Programmers Guide

SmartShelf Scales

Communication Protocol

NG-RIE

Next Generation-Remote Inventory Electronics

METTLER TOLEDO

Document Contents

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1. Introduction

Weighing sensors are the perfect tool to remotely monitor inventory levels. They can be used in a number of different ways: Integrated in shelves and racks, in industrial vending machines or in jobsite containers.

All the weighing electronics have digital connectivity for easy integration into existing networks. This allows remote computer access to your inventory levels. From any place you want you can check not only the actual stock but also analyze usage trends to optimize the supply chain. In combination with appropriate access control such systems can also be used for direct accountability of item or tool check out.

2. Communication Protocol – General Principles

Each command is received by the device via the data interface and it is recognized by a response of the transmitting device. Commands and Responses are strings of data with a fixed format written in Hexadecimal base 16.

All commands start with an **HEAD** character followed by a length byte, the command itself, a checksum byte, and an **END** character at the end.

HEAD | L | x | C | END

2.1. Definitions:

Values in the form 0x00 are base 16 (hex).

HEAD	0xF2
L	Length in bytes counting from the L-byte to the checksum byte.
x	Command byte and literal values to the command.
C	Checksum byte XOR function on all bytes preceding the checksum byte, not include HEAD byte.
END	0xF3

2.2. Remarks:

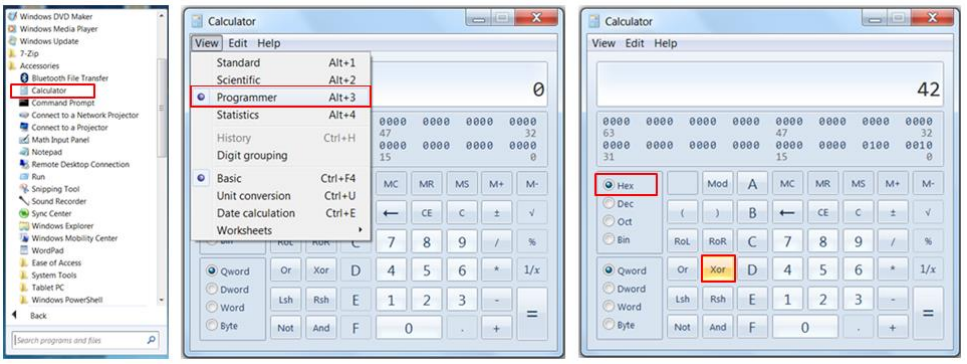
HEAD | L | x | C | END

The characters blocked in red are only separators and are used to delimit the characters.

PAD = 1 weighing unit

2.3. Checksum:

To calculate the checksum, take the Windows "Calculator", then set the mode in "Programmer" and select "Hex"



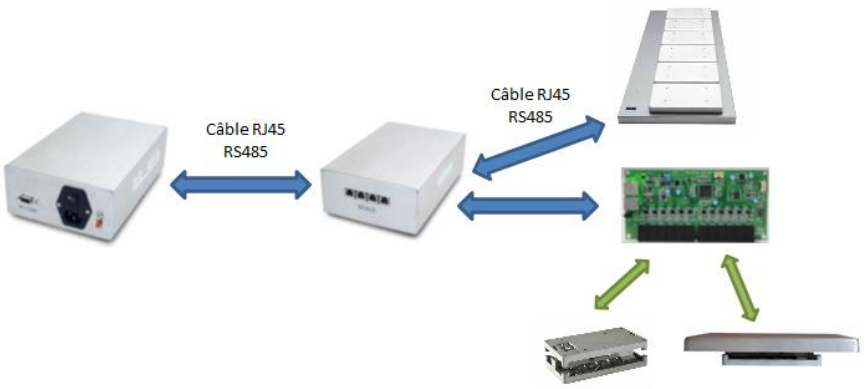
Example of the calculation of the checksum for the command F2 03 41 42 F3:

F2 03 41 42 F3 = 03 Xor 41 Xor = 42

The following site contains information about checksum calculation:
http://www..org/wiml/proj/nmeaxor.tml

3. Communication Parameters

The transmission of data between the different modules is done via standard RS485.



Communication Parameters

- Baud rate: 9600
- Data Bits: 8
- Parity: No
- Stop Bits: 1

Protocol settings cannot be changed. You must use the parameter settings shown above.

