SmartShelf Scales
Communication Protocol

Programmers Guide

NG-RIE
Next Generation-Remote Inventory Electronics

METTLER TOLEDO
# Table of Contents

1 Introduction ................................................................. 3

2 Communication Protocol – General Principles .................................. 3
   2.2 Definitions .......................................................... 3
   2.3 Remarks ............................................................. 3
   2.4 Checksum ............................................................ 4

3 Communication Parameters .................................................. 4

4 Example of how to structure the commands ................................ 5
   4.2 Setting the Scale ID ................................................ 5

5 PCB Configuration .......................................................... 6
   5.2 PadMode ............................................................. 6
   5.3 ShelfMode ........................................................... 6

6 Configuration Commands .................................................... 6
   6.2 Set PreDefined Model Number .................................... 6
   6.3 Request PreDefined Model Number ............................... 7
   6.4 Set Pad Model Number ............................................. 7
   6.5 Request Pad Model Number ....................................... 8
   6.6 Set Calibration WT when scale is in predefined model ........ 8
   6.7 Set Calibration WT when scale in pad by pad model ........... 8
   6.8 Request predefined model Calibration WT ....................... 9
   6.9 Request pad by pad model Calibration WT ....................... 9
   6.10 Request Firmware Version ........................................ 9
   6.11 Request Serial Number (from Scale PCB Board) ................ 10
   6.12 Set Scale Alias Name ............................................ 10
   6.13 Request Scale Alias Name ........................................ 10

7 Addressing Commands ...................................................... 11
   7.2 Set Scale ID ......................................................... 11
   7.3 Retrieve Scale ID .................................................. 11
   7.4 Change Scale ID ................................................... 12
   7.5 Retrieve Channel Counts .......................................... 12

8 Operational Commands ..................................................... 12
   8.2 Request Weight ..................................................... 12
   8.3 Request All Weights ............................................... 13
   8.4 Zero Scale .......................................................... 14
   8.5 Request Valid Channels Weight .................................. 14
   8.6 Request channels Weight ......................................... 15
   8.7 Reset Scale ........................................................ 15

9 Calibration Commands .......................................................... 16
   9.2 Start Calibration (step 1) .......................................... 16
   9.3 Sample Deadload (step 2) ......................................... 16
   9.4 Sample Load (step 3) .............................................. 16

10 Error Codes ...................................................................... 17

11 ASCII Table ...................................................................... 18
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).

<table>
<thead>
<tr>
<th>Description</th>
<th>Hex Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEAD</td>
<td>0xF2</td>
</tr>
<tr>
<td>L</td>
<td>Length in bytes counting from the L-byte to the checksum byte.</td>
</tr>
<tr>
<td>x</td>
<td>Command byte and literal values to the command.</td>
</tr>
<tr>
<td>C</td>
<td>Checksum byte XOR function on all bytes preceding the checksum byte, not include HEAD byte.</td>
</tr>
<tr>
<td>END</td>
<td>0xF3</td>
</tr>
</tbody>
</table>

2.2. Remarks:

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:

\[ \text{F2 \text{ XOR 03 \text{ XOR 41 \text{ XOR 42 \text{ XOR F3}}}}} = 42 \]

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:

<table>
<thead>
<tr>
<th>Command</th>
<th>PCB Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2 07 53 30 30 30 32 56 F3</td>
<td>F2 07 73 30 30 30 32 76 F3</td>
</tr>
</tbody>
</table>

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**

Below, 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 | L | M | nnnn | mmmmmm | C | END

`nnnn` = PCB identification number

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

Example: Set SmartShelf model to F60025.

