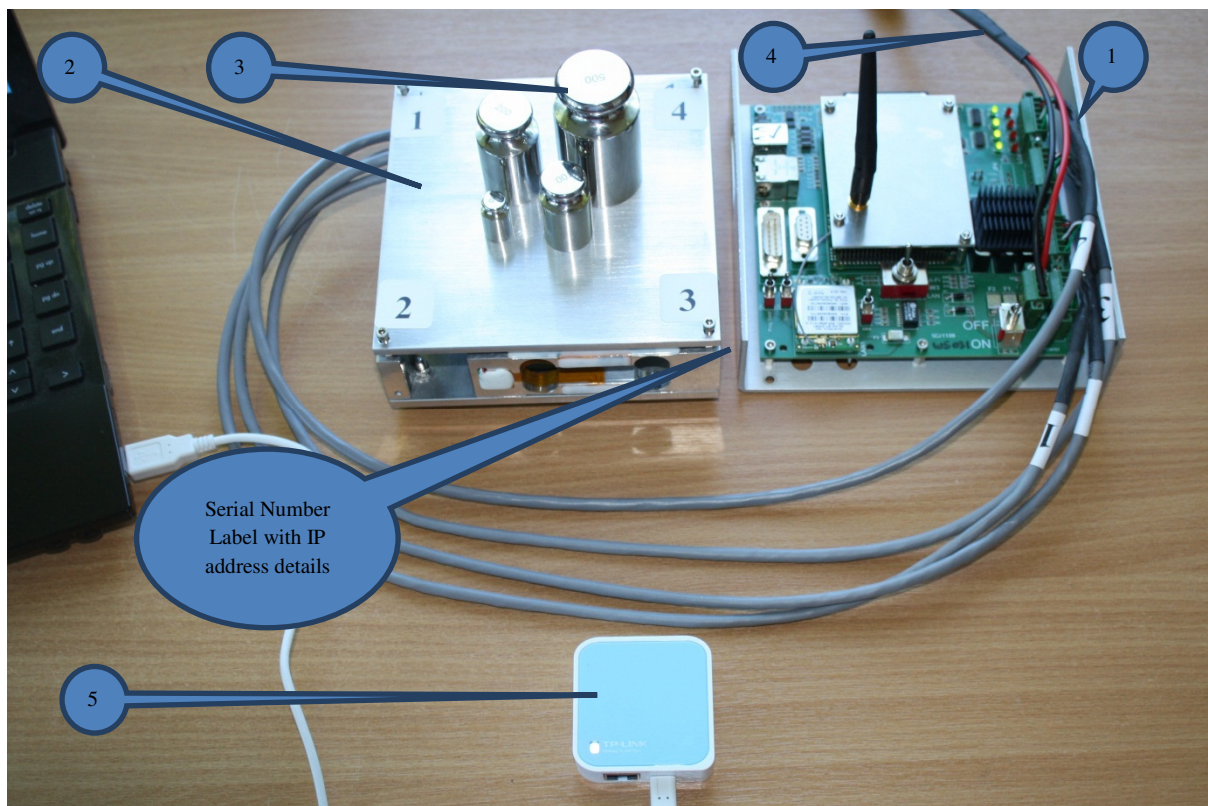


The *Scrapman PlayStation* is a self-contained model of a Heavy-Duty, mobile weighing system but set-up to measure weight, at 1/100,000<sup>th</sup> Scale and being compact, is ideally suited for use in the laboratory or office environment as a tool to help develop and test software for external monitoring systems. It is also extremely useful as a diagnostic tool for isolating any system problems as an aid to training. It comprises the following;

1. ScrapMan Computer Assembly c/w WiFi Antennae
2. Model Weighing Platform c/w Load Cell Cables
3. Set of Test Weights
4. 12V DC Mains Power Supply & Cable
5. WiFi wireless *Nano* router complete with USB Power Cable.



Like the actual trailer, the load cells are “digital” in that they are laboratory calibrated and scaled and so can be swapped over with simplicity. In the case of the PlayStation, the load cells have been deliberately scaled to read **30,000** with an applied load of 300gm thus allowing the system to *apparently* weigh in Tonnes (30T).