Note: The RJ45 Cable (Standard Ethernet) should not exceed a length of 20 meters and it should be a standard connections (wiring non-crossover).

4. Example of how to structure the commands

Below find an example on how the protocol commands are defined and structure. For this example, we will use the SET SCALE ID command.

4.1. Setting the Scale ID

It is necessary to set the Scale ID's individually (without being connected to the network). Standard from the factory, the PCB boards are delivered with the Scale ID set to "0000". Every PCB in the network needs to be set to a different Scale ID. This can go from 1 to 999.

To set up the Scale ID, you will need to send the following command:

4.1.1. Command : HEAD | L | S | nnnn | C | END
nnnn = PCB identification number

4.1.2. Response : HEAD | L | s | nnnn | C | END

If an error occurs, the response will be:
HEAD | L | s | E | xx | C | END
xx = Error Number

So the following command will received the indicated response:

Command	PCB Response
F2 07 53 30 30 30 32 56 F3	F2 07 73 30 30 30 32 76 F3

So the command needs to be structured as follows:

HEAD | L | S | nnnn | C | END

HEAD: F2
L: 07 – Since the length between the head and the end is 7 places (L | S | nnnn | C)
S: 53 – This is the letter S in Hex
nnnn: 30 30 30 32 – This is the scale ID 0002, which is hex 30 30 30 32 (30 = 0 and 2 = 32)
C: 56 – This is the check sum of 07 53 30 30 30 32
END: F3

This makes the command as F2 07 53 30 30 30 32 56 F3

This command will set the scale ID to 2.

The response from the command will be F2 07 73 30 30 30 32 76 F3 unless there is an error. This comes from the response HEAD | L | s | nnnn | C | END which translates as follows:

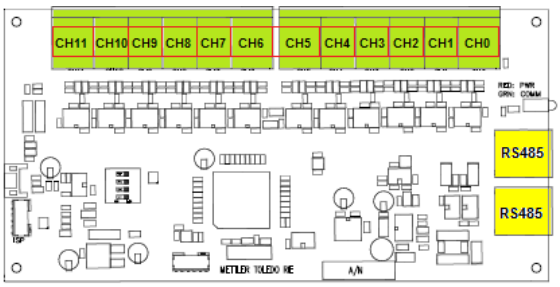
HEAD: F2
L: 07 – Since the length between the head and the end is 7 places (L | s | nnnn | C)
s: 73 – This is the letter s in Hex
nnnn: 30 30 30 32 – This is the scale ID 0002, which is hex 30 30 30 32 (30 = 0 and 2 = 32)
C: 76 – This is the check sum of 07 73 30 30 30 32
END: F3

5. PCB Configuration

There are two ways to configure the PCB. These are as follows:

5.1. PadMode

This allows you to custom set the PCB individually.

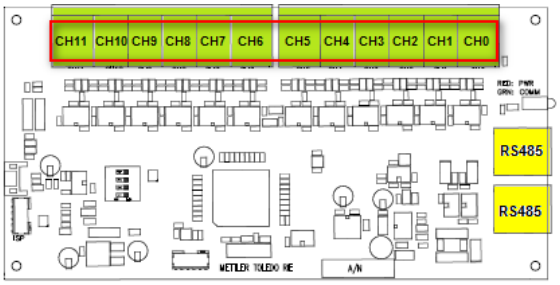


Example: You can connect different capacity weight pads to the PCB and configure them. So you can have a 2kg and/or 10kg and/or 20 kg PADs in the same PCB.

5.2. ShelfMode:

This configures the PCB to a specific SmartShelf model so all the channels on the PCB will be set to the same setting.

(For example, "A60008" corresponds to a shelf that contains 6 weight PADs of 8kg x 2g each).



Example: You can only connect the selected SmartShelf. That is either the 1, 4 or 6 8kg or 20kg or 100 kg PADS on the PCB.

6. Configuration Commands

Bellow, find the available configuration commands and their appropriate responses.

6.1. Set PreDefined Model Number

This will explain how to set the Scale Board (ID) 2 to a predefined model number.

6.1.1. Command : HEAD I L I M I nnnn I mmmmmm I C I END

nnnn = PCB identification number

mmmmmm = Predefined template type

6.1.2. Response : HEAD I L I m I mmmmmm I C I END
mmmmmm = Predefined template type

Example: Set SmartShelf model to F60025.

