Universal Digital Load Cell Amplifier OWA200

Technical Manual

Table of contents

1 About This Document

1.1 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 the 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.

1.2 Safety instructions

Safety regulations

Please note the following safety instructions and explanations!
Product-specific safety instructions can be found on following pages or in the areas mounting, wiring, commissioning etc.

Exclusion of liability

All the components are supplied in particular hardware and software configurations appropriate for the application. Modifications to hardware or software configurations other than those described in the documentation are not permitted, and nullify the liability of OWECON

Personnel qualification

This description is only intended for electric educated and qualified personnel who are familiar with the applicable national standards.

Description of instructions

In this documentation the following instructions are used.
These instructions must be read carefully and followed without fail!

⚠ DANGER	
	**Serious risk of injury!** Failure to follow this safety instruction directly endangers the life and health of persons.
⚠ WARNING	
	**Risk of injury!** Failure to follow this safety instruction endangers the life and health of persons.
⚠ CAUTION	
	**Personal injuries!** Failure to follow this safety instruction can lead to injuries to persons.
NOTE	
	**Damage to environment/equipment or data loss** Failure to follow this instruction can lead to environmental damage, equipment damage or data loss.

Tip or pointer

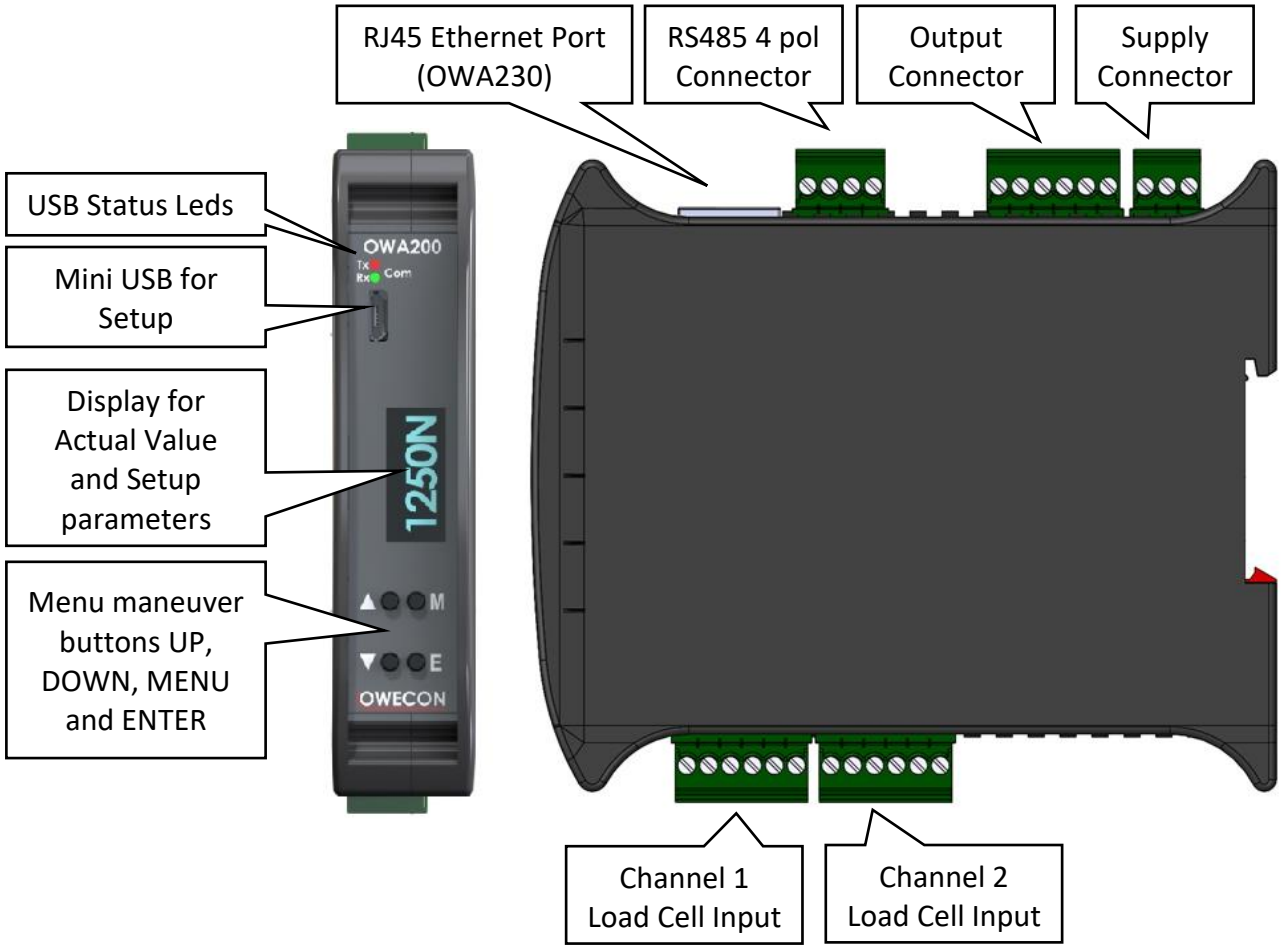
This symbol indicates information that contributes to better understanding.

2 General Description

The OWECON OWA200 series amplifier comes in three different versions for the customer to choose based on the need in the actual application.

OWA210: 1 channel Load cell amplifier, Modbus RS485 RTU communication
OWA220: 2 channel Load cell amplifier, Modbus RS485 RTU communication
OWA230: 2 channel Load cell amplifier, Modbus RS485 RTU, Ethernet TCP/IP communication

The installation and calibration is very easy to do and due to the internal recognition feature the output automatically adjusts to the load cell input.
The internal filters give a steady display output and a balanced output signal, for easier handling of the actual data reading.
The OWA200 series is a universal digital amplifier designed to meet all requirements of tension sensing within industries that is handling printing applications, converting, paper, foil, narrow web, labels, ribbon, wire and other weight systems. The design does the amplifier able to handle all types of foil or semiconductor load cells known to us so far.



