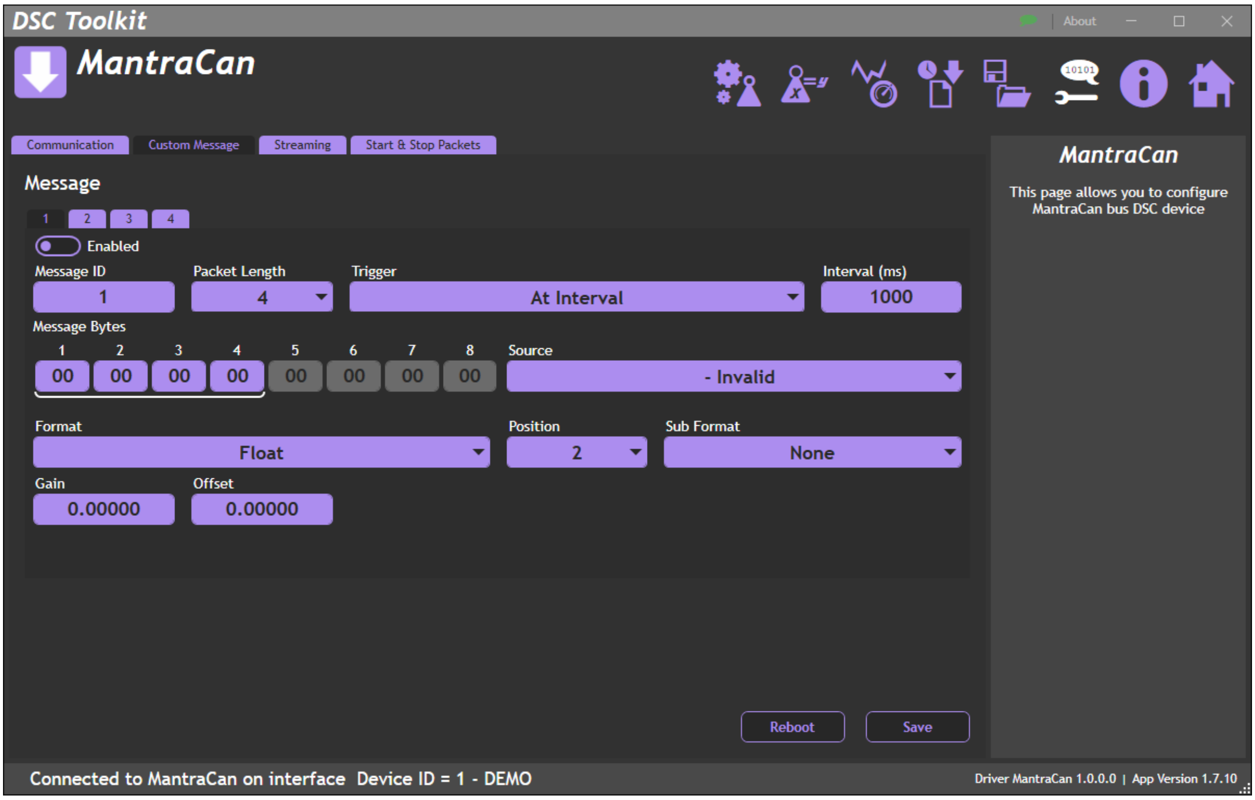
Here you can change the **CAN ID**, **Bitrate** and **ID Length** of the connected device.

> Please ensure that you record any settings that you change as you will not be able to connect to the device again without them

Once you have the required settings, click **Save** then **Reboot** to commit them to memory. You will then need to reconnect to the device from the **Home** page using the new communication settings.

Item	Description
CAN ID entry field	Enter the required CAN ID. 11 bit **ID**: 1-1023, 29 bit **ID**: 1-536870911
Bitrate drop-down	Enter the required Bitrate from the list: 20K 50K 100K 125K 250K 500K (factory) 800K 1M
ID Length drop-down	Select from: 11 bit 29 bit
Reboot button	Restart device once the new communication settings have been applied
Save button	Save the new communication settings

Custom Message

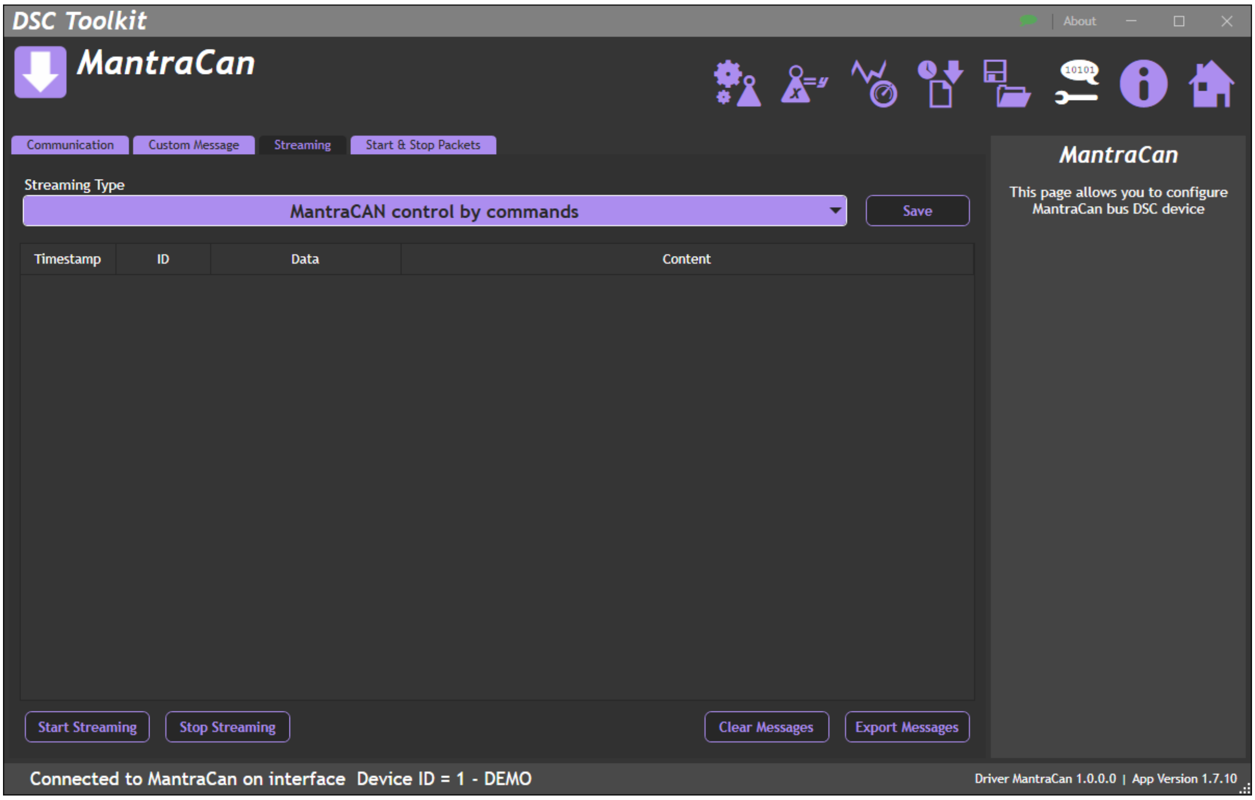


Here you can configure up to four custom messages. This can allow the device to exist on a proprietary CAN bus.

Item	Description
Enabled switch	Enable/disable the selected message
Message ID entry field	Message identifier
Packet Length drop-down	Packet length in bytes?? Select from: **0-8**
Trigger drop-down	Select from: **At Interval** **At Interval and On Change** **On Change Only**
Interval entry-field	Only active if trigger is interval. From 10 ms
Message Bytes entry-field	Enter any fixed message bytes manually here
Source drop-down	Data source, select from: **All available parameters, see appendix ()**

Format drop-down	Data format, select from: **Float** **Byte Unsigned** **Byte 2s Compliment** **Byte Sign Bit** **Integer Unsigned** **Integer 2s Compliment** **Integer Sign Bit** **Long Unsigned** **Long 2s Compliment** **Long Sign Bit**
Position drop-down	Data position, select from: **1-8**
Sub Format drop-down	Data sub format, select from: **None** **Reverse Bytes** **Reverse Words** **Reverse Bytes and Words**
Gain entry-field	Gain to apply to the Source?
Offset entry-field	Offset to apply to the Source?

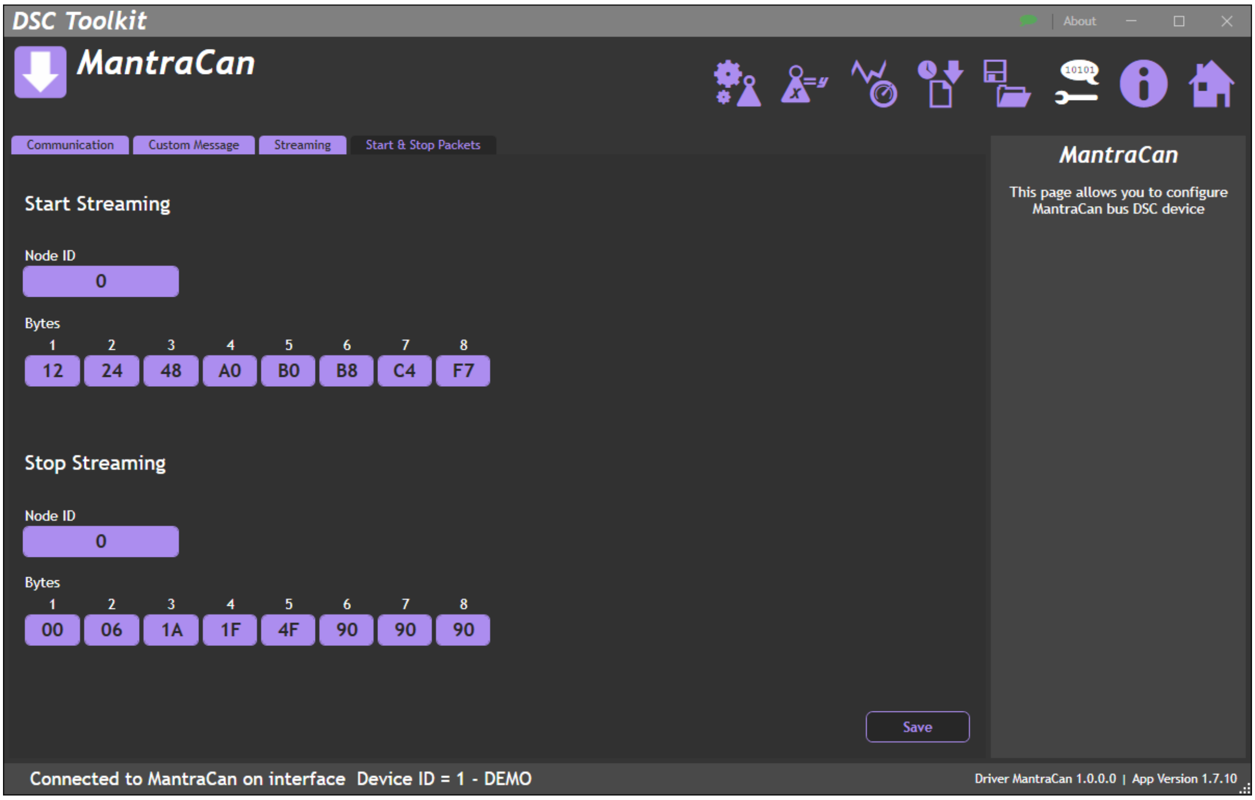
Streaming



Here you can view the incoming messages on the bus and start/stop streaming.

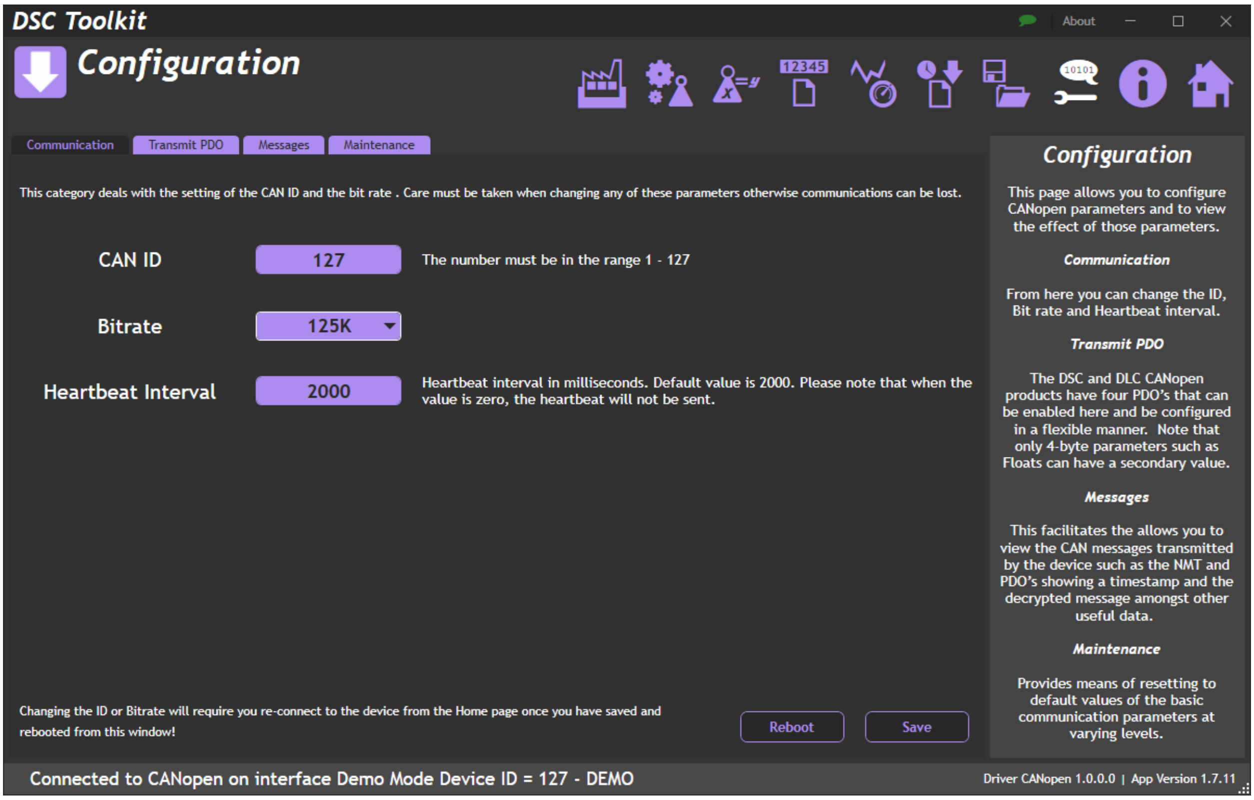
Item	Description
Streaming Type drop-down	Select from: **MantraCAN control by commands** **Automatic. Streaming starts on power up** **Custom. Streaming is controlled by the user defined start and stop packets**
Save button	Save the MantraCAN settings
Start Streaming button	Send standard MantraCAN start message
Stop Streaming button	Send standard MantraCAN stop message
Clear Messages button	Clear current message list
Export Messages button	Save current message list to clipboard

Start and Stop Packets



This page allows definition of custom start and stop packets.

Item	Description
Start Streaming Node ID entry field	Set to zero for broadcast
Start Streaming Bytes 1-8?? entry fields	Custom start streaming message
Stop Streaming Node ID entry field	Set to zero for broadcast
Stop Streaming Bytes 1-8?? entry fields	Custom stop streaming message
Save button	Save current settings



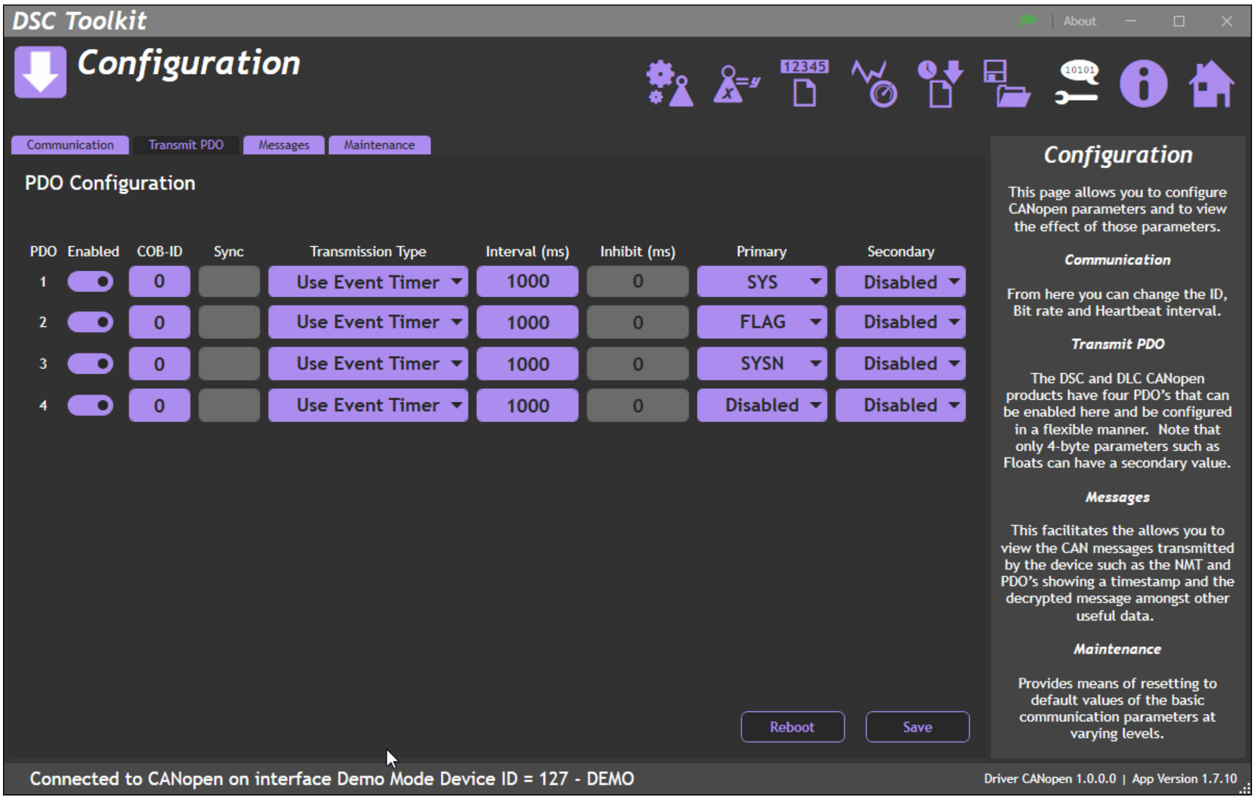
Here you can change the **CAN ID**, **Bitrate** and **Heartbeat Interval** of the connected device.

> Please ensure that you record any settings that you change as you will not be able to connect to the device again without them

Once you have the required settings, click **Save** then **Reboot** to commit them to memory. You will then need to reconnect to the device from the **Home** page using the new communication settings.

Item	Description
CAN ID entry field	Enter the required CAN ID (in decimal) (Must be 1-127)
Bitrate drop-down	Enter the required Bitrate from the list: 20K 50K 100K 125K (factory) 250K 500K 800K 1M
Heartbeat Interval entry field	Set in milliseconds. Set to zero to disable heartbeat
Reboot button	Restart device once the new communication settings have been applied
Save button	Save the new communication settings

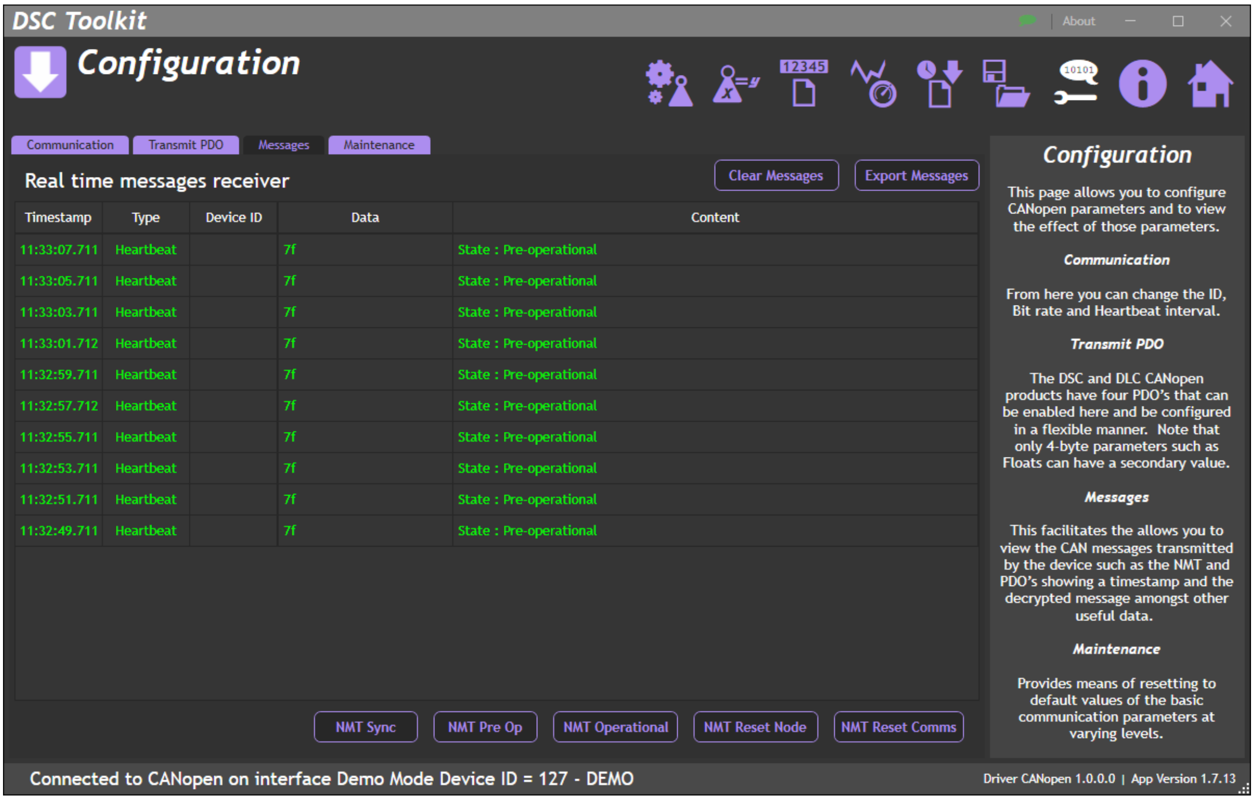
Transmit PDO



This page allows the definition of up to four different PDOs.

Item	Description
PDO 1-4 row	
Enabled switch	Enable/disable the PDO
COB-ID entry field	The COB-ID of this PDO
Sync drop-down?	Number of Sync packets to receive before triggering transmission of PDO
Transmission Type drop-down	Select from: **Synchronous** **Change of State** **Use Event Timer**
Interval entry-field	Interval between PDO transmissions (must be more than 10 ms)
Inhibit entry-field	Minimum time between Change of State PDO transmissions
Primary drop-down	Primary mapping Select from: **All available parameters, see appendix ()**
Secondary drop-down	Secondary mapping Select from: **All available parameters, see appendix ()**

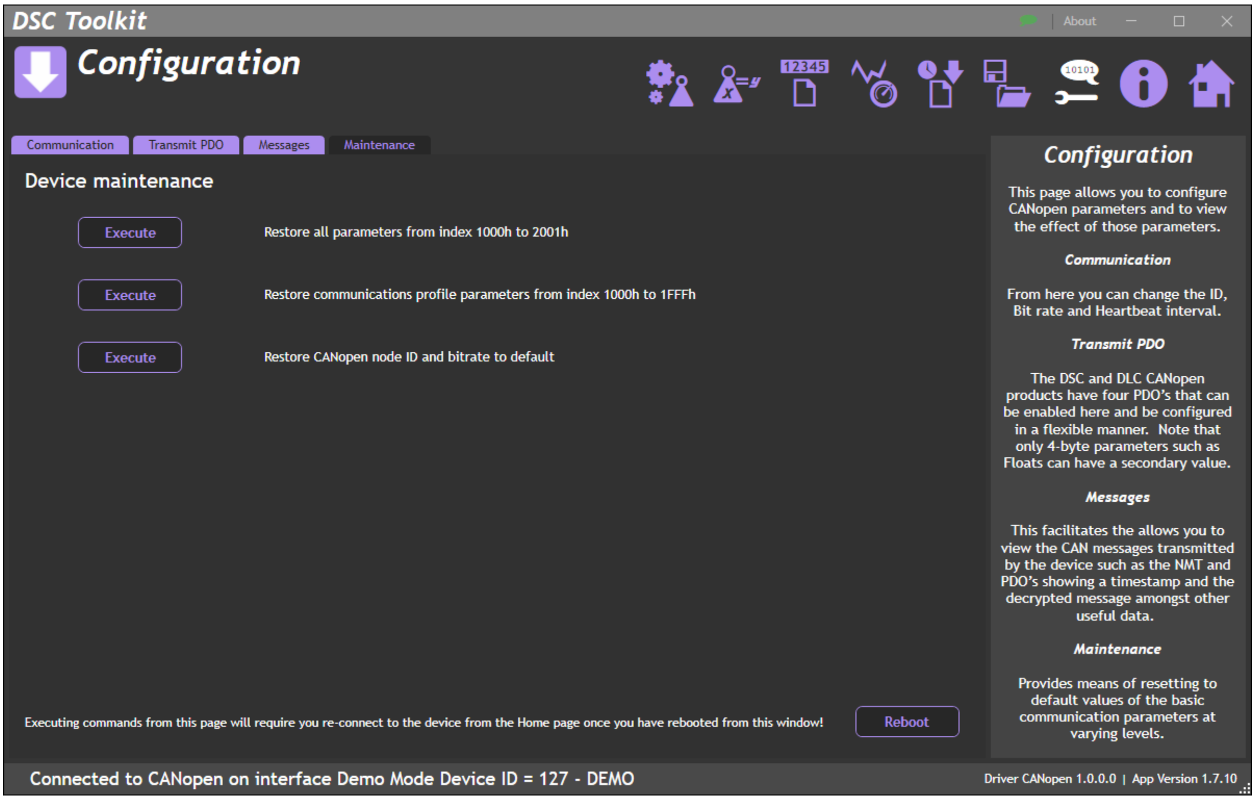
Messages



Here you can view the messages from the device and change the NMT state of the device.