Command	PCB Response
F2 0D 4D 30 30 30 32 46 36 30 30 32 35 35 F3	F2 09 6D 46 36 30 30 32 35 13 F3

Response: F60025

6.2. Request PreDefined Model Number

6.2.1. Command : HEAD I L I Q I nnnn I C I END
nnnn = PCB identification number

6.2.2. Response : HEAD I L I q I mmmmmm I C I END
mmmmmm = Predefined template type

Example:

Command	PCB Response
F2 07 51 30 30 30 32 54 F3	F2 09 71 46 36 30 30 32 35 0F F3 or F2 0B 71 50 41 44 4D 4F 44 45 00 2C F3

Response: F60025 id ShelfMode or PADMODE if PadMode

6.3. Set Pad Model Number

6.3.1. Command : HEAD I L I M I nnnn I # I p I dddddccccc I uu I C I END
nnnn = Scale ID number (PCB board)
= Fixed variable. # in Hex is 23
p = Channel number from '0' to '9' and 'A' & 'B' (10-11)
ddddd = PAD resolution/divisions in Ascii string. 1 g = 00001
ccccc = PAD Capacity in Ascii string. 6kg = 06000
uu = Two reserve bytes

6.3.2. Response : HEAD I L I m I # I p I dddddccccc I u I C I END

Example:

Command	PCB Response
F2 15 4D 30 30 30 32 23 30 30 30 30 30 31 30 36 30 30 30 75 75 4E F3	F2 10 6D 23 30 30 30 30 30 31 30 36 30 30 30 75 1C F3

Response: Resolution: 00001 (g)
Max Capacity: 06000 (g)

6.4. Request Pad Model Number

6.4.1. Command : HEAD I L I Q I nnnn I # I p I C I END
nnnn = Scale ID number (PCB board)
= Fixed variable. # in Hex is 23
p = Channel number from '0' to '9' and 'A' & 'B' (10-11)

6.4.2. Response : HEAD I L I m I dddddccccc I ' ' I C I END
ddddd = PAD resolution/divisions in Ascii string. 5 g = 00005
ccccc = PAD Capacity in Ascii string. 8 kg = 08000
' ' = Black space, reserved character

Example:

Command	PCB Response
F2 09 51 30 30 30 32 23 30 49 F3	F2 0E 71 30 30 30 30 35 30 38 30 30 30 20 62 F3

Response: 00005 g / 08000 kg

6.5. Set Calibration WT when scale is in predefined model

6.5.1. Command : HEAD I L I B I nnnn I wwwww I C I END
nnnn = Scale ID number (PCB board)
wwwww = Calibration weight value

6.5.2. Response : HEAD I L I b I wwwww I C I END
wwwww = Calibration weight value

Example: Calibration weight of 4 Kg would be set as "04.00". The format must be in accordance to the PAD resolution.

Command	PCB Response
F2 0C 42 30 30 30 32 30 34 2E 30 30 66 F3	F2 08 62 30 34 2E 30 30 40 F3

Response: 04.00 (kg)

6.6. Set Calibration WT when scale in pad by pad mode

6.6.1. Command : HEAD I L I B I nnnn I # I p I wwwww I C I END
nnnn = Scale ID number (PCB board)
= Fixed variable. # in Hex is 23
p = Channel number from '0' to '9' and 'A' & 'B' (10-11)
wwwww = Calibration weight value

6.6.2. Response : HEAD I L I b I wwwww I C I END
wwwww = Calibration weight value

Example: Calibration weight of 4 Kg would be set as "04.00". The format must be in accordance to the PAD resolution.

Command	PCB Response
F2 0E 42 30 30 30 32 23 30 30 34 2E 30 30 77 F3	F2 08 62 30 34 2E 30 30 40 F3

Response: 04.00 (kg)

6.7. Request predefined model Calibration WT

6.7.1. Command : HEAD I L I O I nnnn I C I END
nnnn = Scale ID number (PCB board)

6.7.2. Response : HEAD I L I o I wwwww I C I END
wwwww = Calibration weight value

Example: Reads the configured calibration weight.

