

ENGLISH



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User Manual

version 1.02

COD

COMMUNICATION

PROTOCOL

SYMBOLS

Here are the symbols used in the manual to draw the reader's attention:



Pay particular attention to the following instructions.

WARRANTY

24 months from the date of the delivery note. Warranty covers only failures of defective components (due to construction defects or defects in materials) and includes replacement or repair of the components and related labor costs.

Warranty is automatically forfeited in the event of:

- tampering, deletion, removal of the identification label and/or serial number of the product
- misuse, transformation, alteration, repair of products not carried out by Laumas personnel

Laumas provides a 1-year warranty from the date of the delivery note on defects in material or manufacture of the battery.

GUIDELINES FOR PROPER DISPOSAL



**Sealed Lead Acid
Battery
Must be recycled
Properly**

This symbol on the product or packaging indicates that:

- This is electrical/electronic equipment and cannot be disposed of as municipal solid waste, but must be delivered to a recycling center
- Improper use or disposal can pollute the environment or damage human health
- Non-compliance with these guidelines will be penalized in accordance with the regulations in force in the country of destination
- It is recommended to dispose of the packing and packaging as required by local regulations

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INTRODUCTION

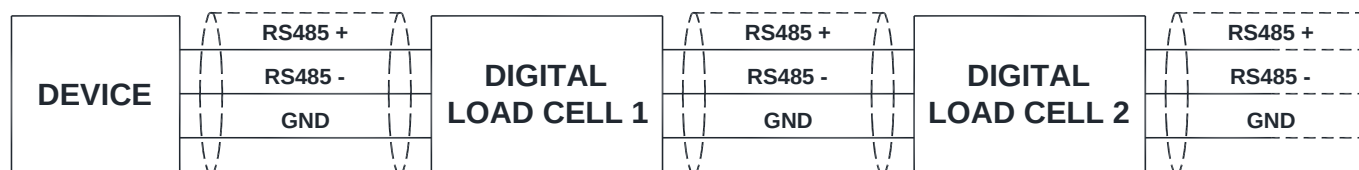
This manual illustrates the operation of the COD digital load cell communication protocol: it is a bidirectional protocol, with data exchange over an RS485 serial line, and supports up to 32 digital load cells on the same communication line, each identified by a numeric address.

ELECTRICAL CONNECTIONS

Signal	COD load cell cable color
SHIELD	
+POWER SUPPLY (9÷12 VDC)	BLUE
-POWER SUPPLY	BLACK
RS485+	WHITE
RS485-	RED

WEIGHING SYSTEM WITH MULTIPLE DIGITAL LOAD CELLS

All the digital load cells used must be connected to the same serial port as the reading device used.



SERIAL COMMUNICATION SETTING

Configure the serial port of the instrument used as follows:

COMMUNICATION SPEED	38400 bps
DATA BITS	8
PARITY	None
STOP BITS	1

COMMUNICATION PROTOCOL

In general, queries and responses to and from a digital load cell are composed as follows:

Synch. Frame	Length	Address	Command	Data	Check code
--------------	--------	---------	---------	------	------------

Synch. Frame: identification code for the start of a query or response.

The size of this field is 3 bytes and the expected values are:

- 0xFFFFFFFF in the case of query sent
- 0xAAAAAA in the case of a response received

Length: the number of bytes that make up the query or response after the Synch. Frame.

The size of this field is 1 byte:

- the 4 least significant bits contain the calculated length
- the 4 most significant bits contain the complement of 15 of the calculated length

Example: if the length of a query sent to a digital load cell is 7 bytes, the value entered in the Length field will be 0x87, obtained as per the following table

Bit 7 ÷ Bit 4	Bit 3 ÷ Bit 0
15-7=8	7

Address: address of the digital load cell to which the query is directed or from which the response comes.

The size of this field is 1 byte and the permissible values are 0÷31.

Command: numeric code of the command sent to the digital load cell.

The size of this field is 1 byte; refer to the **COMMAND CODES** section for a complete list of the commands supported by the communication protocol.

Data: a set of data exchanged between the digital load cell and the instrument.

The size of this field varies according to the Command; values expressed with more than one byte are represented using the Little Endian notation, that is the least significant byte is the first of those that make up the value.

Check Code: a numeric code used to verify the integrity of the query or response.

The size of this field is 1 byte; the Check Code is the least significant byte of the numerical sum of the bytes that make up the query or response.