**The computer board supplied with the PlayStation equipment would normally be the spare computer and is nominally set to have an *identity* of Trailer 0 (zero) with a fixed IP address of 123.1.224.213; this can be changed at any time.**

# Getting Started Guide

## Connection and assembly ready for use.....

Take care connecting the model weighbridge and power supply to the computer mother board and assemble the equipment as outlined below.

**Load cell connectors** are 6 way headers and the single power connector is a 4 way header. **Take care when connecting this**; the connectors are polarised so it is impossible to put them in the wrong way round and without being forced, it is impossible to insert the four way power connector into a load cell socket but if this was achieved it could cause irrevocable damage to the RS485 control circuit of the CPU

**Power Connector**; the top two pins are +ve Battery 1 and Battery 2 (12V DC) respectively, lower two pins are 0Volts (Ground).

Once assembled, powered-up and running, the PlayStation can be accessed by a web browser such as Microsoft Internet Explorer but this is dependent upon having a compatible network configuration. If the settings aren't compatible then there will be no communication and it will be necessary to change EITHER the PlayStation OR the LAN settings accordingly.

## Connection to host computer

The supplied Nano router is set up as follows:

- SSID = 'scrapman'
- Security = WPA2 – PSK
- Encryption = AES
- Passphrase = 'scrapman'
- IP address of router = 123.1.224.200
- Subnet mask = 255.255.255.0
- DHCP server = enabled
- DHCP address range = 123.1.224.100 - 123.1.224.199

The host computer may be connected to the Nano router by either a wired connection or wirelessly. In both cases it is preferred to set the host computer to 'Obtain IP address automatically'. If connecting wirelessly, set the wireless SSID and security settings as described above.

The ScrapMan computer system in the PlayStation is set up to communicate over WiFi as follows:

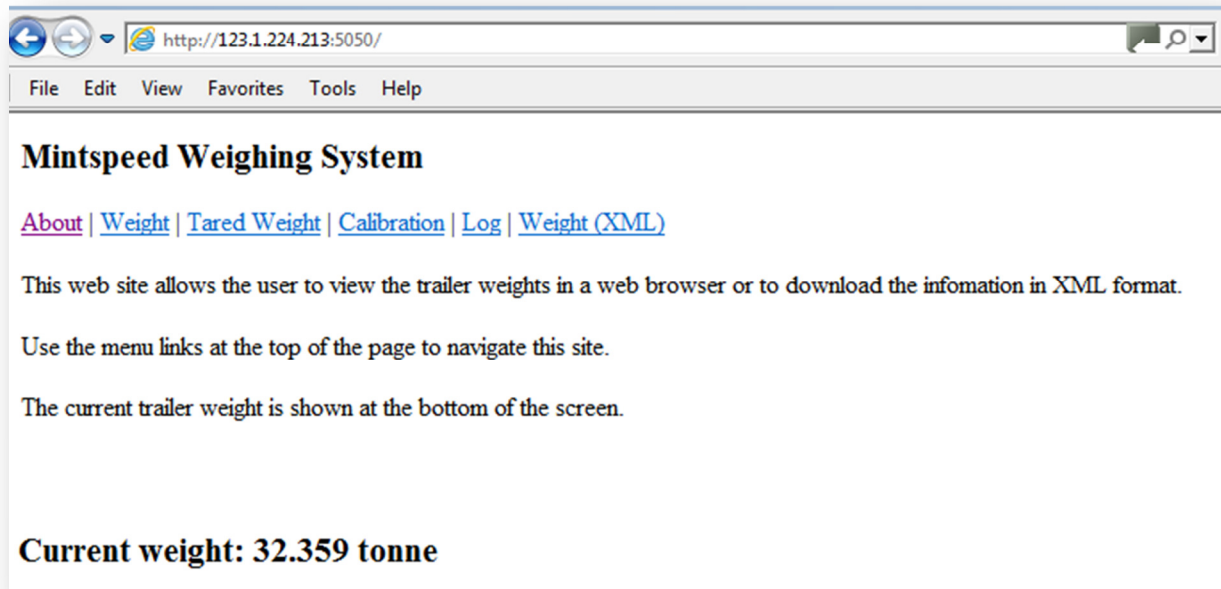
- SSID = 'scrapman'
- Security = WPA2 – PSK
- Encryption = AES
- Passphrase = 'scrapman'
- IP address = 123.1.224.213 (Trailer 0)
- Subnet mask = 255.255.255.0

## Booting the Weighing System

1. **Always ensure that the Network Switch is in the *WiFi* position.**
2. Turn on the power to the weighing system.
3. Wait for the status LED's to show four flashing green lights.

