



# MEASUREMENT AND CONTROL SOLUTIONS

## LOADCELLS AND AMPLIFIERS FOR TENSION MEASUREMENT

### DCA-22 Dual Channel Loadcell Amplifier Technical Manual

- Total, Left and Right load outputs
- Outputs 0 to 10VDC and 4 to 20mA
- Simple push button calibration of zero and span
- Logical user friendly programming
- Displayed value and diagnostic data
- Response time 1ms
- Foil and semiconductor strain gauges
- Modbus RTU/RS485 comms



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TTS Systems offers a complete range of loadcells, amplifiers  
& controllers for web, wire and filament tension measurement.  
Plus position and edge sensing, compact web guides and retro-fit.

[www.tts-systems.com](http://www.tts-systems.com)

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## Notes on the Documentation

This description is only intended for the use of trained specialists in control and automation engineering who are familiar with the applicable national standards.

It is essential that the documentation and the following notes and explanations are followed when installing and commissioning the components.

It is the duty of the technical personnel to use the documentation published at the respective time of each installation and commissioning.

The responsible staff must ensure that the application or use of the products described satisfy all the requirements for safety, including all relevant laws, regulations, guidelines and standards.

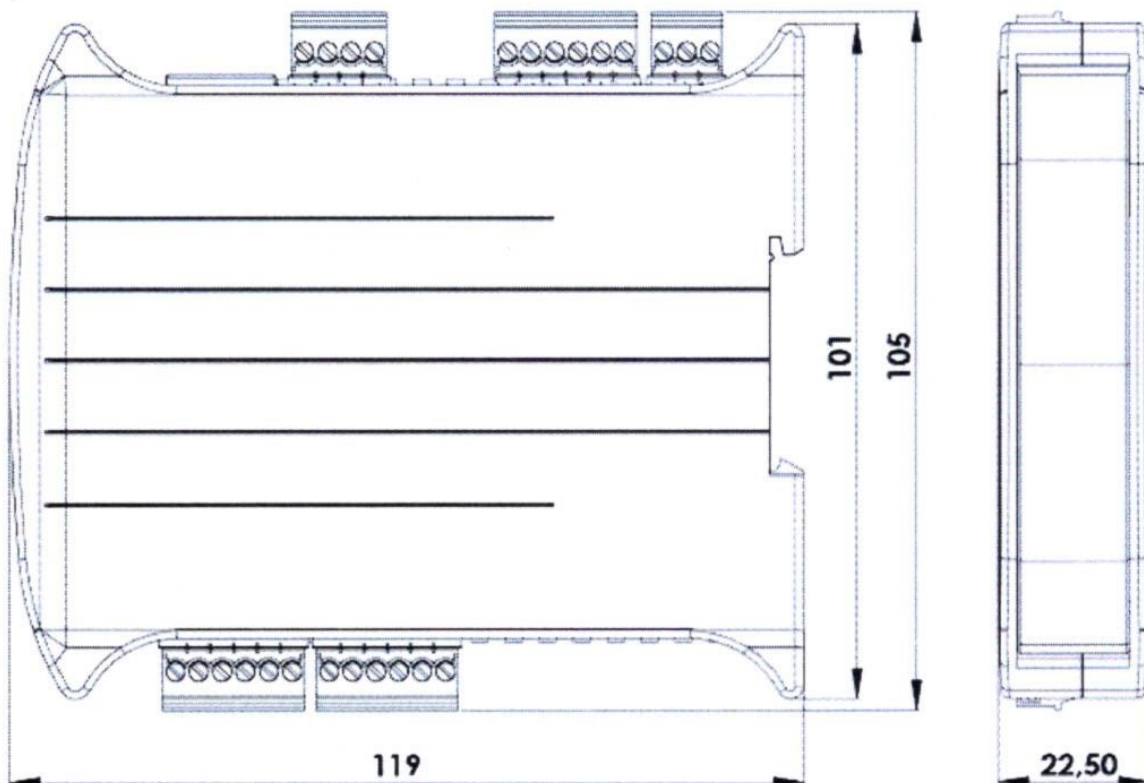
## Disclaimer

The documentation has been prepared with care. The products described are, however, constantly under development.

We reserve the right to revise and change the documentation at any time and without prior announcement.