2.1 Technical Features

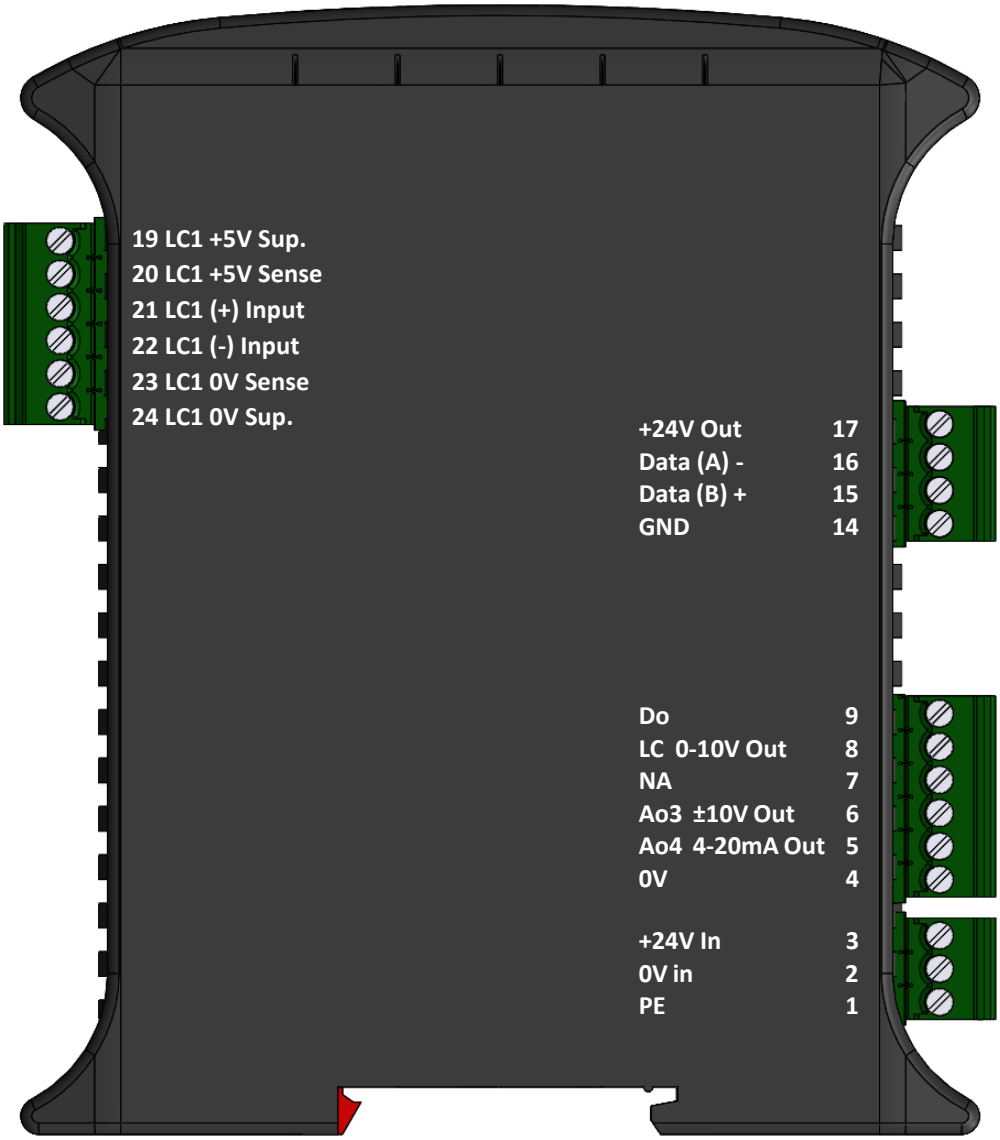
Technical Features	OWA210	OWA220	OWA230
Mini USB-port for programming	**X**	**X**	**X**
Total-Left-Right load measurement		**X**	**X**
Modbus RTU/RS485	**X**	**X**	**X**
Modbus TCP/IP Ethernet			**X**

Power supply	24VDC ±15%
Measure range	±39mV to ±4.96V
Number of load cells Semiconductor	4 of 120 Ω Half bridge
Number of load cells Strain gauge	4 of 350 Ω Full bridge
Load cell's sensitivity	±1mV/V to ±100mV/V
Conversion per second	1.000/s
Response time	1ms
Analog output	2 of 0-10V, 1 of ±10V and 1 of 4-20mA
Working temperature	-20° to +60°C

2.2 **OWA210 Feature**

The OWA210 digital amplifier is designed for applications with 1 or 2 of semiconductor half bridge load cells and for 1 or 2 of foil gauge full bridge load cells mounted in parallel to provide a calibrated total tension output.

All load cell connection cables are mounted in one 6 pin plug screw terminal.
The power supply for the amplifier is 24V.
The output alternatives are 1 of 0-10V, 1 of ± 10V and 1 of 4-20mA
For data communication the Modbus RTU/RS485 terminal is available.

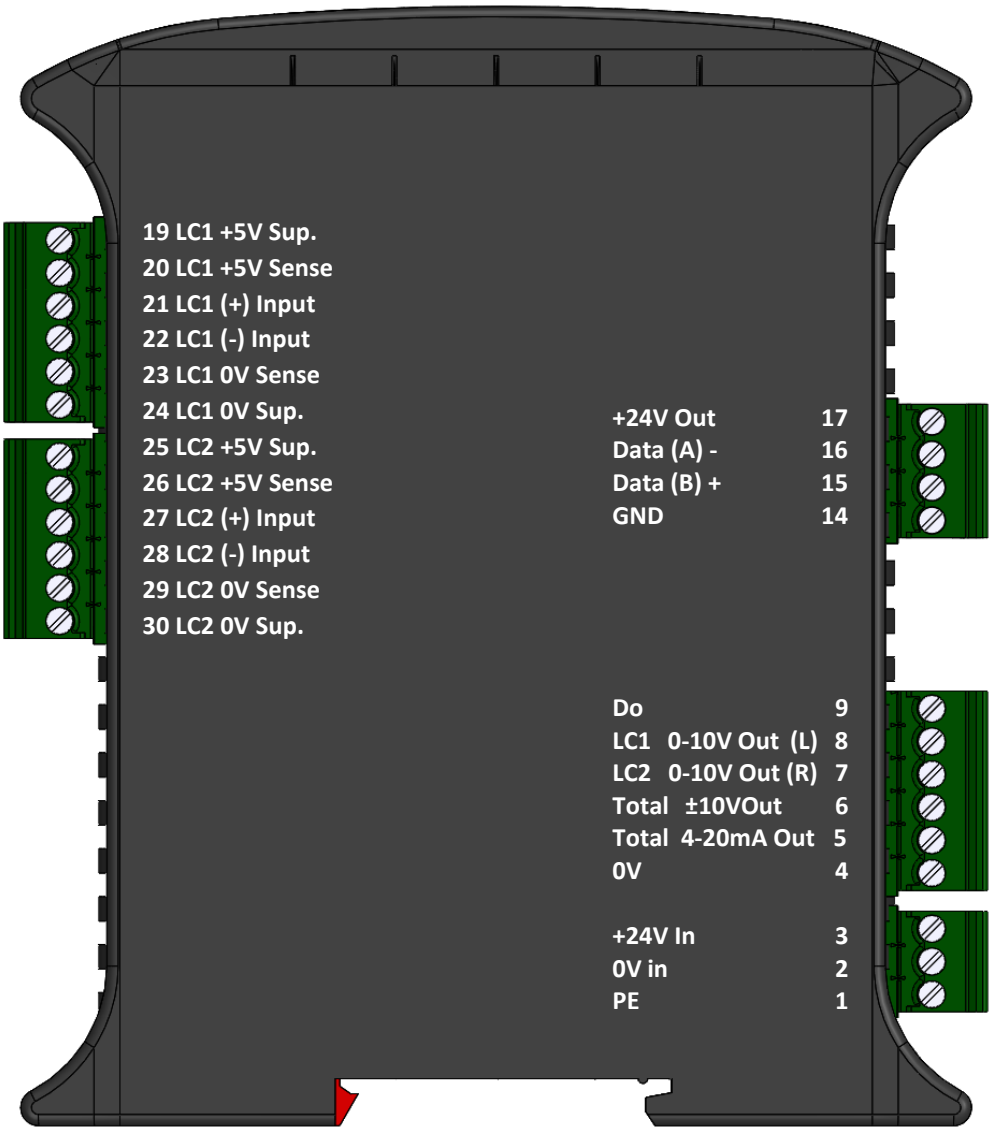


2.3 OWA220 Feature

The OWA220 digital amplifier is designed for applications with 1 or 2 of semiconductor half bridge load cells and for 1 or 2 of foil gauge full bridge load cells mounted in parallel to provide a calibrated total tension output.