## Communicating with Weighing System with Web browser

The weighing system has a web server running, through which all communications normally takes place. The web server listens to port 5050 (rather than the standard 80). As a simple sanity check, fire up internet explorer on the host computer and type <http://123.1.224.213:5050> into the address bar; this should fire up the homepage for *Trailer 0* as shown below .....



## Communicating with Weighing System from application program

From an application program, the user should open a socket to the IP address of the weighing system using port 5050.

There are several important strings to send to request information:

1. `GET /weight.xml HTTP/1.1\r\nHost: <ipAddr>\r\n\r\n`  
This causes an .xml file containing all available about the current state of the weighing system, including gross weight and battery voltages.
2. `GET /tare.htm HTTP/1.1\r\nHost: <ipAddr>\r\n\r\n`  
This returns a simple page containing the tared weight and the gross weight.
3. `GET /tare.htm?tare HTTP/1.1\r\nHost: <ipAddr>\r\n\r\n`  
This returns a simple page containing the tared weight and the gross weight and tares the tared weight to zero.
4. `GET /tare.htm?untare HTTP/1.1\r\nHost: <ipAddr>\r\n\r\n`  
This returns a simple page containing the tared weight and the gross weight and clears any taring (causing tared weight to equal gross weight).

Where:

- \r is a carriage return character.
- \n is a new line character.
- <ipaddr> is the ipaddress of the *weighing system*.

## System Parameters and Configuration

Unless otherwise requested or changed by the end client user, the default WiFi settings programmed into the FLASH memory for the PlayStation (Trailer 0) are as follows;

Property	Factory Setting	Client Setting
Network Name (SSID)	scrapman	
Password	scrapman	
Encryption	WPA2-PSK	
DHCP (0=disabled, 1=enabled)	0	
IP Address	123.1.224.213	
Authorisation	Shared	
Region	US	
FTP Server (0-disabled, 1=enabled)	0	
DNS Server 1	194.168.4.100	
DNS Server 2	194.168.4.100	

These can be modified and set-up as described in the following pages.

## Trailer Configuration Guide

### Overview

The operation of the trailer weighing system is controlled by the following files in the root directory of the CF card:

- ✦ CalibrationSettings.xml
- ✦ CommsSettings.xml
- ✦ TimeSettings.xml
- ✦ Various .cfb files containing WiFi settings.

### CommsSettings.xml

This controls how the wireless bridge is configured and has the following user-programmable tags:

#### <Bridge><ConfigFile>

This tag holds the filename of the bridge configuration file. This file contains all the commands to send to the bridge whenever it needs configuring after a bridge reset procedure has been carried out. These commands primarily control the WiFi settings of the weighing system.

The bridge is configured using commands detailed in the “Airborne Enterprise Command Line Reference Guide”.

See 'scrapman.cfb' as an example Config File.

#### <Ping><Address>

Some wireless infrastructure systems do not support 'passive clients'. This class of network require clients to occasionally generate traffic. The weighing system is essentially a passive client, it only responds when spoken to. The Ping capability allows the weighing system to generate a ping command to the IP address specified in this field (typically set to the IP address of the router gateway).

#### **<Ping><Interval>**

This tag holds the interval, in seconds, between ping requests to keep the weighing system from being de-associated from the network as a 'passive client'. Set to zero (0) if the network infrastructure supports 'passive clients' and pings are, therefore not required, in which case no pings will be issued.

#### **<Ping><Log>**

0 – Do not log ping results to ceWeighLog.txt

1- Log ping results to ceWeighLog.txt

#### **<WeightXML><Format>**

This tag controls how much information is sent in response to accesses to weight.xml

Full – A verbose file that includes all fields available and comments.

Concise – A smaller file that only contains important weighing fields and no comments. Reduces network loading.

### **CalibrationSettings.xml**

This controls calibration settings applied to the weights returned by the weighing system. They are set by the calibration procedure and are not designed to be user modifiable.