## General Technical Specification

Supply Voltage .....	24VDC +/-15%
Power Consumption .....	Less than 100mA
Foil Strain Gauges .....	Full Bridge 350 / 720 / 1k Ohm
Semiconductor Strain Gauges .....	Half Bridge 120 Ohm
Excitation Voltage .....	5VDC
Measuring Range .....	+/-39mV to +/-4.96V
Conversion Rate .....	1.000/s
Response Time .....	1 ms
Calibration Units .....	N, Kg, lbs, %
Output Total Load .....	+/- 10VDC and 4 to 20mA
Output Left and Right Load .....	0 to 10 VDC each
Working Temperature .....	-20 to +60 degC
DIN Rail Mounting .....	35mm to EN 60715
Mounting Clearance .....	20mm required above, below and both sides



Channel 1  
Loadcell  
Input

Channel 2  
Loadcell  
Input



RS485  
4 way  
Connector

Output  
Connector

Supply  
Connector

The DCA-22 is a universal digital amplifier designed to meet all requirements of tension sensing within that is converting, print handling, paper, foil, narrow web, labels, ribbon, wire and other reel to reel materials.

The design allows for the amplifier to handle all types of strain gauges - foil and semiconductor based loadcells.

Installation and calibration are easily completed with the internal recognition feature that automatically adjusts to the loadcell input. Whilst internal filters are used to give a steady and balance output signal of the measured reading.

Connecting the loadcells - LC1 - Left and LC2 - Right makes it possible to the following three outputs = Left, Right and Total ( summation of Left and Right )



## Installation



### WARNING

#### Risk of electric shock and damage of device!

- Have the installation carried out only by educated and qualified personnel
- Remove power before starting installation, disassembly or wiring of the Amplifier
- The PE terminal must not be used for other potentials!



### NOTICE

#### Destruction of the devices by electrostatic discharge possible!

- Please ensure you are electrostatically discharged use an insulated screwdriver to avoid touching the contacts of the device directly.

## DIN Rail Mounting

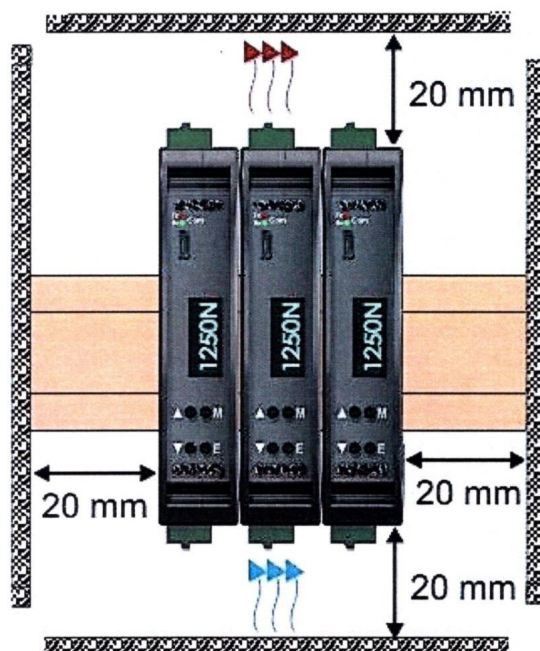
The loadcell amplifier module is mounted using a 35 mm DIN rail according to EN 60715

## EMC Cable Shield Earthing

For good process measurement and operation of the DCA-22 - a good electrical earth is required!

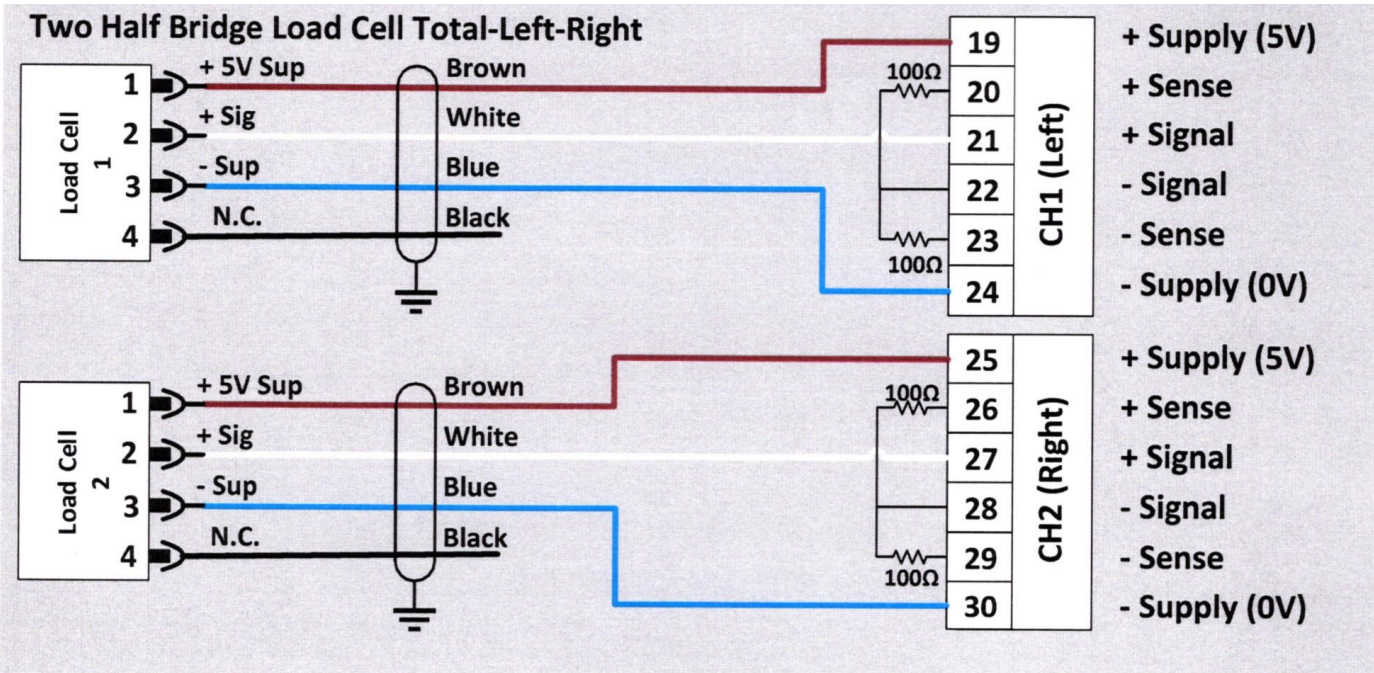
- Earthing of the loadcell signal cables is very important
- Route signal cables separately from mains power supply, motor control , etc.
- Route cables so that they do not rub or become crushed, cut or caught
- Use proper shield clamps and earthing components