The mounting of the load cells in the LC1-Left and LC2-Right terminal blocks makes it possible to have a “Total-Left-Right” measurement of the tension in the web.

All load cell connection cables are mounted in one 6 pin plug screw terminal.
The power supply for the amplifier is 24V.
The output alternatives are 2 of 0-10V, 1 of ± 10V and 1 of 4-20mA
For data communication the Modbus RTU/RS485 terminal is available.

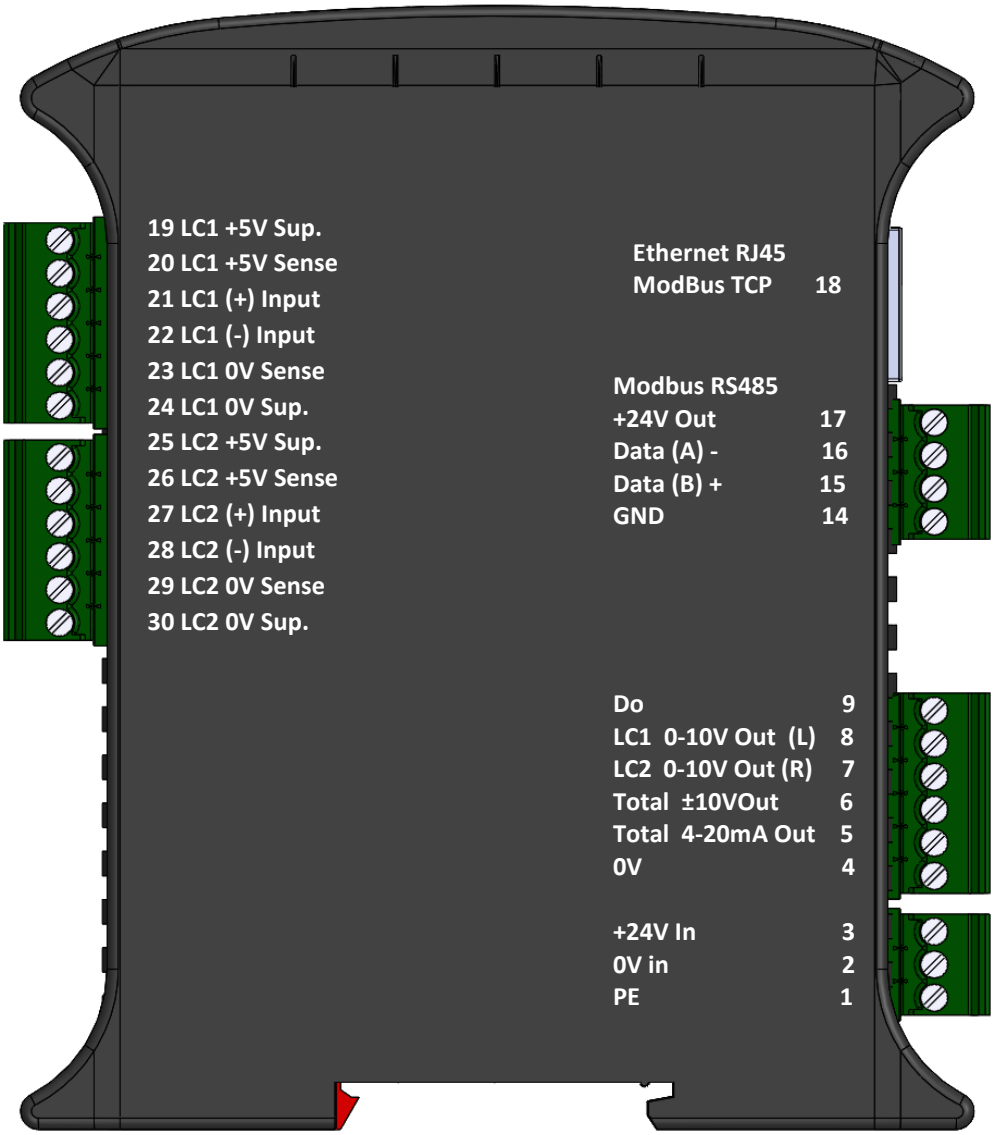


2.4 **OWA230 Feature**

The OWA230 digital amplifier is designed for applications with 1 or 2 of semiconductor half bridge load cells and for 1 or 2 of foil gauge full bridge load cells mounted in parallel to provide a calibrated total tension output.

The mounting of the load cells in the LC1 and LC2 terminal blocks makes it possible to have a "Total-Left-Right" measurement of the tension in the web.

All load cell connection cables are mounted in one 6 pin plug screw terminal.
The power supply for the amplifier is 24V.
The output alternatives are 2 of 0-10V, 1 of ± 10V and 1 of 4-20mA
For data communication the Ethernet port and the Modbus RTU/RS485 terminal is available.



3 Installation

3.1 General Safety Instructions

⚠ DANGER

Danger of death caused by moving machine parts!

- Parts of your body could be crushed, cut, drawn in or hit.
- Never reach in-between the area containing moving rolls, shafts, brakes or machine parts.
- Do not wear any necklaces, scarves or similar near to moving rolls / parts of the machine.
- Never stay in the pivot / traversing area of moving machine parts or reach into the section.
- Before setting up / operating the system, ensure that no other person is in the working area of the moving machine parts.

⚠ DANGER

Danger of death from electric shock!

Life threatening injuries caused by incomplete switching off or residual current.
With defective insulators or live parts, switch off the power supply immediately and have the repairs carried out by a qualified electrician.
Switch the system off completely, switch free of voltage and wait 10 minutes before carrying out any maintenance, repair, cleaning or assembly work.
Secure the system against being switched back on.

⚠ WARNING

Risk of cutting on sharp edges of the material web!

Severe cutting injuries from the edges of the running material web.
Never touch the edges of running material webs.

⚠ WARNING

Danger of falling and damage to assets caused by stepping/climbing onto components!

Stepping/climbing onto components (e.g. Rolls, Rollers or Load Cells) can lead to life-threatening falling accidents and to the destruction of the components.

- Never climb or step onto components.

NOTICE

Damage to the system from drilling dust and loose parts!

Drilling dust, splitter and loose parts may damage Parts in the electrical cabinet

- Before carrying out drilling or installation work, cover the affected area with film or paper.

3.2 Installation of the Load cell amplifier

⚠ 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.