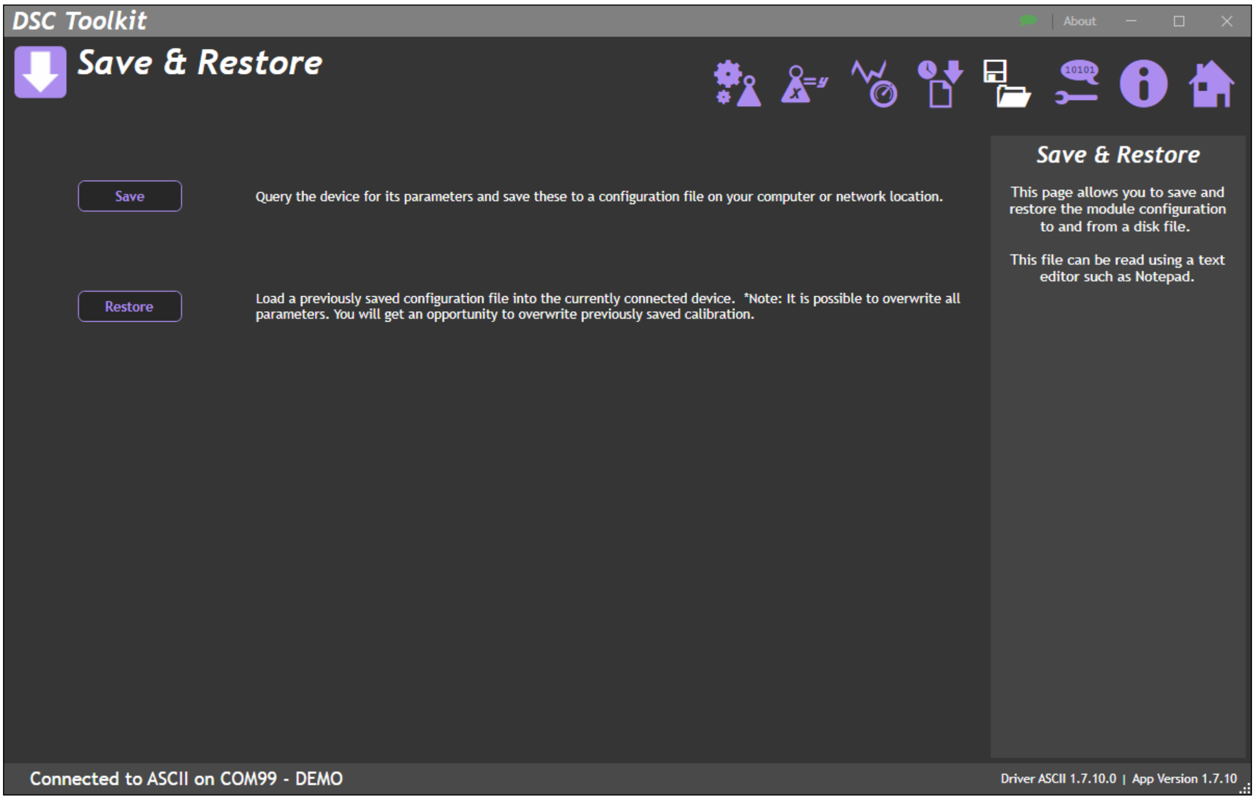
Item	Description
Clear Messages button	Clear all messages from the window
Export Messages button	Copy all messages to the clipboard
NMT Sync button	Sends NMT Sync message
NMT Pre Op button	Puts the device into Pre Op mode
NMT Operational button	Puts the device into Operational mode
NMT Reset Node button	Reset to defaults
NMT Reset Comms button	Reset Communications to default values (Index range 1000h to 1FFFh)

Maintenance



Item	Description
Execute button	Restore all parameters from index 1000h to 2001h
Execute button	Restore communications parameters from index 1000h to 1FFFh
Execute button	Restore CANopen node ID and bitrate to default (may result in loss of communications)

Save and Restore

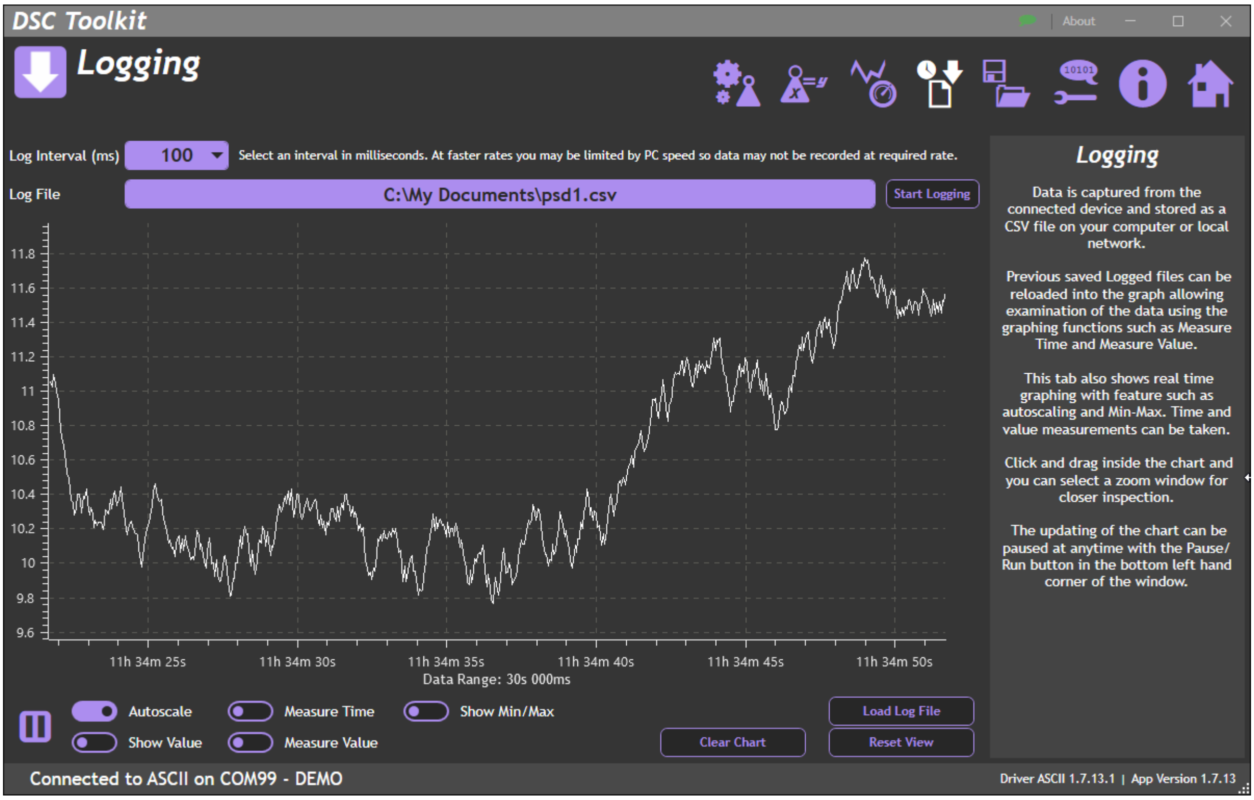


Clicking the **Save** buttons will allow you to specify a file to which the configuration of the connected module is written.

Once saved this file can be selected, after clicking the **Restore** button, and the settings restored to the same module or to another module.

Item	Description
Save button	Save the device's configuration settings to a file
Restore button	Restore settings to the device from a previously saved file

Logging

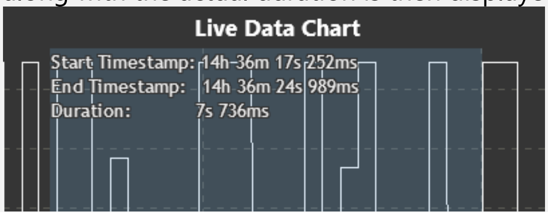
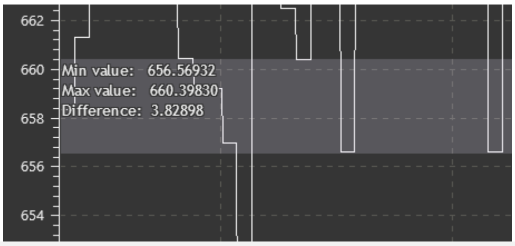


This page allows logging to a CSV file (up to 200 Hz). This CSV file can be loaded at a later point for analysis.

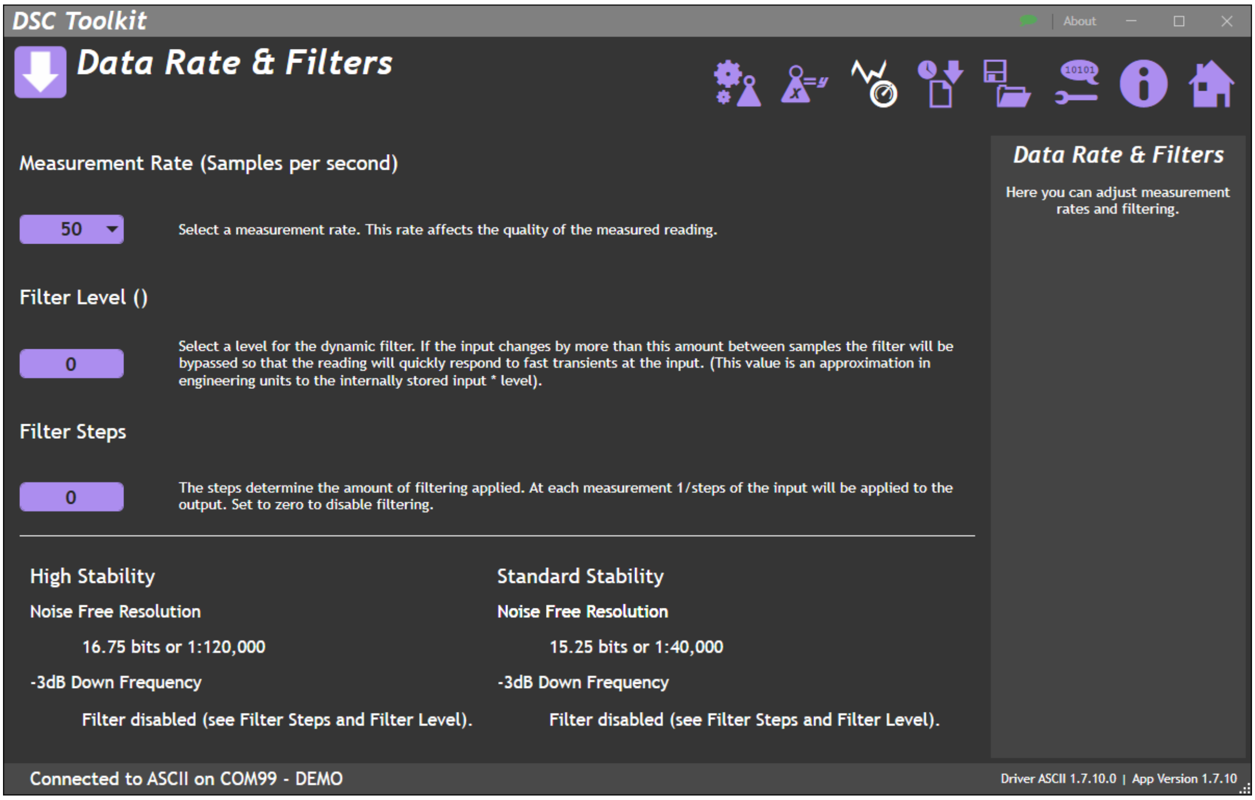
The chart updates live (at the **Measurement Rate**, up to 100 Hz) and can also be paused for analysis.

This page is also available when no device is connected, allowing you to load and analyse previous logged data.

Item	Description
Log Interval drop down	Set the logging rate in milliseconds, (5-1000 ms)
Log File entry field	Enter the location and name of the log file. Double click to browse
Start Logging button	Start logging. You will be warned if the file already exists and given the option to continue or cancel logging
Chart chart	The chart itself can be clicked on and supports the following actions: **Zoom In** – Performed by clicking and dragging to draw a box over the portion of the chart to zoom in on. To zoom in the mouse must move to the right after clicking. **Zoom Out** – Zoom back out to the full chart view by clicking and dragging to draw a box. The mouse must move to the left after clicking to zoom out. **Free Zoom** – Use the mouse wheel to zoom in or out focused at the position of the mouse pointer. **Scroll Vertically** – Click and drag the Y axis (Value). Only useful when Autoscale is off. **Free panning** – Click and drag the chart using the right mouse button to pan around the data. Only useful when Autoscale is off.
Pause icon	Toggles between paused and running. When paused the chart data continues to be saved and will be populated when next resumed.

Autoscale switch	Select whether to automatically scale the chart. **Off** Chart will not automatically scale to suit data as it is added. Click the Reset View button to perform a one off auto scale. **On** Chart will automatically scale to the data as it is added.
Show Value switch	Select whether to show information popup window as the mouse pointer hovers over data points **Off** Nothing is displayed. **On** Display pop-up information box showing the time and value of the data point under the mouse pointer.
Measure Time switch	Select whether to display the on chart tool for measuring the time between two horizontal points on the chart. This is made much easier if the chart is paused. **Off** Nothing is displayed. **On** The Measure Time tool is displayed. A vertical shaded box will appear and the sides can be dragged with the mouse to cover the desired part of the chart. The start and end timestamps along with the actual duration is then displayed. 
Measure Value switch	Select whether to display the on chart tool for measuring the value between two vertical points on the chart. This is made much easier if the chart is paused. **Off** Nothing is displayed. **On** The Measure Value tool is displayed. A horizontal shaded box will appear and the top and bottom can be dragged with the mouse to cover the desired part of the chart. The min and max values along with the actual difference between the two are displayed.. 
Show Min/Max switch	Select whether to show lines to indicate the minimum and maximum value in the chart data. **Off** Nothing is displayed. **On** Min and max lines are shown in red and green respectively.
Load Log File button	Opens a file dialog to allow you to select a previously logged data file. This file data will be loaded into the chart and can be viewed with all the tools available. The button caption will change to **Back To Realtime Chart** after the file has loaded.
Clear Chart button	Clear all data from the chart.
Reset View button	Returns the chart to its default view and zoom level after zooming or panning the chart.

Data rate and Filters



This page allows setting of the speed of measurement and filtration. See Appendix F for full details of filtration.

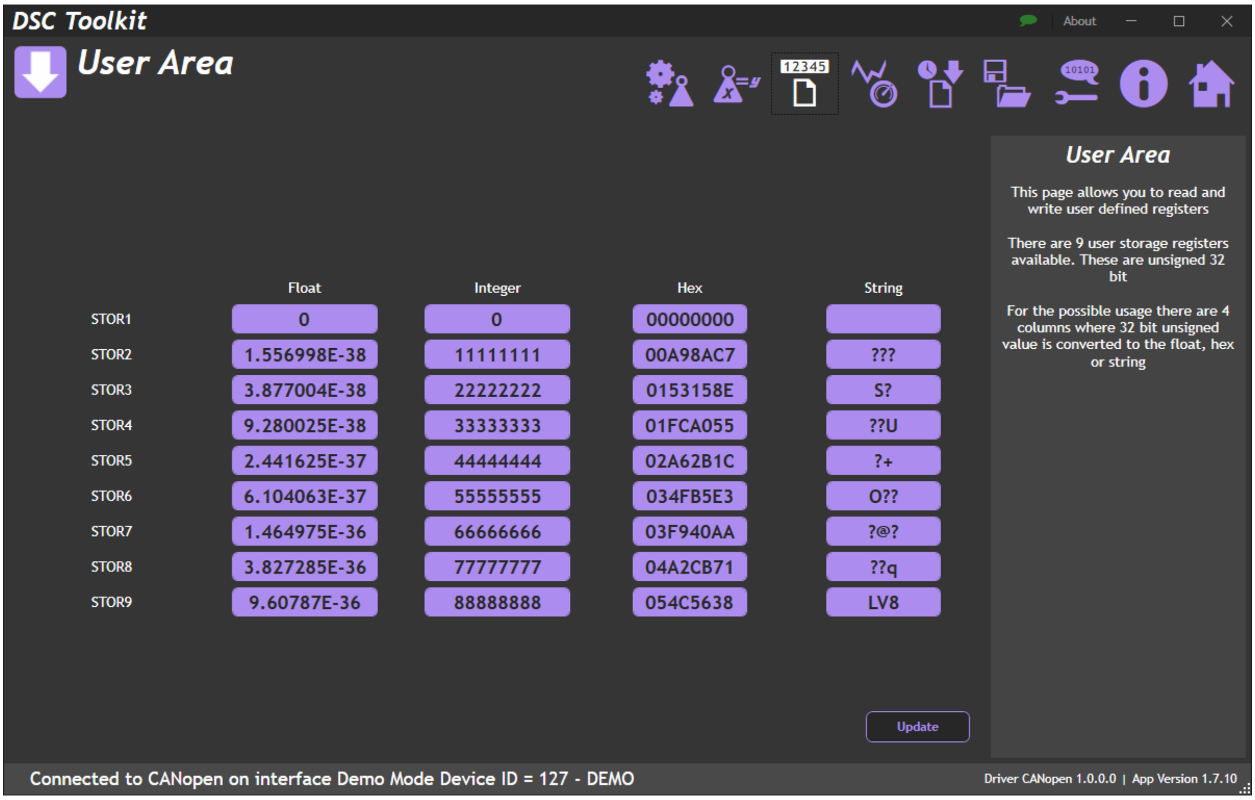
The resolution and frequency response for the selected settings are shown at the bottom.

Item	Description
Measurement Rate drop-down	Select the desired internal measurement rate of the handheld. The faster the measurement the better the detection of fast transient peak and trough values will be but the noise free resolution will decrease. **1** A new measurement value is generated every second. **2** A new measurement value is generated 2 times a second. **5** A new measurement value is generated 5 times a second. **10** A new measurement value is generated 10 times a second. **20** A new measurement value is generated 20 times a second. **50** A new measurement value is generated 50 times a second. **60** A new measurement value is generated 60 times a second. **100** A new measurement value is generated 100 times a second. **200** A new measurement value is generated 200 times a second. **300** A new measurement value is generated 300 times a second *(not available for CAN devices)* **500** A new measurement value is generated 500 times a second *(not available for CAN devices)*
Filter Level entry field	If input change between readings is greater than this level, filter will be bypassed. If it is less, filter will be applied. Set in engineering units. Set to zero to disable filtration.
Filter Steps entry field	Filtered output will be difference between previous output and latest reading divided by number of steps. Set to zero to disable filtration.

User Area

Product Specific Pages

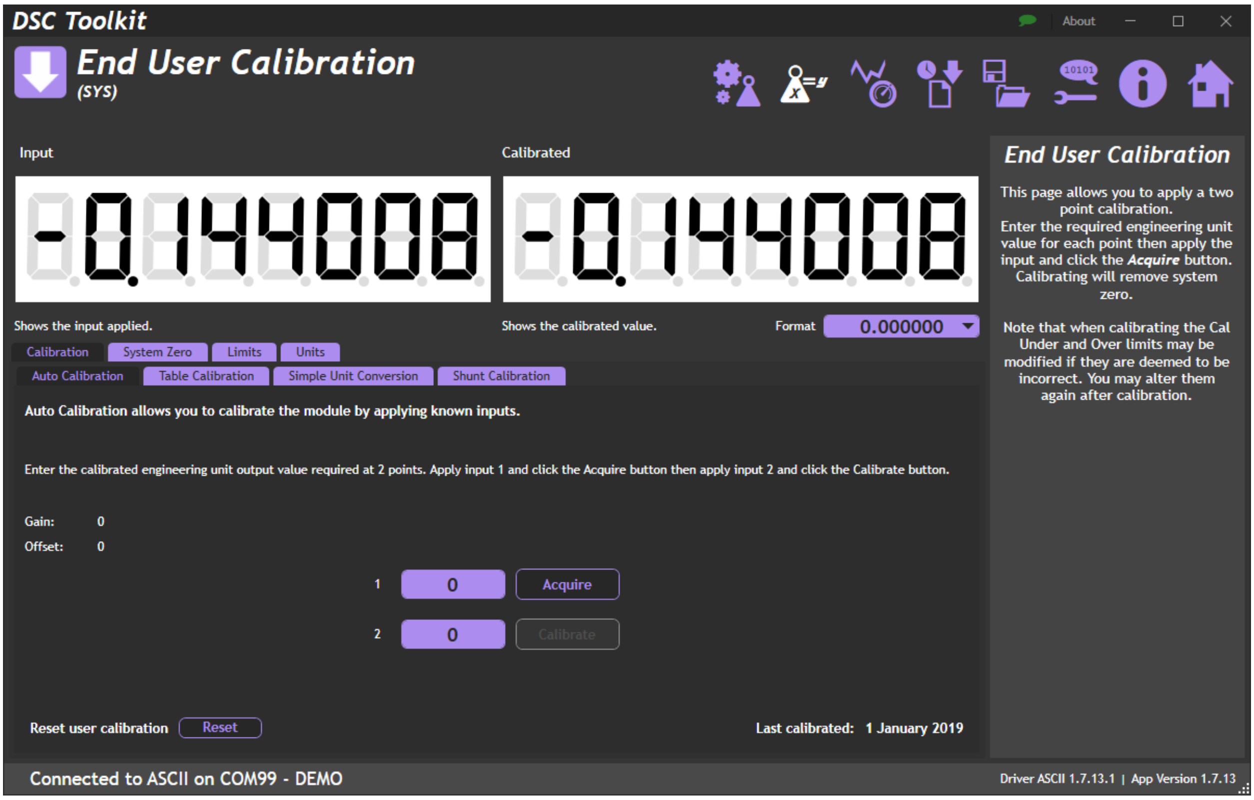
CANopen



User storage for information such as calibration initials. When you enter in one format, the toolkit will attempt to convert it to the other formats. The value is stored as unsigned 32 bit.
This page is only available for firmware version 2.01 and above.

Item	Description
STOR1-9 row	Name of storage location
Float entry field	Floating point number
Integer entry field	Integer
Hex entry field	Hexadecimal
String entry field	ASCII string
Update button	Save settings

End User Calibration

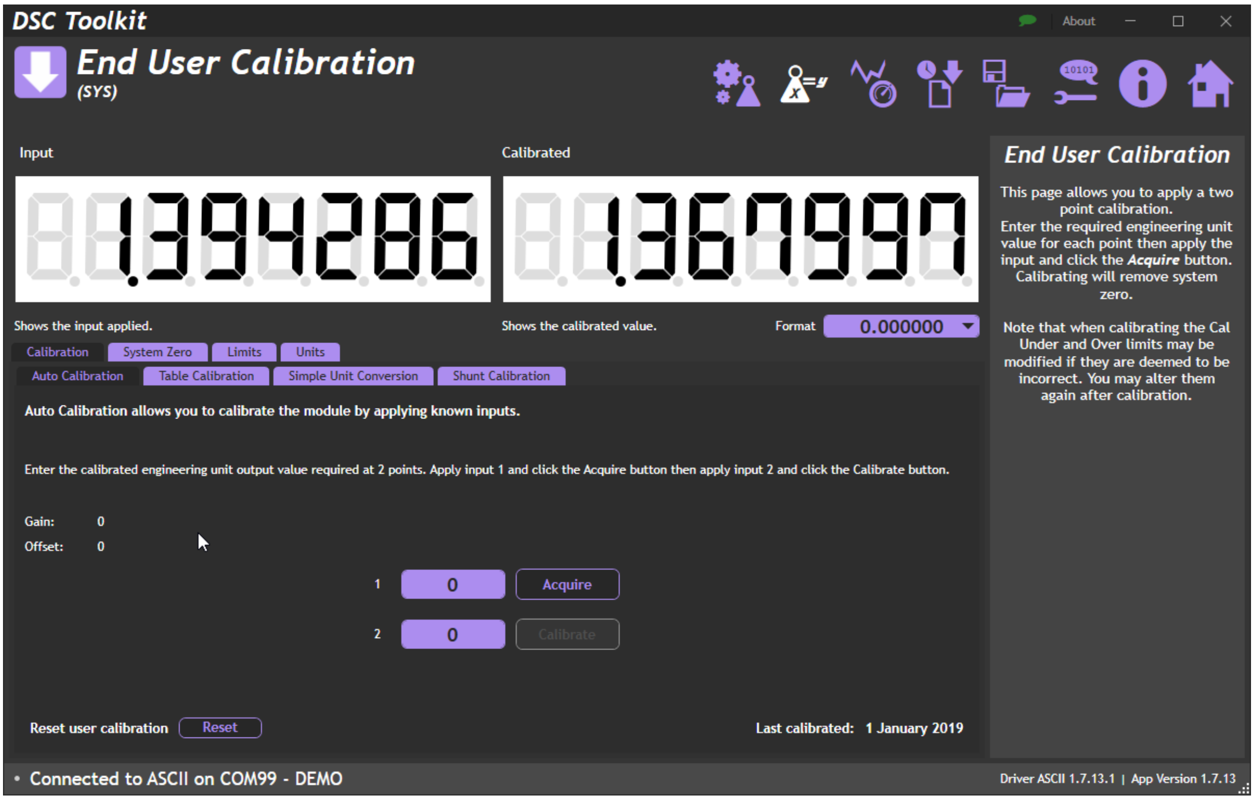


This section allows the end user to apply their own calibration without erasing any OEM Advanced calibration that may have been applied. If an Advanced calibration has been applied, the input on these pages may not be in mV/V.