## Mechanical Mounting



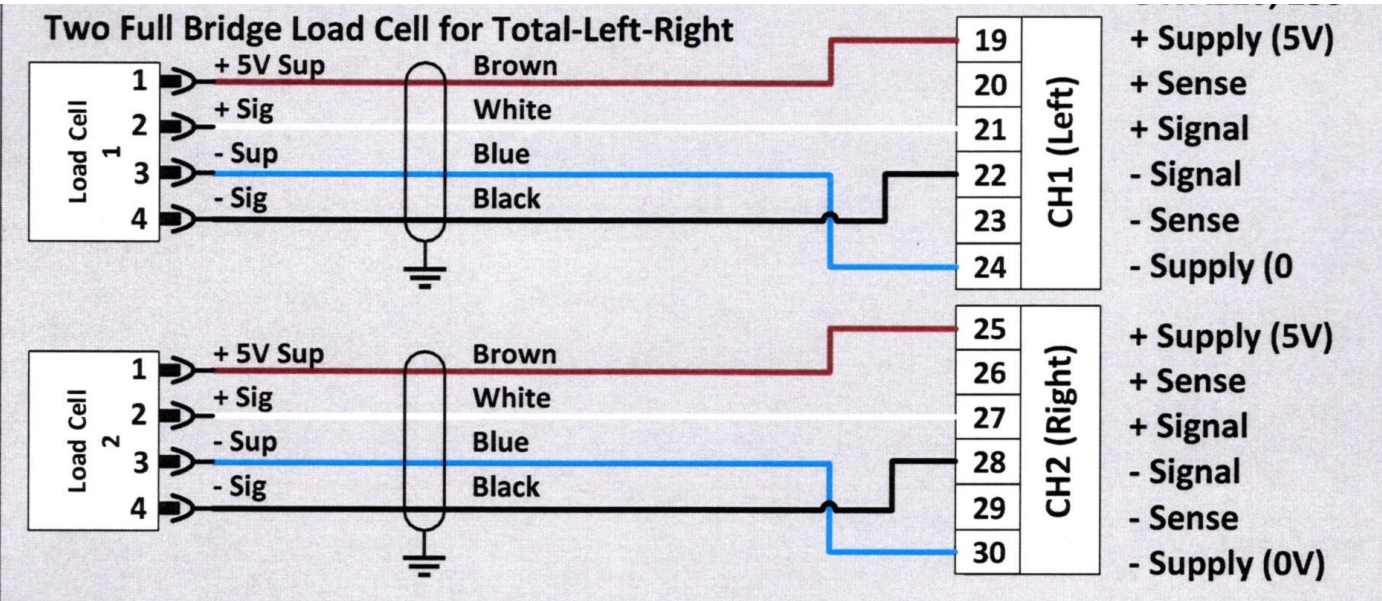
Recommended distances for standard installation