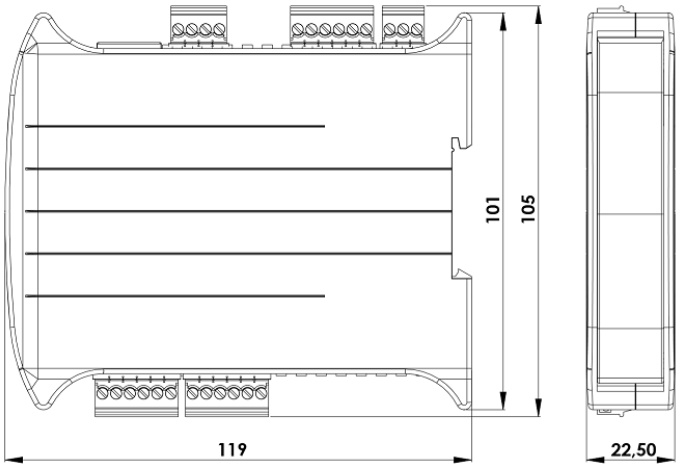
3.2.1 Mounting on DIN rail in cabinets

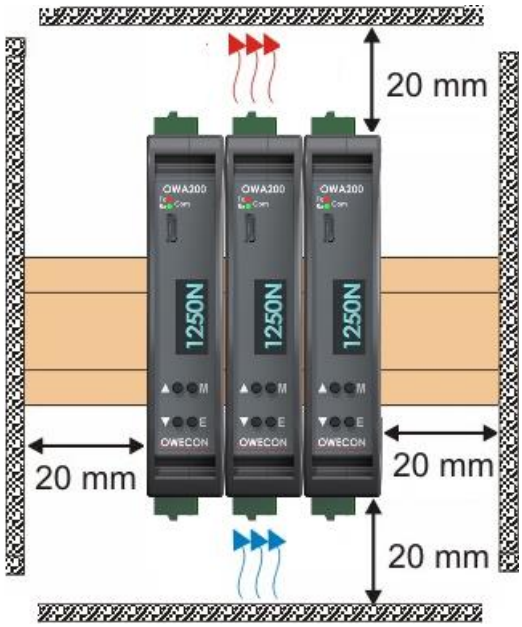
The Load cell amplifier module are attached to commercially available 35 mm mounting rails (DIN rails according to EN 60715)

Attach the module to the mounting rail, by sliding the top groove over the top edge of the DIN rail and lightly press the module down until the Red lock snap over the bottom edge of the rail.

To remove the module from the DIN rail, retract the Red lock with a screwdriver.