<table>
<thead>
<tr>
<th>Command</th>
<th>PCB Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2 0D 4D 30 30 30 32 46 36 30 30 32 35 35 F3</td>
<td>F2 09 6D 46 36 30 30 32 35 13 F3</td>
</tr>
</tbody>
</table>

Response: F60025

6.2. Request PreDefined Model Number

6.2.1. Command: HEAD | L | Q | nnnn | C | END

Example:

<table>
<thead>
<tr>
<th>Command</th>
<th>PCB Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2 07 51 30 30 30 32 46 30 30 30 30 31 30 36 30 30 30 75 75 4E F3</td>
<td>F2 09 71 46 36 30 30 32 35 0F F3 or F2 0B 71 50 41 44 4D 00 2C F3</td>
</tr>
</tbody>
</table>

Response: F60025 id ShelfMode or PADMODE if PadMode

6.3. Set Pad Model Number

6.3.1. Command: HEAD | L | M | nnnn | # | p | ddddccc | uu | C | END

Example:

<table>
<thead>
<tr>
<th>Command</th>
<th>PCB Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2 15 4D 30 30 30 32 23 30 30 30 30 30 30 31 30 36 30 30 30 75 75 4E F3</td>
<td>F2 10 6D 23 30 30 30 30 30 30 31 30 36 30 30 30 75 1C F3</td>
</tr>
</tbody>
</table>

Response: Resolution: 00001 (g)
Max Capacity: 06000 (g)
6.4. Request Pad Model Number

6.4.1. Command : HEAD | L | Q | nnnn | # | p | C | 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 | L | m | dddd | cccc | ' ' | C | END

*dddd* = PAD resolution/divisions in Ascii string. 5 g = 00005
*cccc* = PAD Capacity in Ascii string. 8 kg = 08000
' ' = Black space, reserved character

Example:

<table>
<thead>
<tr>
<th>Command</th>
<th>PCB Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2 09 51 30 30 30 32 23 30 49 F3</td>
<td>F2 0E 71 30 30 30 35 30 38 30 30 30 20 62 F3</td>
</tr>
</tbody>
</table>

Response: 00005 g / 08000 kg

6.5. Set Calibration WT when scale is in predefined model

6.5.1. Command : HEAD | L | B | nnnn | wwww | C | END

*nnnn* = Scale ID number (PCB board)
*wwww* = Calibration weight value

6.5.2. Response : HEAD | L | b | wwww | C | END

*wwww* = 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.

<table>
<thead>
<tr>
<th>Command</th>
<th>PCB Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2 0C 42 30 30 30 32 3D 34 2E 30 30 66 F3</td>
<td>F2 08 62 30 34 2E 30 30 40 F3</td>
</tr>
</tbody>
</table>

Response: 04.00 (kg)

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

6.6.1. Command : HEAD | L | B | nnnn | # | p | wwww | C | 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)
*wwww* = Calibration weight value
6.6.2. Response: HEAD | L | 6 | wwww | C | END

wwww = 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.

<table>
<thead>
<tr>
<th>Command</th>
<th>PCB Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2 0E 42 30 30 32 23 30 34 2E 30 30 77 F3</td>
<td>F2 08 62 30 34 2E 30 30 40 F3</td>
</tr>
</tbody>
</table>

Response: 04.00 (kg)

6.7. Request predefined model Calibration WT

6.7.1. Command: HEAD | L | 0 | nnnn | C | END

nnnn = Scale ID number (PCB board)

6.7.2. Response: HEAD | L | 6 | wwww | C | END

wwww = Calibration weight value

Example: Reads the configured calibration weight.

<table>
<thead>
<tr>
<th>Command</th>
<th>PCB Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2 07 4F 30 30 30 32 4A F3</td>
<td>F2 08 6F 31 30 2E 30 30 48 F3</td>
</tr>
</tbody>
</table>

Response: 10.00 (kg)

6.8. Request pad by pad model Calibration WT

6.8.1. Command: HEAD | L | 0 | nnnn | # | p | C | 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 | L | 6 | wwww | C | END

wwww = Calibration weight value

Example: provides value of the calibration weight.