Item	Description
Input value	This is the output value after advanced calibration has been applied (CELL)
Calibrated value	This is the output value after end user calibration has been applied (SYS)
Format drop-down	Select the format of the End User calibrated display

Calibration

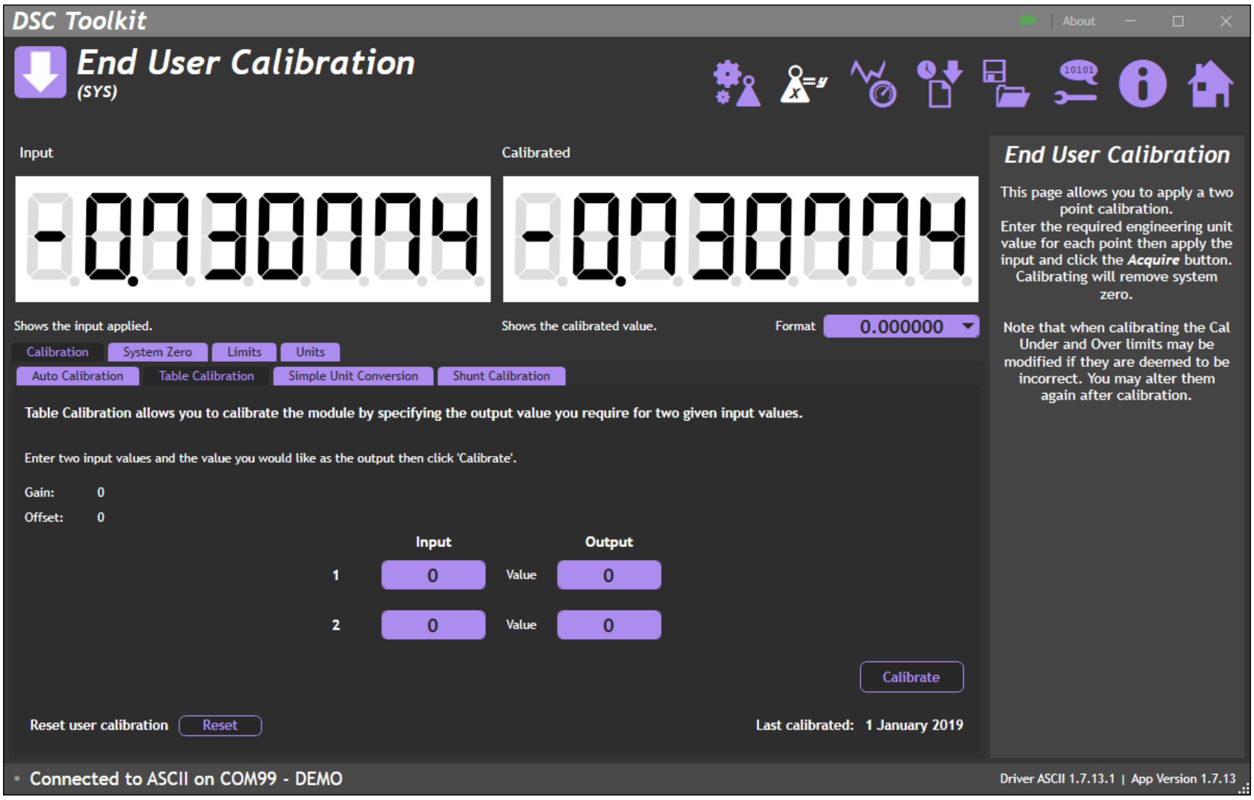
Auto Calibration



Two-point calibration using live/known loads

Item	Description
Gain information	Currently applied end user gain
Offset information	Currently applied end user offset
1 entry field	Enter ‘low’ output value required
2 entry field	Enter ‘high’ output value required
Acquire button	Apply ‘low’ load, allow to settle then click Acquire
Calibrate button	Apply ‘high’ load, allow to settle then click Calibrate (Not available until value 1 has been acquired)
Reset button	Clear any applied end user calibration
Last calibrated information	Date that the last user calibration was applied

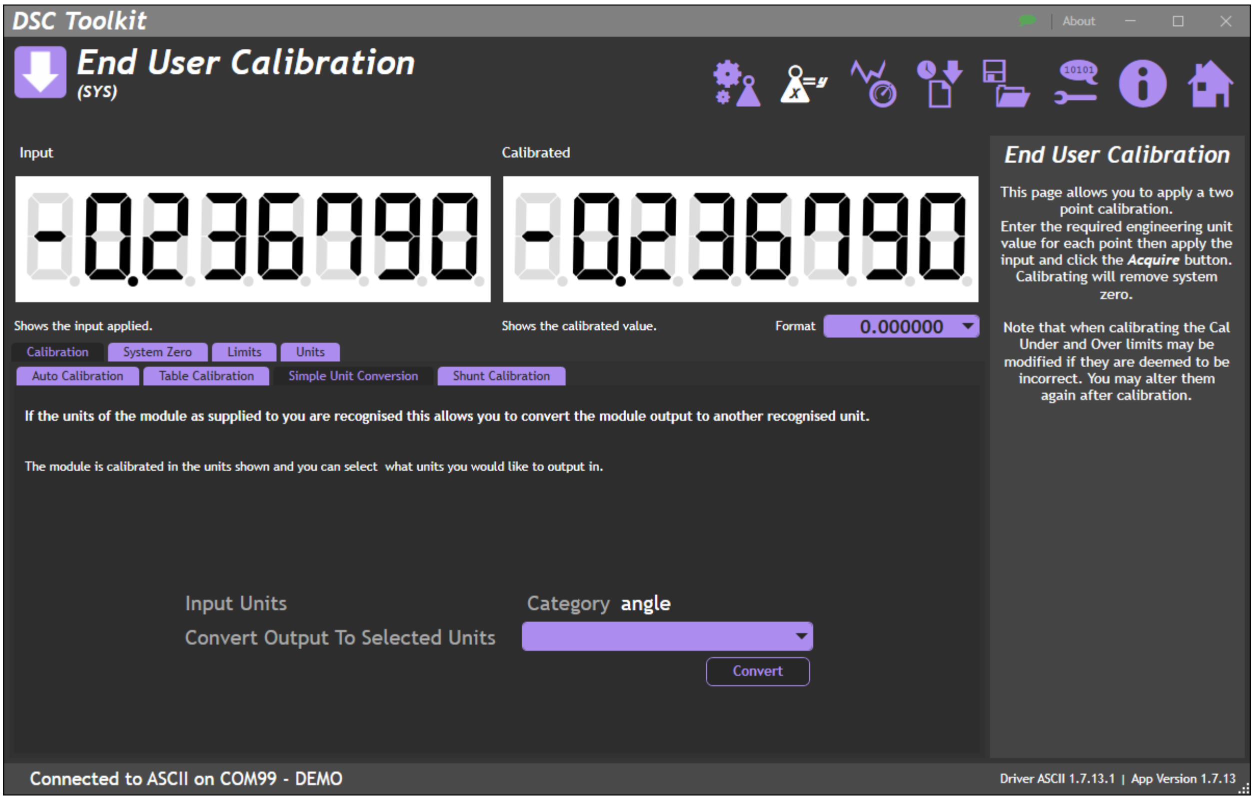
Table Calibration



Calibrate using table information such as load cell manufacturer's calibration certificate.

Item	Description
Gain information	Currently applied end user gain
Offset information	Currently applied end user offset
1 Input entry field	Enter 'low' input value required
2 Input entry field	Enter 'high' input value required
1 Output entry field	Enter 'low' output value required
2 Output entry field	Enter 'high' output value required
Calibrate button	After entering the above values, click Calibrate to apply
Reset button	Clear any applied end user calibration
Last calibrated information	Date that the last user calibration was applied

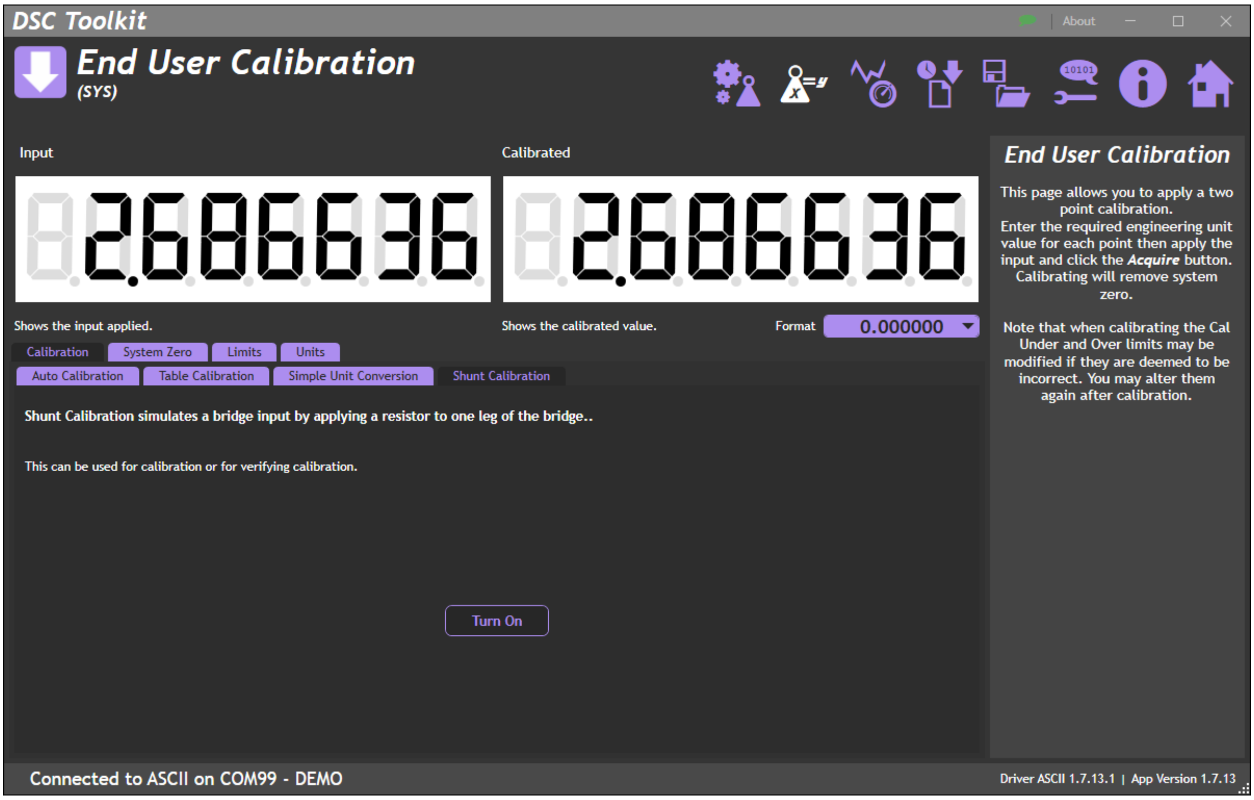
Simple Unit Conversion



If the OEM Advanced calibration is in recognized units, you can use this page to convert to another unit in the same category.

Item	Description
Input Units information	Advanced calibration units
Category information	Category that these units fit into
Convert output to selected units drop-down	Select the required output units from the available list
Convert button	Apply conversion

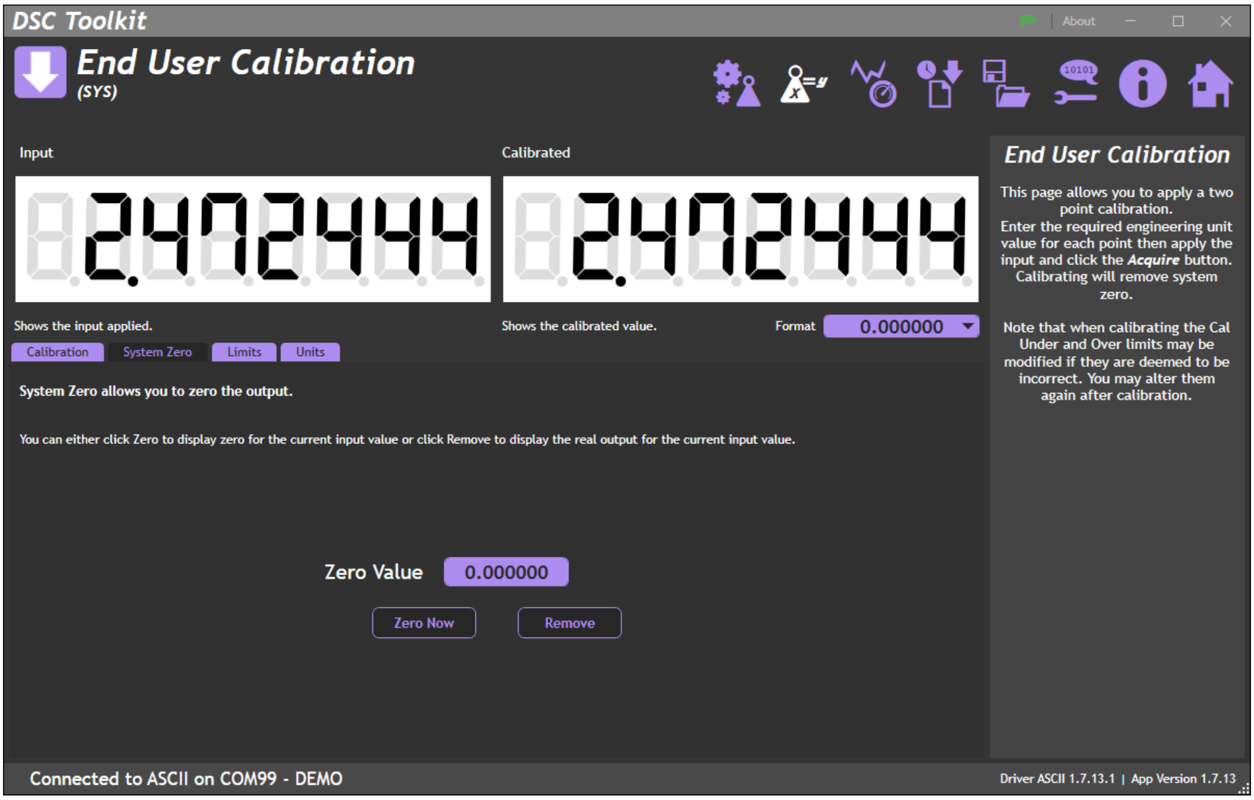
Shunt Calibration



Shunt Calibration can be used to verify calibration is still good. After calibration, note the change in output with shunt calibration on and off. This change can then be checked at a later date to ensure it is the same. If there is variation, the calibration will need to be checked.

Item	Description
Turn on/off button	Switches in a 100k resistor across the strain gauge bridge to simulate a fixed change in input. Ensure you click again to toggle off before taking any 'real' readings

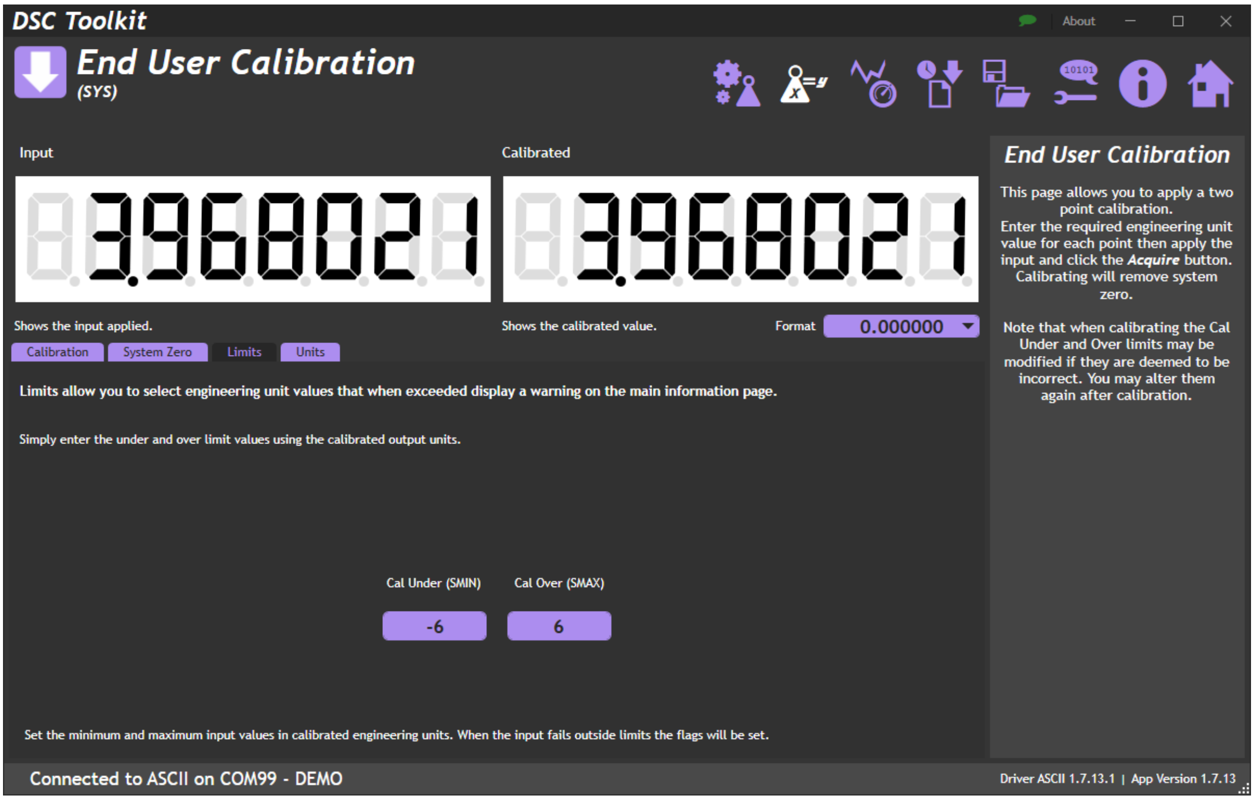
System Zero



This page allows setting of system zero.

Item	Description
Zero Value entry field/information	Shows the current value of zero Manual entry of zero possible in this field
Zero Now button	Set the current reading as zero
Remove button	Clear the current Zero Value

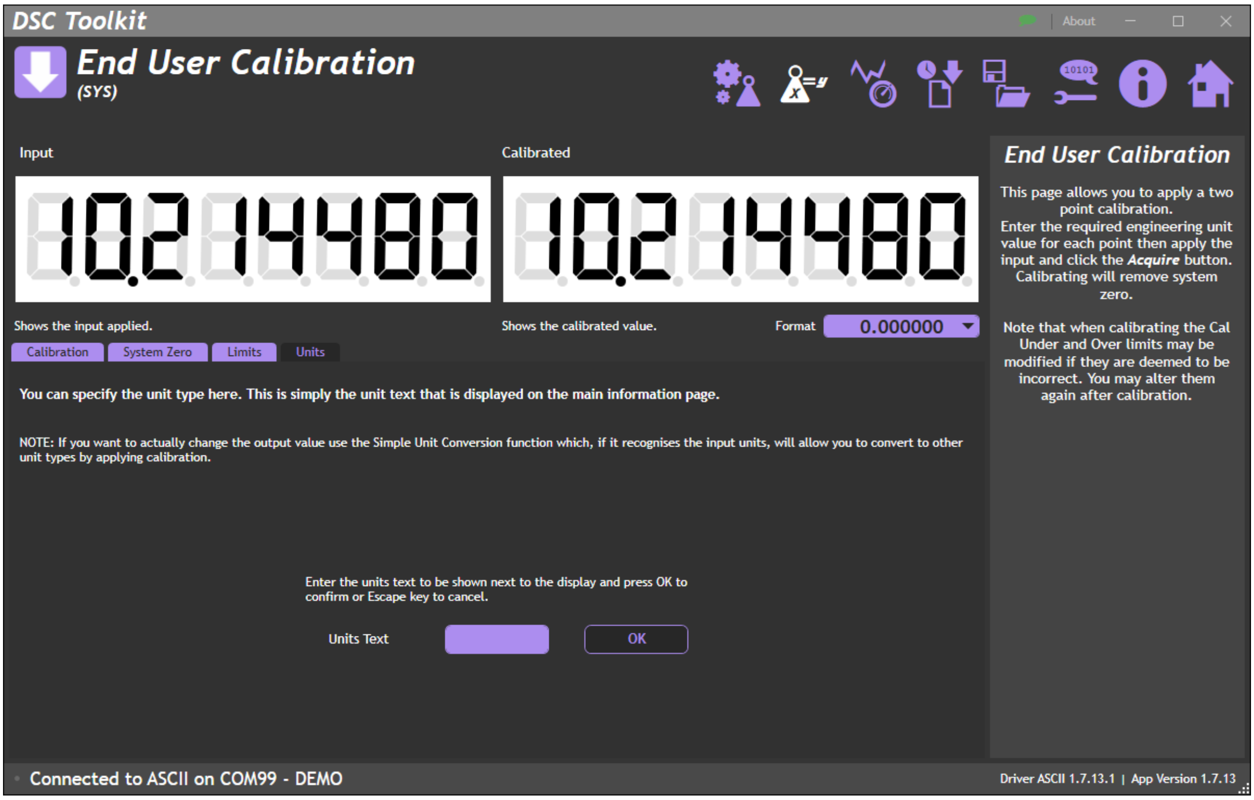
Limits



Set the upper and lower limits in the End User calibrated units. If these are exceeded the SYS over/under flags are set. These are visible on the Information page.

Item	Description
Cal Under (SMIN) entry field	Enter minimum limit. If the SYS value is below this the SYSUR flag will be set
Cal Over (SMAX) entry field	Enter maximum limit. If the SYS value is above this the SYSOR flag will be set

Units



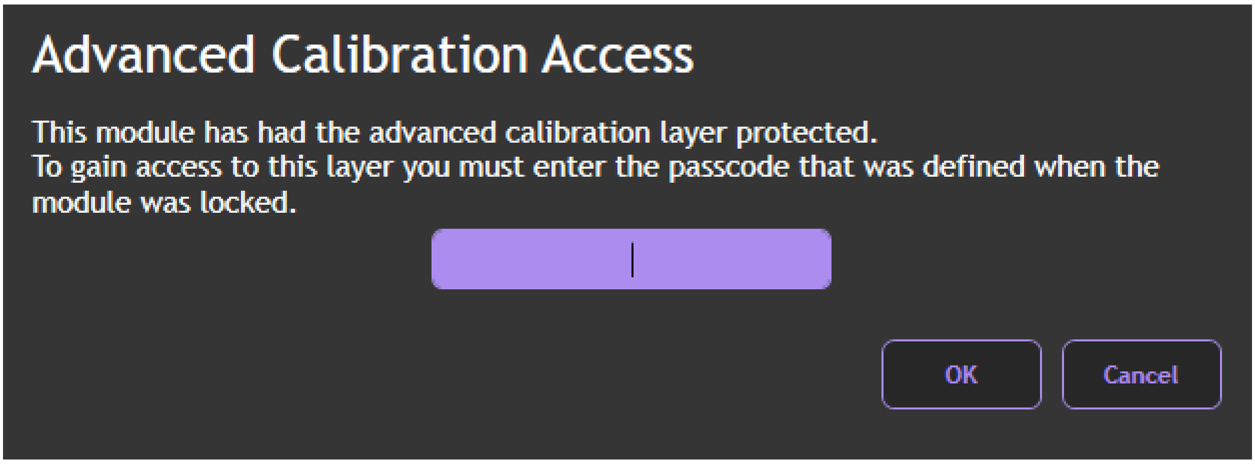
Manually enter the End User calibrated unit here. If you simply wish to convert from units already set in OEM calibration you could use the Simple Unit Conversion in the calibration tab.

Item	Description
Units Text entry field	Enter the text required to be shown
OK button	Click to confirm, press escape to cancel

OEM Advanced Calibration

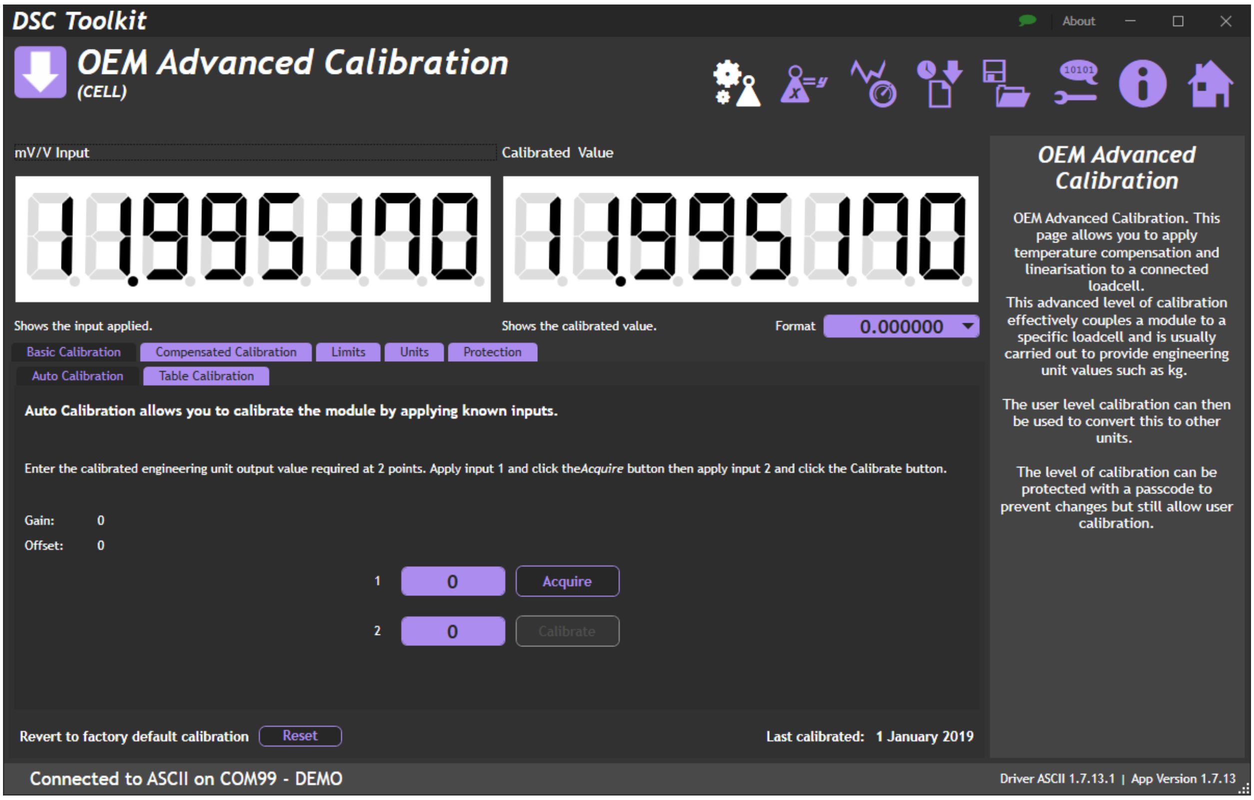
This section allows the OEM to apply their own calibration and protect it so that it cannot be accidentally changed. In addition to a two-point calibration, temperature compensation, multi-point linearisation and calibrated units can be set.

Enter Passcode



If the module has been protected, you will have to enter the passcode here to access the Advanced Calibration pages.