3.2.2 Mechanical dimensions

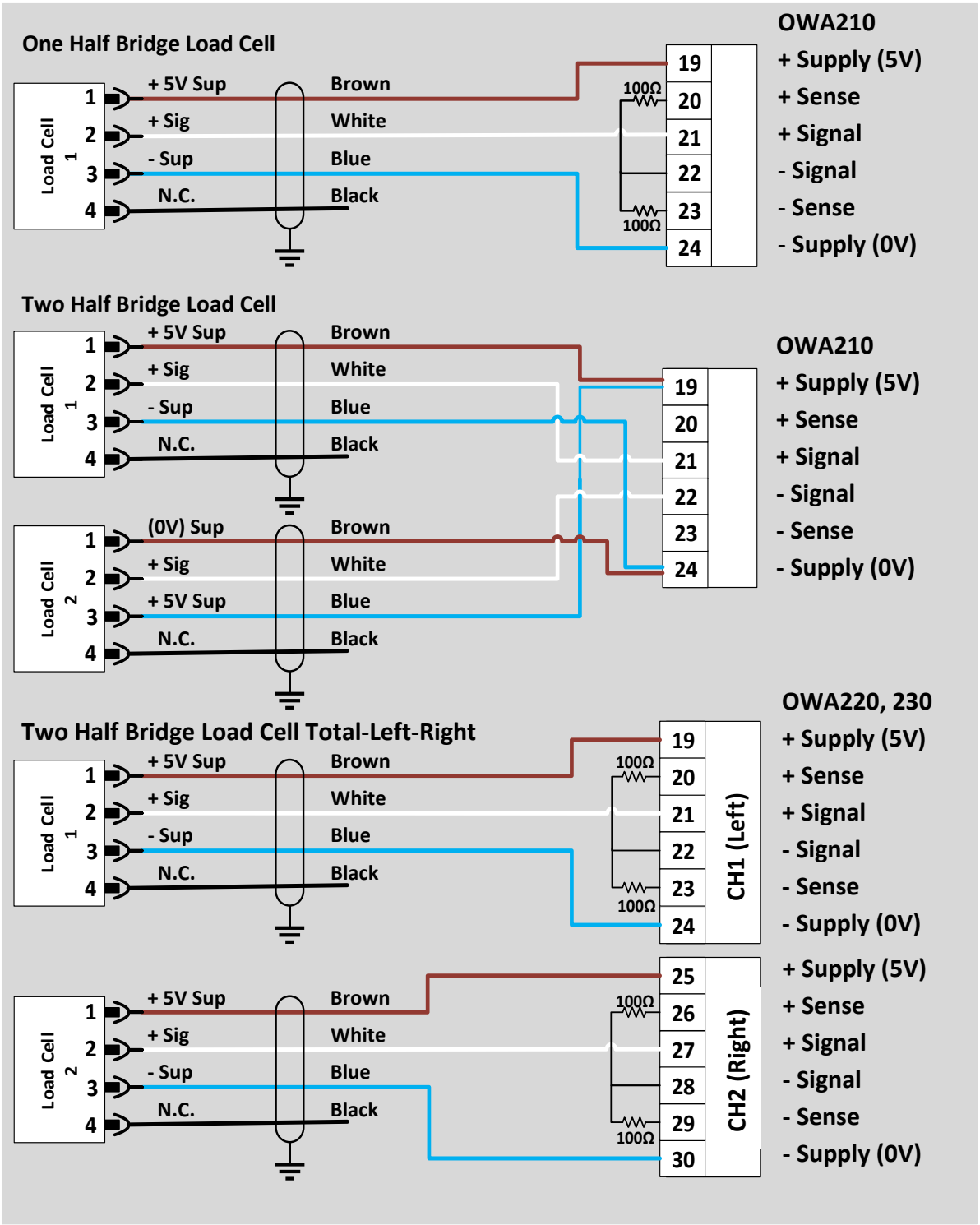




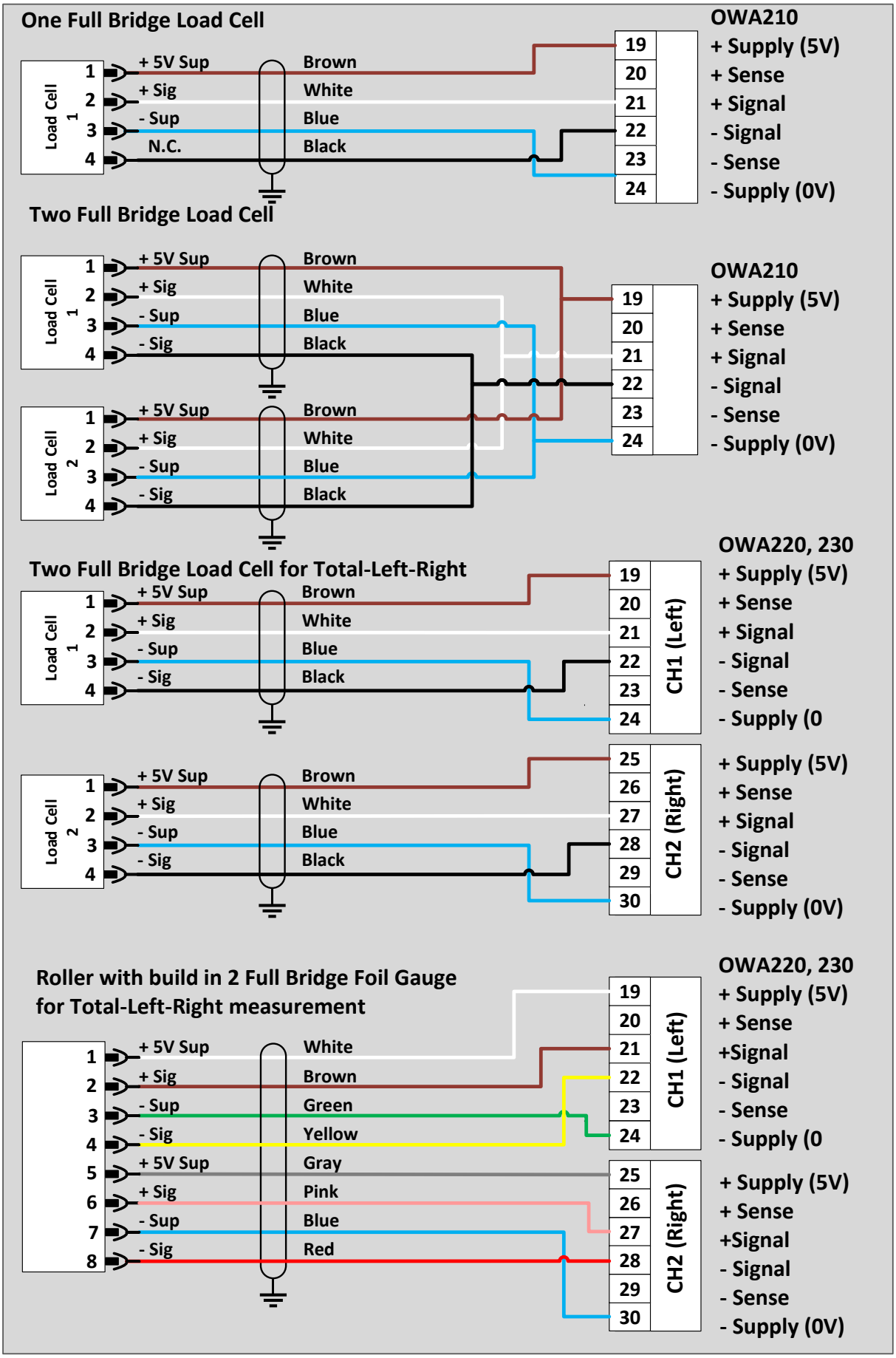
Recommended distances for standard installation position

3.3 Load cell wiring diagrams

3.3.1 OWECON Half-Bridge 3 wire 120 Ω Semiconductor load cell connections



3.3.2 OWECON Full-Bridge 4 or 8 wire 350 Ω Foil load cell connections



3.4 **EMC cable shield earthing**

For process measurement a high level of protection against noise is required.
The area where the cable shield is connected to the enclosure earth is a critical point.
It is very important that the connection has a low resistance.

- Earthing of the signal cable shields is very important.
- Route signal cables separately from supply, motor and other power cables.
- Route the cables so that they do not rub or become crushed, cut or caught.
- Use proper Shield clamps and earthing components.

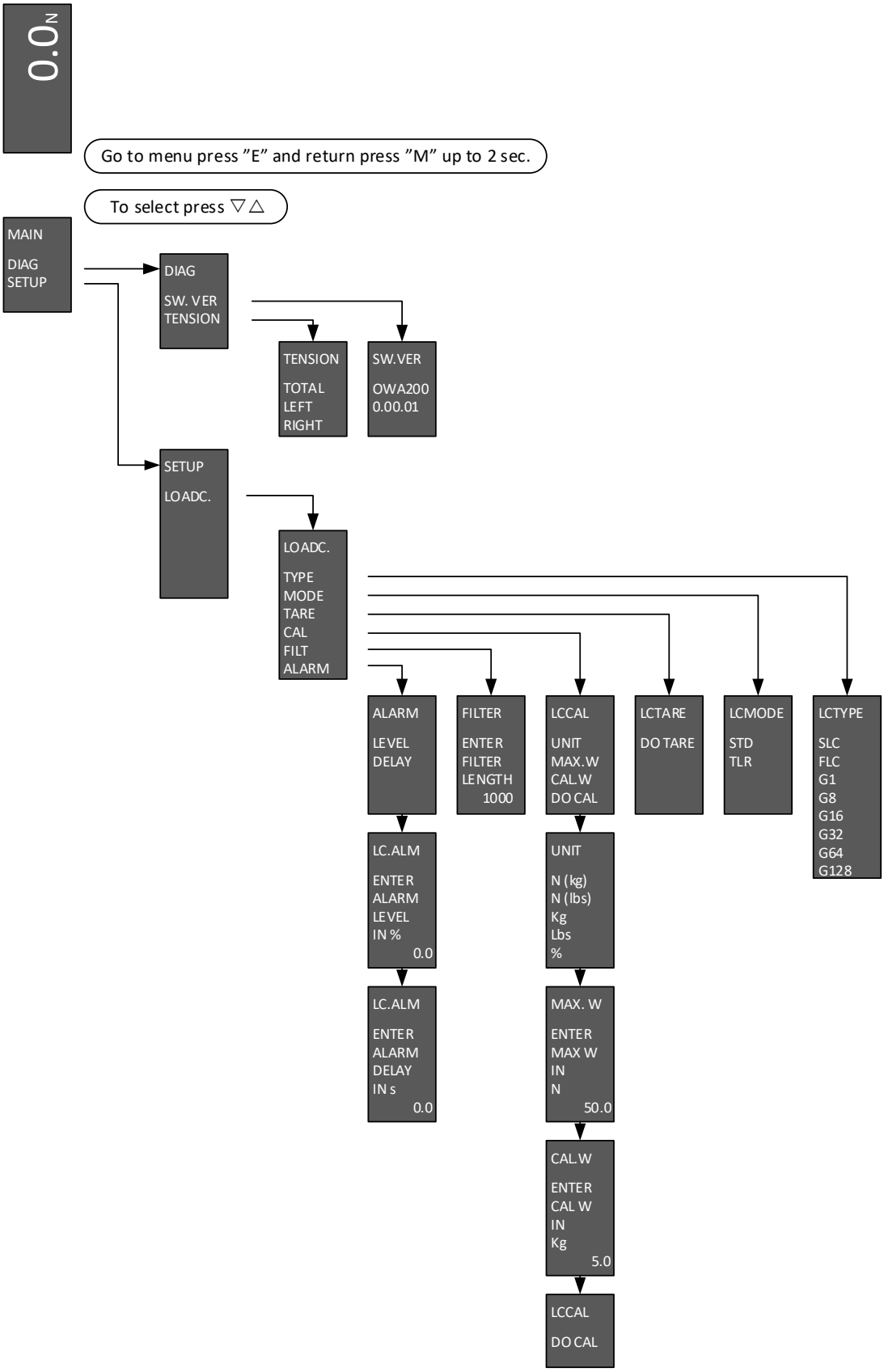
Examples of shield methods






4 Setup and calibration menu:

4.1 Menu tree



4.2 **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 Ω semiconductor resistance

FLC : Foil gauge Load Cell 350 Ω resistance

G1-G128 : Gain factor gives a selectable input range as follows:

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)

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.