# Semiconductor Loadcell Wiring



## Foil Strain Gauge Loadcell Wiring - Full Bridge

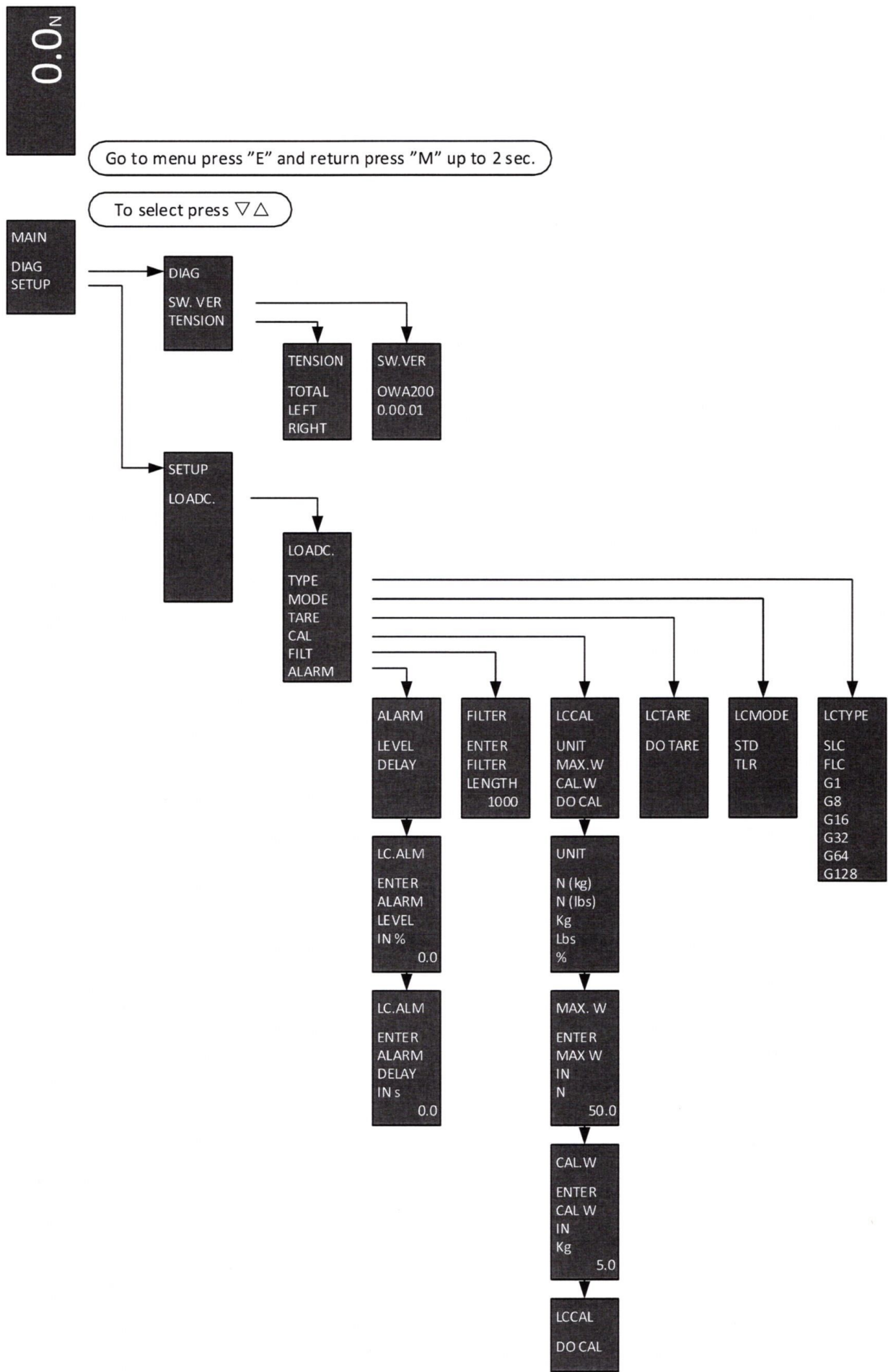
### TTS Systems - CRL, CRL and FB Standard Loadcells