Example: for a digital load cell with address 3, the status read query is composed as follows

Synch. Frame	Length	Address	Command.	Data	Check code
0xFF 0xFF 0xFF	0xB4	0x03	0x10	--	0xC7

The value in bytes of the Check Code is obtained via the following calculation: 0xB4+0x03+0x10=0xC7

COMMAND CODES

The following table gives the conventions used in this section.

**	Address of the digital load cell
##	Check code
??	One or more bytes of data
--	Field not required

STATUS REGISTER

This 16 bit register contains information about the load cell status and the command execution status according to the following table.

Bit 0		Bit 8	Incorrect password
Bit 1	Internal failure	Bit 9	Invalid command
Bit 2		Bit 10	Invalid parameter value
Bit 3		Bit 11	Overload condition*
Bit 4		Bit 12	Incorrect password
Bit 5		Bit 13	
Bit 6		Bit 14	
Bit 7		Bit 15	

* Calculated weight greater than the capacity of the digital load cell

STATUS REGISTER READING

	Synch. Frame	Length	Address	Command	Data	Check code
Master	0xFF 0xFF 0xFF	0xB4	**	0x10	--	##
Load cell	0xAA 0xAA 0xAA	0xA5	**	--	??	##

Response Data field: a 16 bit integer that can contain information about the status of the load cell and the command execution status (see section **STATUS REGISTER**).

READING THE DIGITAL LOAD CELL MODEL

	Synch. Frame	Length	Address	Command	Data	Check code
Master	0xFF 0xFF 0xFF	0xB4	**	0x01	--	##
Load cell	0xAA 0xAA 0xAA	0x69	**	--	??	##

Response Data field: 6-character alphanumeric string containing the queried load cell model.

Example: in the case of the COD digital load cell, the string returned in the data field is as follows:

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
'C'	'O'	'D'	' '	' '	' '

FULL SCALE READING

	Synch. Frame	Length	Address	Command	Data	Check code
Master	0xFF 0xFF 0xFF	0xB4	**	0x43	--	##
Load cell	0xAA 0xAA 0xAA	0x87	**	--	??	##

Response Data field: a 32 bit integer corresponding to the full scale of the queried load cell.

READING THE MAXIMUM OVERLOAD VALUE RECORDED

	Synch. Frame	Length	Address	Command	Data	Check code
Master	0xFF 0xFF 0xFF	0xB4	**	0x11	--	##
Load cell	0xAA 0xAA 0xAA	0x87	**	--	??	##

Response Data field: a 32 bit single-precision, floating-point number, formatted as per the standard IEEE 754, corresponding to the value of the maximum weight recorded by the queried load cell in a condition of overload.

ZERO-SETTING THE MAXIMUM OVERLOAD VALUE RECORDED

	Synch. Frame	Length	Address	Command	Data	Check code
Master	0xFF 0xFF 0xFF	0xB4	**	0x12	--	##
Load cell	0xAA 0xAA 0xAA	0x87	**	--	??	##

Response Data field: a 16 bit integer (see section **STATUS REGISTER**).

READING THE NUMBER OF OVERLOAD CONDITIONS DETECTED

	Synch. Frame	Length	Address	Command	Data	Check code
Master	0xFF 0xFF 0xFF	0xB4	**	0x13	--	##
Load cell	0xAA 0xAA 0xAA	0x87	**	--	??	##

Response Data field: a 32 bit integer corresponding to the number of overload conditions detected by the queried load cell since the last zero-setting.

ZERO-SETTING THE NUMBER OF OVERLOAD CONDITIONS DETECTED

	Synch. Frame	Length	Address	Command	Data	Check code
Master	0xFF 0xFF 0xFF	0xB4	**	0x14	--	##
Load cell	0xAA 0xAA 0xAA	0xB4	**	--	??	##

Response Data field: a 16 bit integer (see section **STATUS REGISTER**).

ADDRESS ASSIGNMENT BY SERIAL NUMBER

	Synch. Frame	Length	Address	Command	Data	Check code
Master	0xFF 0xFF 0xFF	0x69	0xFF	0x60	??	##
Load cell	0xAA 0xAA 0xAA	0xA5	**	--	??	##

Query Address field: contains the 0xFF value, which corresponds to the broadcast value.

Query Data field: 5 bytes in size, the first four bytes contain the serial number of the queried load cell, the fifth byte contains the address to be set. Receiving a response indicates that the address is correctly assigned to the load cell. Response Data field: a 16 bit integer (see section **STATUS REGISTER**).