% : Actual tension displayed in % and the physical calibration weight given in % of max tension

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%.

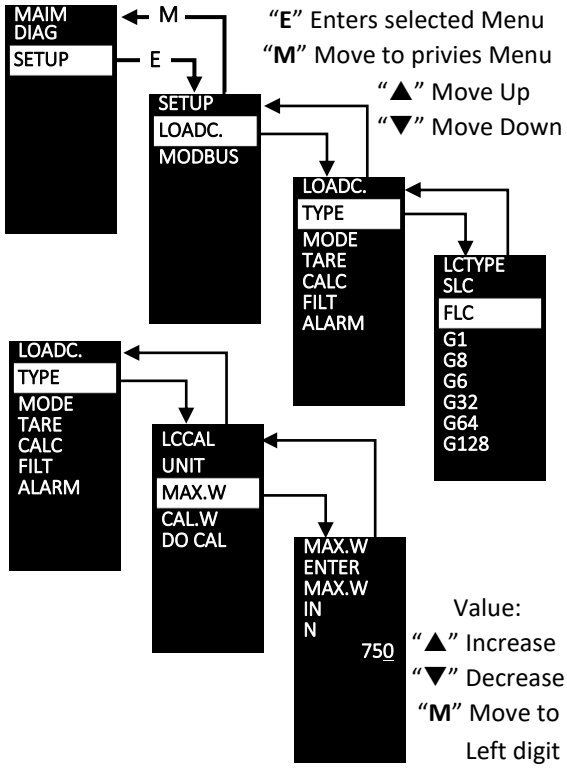
Alarm delay : Select the delay in seconds before “Alarm” is activated.

4.3 Load Cell 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

Menu system:

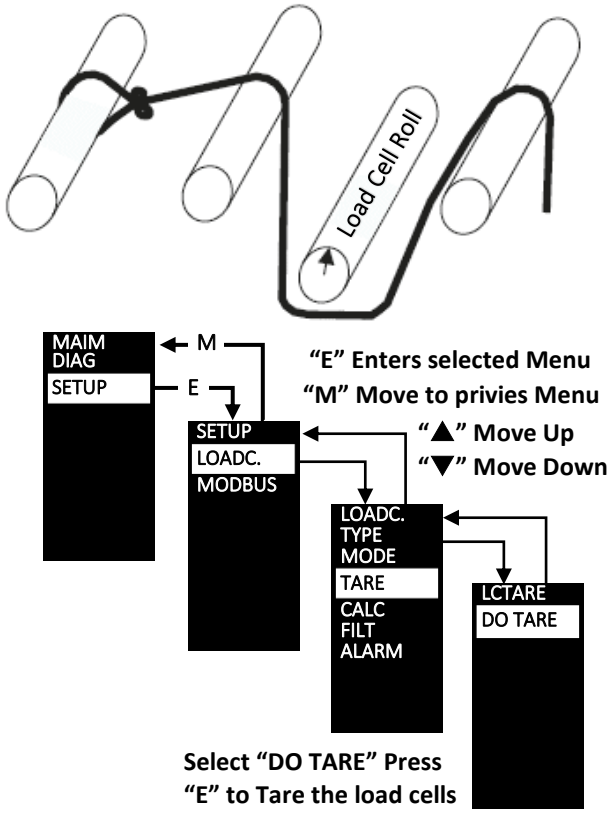
use the [**M, E**, ▲ &▼] buttons on the front



Press and hold "**M**" for 2sec to Abort change
Press"**E**" Safes new value

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.

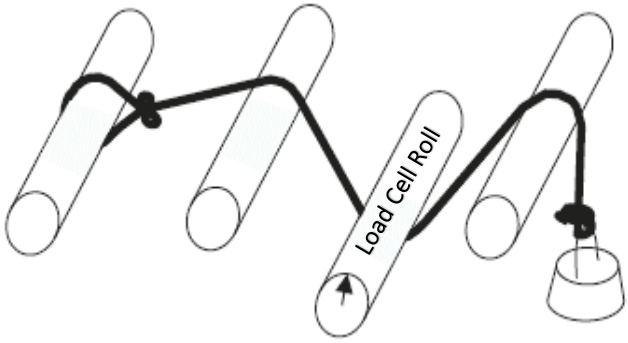


Select "DO TARE" Press "E" to Tare the load cells

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

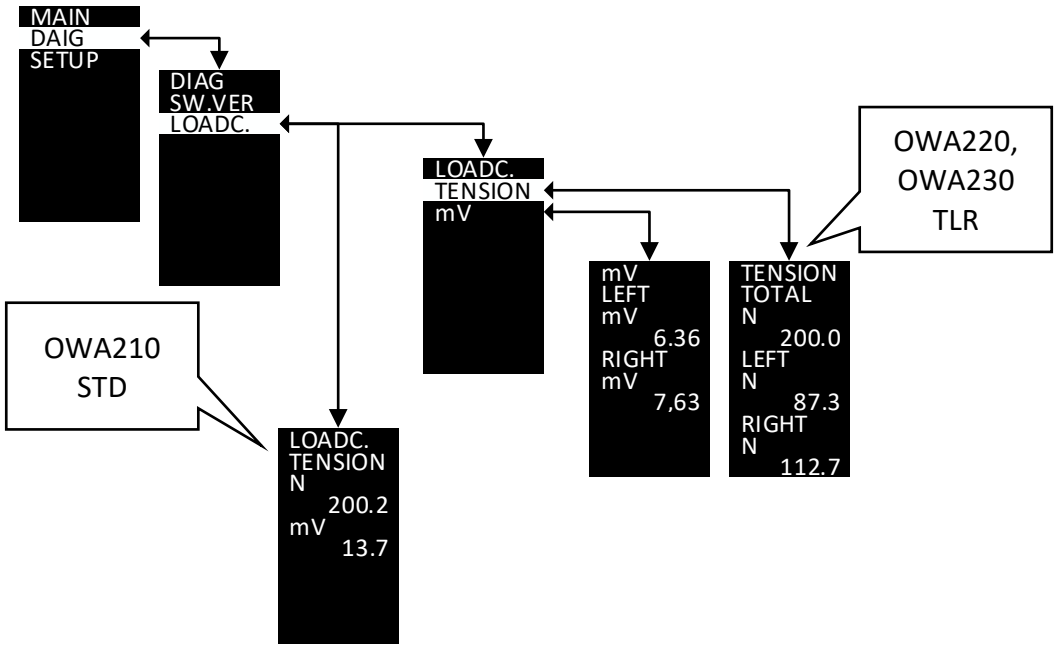


Select "DO CAL." Press"E" to Calibrate the amplifier to the force on the load cell roller

4.4 Diagnostic

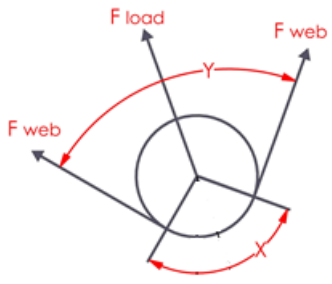
The Diagnostic Menu displays the Actual Tension from the Load Cells and the mV directly on the input terminals from the Loadcells