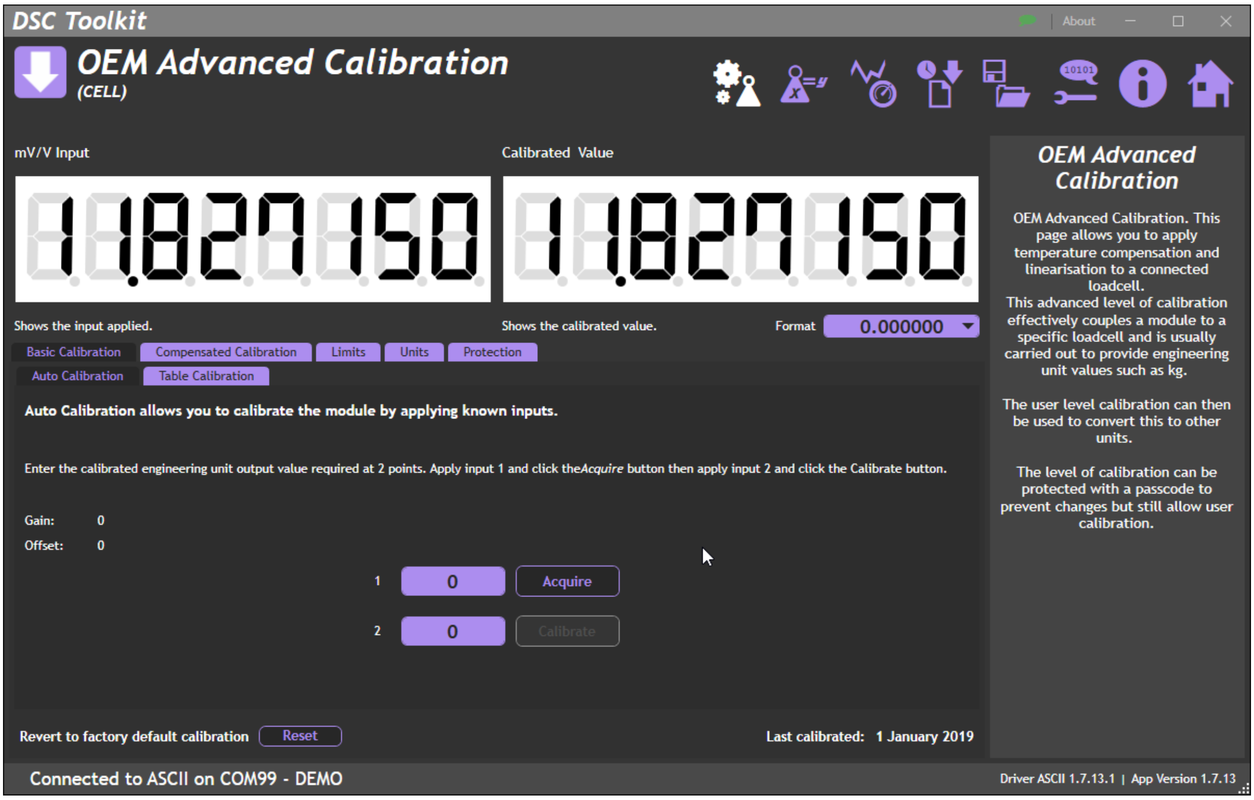
Item	Description
Advanced Calibration Access entry field	Enter the correct passcode
OK button	Confirm passcode
Cancel button	Cancel passcode entry and return to previous tab



Item	Description
mV/V input value	This is the mV/V input value before any calibration has been applied (MVV)
Calibrated Value value	This is the output value after end user calibration has been applied (CELL)
Format drop-down	Select the format of the Advanced (OEM) calibrated display

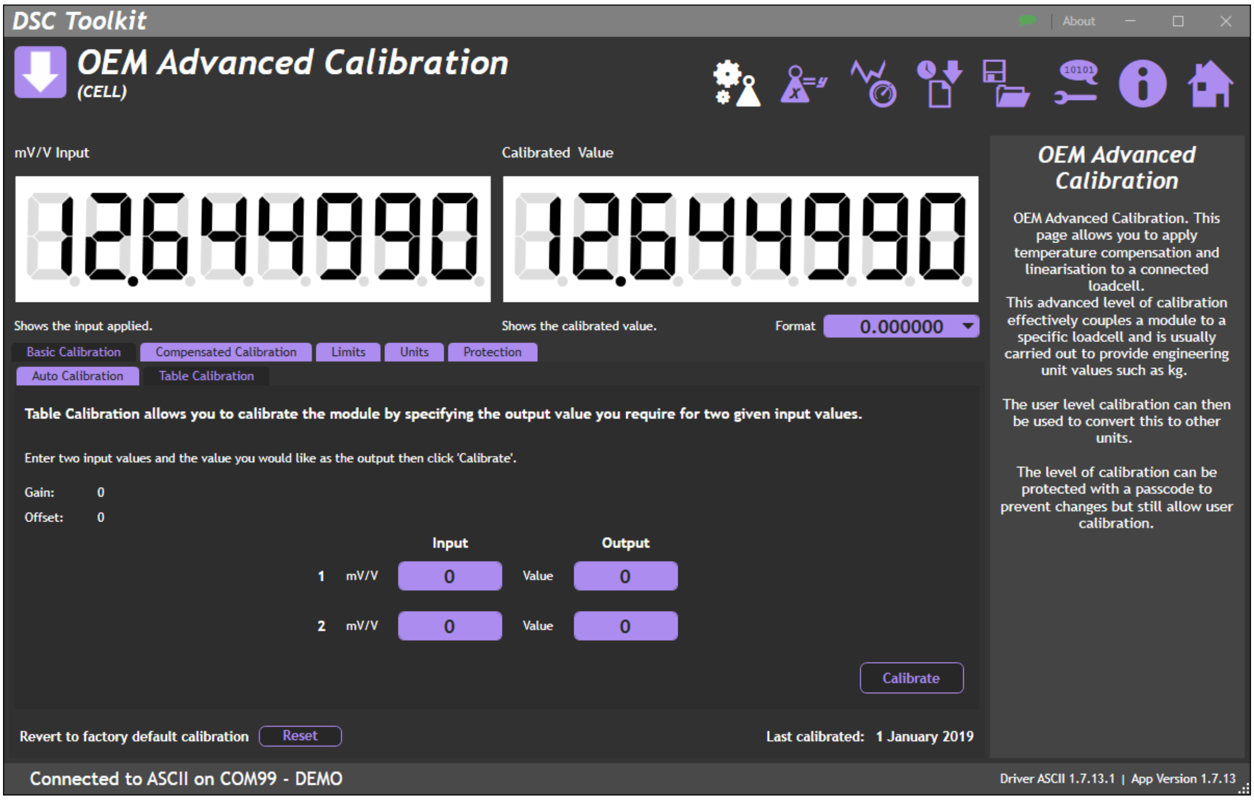
Basic Calibration

Auto Calibration



Two-point calibration using live/known loads

Item	Description
Gain information	Currently applied OEM gain
Offset information	Currently applied OEM offset
1 entry field	Enter 'low' output value required
2 entry field	Enter 'high' output value required
Acquire button	Apply 'low' load, allow to settle then click Acquire
Calibrate button	Apply 'high' load, allow to settle then click Calibrate (Not available until value 1 has been acquired)
Reset button	Clear any applied OEM calibration
Last calibrated information	Date that the last OEM calibration was applied



Calibrate using table information such as load cell manufacturer's calibration certificate.

Item	Description
Gain information	Currently applied OEM gain
Offset information	Currently applied OEM offset
1 Input entry field	Enter 'low' input value required in mV/V
2 Input entry field	Enter 'high' input value required in mV/V
1 Output entry field	Enter 'low' output value required
2 Output entry field	Enter 'high' output value required
Calibrate button	After entering the above values, click Calibrate to apply
Reset button	Clear any applied OEM calibration
Last calibrated information	Date that the last OEM calibration was applied

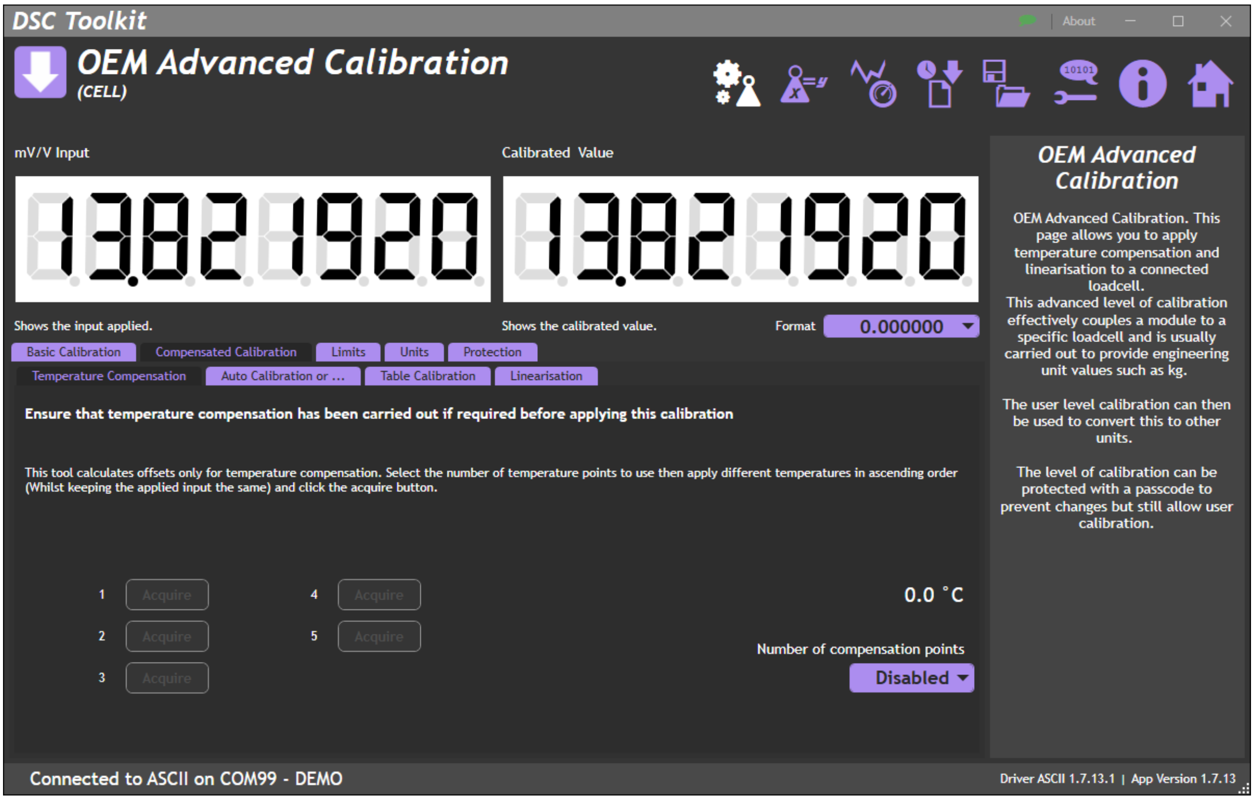
Compensated Calibration

Select this instead of Basic Calibration if you require temperature compensation or linearization.
To carry out compensated calibration, you **must** perform the different calibration sections in the following order.

1. Temperature Compensation (optional)
2. Auto Calibration must be completed OR complete the Table Calibration
3. Table Calibration must be completed if you did not use Auto Calibration.
4. Linearisation (optional)

If you go back and redo any of these tabs then you must also redo any later numbered tabs.
It is advisable that you click the Revert to factory default calibration button before you start a complete calibration sequence on an unknown module or one that has been calibrated before.

Temperature Compensation



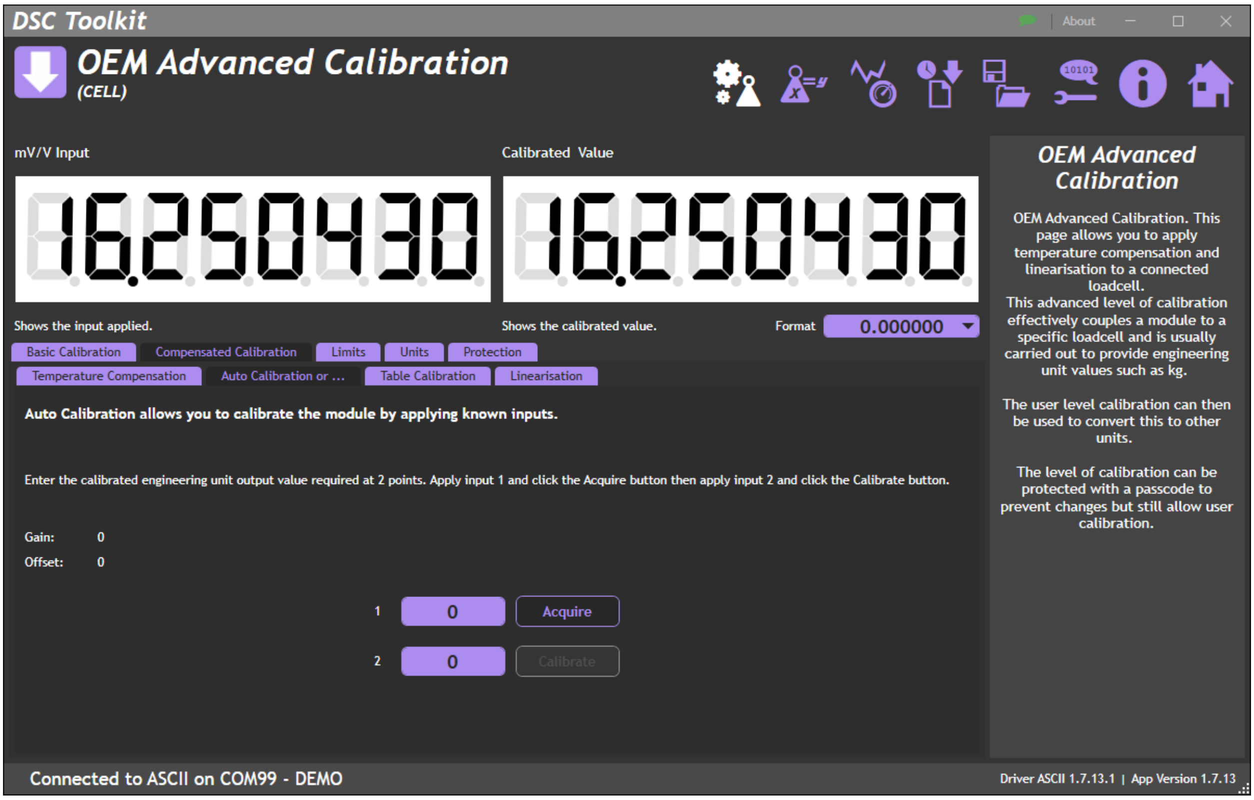
> **!** If Temperature Compensation is required, it should be applied before any other calibrations.

Temperature Compensation must be carried out with a constant load applied and a DTEMP suitably connected.

Item	Description
1 Acquire button	Apply the lowest temperature (allow settle time) and click Acquire
2 Acquire button	Apply the next temperature (allow settle time) and click Acquire (must be greater than the previous temperature)
3 Acquire button	Apply the next temperature (allow settle time) and click Acquire (must be greater than the previous temperature)
4 Acquire button	Apply the next temperature (allow settle time) and click Acquire (must be greater than the previous temperature)
5 Acquire button	Apply the next temperature (allow settle time) and click Acquire (must be greater than the previous temperature)

Temperature information	Current temperature as detected by the DTEMP
Number of compensation points drop-down	Disable temperature calibration or select the number of points required

Auto Calibration or…

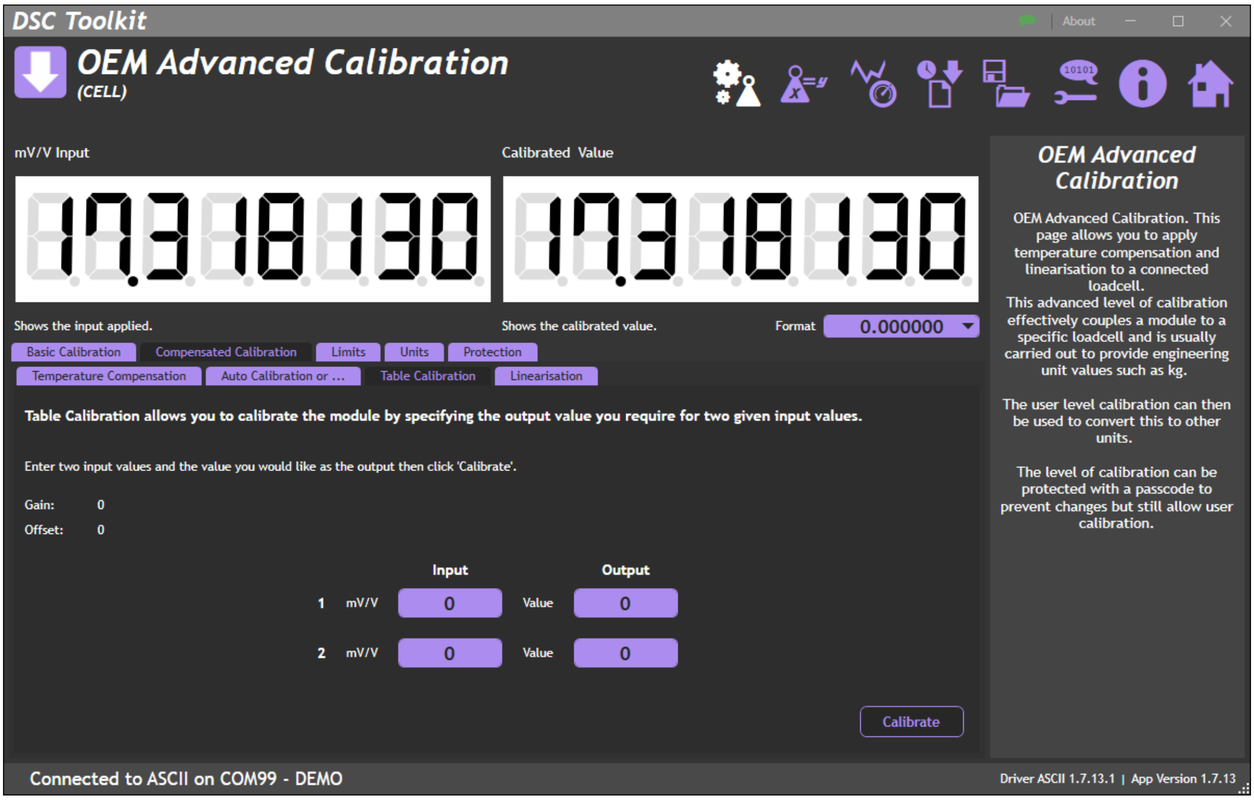


Two-point calibration using two live/known loads.

! You must do this or Table Calibration before Linearisation

Item	Description
Gain information	Currently applied OEM gain
Offset information	Currently applied OEM offset
1 entry field	Enter 'low' output value required
2 entry field	Enter 'high' output value required
Acquire button	Apply 'low' load, allow to settle then click Acquire
Calibrate button	Apply 'high' load, allow to settle then click Calibrate (Not available until value 1 has been acquired)

Table Calibration

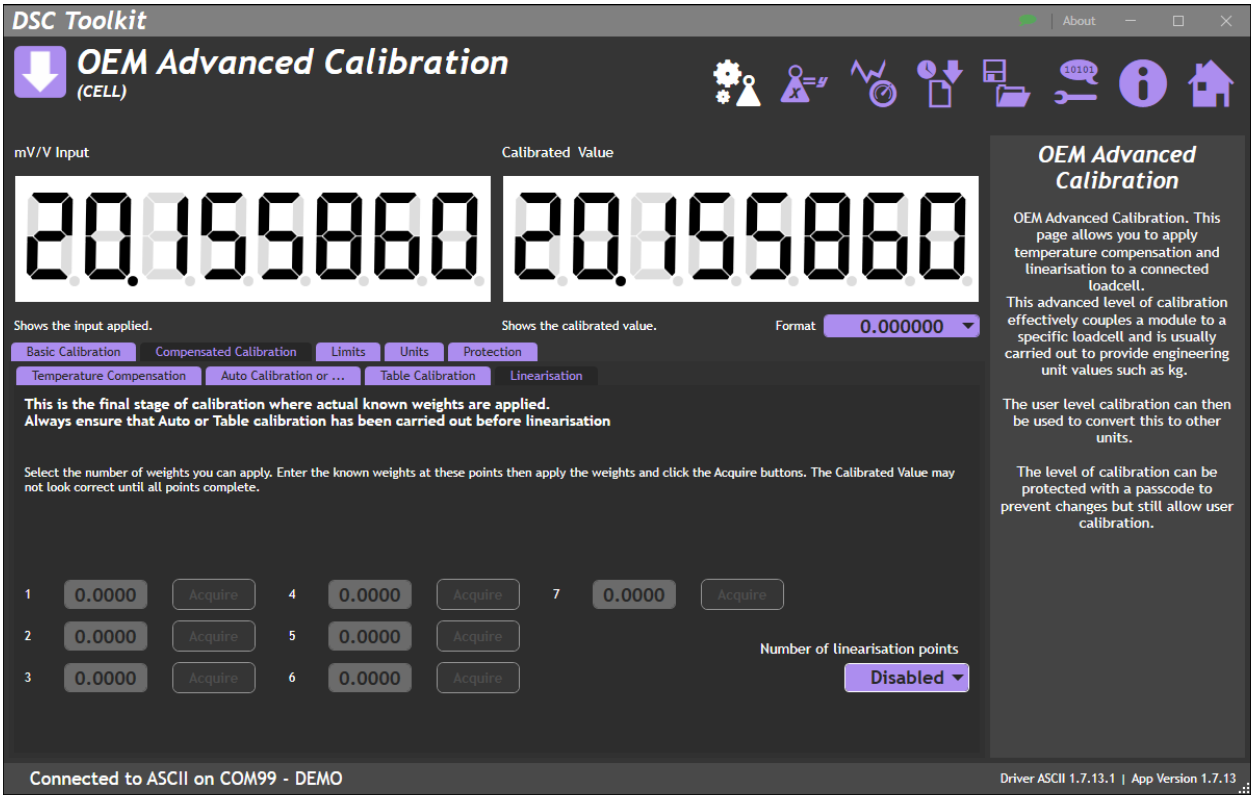


Calibrate using table information such as load cell manufacturer's calibration certificate.

! You must do this or Auto Calibration before Linearisation

Item	Description
Gain information	Currently applied OEM gain
Offset information	Currently applied OEM offset
1 Input entry field	Enter 'low' input value required in mV/V
2 Input entry field	Enter 'high' input value required in mV/V
1 Output entry field	Enter 'low' output value required
2 Output entry field	Enter 'high' output value required
Calibrate button	After entering the above values, click Calibrate to apply
Reset button	Clear any applied OEM calibration
Last calibrated information	Date that the last OEM calibration was applied

Linearisation



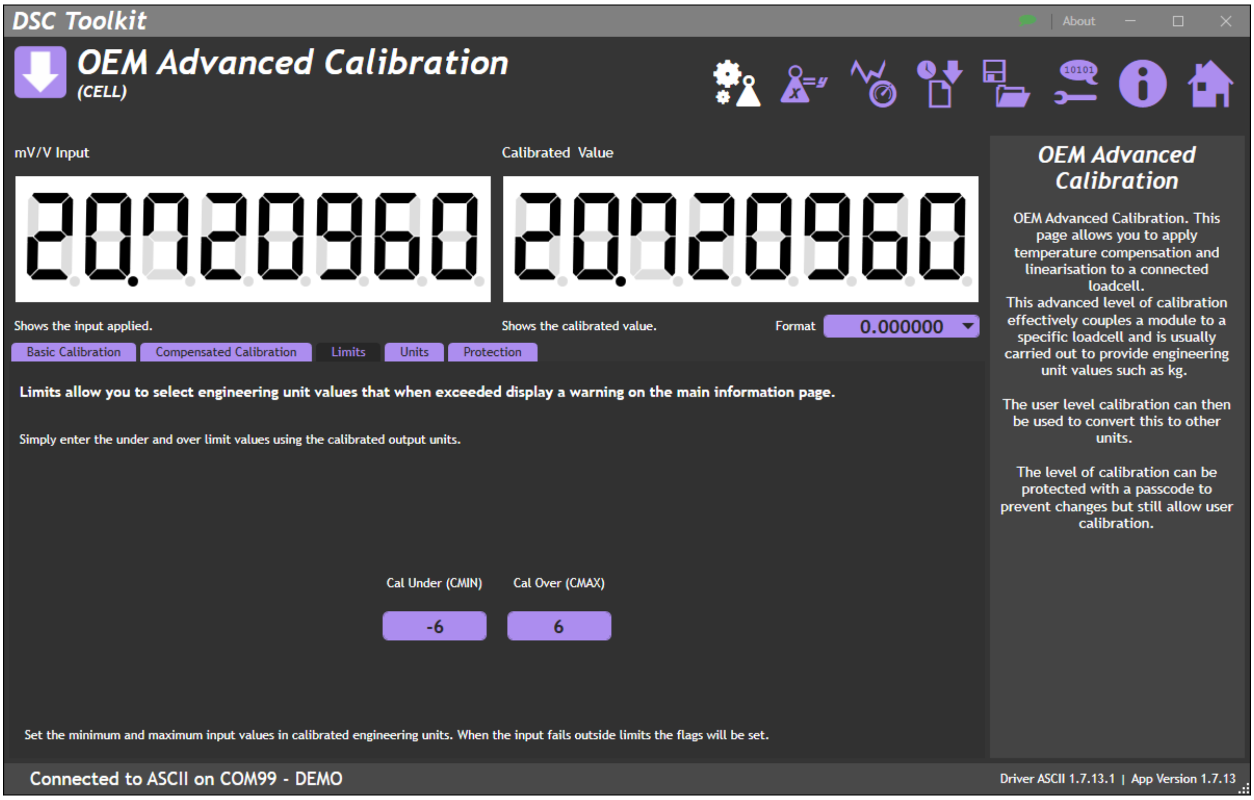
This page allows linearization with live loads. Up to seven linearization points can be used.

> **!** Auto or Table Calibration must be applied before Linearization.