#### **<Weight><Gain>**

The multiplier applied to all weight readings (default 1.0)

#### **<Weight><UseOffset>**

0 – Do not apply offset correction (default).

1 – Subtract the offset from reported weight. Most useful for removing the weight of the weigh bed.

#### **<Weight><Offset>**

The offset (in Kg) removed from all weight readings (default 0).

#### **<Battery><Gain>**

The multiplier applied to all battery voltage readings (default 1.0).

### **TimeSettings.xml**

The weighing system does not have a battery backed real time clock, however it can synchronize it's volatile clock from an NTSF time server. This is configurable from this file and has the following user-programmable tags:

#### **<TimeSettings><Enable>**

0 – Do not attempt to synchronize time from server

1- Attempt to synchronize time from server specified.

#### **<TimeSettings><Server>**

The URL of the time server (e.g. time.windows.com). (Note that wireless bridge must have its DNS server settings configured for this to work).

#### **<TimeSettings><DebugMode>**

0 – Do not log results to TimeLog.txt (default)

1- Log results to TimeLog.txt

**scrapman.cfb** (example shown for **Trailer 0**; 123.1.224.213)

```
#####  
#Following must not be modified  
#  
#####  
#  
ftp-server disable  
#  
#####  
#Following must be configured  
#  
#####  
#  
wl-region US  
wl-ssid scrapman  
wl-dhcp 0  
#  
#####  
#Following must be configured  
# if DHCP = 0 (disabled)  
#  
#####  
#  
wl-ip 123.1.224.213  
wl-subnet 255.255.255.0  
wl-gateway 123.1.224.200  
dns-server1 194.168.4.100  
dns-server2 194.168.8.100  
#  
#####  
#Following are example security settings  
#  
#####  
#  
pw-wpa-psk scrapman  
wl-security wpa2-psk  
wl-auth shared
```

The above example is for **Trailer 0** and it would normally be edited with a text editor such as Notepad

**It is essential to do a cold start before using the revised wireless set-up.....**

1. With the computer OFF, put the WiFi / LAN switch in the WiFi position
2. Hold down the WiFi RESET switch (its sprung-loaded)
3. Turn the computer ON and wait until all LED activity has ceased – about 10 seconds. This will cause the WiFi module to revert to its Mintspeed Factory Settings.
4. Release the WiFi RESET switch and turn the computer OFF
5. Wait a few seconds then turn the computer ON. This will start the configuration process which will overwrite the Mintspeed factory settings with those in the XML file in the FLASH memory. This is a fairly slow process – about 5 minutes. Once finished the program will “find” the four load cells and then run normally. If it doesn’t, do a power-cycle reset OFF then ON again, once running correctly, all four GREEN LED’s should be flashing.

## The Weighing Page

**Mintspeed Weighing System**

[About](#) | [Weight](#) | [Tared Weight](#) | [Calibration](#) | [Log](#) | [Weight \(XML\)](#)

**Current Weights:**

	Min	Ave	Max	Curr
Total	32301	32302	32303	32303
SN101	11695	11695	11695	11695
SN102	5569	5569	5570	5570
SN103	9194	9194	9194	9194
SN104	5843	5844	5844	5844

**Serial Numbers:**

	Serial No
SN101	16834493
SN102	16834487
SN103	16834491
SN104	16834489

**Battery Voltage:**

	Voltage
Battery 1	12.12
Battery 2	12.23

**Current weight: 32.301 tonne**



## The XML Page

### 'Concise'

```
<?xml version="1.0" encoding="utf-8" ?>
<IJMSoftware>
<MintSpeed>
<TrailerWeighingSystem>
<System>
<SoftwareVersion>03.58</SoftwareVersion>
<XMLPageVersion>1.0.0</XMLPageVersion>
<BatteryVoltage1>12.09</BatteryVoltage1>
<BatteryVoltage2>12.22</BatteryVoltage2>
</System>
<Weight>
<LoadCell1>
<CurrentWeight>11615</CurrentWeight>
<AverageWeight>11615</AverageWeight>
</LoadCell1>
<LoadCell2>
<CurrentWeight>5668</CurrentWeight>
<AverageWeight>5668</AverageWeight>
</LoadCell2>
<LoadCell3>
<CurrentWeight>9145</CurrentWeight>
<AverageWeight>9146</AverageWeight>
</LoadCell3>
<LoadCell4>
<CurrentWeight>5883</CurrentWeight>
<AverageWeight>5883</AverageWeight>
</LoadCell4>
<Total>
<CurrentWeight>32311</CurrentWeight>
<AverageWeight>32312</AverageWeight>
<MinWeight>32311</MinWeight>
<MaxWeight>32312</MaxWeight>
<NetCurrentWeight>32311</NetCurrentWeight>
<NetAverageWeight>32312</NetAverageWeight>
<AverageLength>20</AverageLength>
</Total>
</Weight>
</TrailerWeighingSystem>
</MintSpeed>
</IJMSoftware>
```