4.4.1 Diagnostic Menu Tree



4.4.2 Load Cell Force Table

The table can be used to estimate the resulting Force on the load Cells.
If the Load Cell Output is too high at max tension, the measuring range can be changed Under the 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
50	**60**	**1.00**	**50**	**500**
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)

5 Communication

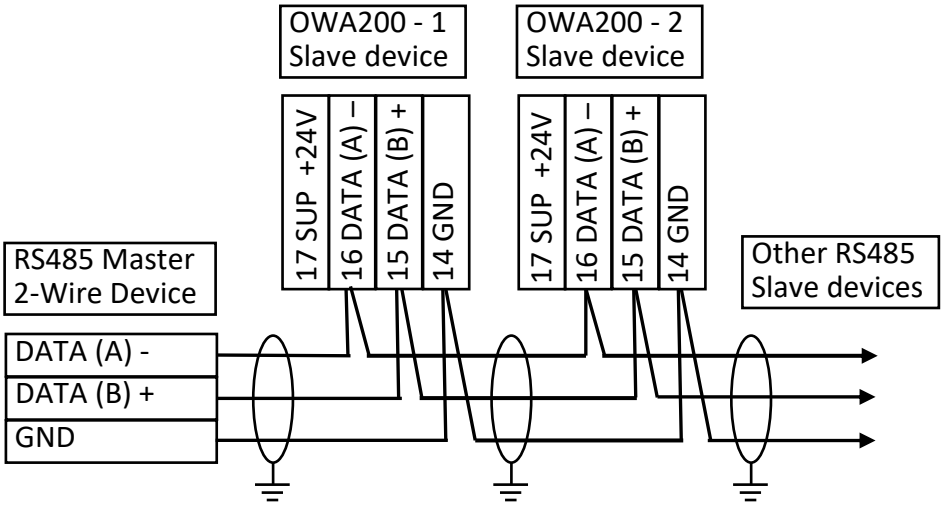
The OWA200 series amplifier supports Modbus Slave protocols RTU and optional TCP

5.1 Modbus RTU RS485

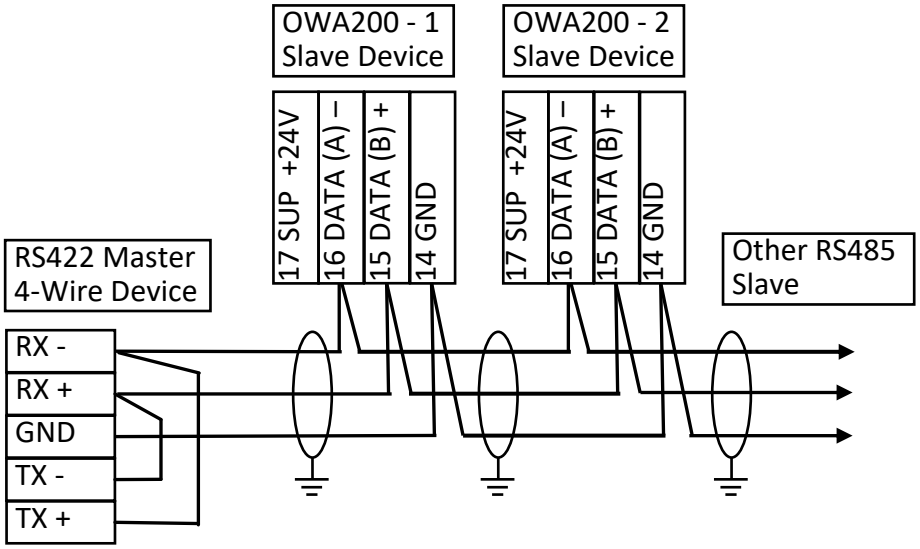
Modbus is a serial communication protocol developed by Modicon published by Modicon® in 1979 for use with its programmable logic controllers (PLCs). In simple terms, it is a method used for transmitting information over serial lines between electronic devices. The device requesting the information is called the Modbus Master and the devices supplying information are Modbus Slaves. In a standard Modbus network, there is one Master and up to 247 Slaves, each with a unique Slave Address from 1 to 247

The Modbus RTU Master sends data on the two data lines while all Modbus RTU Slave devices listen. The Modbus RTU Slave recognizing itself as the destination of the message now becomes the sender and sends the response. The Modbus RTU Master becomes a listener after finishing transmission to get the response from the Modbus RTU Slave. Transmissions like this are known as Half Duplex communications.