<table>
<thead>
<tr>
<th>Command</th>
<th>PCB Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2 09 4F 30 30 30 32 23 30 57 F3</td>
<td>F2 08 6F 34 2E 30 30 30 4D F3</td>
</tr>
</tbody>
</table>

Response: 4.000 (kg)

6.9. Request Firmware Version

6.9.1. Command: HEAD | L | V | nnnn | C | END

nnnn = Scale ID number (PCB board)
6.9.2. Response: HEAD | L | v | v | END

\[ \text{vv...vvv = Version String} \]

Example: Provides the firmware of the Scale Board.

<table>
<thead>
<tr>
<th>Command</th>
<th>PCB Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2 07 56 30 30 30 32 53 F3</td>
<td>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</td>
</tr>
</tbody>
</table>

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

6.10. Request Serial Number (from Scale PCB Board)

6.10.1. Command: HEAD | L | nnnn | 1 | C | END

\[ \text{nnnn = Scale ID number (PCB board)} \]

6.10.2. Response: HEAD | L | 0 | sss...sss | C | END

\[ \text{ssss...ssss = 16 bytes SN ASCII string} \]

Example: provides the serial number of the Scale Board.

<table>
<thead>
<tr>
<th>Command</th>
<th>PCB Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2 08 31 30 30 30 32 31 0A F3</td>
<td>F2 13 30 20 20 20 20 20 20 20 20 20 20 20 20 20 23 F3</td>
</tr>
</tbody>
</table>

6.11. Set Scale Alias Name

6.11.1. Command: HEAD | L | nnnn | 2 | aaaa...aaa | C | END

\[ \text{nnnn = Scale ID number (PCB board)} \]

\[ \text{aaaaa...aaa = 16 bytes ASCII string Name} \]

6.11.2. Response: HEAD | L | 0 | aaaa...aaa | C | END

\[ \text{aaaaa...aaa = 16 bytes ASCII string Name} \]

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

<table>
<thead>
<tr>
<th>Command</th>
<th>PCB Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2 18 31 30 30 30 32 32 4D 45 54 54 4C 45 52 20 20 20 20 20 20 20 20 6A F3</td>
<td>F2 13 30 4D 45 54 54 4C 45 52 20 20 20 20 20 20 20 20 50 F3</td>
</tr>
</tbody>
</table>

Response: METTLER

6.12. Request Scale Alias Name

6.12.1. HEAD | L | nnnn | 3 | C | END

\[ \text{nnnn = Scale ID number (PCB board)} \]
6.12.2. Response: HEAD | L | 0 | aaaa...aaa | C | END
  
  aaaa...aaa = 16 bytes ASCII string Name

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

<table>
<thead>
<tr>
<th>Command</th>
<th>PCB Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2 08 31 30 30 30 32 33 08 F3</td>
<td>F2 13 30 4D 54 54 4C 52 20 20 20 20 20 20 20 20 20 20 20 20 50 F3</td>
</tr>
</tbody>
</table>

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 | L | S | nnnn | C | END
  
  nnnn = PCB identification number

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

  nnnn = PCB identification number
  xx = Error number

  Example: Setting the Scale Board ID to 2.

<table>
<thead>
<tr>
<th>Command</th>
<th>PCB Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2 07 53 30 30 30 32 56 F3</td>
<td>F2 07 73 30 30 30 32 76 F3</td>
</tr>
</tbody>
</table>

7.2. **Retrieve Scale ID**

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

7.2.2. Response: HEAD | L | A | nnnn | C | END

  nnnn = PCB identification number

  Example: This command will retrieve the Scale Board ID.

<table>
<thead>
<tr>
<th>Command</th>
<th>PCB Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2 03 41 42 F3</td>
<td>F2 07 61 30 30 30 32 64 F3</td>
</tr>
</tbody>
</table>

  Result: 0002
7.3. **Change Scale ID**

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

7.3.2. Response:  
    HEAD | L | nnnn | C | END or  
    HEAD | L | E | xx | C | 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.