## 'Full'

```
<?xmlversion="1.0"encoding="utf-8" ?>
- <IJMSoftware>
- <MintSpeed>
- <!-- TrailerWeighing System is a container for all the data that might be
produced by the trailer weighing system software.
-->
- <TrailerWeighingSystem>
- <!-- System contains all the information connected with the system
-->
- <System>
<SoftwareVersion>01.04</SoftwareVersion>
<XMLPageVersion>1.0.0</XMLPageVersion>
- <!-- OK, Initialising, Initialisation Failed
-->
<SoftwareStatus>Not Implemented</SoftwareStatus>
- <LoadCell>
- <!-- The number of load cells found on the bus, should be 4
-->
<LoadCellsPresent>Not Implemented</LoadCellsPresent>
- <!-- The load cell serial numbers as read from the RS485 bus
-->
- <SerialNumbers>
<LoadCell1>1000412861</LoadCell1>
<LoadCell2>1000412864</LoadCell2>
<LoadCell3>1000412867</LoadCell3>
<LoadCell4>1000412871</LoadCell4>
</SerialNumbers>
</LoadCell>
- <!-- trailer battery voltage
-->
<BatteryVoltage1>12.14</BatteryVoltage1>
<BatteryVoltage2>12.12</BatteryVoltage2>
</System>
- <!-- The Weight section contains all the real time weight information. It's
divided into 5 sections: one for each load cell and one for the sum.
-->
- <Weight>
- <LoadCell1>
- <!-- The current weight!!
-->
<CurrentWeight>120</CurrentWeight>
- <!-- The current weight!!
-->
- <!-- the average weight calculated over the last 100 weight read
-->
<AverageWeight>120</AverageWeight>
- <!-- The minimum weight read in the last 100 weights read
-->
<MinWeight>120</MinWeight>
- <!-- The minimum weight read in the last 100 weights read
-->
<MaxWeight>120</MaxWeight>
- <!-- The number of weights used to calculate the average, min and max
-->
<AverageLength>20</AverageLength>
</LoadCell1>
- <LoadCell2>
<CurrentWeight>29308</CurrentWeight>
<AverageWeight>29308</AverageWeight>
<MinWeight>29308</MinWeight>
<MaxWeight>29308</MaxWeight>
```

```

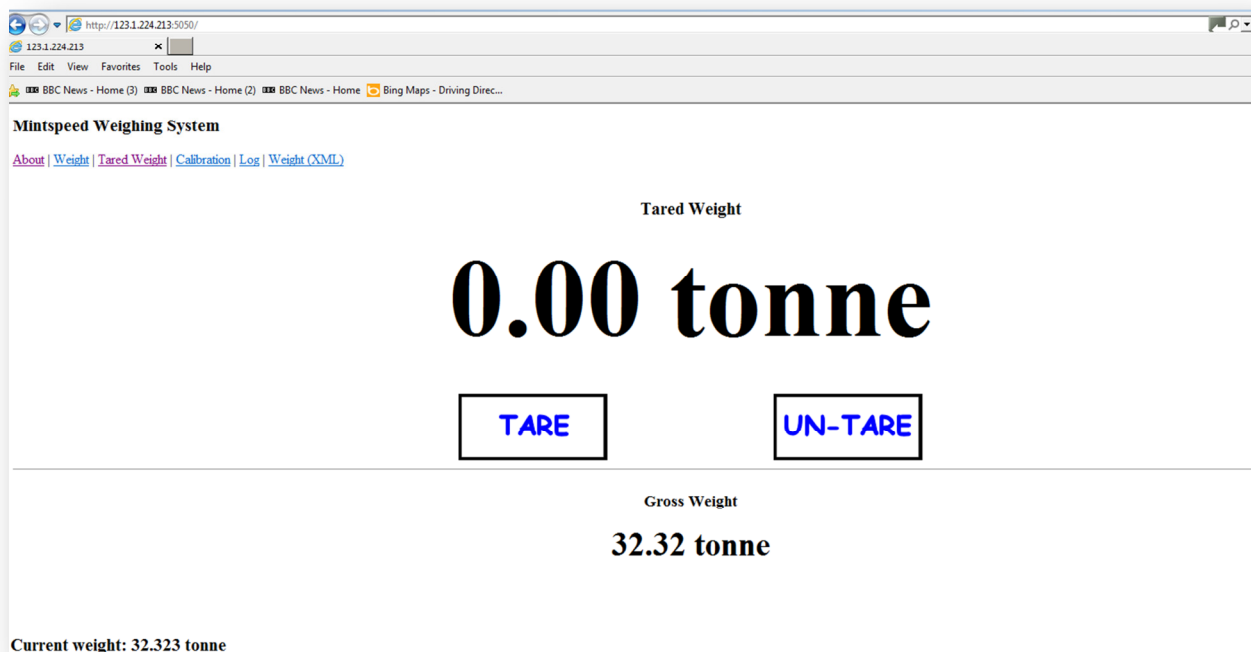
<AverageLength>20</AverageLength>
</LoadCell2>
- <LoadCell3>
<CurrentWeight>184</CurrentWeight>
<AverageWeight>184</AverageWeight>
<MinWeight>184</MinWeight>
<MaxWeight>184</MaxWeight>
<AverageLength>20</AverageLength>
</LoadCell3>
- <LoadCell4>
<CurrentWeight>29391</CurrentWeight>
<AverageWeight>29391</AverageWeight>
<MinWeight>29391</MinWeight>
<MaxWeight>29391</MaxWeight>
<AverageLength>20</AverageLength>
</LoadCell4>
- <Total>
<CurrentWeight>61336</CurrentWeight>
<AverageWeight>61336</AverageWeight>
<MinWeight>61336</MinWeight>
<MaxWeight>61336</MaxWeight>
<AverageLength>20</AverageLength>
</Total>
</Weight>
</TrailerWeighingSystem>
</MintSpeed>
</IJMSoftware>