Standard wiring colour codes for a TTS Systems loadcell with the M12 connector



# Setup and Calibration



## Glossary

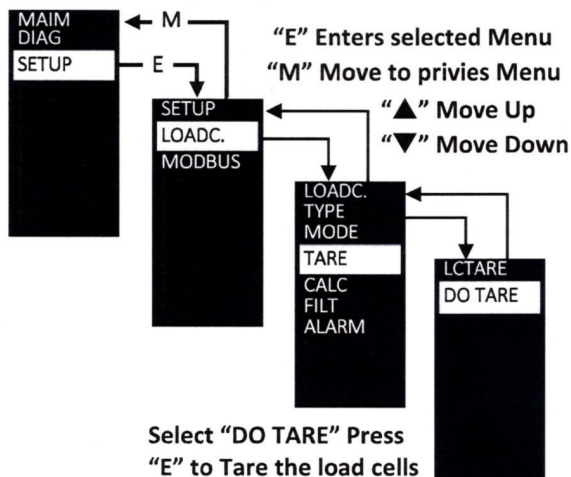
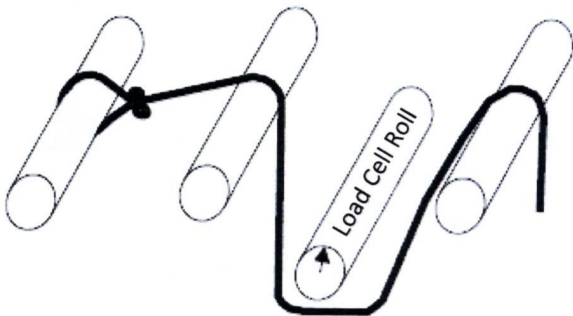
DIAG	:	Diagnostic
SW. VER	:	Software version; actual software version
LOADC.	:	Load Cell
LCTYPE	:	Load Cell type based on type of gauge
SLC	:	Strain gauge Load Cell 120 $\Omega$ semiconductor resistance
FLC	:	Foil gauge Load Cell 350 $\Omega$ resistance
G1-G128	:	Gain factor gives a selectable input range as follows:
G1	:	$\pm 4.9V$
G8	:	$\pm 614 \text{ mV}$
G16, SLC	:	$\pm 306 \text{ mV}$ (Half Bridge 120 Ohm)
G32	:	$\pm 153 \text{ mV}$
G64	:	$\pm 76 \text{ mV}$
G128, FLC	:	$\pm 38 \text{ mV}$ (Full Bridge 350, 720, 1k Ohm)
LCMODE	:	How the Load Cell is connected
STD	:	Standard is giving an average reading if two Load Cells are connected
TLR	:	Total-Left-Right is giving separated reading on each of two Load Cells connected, so the "Total" average reading, the Left-side and Right-side reading is available
TARE	:	Zero calibration without tension on the Load Cell
CAL	:	Calibration; with an know weight giving tension to the Load Cell
UNIT	:	The selected display and calibration weighing unit
N (kg)	:	Actual tension displayed in N and the physical calibration weight given in Kg.
N (lbs)	:	Actual tension displayed in N and the physical calibration weight given in lbs.
Kg	:	Actual tension displayed in Kg and the physical calibration weight given in Kg.
Lbs	:	Actual tension displayed in lbs and the physical calibration weight given in lbs.
% tension	:	Actual tension displayed in % and the physical calibration weight given in % of max
MAX. W	:	Max weight = Tension to be entered in selected display unit
CAL. W	:	Calibration weight to be entered in the selected calibration unit
FILT	:	Filter is selectable for analog output "Ao1", "Ao2" and "Ao4", all in one, output "Ao3" has no filter. The filter is based on a sampling frequency of 1 Khz and the filter is the average reading of the selected number of samples.
Alarm level	:	Level in % of max. tension when alarm is activated. Connected to output "D0" and preset value is 5%.
Alarm delay	:	Select the delay in seconds before "Alarm" is activated.

# Loadcell Calibration

SETUP			
LOADC.	LOADC.		
	TYPE	LCTYPE	
		SLC	
		FLC	FLC
		G1-G128	
	MODE	LCMODE	
		STD	STD
		TLR	
	TARE	LCTARE	
		DO TARE	Enter
	CAL	LCCAL.	
		UNIT	N
		MAX.W	100.0
		CAL.W	50.0
		DO CAL	Enter
	FILT	FILTER	1000
	ALARM	ALARM	
		LEVEL	0.0
		DELAY	0.0

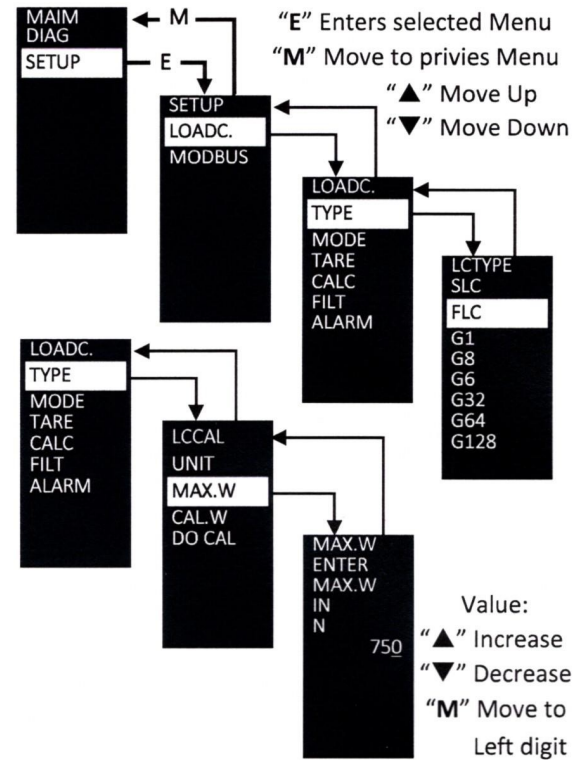
## 4.3.1 TARE the load cell roller

Tare the amplifier. Loosen or remove the web so no tension is applied to the Load cell roller.