5.1.1 Wiring diagram with 2-wire master



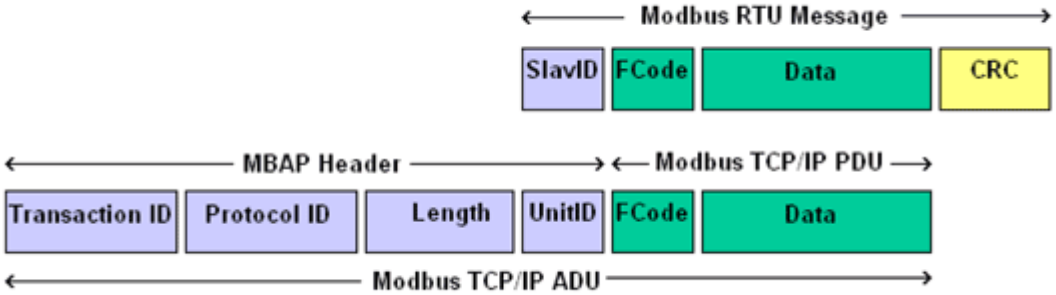
5.1.2 Wiring diagram with 4-wire master



5.2 Modbus TCP/IP

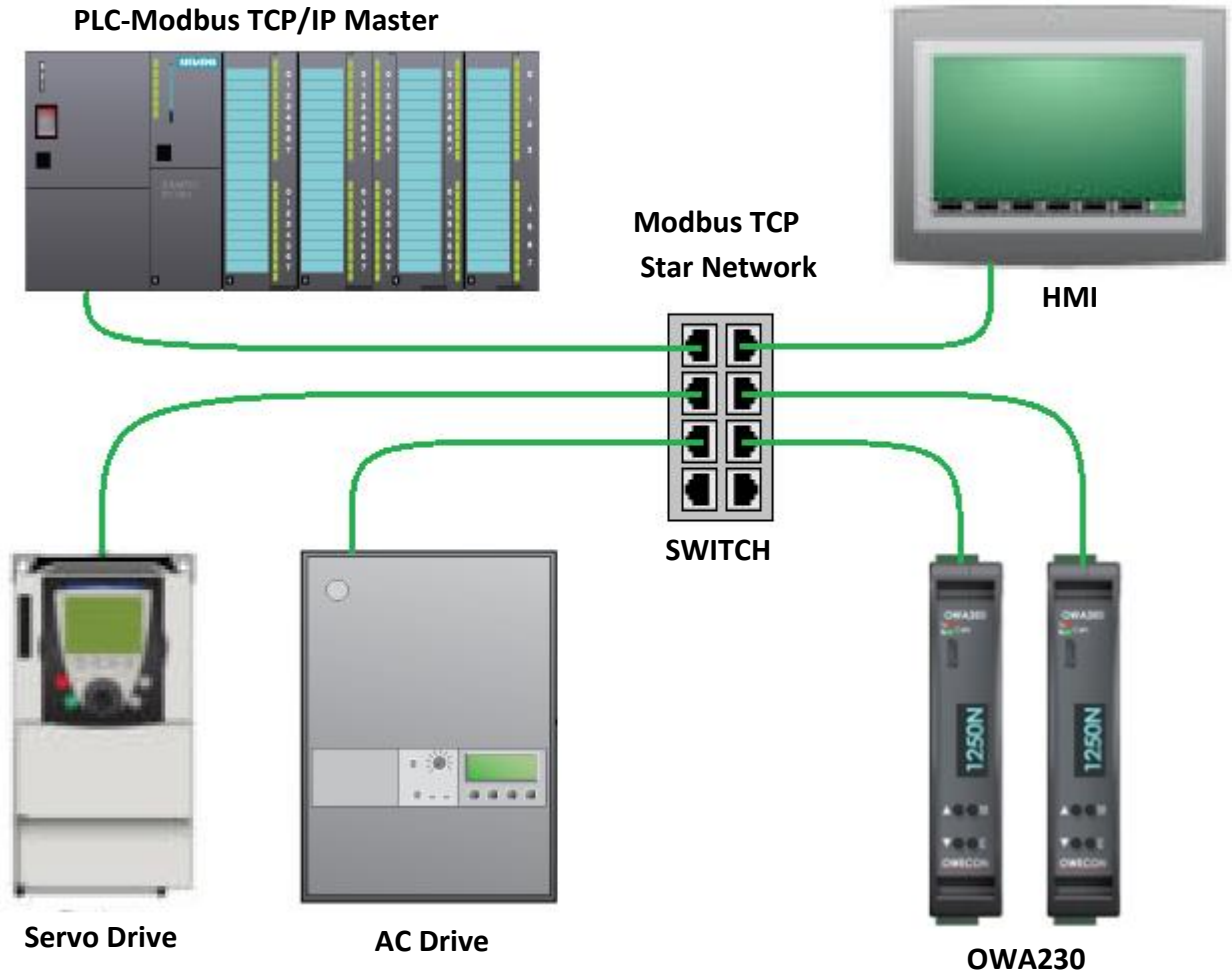
TCP is Transmission Control Protocol and IP is Internet Protocol. These protocols are used together and are the transport protocol for the internet. When MODBUS information is sent using these protocols, the data is passed to TCP where additional information is attached and given to IP.

The basic difference between MODBUS RTU and MODBUS TCP (Also known as MODBUS IP, MODBUS EtherNet, and MODBUS TCP/IP) is that MODBUS TCP runs on an Ethernet physical layer and Modbus RTU is a serial level protocol.

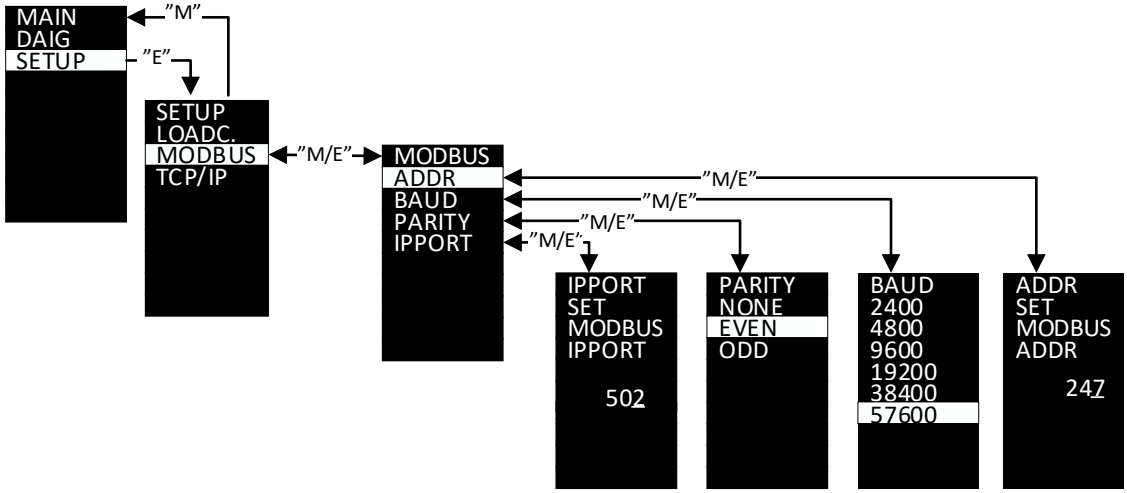


5.2.1 Network Installation

OWA230 uses IEEE 802.3 100BaseT hardware standard. This means it runs at 10/100Mbaud on twisted pair wiring rated Category 5 or higher and uses RJ45 connectors. Twisted pair networks generally use a star topology, which means that each device is wired to a **single switch device**, as illustrated below:

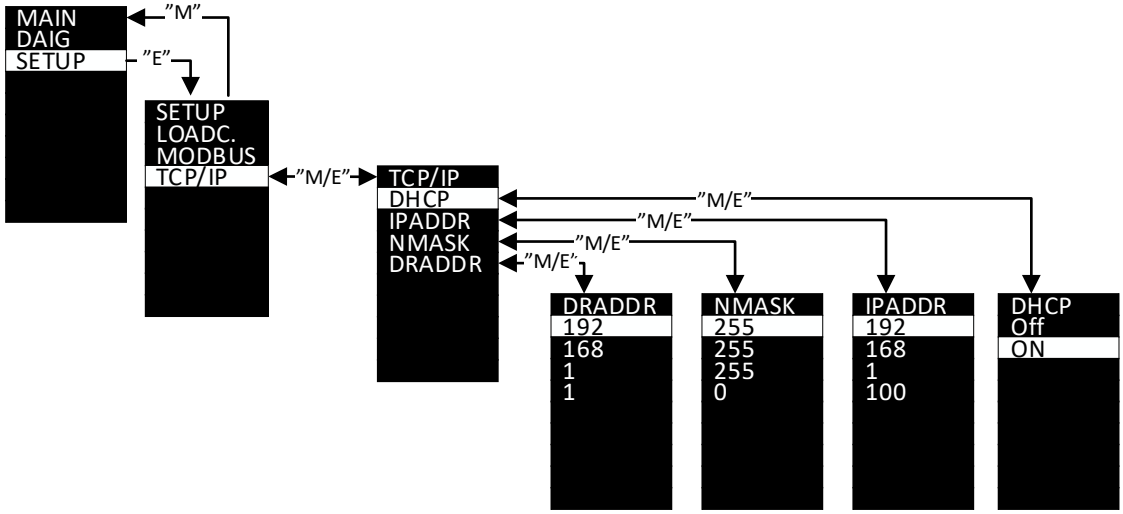


5.2.2 Menu tree RTU



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

5.2.3 Menu tree TCP



TCP/IP	:	Menu for Ethernet Setup
DHCP	:	ON: Dynamic assigned IP Address from the network.
		OFF: Static IP Address
IPADDR	:	IP Address (192.168.1.100)
NMASK	:	Network Mask (255.255.255.0)
DRADDR	:	Gateway (192.168.1.1)

5.3 Modbus RTU and TCP Holding Parameters

The OWA200 Load Cell amplifier uses Holding register (Analog 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