Command	PCB Response
F2 07 4F 30 30 30 32 4A F3	F2 08 6F 31 30 2E 30 30 48 F3

Response: 10.00 (kg)

6.8. Request pad by pad model Calibration WT

6.8.1. Command : HEAD I L I O I nnnn I # I p IC I END
nnnn = Scale ID number (PCB board)
= Fixed variable. # in Hex is 23
p = Channel number from '0' to '9' and 'A' & 'B' (10-11)

6.8.2. Response : HEAD I L I o I wwwww I C I END
wwwww = Calibration weight value

Example: provides value of the calibration weight.

Command	PCB Response
F2 09 4F 30 30 30 32 23 30 57 F3	F2 08 6F 34 2E 30 30 30 4D F3

Response: 4.000 (kg)

6.9. Request Firmware Version

6.9.1. Command : HEAD I L I V I nnnn I C I END
nnnn = Scale ID number (PCB board)

6.9.2. Response : HEAD I L I v I vvv…vvv I C I END
vvv...vvv = Version String

Example: Provides the firmware of the Scale Board.

Command	PCB Response
F2 07 56 30 30 30 32 53 F3	F2 21 76 53 70 65 65 64 79 20 56 30 2E 30 33 3B 42 4C 20 37 32 32 36 33 37 38 39 20 56 30 2E 30 33 78 F3

Response: Speedy V0.03; BL 72263798 V0.03

6.10. Request Serial Number (from Scale PCB Board)

6.10.1. Command : HEAD I L I 1 I nnnn I 1 I C I END
nnnn = Scale ID number (PCB board)

6.10.2. Response : HEAD I L I 0 I sss……sss I C I END
ssss...ssss = 16 bytes SN ASCII string

Example: provides the serial number of the Scale Board.

Command	PCB Response
F2 08 31 30 30 30 32 31 0A F3	F2 13 30 20 20 20 20 20 20 20 20 20 20 20 20 20 20 23 F3

6.11. Set Scale Alias Name

6.11.1. Command : HEAD I L I 1 I nnnn I 2 I aaaaa…aaa I C I END
nnnn = Scale ID number (PCB board)
aaaaa..aaa = 16 bytes ASCII string Name

6.11.2. Response : HEAD I L I 0 I aaaaa…aaa I C I END
aaaaa..aaa = 16 bytes ASCII string Name

Example: This command sets the name sent to the Scale Board. In this example, METTLER

Command	PCB Response
F2 18 31 30 30 30 32 32 4D 45 54 54 4C 45 52 20 20 20 20 20 20 20 20 20 6A F3	F2 13 30 4D 45 54 54 4C 45 52 20 20 20 20 20 20 20 20 50 F3

Response: METTLER

6.12. Request Scale Alias Name

6.12.1. HEAD I L I 1 I nnnn I 3 I C I END
nnnn = Scale ID number (PCB board)

6.12.2. Response : HEAD I L I 0 I aaaaa…aaa I C I END
aaaaa..aaa = 16 bytes ASCII string Name

Example: This command retrieves the name stored inside the Scale Board.

Command	PCB Response
F2 08 31 30 30 30 32 33 08 F3	F2 13 30 4D 45 54 54 4C 45 52 20 20 20 20 20 20 20 20 20 50 F3

Response: METTLER

7. Addressing Commands

Addressing the Scale Boards is a key component of setting the SmartShelf Scales network. The first thing that needs to be done is to address each individual Scale PCB Board, without these being connected to the network. Use the following commands to set the Scale Boards accordingly. From the factory, the Scale Boards are delivered with the ID set as "0000".

7.1. Set Scale ID

7.1.1. Command : HEAD I L I S I nnnn I C I END
nnnn = PCB identification number

7.1.2. Response: HEAD I L I s I nnnn I C I END or
HEAD I L I s I E I xx I C I END → *Error occurred*

nnnn = PCB identification number
xx = Error number

Example: Setting the Scale Board ID to 2.

Command	PCB Response
F2 07 53 30 30 30 32 56 F3	F2 07 73 30 30 30 32 76 F3

7.2. Retrieve Scale ID

7.2.1. Command : HEAD I L I A I C I END

7.2.2. Response: HEAD I L I a I nnnn I C I END
nnnn = PCB identification number

Example: This command will retrieve the Scale Board ID.