<table>
<thead>
<tr>
<th>Command</th>
<th>PCB Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2 0B 49 30 30 30 33 30 30 32 43 F3</td>
<td>F2 07 69 30 30 30 32 6C F3</td>
</tr>
</tbody>
</table>

Result: 0002

7.4. **Retrieve Channel Counts**

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

7.4.2. Response: HEAD | L | 0 | nn | C | 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.

<table>
<thead>
<tr>
<th>Command</th>
<th>PCB Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2 08 31 30 30 30 32 34 0F F3</td>
<td>F2 05 30 31 32 36 F3</td>
</tr>
</tbody>
</table>

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 | L | W | nnnn | N | C | END  
    nnnn = PCB identification number  
    N = pad number from ‘0’ to ‘9’ and ‘A’ & ‘B’ (10-11)
8.1.2. Response: HEAD | L | w | swwwwwwww | x | C | END
  s = sign (space or -)
  w = 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:

<table>
<thead>
<tr>
<th>Command</th>
<th>PCB Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2 08 57 30 30 30 32 30 6D F3</td>
<td>F2 0D 77 20 20 20 36 2E 30 30 30 20 72 F3</td>
</tr>
</tbody>
</table>

8.2. Request All Weights

8.2.1. Command : HEAD | L | T | nnnn | C | END
  nnnn = PCB identification number

8.2.2. Response: HEAD | L | T | chn | swwwwwwww | x |………| swwwwww | ww | x | C | END
  Scale Channels
  s = sign (space or -)
  wwwwwww = 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

<table>
<thead>
<tr>
<th>Command</th>
<th>PCB Response</th>
</tr>
</thead>
</table>
| F2 07 54 30 30 30 32 51 F3 | F2 7C 74 43 20 20 20 36 2E 30 30 30 20 \(\downarrow\) Channel 0 : 6.000
  20 20 20 20 34 2E 30 30 30 20 \(\downarrow\) Channel 1 : 4.00
  45 31 30 20 20 20 20 20 20 \(\downarrow\) Channel 2: Error
  10 
  \ldots\
  45 31 30 20 20 20 20 20 20 \(\downarrow\) 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 | L | Z | nnnn | N | C | END`
- `nnnn` = PCB identification number
- `N` = pad number from ‘0’ to ‘9’ and ‘A’ & ‘B’ (10–11)

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

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

<table>
<thead>
<tr>
<th>Command</th>
<th>PCB Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2 08 5A 30 30 30 32 60 F3</td>
<td>F2 04 7A 5A 24 F3</td>
</tr>
</tbody>
</table>

---

### 8.4. Request Valid Channels Weight

8.4.1. Command: `HEAD | L | T | nnnn | # | C | END`
- `nnnn` = PCB identification number

8.4.2. Response: `HEAD | L | T | n1 | s | wwww | ... | nx | s | wwww | x | C | END`
- `s = sign (space or -)`
- `n1, n2…nx = valid channel number, ‘0’~‘9’, ‘A’~‘B’`
- `www = 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 `www` is an error number

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

<table>
<thead>
<tr>
<th>Command</th>
<th>PCB Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2 08 54 30 30 30 32 23 7D F3</td>
<td>F2 1A 74 23</td>
</tr>
<tr>
<td></td>
<td>50 20 20 20 20 36 2E 30 30 32 43 Channel 0 : 6.000 with error</td>
</tr>
<tr>
<td></td>
<td>31 20 20 20 20 20 20 34 2E 30 30 20 Channel 1 : 4.00</td>
</tr>
<tr>
<td></td>
<td>3F 3</td>
</tr>
</tbody>
</table>

Response Notes: Channel 0: 6.000  but with error (Message indicating the scale at its max capacity)
8.5. Request channels Weight

8.5.1. Command: HEAD | L | I | nnnn | I | nnnn | 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 Channel 0 + 1...+6 will be selected

8.5.2. Response: HEAD | L | I | nnnn | I |  wwww | I | ... |  wwww | I | C | I | END

s = sign (space or -)

wwwwwww = 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 wwww is an error number