```

## Tare and Un-Tare



Having pressed TARE, the display is effectively zeroed to allow loading of precise amounts. Tare can be pressed as many times as required. The system also displays the total GROSS load and it can also be UNTARED at any time.



# Trailer Software

## Overview

The trailer control is built on a Windows CE kernel. This provides a real-time environment for the control software. On top of the OS is .NET Framework. This provides a managed environment for the control software. The software itself consists of two main entities, TrailerLauncher.exe and ceWeigh.exe both written in C#.

### TrailerLauncher.exe

This is responsible for launching ceWeigh.exe. It also scans the root directory and 'Utils' directory of the 'Storage Card' for any files with an extension of .new (e.g. ceWeigh.exe.new). Should it find such a file it will 'kill' ceWeigh.exe and then, for each '<file>.new' replace '<file>.old' with <file> and <file> with '<file>.new'. Thus each file gets updated with a backup saved. Finally TrailerLauncher.exe stops refreshing the watchdog and a 'watchdog timeout' reset happens. The system reboots with the new firmware operating.

### ceWeigh1.exe

This is the main application. It consists of the following main functions:

#### Main marshalling thread

This spawns the Webserver thread and polls all the load cells to ensure they are present. If it detects missing cells, then it attempts to install a 'fresh' load cell (See Maintenance section in hardware manual). If there are missing load cells it reports this and awaits a reboot.

If all load cells are present and correct, then the weighing thread is kicked off.

#### Webserver (serving port 5050)

This is a lightweight server, supporting the GET and PUT functions of HTTP. Its main purpose is to provide a UI for calibration and system status as well as sourcing .xml files containing all the weighing information for networked computer systems to deal with.

#### Weighing thread

This regularly polls all the load cells. It keeps a running average of the last several readings and reports the following:

Current weight – the last reading received.

Average weight – the mean of all readings in buffer.

Minimum weight – the smallest weight.