Command	PCB Response
F2 03 41 42 F3	F2 07 61 30 30 30 32 64 F3

Result: 0002

7.3. Change Scale ID

7.3.1. Command : HEAD I L I I I xxxx I nnnn I C I END
xxxx = old PCB identification number
nnnn = new PCB identification number

7.3.2. Response: HEAD I L I i I nnnn I C I END or
HEAD I L I i I E I xx I C I END → *Error occurred*

nnnn = new PCB identification number

Example: This command will change the Scale Board ID to the one indicated. In this example, we are changing the Scale Board ID from 3 to 2.

Command	PCB Response
F2 0B 49 30 30 30 33 30 30 30 32 43 F3	F2 07 69 30 30 30 32 6C F3

Result: 0002

7.4. Retrieve Channel Counts

7.4.1. Command : HEAD I L I 1 I nnnn I 4 I C I END
nnnn = new PCB identification number

7.4.2. Response: HEAD I L I 0 I nn I C I END
nn = two bytes ASCii string counts representing the number of channels

Example: This command requests the number of channels from the Scale Board ID 0002.

Command	PCB Response
F2 08 31 30 30 30 32 34 0F F3	F2 05 30 31 32 36 F3

Result: 12 (Channels)

8. Operational Commands

This section explains how to perform all the operational commands and their appropriate responses.

8.1. Request Weight

8.1.1. Command : HEAD I L I W I nnnn I N I C I END
nnnn = PCB identification number
N = pad number from '0' to '9' and 'A' & 'B' (10-11)

8.1.2. Response: HEAD I L I w I swwwwwwwwx I C I END

s = sign (space or -)

wwwwwwwww = Weight in lb. Pad with leading 0's. Includes decimal point

x = Scale Status

- **M = In-Motion**
- **C = Over Capacity**
- **I = Invalid Weight**
- **Space = OK**

If s = E, then **wwwwwwwww** is an error number

Example:

Command	PCB Response
F2 08 57 30 30 30 32 30 6D F3	F2 0D 77 20 20 20 20 36 2E 30 30 30 20 72 F3

8.2. Request All Weights

8.2.1. Command : HEAD I L I T I nnnn I C I END

nnnn = PCB identification number

8.2.2. Response: HEAD I L I t I chn I swwwwwwwwx I .....I swwwwwwwwx I C I END

Scale Channels

s = sign (space or -)

wwwwwwwww = Weight in lb. Pad with leading 0's. Includes decimal point

x = Scale Status

- **M = In-Motion**
- **C = Over Capacity**
- **I = Invalid Weight**
- **Space = OK**
- **chn = Scale pad counts, if scale is predefined model, it will be model channels counts; if scale is pad by pad, it will be maximum channels counts.**

If s = E, then **wwwwwwwww** is an error number

Example: Weight readings for all channels of the scale PCB

Command	PCB Response
F2 07 54 30 30 30 32 51 F3	F2 7C 74 43 20 20 20 20 36 2E 30 30 30 20 ⇐ Channel 0 : 6.000 20 20 20 20 20 34 2E 30 30 20 ⇐ Channel 1 : 4.00 45 31 30 20 20 20 20 20 20 ⇐ Channel 2: Error 10 ..... 45 31 30 20 20 20 20 20 20 ⇐ Channel 11 : Error 10 59 F3

Remarks: On the example above, Channel 2 and 11 presented an error 10 that indicates there is no Weighing Pad connected. The remaining channels were active and found.

8.3. Zero Scale

8.3.1. Command : HEAD I L I Z I nnnn I N I C I END
nnnn = PCB identification number
N = pad number from '0' to '9' and 'A' & 'B' (10-11)

8.3.2. Response: HEAD I L I z I Z I C I END or
HEAD I L I z I E I xx I C I END → Error occurred
If s = E, then **xx** is an error number

Example: This command zeros the specified channel number, in this case 0.