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

<table>
<thead>
<tr>
<th>Command</th>
<th>PCB Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2 08 54 30 30 30 32 33 6D F3</td>
<td>F2 22 74 33 20 20 20 20 36 2E 30 30 31 43 (\leftarrow) Channel 0 : 6.000 with error</td>
</tr>
<tr>
<td>\</td>
<td>20 20 20 20 34 2E 30 30 31 20 (\leftarrow) Channel 1 : 4.00</td>
</tr>
<tr>
<td>\</td>
<td>45 31 30 20 20 20 20 20 36 2E 30 30 31 20 (\leftarrow) Channel 2 : Error 10</td>
</tr>
<tr>
<td>\</td>
<td>70 F3</td>
</tr>
</tbody>
</table>

Response Channel 0 = 6.000 \(\Box\) (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 | L | I | R | nnnn | I | C | I | END

nnnn = PCB identification number

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

nnnn = PCB identification number

Example: This command resets all parameters to default values.

<table>
<thead>
<tr>
<th>Command</th>
<th>PCB Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2 07 52 30 30 30 32 57 F3</td>
<td>F2 07 72 30 30 30 32 77 F3</td>
</tr>
</tbody>
</table>
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 | L | C | nnnn | N | C | END
```

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

9.1.2. **Response:**

- `HEA D I L I E I C I E N D` or
- `HEA D I L I E I E I xx I C I E N D` → *Error number*

- **xx** = Error number

**Example:**

<table>
<thead>
<tr>
<th>Command</th>
<th>PCB Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2 08 43 30 30 32 30 79 F3</td>
<td>F2 04 63 56 32 F3</td>
</tr>
</tbody>
</table>

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

### 9.2. Sample Deadload (step 2)

9.2.1. **Command:**

```
HEAD | L | E | nnnn | N | C | END
```

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

9.2.2. **Response:**

- `HEA D I L I E I C I E N D` or
- `HEA D I L I E I E I xx I C I E N D` → *Error number*

- **xx** = Error number

**Example:**

<table>
<thead>
<tr>
<th>Command</th>
<th>PCB Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2 08 45 30 30 32 30 7F F3</td>
<td>F2 04 65 46 27 F3</td>
</tr>
</tbody>
</table>

**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 | L | F | nnnn | N | C | END
```

- **nnnn** = PCB identification number
- **N** = pad number from ‘0’ to ‘9’ and ‘A’ & ‘B’ (10-11)
9.3.2. Response:  
HEAD L I I E I C I END or  
HEAD L I I E I xx I C I END → Error number

xx = Error number

Example:

<table>
<thead>
<tr>
<th>Command</th>
<th>PCB Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2 08 46 30 30 30 32 30 7C F3</td>
<td>F2 04 66 43 21 F3</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Error Number</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Load cell error</td>
<td>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.</td>
</tr>
<tr>
<td>2</td>
<td>Calibrate data empty</td>
<td>Channel is not calibrated. Please calibrate the weight pad on the channel.</td>
</tr>
<tr>
<td>3</td>
<td>In motion</td>
<td>Pad is in motion status, can’t get stable weight. Wait for stable pad</td>
</tr>
<tr>
<td>4</td>
<td>Scale model not set</td>
<td>Scale model has not been set. Set the scale model. For example “A60008”</td>
</tr>
<tr>
<td>5</td>
<td>Scale channel number error</td>
<td>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.</td>
</tr>
<tr>
<td>6</td>
<td>Command error</td>
<td>Command is not correct, check your syntax.</td>
</tr>
<tr>
<td>7</td>
<td>Eprom rd/wr error</td>
<td>EEPROM data error. Try to download firmware and recalibrate the scale. If error continues, change the PCBA Scale Board.</td>
</tr>
<tr>
<td>8</td>
<td>Error calibration weight</td>
<td>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.</td>
</tr>
<tr>
<td>10</td>
<td>Pad disabled, can’t weight</td>
<td>Scale is not in Padmode, but a weight has been requested.</td>
</tr>
<tr>
<td>11</td>
<td>Shelf mode can’t run command of pad</td>
<td>Scale is set in Shelf mode. Padmode setting commands cannot be used.</td>
</tr>
<tr>
<td>12</td>
<td>Pad mode can’t run command of shelf</td>
<td>Scale is set in Padmode. Shelf mode setting commands cannot be used.</td>
</tr>
<tr>
<td>PW</td>
<td>Scale is in power up mode, please wait several seconds to send command</td>
<td>Command was sent too quickly. Wait for 3-5 seconds after power up.</td>
</tr>
</tbody>
</table>
11. ASCII Table