Item	Description
1 entry field	Enter first output value required
1 Acquire button	Apply first load, allow to settle then click Acquire 1
2 entry field	Enter second output value required
2 Acquire button	Apply second load, allow to settle then click Acquire 2
3 entry field	Enter third output value required
3 Acquire button	Apply third load, allow to settle then click Acquire 3
4 entry field	Enter fourth output value required
4 Acquire button	Apply fourth load, allow to settle then click Acquire 4
5 entry field	Enter fifth output value required
5 Acquire button	Apply fifth load, allow to settle then click Acquire 5
6 entry field	Enter sixth output value required
6 Acquire button	Apply sixth load, allow to settle then click Acquire 6

7 entry field	Enter seventh output value required
7 Acquire button	Apply seventh load, allow to settle then click Acquire 7
Number of linearisation points drop-down	Disable linearisation or select the number of points required

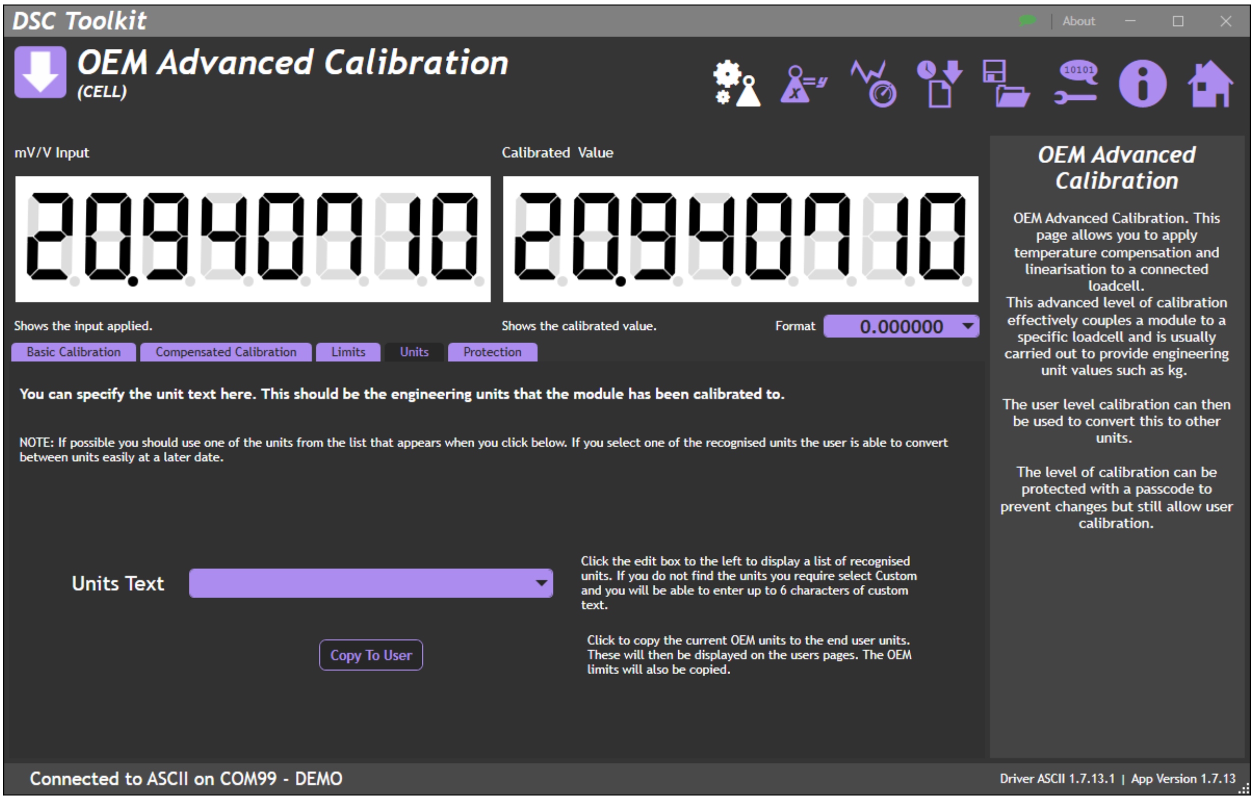
Limits



Set the upper and lower limits in the OEM calibrated units. If these are exceeded the CRAW over/under flags are set. These are visible on the Information page.

Item	Description
Cal Under (CMIN) entry field	Enter minimum limit. If the CRAW value is below this the CRAWUR flag will be set
Cal Over (CMAX) entry field	Enter maximum limit. If the CRAW value is above this the CRAWOR flag will be set

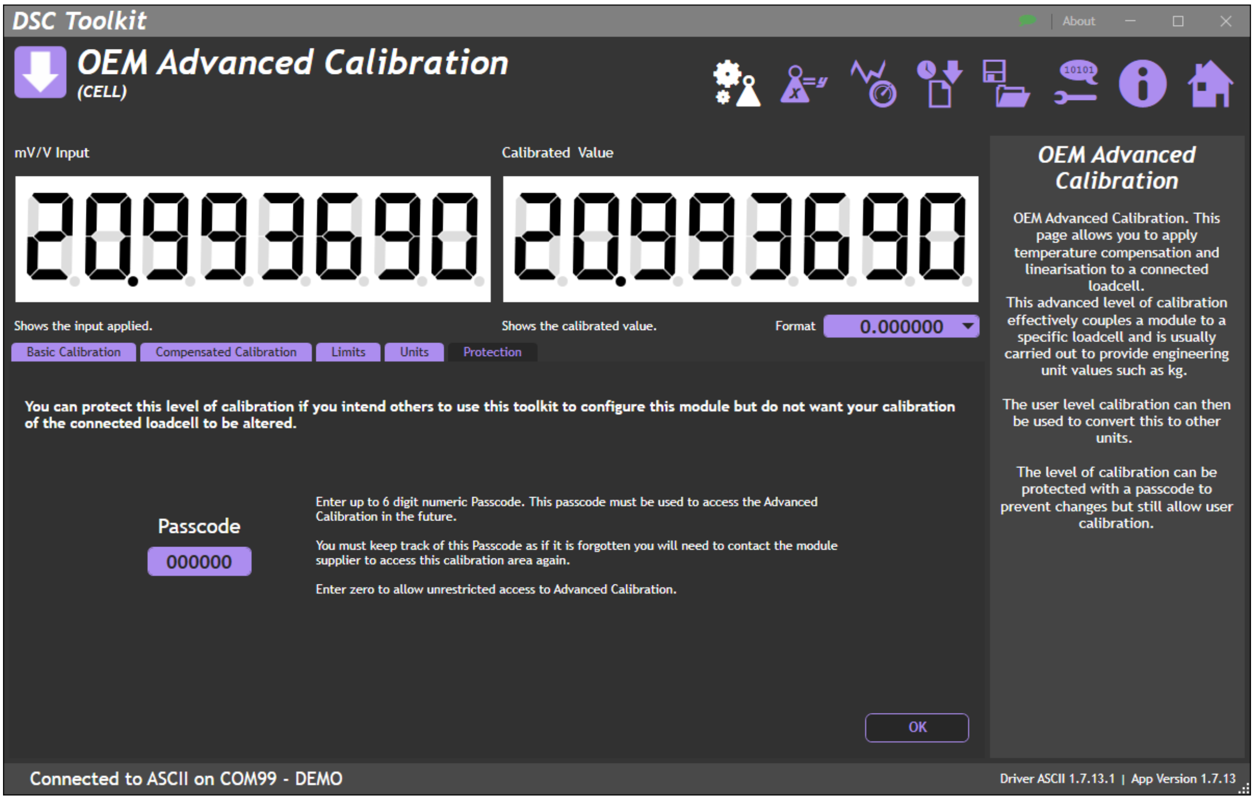
Units



This tab allows the setting of the calibrated units. You can manually enter anything here but, if you select units from the drop down, it will be possible to do simple unit conversion in the End User Calibration pages.

Item	Description
Units Text drop-down	Select from available units. If your required unit is not in the list, select custom to enter custom text.
Copy to User button	Copy the currently selected units to the End User Calibration

Protection



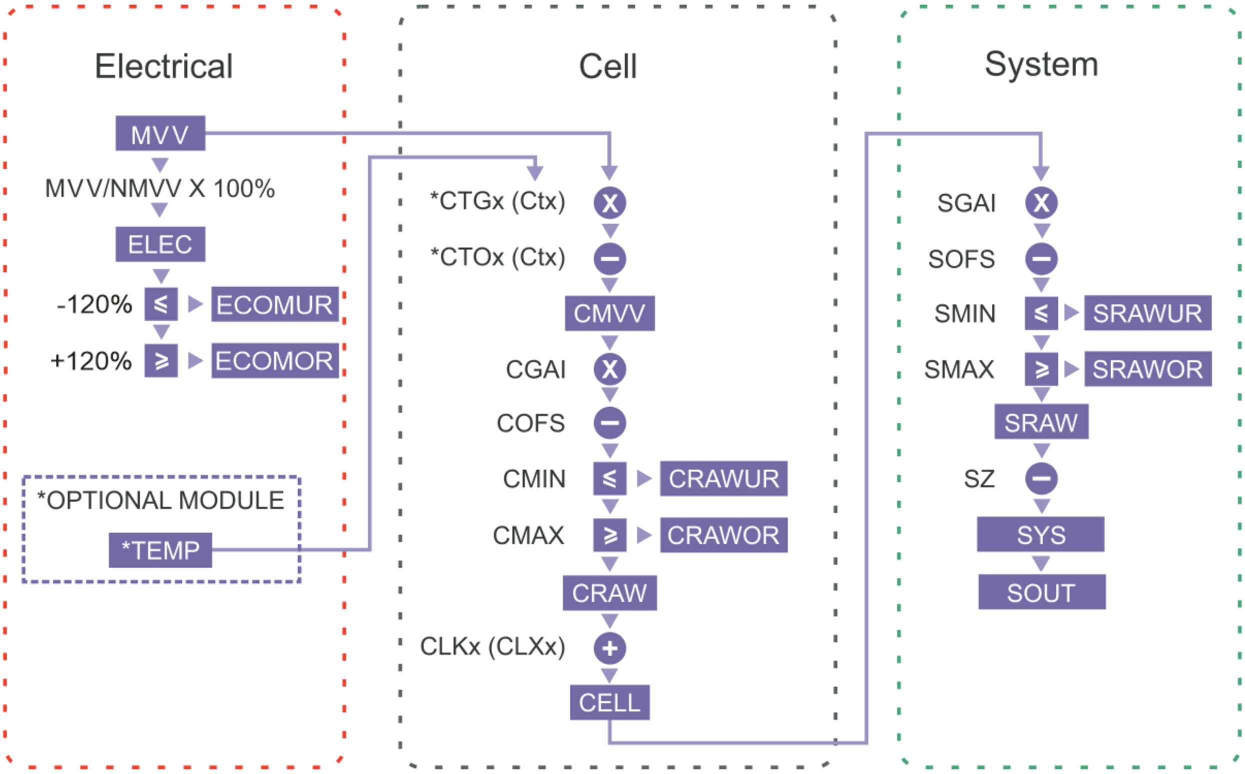
This tab allows the OEM to protect their calibration settings from accidental editing.

> ! Make sure that you remember your passcode!! You will have to contact your supplier to unlock without it which may involve a charge

Item	Description
Passcode entry field	Enter a passcode up to six digits. (enter zero to disable password protection)
OK button	Confirm the change of Passcode

Advanced Usage

The Measurement/Readings Process



To aid in the explanation of the measurement process, it may be helpful to think about it in three separate sections, Electrical, Cell and System. Electrical is the filtered input. Cell is designed to be used by the OEM integrator to apply temperature compensation, simple gain and offset and optional multipoint. System is the final stage where an alternate gain and offset can be applied (for instance for unit conversion) and a final system zero can be applied.
The underlying analogue to digital conversion rate is 4.8 kHz (RS232 and RS485) or 1627 Hz for CAN products. These results are block averaged to produce the output at the RATE. This then has the **dynamic filter** applied to it at the same rate and then follows through the flow as shown.
Full details of the parameters shown is in Appendix C.

Electrical

This is where the filtered electrical inputs come in. MVV from the load cell and TEMP if fitted. The ELEC value is included for backwards compatibility.
The ECOMUR and ECOMOR flags are triggered by the MVV being +/-120% of the NMVV.

Cell

This is where the first calibration is applied. First temperature compensation to give CMVV. Then gain and offset is applied to give CRAW and to set the CRAWUR and CRAWOR flags. Finally multipoint calibration can be applied to improve linearity.

System

Here another gain and offset can be applied, allowing an end user to tweak the output without messing up the CELL calibration. Finally, a system zero (SZ) can be applied.

Changing Sensitivity

The DSC/DLC products are all designed with nominal input sensitivity of +/-2.5 mV/V.
The absolute maximum bridge output that can be accommodated is +/-3 mV/V. It is possible to use bridges with a lower sensitivity (such as 1 mV/V) but the effective resolution will suffer as you will be only using a portion of the input range.
If a bridge of sensitivity greater than 3 mV/V must be used then the gain of the module will need to be decreased to stop the input from saturating.
For bridges with a sensitivity of less than 2 mV/V it may be possible to use software gain to achieve the required outcome. If not, it will be necessary to increase the gain of the module. It is likely that, even with the correct gain resistor, sensitivities below 0.5 mV/V will have too much noise relative to the signal.

> ! To maintain performance, an 0805 size surface mount resistor with 0.1%, 5 ppm/℃ should be used

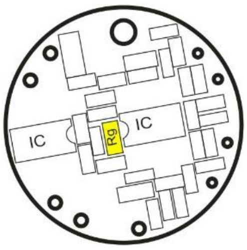
Instructions for changing/fitting a new gain resistor (R_g) are different depending on the module. Please see below.

The following effects should be noted:

1. Changing the resistors will alter the factory mV/V calibration. You will no longer be able to use any table calibration functions of the toolkit software and calibration will have to be redone after this change. For instance, if you changed to a nominal sensitivity of 10 mV/V the MVV value shown at 10 mV/V would be approximately 2.5 mV/V.
2. The purpose of increasing sensitivity is to reduce reading noise, which governs the effective resolution. Using software gain alone gives reduced performance.
3. The sensitivity should, however, not be set greater than typically 0.5 mV/V. Beyond this, input noise usually dominates and no extra benefit can be achieved.

DLC

Identifying the 'R_g' Resistor



The gain resistor on DLC devices should only be changed by a technician competent with surface mount components.
Rg is an 0805 surface mount resistor, highlighted above.

Change Sensitivity

To change sensitivity, the gain resistor (Rg) needs to be removed and a new one fitted. The value of the resistor fitted, in ohms, should be

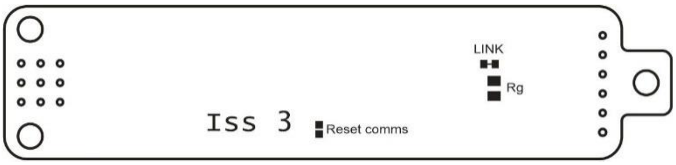
$$R_g = (required\ mV/V) \times 40$$

Example: For 10mV/V

$$R_g = 10 \times 40 = 400\ \Omega$$

DSC

Identifying the Gain Resistor position and the Link Track



Reduce Sensitivity

To accommodate a maximum sensor output larger than 2.5 mV/V, it is necessary to reduce the electrical sensitivity of the input circuitry.

To decrease sensitivity, the link should be cut to take the current gain resistor out of circuit, and the value of the resistor fitted, in Ω, should be –

$$R_g = (required\, mV/V) \times 40$$

Example: For 10mV/V

$$R_g = 10 \times 40 = 400\ \Omega$$

Increase Sensitivity

When the full-scale output from the bridge is smaller than 2.5 mV/V, it may be desired to increase sensitivity.

To increase sensitivity, the Link Track is left in place, so that the fitted R_g appears in parallel (this gives better temperature stability). Its value should then be-

$$R_g = \frac{1}{\left(\frac{0.025}{required\, mV/V} - 0.01\right)}$$

Specifications

DLC and DSC

Technical Specifications

All Variants

Set for 2.5 mV/V sensitivity.

Parameter	Min	Typical	Max	Units
Strain Gauge Excitation System	4 Wire			
Strain Gauge Excitation Voltage	4. 5	5	5.25	Vdc
Strain Gauge Drive Capability	320	-	5000	ohms
Strain Gauge Sensitivity	-3	2.5	3	mV/V
Factory mV/V calibration		0.05		%FS
Electrical				
Power Supply voltage	5.6	12	18	Vdc
Power Supply ripple			100	mV ac pk-pk
Power Supply current (350R Bridge) (1)		45	60	mA
Power @ 10 V (350R Bridge)		450		mW
Open collector digital output at 30 V			100	mA
Environmental				
Operating temperature range	-40		+85	°C
Storage temperature	-40		+85	°C
Humidity	0		95	%RH
PCB Dimensions DSC	87.4 x 20 x 8.5 mm			
PCB Dimensions DCell	Diameter 20 mm, Height 5.3 mm (CAN version 10 mm height)			

Notes.

1. RS232 output uses approx. 10 mA extra

High Stability

Parameter	Min	Typical	Max	Units
Offset Temperature Stability		1	4	ppm/°C
Gain Temperature Stability		3	5	ppm/°C
Offset Stability with Time (1)		20	80	ppm of FR
Gain Stability with Time (2)			30	ppm of FR
Non Linearity before Linearization		5	25	ppm of FR
Resolution				
Internal Resolution		16 Million		Counts/divs
Resolution @ 1 Hz readings (Noise stable) over 100s		200 000		Counts/divs
Resolution @ 10 Hz readings (Noise stable) over 100s		120 000		Counts/divs
Resolution @ 100 Hz readings (Noise stable) over 100s		50 000		Counts/divs
Resolution @ 500 Hz readings (Noise stable) over 100s (3)		18 000		Counts/divs
Signal Filter	Dynamic recursive type user programmable			

Notes.

1. From original offset at any time
2. 1st Year
3. Max rate for CAN is 200 Hz

Industrial Stability

Parameter	Min	Typical	Max	Units
Offset Temperature Stability		5	10	ppm/°C
Gain Temperature Stability		30	50	ppm/°C
Offset Stability with Time (1)		35	160	ppm of FR
Gain Stability with Time (2)			300	ppm of FR
Non Linearity before Linearization		5	25	ppm of FR
Internal Resolution		16 Million		Counts/divs
Resolution @ 1 Hz readings (Noise stable) over 100s		66 000		Counts/divs
Resolution @ 10 Hz readings (Noise stable) over 100s		40 000		Counts/divs
Resolution @ 100 Hz readings (Noise stable) over 100s		10 000		Counts/divs
Resolution @ 500 Hz readings (Noise stable) over 100s (3)		5000		Counts/divs
Signal Filter	Dynamic recursive type user programmable			

Notes.

1. From original offset at any time
2. 1st Year
3. Max rate for CAN is 200 Hz

RS232/RS485

Parameter	Min	Typical	Max	Units
Output Data terminal	RS485 (DSC offers RS232)			
Data transmission rate	2400	-	460 800	bps
RS485 Output cable length (1)			1000	m
RS232 Output cable length (1)			20	m

Notes.

1. Dependant on cable type and data transmission rate

CAN

Parameter	Min	Typical	Max	Units
Output Data terminal	CAN 2.0A and 2.0B 11/29 bit identifiers			
Data transmission rate	20K	-	1M	bps
Output cable length (1)			1000	m

Notes.

1. Dependant on cable type and data transmission rate

Appendices

Appendix A - Communication Interface

RS232

RS232 is used for one-to-one connection. It has separate transmit (TX) and receive (RX) lines. Each wire is permanently driven by the sending end and there are no transmit enable/disable controls.
Effectively the connection is three-wire as the TX and RX share a common ground potential. This is also shared with the V-.
The RS232 standard specifies operation of over lengths of 15 m or less, independent of baud rate.

RS485

RS485 is a two-wire, half duplex bus. Ideally these should be twisted, shielded pair cable.
There is no defined ground connection. All attached devices load the A and B lines to normally pull the grounds of floating devices to within a few volts of each other. The common mode tolerance (approx. +/-7 V) then allows communications without further grounding provision.

CAN

CAN bus (Controller Area Network) is a widely used communication protocol for transmitting data between electronic devices in vehicles and industrial systems. It supports multi-master serial bus architecture and uses differential signalling for robustness against noise. Messages consist of an identifier and payload, with arbitration resolving conflicts. CAN bus supports different bit rates, incorporates error detection and correction, and finds applications in automotive and industrial domains. It enables reliable and efficient data exchange among system components.

Appendix B - Communication Protocol

ASCII

The ASCII protocol uses only printable characters and carriage-return ('<CR>'), which allows a "dumb" terminal device or a PC programme like Hyper-Terminal to interrogate the device.

Host Command Message Format

The command required to write 123.456 to parameter SGAI on station 1 is made up as follows:

Framing Character	**Station Address**	**Separator**	**Command Identifier**	**Access Code** (read/write only)	**Data** (write only)	**End of frame**
!	001	:	SGAI	=	123.456	<CR>

Where

- **Framing Character**
  A "!" character is used to signal the start of a new message. This character is only ever transmitted by the host, for framing purposes
- **Station Address**
  A three-digit ASCII decimal number (0-999), determining which slave device(s) the command is intended for. All three digits must be sent.
  Address 000 is reserved for broadcast addressing.
- **Separator**
  This is always present. As no checksum or message verification technique is used, slaves use this as an extra check on message validity
- **Command Identifier**
  Up to 4 alpha-numeric characters, case insensitive, giving the name of the required command.
- **Access Code** (read/write only)
  Defines what sort of response is expected :–
  '**=**' means write data is expected to follow
  '**?**' means the host is expecting to receive read data back
- **Data**
  An ASCII decimal-formatted number, can include 0..9, '+','–', '**.**' and spaces.
  This field can have a maximum length of 15 characters
- **End of frame**
  <CR> always present to indicate the end of the message

The above command would be sent as follows

```
!001:SGAI=123.456<CR>
```

Summary

- A command message begins with '**!**', followed by a three-digit station address, then a '**:**', and finishes with a <CR>.
- The '**!**' and <CR> *only* appear at the beginning and end of commands respectively
- From the '**:**' to the final <CR> is the command 'instruction' (of read, write or execute type)
- All instructions begin with an alphanumeric command identifier of up to 4 characters (see commands list below), and end with a non-alphanumeric (which may be the final <CR>).

Slave Response Message Formats

Each slave monitors the bus for command messages. It responds to any message that is addressed to it by sending a response message.
To be accepted by a slave device, a message must start with '**!**', the correct three-digit slave address and '**:**', and end with <CR>, with no intervening extra '!'.
The slave will then *always* respond.

Response types

ACK

This is a single <CR> character. This confirms an execute or write command.

Examples

1. Write Command
If the device accepts the command, then a <CR> is transmitted. There is no error checking on the data received by the device.
EG
A command to set the BAUD parameter to three on station 1 could look like this–

```
!001:BAUD=3<CR>
```

If a device with STN=1 is present, it will respond with–

```
<CR>
```

2. Action Command
If the device accepts the command, then a <CR> is transmitted.
EG
A command to reset device 14 would look like –

```
!014:RST<CR>
```

If a device with STN=14 is present, it will respond with–

```
<CR>
```

3. Broadcast Commands
If the station address in a command message is "000", this means a broadcast command.
All slaves act as normal on a broadcast command, but do not respond.
EG
A command to all devices on the bus to sample their inputs would look like this–

```
!000:SNAP<CR>
```

there is no response.

ACK-with-data

This is a decimal number, followed by <CR>. This confirms a read and returns the data value.

Example

Read Command
Returns the requested value specified by the command.
The returned value is formatted according to the DP and DPB values: The response consists of a sign character (±), DPB decimal digits before a decimal point, DP digits after the point and a terminating <CR>:
The length of the response is thus fixed at DP+DPB+3 characters.
EG
A command to read the SOUT output could look like this –

```
!001:SOUT?<CR>
```

if the value=32.1, and format settings are DP=3 and DPB=5, the response string will be –

```
+00032.100<CR>
```

NAK

This is an '?' <CR> sequence. The device rejected the command.
There Are Several Possible Reasons For A NAK Response

- Command identifier not recognised
- Badly formatted command: Missing command identifier, unrecognised access-code character, or unexpected character somewhere else
- Access attempted not supported by this command.

Example

Bad Commands

If any command is not understood by the device then a "?" is transmitted followed by a <CR>.

EG

An unrecognised command, correctly addressed to station 173–

```
        !173:XYWR?<CR>
```

produces the general error response–

```
        ?<CR>
```

NOTES

- From receipt of the host's terminating <CR> to a response from the device (if any) will be at most 50mS. After this, it can be assumed there is no response.
- There is no value-checking: a slave cannot NAK a command because a write data value is 'unsuitable' in some way, only if write access itself is disallowed.
- There is no checksum. If corruption of the data occurs, there is no way of telling.

Continuous Output Stream (ASCII ONLY)

For the ASCII protocol only, there is a 'continuous output' mode controlled by setting the station number to 998 (stream from power up) or 999 (stream on request).
The SOUT value is continually broadcast at the output rate. The maximum output rate is 300Hz with minimum baud rate of 115200.
The output is switched on and off by sending the standard ASCII 'XON/XOFF' control bytes (ctrl-Q = 0x11 and ctrl-S = 0x13).
This feature is intended for output to a single, simple serial display device or printer.

It has certain special limitations as follows:

- It can only be used in one-to-one operation, i.e. only one unit on a bus otherwise collisions will occur.
- On a RS485 bus it is not always easy to switch off, as the stop instruction must be transmitted when the device itself is not transmitting: If the output rate is limited by communications speed, then output is virtually continuous and may be impossible to stop.
  (N.B. this does not apply to RS232, which has separate transmit and receive connections)
- The operation does not start automatically, i.e. an initial Ctrl-Q must be sent. This means that if there is (for instance) a brief power interruption, output will stop.

Mantrabus II

Mantrabus-II is a two-wire system where data is transmitted & received over a common pair of wires. For this reason the framing character must not be sent in a reply from the responding DSC/DLC.
The protocol ensures this does not occur by splitting byte data into nibbles with the exception of the framing character & station number.

Message Format

Framing Character

The framing character for Mantrabus-II is **FEh**, (this being different from the older Mantrabus-I **FFh** to allow the two protocols to be mixed on one bus).

Checksum

Both Host & Device send their XOR checksum of all data sent, excluding framing character, in nibble format the MS nibble being first.
eg. XOR Checksum of data is A7h. Checksum characters sent = 0Ah, 07h

Data Transfer

Data is both sent and received as 4 bytes split into 8 nibbles following the station number, plus two nibbles of checksum.

Floating-Point Data Format

All data sent & received in Mantrabus-II is in the IEEE floating-point format, this being a 4-byte floating-point number. The byte containing the sign & exponent is sent first, with the LS byte of the mantissa being last.
The Memory Layout Of The 4-Byte Floating-Point Numbers Is:

MSB	31	**Sign** bit ,	1=negate
	30-23	**Exponent**,	7-bit excess-127
LSB	22-0	**Mantissa**,	23-bit fraction with implicit 1

The value of the number is thus
{ $(-1)^{Sign} * 2^{(Exponent-127)} * 1.Mantissa$ },
Note the 'assumed 1' before the mantissa. The exception to this is the special value 0.0, which is represented as 4 zeroes.
eg. a floating-point number of -12345.678 is represented as – [hex] C6, 40, E6, B6
This is transmitted in nibble format as – [hex] 0C, 06, 04, 00, 0E, 06, 0B, 06.

End of Data Identifier

As the protocol has no fixed length or length identifiers the **last** nibble of **data** sent to the device has its **MS nibble set**. This indicates to the device that all data has been received & the next two bytes will be checksum data.

ACK & NAK

Mantrabus-II supports ACK & NAK, sending ACK (06h) at the end of a successful operation, and NAK (15h) for an unknown command or failed operation. These are always preceded by the station number (see examples below).
N.B. Mantrabus-II will ***not*** transmit a NAK for invalid checksum data, but instead remains silent. (This is different from the behaviour of the older Mantrabus-I).