Example: to assign address 3 to a load cell with serial number 3656 (0x00000E48), the query is composed as follows:

	Synch. Frame	Length	Address	Command	Data	Check code
Master	0xFF 0xFF 0xFF	0x69	0xFF	0x60	0x48 0x0E 0x00 0x00 0x03	0x21

CALCULATED WEIGHT VALUE READING

	Synch. Frame	Length	Address	Command	Data	Check code
Master	0xFF 0xFF 0xFF	0xA5	**	0x3A	0x0A	##
Load cell	0xAA 0xAA 0xAA	0x87	**	--	??	##

Response Data field: a 32 bit single-precision, floating-point number, formatted as per the standard IEEE 754, corresponding to the last value of the weight calculated by the queried load cell.

PASSWORD CHECK

	Synch. Frame	Length	Address	Command	Data	Check code
Master	0xFF 0xFF 0xFF	0x78	**	0x70	??	##
Load cell	0xAA 0xAA 0xAA	0xA5	**	--	??	##

Query Data field: a 32 bit integer corresponding to the password of the queried load cell, with the least significant byte encrypted according to the following algorithm:

Given X1, X2, X3 and X4 the bytes that make up the password value (with X1 bytes least significant), bytes Z1, Z2, Z3 and Z4 that make up the transmitted value are obtained as follows:

$$Z1=(X1^Y)-Y \quad Z2=X2 \quad Z3=X3 \quad Z4=X4$$

For COD digital load cells, Y=0x0B.

Example of calculation of the transmitted value for password equal to 0x44332211:

Password bytes	Transmitted bytes
X1 = 0x11	Z1 = (0x11^0x0B)-0x0B=0x0F
X2 = 0x22	Z2 = 0x22
X3 = 0x33	Z3 = 0x33
X4 = 0x44	Z4 = 0x44

WEIGHT READING PROCEDURE

COD digital load cells are password protected and the value of the read weight is encoded: for a correct use, follow the instructions given in this section.

UNLOCKING THE LOAD CELL

Each time the digital load cell is switched on, it is locked and must be unlocked by checking its password; send the Check password query and verify the response received (see sections **PASSWORD CHECK** and **STATUS REGISTER**):

- if the *Incorrect Password* bit is equal to 0, the password is correct and the load cell is unlocked;
- if the *Incorrect Password* bit is equal to 1, the password is incorrect and the load cell remains locked, check the password you sent and try again.
- The unlocked status is lost when the digital load cell is switched off.

WEIGHT INTERPRETATION

For a correct interpretation of the received weight, the following algorithm must be applied: given the bytes X1, X2, X3 and X4, that make up encoded weight value (with X1 bytes least significant), and Y1,Y2,Y3,Y4 that make up the the password value (with Y1 bytes least significant), the bytes Z1, Z2, Z3 and Z4, that make up the unencoded weight value, are obtained as follows:

$$Z1=(X1+Y1)^{Y1} \quad Z2=(X2+Y2)^{Y2} \quad Z3=(X3^{Y3})+Y3 \quad Z4=(X4^{Y4})+Y4$$

Example of reading the calculated weight value for a transmitted weight value of 30000.09:

	Synch. Frame	Length	Address	Command	Data	Check code
Master	0xFF 0xFF 0xFF	0xA5	01	0x3A	0x0A	0xEA
Load cell	0xAA 0xAA 0xAA	0x87	01	--	0x2B 0x20 0xA6 0xBE	0X45

For a password equal to 0x44332211 and applying the algorithm to the received data, you get:

Byte	Received	Decoded
Z1	0x2B	$(0x2B+0x11)^{0x11}=0x2D$
Z2	0x20	$(0x20+0x22)^{0x22}=0x60$
Z3	0xA6	$(0xA6+0x33)^{0x33}=0xEA$
Z4	0xBE	$(0xBE +0x44)^{0x44}=0x46$

Applying the IEEE 754 standard to the obtained value gives the decimal value of 30000.09, corresponding to the correct value of the calculated weight.

On our website www.laumas.com there are videos on the guidelines for correct installation of weighing systems and video tutorials on configuring our transmitters and weight indicators.

All Laumas product manuals are available online. You can download the manuals in PDF format from www.laumas.com by consulting the Products section or the Download Area. Registration is required.

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