## Menu system:

use the [ M, E, ▲ & ▼ ] buttons on the front



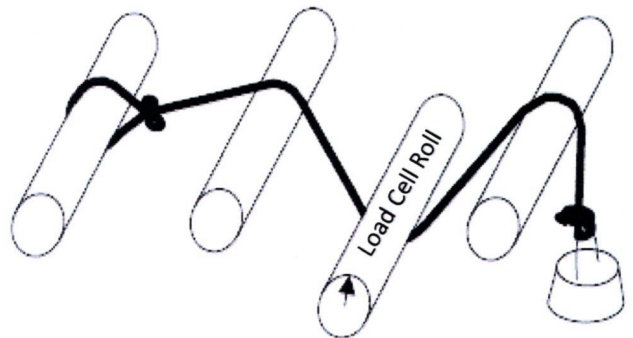
## 4.3.2 Calibrate the load cell roller

Under "TYPE" Select "SLC" (Semiconductor Half bridge load cells 50mV/V) or "FLC" (Foil Full Bridge Load cells 2mV/V)

Under "CAL."

"UNIT" Select the engineering unit for the display  
 "MAX.W" Set the max web tension for the application  
 "CAL.W" Use a known weight of min 20% of the max web tension.

Thread a rope over the center of the Load cell roller following the path of the web. Fasten one end of the rope and apply known weight to the other end

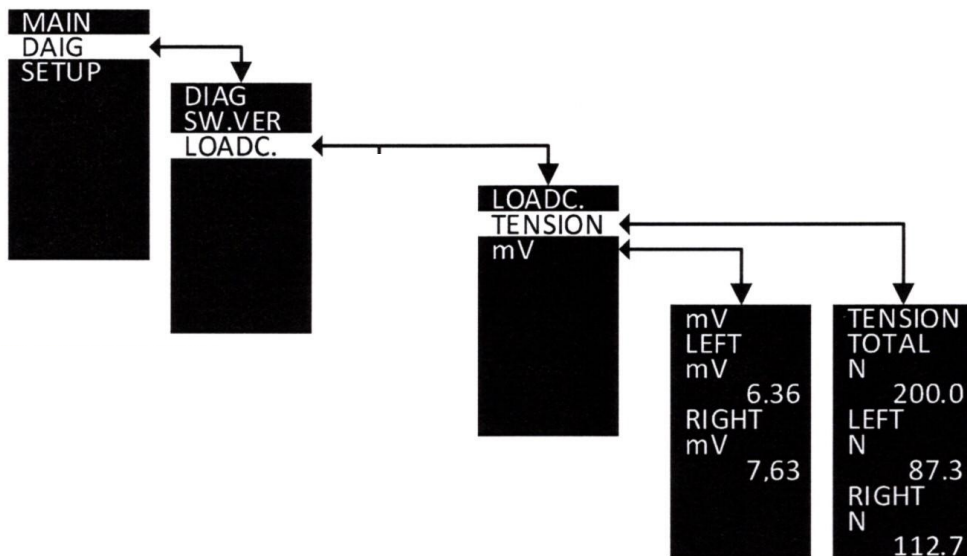


Select "DO CAL." Press "E" to Calibrate the amplifier to the force on the load cell roller



## Diagnostic

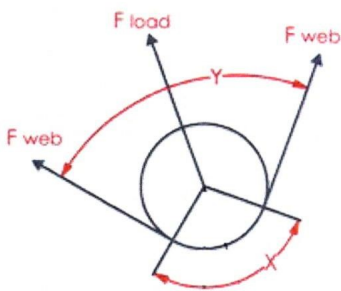
The diagnostic menu displays the actual tension from the loadcells and the mV directly on the input terminals from the loadcells.



## Loadcell Force Table

The table below can be used to estimate the resulting Force on the loadcells.

If the loadcell output is too high at maximum tension, the measurement range can be changed under TYPE MENU.