Maximum weight – the largest weight.

By providing minimum and maximum weights, the system allows an external computer system to ensure weights have 'settled' before accepting the weight.

Each individual load cell's weight is reported along with the total weight on the weigh bed. The total weight has a gain correction applied to it. This correction factor is held in a set up file - SetIpAddressInfo.xml – and the value is set during the 'Calibration Procedure'. The individual load cell readings are NOT gain corrected.

#### Watchdog refresh thread

This thread 'pings' the Webserver thread, to ensure it is 'alive'. It also polls a counter that the 'Weighing Thread' increments on every loop. This thread periodically 'kicks' the watchdog circuit as long as the Webserver is alive, and the counter incrementing. Should anything not respond or 'crash', including this thread, then the watchdog will fail to be 'kicked' and a system reset initiated after around 25 seconds from the last kick.

## Software Upgrade

Upgrading software can be achieved via two methods:

### Replace Flash memory card.

Take pre-programmed flash memory and fit to computer card. See Trailer Manual for more information. When replacing the Flash memory card, note that any user calibration data (held in 'calibrationSettings.xml') and the wireless LAN settings (held in (by default) 'scrapman.bfg') will be lost, unless copied across to the new card.

### Upload files via ftp.

The trailer includes an ftp server. This allows files to be uploaded to the trailer. In order to support overwriting running programs, all updated files must have a suffix '.new' appended to their filename, this will cause the weighing app to terminate, rename file and reboot. See description of TrailerLauncher.exe for further details. The ftp server does not require a username or password.

## Log Files

### ceWeighLog.txt

This file is appended to whenever a significant event happens (typically system reboots, calibration setting changed, errors received within the app). It is a simple text format and can be downloaded via the ftp server at any time.

```
Tuesday, June 01, 1999: *****
Tuesday, June 01, 1999: *****
Tuesday, June 01, 1999: iWebServer Log Messages
Tuesday, June 01, 1999: Software Version: 01.02
Tuesday, June 01, 1999: Web Server Running...
Tuesday, June 01, 1999: Port: 5050
Tuesday, June 01, 1999: Web Root Directory: \Storage Card\MyWebServer\Webroot\
Tuesday, June 01, 1999: Server Data Directory: \Storage Card\MyWebServer\Data\
Tuesday, June 01, 1999: Initialising Weighing System
Tuesday, June 01, 1999: Opening Serial Port: COM3 115200
Tuesday, June 01, 1999: Serial Port opened OK
Tuesday, June 01, 1999: Found Load Cell at Station ID: 101
Tuesday, June 01, 1999: Found Load Cell at Station ID: 102
Tuesday, June 01, 1999: Found Load Cell at Station ID: 103
Tuesday, June 01, 1999: Found Load Cell at Station ID: 104
Tuesday, June 01, 1999: Weighing System Initialised OK
```

## Programming and operational Tips

A number of factors need to be considered when writing software for the Scrapman weighing system to get the best out of it.

- 1) Do not poll the trailer unnecessarily. It is only essential to get the weight readings at high frequency when the trailer is actually involved in being loaded with material. At other times, for example when parked or being moved, it achieves nothing and wastes battery power.
- 2) If the trailer is out of commission (for example being serviced) then as well as switching the trailer computer off, disable the trailer from the network until needed again.
- 3) After moving the trailer to a new stock location, instigate a “Pseudo-Tare” BEFORE starting loading. Moving the trailer around the site will settle the scrap in the basket and may also settle the weighing; TARING will clear any small error.
- 4) You must decide whether you want to use the TARE facility within the trailer OR carry out this function within your software and host system.
- 5) Check Battery voltages frequently and build-in an alarm system if the voltage falls below 12.0V. The batteries may suffer permanent damage if discharged too much.
- 6) Carry out a “sanity check” when an empty basket is lowered onto the weighing system in the melt shop. This is the ONLY TIME you may detect an error in the weighing system. You should have an idea what an empty basket weighs, and you should check for this when the empty basket is put down.

## Wireless Networks

A suitable wireless network conforming to 802.11.b.g standards should be in place in the scrap yard and it may be necessary to use the services of an RF engineer with appropriate equipment to assess the WiFi coverage on site to ensure that there are no blind spots where the trailers and other mobile plant travel in the course of loading material.