Command	PCB Response
F2 08 5A 30 30 30 32 30 60 F3	F2 04 7A 5A 24 F3

8.4. Request Valid Channels Weight

8.4.1. Command : HEAD I L I T I nnnn I # I C I END
nnnn = PCB identification number

8.4.2. Response: HEAD I L I t I n1 I swwwwwwwwx I .....nx I swwwwwwwwx I C I END

Scale Channels

s = sign (space or -)
n1, n2...nx = valid channel number, '0'~'9' ,'A'~'B'
wwwwwwww = Weight in lb. Pad with leading 0's. Includes decimal point
x = Scale Status

- **M = In-Motion**
- **C = Over Capacity**
- **I = Invalid Weight**
- **Space = OK**

If s = E, then **wwwwwwww** is an error number

Example: Weight readings for all active channels of the Scale PCB

Command	PCB Response
F2 08 54 30 30 30 32 23 7D F3	F2 1A 74 23 30 20 20 20 20 36 2E 30 30 32 43 ⇐ Channel 0 : 6.000 with error 31 20 20 20 20 20 34 2E 30 30 20 ⇐ Channel 1 : 4.00 3F F3

Response Notes: Channel 0: 6.000 C but with error (Message indicating the scale at its max capacity)

8.5. Request channels Weight

8.5.1. Command : HEAD I L I T I nnnn I N I C I END

nnnn = PCB identification number

N = It is used in pad by pad mode; it will request front number channels weights, where is the number of channels you want to retrieve weights from. It always start at 0, so N = 1 is just for channel 0.

N = 3 Channel 0 + 1 + 2 will be selected, if **N** = 7 Cannel 0 + 1…+6 will be selected

8.5.2. Response: HEAD I L I t I N I swwwwwwwwx I ……..I swwwwwwwwx I C I END

Scale Channels

s = sign (space or -)

wwwwwwww = Weight in lb. Pad with leading 0's. Includes decimal point

x = Scale Status

- **M = In-Motion**
- **C = Over Capacity**
- **I = Invalid Weight**
- **Space = OK**

If s = E, then **wwwwwwww** is an error number

Example: Weight readings for all active channels of the Scale PCB

Command	PCB Response
F2 08 54 30 30 30 32 33 6D F3	F2 22 74 33 20 20 20 20 36 2E 30 30 31 43 ⇐ Channel 0 : 6.000 with error 20 20 20 20 20 34 2E 30 31 20 ⇐ Channel 1 : 4.00 45 31 30 20 20 20 20 20 20 20 ⇐ Channel 2 : Error 10 70 F3

Response Channel 0 = 6.000 C (Message indicating the scale at its max capacity) and Channel 2 = error 10 (there is no Weighing Pad connected)

8.6. Reset Scale

8.6.1. Command : HEAD I L I R I nnnn I C I END

nnnn = PCB identification number

8.6.2. Response: HEAD I L I r I nnnn I C I END

nnnn = PCB identification number

Example: This command resets all parameters to default values.

Command	PCB Response
F2 07 52 30 30 30 32 57 F3	F2 07 72 30 30 30 32 77 F3

9. Calibration Commands

This section explains the available calibration commands and their appropriate responses.

9.1. Start Calibration (step 1)

9.1.1. Command : HEAD I L I C I nnnn I N I C I END

nnnn = PCB identification number
N = pad number from '0' to '9' and 'A' & 'B' (10-11)

9.1.2. Response: HEAD I L I c I U I C I END or
HEAD I L I c I E I xx IC I END → *Error number*

xx = Error number

Example:

Command	PCB Response
F2 08 43 30 30 30 32 30 79 F3	F2 04 63 55 32 F3

Remarks: This step is used to set the zero to empty

9.2. Sample Deadload (step 2)

9.2.1. Command : HEAD I L I E I nnnn I N I C I END

nnnn = PCB identification number
N = pad number from '0' to '9' and 'A' & 'B' (10-11)

9.2.2. Response: HEAD I L I e I F I C I END or
HEAD I L I e I E I xx IC I END → *Error number*

xx = Error number

Example:

Command	PCB Response
F2 08 45 30 30 30 32 30 7F F3	F2 04 65 46 27 F3

Remarks: This step is used to adjust the preload and sets the zero with a tare

9.3. Sample Load (step 3)

Place the calibration weight on the platter before sending the command.

9.3.1. Command : HEAD I L I F I nnnn I N I C I END

nnnn = PCB identification number
N = pad number from '0' to '9' and 'A' & 'B' (10-11)

9.3.2. Response: HEAD I L I f I C I C I END or
HEAD I L I f I E I xx IC I END → *Error number*

xx = Error number

Example:

Command	PCB Response
F2 08 46 30 30 30 32 30 7C F3	F2 04 66 43 21 F3

Remarks: This step is used to calibrate the Pad with the predetermined weight in 6.5.