Max Tension [Kg]	Wrap angle	Angle Force factor	total resultant force [kg]	Min Load cell Size [N]
50	180	2.00	100	1000
50	150	1.93	97	966
50	120	1.73	87	866
50	90	1.41	71	707
<b>50</b>	<b>60</b>	<b>1.00</b>	<b>50</b>	<b>500</b>
50	30	0.52	26	259

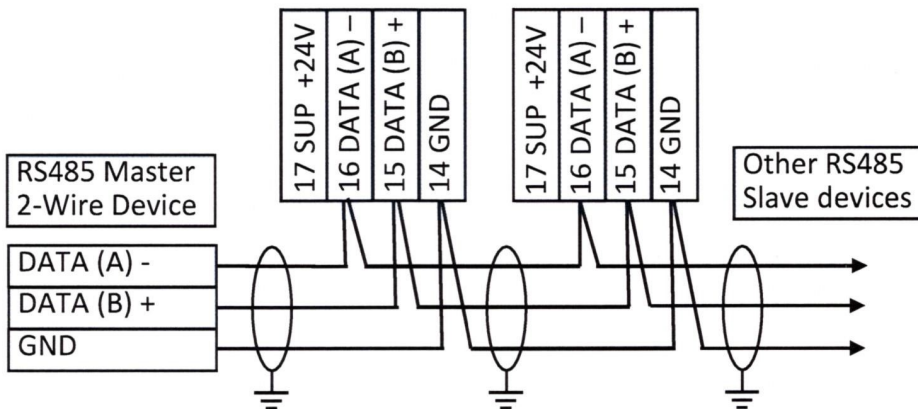
### TYPE MENU:

G1:	± 4.9V
G8:	± 614 mV
G16, SLC:	± 306 mV (Half Bridge 120 Ohm)
G32:	± 153 mV
G64:	± 76 mV
G128, FLC:	± 38 mV (Full Bridge 350, 720, 1k Ohm)

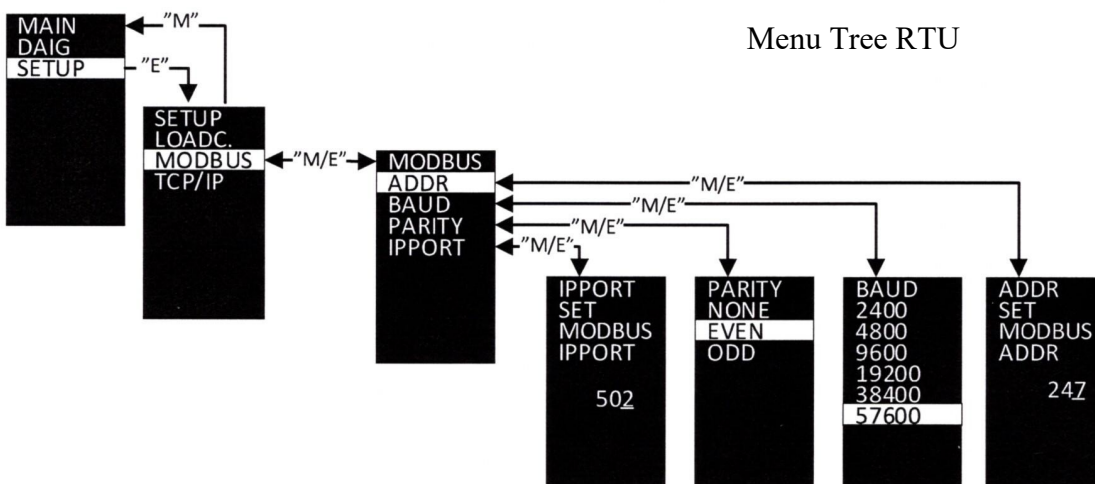
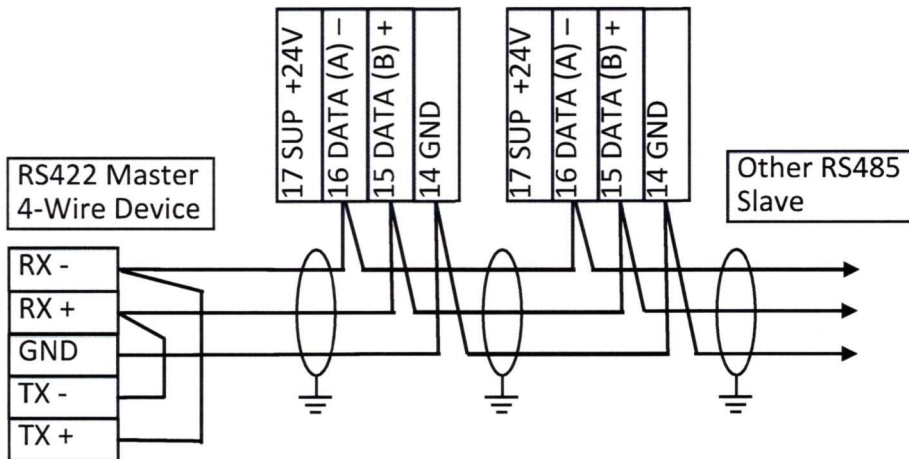
## Communication - Modbus RTU RS485