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

<table>
<thead>
<tr>
<th>Dec</th>
<th>Hex</th>
<th>Char</th>
<th>Dec</th>
<th>Hex</th>
<th>Char</th>
<th>Dec</th>
<th>Hex</th>
<th>Char</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>00</td>
<td>Null</td>
<td>32</td>
<td>20</td>
<td>Space</td>
<td>64</td>
<td>40</td>
<td>@</td>
</tr>
<tr>
<td>1</td>
<td>01</td>
<td>Start of heading</td>
<td>33</td>
<td>21</td>
<td>!</td>
<td>65</td>
<td>41</td>
<td>A</td>
</tr>
<tr>
<td>2</td>
<td>02</td>
<td>Start of text</td>
<td>34</td>
<td>22</td>
<td>”</td>
<td>66</td>
<td>42</td>
<td>B</td>
</tr>
<tr>
<td>3</td>
<td>03</td>
<td>End of text</td>
<td>35</td>
<td>23</td>
<td>#</td>
<td>67</td>
<td>43</td>
<td>C</td>
</tr>
<tr>
<td>4</td>
<td>04</td>
<td>End of transmit</td>
<td>36</td>
<td>24</td>
<td>$</td>
<td>68</td>
<td>44</td>
<td>D</td>
</tr>
<tr>
<td>5</td>
<td>05</td>
<td>Enquiry</td>
<td>37</td>
<td>25</td>
<td>%</td>
<td>69</td>
<td>45</td>
<td>E</td>
</tr>
<tr>
<td>6</td>
<td>06</td>
<td>Acknowledge</td>
<td>38</td>
<td>26</td>
<td>&amp;</td>
<td>70</td>
<td>46</td>
<td>F</td>
</tr>
<tr>
<td>7</td>
<td>07</td>
<td>Audible bell</td>
<td>39</td>
<td>27</td>
<td>'</td>
<td>71</td>
<td>47</td>
<td>G</td>
</tr>
<tr>
<td>8</td>
<td>08</td>
<td>Backspace</td>
<td>40</td>
<td>28</td>
<td>(</td>
<td>72</td>
<td>48</td>
<td>H</td>
</tr>
<tr>
<td>9</td>
<td>09</td>
<td>Horizontal tab</td>
<td>41</td>
<td>29</td>
<td>)</td>
<td>73</td>
<td>49</td>
<td>I</td>
</tr>
<tr>
<td>10</td>
<td>0A</td>
<td>Vertical tab</td>
<td>42</td>
<td>2A</td>
<td>_</td>
<td>74</td>
<td>4A</td>
<td>J</td>
</tr>
<tr>
<td>11</td>
<td>0B</td>
<td>Form feed</td>
<td>43</td>
<td>2B</td>
<td>+</td>
<td>75</td>
<td>4B</td>
<td>K</td>
</tr>
<tr>
<td>12</td>
<td>0C</td>
<td>Carriage return</td>
<td>44</td>
<td>2C</td>
<td>,</td>
<td>76</td>
<td>4C</td>
<td>L</td>
</tr>
<tr>
<td>13</td>
<td>0D</td>
<td>Shift out</td>
<td>45</td>
<td>2D</td>
<td>-</td>
<td>77</td>
<td>4D</td>
<td>M</td>
</tr>
<tr>
<td>14</td>
<td>0E</td>
<td>Shift in</td>
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<td>2E</td>
<td>,</td>
<td>78</td>
<td>4E</td>
<td>N</td>
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<td>15</td>
<td>0F</td>
<td>Data link escape</td>
<td>47</td>
<td>2F</td>
<td>/</td>
<td>79</td>
<td>4F</td>
<td>O</td>
</tr>