Writing to Variables

Station number and command number are followed by 8 bytes of nibble data (the last having its MS bit set), followed by the two checksum nibbles.

eg. To write the value 100.0 (Floating point 100.0 = 42h, C8h, 00h, 00h) to variable CGAI **(command number 40) at station 20, send the following**

Framing Character	**Station Address**	**Command**	**Data**			**(note MS bit of last data byte is set)**	**XOR Checksum**
FEh	14h	28h	04h, 02h	0Ch, 08h	00h,00h	00h, 80h	0Bh, 0Eh

the response is then –

14h, 06h **i.e. 'station number', 'ACK'.**

Reading of Variables

To read an individual variable, the command number is sent with the MS bit set (i.e. no data following).

eg. To read *CGAI* **(command number 40) from station number 20, send the following –**

Framing Character	**Station Address**	**Command (note MS bit of last byte is set)**	**Data**				**XOR Checksum**
FEh	14h	A8h					0Bh, 0Ch

Assuming the value was -12345.678 (coded as C640E6B6h, representing -1 * 2^{13}* 12345.678 / 8192), the response will be –

Framing Character	**Station Address**	**Command**	**Data**			**(note MS bit of last byte is set)**	**XOR Checksum**
FEh	14h		0Ch,06h	04h,00h	0Eh,06h	0Bh,86h	09h, 0Fh

Action Commands

These are transmitted like read commands, i.e. no data sent. The response is as for write commands.

eg. To reset station three (command 100), send the following.–

Framing Character	**Station Address**	**Command (note MS bit of last byte is set)**	**Data**				**XOR Checksum**
FEh	03h	E4h					0Eh, 07h

The response is then –

03h, 06h **i.e. 'station number', 'ACK'.**

Modbus RTU

The MODBUS-RTU Protocol

MODBUS is a proprietary standard of Modicom Inc.
The full specification is quite complex, including a timeout-based framing strategy and polynomial CRC calculation, so full details are not given here. Refer to Modicom documentation. Knowledge of the MODBUS protocol is therefore required.

The MODBUS protocol is a partial implementation of the "RTU" (binary) form of the MODBUS standard, sufficient to allow DSC/DLC units to coexist on a serial bus with other MODBUS-compliant devices.
NOTE:
Third-party applications for MODBUS communications are readily available (e.g. ModScan from Win-Tech software, www.win-tech.com, who offer a free trial version).

Modbus Messages

All messages and responses are formatted and check summed according to the normal RTU rules.
The slave number is the device station number: Slave '0' may also be used for broadcast writes.

The device command-set is mapped into the MODBUS 'Output' or 'Holding Registers' –

Parameters (read or write) are mapped onto a pair of registers containing a 4-byte floating-point value

Action Commands are implemented as dummy parameters: Writing activates the command and reading returns a dummy value (with no action)

Only Two Valid Message Function Codes Are Supported

Function 03	'Read Holding Registers'	- to read a register-pair
Function 16	'Preset Multiple Registers'	- to write a register-pair

The start address must always be a valid parameter address, which is always an odd number (see the following).

The ***only*** permitted data length is two registers, i.e. 4 bytes.
Registers ***cannot*** be read or written singularly, in larger groups or using other addresses (i.e. even-numbered registers cannot be addressed directly).

Parameter Addresses

All MODBUS parameter addresses are derived from the equivalent MANTRABUS register number by a simple "times 2 plus 1" calculation.
For example, the 'FLAG' parameter is Mantrabus register#14, so this occupies MODBUS holding registers 29 and 30 (because 2×14+1 = 29).

See the command list below for the starting register numbers.

Parameter Values

All exchanged values (read and write parameters) are in the standard IEEE 4-byte floating-point format:
The 32 Bits Of The Number Are Distributed As Follows

MSB	31	**Sign** bit ,	1=negate
	30-23	**Exponent**,	7-bit excess-127
LSB	22-0	**Mantissa**,	23-bit fraction with implicit 1

The value of the number is thus
$\{ (-1)^{Sign} * 2^{(Exponent-127)} * 1.Mantissa \}$,

Note the 'assumed 1' before the mantissa. The exception to this is the special value 0.0, which is represented as 4 zeroes.

eg. a floating point number of -12345.678 is represented as – [hex] C6 40 E6 B6

These 32 bits are mapped onto a register pair in the following way: The lower register holds bits 15-0 and the upper register bits 31-16.

These values are coded according to normal Modbus conventions, so the actual byte sequence in a read/write message is thus –

$R1_{hi}$, $R1_{lo}$, $R2_{hi}$, $R2_{lo}$

– Which in terms of bits is–

15:8, 7:0, 31:24, 23:16

Error Codes

Only Three Modbus Error Codes Are Supported, Which Are Used As Follows

01 'Illegal Function' request for function other than 3/16

02 'Illegal Data Address' attempt to read an unsupported register address

03 'Illegal Data Value' attempt to write a read-only parameter, or message too long for buffer (valid messages have a known maximum length)

Write Command Example

Write value 1.23 (represents as hex 3F9D70A4) to registers 57,58 on station#4

by sending

[hex]	04	station address
	10	function code
	00 38	start-reg hi, lo (NB 38h=56 addresses register 57)
	00 02	quantity = 2 registers
	04	byte-count = 4
	70 A4	first=lower register (17) value = hi, lo
	3F 9D	second=upper register (18) value = hi, lo
	6B AB	checksum = hi, lo

A Correct Response Would Then Be

[hex]	04	station address
	10	info copied from command ...
	00 38	
	00 02	
	C0 50	checksum = hi, lo

Read Command Example

Read a value from registers 13,14 on station#52

by sending –

[hex]	34	station address
	03	function code
	00 0C	start-reg hi, lo (NB 0Ch=12 addresses register 13)
	00 02	quantity = 2 registers
	01 AD	checksum = hi, lo

A Correct Response, With A Value -55.2317 (Hex C25CED51) Would Then Be

[hex]	34	station response
	03	function
	04	byte-count
	ED 51 C2 5C	data
	AA D4	checksum = hi, lo

Execute Command Example

Execute command 101 on station#17
by sending –

[hex]	11	station address
	10	function code
	00 64	start-addr (NB 64h=100 addresses register 101)
	00 02	quantity = 2 registers
	04	byte-count
	00 00 00 00	data (value irrelevant)
	A0 B4	checksum = hi, lo

The Acknowledge Response Is Then

[hex]	11	station response
	10	info copied from command ...
	00 64	
	00 02	
	02 87	checksum = hi, lo

MantraCAN

MantraCAN is Mantracourt's proprietary CAN protocol. It allows customizable streaming of data that can exist on most CAN networks (eg CANopen or J1939).
However, the only interaction the DSC/DLC will have with these CAN networks is via customizable start and stop streaming messages. It will not be possible to read or write any parameters or action commands with a non MantraCAN network. Therefore all setup should be carried out with the toolkit as detailed above.

MantraCAN Communication Protocol

This chapter gives details of communication protocols and bus connections.
Each device has a singe base ID to enable configuration and is factory set to 1. All data sent to the device is sent to this ID. All data returned from the device is on the base ID + 1.
The ID can be changed via standard parameters.
Communications defaults are 500K bit rate with 11 bit identifier (CAN 2.0a)

Basic Command Structure

To read, write and issue commands the following format is used:

CAN ID	CAN Data		
	Descriptor	**Command Number**	**Data**
11 or 29 bit	1 Byte	1 Byte	4 Bytes

ID

The ID of the device. set by **NODEIDL** and **NODEIDH**. The size of the ID is set by **IDSIZE**

Descriptor

The Descriptor is used to indicate the type of message, a message can be one of the following types:-

- Write which writes a new value into a parameter, Write is also used to perform an action command such as **RST**, in which case no data is sent.
- Read is used to read back the value of a parameter.
- Response is always sent by the slave on receipt of a valid message. The response always returns the command number byte sent by the master.
- A NAK is sent if the Command index is not recognised or if the data sent is invalid.

Type	Descriptor Value
Read	1
Write	2
Response	6
NAK	21

Command Number

Refer to the table below for command numbers.

Data

Data is **ALWAYS** in the format of a floating point number to the IEEE 854-1987 standard. When requesting parameter values do not use data. Also do not use data when issuing a command.

Read

To **read a parameter** send message to appropriate ID with a Request descriptor, data will be ignored so can optionally be left off.

CAN ID	CAN Data	
Base ID	**Descriptor**	**Command Number**
11 or 29 bit	Read (01)	1 Byte

Then wait a timeout period for a message of the Base ID+1 marked as either **Response** or **NAK** descriptor. If a response descriptor is received then the result will be in the data part. The Command number in the reply will match the transmitted Command number.

Successful response from slave

CAN ID	CAN Data		
Base ID + 1	**Descriptor**	**Command Number**	**Data**
11 or 29 bit	Response (06)	1 Byte	4 Bytes

Not acknowledged response from slave

CAN ID	CAN Data	
ID + 1	**Descriptor**	**Command Number**
11 or 29 bit	NAK (21)	1 Byte

The reason for a NAK response would be if the command number does not exist in the device.

Example of Read

The following example is to read SYS from an ID of 100.

Message from master

CAN ID	CAN Data		
Base ID	**Descriptor**	**Command Number**	
0x64	01h	0Ah	Hexadecimal
100	1	10	Decimal

Successful response from slave. The value returned is 123.456

CAN ID	CAN Data			
Base ID + 1	**Descriptor**	**Command Number**	**Data**	
0x65	06h	0Ah	3Fh, 80h, 00h, 00h	Hexadecimal
101	6	10	63, 128, 0, 0	Decimal

Not acknowledged response from slave. For example if the device did not support command number 10

CAN ID	CAN Data		
Base ID + 1	**Descriptor**	**Command Number**	
0x65	15h	0Ah	Hexadecimal
101	21	10	Decimal

Write

To **write a parameter** send message to appropriate ID with a Write descriptor and IEEE floating point data.

Message From master

CAN ID	CAN Data		
Base ID	**Descriptor**	**Command Index**	**Data**
11 or 29 bit	Write (02)	1 Byte	4 Bytes

Then wait a timeout period for a message of the same ID marked as either Response or NAK descriptor. If a response descriptor is returned then this acknowledges receipt but does not contain data.

Successful response from slave.

CAN ID	CAN Data	
Base ID + 1	Descriptor	Command Index
11 or 29 bit	Response (06)	1 Byte

Not acknowledged response from slave.

CAN ID	CAN Data	
Base ID + 1	Descriptor	Command Index
11 or 29 bit	NAK (21)	1 Byte

Example of Write

The following example is to write ID 100 the value –100.0 to SZ.

Message from master

CAN ID	CAN Data			
Base ID + 1	Descriptor	Command Number	Data	
0x64	02h	16h	C2h, C8h, 00h, 00h	Hexadecimal
100	2	22	194, 200, 0, 0	Decimal

Successful response from slave.

CAN ID	CAN Data		
Base ID	Descriptor	Command Number	
0x65	06h	16h	Hexadecimal
101	6	22	Decimal

Not acknowledged response from slave. For example if the data was out of range

CAN ID	CAN Data		
Base ID + 1	Descriptor	Command Number	
0x65	15h	0Ah	Hexadecimal
101	21	10	Decimal

Execute a Command

To **execute command** send message to appropriate ID with a Write descriptor and no data.

Message from master

CAN ID	CAN Data	
Base ID	Descriptor	Command Index
11 or 29 bit	Write (02)	1 Byte

Then wait a timeout period for a message of the same ID marked as either Response or NAK descriptor.
If a response then this acknowledges receipt and does not contain data.

Successful response from slave.

CAN ID	CAN Data	
Base ID + 1	Descriptor	Command Index
11 or 29 bit	Response (06)	1 Byte

Not acknowledged response from slave.

CAN ID	CAN Data	
Base ID + 1	Descriptor	Command Index
11 or 29 bit	NAK (21)	1 Byte

Example of execute a command

The following example is to execute **RST** command to ID 100.

Message from master

CAN ID	CAN Data		
Base ID	**Descriptor**	**Command Number**	
0x64	02h	64h	Hexadecimal
100	2	100	Decimal

Successful response from slave.

CAN ID	CAN Data		
Base ID	**Descriptor**	**Command Number**	
0x65	06h	64h	Hexadecimal
101	6	100	Decimal

Not acknowledged response from slave. For example, if the device did not support command number 100

CAN ID	CAN Data		
Base ID + 1	**Descriptor**	**Command Number**	
0x65	15h	64h	Hexadecimal
101	21	100	Decimal

Data Type Conversions and Rounding

Type Conversion

Depending on the protocol, an integer/byte parameter may need to be converted to or from a floating-point representation for reading or writing.

The rules are as follows
For reading, integer and byte parameters are treated as unsigned, and never read negative
- i.e. read value ranges are 0 to 65535.0 and 0 to 255.0
For writing, values written to integer and byte parameters are truncated to the nearest integer, and negative or positive values are acceptable
NOTE: Floating-point data is not always exact, even when reading integral data

E.G. could get 3.999974 instead of 4
E.G. for a byte write 240, 240.1 and 239.66 are all the same value

Rounding
Although rounding is applied when writing to integral values, data read from a device is ***not*** rounded off.

CANopen®

CANopen® Features Support Summary

Device Profile	Manufacturer defined (type 0)
NMT support	Slave device
Boot up	Minimum boot up device
COB ID Distribution	by SDO (no DBT support)
Node ID Distribution	by SDO (no LMT support)
PDO's	4tx, 0rx
SDO's	1
PDO modes	Sync, Async, Cyclic, Acyclic
Variable PDO mapping	Y Maximum 2 objects / PDO
Emergency Message	Y
Life Guarding	N
Heartbeat Producer	Y

Additional Notes:
Changes to NodeID, CANbus Bit Rate and PDO communication Parameters will require the device to be power cycled.

Object Dictionary Summary

DSC/DLC internal data values are mapped into the object dictionary in three distinct areas :–

1. The main output values are mapped into the 'Device Profile' area, at 6000h onward
2. Special control parameters, specific to the CANopen® version, are at 2000h onward
3. The DCell, DSC internal Configuration parameters are mapped at 5000h onward

Object index	Sub-index	Type	Access	Description	[Default]
1000 –1FFF	–	–	–	Standard communications area	–
2000	0	UNSIGNED8	R/W	CANopen® node id	127 (0x7F)
2001	0	UNSIGNED8	R/W	CANbus bitrate control	3 = 125kb/s
5000 –5FFF	0	REAL32	–	DSC internal parameters	–
6000	0	FLOAT32	RO	"**SYS**" main value output (Scaled)	–
6001	0	UNSIGNED16	RO	DSC "**FLAG**" error register	–
6002	0	FLOAT32	RO	"**SYSN**" main value (Snapped **SYS** Value)	–

The device supports a manufacturer-specific device profile with Limited PDO mapping of 2 objects to each Transmit PDO. The following communications objects are implemented:–

- SDO
- Transmit PDO-1
- Transmit PDO-2
- Transmit PDO-3
- Transmit PDO-4

Error Management

The DSC/DLC **FLAG** value is mapped to the profile object at 6001h. Flags set also cause appropriate bits in the standard Error Register (object index 1001h) to be set.
In some cases, an Emergency telegram is also broadcast. In this case, the “Manufacturer Specific Error Field” simply contains the actual 16-bit “FLAG” value, followed by void bytes.
When the error condition is removed, the error register reverts to 0, and a further “No error” emergency telegram is sent, if appropriate.
The error and emergency codes generated by DSC/DLC error conditions are the following :—

Bit	Value	Description	Error Register Bit(s)	Emergency Telegram Code
0	1	(unused – reserved)	Unused	NONE
1	2	(unused – reserved)	Unused	NONE
2	4	Temperature under range (TEMP)	0,3 = temp	4200h = device temp
3	8	Temperature over-range (TEMP	0,3 = temp	4200h = device temp
4	16	Strain gauge input under-range	0,7 = mfr-specd	-
5	32	Strain gauge input over-range	0,7 = mfr-specd	-
6	64	Cell under-range (CRAW)	0,7 = mfr-specd	-
7	128	Cell over-range (CRAW)	0,7 = mfr-specd	-
8	256	System under-range (SRAW)	0,7 = mfr-specd	-
9	512	System over-range (SRAW)	0,7 = mfr-specd	-
10	1024	(unused – reserved)	0,7 = mfr-specd	-
11	2048	Load Cell Integrity Error (LCINTEG)	0,7 = mfr-specd	-
12	4096	Watchdog Reset	0,7 = mfr-specd	-
11	8192	(unused – reserved)	0,7 = mfr-specd	-
14	16384	Brown-Out Reset	0,7 = mfr-specd	-
15	32768	Reboot warning (Normal Power up)	0,7 = mfr-specd	6000h = device software

Communications Controls

NODE ID

The unit’s NODE ID is configured over the CANbus by writing to the object at index 2000h sub index 0.
The Node ID is stored in non volatile memory and changes will not take effect until the unit is power cycled.
Devices are delivered with a CANopen® Node-ID set to 127

Bit Rate

The CANbus Bit Rate can be configured by writing to the object at index 2001h sub index 0, where the following value settings are defined :–

Setting:	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Rate/kbs	20	50	100	125	250	500	800	1000

If a value < 0 or > 7 is sent to the unit the next time the power is cycled the unit will return to it’s default Bit rate of 125 Kbits to avoid losing communications with the unit by entering an invalid Bit Rate. It is Essential that the Bit Rate is set correctly or communications with the device will no longer be possible.

Again, stored in non volatile memory and changes will not take effect until the unit is power cycled.

On receiving a NMT "Reset_Node" or "Reset_Communication" service, all the device-independent communications settings revert to the CANopen® standard default settings. The Node-ID and Bit Rate are not reset by this.

Communications Profile Area

Device Description and Communication Specific

Name	Description	Access	Object Dictionary Index	Object Dictionary Sub Index	Data Type
-	DEVICE TYPE	RO	1000h	0	Unsigned 32 bit
-	ERROR REGISTER	RO	1001h	0	Unsigned 8 bit
-	PRE-DEFINED ERROR FIELD	RO	1003h	0	Unsigned 32 bit
-	COB-ID SYNC MESSAGE	RO	1005h	0	Unsigned 32 bit
-	RESTORE ALL PARAMETERS FROM 1000H TO 2001H	WO	1011h	1	Unsigned 32 bit note 1
-	RESTORE COMMUNICATIONS PROFILE PARAMETERS 1000H TO 1FFFH	WO	1011h	2	Unsigned 32 bit note 1
-	RESTORE CAN COMMUNICATIONS NODE ID & BITRATE	WO	1011h	4	Unsigned 32 bit note 1

Note 1 should always be 4 bytes value = "save"

MSB						LSB	
65h	'e'	76h	'v'	61h	'a'	73h	's'

Transmit PDO Operation Specific

Name	Description	Access	Object Dictionary Index	Object Dictionary Sub Index	Data Type	Default
PDOT1	TPDO 1 transmit Type	RW	1800h	02h	Unsigned 8 bit	255 = Use Event timer
PDOC1	TPDO 1 COBID	RW	1800h	01h	Unsigned 32 bit	0 = Use default of 0x180 + Node ID See Note 3
PDOI1	TPDO 1 Inhibit timer	RW	1800h	03h	Unsigned 16 bit	0 = Disabled
PDOE1	TPDO 1 Transmission interval	RW	1800h	05h	Unsigned 16 bit	100mS
PDOT2	TPDO 2 transmit Type	RW	1801h	02h	Unsigned 8 bit	255 = Use Event timer
PDOC2	TPDO 2 COBID	RW	1801h	01h	Unsigned 32 bit	0 = Use default of 0x280 + Node ID See Note 3
PDOI2	TPDO 2 Inhibit timer	RW	1801h	03h	Unsigned 16 bit	0 = Disabled

PDOE2	TPDO 2 Transmission interval	RW	1801h	05h	Unsigned 16 bit	100mS
PDOT3	TPDO 3 transmit Type	RW	1802h	02h	Unsigned 8 bit	255 = Use Event timer
PDOC3	TPDO 3 COBID	RW	1802h	01h	Unsigned 32 bit	0 = Use default of 0x380 + Node ID See Note 3
PDOI3	TPDO 3 Inhibit timer	RW	1802h	03h	Unsigned 16 bit	0 = Disabled
PDOE3	TPDO 3 Transmission interval	RW	1802h	05h	Unsigned 16 bit	100mS
PDOT4	TPDO 4 transmit Type	RW	1803h	02h	Unsigned 8 bit	255 = Use Event timer
PDOC4	TPDO 4 COBID	RW	1803h	01h	Unsigned 32 bit	80000000h = Disabled See Note 3
PDOI4	TPDO 4 Inhibit timer	RW	1803h	03h	Unsigned 16 bit	0 = Disabled
PDOE4	TPDO 4 Transmission interval	RW	1803h	05h	Unsigned 16 bit	100mS

Note

1. Each TPDO can have a maximum of two objects mapped.
2. PDO Parameters are stored directly to non volatile memory but will not take effect until the device has been re-booted or an NMT reset communications has been issued.
3. 80000000h (setting the most significant bit) disables the TxPDO otherwise, setting a non zero value will result in this value being used instead.

Transmit PDO Mapping Specific

Name	Description	Access	Object Dictionary Index	Object Dictionary Sub Index	Data Type	Defaults
PDOP1	TPDO 1 Mapping item 1	RW	1A00h	01h	See details below	50050004h 'SYS', Sub Index 0, Length of 4 Bytes
PDOS1	TPDO 1 Mapping item 2	RW	1A00h	02h	See details below	0 = Disabled
PDOP2	TPDO 2 Mapping item 1	RW	1A01h	01h	See details below	50090002h 'FLAG', Sub Index 0, Length of 2 Bytes
PDOS2	TPDO 2 Mapping item 2	RW	1A01h	02h	See details below	0 = Disabled
PDOP3	TPDO 3 Mapping item 1	RW	1A02h	01h	See details below	500D0002h 'SYSN', Sub Index 0, Length of 4 Bytes
PDOS3	TPDO 3 Mapping item 2	RW	1A02h	02h	See details below	0 = Disabled
PDOP4	TPDO 4 Mapping item 1	RW	1A03h	01h	See details below	0 = Disabled
PDOS4	TPDO 4 Mapping item 2	RW	1A03h	02h	See details below	0 = Disabled

PDO mapping data entries consist of the following data, which are 4 bytes total

Object Dictionary Index	**Object Dictionary Sub Index**	**Required Data Length**
5005	00	04

So, the default for PDOP1 would be using Object Dictionary Index 5005h, sub Index 00h (**SYS**) with a length of four bytes. Some implementations of CANopen interpret this as being four bits, please contact us if you have problems.

Note: The TxPDOs defaults have been mapped to the Manufacturers Specific Profile Area and not the Standardised Device Profile Area.

Name refers to the Mantracourt assigned name.

Manufacturer Specific Area

Name	Description	Access	Object Dictionary Index	Object Dictionary Sub Index	Type
CMVV	Temp Compensated mV/V	RO	5000h	0	FLOAT
STAT	Status	RO	5001h	0	UINT16
RMVV	Raw mV/V	RO	5002h	0	FLOAT
MVV	Filtered & factory calibrated mV/V	RO	5003h	0	FLOAT
SOUT	Selected output (copy of SYS)	RO	5004h	0	FLOAT
SYS	Main output	RO	5005h and 6000h	0	FLOAT
TEMP	Temperature	RO	5006h	0	FLOAT
SRAW	Raw System output	RO	5007h	0	FLOAT
CELL	Cell output	RO	5008h	0	FLOAT
FLAG	Error flags	RW	5009h and 6001h	0	UINT16
CRAW	Raw cell output	RO	500Ah	0	FLOAT
ELEC	Electrical output	RO	500Bh	0	FLOAT
SZ	System zero	RW	500Ch	0	FLOAT
SYSN	Snapshot result	RO	500Dh and 6002h	0	FLOAT
PEAK	Peak value	RO	500Eh	0	FLOAT
TROF	Trough value	RO	500Fh	0	FLOAT
SERL	Serial number low	RO	5010h	0	UINT16
SERH	Serial number high	RO	5011h	0	UINT16
RATE	Reading rate select	RW	5014h	0	UINT8
NMVV	Nominal mV/V for scaling ELEC	RW	5015h	0	FLOAT
CGAI	Cell gain	RW	5016h	0	FLOAT
COFS	Cell offset	RW	5017h	0	FLOAT
CMIN	Cell range min	RW	5018h	0	FLOAT
CMAX	Cell range max	RW	5019h	0	FLOAT
CLN	Number of Linearisation points	RW	501Eh	0	UINT8
CLX1…7	Linearisation raw-values	RW	501Fh … 5025h	0 … 0	FLOAT
CLK1…7	Linearisation corrections	RW	5026h … 502Ch	0 … 0	FLOAT
SGAI	System gain	RW	502Dh	0	FLOAT
SOFS	System offset	RW	502Eh	0	FLOAT
SMIN	System range min	RW	502Fh	0	FLOAT
SMAX	System range max	RW	5030h	0	FLOAT
USR1…9	User storage values	RW	5031h … 5039h	0 … 0	FLOAT
FFLV	Dynamic Filter Level	RW	503Ch	0	FLOAT
FFST	Dynamic filter steps	RW	503Dh	0	UINT8

CTN	Number of Temperature Compensation points	RW	503Eh	0	UINT8
CT1…5	Temperature Compensation Point	RW	503Fh … 5043h	0 … 0	FLOAT
CTG1…5	Temperature Compensation Gain adjust	RW	5044h … 5048h	0 … 0	FLOAT
CTO1…5	Temperature Compensation Offset Adjust	RW	5049h … 504Dh	0 … 0	FLOAT
RST	Reset	WO	5050h	0	N/A
SNAP	Take snapshot	WO	5051h	0	N/A
RSPT	Reset peak & trough	WO	5052h	0	N/A
SCON	Shunt cal ON	WO	5053h	0	N/A
SCOF	Shunt cal OFF	WO	5054h	0	N/A
OPON	Digital Output On	WO	5055h	0	N/A
OPOFF	Digital Output Off	WO	5056h	0	N/A

Table Key

"..." - Denotes a range (e.g. CLK1...7 means "CLK1" to "CLK7")

See detailed descriptions in Parameter Detail General.