The DCA-22 amplifier supports Modbus Slave protocols RTU RS485

Wiring Diagram with 2-wire master



Wiring Diagram with 4-wire master



- MODBUS : Menu for Modbus Setup
- ADDR : Modbus slave ID (1-247)
- BAUD : Baud rate 2400 - 57600
- PARITY : NONE, EVEN or ODD, must be the same as the master
- IPPORT : the protocol uses Port 502 as local port in the Modbus TCP server

## Modbus RTU and TCP Holding Parameters

The DCA-22 uses Holding Register ( Analogue Values, Variables ) 400000 - 465534 is INT16

Address	Block	Description	Type	Range	Notes
400009	System	System Command (2=Save NV data)	Int16 R/W	0-9 2: Save to Flash	
401801	Load Cell	Calibrated output from Load Cell 1	Int16, Ro	-30000 to 30000 -300.00% to 300.00%	
401802	Load Cell	Calibrated output from Load Cell 2	Int16, Ro	-30000 to 30000 -300.00% to 300.00%	
401803	Load Cell	Calibrated total output from Load Cell 1+2	Int16, Ro	-30000 to 30000 -300.00% to 300.00%	
401804	Load Cell	Filtered Left Tension	Int16, Ro	-30000 to 30000 -300.00% to 300.00%	
401805	Load Cell	Filtered Right Tension	Int16, Ro	-30000 to 30000 -300.00% to 300.00%	
401806	Load Cell	Status codes	Int16, Ro	0 to 255 0: OK 201: Calibrating	
401807	Load Cell	Error bit	Int16, Ro	0-1	Error at Tare
401812	Load Cell	Filteret Total Tension	Int16, Ro	-30000 to 30000 -300% to 300%	
401813	Load Cell	Left Load Cell raw input	Int16, Ro	-32768 to 32767 -327.68 to 327.67mV	Measure the raw mV from the Load Cells
401814	Load Cell	Left Load Cell raw input	Int16, Ro	-32768 to 32767 -327.68 to 327.67mV	Measure the raw mV from the Load Cells
401820	Load Cell	Cal value	Int16, R/W	1000 to 10000 10% to 100%	Percent of full scale
401830	Load Cell	Bit to auto Tare	Int16, R/W	0 - 1	Write 1 to auto tare
401831	Load Cell	Bit to auto Calibrate	Int16, R/W	0 - 1	Write 1 to Auto calibrate
401844	Load Cell	Output 1 and 2 filter	Int16, R/W	1 to 10000 Samples	Sampling middling via stak
401853	Load Cell	Display filter	Int16, R/W	10 to 10000 Samples	Sampling middling via stak
402301	Modbus	Modbus slave address	Int16, R/W	1-247	Default: 247 "DATABITS=8" "STOPBITS=1"
402302	Modbus	Modbus slave baudrate	Int16, R/W	0 to 32767 24: 2400 48: 4800 96: 9600 192: 19200 384: 38400 576: 57600	Default: 576
402303	Modbus	Modbus slave parity	INT16	0: NONE 1: EVEN 2: ODD	Default: EVEN

## Replacing a TTS DCA-10 amplifier

### Easy - cross reference guide

Below is the OLD to NEW wiring connections

Then follow Loadcell Calibration on Page 9

DCA-10 OLD	Function	DCA-22 NEW
<b>1</b>	Loadcell 1 + Exc	<b>19</b>
<b>2</b>	Loadcell 1 + Sig	<b>21</b>
<b>3</b>	Loadcell 1 - Sig	<b>22</b>
<b>4</b>	Loadcell 1 - Exc	<b>24</b>
<b>5</b>	Loadcell 2 + Exc	<b>25</b>
<b>6</b>	Loadcell 2 + Sig	<b>27</b>
<b>7</b>	Loadcell 2 - Sig	<b>28</b>
<b>8</b>	Loadcell 2 - Exc	<b>30</b>
<b>31</b>	Power + 24VDC	<b>3</b>
<b>32</b>	Power 0VDC	<b>2</b>
<b>27</b>	Output Total +ve	<b>6</b>
<b>28</b>	Output Total 0V	<b>4</b>
<b>17</b>	Output Left +ve	<b>8</b>
<b>18</b>	Output Left 0V	<b>4</b>
<b>21</b>	Output Right +ve	<b>7</b>
<b>22</b>	Output Right 0V	<b>4</b>

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