10. Error Codes

If an error occurs during any of these steps, you will need to re-start the steps from the beginning.

Error Number	Description	Notes
1	Load cell error	Load cell data is not correct. Exceeding limits. Try to recalibrate the pad. If not successful, try connecting a working pad. If successful, the A/D channel is bad; otherwise the load cell is defective.
2	Calibrate data empty	Channel is not calibrated. Please calibrate the weight pad on the channel.
3	In motion	Pad is in motion status, can't get stable weight. Wait for stable pad
4	Scale model not set	Scale model has not been set. Set the scale Model. For example "A60008"
5	Scale channel number error	Channel number has some limitation. For example 0~5 for 6 channel Scale Board. If you try to read channel number 8, you will receive this error. This is an application error.
6	Command error	Command is not correct, check your syntax.
7	Eprom rd/wr error	EEPROM data error. Try to download firmware and recalibrate the scale. If error continues, change the PCBA Scale Board.
8	Error calibration weight	Ensure the calibration weight is correct. Software has a built in tolerance to ensure the calibration weight is within the limits. For example, if set for 5kg, the weight should be close to 5kg, or else, it will fail.
10	Pad disabled, can't weight	Scale is not in Padmode, but a weight has been requested.
11	Shelf mode can't run command of pad	Scale is set in Shelf mode. Padmode setting commands cannot be used.
12	Pad mode can't run command of shelf	Scale is set in Padmode. Shelf mode setting commands cannot be used.
PW	Scale is in power up mode, please wait several seconds to send command	Command was sent too quickly. Wait for 3-5 seconds after power up.

11. ASCII Table

The ASCII table can be used to determine the required code for each of the commands listed in this manual.

Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char
0	00	Null	32	20	Space	64	40	@	96	60	`
1	01	Start of heading	33	21	!	65	41	A	97	61	a
2	02	Start of text	34	22	"	66	42	B	98	62	b
3	03	End of text	35	23	#	67	43	C	99	63	c
4	04	End of transmit	36	24	$	68	44	D	100	64	d
5	05	Enquiry	37	25	%	69	45	E	101	65	e
6	06	Acknowledge	38	26	&	70	46	F	102	66	f
7	07	Audible bell	39	27	'	71	47	G	103	67	g
8	08	Backspace	40	28	(	72	48	H	104	68	h
9	09	Horizontal tab	41	29	)	73	49	I	105	69	i
10	0A	Line feed	42	2A	*	74	4A	J	106	6A	j
11	0B	Vertical tab	43	2B	+	75	4B	K	107	6B	k
12	0C	Form feed	44	2C	,	76	4C	L	108	6C	l
13	0D	Carriage return	45	2D	-	77	4D	M	109	6D	m
14	0E	Shift out	46	2E	.	78	4E	N	110	6E	n
15	0F	Shift in	47	2F	/	79	4F	O	111	6F	o
16	10	Data link escape	48	30	0	80	50	P	112	70	p
17	11	Device control 1	49	31	1	81	51	Q	113	71	q
18	12	Device control 2	50	32	2	82	52	R	114	72	r
19	13	Device control 3	51	33	3	83	53	S	115	73	s
20	14	Device control 4	52	34	4	84	54	T	116	74	t
21	15	Neg. acknowledge	53	35	5	85	55	U	117	75	u
22	16	Synchronous idle	54	36	6	86	56	V	118	76	v
23	17	End trans. block	55	37	7	87	57	W	119	77	w
24	18	Cancel	56	38	8	88	58	X	120	78	x
25	19	End of medium	57	39	9	89	59	Y	121	79	y
26	1A	Substitution	58	3A	:	90	5A	Z	122	7A	z
27	1B	Escape	59	3B	;	91	5B	[	123	7B	{
28	1C	File separator	60	3C	<	92	5C	\	124	7C	|
29	1D	Group separator	61	3D	=	93	5D	]	125	7D	}
30	1E	Record separator	62	3E	>	94	5E	^	126	7E	~
31	1F	Unit separator	63	3F	?	95	5F	_	127	7F	□

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For more information

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