Appendix C - Commands

Command list ASCII, Mantrabus, Modbus

ASCII command	Mantrabus register (decimal)	Modbus register (decimal)	Format	Permissions	Description
CMVV	5	11	FLOAT	RO	Temperature Compensated mV/V
STAT	6	13	UINT16	RO	Dynamic status flags (See here for decoding)
MVV	8	17	FLOAT	RO	Filtered & factory calibrated mV/V
SOUT	9	19	FLOAT	RO	Selected output (same as SYS)
SYS	10	21	FLOAT	RO	System output
TEMP	11	23	FLOAT	RO	Temperature
SRAW	12	25	FLOAT	RO	Raw system output
CELL	13	27	FLOAT	RO	Cell output
FLAG	14	29	UINT16	RW	Latched warning flags (See here for decoding)
CRAW	15	31	FLOAT	RO	Raw cell output
ELEC	16	33	FLOAT	RO	Electrical output
SZ	22	45	FLOAT	RW	System zero
SYSN	23	47	FLOAT	RO	Snapshot result
PEAK	24	49	FLOAT	RO	Peak value
TROF	25	51	FLOAT	RO	Trough value
CFCT	26	53	FLOAT	RW	Communications failure count
VER	30	61	FLOAT	RO	Software version
SERL	31	63	UINT16	RO	Serial number low
SERH	32	65	UINT16	RO	Serial number high
STN	33	67	UINT16	RW	Station number
BAUD	34	69	UINT8	RW	Baud rate select
RATE	36	73	UINT8	RW	Reading rate select
DP	37	75	UINT8	RW	Digits after point (ASCII only)
DPB	38	77	UINT8	RW	Digits before point (ASCII only)
NMVV	39	79	FLOAT	RW	Nominal mV/V for scaling ELEC
CGAI	40	81	FLOAT	RW	Cell gain
COFS	41	83	FLOAT	RW	Cell offset
CMIN	44	89	FLOAT	RW	Cell range min
CMAX	45	91	FLOAT	RW	Cell range max
CLN	50	101	UINT8	RW	Linearisation n-points
CLX1..7	51..57	103..115	FLOAT	RW	Linearisation raw-values
CLK1..7	61..67	123..135	FLOAT	RW	Linearisation corrections
SGAI	70	141	FLOAT	RW	System gain
SOFS	71	143	FLOAT	RW	System offset
SMIN	74	149	FLOAT	RW	System range min
SMAX	75	151	FLOAT	RW	System range max
USR1..9	81..89	163..179	FLOAT	RW	General purpose storage values
FFLV	92	185	FLOAT	RW	Dynamic Filter Level
FFST	93	187	FLOAT	RW	Dynamic filter steps
RST	100	201	EMPTY	CMD	Reboot
SNAP	103	207	EMPTY	CMD	Take snapshot (stored in SYSN)
RSPT	104	209	EMPTY	CMD	Reset peak & trough
SCON	105	211	EMPTY	CMD	Shunt cal ON
SCOF	106	213	EMPTY	CMD	Shunt cal OFF
OPON	107	215	EMPTY	CMD	Digital Output on (DSC only)

OPOF	108	217	EMPTY	CMD	Digital output off (DSC only)
CTN	110	221	UINT8	RW	Temp compensation n-points
CT1..5	111..115	223..231	FLOAT	RW	Temp compensation temp points
CTG1..5	116..120	233..241	FLOAT	RW	Temp compensation gain-adjust
CTO1..5	121..125	243..251	FLOAT	RW	Temp compensation offset-adjust

Parameter Detail General

For full details of the interactions between the various parameters, see the Readings Process.
Due to the Finite Non-Volatile Memory Life of the EEPROM you should not write to the parameters too frequently. Any parameter can be written in the region of 100 000 times.

CMVV

mV/V value after temperature compensation has been applied.

STAT

Live flags indicating the current status of the device.

Bit	Value	Description	Name
0	1	(Unused – reserved)	Unused
1	2	Digital Input status (DSC ONLY)	IPSTAT
2	4	Temperature under range (**TEMP**)	TEMPUR
3	8	Temperature over-range (**TEMP**)	TEMPOR
4	16	Strain gauge input under-range (**ELEC**-120%)	ECOMUR
5	32	Strain gauge input over-range (**ELEC**+120%)	ECOMOR
6	64	Cell under-range (**CRAW**)	CRAWUR
7	128	Cell over-range (**CRAW**)	CRAWOR
8	256	System under-range (**SRAW**)	SYSUR
9	512	System over-range (**SRAW**)	SYSOR
10	1024	(unused – reserved)	Unused
11	2048	Load Cell Integrity Error	LCINTEG
12	4096	Shunt Calibration Resistor ON	SCALON
13	8192	Stale output value (previously read) Set when SOUT is read, cleared when there is a new value	OLDVAL
14	16384	(unused – reserved)	Unused
15	32768	(unused – reserved)	Unused

MVV

Factory calibrated mV/V output and it is this value that all other measurement output values are derived from.

SOUT

Included for backwards compatibility and used for stale output value. Equal to **SYS**.

SYS

Main output value. **SRAW** with **SYSZ** applied.

TEMP

If the DTEMP optional temperature module is fitted, then this will hold actual temperature in degree C. Otherwise it will display 125 degree C. This is used by the temperature compensation.

SRAW

CELL with **SGAI** and **SOFS** applied.
The same as **SYS** value without **SYSZ** applied.

CELL

CRAW with linearization applied.

FLAG

Latched warning flags since last reset.

Bit	Value	Description	Name
0	1	(unused – reserved)	Unused
1	2	(unused – reserved)	Unused
2	4	Temperature under range (**TEMP**)	TEMPUR
3	8	Temperature over-range (**TEMP**)	TEMPOR
4	16	Strain gauge input under-range (**ELEC**-120%)	ECOMUR
5	32	Strain gauge input over-range (**ELEC**+120%)	ECOMOR
6	64	Cell under-range (**CRAW**)	CRAWUR
7	128	Cell over-range (**CRAW**)	CRAWOR
8	256	System under-range (**SRAW**)	SYSUR
9	512	System over-range (**SRAW**)	SYSOR
10	1024	(unused – reserved)	Unused
11	2048	Load Cell Integrity Error (**LCINTEG**)	LCINTEG
12	4096	Watchdog Reset	WDRST
13	8192	(unused – reserved)	Unused
14	16384	Brown-Out Reset	BRWNOUT
15	32768	Reboot warning (Normal Power up)	REBOOT

CRAW

CMVV with **CGAI** and **COFS** applied

ELEC

Calculated percentage the current **MVV** value is of the **NMVV** value.

SZ

System zero. Applied to **SRAW** to give **SYS**. Can be used to generate a net value, with SRAW then being gross.

SYSN

When **SNAP** command is triggered, the value of **SYS** is written to **SYSN**.

PEAK

Maximum **SYS** value recorded since last power up or reset.

TROF

Minimum **SYS** value recorded since last power up or reset.

CFCT

Communications Failure Count. Number of UART framing errors or data overrun errors since last power up or reset.

VER

Firmware version. Coded as 256 * (major release) + (minor release). Eg. **VER** 3.1 is 256 * 3 + 1 = 769

SERL

Low bytes of device serial number. Coded as Serial Number = 65536 * **SERH** + **SERL**

SERH

High bytes of device serial number. Example: Serial Number = 65536 * 262 + 8993 = 17179425

STN

Device address for communications. Requires reset after changing. Also note that the new station number will be required to reconnect to the device.

BAUD

Communications baud rate as specified below

BAUD value	0	1	2	3	4	5	6	7	8	9
baud rate (bps)	2400	4800	9600	19K2	38K4	57K6	76K8	115K2	230K4	460K8

BAUD can only accept the above values. Any other values will default to 2 (9600 baud).
Requires a reset after changing. Also note that the new setting will be required to reconnect to the device and the connected hardware must support the new baud rate.

RATE

The rate at which the readings are updated as specified below

RATE value	0	1	2	3	4	5	6	7	8	9	10
update rate (readings per second)	1	2	5	10	20	50	60	100	200	300	500

RATE can only accept the above values. Any other values will default to 3 (10 Hz).
The underlying ADC rate is 4.8 kHz for RS232 and RS485 devices. For CAN devices the underlying ADC rate is 1627 Hz.
CAN devices maximum update rate is 200 Hz.
Those results are then block averaged to give the required **RATE**.
Requires a reset after changing.

DP

Number of digits after the decimal point. (ASCII output only). Requires a reset after changing.
Change this parameter last as it affects the information sent with the toolkit and could end up corrupting values.

DPB

Number of digits before the decimal point. (ASCII output only). Requires a reset after changing.
Note that if **DPB** is set to 3, then the maximum value that can be displayed is 999. Numbers greater than that will lead to non-numeric ASCII codes after the polarity character.
Change this parameter last as it affects the information sent with the toolkit and could end up corrupting values.

NMVV

Nominal mV/V value representing 100% of full scale. Used for the generation of **ELEC**.

CGAI

Cell gain. Used to generate **CRAW**.

COFS

Cell offset. Used to generate **CRAW**.

CMIN

Minimum value allowed for **CRAW**. **CRAWUR** flag triggered if value is lower than this.

CMAX

Maximum value allowed for **CRAW**. **CRAWOR** flag triggered if value is greater than this.

CLN

Number of linearization points applied to **CRAW** to give **CELL**. Maximum value is 7. If **CLN** is less than 2, **CELL** will equal **CRAW**.

CLX1..7

Value of **CRAW** at n point.

CLK1..7

Offset applied to **CRAW** at n point to give **CELL**.

SGAI

Gain value applied to **CELL** to give **SRAW**. This can be used to scale the original **CELL** calibration.

SOFS

Offset value applied to **CELL** to give **SRAW**. This can be used to offset the original **CELL** calibration.

SMIN

Minimum value allowed for **SRAW**. **SRAWUR** flag triggered if value is lower than this.

SMAX

Maximum value allowed for **SRAW**. **SRAWOR** flag triggered if value is greater than this.

USR1..9

User storage locations.

FFLV

Dynamic Filter level. See here for more information.

FFST

Dynamic filter steps. See here for more information.

RST

Reset command. Must be used after changing **RATE**, **STN**, **BAUD**, **DP** and **DPB**

SNAP

When **SNAP** command is triggered, the value of **SYS** is written to **SYSN**.
The main use of this is where a number of different inputs need to be sampled at the same instant.
Normally, multiple readings are staggered in time because of the need to read back results from separate devices in sequence: By broadcasting a **SNAP** command at the required time, all devices on the bus will sample their inputs within a few milliseconds. The resulting values can then be read back in the normal way from all the devices **SYSN** parameters.

RSPT

Reset **PEAK** and **TROF** values.

SCON

Switch 100K shunt cal resistor across bridge. Gives approximate change of 0.8 mV/V at nominal 2.5 mV/V with 350R bridge.

SCOF

Remove shunt cal resistor from bridge.

OPON

Open collector digital output switched on.

OPOF

Open collector digital output switched off.

CTN

Number of temperature compensation points applied to **MVV** to give **CMVV**. Maximum value is 5. Values greater than 5 will set **CTN** to zero.

CT1…5

Value of **TEMP** at n point. Must be in increasing temperature value.

CTG1…5

Gain applied to **MVV** at n point to give value of **CMVV**.

CTO1…5

Offset applied to **MVV** at n point to give value of **CMVV**.

Command List MantraCAN

Name	Description	Access	Command Number
CMVV	Temp Compensated mV/V	RO	5
STAT	Status	RO	6
MVV	Filtered & factory calibrated mV/V	RO	8
SOUT	Selected output (copy of SYS)	RO	9
SYS	Main output	RO	10
TEMP	Temperature	RO	11
SRAW	Raw System output	RO	12
CELL	Cell output	RO	13
FLAG	Error flags	RW	14
CRAW	Raw cell output	RO	15
ELEC	Electrical output	RO	16
SZ	System zero	RW	22
SYSN	Snapshot result	RO	23
PEAK	Peak value	RO	24
TROF	Trough value	RO	25
CFCT	Communications failure count	RW	26
VER	Software version	RO	30
SERL	Serial number low	RO	31
SERH	Serial number high	RO	32
RATE	Reading rate select	RW	36
NMVV	Nominal mV/V for scaling ELEC	RW	39
CGAI	Cell gain	RW	40
COFS	Cell offset	RW	41
CMIN	Cell range min	RW	44
CMAX	Cell range max	RW	45
CLN	Number of Linearisation points	RW	50
CLX1..7	Linearisation raw-values	RW	51..57
CLK1..7	Linearisation corrections	RW	61..67
SGAI	System gain	RW	70
SOFS	System offset	RW	71
SMIN	System range min	RW	74
SMAX	System range max	RW	75
USR1..9	User storage values	RW	81..89
FFLV	Dynamic Filter Level	RW	92

FFST	Dynamic filter steps	RW	93
RST	Reset	X	100
SNAP	Take snapshot	X	103
RSPT	Reset peak & trough	X	104
SCON	Shunt cal ON	X	105
SCOF	Shunt cal OFF	X	106
OPON	Digital Output on	X	107
OPOF	Digital output off	X	108
CTN	Number of Temperature Compensation points	RW	110
CT1..5	Temperature Compensation Point	RW	111..115
CTG1..5	Temperature Compensation Gain adjust	RW	116..120
CTO1..5	Temperature Compensation Offset Adjust	RW	121..125
STRMON	Start Data Streaming	X	128
STRMOFF	Stop Streaming Data	X	129
STRMTYPE	Stream Type	RW	130
NODEIDL	Low word of CAN ID	RW	131
NODEIDH	High Word of CAN ID	RW	132
BPS	CAN Bit Rate	RW	133
IDSIZE	CAN ID Size 11 or 29 Bit	RW	134
CANTXERR	CAN Transmit Error Count	RO	135
CANRXERR	CAN Receive Error Count	RO	136
CANSTATUS	CAN Status Flag	RO	137
RSTCANFLG	Reset Can Status Flag	X	138
MSG1EN	Enable message 1	RW	140
MSG1IDL	Low word of message 1 CAN ID	RW	141
MSG1IDH	High Word of Message 1 CAN ID	RW	142
MSG1PL	Message 1 Packet length (1 – 8)	RW	143
MSG1B1	Byte 1 value	RW	144
MSG1B2	Byte 2 value	RW	145
MSG1B3	Byte 3 value	RW	146
MSG1B4	Byte 4 value	RW	146
MSG1B5	Byte 5 value	RW	148
MSG1B6	Byte 6 value	RW	149
MSG1B7	Byte 7 value	RW	150
MSG1B8	Byte 8 value	RW	151
MSG1SRC	CAN command number for required Data	RW	152
MSG1FM	Data Format	RW	153
MSG1SFM	Data Sub Format	RW	154
MSG1SP	Position to place Data in Packet	RW	155
MSG1GAI	Gain to apply to data	RW	156
MSG1OFS	Offset to apply to Data	RW	157
MSG1INT	Interval to send Data in ms	RW	158
MSG1TRG	Trigger Type	RW	159
MSG2EN	Enable message 2	RW	160
MSG2IDL	Low word of message 2 CAN ID	RW	161
MSG2IDH	High Word of Message 2 CAN ID	RW	162
MSG2PL	Message 1 Packet length (1 – 8)	RW	163
MSG2B1	Byte 1 value	RW	164
MSG2B2	Byte 2 value	RW	165
MSG2B3	Byte 3 value	RW	166
MSG2B4	Byte 4 value	RW	166
MSG2B5	Byte 5 value	RW	168
MSG2B6	Byte 6 value	RW	169
MSG2B7	Byte 7 value	RW	170
MSG2B8	Byte 8 value	RW	171

MSG2SRC	CAN command number for required Data	RW	172
MSG2FM	Data Format	RW	173
MSG2SFM	Data Sub Format	RW	174
MSG2SP	Position to place Data in Packet	RW	175
MSG2GAI	Gain to apply to data	RW	176
MSG2OFS	Offset to apply to Data	RW	177
MSG2INT	Interval to send Data in ms	RW	178
MSG2TRG	Trigger Type	RW	179
MSG3EN	Enable message 3	RW	180
MSG3IDL	Low word of message 3 CAN ID	RW	181
MSG3IDH	High Word of Message 3 CAN ID	RW	182
MSG3PL	Message 3 Packet length (1 – 8)	RW	183
MSG3B1	Byte 1 value	RW	184
MSG3B2	Byte 2 value	RW	185
MSG3B3	Byte 3 value	RW	186
MSG3B4	Byte 4 value	RW	186
MSG3B5	Byte 5 value	RW	188
MSG3B6	Byte 6 value	RW	189
MSG3B7	Byte 7 value	RW	190
MSG3B8	Byte 8 value	RW	191
MSG3SRC	CAN command number for required Data	RW	192
MSG3FM	Data Format	RW	193
MSG3SFM	Data Sub Format	RW	194
MSG3SP	Position to place Data in Packet	RW	195
MSG3GAI	Gain to apply to data	RW	196
MSG3OFS	Offset to apply to Data	RW	197
MSG3INT	Interval to send Data in ms	RW	198
MSG3TRG	Trigger Type	RW	199
MSG4EN	Enable message 4	RW	200
MSG4IDL	Low word of message 4 CAN ID	RW	201
MSG4IDH	High Word of Message 4 CAN ID	RW	202
MSG4PL	Message 4 Packet length (1 – 8)	RW	203
MSG4B1	Byte 1 value	RW	203
MSG4B2	Byte 2 value	RW	205
MSG4B3	Byte 3 value	RW	206
MSG4B4	Byte 4 value	RW	207
MSG4B5	Byte 5 value	RW	208
MSG4B6	Byte 6 value	RW	209
MSG4B7	Byte 7 value	RW	210
MSG4B8	Byte 8 value	RW	211
MSG4SRC	CAN command number for required Data	RW	212
MSG4FM	Data Format	RW	213
MSG4SFM	Data Sub Format	RW	214
MSG4SP	Position to place Data in Packet	RW	215
MSG4GAI	Gain to apply to data	RW	216
MSG4OFS	Offset to apply to Data	RW	217
MSG4INT	Interval to send Data in ms	RW	218
MSG4TRG	Trigger Type	RW	219
SONIDL	Custom Start ID Low	RW	220
SONIDH	Custom Start ID High	RW	221
SONB1	Custom Start Data Byte 1	RW	222
SONB2	Custom Start Data Byte 2	RW	223
SONB3	Custom Start Data Byte 3	RW	224
SONB4	Custom Start Data Byte 4	RW	225
SONB5	Custom Start Data Byte 5	RW	226

SONB6	Custom Start Data Byte 6	RW	227
SONB7	Custom Start Data Byte 7	RW	228
SONB8	Custom Start Data Byte 8	RW	229
SOFFIDL	Custom Stop ID Low	RW	230
SOFFIDH	Custom Stop ID High	RW	231
SOFFB1	Custom Stop Data Byte 1	RW	232
SOFFB2	Custom Stop Data Byte 2	RW	233
SOFFB3	Custom Stop Data Byte 3	RW	234
SOFFB4	Custom Stop Data Byte 4	RW	235
SOFFB5	Custom Stop Data Byte 5	RW	236
SOFFB6	Custom Stop Data Byte 6	RW	237
SOFFB7	Custom Stop Data Byte 7	RW	238
SOFFB8	Custom Stop Data Byte 8	RW	239

Table Key
".." - Denotes a range (e.g. CLK1..7 means "CLK1" to "CLK7")

For detail of the commands that are not specific to the MantraCAN protocol such as **SYS**, please see Parameter Detail General.

Parameter Detail MantraCAN

STRMON/STRMOFF

Starts and stops the streaming of custom messages.

STRMTYPE

Sets the type of message stream.

0	MantraCAN control by issuing **STRMON** and **STRMOFF** commands
1	Automatic. Streaming starts on power up
2	Custom. Streaming is controlled by the user defined Start and Stop packets. (See later)

NODEIDL/NODEIDH

Each device has a single base ID to enable configuration and is factory set to 1, this base ID can be changed. All data sent to the device will be sent to this ID. All data returned from the device will be on the base ID + 1.
Because the device ID is set via CAN, the device should be the only device connected to the CAN bus while configuring from factory settings.
If 11 bit ID size is used, **NODEIDH** will not be used and **NODEIDL** will give the node ID. With 29 bit ID size, the two parameters are combined with the hex value from the **NODEIDH** being the most significant and the hex value from **NODEIDL** being the least significant.

BPS

CAN bit rate.

BPS value	0	1	2	3	4	5	6	7
Bit rate (bps)	20K	50K	100K	125K	250K	500K	800K	1M

BPS can only accept the above values.
Requires a reset after changing. Also note that the new setting will be required to reconnect to the device and the connected hardware must support the new baud rate.

IDSIZE

Determines the size of the NODEID

0	11 bit (standard)
1	29 bit (extended)

CANTXERR/CANRXERR

Transmit and receive error counts as defined in the BOSCH CAN 2.0 standard.

CANSTATUS

CANbus error status, derived from the CAN controller.

Bit number	Name	Description
0	AERG	Node detection, dominant bit in the acknowledge slot
1	FERG	Form Error. Violation of one of the fixed bit fields, CRC delimiter, Acknowledgement delimiter or End of Frame
2	CERG	CRC Error
3	SERG	Bit Stuff Error
4	OVRBUF	Buffer Over Run Error
5	OVRTIM	CAN Timer Overrun
6	ERRP	Device is in Error Passive mode
7	BUSOFF	Device is in Bus Off mode

RSTCANFLG

Triggering this command will write zero to the CANSTATUS parameter.

Custom Message Configuration

MantraCAN allows up to 4 custom messages to be streamed. These are user configurable and can contain data from internal parameters. The messages can be streamed at intervals or when the internal parameter value changes or both.
The highly configurable nature of the messages allows the DSC/DLC to stream custom data messages on a variety of CAN based networks.

> NOTE: Only the proprietary MantraCAN protocol can be used to write to the device or request data.

Parameter	**Function**
The parameters are available for MSG1…4	
MSG1EN	Whether this message is enabled. **0** - Disabled **1** – Enabled
MSG1IDL	The low word value of the message identifier. This will contain the decimal value of the lower word (2 bytes) of the ID.
MSG1IDH	The high word value of the message identifier. This will contain the decimal value of the higher word (2 bytes) of the ID. Not necessary if the DSC is set for 11 bit identifiers (CAN 2.0a)
MSG1PL	Message packet length. This value sets the number of data bytes contained in the message. **0 to 8**
MSG1B1	Set the byte value of byte 1 in the message. **0 to 255**

MSG1B2	Set the byte value of byte 2 in the message. **0 to 255**
MSG1B3	Set the byte value of byte 3 in the message. **0 to 255**
MSG1B4	Set the byte value of byte 4 in the message. **0 to 255**
MSG1B5	Set the byte value of byte 5 in the message. **0 to 255**
MSG1B6	Set the byte value of byte 6 in the message. **0 to 255**
MSG1B7	Set the byte value of byte 7 in the message. **0 to 255**
MSG1B8	Set the byte value of byte 8 in the message. **0 to 255**
MSG1SRC	Set the index of the parameter whose data is to be inserted into the outgoing packet. This data will be formatted and placed at the specified position in the message.
MSG1FM	Set the format of the data. See detail below.
MSG1SFM	Set the sub format of the data. See detail below.
MSG1SP	Sets the start position of the data within the message. **1 to 8**
MSG1GAI	The gain to apply to the data value.
MSG1OFS	The offset to apply to the data value.
MSG1INT	The interval that the message shall be sent at in milliseconds . Maybe modified by the MSG1TRG parameter. **100 to 60000**
MSG1TRG	Sets how the message is triggered. **0** - At Interval **1** - At Interval And On Change **2** - On Change Only

MSG1FM

Format	Value Range	Representation	Notes
0 - Float	-1.17594e-38 to 3.402823e+38	MSB | | | LSB	Formatted to IEEE 754 standard MSB first
1 - Byte Unsigned	0 to 255	MSB	
2 - Byte 2s Compliment	-128 to 127	MSB	
3 - Byte Sign Bit	-127 to 127	MSB	The most significant bit indicates a negative number when set to 1.

4 - Integer Unsigned	0 to 65535	MSB | LSB	
5 - Integer 2s Compliment	-32768 to 32767	MSB | LSB	
6 - Integer Sign Bit	-32767 to 32767	MSB | LSB	The most significant bit indicates a negative number when set to 1.
7 - Long Unsigned	0 to 9999999	MSB | | | LSB	
8 - Long 2s Compliment	-9999999 to 9999999	MSB | | | LSB	
9 - Long Sign Bit	-9999999 to 9999999	MSB | | | LSB	The most significant bit indicates a negative number when set to 1.

MSG1SFM

The sub format allows manipulation of the byte order to match the required format.
The following table assumes an original order of

1	2	3	4

SubFormat	Integer	Long & Float
0 – None	1 | 2	1 | 2 | 3 | 4
1 – Reverse Bytes	2 | 1	4 | 3 | 2 | 1
2 – Reverse Words	1 | 2	3 | 4 | 1 | 2
3 – Reverse Bytes & Words	2 | 1	2 | 1 | 4 | 3

Custom Start/Stop

When **STRMTYPE** is set to 2 (Custom) the streaming is controlled by external packets arriving that match the user defined message defined by the following Start and Stop message matching parameters. The identifier and the data can be specified and a matching received message will then start or stop the streaming.
Although all eight data bytes are available to define these messages, the incoming message is only tested against the stored bytes up to its own length. I.e. if the incoming message contained only two data bytes then these will be compared to SONB1 and SONB2 and if they match then the streaming will start.
This technique can be used to let the DSC conform to any CAN based start and stop message. I.e. support NMT messages in CANopen®.

Start Streaming

Parameter	Function
SONIDL	The low word value of the message identifier to start the streaming. This will contain the decimal value of the lower word (2 bytes) of the ID.
SONIDH	The high word value of the message identifier to start the streaming. This will contain the decimal value of the higher word (2 bytes) of the ID. Not necessary if the DSC is set for 11 bit identifiers (CAN 2.0a)

SONB1	The decimal value of data byte 1 that the incoming message must match to start streaming.
SONB2	The decimal value of data byte 2 that the incoming message must match to start streaming.
SONB3	The decimal value of data byte 3 that the incoming message must match to start streaming.
SONB4	The decimal value of data byte 4 that the incoming message must match to start streaming.
SONB5	The decimal value of data byte 5 that the incoming message must match to start streaming.
SONB6	The decimal value of data byte 6 that the incoming message must match to start streaming.
SONB7	The decimal value of data byte 7 that the incoming message must match to start streaming.
SONB8	The decimal value of data byte 8 that the incoming message must match to start streaming.

Stop Streaming

Parameter	Function
SOFFIDL	The low word value of the message identifier to stop the streaming. This will contain the decimal value of the lower word (2 bytes) of the ID.
SOFFIDH	The high word value of the message identifier to stop the streaming. This will contain the decimal value of the higher word (2 bytes) of the ID. Not necessary if the DSC is set for 11 bit identifiers (CAN 2.0a)
SOFFB1	The decimal value of data byte 1 that the incoming message must match to stop streaming.
SOFFB2	The decimal value of data byte 2 that the incoming message must match to stop streaming.
SOFFB3	The decimal value of data byte 3 that the incoming message must match to stop streaming.
SOFFB4	The decimal value of data byte 4 that the incoming message must match to stop streaming.
SOFFB5	The decimal value of data byte 5 that the incoming message must match to stop streaming.
SOFFB6	The decimal value of data byte 6 that the incoming message must match to stop streaming.
SOFFB7	The decimal value of data byte 7 that the incoming message must match to stop streaming.