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<td>16</td>
<td>10</td>
<td>Device control 1</td>
<td>48</td>
<td>30</td>
<td>0</td>
<td>80</td>
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<td>P</td>
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<tr>
<td>17</td>
<td>11</td>
<td>Device control 2</td>
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<td>31</td>
<td>1</td>
<td>81</td>
<td>51</td>
<td>Q</td>
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<tr>
<td>18</td>
<td>12</td>
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<td>32</td>
<td>2</td>
<td>82</td>
<td>52</td>
<td>R</td>
</tr>
<tr>
<td>19</td>
<td>13</td>
<td>Device control 4</td>
<td>51</td>
<td>33</td>
<td>3</td>
<td>83</td>
<td>53</td>
<td>S</td>
</tr>
<tr>
<td>20</td>
<td>14</td>
<td>Device control 5</td>
<td>52</td>
<td>34</td>
<td>4</td>
<td>84</td>
<td>54</td>
<td>T</td>
</tr>
<tr>
<td>21</td>
<td>15</td>
<td>Neg. acknowledge</td>
<td>53</td>
<td>35</td>
<td>5</td>
<td>85</td>
<td>55</td>
<td>U</td>
</tr>
<tr>
<td>22</td>
<td>16</td>
<td>Synchronous idle</td>
<td>54</td>
<td>36</td>
<td>6</td>
<td>86</td>
<td>56</td>
<td>V</td>
</tr>
<tr>
<td>23</td>
<td>17</td>
<td>End trans. block</td>
<td>55</td>
<td>37</td>
<td>7</td>
<td>87</td>
<td>57</td>
<td>W</td>
</tr>
<tr>
<td>24</td>
<td>18</td>
<td>Cancel</td>
<td>56</td>
<td>38</td>
<td>8</td>
<td>88</td>
<td>58</td>
<td>X</td>
</tr>
<tr>
<td>25</td>
<td>19</td>
<td>End of medium</td>
<td>57</td>
<td>39</td>
<td>9</td>
<td>89</td>
<td>59</td>
<td>Y</td>
</tr>
<tr>
<td>26</td>
<td>1A</td>
<td>Substitution</td>
<td>58</td>
<td>3A</td>
<td>;</td>
<td>90</td>
<td>5A</td>
<td>Z</td>
</tr>
<tr>
<td>27</td>
<td>1B</td>
<td>Escape</td>
<td>59</td>
<td>3B</td>
<td>:</td>
<td>91</td>
<td>5B</td>
<td>(</td>
</tr>
<tr>
<td>28</td>
<td>1C</td>
<td>File separator</td>
<td>60</td>
<td>3C</td>
<td>&lt;</td>
<td>92</td>
<td>5C</td>
<td>\</td>
</tr>
<tr>
<td>29</td>
<td>1D</td>
<td>Group separator</td>
<td>61</td>
<td>3D</td>
<td>=</td>
<td>93</td>
<td>5D</td>
<td>)</td>
</tr>
<tr>
<td>30</td>
<td>1E</td>
<td>Record separator</td>
<td>62</td>
<td>3E</td>
<td>&gt;</td>
<td>94</td>
<td>5E</td>
<td>^</td>
</tr>
<tr>
<td>31</td>
<td>1F</td>
<td>Unit separator</td>
<td>63</td>
<td>3F</td>
<td>?</td>
<td>95</td>
<td>5F</td>
<td>@</td>
</tr>
</tbody>
</table>