SOFFB8	The decimal value of data byte 8 that the incoming message must match to stop streaming.

Parameter List CANopen

See CANopen Communications profile area.

Appendix D - Product code list

DLC

DLCHASC	Disc, high stability, ASCII
DLCSASC	Disc, industrial stability, ASCII
DLCHMAN	Disc, high stability, Mantrabus
DLCSMAN	Disc, industrial stability, Mantrabus
DLCHMOD	Disc, high stability, Modbus RTU
DLCSMOD	Disc, industrial stability, Modbus RTU
DLCHMCAN	Disc, high stability, MantraCAN
DLCSMCAN	Disc, industrial stability, MantraCAN
DLCHCOP	Disc, high stability, CANopen
DLCSCOP	Disc, industrial stability, CANopen

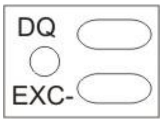
DLC

DSCH2ASC	Card, high stability, RS232, ASCII
DSCS2ASC	Card, industrial stability, RS232, ASCII
DSCH4ASC	Card, high stability, RS485, ASCII
DSCS4ASC	Card, industrial stability, RS485, ASCII
DSCH2MAN	Card, high stability, RS232, Mantrabus
DSCS2MAN	Card, industrial stability, RS232, Mantrabus
DSCH4MAN	Card, high stability, RS485, Mantrabus
DSCS4MAN	Card, industrial stability, RS485, Mantrabus
DSCH2MOD	Card, high stability, RS232, Modbus RTU
DSCS2MOD	Card, industrial stability, RS232, Modbus RTU
DSCH4MOD	Card, high stability, RS485, Modbus RTU
DSCS4MOD	Card, industrial stability, RS485, Modbus RTU
DSCHMCAN	Card, high stability, MantraCAN
DSCSMCAN	Card, industrial stability, MantraCAN
DSCHCOP	Card, high stability, CANopen
DSCSCOP	Card, industrial stability, CANopen

Appendix E - Accessories

DTEMP

The temperature module is a small double sided PCB with an 8 pin SOIC integrated circuit mounted to it. The dimensions are 10.5 x 7.6 x 2.5mm (0.413 x 0.299 x 0.098”). There are two solder pads for connection to the signal conditioner. A 2mm hole is used for fixing the temperature module to the body of the load cell.



The module should, ideally, be positioned as close as possible to the strain gauges. The IC on the temperature module must also be in good thermal contact with the load cell body so the strain gauges and temperature sensor see the same temperature.
A shielded twisted pair is recommended, with a maximum length of 10m, the shield being connected to the load cell body or SH if DSC.

Specification

Parameter	Min	Typical	Max	Units
Measurement Resolution		0.0625		°C
Measurement Accuracy (-10 to 85)		0.5		°C
Measurement Accuracy (-55 to 125)		2.0		°C
Update Speed		5		Seconds

DSJ1

Overview

The function of the DSJ1 is to enable the easy connection of a load cell and a DSC Card for communications to a PC or PLC.

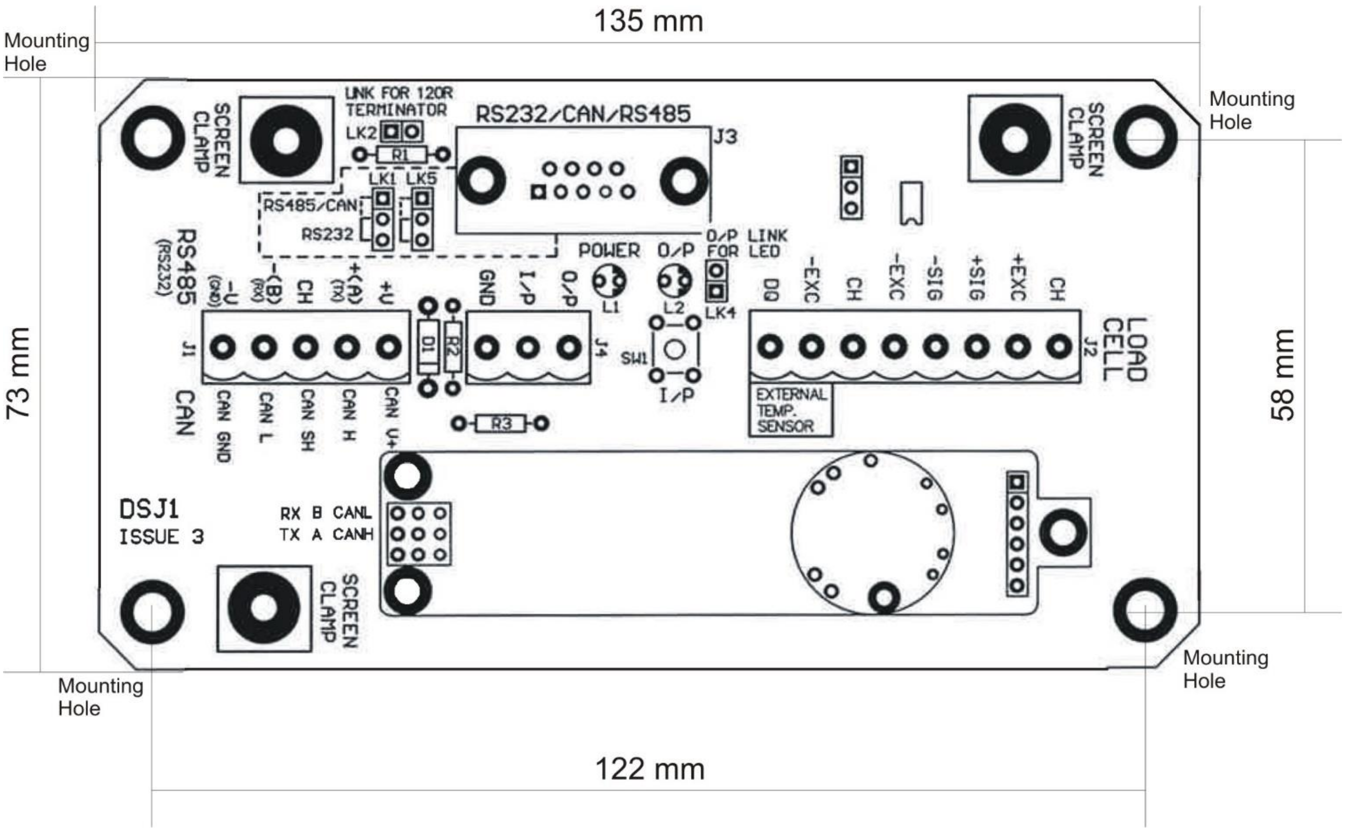
Designed to take one DSC card in a single enclosure, the DSJ1 offers a convenient and practical solution to the installation of digital load cells with platforms, silos and any weighing systems where connection to PC and PLC's is an essential requirement of the system.

Supplied as an OEM device on a single 135 x 73mm PCB, it has options for fitting in an IP65 ABS case, or to a DIN rail fixture. Please ask for details.

When a DSC card or DLC is fitted to the DSJ1 PCB it will enable the connection of a load cell via a two-part connector, with a five-way two-part connector for the communications output and a D type 9 pin connector, as well as connections for digital inputs and outputs and external temperature sensor.

The communications output connection is selectable for RS232, RS485 or CAN by changing the position of the links, see below.

Installation



All connection and links are labelled on the board. Details below.

If a DLC was ordered as part of an EVAL kit then it will be soldered to the board.

Item	Description
Mounting hole	For mounting and grounding

J1	**5-way two part connector; power and comms**		
V+/CAN V+	Power supply positive for DSC/DLC (5.6-18 VDC)		
+(A)/(TX)/CAN H	Comms		
CH/CAN SH	Shield		
-(B)/(RX)/CAN L	Comms		
-V(GND)/CAN GND	Power supply negative for DSC/DLC		
J2	**8-way two part connector; load cell and temperature**		
CH	Shield		
EXC+/-	Excitation for bridge sensor		
SIG+/-	Signal from bridge sensor		
DQ	Connection for DTEMP device (EXC- of DTEMP should be connected to GND or V-)		
J3	**9 pin D-type connector; power and comms (note: this is different than the DSJ4)**		
Pin	RS485	CAN	RS232
1	NC	NC	NC
2	-(B)	CANL	TX
3	NC	NC	NC
4		NC	NC
5	GND	GND	GND
6	NC	NC	NC
7	+(A)	CANH	NC
8	NC	NC	NC
9	NC	NC	NC
J4	**3-way two part connector; IO**		
O/P	Digital output		
I/P	Digital input		
GND	GND		
LK1/LK5	Select correct pins for 9 in D-type for RS232/RS485 and CAN		
LK2	120 ohm terminating resistor. (Do not use for RS232)		
LK3	Select onboard temperature sensor or external DTEMP		
LK4	Connects digital output to Output LED		

DSJ4

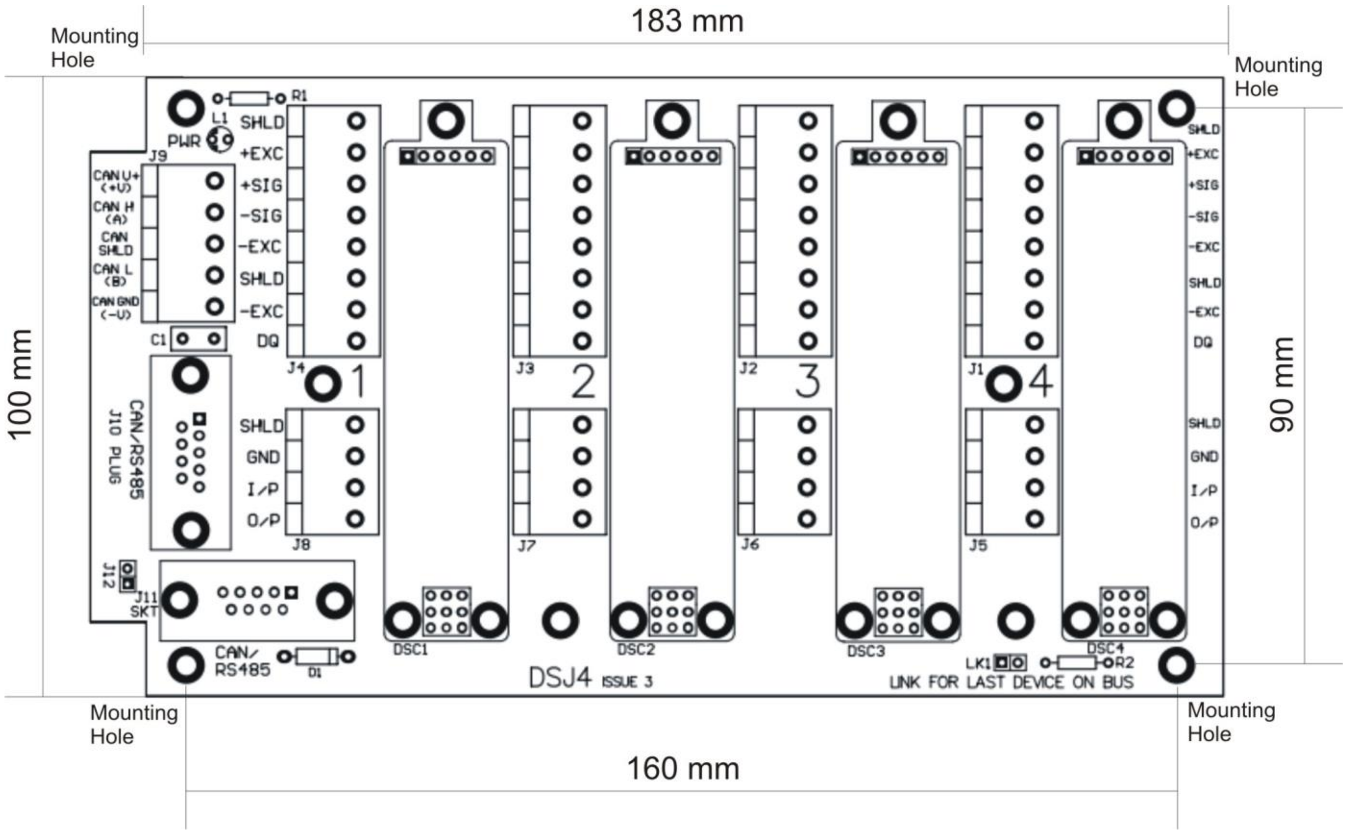
Overview

The DSJ4 facilitates the connection of up to four load cells and DSC cards for communications to a PC or PLC using CAN or RS485 protocols.

Designed to take four DSC cards in a single enclosure, the DSJ4 offers a convenient and practical solution to the installation of digital load cells with platforms, silos and any weighing systems where connection to PC and PLC's is an essential requirement of the system.

The DSCs are easily pushed into the female headers and can be screwed down for grounding and security. There are male and female 9 pin D-type connectors and a 5 way two part connector for comms. Individual 8 way two part connectors are for load cell (bridge sensor) connection. 4 way two part connectors are for digital in/out.

Installation



Item	Description
Mounting hole	For mounting and grounding
J1-J4	**8-way two part connectors; load cell and temperature**
SHLD	Shield
EXC+/-	Excitation for bridge sensor
SIG+/-	Signal from bridge sensor
DQ	Connection for DTEMP device (EXC- of DTEMP should be connected to GND or V-)
J5-8	**4-way two part connectors; IO**
O/P	Digital output

I/P	Digital input	
GND	GND	
SHLD	Shield	
J9	**5-way two part connector; power and comms**	
CAN V+/V+	Power supply positive for DSC (5.6-18 VDC)	
CAN H/(A)	Comms	
CAN SH	Shield	
CAN L/(B)	Comms	
CAN GND/(-V)	Power supply negative for DSC	
J10-11	**9 pin D-type connector; power and comms (note: this is different than the DSJ1)**	
Pin	**RS485**	**CAN**
1	SHLC	CANSHLD
2	NC	NC
3	-V	CANGND
4	B	CAN L
5	NC	NC
6	+V	CAN V+
7	NC	NC
8	A	CAN H
9	NC	NC
LK1/LK5	Select correct pins for 9 in D-type for RS232/RS485 and CAN	
LK2	120 ohm terminating resistor. (Do not use for RS232)	
LK3	Select onboard temperature sensor or external DTEMP	
LK4	Connects digital output to Output LED	

Appendix F - Digital Filtration

The Dynamic filter is basically a recursive filter and therefore behaves like an electronic 'RC' circuit. It has two user settings, a level set in the calibrated engineering units and the maximum number of steps (up to 255).

Instead of outputting every new value, a fraction of the *difference* between the new input value and the current filtered value is added to the current filtered value to produce the filtering action.

If this difference is less than the value set in the **Filter Level** then the fractional amount added each time is decremented until it reaches the minimum level set by **FFST** i.e. **FFST** is the *limit* of the divisor.

e.g. if **Filter Steps** = 10 the fractional part of the difference between the new value and the current filtered value will be added to the current filtered value.

If a rapidly changing or step input occurs and the difference between the new input value and the current filtered value is greater than the value set in **Filter Level** then the output of the filter will be made equal to the new input reading i.e. the fractional amount of the new reading added to the current reading is reset to 1.
This allows the Filter to respond rapidly to fast moving input signals.

When a step change occurs which does not exceed **Filter Level**, the new filtered value is calculated as follows:

New Filter Output value = Current Filter Output Value + ((Input Value - Current Filter Output Value) / Filter Steps)

The time taken to reach 63% of a step change input (which is less than **Filter Level**) is dependant on the frequency at which values are passed to the dynamic filter, set in **Measurement Rate**, multiplied by **Filter Steps**.

The table below gives an indication of the response to a step input which is less than **Filter Level**.

% Of Final Value	Time To settle
63%	**Measurement Rate** * **Filter Steps**
99%	**Measurement Rate** * **Filter Steps** * 5
99.9%	**Measurement Rate** * **Filter Steps** * 7

For example, If **Measurement Rate** is set to 100Hz = 0.01s and **Filter Steps** is set to 30 then the time taken to reach a % of step change value is as follows.

% Of Final Value	Time To settle
63%	0.01 x 30 = 0.3 seconds
99%	0.01 x 30 x 5 = 1.5 seconds
99.9%	0.01 x 30 x 7 = 2.1 seconds

Appendix G - Toolkit Supported CAN Controllers

Ixxat USB to CAN Compact v2

Appendix H - Trouble Shooting

Status LED

When all is good, the LED will be off and flash on for 100 milliseconds at the below rate. If there is a fault detected and shown in the STAT parameter, the LED will be on and flash off for 100 milliseconds.

Protocol	LED flash period
ASCII	0.5 seconds
MODBUS	1 second
MANTRABUS II	2 seconds
MantraCAN	0.5 seconds
CANopen	As per CiA specification

Diagnostic Flags

The main diagnostics facilities are by means of the flags. See Command List for full description of the flags and their meanings.
The flags are normally used something like this.
FLAG is read at regular intervals by the host (like the main output value, but generally at longer intervals)
If some warnings are active, i.e. **FLAG** is non-zero, then the host tries to cancel the warnings found by writing **FLAG**= 0
The host then notes whether the error then either remains (i.e. couldn't be cancelled), or if it disappears, or if it re-occurs within a short time, and will take action accordingly.

The warning flags are latched indicators of transient error events: By resetting the register, the host both signals that it has seen the warning, and readies the system to detect any re-occurrence (i.e. it resets the latch).

What the host should actually do with warnings depends on the type and the application: Sometimes a complete log is kept, sometimes no checking at all is needed.
Often, some warnings can be ignored unless they recur within a short time.

Warning flags survive power-down, i.e. they are backed up in non-volatile (EEPROM) storage.
Though useful, this means that repeatedly cancelling errors which then shortly recur can wear out the device non-volatile storage – see Finite Non-Volatile Memory Life in appendix.

STAT provides a current status of the device. These flags are not latched and not saved on power fail.

No Communications

The majority of problems involve a failure to communicate, as there are a number of optional settings that must be set the same at both ends of the link.
For this reason, any communications application should always check command responses, and flag a problem when there these responses are not activated.

Possible problems can be categorised according to where in the 'chain' of communication the problem may be. The typical chain runs as follows,

- PC software (port connection, baud rate, station number, protocol)
- PC USB (working)
- PC CAN drivers
- USB-CAN device
- Bus wiring
- Device (wiring, ID, bit rate, working)

Bad Readings

The cause can be either hardware or software related.

Software

1. Check the MVV reading first and ensure it is correct. This figure is the RAW input and is not affected by the user configurable calibration settings.
2. If MVV looks correct, check the calibration settings step by step.
   Consider resetting all the calibration controls to default values – see ***Error! Reference source not found.*** in *ref _Ref528052251 \h * Mergeformat* ***Error! Reference source not found.***.

Hardware

1. Load Cell problem should be indicated by Flag **LCINTEG** in **STAT**.
2. Genuine hardware problems usual show up as **total** failure – i.e. no reading = always unchanging, usually near zero, sometimes always full-scale.
   Check wiring, take voltage level readings and again if possible use a known good device and set up.
3. Check the sensor is connected properly, and has some resistance across excitation wires, and around 350 ohms across output wires (when disconnected from DSC/DLC).
4. Check for damaged DSC/DLC device by replacement

Unexpected Warning Flags

Remember that all warning flags in **FLAG** must be explicitly reset –they do not clear themselves when a problem is resolved.
If a flag cannot be cleared, the cause must be persistent –i.e. it keeps happening again. This can be immediate, regular (every few seconds) or irregular (occasional).

Bear In Mind The Following Possible Problems

1. REBOOT or COMMSFAIL may indicate intermittent connections.
2. Where ECOMUR/OR or EXCUR/EXCOR are triggered, suspect input wiring.
3. Various 'range' errors (CRAWUR/OR, SRAWUR/OR) are also likely to be set if the excitation was interrupted (EXCUR/OR).
4. For range errors, check the associated limit parameters (CMIN/MAX, SMIN/MAX).
5. Problems are likely if any calibration MIN/MAX parameters are set the wrong side of zero (i.e. MIN>0 or MAX<0).

Problems with Bus Baud Rate

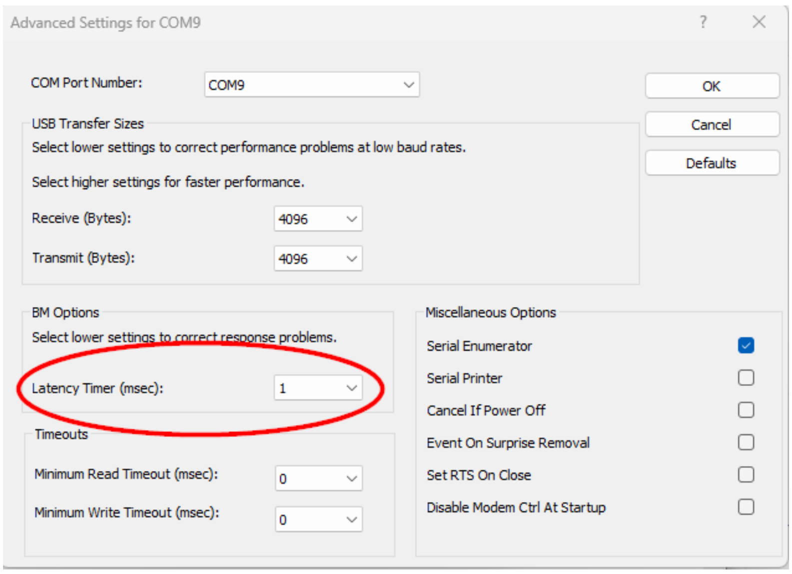
There are a number of special difficulties to be considered here

- Systems with very long cabling may not work with higher bit rates
- Always remember you need to reboot devices before the change takes effect

Difficult problems can always be overcome, if necessary, by isolating individual devices and trying the different bit rates in turn. This deals with all possible problems, as long as your hardware can deliver all the supported baud rates.

Port problems

When a USB com port adaptor is connected to a new USB socket, certain default settings are applied. (This means that even if you have previously changed settings for a device, if you plug it into a new port, the defaults will be applied to that port). One of these is that the latency is set to 16 ms. This will severely limit the speed that communications can take place.
To change it, go into Windows Device Manager and find the relevant com port. Go to Port Settings and Advanced. Change latency to 1 millisecond. Click OK.



Recovering a lost DSC/DLC

DLC RS845

If you have lost the communication settings for these devices, there is no way to recover them except with trial and error. In future ensure that you know the station number/ID and baud rate settings.

DSC RS485 or RS232

RS232 and RS485 versions of the DSC have the ability to have the communication settings reset to defaults (station number 1 and baud rate 115200) by shorting the reset comms pads (see above) together whilst powering up the DSC. You will then need to power cycle the DSC for the changes to be applied.

MantraCAN

Due to the configure ability of the device's CAN settings it is important to note all changes made to these settings or you may lose the ability to communicate with the device. In particular if the ID is changed from the default it would be very difficult to find the ID by trial and error as there are 2047 possible ID's available on a Can 2.0a 11 bit system and 536,870,911 for Can 2.0b 29 bit identifiers.
For this reason the DSC/DLC has a built in mechanism to reset the base ID back to the default value of 1.
To activate this recovery mode the device must be sent 2 commands over the CAN Bus on the broadcast ID of 0 with the second command being sent within 2 seconds of the first.

> ! It is important that the device to be reset is the only device to be connected on the CAN bus otherwise all devices will be reset to the default!!

Each Command consists of 7 ASCII Bytes as its Data message bytes shown below.

First Command

	Byte							
	1	2	3	4	5	6	7	8
ASCII	M	A	N	T	R	S	T	Blank
DECIMAL	77	65	78	84	82	83	84	Blank
HEX	4D	41	4E	54	52	53	54	Blank

Second Command

must be sent within 2 seconds of First Command

	Byte							
	1	2	3	4	5	6	7	8
ASCII	D	O	R	E	S	E	T	Blank
DECIMAL	68	79	82	69	83	69	84	Blank
HEX	44	4F	52	45	53	45	54	Blank

After sending the command sequence recycle the power to the DSC the DSC will then have the default base ID of 1. It should then be relatively simple to discover the Bit Rate.

Appendix I - Known Issues

Finite Non-Volatile Memory Life

The DSC/DLC use EEPROM-type memory as the storage for non-volatile controls (i.e. all the settings that are retained even when powered down).
The device EEPROM itself is specified for 100,000 write cycles (for any one storage location), although typically this is 1,000,000.
Therefore –
When automatic procedures may write to stored control parameters, it is important to make sure this does not happen too frequently.

So, you should not, for example, *on a regular basis* adjust an offset calibration parameter to zero the output value. However, it *is* reasonable to use this if the zeroing process is initiated by the operator, and won't normally be used repeatedly.

For the same reason, automatically cancelling warning flags must also be implemented with caution: It is okay as long as you are not getting an error recurring *repeatedly*, and resetting it every few seconds.

CANopen

Length of data in PDO

It may be that in some interpretations of CANopen the length of data in the PDO is referred to in bits. In the DSC/DLC CANopen devices it is referred to in bytes. This usually is not a problem but some controllers may struggle to decode the data. Please contact Mantracourt for a work around.

EU DECLARATION OF CONFORMITY

We, the undersigned:

Name of Manufacturer:	**Mantracourt Electronics Ltd**
Address:	**The Drive, Farrington, Exeter, Devon, EX5 2JB**
Country:	**United Kingdom**

Declare under our sole responsibility that the following products:

DSC series and DLC series

Are in conformity with the following relevant Union harmonisation legislation:

LVD directive 2014/35/EU
EMC directive 2014/30/EU
RoHS directive 2015/863/EU

Based on the following harmonised standards:

EN 61326-1:2013	**/**	**IEC 61326-1:2012**
EN 61326-2-3:2013	**/**	**IEC 61326-2-3:2012**
EN 61010-1:2010+A1:2019	**/**	**IEC 61010-1:2010/AMD 1:2016/COR1:2019**

Name and position of person binding the manufacturer or authorised representative:

Signed

Name:	**Robert Willmington-Badcock**
Function:	**Managing Director**
Location:	**Mantracourt Electronics Ltd**
Date of issue:	**27th April 2023**

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Warranty

All DSC and DLC products from Mantracourt Electronics Ltd., ('Mantracourt') are warranted against defective material and workmanship for a period of one (1) year from the date of dispatch.

If the 'Mantracourt' product you purchase appears to have a defect in material or workmanship or fails during normal use within the period, please contact your Distributor, who will assist you in resolving the problem. If it is necessary to return the product to 'Mantracourt' please include a note stating name, company, address, phone number and a detailed description of the problem. Also, please indicate if it is a warranty repair.

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In the interests of continued product development, Mantracourt Electronics Limited reserves the right to alter product specifications without prior notice.

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